

# Long Chain Reclaim Ltd.

Long Chain



Presented by: Myles Ethier







# What do we do?

CERTIFIED  
Aboriginal Business

Canadian Council for  
Aboriginal Business 

- We offer in-situ and ex-situ remediation services
- We have an industry proven microbial formula **Bio-Reclaim™** which is highly effective in breaking down and degrading hydrocarbons
- We can access remote areas that are inaccessible or not easily accessible to other technologies
- Our solutions are more cost-effective than other remediation services
- Our processes help keep greenhouse gases low and reduce liabilities
- Help to create a better future and a sustainable environment



# History of LCR



- The founding members of **F4 Environmental Inc.** decided to utilize their expertise to reduce the damage caused by the waste from oil and gas exploration.
- They started doing field trials in 2009 and incorporated in 2012. The company's mandate was to use biologics and chemistry to create a product which would break down contaminants for more efficient removal.
- Through extensive research and development successful products were created allowing **F4** to assist in the clean up of contaminants in more than 80 projects throughout Alberta and Saskatchewan, Canada.
- Due to the success of **F4's** products, in early 2020 **Long Chain Reclaim Ltd. (LCR)** was formed to act as the operations arm of **F4** to scale-up.





# What is Bioremediation?

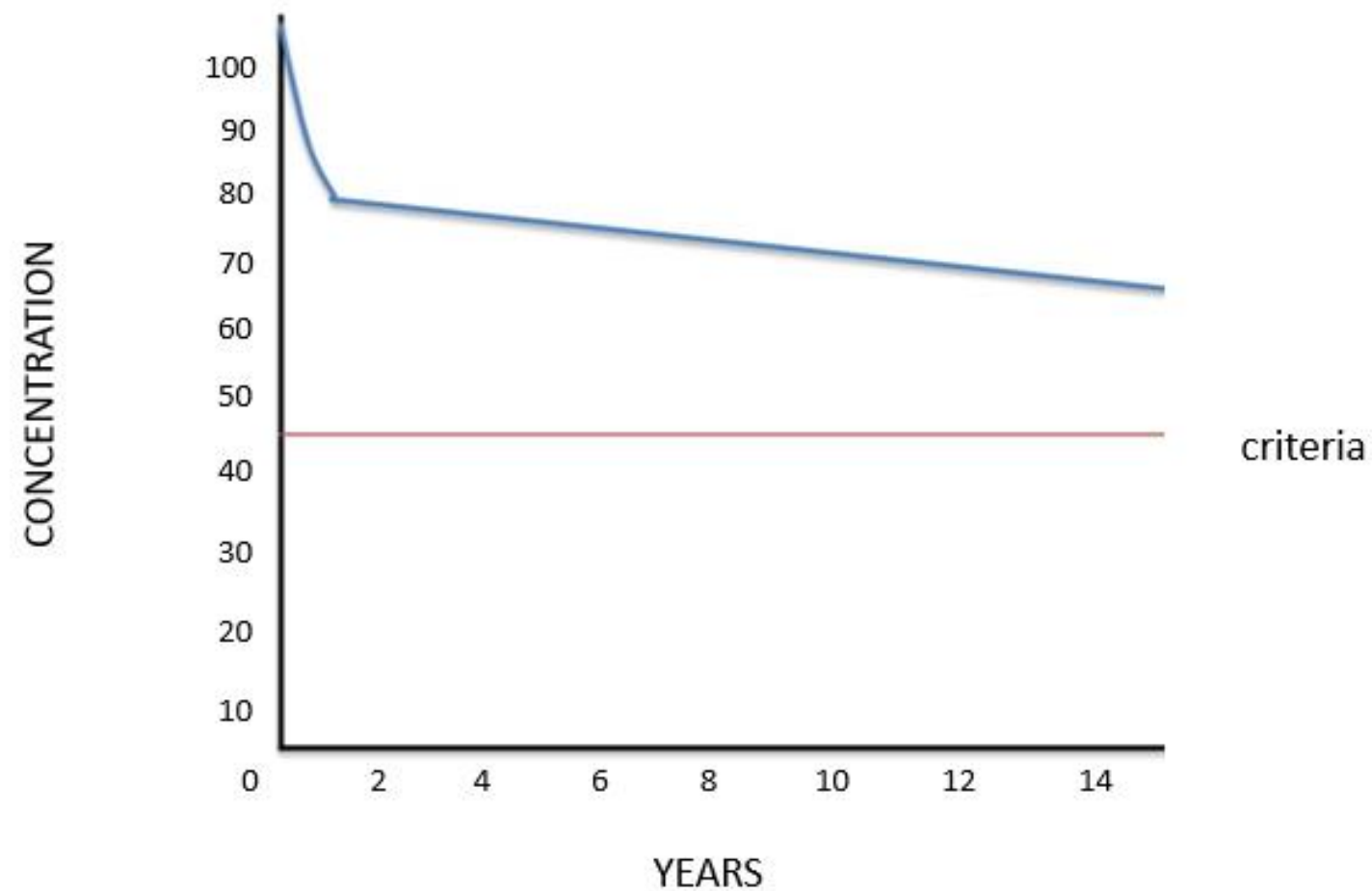
The use of either naturally occurring or deliberately introduced micro-organisms or other forms of life to consume, breakdown, or otherwise remove environmental pollutants in order to clean up a contaminated site.

