CNOOC Petroleum North America

Plan for
Atlantic Canada Offshore Spill Response

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Accountable Owner:	[redacted]	**Responsible Author:**	[redacted]
Publish Date:	19-Mar-21	**Required Review Frequency:**	2 Years
Effective Date:	19-Mar-21	**Revision:**	4.0
Primary Regulation(s) Addressed by Document:	Newfoundland Offshore Petroleum Drilling and Production Regulations (SOR/2009-316)	**Asset Life Cycle:**	**Explore** √ / **Develop** ☐ / **Produce** ☐ / **Market** ☐ / **Abandon** ☐
Standard /Business Process Number & Activity # or Policy Statement #:	GLOBAL-STD-0005: Standard for Emergency Management 7.10	**Applicability:**	Atlantic Canada

For document history, see the CNOOC International Management System (CIMS).

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1. INTRODUCTION

CNOOC International (CNOOC) recognizes that the most effective way to avoid environmental impact from an offshore spill is to prevent the occurrence of releases. CNOOC has in place the personnel, policies, procedures, equipment and training necessary to reduce the probability of incidents from occurring and to minimize the potential effects of spills, should they occur. CNOOC is committed to continual improvement in terms of processes, equipment, systems and training.

The analysis conducted for the Environmental Assessment (EA) of the Flemish Pass Exploration Drilling Project (2018 – 2028) and subsequent EIS amendments, predicted that there is a low probability of a major spill occurring during exploration drilling operations. The probability of small batch spills of fuel, drilling fluid or hydraulic fluids during routine operations is, however, slightly higher. CNOOC has a “zero tolerance” policy towards all unauthorized discharges and emphasizes prevention in the design, operation and maintenance of facilities; procedures employed offshore; and training of personnel. CNOOC maintains the capability for an immediate response to a spill incident that may occur during exploration drilling operations.

Spill trajectory modelling shows that there is only a remote probability of a spilled product reaching the coastline prior to dispersion due to the prevailing wind and current conditions in the Flemish Pass / Cap. In the unlikely event that conditions do allow a spill to approach shore, response techniques will change to coastal and shoreline applications, maintaining the management system described within this plan.

2. PURPOSE

This document details the response actions to be taken by CNOOC in the event of a spill during exploration drilling operations offshore Newfoundland.

3. SCOPE

The Offshore Spill Response Plan (OSRP) covers the management, response options and strategies that will be used in a spill response for CNOOC’s Atlantic Canada exploration drilling operations. This Plan describes the actions to be taken in the event of a spill and is specifically oriented to situations where CNOOC has direct responsibility for the spill incident and its immediate and long-term impacts.

The CNOOC procedures are consistent with the guidance established by the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) for oil spill contingency.

This plan provides a comprehensive overview of:

- CNOOC’s philosophy and procedures concerning spill response;
- The organization of CNOOC’s response efforts and the evolution of those efforts with the increasing scale of the spill response;
- On-water response equipment;
- Appropriate training for personnel;
- Bio-monitoring plans for large spills; and

- Mutual Aid Agreements with other operators.

3.1 GEOGRAPHIC AREA FOR PLAN IMPLEMENTATION

This OSRP has been specifically developed to support exploration drilling operations offshore Newfoundland. The techniques and procedures outlined herein are sufficiently flexible to allow CNOOC to continue to respond to a spill as it moves away from its point of origin. The current acreage held by CNOOC is shown in Figure 1.

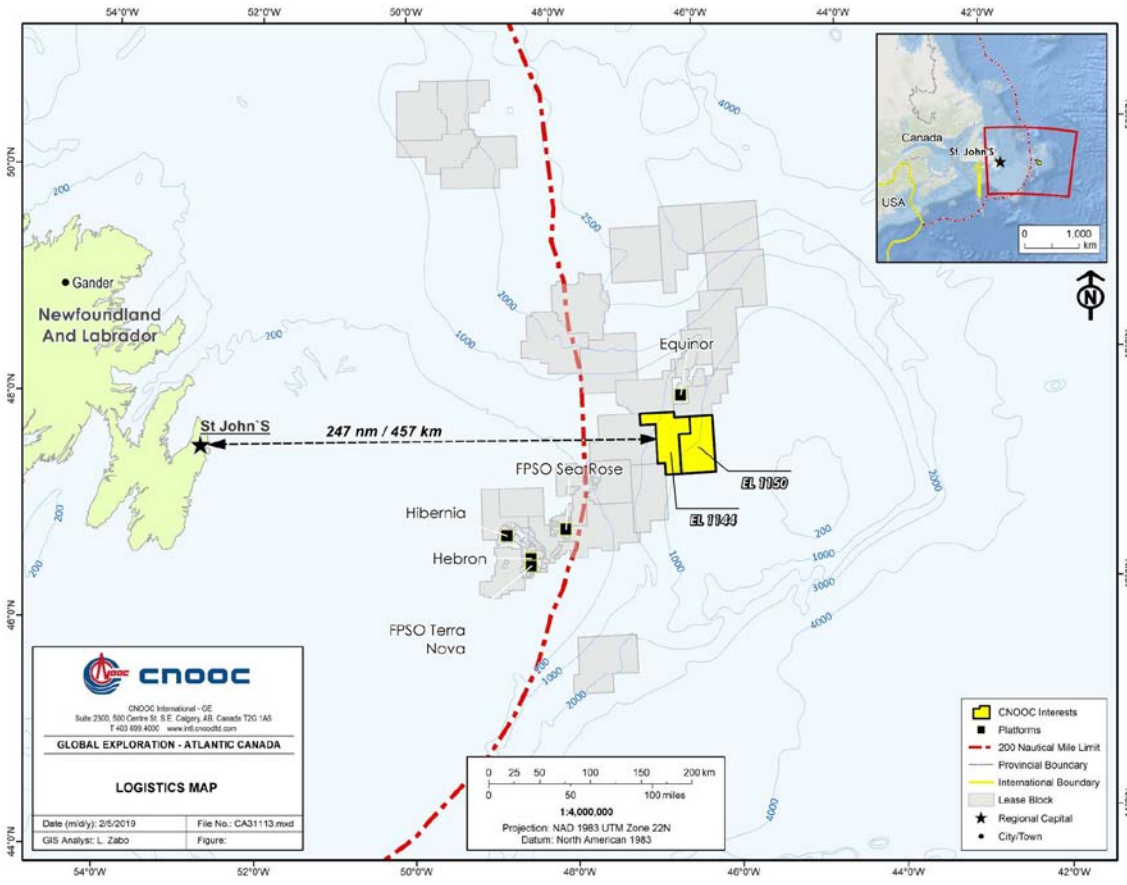

Figure 1. Project Area Map

4. INDIGENOUS AGROUP AND STAKEHOLDER ENGAGEMENT

CNOOC commenced engagement on their proposed exploration program with 41 Indigenous groups in March 2017. Since that time, CNOOC has shared information and discussed their approach to oil spill response with Indigenous groups through information bulletins, and a number of meetings and workshops held in collaboration with other operators seeking to drill exploratory wells offshore eastern Newfoundland.

For a full record of CNOOC's Indigenous engagement prior to the submission of the draft EIS, please see: https://iaac-aeic.gc.ca/050/documents/p80117/122066E.pdf

In addition to individual meetings with Indigenous groups, CNOOC and various other offshore exploration operators met with Indigenous groups in April and October 2018 in

six separate all day workshops in St. John's, NL, Moncton, New Brunswick and Quebec City, Quebec. One component of the sessions was to discuss oil spill prevention and spill response planning in detail. The content developed for discussion at the workshops was based on each company's and industry best practices, regulatory requirements and concerns and questions raised by Indigenous groups participating in the environmental assessment process.

Oil Spill Response topics discussed with Indigenous groups at the workshops included the following:

- Overview of oil spill modelling (i.e. what is modelling, why do we do oil spill modelling, what is the approach and overall conclusions);
- Oil fate processes in water;
- Spill preparedness and response (e.g. regulatory requirements associated with preparedness, control and barriers, response and recovery, Spill Impact Mitigation Assessment (SIMA), surveillance and monitoring, etc.);
- Well control and emergency response (i.e. blowout preventer (BOP), capping and containment, and relief well);
- Overview of response options (i.e. natural attenuation, mechanical containment and recovery, in-situ burning, and dispersants);
- Shoreline monitoring and response; and
- Response capabilities (e.g. tiered response, exercises, etc.).

CNOOC provided a draft of the OSRP to Indigenous groups in February 2020 for review and comment with a deadline for comment of March 6, 2020. No comments were provided by Indigenous groups to CNOOC during this timeframe.

In response to concerns expressed by Indigenous groups that they be notified and maintained informed of operations and in the case of an emergency (such as an oil spill), CNOOC along with four other operators, developed an Indigenous Fisheries Communication Plan in consultation with Indigenous groups that outlines a protocol to be followed in the event of an incident or spill that may result in adverse environmental impacts.

CNOOC will provide Indigenous groups a copy of the final OSRP. CNOOC will also provide Indigenous groups with results of spill response exercises, once reviewed by the C-NLOPB. For notification requirements to Indigenous groups refer to the Indigenous Fisheries Communication Plan.

5. OFFSHORE SPILL RESPONSE STRATEGY

CNOOC employs a structured, systematic and proportional management process in the response to a spill at any offshore site. Priorities in managing the response will follow the PEAR principle:

- Protect **P**eople – Ensure personnel can escape from the immediate vicinity of the emergency to a place of safety where they are accounted for via mustering procedures and arrangements can be made for the retrieval of missing persons;

- Minimize the impact on the **E**nvironment – Minimized by implementing measures to reduce facility inventories (thus limiting a release to environment) and ensuring robust procedures are in place for dealing with environmental impacts;
- Protect operated **A**ssets – Provide protection to facilities following identification of an emergency by reducing and mitigating the hazards. This can be achieved through effective shutdown of equipment, disposal of inventory and firefighting facilities; and
- Preserve **R**eputation – manage stakeholder communications and ensure the emergency response efforts are appropriately prioritized and focused on safeguarding people, communities and the environment.

A spill may occur in conjunction with other offshore emergencies (e.g. fire, explosion, loss of well control, marine or aircraft incidents). Response to an emergency event which threatens personnel will always be the priority. Active spill response operations will be secondary. During an emergency, spill response actions may be limited to planning for onshore management and the activation of resources, including response contractors, equipment and personnel.

While every spill response situation will be unique, there are a few basic strategies that can be practically considered. The response options available during an offshore spill may include the following:

- Surveillance and monitoring;
- Mechanical dispersion;
- Containment and recovery;
- Chemical dispersion;
- In situ burning; and
- Wildlife measures.

An offshore spill, in the absence of intervention, is usually characterized by rapid spreading that covers a large area. In many events the spilled product can be difficult to locate, and operation of response equipment may be impeded by weather and oceanic conditions. Additionally, the remote location provides challenges for logistics management and may reduce the opportunity to utilize spill response specialists offshore. Immediate action will rely on on-site support vessels and crews.

