Baffinland Iron Mines Corporation

Spill at Sea Response Plan (SSRP)

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Rev 0

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Table A: Distribution List for the SSRP

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Acronyms

ACS	Alaskan Clean Seas	MARPOL	International Convention for the Prevention of Pollution from Ships
AMOSC	Australia Marine Oil Spill Centre	MPC	Milne Port Control
AWPPA	Arctic Water Pollution Prevention Act	MRT	Mine Rescue Team
BAOAC	Bonn Agreement Oil Appearance Code	MSC	Mine site complex
BIM	Baffinland Iron Mines Corporation	MSRC	Marine Spill Response Corporation
CCG	Canadian Coast Guard	NIRB	Nunavut Impact Review Board
CEMT	Corporate Emergency Management Team	NOAA	National Oceanic and Atmospheric Administration
CLC	Compensation and Liability Conventions	OPEP	Oil Pollution Emergency Plan
CMP	Crisis Management Plan	OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
CSA	Canada Shipping Act	OSCAR	Oil Spill Contingency And Response Model
DWT	Dead Weight Tonnage	SSRP	Spill at Sea Response Plan
EC	Environment Canada	OSIS	Oil Spill Information System Model
ECRC	Eastern Canada Response Corporation	OSRL	Oil Spill Response Limited
EMT	Emergency Management Team	PPE	Personal Protective Equipment
EMTL	Emergency Management Team Lead	PSC	Port site complex
EPB	Environment Protection Board	RAM	Risk Assessment Matrix
ER	Emergency Response	SAF	Sea Alarm Foundation
ERP	Emergency Response Plan	SAR	Search And Rescue
FLIR	Forward Looking Infrared Radar	SCAT	Shoreline Cleanup Assessment Technique
GIS	Global Information System	SCP	Spill Contingency Plan
GPR	Ground Penetrating Radar	SG	Specific Gravity
GPS	Global Positioning System	SLA	Service Level Agreement
GRN	Global Response Network	SLAR	Side-Looking Airborne Radar
IC	Incident Commander	SMS	Safety Management System
ICC	Incident Command Centre	SOPEP	Shipboard Oil Pollution Plan
IFO	Intermediate Fuel Oil	SOS	Shoreline Oiling Summary
IMO	International Maritime Organisation	USCG	United State Coast Guard
IPIECA	International Petroleum Industry Environmental Conservation Association	WCMRC	Western Canada Marine Response Corporation
ITOPF	International Tanker Owners Pollution Federation	YFB	Iqiluit, Canada (Airport Code)
KEF	Reykjavik, Iceland - Keflavik *(Airport Code*		

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Scope

Baffinland Iron Mines Corporation (BIMC)'s accidents and malfunctions "Prevention, Preparedness and Emergency Response" for the Mary River Project consist of a Crisis management Plan and a comprehensive Emergency Response Plans (ERP). In terms of marine based emergencies involving fuel spills, the main Emergency Response Plan is supported and complemented by the following plans:

- Oil Spill Emergency Plan (addresses spills related to the Oil Handling Facility AT Milne Port); and,
- Spill at Sea Response Plan (addresses fuel spills along the Northern Shipping Route within Nunavut waters).

Purpose of the Spill at Sea Response Plan (SSRP)

This Spill at Sea Response Plan (SSRP) provides guidance on the actions and reporting requirements during a fuel spill from BIMC shipping operations. It follows international and Canadian best practice, ISO 15544, the IMO Manual on Assessment of Oil Spill Risk and Preparedness[1] and the Spill Contingency Planning Guidelines and Reporting Regulations for Nunavut.

The SSPR offers guidance on the necessary actions to prevent and/or minimise accidental discharge of fuel and to mitigate any negative effects. This SSRP follows tiered preparedness and response that is consistent with the OPRC Convention[2].
The SSPR provides specific guidance to personnel who may be involved in a spill response related to BIMC's shipping operations. Specifically it supplies BIMC's Mine Rescue Teams and Emergency Management Teams with the tactical and strategic response strategies, main procedures and information required during a fuel spill response.

This SSPR covers the following BIMC vessel operations in the Nunavut region off Baffin Island:

- Shipping Operations: Fuel spills arising from the transit of vessels along the Northern Shipping Route, within Nunavut waters;
- Ship to Ship hydrocarbon transfers: Fuel spill arising from the transfer of fuel from ship to ship;
- Milne Port: Fuel spills arising from activities associated with vessel movements in proximity of the Port.

[1] International Maritime Organization; 2010 Edition

[2] International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC '90)

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Use of the SSRP

This SSPR consists of two main parts and the Appendices. Part 1, the Action Plan (Sections 1 to 9) should be utilised in the event of an emergency whilst Part 2, Reference Information (Sections 10 to 14) is primarily for regulatory approval and background information.

Preparedness and Response Framework for Spill at Sea

The development and implementation of the SSPR considers the specific requirements of:

1. NIRB Project Certificate No 005 for the Mary River Project
    a. The Project certificate requires BIMC to be self-sufficient for emergency responses for all the Mary River Project activities.
2. Sections 8, 9 and 10 of Marine Safety Directorate Transportation Publication TP 13585 E, "Marine Safety Management System, Environmental Prevention and Response National preparedness Plan (2010)", (website http://www.tc.gc.ca/eng/marinesafety/tp-tp13585-procedures-EPRNPP-3091.htm). This publication provides an outline of the legislative context and the expectations of the regulatory agencies for Preparedness and Response to spill.
    a. Section 8 outlines the shipping operator's role and responsibilities;
    b. Section 9 outlines BIMC's roles and responsibilities for the Oil Handling Facilities which are addressed with BIMC's OPEP; and,
    c. Section 10 outlines BIMC and its contracted Response Organization (OSRL) roles and responsibilities with respect to spills along the shipping route.

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General Overview

The Mary River Project is located on the northern end of Baffin Island, in the Nunavut Territory, in the Canadian Arctic. The Project, involves the transport of iron ore from the Mine Site along the 100km long Milne Inlet Tote Road to Milne Port. During the ice free period (ranging between July 15 and October 15), 3.5 Million Tonnes of ore per year will be transported by ore carriers from Milne Port to Europe via Milne Inlet, Eclipse Sound, into Baffin Bay and then across the North Atlantic to Rotterdam.

Shipping Route

The shipping route runs between the Netherlands and Milne Port, Baffin Island, Canada shown in Figure 1-1. This SSRP concentrates on the Nunavut section of the route, the Northern Shipping Route, as shown in Figure 1-2.

FIGURE 1-1: SHIPPING ROUTE FROM MILNE PORT TO ROTTERDAM

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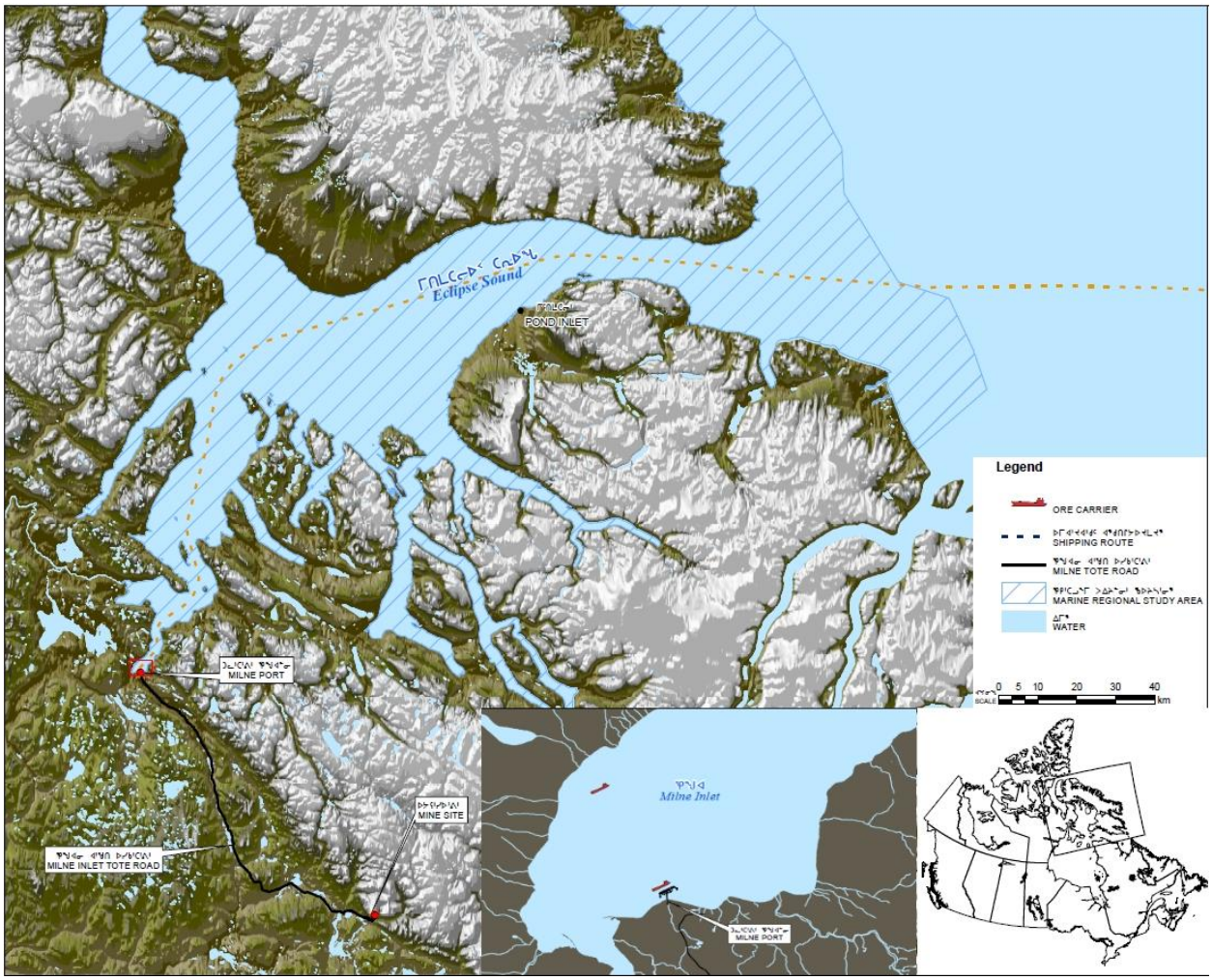

FIGURE 1-2 – NORTHERN SHIPPING ROUTE FROM BAFFIN BAY TO MILNE PORT

Context for the SSRP

The shipping activities associated with the Mary River Project consist of:

1) Annual sealift for construction material and resupply of the mining operation; sealift occur during the open water season, from mid-July to mid-October. Sealift vessels use IFO for propulsion (multiple fuel tanks have total capacity of up to 3000 m^3). It is expected that by the time the sealift vessel enters Nunavut waters, up to 1500^3 of IFO would remain in these propulsion fuel storage tanks.

2) Annual delivery of diesel fuel to Milne Port; fuel is delivered by double-hull tankers (multi-compartment) ranging in size from 10 ML to 16 ML during the open water season from mid-July to mid-October.

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3) Shipment of iron ore by ore carriers (market vessels) during the open water season, from mid-July to mid-October, annually. Ore carriers use IFO for propulsion (fuel tank capacity ranging from 3000 to 4000 m^3, multiple tanks) and it is expected that by the time the vessel enters Nunavut waters, up to 2000^3 of IFO would remain in these propulsion fuel storage tanks.

4) Two tugs and two line boats operating at Milne Port.

At this stage of the Project development, all shipping activities are restricted to the open water season, from mid-July to mid-October, annually.

Ore Carriers

The Iron ore will be shipped from Milne Port to Rotterdam by ore carriers during the summer, Ice free period. The vessels will be chartered and three typical sizes will be used;

- Supramax (Ice class 1C) – approximately 55,000 DWT
- Panamax – approximately 70,000 DWT
- Post Panamax – Approximately 110,000 DWT

Fuel Tankers

Up to four tankers will deliver bulk fuel to the Milne Port. Each delivery is not expected to exceed 15 ML. The tankers capacity will be approximately between 10,000m^3 and 16,000m^3.

Tug Boats

Tug boats will be permanently located at Milne Port to support vessel mooring operations, marine diesel barge maneuvers and will be on stand by to assist vessel in emergency situations. They will also be available for fuel spill response operations (**Refer**: Section 8, Response Technique Selection)

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Action Plan

1 Approach to Spill at Sea Response Plan

The Ship Master has the prime responsibility for the safety of the vessel. For all shipping activities associated with the Mary River Project, should an accident occur along the Northern Shipping Route which results in a spill of fuel, and, the vessel is incapable of handling the situation on its own, BIMC will provide necessary assistance to the distressed vessel for spill containment, and clean up.

In this context, the emergency response for a spill at sea along the Northern Shipping Route is a "Tiered response approach", whereby:

- Tier 1 is the first responder. This responsibility rest with the vessel. The master of the vessel implements the SOPEP.
- Tier 2 consists of external assistance provided to the vessel in distress. BIMC provides Tier 2 response assistance from its Milne Port facility.
- Tier 3 consists of the mobilization of resources that go beyond BIMC's capabilities at Milne Port. It involves the mobilization of OSRL's expertise and resources.

For all shipping accidents resulting in a fuel spill, the priorities for Emergency Response are:

1) Stop the leakage of fuel;

   It is recognized that a breach of the vessel's hull and puncture of one or more of the fuel containment tanks may result in the full loss of the damaged tank.

2) Contain the spill of fuel;

   This consists of booming activities around the ship in order to contain/limit the spread of the fuel. When Tier 2 or Tier 3 responses are activated, this involves deployment of BIMC's response equipment and personnel from Milne Port to the accident site.

3) Once containment is achieved, initiate clean up as weather conditions permit.

   Clean up activities can only be undertaken once the spill is contained and weather conditions permit intervention. Clean up duration will depend on the extent of the fuel slick and how successful containment has been. Clean up activities are undertaken with the assistance of OSRL who is BIMC's RO.

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2 Organizational Structure for Emergency Response

2.1 BIMC Site Wide Emergency response

The following principles apply to fuel spill response management by BIMC:

- The tactical response will be carried out by the Emergency Response Team (ERT) and led by the Incident Commander (IC)
- (If a spill is from a vessel, the vessel master is responsible)
- The strategic response will be managed by the Emergency Management Team (EMT) and led by the Emergency Management Team Lead (EMTL)
- The corporate level strategic response assistance, support and advice will be provided by the Corporate Emergency Management Team (CEMT)

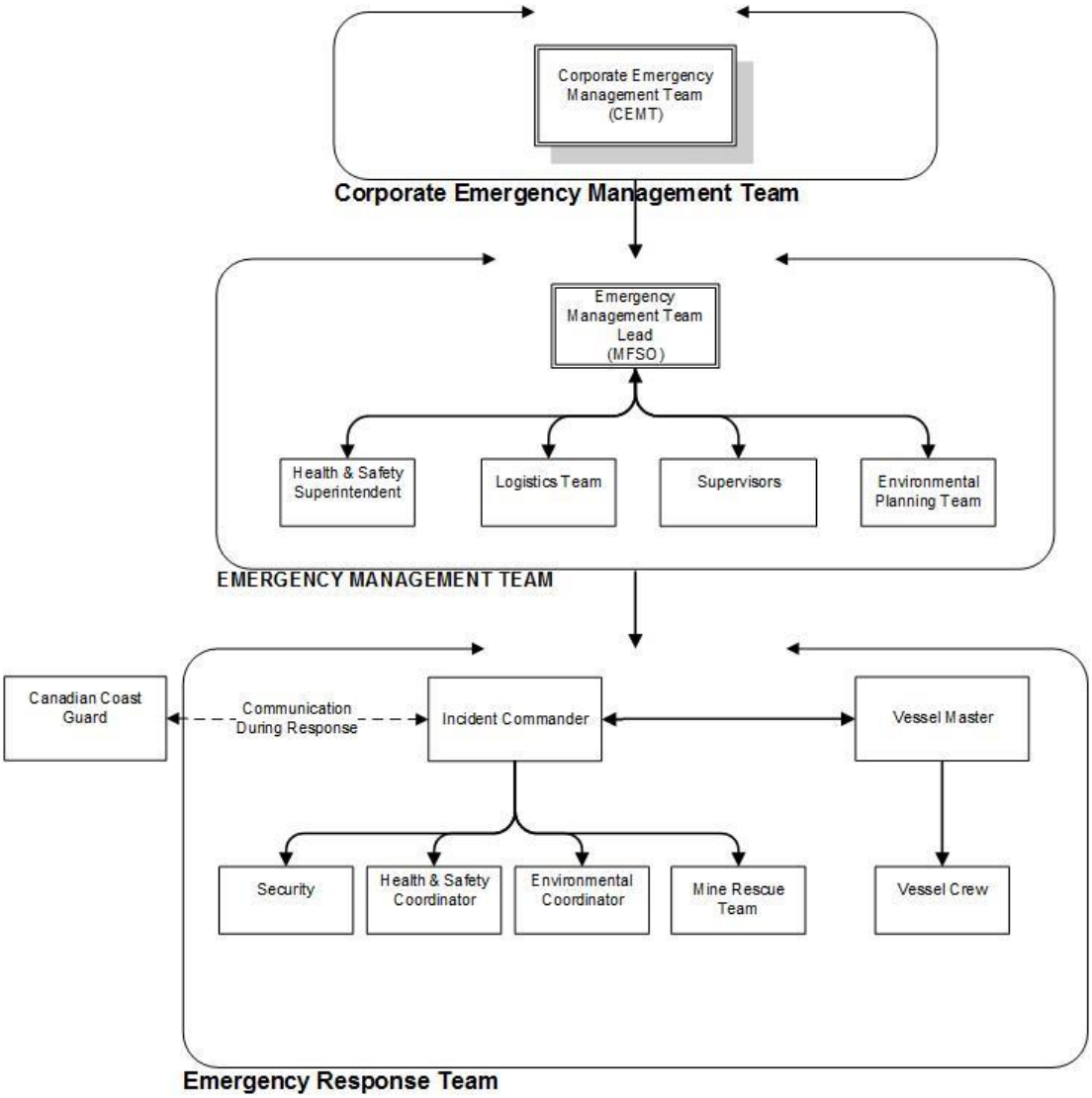

FIGURE 2-1: BIMC EMERGENCY RESPONSE MANAGEMENT STRUCTURE

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2.1.1 BIMC Emergency Response Team (ERT)

The ERT manages the first assessment and response to the incident. The overall site response of the ERT will be directed by the Incident Commander (IC). The ERT Trainer or delegate will fulfil this role in an emergency. Notifications to the nominated contact point within the EMT will be made immediately following a fuel spill by the IC.

Team Structure

The ERT will consist of:

- Incident Commander (IC)
- Health & Safety Coordinator
- Environmental Coordinator
- Mine Rescue Team Captain (MRTC)
- Mine Rescue Teams (MRT)
- Security
- Aircraft Pilots
- Tug boat operators

Responsibilities

The ERT's primary tasks are to:

- Ensure the safety of all workers in the area of the spill
- Assess the spill (incident size, severity, likely impacts)
- Notify the EMTL immediately to activate the EMT response organisation if necessary
- Take appropriate action to mitigate the negative impacts to people, environment and assets in a safe manner
- Mobilise Tier 2 BIMC resources

Refer: Action Checklists, Section 4.4, (p.21) for roles, responsibilities and actions of each key member of the ERT.

2.1.2 Emergency Management Team

The strategic response is managed by the EMT and is led by the EMTL. The Marine Facility Security Officer (MFSO) will fulfil this role. The EMTL will be notified of the incident by the IC. On notification of the incident the EMTL will mobilise the EMT as required. The EMT will be based at Incident Command Centre (ICC) in main conference room at the Milne Port Complex (MPC). The ICC has all the necessary communication tools essential for an effective emergency response including;

- The most current version of the SSRP along with supporting response plans
- Log book
- Emergency site maps, coastal sensitivity maps, and current site plans

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- Site resources equipment list
- Emergency contact information
- Communications recording forms
- ICC attendance forms
- 2-way radio communication (base station or handheld)
- Satellite Phone System
- VOIP phone system
- Network Connections

Team Structure

The EMT is led by the EMTL who is responsible for directing and coordinating the response to the incident. The critical response functions conducted by the EMT are;

- Health & Safety Superintendant
- Environmental Planning Team

In the case of Large Tier 2 or Tier 3 incidents it is likely that further roles will be required to facilitate an effective response. These roles will be filled by Tier 2/3 response organisation and may include;

- Logistics Team
- Operations Team
- Finance

Responsibilities

The EMT's primary responsibilities are to:

- Develop and execute and manage the appropriate strategies to protect people, environment, assets and reputation
- Work in cooperation with all agencies, regulating authorities and government departments involved in the response
- Notify employees and third party Emergency Management Teams
- Notify and liaise with the Corporate Emergency Management Team (CEMT)
- Provide and coordinate specialist support

Refer: Action Checklists, Section 4.5, (p.22) for roles and responsibilities of each key member of the EMT.

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2.1.3 Corporate Emergency Management Team

The Corporate Emergency Management Team (CEMT) provides corporate level strategic response assistance, support and advice to the EMT. The CEMT is based at BIMC's Office, Oakville, Canada and is informed of all fuel spills that may occur associated with BIMC's operations in and around Baffin Island.

Team Structure

Refer: BIMC's CMP for details regarding the CEMT structure and the action checklists for each key member of the CEMT.

Responsibilities

The CEMT will conduct the following responsibilities as required:

- Manage any broader implications to BIMC as a result of the incident
- Provide support to the EMT where local resources are not sufficient to manage the emergency
- Notify expatriate next of kin, shareholders, joint venture partners and financial institutions
- Communicate with international authorities and governments
- Coordinate and approve media releases, issuing international media releases and maintain that a coordinated message is coming for all involved parties within the BIMC's organisation.
- Authorising extraordinary expenditure
- Providing corporate legal advice to the EMT as required

3 Spill at Sea Response

3.1 Tier 1 Responder - Vessel Master and Crew

The Vessel Master is responsible for conducting the statutory internal reporting and notifying the incident according to the Ship Onboard Pollution Emergency Plan (SOPEP).

The Vessel Master will assume the Role of IC and may call upon other support or supply vessels to assist in various spill response strategies.

3.2 Tier 2 Responder – Vessel and BIMC EMT

If the accident results in a fuel spill or may lead to an uncontrolled release of fuel that exceeds the Vessel and crew's capability, the response regime is escalated to Tier 2. BIMC provides Tier 2 response assistance from its Milne Port facility.

The ERT Trainer will assume the role of IC.

3.3 Tier 3 Responder – Vessel, BIMC and OSRL

Tier 3 consists of the mobilization of resources that go beyond BIMC's capabilities at Milne Port. It involves the mobilization of OSRL's expertise and resources.

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4 ACTION CHECKLISTS FOR KEY EMERGENCY RESPONSE TEAM PERSONNEL

Action checklists are available for the Emergency Response Team (ERT) and Emergency Management Team (EMT) members.

Refer: Section 2, (p.15) for further details on the fuel spill response management and the fuel spill at sea emergency response structure.

4.1 SHIP OPERATOR – TIER 1 RESPONDER

For every vessel, the SOPEP provides detailed instruction for Tier 1 emergency response procedure on the vessel.

4.2 SPILL OBSERVER (VESSEL CREW)

SPILL OBSERVER		
Person who first sees the spill and takes instant action.		✓
SAFETY	Make safety your first priority.	
	Stop all hot work and separate ignition sources.	
	If safe, take instant action to stop the spill.	
	ONLY approach the spill from upwind of the source.	
	If area is unsafe, leave and tell others to.	
ALERT	People near the spill.	
	Vessel Master, give information on: • Safety and status of personnel • Location • Source and cause • Extent of spill, if its ongoing or under control • Time and length of spill • Hydrocarbon type • Potential hazards • Weather and sea conditions • Other useful information	
	Initiate the spill tier assessment if requested to do so. **Refer:** Spill Assessment Section 6 (p.29)	
RESPONSE ACTIONS	If trained, required and safe to do so, assist the response.	
	Complete demobilisation procedures.	
	Attend and take part in the debrief (if required)	
	Offer support to the incident investigation.	
	Restart normal operations as told.	

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4.3 VESSEL MASTER

VESSEL MASTER		
Implement SOPEP. Responsible for Tier 1 Response and assist with Tier 2 and 3 Response.		✓
DOCUMENT	Begin Personal Log. **Refer:** Appendix 2, Forms	
SAFETY	Make safety the first priority.	
	ONLY approach the spill from upwind of the source.	
	Liaise with and support the Health and Safety Coordinator ensuring that all crew members are aware of all hazards and accident situations in designated field of operations.	
	Ensure the appropriate SDS's for the substance spilt are available.	
	If the spill is from the vessel: • Stop operations • Prevent further release if possible • Move the vessel to a safe location if possible.	
ALERT	MPC giving details of the spill including; • Safety and status of personnel • Location of incident • Source and cause of spill • Extent of spill and whether it is ongoing or under control • Time and duration of spill • Hydrocarbon type • Potentially hazardous aspects • Any further useful or relevant information • Make notifications as per SOPEP	
ASSESS THE SPILL	Provide the EMT and or CCG with further assessment of the spill, as required **Refer:** Spill Assessment Section 6 (p.29)	
COMMUNICATIONS	Give incident briefings with the IC at suitable time, include: • Changes to the spill and/or incident situation • Are the response strategies working? • Support needs • Site safety concerns	
RESPONSE ACTIONS	Lead the vessel crew.	
	Act on instructions and support from the IC.	
	Coordinate with other support vessels in the vicinity or assisting with emergency operations.	
	Tier 1 equipment – use if safe to do so	
	Assist in managing arrival of **Tier 2/3** equipment and personnel.	
	Assist in Identify lay down area and logistics support needed.	
	Be aware of danger/exclusion zones and the areas where entry is forbidden for people/boats/helicopters.	
	Ensure work is undertaken within the designated site safety zones to prevent contamination into 'clean' areas.	
	Collect and maintain relevant documents for response operations.	
FINAL ACTIONS	Submit Personal Log to EMT.	
	Complete demobilisation procedures.	
	Ensure Tier 1 resources are returned to standby.	
	Attend and participate in incident debrief.	
	Offer support to the incident investigation.	
	When safe, restart normal operations.	

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4.4 BIMC Emergency Response Team (ERT) – Tier 2 Responder

The following checklist for key ERT members includes; Incident Commander (IC).

4.4.1 Incident Commander (IC) – ERT Trainer

IC - MFSO		
Responsible for leading the ERT, communicating with the EMT and working in conjunction with the Vessel Master.		✓
DOCUMENT	Begin Personal Log. **Refer:** Appendix 2, Forms	
SAFETY	Make safety the first priority.	
	ONLY approach the spill from upwind of the source.	
	Liaise with and support the Health and Safety Coordinator ensuring that all MRT members are aware of all hazards and accident situations in designated field of operations.	
	Ensure the appropriate SDS's for the substance spilt are available.	
ALERT	Mobilise the ERT and brief them on the response to be mobilised.	
ASSESS THE SPILL	Provide the EMT with further assessment of the spill, as required. **Refer:** Spill Assessment Section 6 (p.29)	
COMMUNICATIONS	Receive brief/information from the Milne Port Control (MPC) and Vessel Master.	
	Communicate/liaise with Canadian Coast Guard at the incident scene	
	Give incident briefings with the EMTL at suitable times, include: • Changes to the spill and/or incident situation • Are the response strategies working? • Support needs • Site safety concerns • Weather and sea conditions at incident location	
RESPONSE ACTIONS	Lead the ERT.	
	Act on instructions and information from the Vessel Master and EMT.	
	Coordinate with other support vessels in the vicinity or assisting with emergency operations.	
	Deploy Milne Port equipment to vessel if safe to do so and if required.	
	Manage arrival of Tier 2/3 equipment and personnel.	
	Identify lay down area and logistics support needed.	
	Be aware of danger/exclusion zones and the areas where entry is forbidden for people/boats/helicopters.	
	Ensure work is undertaken within the designated site safety zones to prevent contamination into 'clean' areas.	
	Collect and maintain relevant documents for response operations.	
FINAL ACTIONS	Submit Personal Log to EMT.	
	Complete demobilisation procedures.	
	Ensure Tier 1 resources are returned to standby.	
	Attend and participate in incident debrief.	
	Offer support to the incident investigation.	
	When safe, restart normal operations.	

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4.5 Emergency Management Team

4.5.1 Emergency Management Team Leader - MFSO

Emergency Managament Team Leader (EMTL)		
In charge of mobilising the EMT as required. Leads the EMT and defines strategic objectives of the response. Communicates with the Crisis Emergency Management Team (CEMT).		✓
DOCUMENT	Begin Personal Log. **Refer:** Appendix 2, Forms	
SAFETY	Make safety the first priority.	
ALERT	Receive Incident Notification from the MPC.	
	Move to the Incident Command Centre (ICC).	
	Mobilise the EMT as required, establish an appropriate organisation.	
	Liaise with CCG, Transport Canada and the Nunavut Government are Notified	
	Notify the CEMT if required.	
ASSESS THE SPILL	Confirm the spill tier level and applicable response strategies based on the spill information received from the IC. **Refer:** Spill Assessment Section 6 (p.29)	
	Set EMT objectives and priorities.	
	The overall effectiveness of the spill response so far.	
	The need for further spill response resources.	
COMMUNICATIONS	Give initial briefing to EMT Members.	
	Get incident status reports from the IC at regular intervals.	
	Request additional technical staff with suitable experience/training to fulfil roles within the EMT and delegate team objectives to them.	
	Give incident briefings with the EMT at suitable times, outline: • Status of objectives • Provide update on current operations • Limitations, constraints and effectiveness of the response strategies • Highlight safety concerns • Future tasks for EMT • Next meeting time	
	Give incident briefings with the CEMT as appropriate.	
	Coordinate and consult with the Environmental Planning Team Leader on selection of the appropriate strategies and tactics to accomplish objectives.	
	Liaise with Logistics Team with regards to resource requirements.	
	Maintain communications with the CCG, Transport Canada and the Nunavut Government.	
RESPONSE ACTIONS	Coordinate, lead and brief the EMT.	
	Approve the Incident Action Plan. Note: The Incident Action Plan details the planned strategy of response, objectives set and how these objectives should be met. It should be regularly maintained and updated. **Refer:** Appendix 2, Forms	
	Initiate time-outs as appropriate. During this time: • Pass on concise information • Ensure information is understood • Work out what is required • Agree how the objectives are to be achieved	
	Determine the impact of the incident upon business continuity, in particular with reference to shipping activities and scale back other departments if required.	
	Identify and obtain authorisation for unusual expenditure.	
	Ensure a waste management plan is produced.	
	Requests additional resources or for the release of resources from the CEMT	

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	Organise on location reconnaissance and/or aerial surveillance for confirmation of the extent of the impact.	
	Monitor and evaluate the effectiveness of response operations, re-assess response strategies as necessary.	
	Regularly update the Incident Action Plan based on information received. Ensure updates are disseminated during incident briefings.	
	Seek specialist expertise and support as required.	
	Ensure all preparations are made to assist and support the arrival of additional resources and personnel.	
FINAL ACTIONS	Collect Personal Logs for all members of the EMT and IC.	
	Order the demobilisation when appropriate.	
	Complete demobilisation procedures.	
	Lead the response debrief and pass on findings to the CEMT. Give support to the incident investigation.	
	Give feedback to those involved in the response, of any changes and/or developments.	

