Remediation of a Substation Fuel Spill Using Microbes and Activated Carbon

A BioNorth Solutions Case Study

Client Problem: At a substation within the Kenora District, Ontario, a fuel spill occurred that resulted in the impacted soil being excavated. Residual soil contamination remained on site, southeast and north of the building, that could not be excavated. After an assessment of the groundwater quality was complete, it was determined that Microbiate™ SG would be an ideal solution to clean the residual contaminated soil prior to backfilling.

Treatment: An engineering consulting firm first applied Microbiate™ SG to the contaminated soil in July 2022. Activated carbon was also added to the site as a permeable reactive barrier (PRB) to intercept and treat contamination via absorption. The groundwater of nine monitoring wells around the site were sampled for viable microbial cell counts, BTEX concentrations, and F1-F4 hydrocarbon concentrations in August 2022. Samples were taken again in November 2022, where it was noted that biofilm formation has occurred within the treatment site, indicating that bacteria can grow and thrive in the water column. In May 2023, samples demonstrated six of the nine monitoring wells were below acceptable concentration levels of BTEX and F1-F4 hydrocarbons. Per consultant recommendation, final groundwater samples were taken in June 2024, revealing eight monitoring wells are decontaminated.

Table 1: Monitoring Well 8 (MW8) - BTEX and F1-4 Hydrocarbons Analysis

Analyte	MECP Guidelines (µg/L)	04-2022	08-2022	11-2022	05-2023	06-2024
Benzene	**0.5**	<0.5	1.1	5.95	5.54	<0.5
Tolulene	**24**	>0.5	6.34	397	290	34.4
Ethylbenzene	**2.4**	<0.5	1.36	15.4	11.3	0.6
Xylenes	**72**	1.5	5.31	50.2	37.1	1.2
F1 (C6-10)	**420**	118	553	866	408	32
F2 (C10-C16)	**150**	280	539	1030	520	<100
F3 (C16-C34)	**500**	<250	<250	<250	<250	<250
F4 (C34-C50)	**500**	<250	<250	<250	<250	<250

The BTEX and F1-F4 hydrocarbon concentrations were analyzed in groundwater samples taken from nine monitoring wells around the contaminated site. Monitoring well 8 (MW8) is of particular interest due to the higher levels of contamination. By June 2024, MW8 still had high levels of toluene, whereas the other eight wells were decontaminated. Despite this, an overall decreasing trend is observed in the concentration of toluene, which is expected to continue with the microbes and the carbon PRB in place long-term.

Results: The results of the June 2024 samples demonstrated that eight of the nine wells had acceptable BTEX and F1-F4 hydrocarbon concentrations according to the Ontario MECP – Soil, Groundwater and Sediment Standards (2011) and could be deemed fully decontaminated. Monitoring well MW8, however, shows results that are trending towards a decrease that could favour acceptable levels in the future. This may be due to the source well, MW8, being upgradient of the carbon, and therefore contaminants in this well are not being absorbed.

Learn more about our success stories here.
Contact us:
info@bionorthsolutions.com
807-344-1601

Conclusion: The groundwater quality improved in eight of the nine monitoring wells due to the application of Microbiate™ SG, bringing the BTEX and/or F1-F4 hydrocarbon concentrations to acceptable levels. The addition of activated carbon to the treatment site proved to be valuable in promoting biofilm formation, allowing for the microbes to thrive and remediate contamination.

Due to the continued improvement in groundwater quality downgradient of the residual soil impacts and the PRB at the site, it is recommended to discontinue the monitoring program and consider the site decontaminated. In conclusion, Microbiate™ SG is an effective method of in situ remediation, as reflected in the improvement of groundwater quality at the substation.