Offshore Newfoundland prevailing winds and currents will eventually transport the spilled product to the east, away from sensitive marine and coastal resources. With passing time, the spill will spread to cover a large area while the actual amount of product on the surface will decrease naturally through weathering. The spill response logistics effort will also increase quickly as the product spreads and potential response options will become more limited over time.

All strategies used during spill response will include some combination of these techniques. The actual strategy developed for any incident will be based on:

- Type of product spilled;
- Operating conditions at the time of a spill;

- Environmental resources at risk;
- Logistics considerations;
- Availability of response equipment;
- CNOOC's general emergency response structure;
- Existing contract services;
- Provisions made by other offshore operators;
- The requirements of the C-NLOPB; and
- Input from other stakeholders (e.g. Canadian Coast Guard (CCG., Environment and Climate change Canada (ECCC);

CNOOC's spill response capability includes:

- An initial response capability based on a network of equipment and vessels;
- Eastern Canada Response corporation (ECRC) Operational Spill Management services provided on contract to CNOOC;
- Tier 2 equipment available from other offshore Newfoundland Operators; and
- Oil Spill Response Ltd. (OSRL) agreement to provide access to international equipment and trained personnel.

5.1 HEALTH AND SAFETY CONSIDERATIONS

Offshore spills may consist of oils such as crude, diesel, lube, hydraulic or drilling fluids. Each of these fluids will have different physical and chemical characteristics when released to the marine environment. These characteristics will not only affect the choice of equipment and techniques to be used in the response but also have implications from a safety perspective. Volatile fractions will constitute a significant component of any crude. Evaporation and dispersion of these potentially flammable and/or toxic fractions will take place over a possibly extended timeframe but will be of notable concern in the early stages of a response.

5.2 ENVIRONMENTAL CONSIDERATIONS

Most spill scenarios associated with operations offshore Newfoundland anticipate that the response strategies will be focused offshore.

Following is an overview of the physical environment and habitats; meteorological conditions; faunal and socioeconomic sensitivities to spills with an emphasis on marine ecosystems as these are regarded as the most probable sites of oil pollution from offshore Newfoundland operations.

5.2.1 Spill Impact Mitigation Assessment

The objective of a Spill Impact Mitigation Assessment (SIMA), when applied to oil spills, is to conduct an evaluation that will allow spill responders and stakeholders to choose the response strategy that will result in the best overall recovery of the ecological, socio-economic and cultural resources of concern, while maintaining safety of responders as the primary goal. In most spill scenarios, no single response option is likely to be

completely effective. Oftentimes, the best approach to minimize environmental impacts is to employ multiple response options.

The SIMA process is used during a response to ensure evolving conditions are understood, so that the response strategy can be adjusted as necessary to manage individual response actions and end points.

CNOOC's response options are managed through use of the Incident Command System. ICS provides a common, functional organizational structure, nomenclature and terminology, and is used within the offshore Newfoundland oil and gas industry. In this system, the use of SIMA would occur primarily within the Environmental Unit (EU), which contains industry and agency personnel, and advises the Incident Commander on environmental issues. The EU quickly assesses real-time spill conditions (e.g., oil type, quantity, trajectory, etc.), reconfirms information about actual resources at risk in the vicinity, and then adapts conclusions from planning SIMAs, as appropriate, to the actual spill conditions. The SIMA process is cyclical in that the plan is adapted to meet changing spill conditions.

CNOOC has developed a SIMA for this project that has been submitted to the C-NLOPB for review and approval by the C-NLOPB and the Environmental Emergencies Science Table (EEST). Any comments resulting from the review will be incorporated into the next revision of the SIMA document.

5.2.2 Seabirds

The primary environment resource of concern in a spill response will be the impact on seabirds. Table 1 provides a brief description of the seasonal and geographic distribution of the significant seabird's species within the Flemish Pass Exploration Drilling Project Area.

Group		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cormorants													
Gannets													
Phalaropes													
Gulls	Large Gulls												
	Ivory Gull[1]												
	Black-legged Kittiwake												
Terns													
Alcids	Dovekie												
	Atlantic Puffin												
	Black Guillemot												
	Common Murre												
	Thick-billed Murre												
	Razorbill												
Jaegers and Skuas													
Fulmars and Shearwaters													
Storm-Petrels													
Waterfowl													
Shorebirds													
Migratory land birds													

Notes [1] Denotes species at risk

Absent in Regional Study Area (RSA)
Present in RSA
Scarce in RSA
Common in RSA
Flightless birds (dependent young and/or molting adults at sea, potentially in RSA

Table 1 Seasonal and Geographic Seabird Distribution

5.2.3 Fishery

Profiles of the principle commercial fisheries undertaken in the Project Aare provided in the *Flemish Pass Exploration Drilling Project Environmental Impact Statement (2018-2028)*.

The Continental shelf break on the eastern margin of the Grand Banks is an active fishing area supporting Canadian and International ground fish, shrimp, and crab fisheries. The crab fishery relies on fixed traps, while mobile gear is generally used in the ground fish and shrimp fisheries. Figure 2 shows the distribution of fishing activities in/near the Project Area.

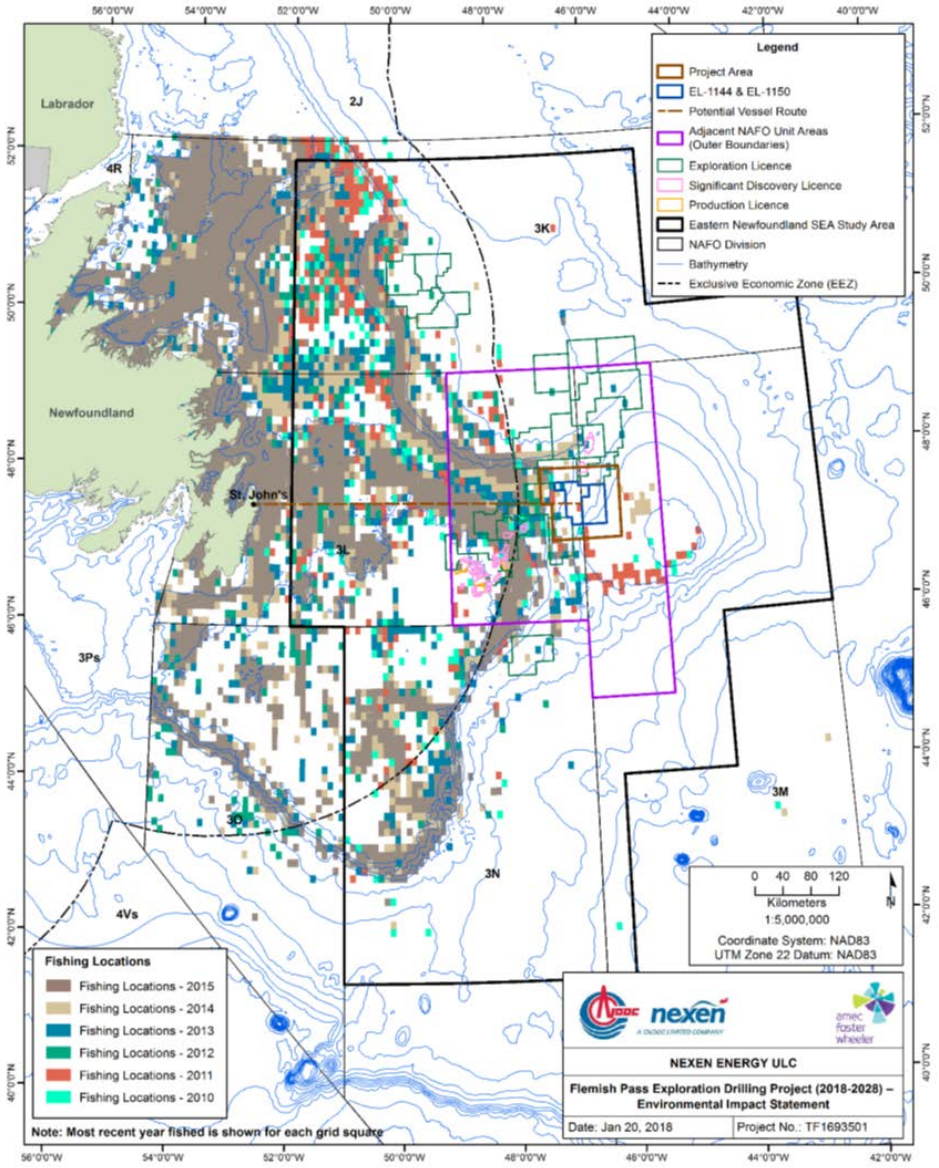

Figure 2. Domestic / Commercial Harvesting Locations (all species 2010-2015)

5.2.4 Other Wildlife

Whales, dolphins, seals and turtles also occur in the Project Area. In general cetaceans and seals do not exhibit large behavioural or physiological reactions to limited surface oiling, incidental exposure to contaminated food or ingestion of oil. Effects of oil on sea turtles are reversible, although there is a possibility that foraging abilities may be inhibited by exposure to oil. The very small number of sea turtles transiting the area makes exposure to spilled oil unlikely.

5.2.5 Environmental Effects Monitoring (EEM)

The initial biophysical conditions of exploration and production sites are assessed as a baseline for comparison of environmental effects following an oil spill. The level of environmental monitoring activity following a spill is determined by:

- Spill volume;
- Wind and sea conditions;
- Nature of the product spilled;
- The resources at risk; and
- Observed environmental impacts (i.e. oiled seabirds).

The C-NLOPB will recommend if an EEM program relating to the spill should be undertaken, and CNOOC, in cooperation with the C-NLOPB will determine the temporal and spatial scope.

5.3 RESPONSE OPTIONS

Strategy development should consider the range of offshore spill response options. An evaluation of the current and forecast operating conditions, the anticipated characteristics of the product spilled, the effectiveness of the response option and the potential effects on the environment are all factors when determining the most effective spill response.

For response planning purposes, the severity of potential spills has been divided into three levels, or Tiers. This classification has been derived in part from the *IOGP Tiered Preparedness and Response (Report # 526 January 2015)*. The classification by Tier allows for an appropriate initial response to each level of spill. It also provides for the escalation of the response should the potential impact of the spill increase. Each Tier will involve a successively higher level of response effort. The parameters to be considered in selecting the appropriate operational response Tier include:

- The description of the spill;
- The resource management / strategy that may be implemented;
- The resources available for the response; and
- The roles of the offshore and onshore responders.

