

Advancing Oil Spill Research under Canada's Ocean Protection Plan

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Introduction

Canada's coastline is the longest in the world. It is the home of diverse marine life and provides economic benefits to thousands of Canadians. As two-in-five Canadians describe themselves as "very" or somewhat worried" about the safety of transporting petroleum in Canadian waters, the Government of Canada recently announced the Oceans Protection Plan (OPP), a comprehensive, transformative \$1.5B strategy to build a world-leading marine safety system to protect Canada's marine ecosystems, while enabling inclusive economic growth. To achieve its goals, initiatives under OPP will include:

- Leading-edge research on oil spill clean-up technologies;
- Enhanced oil spill preparedness and response through area-based planning;
- A greater role for Indigenous groups in the marine safety regime (training for prevention and response operations and shared decision making); and
- Partnerships and continuous improvements to our understanding of how oil spills behave, the impacts they may have, and how to mitigate them; to enhance ecological recovery after an incident.

The analysis of numerous case studies under a recent Royal Society of Canada Expert Panel report, "The Behaviour and Environmental Impacts of Crude Oil Released into Aqueous Environments" indicated that key decisions regarding oil spill clean-up operations were highly dependent on scientific knowledge and advice (Lee et al., 2015). The Multi-Partner Oil Spill Technology Research Initiative (MPRI) is a key component under the Oceans Protection Plan (OPP) with a mandate to establish an integrated research program that will support science-based decision making for oil spill preparedness and response operations. As oil spills are a global issue of concern, funding under MPRI initiative will include leverage of collaborative research among the world's best researchers domestically and internationally within academia, government and industry.

The MPRI program includes the development of protocols for baseline studies and information systems to support oil spill preparedness/response operations, development and validation of current and emerging alternative oil spill clean-up technologies, and the engagement of Indigenous groups for the provision of traditional knowledge and expertise. MPRI strives to address recent recommendations of the Royal Society of Canada's report on oil spills in aqueous environments and the Transport Canada's Tanker Safety Panel (Houston et al., 2013a,b).

Science to Advance Alternative Response Measures

Oil spill response operations are based on the implementation of various strategies that will reduce or eliminate adverse effects on environmentally and economically sensitive resources. In the event of an oil spill, responders must assess the characteristics of both the product spilled and the environment in which the incident has occurred, on the basis of information available; to make a decision on the best strategy or combination of strategies that would best minimize environmental, social and economic consequences. To date, mechanical recovery has been the predominant spill response technique in Canada. However, as demonstrated during the recent Gulf of Mexico oil spill response operations

(i.e. NOAA Oil Budget Calculator Report) the effectiveness of booming and skimming is limited even under calm sea-state conditions. There are a number of Alternative Response Measures (ARMs) that may be more effective at limiting environmental and socio-economic impacts. These include:

- *In-situ burning* - the controlled burning of oil on water at or near the spill site facilitated by the use of fire-resistant booms or chemical herders to contain the oil and thicken it for burning;
- *Spill-treating agents* - such as dispersants help break up an oil slick into tiny droplets which become rapidly diluted within the water column and are more easily biodegraded;
- *Decanting* - the process of collecting oily water from a spill into tanks or storage containers, and separating the water and oil components to increase the available storage capacity for recovered oil.
- *Oil Translocation* – processes such as surf-washing which based on the facilitation of oil-particle interactions that enhance the physical transport and/or dilution of oil in shoreline sediments.

The operational use of these strategies in Canada are currently restricted due to a number of federal and provincial laws that prohibit the release of pollutants or deposit of deleterious substances in water. As currently articulated, these laws and associated regulations impede the use of many alternative response techniques, as well as decanting, even when there would be a net environmental benefit to their employment in a spill situation. Transport Canada's Tanker Safety Expert Panel report recommended that the Government should remove the legislative impediments for the use of alternative response techniques, if they result in a net environmental benefit.

It is important to note that there is no oil spill response strategy that is 100% effective. Thus, there is a need to better understand the effectiveness of natural attenuation as an operational oil spill response strategy. Under Net Environmental Benefit Analysis (NEBA), a particular response technique should be seriously considered for use if it mitigates the impacts of a spill better than other techniques or natural attenuation. Canada is currently working on a legal and operational framework, supported by various programs such as MPRI, to allow the use of ARMs.

The potential use of ARMs should be validated in advance given our knowledge on limited "windows of opportunity" for various response measures such as oil dispersants. The efficacy of ARMs will likely be influenced by the weathering of oil that will change its physico-chemical properties and thus influence its environmental fate, behaviour and effect. Most of what is known about oil spill response technologies has been developed through laboratory work and case studies. To fully understand the potential of ARMs at an operational scale, they should be evaluated in field trials (controlled releases of oil) and spills-of-opportunity. For the creation of operational guidelines requires knowledge on the effectiveness of ARMs under actual environmental conditions. For Canada, research must also consider the effectiveness of oil spill response measures in the Arctic, including studies that explore the interactions of oil with ice.

Conclusion

The Multi-Partner Oil Spill Technology Research Initiative aims to advance oil spill research in Canada to enhance our level of preparedness and response capability by leveraging new collaborative research with some of the world's best researchers domestically and internationally. This program will:

- Increase our understanding of the fate, behaviour and potential impact of oil spills in high-risk and poorly understood areas, such as the Arctic;
- Advance remote sensing and in-situ monitoring of oil;
- Provide information on oil fate, behaviour and effects;
- Develop national baseline research and monitoring protocols to support oil-spill response decision making;

- Improve our understanding of how various crude types behave in different ecosystems;
- Provide information on the efficacy and secondary potential detrimental effects of new and emerging spill response technologies;
- Improve oil spill response decision support systems;
- Improve risk assessment protocols for oil spills; and
- Include Indigenous peoples and their traditional knowledge.

In summary, Canada's Ocean Protection Plan is designed to create a world-leading marine safety system that will protect Canada's our coasts and waterways. By focusing on ARMs, MPRI will enable the Government of Canada and its partners to create a world-leading response system based on the use of an expanded range of available response options for ship-source oil spills. Careful selection and appropriate use of alternative response measures in addition to current mechanical measures based on sound scientific knowledge and Net Environmental Benefit and Spill Impact Mitigation Assessment Analysis (NEBA/SIMA) will reduce the overall impact of oil spills on the environment and other important resources such as the fisheries (IPIECA-API-IOGP, 2017).

References

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