Remediation in a Unique and Challenging Location:

Creating a Remedial Solution for a Benzene Release in a 15+ Stakeholder Right-of-Way

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Project Details

Strategic Technical Consultant

- Benzene contamination assessment over 2 ha
- Contaminant assessment and delineation
- First Nation's engagement support
- Remediation design
- Site-specific air quality monitoring program
- Contracting and tendering
- Overseeing engineered remediation
- Devising long-term system/contaminant management



Project Details



Benzene impact scale: 900,000 μg/L in gw, 30,000 μg/g in soil

- 85 pipelines
- Valve stations, watermains, roadside ditches and tributary
- 15+ stakeholders: multiple oil and gas companies, compressed air providers and the municipality
- Right and title holder: First Nation
- Source unknown



Investigation

- Stringent ground breaking restrictions
 - Previous investigations via hydrovac & did not assess shallow soils
- Slot trenching clearances via hydrovac to ~3 m bgs
- Multiple shallow test pits
- ~130 boreholes
- ~100 monitoring wells
- Relocate tributary 35 metres north





Project Details

Remedial Objectives

- Protection of ditch water and down-gradient soil and groundwater from benzene impacts
- Mitigation of benzene exposure to onsite human and ecological surface receptors
- Reduction of benzene concentrations in soil and groundwater













Investigation

- Electromagnetic (EM) surveys to minimize hydroexcavation and utility daylighting exploration (multiVIEW)
- Real-time contaminant identification using Membrane Interface Probe (MIP) technology and 3D data modeling (Vertex Environmental)







Remedial Option Evaluation

- In-depth review of remedial method options
 - Biological, chemical, physical, control, etc.
- EH&S: truck/pedestrian traffic, security, vapour control, dust mitigation, dewatering & waste management
- Collaboration with stakeholders and the Ministry of Environment
- Selection of the RAP





Remedial Action Plan

- Groundwater depression/extraction trenches creating radially inward gradients inducing flow towards the impacted zones while minimizing the outward movement of impacts
- Trenches supplemented with groundwater extraction wells (to address areas within pipeline corridors where trenches were not practical) that were tied to a permanent Groundwater Extraction and Treatment System (GETS)
 - Granular activated carbon (GAC)







GETS Details

- Treats 20,000 LPD (at steady state)
- ~5,000,000 L treated since installation (June, 2017)
- Influent concentrations of 10,000 to 20,000 µg/L treated to non-detect

Remedial Boundary







GW Extraction Well

GETS

Remedial Action Plan

- Development of RAP-specific air quality criteria for benzene identified through risk assessment
 - Needed approval from First Nation stakeholders and the Ministry
- Implementation included sheetpiling and slide-rails plus concurrent vapour control





Remedial Action Plan

- Excavation of surficial soil from within the impacted areas
- Surface barrier geosynthetic clay liner installed
 - Barrier between the remaining impacted soil and groundwater, and the surficial soils and ditch water





Results

- Reduction in impacted groundwater
 - 15,100 to 1.82 μg/L (2015 vs 2018)
 - 181,000 µg/L to non-detect (2014 vs 2018)

- Variability in concentrations, although overall decline in benzene concentrations
 - Asymptotic concentrations anticipated





Post Implementation Monitoring

 Ongoing monitoring of ditch water, air quality, soil and groundwater

 Ongoing sharing of results and consultation with stakeholders and the First Nation











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Yukon