

# **Beaufort Sea Oil Spills State of Knowledge Review and Identification of Key Issues**

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## **Abstract**

The study team was commissioned by the Environmental Studies Research Funds to document the current state of knowledge with regards to countermeasures for oil spills that might result from exploration and production activities in the Canadian Beaufort Sea. A second part of the work was to identify key issues of concern regarding planning and response to spills in the Beaufort.

## **1 Introduction**

Exploration activities by Imperial Oil Limited, Dome Petroleum Limited, Gulf Canada Resources Limited, and Panarctic Oils Limited in the 1960s through to the 1980s identified significant oil and gas potential in the Canadian Arctic. With the exception of one tanker of oil from an extended flow test from Gulf's Amauligak discovery in the Beaufort Sea and a few years of seasonal tanker shipments of oil from Panarctic's Bent Horn operation on Cameron Island, these discoveries were not developed and oil and gas activity in the Canadian north stagnated. The issuance of new offshore exploration leases in recent years and changing market conditions have resulted in an increased interest and activity in oil and gas in the Canadian Arctic.

Increased exploration activity will bring with it an increase in the risks associated with accidental spills from the operations. The proposed presentation will describe the results of a recently-completed study commissioned by the Environmental Studies Research Funds (ESRF) with the objectives of:

- Reviewing the current state of knowledge of oil spills in Arctic waters;
- Identifying the key issues associated with them;
- Providing a current reference document for use by industry, regulators and the public; and
- Preparing a geographic database of coastal resources, vulnerabilities and sensitivities that may influence the choice of oil spill containment and recovery methods.

As a culmination to this study, a workshop was held in October 2009 involving representatives of government and oil companies that may be involved in Beaufort Sea exploration and development. At the workshop, members of the study team presented the draft findings of the study. This was followed by a discussion of a number of key issues of concern regarding planning and response to potential spills in the Beaufort Sea.

This paper provides a brief overview of the main advances in the past 20 years and the current state-of-the-art for each of the main categories of countermeasures. As well, the paper summarizes the key issues and concerns raised by stakeholders and addressed in the workshop.

## **2 Countermeasures Overview**

The entire ESRF report is available at <http://www.esrfunds.org/pdf/177.pdf>. For each of the main facets of oil spill response, the report contains a brief summary of the state of knowledge as it existed in the early 1990s, the most recent period of exploration activity in the Beaufort. This is followed by a description of the research and development efforts to improve the understanding, equipment, and techniques over the subsequent two decades. The following summarizes some of the key advances in knowledge and techniques over the past 20 years as described more fully in the ESRF report.

**Spill Behaviour and Modelling:** Laboratory and field studies have advanced the knowledge of basic spill processes, in particular, the slower weathering and emulsification of oil spilled in Arctic conditions, which may be beneficial for some countermeasures techniques.

**Surveillance and Monitoring:** Detecting and tracking oil in ice and in partially ice-covered waters can be accomplished with a range of existing sensors with some limitations; work is ongoing on developing new sensors using technologies such as ground penetrating radar and nuclear magnetic resonance.

**Containment and Recovery:** While skimmers may be used for smaller operational-type spills, a containment and recovery system would not likely be the primary strategy for a Tier 2 or Tier 3 spill, particularly in the early stages of the resumption of exploration drilling, given the limited marine infrastructure for supporting on-water operations and for dealing with recovered fluids. In recent years, skimmers have been developed for recovering oil spilled among ice, and would be most applicable to small batch-type spills in dense concentrations of brash ice, such as in a ship track or in the vicinity of fixed offshore structures.

**In-situ Burning:** Significant improvements have been made in the past 20 years in the areas of fire-resistant booms for in-situ burning on water, and field tests have shown the viability of using booms to contain and burn oil in concentrations of up to 1 to 3/10ths. Recent work has demonstrated the potential for using chemical herders to facilitate burning in open areas between ice floes in concentrations up to 7/10ths ice coverage. Significant advances have also been made in quantifying and characterizing emissions from ISB fires, and decision-making models and protocols have been developed accordingly.

**Dispersants and the Use of Oil-Mineral Aggregates:** Laboratory-, tank-, and field-testing have been performed to demonstrate that dispersant can be used effectively in cold waters, in waters where ice is present, and in brackish waters, which may be of concern in areas affected by the Mackenzie River outflow. The use of additional mixing energy from a ship's propellers has been shown to be beneficial for aiding dispersion in dense ice concentrations. The use of Oil-Mineral Aggregates has been investigated in recent lab and field testing, and has shown promise in greatly enhancing the degradation of oil spilled in ice.

