CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

Grand Banks Offshore Operators Spill Response Capacity Report Overview and Context

Operators of installations offshore Newfoundland and Labrador are required to prepare and to maintain comprehensive emergency response plans in respect of their operations. The emergency situations that these plans must address include hydrocarbon spills. Spill response plans are submitted to the C-NLOPB for review at the time an operator applies for authorization of drilling or production activity, and are updated and reviewed regularly throughout the life of the operation.

While operators' plans have been regularly maintained and reviewed, C-NLOPB became concerned in 2008 that the overall level of response capability in the plans had not been assessed at a strategic level, in light of the international state-of-the-art, for some time. C-NLOPB focused particularly upon development-drilling and production operations, all of which currently are located on the northeast Grand Banks, due to their year-round presence, their long operating life and their exposure during most of that operating life to substantial quantities of hydrocarbons.

Therefore, in the fall of 2008, the C-NLOPB required the producing operators (Hibernia, Suncor Energy and Husky Energy) to undertake an assessment of their hydrocarbon spill response capability, and to report to the C-NLOPB's Chief Conservation Officer (CCO) no later than November 20, 2009.

The three producing operators cooperated, through the Canadian Association of Petroleum Producers (CAPP), in producing a single report, *Marine Hydrocarbon Spill Response Capability Assessment, Jeanne d'Arc Production Operations*, and submitted it to C-NLOPB on November 20, 2009.

C-NLOPB reviewed the report and provided its review comments to the operators in May 2010. The operators responded, in part, in June 2010, with supplementary responses in September 2010 and in December 2010 (through an internal oversight, one operator's response was not formally transmitted until August 2011).

In January 2011, the United States *National Commission Report to the President on the Macondo accident* (the "National Commission report") was published, and the C-NLOPB directed its senior staff to undertake a detailed review of the document and its potential implications for NL offshore operations. Later, in April 2011, the Government of Newfoundland and Labrador released its *Review of Offshore Oil-spill Prevention and Remediation Requirements and Practices in Newfoundland and Labrador* (the "Turner report"), which underwent a similar C-NLOPB review. It was decided not to finalize a response to the operators until these two reviews were complete and the results approved by the Board.

Subsequently, C-NLOPB finalized its response, and the C-NLOPB's Chief Conservation Officer responded to the operators on March 8, 2012.

Suncor Energy transmitted a response to the CCO's letter on November 7, 2012, Husky Energy on November 21, 2012, and the Hibernia Management and Development Company on March 20, 2013.

The C-NLOPB's CCO formally closed the review by letter to the operators on April 2, 2013. CAPP subsequently provided an overview letter that provided its perspective on the report and subsequent developments on October 10, 2013.

The report and associated documents are available from the C-NLOPB on request. The Board is updating the spill readiness and spill response section of the website. This report will be posted to the site along with the other related documents.

The Board will continue to work with operators to ensure modern, up-to-date spill response plans are in place for operators as part of the regulatory authorization process. Environmental protection is a priority of the Board and spill prevention is key.

8010 E6E6

Ken – FYI
→ WR EPP file

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

October 7, 2008

[redacted]
Hibernia Management and Development Company
100 New Gower Street
St. John's, NL A1C 6K3

[redacted]
Husky Energy, East Coast Operations
Suite 901, Scotia Centre
235 Water Street
St. John's, NL A1C 1B6

Dear Sirs:

Subject: Oil Spill Response Capability for Production Operations

Operators of production installations on the Grand Banks are required to prepare and to maintain comprehensive emergency response plans in respect of their operations. The emergency situations that these plans must address include hydrocarbon spills. Under the current Accord regulatory structure, these spill response plans form part of the Environmental Protection Plan (EPP) approved pursuant to subsection 51(5) of the *Newfoundland Offshore Area Petroleum Production and Conservation Regulations*.

C-NLOPB staff are concerned that the level and adequacy of mechanical spill response capability for production operations on the northeast Grand Banks has not changed substantially for some time, with the exception of the acquisition of a skimmer system within the past year. We note that equipment has been developed, and is in use, in other jurisdictions that appears to represent a potential for improvement in response capability, particularly at the Tier 2 and Tier 3 response levels. We also observe that recent EPP revisions have not discussed how operators continue to satisfy themselves that the spill response capability readily available to them is sufficient in terms of its condition and efficacy. This state of affairs, in our opinion, is common to all producing operations on the Grand Banks and deserves a collaborative effort to address.

Factors that should be considered in this effort, we believe, include:

- The range of meteorological and oceanographic conditions on the northeast Grand Banks;
- The nature of spill scenarios that are reasonably foreseeable in association with Grand Banks production operations;
- The condition and operability of existing equipment currently available to operators in eastern NL; and

- The degree to which additional or alternative equipment available internationally may enhance existing response capability in terms of the speed of its deployment, the range of conditions in which it may prudently be operated, the degree to which it minimizes the need for on-deck work by personnel, or some combination of the above.

We wish to advise you that, should the issue remain unaddressed, we intend to place the following condition on your company's Production Operations Authorization upon its renewal:

> **The Operator, no later than November 20, 2009, submit a report to the satisfaction of the Chief Conservation Officer on its assessment of its hydrocarbon spill response capability, including a plan for any equipment upgrade or acquisition that may be required as a result of the foregoing analysis.**

I and the Environmental Affairs department are available to discuss further the scope of the assessment described above, and for any consultation that may be necessary during its conduct.

Yours sincerely,

[redacted]

David G. Burley
Manager, Environmental Affairs

c.c. [redacted]
Petro-Canada, East Coast Operations

SUNCOR
ENERGY

Suite 201, Scotia Centre
235 Water Street
St. John's, NL A1C 1B6
Tel 709 778 3500
Fax 709 724 2901

November 20, 2009

PES-CNO-TER-0406-1747

Mr. Frank Smyth, P.Eng.
Chief Conservation Officer
Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water Street
St. John's, NL A1C 6H6

Dear Mr. Hawkins:

Re: Report to the C-NLOPB on the Assessment of Marine Hydrocarbon Spill Response Capability for Jeanne d'Arc Basin Production Operations

In response to Condition 32 of the amended Terra Nova Operations Authorization No. 23001-001 issued by the C-NLOPB May 29, 2009, please find attached two hard copies and one electronic copy of the report on the assessment of marine hydrocarbon spill response capability for Jeanne d'Arc Basin production operations. The attached report has been prepared on behalf of Suncor Energy, Husky Oil Operations and Hibernia Management Development Company.

Included within the report is an overview of meteorological and oceanographic conditions on the northeast Grand Banks and reasonably foreseeable hydrocarbon spill scenarios; a description of international oil spill response programs and associated equipment and processes; a summary of current oil spill response capability of for Jeanne d'Arc Basin production operations; and conclusions on future activities that will be considered to enhance oil spill response capability.

Please feel free to contact [redacted] if you have any questions or wish to discuss this information in greater detail.

Sincerely,

[redacted]

TRIM #:
Date Rec'd November 20, 2009
File #.
Canada Newfoundland & Labrador Offshore Petroleum Board

Husky Energy

Suite 901, Scotia Centre
235 Water Street
St. John's, NL, Canada
A1C 1B6

Phone: (709) 724-3900
Fax: (709) 724-3915

November 20, 2009

Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water Street
St. John's, NL
A1C 6H6

Ref. No.: HUS-CPB-WR-LTR-00636

Attention: Mr. David Burley

Dear Mr. Burley:

Subject: Condition 27 of Operation Authorization – Production (Program No. 40,020-OA #1)

Please find enclosed 2 binder copies and an electronic copy of the Marine Hydrocarbon Spill Response Capability Assessment Jeanne d'Arc Production Operations for your review. This document is submitted to satisfy Condition 27 of Husky's Operations Authorization – Production Program No. 40,020-OA #1, specifically:

> *The Operator shall, no later than November 20, 2009, submit a report to the satisfaction of the Chief Conservation Officer on its assessment of its hydrocarbon spill response capability, including a plan for any equipment upgrade or acquisition that may be required as a result of the foregoing analysis.*

If you have any questions or require further information, please contact Mr. Gerald Snook at 709-724-4768.

Yours sincerely,

HUSKY OIL OPERATIONS LIMITED

[redacted]

gs/st/pk

Enclosed: Marine Hydrocarbon Spill Response Capability Assessment Jeanne d'Arc Production Operations

cc: [redacted]
Husky Energy

Hibernia

Management and Development Company Ltd.
Suite 1000, 100 New Gower Street
St. John's, NL A1C 6K3
Tel: (709) 778-7000

November 20, 2009

Dave Burley
Canada-Newfoundland
Offshore Petroleum Board
5th Floor, TD Place
140 Water Street
St. John's, NL
A1C 6H6

Serial No.: HSCNOPB2370
File No.: 267.1
Oil Spill Capability Study

Dear Mr. Burley:

Further to your letter dated October 7, 2008 HMDC would like to submit the attached Oil Spill Capability Assessment for your review.

Should you have any questions or concerns regarding this submission, please feel free to contact [redacted]

Regards,

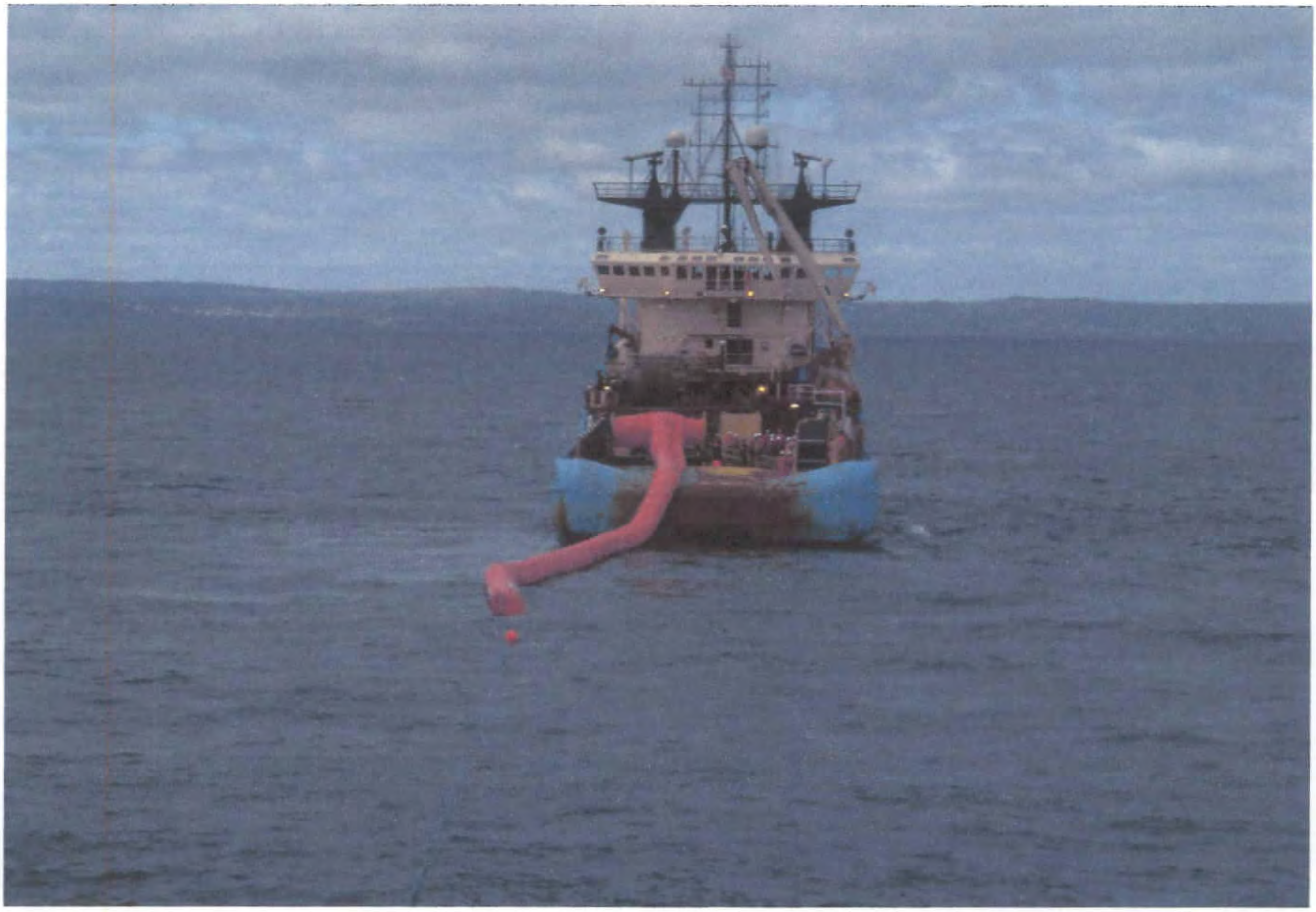
[redacted]

Hibernia Management

cc: Central Files
[redacted]

TRIM #:
Date Rec'd. November 20, 2009
File #.

Canada-Newfoundland & Labrador Offshore Petroleum Board



Marine Hydrocarbon Spill Response Capability Assessment Jeanne d'Arc Production Operations

November, 2009

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MARINE HYDROCARBON SPILL RESPONSE CAPABILITY ASSESSMENT JEANNE D'ARC BASIN PRODUCTION OPERATIONS

CHAPTER 1 - INTRODUCTION

Prepared For:

Canadian Association of Petroleum Producers
403, 235 Water Street
St. John's, NL
CANADA
A1C 1B7

On Behalf Of:

Suncor Energy
235 Water Street
St. John's, NL
CANADA
A1C 1B6

Husky Energy
235 Water Street
St. John's, NL
CANADA
A1C 1B6

Hibernia Management and Development Company
Suite 1000, 100 New Gower Street
St. John's, NL
CANADA
A1C 6K3

Prepared By:

Cormorant Ltd.
280 B Water Street
St. John's, NL
CANADA
A1C 1B7

Lorax Environmental
Suite 504, 215 Water Street
St. John's, NL
CANADA
A1C 6C9

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EXECUTIVE SUMMARY

This report provides an evaluation of the oil spill response capability currently in place to support offshore oil and gas production operations in Newfoundland and Labrador. The report was prepared on behalf of Suncor Energy (Suncor), Husky Oil Operations (Husky), and Hibernia Management and Development Company (HMDC), as the operators of the Terra Nova, White Rose, and Hibernia fields, respectively. While the report addresses the status of all current or anticipated operations, the focus is on measures to support these three producing oil fields in the Jeanne d'Arc Basin on the Grand Banks of Newfoundland and Labrador.

The evaluation of the current oil spill response capability is presented in the context of the local working environment and regulatory regime. The report concludes with a summary of the current conclusion adopted by Suncor, Husky, and HMDC to review their collective oil spill response capability.

After the introduction, Chapter 2 provides background information and sets the context for offshore oil spill response preparations. Current and anticipated offshore operations are discussed in terms of activities, numbers of vessels and platforms involved, and volumes of oil produced. Next, the physical environment of the Grand Banks is described. Particular attention is paid to conditions that may define or impact oil spill response operations. The risk to the environment is considered in terms of marine life and wildlife that can be found in the study area. The offshore fishery is included as a resource that could be at risk from an offshore oil spill.

The characteristics of offshore oil spills are discussed in terms of potential sources, effects of weathering, and probable spreading in local conditions. The results of past crude oil testing programs are reviewed in the context of countermeasures effectiveness.

Prior to describing the current oil spill response capability in Newfoundland and Labrador, Chapter 3 explores the level of preparedness in place to support crude oil production in other jurisdictions. Both equipment inventories and management systems are included in this review.

Chapter 4 reviews the current capability of Grand Banks operators in a holistic and comprehensive manner. After describing the offshore regulatory environment and contingency planning, the report outlines the processes in place to conduct and manage oil spill response operations. Fundamental to the current level of preparedness is the concept of a tiered response strategy, in which the level of operations and resources can be escalated through a managed process that begins offshore and has the potential to include international input. Support functions including availability of response vessels, waste management, and training complete the current response structure. The chapter also discusses other technologies that might be considered to complement existing offshore countermeasures preparations.

An important component of current preparedness is the designation of Eastern Canada Response Corporation (ECRC) as a response contractor. As a certified Response Organization under the *Canada Shipping Act*, ECRC has considerable expertise in the field of marine oil spill response. All operators base their oil spill response management processes on their own emergency response systems combined with the specific expertise of the ECRC Spill Management Team. An important development will be the extension of ECRC's role to include comprehensive oil spill response preparedness services. Suncor, Husky and HMDC are entering into a multi-party agreement with ECRC that will include personnel training, contingency planning, and equipment maintenance. The contract also provides for the development of a pool of responders that have been specifically trained for offshore operations and can be mobilised at the time of a response.

Chapter 5 provides a summary of the current oil spill response capability and plans for Suncor, Husky, and HMDC to enhance this capability. The operators will consider the following:

- Promote a cooperative approach to response preparedness through the formation of a joint operators' oil spill response steering committee;
- Develop a training and maintenance program for the newly-purchased Norwegian Standard System (i.e., Norlense 1200-R self-inflating boom, Framo Transrec 150 weir skimmer and Lamor LLP 200 kW power pack) through a multi-party preparedness contract with ECRC;
- Improve the efficiency of deployment of existing Tier 1 response equipment and mobilization of Tier 2 equipment from shore;
- Consider potential new technologies to enhance the existing capability;
- Based on an analysis of the current body of research and on an understanding of the practical requirements for field operations and monitoring, consider the use of chemical dispersants as an oil spill countermeasure offshore Newfoundland; and
- Monitor and support appropriate oil spill response research and development.

1.0 INTRODUCTION

The development and maintenance of an adequate level of oil spill response capability is an integral component of offshore operational requirements. Operators on the Grand Banks are required to prepare and maintain comprehensive oil spill response plans as part of their Environmental Protection Plans. An assessment of oil spill response capability from a combined technical, management, administrative, and regulatory perspective will help to identify areas that are strongly developed, areas that have not yet been developed, and additional enhancement opportunities.

This document is intended to provide an assessment of the current Newfoundland and Labrodor offshore industry oil spill response capability and to offer recommendations for capability enhancement.

1.1 C-NLOPB Expectations

In addition to committements already provided by Newfoundland Offshore Operators, the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) has requested a formal review of hydrocarbon spill response technology. In particular, the lack of enhancement of the industry Tier 2 and Tier 3 capability, in spite of steadily developing technology world wide, has been noted. The C-NLOPB has requested that the producing operators will:

- Assess their current oil spill response capability in the context of Grand Banks operating conditions;
- Discuss the degree to which available alternative equipment may enhance this current capability; and
- Describe plans for any equipment upgrade or acquisition that may be required as a result of this analysis.

1.2 Purpose

The stimulus for this review is the need to consider the level of operational spill response preparedness in light of eleven years of production experience offshore Newfoundland. The timing coincides with initiatives being taken by Suncor, Husky, and HMDC to both increase the inventory of ocean-going Tier 2 equipment available in St. John's and establish an enhanced service agreement with ECRC.

1.3 Scope

The existing capability is reviewed in consideration of:

- The range of Grand Banks meteorological and oceanographic conditions;
- The nature of spill scenarios that are reasonably foreseeable in association with Grand Banks production operations; and
- The condition and operability of existing equipment currently available to production operators.

Any potential equipment enhancements are discussed here in terms of:

- Speed of deployment;

- Range of conditions in which oil spill response equipment may be safely and effectively operated; and
- The degree to which new technology can improve the safety of operations by minimizing the need for on-deck workers.

While the need for additional equipment is a prime focus of this review, this report includes a holistic review of the Operator's overall program objectives, contingency planning, response management, training and exercising programs, and contractor and logistics infrastructure.

The scope of the evaluation is based on the guidelines prepared for response planning and readiness assessments by a special committee of the 2008 International Oil Spill Conference (Taylor, et. al, 2008).

1.4 Document Structure

To provide a more logical approach to the evaluation, this report has been prepared in five discreet chapters. Each chapter has been composed as a separate Microsoft Word file and is marked by individual binder tabs in the hard copy version. Each file has its own table of contents.

The individual chapters include:

- Introduction;
- Background information;
- Description of other oil spill response programs;
- Description of current offshore Newfoundland oil spill response program; and
- Conclusions.

2.0 GLOSSARY

2.1 Definitions

ADDS Airborne Dispersant Delivery System. A modular system built for installation in a C-130 Hercules aircraft for the aerial application of chemical dispersants.

ADIOS Automated Data Inquiry for Oil Spills - software that predicts the characteristics of spilled oil over time.

API Gravity The American Petroleum Institute (API) scale for the designation of an oil's specific gravity. API gravity depends on temperature and barometric air pressure, and is generally measured at 16° C and one atmosphere pressure. API gravity is inversely proportional to specific gravity.

API = 141.5/(specific gravity @ 16° C) - 131.5

- API (water) = 10
- API (light crude oil) = 40
- API (Grand Banks crude) is approximately 30

Argosphere An oil spill tracker buoy which determines its position by an onboard GPS and transmits that position to shore via the Argose satellite network.

Asphaltene Three classes of hydrocarbon that tend to encourage the formation of stable water-in-oil emulsions.

Barite A mineral additive used in the mixing of drilling muds

Barrel (bbl) A volumetric unit of measurement for oil and oil products, used extensively by the oil industry. The bbl should not be confused with the standard 205 litre steel drum used throughout industry for transporting lube oils, hydraulic oil, gasoline, chemicals, etc.

- 1 bbl = 159 litres
- 1 bbl = 35 gallons (Imperial)
- 1 bbl = 42 gallons (US)

Batch Oil Spill The release of oil into the environment. Such a release might occur through platform process equipment failure, storage cell rupture, pipeline rupture, or OLS offshore loading system failure, or during transfer of diesel fuel. The oil is not necessarily under pressure. Batch spills can introduce large discharges, over periods of time that are generally of the order of minutes or hours.

Benthos Marine organisms that live within the seabed sediments.

Bentonite A mineral additive used in the mixing of drilling muds

Bioremediation A technique for cleanup of an oil spill either by introducing oil-eating bacteria into the natural environment or by stimulating the growth of such naturally- occurring bacteria through feeding.

Blowout An uncontrolled flow or discharge of gas, oil, or other fluids from the reservoir. A blowout might occur during drilling, completion, or workover operations. Blowouts, whether subsea or above surface, can introduce a large discharge over periods of time that can be of the order of days.

Bonn Agreement An international convention which allow signatory European nations to offer or receive mutual aid in the event of a major oil spill event.

Communications	An integrated network of appropriate technologies (such as telephone, facsimile and clear-channel radio) to link both onshore and offshore response operations, and response operations and the outside world.
Containment and Recovery	The use of mechanical equipment to control the spread of spilled material and to temporarily store spilled material reclaimed from the waters.
Crude Oil	Oil is a liquid mineral compound of hydrocarbons, with minor amounts of other substances, that is insoluble in, and lighter than, water. Crude oil is naturally-occurring undistilled or unrefined oil. The physical and chemical properties of crude oils vary considerably.
Demobilization	The orderly, phased withdrawal of equipment and personnel resources no longer needed in response operations. Withdrawal may occur throughout response operations as well as at their close. Demobilization missions include inspecting, cleaning and restoring to original condition all equipment; inspecting and restoring all areas involved in response operations; and processing information about personnel released from response operations.
Dispersion	The separation of a coalesced slick into very small droplets. Dispersion can occur naturally due to wave action or can be achieved through directed physical actions (prop washing) or use of chemical dispersants. Dispersion of oil into the water column accelerates the natural degradation processes by making it available to seawater bacteria. Any chemical use requires government approval.
Dissolution	Disintegration or decomposition, such as during the dissolving of one substance in another. During oil weathering, certain "slightly" soluble hydrocarbons and various mineral salts present in the oil are dissolved in the surrounding water.
Emulsion	A mixture of two fluids that do not usually mix, such as an oil-in-water, or water-in-oil mixture. In the case of spilled oil, these emulsions are usually formed as a result of wave action.
Enform	A consulting company which provides management and training services to the Western Canada Spill Services cooperative.
Epibenthos	Marine organisms that live on the seabed.
Flash Point	The temperature at which vapors produced by a substance; oil, for example, will ignite when exposed to an ignition source, such as an open flame.
Heavy Fraction	Hydrocarbon compounds with a very high boiling point (>350° C).
Heli-torch	A device suspended from a helicopter to apply burning gelled gasoline to oil on water in an in- situ burning operation.
Hydrocarbon	Organic compound composed only of hydrogen and carbon. Hydrocarbons are the principal constituents of crude oils, natural gas, and refined petroleum products. Hydrocarbons include four major classes of compounds: alkanes, alkenes, naphthalenes, and aromatics. These compounds each have characteristic structural arrangements of hydrogen and carbon atoms, as well as different physical and chemical properties.
Ichthyoplankton	Planktonic fish eggs or larvae.
In Situ Burning	A technique for removing oil from the water's surface by setting the oil afire. In-Ssitu burning always requires government approval.

Incident	An occurrence or event, either human-caused or as the result of natural phenomenon, that requires action by emergency response personnel to prevent of minimize loss of life or damage to property and/or natural resources.
Incident Command System (ICS)	A combination of facilities, equipment, personnel, procedures, processes, management tools and communications operating within a common organizational structure and location, with responsibility for the management of assigned resources at an incident.
iSphere	An oil spill tracker buoy which determines its position by an onboard GPS and transmits that position to shore via the Iridium satellite network.
Logistics Support Infrastructure	The various personnel, equipment, materials, supplies, and services necessary to support response operations in the field and onshore. Such support ranges from the provision of food, clothing, and shelter for response personnel to the routing, fueling, inspecting, maintenance, and repair of response equipment.
Loss	Refers to a spill of packaged hazardous goods under the *Pollution Discharge Reporting Regulations*, and carries a similar meaning to Actual Discharge in reference to bulk spills under Canada Shipping Act.
Marine Communications and Traffic Services (MCTS) Officer	The Canadian Coast Guard duty person who will receive the initial notification of a spill event.
Mass Balance	The calculation of the fate of the material that has been released into the environment, including: evaporation, natural or chemical dispersion, biodegradation, mechanical recovery and burning.
Next Operational Period (NOP)	The NOP is a period of time as determined by the Incident Commander that will naturally define the beginning and end of shifts and operational tactics. Once the response has entered the Reactive Phase, the NOP will usually be 24-hours, from daybreak. When the operations become repetitive within the Proactive (or Project) Phase, the NOP may extend to a few days or weeks.
NOP Plan	Document describing Work Tasks to be carried out during the Next Operational Period.
Notification	In-house call-out procedures and mandatory notifications made to government agencies.
Ocean Boom Vane	A paravane that can be used to tow the outboard end of a containment boom from in place of a second vessel or rigid side sweep arm.
Ohmsett	The National Oil Spill Response Research & Renewable Energy Test Facility. This is a facility in Leonardo, New Jersey, where full-scale oil spill response equipment testing, research, and training can be conducted in a marine environment with oil under controlled environmental conditions

Oil Spill	An unintentional discharge of hydrocarbons to the marine environment which occurs within, but may disperse beyond, the regulated safety zone associated with field operations. This includes hydrocarbon spills originating from the drilling or production facilities or supply vessels. Hydrocarbon spills from tankers and their operations before or after they have connected to the offshore loading system are necessarily the responsibility of others. Where appropriate and practical, the operator may respond to the spill on behalf of the responsible party and carry out environmental effects monitoring.
Oil Spill Trajectory	The path (modeled/predicted or observed) of oil spilled on the water surface. The path of the oil changes with time and is a function of a number of factors including wind speed, surface current (including tide and residual currents) speed, air and water temperature, the presence of ice, the amount of oil spilled, and the physical and chemical properties of the oil.
On-Scene Commander	In an offshore oil spill response, the OSC is the person at site responsible for the implementation of response measures. On the FPSO or MODU this person directs the onboard Emergency Response Team. Other response strategies designate the person with ultimate authority for the response as the OSC. The onshore Incident Commander has the ultimate authority in a major oil spill response.
Phytoplankton	Unicellular plants which drift with ocean currents and form the base of the Mmarine food chain.
Pour Point	The lowest temperature at which a substance, e.g. oil, will flow under specified conditions. For crude oils this generally varies between -57° C and 32° C. Lighter oils, with low viscosities have lower pour points.
Prioritized Objectives	Prioritized Objectives are used throughout the ICS process to ensure that everyone has a common view of the direction of the response so that, no matter what their line of sight, they can make decisions (small or large) that will support the overall objectives.
Resources	The amount of major equipment and personnel resources needed to carry out planned tactics.
Responsible Party	The company legally responsible for the impact of an oil spill incident. In Canada, the Responsible Party is usually the company who had possession of the oil at the time of discharge.
Sorbent Boom	A containment and recovery countermeasure that uses sorbent materials towed on the sea surface to collect oil. All Grand Banks offshore supply vessels are equipped with sorbent boom
Source Control	Actions designed to bring under control the cause of the incident. Includes stopping the source of the emission, salvage, equipment stabilization, etc.
Specific Gravity	The ratio of the weight of one substance (e.g. oil) to the weight of an equal volume of pure water. Most crude and refined oil products have a specific gravity of less than 1.0 and so are more buoyant than water and will float on water.
Spill Response Manager	The ECRC manager who is vested with the authority for the overall management of Spill Management Team response operations.

Spreading	The tendency for oil on water to form a thin layer over a large surface area. The rate and extent of spreading will depend upon the oil's viscosity, pour point, and wax content as well as on seastate and weather conditions.
Staging Area	A location that has the space and services adequate to allow an assembly of people and equipment for deployment to the locations in which their Work Tasks will be occurring. Staging Areas will often also contain decontamination and equipment maintenance facilities and may have a location for personnel training, and eating.
Stochiastic Trajectory modeling	A method for determining the probability of spilled oil reaching a geographic location using multiple trajectory model runs which are driven by historical environmental conditions.
Surfactants	A substance that reduces the surface tension of the liquid in which it is dissolved.
Surveillance and Monitoring	The observation and tracking of spilled material, either visually or with the aid of electronic equipment, to forecast its movement and determine the best placement of response personnel and equipment.
Tier Levels	The categorization of an incident according to the level of response thought to be necessary. Tier Levels are related to the source of the problem and the internal resources already available to deal with it. All offshore operators use a three-tier system.
Viscosity	The property of a fluid that retards but cannot stop flow within the fluid.
Weathering	The alteration of the physical and chemical properties of spilled oil through a series of natural processes that begin when the oil is spilled, and continue for as long as the oil is in the environment. These processes include evaporation, emulsification, oxidation, dissolution, and microbial degradation.
Zooplankton	Small animals of several biological families which drift with ocean currents. Zooplankton may be the larval or mature forms of a species.

2.2 Acronyms

ACS	Alaska Clean Seas
ADDS	(OSRL) Airborne Dispersant Deployment System
ADIOS	Automated Data Inquiry for Oil Spills
AMOP	Arctic Marine Oil Pollution Conference
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
BIOS	Baffin Island Oil Spill Study
BSOC	Beaufort Sea Oilspill Cooperative
CCA	Clean Caribbean and Americas
CCG	Canadian Coast Guard
CCO	Chief Conservation Officer
CCR	Central Control Room
CEPA	Canadian Environmental Protection Act
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board

C-NSOPB	Canada - Nova Scotia Offshore Petroleum Board
COGLA	Canada Oil and Gas Lands Administration
COOGER	Centre for Offshore Oil, Gas, and Energy Research
COOTAF	Canadian Offshore Aerial Applications Task Force
COOSRA	Canadian Offshore Oil Spill Research Association
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPA	Canadian Petroleum Association
CPPI	Canadian Petroleum Products Institute
CSA	Canada Shipping Act
CWS	Canadian Wildlife Service
DFO	Department of Fisheries and Oceans
DIAND	Department of Indian and Northern Development
DOR	Dispersant to oil ratio
EAMES	Eastern Arctic Marine Environmental Studies
EC	Environment Canada
ECC	Emergency Command Centre on an offshore platform
ECRC	Eastern Canada Response Corporation
EEM	Environmental Effects Monitoring
EIS	Environmental Impact Statement
EOC	(HMDC) Emergency Operations Centre
ERT	Emergency Response Team
ESG	(HMDC) Emergency Operations Group
ESRA	East Coast Spill Response Association
ESRF	Environmental Studies Research Fund
ESRI	East Coast Spill Response Inc.
FLIR	Forward Looking Infrared
FPSO	Floating Production, Storage, and Offloading Platform
GBS	(Hibernia) Gravity Base Structure
GRN	Global Response Network
HMDC	Hibernia Management and Development Company
Hs	Significant Wave Height
ICC	Incident Coordination Centre
ICS	Incident Command System
IIP	International Ice Patrol
IPAC	Independent Petroleum Association of Canada
ISB	In-Situ burning
ITOPF	International Tanker Owners' Pollution Federation
JBO	Jeanne d'Arc Basin Operators
MCTS	Marine Communications and Traffic Services
MED	Marine Emergency Duties

MET	(Husky or Suncor) Major Emergency Team
MFPSV	Multi-Function Platform Support Vessel
MMS	US Minerals Management Service
MODU	Mobile Offshore Drilling Unit
MRN	Marine Response Network
MSRC	Marine Spill Response Corporation
NCA	Norwegian Coastal Authority
NEBA	Net Environmental Benefit Analysis
NEIA	Newfoundland and Labrador Environmental Industries Association
NFAC	North West Atlantic Fisheries Centre
nm	Nautical Miles
NOBE	Newfoundland Offshore Burn Experiment
NOFO	North Sea Operators Clean Seas Association
NPD	Newfoundland Petroleum Directorate
NRC	National Response Corporation
OLABS	Offshore Labrador Biological Studies
OLS	Offshore Loading System
OMA	Oil-Mineral Aggregation
OSC	On-Scene Commander
OSCAR	Oil Spill Containment and Recovery
OSR	Oil Spill Response
OSRO	Oil Spill Removal Organization
OSRV	Oil Spill Response Vessel
PAL	Provincial Aerospace Ltd
POB	Personnel On Board
PPE	Personal Protective Equipment
PTMS	Point Tupper Marine Services
RCC	Rescue Co-ordination Centre
REET	Regional Environmental Emergency Team
REMPEC	Regional Marine Pollution Emergency Response
RO	Response Organizations
SARA	Species at Risk Act
SCAT	Shoreline Cleanup Assessment Team
SDL	Significant Discovery Licence
SMS	(ECRC) Spill Management System (also Safety Management System)
SMT	(ECRC) Spill Management Team
SOPEP	Ship Oil Pollution Emergency Plan
SVSS	Single Vessel Side Sweep
TAR	Thickness Appearance Rating
TC	Transport Canada

TDG	Transportation of Dangerous Goods
TFOSP	Task Force on Oil Spill Preparedness
WCSS	Western Canadian Spill Services

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MARINE HYDROCARBON SPILL RESPONSE CAPABILITY ASSESSMENT JEANNE D'ARC BASIN PRODUCTION OPERATIONS

CHAPTER 2 – BACKGROUND INFORMATION

Prepared For:

Canadian Association of Petroleum Producers
403, 235 Water Street
St. John's, NL
CANADA
A1C 1B7

On Behalf Of:

Suncor Energy
235 Water Street
St. John's, NL
CANADA
A1C 1B6

Husky Energy
235 Water Street
St. John's, NL
CANADA
A1C 1B6

Hibernia Management and Development Company
Suite 1000, 100 New Gower Street
St. John's, NL
CANADA
A1C 6K3

Prepared By:

Cormorant Ltd.
280 B Water Street
St. John's, NL
CANADA
A1C 1B7

Lorax Environmental
Suite 504, 215 Water Street
St. John's, NL
CANADA
A1C 6K3

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1.0 HISTORY OF OFFSHORE OIL SPILL PREPAREDNESS

After the discovery of the Hibernia oil field in 1979, the need for an oil spill response capability to support exploratory drilling on the Grand Banks was recognized. The response group created was the East Coast Spill Response Association (ESRA), a cooperative alliance between industry and the Canadian Coast Guard whose mandate was to respond to oil spills related to the upstream oil industry. Mobil Oil served as the managing operator of ESRA on behalf of member companies. ESRA equipment and personnel were initially housed in the Canadian Coast Guard spill response facilities in St John's, but eventually moved to its own warehouse and office facilities.

In 1984, ESRA was incorporated under the name East Coast Spill Response Inc. (ESRI) and developed a shareholders' agreement regarding capital, operating budgets, and access to equipment and personnel. ESRI had a Board of Directors, as well as a member company committee. ESRI staff included a small group of permanent employees to manage and maintain the depot and provide training and a team of contract responders that could be mobilized in the event of a spill. ESRI's mandate was to provide upstream operations in east coast Canadian waters with an oil spill response capability. At its Torbay Road warehouse, ESRI maintained a suite of equipment that included booms, skimmer systems, deck tanks, pump systems, dispersants, and support equipment.

ESRI was an offshore industry cooperative and operator membership fluctuated with industry highs and lows during the years of operations (1984 – 1993). During this period all member companies were offshore lease holders or operators participating in exploration drilling. In time, the potential for future oil production prompted the ESRI Board of Directors to plan for equipment upgrades/replacements that were complementary to the industry's goals, including equipment specifically designed to deal with heavy, waxy crude from Grand Banks wells.

In 1987 - 1988, the offshore regulatory regime on Canada's east coast changed with the passing of the *Canada-Newfoundland Atlantic Accord Implementation Act* (1987) and the *Canada-Nova Scotia Atlantic Accord Implementation Act* (1988). As a result, the Canada Oil and Gas Lands Administration (COGLA) and the Newfoundland Petroleum Directorate (NPD) gave way to what became the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) and the Canada-Nova Scotia Offshore Petroleum Board (C-NSOPB).

By the end of 1991, exploration drilling on the east coast had halted. As a result of industry inactivity, ESRI was disbanded in 1993. A portion of ESRI assets were sold to Marine Spill Response Corporation (MSRC) in the USA, while the remaining equipment was sold to Pier Atlantic, a Halifax harbour response cooperative.

Following the Exxon Valdez and Nestucca oil spills, a task force was established in the early 1990s to review Canada's oil spill response regime. The result was a revision to Chapter 36 of the *Canada Shipping Act* (CSA), which specified the private sector's increased oil spill preparedness responsibility. However, because of the joint federal-provincial jurisdiction of the offshore industry in Atlantic Canada, the CSA revisions did not specifically apply to active offshore drilling and production operations.

The downstream oil industry recognized the changes that a revised CSA would bring and responded by creating the certified Response Organizations (RO) specified by the Act. In eastern Canada, Imperial Oil, Petro-Canada, Ultramar, and Shell formed Eastern Canada Response Corporation (ECRC). The core of ECRC's structure was a series of existing local spill response cooperatives in Ontario, Quebec and the Maritimes, including Pier Atlantic.

ECRC began operations in Newfoundland in mid-1994, originally operating under the Pier Atlantic name while the ECRC corporate structure was being assembled. Equipment was acquired, including some of the gear formerly owned by ESRI, to meet the standards under the *Act*. In 1995, ECRC received its first certification under the CSA and received a mandate to provide ships and designated oil-handling facilities (i.e. the downstream oil sector) with oil spill response preparedness requirements under the CSA.

Exploration drilling resumed on Newfoundland's west coast in 1995 and with it came a renewed requirement for oil spill response services for the upstream sector of the oil and gas industry. Drilling resumed on the Grand Banks in 1997 with Amoco's exploration drilling at West Bonne Bay and with Hibernia commencing production. Activity increased as Husky Energy (Husky) and the Jeanne d'Arc Basin Operators (JBO) began delineation drilling. With production operations at Terra Nova and White Rose, and exploration drilling in the Orphan Basin, Flemish Pass, South West Grand Banks, and the Laurentian Basin, the requirement for oil spill response services for the upstream industry has continuously grown since the late 1990s.

With the resumption of offshore activity in the mid 1990s under the jurisdiction of the C-NLOPB, offshore operators were expected, as a component of their respective operating licences, to develop a credible offshore response capability. To meet this need, ECRC has developed an offshore subscriber arrangement to provide response services to individual offshore operators. Similar to the subscriber arrangements developed for CSA clients, the offshore agreement allows the offshore operator access to ECRC resources at the time of a spill. This arrangement has come to be recognized as the standard for all offshore Newfoundland operations.

Response preparedness in the offshore industry has evolved to the following level:

- All offshore vessels and platforms have been equipped with Tier 1 response equipment and training that includes sorbent boom, sampling kit, satellite tracker buoys, and oil on water surveillance expertise;
- Production platforms have been outfitted with the Single Vessel Side Sweep (SVSS) which is an open-ocean grade oil containment and recovery system that can be deployed and operated by a single vessel;
- Suncor and HMDC are members of Oil Spill Response, an international Tier 3 response contractor;
- Suncor, Husky, and HMDC have jointly purchased a complete open ocean containment and recovery system that meets the standards of NOFO, the Norwegian offshore spill response cooperative; and
- Suncor, Husky, and HMDC are in the process of entering into a multi-party arrangement with ECRC for the provision of a complete oil spill preparedness program above and beyond the existing oil spill response arrangement.