Table 2 provides an overview for Tier 1, 2, and 3 Response description, strategy, response options and resources available

		Spill Description	Spill Strategy	Offshore Response		Onshore Response	Resources Available
Tier 1	Type:	• Batch • Instantaneous	• Prop-wash for small volumes, thin slick; • Recover with Sorbent Boom; • Chemical Dispersion for fresh oil with authorization from ECCC • Opportunistic aerial surveillance if aircraft are already in the field; and • Consider dedicated aerial surveillance for spills >1m^3	Facility:	• Ensure safety of personnel and facility; • Secure spill source; • OIM in command; • Advise onshore IMT; • Initial notification to CCG, Status reports sent to on call OPSC onshore for distribution	• OPSC Notifies the IC or, if IMT is activated, the Safety / Liaison Officer • Notify C-NLOPB; • Ensure CCG MCTS is notified;	• Sorbent Boom stored on each supply vessel. Possible deployment as side sweep with vessel crane; • Dispersants – maybe stored on offshore assets; • Wildlife – use ship and noise makers where seabirds congregate; and • Surveillance – use Helicopter contractor as available; • Spill Tracker buoy; • Use aerial surveillance if available • Complete oil and oiled wildlife sampling.
	Volume:	• Small (50 L or less as per C-NLOPB Incident Reporting and Investigation Guideline)					
	Source:	• Identified; • Stopped		Marine:	• On-water operations • Oil & wildlife sampling • May be supported by installation personnel • Supply Vessel may use prop-washing, sorbents, or dispersants.		
	Continued Risk:	• Low					
	Examples:	• Product transfer operations with Supply Vessel; • Minor process leaks; • Failure of Installation drainage systems; or • Failure of MODU SBM solids control					
Tier 2	Type:	• Batch • Instantaneous or continuous discharge over short period.	• Spill Impact Mitigation Assessment (SIMA) • Contain and Recover; • Dispersants for fresh oil with slick thickness >0.0001 mm with ECCC authorization.	Facility:	• Ensure safety of personnel and facility; • Secure spill source; • OIM in command initially then passes to IMT onshore • Initial notification to CCG • Field support and local coordination of marine operations	• Response managed by Expanded IMT with ECRC support; • Resources form shore on site within 24 hours of spill; • Dispersant approval application to C-NLOPB, unless pre-approval in place; and • ECRC prime response contractor managing routine response operations including response personnel and equipment. (For ECRC activities outside 200 mile limit special consideration and sign off is required.)	• Tier 1 plus; • Deploy bird scaring devices where seabirds congregate; • Helicopter sweeps of area; • Area surveillance; • Spill tracking buoys; and • Trajectory modelling.
	Volume:	• Significant (between 50 and 500 L as per C-NLOPB Incident Reporting and Investigation Guideline)					
	Source:	• Identified and Controlled		Marine:	• Large on-water response effort with equipment and vessels mobilized from shore, as required • Possible dispersant usage with authorization from ECCC; • Monitoring and surveillance; and • Oil & oiled wildlife sampling.		
	Continued Risk:	• Moderate to High					
	Examples:	• Failure during bunkering operations; or • SBM spill.		Aerial	• Aerial Surveillance to be used routinely • Helicopter contractor to incorporate surveillance into daily operations; and • Report to Installation and response vessels by radio. Hard copy to IMT		
Tier 3	Type:	• Blow-out or very large Batch spill; • Continuous over extended period (days to weeks)	• Contain and Recover; • Dispersants – ongoing for fresh oil; • In situ burning – for fresh, thick oil; and • Surveillance – continuous, routine.	Facility:	• Ensure safety of personnel and facility; • Increased Tier 2 actions plus; • Provide operational support, as required; • Possible well control; and • Possible down-manning or abandon.	• Tier 2 actions plus; • Dispersant approval application to C-NLOPB • Mobilize OSRL • May require extended well and source control effort.	• Tier 2 resources plus; • OSRL Aerial Dispersant Delivery System for large area coverage; and • Fire boom and ignition mechanism to be sourced as required for in situ burning
	Volume:	• Major (Greater than 500 L less as per C-NLOPB Incident Reporting and Investigation Guideline)					
	Source:	• Loss of well control • May be unidentified • May be uncontrolled		Marine:	• Large on-water response with equipment and vessels mobilized from shore; • Possible dispersant usage • Monitoring and surveillance • Well and source control may be required		
	Continued Risk:	• High					
	Examples	• Loss of Well control		Aerial	• Dispersant application - OSRL • Aerial surveillance to be conducted routinely; • Helicopter contractor to incorporate sweep surveillance in daily flights • Report to installation and response vessels by radio. Hard copy to IMT		

Table 2 Tier 1, 2, and 3 Description, Strategy, Response and Resources

5.4 STRATEGY CONSIDERATIONS

Listed below are considerations that can be used when developing a strategy:

- The On-Scene Commander (OSC) at site will always make the most informed decision and should be confident in his/her judgement;
- Seabirds are the primary environmental resource at risk. If seabirds are observed in the area, hazing techniques (e.g. ship noises and electronic noise-generating devices) should be employed to scare them away from the spill site;
- If seabirds are oiled, an effort should be made to capture live seabirds and transport to shore for rehabilitation and collect oiled carcass samples;
- The trajectory of the slick can be monitored by use of tracker buoys;
- If there are seabirds nearby, the use of physical or chemical dispersion should be considered to remove the spilled product from the sea surface. Prop-washing will work well on thin films and sheens. Dispersants work best on thicker slicks although can be used on sheen if the threat to wildlife is great;
- Use of chemical dispersants must be authorized by ECCC;
- Prop-washing is not effective for heavy oil or thick slicks;
- In poor weather conditions, natural degradation and dispersion is enhanced;
- Sorbent boom should be considered for any small spill because of speed of deployment;
- Aerial surveillance is always useful. Try to avail of any aircraft (including Department of Fisheries and Oceans (DFO) or Canadian coast Guard (CCG) pollution flights) working in the area at the time of the spill. If the volume of product spilled is unknown or if conditions are hard to control, arrangements should be made for dedicated aerial reconnaissance;
- Every planned task should include frequent situation analysis to determine the success of the operation and to help decide when to terminate operations;
- Waste disposal capability will be limited in every spill response and could create bottlenecks in operations. Temporary storage on collection vessels should be included in any strategy; and
- In larger spills several collection and recovery systems may be required.

5.5 STRATEGY DECISIONS

Below are graphical guidelines for determining response strategy. Figure 3 shows approximate operation windows for specific techniques. Figure 4 provides a decision-making guideline for the development of the response strategy to a specific spill incident.

The response options presented in each figure are generic and apply to any level of response. There is considerable overlap in the abilities of each technique to handle a spill and so, for any given scenario, there is not always a prescribed strategy that must be used. The OSC should feel confident that they have options when considering the actual spill situation.

