



A Case Study: The Use of Chemical and Biological Techniques to Remediate a cVOC Plume at a Former Landfill

Chlorinated volatile organic compounds (cVOCs) are utilized across various industries due to their effectiveness in cleaning and degreasing applications. These compounds are valued for their ability to dissolve oils from metal surfaces, making them indispensable in the manufacturing sector. However, their release into the environment have led to persistent groundwater contamination that pose considerable health risks to human and ecological receptors. To mitigate these risks, governments and regulators have supported the remediation of groundwater contaminated with cVOCs. While there is a well documented history of remediation efforts related to treatment of groundwater plumes containing cVOCs, there are few case studies documenting the effectiveness of the combined use of chemical (activated carbon + sulfidated micro-scale zero valent iron) and biological (supplementation of anaerobic bacteria *Dehalococcoides* (Dhc)) remedial agents. The chemical part of the application involves the sequestration of cVOC and other groundwater contaminants in the aquifer via sorption as well as chemical degradation, whereas the biological part of the application involves the promotion of bioremediation of the cVOCs. In this case study, we explore the following: 1) the importance of high-resolution delineation of cVOC contamination in groundwater in a leaky confined aquifer with silt lenses; 2) the performance of in-situ injections and delivery of both chemical and biological remedial agents into this aquifer to treat the cVOC plume hot spots; and 3) the supplementation of a Dhc population to treat the groundwater cVOC plume at large. Modelling a high-resolution spatial-temporal dataset in three-dimensions, we have shown the importance of contaminant delineation at the start of the remedial process, and we have demonstrated that in-situ chemical and biological remedial agents can effectively treat cVOC source zones, while in-situ injections of biological treatments alone can be a more cost effective means of treating the tail end of the cVOC plume.

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Mitchell A. Davidson, M.A.Sc., P.Geo., is an Environmental Scientist and Project Manager, with five years of experience advancing site assessment and remediation across complex contaminated sites. Registered as a Professional Geoscientist in Ontario, Mitchell integrates rigorous field practice with data-driven analysis to design resilient, cost-effective remediation strategies. His work spans the full project lifecycle—from proposal and stakeholder coordination to conceptual site modeling, implementation, and reporting—anchored by a clear commitment to client service, safety, and technical excellence.

Mitchell is particularly noted for bringing modern geostatistical and 3D subsurface visualization tools to contaminated site decision making. Using Leapfrog™ and related platforms, he builds three-dimensional conceptual site models that synthesize stratigraphy, seasonal groundwater dynamics, and contaminant plume behavior. He has applied these capabilities to challenging chlorinated solvent (DNAPL/cVOC) plumes and emerging contaminants such as PFAS, enabling targeted injections, adaptive monitoring, and clear communication of subsurface conditions to owners, regulators, and community partners.

Representative contributions include field leadership, injection coordination, and reporting for multi-year remedial programs; remedial options evaluations; remedial action plans; and integrated groundwater, vapor intrusion, and indoor air quality programs. Committed to safe, compliant operations, Mitchell remains focused on advancing transparent, evidence-based environmental remediation—delivering actionable insights, defensible documentation, and durable outcomes for clients and communities.™ in the Northwest Territories, Nunavut, Ontario and the Yukon.