Oil Spill Research in Canada: Multi-Partner Research Initiative – Phase II

Kenneth Lee

2023 ITAC Meeting
National Oceanography Centre (NOC)
Southampton, UK
24-26 October 2023

MPRI Phase I (2017-2022 Fisheries and Oceans Canada)

GOAL: To *establish an integrated, global research network* to advance oil spill research in Canada and enhance Canada's level of preparedness and response capability.

FOCUS: To advance scientific knowledge and science-based decision making in oil spill response operations by *improving our knowledge of current and emerging oil spill response and remediation strategies*

MPRI Phase II (2022-2027 Natural Resources Canada)

Expanded scope of research: *offshore (offshore platform and marine environment) and onshore (federally regulated pipeline oil spill scenarios)*

- *$30.37M over 5 years*

MPRI Aims to Expand the Spill Response Community

TRAINING THE NEXT GENERATION: Including students and other types of Highly-Qualified Personnel (HQP) in research projects

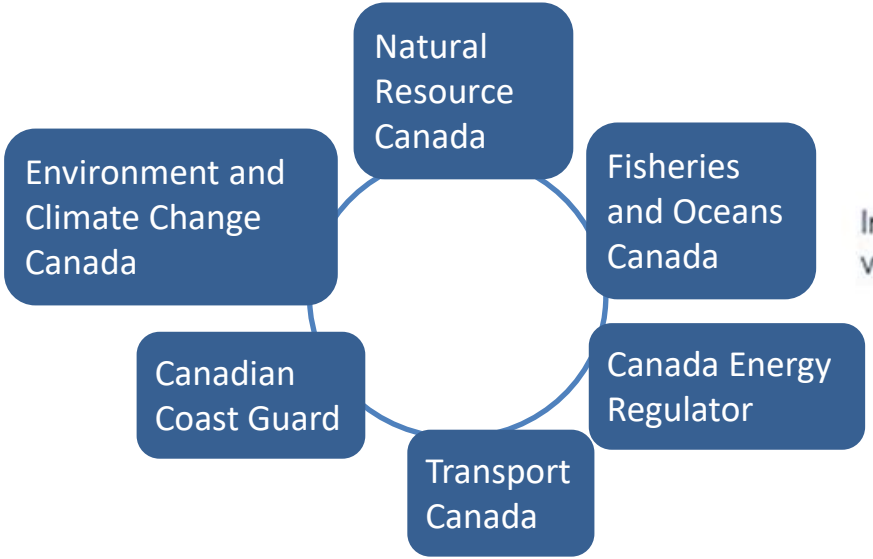
NETWORKING / INTERNATIONAL PARTERSHIPS: Fostering interactions between academic and industry researchers with key international organizations in oil spill research

ENGAGEMENT: Involving clients and stakeholders from the Federal Government, Provinces and Territories, Indigenous Groups, the Oil and Gas Industry, regulators, spill response organizations, and fisheries non-governmental organizations (NGOs)

MPRI Phase II – Program Governance

DG Level Steering Committee

(Chair – DG CanmetENERGY Devon)



In collaboration with...

Advisory Committee

(Chair – Dr. Ken Lee)

MPRI II Research Network Themes/Topic areas

Offshore and onshore

- **Fate, Behaviour, and Transport of Oil in the Environment**
- **Alternative Response Measures**
- **Oil detection and monitoring**
- **Biological Effects of Oil**
- **Physical Recovery of Oil**
- **Response Planning and Decision-making**

Identification and Prioritization are based on recommendations from:

- Royal Society of Canada Report on oil spill research
- Transport Canada's review on Canada's Ship-Source Oil Spill Preparedness and Response Regime
- USA's Interagency Coordinating Committee on Oil Pollution Research (ICCOPR) 2022-2027 R&D Plan
- Feedback following MPRI's 2022 International Oil Spill Science Conference (IOSSC 2022)
- National Academy of Science's recent Oil in the Sea IV report