**Acute and Long-term Impacts of Spills and Countermeasures:** Advances in knowledge in this area are documented in the report but cannot be easily summarized here.

**Present Oil Spill Response Capability:** The present capability is documented in the report, and includes a number of resources that could be called upon for a Tier 2 or Tier 3 response, with

some caveats such as transit times to the Beaufort and that most such equipment is most suited to nearshore operations.

General Reviews and Research Recommendations: These are reviewed, and include the recommendations from various workshops and studies with a focus on Arctic spill technologies and underlying research.

### **3 Geo-References**

An additional goal of the study was to prepare a geographic database of coastal resources, vulnerabilities and sensitivities that may influence the choice of oil spill containment and recovery methods. The results of a comprehensive literature search process were tabulated and made available in digital form as part of the report deliverable.

### **4 Stakeholder Views of Oil Spill Response Options**

A final goal of the work was to identify key issues and concerns relating to oil spill response. This was accomplished in two parts: first by polling a number of important stakeholders and soliciting their views; second, the results of this survey were used to establish an agenda for discussion at a workshop held in Calgary in October 2009, where the draft results of the entire study were also presented. The following summarizes the key messages delivered in this phase of the work.

1. *In-situ burning appears to be a viable and important countermeasure for some situations: Will it be approved? Can it be implemented?*
  - It was generally agreed that there are, at present, no specific Canadian guidelines regarding in-situ burning (ISB) or regulatory approval.
  - The National Energy Board (NEB) is the regulatory agency with the mandate for contingency plan approval: if ISB is to be used, the plan for its use must be included in the emergency response plan filed as part of the Drilling Program Approval (DPA). The NEB will circulate the submission for comment and input from stakeholders, but if the plans for ISB are approved as part of the DPA then its use, as specified in the plan, is approved. The process for consultation at the time of a spill is not well defined.
  - Industry considers both ISB and dispersant use to be primary countermeasures for any large spill or 'worst-case' spill scenario.
  - The Government of Northwest Territories (GNWT) Environmental Protection Act may apply in the Beaufort Sea. Environment Canada also noted that an EC Air Issues Specialist is examining air quality issues associated with mining and petroleum development.
  - The Regional Environmental Emergencies Team (REET) expects to be consulted, although this is not required by legislation. They will provide comments and advice on a plan or proposed burning operation, but will not approve a plan per se.
2. *Dispersant use appears to be a viable and important countermeasure for some situations: Will it be approved? Can it be implemented?*
  - Again, it was noted that industry considers both ISB and dispersant use to be primary countermeasures for any large spill or 'worst-case' spill scenario.

- Presently, the only regulations governing dispersant use are the “Guidelines on the use and acceptability of oil spill dispersants” (Environment Canada Regulations, Code and Protocols Report EPS 1-EP-84-1, 1984, 2<sup>nd</sup> edition). REET’s position in the planning process was to provide advice, which the spiller could choose to accept or disregard. It was noted that REET should be consulted in the decision-making process, but that there was no regulatory requirement to do so.
  - As with ISB, NEB considers this to be an issue that should be handled in the contingency planning process as part of the DPA. If dispersant use is to be included as a response option, it should be included in the contingency plan, and if the plan is approved, dispersant use is approved implicitly.
  - Several options for dispersant application were discussed. There are no dispersant stockpiles or spraying equipment presently available in Canada, but they could be obtained from OSR (Southampton) and SERVs (Anchorage, AK) within a period of 24 to 48 hours.
  - On the question of dispersant products approved for use in Canada: in recent conversations with Environment Canada, the term ‘approved’ is inappropriate. EC has sufficient information to formulate an opinion on only Corexit 9500 and 9527.
3. *What is the availability of regional and national resources in the event of a spill? (e.g., CCG, MDSRC, WCMRC, ECRC, and ACS)*
- Canadian Coast Guard (CCG) has a number of depots in the North, but mostly relatively small, inshore equipment. It and other CCG resources nationwide would be available if required, but the transport times to the Beaufort would be excessive.
  - Alaska Clean Seas (ACS) in the Alaskan Beaufort is a possibility, with some caveats: much of the equipment is best suited for nearshore waters; it has few offshore response resources; only a portion of resources might be available as they may have to reserve equipment to satisfy state legislative requirements; crossing international borders with equipment and labour would be a significant problem that is solvable but requires planning beforehand.
  - Other resources were mentioned briefly: Marine Spill Response Corporation (MSRC), Western Canada Marine Response Corporation (WCMRC), Eastern Canada Response Corporation (ECRC), and Oil Spill Response (OSR).
4. *Need to clarify regulatory agency jurisdiction during both the approval phase and, in the event of a spill, the response phase. Need to understand how the agencies will work together in supporting and working with the responsible party during a major spill response incident (e.g., strategy, tactics and planning; role of Lead Agency; and role of REET)*
- The NEB’s role is clear, with the authority over planning and managing a response related to oil exploration and production operations.
  - The roles of other agencies (NWT, CCG, INAC, Environment Canada, and REETs) require clarification, and should be addressed in pre-spill planning and exercises.
  - The Canada Shipping Act (CSA) requires a Shipboard Oil Pollution Emergency Plan (SOPEP) for activities north of 60°, but does not require an arrangement with a Response Organization (RO), as is required in the south. Need to clarify differences between an RO for vessels, as required under CSA, and an RO for industry, as required by the NEB.

