Oil Decanting During Marine Oil Spill Response Operations

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Scope of Work

Background

- Decanting of oily wastewater collected during marine oil spill response creates significant storage and treatment savings.
- Discharge of decanted water generally prohibited under the Canada Fisheries Act.
- Current decanting limitations include: vague discharge standards; limited technological development; and, uncertain impact and environmental fate of potential contaminants.

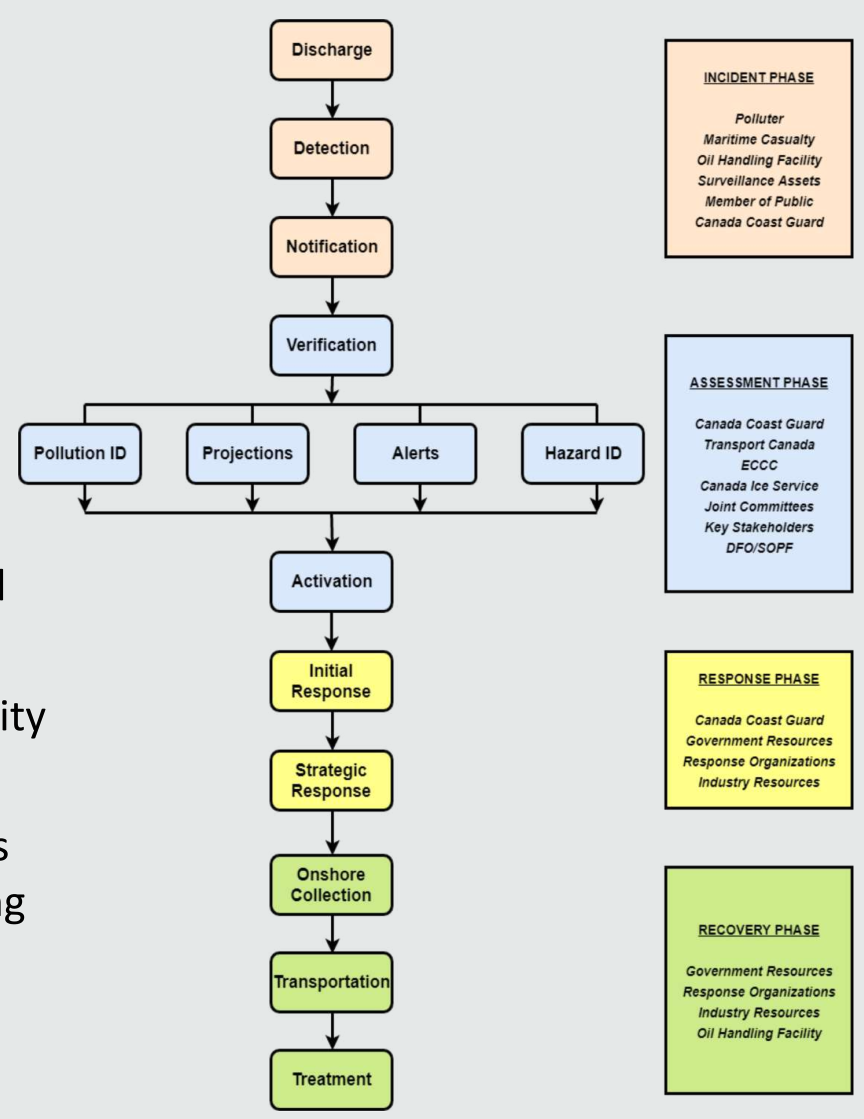
Objectives

- Evaluate factors limiting the use of offshore decanting within the Canadian oil spill response industry.
- Propose alternate decanting methods for effective management and treatment of oily wastewater generated from marine oil spills.

Industry Assessment

Response Procedure

- Canadian oil spill response built upon government-industry partnership
- Response operations governed by Canada Coast Guard Incident Command System
- CCG assumes initial operational command
- RO's accountable for larger response capacity
- Offshore decanting is one of many decisions made prior to initiating the response phase
- Several stakeholders involved in each response phase



Regulatory Assessment

International

- MARPOL discharge standard of <15 ppm oil-in-water permitted

Canada

- Planning standard: 10,000 tonnes
- Decanting permitted on a case-by-case basis, approval unlikely

Norway

- Oil spill dispersant application pre-approved for research
- Standardized contingency plan amongst response organizations

United States

- Planning standard: worst-case discharge
- Decanting pre-approved on a case-by-case basis, otherwise regarded as a last resort

Design Approach

Identified Decanting Technologies

- Automated Controls, Emulsion Breaking Chemicals, Hydrocyclones, Membrane Separation