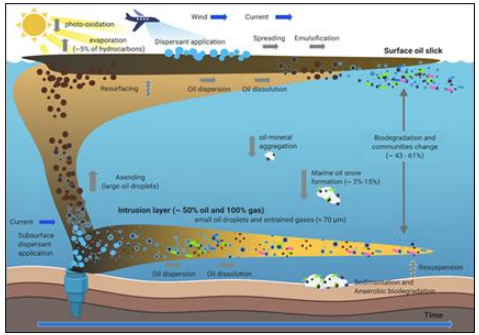
Fate, Behaviour and Transport of Oil in the Environment

- Assessment of natural attenuation potential and the development of bioremediation strategies in Arctic and freshwater environments, including the conduct of controlled field studies and spill-of-opportunity studies.
- Development of experimental processes to investigate the formation and stability of oil emulsions under real-world conditions, and the influence of emulsified oil to the effectiveness of various spill response options.
- Fate, behaviour, and transport of oil, including diluted bitumen, spilled in freshwater or estuarine waters, including modelling, formation, and ecological significance of oil-particle aggregates

Fate, Behaviour and Transport of Oil in the Environment

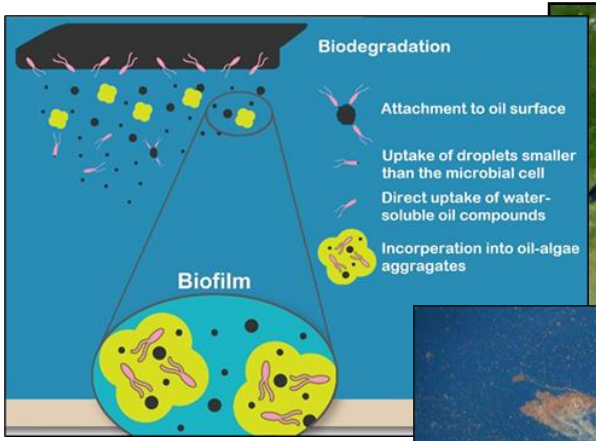
- Studies on factors that influence oil droplet size, plume behaviour and slick formation following surface and subsurface releases in freshwater and marine environments.

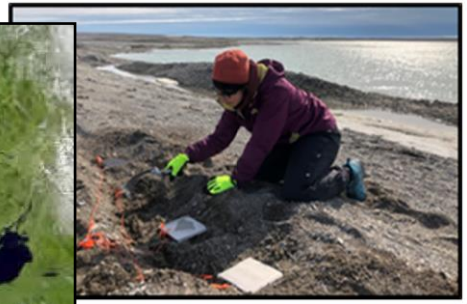
- Modelling of oil spill behaviour following from accidental subsurface pipeline releases and deepwater blowouts (including subsea dispersant injection [SSDI])



Oil-Particle Interactions in Our Waters of the North (OPI-OWN) - *Lake Superior State University*

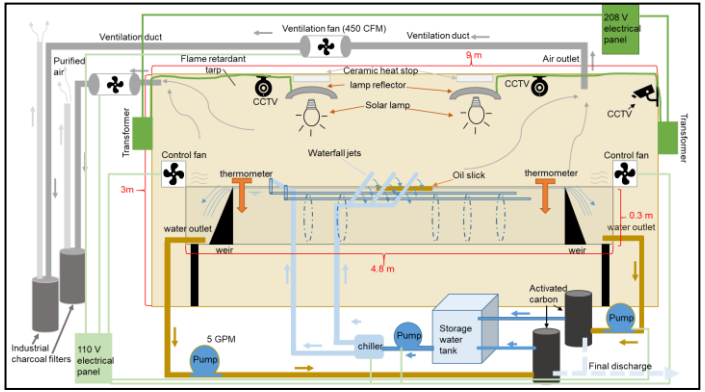
Development of Bioremediation and Natural Attenuation Strategies for Arctic Marine Beaches Contaminated with Hydrocarbons - *McGill University*