Our microbial package, **Bio-Reclaim™**, degrades petroleum hydrocarbons (PHCs).





# Typical Hockey Stick Curve





- Create not emulate
- In the past, the bacteria used were ***Bacillus*** strains
- **Bio-Reclaim™** uses ***Pseudomonas* spp.** bacteria
  - These bacteria have an affinity for mineral oil and mineral grease. **Their nutrient source is hydrocarbons**
  - ***Pseudomonas* spp.** cannot sporulate, and we utilize non-pathogenic species
- Side products from process is limited to minute quantities of CO<sub>2</sub>, water, and microbial biomass

## Pre Treatment



Soil and ground water polluted with hydrocarbons heavily impacting health of flora and fauna

## Post Treatment



Soil and ground water revitalized allowing flora and fauna to prosper

# Our Technology





# Bio-Surf™ - our proprietary surfactant

## **What are surfactants?**

Compounds that reduce the surface tension between two fluids, allowing them to mix or emulsify.

## **Why do we use a surfactant?**

PHCs are hydrophobic; adding surfactant allows PHCs to mix with water and improve bioaccessibility for Bio-Reclaim™ microbes.

## **Bio-Surf™**

Our surfactant is biodegradable, environmentally safe, and microbially compatible, in addition to providing ideal water/hydrocarbon miscibility







## Microbe Facts

- Each cell is expected to reproduce 7-12 times every 20 minutes over the lifespan of the culture
- Hydrocarbons are their carbon source & the culture will continue to degrade until all nutrients are depleted
- Nature provides 1-5 million per gram while **Bio-Reclaim™** provides trillions of microbes per gram

# Our Technology





# Features & Benefits Overview

- Proven chemical/biological system
- **Bio-Surf™** is a completely biodegradable, water-based formula
- Total hydrocarbon degradation
- Minimal amount of ground disturbance
- No adverse effects to the environment
- Can be applied in restricted areas
- **Bio-Reclaim™** is pathogen free and non-GMO
- Products are NCP and TSCA approved allowing them to be shipped and used worldwide
- **Highly cost effective** in comparison to other historical methods such as excavating, transporting, and 'storing' contaminated materials
- Eliminates potential future liabilities from landfill containment failure





