

PRESERVING OUR WATER, OUR ENVIRONMENT, OUR FUTURE



JACOR LLC. EXTENDS ITS RESEARCH
INTO FRESH WATER REMEDIATION IN
PARTNERSHIP WITH CANADIAN
EXPERIMENTAL LAKES AREA FRESH
WATER PROJECT



Urgent Need for Scientific Study of Oil Spills in Oceanic and Fresh Water



- Baseline data often lacking on spill response, cleanup, and effects assessment
- Need to assess aquatic system productivity
- Effects on ecological processes, trophic interactions not well understood
- Resiliency of aquatic ecosystem
- Efficacy of remediation
- Relationships need to be established among waterborne concentrations of hydrocarbons, tissue concentrations, genomic responses and toxic effects

Urgent Needs for Scientific Study of Oil Spills in Fresh Water

- Improved remediation of damaged freshwater habitats after oil spills.
- Efficacy of conventional and new oil spill remediation options in freshwater ecosystems.
- Strategies that do not effect shoreline health and stability but still remove oil effectively are ecologically and socially desirable

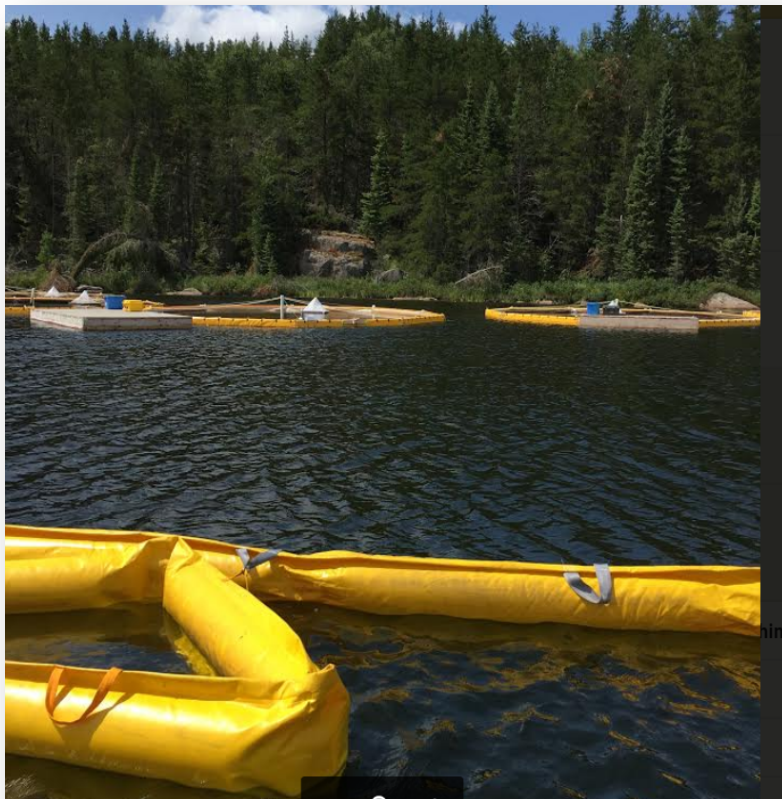


How best to cleanup oil that becomes deposited on shore after an oil spill?

What is **ELA 50**?