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4.5.2 Environmental Planning Team Leader (Environmental Manager or designate at Site)

Environmental Planning Team Leader		
Leads the Planning Team. Responsible for the collection, evaluation, dissemination and use of the incident information and maintaining status of assigned resources. Liaise with Science Table (advise from EC and DFO)		✓
DOCUMENT	Begin Personal Log. **Refer:** Appendix 2, Forms	
SAFETY	Make safety the first priority.	
ALERT	Receive mobilisation of the EMT from the EMTL.	
ASSESS THE SPILL	Identify the support, service, and personnel requirements for ongoing and future response operations.	
	Assist in assessment of the overall effectiveness of the spill response so far.	
	Draft EMT objectives and priorities and gain agreement from the EMTL.	
	Assist in the potential requirement for further spill response resources.	
COMMUNICATIONS	Receive initial incident brief from the EMTL.	
	Request additional technical staff with suitable experience/training to fulfil roles within the Environmental Planning Team and delegate team objectives to them.	
	Attend incident briefings with the EMT as required: • Propose draft incident objectives • Present projections for operational status	
	Coordinate and consult with the Operations Team Leader on selection of the appropriate strategies and tactics to accomplish objectives.	
	Liaise with Logistics Team with regards to acquiring the resource requirements.	
RESPONSE ACTIONS	Coordinate, lead and brief the Planning Team.	
	Advise on Incident Action Plan as required. • Response Strategies • Utilize Spill Modelling Report • Liaise with Marine Security Master who is getting advise from Science Table (EC, TC and DFO) • Situation Map • Weather Forecast • Environmental Plan • **Refer:** Appendix 2, Forms	
	Assist with new/revised incident objectives and provide to the EMTL.	
	Assist with other incident supporting plans (e.g. salvage, transition, security).	
	Assist with tasks assigned by the EMTL.	
	Advise on the need for any specialised resources in support of the incident.	
	Establish special information collection activities as necessary (e.g. weather, environmental, toxics etc).	
	Regularly assist in the update of the Incident Action Plan based on information received. Identify resources requirements for all response operations.	
	Process and facilitate requests from the EMT for additional resources.	
FINAL ACTIONS	Provide the EMTL with completed Personal Log.	
	Assist with long range strategic contingency and demobilisation plans.	
	Assist in the completion of demobilisation procedures.	
	Provide support for the incident investigation and analysis as required.	
	Give feedback to those involved in the response, of any changes and/or developments.	

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4.5.3 LOGISTICS TEAM LEADER (PORT LOGISTICS MANAGER OR DESIGNATE)

Logistics Team Leader		
Leads the Logistics Team. Manages logistical support of the incident, e.g. facilities, materials and services.		✓
DOCUMENT	Begin Personal Log. **Refer:** Appendix 2, Forms	
SAFETY	Make safety the first priority.	
ALERT	Receive mobilisation of the EMT from the EMTL.	
ASSESS THE SPILL	Identify the support, service, and personnel requirements for ongoing and future response operations.	
COMMUNICATIONS	Receive initial incident brief from the EMTL.	
	Request additional technical staff with suitable experience/ training to fulfil roles within the Logistics Team and delegate team objectives to them.	
	Attend incident briefings with the EMT as required: • Provide an update on logistical status • Provide logistical information as necessary	
	Coordinate and consult with the Environmental Planning and Operations Team Leaders on logistical requirements.	
RESPONSE ACTIONS	Coordinate, lead and brief the Logistics Team.	
	Determine and supply immediate incident resource and facility needs.	
	Assume responsibility for tasks assigned by the EMTL.	
	Develop and advise the EMT of resource approval and requesting process.	
	Assist in the production of the Incident Action Plan. In particular focus on service and support areas of the action plan. **Refer:** Appendix 2, Forms	
	Regularly assist in the update of the Incident Action Plan based on information received. Identify resources requirements for all response operations.	
	Process and facilitate requests from the EMT for additional resources.	
	Plan equipment and supplies requirements to ensure the location and status of all resources is known (including information regarding maintenance).	
	Ensure Cost Center and Purchase Orders are in place for expenditures	
	Evaluate logistical support effectiveness and make organisational and procedural adjustments as necessary.	
	Make all preparations to assist and support the arrival of additional resources and personnel.	
POST SPILL ACTIONS	Provide EMTL with completed Personal Log.	
	Assist with long range strategic contingency and demobilisation plans.	
	Develop recommended list of logistics resources to be demobilised as appropriate and initiate recommendation for their release.	
	Assist in the completion of demobilisation procedures.	
	Provide support for the incident investigation and analysis as required.	
	Give feedback to those involved in the response, of any changes and/or developments.	

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4.5.4 HEALTH AND SAFETY TEAM LEAD (MEMBER OF THE ERT)

HSE Team Leader		
Responsible for the development and recommending measures for assuring personal safety and to assess and or anticipate hazardous and unsafe situations.		✓
DOCUMENT	Begin Personal Log. **Refer:** Appendix 2, Forms	
SAFETY	Ensure that safety is the first priority for all onsite operations.	
ALERT	Receive notification from EMTL.	
	Move to the ICC.	
GENERAL TASKS	Develop a Site Safety Plan **Refer:** Appendix 2, Forms	
	Participate in planning meetings.	
	Identify hazardous situations associated with the incident.	
	Review the Incident Action Plan for safety implications.	
	Exercise emergency authority to stop and prevent unsafe acts.	
	Investigate accidents that have occurred within the incident area.	
	Assign Assistants as needed.	
FINAL ACTIONS	Submit Personal Log.	
	Assist in demobilisation procedures.	
	Attend incident debrief.	
	Provide support for the incident investigation and analysis as required.	

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5 ALERT PROCEDURE, INITIAL ACTIONS AND NOTIFICATIONS

5.1 INITIAL ACTIONS

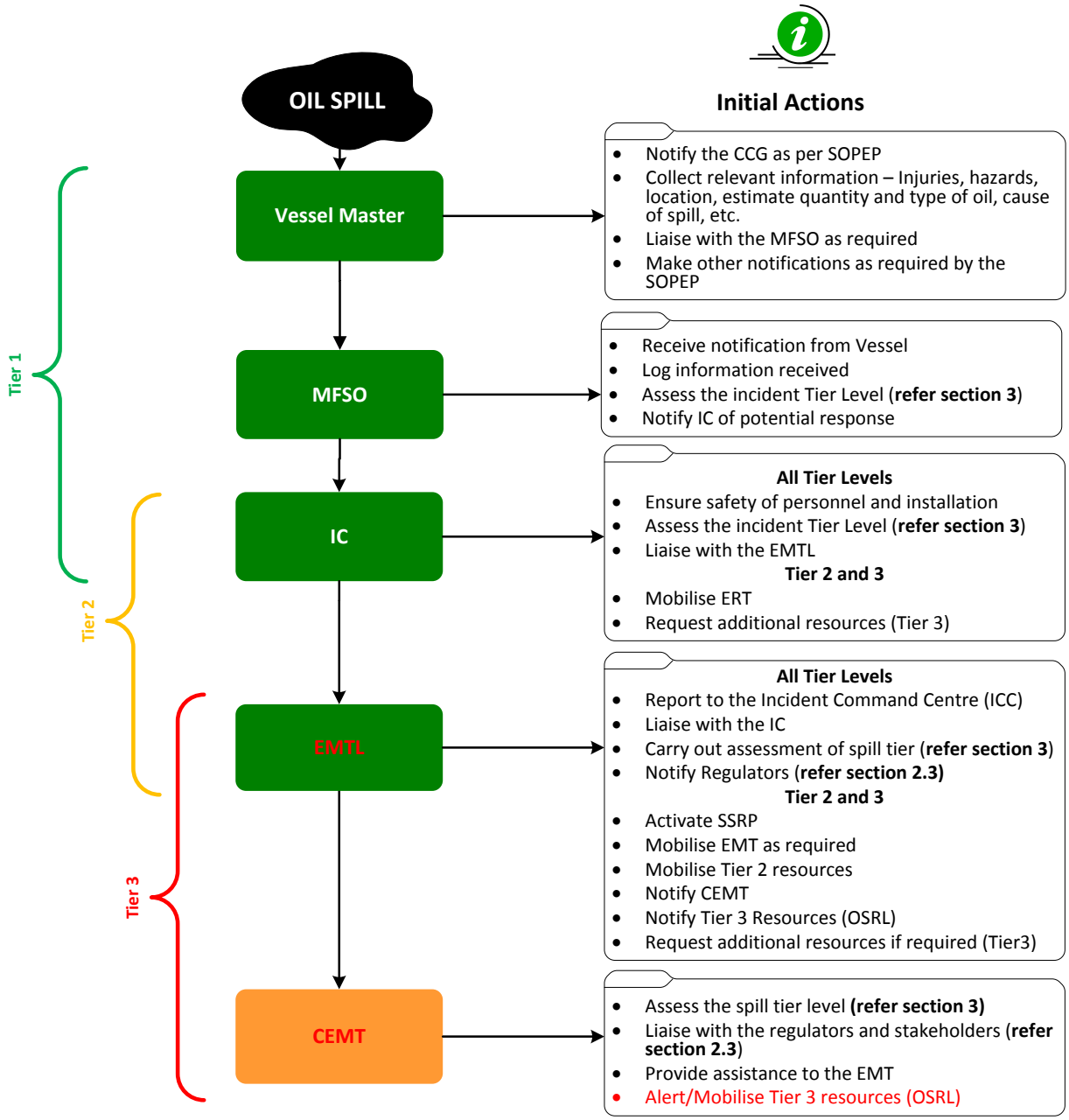

FIGURE 5-1 INITAIL ACTIONS

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NOTIFICATIONS

TABLE 5-1 NOTIFICATIONS

From	To	Method	When
Vessel Master	Canadian Coast Guard	Contact as per SOPEP	As soon as possible
Canadian Coast Guard	MFSO	Tel (647)253-0596 ext. 4630	As soon as possible
MFSO	IC	VHF Channel 5 Tel (647)253-0596 ext. 4219 Spill Notification Form (refer appendix 2, Forms)	As required
EMTL	EMT Members as required	Telephone **Refer:** Appendix 1, Contacts Directory	As required for Tier 2/3 response
EMTL	CEMT	Tel (416)-996-5523 Spill Notification Form (refer appendix 2, Forms)	As required for Tier 2/3 response
EMTL	OSRL	Tel +44 (0) 2380 331 551 Fax +44 (0) 2380 724 314 OSRL Notification Form OSRL Mobilisation Form (refer appendix 2, Forms)	When additional resources are anticipated or required.
EMTL	Canadian Coast Guard (Central and Arctic Region)	Ontario – Tel +1 800 265 0237 Fax: (519) 337 2498	As appropriate if required
	Transport Canada	Jaideep Johar Manager, Technical services Marine Safety,Tel: 204 984 8618 Cell: 204 880 0754,Email:joharj@tc.gc.ca Craig D. Miller Manager, Marine Safety (PNR) Email: craig.miller@tc.gc.ca Telephone (204) 984-0397 / Facsimile, (204) 984-8417	
	Nunavut Government	24-Hour Spill Report Line spills@gov.nt.ca Tel. (867) 920-8130 or Fax (867) 920-8127	
CEMT	Media Liaison	As required15	At regular intervals as required

Refer: Appendix 1 for further contact details

Refer: Appendix 2 for all spill reporting forms

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6 SPILL ASSESSMENT

It is a requirement of the Canada Shipping Act (2001) that all vessels with a gross tonnage of 300 or more, and those vessels involved in towing or pushing operations with a combined gross tonnage of 500 or more, are subject to mandatory reporting under NORDREG. Mandatory reporting also applies to all vessels of any size that carry, tow or push cargos of pollutants or dangerous goods.

To comply with the scheme, Masters operating vessels within the NORDREG zone are required to submit four different types of reports to Transport Canada:

- a Sailing Plan ("SP"), which is required prior to entering the zone;
- a Position Reports ("PR"), which are required upon entry and then daily thereafter;
- a Final Report ("FR"), which is required upon berthing or departure; and,
- a Deviation Reports ("DR"), which are required whenever a vessel deviates from its Sailing Plan.

Part 8 of the Transportation of Dangerous Goods Act (TDGR) imposes immediate reporting requirements for accidental release and/or imminent accidental release of dangerous substances. Should an emergency occur, the Master of the Ship has the responsibility for immediate notification of the incident/accident to regulatory authorities (CCG and Transport Canada).

6.1 SPILL ASSESSMENT TIER LEVEL

In the event of a vessel emergency resulting in a spill or an imminent release of fuel, the Master of the Ship provides the initial assessment of the damage to the vessel and notifies the CCG of:

- The vessel exact location;
- Quantities of fuel or hazardous substances released or likely to be released, and,
- Any other information as required under the shipping regulations and TDGR.

As the Tier 1 responder, the Master of the Vessel implements the ship's SOPEP. With the notification to the CCG, the Master of the Ship also states the ship's requirement for external assistance. In the event that the emergency results or may result in a spill of fuel, and that the ship is unable to contain the expected volume of fuel spilt with the ship's resources, the Vessel Master notifies BIMC's Marine Security Master at Milne Port. This notification from the Vessel Master automatically triggers the Tier 2 response, and, preparedness for Tier 3 response, depending on the severity of the shipping incident.

At the onset of the incident/accident, the Tier 2 response may be activated based on the Master of the Ship's initial assessment of the severity of the spill. An initial action of Tier 2 response is for BIMC to dispatch a helicopter to the scene of the incident (weather permitting) which will confirm the Master of the Ship's initial assessment of the potential fuel spill. If a fuel slick is visible by the aerial reconnaissance, the BIMC's ERTL will immediately dispatch the Tier 2 Response resources (boats and booming equipment) to the scene of the accident. The aerial reconnaissance will also enable the EMTL to reassess the severity of the incident/spill and to determine the need to escalate the response level to a Tier 3.

Use the Tier assessment (Refer: FIGURE 6-1) system to confirm the severity of the spill and determine the Tier Level. If any Tier 3 characteristics are present, then it is a Tier 3 spill.

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By identifying the tier level, the IC and EMT can mobilise the appropriate response technique resources to combat the spill, based on the fuel type spilled, location and the available resources.

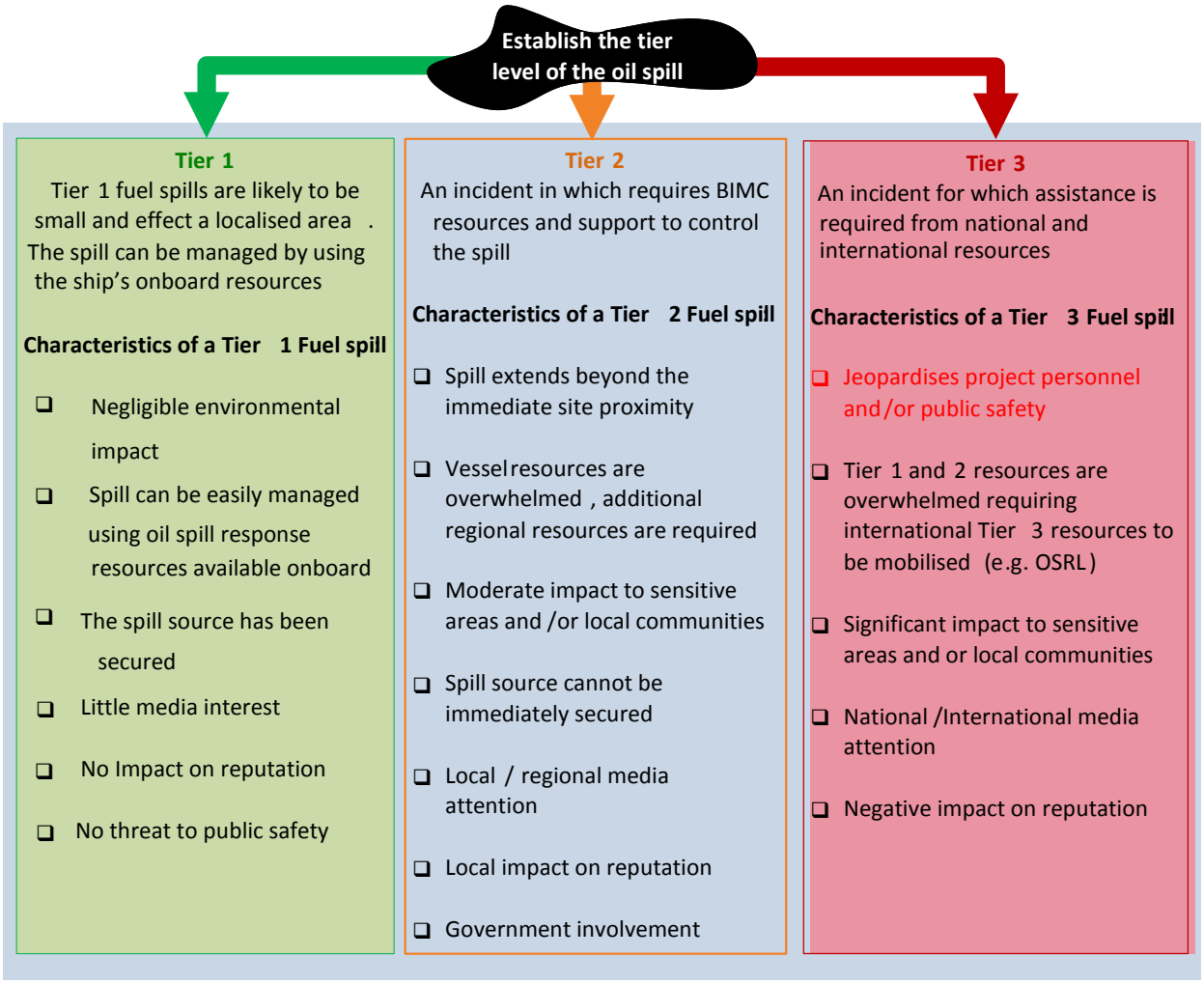

FIGURE 6-1 TIER LEVEL ASSESSMENT CHART

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7 CONSTRAINT – EXTREME WEATHER CONDITIONS

The open water season along the Northern Shipping Route is generally from mid-July to mid-October. For this phase of the Mary Project Development, BIMC expects that all shipping activities will occur during the open water period. Shipping of fuel in pack ice or under landfast ice conditions is not planned. Only shipment of iron ore (ore carrier) may encounter ice conditions during the shoulder season.

BIMC acknowledges that ice flows may be encountered at the beginning and at the end of the shipping season. Therefore, response to ore carriers emergencies that result or may result in fuel spill may be complicated by the presence of ice during the shoulder season of the shipping period.

7.1 TIER 2 RESPONSE DURING ICE MELT (JULY)

The tug boats used by BIMC are ice class vessel and can manoeuvre through broken ice. However, at the beginning of the open water shipping season, the presence of drifting broken ice may pose challenges for the effective deployment of containment booms.

For a Tier 2 response, during this period, BIMC may dispatch up to three vessels to assist in containment of the fuel slick. The functions of the vessels are as follows:

- One tug (ice class vessel) to push away broken ice from the scene of the accident;
- Two line boat to deploy containment booms.

Spill recovery would begin as soon as the spill is contained and the weather conditions (winds) permit. After deployment of the containment booms, one of the line boat would tow the floating barge equipped with a skimmer to pick up the slick.

7.2 TIER 2 RESPONSE DURING FREEZE-UP (OCTOBER)

Freeze up occurs rapidly. As ice forms, it is no longer feasible to deploy boom or containment equipment. Furthermore, no “on-ice” intervention can take place until the ice cover is sufficiently thick to support mobile equipment.

BIMC’s shipping activities during this period will be limited to ore shipment (ore carriers using IFO for propulsion). Should a release of fuel occur during this period (mechanism for spill to occur undefined), there is a remote possibility that the IFO would remain trapped under/within ice until spring break-up.

The Tier 2 response activity would consist of monitoring potential movement of fuel under ice as soon as thickness of the ice permits the deployment of mobile equipment.

7.3 TIER 2 RESPONSE DURING ICE COVERED PERIOD (END OF OCTOBER TO MID-JULY)

Once the Project Certificate No 005 is amended by the NIRB to allow winter shipping of ore via the Northern Route, the SSRP will be amended to address response for winter shipping operations.

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As part of the winter shipping operation, BIMC will have two Ice Management Vessels (ice breakers) stationed at Milne Port. These IMVs will be available to assist distress ore carriers in emergency situation.

Only ice class ore carriers will navigate the Northern Shipping Route during the ice covered period of mid-October to mid-July (Zone-date system established under the CSA 2001). Ore carriers use IFO for propulsion fuel. Because of the design of the ice class ore carriers and the physical position of the fuel tanks within the carrier hull, a puncture of the ore carrier's fuel tanks is unlikely, even if the vessel is involved in a collision.

Catastrophic Event

An uncontrollable IFO fuel release to the sea would most likely result from an explosion, extensive corrosion due to poor maintenance of the vessel (structural integrity of the ship), or, sabotage/human error within the ship, and, would require extensive physical damage to the fuel tank(s) as well as puncture of the ship's hull, in which case, the ship is more likely to sink.

For such a scenario, BIMC's response effort will focus on rescuing the ship crew with the use of helicopter and/or BIMC's IMVs.

Event Leading to Spill of IFO Fuel on Ice or Under Ice

Although the sequence of events leading to such a scenario is not understood, there is a remote possibility that the content of the ore carrier's fuel tank (up to 2000 m^3 of IFO) could be release to sea as a result of an "undefined" on-board ship accident.

After receiving notification of the incident from the CCG, BIMC's Tier 2 response for such a scenario would consist of:

1) Dispatch the IMVs to the scene of the incident (arrival time between 4 to 12 hours depending on location of the distressed vessel);
2) Deploy on-ice fuel containment equipment – if practical to do so (**Refer:** SOPs related to working on ice, Appendix 3);
3) If ice is sufficiently thick to support mobile equipment (**Refer**: SOP for testing of ice strength, Appendix 3), mobile equipment (loader) is used to build containment berms around the spilt fuel on ice surface.
4) Recovery of the contaminated snow commences as soon as the source of the leak is contained. Loaders are used to scoop contaminated snow into containers. The containers are transported to Milne Port by the IMVs and the contaminated snow is dumped in the landfarm.
5) Bore holes are drilled through the ice at a number of locations around the damaged ship to detect the presence of fuel under ice. If fuel under ice is detected, various SOPs are presented in Appendix 2 for under ice fuel recovery.
6) Once the damaged ore carrier is towed away from the accident site, under ice monitoring for the presence of fuel around the incident site continues until the melt. This monitoring will track the movement of under ice fuel slick should it occur.

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8 RESPONSE TECHNIQUE SELECTION

The Response Techniques available to BIMC are;

- Assess the Spill (Appendix 3.1)
- Assisted Natural Dispersion (Appendix 3.2)
- Shoreline Protection and Cleanup (Appendix 3.3)
- At Sea Containment and Recovery (Appendix 3.4)
- Spill Response in Ice (Appendix 3.5)
- Spill Response in Broken Ice (Appendix 3.6)
- Spill Response Under Ice (Appendix 3.7)
- Shoreline Cleanup Assessment Technique (SCAT) (Appendix 3.8)
- Waste Management (Appendix 3.9)

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8.1 Response Technique Decision Flowchart

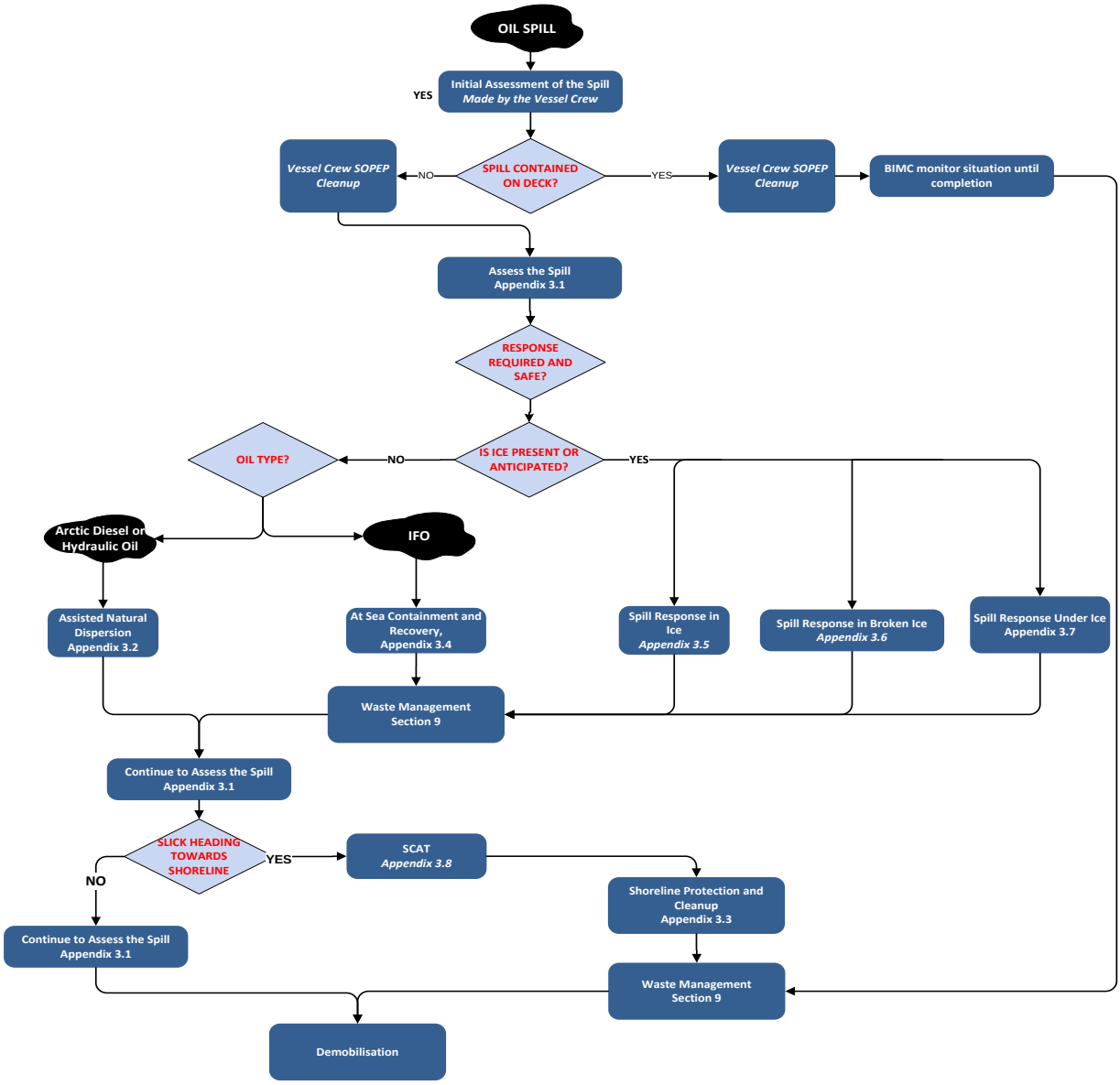

FIGURE 8-1 RESPONSE TECHNIQUE DECISION FLOW CHART

Figure 8-1 shows BIMC's appropriate response technique selection decision options. This flow chart can be used to implement the appropriate strategies in an effective manner.

The Tier 1, 2 and 3 response resources that support these response techniques are contained in Section 10, Spill Response Resources (p.36)

Appendix 3 provides Standard Operating Procedures (SOPs) associated with each of these response techniques.

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9 WASTE MANAGEMENT

All waste collected from clean-up operation is sent off-site for treatment at an approved treatment facility.

For storage of recovered fuel slick (from skimmers):

- A 25 m^3 inflatable barges is available and stored at Milne Port.
- Up two 150 m3 storage (bladders) at Milne Port (bladders can be loaded on barge as required).
- Slop recovered from skimming the spill is stored in this inflatable barge (temporarily) until a large vessel can be chartered to store and transport the recovered slop to an approved treatment facility (most likely Valleyfied, PQ).
- For slick recovered from shore clean up that may contain sand/gravel and shore debris – barge used to transport to transfer facility/point (i.e. larger vessel chartered to transport contaminated wastewater). Soil/debris stored separated and transported to an approved treatment facility (most likely Valleyfied, PQ).
- Same applies for dead birds and wildlife.
- No storage, treatment or disposal of recovered waste at Milne Port, except for contaminated snow recovered from spill on ice during winter.

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10 Spill Response Resources

10.1 Ship Response Equipment (Tier 1 Capability – SOPEP Resources)

All vessels are required to have onboard spill cleanup equipment and materials. These are detailed in each vessel's individual SOPEP. The typical list of equipment and materials found onboard is detailed in Table 10-1. These materials are designed to cleanup small operational spills contained onboard or in very close proximity to the vessel. It is stored in a response ready state and can be deployed immediately.

TABLE 10-1 – ONBOARD SOPEP EQUIPMENT AND MATERILS

Pollution	Drums	Yellow Salvage drums 95 gallons	Each	0		0	Pollution Container	
Pollution	Boom	Oil absorbent boom	Each	1		1	Pollution Container	
Pollution	Boom	Oil containment boom	Each	1		1	Port side reel or container	(1200ft)
Pollution	Pump	Diaphragm pump Sandpiper / Model FR2-M N0-515177	Each	1		1	Pollution Container	
Pollution	Absorbent	Oil absorbent 15 kilo bags	Each	22		22	Pollution Container	
Pollution	Skimmer	Pedco Mini Oil Skimmer	Each	1		1	Pollution Container	
Pollution	Recovery Pump	Honda model WT 20X	Each	1		1	Pollution Container	
Pollution	Suction hose	2 inch tank wagon X 25 feet	Each	1		1	Pollution Container	
Pollution	Discharge hose	2 inch lay flat X 25 feet	Each	1		1	Pollution Container	

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10.2 Baffinland Spill Equipment (Tier 2 Capability)

10.2.1 Milne Port Resources

Table 10-2 details BIMC's spill response capability. These resources are stored in a response ready state and can be mobilised in 1 hour.