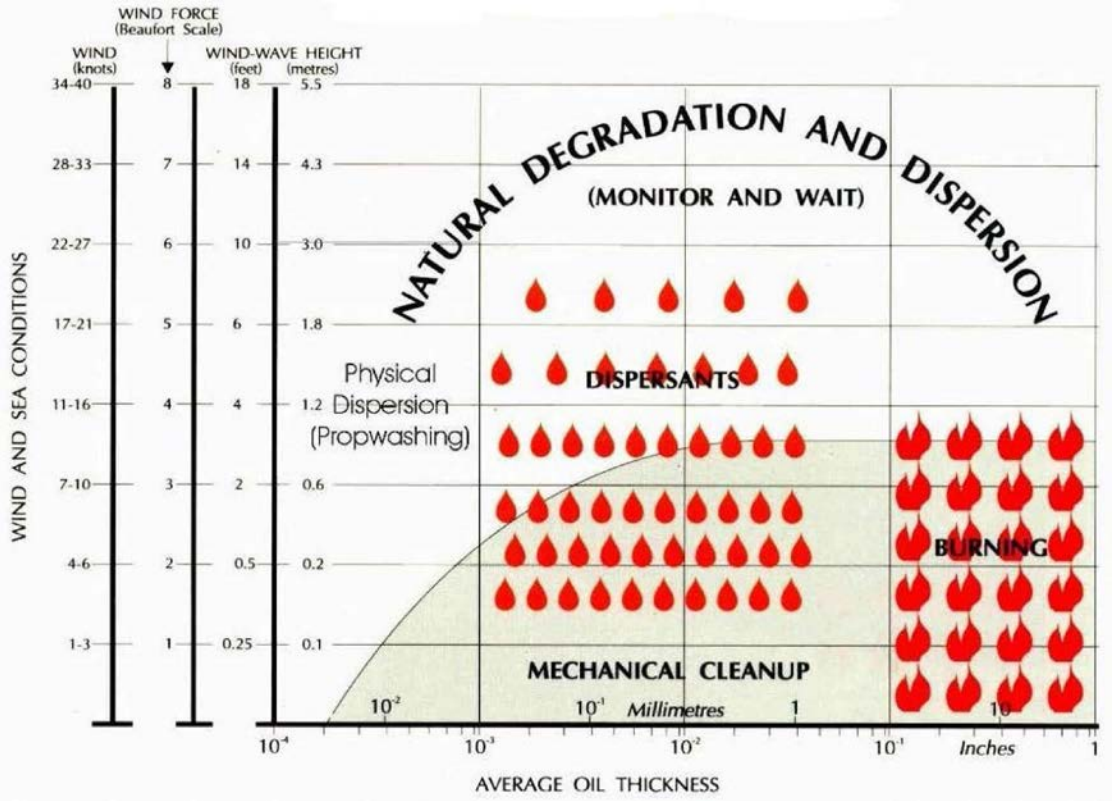

Figure 3. Operating Conditions for Oil Spill Response Options

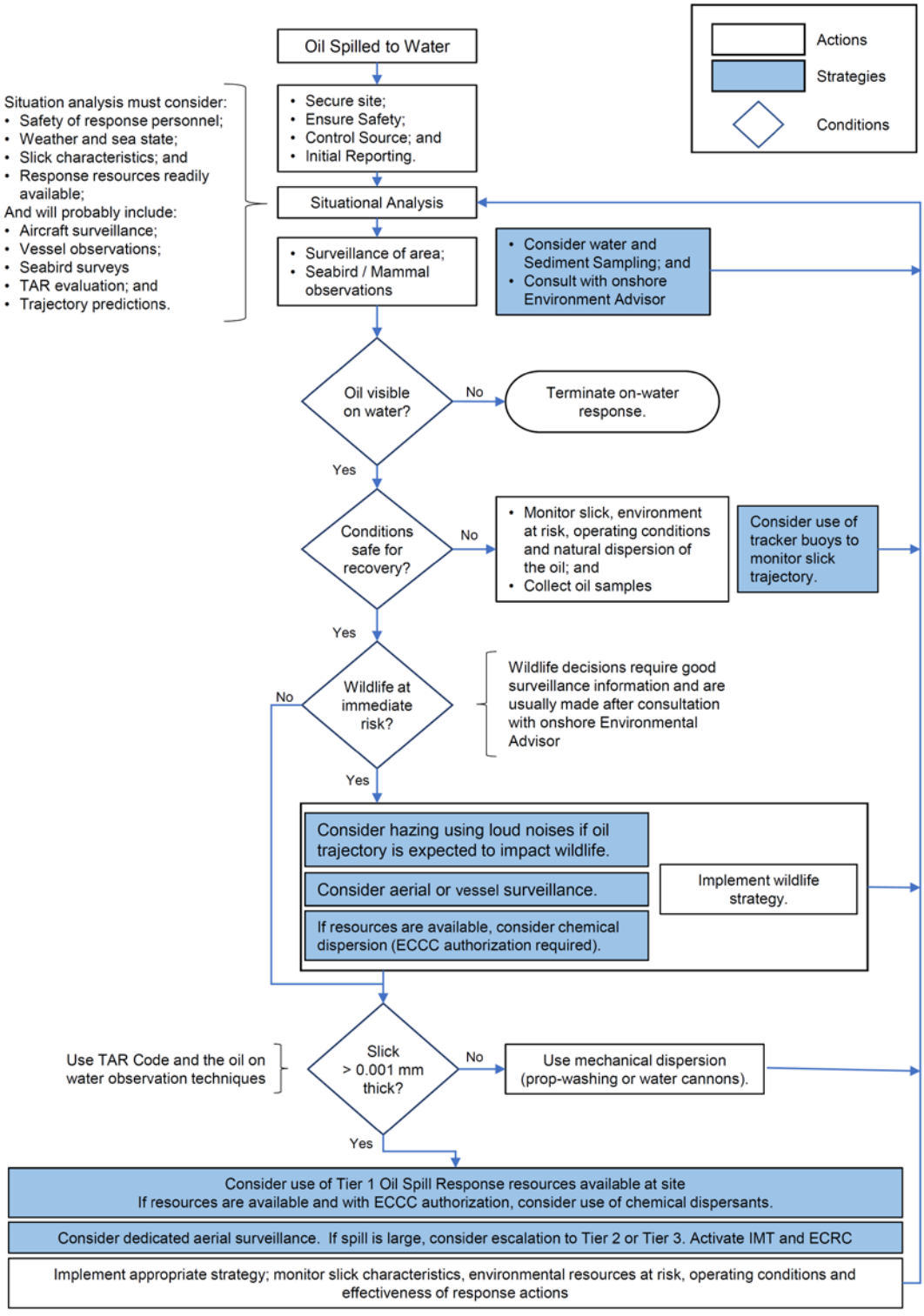

Figure 4. Decision Making Guidelines for a Spill Response Strategy

6. RESOURCES AT RISK

When developing a strategy for a spill response, the major objective will be to protect the resources most sensitive to impacts from a spill.

6.1 GENERIC SENSITIVITY TO MARINE SPILLS

A marine spill will impact the environment in three general ways:

- Biological – Spills may affect marine life or wildlife due to toxic effects, smothering or destruction of habitat. In an offshore spill incident, the Canadian Wildlife Service (CWS) of ECCC is particularly concerned about impacts to seabirds, while the DFO will be concerned about impacts to any fish, mammal or invertebrate populations.
- Physical – Oil that is not evaporated, dispersed, (and then metabolized naturally by bacteria) or recovered will persist and pose an ongoing threat to the local environment. In the event of shoreline oiling, gravel beaches and manmade structures can be particularly sensitive as floating oil can become trapped in cavities and then become difficult to recover.
- Human Use – persistent oil will contaminate equipment or structures and will interfere with human activities. Oil may be difficult to remove from vessels or equipment or may prevent normal commercial operations. Because of the food implications, all aspects of the fishery are particularly vulnerable to oil spills.

6.1.1 Evaluation of Sensitivity

There is no universal standard for the evaluation or ranking of resource sensitivity. Priorities for protection are typically determined at the time of the spill and based on the conditions at the site. As such priorities are dependent on the likelihood of the resource becoming oiled, the direct impact that the oiling would probably have on the resource and the effort required to clean the resource after oiling.

Environmental information to establish clean-up priorities is available in the CNOOC Environmental Assessment, through the Environment and Climate Change Canada's National Environmental Emergencies Centre (NEEC), and through CNOOC's Response Organization, ECRC.

6.2 SOCIO-ECONOMIC CONSIDERATIONS

There is a potential for the environmental effects of a spill to have an impact on human activities and employment in the offshore, primarily as the spill might affect surface transportation (fishing and support vessels) and the activities of other offshore operators. In the unlikely event of a vessel transiting the spill area, there is potential for health effects on crews, and the logistics of vessel decontamination.

CNOOC will work to minimize any interference with the established fishing industry operating in the Offshore Newfoundland area. This will be done through various means including, but not limited to:

- Engagement via Newfoundland and Labrador's One Ocean that brings together oil and fishing industry representatives to discuss plans and issues of mutual interest and concern;

- Implementation of compensation for attributable damage will be consistent with the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity (C-NLOPB March 2002); and
- Where required CNOOC will comply with the Canadian East Coast Offshore Operators Non-Attributable fisheries Damage Compensation Program (CAPP February 2007).

6.3 LOGISTICS ISSUES AFFECTING STRATEGY DEVELOPMENT

Vessels

The response strategy developed will be dependent upon the availability of response vessels. This plan recognizes the constraints that may be placed on designated installation standby vessels and that most standby activities will take precedence over response to minor spills. The response options recommended in the guidelines described in Section 7.0 have been selected in the interest of rapid mobilization and as techniques that might be practical for use on a designated standby vessel. Prop-washing and recovery of oil using sorbent booms are techniques that can be mobilized quickly, without compromising the deck layout of the standby vessel.

It will be the Offshore Installation Manager's (OIM) decision to release any vessel from its current duties offshore to participate in the response.

A Mutual Emergency Assistance Agreement is in place among all offshore Newfoundland Operators. In general, the agreement can be activated by a telephone call, followed by written confirmation from the requesting party that the Agreement has been activated. As part of the integration of offshore operations all Operators have agreed to share vessel and equipment resources in the event of a spill at either installation.

Aircraft

CNOOC can avail of aircraft services providers for spill surveillance. The OSC should consider mobilizing an aircraft from shore to conduct dedicated surveillance to determine the characteristics of the slick and to identify environmental resources at risk (see Section 6.0).

6.4 TYPES OF SPILLS

Marine spills can be categorized as either blow-outs or batch spills. A blow-out represents and uncontrolled, persistent release of oil from the well (sub-sea or surface) with variable duration, coverage, extent and persistence. A batch spill is limited in its ultimate size and may persist over a period of minutes to hours.

6.4.1 Subsea Blow-out

A subsea blow-out generally results in the release of both crude oil and natural gas. Natural gas under pressure in the reservoir expands rapidly, propelling the gas and oil out of the well-head at high velocity. The high velocity of the crude oil entering the water column often causes it to fracture into small droplets which are entrained in the rising plume and lifted by the expanding gas and oil buoyancy. These small droplets are too small to allow interaction with seawater, even in the high energy wave zone, and do not emulsify readily or re-coalesce to form a slick. On the sea surface above the plume, the

oil quickly disperses in a radial pattern. As the oil spreads it assumes a hyperbolic shape under the influence of thin oil or sheen on open water.

6.4.2 Surface Blow-out

Oil released during a surface blow-out will exit the platform at the top of the riser at high velocity, forming fine droplets as it enters the atmosphere. These droplets will be projected some height above the platform and then "rain" down on each other. Rapid evaporation while airborne may cause droplets to form a waxy skin which will reduce the probability of sheening on the sea surface. On the water, this slick may form a stable emulsion of extremely high viscosity.

6.4.3 Drilling Fluid (SBM) Spill

Synthetic Based Mud (SBM)spills may occur as a result of an accidental deck release, a subsurface release through a crack or orifice in the flex joint, riser or lines, or a bottom release due to an emergency riser disconnect event (due to hazardous weather or other cause).

6.4.4 Batch Spill

A batch spill can occur as a result of system or equipment failure. Batch spills are near instantaneous, with the oil flowing quickly in to the water without rapid evaporation or formation of droplets. The oil characteristics will change over time as it "weathers" in the marine environment. Ultimately, the spilled product will form slicks, sheens and tar balls which will drift with the wind and current.

6.4.5 Marine Diesel Spill

Spills to the marine environment can occur during the standard and routine use, storage and movement of fuels on MODUs and supply vessels. These often comprise instantaneous or short-duration discharges into the marine environment during planned drilling activities. A large diesel spill could also occur as a result of a vessel collision and complete loss of cargo or fuel from a supply vessel.

6.5 FATE OF SPILLED OIL

The eventual fate of oil spilled offshore is governed by the complex interaction of the spill source, quality and type of oil spilled, wind, water and air temperatures, current and sea state conditions. Some of the weathering processes that affect the behaviour of oil at sea are described in Figure 5. Key weathering characteristics include:

- Drifting – Physical movement of surface oil from one location to another due to the combined effects of 100% current speed and direction and 3% wind speed and direction.
- Spreading – Increase in the length and breadth of the oil slick as it spreads and thins on the sea surface;
- Evaporation – Evaporation of lighter hydrocarbons from the oil to the atmosphere;
- Oxidization – oxidation is promoted by sunlight and may lead to the formation of soluble products or pertinent tars. Its overall effect on dissipation is minor.

- Dispersion – The formation of oil droplets due to breaking waves, resulting in transport of oil from the sea surface into the water column;
- Dissolution – Physical chemical process resulting in oil from the oil slick or from suspended oil droplets dissolving into the water column;
- Emulsification – Formation of water in oil emulsions, resulting in an increase in oil viscosity. Oils with high asphaltene content are more likely to form stable emulsions;
- Sedimentation – Increase in density of oil due to weathering and interaction with suspended sediments or biological material. Tar balls may be formed, which could be deposited on the seabed;
- Biodegradation – Biological chemical process altering or transforming hydrocarbons through the action of microbes and/or the ingestion by plankton and other organisms.

Spill Trajectory Modelling provides detail on fate and spill trajectory modelling as derived from the CNOOC Flemish Pass Exploration Drilling Project (2018-2028) Trajectory Modelling Report.