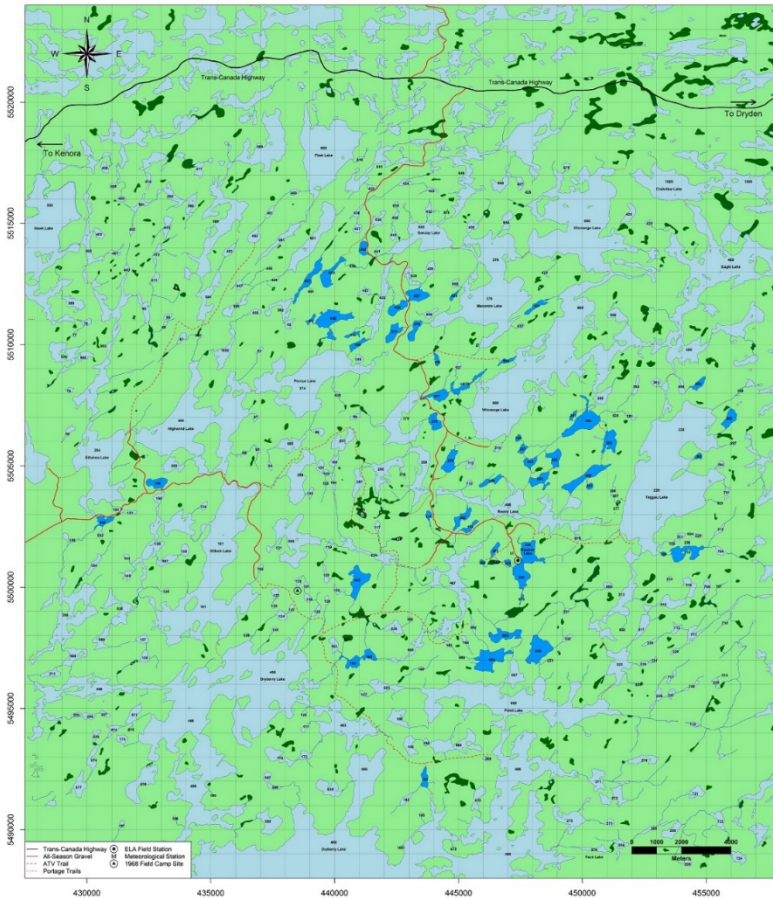
IISD Experimental Lakes Area

INTERNATIONAL INSTITUTE FOR SUSTAINABLE
DEVELOPMENT (IISD) - EXPERIMENTAL LAKES AREA (ELA)
CANADIAN FRESH WATER PROTECTION PROJECT



ELA 5

IISD Experimental Lakes Area

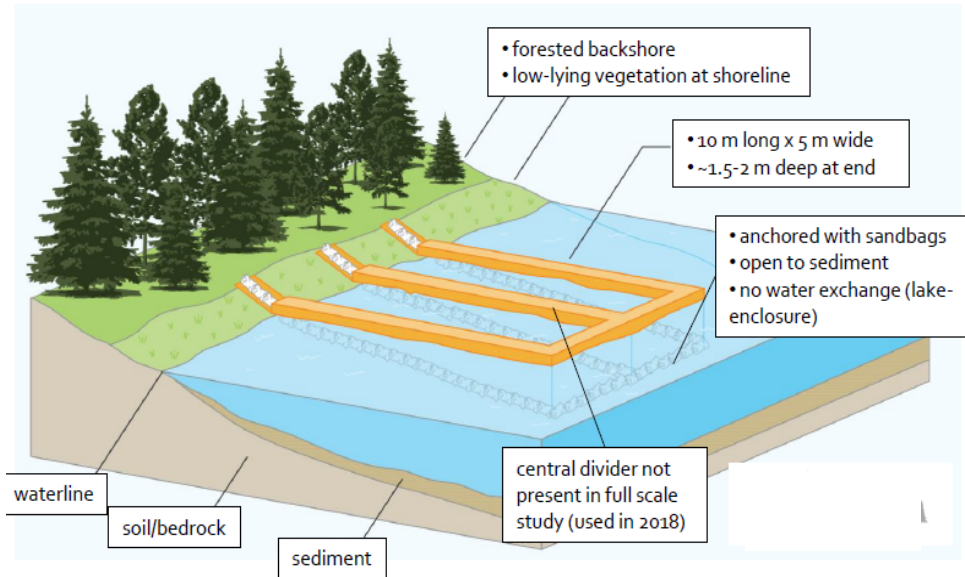


The IISD-Experimental Lakes Region

Research Facilities



Open Lake Experimental Facilities



Large enclosures allow balance of ecological relevance relative to a whole-lake and allow control additions and movement of applied oil.

Shoreline enclosures test different non-invasive methods to remediate shoreline affected by oil spill



Aerial view

What is EcoBioClean®?