The IC is responsible for mobilising these resources.

TABLE 10-2 TIER 2 CAPABILITY

Tier 2 resources based at Milne Port/Mary River		
Resource	**Quantity**	**Details/Image**
Helicopter	2	Single engine On site between June 15th to September 15th. 
Dornier Aeroplane	1	Fixed wing aircraft 
Containment Boom kits	1	1500 m in towable lengths long x 24" wide Anchor kits x 9 Towing bridles x 10 
Spill Response Unit	8	Includes; 300 bales of sorbent Pads 8-8' Socks 8-4' Socks Plug N Dike 10 lb container

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		12 large pillows small pillows 2 plug patties (instant leak stop) 2 neoprene drain covers telescopic shovel 25 lb Bag granular/peat 2 pr. Nitrile gloves 2 Tyvek poly-coated suits 1 roll (20) disposal bags 1 roll of barrier tape Castors available Capacity 546 litres / 120 gallons.
Overpack spill kit	4	Includes; 100 Sorbent pads 6 small pillows 2 large pillows 5 – 8’ socks 5 – 10’ socks 2 – 4’ socks Sorbent granular bag - 25lb Plug patties Goggles Gloves Tyvek suits 

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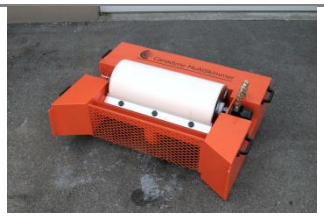
Multizorb Granular	500	12 kg bags
Transfer Pump	1	Custom pump skid for emergency fuel transfer from one tank to another
Transfer Pump Hose	8	2” x 8 m
Arctic mini berm - small	12	0.5m x 0.5m x 0.15m
Arctic mini berm	12	1m x 1m x 0.15m
Insta Berm	2	3m x 3m x 0.4m
Sorbent sheets	300	
Workboat	1	Aluminium Hull Outboard Towing post 
Drum Skimmer and diesel power pack	1	7.5 tonnes per hour 
Brush/Drum skimmer complete with diesel driven powerpack	1	20 tonnes per hour, brush attachment for higher viscosity product recovery 
Vacuum Truck	1	13,500 L capacity
Steel Drums	20	200 Litre Capacity
Rakes	12	For beach cleaning
Perforated Shovels	12	

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Pitch Fork	12	
Personal Flotation Devices	12	
Sand Stock pile	10 ton	for berming or making sand bags
Wildlife Protection Kit	1	Includes; Pyrotechnics (shell crackers, screamers, propane cannons for shore based spills. Visual scare tactics (helicopters, emergency response vessels) Broadcast Sounds (Breco bird scarer) Netting

Spill Response Vessels (2 charter tug boats and two line boats at Milne Port)	• Ability to cover a range of 100nm • Enclosed wheel house • Onboard accommodation • Onboard crane • Large deck space for working areas and equipment storage • Ability to maintain a low speed of 1 to 2 kts	

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Inflatable barge	2 X 10 m³ Capacity Towable	Stored at Milne Port 
Waste Storage Bladders	6 at 25 m^3 capacity	Stored on site at Milne Port

10.2.2 BIMC Response Times

Accident Location	Distance from Milne Port	Travel time by BIMC tugs from Milne Port to reach Accident site	Full containment fuel spill (booming)
Entrance to Baffin Bay	120 nm	12 hours	Up to 2 days
Mid Eclipse Sound	80 nm	8 hours	Up to 2 days
Entrance to Milne Inlet	40 nm	4 hours	Up to 2 days

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10.3 Tier 3 Arrangements

10.3.1 OSRL

BIMC is an Associate member with OSRL, therefore has immediate access to Tier 3 technical advice, resources and expertise 365 days a year on a 24 hr basis.

Table 10-3 summarises the OSRL service level agreement (SLA) available to BIM.

TABLE 10-3 OSRL SERVICE LEVEL AGREEMENT SUMMARY

Service	Service Standard
Response notification service/advice	In an incident a call should be placed to one of the following numbers: Emergency Contact: **TELEPHONE** — UK/Bahrain +44 (0) 2380 331 551; Singapore +65 6266 1566 Emergency Contact: **FAX** — UK/Bahrain +44 (0) 2380 724 314; Singapore +65 6266 2312
	The Duty Manager will speak and advise BIMC immediately, or call BIMC back within 10 minutes.
Spill response equipment	Response equipment is housed in secure facilities in Southampton, Fort Lauderdale, Bahrain and Singapore. Response equipment is customs cleared and response ready. **Refer:** OSRL Yearbook for a complete list of equipment available, www.oilspillresponse.com and **Refer:** the equipment stockpile status report http://www.oilspillresponse.com/activate-us/equipment-stockpile-status-report
	As per the SLA, BIMC can mobilise up to 50 % of the global stockpile. If there is more than one spill, BIMC can mobilise 50 % of what remains.
World-wide transportation of equipment	Hercules L382G in the UK will be used for transportation of Tier 3 response equipment. The aircraft are available for loading at the nominated base within 4 hrs from notification.
	24 hour access to global network of cargo and passenger charter services through a dedicated broker.
Spill trajectory and tracking	Trajectory and stochastic services for surface or subsurface spills on request, and backtrack services for surface spills using commercial modelling software: • Oil Spill Information System (OSIS) • OILMAP • Oil Spill Contingency and Response Model (OSCAR) Satellite imagery services can be provided on request.
Response Personnel	OSRL can respond to 2 major oil spills simultaneously, each with a maximum of 18 OSRL responders: • 1 x Incident Manager • 1 x Response Manager • 1 x Administrator • 14 x Spill Response Specialists • 1 x Technical Specialist
	A Technical Advisor can be dispatched to offer support to BIMC if they have a spill incident or the potential for an incident to occur. This is provided free of charge for the initial assessment period of up to 48 hrs. If a full response team is then mobilised, the technical advisor will form part of the available team headcount.

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OSRL Response Times

The following table provides an estimation of response times for mobilisation of Tier 3 resources to Baffin Island. OSRL can provide more accurate timescales at the time of a real incident.

		Resource	
		Tier 3 containment and recovery equipment	
Provider		OSRL charter on BIMC's behalf	
Start Location		Southampton	
Destination		Mary River	Pond Inlet
Aircraft type(s)		Variable based on availability	
Mobilisation and loading time		6 hours	
Time for over flight passes		24 – 48 hours	
Transit	**Start to destination (total)**	27 Hours	
	Fuel stop in (Airport code)	KEF and YFB	
Total		57 – 81 hours	
Comment		Payload and mobilisation time is dependent upon aircraft availability.	

Note: *All response times are subject to suitable availability of aircraft, weather conditions, security and over flight clearances. Additional time may be required to ensure timely application of applicable visas for Spill Response Specialists.*

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Logistical Support

OSRL respond to locations around the world. BIMC has an established logistics network in Northern Canada. To ensure equipment gets through customs clearance quickly and on to the lay down area for response, BIMC shall make the necessary arrangements for the equipment and OSRL personnel once in country.

An overview of the responsibilities for Client and OSRL are presented in Figure 10-1.

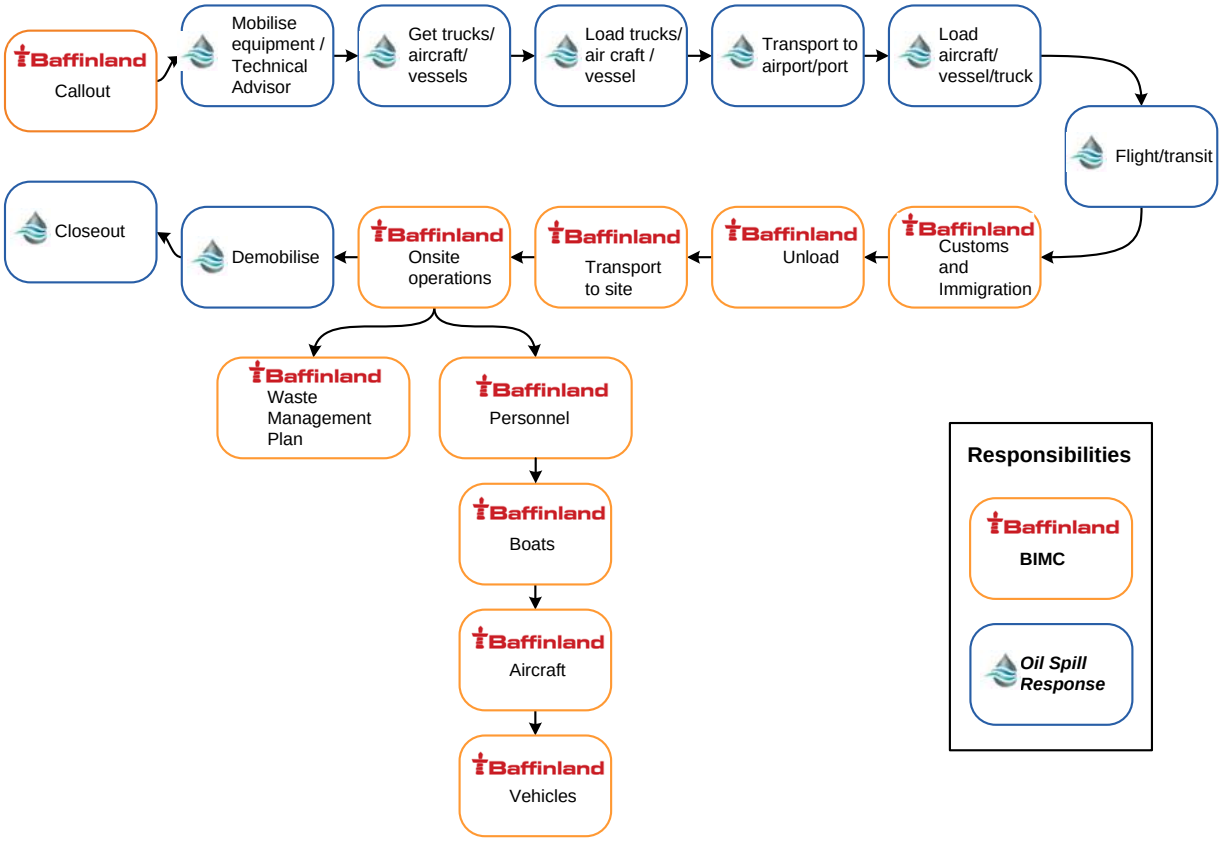

FIGURE 10-1 LOGISTICS RESPONSIBILITY

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10.3.2 Additional Tier 3 Resources

Contaminated Wildlife Response Resources

Sea Alarm

Through OSRL, BIMC has access to an external international wildlife response capability. The Sea Alarm Foundation (SAF) has extensive experience in dealing with contaminated wildlife emergencies. Specialised wildlife response equipment is pre-packaged, custom approved and stockpiled at OSRL in Southampton. This equipment can be mobilised on request by BIM. The mobilisation of Tier 3 wildlife emergency teams is not guaranteed and will depend on availability and voluntary commitment. This equipment is available 365 days a year on a 24 hr basis, as part of the Service Level Agreement. Experts from outside of OSRL and SAF are required to operate the equipment.

According to the SeaAlarm Country Wildlife Response Profile for Canada[3], the Environmental Protection Branch (EPB) of Environment Canada (EC) is responsible for preparation and response to contaminated wildlife incidents.

Table 10-4 provides contact details of other Wildlife response organisations that may be able to respond in the event of wildlife becoming contaminated.

TABLE 10-4: WILDLIFE EMERGENCY CONTACTS

Name	Location	Phone Number	Purpose
Canadian Wildlife Services (CWS)	Qimugjuk	1-867-979-7279	Knowing and providing information on the migratory bird resource and species at risk (under CWS jurisdiction) in the area of a spill (this includes damage assessment and restoration planning after the event) Minimizing the damage to birds by deterring unoiled birds from becoming oiled Ensuring the humane treatment of captured migratory birds and species at risk by determining the appropriate response and treatment strategies which may include euthanization or cleaning and rehabilitation.
Cobequid Wildlife Rehabilitation Centre	Brookfield, NS	1-902-893-0253	Provide veterinary care and rehabilitation for wildlife
Nunavut Emergency Management	P.O. Box 1000, Station 700 Iqaluit, NU X0A 0H0	1-800-693-1666	Nunavut Emergency Management is responsible for developing the territorial emergency response plans, coordinating general emergency operations at the territorial and regional levels, and supporting community emergency response operations.
International Bird Rescue	International	1-888-447-7143	Wildlife rehabilitation specialists, can manage all aspects of wildlife response

[3] Available [online] at: http://www.sea-alarm.org/publications/country-wildlife-response-profiles/

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The Global Response Network (GRN)

OSRL can also facilitate the mobilisation of further resources through the Global Response Network (GRN). The GRN is a collaboration of six major oil industry funded spill response organisations whose mission is to harness cooperation and maximise the effectiveness of spill response services worldwide. It includes:

- Alaska Clean Seas (ACS)
- Australia Marine Oil Spill Centre (AMOSC)
- ECRC (Eastern Canada Response Corporation)
- Marine Spill Response Corporation (MSRC)
- Oil Spill Response Limited (OSRL) (America, Europe, Middle East, Africa, Asia and Pacific)
- Western Canada Marine Response Corporation (WCMRC)

10.4 Additional Assistance Agreement

BIMC recognizes that organizing an effective response for a large spill event may require the use of additional tugs to effectuate sweeps and resupply crews at the incident scene, skimmers and barges for storage of waste.

Depending on where the incident occurs, it may be more practical to deliver OSRL's support equipment to a port where additional boat can be hired to transport the response equipment to the spill site.

As part of the on-going development and continuous improvement of BIMC's response capabilities, BIMC is pursuing Assistance Agreements with selected tug boat operators operating in the St Lawrence River or the Eastern seaboard as well as shipping providers for the provision of emergency transportation of response equipment in the event of a spill.

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REFERENCE INFORMATION

Introduction

This section contains background information and data on operating at Baffin Island, Canada. The section covers:

- Fuel Inventory
- Fuel Characteristics in Cold Marine Environment
- Mitigation Measures
- Historic Spill Data
- Spill Response Governance
- Fuel spill risk assessment

11 FUEL CHARACTERISTICS

Table 11-1 details the fuel volumes and characteristics that may be onboard transiting vessels under the scope of this SSRP. This table should be used for information only and not for possible spill scenarios. Reference should be made to Section 15, Fuel Spill Risk Assessment (p.59) for credible spill scenarios.

TABLE 11-1 FUEL INVENTORY

Location	Fuel Type	Volume	°API	SG	Viscosity (cSt @ 40°C)	Pour Point (°C)	Wax Content	ITOPF Group
Tanker	IFO	Combined = 17,000m³	17.6	0.949	0.99	-1	0	III
	Low Sulphur Fuel		17.6	0.949	0.99	-1	0	III
	Arctic Diesel		30-37	0.84-088		-17°C - -30°C		II
	Jet A fuel		45	0.8	1-1.9			I
	Marine Diesel		30-37	0.84-088		-17°C - -30°C		II
	Hydraulic Fluid		<35	0.88	100	<0	0	III
Ore Carrier	IFO	Combined = 3,000m³	17.6	0.949	0.99	-1	0	III
	Low Sulphur Fuel		17.6	0.949	0.99	-1	0	III
Tug Boats	Marine Diesel	100m³	30-37	0.84-088		-17°C - -30°C		II
Dry Cargo Vessels	IFO	1500 m³	17.6	0.949	0.99	-1	0	III
	Low Sulphur Fuel		17.6	0.949	0.99	-1	0	III
	Hydraulic Fluid		<35	0.88	100	<0	0	III

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Detailed below is a summary of the properties of each fuel and its likely behaviour when spilt.

IFO and Low Sulphur Fuel - ITOPF Group 3

IFO and Low Sulphur Fuel, are classified in Group 3 of the ITOPF classification according to their specific gravity. Group 3 oils undergo evaporation at a moderate rate; about one third will evaporate within 24 hours. This Group 3 characteristics are also highly variable, particularly in their tendency to emulsify and in their pour points.

The pour point affects the viscosity of the fuel and hence its dispersibility. The pour point is the temperature at which a fuel becomes semi-solid and ceases to flow. This happens because the waxes in the fuel crystallize out of solution. This causes the fuel to "gel" and greatly increase in viscosity.

The pour point of spilled fuel does not remain constant over time. It will gradually increase because evaporation of the lighter components of the fuel causes the waxes in the residual fuel to become concentrated, thus forcing their precipitation. This means that a freshly spilled fuel with a relatively low pour point may not gel, but may gel after some weathering.

This type of fuel normally forms emulsions readily; the rate of this formation and the stability of the emulsions formed are highly variable depending on their asphaltene content. High asphaltene content will promote rapid emulsification which can result in substantial increase in the viscosity and reduce the amenability to dispersants.

Fuels with high asphaltene content are typically heavier and more persistent fuels. Because of this nature, Group 3 is often classified as persistent; they may not be completely removed from an affected environment as a result of weathering processes or clean-up operations. This may result in long term effects to the environment.

Arctic Diesel

Arctic diesel fuel is a light petroleum distillate. Diesels vary in their properties, but have a specific gravity in the range 0.84-0.88 g/cm^3 (30-37^{o}API), with pour points of between -17^{o}C and -30^{o}C. As such they are generally classed in Group II, i.e. light persistent fuel, under the ITOPF classification according to their specific gravity[4].

Although classed as persistent, diesels contains a high proportion of light-ends which means that evaporation will be an important process contributing to the removal of spilt diesel from the sea surface. Evaporation of the lighter ends will be enhanced by higher wind speeds and warmer sea and air temperatures. Small diesel spills will usually evaporate and disperse within a day or less.

When spilled on water, arctic diesel spreads very quickly to a thin film of rainbow and silver sheens which elongates rapidly in the direction of the prevailing wind and waves. The low density and viscosity of the diesel contributes to rapid dispersal of the fuel into the water column; the speed of dispersion increases

4 ITOPF. 2010. Handbook 2010/11. Fate of Marine Oil Spills.

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with the wind speed. Dispersed diesel is readily and completely degraded by naturally occurring microbes, under time frames of one to two months.

Dispersed diesel in the water column can adhere to fine-grained suspended sediments (adsorption) which then settle out and may be deposited on the seafloor. This process is more likely to occur near river mouths where fine-grained sediments are carried in by rivers. It is less likely to occur in the open marine environment[5].

Under certain sea states diesel may form an emulsion although this will be unstable due to the absence of asphaltenes.

Hydraulic Fluid

Hydraulic fluid (specific gravity 0.88 g/cm^3, °API < 35, viscosity 100 cSt @ 30°C, pour point < 0°C, flash point >60°C) is a relatively viscous fluid and is classed in Group 3 under the ITOPF classification according to their specific density[6].

Hydraulic fluid has a low volatility and moderate flash point, so there is no major safety issue when dealing with this fluid. However, this fluid is fairly persistent in the environment. Expect limited spread and minimal loss through evaporation and natural dispersion. The action of mixing energy on hydraulic fluid is likely to produce a frothy emulsion.

Lubricating Fluid

Lubricating fluid or 'lube oil" (specific gravity 0.87 g/cm^3, °API 29, viscosity = 79-86 cSt @ 20°C, pour point -35°C, flash point >60°C) is relatively viscous fluid and is classed in Group 3 under the ITOPF classification according to their specific density[7].

Lubricating fluid flows easily and is easily dispersed if treated promptly[8]. However, this fluid is not easily assimilated by the environment and tends to persist in the environment. There is likelihood that the action of mixing energy on lubricating fluid will produce frothy emulsions. Emulsion can greatly increase the fluid viscosity as well as the total volume of fluid while inhibiting all other natural weathering processes (which act to reduce the spill volume) and the effectiveness of most response options. In addition, with the low volatility and moderate flash point, there is no major safety issue when dealing with this fluid.

[5] NOAA. 2006. Fact Sheet: Small Diesel Spills (500-5000 gallons), NOAA Office of Response and Restoration.

[6] ITOPF. 2010. Handbook 2010/11. Fate of Marine Oil Spills.

7 ITOPF. 2010. Handbook 2010/11. Fate of Marine Oil Spills.

8 EPA, 2009, Types of Refined Petroleum Products http://www.epa.gov/emergencies/content/learning/refined.htm [Accessed February, 2010]

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Jet A Fuel

Jet A Fuel (Specific Gravity 0.8 g/cm^3, °API 45) is a kerosene type aviation gas-turbine engine fuel and is categorised as Group 1 under the ITOPF classification[9]. Jet A1 flows easily and spreads rapidly. They are easily dispersed and do not have any tendency to emulsify[10].

As this fuel is composed of mainly the low-weight components, they are highly volatile. They will evaporate and dissolve readily and leave little or no residue. However, many of these low-weight components are toxic and potentially flammable and readily inhaled and are of concern for human health and safety.

11.1 Fuel Characteristics in Cold Marine Environments

11.1.1 Fuel Properties

The main properties of fuel that affect its behaviour if split at sea are:

- specific gravity (SG) (its density relative to pure water often expressed as an °API)
- distillation characteristics (its volatility)
- viscosity (its resistance to flow)
- pour point (the temperature below which it will not flow)

The International Tanker Owners Pollution Federation (ITOPF) classifies oil into four main groups based roughly on their SG. Predicted rates of dissipation are determined from the classification of the oil.

Figure 11-1 shows the oil classifications and the time anticipated for the oil to dissipate. The graph also takes account of the competing process of emulsification, which for most oil leads to an increase in volume. The curves on the graph represent an estimated 'average' behaviour for each group. The behaviour of a particular oil may differ from the general pattern depending on its specific properties and the environmental conditions at the time of the spill.

9 ITOPF. 2010. Handbook 2010/11. Fate of Marine Oil Spills.

[10] NOAA. 1992. Introduction to Coastal Habitats and Biological Resources for Spill Response. Oil Behaviour and Toxicity.

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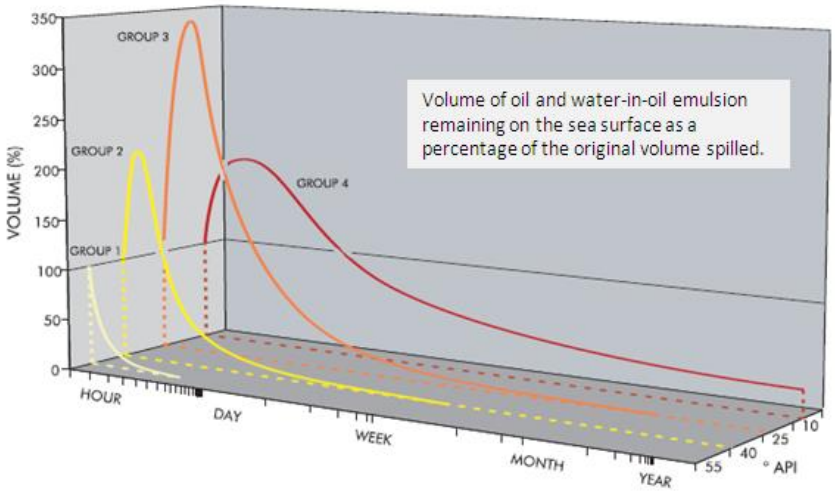

Source: ITOPF Handbook 2010/11

Group 1 SG 0.8 (°API >45)	**Group 3 SG 0.85-0.95 (°API 17.5-35)**
Group 2 SG 0.8-0.85 (°API 35-45)	**Group 4 SG >0.95 (°API <17.5)**

FIGURE 11-1 CLASSIFICATION OF OIL ACCORDING TO SPECIFIC GRAVITY

11.1.2 Spill Fate and Behaviour in Cold Marine Environments

The fate and behaviour of fuel spilled at sea depends largely on the physical and chemical properties of the fuel. It is the fuel's chemical composition, in combination with meteorological conditions, which affect the way in which the fuel breaks up and dissipates into the marine environment, or persists. This interaction between the spilled fuel and its new environment is a process known as weathering, and it can only be predicted if the fuel's properties are known.

The behaviour of spilled fuel depends on properties such as density, viscosity and pour point. At cold temperatures, fuel will be denser and more viscous than in standard conditions. If ambient air and water temperatures approach the fuel's pour point, it will cease to flow.

11.1.3 The Weathering Process

Once spilled, fuel is exposed to a wide variety of physical, chemical and biological processes that begin to break down the fuel, changing its composition, behaviour and toxicity. These processes are known as weathering (Figure 11-2) and apply to open ocean and ice-bound environments (Table 11-2). They are influenced by the cold weather environment, with both temperatures and the presence of ice greatly impeding the spread and weathering of fuel (Figure 11-3).

Tiered resources and response techniques for operations BIMC's location have been planned based on the fuel's predicted weathering in the marine environment. This has been done using oil spill models that include algorithms for weathering processes on tested fuels and/or using historical spill records for fuels with similar properties.

If fuel is spilled, additional modelling can predict the fate and behaviour of the spilled fuel based on the current and forecast meteorological conditions.

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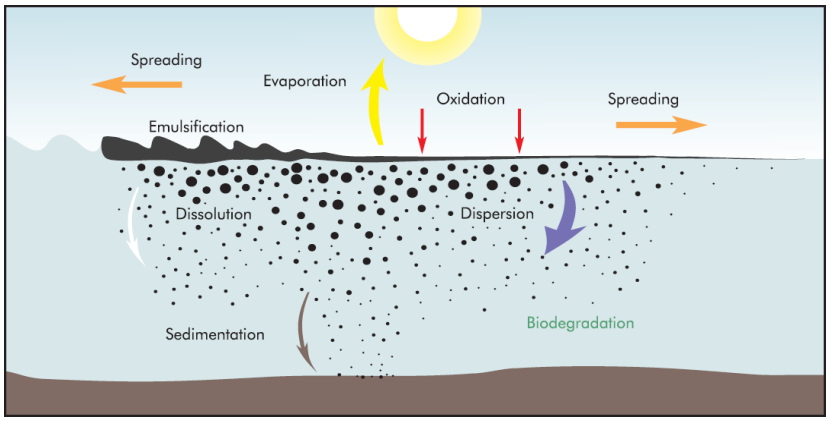

FIGURE 11-2: WEATHERING OF FUEL SPILLED IN THE MARINE ENVIRONMENT

TABLE 11-2: LOCATION-SPECIFIC WEATHERING OF FUEL.

	Open Water	In Ice (with increasing ice coverage)
Spreading	Cold water increases fuel viscosity and reduces the rate of spreading. A fuel slick on cold water is usually thicker and occupies a smaller area than it would in a warmer climate.	Rate of fuel spreading on ice is controlled primarily by fuel viscosity, so is slow in cold temperatures. Deformed ice features may create pools of fuel, whilst snow will absorb the fuel, reducing spreading.
Drift	Fuel will drift according to wind and currents.	Fuel will drift in the direction of drifting ice. Ice and low water temperature reduce the rate of spreading and drifting of spilled fuel.
Evaporation	Surface fuel slicks will maintain a steady rate of evaporation. Evaporation is reduced compared to more temperate climates.	Cold temperatures and increased fuel slick thickness (due to confinement in ice) reduces both the rate and degree of evaporation.
Emulsification	Dependent on wave action mixing water droplets into the spilled fuel. Mainly occurs in the presence of breaking waves.	Emulsification of fuel in ice is uncommon. Usually decreases or does not occur with increasing ice coverage due to less energy.
Natural Dispersion	Natural dispersion is driven by wind or wave action so is dependent on sea state rather than temperature.	Low rate of natural dispersion due to reduced energy conditions and opportunities for mixing when fuel is spilled in the ice. Ice floes are a source of surface turbulence.
Biodegradation	Many marine bacteria are present even in cold water environments. Bacteria consume the hydrocarbons in fuel, naturally reducing its volume.	Bacteria are present in ice covered areas, but may not be in contact with fuel as freely as in open water. Bacteria slowly break down hydrocarbons.
Dissolution	Fuel contains water-soluble compounds which may dissolve in the surrounding water.	Very few of the water-soluble components of fuel could diffuse down to the bottom of the ice sheet.

Due to the natural dynamism of the cold weather environment (instability of moving ice and changing weather conditions) the weathering of spilled fuel may not necessarily follow the expected behaviour.

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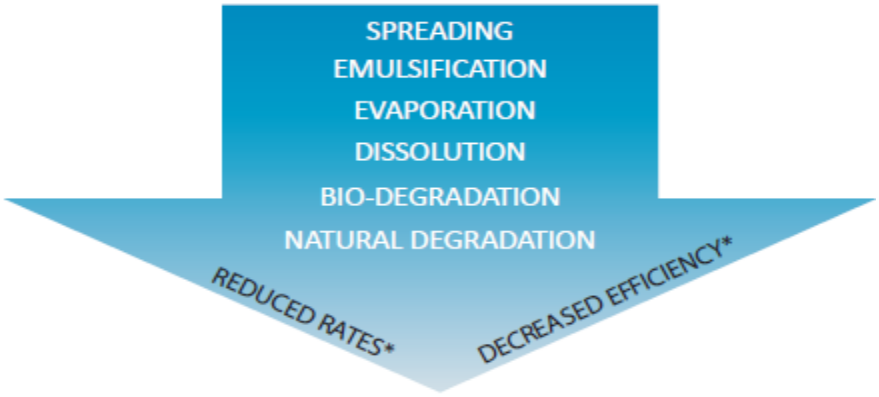

FIGURE 11-3: EFFECT OF COLD TEMPERATURES ON THE WEATHERING OF FUEL

In general, the cold environment will reduce the rate of weathering and decrease the spread of the fuel, however the extent of the influence will be dependent on the location in which the fuel is present (Figure 11-4).

FIGURE 11-4: POTENTIAL FATES OF FUEL SPILLED IN COLD MARINE ENVIRONMENTS

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12 MITIGATION MEASURES

Risk management is a process that evaluates outputs from risk assessments and puts in place measures to ensure that identified risks are acceptable or require mitigation. Risk reduction measures must be technically feasible and cost effective (i.e. the associated costs should not be disproportionate to the benefits gained). BIMC has put in place the following mitigation measures to reduce the potential for an fuel spill to occur and the impact it may have.