Consortium for Evaluation of Mechanisms of Oil Fate and Transport and Response Actions (CEMOR): Emulsion, Oil Particle Aggregates, Underwater Release, and Three-Dimensional Modeling - *New Jersey Institute of Technology*

Enhanced Understanding of the Fate and Behaviour of Oil for Improving Spill Response in Canadian Estuarine Shorelines - *Concordia University*



Alternative Response Measures: In-Situ Burning (ISB) and Spill Treating Agents (STAs)

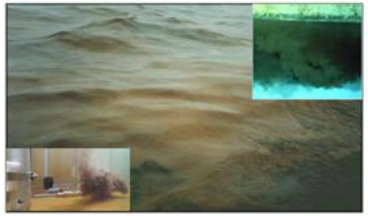
- Development of smoke suppressants to support ISB operations
- Enhanced understanding of the fate and behaviour of oil on shoreline environments
- Development of next generation STAs.

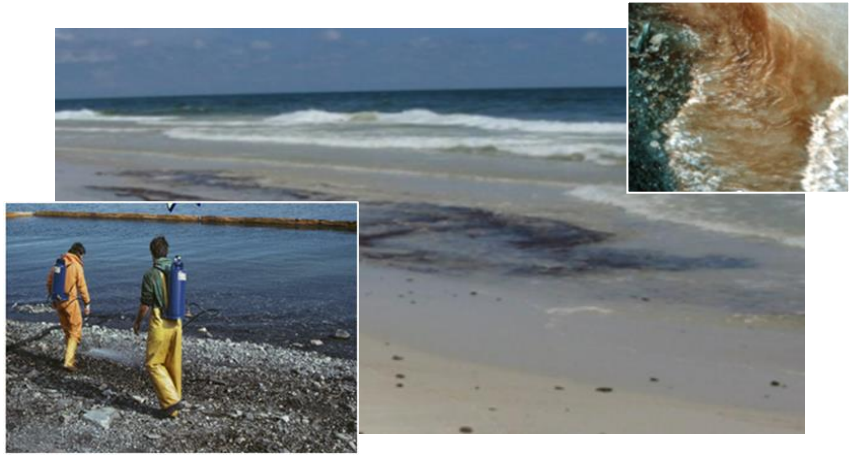
Development of Smoke Suppressants for In-Situ Burning of Oil Spilled in Inland Waters - *Western University*

Development of Ferrocene-Based Systems for Smoke Reduction, Enhanced Burn Efficiency and Training in their Use - *Lakeland College*

Development and Evaluation of Next-Generation Dispersants for Application in Canadian Freshwater and Estuarine Environments - *Memorial University*

Development and Evaluation of Improved Low-toxicity Surface Washing Agents for Shoreline Spill Response - *Concordia University*