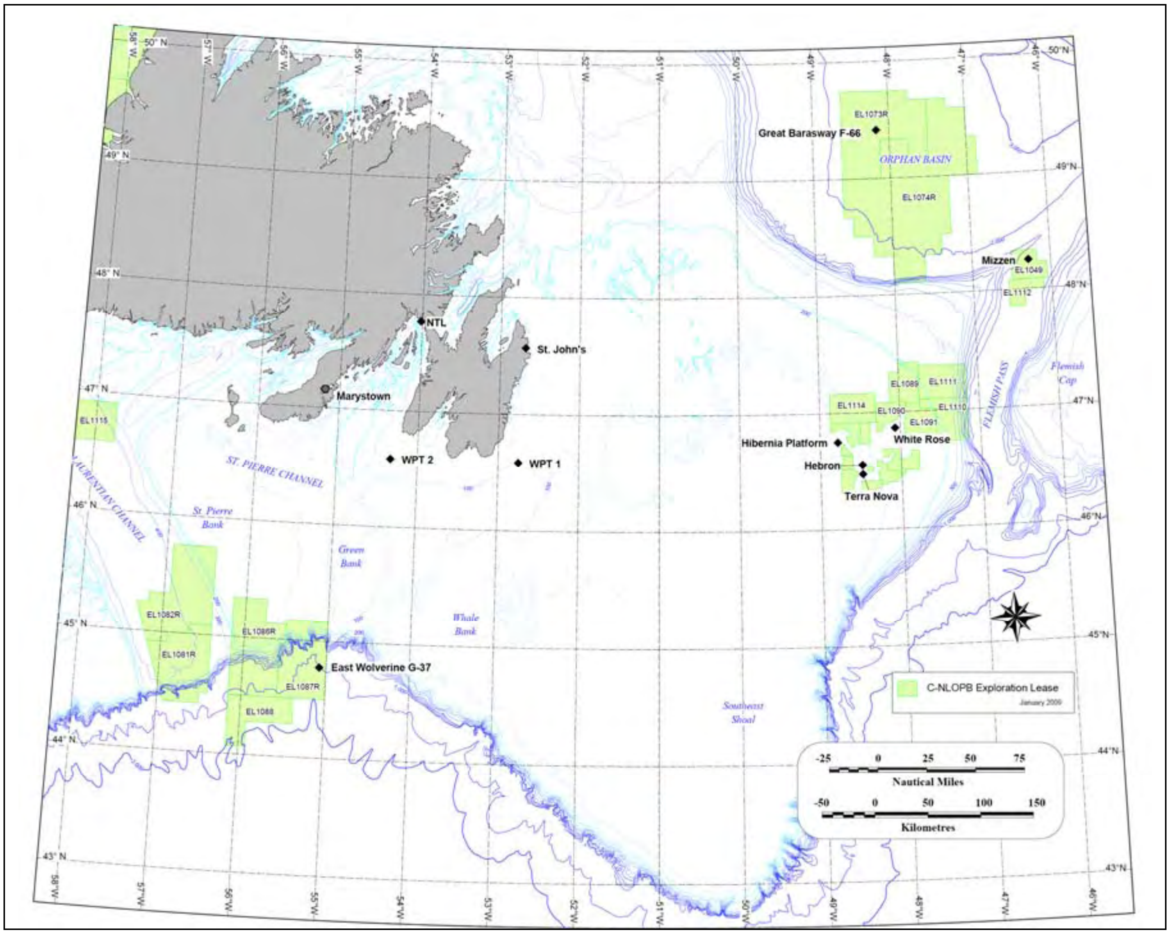
2.0 NEWFOUNDLAND AND LABRADOR OFFSHORE OPERATIONS

Newfoundland and Labrador's offshore oil and gas industry has three producing projects - Hibernia, Terra Nova and White Rose (see Figure 1) currently producing over 300,000 barrels of oil per day. Newfoundland and Labrador's fourth offshore oil development, Hebron, is expected to begin production by 2017. The following sections highlight the activities of current drilling and producing projects.

2.1 Geographical Area

The general area of interest for offshore oil spill response operations can be described as the collection of existing production operations, and current or anticipated drilling projects. Most probable sources of spilled oil will be at the drilling and production sites shown in Figure 1. For the purposes of this document, these sites and the surrounding offshore region have been designated as the Newfoundland and Labrador Offshore Study Area (Study Area).

Figure 1 Newfoundland and Labrador Offshore Study Area



2.2 Current Offshore Production Activity

2.2.1 Hibernia (Hibernia, 2009)

The Hibernia oil field was discovered in 1979 and is located 310 km east southeast of St. John's in 80 metres of water. The field is within the Jeanne d'Arc Basin and consists of two principal reservoirs, Hibernia and Ben Nevis-Avalon, which are located at depths of 3,700 and 2,400 metres, respectively.

As of 2009, the Hibernia field is estimated to have a remaining production life of 23 to 27 years. Total production for 2008 was 98.7 million m^3 (gross), with an average production rate of 21,940 m^3 (gross) per day. At the conclusion of 2008 there were 55 development wells operational, including 38 producer wells, eight gas injection wells and 17 water injection wells.

All drilling and production activities are undertaken from the Hibernia Platform, a concrete gravity-based structure (GBS) which rests on the seabed. Oil is transferred from the platform to shuttle tankers via an Offshore Loading System (OLS), located 2 kilometres from the platform. The OLS consists of subsea pipelines, sub-surface buoys, and flexible loading hoses.

Hibernia Management & Development Company Limited (HMDC), an agency company, was formed by the field owners to oversee the management and development of the field. Maersk/Seabase is contracted to vessel support to the platform through the use of multi-purpose platform support vessels. Either the Maersk Nascopie or Maersk Norseman is on standby at the platform at all times, while the other provides platform resupply and ice management support. The Maersk Placentia provides platform resupply and ice management support as needed.

2.2.2 Terra Nova

Production at the Terra Nova field began in January, 2002. Terra Nova is the second largest offshore oil field off Canada's East Coast and is located in the Jeanne d'Arc Basin, approximately 340 kilometres east of St. John's and 38 kilometres southeast of Hibernia. Suncor is the operator and the majority interest holder in the development.

The Terra Nova oil field is comprised of three fault blocks: Graben; East Flank; and Far East. Terra Nova's life of field production is estimated at 70 million m^3 with about 63.6 million m^3 of production from the Graben and East Flank and 6.4 million m^3 expected from the Far East. Estimated remaining field life is between 13 and 20 years.

The Terra Nova field utilizes a Floating Production Storage and Offloading (Terra Nova FPSO) vessel as the production platform. A network of more than 40 kilometres of flexible flowline is used to carry hydrocarbons to and from the wells. Produced gases are separated from the oil and re-injected into the reservoir for possible future extraction.

The FPSO is a registered vessel with integrated oil storage from which oil is offloaded to a shuttle tanker and transported to the Newfoundland Transhipment Limited terminal, at Whiffen Head, Placentia Bay. Vessel support is provided to the FPSO through the use of multi-purpose support vessels. The Atlantic Eagle and Burin Sea are on long term charter while other vessels are chartered temporarily during drilling or ice management operations. As with Hibernia, vessels are used for standby purposes, as well as platform resupply and ice management support.

2.2.3 White Rose (Husky, 2009)

The White Rose field and satellites are located in the Jeanne d'Arc Basin, approximately 350 kilometres east of St. John's. Husky is the Operator and Suncor is the joint-venturer. The estimated White Rose production life is 12 to 15 years. Development of nearby ancillary pools will extend production. The White Rose production system is designed for a 20-year life.

Initial development has focused on the South Avalon oil pool, which covers approximately 40 km^2. The White Rose oilfield development is significantly smaller than previous oil and gas developments on the Grand Banks. At the end of 2008, there were 20 development wells, including eight oil producers, two gas injectors, and 10 water injectors. First oil from the core field was achieved in November, 2005. In 2008, total production was 18.2 million m^3, with an average daily production rate of 16,057 m^3 per day.

In addition to ongoing production, Husky maintains a drilling program using a Mobile Offshore Drilling Unit (MODU), GSF Grand Banks. In 2010, and 2011, drilling activity is expected to increase with the addition of another MODU. Husky intends to add three satellite fields through a series of subsea tiebacks, beginning with the North Amethyst field which will be completed in late 2009.

Like Terra Nova, White Rose utilizes an FPSO. Fluids are carried between the reservoir and SeaRose FPSO through more than 41 kilometres of flexible flowlines, umbilicals and risers. Shuttle tankers load oil from the stern of the SeaRose FPSO, which has a storage capacity of 149,443 m^3 of processed oil. Vessel support is provided to the White Rose field through the use of multi-purpose support vessels (Atlantic Osprey, Atlantic Hawk, Maersk Chancellor, and Maersk Chignecto) that are on long-term charter. Other vessels are chartered as required for additional specific activities. As with Hibernia and Terra Nova, vessels are used for standby purposes, platform resupply, and ice management.

2.3 Hebron Production

The Hebron Field is less than 5 kilometres north-west of Terra Nova and will be developed using a stand-alone concrete GBS. Construction of the GBS is expected to begin in 2011 and be completed in 2016 or 2017. Production drilling will be undertaken for several more years directly from the GBS, once the platform has been installed (ExxonMobil, 2009).

The field has the potential for a 30-year production life span with an estimated production rate of 18,000 – 27,000 m^3/day. Onboard storage capacity will be approximately 159,000 m^3 of crude oil. Like Hibernia, oil will be transferred from the platform to shuttle tankers via an Offshore Loading System (C-NLOPB *et al*. 2009).

With the commencement of drilling activities, the Hebron field will be supported by two to three offshore supply vessels.

3.0 NEWFOUNDLAND OFFSHORE ENVIRONMENT

3.1 Description of Physical Environment

The feature that distinguishes the Newfoundland offshore area from other offshore exploration and production areas is the combined occurrence weather conditions, which include poor visibility for extended periods, sea ice, and icebergs.

3.1.1 Wind

Winds offshore Newfoundland are largely determined by the relatively deep low-pressure region (the polar convergence zone), centered between Iceland and the southern tip of Greenland. The counterclockwise circulation above this region causes the mean wind to have a west to west-northwest direction. Added to this are the short-term storms associated with passing weather systems that occur between late fall and early spring. Figure 2, taken from the Transport Canada Wind and Wave Atlas, shows the frequency of wind speed by direction on the eastern Grand Banks. While winds are generally westerly or southwesterly, it can be seen that winds are most variable in spring (the peak of the ice season) and in the fall (tropical storm season).

3.1.2 Waves

The Grand Banks are exposed to high sea states generated by local and distant winds Eid *et. al.*, 1991). Figure 2 also shows the frequency of Significant Wave Height (Hs) by direction.

Any active oil spill response operations can be limited by weather. Sea state will, in particular, limit the ability to undertake any containment and recovery operations. Safety for deck operations will be the primary concern, but sea state will also limit the effectiveness or the integrity of deployed equipment.

The Response Organization Standards of the *Canada Shipping Act* do not require equipment handling in sea states of greater than Beaufort 4 (1.5 m Hs). While this threshold is, indeed, a very safe precaution, Beaufort 4 is not representative of realistic operating conditions offshore Newfoundland, which sees sea states of Beaufort 5 or Beaufort 6. Based on historical Hibernia wave data, Figure 3 illustrates the annual frequency of Beaufort sea states 4, 5, and 6. By extending the sea state operating standard to either Beaufort 5 or Beaufort 6, the window of opportunity for equipment use is increased to the entire year. Figure 4 is a representative time series of Hibernia wave data. In this data set, it can be seen how weather windows improve in winter months if operations in higher sea states can be undertaken.

Figure 2 Grand Banks Monthly Wind and Wave Statistics

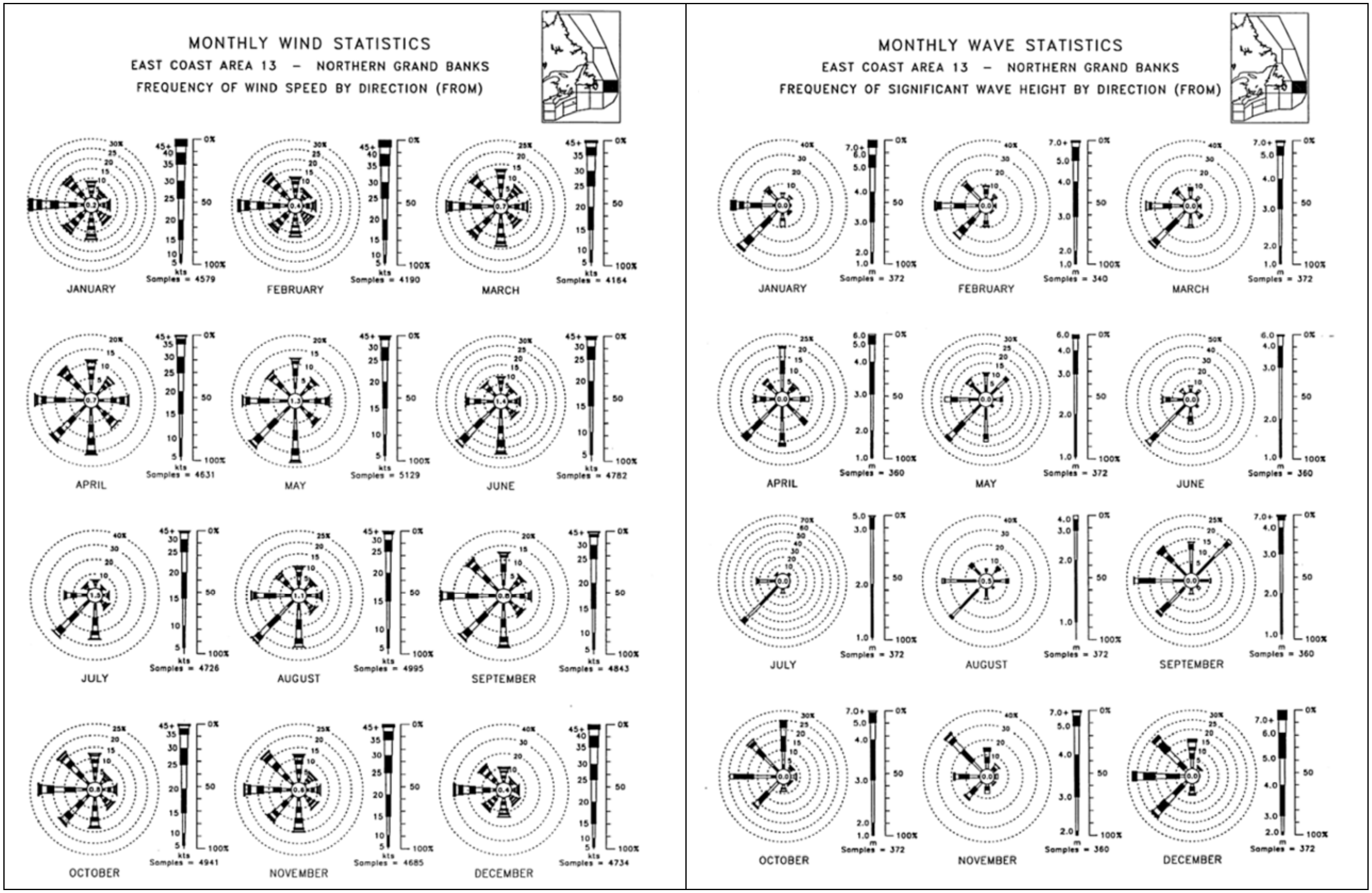


Figure 3 Frequency of Annual Grand Banks Sea State Conditions And Operating Limits

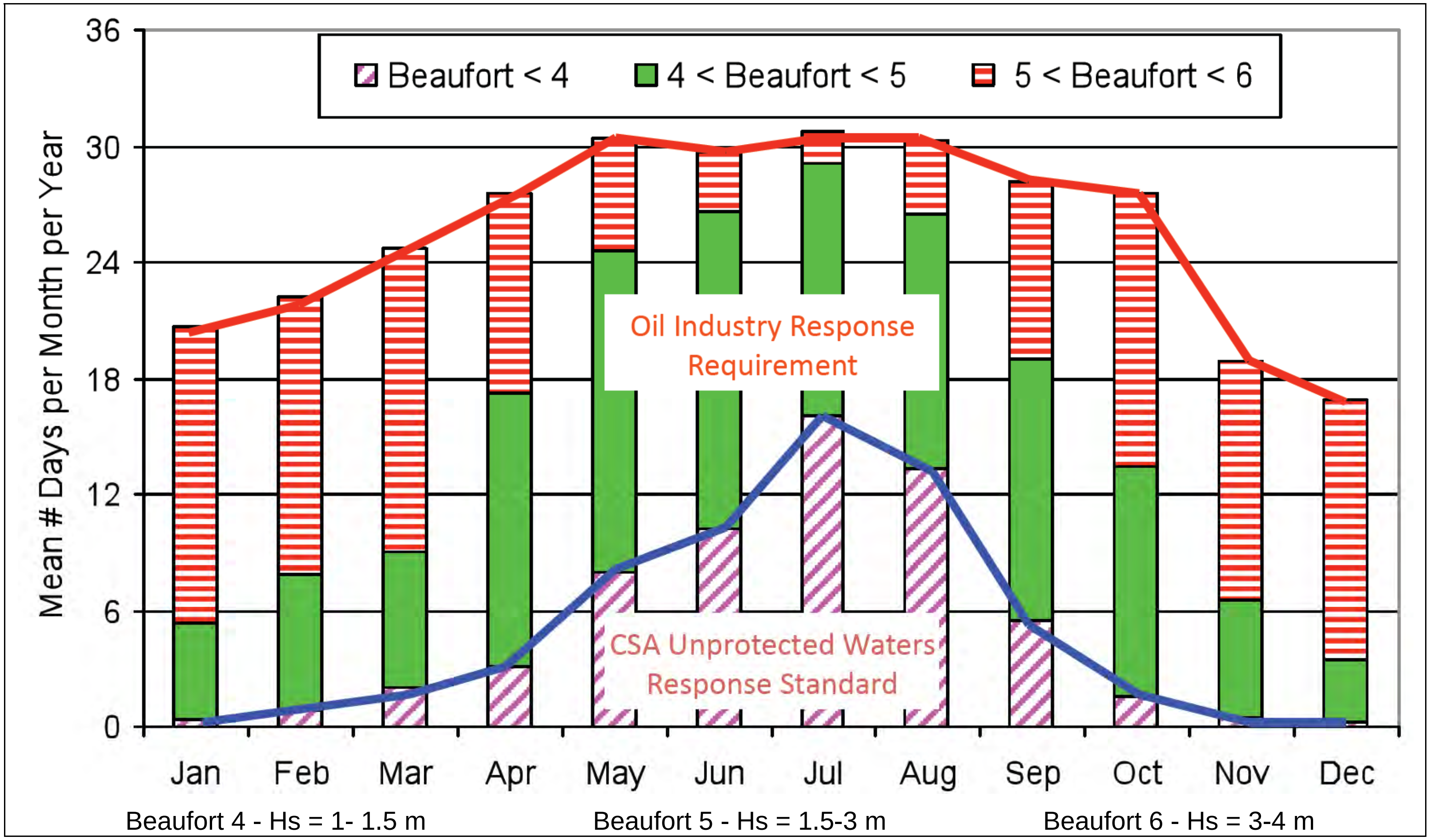
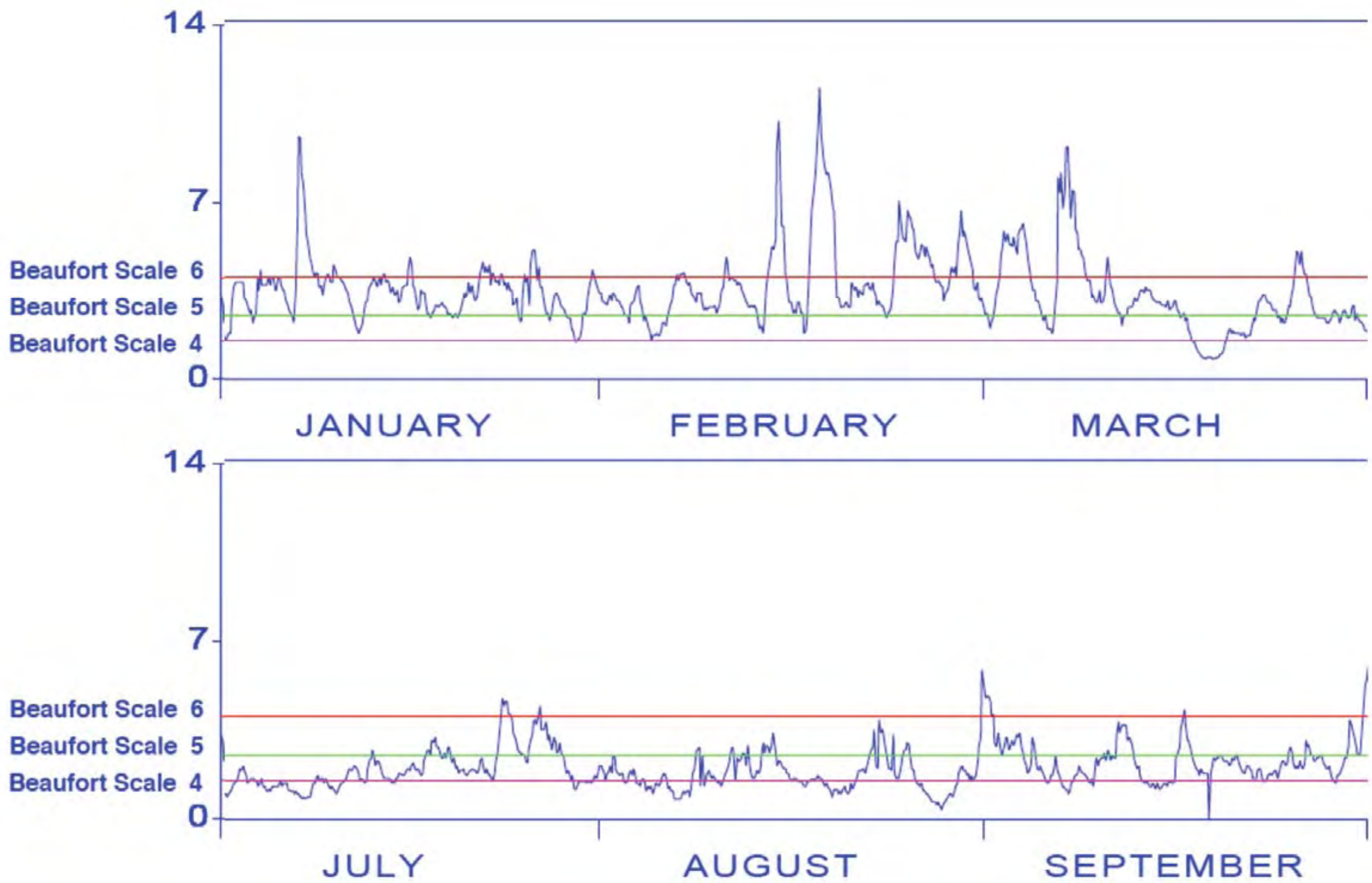


Figure 4 Representative Annual Time Series of Sea State Conditions at Hibernia



Beaufort 4 - Hs = 1- 1.5 m Beaufort 5 - Hs = 1.5-3 m Beaufort 6 - Hs = 3-4 m

3.1.3 Winter Season Characteristics

The prevailing upper level weather pattern during the winter season causes low pressure systems to move through the Newfoundland region on a general north-eastward track. The intensity of systems ranges from relatively weak features to major winter storm systems that affect a large area with storm-force winds and high seas. Precipitation offshore is more likely to be rain or drizzle, with relatively infrequent periods of continuous snow, often in the unstable air in the wake of cold fronts.

3.1.4 Summer Season Characteristics

With low pressure systems normally passing to the north of the region, in combination with the northwest shoulder of the sub-tropical high to the south, the prevailing flow across the Grand Banks is from the southwest during the summer season. Wind speeds are lower during the summer and the incidence of gale or storm-force winds is low.

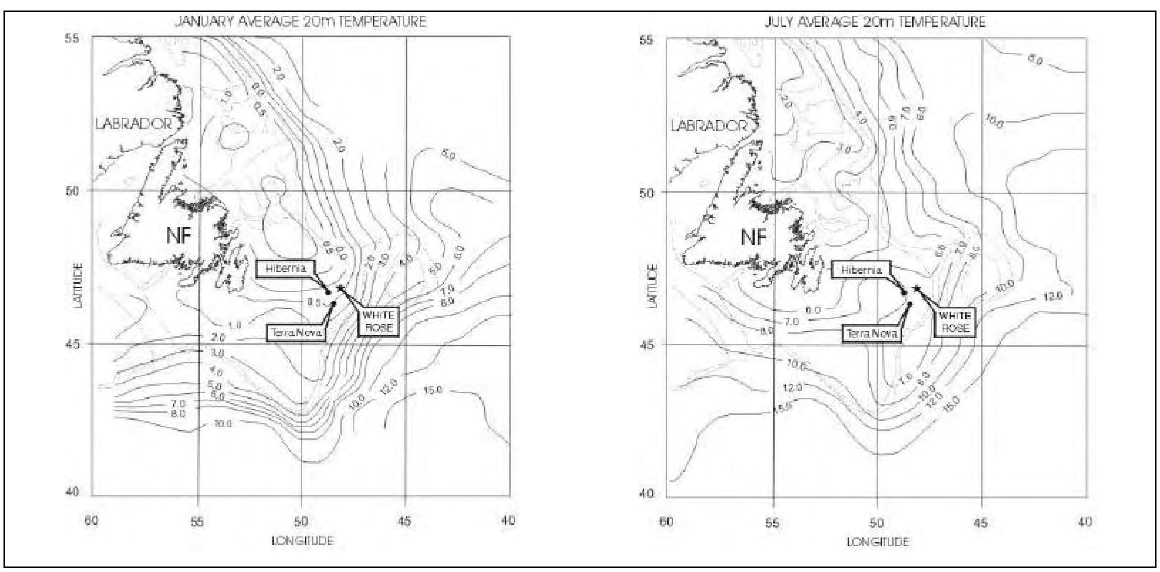
3.1.5 Tropical Weather Systems

The hurricane season in the North Atlantic Basin extends from June through November. While the incidence of tropical depressions, storms, hurricanes or the remnants of such systems is infrequent, the risk of occurrence is greatest between August and October. The frequency of tropical systems affecting the region in any particular year is low. Following the upper level circulation during the period, these systems normally approach the region from the south to southwest. Conditions on the Grand Banks associated with tropical cyclones range from minor events to major storms.

3.1.6 Sea Water Temperature

Water temperature and salinity both affect the weathering of oil at sea. The water characteristics offshore Newfoundland can be expected to show yearly variations depending on the strength and position of the northern branch of the Gulf Stream and the Labrador Current flowing along the edge of the Grand Banks, through the Flemish Pass. Representative winter and summer temperatures are presented in Figure 5 (Husky, 2000).

Figure 5 Seasonal Near Surface Temperatures

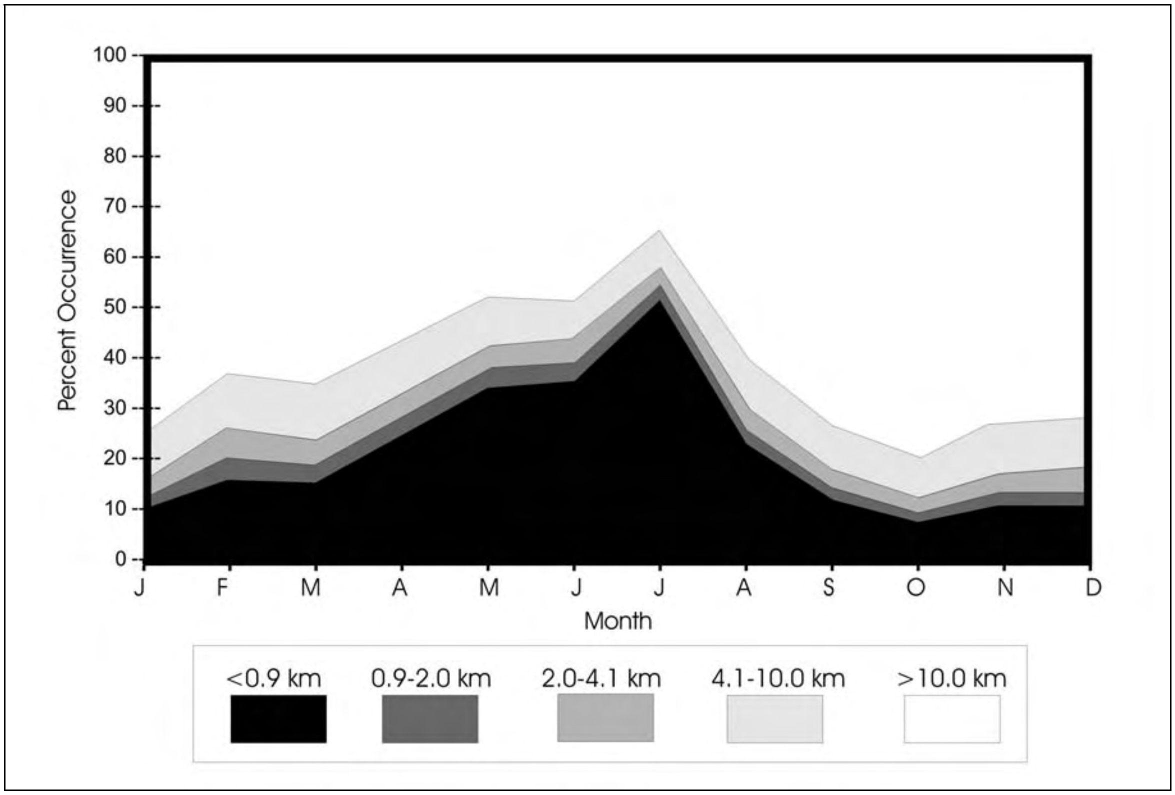


3.1.7 Fog

Extended periods of fog can be anticipated in the Newfoundland offshore region. The percentage of time that visibility is less than a kilometer increases steadily from a January low of 5% to a high of 50% in July, when southwesterly winds bring warm moist air from the Gulf Stream to the cold water of the Grand Banks (See Figure 6). The frequency of low visibility decreases as the summer progresses, to 10% by September.

Fog can have a significant affect on response operations by limiting the ability to track oil movement and by impeding aircraft operations. The most significant occurrences of fog coincide with the peak time period for icebergs; this necessitates that appropriate resources be dedicated to iceberg detection and monitoring during a response operation (Petro-Canada, 1996).

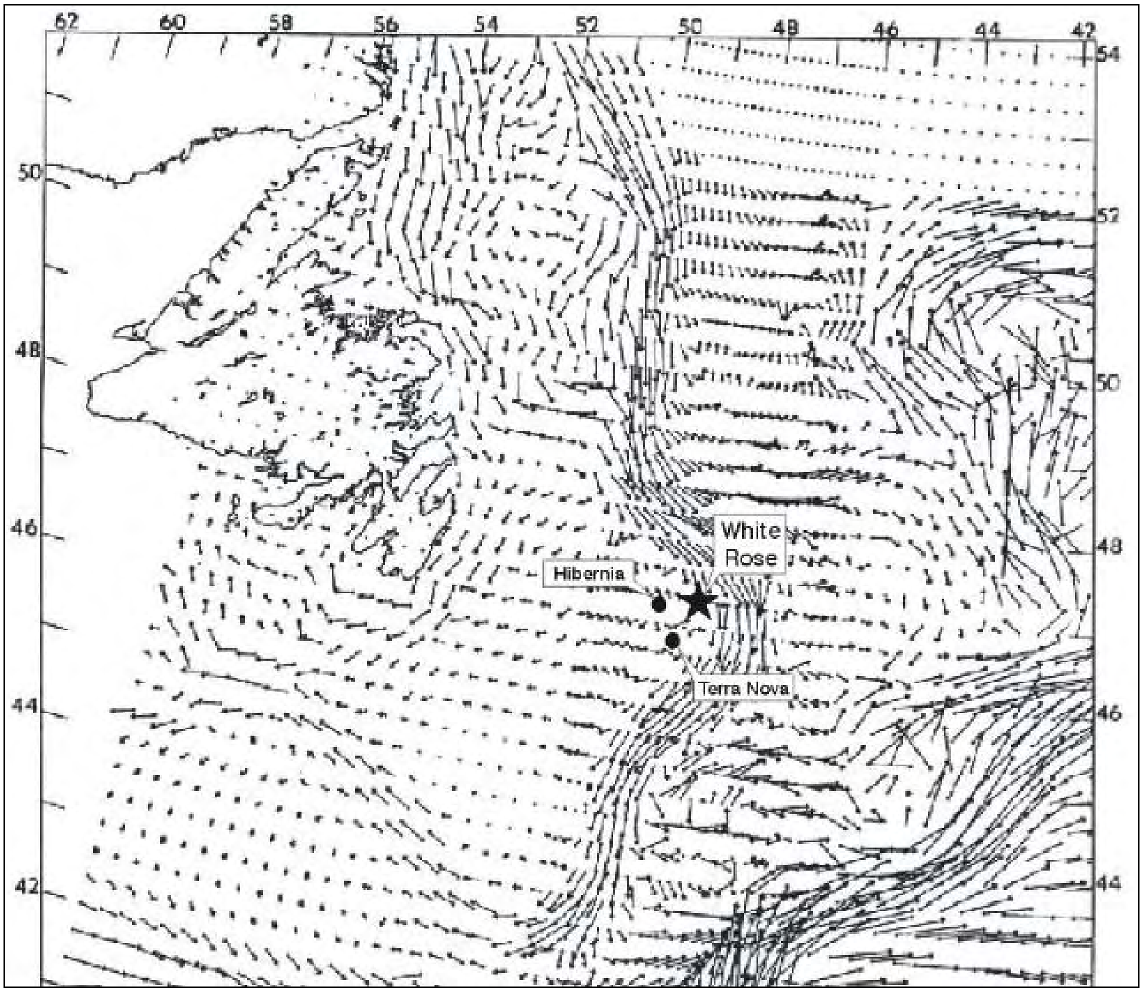
Figure 6 Production Area Visibility Conditions



3.1.8 Currents

Ocean currents offshore Newfoundland are dominated by the Labrador Current and its interaction with the Gulf Stream. The Labrador Current splits along the northern margin of the Grand Banks so that one branch flows southward, along the East Coast of Newfoundland in the Avalon Channel, and the main branch flows around the continental shelf break, to the southeast, toward the Flemish Pass. To the south of the Flemish Pass is a large area of mixing with the meanders and eddies of the Gulf Stream. Currents in the shallow waters of the Grand Banks are primarily wind and tide driven. Figure 7 shows the flow of the major surface currents on the Grand Banks as determined through a compilation of several years of drifter data (Husky, 2000).

Figure 7 Surface Currents Offshore Newfoundland

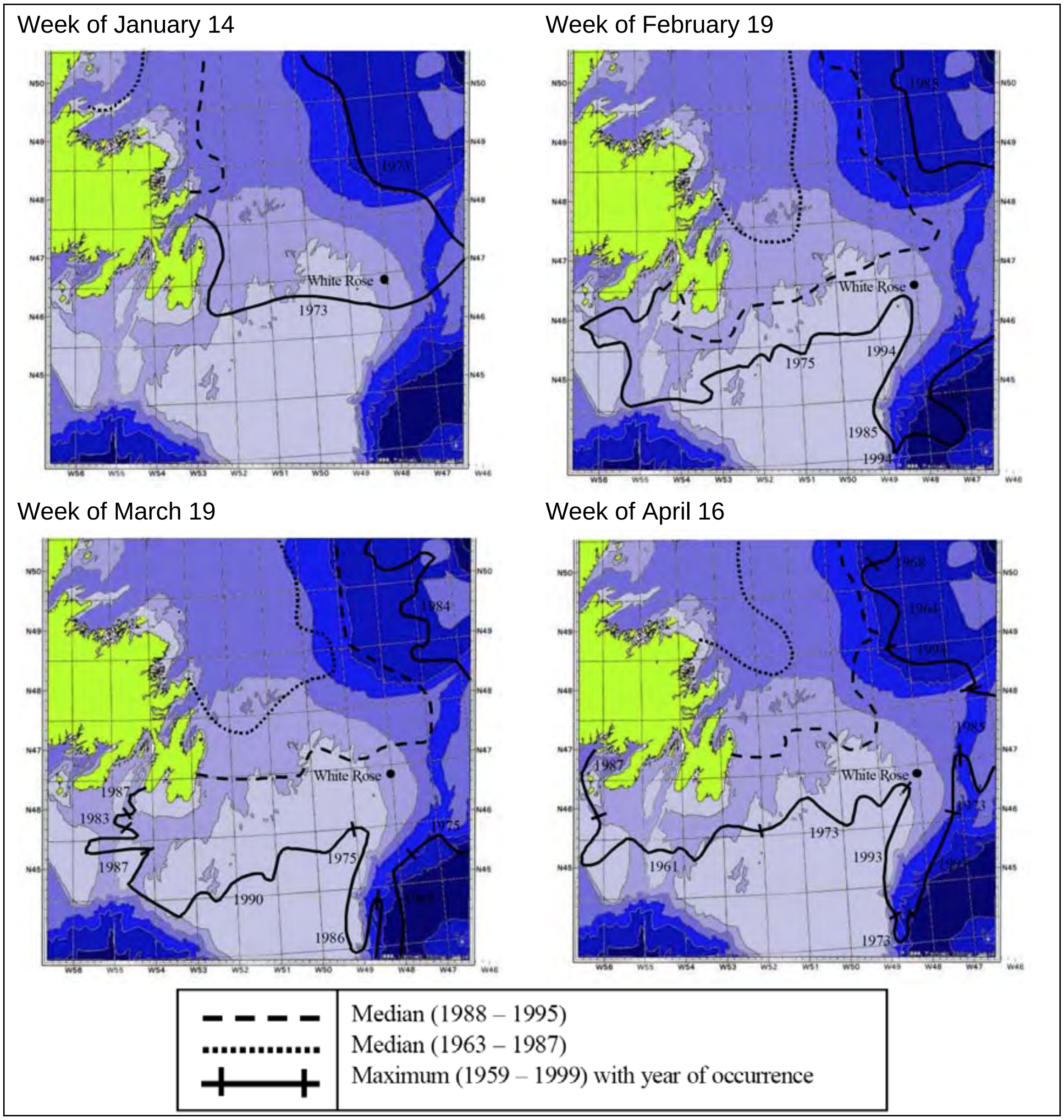


3.1.9 Sea Ice

Oil spill response operations will be limited by the presence of sea ice due to restrictions in vessel operations. Broken sea ice will, however, provide open areas where pockets of oil may be trapped and not allowed to spread. The Jeanne d'Arc Basin production sites offshore lie close to the extreme southern limit of the regional ice pack. In this area, relatively high water temperatures dissipate the last remnants of ice that have drifted south from original ice growth areas in Baffin Bay, Davis Strait, and the Labrador Sea. In typical years, the ice edge reaches the northern tip of Newfoundland in early January and the Grand Banks in mid-February. The pack ice off Newfoundland generally reaches annual peak coverage in March but can remain at high levels through early May. Subsequently, the ice pack retreats rapidly northward with substantial ice concentrations confined to north of Labrador by the end of July (Husky, 2000).

Seasonal ice coverage in Newfoundland waters is shown in Figure 8, using plots of extreme and median positions of the ice edge, midway through each of the months of January through April (Husky, 2000).

Figure 8 Grand Banks Sea Ice Conditions



3.2 Environmental Resources at Risk

For the purposes of this review, the biological environment under consideration is the Grand Banks ecosystem, a dynamic and complex system driven by many components. The mixing of the cold water from the Labrador Current and the warmer Gulf Stream, combined with the physical shape of the ocean bottom, lifts nutrients to the surface creating one of the richest ecosystems in the world.

This ecosystem has been described in detail in the past in various EIS documents. The following description is intended to provide a brief summary of the biological environment of the Grand Banks ecosystem in the context of oil spill preparedness.

3.2.1 Plankton

Plankton are drifting organisms that inhabit oceanic pelagic zones, which are an essential source of food for fish, and which may be the larval form of commercially-important fish and shell fish species. Plankton distribution and abundance are largely determined by ocean conditions and may vary horizontally, vertically, and seasonally. Primary production of phytoplankton generally occurs in the upper 50 metres of the water column. Seasonal variations in phytoplankton are influenced by light and available nutrients with peaks (blooms) in the spring and in the fall. Marine phytoplankton are essential contributors to the ocean's carbon cycle. Zooplankton populations on the Grand Banks are typical for arctic or boreal waters and vary in population size with phytoplankton blooms.

Ichthyoplankton are the eggs and larvae of fish, found mainly in the upper 200 metres of the water column. Ichthyoplankton abundance have been demonstrated to be good indicators of the transient spawning population size of the adults, and also can provide an indication of a healthy or stressed ecosystem. At least 45 species of fish have been identified as early life stages in the ichthyoplankton of the Grand Banks. The most frequently reported of these are herring, capelin, cod, sandlance, redfish, sea snail, witch flounder, American plaice and yellowtail flounder (Husky, 2000).