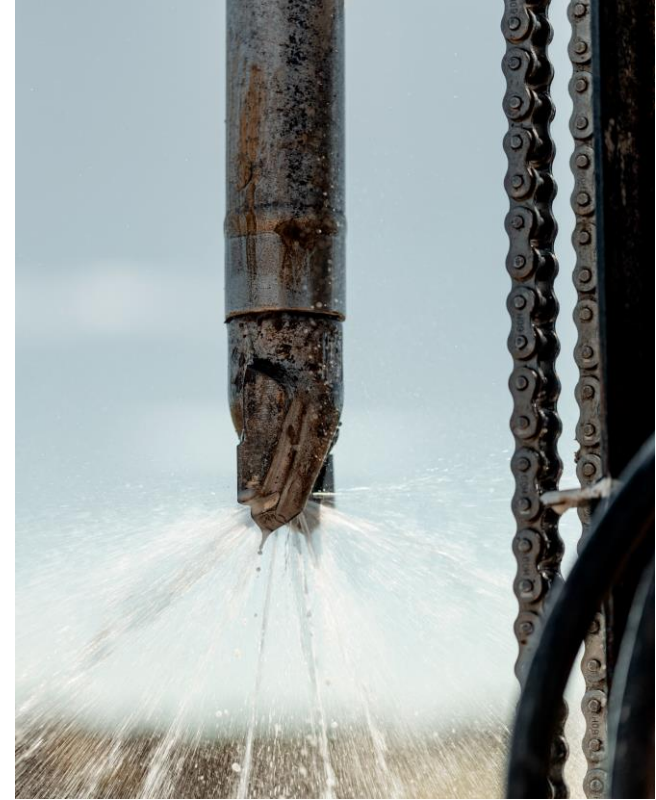
# Applications

- Hydrocarbon spills & historical contamination (land & water)
- Oil & Gas Industry
  - Inert cuttings / drilling waste
  - Soil
  - Sumps
- Brownfields
  - Bulk Fuel Stations
  - Underground Storage Tanks
  - Retail
- Abandoned Property
  - Commercial
  - Industrial
  - Private / residential





# LCR *in situ* Services



Remediation of an area with minimal ground disturbance with LCR's *in situ* drill





# Services



Remediation of an area using a combination of excavators and LCR's Earth Cleaning Machine (ECM)



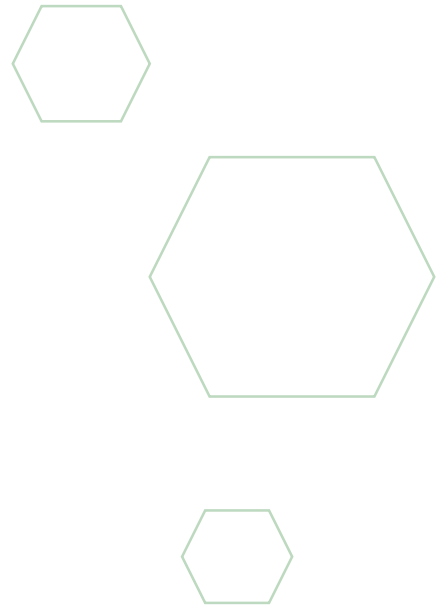


# Contaminants Degraded by Bio-Reclaim™



**Aliphatic Hydrocarbons**  
**BTEX**  
**Chloride**  
**Chlorinated Solvents**  
**Citronellol**  
**Creosote**  
**Crude oils/sludge**  
**Dichlorobenzene**

**Dichlorotoluene**  
**Fluorene**  
**Isoprenoids**  
**Limonene**  
**Methylene**  
**Methyl Ethyl**  
**Naphthalene**





# Case Examples



# *In situ* Example Case – Red Deer Automotive Dealership

- An automobile dealership on the site of a former fueling station was found to have petroleum hydrocarbon contamination resulting from the original underground storage tanks
- Primary fractions of concern included F1 – F2 hydrocarbons, including benzene
- Geoprobe® 7822DT was used to direct-push 26 injection points to create a bioremediation array







*In situ* Example Case –  
Red Deer Automotive Dealership 2019



# *In situ* Example Case - Wood Buffalo Site 2021

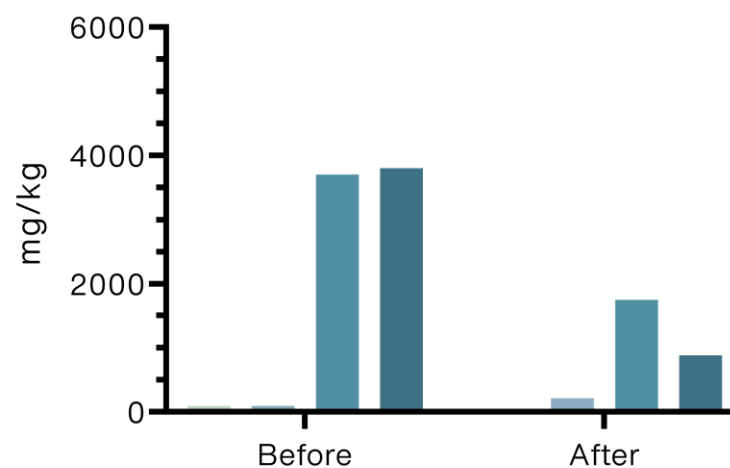
- Former refueling/maintenance depot, soil contaminated with BTEX, F1-F4, and associated compounds
  - e.g., trichlorobenzene isomers, naphthalene, anthracene
- Treated via *in situ* vertical drill injection, depths ranging from 1 to 6 meters below ground surface