Comparison Scenario

- Modelling of two spill sizes each for two oils of varying densities

Pairwise Comparison Matrix Development

- Criteria: Operational Safety, Environmental Effects, Technical Efficiency, Feasibility
- Evaluation: Safety Indices, Mass Balance, Literature Review, Stakeholder Input

Oil Spill Modelling

Modelling Software

- Automated Data Inquiry for Oil Spills (ADIOS)
- General NOAA Operational Modelling Environment (GNOME)

Spill Parameters

- Oil Type: Yorba Linda Shell Oil
- Location: Passamaquoddy Bay, NB
- Start Time: March 9th, 2019 00:00
- Sea State: 2°C, Wind Speed Varied
- Quantity: 10,000 tonnes
- Additional scenarios modelled for small quantities, dense oil

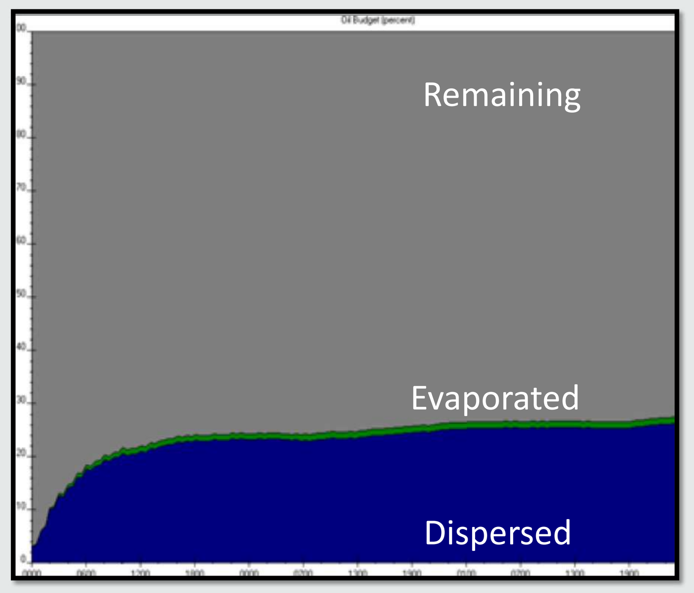


Figure 1. ADIOS output of oil budget for a 10,000 tonne spill over 72 hours

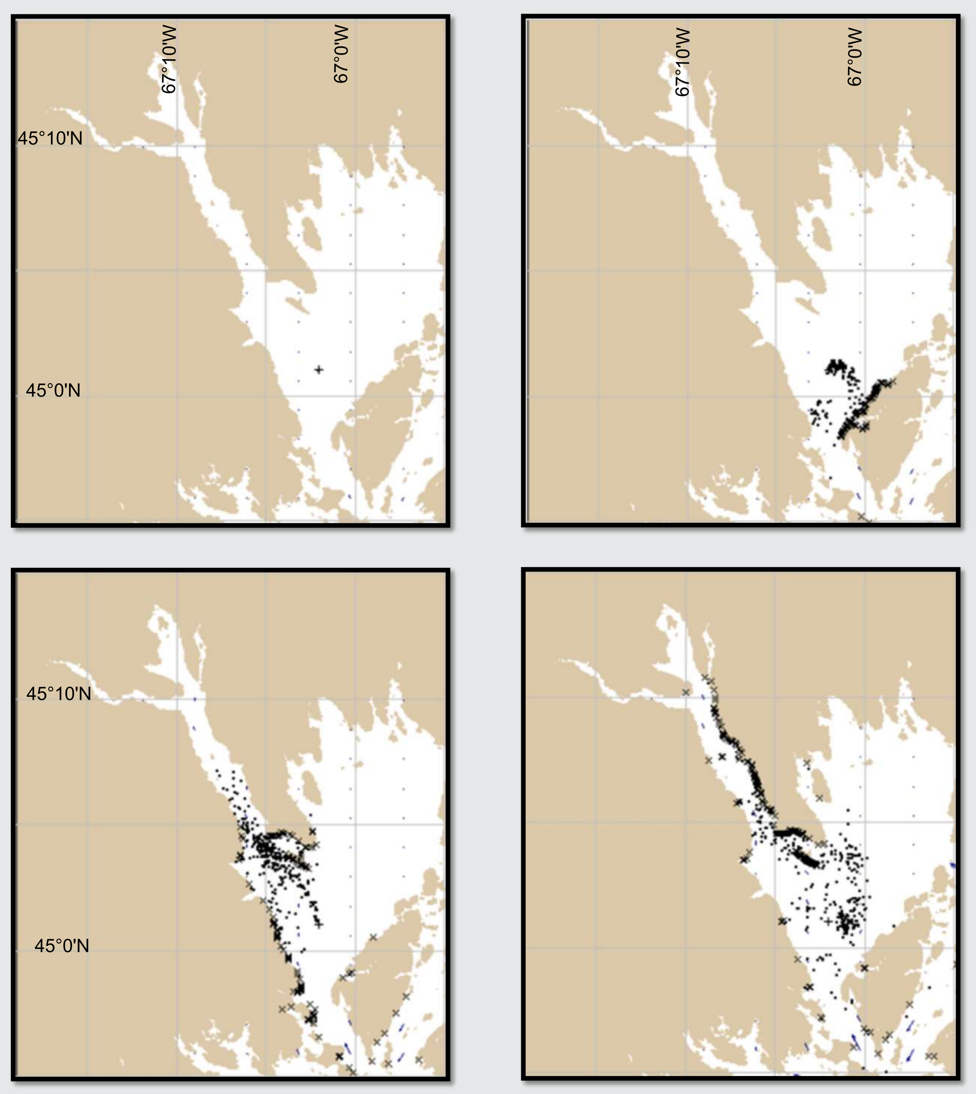


Figure 2. GNOME outputs of spill fate for a 10,000 tonne spill at 0, 24, 48, 72 hours

Key Findings

- Slick spread largely depends on time, rather than oil type or quantity
- Weathering behavior remains consistent across spill sizes for the same oil type
- Lighter oils exhibit far more extensive weathering than heavier oils
- Heavier oils emulsify at a significantly slower rate than lighter oils

Comparison of Decanting Technologies

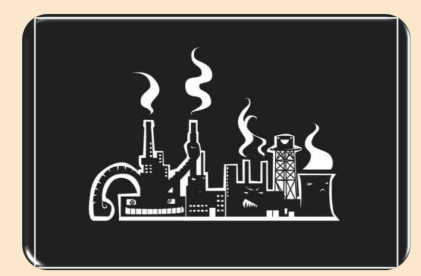
		Automated Controls		Membrane Separation		Emulsion Breakers		Hydrocyclones	
Criteria	Importance	Weight	Score	Weight	Score	Weight	Score	Weight	Score
Safety	0.495	0.477	**0.236**	0.161	0.080	0.280	0.139	0.080	0.040
Environment	0.242	0.289	0.070	0.455	**0.110**	0.080	0.019	0.175	0.042
Technical	0.178	0.495	**0.088**	0.242	0.043	0.177	0.032	0.086	0.015
Cost	0.086	0.294	0.025	0.066	0.006	**0.479**	0.041	0.133	0.011
			0.419		0.239		0.231		0.108

Preference of each criteria ranked from 1 (least preferable) to 4 (most preferable) prior to pairwise comparison of each performance criteria