3.2.2 Bottom Species

Benthos are the organisms which live in the seabed. Epibenthos are those that live on the seabed. The epibenthos are very diverse and include species ranging from attached micro-algae to commercially important species like scallop, lobster, shrimp and crab. Groundfish are also associated with the sea floor and use the substrate for cover, feeding, and egg laying. Epibenthic community structure, animal and plant distributions, and standing crop of benthic animals are related to water mass characteristics, including temperature, water depth, food supply, predation within the benthos, predation by fish and other pelagic predators, passage of time, and disturbance. The deep waters and northern areas of the banks contain predominantly Arctic and sub-Arctic taxa, while the shallow waters and southerly portions of the banks are characterised by more temperate assemblages. American plaice, sand lance, snow crab, brittle stars and sand dollars are all common epibenthic species (Husky, 2000).

3.2.3 Fish

The Grand Banks is a highly productive region, supporting huge schools of pelagic and groundfish, many of which were commercially important in the past or may become commercially important in the future. The most prolific fish species on the Grand Banks was traditionally cod, but there are also flounder, haddock, turbot, and other species present. Habitat and life history, as well as the status of several commercially important species, were extensively covered in the White Rose Comprehensive Study (Husky, 2000) and will not be repeated for the purposes of this review.

3.2.4 Seabirds

The Grand Banks are host to over 60 species of sea birds, including puffins, guillemots, razorbills, murres, storm petrels, shearwaters, and others (Table 1). Of the 60 or so species found, 18 are pelagic, preying on capelin, copepods, amphipods, etc., at different water depths. In total, several million birds visit the Grand Banks annually to forage. In addition to direct "visitors", some of the largest seabird nesting colonies in eastern North America, south of Hudson Strait, are located along Avalon and Burin Peninsula coastlines, adjacent to the Grand Banks (Husky, 2000).

Table 1 Seabirds Observed in the Operating Area

Glaucous Gull	Little Shearwater	Red-Necked Pharalope
Great Black Back Gull	Greater Shearwater	Red Pharalope
Lesser Black-Backed Gull	Cory's Shearwater	Wilson's Storm Petrel
Herring Gull	Sooty Shearwater	Leach's Storm Petrel
Black Legged Kittiwake	Manx Shearwater	Northern Gannet
Iceland Gull	Northern Fulmar	Thick Billed Murre
Sabine's Gull	Pomarine Jaeger	Common Murre
Ivory Gull	Parasitic Jaeger	Razorbill
Common Tern	Long-Tailed Jaeger	Puffin
Arctic Tern	Great Skua	Dovekie

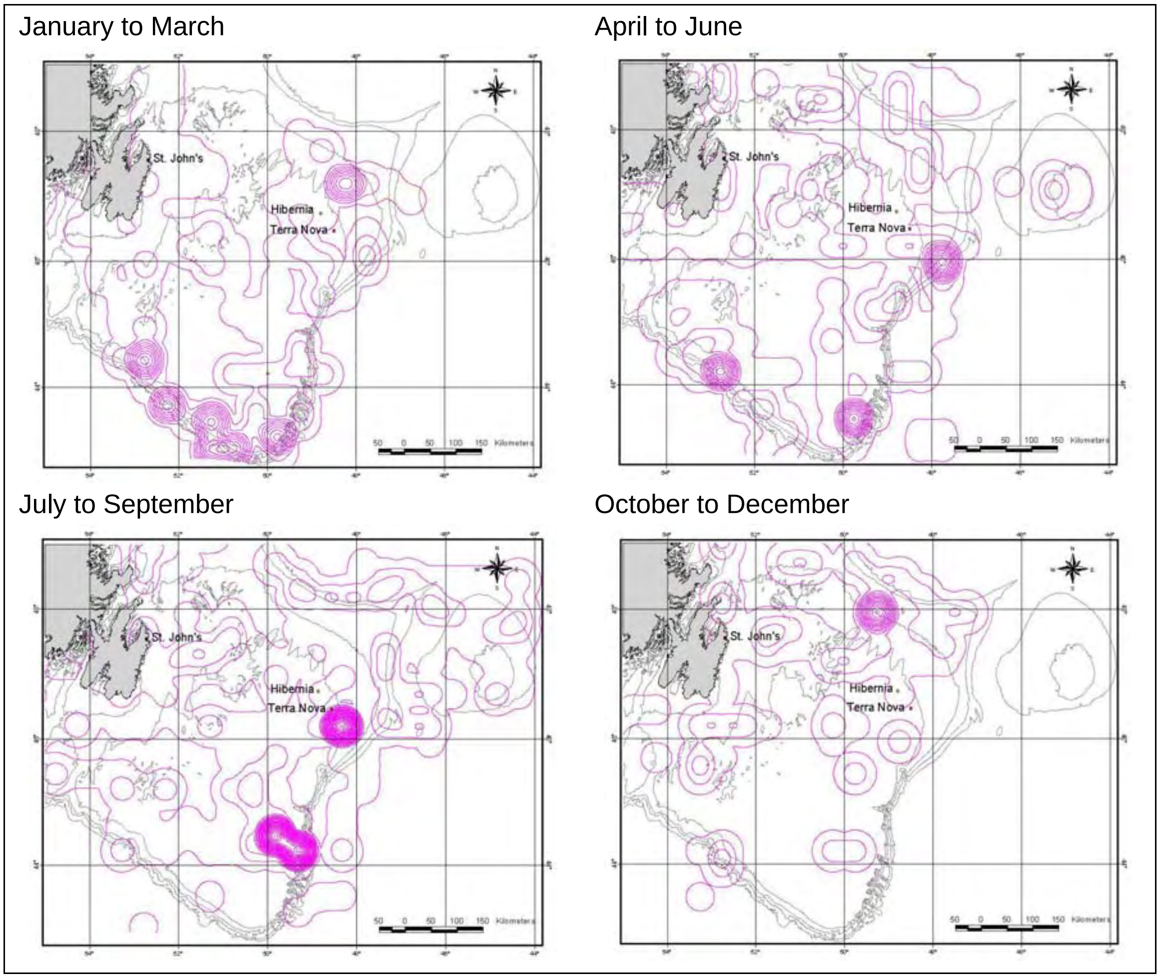
Seabirds are present on the Grand Banks throughout the year, although individual species occur in higher concentrations only at certain seasons and locations. The level of impact in a major spill will be primarily determined by the time of year in which it occurs. Table 2 indicates the commonly observed species for the Grand Banks (Husky, 2000).

Table 2 General Distribution Of Seabirds Near The Grand Banks

Area	Subarea	Birds Commonly Observed
Flemish Cap		• Year Round: Northern Fulmar, shearwaters, Black Legged Kittiwake, storm petrels, and dovekies
Grand Banks	Southeast Shoal	• Summer: Northern Fulmar, Greater Shearwater, Sooty Shearwater, storm petrels, jaegers and skuas • Winter: Northern Fulmar and Black-Legged Kittiwake
	Tail of the Bank	• Spring and Summer: Northern Fulmar and shearwaters are common. Storm petrels, jaegers, Black-Legged kittiwake and murres also present. • Winter: Black-Legged Kittiwake, murres, and dovekies
	Shelf Edge	• Spring and Summer: Northern Fulmar, shearwaters, storm petrels, jaegers, Black-Legged Kittiwake common. Phalaropes also present. • Winter: Many Northern Fulmar, Black-Legged Kittiwake, Glaucous Gull, Iceland Gull, skuas, and dovekies

In the Gazetteer of Marine Birds (Lock *et al*., 1994), the Canadian Wildlife Service has classified some pelagic seabird species as vulnerable. The most vulnerable are those that spend time on the water or diving for prey. Vulnerable species of concern include: murres, dovekies, fulmars, shearwaters, gannets and kittiwakes. Figure 9 presents the seasonal distribution of vulnerable seabirds on the Grand Banks, contoured to show levels of population density.

Figure 9 Distribution Of Vulnerable Seabirds



3.2.5 Marine Mammals

As many as 18 species of marine mammals have been identified to occur in the Grand Banks area, including 14 species of whales and dolphins and four species of seals. Other species are known to occur, but with such rarity that they are not considered important components of the ecosystem. Although most species are seasonal inhabitants, the waters of the Grand Banks and surrounding areas are important feeding grounds for some (Husky, 2000).

3.2.6 Species at Risk

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC), an independent, non-government group of experts, assesses the status of wildlife species. Wildlife species that have been designated by COSEWIC may then qualify for legal protection and recovery under *Species at Risk Act* (SARA). The purposes of the Act include the prevention of Canadian indigenous species, subspecies, and distinct populations from becoming extirpated or extinct, as well as the provision for the recovery of endangered or threatened species, and the management of other species to prevent them from becoming at risk. Currently, there are over 300 wild plant and animal species protected under the Act. Fish, birds and marine mammals in the Grand Banks area listed in the SARA or with COSEWIC are included in Table 3(Taylor, 2008).

Table 3 Species at Risk

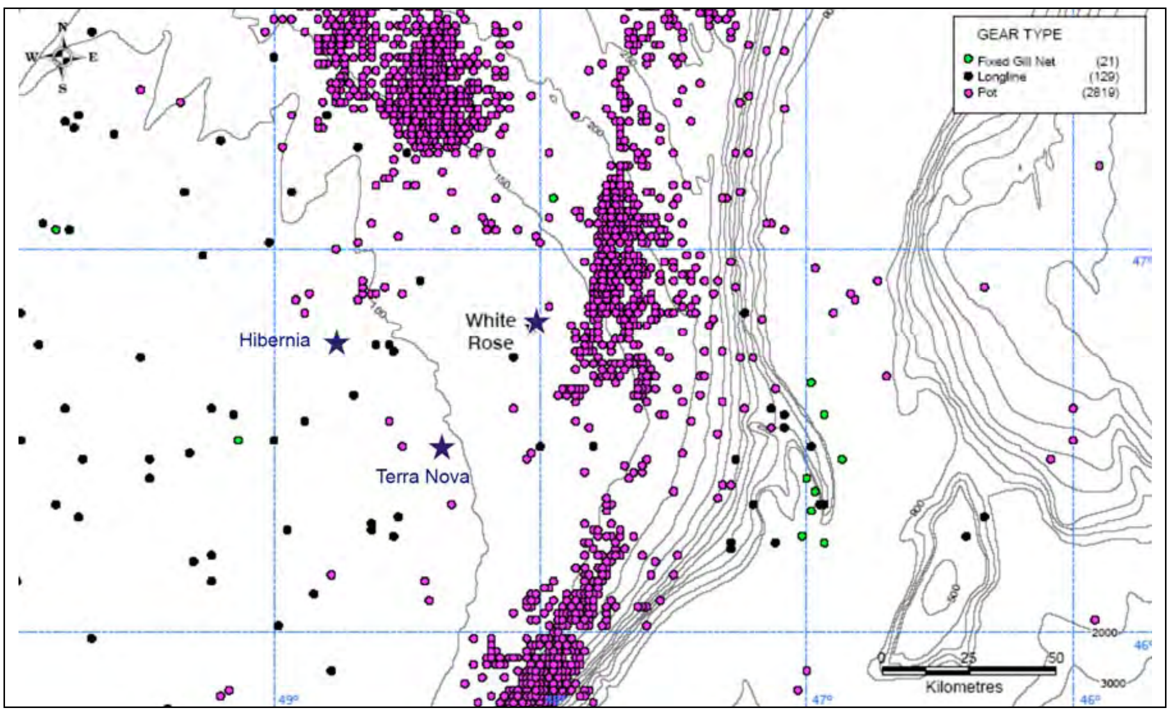
Species	SARA Schedule 1			COSEWIC			
	Endangered	Threatened	Special Concern	Endangered	Threatened	Special Concern	Candidate
Ivory Gull			X	X			
Northern Wolffish		X			X		
Spotted Wolffish		X			X		
Atlantic Wolffish			X			X	
Atlantic Cod (NL Population)				X			
Porbeagle Shark				X			
White Shark				X			
Roundnose Grenadier				X			
Cusk					X		
American Shad							Mid-priority
Alewife							Mid-priority
Capelin							Mid-priority
Haddock							Mid-priority
Shortfin Mako Shark					X		
Blue Shark						X	
American Eel						X	
Roughhead Grenadier						X	
Bluefin Tuna							Under review
Spiny Eel							Mid-priority
Pollock							Mid-priority
Spinytail Skate							Mid-priority
Atlantic Salmon							High priority
Ocean Pout							High priority
American Plaice (NL Population)					X		
Blue Whale	X			X			
North Atlantic Right Whale	X			X			
Fin Whale (Atlantic Population)			X			X	
Killer Whale (Nw Atl Population)						X	
Sperm Whale							Low priority
Cuvier's Beaked Whale							Mid-priority
Sowerby's Beaked Whale						X	
Harbour Porpoise						X	
Hooded Seal							Low priority
Harp Seal							Low priority
Leatherback Sea Turtle	X			X			

3.2.7 Offshore Fishery

The Newfoundland Offshore Study Area is located in NAFO Division 3L. The fishery in this area is predominantly fixed gear (crab - see Figure 10), with the most intensive fishing activity typically occurring from June through September. Other important fisheries (existing and potential) in the Study Area are shrimp, Greenland halibut, and possibly American plaice and northern cod (Husky, 2000).

Oil spill modelling trajectories developed for the White Rose EIS indicate that an oil spill occurring in the Study Area would probably disperse offshore and to the south of the Study Area. Fisheries that would most likely be affected are those around the Flemish Pass and the Flemish Cap. Modelled oil spill trajectories (see Section 5.5.2 Figure 10) also indicate that a significant overlap with the highest concentrations of fixed fishing gear would likely occur. Since icthyoplankton (fish eggs and larvae) populations similarly peak during the spring-summer season, the potential also exists for effects on fish population levels.

Figure 10 Representative Fishing Activity Near Production Sites



4.0 POTENTIAL SOURCES OF CRUDE OIL SPILLS

Marine oil spills can be categorized as either blow outs or batch spills. A blow out represents an 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. Marine oil spills that result from offshore oil well blow outs will behave very differently from instantaneous batch spills. Potential spill sources are summarized in Table 4.

4.1 Blow Outs

There are two basic kinds of offshore oil-well blow outs:

- Sub sea blow out, during which the oil is discharged from a point on the seabed, in an uncontrolled manner, and rises through the water column to the water surface; or
- Above-surface blow out in which oil discharges into the atmosphere from some point on the platform, above the water surface, and subsequently falls on the water at some distance downwind.

Subsea and above-surface oil-well blow outs generally involve two fluids: crude oil and natural gas. The volume ratios of these two fluids are a function of the characteristics of the fluids and of the pressure and temperature of the geological reservoir. The natural gas, being a compressible fluid under pressure at reservoir conditions, provides the driving force for an uncontrolled blow out. Generally, slicks resulting from an above-surface blow out are much thicker and narrower than slicks produced by sub sea blow outs and, therefore, are easier to control and recover using conventional spill cleanup equipment.

4.2 Batch Spills

A batch spill can occur due to a storage tank rupture, system failures, hose rupture, or valve failure. Batch spills are near-instantaneous, so that the oil flows quickly into the water without rapid evaporation or formation of droplets. The emulsified product will form a slick which will drift with wind and current like most medium-gravity crude oils.

Table 4 Summary Of Sources Of Significant Oil Spilled In The Marine Environment

Spill Source	Description	Risk	Type
BLOW OUT			Crude Oil
	Uncontrolled flow of gas, oil, or other well fluids from the reservoir (sub sea or at the surface) during drilling, completion, or work over.	Worst Case: 4,800 m^3/day - 90 days	
BATCH SPILLS			
Platform Process Equipment Failure	Process system upset, control system failure, or rupture of process piping equipment.	Small amounts, low risk of release to environment.	
Storage Tank Rupture	Rupture of crude oil storage tank on FPSO.	Typical Case: 32,000 m^3 - 24 hrs	
Pipeline Rupture/Tanker Loading System	Rupture of export pipeline(s) to tanker loading system or loss of connection with tanker while loading crude oil.	Typical Case Tanker Loading System (at transfer rate): 8,000 m^3/hr	
Diesel Fuel Transfer	Failure of off-loading line or connection with Supply Vessel while transferring diesel to platform.	Low volume, limited persistence on sea surface.	Diesel Oil
Base Oil Transfer	Failure of off-loading or connection with Supply Vessel while transferring base oil to platform.	Low volume, limited persistence due to degradation by sunlight and bacteria in water.	Base Oil (IPAR3)
Oil Based Mud (OBM) Transfer	Failure of off-loading or connection with Supply Vessel while transferring OBM to and from platform	Low volume, limited persistence due to degradation by sunlight and bacteria in water.	Oil Based Mud
Cuttings Discharge	Expelled from shale shaker system or via platform drainage system	Low volume, limited persistence due to degradation by sunlight and bacteria in water.	Oil Based Mud

5.0 CHARACTERISTICS OF SPILLED CRUDE OILS

The eventual fate of any hydrocarbon spilled at a drilling or production facility offshore Newfoundland will be determined by interactions of the following:

- The source, quantity, and type of oil spilled;
- The way in which the oil was discharged;
- Wind, current, and sea state conditions at the time of the spill; and
- Water and air temperature.

5.1 Oil Properties

The fate of oil spilled in the marine environment is determined by the physical properties of the oil itself. Crude oil properties that affect the behaviour of spilled oil include: Specific Gravity, Volatility, Viscosity, Pour Point and Asphaltene Content (see Chapter 1 Glossary for definitions).

5.2 Weathering Of Oil In The Marine Environment

Long-term fate of oil at sea is a function of a number of weathering processes that occur simultaneously. The processes (see Figure 11) that affect oil behaviour include:

- Spreading and Drifting;
- Evaporation;
- Dispersion;
- Emulsification;
- Sedimentation; and
- Biodegradation.

Figure 12 shows the general time frame for weathering processes; Figure 13 shows how the weathering process affects mechanical, chemical, and burning countermeasures (Evers *et al.,* 2004).

Figure 11 Fate Of Oil In A Marine Spill

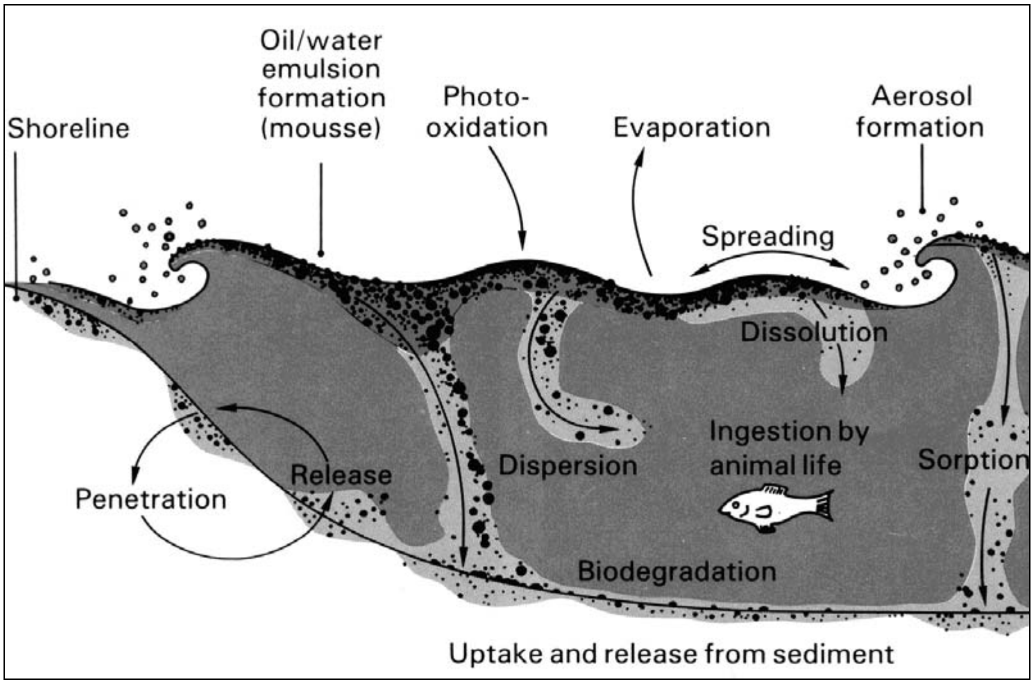


Figure 12 Weathering Processes Over Time

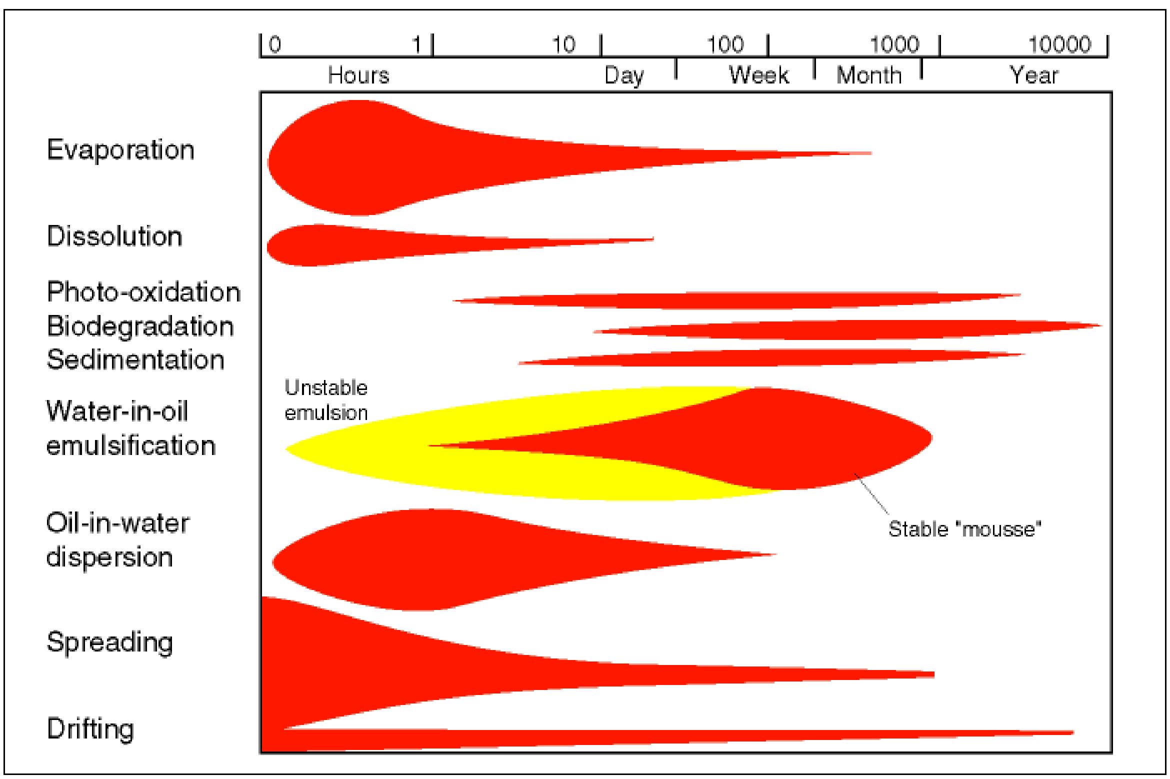
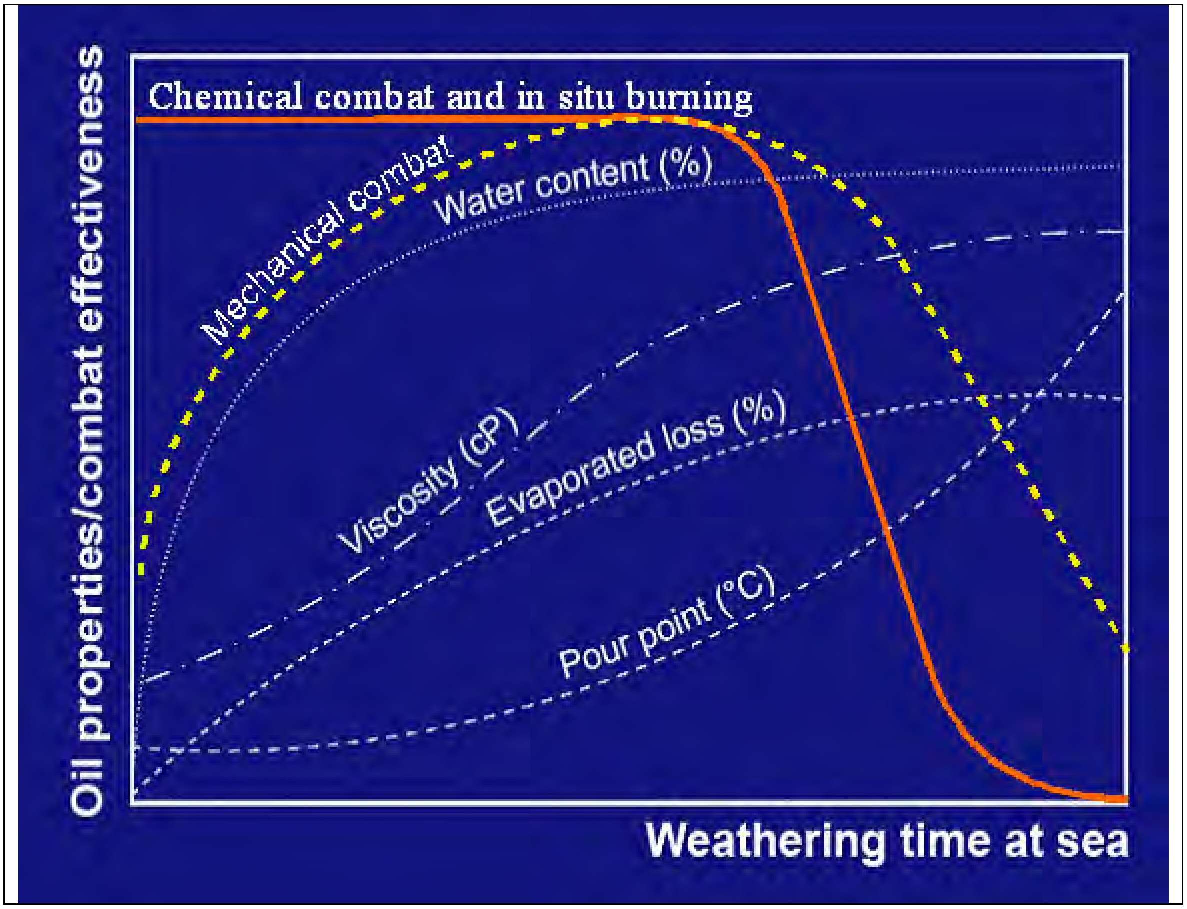


Figure 13 The Effect Of Weathering On Response Effectiveness



5.2.1 Spreading And Drifting

During the early stages of an oil spill, the oil will spread horizontally over the sea surface. The spreading rate will be affected by viscosity, pour point, wax content, sea state, and weather conditions. After a few hours, the slick will begin to break up and form narrow bands or windrows parallel to the wind direction. Slicks will normally move in the same direction, and at the same speed, as the current and will also move in the same direction as the wind, but at only 3% of the wind speed. The properties of the spilled oil do not significantly affect the drifting process. The surface oil is usually not a uniform, thin sheet of oil; it is usually composed of thick patches that contain most of the spill volume, surrounded by areas of very thin sheen.

5.2.2 Evaporation

Evaporation, while reducing oil volume, also causes an overall increase in oil density, viscosity, and pour point of the spilled oil. Qualities of specific hydrocarbons include:

- Non-persistent refined products may evaporate completely in a few hours;
- Light crude oil spills can be reduced by up to 40% in volume in the first day; and
- Heavy crude and fuel oils undergo very little evaporation.

The rate of evaporation will depend upon spreading, sea state, wind conditions, and air and sea temperatures. A large spill area, rough seas, high winds, and warm temperatures will all increase the evaporation rate.

5.2.3 Dispersion And Dissolution

Dispersion is a physical process by which oil breaks into small droplets and move from the slick into the water column. For conventional crude oil spills, oil droplets are dispersed into the water column by the high energy mixing action of waves:

- Larger droplets, which are buoyant, resurface quickly and rejoin the slick;
- Smaller droplets remain in suspension in the water column; and
- Lighter hydrocarbons partition from these droplets to dissolve in water.

5.2.4 Emulsification

When most crude oils are spilled at sea, they tend to form water-in-oil emulsions. Emulsification occurs in the presence of mixing energy such as that provided by wave action. During emulsification, small droplets of seawater form a matrix with the oil. This water intake results in a significant increase in the bulk volume of the oil (up to a ten-fold increase) and a marked increase in fluid viscosity. Spills of some conventional crude oils will start to form emulsions within a few minutes of being spilled, and will form a highly viscous and stable emulsion within hours. Most refined petroleum products do not emulsify. Many crude oils do not begin to emulsify immediately, but will emulsify after the oil has evaporated to some extent.

The potential for a crude oil to form a stable emulsion appears to be directly proportional to the concentration of asphaltenes. As the lighter fractions of a crude oil dissipate with weathering, asphaltene concentration increases and the emulsification process will begin. Typically, a stable emulsion will form at a 5% asphaltene concentration (see Table 7) (SL Ross, 2008A).

5.2.5 Biodegradation

Seawater contains a variety of marine microorganisms that, over time, metabolize hydrocarbons. Biodegradation is retarded in large, thick slicks, as the oil presents less surface area to microorganisms than when it is dispersed into small droplets.

5.2.6 Sedimentation

Some of the oil that becomes entrained in the water column may become associated with suspended particulate matter that ultimately may settle to the seabed. The amount and concentrations of hydrocarbons that reach the seabed near a spill site is a function of the amount of oil entrained in the water column, the amount and nature of particulate matter suspended in the water, the level of bacterial activity, and water depth.

5.3 Summary of Crude Oil Testing Programs

The physical properties of Grand Banks crude oils have been tested often since 1982, as a part of the environmental assessment process for production programs. These studies describe the behaviour of crude oil when spilled in the marine environment. Several testing programs have also been initiated to determine the effectiveness of the application of chemical dispersants as an oil spill countermeasure. A chronology of these testing programs is presented in Table 5. The results of these tests have been summarized in the report *Net Environmental Benefit Analysis of Dispersants for*

Cleaning Oil Spills from Production Platforms on the Newfoundland Grand Banks (S.L. Ross, 2008).

The most important spill-related properties of crude oils include density, pour point, viscosity, and dispersability. By measuring each of these parameters, as the oil becomes progressively weathered, the potential suitability and/or window of opportunity for specific response technologies may be determined. Test results indicate that crude oil density and viscosity increases with weathering, and that emulsification may limit the effectiveness of mechanical oil recovery methods and chemical dispersion.

Table 5 Historical Testing of Grand Banks Crude Oils (SL Ross, 2008A)

CRUDE OIL	YEAR	STUDY/REPORT
Hibernia	1982	Mackay, D. 1982. Emulsification properties of Hibernia Crude Oil. Preliminary Report to ExxonMobil.
	1984	S.L. Ross, Hibernia Oil Spills and their Control, for Mobil Oil Canada
	1986	Environmental Protection Agency/Environment Canada
	1989	Buist, Ian
	1999	Environment Canada
	1999	S.L. Ross. Re-examination of the properties, behaviour and dispersibility of Hibernia oil spills, for HMDC
	2002	S.L. Ross, Dispersant Effectiveness Testing in Cold Water, for U.S. Dept of Interior Minerals Management Service and ExxonMobil
	2006	SL Ross Spill related properties of Hibernia Crude oil for HMDC
	2006	S.L. Ross et al.. Dispersant Effectiveness testing on water in oil emulsions at Ohmsett for U.S. Dept. of the Interior, Minerals Management Service
Terra Nova	1996	LGL Ltd., ASL Environmental Services, and S.L. Ross, Terra Nova Environmental Impact Statement, for Petro-Canada
	2001	S.L. Ross, Spill Related Properties and Dispersant Effectiveness of Terra Nova L98-2 PG-1 Oil, for Petro-Canada
	2002	S.L. Ross, Large Tank Tests to Determine the Effectiveness of Corexit 9500 Dispersant When Applied to Terra Nova Crude Oil, for Petro-Canada
	2006	S.L. Ross, Dispersant Effectiveness Testing in Cold Water on Terra Nova and White Rose Crude Oils, for Petro-Canada and Husky Oil
White Rose	2000	S.L. Ross. Spill related properties and dispersant effectiveness of White Rose crude oil. for Husky Oil
	2001	Belore, R. The S.L. Ross oil spill fate and behaviour model: SLROSM.
	2006	S.L. Ross, Dispersant Effectiveness Testing in Cold Water on Terra Nova and White Rose Crude Oils, for Petro-Canada and Husky Oil
	2007	S.L. Ross, Spill Related Properties of White Rose (2007) Crude Oil, for Husky Oil

Prior to 1992, most crude oil testing was conducted with bench-scale testing methods using small sample volumes, making simulation of energies in an open ocean environment difficult. Test data has, therefore, been unreliable and difficult to compare between studies.

5.3.1 Recent Grand Banks Crude Oil Testing Programs

Recent large-scale wave tank (S.L.Ross, 2008A), and flume tank (Guyomarch, 2005) analyses of Grand Banks crude oils have provided more insight into the behaviour of spilled oil in open ocean conditions, which is imperative in oil spill response planning. The US National Oil Spill Response Test Facility (Ohmsett) has been useful for testing the application and performance of dispersants. However, the behaviour of spilled oils can only be studied in actual field trials, such as oil-on-water exercises conducted regularly in Norway.

The results of the most recent physical property analyses of Grand Banks crude oils are presented in Table 6 (summarized from S.L. Ross, 2008A). All samples were obtained in post-production, after offloading to shuttle tankers. The worst-case temperature conditions are presented here for the purposes of comparison, with viscosity, density and dispersability data, in order to illustrate the behaviour of Grand Banks crude oils in both the fresh and weathered states.

As crude oils become weathered by exposure to wind and wave action, a percentage is lost due to evaporation, and the density and viscosity increase as water-in-oil emulsions are formed. For all samples, except the Hibernia crude oil, this, in turn, decreased the oils amenability to chemical dispersion.

Table 6 Physical Properties of Crude Oils Tested At Ohmsett

Crude Oil Source	Year of Test	Percent Weathered (by volume)	Density (mg/L)	Weathered Viscosity (cP)	Dispersion Index (%)
Hibernia	2002	0	0.873	25	>90
Hibernia	2002	10	0.903	160	82
Hibernia	2002	20	0.923	1940	95
Terra Nova	2006	0	0.859	187	83
Terra Nova	2006	11	0.875	1824	53
Terra Nova	2006	22	0.891	2185	29
White Rose	2006	0	0.873	1037	72
White Rose	2006	10	0.888	2312	38
White Rose	2006	13	0.893	2311	35

The concentrations of asphaltenes from recent testing of Grand Banks crude oils are presented in Table 7. When spilled oil becomes weathered, the concentration of asphaltenes increases as lighter hydrocarbon fractions are lost during evaporation. Since asphaltene concentrations in the fresh crude oil are typically less than the 5%, it can be assumed than emulsions will form, but will not remain stable. More testing would be required to predict the physical properties of these types of emulsions and the resulting implications for oil spill countermeasures.

Table 7 Comparison Of Asphaltene Content Of Grand Banks Crude Oil

Crude Oil Source	Year of Sample	Ashphaltene Content (%)
Hibernia (Guyomarch, 2005)	2005	1.3
Terra Nova (Guyomarch, 2005)	2005	1.2
White Rose (S.L. Ross, 2007)	2007	0.39

5.4 Oil Spill Fate and Behaviour Modelling

Probable oil spill scenarios have been created in preparation for all drilling and production projects offshore Newfoundland, and spill behaviour predictions made using a state-of-the-art spill behaviour and fate computer model. A sample of the resulting trajectories of these hypothetical oil spills are provided in Section 5.5 . The model incorporates:

- Seasonal temperatures and winds for the scenario descriptions;
- Time-varying winds were used for the trajectory analysis; and
- Crude oil properties.

A similar approach is used for all modelling for batch spills, including transfers and tanker accidents, and for blow-outs, either above surface or subsea. Scenarios are modelled for a period of time, during summer and winter conditions, and the properties and behaviour of the oil are predicted. Offshore projects reports for which oil spill modelling was conducted in the past include:

- Hibernia Environmental Impact Statement (Mobil Oil, 1985);
- Terra Nova Environmental Impact Statement (Petro-Canada, 1996);
- White Rose Environmental Impact Statement (Husky, 2000);
- Lewis Hill (SL Ross, 2002);
- Orphan Basin (SL Ross, 2005);
- Flemish Pass Drilling Operations (SL Ross, 2008B);
- Laurentian Sub-Basin Drilling Operations (LGL, 2009); and
- East Wolverine G-37 Drilling Project Oil Spill Response Plan (LGL, 2009).

5.5 Probable Trajectories - Newfoundland Offshore Operating Area

Once spilled, oil is transported by currents and wind until it disperses in the water column, diffuses on the surface to low concentration, or contacts land. Grand Banks crude oils are generally expected to be persistent, and survival times of weeks and even months are conceivable. The main questions to be addressed in trajectory modelling are: 1) whether spills will damage Newfoundland shorelines, and 2) where will oil spilled travel in relation to fishing activities or offshore seabird populations?

This section summarizes the anticipated trajectories of oil that might be spilled from drilling or production sites in the Newfoundland Offshore Area. Presented here are trajectory model outputs for several locations which are representative of current or recent offshore activities in the study area Figure 14. The information provided here comes directly from work by SL Ross Environmental for the following locations:

- **Orphan Basin** (SL Ross, 2005) - Chevron Great Barasway drilling program Environmental Assessment;
- **Flemish Pass** (SL Ross, 2008B) - StatoilHydro Mizzen drilling program Environmental Assessment;
- **North East Grand Banks A** (SL Ross, 2007B) – Husky multi-site drilling program Environmental Assessment;
- **North East Grand Banks B** (SL Ross 2007B) – Husky multi-site drilling program Environmental Assessment;
- **Jeanne d'Arc Basin** (Husky 2000) – Husky Energy White Rose Oilfield Comprehensive Study; and
- **South West Grand Banks** (SL Ross, 2002) – Husky Lewis Hills drilling program Environmental Assessment. This location is also somewhat representative of the site for the 2010 ConocoPhillips Laurentian Basin drilling program.

The source documents for each of these are cited in the references in Part 1 of this series and should be consulted for a more detailed explanation of the nature of batch spills and blow outs and the differences in behaviour of specific oil types.

The modelling approach for each of these sites is described in Section 5.5.1 . The approach is stochastic with the intention of providing the probability of oil transport for each calendar month, based on historical wind data. Descriptions of the trajectory model input parameters are provided in Table 8. Representative stochastic model outputs are presented for all sites in Figure 15 (April) and Figure 16 (August). April and August represent the months when weather conditions, and therefore spill trajectories, are most variable and most consistent, respectively.

5.5.1 Modelling Approach

The objective of trajectory modelling from an environmental assessment perspective is to present a graphical representation of the percent probability of oil spilled at each location reaching any other location offshore Newfoundland over a thirty-day period. Model outputs are presented as monthly probability maps. Trajectory data have been processed to identify the likelihood of a slick reaching a given area on the Grand Banks. The slick movements for all spills released in each month have been processed to identify the percent of the spills released in the month that enter any cell in a 1 km x 1 km grid.