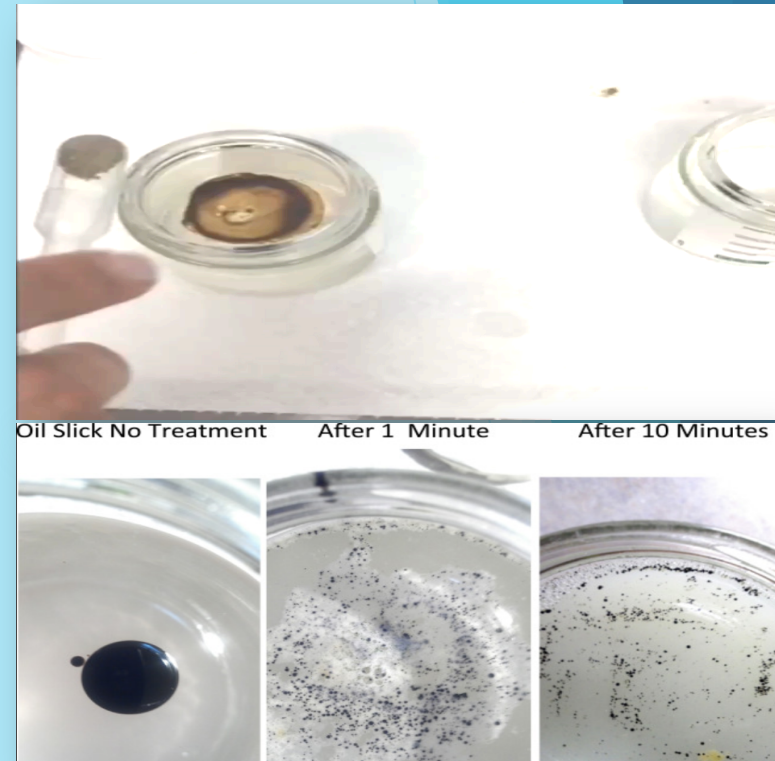
EcoBioClean® is an eco-friendly green chemistry technology in a novel formula of microorganisms, enzymes, catalysts and nutritive components designed for oil bioremediation

EcoBioClean® rapidly, safely and visibly eliminates dangerous hydrocarbon contaminants in crude oil, catalyzing their conversion into molecules used as energy by microorganisms and other species up the food chain.

EcoBioClean® is a hydrocarbon remediation and conversion system which works within minutes to alter an oil slick into punctate particles resembling ground black pepper.

EcoBioClean® technology minimizes the need for chemical reaction solvents, eliminating toxic hydrocarbons in crude oil via biocatalyst reverse-engineering.

EcoBioClean® is a major advance over standard chemical dispersant usage and other mechanical clean up measures.





Sustainable method for degrading hydrocarbons

Janet Angel

JACOR LLC private company, 1000 Brown St., Suite 208, Wauconda, IL 60084, United States



ARTICLE INFO

Keywords:
Bioremediation
Hydrocarbons
Crude oil
Microbes
Dispersants
Sustainable

ABSTRACT

Conventional treatment of crude oil contamination in open water of chemical dispersants, churning, burning, and soaking has limited effect and in itself is potentially hazardous. We sought to provide an advanced bio-based green and sustainable chemistry solution that is safe and effective. A novel formula (EcoBioClean®) of proprietary microorganisms, enzymes, catalysts and nutritive components was constituted as a non-toxic rapid-impact remediation, reverse-engineering and bioconversion system. The formula transformed a crude oil slick within minutes into punctate particles resembling ground black pepper. A 21-day post treatment analysis using GC-MS confirmed the North Alaskan Slope Crude had become a nutrient-rich broth containing valuable elements such as choline, fatty acids, Carotene, Vitamin C, Iron, Vitamin E, Copper, Magnesium, Manganese, Phosphorus, Potassium, Zinc, Vitamin D and more than 15 amino acids. Upon contact EcoBioClean® initiates the conversion of crude oil into bio-available nutrient rich marine food. The result is a benefit to marine life, the ecosystem, the environment, and the economy.