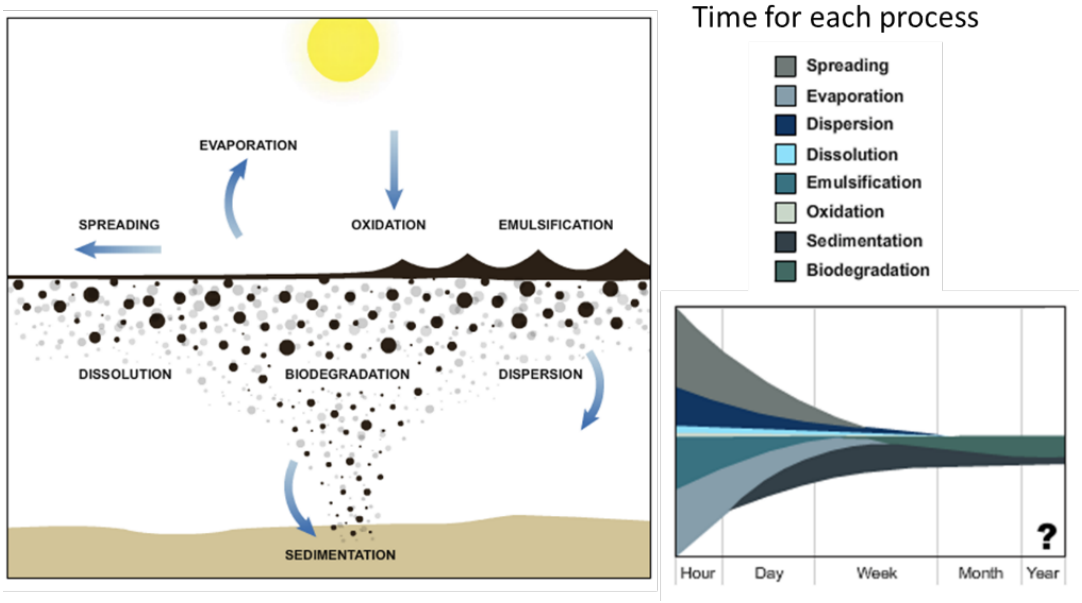

Figure 5. Fate of Oil in a Marine Spill

7. SPILL RESPONSE MANAGEMENT

The management of CNOOC's response to an offshore spill will follow the processes established for the response to all situations, events and incidents as outlined in:

- Atlantic Canada Emergency Response Plan (AS-ATC-PRA-0028);
- Atlantic Canada Initial IMT Emergency Response Procedure (AS-ATC-PRA-0029); and

- Atlantic Canada Expanded IMT Emergency Response Procedure (AS-ATC-PRA-0030).

Expansion of the Incident Management Team (IMT), integration of contracted/advisory resources and the development of incident action plans follow the Incident Command System (ICS) process. Operational management, span of control and response options are determined by:

- Immediate reaction to the incident controlled by the Person in Charge in the control room or bridge of the offshore facility;
- Prompt and direct support for the offshore emergency response by CNOOC onshore IMT;
- Escalation of the onshore response to include long term management of post-emergency clean-up activities through the Expanded IMT; BST and CICMT;
- Activation of ECRC in all spill events requiring mobilization to CNOOC's Incident Command Post (ICP), as advisors to the CNOOC Expanded IMT or through mobilization of the ECRC Spill Management Team; and
- Activation of OSRL.

The IMT is a resource that is prepared to support the response to any emergency relating to CNOOC offshore activities. Core IMT responder roles are assigned to designated on-call personnel on a weekly basis.

7.1 INCIDENT COMMAND SYSTEM AND SPILL RESPONSE

CNOOC's management of the planning, coordinating and documenting of a spill response is influenced by the principles of the ICS. This management structure is also used by CNOOC's contracted Response Organization (RO), ECRC. Key features of the CNOOC's ICS are shown in Figure 6 and include:

An Initial IMT consisting of:

- Command Staff that includes Human Resources Officer; Safety/Liaison Officer and Public Information Officer;
- General staff that includes Planning, Operations and Logistics Sections; and Incident Command, that is responsible for the overall response management.

An Expanded Incident Management Team consisting of the Initial IMT with support, as required, from the:

- Business Support Team (BST) Calgary; and
- CNOOC International Crisis Management Team (CICMT)(Beijing.

While each group has its own responsibilities, considerable interaction between groups is necessary to ensure efficiency in the response operation. An overview of the role responsibilities is provided in Section 6.3. CNOOC ICS structure for Atlantic Canada is shown in Figure 6.

Regardless of the phase of the response, the ICS process relies on a continuing cycle of planning and implementation. Known as the Planning "P" Process. Plans are developed for a defined period and are focused on meeting clear objectives, taking into consideration

operating conditions, available resources and performance during pervious operating periods. This planning cycle provides the basis for both tactical and strategic resourcing.

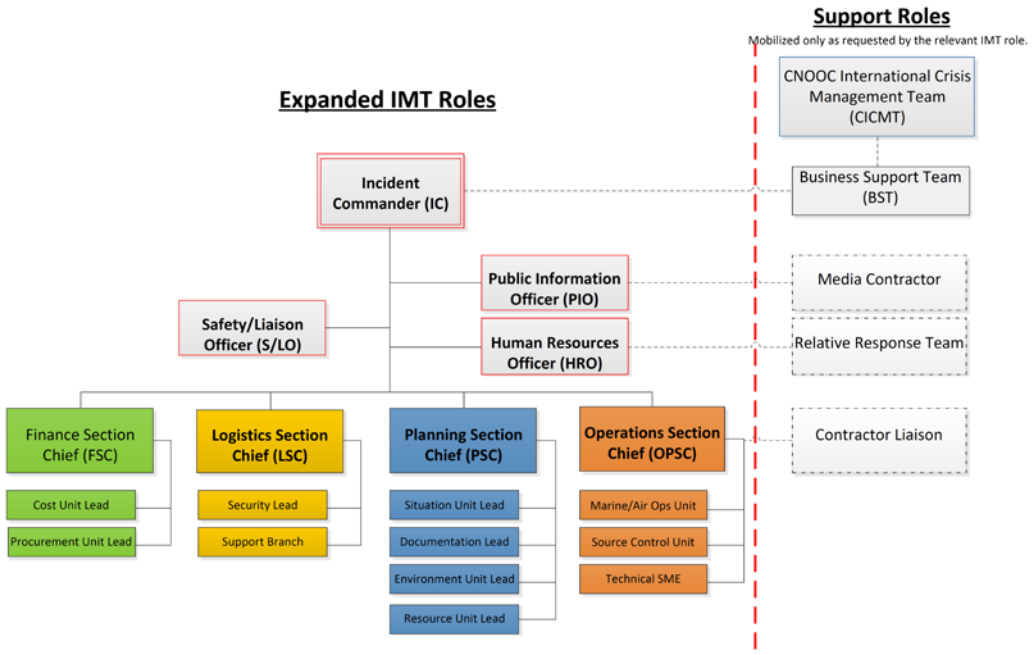

Figure 6. CNOOC's Incident Command Structure

7.2 PERSONNEL

Tier 1 spill response personnel will be drawn from the crews of the MODU and support vessels lead by the OSC. Select members of the IMT and the ECRC spill response manager, may provide support on shore. If necessary, operational personnel may be flown to the MODU to supplement the crew at site.

Depending on the scale of Tier 2 or 3 response operations, personnel may be enlisted from a variety of sources to respond to an offshore spill:

- Offshore Response Teams
- CNOOC IMT;
- CNOOC BST
- CNOOC CICMT
- ECRC Spill Management Team (SMT);
- CCG Environmental Response Division personnel;
- CCG marine crews;
- Supply vessel crews;
- PAL or Helicopter Contractor surveillance crews; and
- OSRL operations personnel.

7.3 ROLES AND RESPONSIBILITIES

Role	Responsibility
Incident Commander (Supported by Command Staff)	• Overall responsibility for management of the response; • Direct link to the Lead Agency (C-NLOPB), EEST, and other regulatory agencies; and • Formal link with Insurance.
Safety Liaison Officer	• Notify C-NLOPB: Tel - (709) 682-4426; Fax – (709) 778-1473. • Consider potential for oil spill in conjunction with the incident that has already occurred. • Request that an ECRC Representative comes to the ICP to provide advice in person. • Consider Transport Canada role. • Ensure appropriate offshore Tier 1 actions have been taken by the MODU/vessel. • Request the Offshore Spill Response Checklist (completed by Offshore HSE Advisor). • Obtain information to assess environment at risk (i.e. sea bird survey, nearby fishing activity, etc.). • Verify TAR code estimates provided by offshore observers. • Contact Canadian Coast Guard Marine Communications and Traffic Services (MCTS) at 772-2083 to confirm that the spill has been properly reported by the offshore MODU. • Notify the Environment Advisor that a spill has occurred and that the IMT has been activated. • Liaise with the Logistics Section Chief.
Public Information Officer	• Anticipating potential questions and being able to provide timely effective answers; • Gathering information relating to the incident; • Completion of Incident Update Bulletins; • Complete Holding statement template for approval and signature by IC and BST Comms Lead; • Development of Key messages; • Maintain communication with the Indigenous Groups Liaison; and • Liaise with Reception
Operations Section Chief	• Responsible for implementation of all spill response operations; • Monitor field operations executed by contractors; • Direct link to ECRC Response Manager; • Supported by ECRC personnel; • Provide Technical assistance to offshore OSC as required; • Link to other offshore operators; • Confirm with SLO that C-NLOPB is aware of spill and response action taken; • Arrange additional resources to support spill response if required; • If spilled oil volume is greater than 1 m^3 and flying conditions are good, consider a dedicated aerial surveillance flight through a contracted service provider; and • Log all actions and communications.

Role	Responsibility
Logistics Section Chief	• Coordinate all marine and aviation operations; • Ensure reliable offshore communications; • Facilitate any services that might be offered by existing supply contractors or personnel; • Direct link to ECRC Logistics Manager; and • Coordination of waste transport and disposal.
Planning Section Chief	• Coordinate all planning activities; • Direct link to ECRC Planning Manager; and • Direct link to NEEC.
Support Vessel Master	• Situation Analysis - in Consultation with On-Scene Commander: o Consider current and forecast weather and sea state conditions; o Determine current slick characteristics; o Determine health and safety risks to vessel crew; o Determine environmental sensitivities at time of spill; o Evaluate consequences if no active response is undertaken; and o Determine if additional resources will be required for response. • If released for action, implement on-water tactical response plan: o Sorbent Recovery techniques; and o Mechanical or Chemical Dispersion techniques; • Ensure safety of all personnel on board; • Maintain Communications with OSC on MODU; and • Log all actions and communications.

MODU Worker	• Reports spill as per MODU procedures.

On Scene Command	• In charge of all offshore spill response operations;
	• Assess and document spill situation from Offshore Facility Workers' reports:
	  • Determine the time and cause of spill;
	  • Identify the type of product spilled;
	  • Estimate the volume of the spill; and
	  • Identify safety hazards associated with the spill.
	• Implement necessary safety measures to secure spill location;
	• Implement measures to stop flow of oil;
	  • Notify standby vessel of spill and establish communications requirements for spill response operations.
	• Complete Spill Notification Form and Event Notification Form;
	  • Notify onshore IMT OPSC;
	  • Notify CCG by telephone (709) 772-2083 or 1-800-563-9089.
	• Situation Analysis - in Consultation with Standby Vessel Master:
	  • Consider current and forecast weather and sea state conditions;
	  • Consider current and anticipated slick;
	  • Determine safety and health risks to responders;
	  • Determine environmental sensitivities at time of spill;
	  • Confirm inventory of response equipment available offshore;
	  • Evaluate consequences if no active response is undertaken;
	  • Determine if Standby Vessel can be used for response;
	  • Identify other potential response vessels; and
	  • Determine if additional resources will be required for response.
	• Finalize First Response Plan:
	  • Establish objectives;
	  • Clear direction to response vessel; and
	  • Advise installation personnel of roles.
	• Provide IMT with completed Spill Description Form report:
	  • Provide information on spill situation (time, location, product, volume);
	  • Advise of first response actions to be taken;
	  • Establish communications requirements for spill response operations; and
	  • Request support required for offshore response.
	• Log all actions and communications.