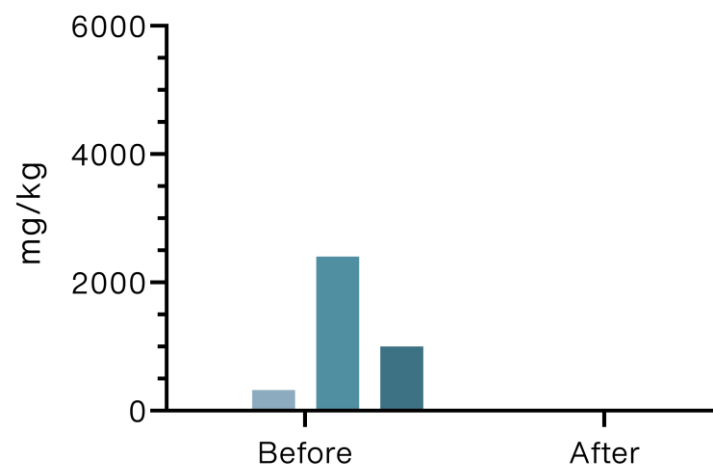




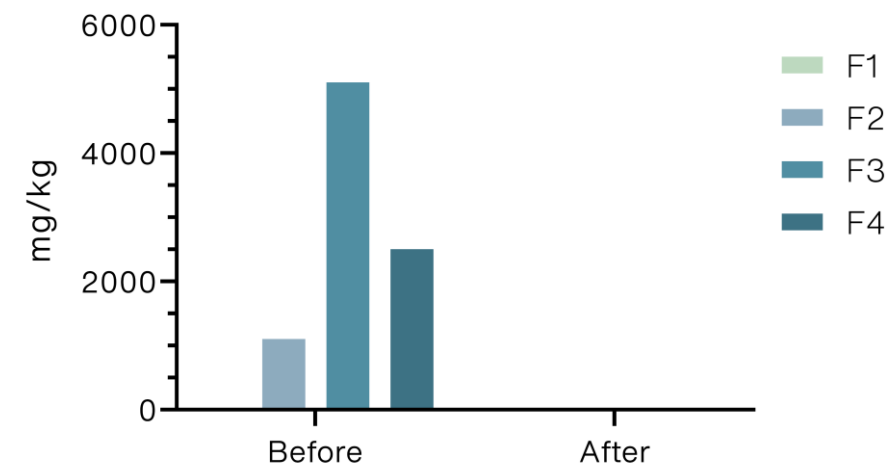
Wood Buffalo Site A;  
June - September, 2021



Wood Buffalo Site B;  
June - September, 2021



2021 Wood Buffalo Site C;  
June - September, 2021



*In situ* Example Case - Wood Buffalo Site  
2021



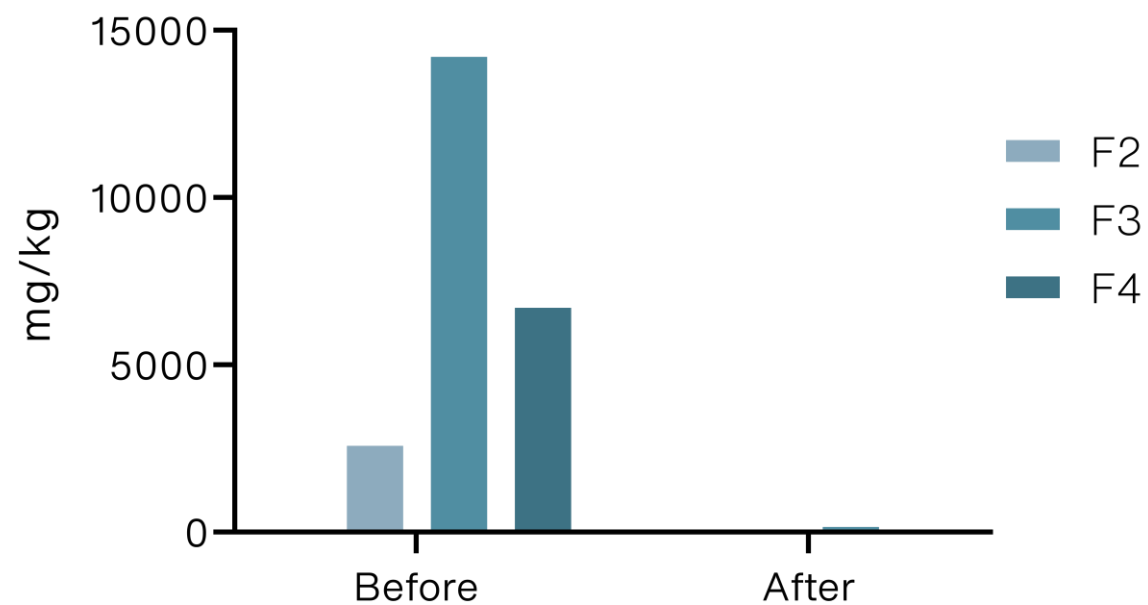
# Broadcasting Example Case - Flare Stack Release 2018

