

Bioremediation - Eliminating the Entire Spectrum of Hydrocarbons Through a One-time Application

Myles Ethier, Long Chain Reclaim Ltd.

F4 Environmental Inc. has developed the bioremediation technology to transform hydrocarbon contaminants into water and a minute amount of carbon dioxide through a 100% environmentally sustainable and safe process.

Our technology can change the world's perception of oil contamination and waste generated from related industries by providing an environmentally sustainable bioremediation solution for not only the shorter- chain hydrocarbons, the BTEX, our bioremediation technology can remediate the long-chain hydrocarbons also.

Long Chain Reclaim Ltd. utilizes, a non-invasive, on site, in-situ drilling implementation soil treatment, and on-site ex-situ soil treatment processes where the soil is excavated for remediation using an Earth Cleaning Machine.

Bio-Reclaim is our highly purified, naturally occurring bacteria (*Pseudomonas*) that mineralize the petroleum hydrocarbons and toxic organics into water and a minute amount of carbon dioxide; their main nutrition is hydrocarbons. Bio-surf is the delivery agent for Bio-Reclaim. It is a surfactant that decreases the surface tension, allowing delivery of our microbes into soil contamination pockets. Bio-surf is environmentally friendly, and bio-degrades rapidly. Both Bio Reclaim & Bio Surf are pathogen free, DNA tested, listed on the DSL (Domestic Substance Listing), TSCA approved, NCP approved, and approved for shipment worldwide.

Case Study 1

An old Fuel Station that is a now defunct fueling station with all associated support structures, involved in the fueling and maintenance of trucks and/or equipment have been removed. The plume of contaminated soil was estimated to be 8,000 cubic meters located in seven different subsites.

From the datasets collected by the Environmental Consultant, it was demonstrated that hydrocarbons from all four fractions were detected in differing concentrations throughout the site, in addition to BTEX, and miscellaneous aromatic compounds of definite human origin (i.e., trichlorobenzene isomers).

Instead of a traditional "dig and dump" remediation of the 8,000m³, a time and cost-effective in-situ solution with drilling and injection of the Bio-Reclaim program was selected. The injection of Bio-Reclaim was done in July 2021.

Sampling conducted in September 2021 identified a significant reduction in the level of Petroleum Hydrocarbons. 5 of the 7 sub-sites was within Tier 1 thresholds and the

8,000m³ was reduced to an estimated 525m³. Confirmative sampling of the two remaining subsites is planned for July 2022.

Case Study 2

Petroleum Hydrocarbons was detected in two areas both in soil and groundwater at a retail fuel station and commercial site in Olds, Alberta.

Traditional excavation was not considered in the two areas due to the proximity to the building, the presence of several buried utilities and the operation of a drive-through window. Area 1 was treated in July 2018 with 800 L of inoculated Bio ReClaim™ product mixed with a water solution using direct push drilling equipment.

Area 2 was treated in October 2018 with 1750 L of solution using the same methods. Traditional excavation was partially completed in this area, however, buried utilities and schedule constraints limited the full removal of all PHC impacts from the site.

The soil from Area 1 was re-sampled approximately 11 months after treatment and the treatment was considered successful in reducing the elevated ethylbenzene, xylenes and PHC F2 concentrations in Area 1 to within guideline criteria.

The soil from Area 2 was re-sampled approximately 17 months after treatment and the treatment was considered successful in reducing the elevated levels of PHC F2 to F4.

Case Study 3

Speak on Rainbow Lake spill by Pace Oil & Gas in 2009 where LCR successfully treated 14 hectares.

Myles Ethier

Myles Ethier has over 10 years in leadership roles and business development in the hospitality, real estate, and environmental assessment/remediation/risk management sectors. His experience includes proposal, project, and site management, as well as technical support for a range of sites. Myles is the Vice President of Long Chain Reclaim and current responsibilities include portfolio management, client liaison, and stakeholder engagement.