

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

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Aerial view of northern portion of Site



Introduction

- June 12, 2020, a pipe fitting failed at a pipeline pump station near Abbotsford, BC
- ~ 150-190 cubic metres of crude oil was released to the environment
- The pipeline operator notified the Canada Energy Regulator (CER), local Indigenous groups, nearby municipalities, and other relevant provincial and federal regulators of the Incident

Aerial view of southern portion of Site

Site Setting

- Within the Sumas Prairie, in the eastern portion of the City of Abbotsford
- Surrounding land is predominantly flat and the closest surface water body is 700 meters to the west (Sumas River)



Site Setting

- Area A Sumas Pump Station in the north portion of the property
- Area B Operator owned agricultural field to the south
- Culvert Located between Area A (inlet) and Area B (outlet)



Aerial view of pump station with approximate incident location

Response and Remediation Work



Excavation Complexities



Excavation and product recovery around existing infrastructure

Working within complex geotechnical and facility restraints

Dissolved Phase Groundwater Trends





- Seasonal groundwater elevation fluctuations create a dynamic flow system
- Various remediation efforts at the Site have influenced the behaviour of residual impacts and have reduced the extent of dissolved phase migration
 - PetroFix®
 - Biosparge system
- Since the installation of the biosparge system, dissolved phase concentrations have been steadily decreasing

Residual Groundwater Impacts



Monitoring Well (690 – 10,000 µg/L benzene)
Monitoring Well (400 – 690 µg/L benzene)

- Monitoring Weil (400 000 pg/L benzen
- Monitoring Well (5- 400 µg/L benzene)

Monitoring Well (< 5 µg/L benzene)

LNAPL Characteristics

LNAPL Distribution

The inferred extent of remaining LNAPL is primarily in the centre of Area A (up to 5 m BGS) where excavation was not practicable and extends east along the dissolved phase groundwater plume, upgradient of the migration control.

LNAPL Mobility/Recoverability

Since March 2021, transmissivity testing results have not exceeded de minimis criteria. Since May 2021 (recovery end point), measurable LNAPL observations have decreased. LNAPL is largely present as immobile/unrecoverable residual.

The fraction of the LNAPL body that might be recoverable is negligible and the activity would have no effect on residual LNAPL composition.

LNAPL Body Stability

Site monitoring has demonstrated that the LNAPL body is stable (i.e., not expanding) and is actively degrading.

Natural Attenuation

Results from NSZD testing conducted to date (CO2 trap testing and temperature profiling) indicate that LNAPL is actively degrading at significant rates via NSZD processes.



NSZD measurement options



1. Surficial CO₂ Efflux (dynamic closed chamber, CO₂ Trap) 2. Biogenic heat 3. Vertical soil gas gradients (CO_2 , O_2 , CH_4)

4. Compositional change

NSZD Measurement Approach



Baseline NSZD Monitoring



Baseline NSZD Monitoring



Enhancing NSZD



Next Steps

Additional work is being conducted to continue remediating and monitoring remaining impacts associated with the crude oil released at the Site.



#02

#03

Enhancing Natural Source Zone Depletion

Continue to monitor natural attenuation (NSZD) of LNAPL in Source Area during ongoing enhancement efforts.

Enhancing Natural Source Zone Depletion

Continue to operate and adjust thermal remediation systems to enhance NSZD

Migration Control

Continue to mitigate migration of dissolved phase groundwater impacts towards the Site boundary and consider reducing the number of sparging wells.



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