At every point in time during the modelling process, the motion of the floating oil was determined by calculating the dead reckoning position of the centre of the slick based on an oil velocity vector and the time interval since the previous position. Velocity vector components were determined as:

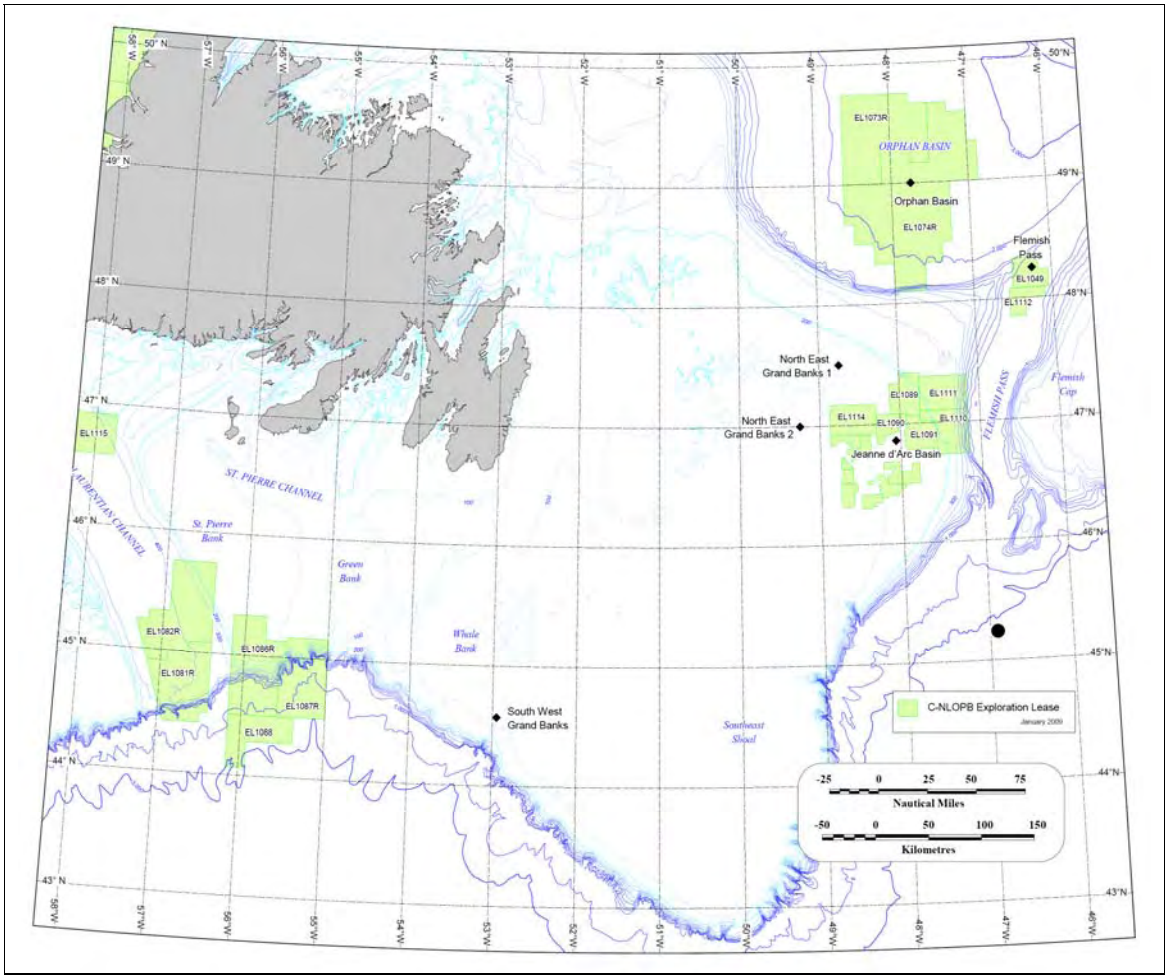
- 100% of the surface current velocity; and
- 3% of the wind velocity.

A release of oil was tracked for every day of the year, for the respective years of available wind data. Modelled spills were tracked until they either:

- Dispersed from the surface;
- Were on the surface a minimum of 30 days and diffused to an average concentration on the surface of less than 1 g oil per 25 m^2 of surface area; or
- Exited the study boundaries.

These criteria were used as they are all conditions at the end of the slick life that are unlikely to generate impacts.

Figure 14 Locations Selected for Trajectory Modelling



5.5.2 Site-Specific Oil Spill Modelling

The technique used in modelling spill trajectories is based on wind and current data sets and graphically illustrates the movement of spilled oil. A 10,000 m^3 batch spill was selected for the Jeanne d'Arc Basin (White Rose) site analysis because:

- It represents a large batch spill from an offshore storage site;
- It is the same size used in similar modelling for the Terra Nova and Hibernia assessments; and
- It is the largest spill size used for planning purposes under the *Canada Shipping Act Response Organizations Standards*.

For all other locations, the spill modelled was a surface blow out as this would be a worst-case scenario for an offshore drilling location.

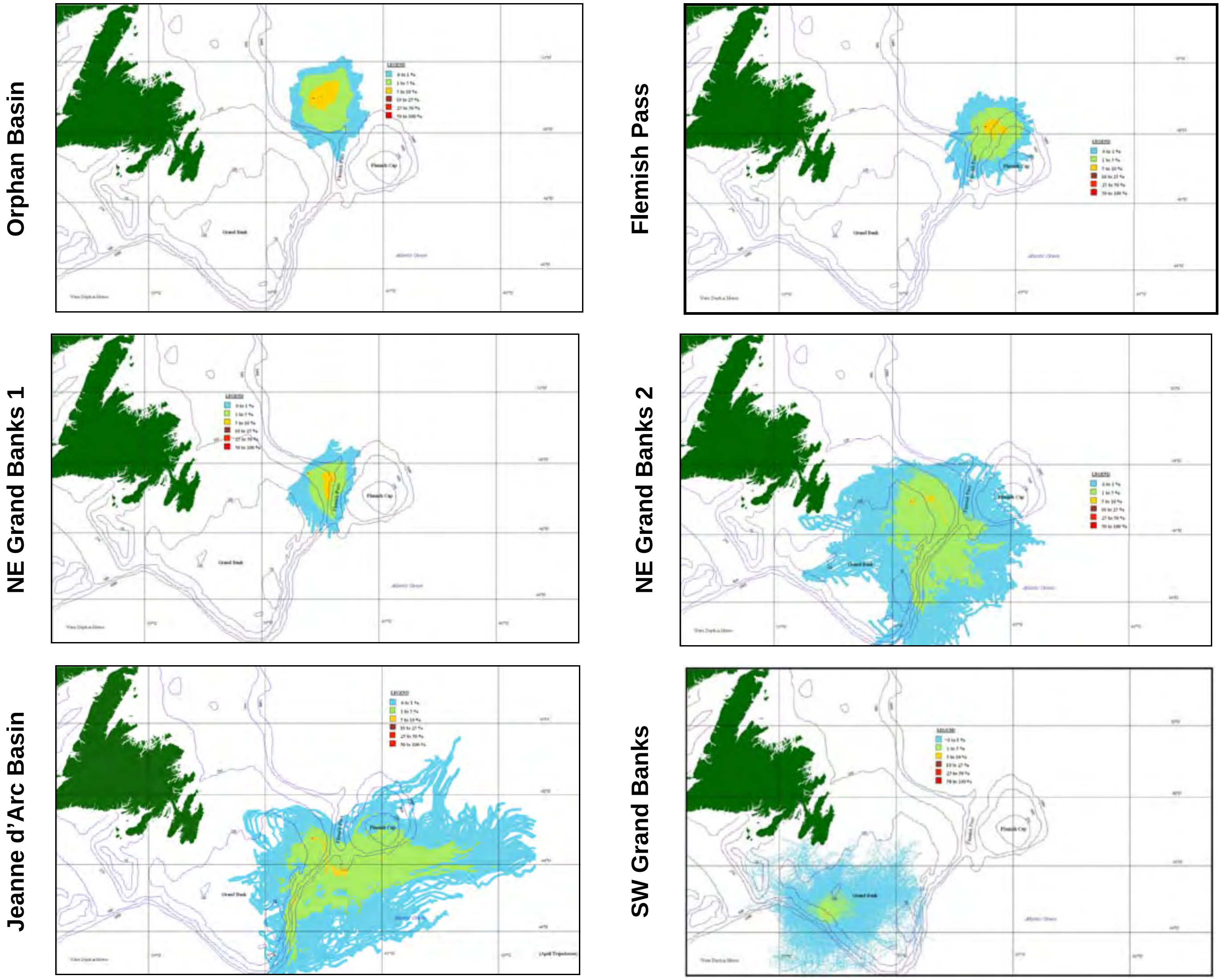
5.5.3 Stochastic Trajectory Input

The 40-year AES40 wind data set was prepared by the U.S. National Centres for Environmental Prediction (NCEP) and the U.S. National Centre for Atmospheric Research (NCAR) and was used for the South-West Grand Banks and Jeanne d'Arc and Orphan Basin models. An updated version of the AES40, the MSC50 wind data set (Swail et al., 2006) was used for all more recent modelling. Current input was either the 1995 International Ice Patrol (IIP) surface current normals or a more recent surface current data set assembled by the North West Atlantic Fisheries Centre (NFAC) of the Department of Fisheries and Oceans (Han, 2007).

Table 8 Parameters For Stochastic Trajectory Models

	Orphan Basin	**Flemish Pass**	**North-East Grand Banks 1**	**North-East Grand Banks 2**	**Jeanne d'Arc Basin**	**South-West Grand Banks**
Model Date	2005	2008	2007	2007		
Latitude	49.0° N	48.25°N	47.5°N	47.0°N	46.86° N	44.57°N
Longitude	47.75° W	46.25 °W	47.6°W	49.25°W	48.06° W	52.95°W
Spill Type	Blowout	Blowout	Batch	Batch	Batch	
Spill Size	5000 m^3/d	5000 m^3/d			10,000 m^3	
Trajectories	14,600	19,032	19,032	19,032	4,600	
Wind Data Input	AES40 40 years 6-hourly	MSC50 52 years 6-hourly	MSC50 52 years 6-hourly	MSC50 52 years 6-hourly	AES40 40 years 6-hourly	AES40 40 years 6-hourly
Current Data Input	IIP 1995	NAFC 2007	NAFC 2007	NAFC 2007	IIP 1995	IIP 1995
Shoreline Impact?	No	No	No	No	No	Yes - x

Figure 15 April Trajectories from Six Offshore Newfoundland Sites

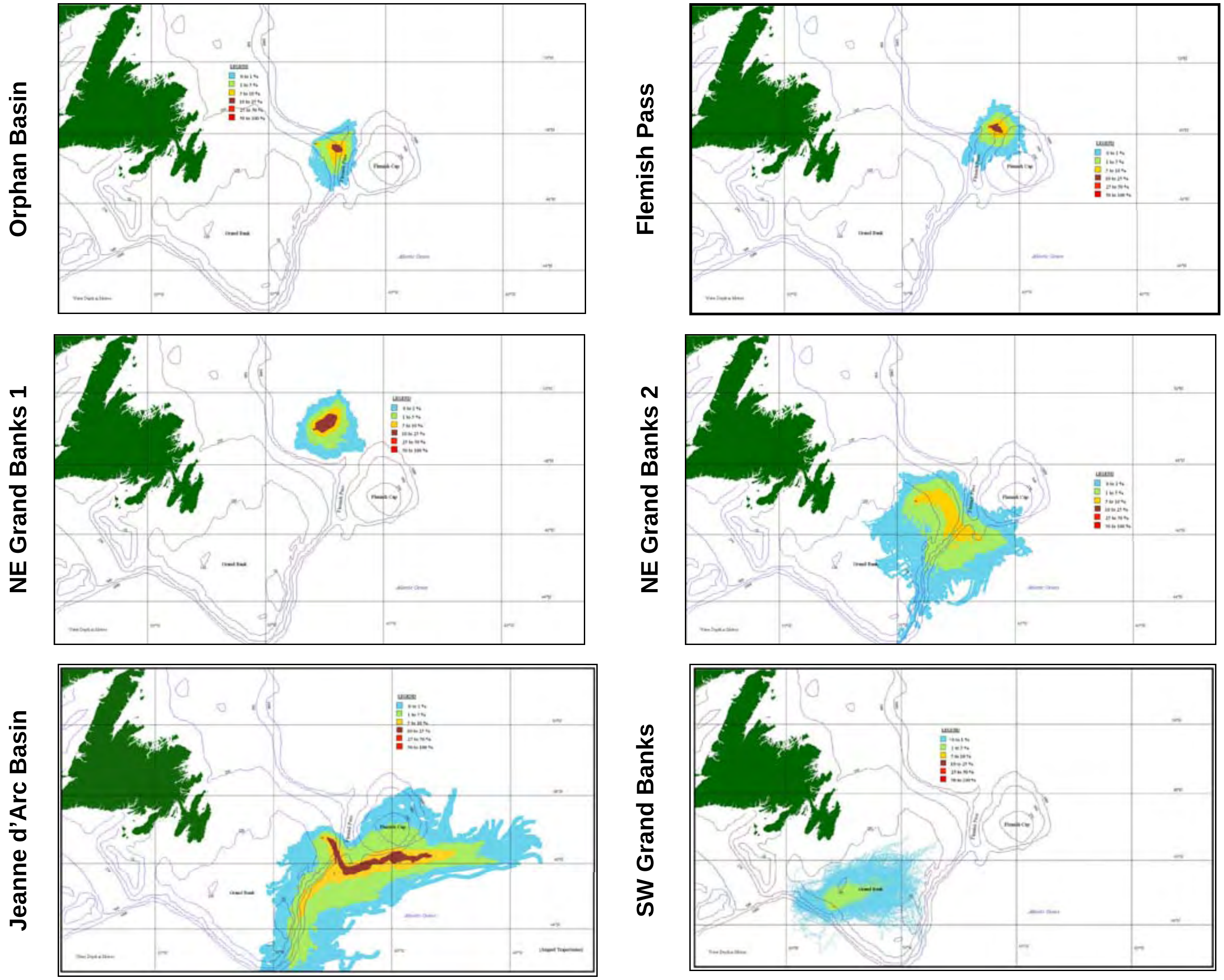


LEGEND

Probability (%) of oil transiting a grid cell

Red	50-100
Orange	25-50
Brown	10-25
Yellow	5-10
Green	1-5
Blue	<1

Figure 16 August Trajectories from Six Offshore Newfoundland Sites



LEGEND

Probability (%) of oil transiting a grid cell

Red	50-100
Orange	25-50
Brown	10-25
Yellow	5-10
Green	1-5
Blue	<1

5.6 Trajectory Example – 10,000 m^3 Hibernia Spill

The purpose of this section is to describe the fate of a hypothetical 10,000 m^3 spill from the Hibernia platform in specific, not statistical, conditions.

5.6.1 Scenario Development

The information below is based on a trajectory modelling exercise undertaken by S.L. Ross on behalf of Cormorant Ltd., using Hibernia crude weathering properties and historical weather records.

Hibernia oil, as loaded to tanker, is relatively light, non-waxy, and generally conventional in properties. The oil has a very low interfacial tension due to the addition of surfactants during processing prior to loading. The behaviour and persistence of this oil once spilled will depend on how quickly the surfactants leach from the oil. For this scenario, it is assumed that Hibernia crude will quickly lose the surfactant and the oil will regain a "normal" interfacial tension, and will form water-in-oil emulsion upon release. This creates a more persistent spill upon which cleanup countermeasures can be assessed.

5.6.2 Spill Characteristics

On June 6, a tanker loading at Hibernia spills 10,000 m^3 of crude oil within an hour.

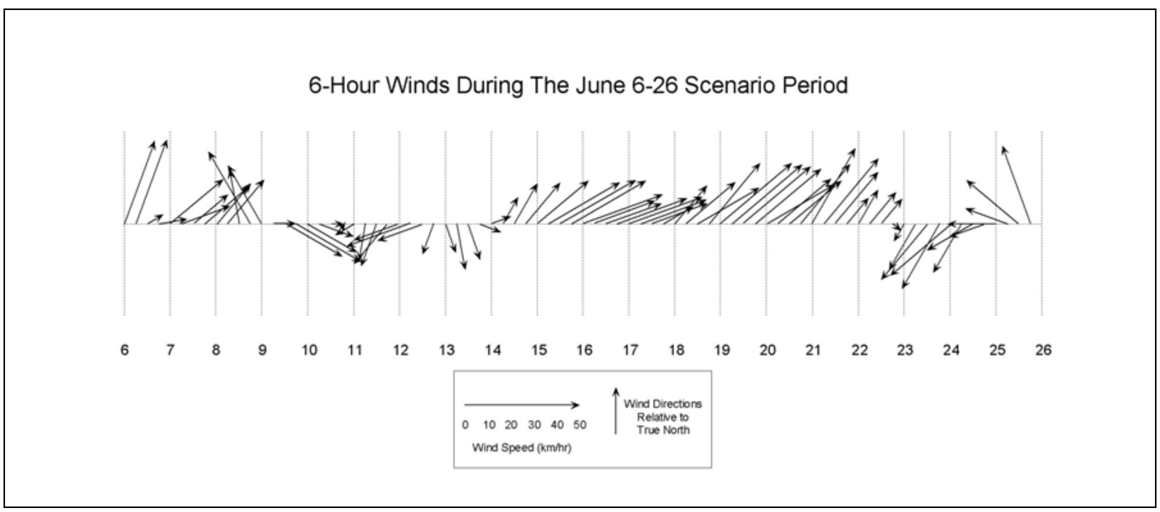
Table 9 Conditions At The Time Of The Spill

Amount Spilled:	10,000 m^3	***Fresh Oil Density***	858 kg/m^3
Air Temperature	5°C	***Fresh Oil Viscosity***	63 cP
Water Temperature	5°C	***Fresh Oil Pour Point***	-7.7°C

5.6.3 Weather Conditions

Historical winds (AES-40) for the month of June were selected for use in this scenario. These winds are typical for this season, with speeds ranging from 5 to 50 kilometres per hour. Figure 17 shows the wind speed history used in the spill modelling.

Figure 17 Wind Speed Record Used In Spill Fate Modelling

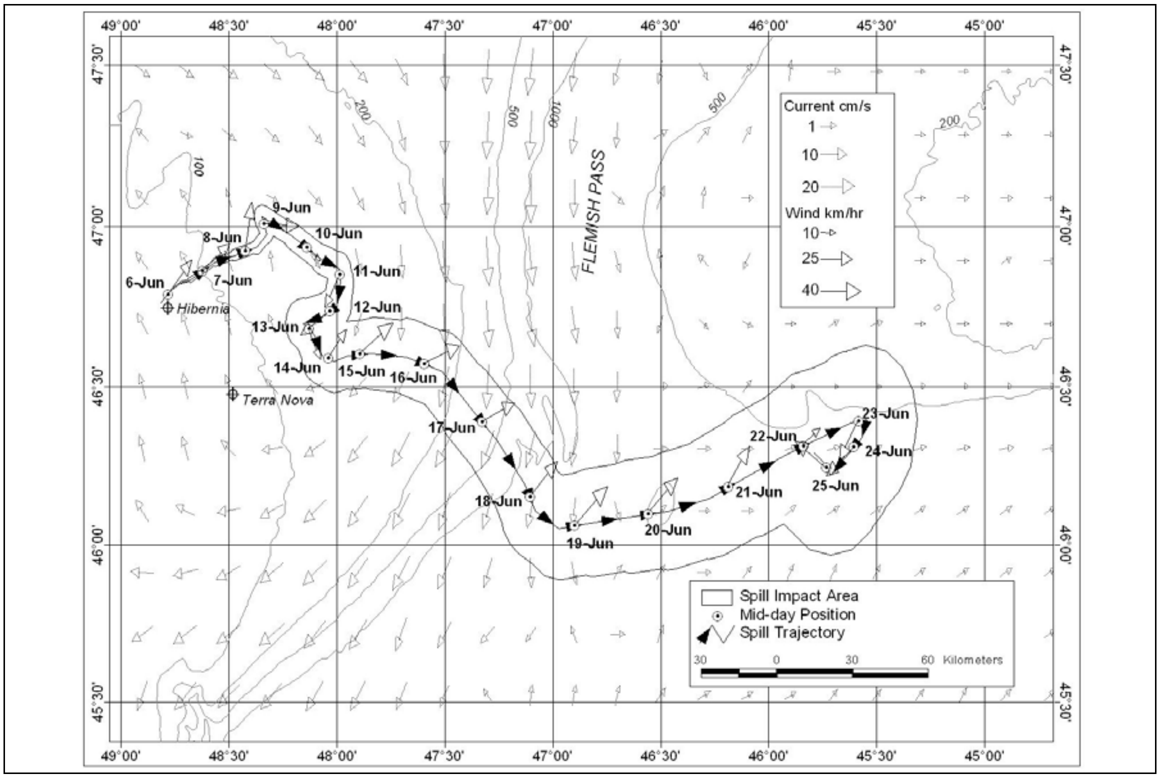


5.6.4 Fate Of The Spilled Oil

Over the scenario period, the spilled oil weathers naturally. Important processes include spreading, evaporation, and natural dispersion into the water column. A key element of this scenario is the rapid emulsification of the oil. Based on the sea conditions at the time, after the first 6 hours of exposure, the slick will emulsify to 75% water content and the viscosity will rise to about 3000 cP. Viscosity continues to rise slowly as the oil continues to evaporate. Table 10 shows the daily chronology of the weathering process.

Figure 18 shows how the oil drifts and spreads with the wind and current during the scenario period. On two occasions, the prevailing South-West winds are interrupted by weather systems which result in winds from the North-East and South-East. Also shown is the potential area of impact by the spill due to spreading of the slick. This area is defined by the "Okubo Area" as described in Section 5.6.7 .

Figure 18 Predicted Trajectory and Extent Of Spilled Oil



5.6.5 Slick Cohesiveness

The oil slick will start as a fairly continuous sheet of thick oil followed by a large area of upwind sheen. Generally, 90% of the slick area is thin oil or sheen, and 10% of the area is thick. Early on, the thick downwind slick will remain relatively cohesive. As days pass and storm fronts move through the slick, the thick oil will be broken into smaller and smaller patches that slowly create a mosaic of oil patches, surrounded by areas of thin oil or sheen and open water.

Table 10 Characteristics Of Spilled Oil During The Scenario Period

Date	**Area Covered**										**Emulsion**						**Natural Remediation Of Spilled Oil**		
	Total Area Affected (Spill Area)	Total Area Oiled	Thick Oil Area		Thick Oil Patchiness: Diameter	Thick Oil Patchiness: Separation	Thin Oil Area		Open Water Area		Surface Emulsion Volume	Volume of Oil in Surface Emulsion		Emulsion Thickness	Average Emulsion Coverage	Emulsion Viscosity	Remaining on Surface	Evaporated	Dispersed
	(km^2)	(km^2)	(km^2)	(%)	(m)	(m)	(km^2)	(%)	(km^2)	(%)	(m^3)	(m^3)	(%)	(mm)	(mm)	(cP)	(%)	(%)	(%)
June 06		4.5	0.5	11%			4	89%	0	0%	9,996	10,000	100%	20.00	2.2222	63	100%	0%	0%
June 07		10.4	0.8	7%	200.00	750.0	10	93%	0	0%	36,923	9,240	25%	48.14	3.5542	3,507	92%	6%	2%
June 08		15.0	0.9	6%	100.00	580.0	14	94%	0	0%	34,264	8,580	25%	37.97	2.2845	4,296	86%	9%	5%
June 09	35.1	16.6	1.0	3%	55.00	430.0	16	44%	19	53%	32,402	8,116	25%	32.22	0.9223	4,823	81%	11%	8%
June 10	68.9	16.7	1.1	2%	30.00	320.0	16	22%	52	76%	29,617	7,420	25%	27.25	0.4300	5,371	74%	12%	13%
June 11	116.1	16.8	1.2	1%	20.00	240.0	16	13%	99	86%	28,285	7,087	25%	24.52	0.2436	5,702	71%	13%	16%
June 12	177.9	16.8	1.2	1%	18.00	180.0	16	8%	161	91%	27,533	6,899	25%	22.77	0.1548	5,942	69%	13%	17%
June 13	255.1	16.8	1.2	0%	15.00	130.0	16	6%	238	93%	25,956	6,505	25%	21.46	0.1017	6,284	65%	14%	21%
June 14	348.7	16.8	1.2	0%	10.00	80.0	16	4%	332	95%	25,223	6,321	25%	20.86	0.0723	6,507	63%	14%	22%
June 15	459.4	16.8	1.2	0%	3.00	50.0	16	3%	443	96%	24,455	6,129	25%	20.22	0.0532	6,715	61%	15%	24%
June 16	587.8	16.8	1.2	0%	1.00	25.0	16	3%	571	97%	21,719	5,445	25%	17.96	0.0369	7,065	54%	15%	30%
June 17	734.7	16.8	1.2	0%	0.80	20.0	16	2%	718	98%	19,230	4,823	25%	15.90	0.0262	7,395	48%	16%	36%
June 18	900.6	16.8	1.2	0%	0.50	15.0	16	2%	884	98%	16,884	4,237	25%	13.96	0.0187	7,716	42%	16%	42%
June 19	1,086.0	16.8	1.2	0%	0.30	10.0	16	1%	1,069	98%	15,313	3,844	25%	12.66	0.0141	7,978	38%	16%	45%
June 20	1,292.0	16.8	1.2	0%	0.20	8.0	16	1%	1,275	99%	12,016	3,020	25%	9.94	0.0093	8,361	30%	17%	53%
June 21	1,518.0	16.8	1.2	0%	0.10	4.0	16	1%	1,501	99%	9,613	2,419	25%	7.95	0.0063	8,735	24%	17%	59%
June 22	1,766.0	16.8	1.2	0%	0.08	3.0	16	1%	1,749	99%	7,013	1,769	25%	5.80	0.0040	9,166	18%	17%	65%
June 23	2,035.0	16.8	1.2	0%	0.05	2.0	16	1%	2,018	99%	5,063	1,281	25%	4.19	0.0025	9,622	13%	17%	70%
June 24	2,326.0	16.8	1.2	0%	0.03	2.0	16	1%	2,309	99%	4,427	1,122	25%	3.66	0.0019	9,928	11%	17%	72%
June 25	2,640.0	16.8	1.2	0%	0.02	1.0	16	1%	2,623	99%	2,045	527	26%	1.69	0.0008	10,669	5%	17%	77%
June 26	2,976.0	16.8	1.2	0%	0.01	0.5	16	1%	2,959	99%	969	258	27%	0.80	0.0003	11,572	3%	17%	80%

5.6.6 Oil Spill Phases

The oil spill can be divided into phases based on the characteristics and location of the slick over time. Key considerations in determining the geographic description of each phase include: the distribution of oil on the surface; the surface dynamics that are transporting and weathering the oil; and whether or not the slick is in Canadian waters.

Figure 19 presents the daily distribution of oil in terms of percentages of thick oil, thin oil and open water within the spill area. The daily distribution of oil can be interpreted as four phases. The first phase covers the first three days of the trajectory and is based on an absence of open water. The second phase is the period when a noticeable proportion of thick oil remains on the surface. In the third phase, the spill is under the influence of the Labrador Current and then the Gulf Stream, where horizontal transport and dispersion are accelerated. In the fourth phase, the oil is removed from the surface as it has been dispersed naturally into the water column.

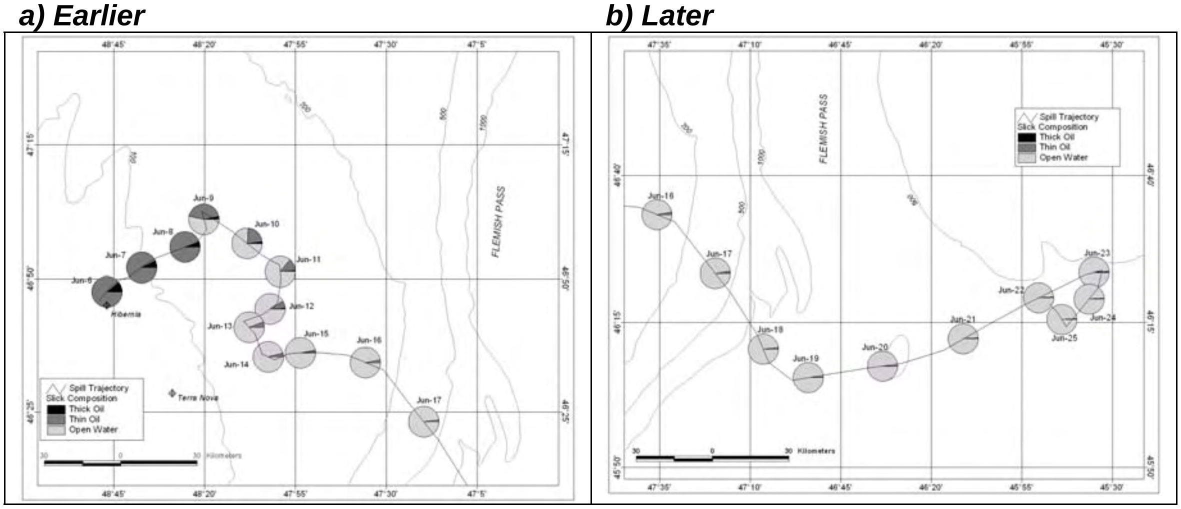
5.6.7 Distribution Of Oil Within The Spill Area

Using the SL Ross model, there are two ways of attempting to quantify oil distribution. The first method involves estimating the likely extent of the zone over which the oil patches will be spread and comparing this to the actual area of the thick oil patches or the volume of emulsified oil remaining. Using a simple oceanic diffusion model (Okubo, 1971), the possible total extent of the spill area can be estimated. An average oil thickness can be determined and then be used to calculate oil encounter rates for countermeasures operations, etc..

A second way of quantifying the possible oil distribution is to assume an average thick oil patch size and calculate the spacing between patches, if they were uniformly distributed throughout the spill area. Slick coverage and oil patch separation are more appropriate after the spill has been subjected to weathering and can no longer be considered a single oil slick. Figure 19 shows oil coverage and slicklet spacing estimates for this spill as time progresses. After 5 days, the average emulsion coverage will only occupy less than 1% of the area influenced by the spill at this time. If the average thick oil patch size is assumed to be about 20 metres on a side after 5 days, the oil patches will be separated by about 240 metres of sheen or open water.

Figure 19 Trajectory Scenario – Oil Distribution Over Time

a) Earlier ***b) Later***



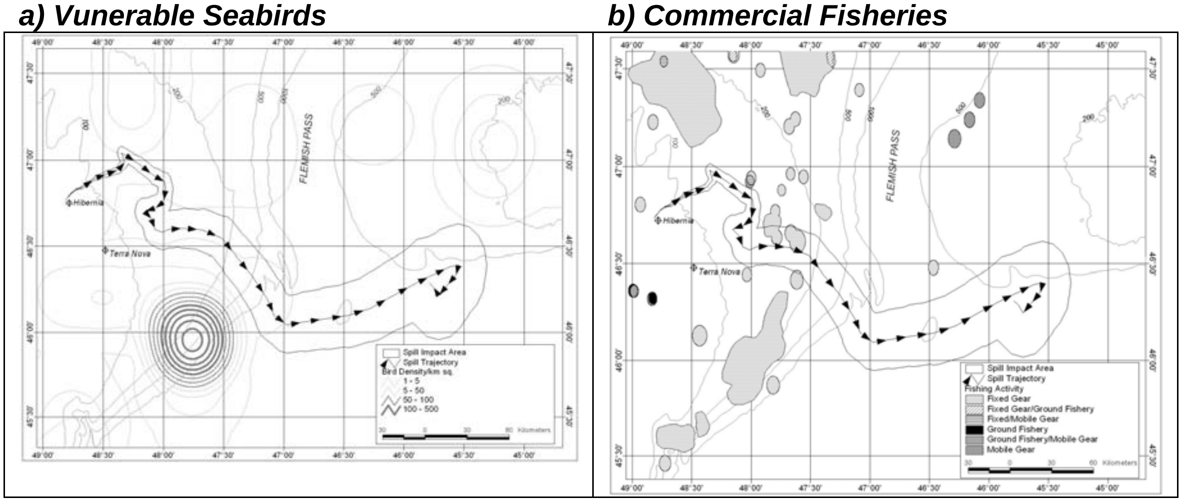
5.6.8 Environmental Resources At Risk

Figure 20(a) shows anticipated concentrations of "vulnerable" seabirds in June, based on a Canadian Wildlife Service compilation of past offshore bird observations (Lock *et al.*, 1995). For this presentation, the CWS data has been contoured to show a continuous picture of bird distribution.

The eastern margin of the Grand Banks is an important fishing area supporting active Canadian and International groundfish, shrimp, and crab fisheries. Figure 20(b) shows the distribution of fisheries in June 2000 based on gear type. This information was compiled by Canning and Pitt and is based on DFO catch records. Crab traps are the principal fixed gear fishery in the area although there could be some set gillnets for groundfish. Mobile gear is used in the groundfish and shrimp fisheries. Based on trajectories for this hypothetical scenario, it would seem likely that the spill or response equipment would encounter vulnerable seabirds or commercially important fisheries resources.

Figure 20 Environmental Resources At Risk

a) Vunerable Seabirds ***b) Commercial Fisheries***



MARINE HYDROCARBON SPILL RESPONSE CAPABILITY ASSESSMENT JEANNE D'ARC BASIN PRODUCTION OPERATIONS

CHAPTER 3 – OTHER OIL SPILL RESPONSE PROGRAMS

Prepared For:

Canadian Association of Petroleum Producers
403, 235 Water Street
St. John's, NL
CANADA
A1C 1B7

On Behalf Of:

Suncor Energy
235 Water Street
St. John's, NL
CANADA
A1C 1B6

Husky Energy
235 Water Street
St. John's, NL
CANADA
A1C 1B6

Hibernia Management and Development Company
Suite 1000, 100 New Gower Street
St. John's, NL
CANADA
A1C 6K3

Prepared By:

Cormorant Ltd.
280 B Water Street
St. John's, NL
CANADA
A1C 1B7

Lorax Environmental
Suite 504, 215 Water Street
St. John's, NL
CANADA
A1C 6K3

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1.0 INTRODUCTION

Oil spill preparedness programs must address the need for the escalation of oil spill response operations as the scale of the incident increases. Whether the operation is offshore production, marine terminal activities, marine operations, pipeline operations, or terrestrial operations, the concept of a tiered approach will apply.

A **Tier 1** spill poses the least threat of impact, and can be managed using resources available on site.

A **Tier 2** spill response requires local shore-based support and/or contract resources in addition to those offshore already.

A **Tier 3** oil spill has the potential to affect the Operator and shareholder company business operations. A Tier 3 response involves considerable corporate and contract resources, drawn from local, regional, and international sources.

The challenge in preparing for escalation has been the difficulty individual operators have in developing an effective and affordable Tier 2 response capability. While the effort required to prepare for the small events that would constitute Tier 1 responses is feasible, individual operators have often been unable to manage the stockpiling of sufficient additional resources to supplement Tier 1 preparations. This is especially the case in remote areas where mutual aid is impractical. The potential impact of very large oil spills on the environment, operator reputation, and the responsible party's longer term business has resulted in the creation of large international oil spill response contractors that can provide a Tier 3 capability. Such contractors are always located in a central location. For subscribers close by, the Tier 3 stockpile can be used in the initial Tier 2 escalation. This is, however, an impractical Tier 2 solution for remote or international subscribers.

In this section, several examples of industry efforts to develop a cooperative Tier 2 oil spill response capability are reviewed and evaluated in the context of the Newfoundland offshore industry's situation.

1.1 Tier 3

Before reviewing representative Tier 2 arrangements, this section briefly discusses examples of Tier 3 arrangements made both at international and industry levels.

1.1.1 International Conventions

At the highest level, conventions define how countries will work together in the event of a pollution event that spans international boundaries. An example of this is the Bonn Agreement which ensures mutual cooperation between nations in the avoidance and combating of environmental pollution in the European Community in general and in the North Sea in particular. Under the Bonn Agreement, oil spill response vessels from the Netherlands, Germany, Norway, France, and Denmark were sent to Spain to assist in the offshore response to the Prestige spill in 2002 - 2003.

1.1.2 International Agencies

In some cases, the Tier 3 capability is provided by regional cooperatives of national or private resources. Such arrangements result from the mutual need of several national stakeholders in a clearly-defined geographic area.

Examples of international oil spill response associations include:

- Helsinki Commission - HELCOM (Baltic Sea);
- CARICOM (Caribbean Sea);
- ROPME (Middle East);
- Regional Marine Pollution Emergency Response (REMPEC) Centre for the Mediterranean Sea;
- Convention on the Protection of the Black Sea Against Pollution; and
- Global Initiative – West and Central Africa (WACAF).

1.1.3 Industry Cooperatives

Industry has created a Tier 3 capability through the development of large scale oil spill response cooperatives. These are owned jointly by several major oil companies having a mutual interest in an oil spill response service that can mobilize extended resources over a broad geographical region. Many of these cooperatives have formed an alliance, the Global Response Network (GRN), to provide a Tier 3 mutual aid opportunity. The GRN also provides a framework between member organizations that allows all to improve benchmarking and knowledge-sharing. Members of the GRN (see Figure 1) include:

- Oil Spill Response (OSR);
- Marine Spill Response Corporation (MSRC);
- Alaska Clean Seas (ACS);
- Australian Marine Oil Spill Centre (AMOSC);
- Clean Caribbean and Americas (CCA);
- Eastern Canada Response Corporation (ECRC); and
- Western Canada Marine Response Corporation (WCMRC).

Figure 1 Participating GRN Companies

1.2 Tier 2 Response Organization Reviews

Four industry oil spill response cooperatives are reviewed in this section:

- Norwegian Clean Seas Association for Operating Companies (NOFO);
- Australian Marine Oil Spill Centre (AMOSC);
- Alaska Clean Seas (ACS); and
- Western Canadian Spill Services (WCSS).

NOFO provides direct support to the Norwegian offshore industry in a marine environment that is very similar to conditions offshore Newfoundland. NOFO provides an example of an industrial oil spill response program that is fully developed to include its own equipment and training standards. Close partnerships with suppliers and the shipping industry ensure that equipment is developed to meet local operating conditions (NOFO, 2008). While there are similarities in operating conditons in Norway and Newfoundland, NOFO has been developed to serve a much larger offshore industry than is found offshore Newfoundland.

AMOSC is a subsidiary of the Australian Institute of Petroleum and provides direct support to all Australian marine industries, especially offshore oil and gas production. AMOSC illustrates an efficient method of pooling and sharing industry and government resources in a setting where oil-related activities are spread over an extensive geographical area (AMOSC, 2002).

ACS is an example of a response organization which supports an oil industry operating in harsh environmental conditions. ACS supports both onshore and offshore operations within North America in an area where industry must operate generally independent of public sector preparedness (ACS, 2008).

WCSS provides an example of a ooperative solution to oil spill preparedness in the Canadian upstream oil industry. WCSS has developed consistent equipment, planning, and training standards that are in use by over 50 companies in 18 individual cooperatives (WCSS, 2009).

In the following sections, each organization will be discussed in detail. Ownership, management, equipment specification, and training programs are described.

Brief reviews of East Coast Spill Response Inc. (ESRI) and the Beaufort Sea Oil Spill Cooperative (BSOSC) are also included to illustrate the historical Canadian offshore industry oil spill preparedness model.

1.3 Response Organization Summary

All of the reviewed response organizations support larger production operations than the Newfoundland offshore industry (see Table 1). Each has been established to meet the needs of the oil industry in the context of the local environment, level of production operations, and regulatory regime. While none of these models is exactly applicable to the small production base and environment of offshore Newfoundland, each model offers insight to some of the issues encountered by the Newfoundland operators.

Table 1 Reviewed Response Organizations – Operating Environment

	Environmental	Geographic Description	Production Rate – Crude (bbl/day)	Operators	Active Facilities Supported
NOFO (Norway)	• Offshore • Oceanic conditions • Climate range from temperate to arctic • Much in field infrastructure	• 80,000 km of exposed coastline • Offshore area ~2,000 long	• 3,000,000 (2009, Kystverket)	• 21 member companies	• 8 producing fields in Central North Sea • 15 producing fields in Northern North Sea • 1000s of km of pipelines • Crude oil, gas production
AMOSC (Australia)	• Near shore • Offshore • Exposed shorelines • Coral reefs • Fields very separate	• Entire Australian coast line • Offshore production off NW coast and in Bass Strait in SE • Many exposed coastlines	• ~500,000 (2008, Geology news)	• 9 participating companies • 17 associated companies	• Crude oil, condensate, and gas production • Major fields in Bass Strait (Victoria), Timor Sea (Northern Territory), and Carnarvon Basin (Western Australia)
ACS (Alaska)	• Near shore and terrestrial • Delicate arctic ecology • Concentrated activity	• Small area • North slope of Alaska	• >650,000 • (Reuters – 2009 est.)	• 11 member companies	• 1000s of km of pipelines • 1000s of wells (most onshore) • Gas and oil production
WCSS (Western Canada)	• Terrestrial • Prairie climate	• All of Alberta • Parts of BC and Saskatchewan	• >527,000 (Alberta/ NE BC - CAPP 2009)	• 50 member companies • 18 local cooperatives	• Extensive pipeline infrastructure • 1000s of wells • Oil and gas production
Jeanne d'Arc Basin	• Offshore • Oceanic conditions • Remote	• Small production area • No exposed coastline	• < 343,000 (CAPP 2009)	• 3 production operators	• 3 producing fields in basin • Crude oil • 3 production platforms • Associated drilling • Subsea flow lines at each site – no pipelines

2.0 NOFO

The oil spill response regime in Norway is based on three principal elements: the private sector, national government agencies, and community input at the municipal level. Private industry is responsible for the response when an oil spill is the result of offshore operations on the Norwegian Continental Shelf. Municipalities are responsible when spills result from coastal operations in harbours or at marine terminals. The Norwegian Government, through the Norwegian Coastal Authority (NCA), is responsible for oil spills from ships, or activities not covered by industry or municipalities. Each element has its own individual oil spill response capability. The responsibilities and capabilities of each element are integrated so that mutual support is optimized (Jorgensen, 2004).

NOFO was formed following the Bravo blow-out in the North Sea in 1977 (NOFO, 2008).

2.1 NOFO Structure

NOFO is an offshore oil and gas industry response cooperation aimed at establishing and maintaining oil spill preparedness for operators on the Norwegian Shelf. Services provided to member companies include: oil spill response, oil spill preparedness, environmental consulting, and research and development (Jorgensen, 2004).