1. Introduction

Each year over 1.3 million gallons (493,000 l) of crude oil are spilled or leak into US waterways with millions more globally (Thompson, 2010). In 2010 alone BP spilled over 200 million gallons (757.8 million liters) of crude oil into the Gulf devastating greater than 68,000 square miles and spending over \$60 billion US dollars in related clean-up costs (NY Times Associated Press, 2012). Despite the large sums invested, the problems associated with traditional site clean-up are far from solved. Moderately effective conventional technologies such as combustion to burn off the top layers of oil, spinners that churn or mobilize, soakers or booms, and chemical dispersants that reduce the particle size of crude, have been unable to restore many sites to the standards set by environmental regulations for protection of public health and the environment. Adding chemical dispersants to a chemical disaster is not only counter-productive, it creates an “out of sight – out of mind” state-of-affairs by allowing dispersants to force these toxins to the ocean floor or to deposit toxin-soaked clean-up materials into landfills. Several components of hydrocarbons also belong to the family of carcinogens and neurotoxic organic pollutants threatening public health.

No matter how many preventative measures may be available there will continue to be crude oil and petro-chemical spills due to accidents on drilling rigs, human failure, degradation of underground piping, containment materials, erosion, natural disasters, shifting ocean floors, or terrorist attacks. Driven by stringent “green” laws

including natural resource preservation the Environmental Protection Agency (EPA) in the United States has asked giant oil producers to employ safer measures for crude oil spill cleanup (EPA.gov Recent Impact Report-Protecting American Families and Workers from Hazardous Chemicals). Other countries employ similar regulatory guidelines to protect the environment.

Accordingly, we have employed nontoxic rapid reduction technology, EcoBioClean®, which biochemically transitions toxic hydrocarbons into beneficial molecules such as choline, fatty acids, Carotene, Vitamin C, Iron, Vitamin E, Copper, Magnesium, Manganese, Phosphorus, Potassium, Zinc, Vitamin D and more than 15 amino acids rapidly consumed by aquatic and ground life. Some of these elements exist naturally as original molecules locked into animal, vegetable, mineral particles that comprise fossil fuel, others are part of the EcoBioClean® proprietary formula that stimulates rapid consumption by indigenous as well as complementary microbial, fungal, and algae species. Like human body systems, marine ecosystems maintain biochemical health through metabolic processes that insure vital nutrient balance and the elimination of toxins. EcoBioClean® was developed based on the concept that these processes can be extrinsically engineered to reconstitute the ability of a hydrocarbon-damaged ecosystem to recover homeostasis after a major oil spill. This green biotechnology supports the marine “immune” response and its ability to effectively abate disruption to its biochemical balance, acting to clean, preserve and nourish the environment rather than to poison it. In this way the technology we describe here provides a solution to currently

E mail address: janetangel@ecobioclean.com.

<https://doi.org/10.1016/j.scp.2018.08.004>

Received 20 May 2018; Received in revised form 15 August 2018; Accepted 17 August 2018

Available online 28 August 2018

2352-5541/© 2018 The Author. Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Seminal paper on the action of EcoBioClean® on crude oil

First Phase Collaboration

- ❑ Study cleanup and recovery using weathered crude oil.



- ❑ Determine effectiveness of minimally invasive secondary remediation in different shoreline types
- ❑ Determine the timeline for ecosystem recovery

Modeling the Effects of EcoBioClean® in Lake and Wetland Oil Spill Remediation



Model shown avoids disturbance of sensitive shoreline habitats



EcoBioClean® inventor Janet Angel PhD works with IISD-ELA Chief Scientist Vince Palace PhD.

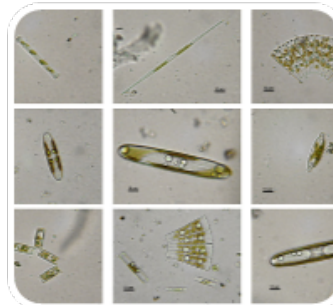
How secondary bioremediation effects of EcoBioClean[®] will be Measured

Measurements of oil effects on enclosed shoreline ecosystems within 6 project themes