- Need to understand how government agencies will work with the operator during a major spill incident. Will there be a Unified Command via the Incident Command System? Consider involving agencies in communications exercises, tabletop exercises, and demonstrations prior to operations. Need to clarify role of Lead Agency concept: NEB and how other agencies will work with NEB to advise, consult and review.
5. *Associated with the above is understanding the requirements for operators working in the Beaufort with respect to regulator expectations and spill response (e.g., best practices for response strategies)*
    - It was noted that there are no established standards or guidelines for contingency planning, but the expectation by industry and the regulator is that a reasonable plan will include a dedicated Tier 1 response capability, with Tiers 2 and 3 sourced from national and international arrangements.
    - Industry has made clear that dispersants and ISB will be considered primary response options.
  6. *How will a major response be mounted in the absence of logistics and marine infrastructure, as there was in the 1970s and 1980s?*
    - It was noted that plans for upcoming drilling programs will include very limited infrastructure offshore and onshore (at Tuktoyaktuk) compared with the situation in the 1970s and 1980s.
    - Offshore response options must be developed with this in mind. For example, offshore dispersant spraying operations can be performed using outside resources (e.g., Oil Spill Response [OSR] from Southampton) using only limited logistical support in the region.
  7. *Will the Beaufort Sea Oil Spill Cooperative be resurrected in some form?*
    - This may be an expectation of local interests, but may not have much justification on purely technical grounds. Local communities will likely expect a Co-op in some form because there was one before, and would expect equipment, personnel, and training facilities.
    - Industry needs to inform and educate stakeholders on what spill response and infrastructure will look like in the Beaufort in 2011 and beyond.
  8. *Is there a need for further field experiments in the Beaufort? What is the likelihood of gaining permits for an experimental spill?*
    - Acquiring a permit will be a significant hurdle (application to Regional Ocean Dumping Advisory Committee [RODAC]). Community approval will be crucial. Need to identify those to be consulted: CWS, CEAA, Communities, EC, IGC, Hunters and Trappers.
    - After the 1986 dispersant experiment, some locals said, “no more”. More recently it appears that leaders may be neutral or swayed to a new round of testing: the Inuvialuit Game Council (IGC) has not said, “yes”, but neither has it said, “no”.
    - Inuvialuit are knowledgeable and well aware of research and the need to have industry and government provide a summary of Arctic research and how much has been gained. Experiments and/or demonstrations may be required to establish that a credible capability exists.

9. *How does the knowledge and experience from the 1970s and 1980s translate to the currently proposed drilling locations (deeper water, further offshore) with regards to spill behaviour and countermeasures applicability?*

- Some of the offshore locations presently being considered (e.g., Ajurak) have much greater water depths and different ice conditions than those considered in the R&D of the 1970s and 1980s. Consequently, surveillance and tracking might be more challenging, and the melt-pool burning scenarios might be quite different. Ice-tracking buoys were to be deployed this winter to gather information on the movement of ice leaving the Ajurak site.
- Recognized knowledge gap on oil migration through second-year ice. Need to understand the relative concentrations of second-year and multi-year ice at the proposed sites. Need to understand plume dynamics in deeper waters.
- The offshore locations presently under consideration (100+ kilometres from shore in 600 m of water) have implications for decision-making regarding dispersants and ISB, compared with the situation in the 1970s and 1980s. In the earlier situation, smoke from burning spills could conceivably reach a settlement, posing health risks, and dispersed oil from a dispersant-based response could produce clouds of dispersed oil in shallow, nearshore waters.

10. *Who will take the lead in investigating waste disposal options?*

- The regulatory landscape has changed since the 1980s: Inuvialuit Land Administration (ILA) and Environment Canada now have new processes and permitting procedures.
- Lack of infrastructure and logistics complicates the problem and there are no simple solutions. Need to consider waste minimization in response plans and operations: dispersants and ISB offshore reduce waste and prevent shoreline oiling; in-situ treatments on shorelines.