NOFO is financed by members according to cost sharing principles that are based on the level of each member's holdings and activity. All NOFO member companies (see Table 2) are represented in the General Assembly, the NOFO governing body that approves strategy and budget (NOFO, 2008).

Table 2 NOFO Member Companies (General Assembly)

Eni Norway AS	Petro-Canada Norway Inc.	Chevron Norway AS
ConocoPhilips Norway	Marathon Petroleum Co. (Norway)	Wintershall Norway ASA
BP Norway AS	Endeavor Energy Norway AS	Hess Norway AS
GDF SUEZ E&P Norway	Norwegian Energy Company ASA	StatoilHydro ASA
BG Norway Ltd.	The Norwegian Oil Company, ASA	Total E&P Norway AS
DONG E&P Norway AS	Exxon Mobil E&P Norway AS	A/S Norwegian Shell
RWE Dea Norway AS	Talisman Energy Norway AS	Lundin Norway AS

NOFO organization is presented in Figure 2. A Board of Directors is elected annually and consists of five members of the General Assembly. The Board handles organizational policy, implementation of strategy, and work programs. NOFO's Managing Director oversees day-to-day activities and the three NOFO divisions (Environment, Operations, and Administration). Approximately 20 personnel are based at NOFO Headquarters in Stavanger (NOFO, 2008).

As shown in Figure 2 and Figure 3, NOFO equipment is staged in five depots at onshore supply bases, at the StatoilHydro refinery in Mongstad, and on multipurpose standby vessels at four strategic locations in the Norwegian North Sea Sector. Approximately 80 NOFO employees are required to man the onshore depots (NOFO, 2008).

Figure 2 NOFO Organization

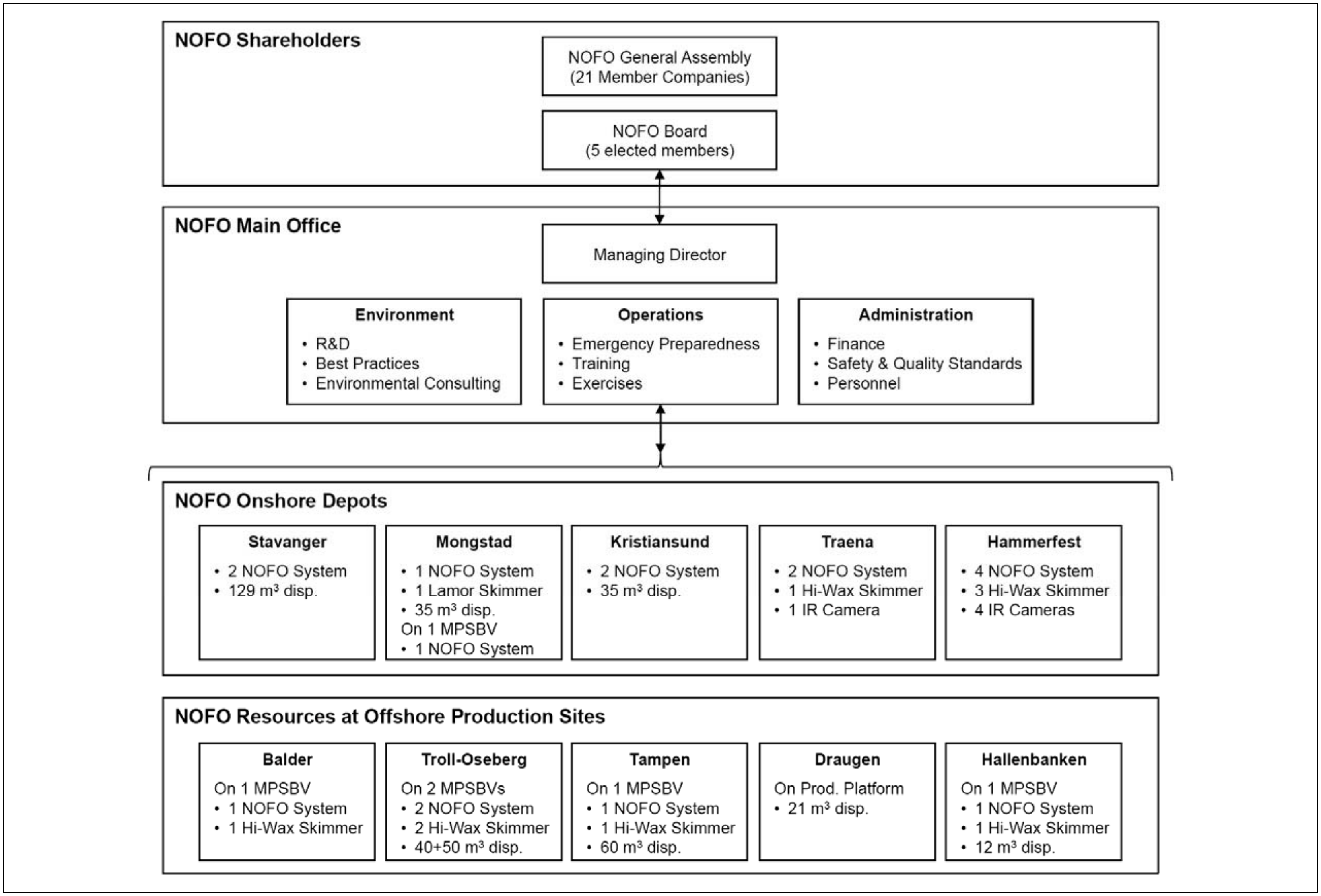
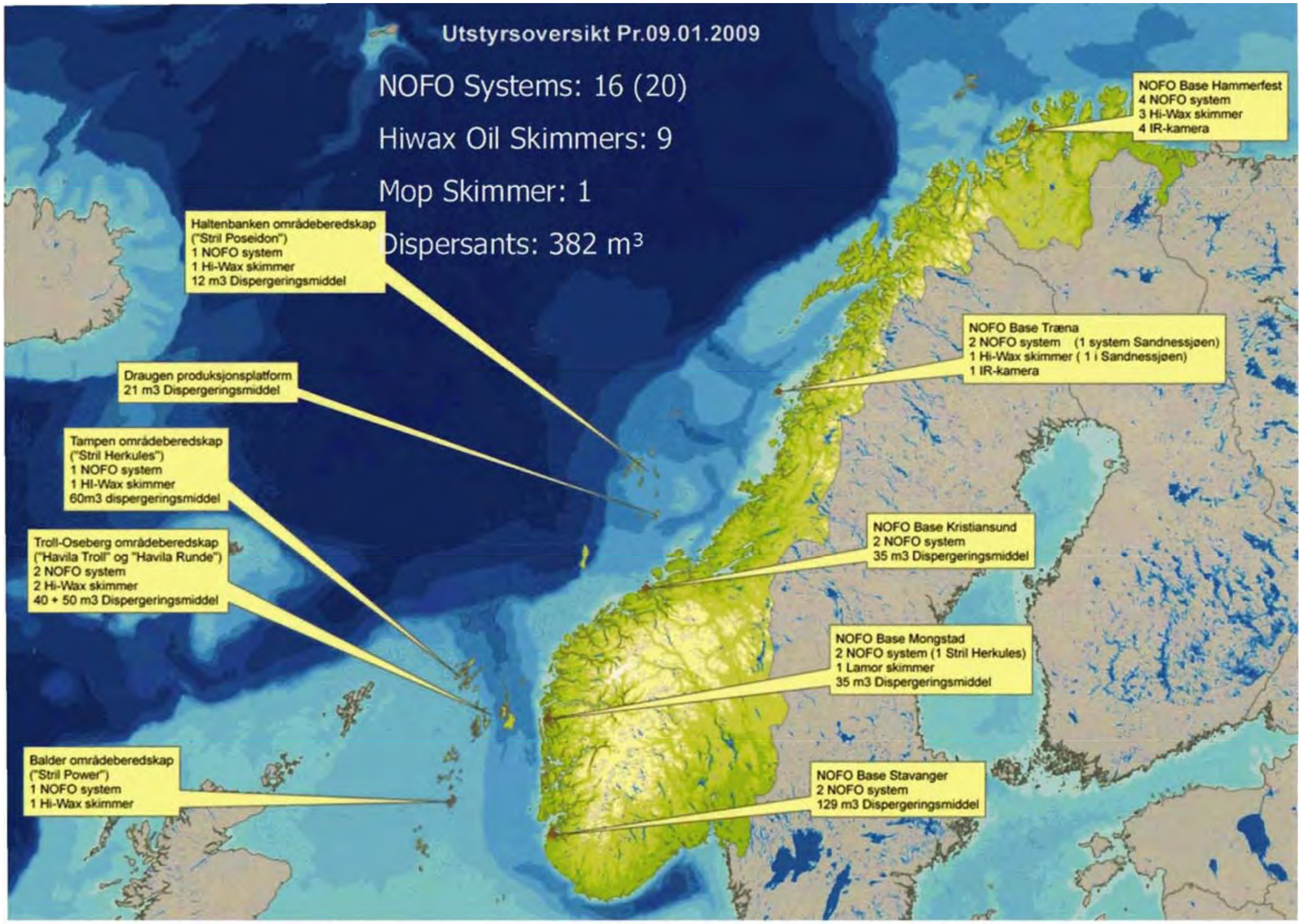


Figure 3 Distribution of NOFO Equipment (NOFO et. al., 2009)



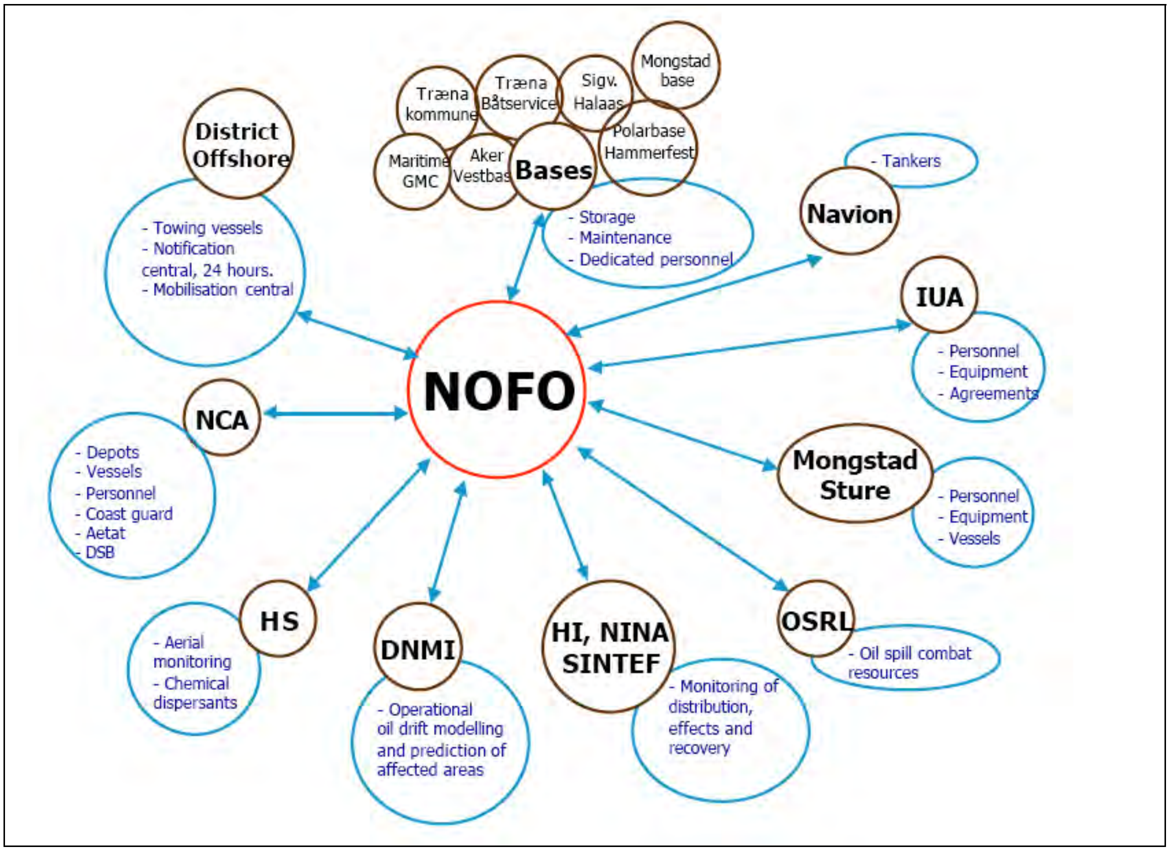
2.2 Planning

Each operating company has emergency preparedness plans to reduce the consequences of acute oil spills. NOFO's regional emergency preparedness plans are an integral part of the operators' own oil spill response plans (NOFO, 2008).

2.3 Partnerships

In addition to NOFO equipment, a series of binding agreements make services, equipment, personnel, and expertise available from private industry, municipalities and government in the case of a spill emergency. Municipalities across Norway have approximately 50 depots with over 2,000 personnel, while government has 15 depots with approximately 150 people (NOFO, 2008).

Figure 4 NOFO Partner Links (NOFO et. al., 2009)



2.4 Vessels

NOFO has standardized all aspects of vessel operations by pre-identifying response vessels and outfitting these vessels to common standards, as well as providing all necessary equipment and training to vessel operators.

NOFO vessel standards (NOFO, 2009) specify installation requirements, internal tankage, discharge and loading systems for recovered oil, as well as required fittings, and water and hydraulic support for all installed equipment. All vessels included in NOFO's standby fleet must meet these requirements. Vessels must also satisfy requirements set by the Norwegian authorities and classification societies (NOFO, 2008).

2.4.1 Operator's Vessels

Currently, 16 operator-owned vessels have been designated for deployment of the NOFO Standard Oil Containment and Recovery System (see Section 2.5.2). It is the responsibility of both the owner and the operator to ensure these vessels meet NOFO standards. These vessels participate in the routine operations on the Norwegian Shelf, but may be called into service at the time of an oil spill (NOFO, 2008).

2.4.2 Multi-purpose Standby Vessels

In addition to the regular fleet of supply vessels serving the Norwegian offshore industry, four purpose-built multi-use vessels have been constructed and designated for long term standby at key production areas. As well as the safety and fire-fighting features typically found on standby vessels, this new generation of vessels has been permanently equipped with the NOFO Standard Oil Containment and Recovery System and chemical dispersants, thereby placing equipment in close proximity for rapid response. An example of this class of vessel is shown in Figure 5. The offshore stations occupied by these vessels and the NOFO resources stored onboard each are shown in Figure 2 and Figure 3 (Jorgensen, 2004).

Figure 5 NOFO Multipurpose Vessel (NOFO et. al., 2009)

2.4.3 Towing Vessels

NOFO has developed partnerships with the fishing and shipping industries for the provision of towing vessels to assist with the operations using the standard NOFO containment and recovery system. Offshore trawlers and tugs are less expensive and more readily available than offshore supply boats, and are well suited to towing the lead of a Norlense boom (see Figure 6) of the NOFO Standard System (NOFO *et.al.*, 2009).

Figure 6 Two Vessels Towing The NOFO Standard System

2.5 Equipment Resources

2.5.1 Single Vessel Containment and Recovery

The Norwegian model for first response to offshore oil spills has been to ensure that platform standby vessels are equipped with suitable open-ocean equipment for rapid response. The operating standard for the past decade has relied on a complete oil containment and recovery system on standby vessels. In many cases, this system has consisted of the following:

- Skimmer stored onboard in such a way that it can be deployed quickly. On many vessels, this has been a Transrec 250 housed in a storage area on the starboard side in the aft area of the accommodation block (see Figure 8a). The skimmer is mounted on a trolley that can run aft on a rail incorporated into the starboard side crash rail. When required, the skimmer is run back on the rail and deployed into the boom by the Transrec A-Frame and reel.
- A containment boom, typically a 50-75 metre NOFI 800, stored on a reel, is inflated and deployed off the starboard side of the vessel.
- The outboard end of the boom is towed into an oil-collecting configuration by a small craft, much like a commercial seine boat, launched from the oil recovery vessel.

The current NOFO initiative is to upgrade the single vessel system in two initiatives:

- Replace the conventional U-shaped boom with a NOFI ocean buster capable of towing speeds of 4-5 knots; and
- Replace the need for an auxiliary towing vessel with an Ocean Boom Vane.

These improvements allow for a safer operating procedure as personnel, are not required to tow the containment boom in a small craft in offshore conditions. The system is more productive in that the encounter rate can be increased several times by the higher towing speeds. This system is shown in operation in Figure 7.

Figure 7 NOFI Ocean Buster With Ocean Boom Vane

2.5.2 NOFO Standard Oil Containment and Recovery System

NOFO has developed a standard large scale system for open ocean oil containment and recovery. 16 of these systems are stored at the five onshore depots, on multipurpose standby vessels at four strategic offshore fields, and at the StatoilHydro Mongstad refinery. The current system represents a complete re-tooling of the hardware components based on improved technology and NOFO's experiences during the *Prestige* oil spill response in 2002-2003. Each NOFO system consists of the following components:

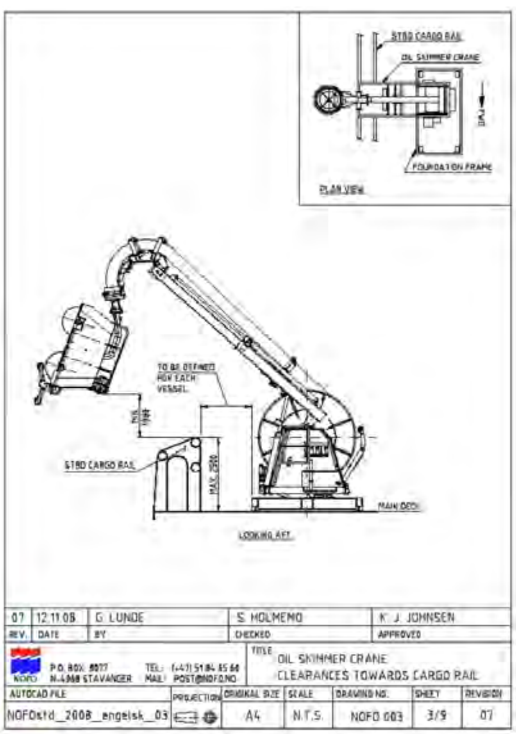
- A primary vessel for oil recovery and a secondary vessel for towing the lead end of the containment boom;
- Oil boom: 400 m Norlense NO 1200-R (rated for Hs height 3.5 m);
- Oil skimmer: FRAMO TransRec 150 (maximum capacity 420 m^3/h); and
- Containers for equipment and tools and for decontamination.

NOFO personnel required, in addition to the vessel crew, to operate the NOFO system include an on-scene commander (OSC), one supervisor and three operators. The standard system can be modified in the field by replacing the standard weir skimming head with the Hi-Wax skimming head if higher viscosity oil is encountered (NOFO *et.al.*, 2009).

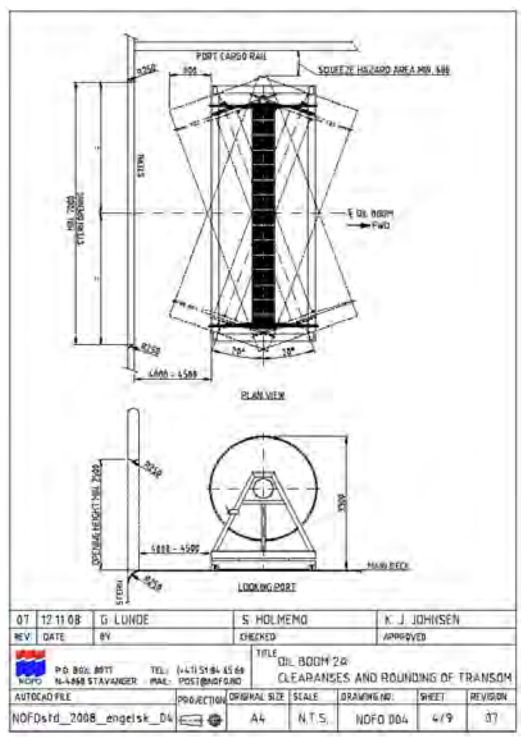
Hi-Wax skimmers are available at the northern depots, in anticipation of highly viscous emulsions that appear to form from the crude oils found in those fields.

Figure 8 NOFO Containment and Recovery System

a) Designated Response Vessel Configured To NOFO Standard (NOFO *et.al.*, 2009).



b) Transrec 150 Skimmer – Hi-Wax Head (NOFO, 2009)



c) Norlense 1200 Boom On Reel (NOFO, 2009)

2.5.3 Chemical Dispersion

Although environmental regulations in Norway are quite stringent, provisions have been made for the use of chemical dispersants in the event of a marine oil spill. The offshore OSC may be permitted to use a limited volume of dispersant for smaller spills, if the use of chemicals is clearly outlined in a plan that has been pre-approved by the Norwegian government. Further use of dispersants is only possible through permits which are issued on a case-by-case basis. Currently, NOFO has stockpiled several hundred cubic metres of chemical dispersant at strategic offshore and onshore localities (see Figure 3). Chemical dispersants are applied using aircraft or vessel-adapted equipment (NOFO *et.al.*, 2009).

Airborne Application

Current technology allows chemical dispersants to be applied to an oil spill from a helicopter or a fixed wing aircraft, depending upon the quantity of dispersant required.

Adapted for small-scale applications, a spray bucket, developed by Helikopter AS and now marketed by Framo, may be suspended from a standard offshore transportation helicopter. For quick mobilization, the spray bucket can be transported offshore as cargo (see Figure 9a). The bucket holds 3 m^3 of chemical dispersant, and can be refilled from a vessel or platform using a suspended immersion pump (see Figure 9b) while the helicopter is hovering, thereby eliminating the need for landing facilities offshore.

Figure 9 Helicopter Application Of Chemical Dispersants

a) Tier 2 - 3 m^3 Heli Bucket **b) Helicopter Airborne System**

Larger scale applications require deployment from fixed wing aircraft. For this application, NOFO has agreements for the use of the OSR C-130 Hercules aerial system using the Nimbus modular dispersant spray system. This unique system, which comprises four Tank Modules and a combined Spray Arm/Pump Module, can be installed, loaded, and in operation within a matter of hours for local spills (see Figure 10) (NOFO *et.al.*, 2009) .

Figure 10 Fixed Wing Air Craft Application Of Chemical Dispersants

Vessel Application

NOFO has developed a dispersant delivery system consisting of a bow-mounted spray arm assembly for application before the oil encounters the ships wake (see Figure 11). This system, along with an inventory of dispersant chemicals, is installed on all multi-purpose standby vessels on the Norwegian Shelf (NOFO *et.al.*, 2009)..

Figure 11 Vessel Application Of Chemical Dispersants

2.6 Training Program

All NOFO oil spill response personnel at bases or on vessels have a minimum of one training exercise per year. In addition, drills and exercises are organized with member companies, government, and municipalities. Skills are also upgraded though courses offered by NOFO throughout the year. Course topics include:

- Oil Spill Overview Course;
- Oil Spill Management;
- Meteorology;
- Remote Sensing;
- Dispersants;
- Common Course for Ships Crew;
- Coastline Response; and
- Special Courses: designed and implemented for specific purposes (NOFO, 2008).

NOFO spends an approximate 15% of the annual budget on training and exercises. The 2009 NOFO training program included:

- 36 standard exercises with NOFO equipment;
- 15 desk-top exercises with operators;
- 5 desktop exercises with municipalities and government;
- 5 full-scale exercises;
- 1 oil-on-water exercise;
- 40 NOFO courses; and
- 10 collections of emergency preparedness groups (NOFO, 2009B).

3.0 AMOSC (AMOSC, 2008)

3.1 Oil Spill Response Planning

3.1.1 National Plan

The National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances (National Plan) is the umbrella contingency planning and response arrangement for Australia and is a cooperative arrangement between the Commonwealth and State governments and the shipping and oil industries.

3.2 Australian Marine Oil Spill Centre

AMOSC was established in 1991 as the result of a post-Exxon Valdez review of the Australian oil industry's capability. AMOSC operates the oil industry's major oil spill response facility. Situated in Geelong, near Melbourne, AMOSC is a subsidiary of the Australian Institute of Petroleum Ltd. (AIP) and is financed by participating companies which carry out the majority of the oil and gas production, offshore pipeline, terminal operations and tanker movements around the Australian coast.

AMOSC provides response in Australian waters (see Figure 12) and may be requested to respond to major oil spills throughout the South Pacific region. Response activities are undertaken by staff, consultants, and subscriber company personnel.

Figure 12 AMOSC Area Of Operation

3.2.1 AMOSC Mandate

AMOSC's role is to provide:

- Equipment and personnel on a 24 hour standby basis, to respond to oil spills;
- Oil spill training services at the training centre in Geelong;
- Administration of the oil industry mutual aid arrangements; and
- Advice on oil spill equipment and issues as required.

3.2.2 AMOSC Membership

AMOSC has two levels of membership – Participating and Associate (see Table 3).

Table 3 AMOSC Member Companies

Participating Companies		
Chevron	ExxonMobil	Shell
Apache	BHPBilliton	Caltex
Santos	BP	Woodside
Associated Companies		
Afrlcan Gove	Inpex Browse	Roc Oil
ASP Ship Management	InterOil Ltd	Stuart Petroleum
Beach Petroleum Ltd	Nexus Energy Limited	Tap Oil
ConocoPhillips	Oil Search Limited	Teekay Shipping
East Puffin Ld	Origin Energy	Vermillion Oil & Gas
ENI	PTTEP Australasia (Ashmore Cartier) Pty. Ltd.	

Participating companies include Australia's major oil producers and refiner/marketers. Annual subscriptions contribute to the capital and operating costs of AMOSC and for Participating companies, costs are a reflection of the level of production, refining capacity, or annual movements of oil by sea.

Associated companies include ship owners and operators and companies engaged in oil exploration, production and/or distribution. Associated companies have access to industry mutual aid arrangements, but are generally not able to lend any of their own resources. Associated companies have access to AMOSC training workshops at Participating company rates. Access to AMOSC and other company resources for oil spill response is available at 1.5 times Participating company rates. Associated companies pay an annual subscription which includes membership of AIP. All subscriber companies can access AMOSC equipment for short-term standby requirements under the AMOSPlan (see 3.2.3).

Non-subscriber companies are able to access training and oil spill response services at a premium rate, either directly through AMOSC, or through the National Plan.

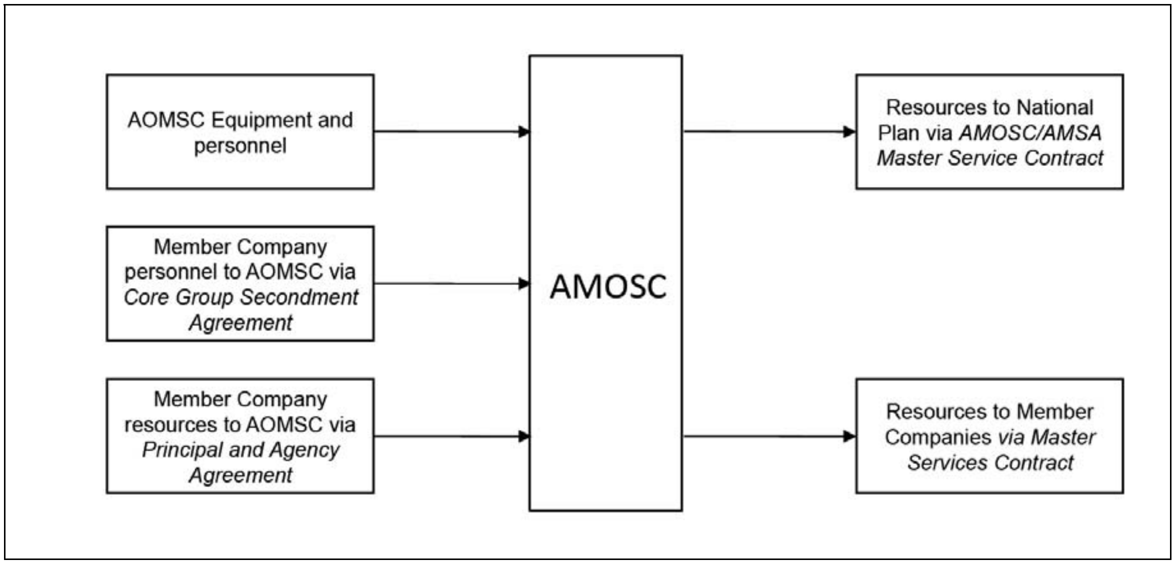
3.2.3 AMOSPlan

The cooperative arrangements for response to oil spills by the Australian oil and associated industries are brought together under the *Australian Marine Oil Spill Plan* (AMOSPlan). AMOSPlan is managed by AMOSC, which also coordinates participation of the oil industry in Australia's *National Plan to Combat Pollution of the Sea.*

The principle of the AMOSPlan mutual aid arrangements is that, in order to assist in a local response to an incident, individual company resources are available under cooperative arrangements through the AMOSC hiring agreements (see Figure 13). A Master Service Contract is in place between AMOSC and Australian Maritime Safety Authority (AMSA), enabling AMSA to hire equipment and personnel from AMOSC on behalf of the National Plan. These resources include both AMOSC's own resources and those that may be available from Participating Companies. In a practical sense, however, individual companies initially deal with each other using nominated Mutual Aid

Contacts. If the spill response requires additional resources, AMOSC staff, core group personnel and equipment are rapidly mobilized.

Figure 13 AMOSPlan Resources Sharing Guidelines



3.2.4 Equipment Resources

AMOSC's stockpile of oil spill response equipment includes oil spill dispersant and containment, recovery, cleaning, absorbent, and communications equipment. Equipment is located in three venues, close to offshore production operations:

- The primary stockpile of equipment is maintained at the Geelong Centre; and
- Secondary inventories are housed at Exmouth and Broome, Western Australia.

Current thinking in Australia is that containment and recovery is not a practical option for the response to offshore oil spills which threaten exposed coastlines. Because they can be deployed rapidly over a large area of open ocean, chemical dispersants are a primary response tool for the Australian offshore industry. AMSA has located dispersant stockpiles strategically near airfields around the Australian coastline.

AMOSC shares in this program and pays half the annual cost of the National fixed wing aerial dispersant spray standby contract. All AMOSC equipment is containerized for rapid handling and is on 24-hour standby for a speedy response. Additional equipment can be accessed as required directly from oil companies.

In order to ensure that the best possible resources are applied to an oil spill response situation, oil company-owned equipment is shared under AMOSPlan. The principle of the AMOSPlan mutual aid arrangements is that individual company resources are available under cooperative arrangements through the AMOSC hiring agreements.

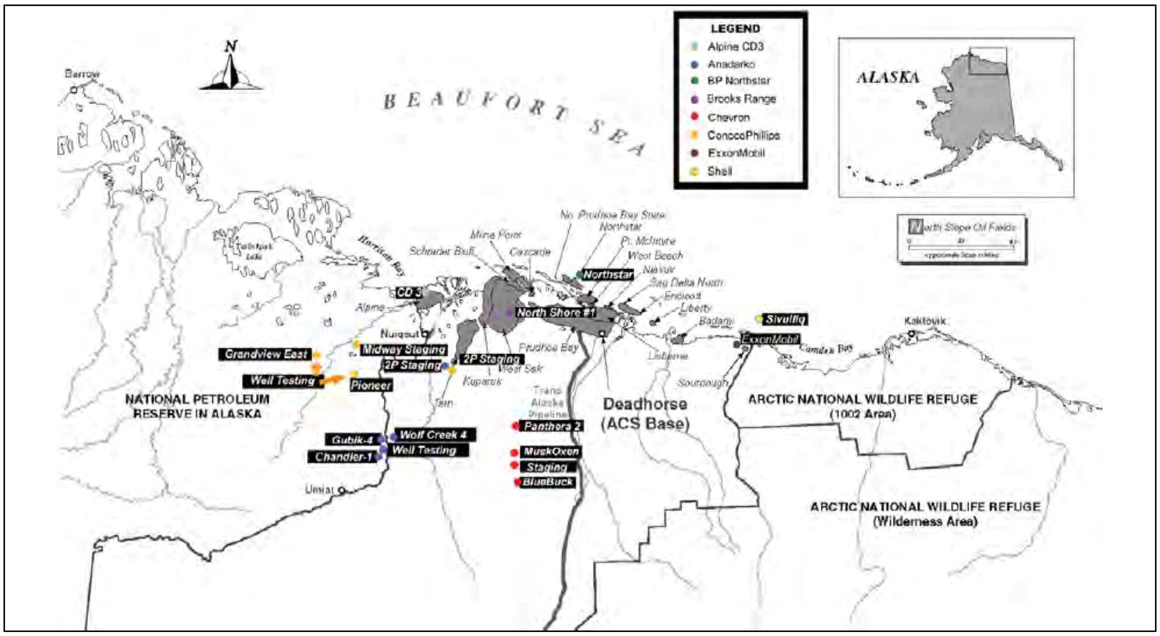
3.2.5 Training

Training programs offered by AMOSC include management overview, oil spill response management, equipment operation, and shoreline cleanup. Scheduled or tailored programs are also conducted at the client's request.

4.0 ALASKA CLEAN SEAS (ACS, 2009)

Alaska Clean Seas (ACS) is a non-profit oil spill response cooperative providing oil spill preparedness and response services to oil and pipeline companies. Originally formed in 1979 as ABSORB, ACS was restructured in 1990 from an equipment cooperative into a full-response organization which can respond to an emergency with trained people and equipment. ACS also provides its member companies with oil spill management and response training, research and development, and day-to-day field environmental and spill response support.

Figure 14 North Slope Oil Fields With Alaska Pipeline Leading South



4.1 Membership

Current ACS membership (see Table 4) includes all oil and pipeline companies that engage in, or intend to undertake, oil and gas exploration, development, production, or pipeline transport activities on the North Slope of Alaska (see Figure 14). Membership is divided into Producing Members, who are actually transporting oil by pipeline, and Non-Producing Members who are only involved in exploratory drilling operations.

Table 4 ACS Member Companies

Alyeska Pipeline Service Company	Chevron (Union Oil of California)
FEX L.P.	Pioneer Natural Resource (USA) Inc.
Anadarko Petroleum Corporation	ConocoPhillips Alaska, Inc
ExxonMobil Production Company	Shell Offshore Inc
BP Exploration (Alaska)	Eni US Operating Company Inc
Brooks Range Petroleum Company	

4.2 Personnel

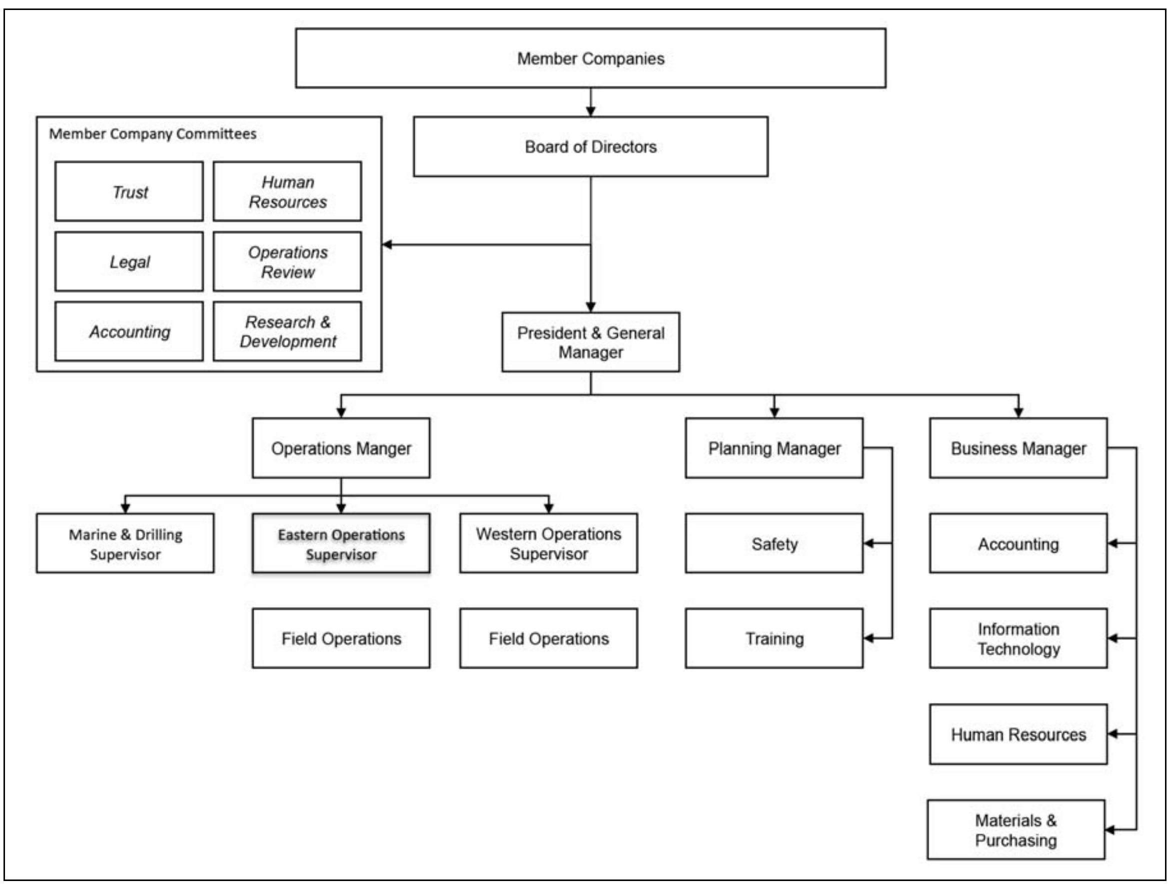
ACS has an elected Board of Directors, comprised of Producing Members. ACS maintains approximately 74 full-time staff, all of whom are available for response operations. About half of these employees are located within the fields and perform daily spill response and environmental duties under the immediate direction of the member companies. Additionally, a minimum of 115 qualified response personnel, supplied by operating companies under a mutual aid agreement, are immediately available on a daily basis to participating member companies. Over 500 contractor personnel and North Slope Village Response Teams, all trained by ACS, are also available to ACS in the event of a major spill.

4.3 Governance

Major decision-making is the responsibility of a Board of Directors comprised of elected representatives of the Producing Members. Board responsibility includes annual program and budget approval. Program implementation and operational management are the responsibility of the President/General Manager and staff (see Figure 15).

Member Companies have direct involvement in the running of the organization through participation in six standing committees which monitor ACS business activity and determine future direction and development.

Figure 15 ACS Organization



ACS provides personnel, material, equipment, and training to its members. Under ACS by-laws, all members are entitled to call upon ACS and receive assistance in the above activities. Members may refer to ACS resources in their contingency plans and to represent that these resources are available to them in the event of a spill. When authorized by the Board of Directors, ACS may also respond to non-member spills.

4.4 Funding Arrangement

4.4.1 Production Fees

The ACS annual budget is based on annual production fees, which are based on production volumes and pipeline throughput for each of the Producing Members. Fee calculations also take into account the environmental sensitivity of, and access to, each operation.

4.4.2 Membership Fees

A Customer Service Agreement is signed with each North Slope Production or Drilling operation. The agreements outline the roles and responsibilities of both ACS and field operations. The ACS Cost Sharing Principles define which activities are billed directly to the member companies and which activities are shared within ACS's annual budget. The current membership fee structure is outlined in Table 5.

Table 5 Current ACS Membership Fee Structure

	Producing Members	**Non-Producing Members**
New Member Initiation Fee	• $500,000	• $100,000
Annual Membership Fee	• $50,000	• $15,000
Additional Setup Charges	• $500,000 (large barge not needed in contingency plan) • $1,000,000 (large barge is needed in contingency plan) • $1,250 Daily Development Fee • Direct billing for any Spill Technician assigned for non-preparedness task	• $2,500 (large barge not needed in contingency plan) • $10,000 (large barge is needed in contingency plan) • Direct billing for any assigned Drill Rig Spill Technician
• All charges are in US Dollars		

4.5 Response Operations

The ACS network allows for complete management in the response to Tier 1 and Tier 2 incidents. In the event of a Tier 3 response, additional equipment may be obtained in Alaska under standing agreements with SERVS, the Alyeska Pipeline response organization in Anchorage and Cook Inlet Spill Prevention and Response Inc.

ACS has Emergency Operations Centres (EOC) at ACS base in Deadhorse and at member company's operations in Alpine, Kuparuk, Milne Point, and the Prudhoe Bay Operations Centre. These, and other mobile facilities, are available to all member companies through the mutual aid agreement.