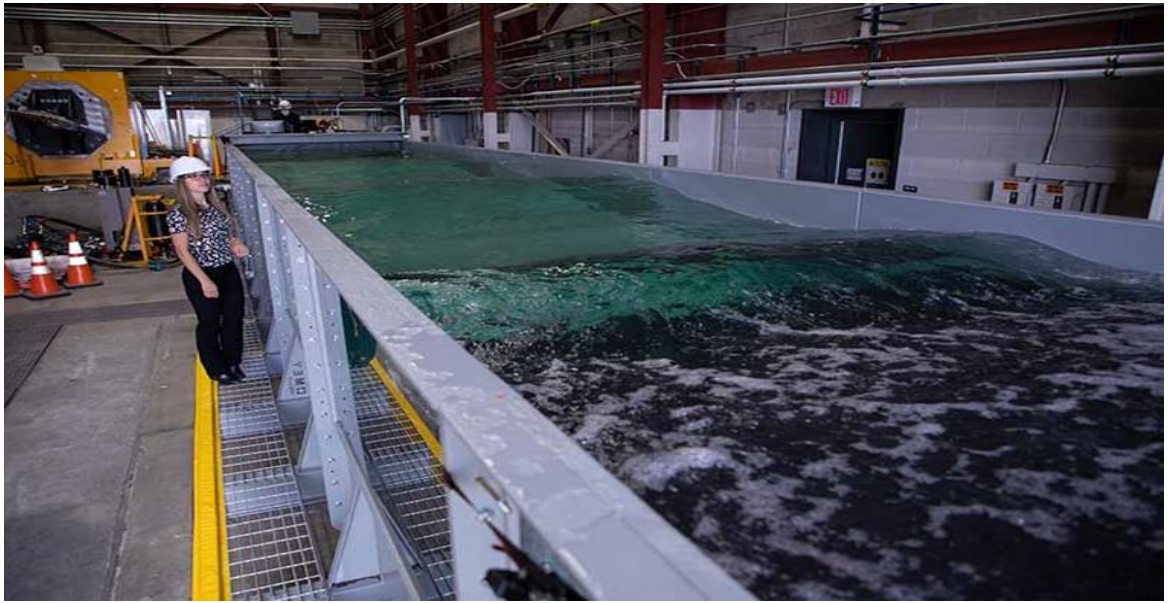


Oil Detection and Monitoring

- Advancing unmanned surface and subsurface vehicles for oil spill response monitoring
- Evaluation and application of in situ oil sensors
- Improvement of the Special Monitoring of Applied Response Technologies (SMART) protocol.
- Detection, quantification, and remediation of sunken oil

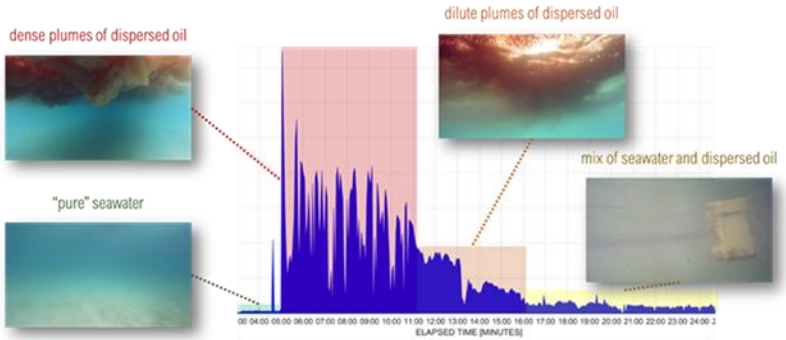
Monitoring and Detection of Oil in Our Waters of the North (MONDE-OWN) -

Lake Superior State University



Advancing the Monitoring, Response, and Assessment of Oil Spills with an Integrated System of Autonomous Marine Vehicles, In-Situ Oil Sensors, and Predictive Models - *Dalhousie University*

Unmanned Surface Vehicle with Modular Design and Multi-Level Sensing Capacity for Oil Spill Detection, Monitoring, and Sampling - *Texas A&M University*



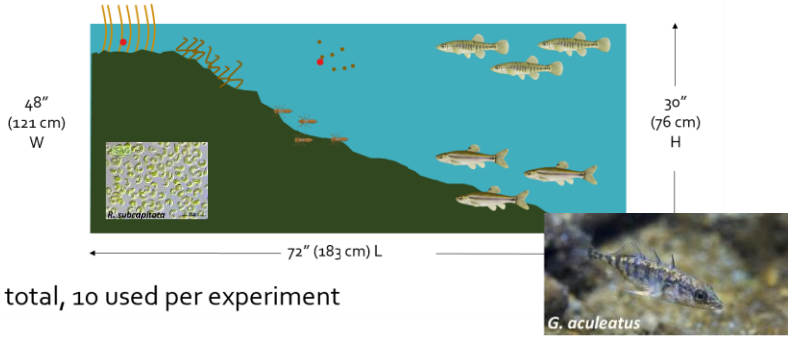
Biological Effects of Oil

- Development of predictive risk assessment models that integrate data on oil fate, behaviour and toxicity for oil spill preparedness, response operations and damage assessments.
- Refinement of ecosystem models to predict oil fate, behaviour, transport, and effects (including effects of response options).
- Research that investigates the long-term ecological effects of oil spills in marine and freshwaters at the population and community levels.

