Evaluation of Regulations and Technologies for Oily Solid Waste Management from Marine Oil Spill Operations

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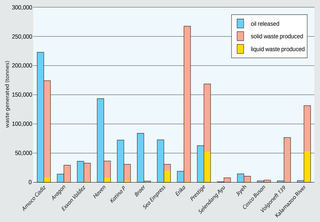
PROJECT SCOPE

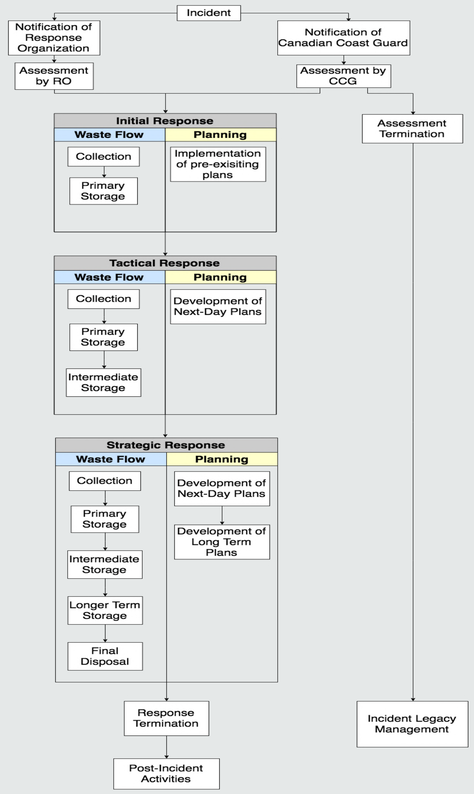
- The objective of this project is to design an analysis method that determines the optimal process for and potential barriers to solid waste treatment from marine oil spills in Canada.
- This project is part the Ocean Protection Plan that was launched in 2017 with the goal of maintaining unpolluted shorelines and improving responsible shipping to protect Canada's marine environment. [1]



- Oil spills typically produce more solid than liquid waste.
- Solid waste includes oil contaminated sand and sediment, dead animals, equipment booms and PPE.

BACKGROUND

- The planning and implementation a spill specific waste management plan is completed through industry and government partnerships.
- Waste is collected, segregated, and stored until it can be treated or disposed of.
- Waste treatment methods include but are not limited to:
  - Re-use and recycling
  - Incineration
  - Landfarming
  - Biodegradation
  - Chemical Washing
- The regulations vary between provinces. Some provinces have pre-defined waste treatment facilities for marine oil spills, while others require treatment and disposal facilities to obtain approvals for waste treatment.



ANALYTIC HIERARCHY PROCESS (AHP)

An AHP model was developed to decide between three alternative technologies. Alternatives were ranked on a preference scale of 1 – 4 (equally important to extremely important).

Weighted Matrices							
Criteria	**Cost**	**Environmental Impact**	**Efficiency**	**Safety**	**Proximity**	**Public Perception**	**Final Value**
Biological Treatment	0.54	0.54	0.30	0.16	0.54	0.54	**0.449**
Thermal Treatment	0.30	0.16	0.54	0.30	0.30	0.16	**0.294**
Landfill	0.16	0.30	0.16	0.54	0.16	0.30	**0.257**

Biological treatment was identified as the preferred treatment method and it should be used when possible.

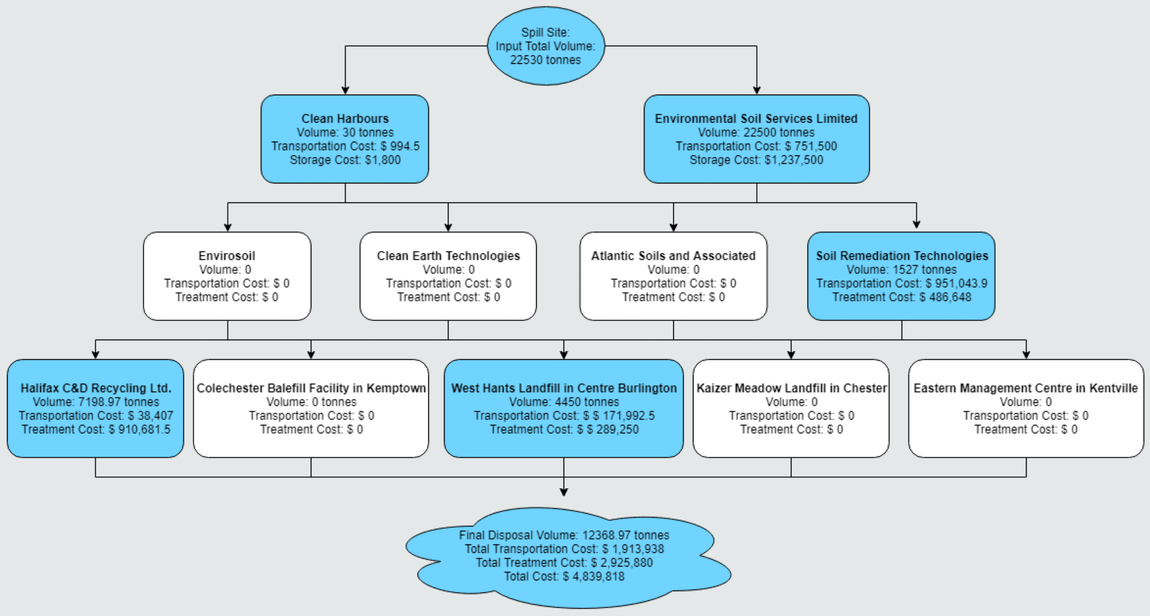
GAPS & BARRIERS ANALYSIS

There are limited waste treatment and disposal locations in Atlantic Canada that can accept oily solid waste.[2]

Insufficient waste storage impacts clean-up and treatment. [3]

Limitations in availability of expertise can lead to poorly created or implemented waste management plans. [3]

LINEAR PROGRAMMING OPTIMIZATION MODEL (LP)



Objective Function: Min = Σ Transportation costs + Σ Treatment costs

This flowchart is a visual representation of the constraints and results of the LP model with the goal of minimizing the waste treatment cost. The model was constructed in three stages:

- transfer station constraints
- treatment facility constraints
- landfill constraints

The primary values of concern are reported in the table below, all other values are presented in the flowchart itself.

Final Outputs	
Initial Volume (tonnes)	22530
Final Volume (tonnes)	12368.97
Transportation Cost	$ 1,913,938.00
Treatment/Storage Cost	$ 2,925,880.00
Total Cost	$ 4,839,818.00

CONCLUSION AND RECOMMENDATIONS

- Treatment and disposal facilities should be identified or developed to ensure sufficient capacity and reduce transportation requirements.
- Direct disposal to landfill was identified as the least preferred option. Waste should undergo treatment prior to disposal when possible.
- Provincial governments should develop pre-determined waste treatment and disposal facilities to improve efficiency of marine oil spill response.

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1. Transport Canada. (2018). Oceans Protection Plan. Retrieved from https://www.tc.gc.ca/eng/oceansprotection-plan.html.
2. J. Whitlock, personal communication, November 22, 2018
3. Condon, M., & Pere, A. (2018). *Oil Spill Response Plan Annex A - Offshore Containment and Recovery Tactical Response Plan.*