4.6 Equipment Inventory

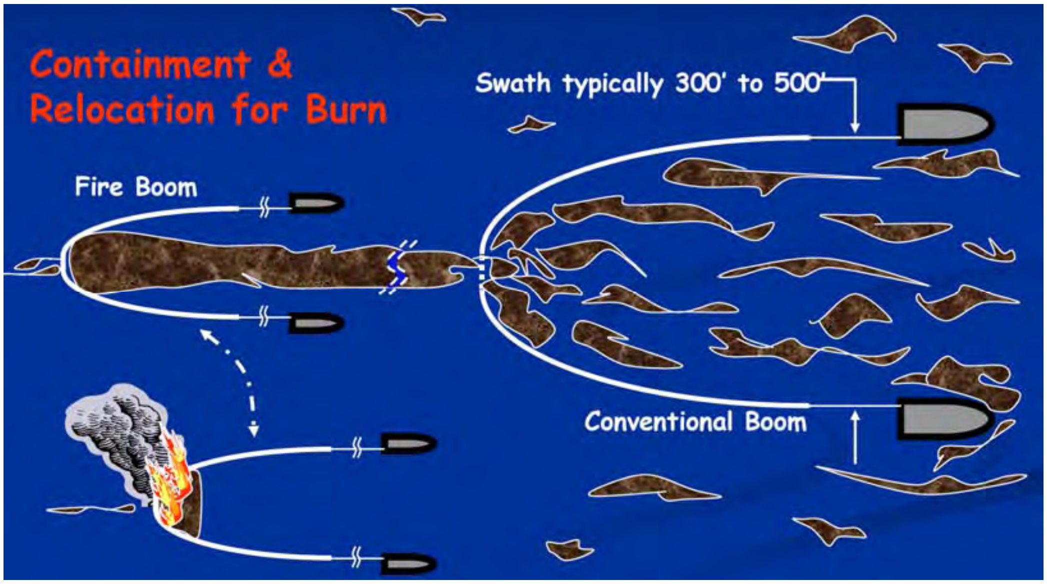
Approximately half of all available response equipment is directly owned by ACS, and half is owned by member companies. All equipment has been selected for use in Arctic conditions and all is maintained by ACS. Resources include:

- 300,000 feet of oil containment boom;
- 19,000 feet of fire boom;
- 185 skimmers;
- 8 helitorch aerial ignition systems;
- 2 x 128 bbl and 12 x 249 bbl mini-barges;
- Various sizes of storage tanks and bladders; and
- Wildlife hazing and stabilization equipment.

Dispersant chemicals are not an option in this region because of the very shallow water depth of the Alaska Beaufort Sea coastline.

After considerable research and development effort, In-situ burning (ISB) is considered to be a viable option for the removal of oil from the surface of ice-infested waters. ISB is a major strategy for the ultimate disposal of the large volumes of oil that could be discharged from a nearshore, shallow water blowout. Figure 16 (Allen, 2008) illustrates the generic strategy for the collection, relocation, and ultimate in-situ burning of crude oil lost during a continuous blow out scenario.

Figure 16 Capture And Burning of Oil Lost In A Blow Out



4.7 Vessel Support

ACS operates a fleet of 96 purpose-built work boats that are suited to the scale of oil spill operations. As well as the standard multipurpose work/tow vessel used to deploy response equipment, ACS has smaller craft, such as the aluminum air boats shown in Figure 18, for shallow water shoreline and estuary work.

Larger supply vessels, tugs, or tankers would be supplied under mutual agreement by the member companies working offshore in the Alaska Beaufort Sea. For oil recovery, ACS has two small (28 bbl) and 12 large (249 bbl) aluminum barges (see Figure 17 and Figure 18). Placement of these barges depends upon the requirement of Member Companies, as detailed in site contingency plans.

Figure 17 ACS Work Boat For Oil Recovery Operations

a) With Large Oil Recovery Barge

b) With Side Sweep Recovery System

Figure 18 ACS Shallow Water Air Boats For Nearshore Operations

a) Moving A Large Oil Recovery Barge Close To Shore

b) On A Tidal Flat With Stranded Ice

b) In Shallow Water On The Beach

4.8 Training

ACS provides arctic-oriented spill response training to its Member Companies, contractors, village response teams, and government agencies. This includes training in all aspects of spill response, including in-situ burning, broken and solid ice response, wildlife protection, incident management, and safety and health issues. In 2007, ACS provided over 23,000 student hours of instruction in 614 classes with 5,522 students.

4.9 Mutual Aid Agreement

Each Member Company can enter into a Mutual Aid Agreement, which provides members with efficiencies and cost savings through the sharing of resources among all members in the event of an oil spill. The Mutual Aid Agreement outlines the terms and conditions under which each member company can make available their employees, contractors, equipment, materials and supplies to each other in the event of an oil spill.

4.10 Development

4.10.1 Permitting

ACS is active in stream-lining approval processes and in fostering a common organizational structure for responding to and managing spills on the North Slope.

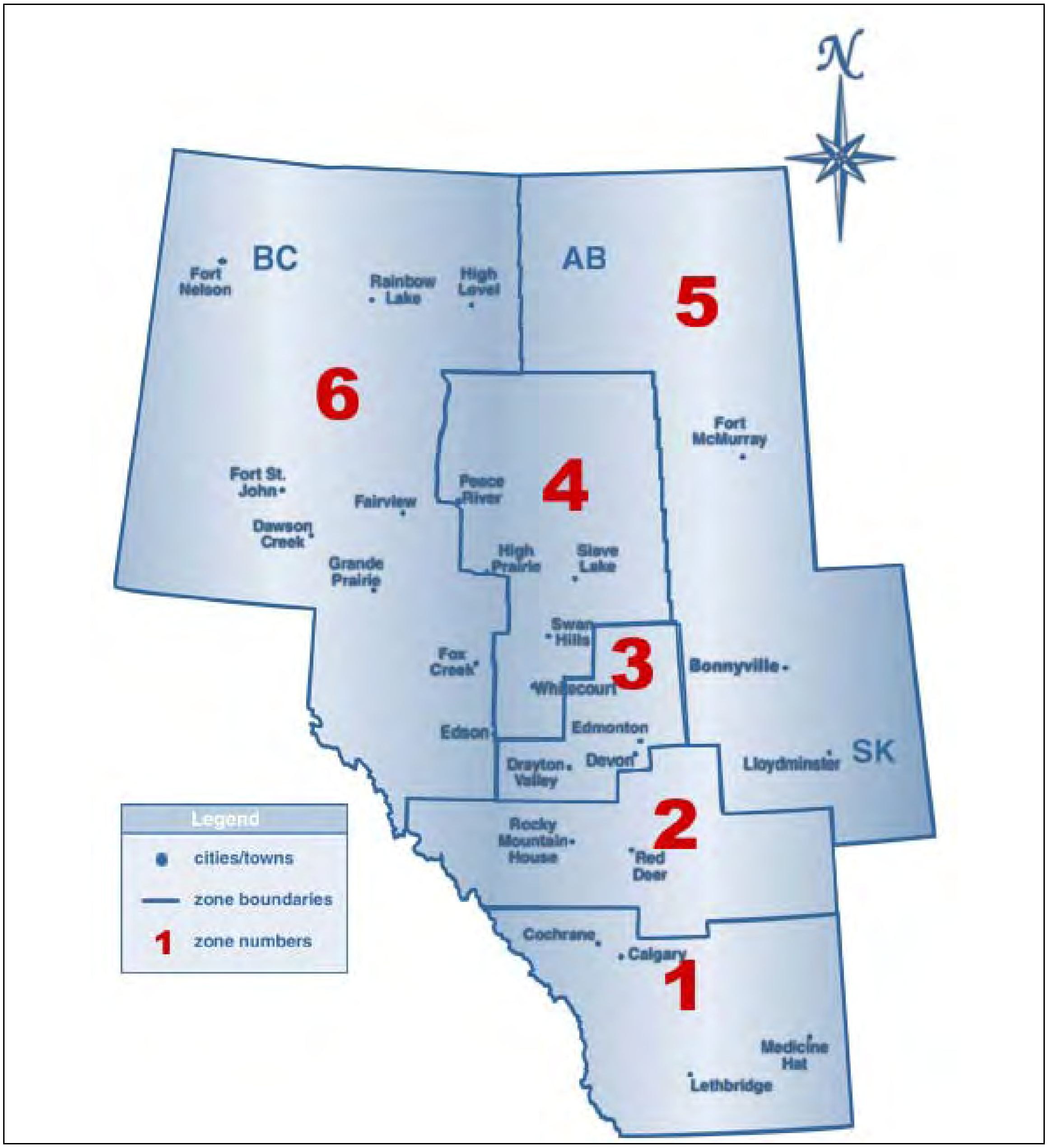
4.10.2 Research and Development

ACS has maintained an active oil spill R&D program since 1979 and acts as a facilitator for much of the research and development related spill response in arctic conditions. The R&D program focuses on specific areas such as oil spill recovery techniques in broken ice as well as, under ice, and detection and tracking of oil under ice. ACS is considered an industry leader in the research of in-situ burning techniques and in-situ burning of water-in-oil emulsions.

5.0 WESTERN CANADIAN SPILL SERVICES (WCSS, 2009)

Western Canadian Spill Services Ltd. (WCSS) is the spill preparedness organization of the upstream petroleum industry in North-Eastern British Columbia, Alberta, and Cooperative VR1, which extends into Saskatchewan (see Figure 19). The purpose of WCSS is to maintain an effective spill response capability for the upstream petroleum industry in western Canada and to provide information and education on spill issues including spill prevention.

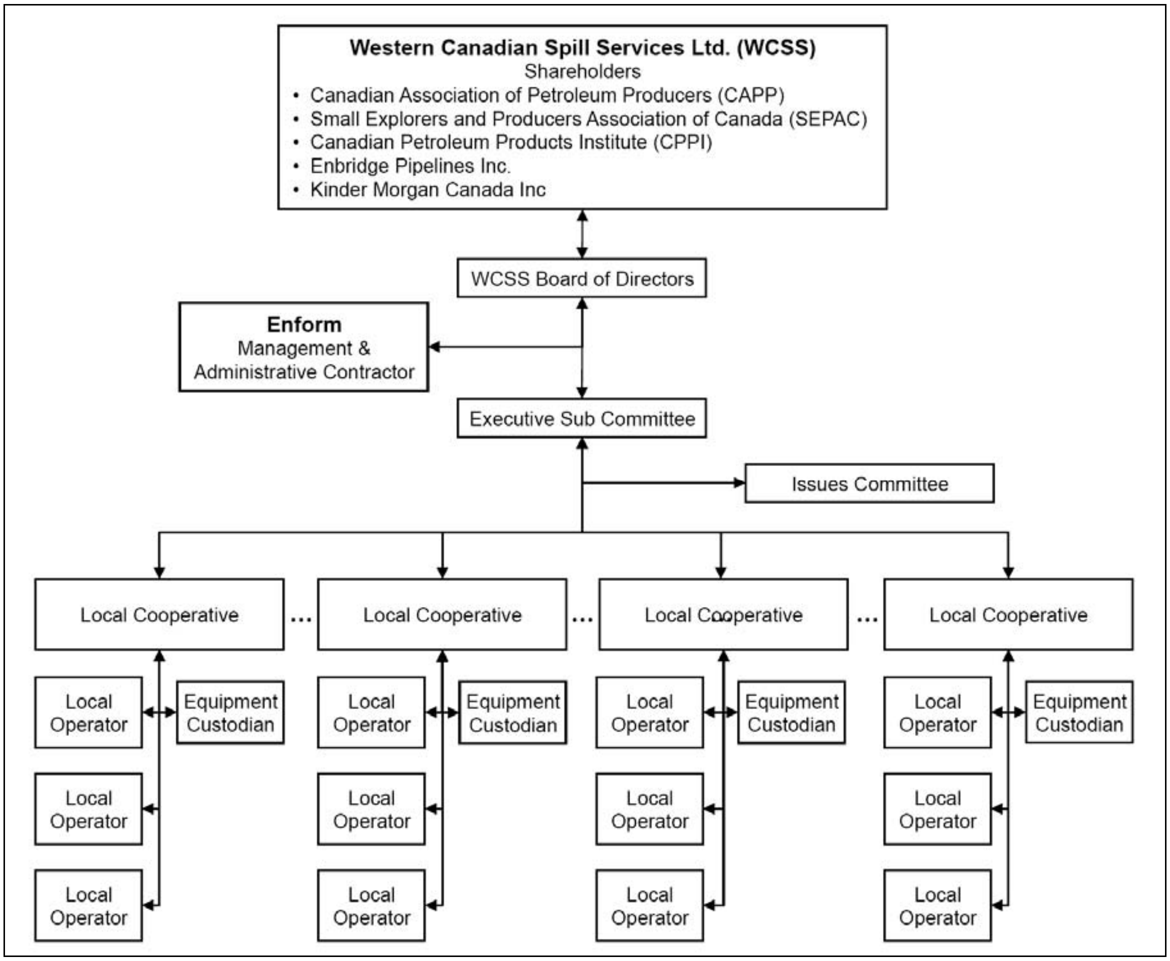
Figure 19 WCSS Operating Area



5.1 Organization

WCSS organizational structure is outlined in Figure 20. Shareholders of WCSS include three industry trade associations and two pipeline companies. Members of WCSS are petroleum corporations or divisions of corporations that contribute to WCSS's budget requirement by paying their annual WCSS membership fees. WCSS includes six Zones with a total of 18 oil spill cooperatives managed through Enform (contract management services), an Executive Committee, Cooperative Chairmen & Alternates, Area Steering Committees, and contract area administrators/equipment.

Figure 20 WCSS Organization



5.2 Cooperative Activities

Member companies in each Cooperative (Co-op) work together to achieve a state of spill response readiness. Co-ops maintain spill contingency plans and strategically place response equipment that is available to all Member Companies in the area. They hold annual training exercises and provide educational funding for their membership. In an effort to continually improve, Co-ops are often involved in research and development projects.

5.2.1 Services Available

WCSS resources include:

- Access to oil spill contingency plans that are specific to each cooperative area;
- Initial spill response equipment in each cooperative area;
- Access to regional and specialized spill response equipment;
- Training programs in each cooperative area on an annual basis;
- Spill response assistance if appropriate (at discretion of Cooperative Chairman);
- Information sharing and benefits of the organization's promotional program; and
- Opportunity to have a voice at the cooperative level and influence the Corporation's decisions.

5.3 Resources

5.3.1 Equipment

More than 50 OSCAR (Oil Spill Containment and Recovery) response units are placed strategically within the WCSS operating areas. All units meet a minimum WCSS standard and are equipped to meet the needs of the members in the area. Inventories are done annually or after the equipment is used, and area equipment needs are assessed on an ongoing basis. Other response kits include:

- Initial spill response units;
- Winter response units; and
- Lake boom units.

In addition to the WCSS equipment, the Canadian Petroleum Products Institute (CPPI) also maintains equipment in Western Canada. An agreement between WCSS and CPPI allows WCSS Members In Good Standing access to this equipment. The units are primarily equipped to manage small land or water spills and contain mostly sorbents, drums and PPE.

Skimmers are in each of the 50 OSCAR WCSS spill response units. When required, there are options for dealing with spills in shallow water, where conventional boom will not be effective. Other specialized equipment includes:

- Air curtain incinerators for effective waste disposal;
- Oil debris separators;
- Boom vanes and boom deflectors for river response; and
- Wildlife response equipment.

5.3.2 Vessels

WCSS maintains a fleet of response vessels designed to deploy containment and recovery equipment in surface water. These boats are strategically placed throughout Western Canada and are available to WCSS Members In Good Standing. Boats can only be operated by personnel who have certification in the Enform/WCSS Boat Handling Course, as well as the Transport Canada appropriate Marine Emergency

Duties (MED) certification. Airboats and barges also require additional certification prior to operating. All boats are equipped with Transport Canada and WCSS standard safety equipment, including radios.

5.4 Contingency Planning

WCSS has developed a standard contingency plan template for use by Member Companies. As well, WCSS coordinates common sources of resource information, such as maps and equipment specifications, to ensure consistency between plans. Plans are required to be updated on an annual basis.

5.5 Training

5.5.1 Responder Training

Practical training is available for Member Companies and contractors. Core courses include:

- Boat handling;
- General spill responder;
- Surface water response; and
- On Scene Commander.

WCSS encourages participation in Canadian and international oil spill conferences.

5.5.2 Exercises

WCSS organizes regular exercises on a regional basis. In each of the six zones, both practical field exercises and table top exercises employing the ICS management system are held annually. In 2009, 21 Co-op exercises were scheduled.

5.6 Research And Development

WCSS maintains an annual R&D budget that is used to address gaps identified in the upstream industry's spill response capability. R&D projects are oriented towards oil spill technology development and field implementation of new techniques for oil spill containment and recovery, particularly spills in freshwater environments.

The following is a list of some recent R&D projects:

- Hydrocarbon sheen control;
- Containment and recovery of sunken oil;
- Winter spills in rivers with an ice sheet cover;
- Inverted weir;
- Aqua dams;
- Air barriers (spargers);
- Fast water techniques;
- Still water techniques; and
- In-situ burning.

6.0 FORMER CANADIAN OFFSHORE OIL SPILL COOPERATIVES

6.1 East Coast Spill Response Inc.

East Coast Spill Response Association (ESRA) was created in 1979. Mobil Oil served as managing operator on behalf of ESRA's member companies and was the legal entity that could enter into contracts on behalf of the association. ESRA had capital and operating budgets and an operating arrangement with the Canadian Coast Guard. ESRA operations were initially housed in Canadian Coast Guard facilities but were eventually moved to its own warehouse and office facilities in the Harvey Industrial Estates on Torbay Road in St. John's.

In 1984, ESRA was incorporated under the name East Coast Spill Response Inc. (ESRI) with a shareholder's agreement that set rules for cost sharing capital and operating budgets, and for Member Companies' access to ESRI equipment and personnel. ESRI had a Board of Directors that set policy and direction and a Member Company committee which monitored day-to-day operations and provided technical expertise when needed. ESRI employed a general manager, a full time staff of five and a team of 30 on-call contract responders. Other services were contracted out.

At the time of demobilization, ESRI equipment had grown to include:

- 3 offshore oil containment booms (2 x Vikoma Ocean-pack, 1 NOFI-1000);
- 4 offshore skimmer systems (2 x Framo ACW-400, 2 x Pharos Marine GT-2600);
- Deck tanks for temporary storage of recovered oil on supply vessels;
- 4 oil transfer pump systems (2 x 200 m^3/h Framo TK5, 2 500 m^3/h Framo TK6);
- 4 diesel-hydraulic power packs;
- 4 Rotortech TC3 helicopter-deployed dispersant application devices;
- 468 drums (96 m^3) of COREXIT 9527 dispersant;
- 5000-ft shoreline protection boom (36-inch);
- 4 Morris MI-30 disk skimmers and portable tanks; and
- An 8-unit helicopter portable ATCO camp.

Through the 1980's, ESRI and its Member Companies participated in oil spill-related research through the Canadian Offshore Oil Spill Research Association (COOSRA), the Baffin Island Oil Spill (BIOS) Project, the Environmental Studies Research Fund (ESRF), Eastern Arctic Marine Environmental Studies (EAMES), and Offshore Labrador Biological Studies (OLABS) project.

ESRA/ESRI existed from 1979 until 1993. During that time, its size fluctuated between six and 11 Member Companies that included BP, Canterra Energy, Chevron Home Oil, Hunt Oil, Husky Oil, Imperial Oil, Mobil Oil, Petro-Canada, Shell, and Texaco. During that period, all member company offshore operations were involved in exploration drilling only. The ESRI Board of Directors, however, was forward looking and had begun the planning process to prepare for oil production. By 1989, an equipment upgrading and replacement program was under way.

ESRI purchased a NOFI-1000 boom system in 1991, as well as two Pharos Marine GT-260 skimmers, to deal with heavy waxy crude oil from Grand Banks wells. A prototype system to feed emulsion breaking chemical into the GT-260 skimmers was also built. An annular water injection flange was designed to deal with waxy Grand Banks crudes (but not built before ESRI was shut down).

At the end of 1991, drilling on the east coast ceased. At the end of 1992 ESRI reduced its staff to one person, and then sold its equipment assets in 1993. ESRI closed down as a company in 1993, at a time when there was no active or immediately anticipated offshore activity. While ESRI was disbanding in 1993, Eastern Canada Response Corporation (ECRC) was being created.

ESRI assets were sold to Marine Spill Response Corporation (MSRC) in the USA and ECRC. Because the ESRI warehouse lease was also transferred to ECRC, little equipment was physically moved and there was an outward perception that ECRC would carry on from where ESRI had left off.

6.2 Beaufort Sea Oil Spill Cooperative

In 1991, a task force published a report on the role of the federal government in the management of oil spills in the Canadian Beaufort Sea (Task Group Five, 1991). In an appendix to this report, the early history of the Beaufort Sea Oil Spill Cooperative is reviewed:

> *In 1974, the Department of Indian and Northern Development (DIAND) … gave Dome Petroleum approval in principle to operate drill ships in the Beaufort Sea. At the same time, the Beaufort Sea Project was established with $12 million shared funding between industry and government to improve the level of emergency preparedness in the north.*
>
> *By 1976, when DOME had satisfied the 13 conditions attached to the drilling program approval, the federal cabinet, acting on the recommendation of DIAND, authorized a $2 million oil spill depot at Tuktoyaktuk under the management of the CCG. Cabinet also established an interdepartmental task force to prepare a Beaufort Sea Oil Spill Contingency Plan.*
>
> *By 1976, the petroleum industry had developed the Beaufort Sea Oil Spill Cooperative, and in subsequent years held joint exercises with the CCG oil spill depot at Tuktoyaktuk. In 1977, the task force's Beaufort Sea Contingency Plan was established under the management of the Deputy Commissioner of the Government of Northwest Territories (GNWT) as the on scene commander.*

Like ESRI, the Beaufort Sea cooperative was a joint effort by all Beaufort Sea operators. Management was similar to ESRI and, in some cases, equipment strategy and specification was developed to suit the needs of each co-op. The Beaufort Sea Oil Spill Cooperative was active until the mid 1990s when, like ESRI, it was disbanded due to lack of offshore activity.

With current activity in the Alaska Beaufort and in anticipation of future activity in the Canadian sector, former members are considering the need for a renewed industry spill response capability. At this time, some member companies are actively involved in arctic spill research. Based on historical experience, a future Beaufort Sea oil spill response capability would probably once again be a cooperative venture between operators.

MARINE HYDROCARBON SPILL RESPONSE CAPABILITY ASSESSMENT JEANNE D'ARC BASIN PRODUCTION OPERATIONS

CHAPTER 4 – CURRENT OIL SPILL RESPONSE PROGRAM

Prepared For:

Canadian Association of Petroleum Producers
403, 235 Water Street
St. John's, NL
CANADA
A1C 1B7

On Behalf Of:

Suncor Energy
235 Water Street
St. John's, NL
CANADA
A1C 1B6

Husky Energy
235 Water Street
St. John's, NL
CANADA
A1C 1B6

Hibernia Management and Development Company
Suite 1000, 100 New Gower Street
St. John's, NL
CANADA
A1C 6K3

Prepared By:

Cormorant Ltd.
280 B Water Street
St. John's, NL
CANADA
A1C 1B7

Lorax Environmental
Suite 504, 215 Water Street
St. John's, NL
CANADA
A1C 6C9

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1.0 INTRODUCTION

In this Chapter, the existing oil spill response capability that has been established by the Newfoundland and Labrador offshore oil industry will be reviewed. The review will include a description of the measures now in place and, where appropriate, comments on these measures. While the overall capability represents the collective effort of several individual operators and contractors, it will be reviewed as an industry position as the efforts made to date by all operators are very similar. Where necessary, differences between operators will be discussed.

1.1 Current Offshore Operations

In late 2009, the following companies are active offshore:

- Suncor is producing oil at the Terra Nova FPSO and is conducting drilling operations at the Terra Nova Field; and
- Husky is producing oil at the SeaRose FPSO and is conducting drilling operations at the White Rose field; and
- HMDC is producing oil and conducting production drilling operations at the Hibernia Platform.

1.2 Components Of An Offshore Oil Spill Response Capability

A comprehensive oil spill response capability includes several components. In this report, the components considered include:

- Oil spill preparedness program in the context of the regulatory environment;
- Contingency planning;
- Response management structure;
- Operational preparations;
- Logistics, contractor and communications support; and
- Response program development and maintenance.

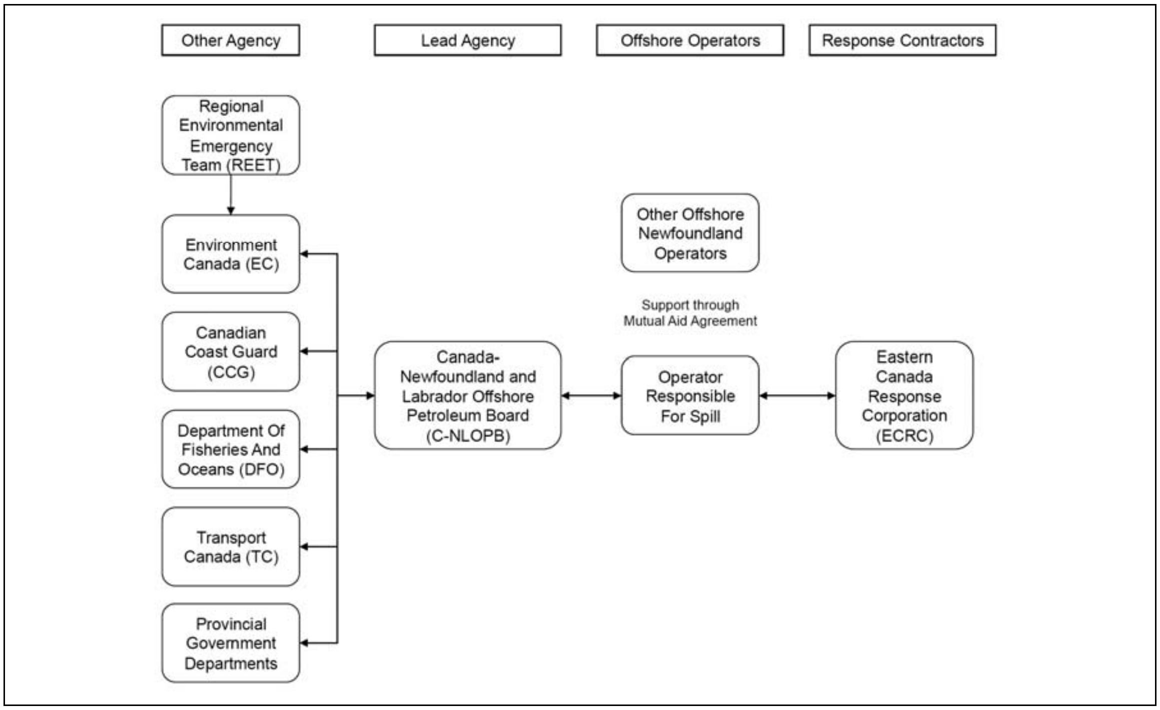
1.3 Evaluation

In this report, evaluation will be in the form of comments only. Conclusions based on the following review are presented in Part 5 of this series.

2.0 REGULATORY REQUIREMENTS

Under the Atlantic Accord, the C-NLOPB is responsible for the regulation of all drilling and production activities offshore Newfoundland and Labrador. Figure 1 outlines the parties who may be involved in the response to an oil spill offshore.

Figure 1 Organization Of Participants In Oil Spill Response



2.1 Atlantic Accord Implementation Act

2.1.1 C-NLOPB Role

Oil spill response at an offshore platform falls under the jurisdiction of the C-NLOPB pursuant to section 161 of the *Atlantic Accord Implementation Act*. The C-NLOPB has a specific regulatory mandate to ensure the operator is taking all reasonable measures to prevent further spillage and to mitigate the effect and impacts of the spill. Where reasonable measures are not being taken, the Chief Conservation Officer (CCO) can direct the operator or can take over management of the response effort directly.

The C-NLOPB is the designated lead agency in offshore spill incidents at offshore Newfoundland drilling sites under a memoranda of understanding with a variety of federal and provincial ministries (see Figure 1). These agencies may include:

- Department of Fisheries and Oceans;
- Canadian Coast Guard;
- Environment Canada;
- Transport Canada; and

- Provincial government departments.

The C-NLOPB is also named as the lead agency in offshore spill incidents under the Regional Environmental Emergencies Team (REET) contingency plan and the Canadian Coast Guard (CCG) National Emergency Response Plan.

2.1.2 Documented Guidelines

Listed below are the regulations or guidelines that specify C-NLOPB requirements:

Newfoundland Offshore Petroleum Drilling Regulations (C-NAAIA, 1987)

Part I – General

64(1) The operator shall have contingency plans to cope with any reasonably foreseeable emergency situation during a drilling program including spills of oil or other pollutants.

Part II – Approval to Drill a Well

113(b) In the event of a marine oil spill, no chemical countermeasures are to be used without approval of the board unless the delay required to obtain that approval will increase the threat to human safety, equipment or the natural environment.

125(c) All personnel employed in the drilling program have received full instructions in respect to their duties during an oil spill.

125(d) The operator must be involved in a practice exercise of oil spill countermeasures at least once in each year of the drilling program.

Guidelines Respecting Drilling Programs

Appendix C – Contingency Planning (Oil Spill Response Plan)

The operator is expected to identify and confirm its arrangements for mobilizing oil spill countermeasures equipment to the wellsite and to document its procedures for responding to an oil spill. The qualifications of personnel responsible for the management of oil spill response should also be documented. The plan should also:

- Include a description of the procedures for responding to small spills;
- Describe the containment and cleanup strategy for shoreline and any ice covered areas; and
- Provide confirmation of the operator's capability to implement an oil spill trajectory model using real time wind and current data.

Environmental reference material necessary to establish oil spill cleanup priorities should be included as an appendix or referenced separately.

Safety Planning Guidelines

Section 7 – Contingency Planning

51(1) An operator shall develop and submit ... a safety plan ... that includes … (e) Oil Spills

7.1.5 Oil Spill Response Capability

Operators are expected to maintain an adequate oil spill response capability which can be mobilized to the area of a spill within a reasonable time period.

2.1.3 C-NLOPB Expectations

The C-NLOPB approach to oil spill preparedness is to review the plans that the Operator submits and, upon acceptance, audit the Operator's activity to the terms of the plan. The C-NLOPB expects that the Operator's capability will include:

- Designated response personnel;
- A training program for Operator personnel and contractors;
- Access to third party oil spill personnel and equipment which has come to be a requirement spill response arrangement with ECRC, a Response Organization certified under the Canada Shipping Act;
- Spill tracking and clean-up equipment at the offshore site;
- Mutual aid agreements with other Grand Banks operators; and
- A Single Vessel Side Sweep (SVSS) system resident at active production sites.

2.2 Canada Shipping Act (CSA)

Because of the joint federal – provincial jurisdiction of the Newfoundland offshore, the *Canada Shipping Act* specifically excludes vessels or platforms directly involved in offshore drilling or production activities from the requirements of the Act and its associated standards. The CSA does apply to operations supporting offshore operations, including:

- Supply vessel and tanker operations outside the safety zone;
- Shore base operations; or
- Drilling or production vessel shipyard activities.

If the spill occurs outside the safety zone and the source of the spill is a supply vessel, oil tanker, or a shore-based facility, the vessel or facility operator will be the Responsible Party under the CSA. The CSA requires that these vessels or facility operators have response plans, designated and trained personnel, and contract arrangements with an oil spill Response Organization (RO) certified by Transport Canada. In every applicable case, ECRC is the RO retained by Operator drilling, vessel, and shore base contractors (CSA, 2001).

The CSA RO Standards are specific. Seastate rating of equipment, pumping rates, waste oil storage capacities, and mobilization time are all parameters that are considered by Transport Canada in reviewing the RO's Area Response Plan for certification. In paricular, the standards define a limit for operations in "unsheltered waters" to be Beaufort sea state 4 (Hs 1.2 m), which is lower than the safe and practical limit for most offshore vessel operations (CSA, 2001).

2.3 Other Applicable Canadian Legislation

2.3.1 Canadian Environmental Protection Act

The *Canadian Environmental Protection Act* (CEPA) provides for the regulation of petroleum product storage, handling and transportation. The Act also requires the issuing of a permit before any substance is disposed of at sea (CEPA, 1990).

2.3.2 Fisheries Act

The *Fisheries Act* prohibits the harmful alteration, disruption or destruction of fish habitat, including spawning grounds, nursery, rearing, food supply and migration areas. The Act also prohibits the deposit of a deleterious substance in waters frequented by fish. Sections of the Act provide for civil liability for an unauthorized deposit of a deleterious substance, except where the discharge is attributable to a ship covered by the CSA (see Section 2.2) (Fisheries Act, 1995).

2.3.3 Transportation Of Dangerous Goods Act

The *Transportation of Dangerous Goods Act* (TDG, 1994)) requires that:

- Dangerous Goods are identified as such during transportation and are packaged and handled so as to avoid accidental release;
- Emergency response plans are developed and an inspection system is established; and
- Information needed in an emergency is readily available.

The Act does not apply to the transportation of dangerous goods in bulk, in vessels within the meaning of the *Canada Shipping Act*.

2.3.4 Migratory Birds Convention Act

Regulations under this Act that pertain directly to Operators' offshore operations forbid:

- The discharge of oil in waters that are frequented by migratory birds; and
- The handling of seabirds in any way without prior permission (permit) from the Canadian Wildlife Service (CWS).

In preparation for the drilling program, operators must obtain the necessary CWS permit (Migratory Birds Convention Act, 1994).

3.0 CONTINGENCY PLANNING

All Operators have developed oil spill response plans to support activities offshore; there is a high level of consistency between these plans. Procedures presented are consistent with the guidelines established by C-NLOPB for oil spill contingency planning.

3.1 Basis For Planning

Prior to offshore activities, the Operator is required to conduct an environmental assessment of the geographic area proposed for offshore activity. All plans consider the following information, as presented in these environmental assessments:

- Risk of an oil spill associated with the Operators' planned activities;
- The nature of spills that could possibly occur;
- The probable fate of possible spills through stochastic trajectory modelling;
- The biological and social resources that may be impacted by a spill; and
- The physical environmental conditions that characterize the location.

These parameters are discussed in Chapter 2, Section 4.0 of this report.

3.2 Plan Objectives

In every plan, the Operator's operating priorities are:

- Health and safety of all personnel;
- Protection of the environment; and
- The integrity of all Operator, contractor, and third party assets.

Four principles are considered paramount in all aspects of an oil spill response:

- The health and safety is top priorities and should never be compromised;
- The emphasis of the response should be on identifying and protecting sensitive environmental and human resources;
- Response planning decisions should be based on net environmental benefit considerations to the maximum extent that is practical; and
- Operational response actions cover a wide range of effort and technology, depending upon the nature of the spill - no response option should be ruled out or limited in advance.

Oil Spill Response Plans cover the management, countermeasures, strategies and training that will be used in response to spills originating inside the safety zone at the Operator's offshore production or drilling location.

3.3 Plan Structure

The common plan structure includes a comprehensive review of:

- Operator philosophy and policies concerning oil spill response;
- The organization of Operators' response efforts and the evolution of those efforts with the increasing scale of the spill response;
- Arrangements for assistance from contractors, other operators, and corporate resources;
- Environmental issues resulting from an offshore oil spill; and
- Operators' policies concerning safety, oil spill waste management, and training.

The appendices provide detailed information in the areas of:

<u>Actions</u> - Personnel checklists and the forms to be used both in the field and by the onshore Emergency Response Team during oil spill response.

<u>Resources</u> - Details of the personnel, equipment and vessel resources available to Operator for use in an oil spill response.

<u>Oil Spill Fate</u> - Anticipated fate and characteristics of spilled crude.

<u>Procedures</u> - Stand-alone detailed procedures which describe specific actions that may be undertaken during oil spill response. Some of these procedures are used directly as training materials.

<u>Glossary</u> - A dictionary of oil spill terms and acronyms.

<u>Contacts</u> - Contact information for:

- Operator emergency personnel;
- Key Operator contractors;
- Oil spill consultants and contractors;
- Government agencies;
- Other offshore Operators' emergency personnel; and
- All Grand Banks offshore platforms and vessels.

4.0 OIL SPILL RESPONSE PARTICIPANTS

All plans identify the roles of key response personnel and the need for escalation to an appropriate level to meet the increasing demands of the spill.

4.1 Offshore Personnel

First Person On Scene

The first person on the scene should report the spill to the Control Room and then, if safely possible, stop the flow of oil and remain at the site to assist response efforts.

Offshore Facility Management

The Person in Charge of the offshore platform or vessel (OIM or Captain) will assume the initial role of On Scene Commander at the outset of any spill incident. On a chartered platform or vessel, the OIM will be supported by the Operator's Representative and by the masters of any supply vessels at the site.

Platform Personnel

The primary task for platform personnel will be to safely prevent any oil from escaping onboard containment systems.

Supply 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 favorable for response activities.

4.2 Onshore Emergency Response Team

Each Operator has an onshore Emergency Response Team (ERT) that is staffed by in-house personnel. Personnel are on call 24 hours per day and are expected to be at the designated emergency response centre within 45 minutes of being paged. The ERT will provide the offshore facility with direct support in any emergency situation. During an oil spill response, additional actions include:

- Confirming proper notification of CCG and C-NLOPB;
- Notifying ECRC and requesting an advisor join the ERT in the emergency response centre (i.e., ICC or EOC); and
- Gathering initial information relating to the spill to assess the situation.

Short term drilling Operators typically only have one level of onshore emergency response. Suncor, Husky, and HMDC all have a structure to expand the onshore ERT to a second level to support the initial emergency response and to manage the issues resulting from the incident. Suncor and Husky share the Incident Coordination Centre (ICC) and MET Centre (see Figure 2) and have similar response processes. HMDC has a standard corporate process which involves the initial activation of the Emergency

Operations Centre (EOC) and the secondary activation of the Emergency Support Group (ESG) (see Figure 3).

Figure 2 Husky/Suncor Onshore Emergency Response Structure

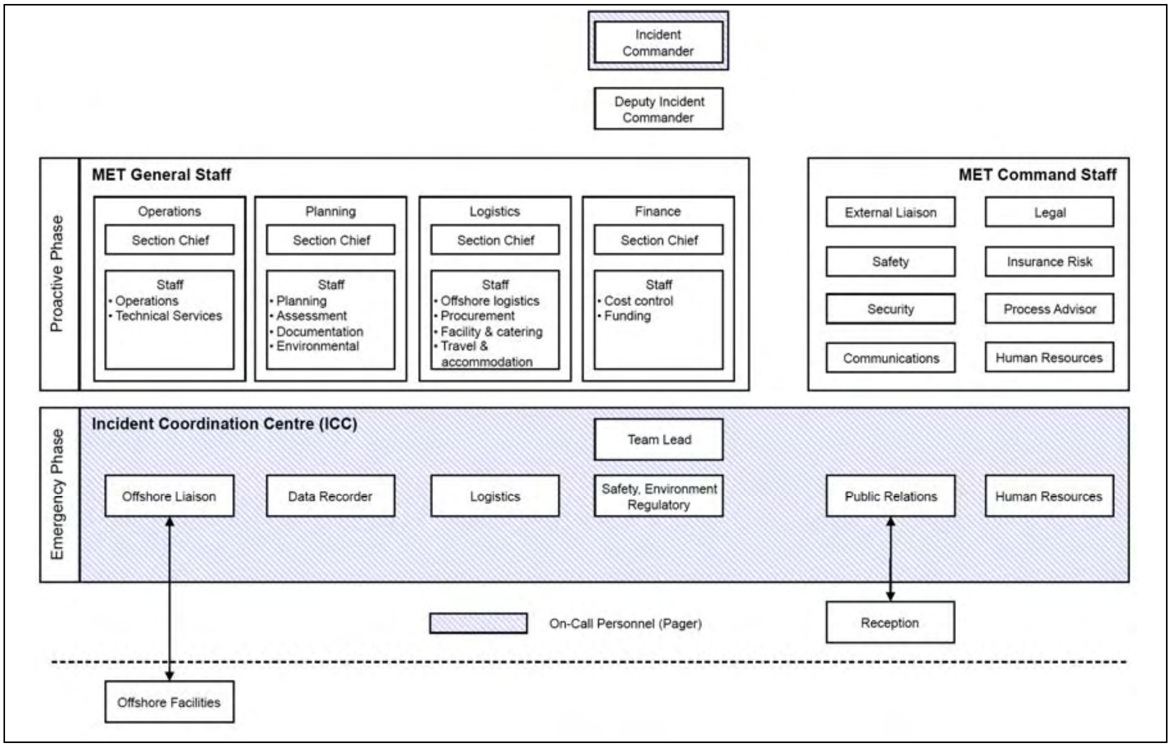
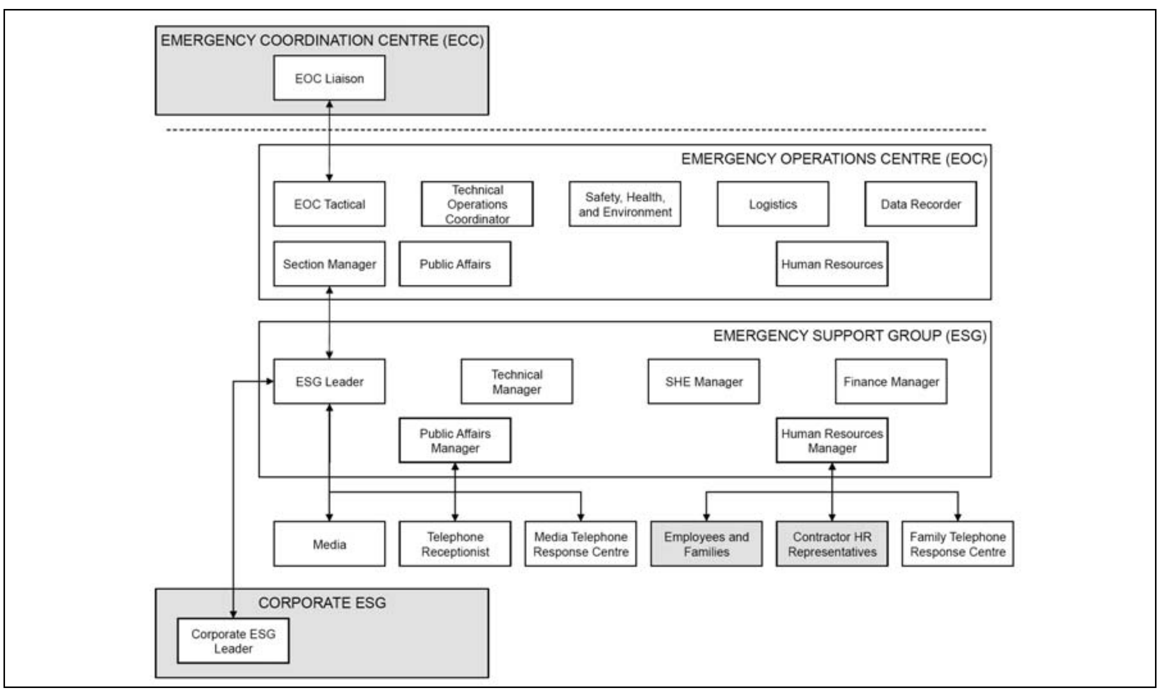


Figure 3 HMDC Onshore Emergency Response Structure



4.3 ECRC (ECRC, 1998)

4.3.1 Structure

ECRC is a private management company, owned by several major Canadian oil companies. ECRC's role is to provide marine oil spill response services, when requested, to the Responsible Party (RP – company or individual responsible for the oil spill), the Canadian Coast Guard or to another Government Lead Agency. ECRC will not assume the role of On-Scene Commander (OSC) but will act under the direction of the RP's OSC to provide a plan of action, equipment, resources and operational management in the clean-up effort (see Section 5.0).