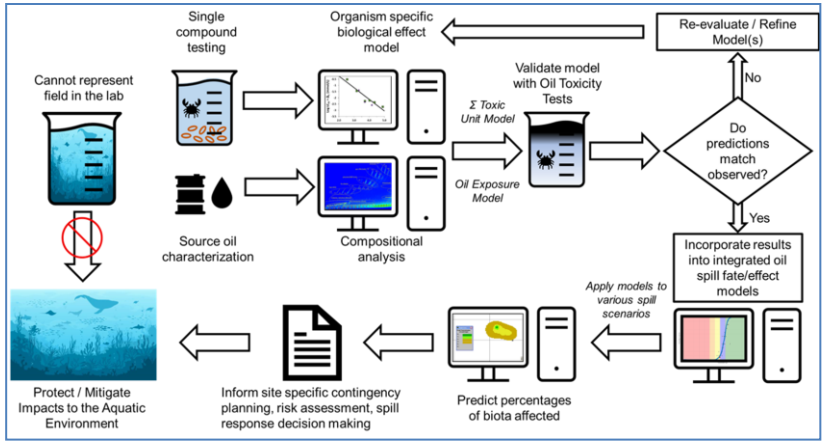
Biological Responses to Oil in Our Waters of the North (BIO-OWN) - *US Geological Survey*

Generating Inputs for the Calibration of Oil Spill Effects Models: Filling Data Gaps for Marine and Freshwater Species of Importance and Application of Oil Spill Biomonitoring System - *Huntsman Marine Science Centre*

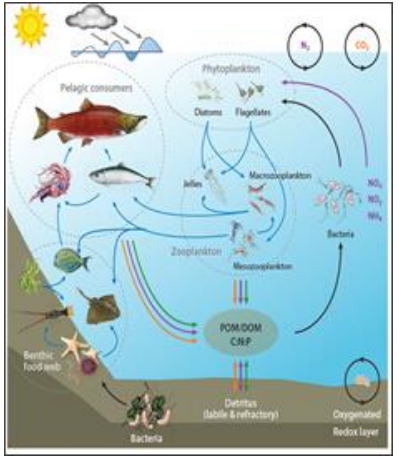
Outdoor Mesocosms to be constructed at Lake Superior State University in collaboration with Algoma University

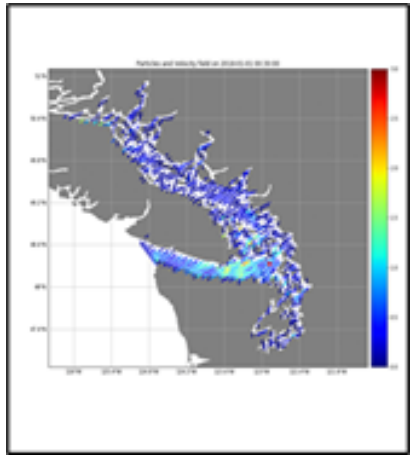


21 total, 10 used per experiment

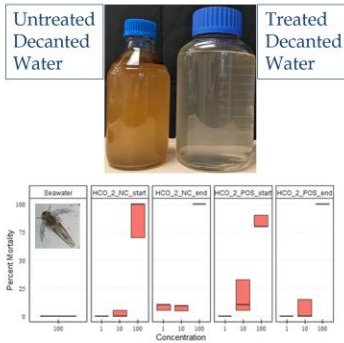


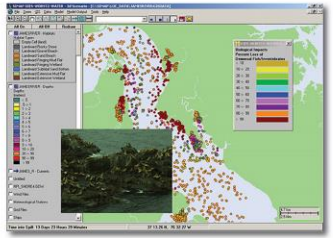
- Refining *Atlantis* to Explore Potential Unexpected Contaminant Risks to Evaluate the Resilience of the Salish Sea - University of British Columbia
- Fate and Effects of Diluted Bitumen in Salmon-Bearing Rivers on Canada's West Coast - Queen's University