- Standard Operating Procedures (SOP's)
- SOPEP's
- Bridge resource management
- COLREG's
- Ice Pilots
- Crew training and certification
- SMS

13 HISTORIC SPILL DATA

The International Tanker Owners Pollution Federation Limited (ITOPF) manages a database with information on nearly 10,000 spills associated with tankers, combined carriers and barges globally. Data collected includes the number of spills annually and volumes spilt from these shipping sources every year since 1970. Tanker spill sizes have been categorised as small spills (<7 tonnes), medium spills (between 7 and 700 tonnes) and large spills (>700 tonnes).

The occurrence of large and medium tanker spills (defined as over 700 tonnes and 7 to 700 tonnes respectively) has decreased over the last 4 decades. In the 2000s there was an annual average of 3.3 large spills and 14.9 medium spills; while in the 1970s an annual average of 24.6 large spills and 54.2 medium spills were recorded. This spill decrease has been observed despite a steady increase in seaborne trading observed since the mid 1980's (Fearn Research and Lloyds List Intelligence, cited in ITOPF 2012).

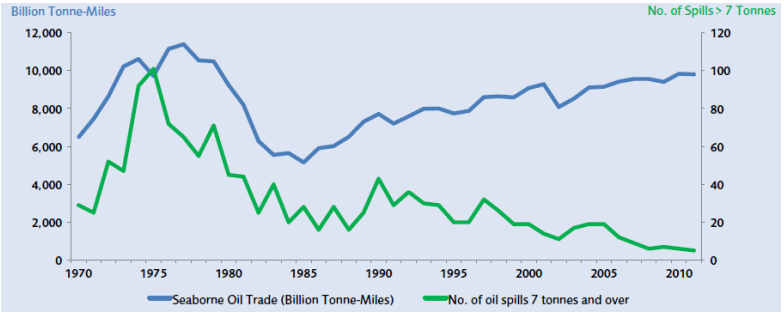

FIGURE 13-1: SEABORNE TRADE AND NUMBER OF TANKER SPILLS >7 TONNES, 1970 TO 2011. SOURCE: ITOPF, 2012

13.1 QUANTITIES OF SPILLS

Although the majority of spills that occur are small (< 7 tonnes), there is insufficient data available on the number and amounts spilt due to inconsistent reporting. ITOPF has used data on medium to large spills to

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generate annual estimates of total spilt between 1970 and 2012. Based on this data, it is estimated that almost 5.75 million tonnes has been spilt through tanker incidents within that time with the vast majority occurring in the 1970s.As with the number of spill incidents, the quantity spilt has reduced significantly over the past 4 decades (Figure 13-2).

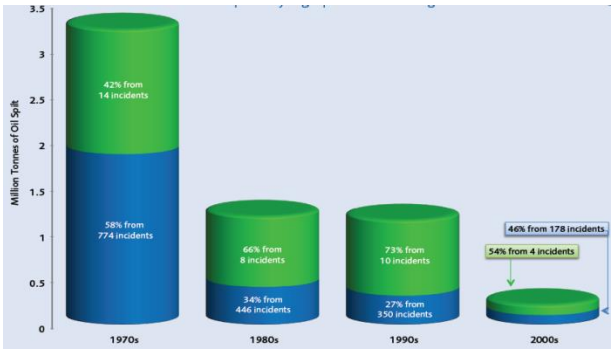

FIGURE 13-2: SPILLS >7 TONNES PER DECADE SHOWING THE INFLUENCE OF A RELATIVELY SMALL NUMBER OF LARGE SPILLS ON THE OVERALL FIGURE (ITOPF, 2012)

13.2 CAUSES OF SPILLS

The causes and circumstances of spills vary and have a significant effect on the final quantity spilt. Small and medium spills account for 95% of all incidents recorded with a large percentage, 40% for small and 29% for medium, of these occurring during loading and discharge at ports and terminals (Figure 13-3 and Figure 13-4). The remaining 5% of incidents are large spills, which have reduced over the years but incidents recorded show that allusions, collisions and groundings accounted for 59% of these large spills (Figure 13-5). Half of these incidents when the vessel was underway in open water (Figure 13-6).

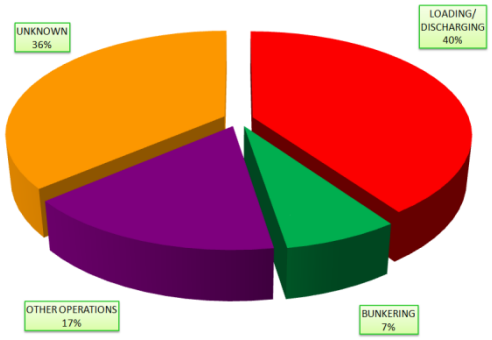

FIGURE 13-3: INCIDENCE OF SPILLS <7 TONNES BY OPERATION AT TIME OF INCIDENT, 1974-2012

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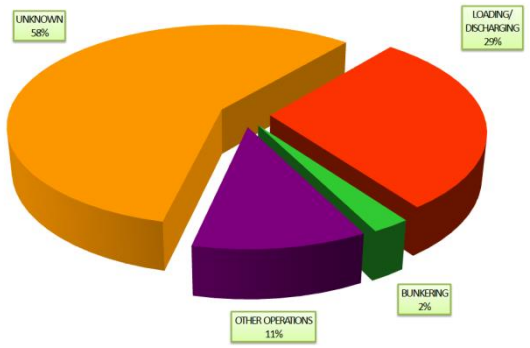

FIGURE 13-4: INCIDENCE OF SPILLS 7-700 TONNES BY OPERATION AT TIME OF INCIDENT, 1970-2012

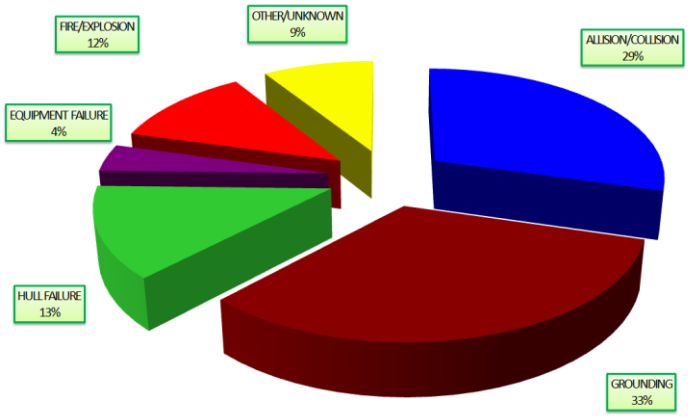

FIGURE 13-5: INCIDENCE OF SPILLS >700 TONNES BY CAUSE, 1970-2012

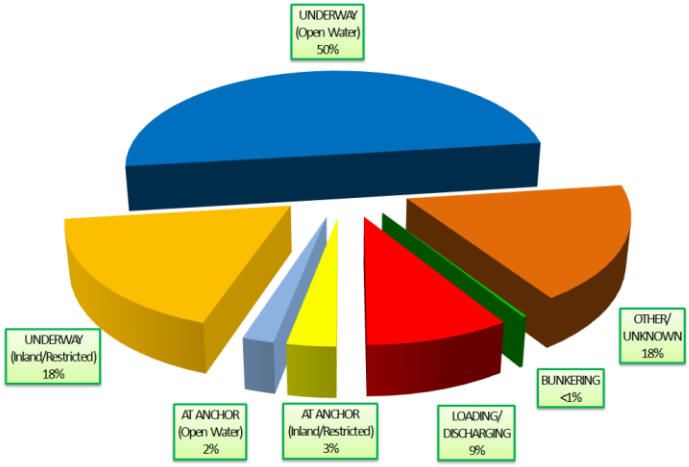

FIGURE 13-6: INCIDENCE OF SPILLS >700 TONNES BY OPERATION AT TIME OF INCIDENT, 1970-2012

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14 KEY CANADIAN ARCTIC STAKEHOLDERS

The following authorities and organisations hold key roles in spill response incident management in the Canadian Arctic.

14.1 THE CANADIAN COAST GUARD

The response to spills at the Milne Inlet site shall be managed in coordination with the Canadian Coast Guard whom are the lead response agency north of 60°.

The Central & Arctic Regional Response Plan (2008) and the Baffin Region, Nunavut Area Plan outline the Canadian Coast Guard's response capability for the Baffin region. This plan is a component of the Canadian Coast Guard National Response Plan which is the responsibility of the Director of Safety and Environmental Response Systems, Ottawa. It establishes the framework and the procedures by which Central & Arctic Region will prepare for, assess, respond to and document actions taken in response to pollution incidents in this Region. This capability and the information contained in the Coast Guard plans are considered a valuable resource in the planning and response to spills at the Milne Inlet Bulk Fuel Storage Facility.

14.2 ENVIRONMENT CANADA SCIENCE TABLE

The Environment Canada Science Table is a multi-agency, multidisciplinary group specializing in environmental emergencies. The Science Table is designed to provide consolidated and coordinated environmental advice, information and assistance in the event of an environmental emergency. The Science Table members represent several federal, provincial, territorial and municipal government departments, aboriginal communities, private sector agencies, and local individuals.

During emergency response situations the Science Table operates as a flexible and expandable multi-disciplinary and multi-agency team brought together to obtain and provide comprehensive and coordinated environmental advice, information and assistance to On Site Coordinator or Lead Government Agency.

14.3 TRANSPORT CANADA

Transport Canada promotes efficient marine transportation and safe, secure and sustainable marine practices; oversees marine infrastructure; regulates the safe transportation of dangerous goods by water; and helps protect the marine environment.

14.4 GOVERNMENT OF NUNAVUT

Quantities of hazardous substances spilled that require reporting are listed in Schedule B of the Nunavut Spill Contingency and Reporting Regulation. After the initial field emergency response to the spill event, spills are reported to the 24-hour Spill Report Line:

24-Hour Spill Report Line
spills@gov.nt.ca

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Tel. (867) 920-8130 or
Fax (867) 920-8127
Failure to report a spill can lead to fines.

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15 Fuel Spill Risk Assessment

15.1 Risk Assessment Methodology

This fuel spill risk assessment has been conducted in five steps which are explained below. The Risk Assessment definitions of Consequence and Likelihood are outcomes from a workshop held with NIRB, GN DoE, and BIMC in June 2012 and are based upon the Transport Canada guidelines. It also meets International Maritime Organisation (IMO) guidance.

The Risk Register (Section 15.2) and Risk Assessment Matrix (RAM) (Section 15.3) show the outcomes of the risk assessment.

Step 1 **Fuel Spill Scenarios**	All operation processes and actions were reviewed to identify potential sources, and events, that could lead to a fuel spill. The potential scenario, fuel type and volume are recorded in the Risk Register. **Refer:** Section 15.2, (p.62).
Step 2 **Likelihood and Consequence**	The likelihood and consequence of all fuel spill scenarios identified were semi quantitatively measured using industry best practise. Only the likely consequence of the scenario on the environment is considered. Table 15-1 and Table 15-2 record the environmental consequence and likelihood. • The likelihood of each scenario is based on historical data sources and considering fuel spill mitigation measures already in place. **Refer**: Mitigation Measures, Section 12, (p.54) and Historical Data, Section 13, (p.54). • The consequence for each scenario has been predicted based on the way the fuel will behave when spilled (**Refer**: Fuel Characteristics, Section 11.1.1, (p.50) and the environmental information (**Refer**: Environmental Information, Appendix 4) which may be affected based on the fuel spill modelling results, Step 3. The potential fuel spill scenarios and assigned likelihood and consequence values are recorded in the Risk Register. **Refer:** Risk Register, Section 15.2, (p.62).
Step 3 **Fuel Spill Scenario Impacts**	The potential impact of the scenarios outlined in the Risk Register have been assessed by: • Fuel spill modelling of the potential credible worst case scenarios identified in Step 2. **Refer:** Fuel Spill Modelling Section, Appendix 5 • Reviewing the environmental information to identify impacts from a fuel spill. **Refer:** Environmental Information, Appendix 4.
Step 4 **Tiered Response**	The tiered response approach and response technique suitable for each scenario were determined. Influencing factors include: fuel type, spill volume, climate, proximity to sensitive resources and response capability. This information has been recorded this information in the Risk Register. **Refer:** Risk Register, Section 15.2, (p.62).
Step 5 **Risk Assessment Matrix**	The risk profile is completed using the RAM. The RAM highlights the scenarios which are deemed low, medium or high risk. **Refer:** RAM, Section 15.3, (p.69).

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TABLE 15-1 DEFINITION OF CONSEQUENCE CATEGORIES

Consequence	Definition
Critical	Major uncontrolled event or inefficiency with uncertain and perhaps prohibitively costly remediation. Health and Safety: Fatality. Production: More than six month production loss or expenditure. Cost: >$500,000,000 damage or additional costs. Environmental Impact/Compliance: Very serious environmental impacts with impairment on landscape/marinescape ecology. Long-term, widespread effects on significant environment. Corporate Image or Utility: Corporate image tarnished internationally. Community Affairs: Non compliance with existing community agreement. Extreme and widespread community concerns with international exposure/influence.
Major	Significant event or inefficiency that can be addressed but with great effort. Health and Safety: Lost-time injury(s) potentially resulting in permanent disability. Production: Three to six months production or expenditure. Cost: $100,000,000 to $500,000,000. Environmental Impact/Compliance: Serious environmental impacts with impairment on ecosystems. Relatively widespread long-term effects. Regulatory approval withdrawn for a few months. Corporate Image or Utility: Corporate image tarnished in North America. Community Affairs: High local community concerns with national exposure/influence
Moderate	Moderate event or inefficiency that might need physical attention and certainly engineering review. Health and Safety: Lost-time injury (no permanent disability). Production: One to three production loss or expenditure. Cost: $1,000,000 to $100,000,000 damage or additional costs. Environmental Impact/Compliance: Some impairment on ecosystem function. Displacement of species. Moderate short-term widespread effects. Regulatory orders with significant cost implications. Corporate Image or Utility: Corporate image tarnished in region. Community Affairs: Moderate local community concern with potential permanent damage to relations.
Minor	Minor incident or inefficiency that might require engineering review and is easily and predictably remediated. Health and Safety: Injury (no lost time). Production: Less than one month production loss or expenditure. Cost: $100,000 to $1,000,000 damage or additional costs. Environmental Impact/Compliance: Minor effects on biological or physical environment. Minor short-term damage to small areas. Corporate Image or Utility: Corporate image not affected, written complaint or concern dealt with internally. Community Affairs: Minimal local community concern with no lasting damage to relations.

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Insignificant	Minor incident or inefficiency of little or no consequence. Health and Safety: No injury or lost time. Production: One to two weeks production loss or expenditure. Cost: <$100,000 damage or additional costs. Environmental Impact/Compliance: No lasting impacts. Low-level effects on biological or physical environment. Limited damage to minimal area of low significance. Corporate Image or Utility: Corporate image not affected or verbal complaint dealt with internally. Community Affairs: No community concern

TABLE 15-2 DEFINITION OF LIKELIHOOD CATEGORIES

Likelihood	Description in Context of Full Operating Life of the Facility	Frequency
Almost Certain	Consequence expected to occur in most circumstances	High frequency of occurrence - occurs more than once per year
Likely	Consequence will probably occur in most circumstances	Event does occur, has a history, occurs once every 1 to 10 years
Possible	Consequence could occur at some time	Occurs once every 10 to 100 years
Unlikely	Consequence may occur at some time	Occurs once every 100 to 1000 years
Rare	Consequence may occur at some time	Occurs once every 1000 to 10 000 years

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15.2 Risk Register

TABLE 15-3: VESSELS

SCENARIO						Initial Risk			Mitigation Measures	Residual Risk		
#	Source	Event	Fuel Type	Spill Volume	Impact	Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
1a	Ship to shore transfer	Small operational deck spill when connecting or disconnecting loading hose.	Arctic Diesel	<0.5m³L	Run off into the water causing large spread sheen around vessel.	Almost Certain	Insignificant	Moderate	• Scupper plugs • Drip trays • Standard Operating Procedures (SOP's) • Training • SOPEP	Likely	Insignificant	Low
1b			Marine Diesel									
1c			Jet A Fuel									
2	Fuelling	Tank over flow out of tank vents onto ships deck during fuellinging operations.	Marine Diesel	<1m³	Run off into water causing sheen around vessel spreading over a large area	Likely	Insignificant	Low	• Scupper plugs • SOP's • Training • Maintaining a constant deck watch • Tank capacity alarms • SOPEP	Likely	Insignificant	Low

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SCENARIO						Initial Risk			Mitigation Measures	Residual Risk		
#	Source	Event	Fuel Type	Spill Volume	Impact	Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
3	Vessel Bilge	Accidental discharge of vessel bilge while transiting the area.	bilge water	<1m³L	Long stream of sheen may be observed behind vessel track. Bilge water will likely disperse rapidly into water column.	Likely	Insignificant	Low	• Bridge resource management • Crew training • Auto overboard valve shut offs • SOPEP	Likely	Insignificant	Low
4	Vessel on board hydraulic equipment	Hydraulic leak from davits/cranes/winches due to malfunction, operator error, collision or lack of maintenance.	Hydraulic fluid	<1m³L	Large sheen across water and around vessel. Spreading rapidly and gradually dispersing into the water column.	Likely	Insignificant	Low	• Vessel maintenance schedule • SOP's • Crew training • Scupper plugs • Isolation valves • SOPEP	Possible	Insignificant	Low

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SCENARIO						Initial Risk			Mitigation Measures	Residual Risk		
#	Source	Event	Fuel Type	Spill Volume	Impact	Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
5	Fuelling	Coupling or hose malfunction during fuelling operation from the fuelling vessel to receiving vessel. Delay in detecting leak leads to larger quantities spilt.	Marine Diesel	0.5 – 1m³	Run off into water causing sheen around. Spreading may occur and impact with Milne Inlet coast line possible.	Likely	Insignificant	Low	• SOP's • Maintaining a constant look out. • Regular inspection to equipment • Routine preventative maintenance. • SOPEP	Possible	Insignificant	Low
6a	Product transfer	Coupling or hose break/malfunction at the ship's manifold	Arctic Diesel	<1m³	Run off into the water causing large spread sheen around vessel. Spreading may occur and impact with Milne Inlet coast line possible.	Likely	Insignificant	Low	• Scupper plugs • Drip trays • SOP's • Regular inspection to equipment • Routine preventative maintenance • Constantly manned ships manifold • Low pressure sensor alarm • SOPEP	Possible	Insignificant	Low
6b			Marine Diesel									
6c			Jet A Fuel									

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SCENARIO						Initial Risk			Mitigation Measures	Residual Risk		
#	Source	Event	Fuel Type	Spill Volume	Impact	Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
7a	Product transfer	Coupling leaking or hose rupture along length of hose between ship and shore manifold. Delay in detecting leak leads to increase spill volume.	Arctic Diesel	<35m³	Possible on land spill and on water spill. Ground penetration and run off into surrounding water.	Possible	Moderate	Moderate	• SOP's • Regular inspection to equipment • Routine preventative maintenance • Constantly manned ships manifold • Low pressure sensor alarm • SOPEP	Unlikely	Moderate	Moderate
7b			Marine Diesel									
7c			Jet A Fuel									
8a	Tanker	Loss of 2 holds due to collision or grounding.	Arctic Diesel	4,000m³	Wide spread coastal impact - location dependant on where the loss occurs.	Unlikely	Critical	Moderate	• Bridge Resource Management • COLREG's • Ice Pilots • Crew training and certification • SOPEP	Rare	Critical	Moderate
8b			Marine Diesel									
8c			Jet A Fuel									

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SCENARIO						Initial Risk			Mitigation Measures	Residual Risk		
#	Source	Event	Fuel Type	Spill Volume	Impact	Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
9a 9b 9c	Tanker	Loss of 2 holds due to collision or grounding during the late shoulder season.	Arctic Diesel Marine Diesel Jet A Fuel	4,000m³	Wide spread coastal impact - location dependant on where the loss occurs. Entrapment in ice if freezing has occurred.	Unlikely	Critical	Moderate	• Bridge Resource Management • COLREG's • Ice Pilots • Crew training and certification • SOPEP • Ice Pilots	Rare	Critical	Moderate
10	Tugs	Loss of vessel	Marine Diesel	<1,000m³	Wide spread coastal impact	Unlikely	Major	Moderate	• Bridge Resource Management • COLREG's • Ice Pilots • Crew training and certification • SOPEP	Rare	Major	Low
11	Tugs	Loss of vessel during late shoulder season.	Marine Diesel	<1,000m³	Wide spread coastal impact. Entrapment in ice if freezing has occurred.	Unlikely	Major	Moderate	• Bridge Resource Management • COLREG's • Ice Pilots • Crew training and certification • SOPEP	Rare	Major	Low

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SCENARIO							Initial Risk			Mitigation Measures	Residual Risk		
#	Source	Event	Fuel Type	Spill Volume		Impact	Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
12	Ore carrier	Loss of entire vessel	IFO Low Sulphur Fuel	2,000m³ 1,000m³	Total = 3,000m³	Wide spread coastal impact.	Unlikely	Critical	Moderate	• Bridge Resource Management • COLREG's • Ice Pilots • Crew training and certification • SOPEP	Rare	Critical	Moderate
13	Ore carrier	Loss of entire vessel during late shoulder season.	IFO Low Sulphur Fuel	2,000m³ 1,000m³	Total = 3,000m³	Wide spread coastal impact. Entrapment in ice if freezing has occurred.	Unlikely	Critical	Moderate	• Bridge Resource Management • COLREG's • Ice Pilots • Crew training and certification • SOPEP	Rare	Critical	Moderate
14	Tanker	Complete loss of entire hydrocarbon inventory by collision or grounding at any given point within Eclipse Sound or Milne Inlet	Arctic Diesel	Total =17,000m³		Wide spread coastal impact - location dependant on where the loss occurs.	Rare	Critical	Moderate	• Bridge Resource Management (**refer:** Mitigation measures section) • COLREG's • Ice Pilots • Crew training and certification • SMS • SOPEP	Rare	Critical	Moderate

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SCENARIO						Initial Risk			Mitigation Measures	Residual Risk		
#	Source	Event	Fuel Type	Spill Volume	Impact	Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
15	Tanker	Complete loss of entire hydrocarbon inventory by collision or grounding at any given point within Eclipse Sound or Milne Inlet late in the shoulder season.	Arctic Diesel Marine Diesel Jet A Fuel IFO Low Sulphur Fuel	Total =17,000m³	Wide spread coastal impact - location dependant on where the loss occurs. Entrapment in ice if freezing has occurred.	Rare	Critical	Moderate	• Bridge Resource Management (**refer:** Mitigation measures section) • COLREG's • Ice Pilots • Crew training and certification • SMS • SOPEP	Rare	Critical	Moderate

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15.3 Risk Assessment Matrix

The risks have been recorded and plotted on the following RAM to identify risks of low, medium or high severity.

TABLE 15-4 RISK ASSESSMENT MATRIX

	Likelihood				
Consequence	**Rare**	**Unlikely**	**Possible**	**Likely**	**Almost Certain**
Critical	**Moderate** 8a, 8b, 8c, 10, 11	**Moderate**	**High**	**Extreme**	**Extreme**
Major	**Low**	**Moderate** 9	**Moderate**	**High**	**Extreme**
Moderate	**Low**	**Moderate** 7a, 7b, 7c	**Moderate**	**Moderate**	**High**
Minor	**Very Low**	**Low**	**Moderate**	**Moderate**	**Moderate**
Insignificant	**Very Low**	**Very Low**	**Low** 4, 5, 6a, 6b, 6c	**Low** 1a, 1b, 1c, 2, 3	**Moderate**

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Appendices

Contents

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Appendix 1 – Contacts Directory

Position/Organisation	Name	Contact Details
Vessel Master		VHF Channel 16
Canadian Coast Guard (Central and Arctic Region)	Duty Officer	Ontario – Tel +1 800 265 0237
Marine Facility Security Officer	Dale DeGagne or delegate	Tel (647)253-0596 ext. 4630 VHF Channel **SS TAC/Emergency/Marine**
Incident Commander	Richard Church Dale Wales Or Designate	VHF Channel **SS TAC/Emergency/Marine** Tel (647)253-0596 ext. 4219
EMT Leader	Dale DeGagne Dwayne Chyz Or Designate	Incident Command Centre Tel (647)253-0596 ext. 4630
Environmental Planning Team Leader	Lea Willemse Nick Kuzyk	Tel (647)253-0596 ext. 4130 VHF Channel **SS Tac**
Logistics Team Leader		
Health and Safety Team Leader	Mario Vottero Brian Larson	Tel (647)253-0596 ext. 4122 VHF Channel **SS Tac**
CEMT Leader	Erik Madsen	416-996-5523
OSRL	Duty Manager (DM)	Tel +44 (0) 2380 331 551 Fax +44 (0) 2380 724 314
Transport Canada	Jaideep Johar Craig D. Miller	Manager, Technical services Marine Safety, Tel: 204 984 8618 Cell: 204 880 0754,Email:joharj@tc.gc.ca Manager, Marine Safety (PNR) Email: craig.miller@tc.gc.ca Telephone (204) 984-0397 / Facsimile, (204) 984-8417
Nunavut Government		24-Hour Spill Report Line spills@gov.nt.ca Tel. (867) 920-8130 or Fax (867) 920-8127

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Department of Environment - Environmental Protection Division PO Box 1000 Station 1300 Iqaluit, NU, Canada X0A 0H0 Tel: (867) 975-7700, 1-866-222-9063 Fax: (867) 975-7742	**Department of Fisheries and Oceans** - Central and Arctic Region 520 Exmouth Street Sarnia, ON N7T 8B1 Tel: (519) 383-1813, (866) 290-3731 Fax: (519) 464-5128
Qikiqtani Inuit Association Igluvut Building, 2nd floor PO Box 1340 Iqaluit, NU X0A 0H0 Tel: (867) 975-8400, 1-800-667-2742 Fax: (867) 979-3238	**AANDC** - Nunavut Regional Office Qimugjuk Building PO Box 2200 Iqaluit, NU X0A 0H0 Tel: (867) 975-4500 Fax: (867) 975-4560
AANDC - Water Resources Division Qimugjuk Building PO Box 100 Iqaluit, NU X0A 0H0 Tel: (867) 975-4550 (Water Resources Manager) Fax: (867) 975-4560	**Mittimatalik Hunters and Trappers Organization** PO Box 189 Pond Inlet, NU, Canada X0A 0S0 Tel: (867) 899-8856 Fax: (867) 899-8095
Nunavut Impact Review Board PO Box 1360 Cambridge Bay, NU, Canada X0B 0C0 Tel: (867) 983-2574, 1-866-233-3033 Fax: (867) 983-2594	**Nunavut Water Board** PO Box 119 Gjoa Haven, NU, Canada X0B 1J0 Tel: (867) 360-6338 Fax: (867) 360-6369
Hamlet of Pond Inlet (867) 899-8934	**Hamlet of Hall Beach** (867) 928-8829 ext 211
Hamlet of Cape Dorset (867) 897-8943	**Hamlet of Arctic Bay** (867) 439-9917
Hamlet of Igloolik (867) 934-8940	**Hamlet of Clyde River** (867) 924-6220
Hamlet of Kimmirut (867) 939-2247	

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Appendix 2 – Forms

1 PERSONAL LOG

Personal Log		
Name:		Date:
Location of Incident:		
Latitude :		Longitude:
GUIDANCE	Safety hazards	Note potentially unsafe activities encountered and measures employed or suggested to mitigate the hazard.
	Initial notification	Record the time of notification of the incident and name of informant.
	Daily activities	Keep a record of the location and time of key activities including meetings attended instructions issued/received, site visits and movements, contacts with outside agencies.
	Personal contacts	Generate a list of relevant contacts, including name, organisation, responsibility and telephone/fax numbers.
	Photographic/video records	Note location, date and time of pictures taken. For oiled areas take a series of shots from different viewpoints and record location of viewpoint if possible.
	Oil distribution	If visiting oiled areas, make rough notes or a sketch showing extent of oiling.
	Site supervision	If leading a response team, ensure an accurate record is kept of the staff working under your supervision and their hours of work. Also keep records of the equipment utilised and its condition.
	Expenditure incurred	Keep receipts / record of all expenditure to validate claims.

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2 BIMC Oil Spill Notification Form

BIMC Oil Spill Notification Form			
	☐ Urgent	☐ Critical	
Date/Time of Report:			
Date/Time of Incident:			
Location of Incident:			
Latitude:		Longitude:	
Original Report Source:			
Contact:	Phone/Mobile:	Fax/Email:	
Nature of incident and spill source (if source unknown give identity and position of adjacent vessels):			
Point of Discharge from Source:			
Cause of Discharge:			
Oil Type or Description:			
Has Discharge Stopped/Temporarily Stopped?			
Extent of Spill:			
Projected Trajectory of Spill:			
Samples Taken: ☐ Yes ☐ No	Photographs Taken: ☐ Yes ☐ No		
Weather / Sea / Tide Conditions:			
Initial Response Actions:			
Corrective Actions Taken:			
Additional Information:			
Report Prepared By:	Phone/Mobile:	Fax/Email:	

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3 OSRL NOTIFICATION FORM

Oil Spill Response

Notification Form

(Initial Incident Information)

Warning! Please telephone the Duty Manager before e-mailing or faxing this completed form

To	Duty Manager		
OSRL Base	Southampton, UK	Loyang, Singapore	Fort Lauderdale, USA
Telephone	+44 (0)23 8033 1551	+65 6266 1566	+1 954 983 9880
Emergency Fax	+44 (0)23 8072 4314	+65 6266 2312	+1 954 987 3001
Email	dutymanagers@oilspillresponse.com		

Safety and Security: Oil Spill Response Limited's safety policy requires us to work closely with the mobilising party to ensure all aspects of safety and security are addressed for our personnel.

Guidance: Please ensure the information given on this form is accurate at the time of completion. This information will be used to develop and recommend the most appropriate response strategy. If new information should become available, or the situation changes, please inform the Duty Manager as soon as possible.

