



Monitoring and Enhancing Natural Source Zone Depletion at a Petroleum Pipeline Release Site in Abbotsford, BC

Matt Rousseau and Arden Wabisca, GHD

In June 2020, a crude oil release occurred at the Trans Mountain Sumas Station in Abbotsford, British Columbia (Site). Approximately 190 cubic metres of crude oil were released as a result of the Incident. Beginning in 2020, GHD implemented and completed various remedial programs that included: soil sampling, air monitoring, monitoring well installation, groundwater sampling, natural source zone depletion (NSZD) monitoring, groundwater monitoring, and a comprehensive excavation program. While a significant remedial excavation was completed, complications surrounding maintaining the geotechnical integrity of the Site's complex pipeline infrastructure resulted in residual impacts to soil and groundwater and the presence of residual light non-aqueous phase liquids (LNAPL) at the Site. A program has been implemented to monitor and enhance NSZD rates at the Site to address residual impacts.

In recent years, the significance and importance of petroleum NAPL NSZD and its potential for more sustainable remediation and management of petroleum-contaminated sites have become increasingly apparent, and the assessment of NSZD is becoming a more standard consideration in petroleum NAPL conceptual site model development and site management decision-making. While numerous (and growing) instances of NSZD case studies at LNAPL sites exist in the literature, there are few published demonstrations of small footprint efforts to enhance NSZD. GHD utilized multiple NSZD measurement techniques to monitor NSZD rates at the Site, both before and after the installation of an impermeable barrier (cap) above the LNAPL body and after implementing a remediation system intended to enhance NSZD activity.

This presentation focuses on remediation efforts conducted to date, the current state of residual contamination on Site, methodology of NSZD, GHD's NSZD monitoring program at the Site, implementation and operation of the eNSZD system, challenges encountered during quantification of NSZD rates, and next steps, such as those outlined below:

- Brief overview of remediation actions completed to date and the current state of residual impacts and LNAPL at the Site.
- Confirmation of NSZD and the estimation of rates a combination of soil gas gradients, biogenic heat, and CO₂ efflux techniques.
- Monitoring events conducted during the initial cleanup of the pipeline release, before and after the installation of an impermeable cap, and prior to and following the installation of the enhanced NSZD (eNSZD) system.
- The challenges of establishing what the average pre-enhancement baseline NSZD rates are in a capped environment where the 'chimney effect' is evident and pronounced.
- Impact on NSZD rates of the eNSZD) system based on low-temperature thermal/heating with the aim to increase treatment zone temperatures by 10-15° C in hopes of enhancing NSZD activity by a factor of 2-3.

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Arden Wabisca

Arden is a project manager responsible for providing environmental consulting and spill response services across Western Canada for Class I railroad clients, oil and gas clients, insurance clients, and many others. She has managed, coordinated, and responded to numerous environmental emergencies including train derailments, pipeline spills, port and marine incidents, highway trucking incidents, chemical fires, and residential heating oil releases in Western Canada and across North America. Arden has a strong technical background in environmental remediation projects, including managing sites with light non-aqueous phase liquid management (LNAPL) using natural source zone depletion (NSZD). She also has significant experience with designing and managing environmental sampling programs, environmental site assessments, unmanned aerial vehicle (UAV) surveys, containing/confinement of spills, stream rehabilitation, maintaining field equipment, air monitoring programs, risk assessment and toxicology, hydrogeology, and contaminant fate and transport.

Matt Rousseau

Matt is a Senior Environmental Engineer and global NAPL Technical Director with GHD based in Canada. Matt has been consulting for almost 25 years, with a focus on sites contaminated with petroleum products and other NAPLs during most of that time. His work focuses on the design of site investigation and monitoring programs and the development of NAPL remediation and management strategies with a focus on sustainable risk-based solutions. Matt regularly provides training related to NAPL site management and has helped develop related technical guidance documents in the U.S. (Interstate Technology & Regulatory Council LNAPLs and LNAPL Update Teams, ASTM E3361), Canada (Federal Contaminated Sites Action Plan, Department of National Defence), and Australia (CRC CARE Technical Report 46 and associated online masterclass). Matt is a licensed professional engineer (Ontario) and has B.A.Sc. (1997) and M.A.Sc. (2000) degrees in Environmental Engineering from the University of Windsor in Windsor, Ontario, Canada.