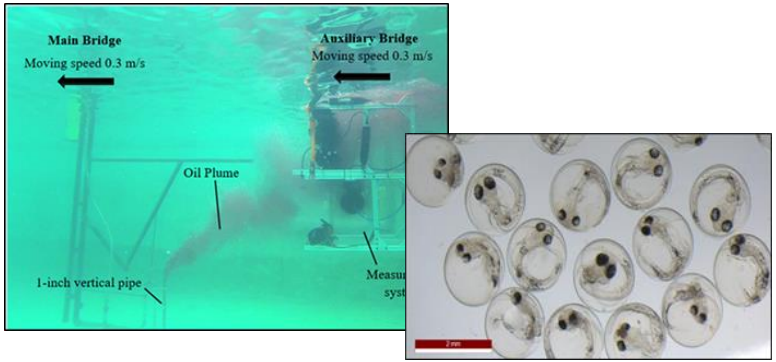




- Release of Oily Decanted Water: Spatial Distribution and Toxicity of the Resulting Plume - *University of Toronto*
- Determination of Critical Targeted Lipid Body Burden (CTLBB) for Marine and Freshwater Species under Different Environmental Modifying Factors and Realistic Exposure Scenarios to Inform Indigenous- or Community-Led Spill Response Management - *Heiltsuk Tribal Council*





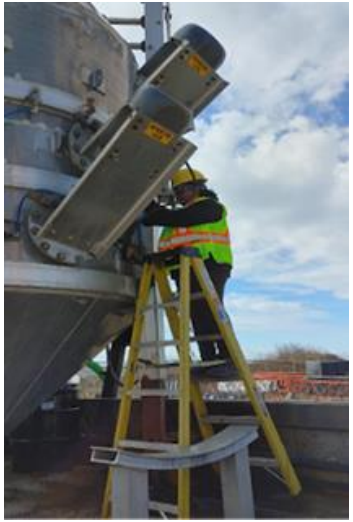


Physical Recovery of Oil

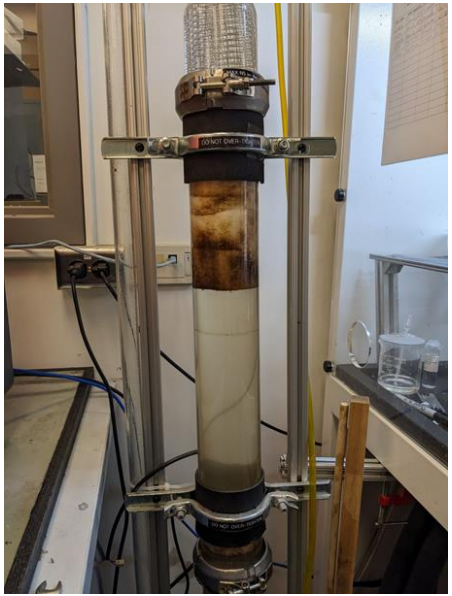
- Advancing oil adsorbant/absorbant, and solidifier technologies.
- Advances in boom and skimmer deployments in open water and rivers.
- Development and evaluation of next generation decanting technologies for on-site oil-water separation and disposal.