Section 1 – Contact Details	**Mandatory Information Required**
Member Company	
Name of Person Notifying OSRL	
Position in Incident	
Direct Phone Number	
Mobile Number	
Fax Number	
Email Address	
Command Centre Address	
Date and Time of Notification	
Section 2 – Location	
Country / Region of Spill	
Latitude / Longitude of Spill Position	
Area Affected	☐ Inland ☐ River ☐ Estuary ☐ Shoreline ☐ Port ☐ Harbour ☐ Offshore ☐ Subsea ☐ Other
Depth of Water (if applicable)	
Section 3 – Spill Details	
Date and Time (of spill – GMT)	
Source of Spill	
Cause of Spill	
Status of Spill	☐ Secured ☐ Uncontrolled ☐ Unknown

Product Properties	Product Name / Type						State Units Alternatively, provide an Assay sheet ☐ Assay sheet provided
	SG or API						
	Pour Point						
	Wax Content						
	Asphaltene						
	Sulphur Content						
	Viscosity						
Release Rate	Instantaneous Release						State Units
	OR						
	Continuous Release		per hour for		☐ Hours	☐ Days	

OSRL 027 - Issue 8 – 03/10/13

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Section 3 – Spill Details cont.		Mandatory Information Required	
Description of Observed Spill	Estimated Quantity		State Units
	Size		
	Appearance		
	Direction of Travel		

Section 4 – Weather		
Wind Direction (wind direction given from)		State Units Alternatively provide a local weather forecast ☐ Weather forecast provided
Wind Speed		
Air Temperature		
Sea Temperature		
Sea State		
Visibility		
Cloud Base		

Section 5 – Oil Spill Model Request			
Information you supply in Section 3 (Spill Details) and 4 (Weather) will be used for the modelling			
Do you require Oil Spill Trajectory Modelling?	☐ Surface 2D	☐ Sub-surface 3D*	☐ Not at this time
Additional information (please include start date and time)			
*Separate model request form required. Sub-surface models require additional time and costs.			

Section 6 – Safety and Security		
Highlight any known Safety or Security Risks		☐ N/A
Describe Security arrangements for OSRL staff (if applicable)		☐ N/A

Additional information if available

Section 7 – Resources at Risk	
Environmental or Socio-economic sensitivities that may be impacted (If possible provide the relevant oil spill contingency plan)	
Section 8 – Equipment	
Equipment already deployed or being mobilised (other than OSRL resources)	

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4 OSRL MOBILISATION FORM

Mobilisation Authorisation Form

Warning! Please Telephone the Duty Manager before e-mailing or faxing this completed form

Safety and Security

Oil Spill Response Limited's safety policy requires us to work closely with the mobilising party to ensure all aspects of safety and security are addressed for our personnel.

To	Duty Manager		
OSRL Base	Southampton, UK	Loyang, Singapore	Fort Lauderdale, USA
Telephone	+44 (0)23 8033 1551	+65 6266 1566	+1 954 983 9880
Emergency Fax	+44 (0)23 8072 4314	+65 6266 2312	+1 954 987 3001
Email	dutymanagers@oilspillresponse.com		

Details of Authorised Contact	
Subject	Mobilisation of Oil Spill Response Limited (OSRL)
Incident Name	
Mobilising Company	
Name of Person Authorising OSRL	
Position in Incident	
Direct Phone Number	
Mobile Number	
Fax Number	
Email Address	

Invoice Address	
Purchase Order Number	

I, authorise the activation of Oil Spill Response Limited and its resources in connection with the above incident under the terms of the Agreement in place between above stated Company and Oil Spill Response Limited.

Signature:		Date / Time:		

If Oil Spill Response Limited personnel are to work under another party's direction please complete details below;

Additional Details	
Company	
Contact Name	
Position in Incident	
Direct Phone Number	
Mobile Number	
Fax Number	
Email Address	

OSRL 025 Issue 7 Jan 2014

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5 AERIAL SURVEILLANCE OBSERVER LOG

Aerial Surveillance Observer Log					
Incident		Date		Observers	
Aircraft Type		Call Sign		Area of Survey	
Survey Start Time		Survey End Time		Average Altitude	
Wind Speed (knots)		Wind Direction		Notes	
Cloud Base (feet)		Visibility (nm)			
Time High Water		Time Low Water			
Current Speed (nm)		Current Direction			

SLICK DETAILS

Slick	Time (Utc)	Oil Position (Centre)		Slick Orient (Degrees)	Oil Slick Length			Oil Slick Width			Area (Km²)	Area Coverage (%)	Oiled Area (Km²)
		Latitude (North / South)	Longitude (East / West)		G/Speed (Knots)	Time (Seconds)	Distance (Km)	G/Speed (Knots)	Time (seconds)	Distance (km)			
A													
B													
C													

Comments: ***include such things as Sensitivities*** –it is important to note any potential ecological impacts – the presence of marine mammals, coral reefs etc

Slick	Oil Appearance Coverage - %						Minimum Volume - M³	Maximum Volume - M³	Type Of Detection (Etc. Visual, Ir)
	1	2	3	4	5	OTH			
A									
B									
C									
D									
E									

The Bonn Agreement Oil Appearance Code (Baoac)			
No	Oil Appearance	Mim. Volume m³ / Km²	Max. Volume m³ / Km²
1	Sheen	0.04	0.30
2	Rainbow	0.30	5.00
3	Metallic	5.00	50.0
4	Discontinuous True Colour	50.0	200
5	True Colour	200	>200

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6 ARCTIC SHORELINE OILING SUMMERY (ASOS) FORM

"SHORT" ARCTIC SHORELINE OILING SUMMARY (ASOS) FORM for _____ Spill Page ____of ____

1 GENERAL INFORMATION	Date (dd/mm/yy)	Time (24h): standard/daylight	Tide Height
Segment ID:			
Operations Division:		hrs to hrs	rising / falling
Survey by: Foot / ATV / Boat / Helicopter / Overlook / _____		Sun / Clouds / Fog / Rain / Snow / Windy / Calm :: Air Temp + / - ___ deg C.	

2 SURVEY TEAM # _____	name	organization	contact phone number

3 SEGMENT *Total Segment Length* _____ *m* *Segment Length Surveyed* _____ *m*

Start GPS: LATITUDE _____ deg. _____ min. LONGITUDE _____ deg. _____ min.

End GPS: LATITUDE _____ deg. _____ min. LONGITUDE _____ deg. _____ min.

Differential GPS Yes / No

4A SHORELINE TYPE *select only one primary (P) oiled shoreline, snow, or ice type and any number of secondary (S) types*

BEDROCK : ____ *MAN-MADE SOLID :* ____	*SEDIMENT BEACH :*	*SEDIMENT FLATS :*
cliff/vertical ____ sloping ____ platform ____	Pebble-Cobble _____ Sand ____	Sand Flats ___ Mud Flats ___
MARSH or WETLAND: ____	Mixed Sand-Gravel ____ Boulder ___	Peb-Cob ___ Sand-Gravel ___
Tundra Cliff : ice rich ____ ice poor ____	*Peat Shoreline:* ____	Boulder ___ *Inundated Low-lying Tundra:* ____

Frozen Swash: _____ *Frozen Spray:* _____ *Ice Foot:* _____ *Grounded Ice Floes:* _____ *Glacier :* _____ *Snow:* _____

4B NEARSHORE ICE CONDITONS

CONCENTRATION:	*FORM:*	*THICKNESS:*
estimate ice cover in tenths	estimate average size of floes (circle one)	estimate thickness (circle one)
_____ / 10	< 2m 2-20m 20-100 > 100m	< 0.1m 0.1 - 0.5m 0.5 - 2.5m > 2.5m
	Tidal Cracks at Shoreline ?: Y / N	

4C COASTAL CHARACTER *backshore character — select only one primary (P) and any number of secondary (S) types*

CLIFF or HILL : ____ : est. height _____ m	Beach ___	Delta ___	Tidal inlet ___	Marsh/Wetland ___
slope: gentle (<5°) ____ medium ____ steep (>30°) ____	Barrier beach ___	Dune ___	Channel ___	other _____

5 OPERATIONAL FEATURES

direct backshore access	Y / N	debris Y / N oiled? Y / N debris amount: _____ bags OR _____ trucks	
alongshore access from next segment	Y / N	suitable backshore staging Y / N	
		access restrictions _____	

6 ZONE ID _____ *Description of Oil Conditions in Supra / Upper / Mid / Lower Intertidal Zone (circle one)*

Oil Band	Surface Oil Distribution	Surface Oil Thickness	Surface Oil Character	Subsurface Oil Penetration	Subsurface Oil Burial
Width Length	< 1%	Film	Fresh Liquid	< 1 cm	*Clean Layer :*
	1 - 10%	Stain	Mousse	1 - 5 cm	
m x m	11 - 50%	Coat	Tarballs	5 - 10 cm	_____ cm
SEDIMENT or SNOW and ICE TYPE(S) :	51 - 90%	Cover	Tar Patties	> 10 cm	*Oiled Layer :*
	91 - 100%	Pooled	Asphalt Pavement		
	_____ %	_____ cm	_____ other	_____ cm	_____ cm

7 ZONE ID_____ *Description of Oil Conditions in Supra / Upper / Mid / Lower Intertidal Zone (circle one)*

Oil Band	Surface Oil Distribution	Surface Oil Thickness	Surface Oil Character	Subsurface Oil Penetration	Subsurface Oil Burial
Width Length	< 1%	Film	Fresh Liquid	< 1 cm	*Clean Layer :*
	1 - 10%	Stain	Mousse	1 - 5 cm	
m x m	11 - 50%	Coat	Tarballs	5 - 10 cm	_____ cm
SEDIMENT or SNOW and ICE TYPE(S) :	51 - 90%	Cover	Tar Patties	> 10 cm	*Oiled Layer :*
	91 - 100%	Pooled	Asphalt Pavement		
	_____ %	_____ cm	_____ other	_____ cm	_____ cm

8 COMMENTS *cleanup recommendations—ecological/recreational/cultural/economic issues & constraints—wildlife obs.*

(for ALL sub-segments record: sub-segment ID, length, length surveyed,and GPS start/end fixes)

Sketch Yes/No **Photos** Yes/No (Roll # _____ Frames_____) **Video Tape** Yes/No (tape #_____)

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Appendix 3 – SOPs

1 ASSESS THE SPILL

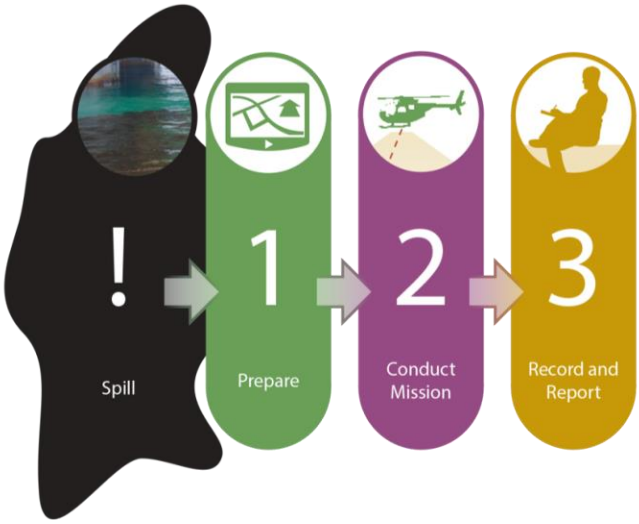
Resources Available

Tier 1	•Vessel Crew
Tier 2	•On site helicopter x 2 •On site Dornier 228 •Workboat x 2 •Line Boats x 2 •Oil Spill Response Vessel x 2 (Tug Boats)
Tier 3	•OSRL

Safety

- **Aircraft** - monitor the area to ensure that there is no explosion risk
- **Support vessels** - approach spill site from upwind, monitor for gases
- Wear the appropriate Personal Protective Equipment (PPE)
- Identify risks and mitigate them where possible
- Communicate any risks and controls in place to control them through a pre-flight or pre-operation safety brief
- All activities will be carried out under the appropriate systems

Key Steps



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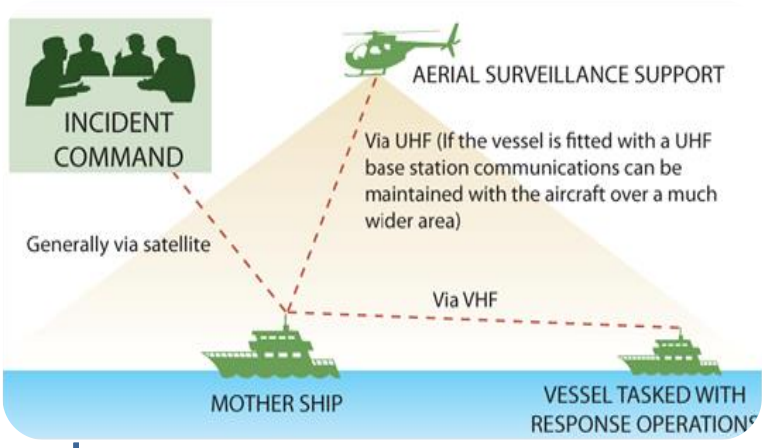
STEP 1 - PREPARE

Communications

Effective communication can enhance operation success.

Ineffective communication can lead to unsafe situations and accidents.



Communications Plan

Who to call in an emergency.

Names of assets deployed, call signs and radio communication frequencies.

Use of 'mother ships'

Ensures a clear line of communication.

Can provide additional resources to response vessels.

GPS Tracking System

To track surveillance operations from the Incident Command Centre.

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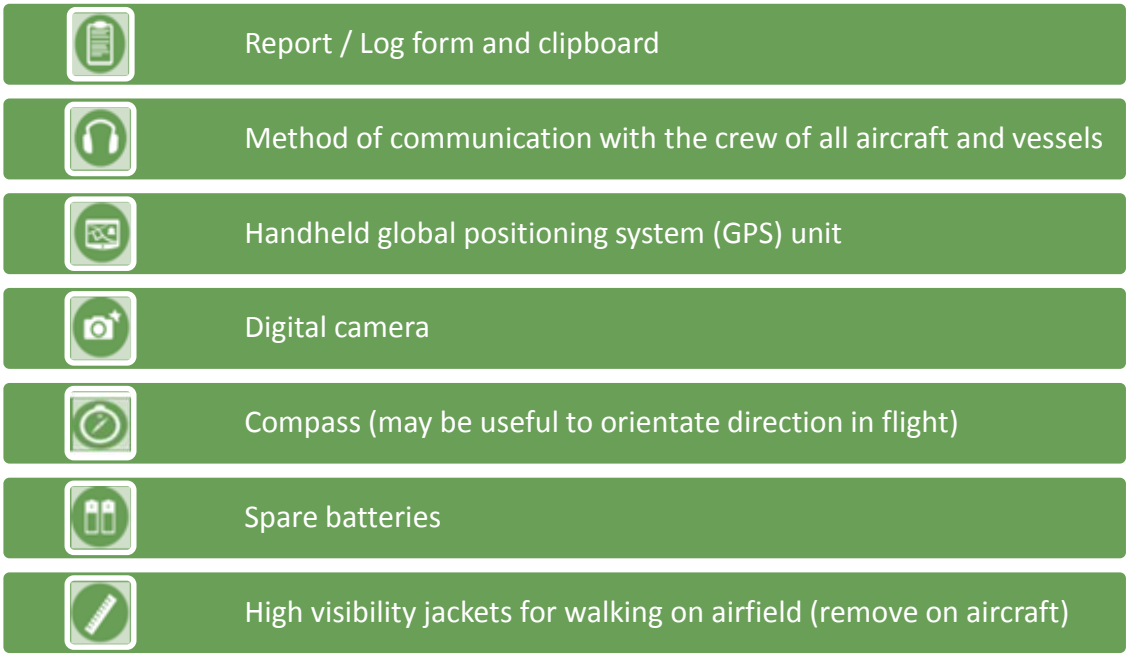
Organise Tools

The resources required for aerial surveillance operations are:



Receive Tasking information

Tasks should include:

- Confirm spill location
- Quantify oil slick
- Direct response operations. For example, direct dispersant operations to the area of thickest oil
- Survey shoreline to identify oil impacted areas

Receive Pre-Flight Briefing

Note: For aerial dispersant operations, give joint briefings to the assigned spotter and spray crews

The briefing should include:

- Location of the operational area
- Radio frequencies used for the response in the area
- Call signs of other aircraft operating in the vicinity
- Locations of any temporary or permanent exclusion zones

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Factors Affecting Visual Observations

Note: Your perspective will be different from another observer. Ensure a comprehensive hand over brief is given to maintain consistency of approach.

Take note of the following factors that can affect the visual observations of oil.

Angle of the Sun on the Water

- To obtain the best view, the aircraft should:
  - Fly at an altitude of 500 to 1000 feet
  - Survey at 30°, with the sun behind the direction of view.

Weather

- Observation can be difficult in:
  - Low contrast light conditions (haze or fog)
  - Extremely bright sunlight, due to glare.
  - Clouds

Sea Conditions

- Oil can become submerged by waves when:
  - Surface wind approaches 30 knots
  - Sea state becomes moderate (2-4 m wave height)

Water Clarity

- Can affect the visual appearance of oil.
  - Convergence zones
  - Seaweed/seagrass
  - River outlets
  - Algal blooms

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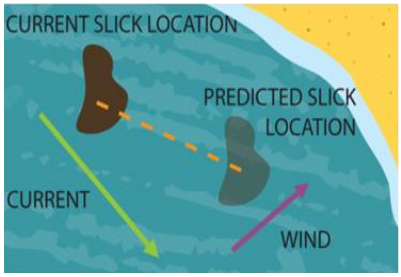
STEP 2 – CONDUCT MISSION: CONFIRM SPILL LOCATION

Predict Spill Location

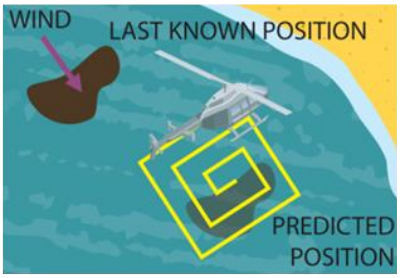
Use wind and current data. Use the predicted location as a starting point for your search.

Note: It is useful for the aerial observer to sit directly behind the pilot when in flight. You will share the same perspective making it easier to direct the aircraft to the oil spill.



Predict Spill Location

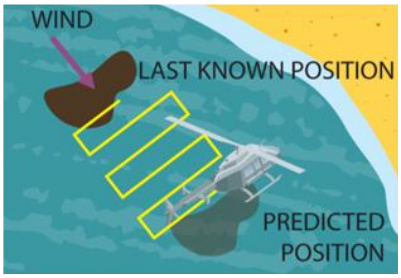
Oil moves ~3% with the wind and 100% with the current.
Use wind and current data to predict the spill location.



Expanding Square/Spiral Search

How: Fly in ever increasing circles around the oil's predicted position until you see the slick.

Why: You expect the oil to have remained within the vicinity of the release position.



Ladder Search

How: Fly a set length and width from the oil's last known position to its predicted position.

Why: You expect the oil to be anywhere in the allocated search area with equal probability.

STEP 2 – CONDUCT MISSION: QUANTIFY SPILL

Calculate spill quantity on the return journey or when the aircraft has landed.

Calculate Spill Area

1. Fly the length of the spill - note speed and time taken
2. Fly the width of the spill - note speed and time taken
3. Calculate distance of spill length or width.

$$\textbf{Distance of slick length or width (nm)} = \frac{time\ taken\ to\ fly\ (seconds) \times\ speed\ (knots)}{3600\ (or\ 60\ if\ time\ taken\ to\ fly\ is\ in\ minutes)}$$

Note: Divide answer by 1.85 to convert to km

4. Calculate the area

$$\textbf{Spill area } (\textbf{km}^2) = length\ (km) \times width\ (km)$$

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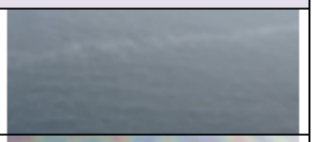
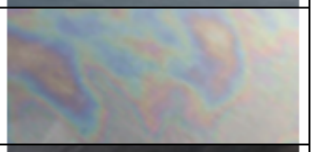
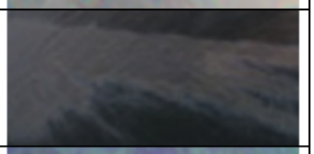
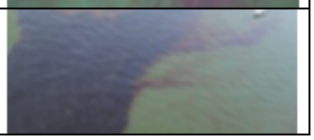
Calculate Spill Volume

1. Use the Bonn Agreement Oil Appearance Code (BAOAC) to estimate the percentage spill coverage.

Code	Description / Appearance	Layer Thickness Interval (Microns)	Litres per km^2	Typical Appearance
1	Sheen (silver / grey)	0.04-0.30	40-300	
2	Rainbow	0.30-5.0	300-5,000	
3	Metallic	5.0-50	5,000-50,000	
4	Discontinuous True Oil Colour	50-200	50,000-200,000	
5	Continuous True Oil Colour	>200	>200,000	

2. Divide the slick into the percentage of each oil thickness based on its appearance.

   For example; 10% Sheen, 40% Rainbow and 50% Metallic.

3. Use the following equation to calculate the minimum and maximum spill volume for each oil type.

$$\begin{aligned} &\textbf{\textit{Spill volume}}\ (m^3) \\ &\quad = total\ area\ oiled\ (km^2) \\ &\quad \times\ area\ covered\ with\ specific\ appearance\ (\%) \\ &\quad \times layer\ thickness\ (max.\ or\ min.)\ (microns) \end{aligned}$$

4. Sum the volumes of all oil types to calculate total minimum and maximum spill volume.

   Note: It is standard practice to calculate two volumes when using the BAOAC: minimum and maximum volume.
   Use the maximum volume to determine the appropriate level of response.

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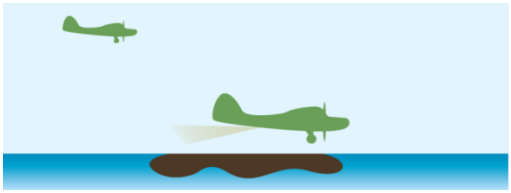
Step 2 – Conduct Mission: Direct Response

Aerial surveillance can increase efficiency of a response.

Aerial Operations

Direct the spray aircraft to the thickest part of dispersible oil.

Aerial dispersant aircraft typically fly 30-45 m (100-150 ft) above the water to apply dispersant at the correct droplet size and swath width. This limits visibility from the spray aircraft.

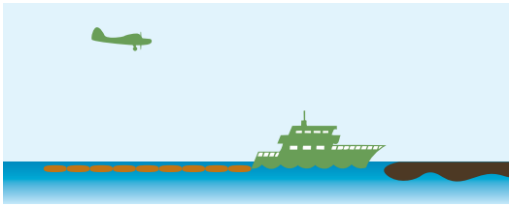


Note: There will be a delay between the spotter crew telling the spray crew to spray, and spraying commencing.

Vessel Operations

Direct the vessel to the thickest part of the oil for:

- Containment and recovery
- Dispersant application
- In-situ burning



Note: Although vessels may have a variety of tasks, the role of aerial surveillance support remains broadly the same.

Other uses of the spotter aircraft:

- Wildlife monitoring
- Responder Safety

Step 2 – Conduct Mission: Aerial Shoreline Surveys

Two types of survey:

- **Pre-impact** –Prioritise sites for protection. Assess the best method and suggest resources.
- **Post-impact** – Report the location and extent of oiling

Note: Oil can get buried by sediment mobilised by the incoming tide.

A ground based shoreline assessment team can verify the presence of oil.

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How to survey shorelines from the air

Record on Map/Chart

- Incident name, date, flight start/end time, aircraft and observers
- Location/source of incident
- Locations of sighted oil

Take Photographs

- Ensure the camera date and time settings are correct
- If taking photos through a window turn off flash
- Photograph with the sun behind you
- Geo-reference photos if possible

Step 3 – Record and Report

Record the mission using:

- Annotated maps
- Photographs (preferably geo-referenced)
- Aerial Surveillance Log

  Refer to: Appendix 2, Forms

Report to the Incident Command Centre:

- Personal Log
- Location of identified oil (either on a map/chart, waypoints on GPS or geo-referenced photo on mapping software)
- Quantity of oil observed, this can be calculated on the Aerial Surveillance Log
- **Refer to:** Appendix 2, Forms
- Information on any oil spill response activities

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2 ASSISTED NATURAL DISPERSION

Resources Available

Tier 1	•Vessel and Crew •On board Life Boats/Resue Boats
Tier 2	•MRT •Workboat x 2 •Line Boat x 2 •On site Helicopter •On site Dornier 228 •Oil Spill Response Vessel x 2 (Tug Boats)
Tier 3	•OSRL

Safety

- Wear the appropriate Personal Protective Equipment (PPE)
- Identify risks and mitigate them where possible
- Stop any ignition sources and ensure gas monitoring is undertaken
- Communicate the risks and controls in place through a pre-operation safety brief

Key Steps

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STEP 1 - PREPARE

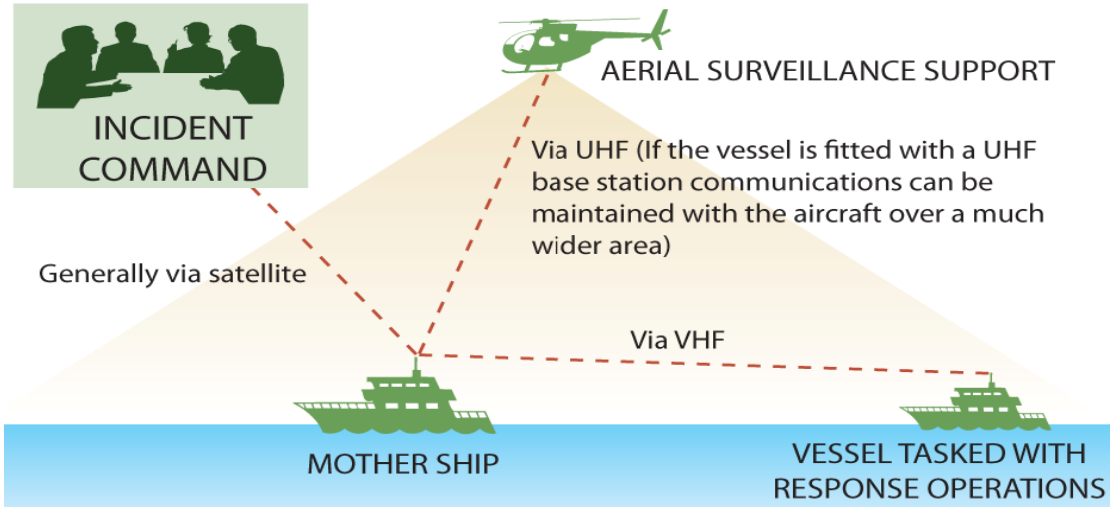
Organise Operations

Guidance: Effective communication can enhance operation success.

Action to take: Follow the steps below to prepare for assisted natural dispersion operations.

1. Produce a communications plan to document:
    - Who to call in an emergency
    - Names of assets deployed, call signs and frequencies of radio communications
2. Consider the use of 'mother ships' to ensure a clear line of communication.

Note: The use of a 'mother ship' may be useful in being able to provide additional resources to vessels conducting response operations. An aerial platform could assist in directing vessels into the thickest areas of oil.



Determine Strategy Suitability

Guidance: Assisted natural dispersion is suitable for oil spills of **low to medium viscosity oils**.

Note: This technique should **not** be used with IFO or Low Sulphur Fuel Oil as the process will fragment, not disperse the spill.

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STEP 2 – PREPARATION

Assist Natural Dispersion

Note: Ensure the spill is approached from upwind at 90° to the direction of the current.

Action to take: Follow the steps below to assist the natural dispersion of oil.

1. Select a suitable method of assisted natural dispersion:

Enhanced agitation through water application

Natural dispersion processes may be assisted by the use of fire-fighting hoses spraying sea water onto the surface of the oil spill to break up and aid dispersion.

Propeller assisted agitation

Vessel "prop wash" can be implemented to mechanically assist break up and spread of oil. The vessel should be directed through the spill focusing on the thicker leading edge.

Note: Undertaking these techniques within a boomed area will reduce technique effectiveness. Oil is contained and its surface area will be reduced reducing the level of dispersion and evaporative processes on the oil.

STEP 3 – RECORD AND REPORT

Action to take: Follow the steps below to record and report on the assisted dispersion operation.

2. Record the operation using:
    - Annotated maps
    - Photographs (preferably georeferenced)
    - Personal Log (**Refer:** Appendix 2, Forms
    - Aerial Surveillance Log (**Refer:** Appendix 2
3. Report to the ICC
    - Team/personal log
    - Location of oil dispersed (either on map/chart, waypoints on GPS or georeferenced photo on mapping software)
    - Visual observations of effectiveness

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3 SHORELINE PROTECTION AND CLEANUP

Resources Available

Tier 1	•Vessel SOPEP equipment
Tier 2	•MRT •Helicopter •Dornier 228 •Containment Boom •Spill Response Unit and Overpack Spill Kits •Skimmer •Work Boats x 2 •Line Boats x 2 •Oil Spill Response Vessel x 2 (Tug Boats) •Inflatable barge
Tier 3	•OSRL

Safety

- Wear the appropriate Personal Protective Equipment (PPE) including respiratory protection
- Identify risks and mitigate them where possible
- Communicate any risks and controls in place through a pre-operation safety brief

Key Steps

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STEP 1 – PREPARE: COMMUNICATIONS

Effective communication can enhance operation success.

Ineffective communication can lead to unsafe situations and accidents.

