LNAPL Characterization, Immobilization and Destruction Technologies in Support of Risk-Based Site Closures

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Property owners and developers need predictable costs and timelines to manage and transact properties. Obtaining regulatory closure on impacted sites typically means obtaining a Certificate of Compliance or Remediation Certificate from provincial regulators. However, remediation costs can sometimes outweigh otherwise inherent property values and limit redevelopment options for significantly impacted sites. Risk assessment can be helpful in these instances in reducing costs by eliminating pathways of concern or re-calculating guidelines to be site-specific using approved approaches and models.

But what happens when a site contains light, non-aqueous phase liquid (LNAPL)? Most Canadian jurisdictions allow risk assessments on petroleum hydrocarbon-impacted sites, but usually contain additional restrictions when LNAPL, or even just a sheen, is present. BC requires practitioners to assess whether LNAPL is mobile or stable, and its presence can trigger a “high-risk site” classification. Alberta requires active remediation/removal to the “extent practicable” of mobile LNAPL, control of non-mobile LNAPL, and proof that the LNAPL source is “stable” and “decreasing”. Even under risk assessment scenarios this can often lead to expensive remediation programs and long-term monitoring that can cause cost overruns and scheduling delays to project objectives.

LNAPL can become problematic even at the site characterization stage. It is notoriously difficult to directly detect in-situ, often requiring consultants to resort to indirect and inferred means of assessment such as comparison of soil and groundwater data to saturation and solubility limits. Fortunately, there are now direct-sensing tools to detect and characterize LNAPLs in-situ, thereby greatly facilitating the timely, accurate and detailed delineation of plumes.

Once LNAPL is confirmed to be present at a site, assuming it does not otherwise pose a risk to human health or the environment (usually via vapour intrusion or migration pathways), there are several new Risk Management Measures available to facilitate risk assessment-based closures. Mobile LNAPL plumes can be immobilized using novel forms of in-situ stabilization techniques. Bulk LNAPL can also be adsorbed and degraded using the latest generation of in-situ remedial amendments. These technologies are often faster acting and less expensive than traditional LNAPL treatment technologies such as excavation and multiphase extraction.

Details on each of these innovative LNAPL characterization immobilization and destruction technologies will be presented and discussed. Real world case studies and cost considerations will also be presented. Overall, this presentation will illustrate new methods to facilitate risk assessment-based closures, obtain regulatory approvals and allow the redevelopment of sites containing LNAPL in a more sustainable, timely and cost-effective manner.

Kevin French

Kevin French is Vice President of Vertex Environmental and has over 35 years of experience and expertise in environmental engineering, specializing in site characterization and remediation. He has been involved in the design and implementation of remediation programs across Canada involving permeable reactive barriers, adsorptive and stabilization technologies, in-situ chemical oxidation and reduction, aerobic and anaerobic biodegradation, etc. in soil, groundwater and fractured bedrock for a variety of contaminants, including PFAS, petroleum hydrocarbons, chlorinated solvents, heavy metals, soil sterilants and other compounds. Kevin holds a Bachelors’ degree in Engineering from the University of Waterloo and is a Professional Engineer and a Qualified Person in Ontario.