Enhancing the Recovery of Oil from Sea: Semi-Permeable Curtains and Enhancing the Flowability of Oil and Emulsions for Skimming - *LGM Ltd.*

Development and Evaluation of Next-Generation Environmentally Friendly Decanting Technologies for On-Site Oil/Water Separation and Disposal - *University of Northern British Columbia*

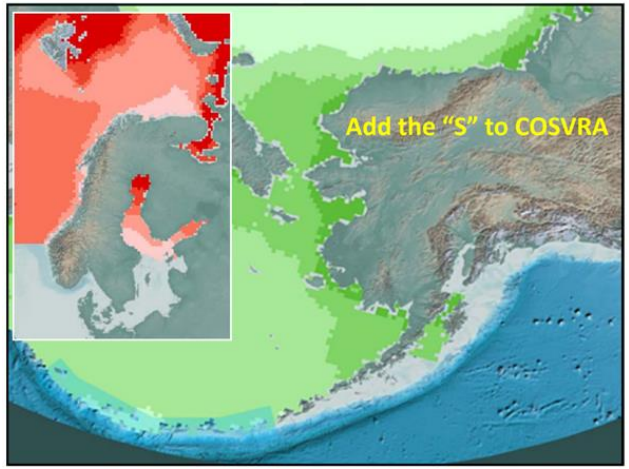
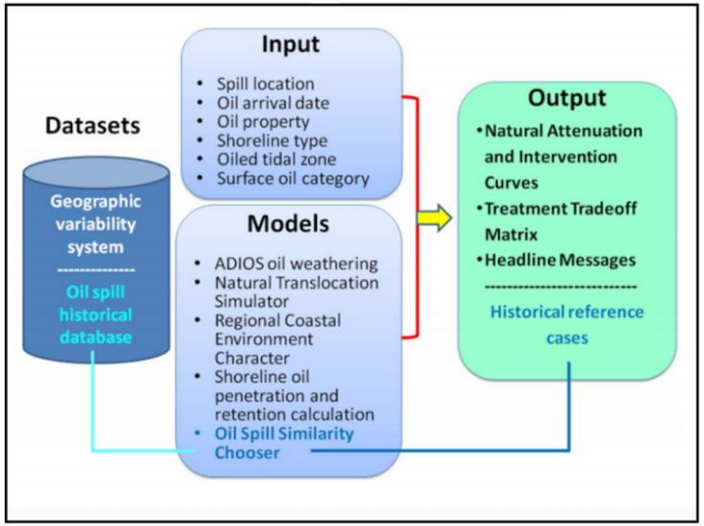
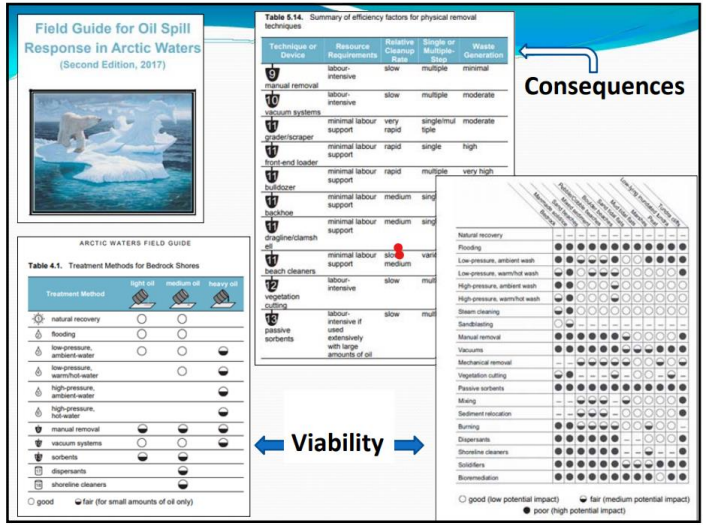


Advancing Porous Materials with High Efficiency and Reusability Towards Practical Decanted Water Treatment - *University of Toronto*



Planning and Decision Making

Data accessibility and mobilization tools (including Artificial Intelligence applications) to advance precision and accuracy of predictive models and decision making by oil spill responders



Shoreline-Circumpolar Oil Spill Response Viability Analysis (S-COSRVA) Decision Support Tool - *International Institute for Sustainable Development (Experimental Lakes Area)*