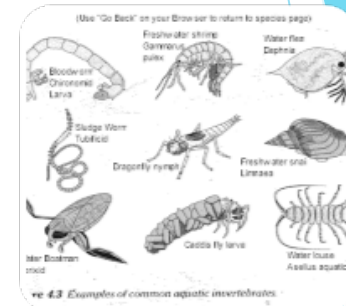
Chemistry



Microbes



Inverts



Fish



Frogs



Vegetation



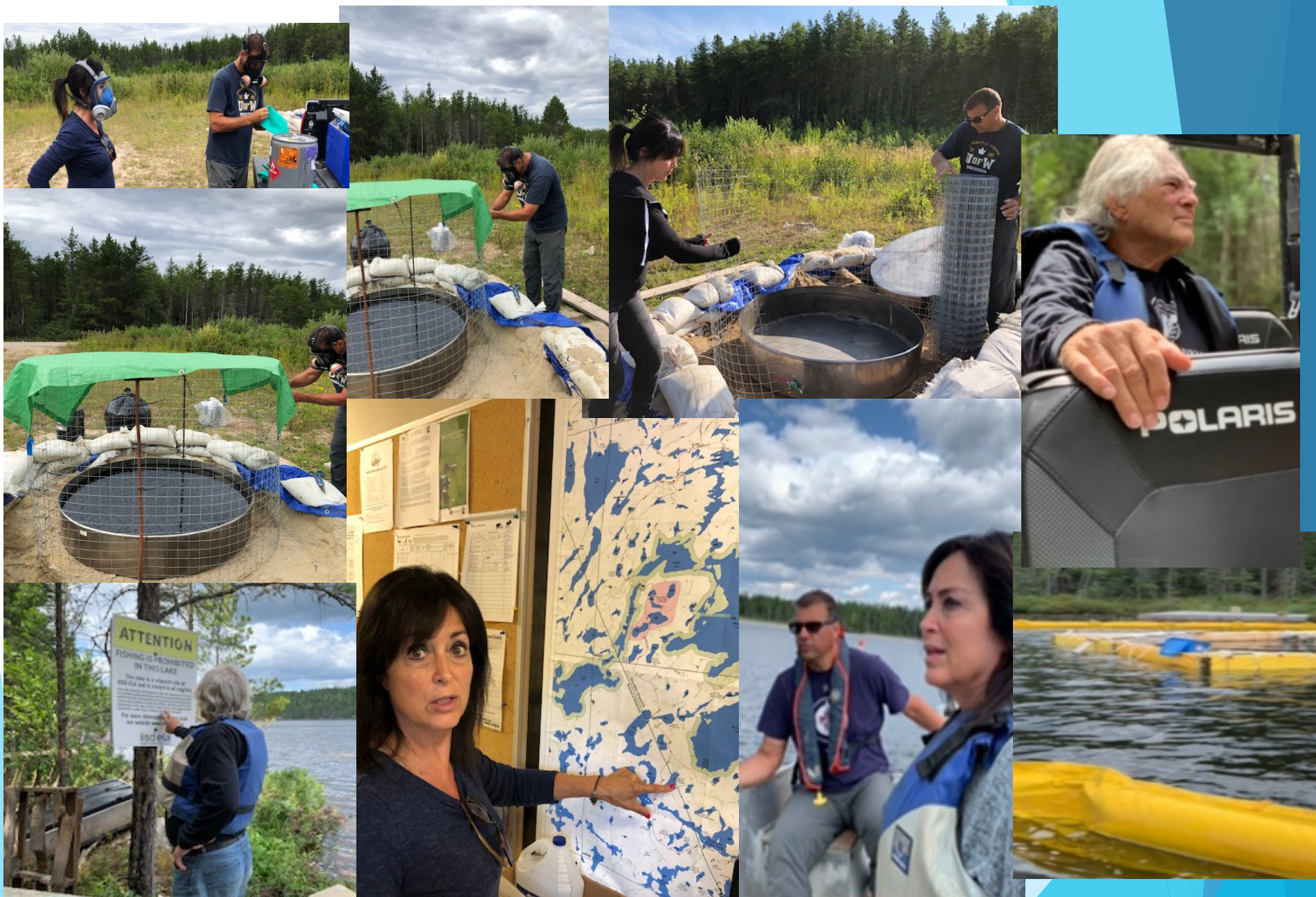
Benefits of the Project



Water Canada (2016)

Demonstrates confidence across industry, government, academia and society in general that response decisions will result in the least impact and best recovery outcomes.

Reduced spill cleanup costs. Biological treatment is 5-6X less costly.



JACOR LLC and ELA IISD Partners in Discovery