Communications Plan

- Emergency contacts
- Names of assets deployed, call signs & radio frequencies

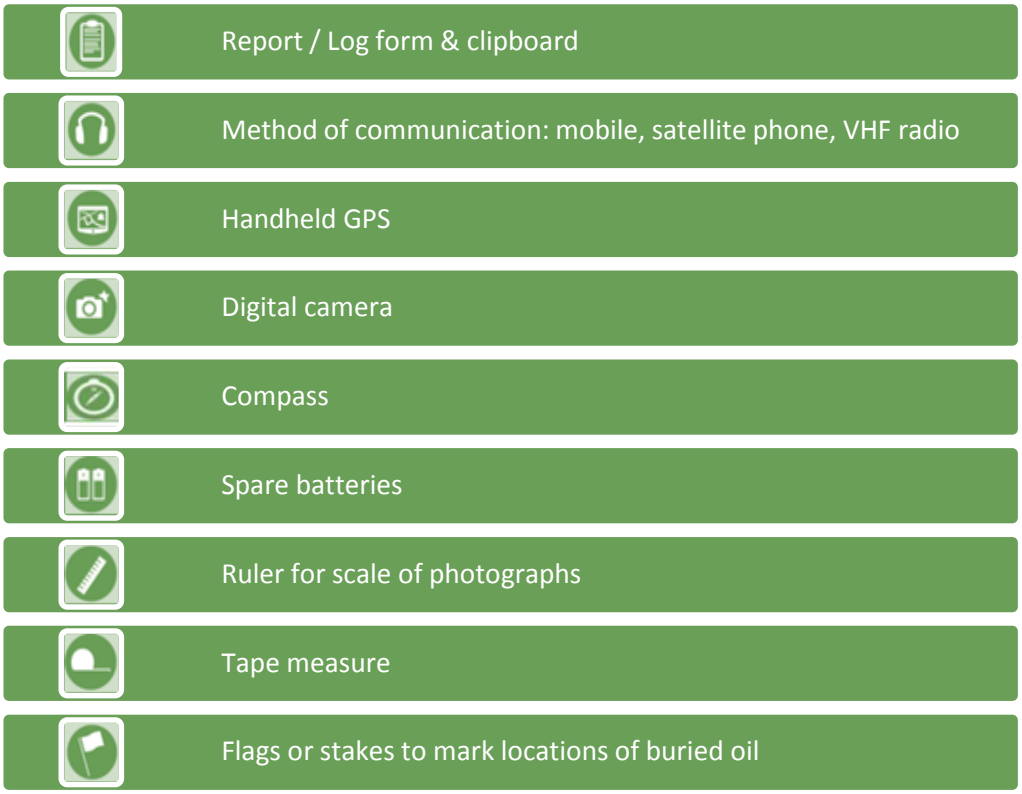
STEP 1 – PREPARE: SHORELINE CLEANUP ASSESSMENT TECHNIQUE (SCAT)

SCAT is a standardised method of assessing, recording and reporting the degree of oiling of the shoreline. **SCAT supports the Environmental Planning Team**

The responsibilities of the SCAT team are to:

- Identify sensitive resources
- Evaluate shoreline oiling conditions
- Recommend clean up methods and end points

The resources required for a shoreline survey are:



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STEP 1 – PREPARE: SURVEY SHORELINE

Segment Shoreline

- Segments are defined geographic areas with similar physical features and sediment types.
- Use sub-segments if the extent of oiling varies significantly within a given segment.
- **Refer to:** Appendix 2, SCAT Report Form.

Standardise Results

- Use standardised descriptions to describe the oil observed.
- Calibrate classifications of oil before doing full scale surveys.

Report to Incident Command

- Communicate the results of shoreline surveys to the Operations Team
- Use surveys to plan priority areas for clean up during the next operational period.

STEP 2 – PROTECT SENSITIVE SHORELINES: IDENTIFY AND PRIORITISE FOR CLEANUP

Some shorelines are more sensitive to oil due to their ecological, economic or cultural importance.

Protect sensitive shorelines from potential oil impact.

1. **Predict Spill Location** by aerial surveillance and oil spill modelling.

   Refer to: Section 1, Assess the Spill (p.80).

2. **Identify Shoreline Ranking**

   Rank shorelines from 1-10 (where 10 is most sensitive, see table) using information from the following resources:

   - Overflights
   - Aerial photography
   - Remotely sensed data
   - Ground truthing
   - Existing maps and data, for example, GIS files

ESI Value	Shoreline type
1	Exposed rocky shore
2	Exposed rocky platforms
3	Fine grained sand beaches
4	Coarse grained sand beaches
5	Mixed sand and gravel beaches
6a	Gravel beaches
6b	Riprap structures
7	Exposed tidal flats
8a	Sheltered rocky shores
8b	Sheltered artificial structures
9	Sheltered tidal flats
10a	Salt to brackish marshes
10b	Freshwater marshes
10c	Swamps

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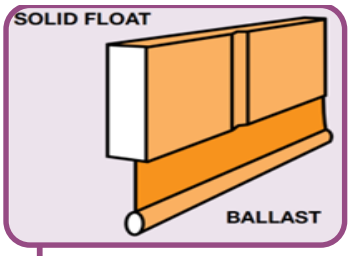
STEP 2 – PROTECT SENSITIVE SHORELINES: DEPLOY SHORELINE BOOM

Choose the most appropriate boom type

Rigid Fence Boom



Pro

Quick to deploy.

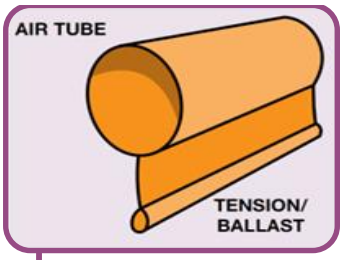
Functions well in calm sea conditions.

Con

Large storage space.

Less effective wave-following characteristics than inflation boom.

Inflation Curtain Boom



Pro

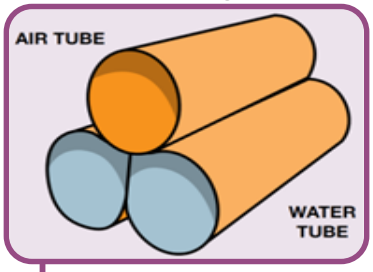
Good wave-following characteristics.

Stored deflated so require little storage space.

Con

Air fan needed to fill air chamber.

Shore Sealing Boom



Pro

Forms an effective barrier in intertidal areas.

Stored deflated so require little storage space.

Con

Water pump needed to fill two water chambers.

Air fan needed to fill air chamber.

Sorbent Boom

Pro

Useful for small spills.

Can use with other types of shoreline boom.

Con

Generates waste - control use.

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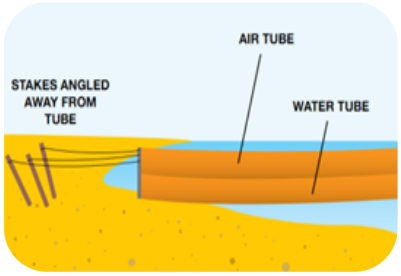
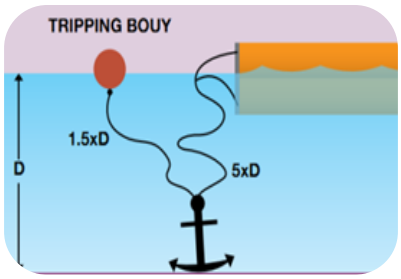
Boom deployment and handling techniques



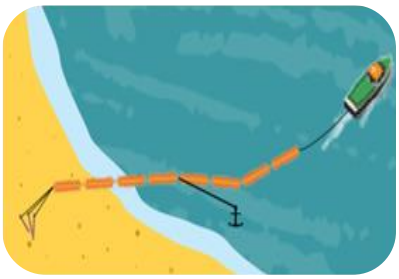
1. Ensure the boom is securely staked, anchored (using land anchors) or attached to a strong fixed point on the shoreline.

2. 'Flake' the boom along the shoreline.

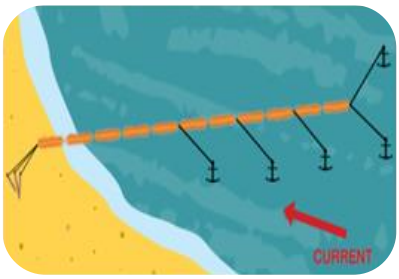
3. If it is a long piece of boom or there is a strong current running, tow the boom from one of the anchor points fixed midway along the boom.



4. Drop the anchor point. The length of the anchor lines should be 5x the water depth; the tripping buoy line should be 1.5x the water depth.

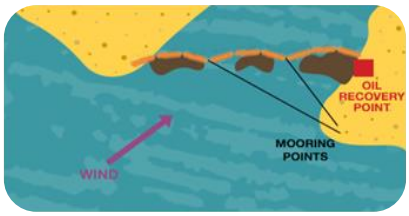


5. Return to the shoreline to retrieve the last anchor point. Drop the anchor to create a straight line of boom.



6. Set more anchors if necessary to hold the boom in place once the position is set.

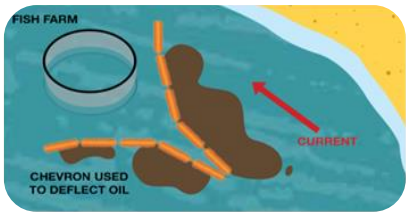
Boom formations



Exclusion booming

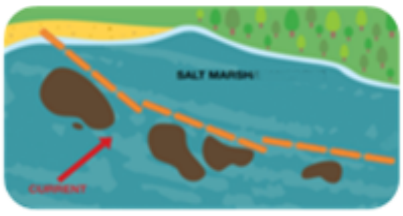
Protects sensitive sites such as inlets and harbour entrances.

Contains oil for recovery.



Chevron booming

Deflects oil away from sensitive sites or resources.



Cascade booming

Deflects oil away from sensitive shorelines to a point of enhanced natural collection for recovery.

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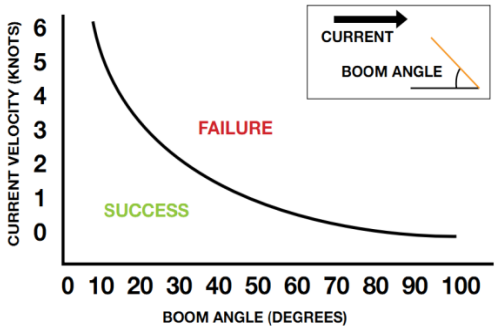


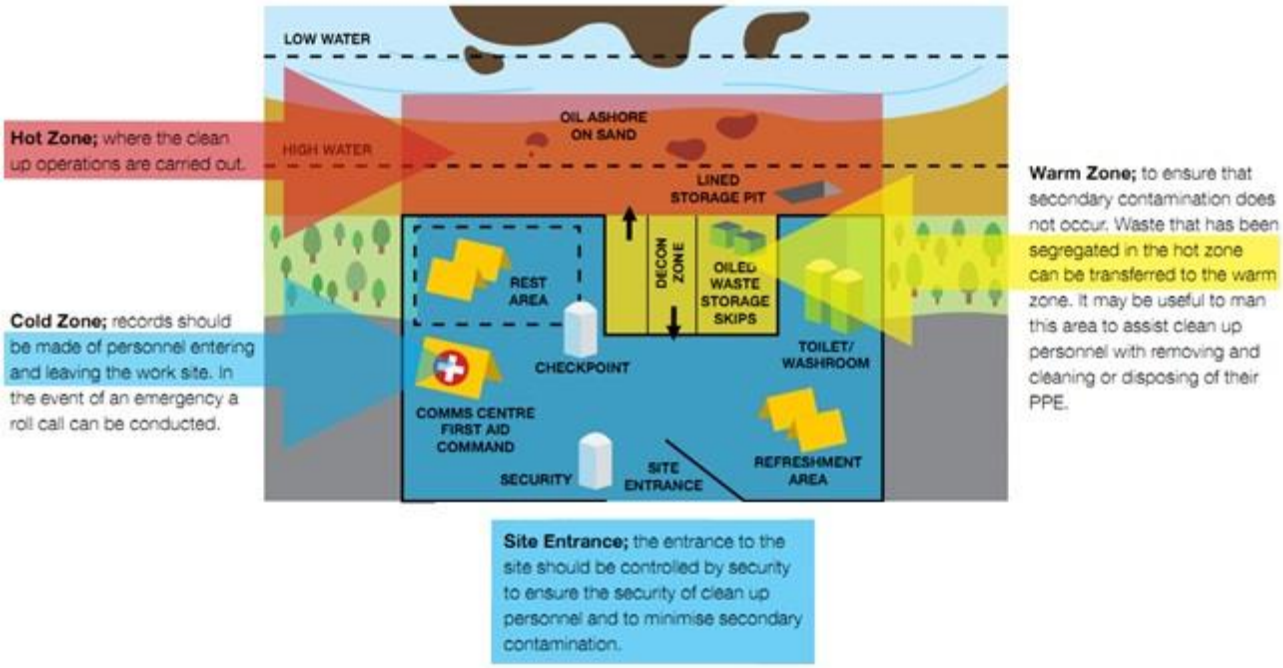
Boom Angle

The angle of the boom influences its success. The faster the current, the narrower the boom angle should be.
Boom will be successful when deployed at an angle of 70-100° in slow current.

Step 3 – Prepare Site for Cleaning: Site Set-up

Effective site set up will maximise site security and minimise secondary contamination.

Identify cold, warm and hot zones for each oiled site.



Step 4 – Cleanup Oiled Shorelines

Implement the appropriate shoreline cleanup response strategy based on shoreline type and level of oiling.
Shoreline cleanup strategies are described below. The figures indicate how appropriate the strategy is for each shoreline type depending on the level of oiling (Low, Medium or High). The colours indicate whether the strategy is recommended (green), has potential (yellow) or should be avoided (red).

Natural recovery

This strategy leaves the shoreline to recover naturally without any human intervention.

- ✅ It may be less environmentally damaging to allow sensitive shorelines to recover naturally
- ❌ This process is slower than other cleanup srategies

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Absorbents

Absorbents (blanket or boom form) are made of oleophillic material which selectively absorbs oil whilst repelling water.

Note: Absorbents are designed for use with light hydrocarbons. Heavy oils will adhere to the outside rather than absorb into the product. Use absorbents sparingly, they create solid waste which must be disposed of appropriately.

Sediment relocation

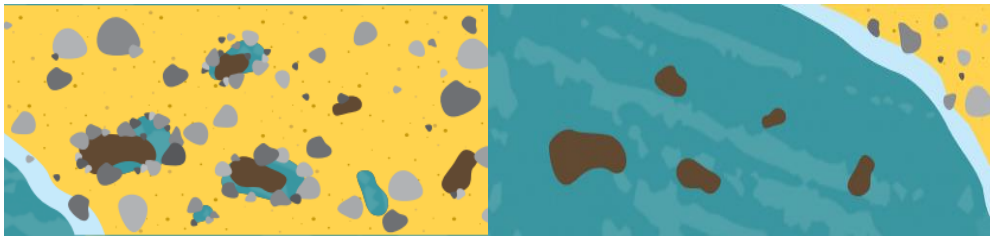
Relocate oiled sediment (surface or buried) to the surf zone where it is cleaned by waves.

- Remobilised oil may impact other shoreline areas

Flooding

Flood oiled areas enclosed by booms or contained in natural geological features (such as rock pools) with seawater. Recover the remobilised oil using skimmers and pumps.

Before Flooding **After Flooding**



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Mechanical recovery using pumping or vacuum equipment

Use specialist oil spill vacuum/pumping equipment or vacuum trucks to recover oil.

- ✗ Heavy machinery driving over oiled sediment will bury oil.
- ✗ Don't use vacuum equipment for light oils until light ends have evaporated - risk of explosion
- ✓ Most successful on thick oil layers

Mechanical recovery using graders and scrapers

Remove oiled sediment from the beach using mechanical equipment if the beach needs to be cleaned quickly for socio-economic reasons.

- ✗ Heavy machinery driving over oiled sediment will bury oil.

Low pressure washing at ambient water temperature

Use pumps and hoses to wash bulk stranded oil from the shoreline. Position containment boom to capture and recover the oily water wash off.

- ✗ Ambient water may harm shoreline organisms unaffected by oil

High pressure washing at ambient water temperature

Use high pressure pumps to wash more persistent oil from the shoreline. Position containment boom to capture and recover the oily water wash off.

Note: This can dislodge shoreline organisms and potentially sterilise the area

Manual cleanup

Large groups of people collect stranded oil either by hand or with tools.

- ✗ Labour intensive

Note: Ensure cleanup personnel only remove oiled sediment to minimise waste generation.

Use of volunteers in shoreline cleanup

Benefits

- Local volunteers may know the affected area
- Can reduce response costs

Challenges

- Often unfamiliar with spill response and associated health and safety issues
- Require management and supervision
- Can be unreliable; may not be available for duration of response

Legal Considerations

It is advisable for the incident owner to ask volunteers to sign a legal release of liability form. This may or may not prevent legal claims, but can assist in clarifying expectations of cleanup volunteers.

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Training

Give volunteers safety and operational training before they start work.

Work Assignments

Identify job role and responsibilities for volunteers. Ensure they are aware of the Volunteer Supervisor. Communicate their location, date and time of work.

Assign PPE

Supply volunteers with sufficient and appropriate PPE and safety equipment.

Endpoint Criteria: How Clean is Clean?

- Establish target cleanup termination or endpoints early on in the response
- Design cleanup methods to meet the specific requirements
- Endpoints are based on cleanup objectives, which may include:

1. Minimise exposure hazards for human health
2. Speed up recovery of impacted areas
3. Minimise the threat of additional or prolonged natural resource impact

Such objectives will result in cleanup strategies that do not cause more harm to the environment than good. The cleanest endpoint is removal of all visible oil. This may not be possible, particularly if there is a background rate of oil deposition. The following table provides a hierarchy of shoreline cleanup endpoints.

	Endpoint	Criteria for use
1	No visible oil	Often used for sand beaches where oil removal can be effective without delaying resource recovery.
2	No more than background oil	Often applied where there is significant background rate of tarball deposition on the shoreline.
3	No longer releases sheen that will affect sensitive areas, wildlife or human health	Used where sheening persists after cleanup efforts become ineffective or on sensitive habitats where further cleanup efforts will cause more harm than natural removal. Residual sheening should persist over a relatively short time period.
4	No longer rubs off on contact	Defined as removal to a stain or coat, or weathering to a point where it is no longer sticky. This is appropriate for hard substrates.
5	Oil removal to allow recovery without causing more harm than natural removal of oil residues	Used where further oil removal will result in excessive habitat disruption or high biota mortality.

Resources

A number of tools are available to assist in the determination of cleanup endpoints:

- Shoreline Assessment Manual, Third Edition, NOAA, 2000

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- Shoreline Assessment Job Aid, NOAA, 2007
- Marine Oil Spill Response Options for Minimizing Environmental Impacts, NOAA, API and USCG, 1998
- Options for Minimizing Environmental Impacts of Freshwater Spill Response, NOAA and API, 1995

Step 5 – Record and Report

Repeat SCAT surveys throughout cleanup operations to assess progress and inform the operations team if their strategy should be changed. **Refer to**: Appendix 2, Forms**Error! Reference source not found.**

Record and report the following data to the ICC:

- Time, date and location of survey
- Composition of shore substrate
- Shoreline features, such as access and potential lay down areas
- Beach profile
- Extent of surface oiling
- Extent of subsurface oiling
- Presence of sensitivities
- Treatment recommendations

Step 6 – Transport Waste

Due to the remote locations, initial transportation will involve small vessels. Subsequent transportation to intermediate or final disposal sites can include tankers for liquid waste and sealed trucks for solid waste.

Ensure the following:

- Trucks have a covered or sealed top
- Trucks are decontaminated before leaving the site
- Waste shipments meet regulations

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STEP 7 – FINAL DISPOSAL

Consider the final disposal destinations for the following waste types.

Recovered liquid waste

Emulsion Breaking

- Waste emulsion can be broken down into its constituent parts of oil and water using a specialised emulsion breaking chemical.
- Oil can then be sent for refining. The emulsion breaking chemicals remain in the water which has to be disposed of appropriately.

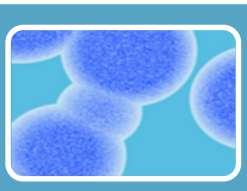
Re-Processing

- Oil is reprocessed through an oil refinery or recycling plant.
- Oil with a high salt content may corrode refinery pipe work.
- Only debris free oil or an oil/water mix can be processed.

Oiled sediment

Beach Washing

- In-situ cleaning of sand, pebbles and cobbles.
- Lightly oiled substrate can be cleaned naturally at the surf zone; collect remobilised oil in containment booms.
- It is not always easy to identify when pebbles are oil free.
- Costly and time consuming.



Bioremediation

- Addition of microbes to break down oil contamination.
- Can be done in-situ or oil waste can be removed and treated elsewhere.
- Produces inert substance which can be disposed of at landfill if oil loading within permitted levels.
- Should be carried out in a controlled environment.

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Other oily waste

Treatment of Oiled Debris & PPE

- Limited options for treating oiled debris.
- Final disposal methods include incineration and landfill.

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4 AT SEA CONTAINMENT AND RECOVERY

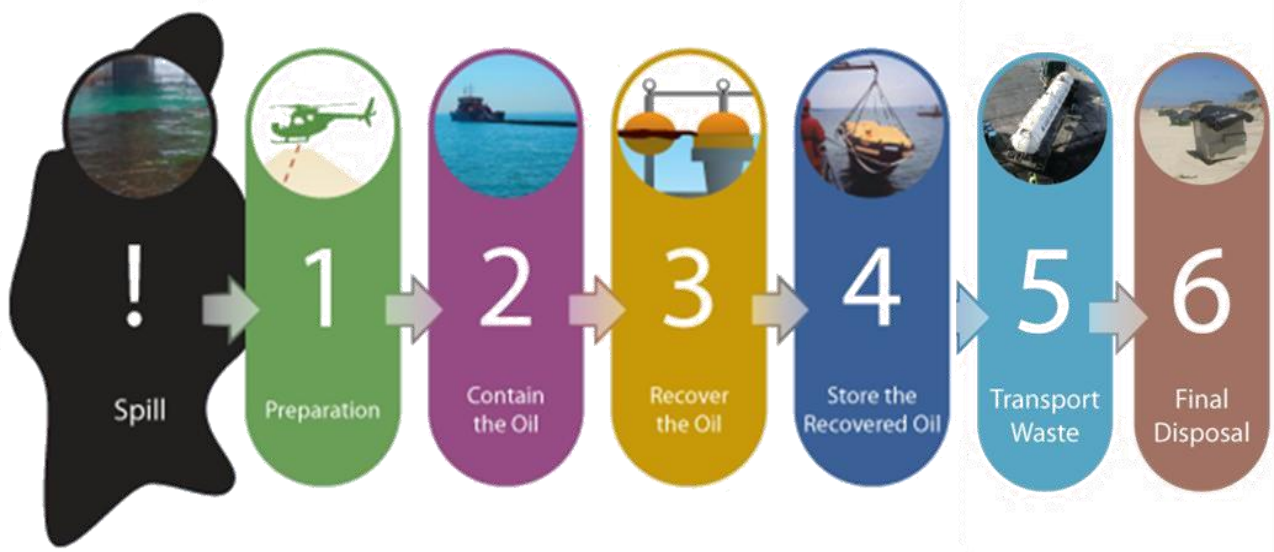
Resources Available

Tier 1	• Vessel SOPEP equipment • Vessel Life boats/Rescue Boats
Tier 2	• Oil Spill Response Vessel x 2 (Tug Boats) • Skimmer • Inflatable Barge • Containmnet Boom • Work boats x 2 • Line Boats x 2 • MRT's
Tier 3	• OSRL

Safety

- Wear the appropriate Personal Protective Equipment (PPE)
- Stop any ignition sources and ensure gas monitoring is undertaken
- Identify risks and mitigate them where possible
- Communicate any risks and controls in place through a pre-operation safety brief
- Do not contain oil directly around the spill site or a tanker. Concentrated oil may increase explosive risk especially when fresh, ensure gas monitoring is undertaken

Key Steps



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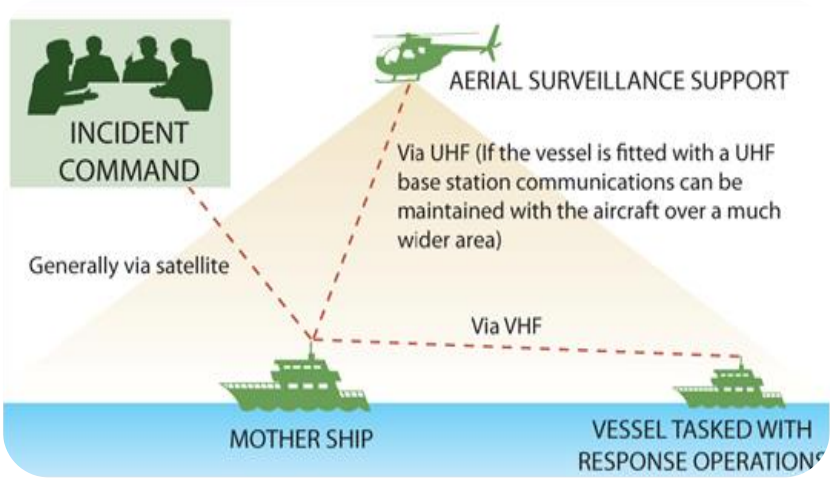
STEP 1 - PREPARE

Effective communication can enhance operation success.

Ineffective communication can lead to unsafe situations and accidents.



Communications Plan

Who to call in an emergency.

Names of assets deployed, call signs and radio communication frequencies.

Use of 'mother ships'

Ensures a clear line of communication.

Can provide additional resources to response vessels.

Automatic Identification System (AIS)

AIS on vessels to track operations from the ICC.

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STEP 2 - CONTAIN THE OIL

Boom Handling

Do...	Don't...
✓ Nominate one person in charge of the deployment ✓ Ensure that all vessels involved in the operation communicate effectively ✓ Ensure equipment is correctly connected ✓ Maintain a slow towing speed (~0.75 knots)	✗ Proceed with deployment until certain that all equipment is secured

Terminology

1 Encounter

- Distance between the two vessels.
- The larger the encounter, the more oil contained.

2 Apex

- The part of the boom where oil will collect.
- Recovery devices are placed in the apex to recover the oil.

Deployment Strategies

Straight lay

- Boom is deployed straight from the boom reel with a buoy attached to the towing line.
- Once the entire boom is deployed the second vessel recovers the buoy and attaches the tow line.
- This is the quickest, most straight forward method of boom deployment; however the vessel which deploys the boom has less control of the boom.

Loop lay

- The boom tow line is secured to the deployment vessel. As the boom is deployed it forms a 'loop' around the stern of the vessel.
- The secondary vessel takes the towing line from the end of the boom as it comes off the reel.
- This method ensures the deployment vessel has control over the boom. It is more complicated and the transfer of lines between vessels can be hazardous. It should be well communicated and undertaken with care.

Boom Configurations

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Pro

Simultaneous containment and recovery is possible.

Primary vessel should direct the speed and course of the recovery vessel.

Con

Provides a smaller encounter.

Pro

Provides a wide encounter.

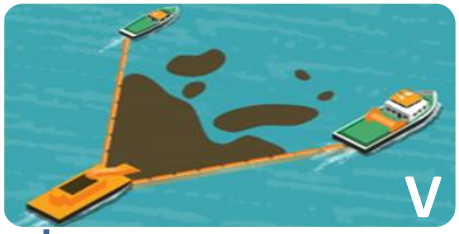
Only the third vessel need break configuration to dispose of oil, leaving the U formation to continue collection.

Con

Difficult to coordinate vessels.

Wide boom apex - difficult to position recovery device for optimum oil recovery.

Greater demand on resources.



Pro

Wide encounter with oil.

Narrow apex, assists in maximising the amount of oil recovered.

Con

Difficult to coordinate vessels.

Wide boom encounter, difficult to hold position of recovery device for optimum oil recovery .

Greater demand on resources.

Pro

Less demand on logistics as only one vessel is required.

Quick to deploy (if side sweep system is available).

Easy to manoeuvre.

Con

Small encounter area.

Causes of Boom Failure

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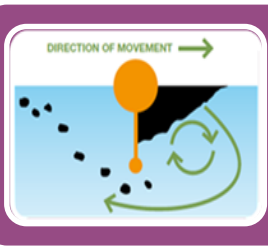
Weather

- Conditions must be favourable:

WIND	WAVES	CURRENT	BOOM PERFORMANCE
0-10kts (0-20km/hr)	Calm, swells	0-0.5kts (0.25m/s)	GOOD
<20kts	<3-4ft (<1m)	>1kt (>0.5m/s)	BAD



Undercutting

- If the boom is towed at excessive speed or the current is running quickly, then oil may undercut the boom and escape.

Boom Saturation

- If the boom fills with oil and a recovery device is not deployed the oil collected may overwhelm the boom and escape.

Boom Damage

- If a chamber is damaged during operations the remainder of the boom will stay afloat.
- Oil may escape though the resultant gap so it should be repaired as soon as practicably possible.

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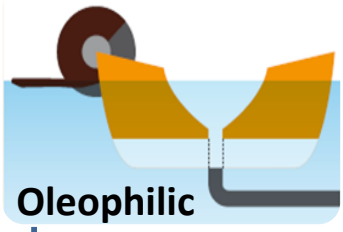
Step 3 - Recover the Oil

Skimmers have a **pump rating.** This is based on test tank conditions and does not reflect offshore recovery operations. **Rated pumping volume will rarely be achieved in field conditions.**

Select the most appropriate skimmers to recover the oil.



Pro

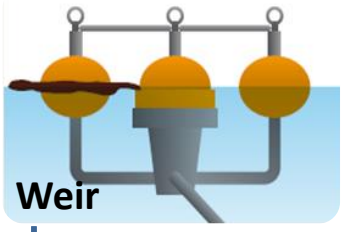
Less water collected compared to other types of skimmers

Efficiency can be increased by using brush or alternate attachments

Con

Generally ineffective in heavily emulsified oil

Oil will not adhere to the oleophillic surface if dispersant has been used



Pro

Effective on higher viscosity oil than the oleophillic skimmer

Con

Sensitive to weather conditions; tend to recover a high proportion of water

Debris in the water may block the hopper and pump

Step 4 – Store the Recovered Oil

Storage could be a limiting factor for offshore containment and recovery operations.

Arrange for suitable types and quantities of temporary storage for containment and recovery operations.
It is likely that a mix of oil and water will be recovered (not purely oil) which will increase the amount of storage required.

Types of temporary storage include:

- Inflated barge (pictured)
- Tanks loaded onto vessel decks
- Vessel internal tanks
- Storage barge

Ensure local oily water discharge regulations are adhered to. Authorities **MAY** allow oily water that has separated in recovery tanks to be discharged back into the apex of the boom to reduce the storage volume and onshore treatment.

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Step 5 – Transport Waste

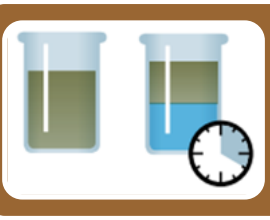
Initial transportation will involve small vessels and barges. Subsequent transportation to intermediate or final disposal sites, includes tankers for liquid waste and sealed trucks for solid waste. Take the following steps:

1. Ensure trucks have covered or sealed top
2. Decontaminate trucks before leaving the site
3. Ensure the shipment for transporting wastes meets requirements / regulations

Refer to: BIM's waste Management Plan

Step 6 – Final Disposal

Recovered Liquid Waste

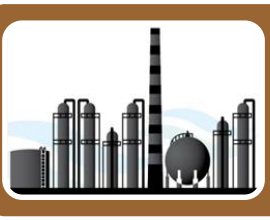


Oil-Water Separation

- Use an onboard oil-water separator to reduce contaminated waste quantities going to final disposal.
- The oil/water residue from separation should meet 15 ppm discharge standards for release into the environment.

Emulsion Breaking

- Waste emulsion can be broken down into its constituent parts of oil and water using a specialised emulsion breaking chemical.
- Oil can then be sent for refining. The emulsion breaking chemicals remain in the water which has to be disposed of appropriately.