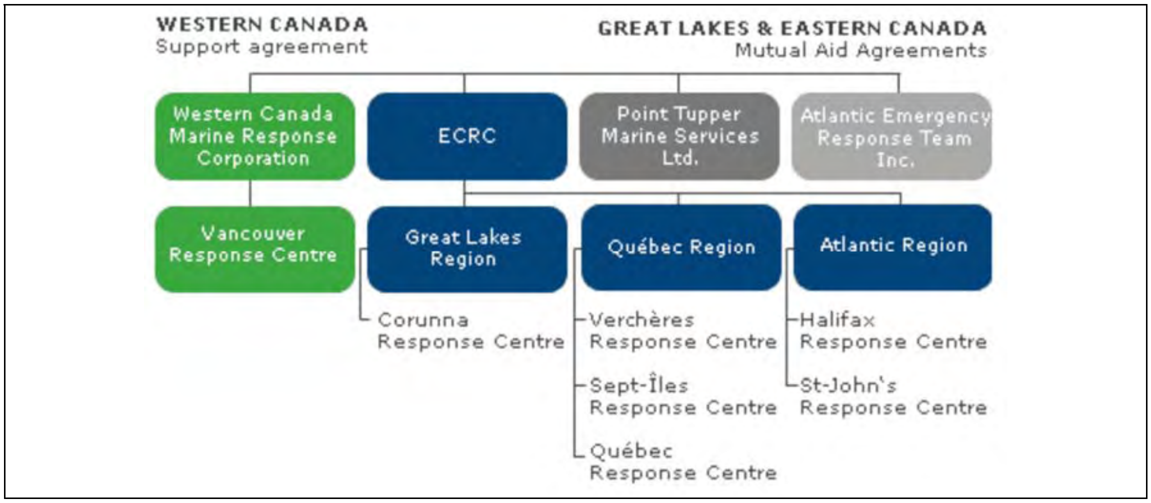
ECRC is certified by Transport Canada as a Response Organization (RO) under the *Canada Shipping Act* (2001) (CSA - see Section 2.2). As a certified RO, ECRC provides oil spill response arrangements on contract to ships and oil-handing facilities to meet the requirements of the CSA. In order to be certified, ECRC must submit a response plan every three years for review by the Marine Safety Branch of Transport Canada..

ECRC provides coverage in all navigable waters east of the Rocky Mountains, except in the Saint John, NB and Point Tupper, NS areas, which are served by local ROs (see Figure 4). ECRC has established mutual aid support agreements with the three other Response Organizations in Canada (see Figure 5): ALERT and Point Tupper Marine Services on the east coast, as well as Western Canada Response Corporation in British Columbia.

ECRC equipment and personnel are stationed at the six response depots shown in Figure 4 and Figure 5. In addition to the permanent staff at each depot, ECRC maintains a pool of trained responders and consultants that can be called out at short notice to assist wth the response.

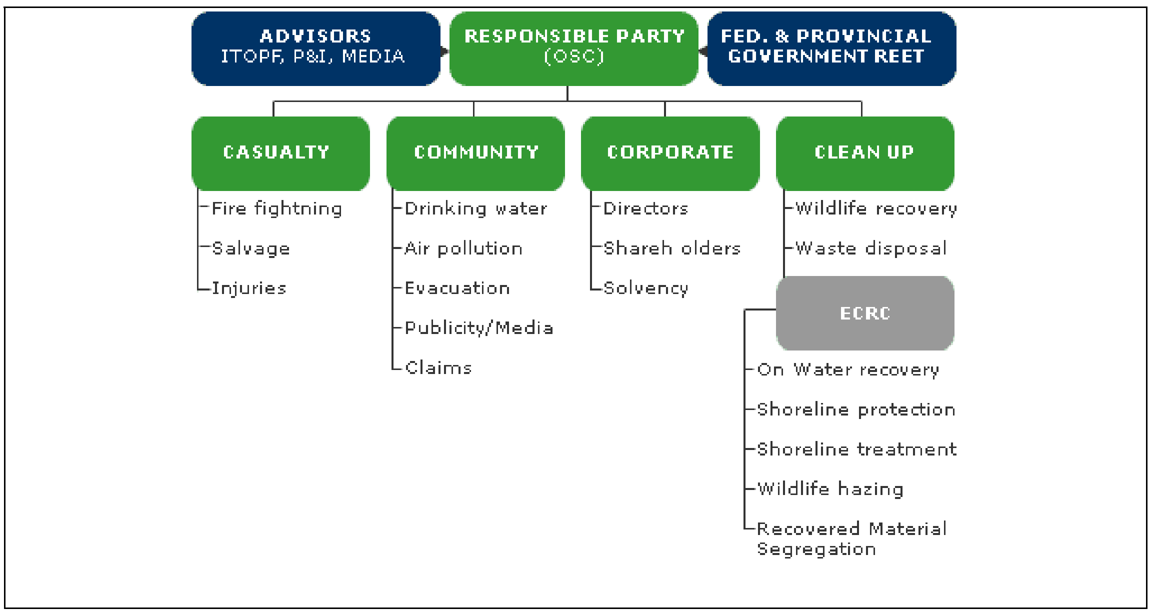
Figure 4 ECRC Geographic Area Of Response

Figure 5 Links Between Canadian Response Organizations



ECRC provides spill response services in support of the RP's overal response to an incident. Figure 6 Shows how ECRC provides clean up services while the RP manages the issues related to it's the public, its operations, and its business.

Figure 6 Responsible Party and ECRC Responsibilities



ECRC staff use a version of the Incident Command System (ICS), called the Spill Management System (SMS), as a model for managing its spill response activities. The SMS is a structured process allowing ECRC's Spill Management Team (SMT) to fulfill its initial response and tactical phase responsibilities while focusing on a movement toward the strategic phase of the response.

The structure of the ECRC SMT is shown in Section 5.3 and the SMT role in an industry oil spill response is described in Section 5.4.

4.3.2 ECRC Equipment

ECRC oil spill response equipment is stored at each of its six operational depots. The type and amount of equipment meets the requirements of local response plans. In order to meet the resource standards for a timely response to a large spill, ECRC has developed a cascade process whereby resources can be mobilized from multiple depots and rapidly transferred to the spill site.

ECRC equipment that may be useful in an offshore spill is listed in Section 6.3.2.

4.3.3 Offshore Response Agreement

Recognizing ECRC's status as a certified RO, all Operators have offshore response agreements ECRC. Under these contracts, ECRC can provide comprehensive response management services, equipment, and trained field personnel to implement technical operations in the field. ECRC is responsible for the direction of resources provided by other contractors and offshore operators under the authority of the Operator's OSC and to provide spill management services in support of the Operator's emergency response process..

4.3.4 Preparedness Integration Agreement

Suncor, Husky, and HMDC are currently in the process of entering into an oil spill preparedness integration agreement with ECRC to further enhance/co-ordinate contingency planning. Included as part of the integration agreement are contingency planning, training, equipment maintenance and storage.

4.4 Canadian Coast Guard

The Canadian Coast Guard (CCG) Environmental Emergencies Unit has a pool of equipment and trained personnel at its depot at Donovan's Industrial Park. If available to the operators at the time of the spill, these resources may be provided on a commercial basis independent of CCG's role as a resource agency to C-NLOPB.

4.5 Mutual Aid

All Operators have entered into a formal Mutual Emergency Assistance Agreement, that establishes the terms in which emergency assistance can be provided to each other. Supply vessels, surveillance aircraft, and helicopters can all be considered as potential platforms to assist in a spill response. Under the agreement, each party agrees to use reasonable effort to make available designated resources in the event of an actual or imminent emergency. Resources will be provided to a requesting party only to the extent that the donor party's operation is not jeopardized or its personnel or facilities put at risk.

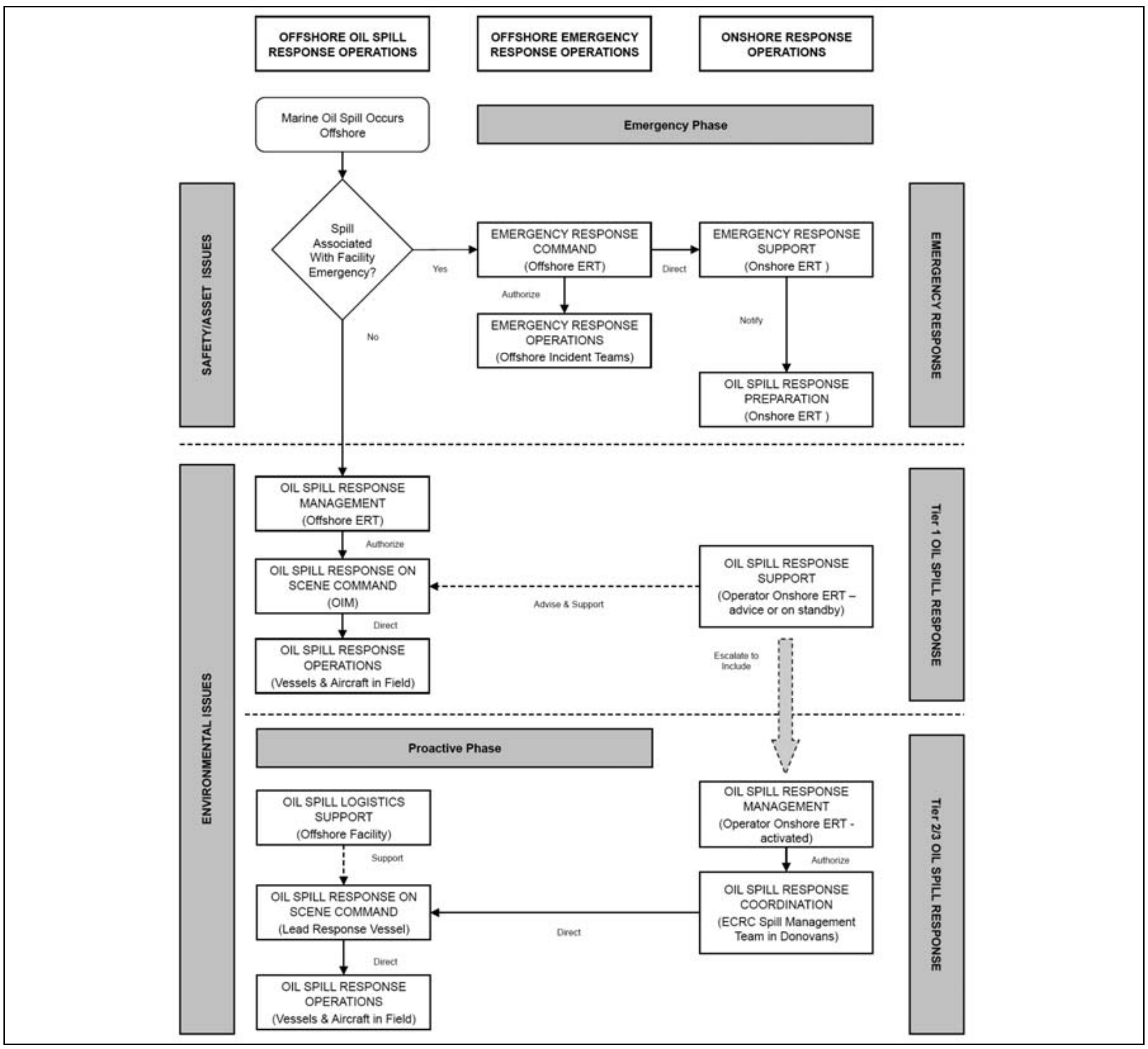
5.0 MANAGEMENT

Each operators' oil spill management structure is based on the Company's existing emergency response program.

5.1 Emergency And Oil Spill Response Management

Oil spills may occur in conjunction with other facility emergencies such as fires or explosions, loss of well control, or marine or aircraft incidents. Response to an incident which threatens personnel will always be the Operator's first priority. Depending upon the severity of the emergency incident and on the availability of resources, preparation for oil spill operations can begin onshore while the ERT is supporting the offshore emergency response. Figure 7 describes how an emergency response might evolve into the subsequent oil spill response. Regardless of the Operator's onshore emergency response structure, all plans reflect this process of escalation.

Figure 7 Transition From Emergency To Oil Spill Management



5.2 Tiered Response

For response planning purposes, all plans classify the severity of potential oil spills into three levels, or Tiers (see Chaper 3, Section1.0). This classification allows for an appropriate initial response to each level of spill, and provides for the escalation of the response should the potential impact of the spill increase. Each Tier will require a successively higher level of operational effort and management. Offshore Management

5.2.1 Notification

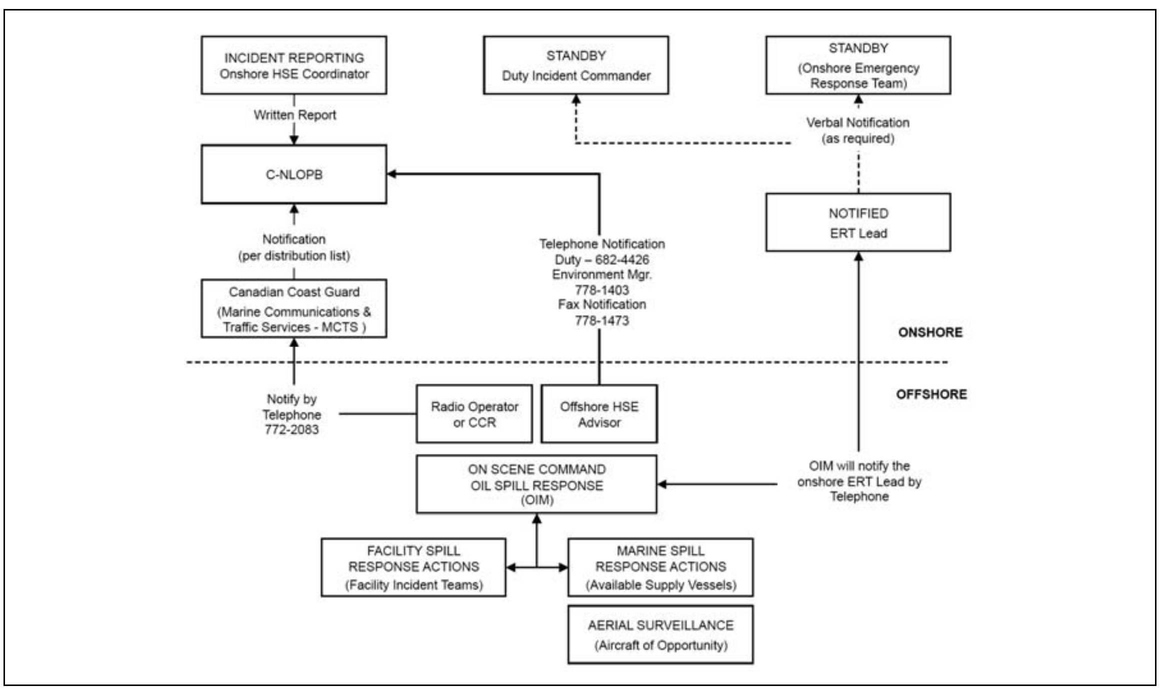
All Operators have protocols in place for the prompt notification of key personnel in the event of a marine oil spill. As soon as is practical following the spill event, the offshore facility will notify:

- Operator management (may require activation of onshore ERT);
- CCG via Marine Communications & Traffic Services (MCTS); and
- C-NLOPB Duty Officer.

5.2.2 Tier 1

The facility Person In Charge (OIM or Vessel Captain) will be designated as the On Scene Commander (OSC), and will assume command and control of the response. Any operations undertaken in response to the spill will be coordinated from the offshore facility's control room or bridge. Spill response operations on the facility will be executed by facility Incident Teams or other designated operations personnel under a local coordinator. Figure 8 illustrates the common Tier 1 management approach followed by all Operators.

Figure 8 Tier 1 Oil Spill Response Management Organization

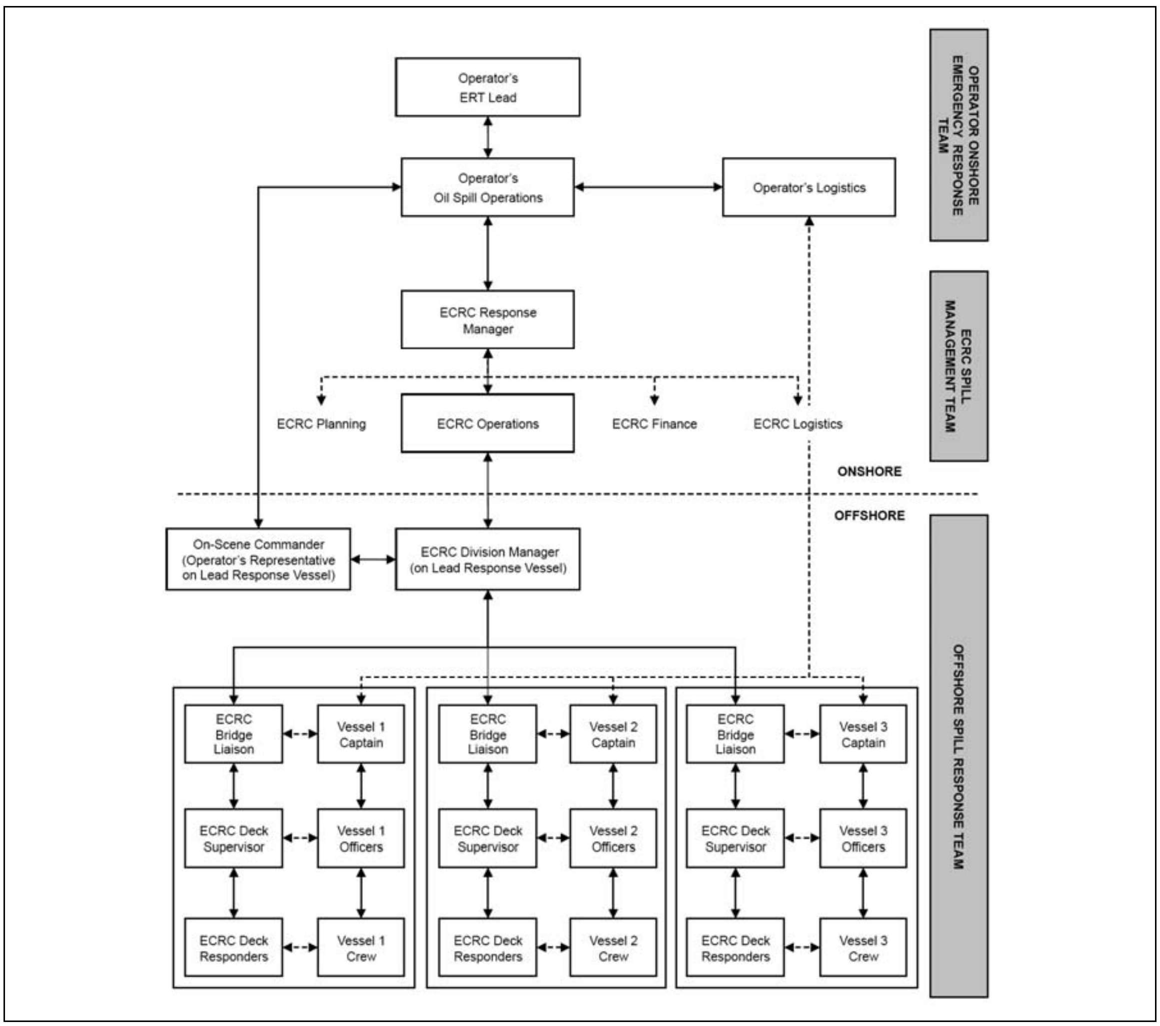


5.2.3 Tier 2 & 3

Once the onshore ERT is fully mobilised, the oil spill response will be managed from shore. Field activities will be directed at site by an On-Scene Commander (OSC – see Figure 9). An Operator representative will fill this role. The OSC will be the formal interface between the onshore ERT and the vessels implementing the response offshore. All plans authorized by the Operator onshore will be transmitted to the OSC for execution. The OSC will be responsible for ensuring that tactical operations are consistent with those plans, and for issuing all field progress reports. Apart from issues relating to the ultimate safety of each vessel (Master's responsibility) and charter issues (Operator Logistics responsibility), all vessel operations will be directed by the OSC.

The OSC will be assisted on the lead response vessel by an ECRC field Division Manager, who will be responsible for directing the tactical implementation of all response actions. The ECRC Division Manager will communicate regularly with the ECRC Operations Manager onshore. Consistency of communications will require close cooperation between the Operator and ECRC onshore and offshore.

Figure 9 Oil Spill Response Field Management



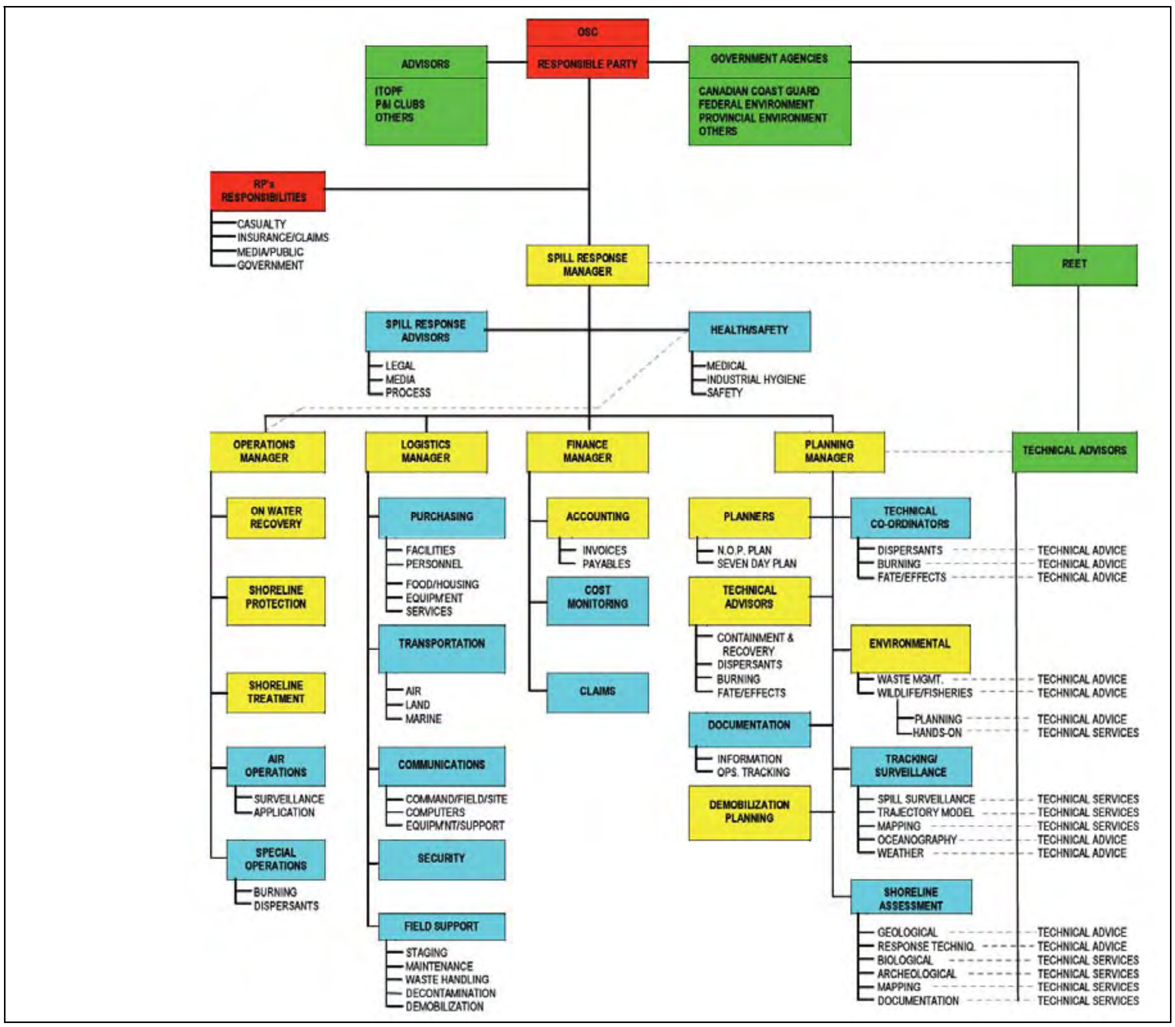
5.3 ECRC Spill Management

The ECRC Spill Management Team (SMT) will:

- Monitor conditions and response activities offshore;
- Develop tactical and strategic plans for field operations (all ECRC plans must be authorized by the Incident Commander before implementation); and
- Coordinate the actions of responders in the field

Management of the planning, coordinating, and documenting of the oil spill response is guided by the principles of the Incident Command System (ICS), the response management structure that is used by Suncor, Husky, and ECRC. ICS will be used in the event that the ECRC Spill Management Team (SMT) is activated to its Spill Response Centre in Donovan's Industrial Park in Mount Pearl. Figure 10 shows the fully-activated ECRC SMT and its relationships to the Responsible Party and government agencies and also the roles played by ECRC Contractors

Figure 10 ECRC Spill Management Team



5.4 Operator's Onshore Emergency Response Team

The Onshore Emergency Response Team (ERT) will be staffed by in-house personnel. This team is on call 24 hours per day and is expected to be at the Operator's onshore emergency response centre in St. John's within 45 minutes of being paged. The duty ERT Team Lead will act as the first point of contact in any emergency situation, including an oil spill, and direct the actions of the onshore Emergency Response Team.

The ERT will provide the offshore facility with direct support in any emergency situation. The ERT Environment Advisor will initiate onshore response actions by:

- Confirming proper notification of Canadian Coast Guard and C-NLOPB;
- Notifying ECRC and requesting that an advisor join the ERT in the ICC; and
- Gathering initial information relating to the spill to assess the situation.

In any oil spill event that leads to the activation of the onshore ERT, additional oil spill response personnel will be activated.

Figure 11 shows how the Husky and Suncor MET process would manage an oil spill response onshore with the assistance of a fully-activated ECRC SMT. Figure 12 presents a similar structure for HMDC. Figure 13 represents the generic oil spill response management structure that would be initiated during a short term single well drilling program.

Figure 11 Suncor and Husky Tier 2/3 Oil Spill Response Management

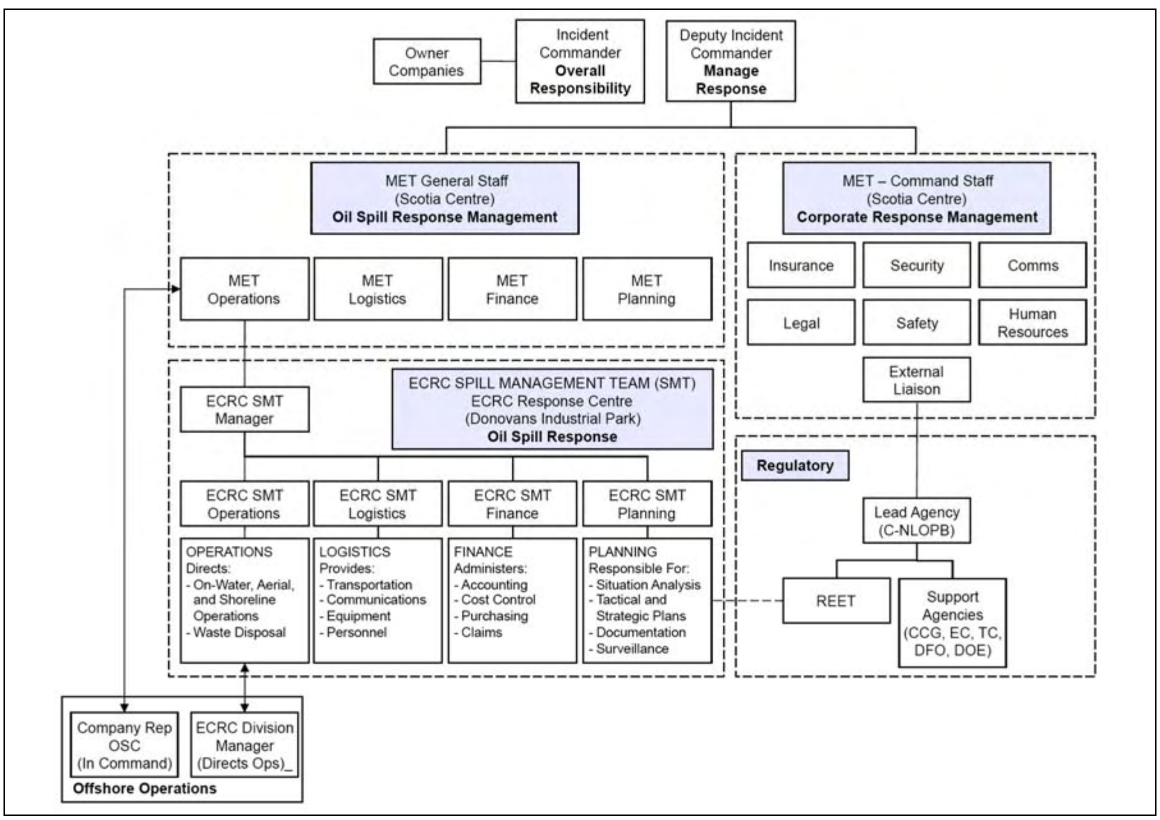


Figure 12 HMDC Tier 2/3 Oil Spill Response Management

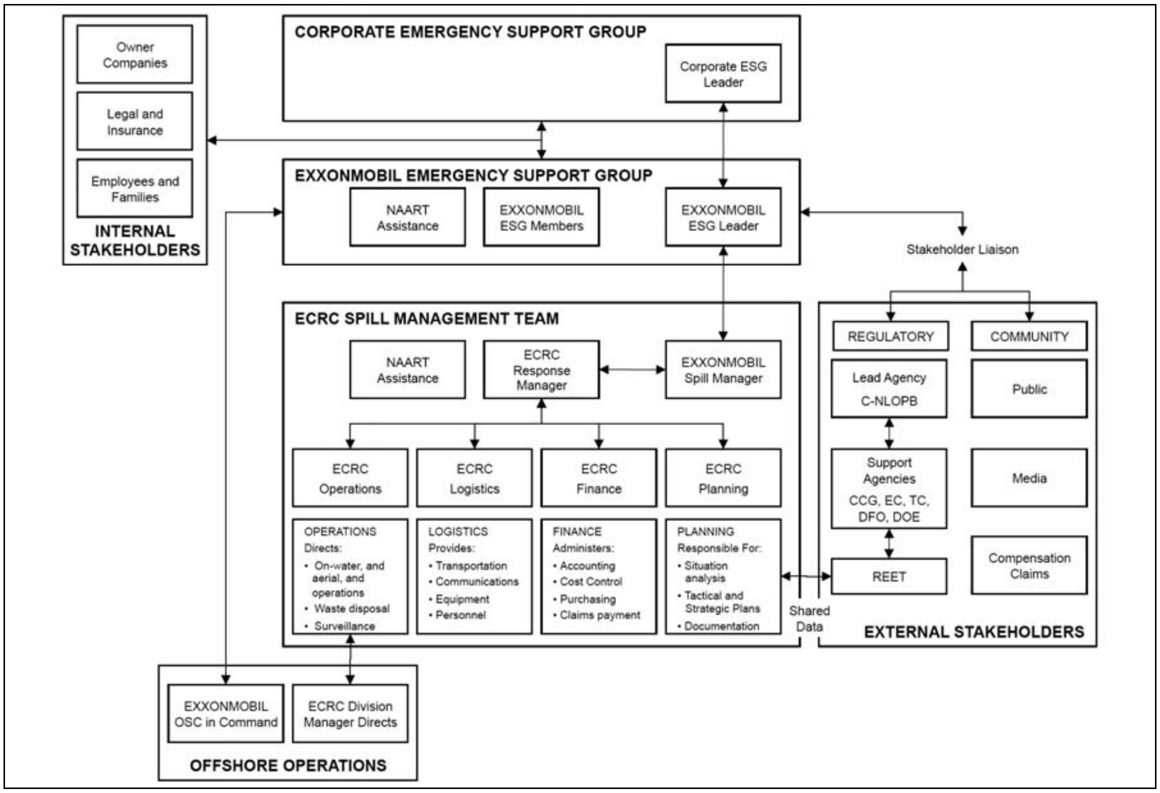
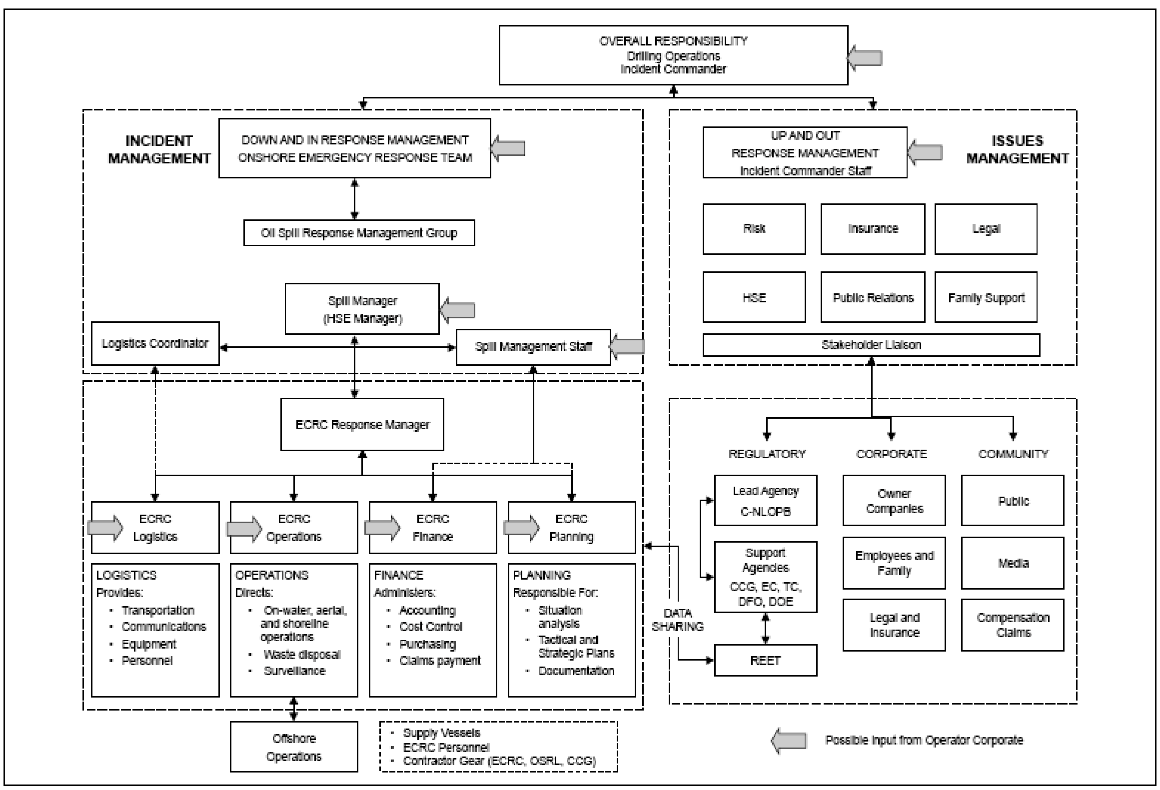


Figure 13 Drilling Operation Tier 2/3 Oil Spill Response Management



6.0 RESPONSE OPERATIONS

6.1 Tier I

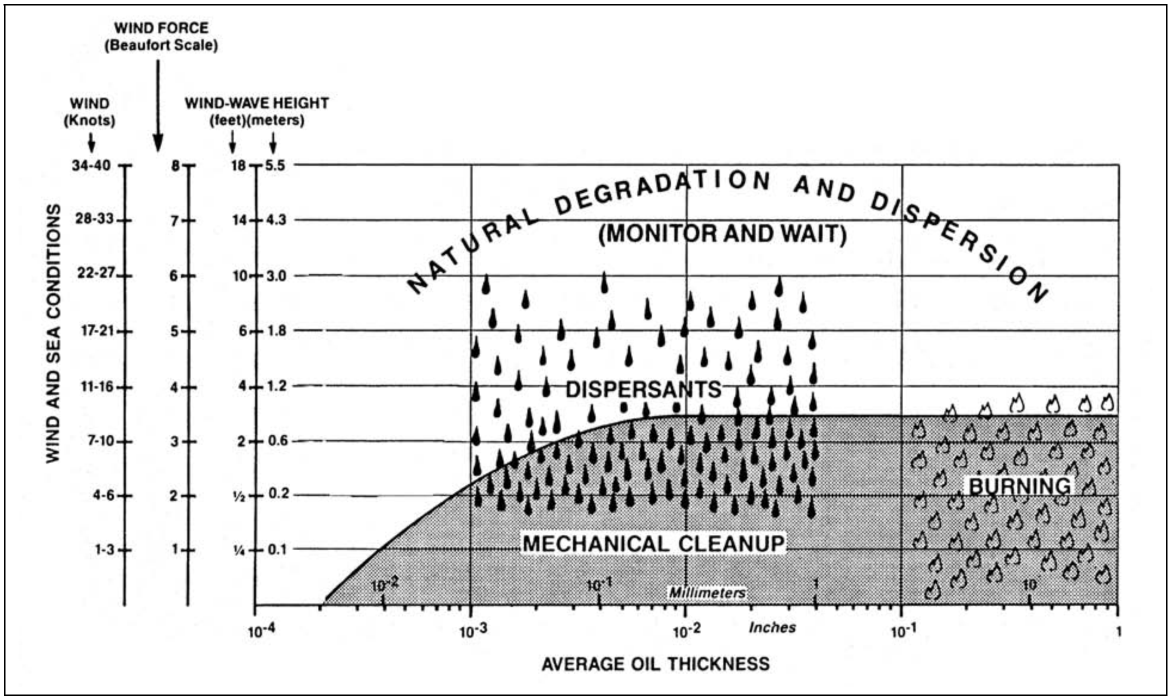
All facilities currently operating offshore Newfoundland, and supply vessels servicing the facilities, have resources to respond to Tier 1 oil spills. At the time of an oil spill, appropriate countermeasures, based on present conditions, must be implemented quickly. The response options potentially available at site during a spill offshore Newfoundland are listed in Table 1.