- Critical failure of flare stack in Sturgeon County released PHCs over neighboring agricultural lot
- Abundant F2 – F4 contamination
- Sensitive case; agricultural land use has stricter remediation requirements compared to industrial in provincial guidelines





## Sturgeon County Flare Stack Release Summer 2018 - 2019



Broadcasting Example Case - Flare Stack Release  
2018





June 27,  
2018



October 17,  
2019

Broadcasting Example Case - Flare Stack Release  
2018





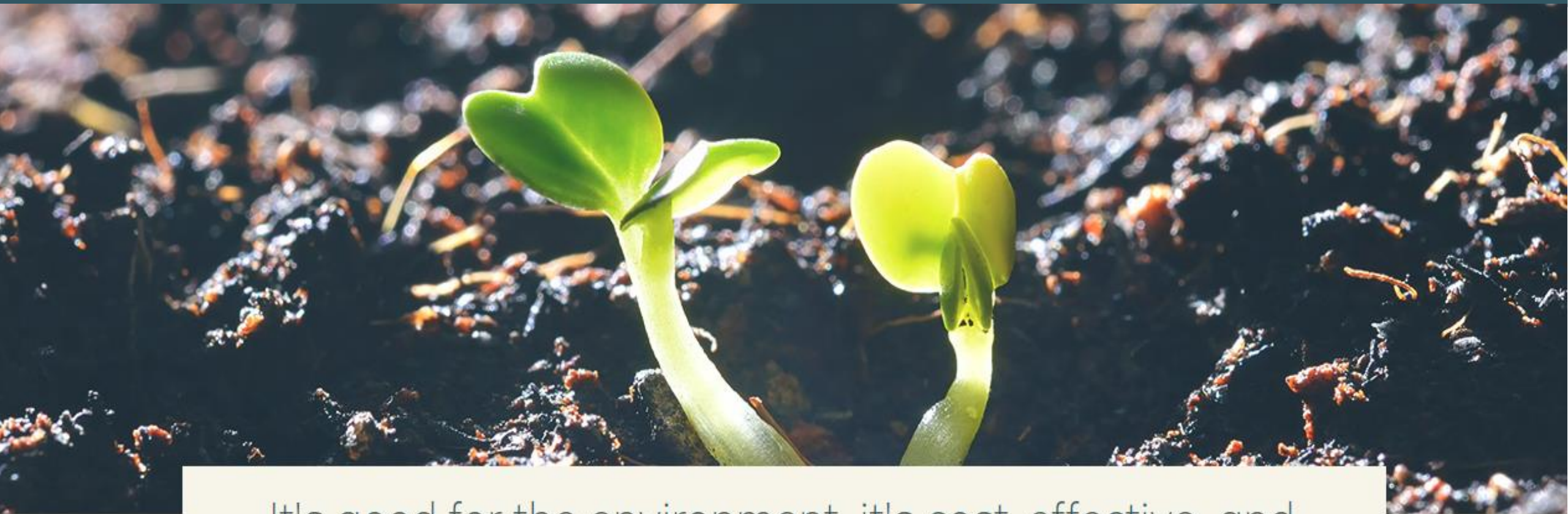
# Broadcasting Example Case - Flare Stack Release 2018

*“Final F4 Environmental confirmatory results from the off-site release area returned analytical results within applicable guidelines for all parameters analyzed. The application of the **F4 Environmental bioremediation strategy removed BTEX and PHC F1 to F4 concentrations from the off-site release area to concentrations below criteria.**”*

- Consultant Summary







It's good for the environment, it's cost-effective, and it's a revolutionary technology.



# LCR Contact Information



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