Re-Processing

- Oil is reprocessed through an oil refinery or recycling plant.
- Oil with a high salt content may corrode refinery pipe work.
- Only debris free oil or an oil/water mix can be processed.

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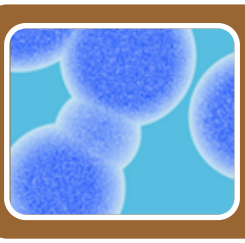
Oiled Sediment

Sand Cleaning

- Specialist mechanical sand cleaners sieve contaminated sand to removed oil

Beach Washing

- In-situ cleaning of sand, pebbles and cobbles
- Lightly oiled substrate can be cleaned naturally at the surf zone; collect remobilised oil in containment booms
- It is not always easy to identify when pebbles are oil free
- Costly and time consuming.



Bioremediation

- Addition of microbes to breakdown oil contamination
- Can be done in-situ or oil waste can be removed and treated elsewhere
- Produces inert substance which can be disposed of at landfill if oil loading within permitted levels
- Should be carried out in a controlled environment

Other Oily Waste

Treatment of Oiled Debris & PPE

- Limited options for treating oiled debris.
- Final disposal methods include incineration and landfill.

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5 Spill Response in Ice

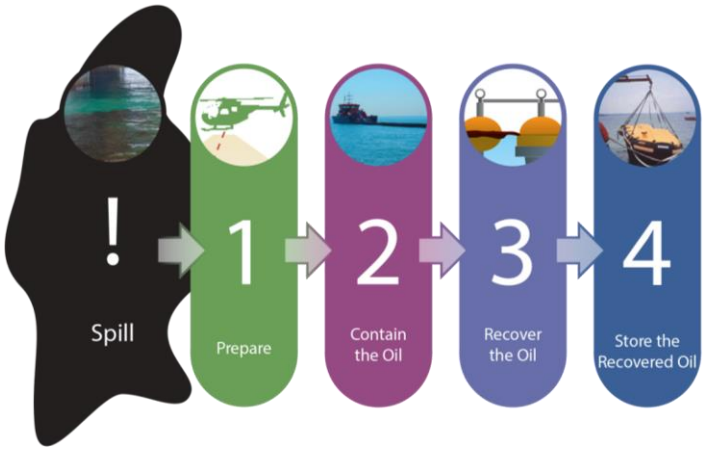
Resources Available

Tier 1	•Vessel SOPEP equipment
Tier 2	•Shoreline Response Package •Spill Response Vessel x 2 (Tug Boats) •Work Boat x 2 •Line Boats x 2
Tier 3	•OSRL

Safety

- Personnel should observe safety considerations for working on ice in extreme cold weather.
- Personnel should not attempt to access the ice in broken ice conditions. All access must be from vessels
- Identify risks and mitigate them where possible
- Communicate any risks and controls in place through a pre-operation safety brief
- Wear the appropriate Personal Protective Equipment (PPE) including: three layers (base layer, insulating middle layer and waterproof outer layer); insulated underwear, overalls, footwear, gloves and hard hat liner; tinted safety specs; ice spikes.
- Assess the ice to ensure it is thick enough to support responders and equipment.

Key Steps



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Step 1 – Prepare: Communications

Effective communication can enhance operation success.

Ineffective communication can lead to unsafe situations and accidents.

Communications Plan

- Emergency contacts
- Names of assets deployed, call signs & radio frequencies

Step 1 – Prepare: Find the Oil

Resources that could be used to find oil include:

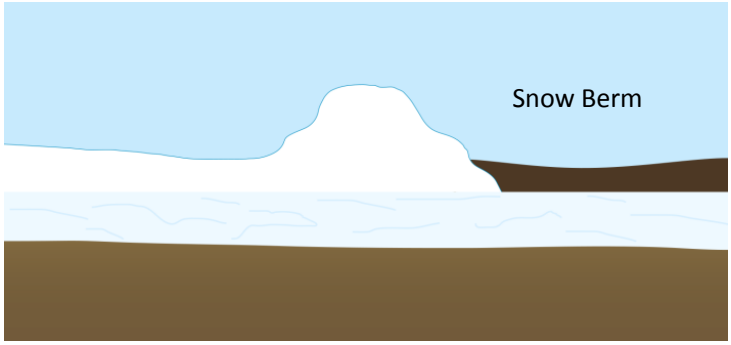
- Side-Looking Airborne Radar (SLAR)
- Satellite-based Synthetic Aperture Radar (SAR)
- Aircraft and vessel-based Forward Looking Infrared (FLIR)
- Trained dogs
- Ground Penetrating Radar (GPR) operated from helicopters and/or ice surface

Step 2 – Contain the Oil: Oil on Ice and Snow

Berms, dikes and dams

Contain spilled oil, limit spreading and accumulate oil for recovery.

- ✓ Contain and stabilise a contaminated area.
- ✓ Contain or divert oil on water, or oil that has potential to migrate.
- ✓ Use natural depressions to contain oil for recovery.
- ✓ May need to incorporate flow regulation, such as a weir or spill way.
- ✓ Use an impermeable lining on permeable surfaces.
- ✓ Construct from readily available materials such as:
  - Earth
  - Gravel
  - Snow
  - Sandbags
  - Oil boom
  - Timber
- ✗ Can damage the environment so obtain appropriate approvals beforehand



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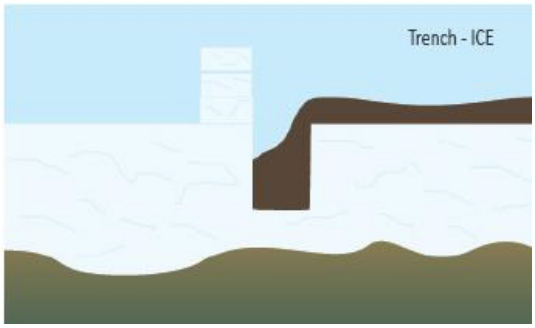
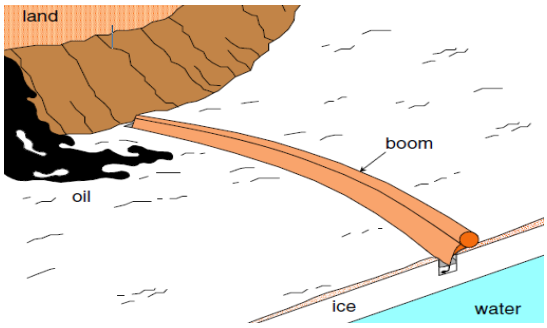
Pits, trenches and slots

Contain oil and aid in its recovery. Excavate a depression or opening in a down-slope/down-current location from the spill into which the oil will pool.

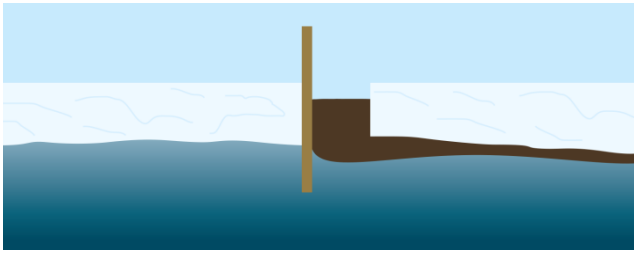


- Contain or divert oil on water or oil that has potential to migrate.
- Use natural topography and hydrology to move the oil to the collection point.
- Use flushing to help collection.
- Stack ice blocks from the trench next to it for added safety and containment.
- Enhance trenches by freezing standard skirt oil boom into them; this effectively creates a berm and recovery pit.
- Obtain appropriate approvals before excavating.
- Investigate subsurface obstacles before starting work.



Step 2 – Contain the Oil: Oil Under Ice and Snow

Slots



Use a chainsaw or auger to cut a slot through the ice to create a void for the oil to allow oil to pool on the water surface for recovery or *in situ* burning.

Configure slots according to the operating environment, oil type, weathering state, ice type and equipment availability.

- Cut slot at an angle and insert plywood to aid containment.
- >0.5 knot current is generally required to move oil under the ice cover. Oil will collect in air pockets under the ice if the current is slow. Slots can be cut above these air pockets.
- Predict the oil flow direction and cut slots to intercept the flow.
- Place insulating material, such as snow, on a growing ice sheet to create a pocket under the ice in which oil can collect.

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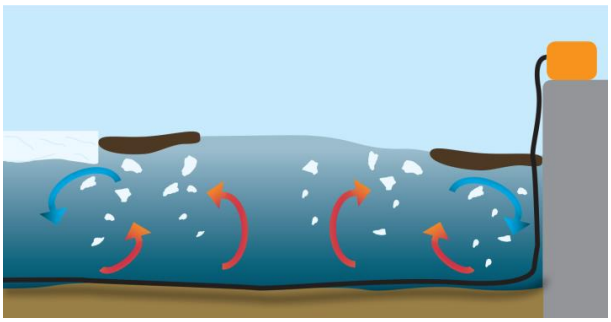
Bubbling techniques

In Ports and Harbours use a compressor to clear a hole in the ice to enable recovery of oil.

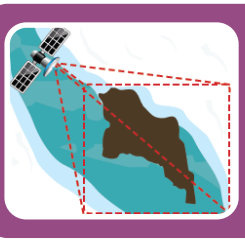


STEP 3 - RECOVER THE OIL

Surveillance

Airborne Surveillance

- Effective in identifying the presence of oil on water when supplemented with visual observations from trained observers.
- Side Looking Airborne Radar (SLAR) helps overcome problems of poor weather conditions and darkness.
- Use of existing airborne sensors can detect and map oil among ice in some situations, but capabilities are not yet proven.



Remote Sensing

- Synthetic Aperture Radar (SAR) satellite systems are not affected by darkness or poor visibility.
- Provides high spatial resolution imagery.
- Useito document changing ice conditions in the vicinity of the spill.

Tracking

- Tracking buoys can monitor the direction and progress of oil.
- In-country oceanographic and meteorological services can predict the movement of oil using weather patterns.

Surface Surveillance

- Deploy surveillance systems at the water's surface (by vessel) or from the surface of the ice.
- Ground-penetrating radar (GPR) uses radar pulses to image the subsurface to detect changes in material, and can be deployed on the ice surface and from aircraft platforms.
- Trained dogs are reliable in identifying small oil spills in snow and on ice.

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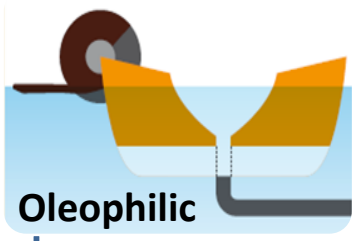
Skimmers

Skimmers have a **pump rating.** This is based on test tank conditions and does not reflect offshore recovery operations. **Rated pumping volume will rarely be achieved in field conditions.**

- Use skimmers designed to skim in ice conditions or modify non-specialist equipment.
- Use hydraulic oil suitable for cold temperature.
- Store equipment in heated stores or keep running to prevent freezing.



Pro

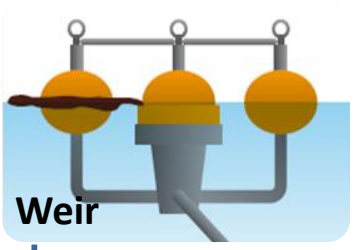
Less water collected compared to other types of skimmers

Rope mop systems can be particularly useful in ice-infested waters

Con

Ineffective in some emulsified oil

Oil will not adhere to the oleophillic surface if dispersant has been used



Pro

Effective on higher viscosity oil than the oleophillic skimmer

Con

Sensitive to weather conditions; tend to recover a high proportion of water

Debris in the water may block the hopper and pump

Step 4 – Record and Report

Repeat surveys throughout cleanup operations to assess progress and inform the operations team if the cleanup strategy needs to be changed. **Refer to**: Appendix 2, Forms**Error! Reference source not found.**.

Record and report the following data to the ICC:

- Time, date and location of survey
- Shoreline features, such as access and potential lay down areas
- Treatment recommendations

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6 SPILL RESPONSE IN BROKEN ICE

Resources Available

Tier 1	• Vessel SOPEP equipment
Tier 2	• Spill Response Vessel x 2 (Tug Boats) • skimmer • Work Boats x 2 • Line Boats x2 • Shore line Response equipment
Tier 3	• OSRL

Safety

- Personnel should observe safety considerations for **Error! Reference source not found.**working on ice in extreme cold weather.
- Personnel should not attempt to access the ice in broken ice conditions. All access must be from vessels

General Considerations

- Seek expert advice at the earliest opportunity following a spill in significant ice.
- Response strategies frequently involve moving ice; changes in ice concentration due to wind shift are likely and may be large.
- There may be no feasible response option if oil is widely distributed within a broken ice field.
- Oil solidifies on the water's surface if ambient temperature is below that of the oil's pour point; this makes traditional recovery techniques inefficient.
- Oil can become mixed or encapsulated in ice, especially during late freeze up; in this scenario the preferred strategy is monitor and evaluate.
- Skimmers are most efficient when positioned in open water or leads between ice pieces.
- Oleophillic skimmers such as suspended vertical rope mops, drum, brush and disk skimmers are the most efficient and least likely to get clogged by ice.

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Techniques

Containment and Recovery

- Techniques for ice coverage up to 25-30% are much the same as those employed in open water (see section 4)
- Equipment may need to be adapted for use at ambient temperature
    - Different grades of oil and fluids
    - Equipment controls useable with gloved hands
- Greater than 25 - 30% ice cover
    - Booms become of little or no use (Owens, et al., 1998)
    - Ice class vessels are required to take skimmers to the oil
    - Recovery rates are typically low, 1-20% (Harvey Consulting, 2009)
- Greater than 70% ice cover
    - Natural containment by ice
    - Ice breakers are required to access the oil
    - Recovery rates are low

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7 Spill Response Under Ice

Resources Available

Tier 1	• Vessel SOPEP equipment
Tier 2	• Spill Response Vessel x 2 (Tug Boats) • skimmer • Shore line Response Package • Work boat x 2 • Line Boat x 2
Tier 3	• OSRL

Safety

- Personnel should observe safety considerations for working on ice in extreme cold weather.

General Considerations

- Seek expert advice at the earliest opportunity following a spill on ice.
- Oil solidifies on the water's surface if ambient temperature is below that of the oil's pour point; this makes traditional recovery techniques inefficient.
- Spilled oils can remain unweathered for several months, this can help the response.
- Equipment should be of an appropriate design and specification for the extreme conditions.
- Fuels and lubricants should be suitable for the ambient temperature to prevent waxing.
- Engines will usually run continuously. Pre-plan fuel, lubricant and spare parts.
- Provide a warm refuge with hot food and drinks.

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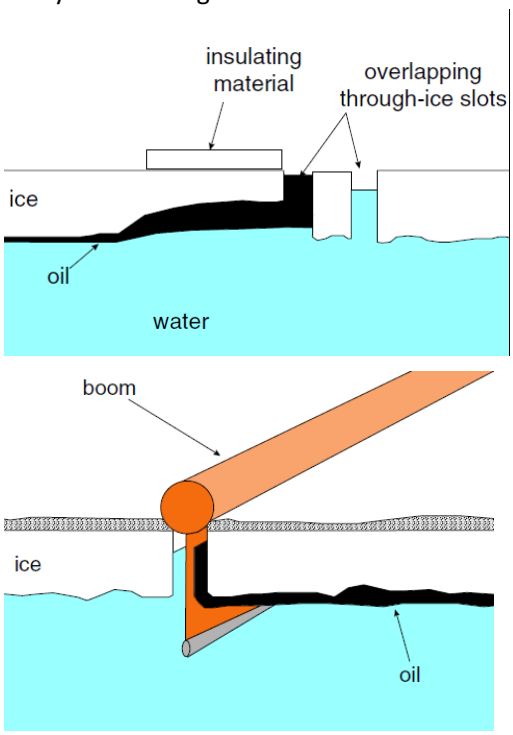
Techniques

- Currents that exceed 1 m/s may prevent successful containment, recovery and burning.
- Cut slots into the ice using a chainsaw or auger to allow the oil to pool on the water surface for recovery or in situ burning.
- If water is flowing faster than 0.4 m/s ice slots should be angled to prevent the oil from flowing past beneath them.
- Place insulating material, such as snow, on a growing ice sheet to create a pocket under the ice in which oil can collect.
- Booms or sheets of metal, plastic or wood can be placed in the ice slots on the opposite side to the current flow to create a subsurface barrier, encouraging the oil to the surface and preventing further spreading.



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8 SHORELINE CLEANUP ASSESSMENT TECHNIQUE (SCAT)

Resources Available

Tier 3	• OSRL Spill Response Specialists

Safety

- Shoreline conditions and composition can vary significantly. Ensure you are familiar with the local conditions and environment. Always consider; access, egress, tidal patterns, load bearing capacity
- Wear the appropriate Personal Protective Equipment (PPE)
- Identify risks and mitigate them where possible
- Communicate any risks and controls in place through a pre-survey safety brief
- Ensure full safety protocols are followed before conducting SCAT surveys

Key Steps

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Effective communication is required for consistency and information flow to incident command.

Communications Plan

- Emergency contacts and procedures
- Names of assets deployed, call signs and radio frequencies

SCAT operations fall under the Environment Planning Team. The SCAT Coordinator could have a SCAT Technical Advisor, SCAT Logistics, SCAT Operations Liaison, SCAT Team Leaders and SCAT Database Coordinator in the structure.

STEP 1 – PREPARE: THE SCAT SURVEY TEAM

A basic briefing is required before any field activities are carried out by the SCAT team(s) to ensure systematic and consistent results.

SCAT Briefing Agenda

- Health, safety and welfare issues
- Allocation of segments to be surveyed
- Communications and reporting channels
- Distribution of maps, assessment forms and guidance
- Check field equipment and supplies
- Assessment methodology understood by all team members

TOOLS CHECKLIST	✓
SCAT Field Guide, SOS Form, clipboard and relevant maps	
A method of communication (e.g. mobile/satellite phones, VHF radio)	
Handheld GPS	
Digital camera	
Spade	
Additional batteries	
Ruler (or other) for scale when taking photos	
Tape measure	
Flags or stake (to mark location of buried oil)	

Pre-Survey Standardisation

- If there are multiple teams and to ensure a high degree of consistency and calibration between them, have a pre-survey session to focus on:
- terminology of oiling characteristics
- shoreline types
- standard definitions

Consideration should always be given to; the extent and duration of environmental impact if the oil is not removed, natural removal rates, potential for remobilised oil to affect other sensitive resources, and likelihood of clean-up to cause greater harm than oil alone.

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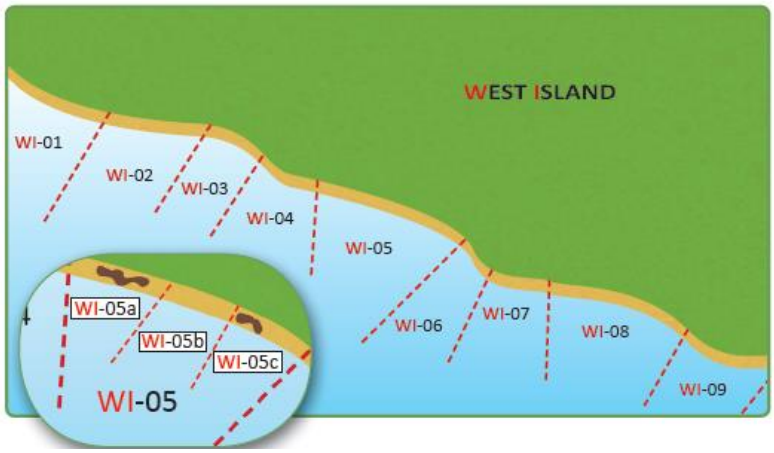
STEP 1 – PREPARE: SEGMENTATION

The first step of a SCAT survey is to divide the coastline into working units called **segments**, within which the shoreline character is relatively uniform in terms of physical features and sediment type.



Principles of Segmentation

- Segmentation is the basis for development of treatment plans
- Boundaries between segments are geological features or change in shoreline type, oiling conditions, river mouths or jurisdictional
- Satellite images, charts and sensitivity maps may assist in defining shorelines
- Segment lengths are 0.2 - 2km, or as access allows.

Segment Characteristics

- Distinct along-shore sections of shoreline that can be used as operational units
- Relatively homogeneous physical features or sediment type
- Identified by a unique location code
- Bounded by prominent geological or operational features, or by changes in shoreline type, substrate, or oiling conditions

Sub-Segmentation

- Sub-segments are created if along-shore oiling conditions vary significantly within a pre-designated segment
- Along-shore oiling conditions change throughout time within a segment during a spill incident
- If there is an operational division boundary within a segment
- Segment lengths are small enough to obtain adequate resolution and detail on the distribtion of oil, but not so small that too much data is generated

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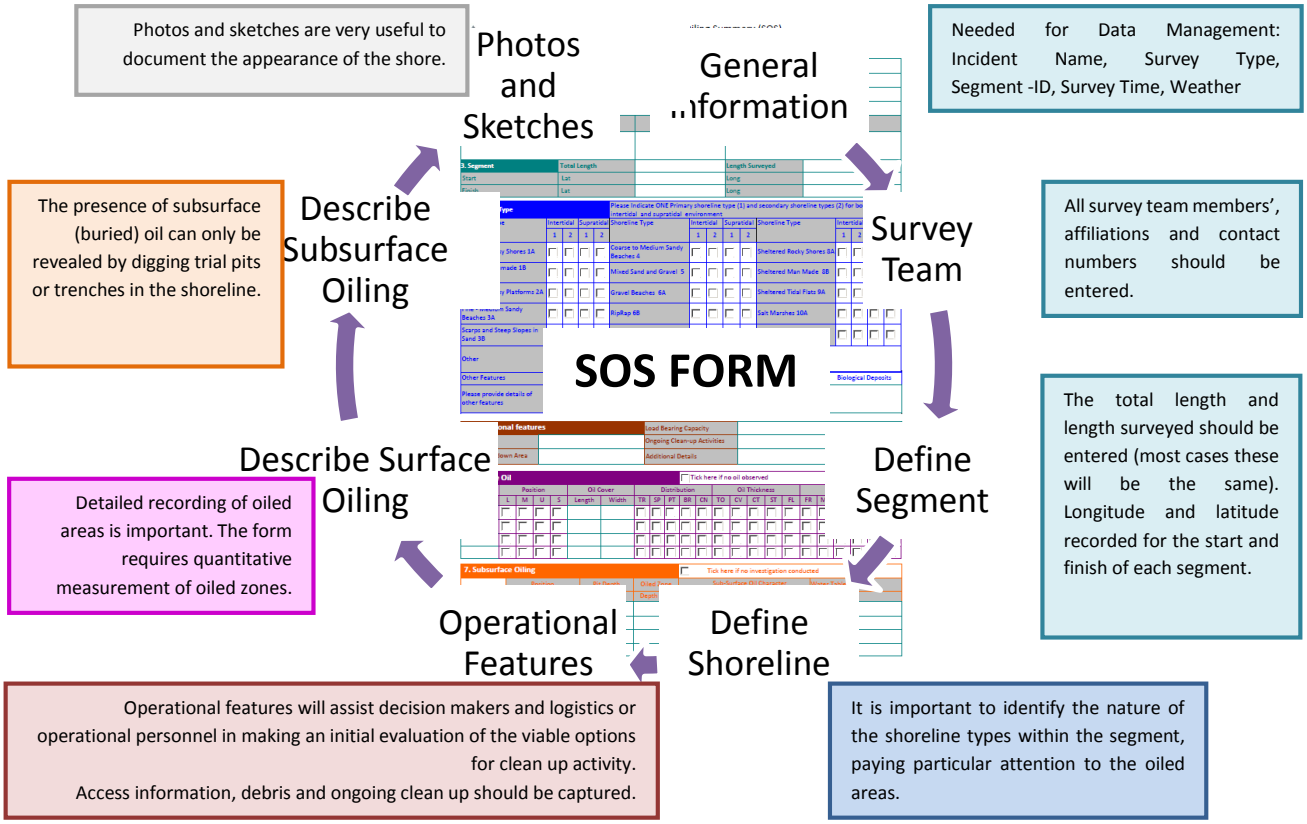
STEP 2 – CONDUCT SHORELINE SURVEY: SOS FORM

Shoreline Oiling Summary (SOS) Forms must be completed for each segment.



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Step 2 – Conduct Shoreline Survey: Define the Shoreline

It is important to identify the nature of the shoreline types within the whole segment, paying particular attention to oiled areas.

Shoreline Type
- Identify all notable shoreline types within the segment
- Select one primary shoreline type for both intertidal and supratidal zones
- There can be several secondary shoreline types within a segment.
- Shoreline types are based on the Environmental Sensitivity Index (ESI) values.

Sediment Type
- Identify sediment type based on sediment size
- Boulder, cobble, pebble, granule, sand, silt and clay

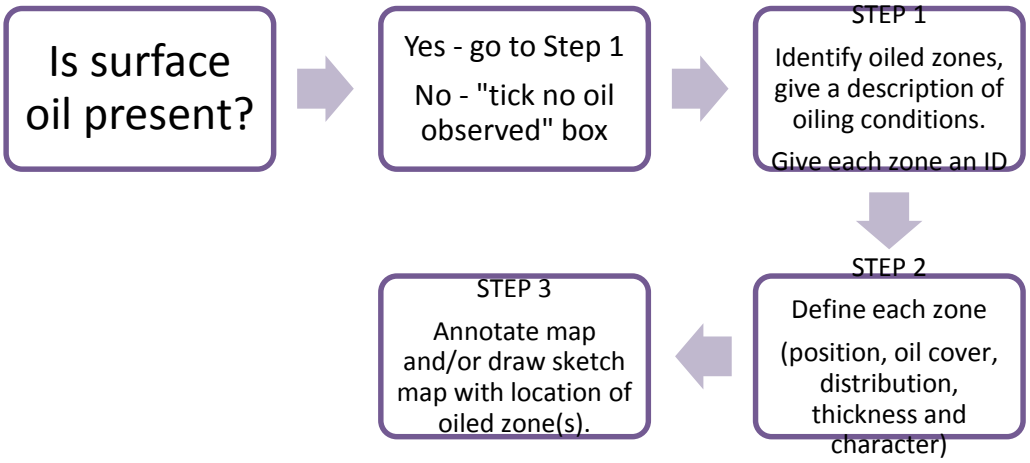
Wave Exposure
- Define the exposure rating of the upper shore parts of the segment
- Very exposed, exposed, very sheltered, partially sheltered

Step 2 – Conduct Shoreline Survey: Define Surface Oil

Making a detailed record of oiled areas is important. The SOS form requires some quantitative measurement of oiled zones. Surface oil is defined as oil that is visible on the surface and up to 5 cm below the surface of sandy beaches.

6. Surface Oil ☐ Tick here if no oil observed

	Position				Oil Cover		Distribution					Oil Thickness					Oil Character					
Zone ID	L	M	U	S	Length	Width	TR	SP	PT	BR	CN	TO	CV	CT	ST	FL	FR	MS	TB	PT	SR	AP
A	X				200 m	2 m			X				X								X	
B		X			300 m	6 m					X				X			X				



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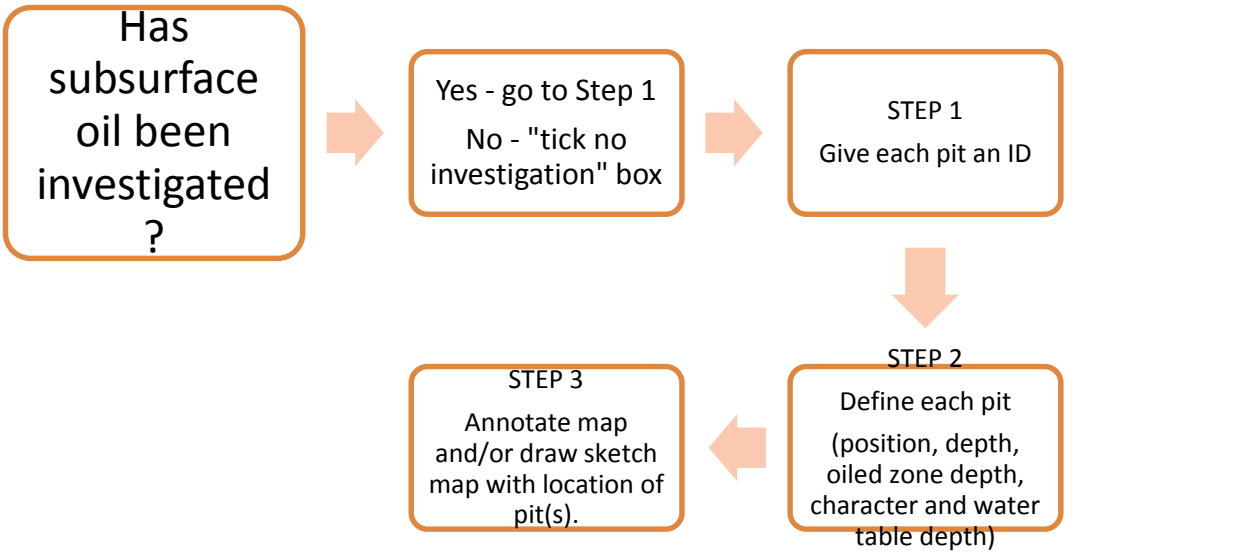
Step 2 – Conduct Shoreline Survey: Define Subsurface Oil

Dig a pit or trench to identify presence of subsurface (buried) oil, if the substrate is penetrable.

7. Subsurface Oiling — ☐ Tick here if no investigation conducted

	Position				Pit Depth	Oiled Zone	Sub-Surface Oil Character							Water Table Depth
Pit ID	L	M	U	S	(cm)	Depth (cm)	SAP	OP	PP	OR	OF	TR	NO	cm
1	☐	☒	☐	☐	19 cm	10 - 15 cm	☐	☐	☒	☐	☐	☐	☐	
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	



Step 2 – Conduct Shoreline Survey: Sketches and Photographs

Field sketches allow more detail on the location of the oil to be captured. Photographs help to illustrate the distribution and extent of oiling, the location and character of the affected areas, the location of any puts, potentially sensitive resources, access points, possible laydown areas and the shoreline response.

Sketches

- north arrow
- segment number
- scale
- segment boundaries
- water levels
- major features and landmarks

Photographs

- set time and date
- capture a scale bar
- mark location of photograph and direction on sketch
- record photograph number on SOS form

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STEP 3 – RECORD AND REPORT

Recording and reporting during shoreline surevys is integral to the SCAT process. After data collection occurs, it must be collated and analysed so recommendations for clean-up can be made.