7.4 REGULATORY CONSIDERATIONS

Under the Atlantic Accord, the C-NLOPB is responsible for the regulation of all exploration drilling activities offshore Newfoundland and Labrador. Through a series of Memoranda of Understanding, C-NLOPB is also the lead agency on behalf of the government of Canada and the government of Newfoundland and Labrador for offshore spills at drilling and production installations. For spills outside the jurisdiction of the C-NLOPB, Transport Canada with support of the Canadian Coast Guard (CCG), is the responsible agency.

Additionally, being the designated lead agency for offshore spills from a regulatory perspective C-NLOPB is named as the lead in offshore incidents under the Environment Emergencies Science Table (EEST) contingency plan and the CCG National Emergency Response Plan. Figure 7 outlines who may be involved in the response to an offshore spill.

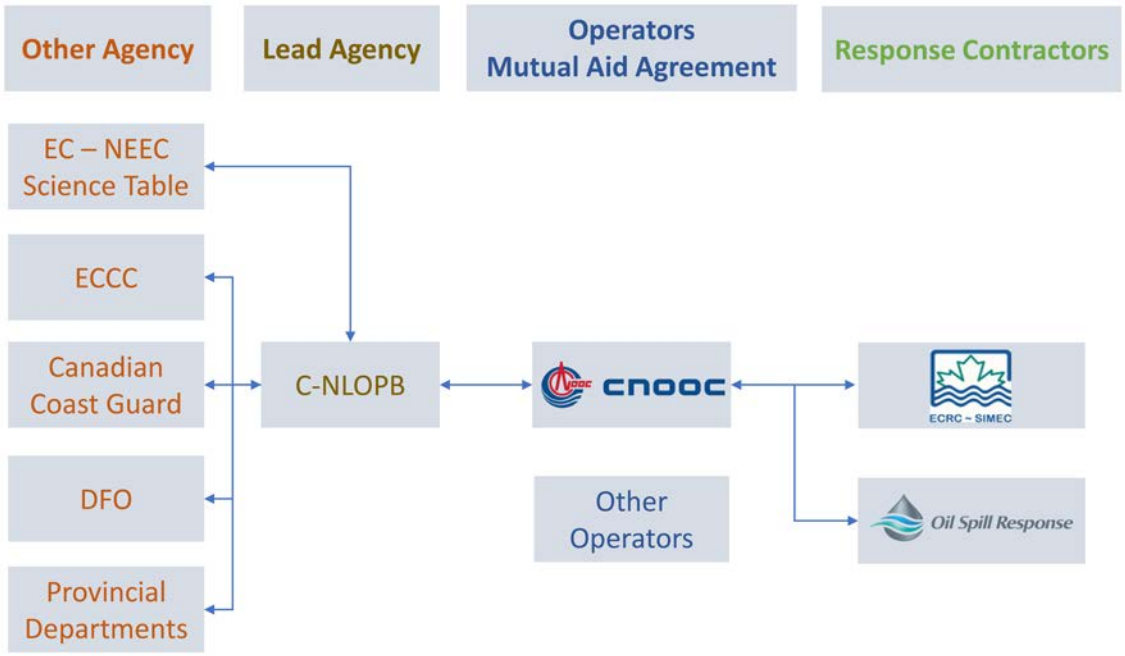

Figure 7. Stakeholders in a Spill Response

As Operator, CNOOC will always assume a responsible role for spills which originate within the designated safety zone for the facility, regardless of the cause of the spill.

7.5 SIZE OF RELEASE

At the time of a spill, it is possible that the actual volume of product lost to the marine environment is not known precisely. Spill volume estimation will be based on:

- Known volume list; or
- The Marine Oil Spill Thickness Appearance Rating (TAR) code (refer to Table 3).

Volume estimation procedures will be based on Surveillance Procedures.

Category	Appearance	Description	Thickness (mm)	L/m²	Quantity L/km²	If IPAR3 Multiply By
A	Barely visible	Barely visible under most favorable light conditions. Films reflect more light than water and looks brighter. May need adjacent water for comparison.	0.00004	0.00004	40	2
B	Silvery Sheen	Visible as a silvery sheen on water surface. A pearly or metallic luster is usually apparent.	0.000075	0.000075	75	2
C	Trace of Color	First trace of color may be observed. First color seen is warm tone, more bronze than yellow. As film thickens, deep violet or purple appears; these colors begin the first set of rainbow bands.	0.00015	0.00015	150	n/a
D	Bright Band of Color	Bright band of colors. The set of bands are in the sequence bronze, purple, blue, green, in order of increasing thickness. These colors are pure and intense. As thickness increases, the set of bands are slightly less intense and have a modified color sequence: yellow, magenta (reddish violet), blue, green. They are quite pure.	0.0003	0.0003	300	n/a
E	Dull Colors	Colors begin to turn dull. There is a reduction in the number and purity of colors. Colors are a rich terra cotta (brick red) and turquoise (rather bright blue-green). As thickness increases these colors are progressively duller or less pure looking. These sets of bands may also contain a trace of white or pale yellow. With increased thickness, any color present is merely a tint in the light and dark alternating bands, The contrast between light and dark bands remains strong but weakens as thickness increases.	0.001	0.001	1,000	2
F	Dark Colors	Colors are much darker. It is apparent that interference effects are weak, and they will quickly disappear as thickness increases.	0.003	0.003	3,000	2
G	Yellowish Brown	Original TAR Code is extended to include oil thicknesses included in the CCG Oil Spill Response Guide.	0.01	0.01	10,000	n/a
H	Light Brown or Black		0.1	0.1	100,000	n/a
I	Thick Dark Brown or Black		1.0	1.0	1,000,000	n/a
J	Heavy oil near the source of a crude or bunker spill		10.0	10.0	10,000,000	n/a

Table 3 Marine Oil Spill Thickness Appearance Rating (TAR) Code

7.6 ESCLATION FROM TIER 1 TO TIER 2 OR TIER 3

The decision to escalate the level of the incident form Tier 1 to Tier 2 will be made by the Incident Commander after consultation with the Drilling Manager, Senior Regional Manager, HSE Lead and the Environment Advisor.

As soon as a spill incident is classified as Tier 2 and the IMT has been activated, ECRC and OSRL may be mobilized to provide operational response as approved.

7.7 TIER 1 RESPONSE MANAGEMENT STRUCTURE

Response to a Tier 1 spill incident will be managed at the site (MODU) using support vessels in the field. Management will be based on the facility's established Tier 1 response structure. Figure 8 describes the Tier 1 spill response management organization.

Involvement of shore-based resources will be at the discretion of the onshore Incident Commander and would typically be limited to incident reporting, stakeholder and media support. If onshore support is required, the CNOOC offshore Drilling Supervisor will notify the on-call Operations Section Chief (OPSC).

Onshore Tier 2 response personnel and response contractor will be notified. Management structure will expand with time to meet the needs of an escalating spill incident.

A Tier 1 Response is characterized by:

- Spill is small and under control;
- Response command and management by facility personnel;
- Operational response by supply vessel(s) at site at the time;
- Environmental impact is minor and only in the immediate area of the spill; and
- Potential/actual media attention.

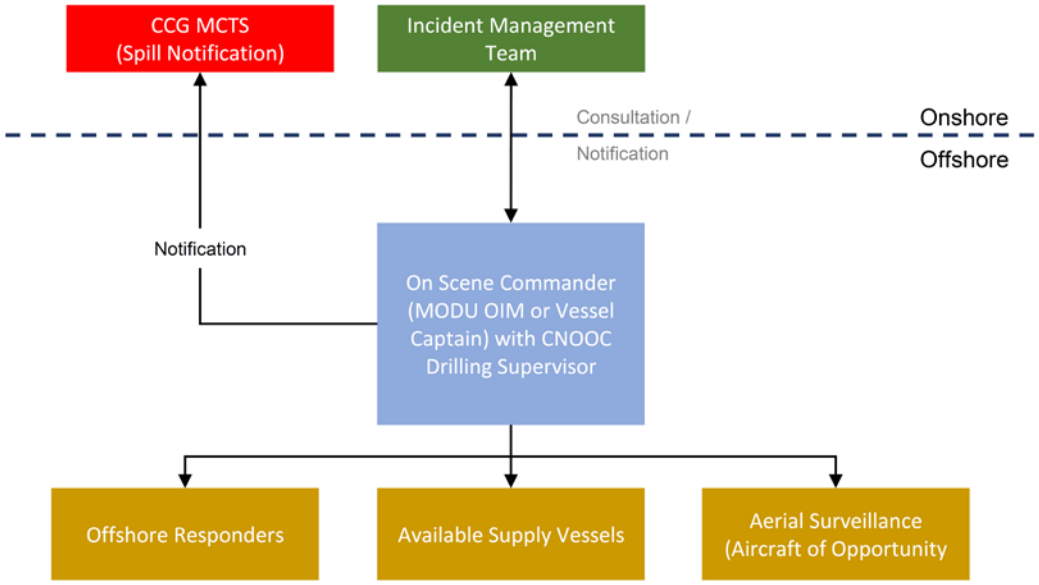

Figure 8. Tier 1 Response Management Organization

7.8 TIER 2 AND 3 RESPONSE MANAGEMENT STRUCTURE

A Tier 2 or Tier 3 spill response will be managed by the CNOOC IMT with support from ECRC and OSRL as required.

- A Tier 2 Response is characterized by:
- Spill is moderate and under control;
- Potential for impact extends beyond the spill site;
- Probable media attention;
- Spill Incident Command transferred to onshore; and
- Mutual Aid response capability may be activated.

Unlike other emergencies, a larger spill may require the mobilization of considerable resources for an extended period. This could include additional personnel, equipment and/or logistics resources that can be sourced locally. For this reason, the IMT may be supported by personnel from the following:

- CNOOC Business Support Team (Calgary);
- Eastern Canada Response Corporation (ECRC);
- Oil Spill response Limited;
- Other offshore Newfoundland operators;
- Canadian Coastguard (CCG) environmental emergency operations personnel; and
- Environmental Emergencies Science Table (EEST).

At Tier 3, the incident has the potential to significantly impact the environment, CNOOC its stakeholders. A Tier 3 response is characterized by:

- Spill is large and not under control;
- Potential for significant environmental and/or navigation impact;
- Corporate personnel are activated;
- Significant business disruption;
- Community and/or public safety impact; and
- Regional or global media attention.