Results

- Survey response from stakeholders within the oil spill response industry determined that safety to personnel was the primary concern with regards to implementing new response technologies.
- Emulsion breakers present the identified technology with the highest decanting potential in terms of volume, however is unlikely to meet discharge standards.
- Membrane separation has potential to meet discharge requirements, however implementation of on-shore treatment techniques to off-shore response is largely untested.
- Automated controls present the best opportunity for technological development for decanting during marine oil spills.

Conclusions and Recommendations

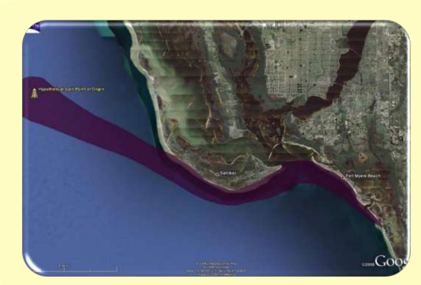


Industry Assessment

- Decanting during marine response is a small component of the larger operation, but presents a significant opportunity for improved response operations.
- Decanting is an unlikely response method for Atlantic Canadian waters.
- Standard methods for decanting performance evaluation are non-existent.

Regulatory Assessment

- Further research is required to justify the 15 ppm discharge standard, accounting for the effects of oil plume dispersion.
- Use of decanting restricted due to environmental uncertainties, lack of pre-approval.



Oil Spill Modelling

- Spill modelling presents opportunities for responders to activate a more tailored response effort
- Worst-case scenario involves high-tonnage spill, low density oil, harsh weather conditions, low viscosity oil

Technological Comparison

- Limited research conducted on the application of on-shore treatment equipment for off-shore spill response.
- Automated controls present the ideal response scenario, however required decanting time presents the same challenges as current decanting procedures.

References

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