Completed SOS Forms and data collected by SCAT Teams needs to be made available quickly to decision makers. Data management system requirements will depend on the size of the incident.

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9 WASTE MANAGEMENT

Resources Available

Tier 1	•On board storage
Tier 2	•Fasttanks •Drums •Vacuum Trucks •Inflatable Barge
Tier 3	•OSRL •Third party contractor vessels

Safety

- Wear the appropriate Personal Protective Equipment (PPE)
- Identify risks and mitigate them where possible
- Communicate any risks and controls in place through a pre-operation safety brief

Key Steps

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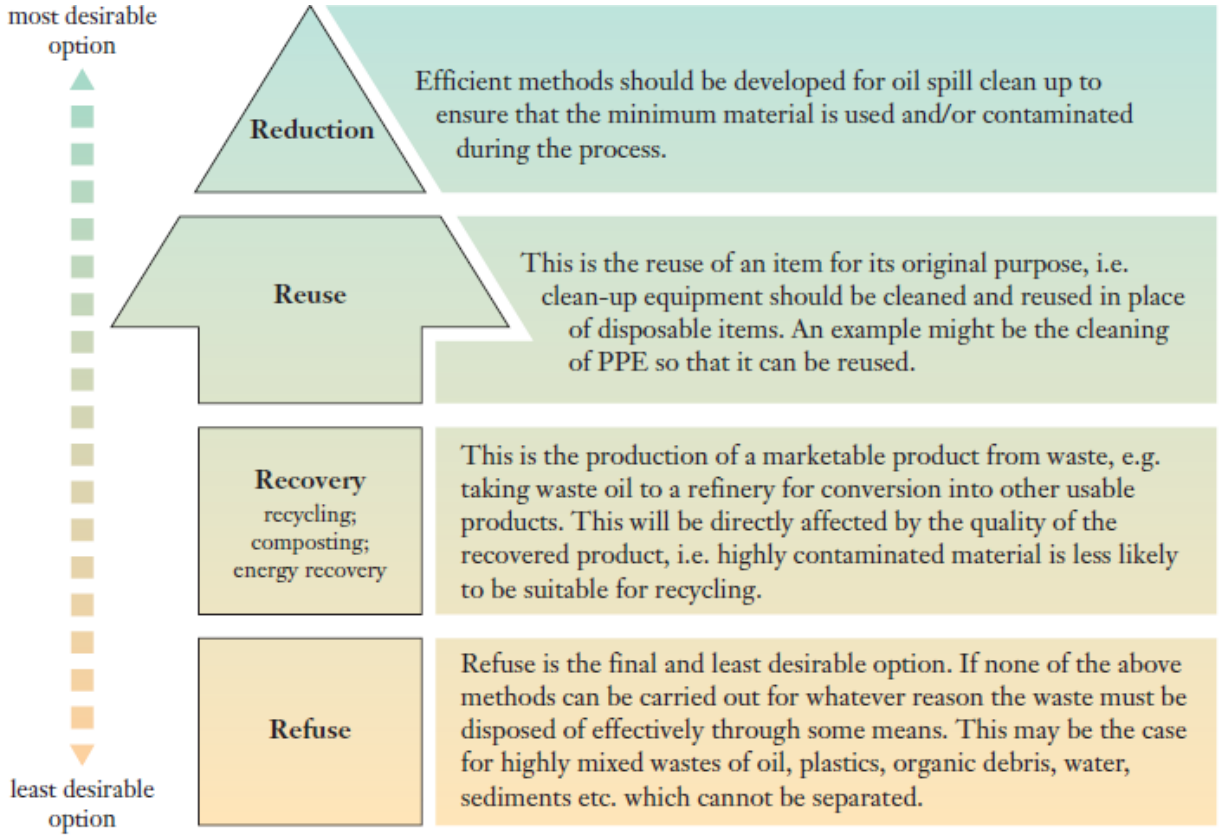
STEP 2 – PREPARE: STORAGE IDENTIFICATION AND WORKFORCE ORIENTATION

Use the waste hierarchy to manage the total amount of waste generated:



(Source: IPIECA, 2004)

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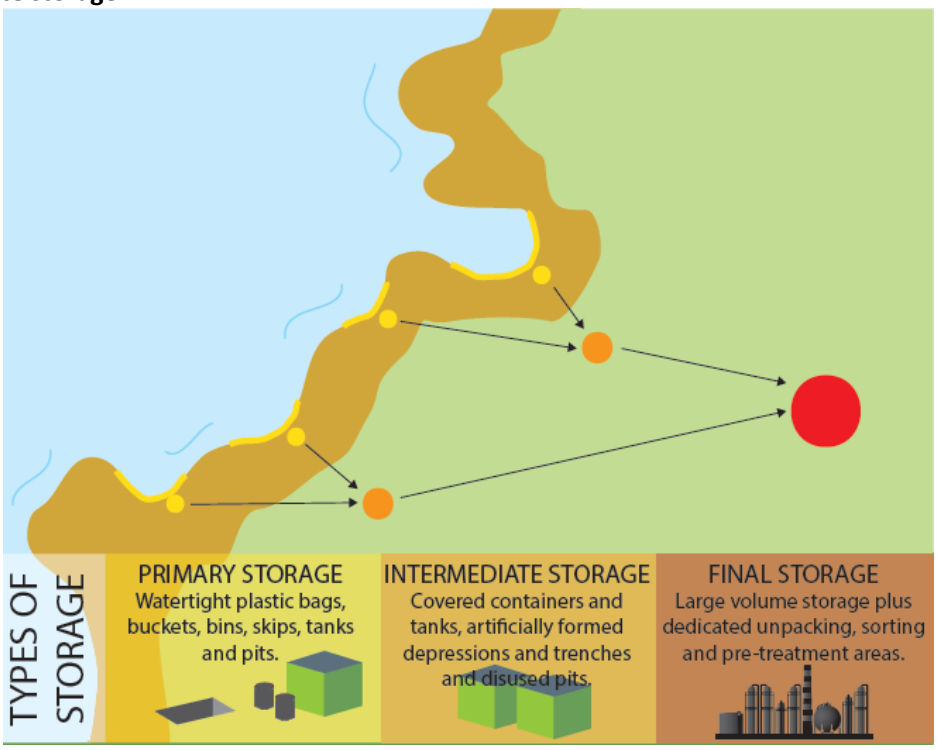
Organise waste storage:



- Identify storage facilities for every stage of the response, from recovery to long term storage, treatment and/or disposal.
- Consider the use of staged storage facilities to minimise cross-contamination.
- Consult stakeholders (local authorities, government) to identify suitable locations of intermediate and long term storage sites.
- Establish waste minimisation guidelines with workforce and instruct in the proper use of equipment and storage facilities

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Temporay Storage Facilities will:

- Prevent delays resulting from many vehicles trying to access one site.
- Allow time to organise final disposal sites or methods whilst the response effort continues.
- Assist in appropriate waste segregation.

Considerations:

- Local, regional and national legal regulations.
- Waste should be labelled with type and source of waste.
- The site set up should allow for waste separation to minimise secondary contamination.

Waste Sites Should:

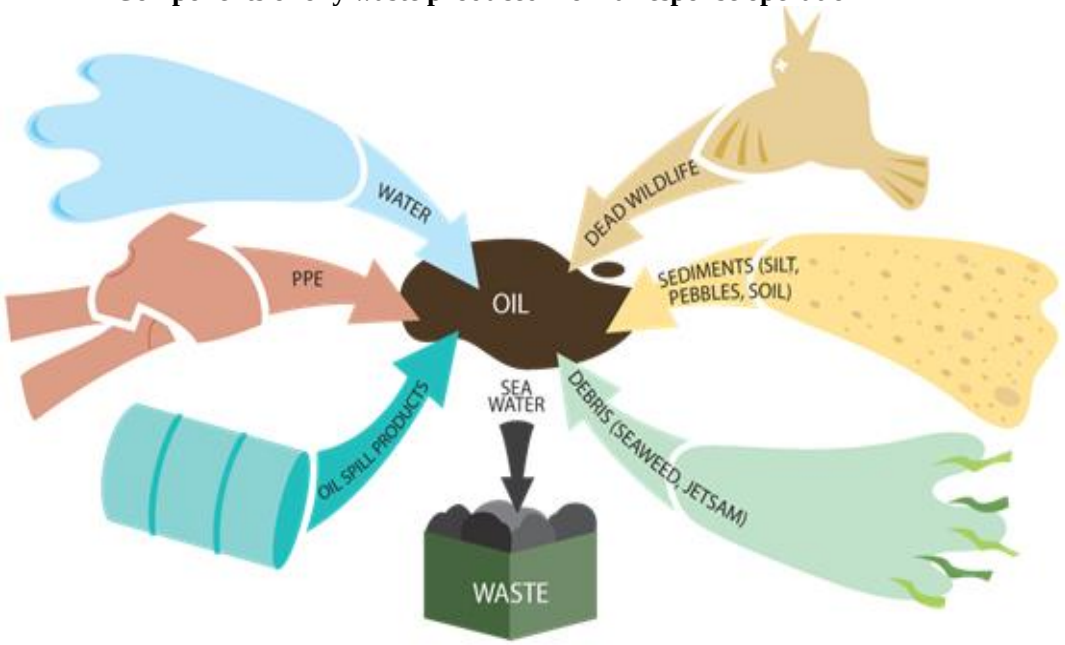
- Be fenced off with controlled site access.
- Have good access and egress.

Storage Containers Should:

- Be suitable for the waste type.
- Have useful and appropriate signage to reflect the site set up.
- Be water tight and lined with polyethylene sheeting to prevent oil leaching.

Step 3 – Reduce Waste: Site Set-Up and Housekeeping

Components of oily waste produced from a response operation



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Shoreline/Inland

- Pre-clean beach/bank sections at risk of contamination before oil impacts to reduce oily waste.
- Block drainage points, if present, which could transfer oil beyond the immediate site.
- If beach/bank has been impacted, minimise contamination by using a defined site set-up (below).

Contain and recover pollution as close to the source as possible.

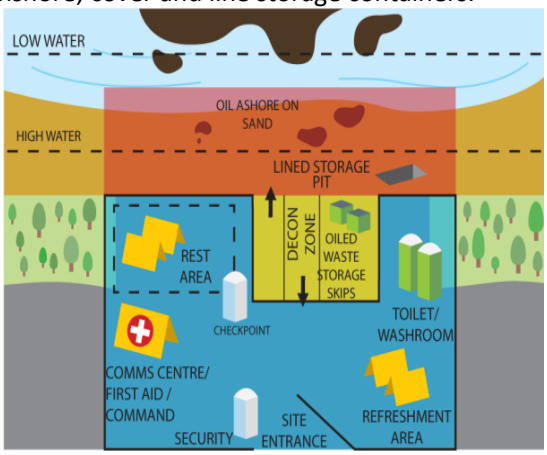
- Minimise the use of sorbents and re-use PPE where possible.
- Store shoreline response resources above high water mark and on level surfaces.
- A wide variety of options can be employed for storage onshore; cover and line storage containers.

Site Set-Up

Hot Zone: Oiled work area, all oil stays in this zone.

Warm Zone (Decontamination Zone): Clean down area; use one entrance/exit channel. Anyone leaving must pass through an organised decontamination process here.

Cold Zone: Waste removal vehicles collect full containers from this clean area so that they do not spread oil onto the roads.



Offshore

- Prepare sufficient temporary onboard waste storage to last operational period.
- Consider the use of inflatable barges, heated tanks and vessel storage tanks.
- Arrange intermediate storage or bulking facility for remote response operations, particularly if more than one vessel is recovering oil.
- Follow work zone arrangement on vessel of opportunity to prevent secondary contamination. Set up defined areas (hot, warm and cold zones) if vessel lacks defined work zones.
- Minimise the use of sorbents, re-use PPE where possible.

Housekeeping

Secondary contamination is the spread of oil via transport, people and equipment to unpolluted areas.

Avoid secondary contamination with good housekeeping:

- Regularly check pumps and hose connections for leaks
- Ensure all storage is water-tight and oil-proof to prevent leakage
- Cover waste containers to prevent rainwater increasing the waste volume
- Line and decontaminant all waste transportation vehicles before leaving site
- Establish a traffic circulation plan for vehicles
- Locate waste storage sites close to recovery equipment

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Types of waste produced by each response technique

	Technique	Waste collected	Waste generated
Offshore Response	Natural Recovery	-	-
	Containment and Recovery	Oil and emulsified oil Contaminated water Contaminated debris	Contaminated boom and skimmer equipment Contaminated vessel
Shoreline and Inland Response	Sediment Relocation	-	Contaminated equipment (spade, bags) & PPE
	Manual Recovery	Oil and oiled sediment (tarballs, emulsified oil) Oiled debris & vegetation	Contaminated equipment (spades, buckets) PPE
	Sorbents	Oil	Sorbents, PPE
	Mechanical Recovery	Oil and oiled sediment	Contaminated equipment (skimmers, pumps) & PPE
	Flushing	Remobilised oil	Sorbents and/or containment boom & PPE

STEP 4 - REUSE: SEGREGATE

Segregation is the first step to reusing and recycling waste.

Waste should be classified, segregated and labelled. Segregate different types of oiled waste and keep non-oiled waste separate.

Refer to: The relevant response technique for the most effective method of removal.

Consider the following to reuse or segregate different types of waste generated

Oiled waste	Considerations
Fluid oil	Feasibility of using recovered oil as a raw material or low grade fuel Prevent water or debris entering waste oil containers (consider decanting) Use cleaners and wash sparingly with water
Heavily contaminated oil	Discharge into lined lagoons, pits or large open topped tanks Separate oil, water and oiled debris; pre-treat if possible.
Solid waste (includes oiled debris and response material)	Do not mix oiled waste with domestic/non-oiled waste Prevent oily wastes from contaminating soil; use liners Use sorbent pads until they become moderately oiled Minimise collection of underlying, non-oiled sediment Clean and re-use recovery equipment (e.g. pom-poms) rather than discarding
Oiled wildlife	Keep dead animals separate from other waste types to prevent spread of disease

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STEP 5 - RECYCLE: PRE-TREAT

Pre-treat waste in situ to reduce the amount of waste that needs to be transported and treated.
Pre-treat by:

- surf washing
- burning
- sand sieving
- bioremediation

STEP 6 – DISPOSE

Initial transportation will involve small vehicles such as dump trucks and front end loaders. Subsequent transportation to intermediate or final disposal sites can include tankers for liquid waste and sealed trucks for solid waste.

Ensure the following:

- Trucks have a covered or sealed top
- Trucks are decontaminated before leaving the site
- Waste shipments meet regulations

Document and retain consignment notes for

- all waste leaving the site
- waste being transferred from an intermediate storage site to a final suitably licensed disposal/treatment site

Disposal options depend on volume and type of oil, contaminated debris volume, spill location (offshore/shoreline), environmental and legal considerations, practical limitations and cost.

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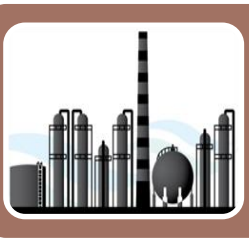
Oil-Water Separation

- Use an onboard oil-water separator to reduce contaminated waste quantities going to final disposal.
- The oil/water residue from separation should meet 15 ppm discharge standards for release into the environment.

Emulsion Breaking

- Waste emulsion can be broken down into its constituent parts of oil and water using a specialised emulsion breaking chemical.
- Oil can then be sent for refining. The emulsion breaking chemicals remain in the water which has to be disposed of appropriately.



Re-Processing

- Treatment of recovered liquid waste.
- Oil is reprocessed through an oil refinery or recycling plant.
- Oil with a high salt content may corrode refinery pipe work.
- Only debris free oil or an oil/water mix can be processed.

Incineration

- Treatment of recovered liquid waste.
- Small portable incinerators must be permitted by the Regulator prior to use.
- High salt content in the oil may render this option unsuitable.
- Costly option (environmentally and economically).
- Facilities are uncommon and are unable to deal with large quantities.

Land Fill

- Treatment of other oily waste (debris/PPE).
- If waste contains approximately 5% oil it can usually be disposed of with general waste, however local and national regulations should always be adhered to.
- Chemical testing required to determine hazardous content.
- Facilities able to receive this type of waste are limited.

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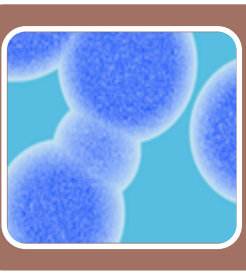
Sand Cleaning

- Treatment of oiled sediment
- Specialist mechanical sand cleaners sieve contaminated sand to removed oil
- Consider NEBA to prevent damage by over cleaning or sterilisation

Beach Washing

- In-situ cleaning of sand, pebbles and cobbles
- Lightly oiled substrate can be cleaned naturally at the surf zone; collect remobilised oil in containment booms
- It is not always easy to identify when pebbles are oil free
- Produces oily water requiring treatment - costly and time consuming.



Bioremediation

- Treatment of oiled sediment
- Addition of microbes to breakdown oil contamination
- Can be done in-situ or oil waste can be removed and treated elsewhere
- Produces inert substance which can be disposed of at landfill if oil loading within permitted levels
- Should be carried out in a controlled environment

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Appendix 4 - Environmental Information

This section highlights the key environmental information for the scope of the SSRP

Sea temperature

Sea temperature averages about 2° C through the area from Milne Inlet to Eclipse Sound, based on HYCOM modelling (). From a conservative (less evaporation loss) view 1° C is selected for the spill weathering.

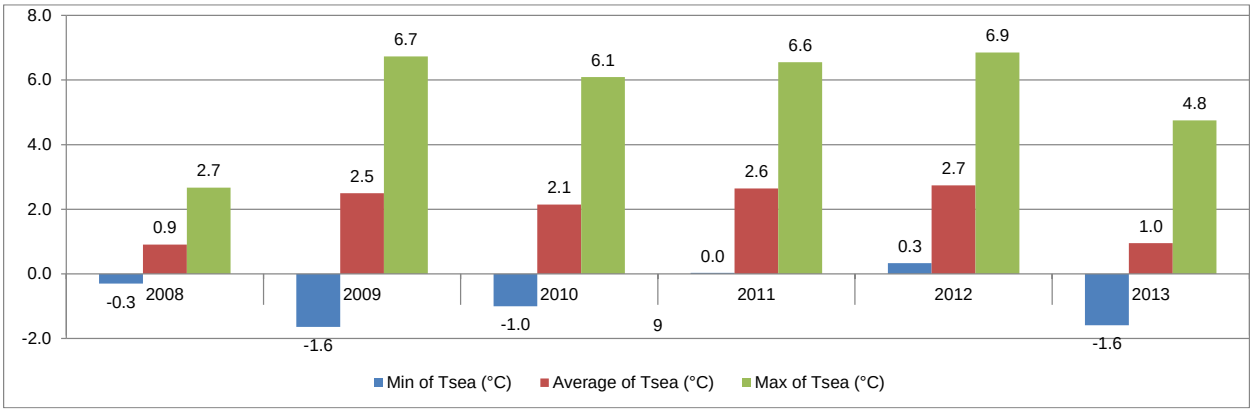

FIGURE 9-1 HYCOM SEA TEMP

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Wind

Winds data for the area of operation using the following sources:

- the met station at the Milne port site
- Environment Canada climate stations at Pond Inlet
- MSC North Atlantic wind and wave hindcast winds just east of the entrance to Pond Inlet
- European Centre for Medium-Range Weather Forecasts (ECMWF), ERA Interim (ERAI) class, Atmospheric Model winds at 10 m, gridded over the study area

The data from these sources is shown in Figure 9-2.

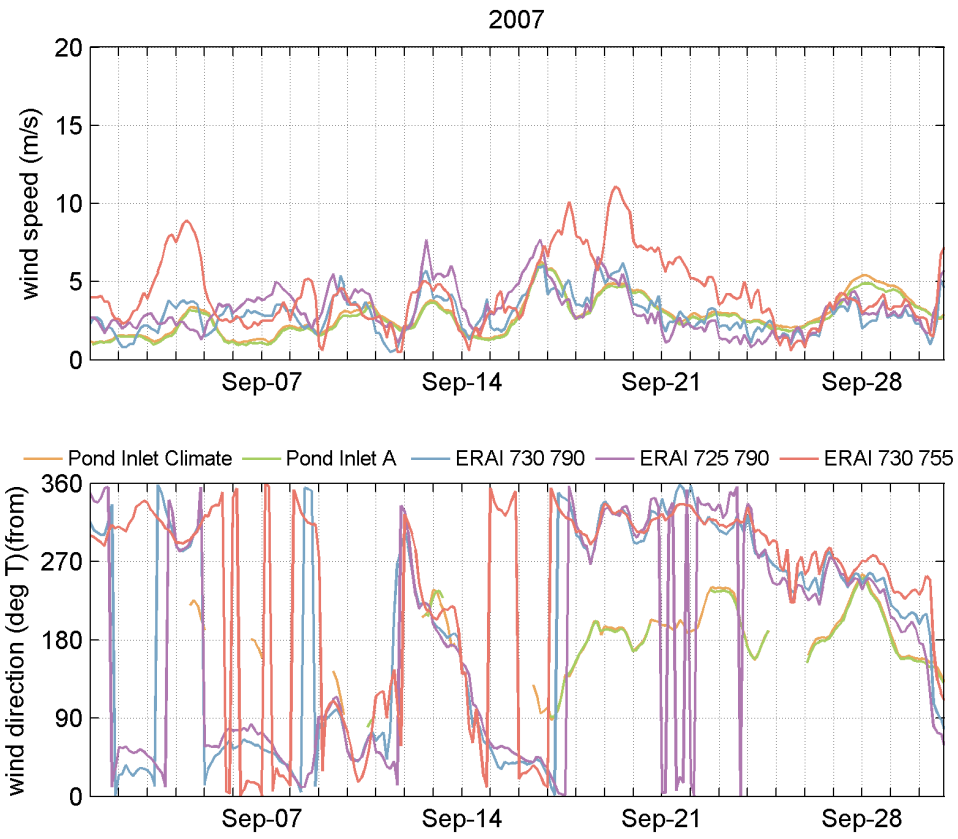

FIGURE 9-2 WIND COMPARISON, SEPTEMBER 2007

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Ocean Currents

Ocean currents are in **Figure 9-3**.

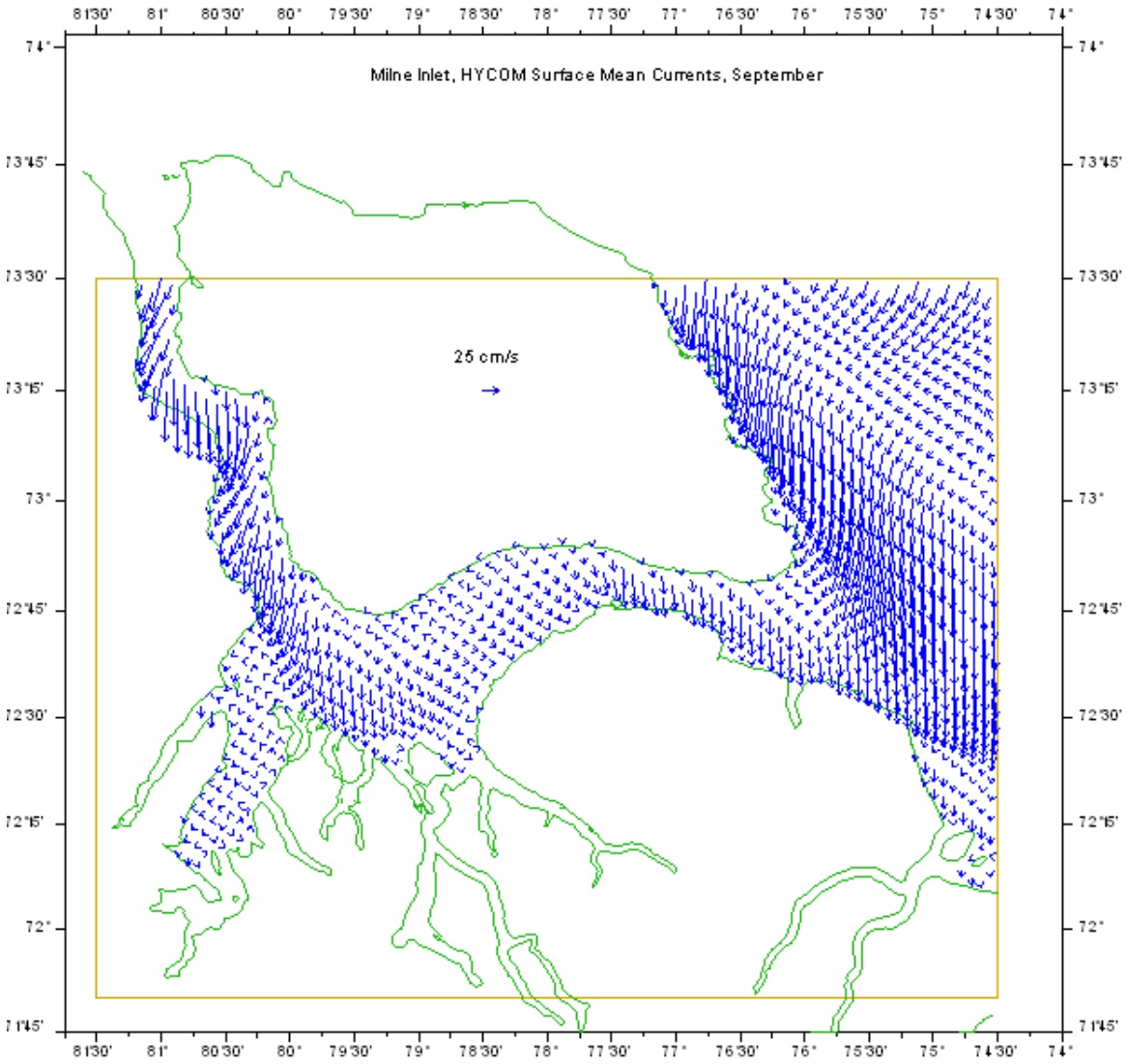

Figure 9-3: Milne Inlet, HYCOM Surface Mean Currents, September

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Area of local importance

During a workshop held by BIMC with attendance from; Oil Spill Response Limited (OSRL), AMEC, Environment Canada, Transport Canada, Canadian Coast Guard, Fisheries and Oceans, Qikiqtani Inuit Association, Pond Inlet Hunters and Trappers Association a number of areas of importance were identified. These are shown in Figure 9-4 along with known natural collections points identified.

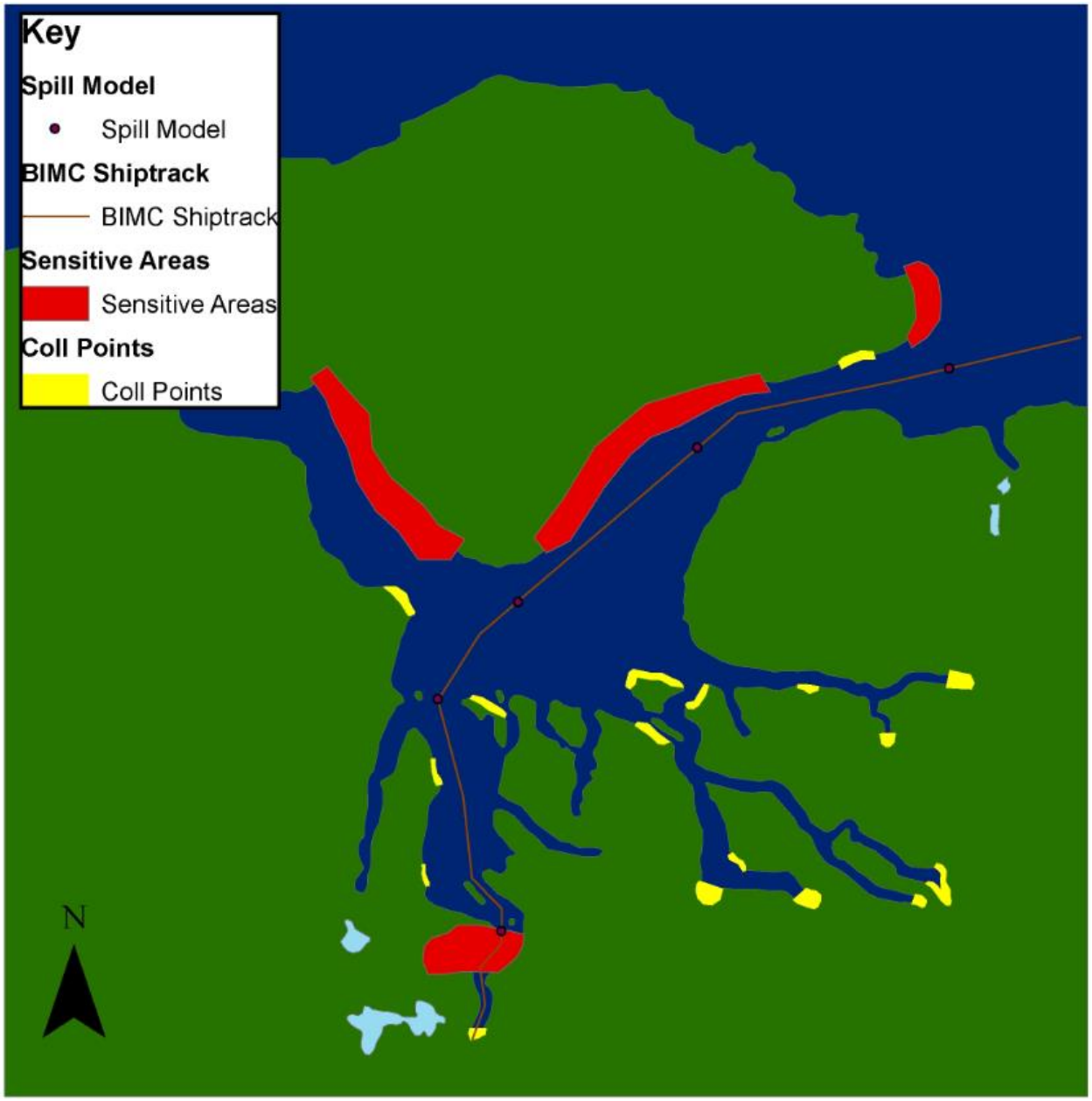

FIGURE 9-4 AREAS OF IMPORTANCE

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Appendix 5 – Fuel Spill Modelling

For all modelling results refer to the Fuel Spill Modelling Report for Milne Inlet, Bruce Head, Eclipse Sound and Pond Inlet conducted by AMEC on behalf of BIMC.

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