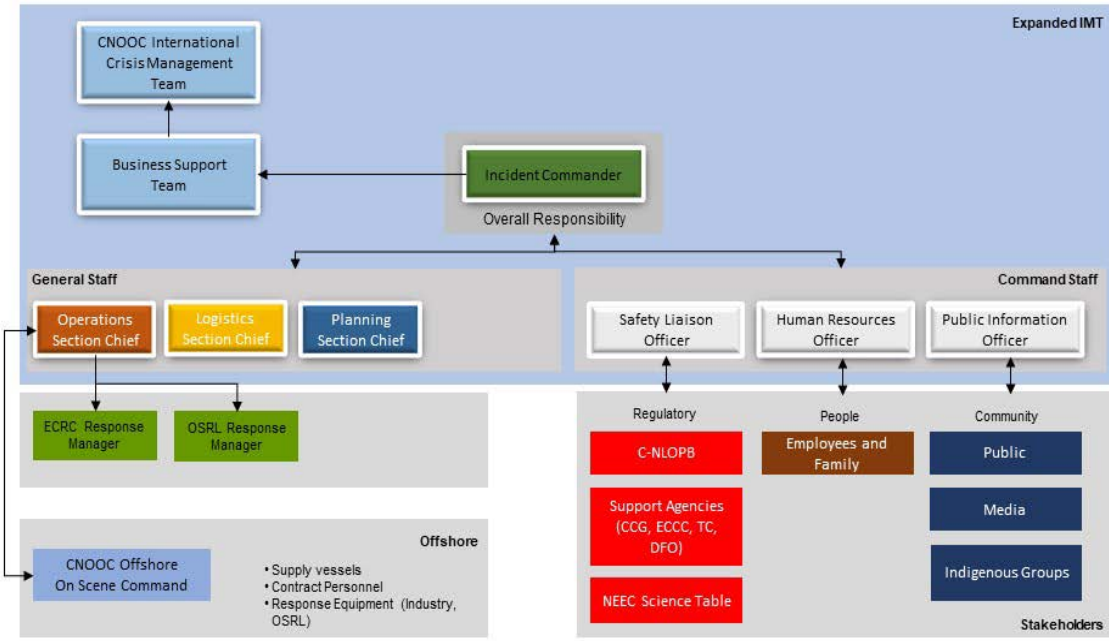

Figure 9. Tier 2 and Tier 3 Response Management Organization

7.9 ROLE OF ECRC

ECRC's overall role will be to provide operational support services under the direction of the CNOOC OPSC. ECRC's specific duties will include:

- Support in coordination of response activities;
- Support the preparation of acceptable plans of action to address the specific incident; and
- Support the preparation and distribution of status reports of the overall spill response progress.

7.9.1 ECRC Oil Spill Response Centre

Spill response operations will be managed on shore from dedicated Response Centres in the St. John's area. The operational management of any spill response will be coordinated by ECRC. ECRC operations will take place (under the authority of the IMT) in its Newfoundland Response Centre in Donovan's Industrial Park, Mt. Pearl. The ECRC Response Centre is equipped with standby electrical generators in the event of power failure.

In the event of primary communications failure, communications between the IMT and ECRC will be by cell phone. Both the ECRC Response Centre and the CNOOC ICP are kept in a state of readiness at all times and are outfitted with telephone, fax/data communications and all spill management maps and posters. All reference and reporting materials will be available at the ECRC Response Centre.

7.10 ROLE OF OIL SPILL RESPONSE LTD.

Oil Spill Response Ltd. (OSRL) provides an international response capability to its members including access to oil spill response equipment, aerial dispersant capability and a technical advisory service to provide on-site advice. OSRL also offers oil spill response training programs. CNOOC has a Participant membership with OSRL which covers operations worldwide. In the event of a Tier 3 spill, OSRL services may be called upon.

OSRL can be activated by contacting their emergency number and are available 24 hours a day, 365 days a year. Refer to the OSRL website for activation information.

OSRL activation website: http://www.oilspillresponse.com/activate-us

7.11 ROLE OF WILD WELL CONTROL

Wild Well is the world's leading provider of onshore and offshore well control emergency response, pressure control, relief well planning, engineering, environmental, and training services. Wild Well provides its services on a global basis.

Wild Well Control maintains and operates the WellCONTAINED System. The WellCONTAINED System is an adaptable equipment package built for a variety of subsea scenarios. The package uses field-proven equipment and is based on years of experience. Design criteria provides for a water depth rating to 10,000 ft (approximately 3,000 m), a shut-in pressure rating of 15,000 psi (approximately 103 MPa), dual mechanical barriers and complete ROV functionality. The systems modular design facilitates rapid global deployment on readily available cargo aircraft but can also be transported by seagoing vessel.

There are two WellCONTAINED equipment packages, staged in Aberdeen, Scotland and Singapore, Southeast Asia. The system to be mobilized will be based on proximity to the incident location with the second system as contingency, if needed.

The WellCONTAINED System consists of four modules:

- Debris removal
- Subsea dispersant application
- Capping stack
- Subsea hydraulic power unit.

7.12 ROLE OF ENVIRONMETNAL EMERGENCIES SCIENCE TABLE

The Environmental Emergencies Science Table (EEST) is a group of diverse designated environmental specialists with a mandate to provide immediate support to an environmental emergency. EEST is coordinated through Environment and Climate change Canada's (EEEC) National Environmental Emergencies Centre (NEEC) in Montreal, Quebec. EEST may be chaired by an EEEC representative and can be activated by ECCC. If contact with EEST is required, they can be reached via the C-NLOPB.

In an oil spill situation EEST's role will be to provide knowledgeable environmental advice to support response operations. The majority of EEST members are local government (federal and provincial) representatives; however, private sector personnel may also be included in the Team. Additionally, ECCC may choose to draw on regional or national

expertise as required to provide the best possible advice. Some EEST members have regulatory responsibilities and may be able to facilitate the issuance of permits such as use of dispersants, decanting at sea, and disposal of waste. EEST is also a vehicle to provide a cross-section of stakeholders that can represent public concerns to the Incident Commander.

At the time of the spill, EEST will endeavour to collect environmental data in order to provide the best possible advice to C-NLOPB and other government agencies involved in the response. EEST can assist with meeting regulatory requirements, especially in permitting.

An assessment of environmental effects will be an important part of CNOC's spill response planning process, so field data collection should be undertaken in collaboration with EEST. The direct interface for data exchange between EEST and CNOOC's spill response management will be through the IMT Planning Section. More formal interaction regarding regulatory compliance will be through the Incident Commander.

7.13 ADDITIONAL TIER 3 RESOURCES

Global Response Network (GRN) is a collaboration of six major oil industry funded spill response organizations whose mission is to harness cooperation and maximize the effectiveness of spill response services worldwide. OSRL or ECRC can facilitate the mobilization of resources through the GRN. The GRN includes the following response organizations:

- Alaska Clean Seas (ACS);
- Australia Marine Oil Spill Centre (AMOSC);
- Eastern Canada Response Corporation (ECRC):
- Marine Spill Response Corporation (MSRC);
- Oil Spill Response Ltd. (OSRL);
- Western Canada Marine Response Corporation (WCMRC); and
- Norwegian Clean Seas Association for Operating Companies (NOFO).

8. SPILL RESPONSE OPTIONS

Offshore spill response options fall into five distinct categories:

1. *Surveillance and Monitoring:* To be used for situation analysis prior to, during and following field operations. If field operations are not possible due to weather or other limitations, monitoring may be the only response option available.
2. *Dispersion of the spilled product into the water column:* Techniques that break the product on the surface into small particles which are then entrained into the water column where they are naturally degraded by the metabolism of micro-organisms. There are two general dispersion techniques that can be used offshore – mechanical and chemical.
3. *Containment and recovery of spilled product on the sea surface:* The product is corralled on the surface and recovered using either sorbent boom, or containment boom and skimmer

4. *In situ burning of spilled product on the sea surface:* Fresh spilled product is corralled to a thickness that twill sustain combustion and ignited.
5. *Wildlife actions:* Surveillance of seabirds, bird hazing and recovery of soiled seabirds and carcasses.

Each countermeasure technique is discussed briefly in sections 8.1 to 8.7.

8.1 SURVEILLANCE AND MONITORING

Understanding the distribution and characteristics of a spill will allow for the development of a response strategy that is appropriate and efficient for the scale of the incident. As the distribution and characteristic of a spill will change over time, regular monitoring of conditions will be necessary so that a realistic situation analysis can be developed before, during and at the end of the active field operations.

8.1.1 Observation Platforms

The best way to observe a marine spill is from the air. An aircraft can view a large area in a short period of time and can quickly adjust to optimize viewing relative to sunlight and sea state. CNOOC's ice surveillance contractor, has the aircraft and experienced personnel to also provide pollution monitoring services. PAL regularly provides this service to CCG as part of a routine monitoring program of territorial waters offshore Newfoundland.

At the time of a spill, aircraft may not be readily available or may be restricted by adverse weather or darkness. At such times, larger surveys may be undertaken by surface vessels. As well, vessel involved in active response operations should continuously monitor spill conditions while working.

8.1.2 Observation Standards

The characteristics of oil on the surface are usually described using visual observation techniques. CCG and Environment Canada have developed a Thickness Appearance Rating (TAR) code for determining the thickness of an oil slick based on its colour. By estimating the total area of individual patches and then applying the TAR thickness to each patch, the total volume of oil on the surface can be calculated. PAL uses the TAR code system as part of its onboard documentation of aerial surveys. Surveillance Procedures provides an overview of how the TAR code will be used by CNOOC contractors.

Monitoring Tools

- The fate of a spill can be monitored by trackers that will drift with the slick and report their positions in real time. Spill tracker buoys are available on supply vessels and the MODU.
- CNOOC has access to spill trajectory models that can be run by a spill modelling contractor which can predict the position of oil on water based on the characteristics of the oil spilled, the physical environmental conditions during the spill response period, any tracker data and real-time observations.
- All chartered vessels are equipped with sampling kits. The kits include clean sample bottles, sampling protocols, and materials for secure shipping of samples

to the analytical facility. Refer to the Offshore Spill Response Manual (AS-ATC-PRA-0107) - Oil and Wildlife Sampling Procedure.

- A Forward-Looking Infra-Red (FLIR) camera capable of detecting oil on the sea surface is installed on the PAL surveillance will increase the productivity of night or low visibility operations.
- Satellite radar imagery is available commercially. Initial imagery of the spill site may be available immediately, depending on the location and configuration of the time of the spill. If required, the satellite orbit and settings for sensors can be re-programmed so that longer term monitoring of the slick may commence within 30 – 60 hours of the spill occurrence.

8.2 MECHANICAL DISPERSION

Mechanical dispersion is the best method of dealing with thin layer slicks. Prop washing or physical dispersion with a vessel's fire-fighting equipment can be used.

There are several prop-washing techniques. For long streaming slicks, the vessel can cut back and forth along the axis of the slick from the source to the ultimate end of the slick. If the slick is concentrated or thicker, in one area, the vessel may use its thrusters and main propulsion to rotate inside the slick for maximum mixing.

When winds exceed thirty knots or sea states exceeds three meters, natural mixing and dispersion of the spill is enhanced. When conditions exceed the safe operating limits of equipment, the response should shift from active response options to surveillance and monitor the effects of natural forces.

8.3 CHEMICAL DISPERSION

Dispersants can be used rapidly and selectively to treat a spill over large areas. The high-speed application rate along with the elimination of the need for recovery, storage, shipping and disposal of spill response waste makes the use of dispersants a highly attractive option.

The effectiveness of chemical dispersants varies depending on prevailing environmental conditions. Corexit 9500A is on the list of chemicals acceptable to Environment and Climate Change Canada (ECCC). In larger applications, it is probable that ECCC will require post application water sampling to determine the effectiveness of the chemical.

Dispersants may be considered for application on slicks in cases where seabirds are at immediate risk of oiling. In these cases, chemical dispersion should be considered but only if the net environmental benefit of the chemical dispersion outweighs any impact caused by the chemical itself.

The use of chemical dispersants for offshore spill response is regulated by ECCC. No dispersants will be used by CNOOC without prior approval. Refer to CNOOC's SIMA for further detail on chemical dispersion.

8.4 AIRBORNE DISPERSANTS

For larger spills, it may be desirable to deploy dispersants using an aerial spray system. OSRL may be used if aerial dispersion is required.

It is likely that Tier 3 resources may be mobilized in the event of a major offshore spill response. As part of this effort OSRL may be asked to provide airborne dispersant capability.

Airborne operations will only be considered in cases where a large volume of oil can be effectively treated. An operational plan will be required before dispersants are applied.

Figure 11 depicts the OSRL TERSUS Dispersant Aerial Spray System. It provides a visual of the onboard system components and application equipment.

Figure 10. OSRL TERSUS Dispersant Aerial Spray System

When to consider using Dispersants:

- Oil characteristics are suitable for safe and effective dispersion;
- The thickness of the oil is sufficient to allow efficient application;
- Sufficient water depth to allow complete mixing of oil and chemical;
- Sensitive environmental or social resources are at risk of oiling;
- Physical recovery methods or natural dispersion will not be adequate; or
- Weather or sea state conditions exceed safe working limits for physical recovery.

8.5 CONTAINMENT AND RECOVERY

CNOOC can contain and recover oil form the sea surface using two general techniques. In the first, oil is corralled inside an impermeable floating boom then removed from the surface using a skimming device. The second method employs a floating oleophilic sorbent boom which both corrals the oil and removes it from the surface.

The conventional boom and skimmer system require considerable mobilization although it can be used over an extended period to collect large volumes of oil. The equipment is restricted by sea state and towing speed.

The sorbent boom can collect as much oil as will adhere to its surface, making it effective for smaller spills. The lightweight sorbent boom has no subsurface skirting and offers little resistance in the water. It can be towed at higher speeds and can be used in higher sea states than conventional containment boom.

8.5.1 Sorbent Boom

An inventory of 320 feet of sorbent boom is stored on each supply vessel. Additional supplies are stored on the MODU. The boom is 8 inches in diameter and 10 feet in length. The boom is packaged in bundles of 40 feet. The sections clip together with an overlap to form a boom system of any length (in 10-foot increments). The boom can be stretched between the side of the supply vessel and the end of the vessel crane to be used in a side sweep configuration (see Figure 12). Due to its sorbent capacity this boom could be deployed in an extended length with a loose end trailing through the slick.

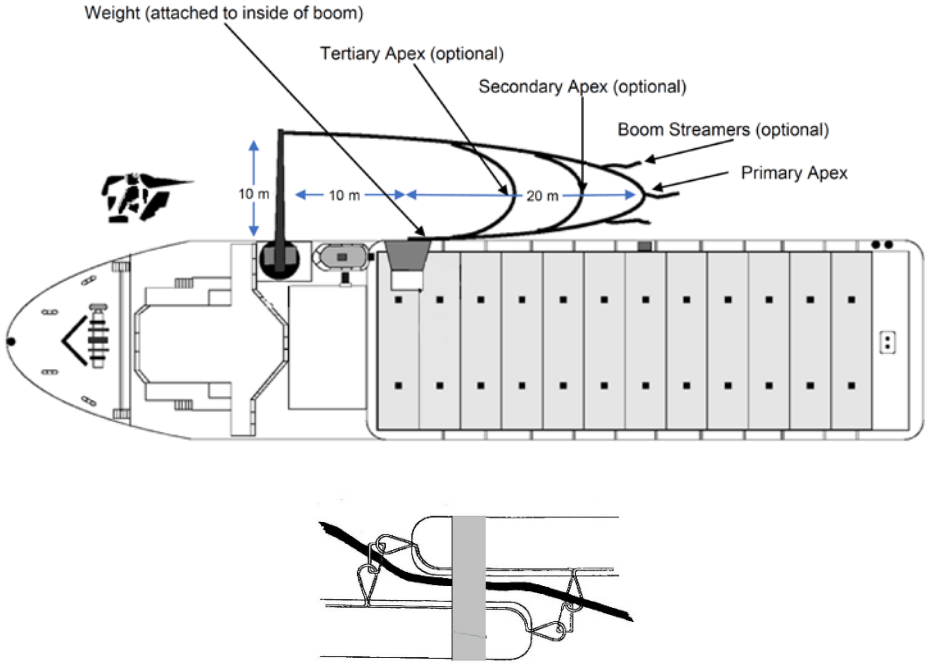

Figure 11. Sorbent Boom Towing Configuration and Junction

In some instances of spill response, the deployment of the Single Vessel Side Sweep (SVSS) system may be considered.

8.5.2 Two Vessel Containment Systems

Most open-ocean containment and recovery systems consist of a long section of floating boom towed in a wide arc by two vessels. Typically, one of these vessels will be equipped with a floating skimmer to recover oil collected at the apex of the towed boom. Most towed booms must be towed at very low speeds (< 1 knot) to ensure efficient oil collection. For this reason, the oil encounter rate is increased by the larger swath width a two-vessel operation can offer. The two-vessel deployment is shown in the Figure 13 below.

Figure 12. NorLense 1200-R Boom – Two Vessel Deployment

8.6 IN-SITU BURNING

Full scale experiments have shown that fresh crude oil can be effectively burned while on water if conditions are good and if the oil has been thickened through booming. Ideally, burning is done inside a fire-proof boom to allow all oil to burn without escaping.

The decision to use in-situ burning techniques will be made based on:

- The probability of success;
- The effort required to collect oil to be burned; and
- The net environmental benefit of the action.

Any decision to burn will be made in consultation with ECCC and NEEC. There are two scenarios where in-situ burning should be considered:

- In pack ice where the oil may collect and thicken naturally between floes; and
- In a blow-out (after a risk assessment) where fresh oil is being continuously released over an extended period allowing timely mobilization of fire booms.

8.7 WILDLIFE ACTIVITIES

Seabirds that live on or close to the sea surface have been identified as the biological resource most vulnerable to an offshore spill. Marine mammals (i.e. whales) are present in low numbers at selected times during the year and potential impacts on whale populations, even from a major spill would be negligible. CNOOC will undertake the following wildlife activities in the event of an offshore spill:

- Downwind aerial and vessel surveillance in advance of the drifting slick to identify the presence of seabirds and mammals at risk;
- Employment of bird hazing techniques to deter seabirds from the affected area, using vessels, aircraft, and noise making devices. The intention is to scare birds away from the spill;
- Recovery, evaluation, and appropriate treatment for affected seabirds (collect carcass, euthanize, or recover for rehabilitation) and delivery of seabirds to a central location for shipment to shore. Refer to Wildlife Response Plan (AS-ATC-PRA-0032).

CNOOC has a signed agreement for access to a Seabird Rehabilitation Centre located in St. John's. The Centre is operated under a Canadian Wildlife Service's permit. Alternatively, CNOOC may access third-party cleaning and rehabilitation expertise to support wildlife response activities.

8.8 VESSELS

A summary of potential spill response vessels based in St. John's is listed in the Spill Waste Management Procedure.

8.8.1 Support Vessels

Standby and supply vessels will be used for on-water response operations, surveillance and wildlife monitoring. Vessel masters will advise the OSC on response strategy and whether operating conditions are favourable for response activities.

8.8.2 Vessels of Opportunity

In a large spill response effort, Vessels of Opportunity (VOO) may be required for several operational roles if they meet the safety, training and certification requirements necessary to provide spill response services.

A VOO listing is maintained. In the event of a large spill, vessels in the region would be contacted to assess possible available resources.

9. TRAINING AND EXERCISE PLAN

Spill response training is structured to provide a variety of skills to the team that may be assembled in the event of an offshore spill. CNOOC's spill response training program is aligned with that of other offshore Newfoundland Operators.

9.1 SPILL RESPONSE MANAGEMENT TRAINING - ONSHORE

Presented to selected members of the IMT, this training provides:

- An overview of spill response and response management, including types of spills, regulatory framework and environmental issues; and
- An introduction to the role of ECRC in an offshore response, including the operation of ECRC's Response Centre and an introduction the ECRC spill management system and how it related to CNOOC's response management process.

9.2 OPERATIONAL TRAINING - OFFSHORE

CNOOC will ensure that key field personnel receive practical instruction in spill response operations. Emphasis will be on Tier 1 response training.

9.2.1 Tier 1 Spill Response Orientation

Intended for offshore management and supervisory personnel. (i.e. Vessel Master, and Drilling Supervisor). This training is focused on Tier 1 response and first response actions for a larger spill. Offshore personnel are provided with an overview of:

- The nature of offshore spills;
- Notification procedures;
- An overview of Atlantic Canada's Offshore Spill Response Plan;

- Spill response preparation;
- Review of available spill response resources; and
- Determining first response strategies.

9.2.2 Tier 1 Vessel Spill Response Training

Crews of CNOOC's chartered supply vessels receive annual hands-on training that includes:

- Surveillance Procedures;
- Wildlife Response Plan (AS-ATC-PRA-0032);
- Oil and Wildlife Sampling Procedures;
- Sorbent Boom Handling; and
- A review of good practices in spill response.

Safety during a spill response operation is covered in this module and is delivered to both installation and supply vessel personnel.

9.3 SPILL COUNTREMEASURES EXERCISE (SYNERGY)

Synergy is an integrated spill response options exercise facilitated by ECRC. This annual exercise emphasizes the integration of operator owned equipment and contractor resources, response management and communication processes.

9.4 TRAINING RECORDS

All training and exercises will be tracked in the CNOOC tracking tool. Lessons learned, and corrective actions will be documented to facilitate continual improvement in spill response competency.

10. SPILL WASTE MANAGEMENT

Wastes are generated by any spill and must be considered by CNOOC in the earliest response planning stages to avoid potential bottlenecks in field operations. This is especially true offshore, where resources are limited, and transportation times are extended. Focused attention to the storage of waste during collections will result in cost efficiencies and will ensure that the optimum capacity of field operations is realized.

As part of spill response, CNOOC will work with response and waste management contractors to ensure that wastes are handled, stored and disposed of in accordance with applicable regulatory requirements. Spill Waste Management Pollution Prevention Division of the Provincial Department of Municipal Affairs and Environment are the lead on waste management onshore.