Table 1 Potential Response Options At Site

Option	Comments
Natural Dispersion / Degradation	• Weathered oil breaks into small droplets by wave action • Droplets are naturally metabolized by micro-organisms • Effectiveness improves as wind and seastate increase • Only option when winds > 25-30 kts and seastate > 2.5-3.0 m
Surveillance And Monitoring	• Always necessary • Helps determine scope of problem prior to forming a strategy • Confirms effectiveness of response actions • More difficult in darkness or low visibility • Monitoring is the only response option in poor conditions • Oil spill tracker beacons are on the Operator supply/standby vessels and/or platforms • CWS protocol for seabird survey
Mechanical Dispersion	• Prop washing or high pressure water spray (Fire Monitor) • Good for small spills/thin layers of oil, not good for crude • Quick implementation, no equipment required
Containment And Recovery	• Effective but limited by seastate, encounter rate of boom system, and need for high logistics support • Low recovery rates as slick spreads • Two available options: o Sorbent boom on Operator supply/standby vessels; and o Single Vessel Side-Sweep System at production sites.
Wildlife Measures	• Surveillance necessary to determine distribution of wildlife and potential for impact by floating oil – deploy Drifter Blocks • Techniques for deterring wildlife are limited to loud noise • Consult onshore HSE Advisor in any incident involving wildlife
Oil And Wildlife Sampling	• Kits have been placed on all platforms and supply/standby vessels for the collection of oil and water, oil on wildlife, and oiled wildlife samples • Environment Canada requires that all oiled birds collected be retained as samples for further assessment on shore • A permit is required for collection of seabirds

All countermeasure techniques will have safe effective operating limits. Figure 14 (Allen, 1988) provides a guideline for the limits to common offshore oil spill response countermeasures. As suggested in Part 2, Section 3.2.1, the limits to mechanical clean up in this diagram should now be extended as high as Hs 3.0 metre with the development of improved open ocean containment and recovery equipment such as the Norwegian Standard System discussed in Part 3, Section 2.5.2.

Figure 14 Wind And Sea State Limits to Countermeasures



6.1.1 Vessel Kits

Table 2 describes the spill response equipment available on all chartered supply vessels.

Table 2 Oil Spill Response Equipment Available At Site

Equipment	Storage Location	Deployment Time
GPS/Satellite spill tracking buoys	1 MetOcean Argosphere or I-sphere buoy on each supply/standby vessel	Less than 15 minutes
8" sorbent boom	320 ft. of boom and 100 ft. of pom poms stored onboard supply/standby vessels	Less than 30 minutes
Oil sampling kit	all offshore facilities; all supply/standby vessels	Immediate. Suggest use of FRC or spinning rod option

6.1.2 Sorbent Boom

The side-sweep sorbent boom system is a single-vessel oil recovery system used by supply and ice management vessels chartered by Newfoundland offshore Operators in response to small oil spills at an offshore facility. Unlike a conventional boom, which acts as an impenetrable barrier that collects floating oil, the side sweep sorbent boom system is constructed of multiple 10-foot sections of 8" sorbent boom, which will absorb oil on contact. Soiled boom is disposed of with the recovered oil. The system uses the ship's crane as an outrigger arm, extending perpendicular to the side of the vessel, to tow the boom. As the vessel steams ahead at slow speed (1-2 knots), a V-shaped boom configuration is formed along the side of the vessel. The system is simple to use and quick to deploy. Figure 15 shows the sorbent boom deployed. Through recent experience in offshore spill situations on the Grand Banks, the sorbent boom has been proven to be successful in offshore applications because of its very shallow draft, which results in little or no drag even in higher seastates.

Figure 15 Side Sweep Sorbent Boom System

6.1.3 Surveillance And Observation

Crews of supply vessels servicing the offshore facilities all receive annual training in oil spill surveillance and observations.

For aerial surveillance there are two options in the offshore Newfoundland area: one of three Aerospatiale Super Puma long range helicopters operated by Cougar Helicopters, or one of the two Beechcraft King Air fixed wing surveillance aircraft operated by Provincial Airlines Limited (PAL). Both aircraft types are permanently stationed at St. John's International Airport at Torbay, Newfoundland.

PAL provides a comprehensive marine surveillance service offshore Newfoundland and Labrador and oil pollution monitoring services to Transport Canada (TC). Although PAL has a strong link to the offshore industry, aircraft availability may be affected by contract commitments for TC surveillance. Surveillance aircraft have been outfitted for this application with dedicated scanning search radar with computerized logging systems; Forward-Looking Infrared (FLIR) sensors; and high resolution/low light cameras. Aircrews are experienced in offshore search and surveillance techniques.

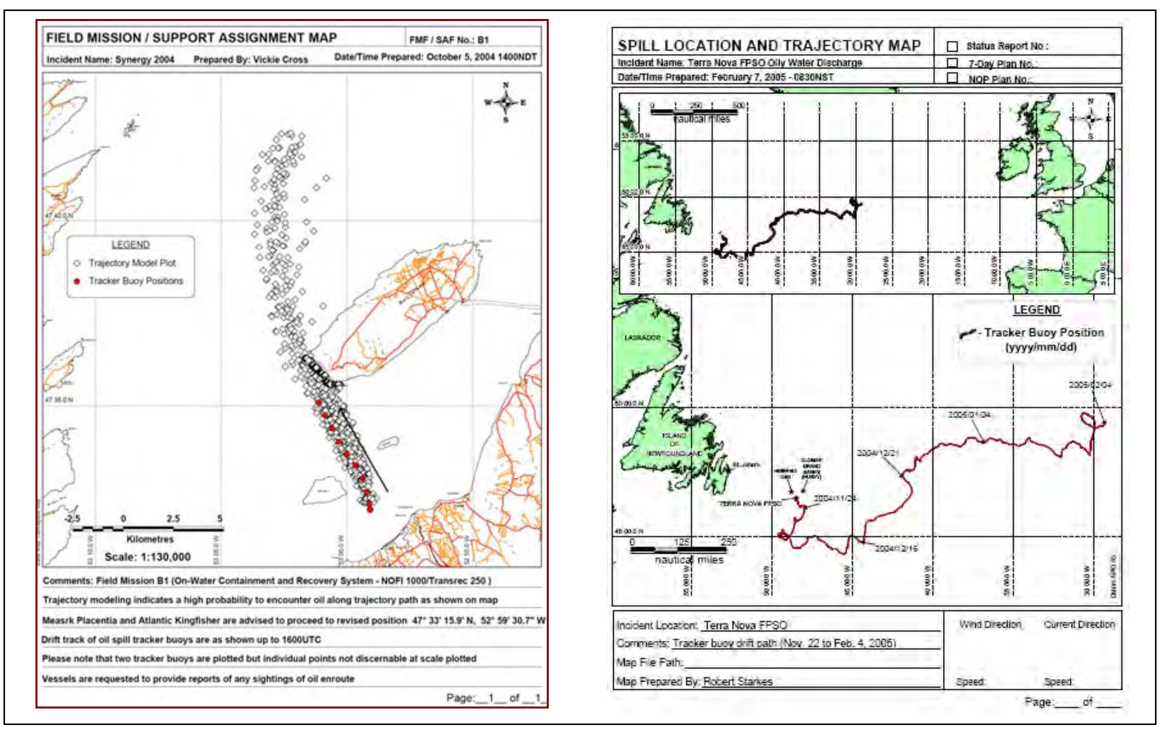
For offshore oil operations in Newfoundland, the Thickness Appearance Rating (TAR) coding system, developed by the Canadian Coast Guard and Environment Canada, has been adopted as the standard reference for visual observations of oil-on-water. PAL incorporates the TAR code into its standard onboard oil spill surveillance software and report products. The TAR code system is based on the observed colour of the floating oil, and provides a standard means to report oil spill characteristics and estimated slick thickness. Methods of volume calculation, however, are not consistent among vessel and PAL flight crews.

6.1.4 Oil Tracking

All supply vessels and some platforms are equipped with satellite tracker buoys. These buoys are equipped with an onboard GPS positioning device and a satellite communicator for reporting the buoy's position. Originally, the MetOcean Argosphere was purchased for this application. Recently, some of the Argosphere have been replaced with the MetOcean iSphere.

Trajectory modeling is provided by Oceans Ltd. or Amec forecast offices. Both have access to Environment Canada gridded weather and updated gridded residual current vectors as input to the model. Modeling can be enhanced by the inclusion of recent trajectory information. Figure 16 shows how ECRC can combine tracker buoy positions and trajectory model output can be combined to provide a tactical map product.

Figure 16 Maps With Tracker Positions and Trajectory Model Output



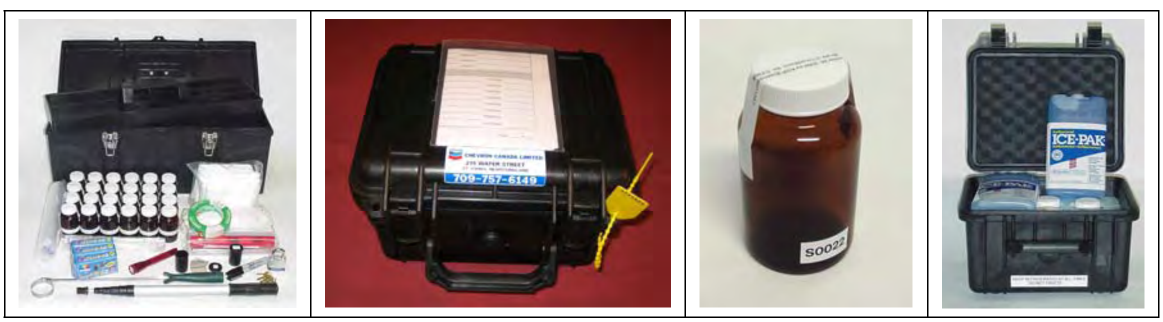
6.1.5 Oil And Oiled Wildlife Sampling

All offshore vessel crews receive training in oil sampling. Operator procedures are based on sampling guidelines developed for the Canadian Coast Guard by Peter Hennigar of the Environmental Protection Branch of Environment Canada. The guidelines are intended for the collection of oil on water, in ship's machinery areas or bilges, on beaches, or on wildlife. The protocols and equipment are currently in use by all Grand Banks Operators. Figure 17 shows the sampling kits used offshore.

The following features characterize the operator's oil and oiled wildlife sampling procedure:

- Offshore personnel are encouraged to sample any oil on water observed at any site, regardless of source;
- All offshore platforms and vessels have been equipped with the sampling equipment described in this document;
- Trained personnel on production platforms or drilling rigs coordinate sampling activity offshore;
- Chain of custody procedures ensure that someone will always be the custodian of the sample until analysis onshore is complete;
- All sample handling actions will be documented (notifications, field notes, proper labelling, and a chain of custody form); and
- Samples will be kept cool at all times and shipped to St. John's as soon as possible.

Figure 17 Standard Oil And Oiled Wildlife Sampling Kit



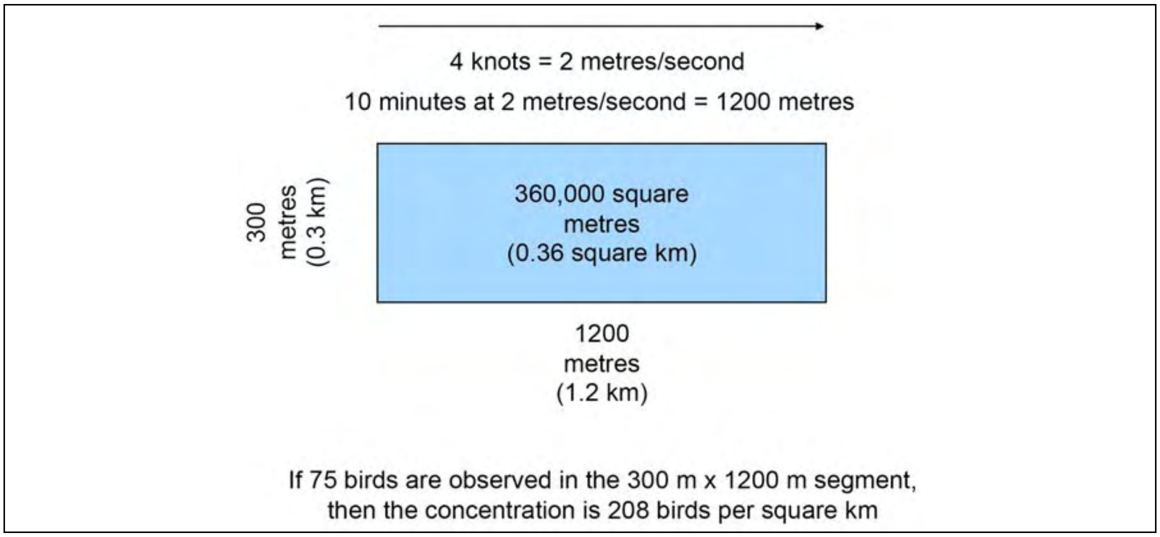
6.1.6 Seabird Observations

Supply vessel crews or offshore personnel may be tasked with initial seabird surveys before seabird specialists can be dispatched to the scene of an offshore oil spill. An experienced observer can be expected to provide reliable species identification. However, without a systematic survey approach, a quantitative appreciation of seabird distribution will be difficult to obtain. Seabird survey training is provided to all charter vessels using a survey technique developed by the Canadian Wildlife Service. The procedure provides non-expert personnel with the tools to undertake offshore seabird surveys which provide adequate quality data in the initial stages of an offshore oil spill, even if confidence in species identification is not high.

To obtain a quantitative estimate of seabird distribution, it is necessary to determine the concentration of each species per unit area. This is accomplished by conducting surveys along straight tracks, or transects. Longer transects will provide an estimate over a larger area.

The minimum speed for seabird observations from moving platforms is 4 knots (about 2m/s) and at a maximum speed of 19 knots (about 9.8 m/s). A typical survey segment will be 10 minutes in length. Figure 18 shows how the density of seabirds can be calculated for a transect segment.

Figure 18 Seabird Density Calculation Based On Transect Survey



6.1.7 Seabird Handling

It is possible that seabirds may be impacted by offshore operations:

- Seabirds may land on ships or installations during late summer or fall. Where possible, these birds are stored temporarily and then released offshore;
- Coastal or terrestrial birds that are blown offshore may land on an offshore facility and need to be transported back to shore for release;
- Seabirds that become oiled on a Suncor, Husky, or HMDC offshore installation or in the marine environment may be collected and sent to shore for cleaning and rehabilitation in the Suncor Seabird Center in St John's or, for Hibernia, in the Newfoundland and Labrador Environmental Association Seabird Cleaning Facility in Ship Cove.

Suncor, Husky and HMDC have made a commitment to rehabilitate birds that can be safely collected. The handling of any migratory bird offshore requires a salvage permit from the Canadian Wildlife Service.

As personnel safety is paramount, seabird rescue operations are at the discretion of offshore personnel. Therefore, implementation should follow an assessment of current conditions. Handling procedures identify some of the hazards associated with the handling of wildlife. All personnel are trained to ensure that the proper personal protective equipment and techniques outlined are used at all times.

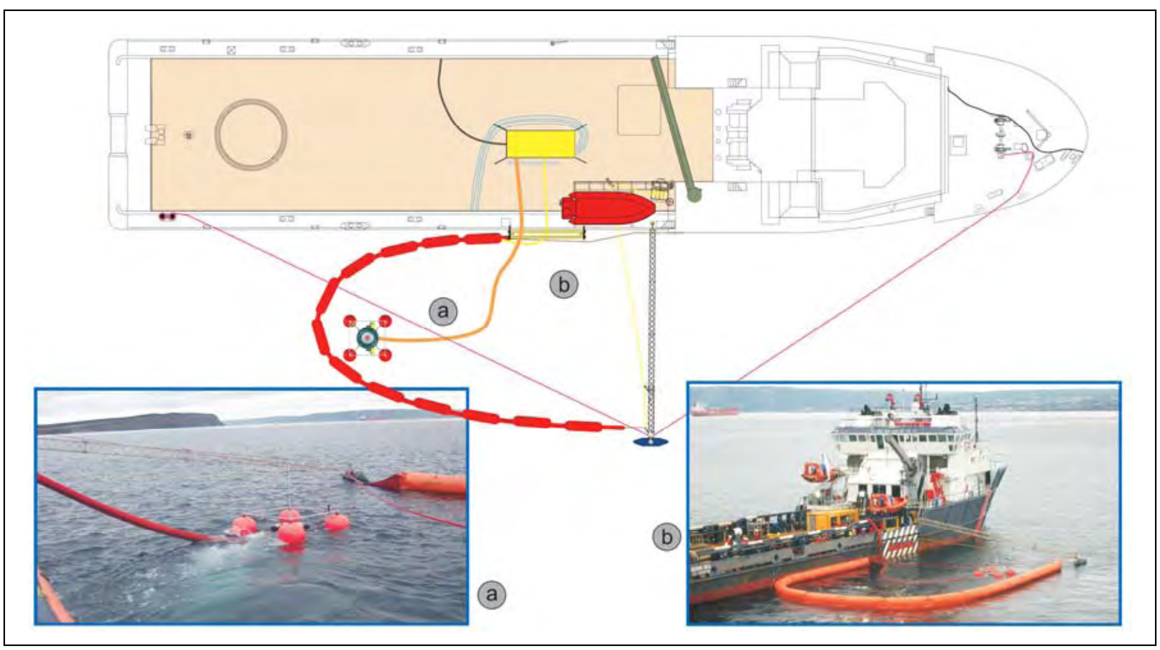
Seabirds are shipped to shore as soon as possible. Key points in this transportation process are:

- Birds will be shipped from the field by the best route at the time. The decision to ship the bird by helicopter or vessel will depend upon the condition of the bird, vessel schedules, and operating conditions;
- In summer months, helicopter schedules may be delayed for periods of several days due to heavy fog and vessel transport may be the only option;
- Trained personnel on the platform or the Captain of the Vessel which collected the bird acts as the point of contact while the bird is in transit; and
- Birds will only be handled by trained personnel.

6.2 Single Vessel Side Sweep System

Each production platform has been equipped with an oil spill containment and recovery system, appropriately named the Single Vessel Side Sweep (SVSS) system, which can be deployed from a single vessel. The philosophy of this system is to ensure that resources are available at site that can be deployed and operated in open ocean conditions by a single vessel. Each system consists of a side-deployed outrigger arm and float, inflatable containment boom, and an archimedean-pump skimmer for oil recovery operations (see Figure 19).

Figure 19 Third Generation SVSS



The system was designed to be suitable for offshore conditions. The third generation skimmer has been built on a broad flotation base and is very stable in a seaway. Its powerful thrusters ensure that the skimmer can be maneuvered into any part of the boom apex in offshore conditions. As the sea state rating for a boom is approximately equivalent to the overall height of the boom, the SVSS nominal sea state rating for Suncor and Husky's NOFI 800 (height = 2150 mm) and HMDC's RoBoom 2200 (height – 2200 mm) is about 2-2.5 metres Hs or Beaufort 5. Figure 20 Shows the Suncor NOFI 800 in use offshore in conditions of Hs 2-2.5 metres.

Figure 20 SVSS Boom Deployed Offshore

6.2.1 SVSS Components

Each Single Vessel Side Sweep (SVSS) system consists of:

Stored on the Production Platform - A customized 20 ft. DNV-class offshore container housing an inflatable oil containment boom, offshore oil skimmer, boom and hose deployment winches (reels), hydraulic control system, sweep arm rigging, hydraulic and discharge hoses, and miscellaneous supplies.

Stored on Designated Supply Vessels - An outrigger arm assembly and boom deployment fairlead. The 20-metre outrigger arm assembly keeps the oil containment boom positioned on the side of the vessel during oil recovery operations. The boom fairlead is designed to aid in the over-the-side deployment and recovery of the containment boom. Each vessel is equipped with dedicated hydraulics.

By concentrating the sophisticated oil recovery equipment in a single container, which is stored on the production platform, there are significant savings in the capital cost, storage space, and system maintenance.

Should the need arise, additional equipment is available to facilitate the deployment of an SVSS system on a suitable vessel-of-opportunity. These spares are, for the most part, limited to sweep arm hardware. In the event that a containment boom or a discharge hose must be replaced or if skimmer or container repairs are required, the only recourse is to take components from another container. Given the consistency of these major components, this could be a cooperative effort between producing Operators.

6.2.2 System Development

The SVSS has been developed in three generations with the commissioning of each Grand Banks production program (Hibernia – two systems, Terra Nova – one system, White Rose – one system and one shared Terra Nova/White Rose system). All systems were built to the same concept and have maintained the consistency necessary to allow deployment of any system on any of the vessels currently designated for SVSS use.

Unlike other oil spill response equipment, which is stored in a warehouse and receives regular preventative maintenance, the SVSS container can be stored on the deck of the production platform and exposed to offshore weather for several months at a time. Therefore, a critical design objective for equipment in this situation is to minimize exposure and vulnerability to moisture. Vulnerability can be reduced through frequent rotation of containers, although this has to be considered in the context of wear and tear resulting from loading and transportation by a supply vessel.

Through improved available technology and the experience gained through operational use, improvements have been realized with each new generation:

- Replaced modified 20 ft. ISO Container provided to Hibernia with a custom-built DNV 2.7-1 class container for Terra Nova and White Rose;
- With each generation, more components (hydraulic connections, boom and hose reel drums, container floor) are stainless steel to avoid corrosion;
- Heavy fiberglass float and RoBoom 2200 have been replaced with lighter NOFI 800 boom and inflatable float in Terra Nova and White Rose generations;
- Significant improvements in the placement and integrity of the container hydraulics with each generation;
- Development of an integrated discharge hose and hydraulic umbilical;
- Development of a hose reel with fluid rotary valve for use with the integrated hose bundle;
- Enhanced heavy oil skimming capability with the addition of a belt attachment on the Terra Nova skimmer and a brush attachment on the White Rose skimmer;
- Development of purpose-built offshore skimmer for White Rose that incorporates the experience gained in earlier SVSS developments;
- Development of formal SVSS procedures and a training video for the Terra Nova and White Rose generation SVSSs; and
- Multiple improvements in container layout.

With the experience of the first two generations, the third-generation White Rose system was completely designed and built in St. John's.

6.2.3 Ocean Boom Vane

This SVSS system has been successful in that it provides an ocean going containment and recovery system offshore at all times. Because of the storage considerations, however, it requires assembly in the field. During the 2008 Synergy exercise in which the system was demonstrated, observers noted that the deployment of the side arm using the ship's crane may limit the use of the system in some seastates.

In December 2008, Husky explored an alternative to the side sweep arm by demonstrating the Ocean Boom Vane (OBV) manufactured by ORC in Goteborg, Sweden. A successful trial was conducted on December 11, 2008, in conjunction with a scheduled SVSS training session on the Atlantic Osprey (see Figure 21 and Figure 22). All observers agreed that with some modifications the deployment of the OBV should be safer and quicker than the sweep arm.

Figure 21 Ocean Boom Vane

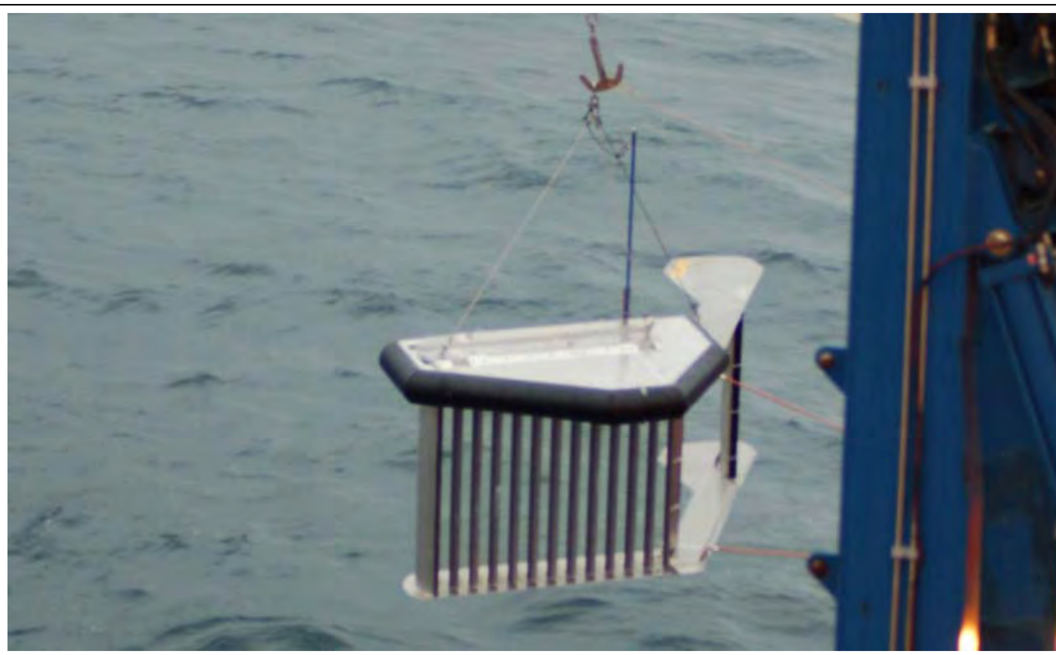


Figure 22 OBV Towing NOFI 800 Boom

6.3 Tier 2 & 3 Equipment

There are three sources of oil spill response equipment that might be considered for use in a Tier 2 or 3 offshore oil spill response:

- Operator owned equipment - additional SVSS systems (see Section 6.2) and the Norwegian Standard System (see Section 6.3.3);
- ECRC equipment stored in Donovan's or cascaded in from other ECRC depots;
- Canadian Coast Guard equipment stored in Donovan's; or
- Equipment provided by OSR (see Section 6.5.1) or another international response organization through the Global Response Network (see Chapter 2, Section 1.1.3).

In reviewing available resources, only equipment suitable for use offshore is considered. As shown in Figure 3 in Chapter 2, equipment capable of operating in seastates above 1.5 m Hs

The current pool of oil spill response equipment that is suitable for offshore use and available in Canada is presented in Section 6.3.3. Equipment in this pool is owned by offshore operators, ECRC and the Canadian Coast Guard. The information is presented in tabular format and sorted by equipment type and owner. Some support information is attached such as the size or capacity. In the case of containment booms, the overall height of each boom is presented as a comment. The rule of thumb is that the seastate limit for boom operations (Hs in metres) is the overall height of the boom.

6.3.1 Key Resources

The most suitable resources availble for an offshore spill response include:

- Operators' 3 SVSS systems on production platforms with 2 spare systems on shore (see Section 6.2);

- Operator's Norwegian Standard System stored at ECRC in Donovan's (see Section 6.4);
- ECRC NOFI 1000 boom stored at ECRC in Donovan's;
- ECRC NOFI Ocean Buster boom (can be towed at 4-5 knots) stored at ECRC in Quebec;
- ECRC GT 260 skimmers with Desmi Helix brush attachments Stored at ECRC in Donovan's;
- ECRC GT 260 skimmers stored at mainland depots;
- CCG Transrec 200 stored at Donovan's; and
- CCG GT 260 skimmers stored at Donovan's.

6.3.2 Summary Of Oil Spill Response Equipment Available To Offshore Industry

Equipment Type	Manufacturer / Model	Owner	Size	Qty,	Comment
Bird Scaring Buoy	Breco	Industry - HMDC		1	• At shore base
Boom - SVSS	Ro-Clean Desmi / Ro2000	CCG	60 m		• 1700 mm • Assigned to Ann Harvey • Stored at CCG, Donovan's
Boom - SVSS	Ro-Clean Desmi / Ro2000	CCG	60 m		• 1700 mm • Available for charter vessel • Stored at CCG, Donovan's
Boom - SVSS	Ro-Clean Desmi / Ro2200	Industry - HMDC	60 m	2	• 2200 mm • In 1st generation Container
Boom - SVSS	AllMaritim / NOFI 800	Industry - Husky	60 m	1	• 2150 mm • In 3rd generation Container
Boom - SVSS	AllMaritim / NOFI 800	Industry - Suncor	60 m	1	• 2150 mm • In 2nd generation Container
Boom - SVSS	AllMaritim / NOFI 800	Industry Suncor/Husky	60 m	1	• 2150 mm • In 3rd generation Container
Boom – 2 vessel	All Maritim / Oil Trawl	CCG		1	• Assigned to Grenfell • Stored at CCG, Donovan's
Boom – 2 vessel	All Maritim / NOFI V-Sweep	CCG		1	• 1800 mm • Available for charter vessel • Stored at CCG, Donovan's
Boom – 2 vessel	Vikoma / Ocean Pack	CCG		1	• Available for charter vessel • Stored at CCG, Donovan's

Equipment Type	Manufacturer / Model	Owner	Size	Qty,	Comment
Boom – 2 vessel	AllMaritim / NOFI 1000	ECRC	370 m	1	• 2350 mm • Stored at ECRC,Donovan's
Boom – 2 vessel	AllMaritim / NOFI-600	ECRC	155 m	1	• 1750 mm • Stored at ECRC,Donovan's
Boom – 2 vessel	AllMaritim NOFI / Vee-Sweep	ECRC	70 m	1	• 1800 mm • Stored at ECRC,Donovan's
Boom – 2 vessel	AllMaritim / Current Buster-600	ECRC	155 m	1	• 1750 mm • Stored at ECRC, Quebec
Boom – 2 vessel	AllMaritim / Ocean Buster-1000	ECRC	155 m	1	• 2200 mm • Stored at ECRC, Quebec
Boom – 2 vessel	Oil Stop / DeepSea	ECRC	250 m	1	• 1626 mm • Stored at ECRC,Donovan's
Boom – 2 vessel	Oil Stop / DeepSea	ECRC	250 m	1	• 1626 mm • Stored at ECRC, Sept Isles
Boom – 2 vessel	Oil Stop / DeepSea	ECRC	250 m	1	• 1626 mm • Stored at ECRC, Halifax
Boom – 2 vessel	Oil Stop / DeepSea	ECRC	250 m	1	• 1626 mm • Stored at ECRC, Sept Isles
Boom – 2 vessel	Ro-Boom Ro1500	ECRC	250 m	1	• 1270 mm • Stored at ECRC,Donovan's
Boom – 2 vessel	Ro-Boom Ro1500	ECRC	250 m	1	• 1270 mm • Stored at ECRC, Halifax
Boom – 2 vessel	Vikoma / Oceanpack	ECRC	500 m	2	• 1100 mm • Stored at ECRC,Donovan's

Equipment Type	Manufacturer / Model	Owner	Size	Qty,	Comment
Boom – 2 vessel	Norlense / 1200R	Industry Suncor/Husky/HMDC	400 m	1	• 3400 mm • Stored at ECRC, Donovan's
Container - SVSS	Buckley Engineering / SVSS	Suncor/Husky	20 ft		• Custom (DNV 2.7-1) • Onshore spare for training
Container - SVSS	Axiom Engineering / SVSS	Industry - HMDC	20 ft	1	• Standard ISO • Modified to DNV 2.7-1 in frame • On Hibernia Platform
Container - SVSS	Axiom Engineering / SVSS	Industry - HMDC	20 ft	1	• Standard ISO • Modified to DNV 2.7-1 in frame • Onshore spare for training
Container - SVSS	Buckley Engineering / SVSS	Industry - Husky	20 ft		• Custom (DNV 2.7-1) • On SeaRose FPSO
Container - SVSS	Buckley Engineering / SVSS	Industry - Suncor	20 ft		• Custom (DNV 2.7-1) • On Terra Nova FPSO
Dispersant System	Axiom Engineering	Industry - HMDC		2	• Built for supply vessel use • Not in service
Aerial Ignitor - Aerial	Simplex / Heli-torch 5400	CCG		2	• Can be used with S-92 heli • Stored at CCG, Donovan's
Power Pack	Axiom Engineering	CCG	100 hp	1	• Portable hydraulic power • Adjustable output • Stored at CCG, Donovan's
Power Pack	Axiom Engineering / SVSS	Industry - HMDC	100 hp	1	• Portable hydraulic power
Power Pack	Buckley Engineering / SVSS	Industry - Husky	100 hp	1	• Portable hydraulic power

Equipment Type	Manufacturer / Model	Owner	Size	Qty,	Comment
Skimmer	Framo / Transrec 200	CCG		1	• Assigned to Wilfred Grenfell • Stored at CCG, Donovan's
Skimmer	Framo	CCG		1	• Old • Stored at CCG, Donovan's
Skimmer	Pharos Marine / GT-185	CCG	100 m3/h	3	• Weir skimmer • Available for charter vessel • Stored at CCG, Donovan's
Skimmer	Pharos Marine / GT-260	CCG	100 m3/h	2	• Weir skimmer • Available for Ann Harvey and charter vessel • Stored at CCG, Donovan's
Skimmer	Pharos Marine / GT-260	ECRC	100 m^3/h	2	• Brush/Weir skimmer • Stored at ECRC, Donovan's
Skimmer	Pharos Marine / GT-185	ECRC	100 m^3/h	3	• Weir skimmer • Stored at ECRC, Halifax
Skimmer	Pharos Marine / GT-185	ECRC	100 m^3/h	3	• Weir skimmer • Stored at ECRC, Quebec
Skimmer	Pharos Marine / GT-185	ECRC	100 m^3/h	3	• Weir skimmer • Stored at ECRC, Sept Isles
Skimmer	Ro-Clean Desmi / Desmi 250	Industry - HMDC	100 m^3/h	2	• Weir skimmer • In 1st generation Container
Skimmer	Ro-Clean Desmi / Buckley Engineering / Desmi 250	Industry - Husky	100 m^3/h	1	• Brush/weir skimmer • c/w radio control, thrusters, and annular water injection • In 3rd generation Container

Equipment Type	Manufacturer / Model	Owner	Size	Qty,	Comment
Skimmer	Ro-Clean Desmi / Buckley Engineering	Industry - Suncor	100 m^3/h	1	• Weir/belt skimmer • c/w radio control, thrusters, and annular water injection • In 2nd generation Container
Skimmer	Framo / Transrec 150	Industry - Suncor/Husky/HMDC		1	• Stored at ECRC, Donovan's
Skimmer	Ro-Clean Desmi / Buckley Engineering Desmi 250	Industry - Suncor/Husky	100 m^3/h	1	• Brush/weir skimmer • c/w radio control, thrusters, and annular water injection • In 3rd generation Container
Sweep Arm/Float	Axiom Engineering / SVSS	Industry - HMDC	20 m	2	• On long term charter vessels
Sweep Arm/Float	Axiom Engineering / SVSS	Industry - HMDC	20 m	1	• Spare at shore base
Sweep Arm/Float	Buckley Engineering / SVSS	Industry - Husky	20 m	4	• On long term charter vessels
Sweep Arm/Float	Buckley Engineering / SVSS	Industry - Husky	20 m	1	• Spare in warehouse
Sweep Arm/Float	Buckley Engineering / SVSS	Industry - Suncor	20 m	3	• On long term charter vessels
Tracker Buoy	MetOcean / Argosphere	Industry - Chevron	ARGOS	3	• Chevron & ConocoPhillips
Tracker Buoy	MetOcean / Radio	Industry - HMDC	UHF	8	• On long term charter vessels
Tracker Buoy	MetOcean / iSphere	Industry - HMDC	Iridium	3	• On long term charter vessels
Tracker Buoy	MetOcean / Argosphere	Industry - Husky	ARGOS	4	• GGB, FPSO, long term charter
Tracker Buoy	MetOcean / Argosphere	Industry - Husky	Iridium	2	• On long term charter vessels

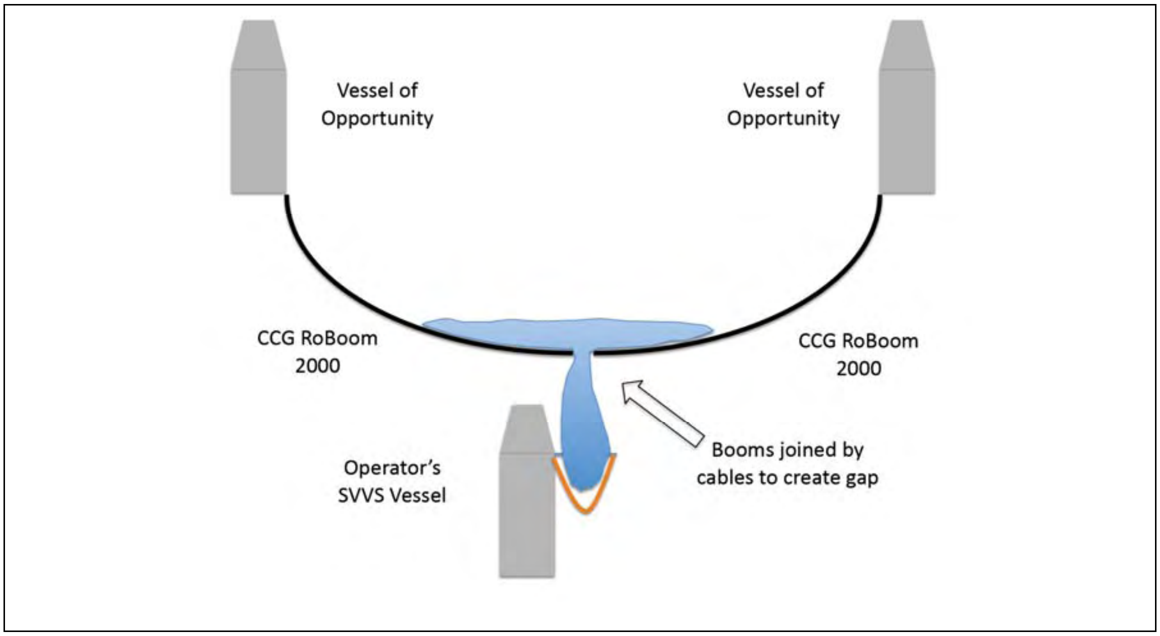
Equipment Type	Manufacturer / Model	Owner	Size	Qty,	Comment
Tracker Buoy	MetOcean / iSphere	Industry - Statoil	Iridium	3	• On Henry Goodrich vessels
Tracker Buoy	MetOcean / Argosphere	Industry - Suncor	ARGOS	4	• On FPSO, long term charter
Transfer Pump	Framo / TK-4	CCG	70 m^3/h	2	• Stored at CCG, Donovan's
Transfer Pump	Framo / TK-6	CCG	500 m^3/h	2	• Up to 75,000 cSt, est. • Stored at CCG, Donovan's
Transfer Pump	Framo / TK-8	CCG	750 m^3/h	4	• Stored at CCG, Donovan's
Transfer Pump	Framo / TK-5	CCG	300 m^3/h	2	• Up to 20,000 cSt, est. • Stored at CCG, Donovan's
Transfer Pump	Framo / TK-5	ECRC	300 m^3/h	2	• Up to 20,000 cSt, est. • Stored at ECRC,Donovan's
Transfer Pump	Framo / TK-6	ECRC	500 m^3/h	2	• Up to 75,000 cSt, est. • Stored at ECRC,Donovan's
Transfer Pump	Ro-Clean Desmi / DOP-250	ECRC	100 m^3/h	2	• Up to 150,000 cSt, est. • Stored at ECRC,Donovan's
Transfer Pump	Ro-Clean Desmi / DOP-250	ECRC	100 m^3/h	2	• Up to 150,000 cSt, est. • Stored at ECRC, Halifax
Transfer Pump	Ro-Clean Desmi / DOP-250	ECRC	100 m^3/h	2	• Up to 150,000 cSt, est. • Stored at ECRC, Quebec
Waste Oil Storage	AF Theriault / Barge/Tank	ECRC	50 m^3	3	• Stored at ECRC, Halifax
Waste Oil Storage	AF Theriault / Barge/Tank	ECRC	50 m^3	4	• Stored at ECRC, Sept Isles
Waste Oil Storage	AF Theriault / Barge/Tank	ECRC	50 m^3	5	• Stored at ECRC, Montreal
Waste Oil Storage	AF Theriault / Barge/Tank	ECRC	50 m^3	4	• Stored at ECRC, Quebec
Waste Oil Storage	C&W Welding / Barge/Tank	ECRC	50 m^3	6	• Stored at ECRC,Donovan's

6.3.3 Tier 2 Applications For the SVSS

The SVSS is a proven offshore containment and recovery system that can be mobilized from the field. In a Tier 2 response, additional SVSS systems may be mobilised but with limited effectiveness due to the low encounter rate caused by the narrow swath width.

Using equipment already resident in Newfoundland, a wide-swath 2-vessel boom system can be deployed to feed contained oil into a SVSS system following behind. The SVSS will be fed through a 5m gap at the wide swath boom's apex.

Figure 23 Wide Swath Boom Feeding The SVSS



The CCG in St John's has two 200m lengths of Ro-boom 2000 mounted in two Rolunds steel containers. The RoBoom 2000 has about the same sea state rating than the RoBoom 2200 or NOFI 800 now used in SVSS systems. The installation of a 5m steel cable spacer section between the two boom sections will create the desired gap at the boom apex. The boom would be towed in tandem by two vessels in a wide-swath U-shape (150m wide) to intercept floating oil and funnel it into a SVSS system.

It is not necessary to use the most capable to tow the wide-swath boom system. Vessels of opportunity with propulsion systems that can maintain a boom towing speed of 0.75 knots (0.4 m/s) can be used to deploy the wide-swath feeder boom. For equipment mobilization, one of the vessels will need an open deck 15-ft wide by 40-ft long to take the Ro-boom containers.

6.4 Acquisition Of The Norwegian Standard System

In 2009, Suncor, Husky, and HMDC shared in the purchase of a Tier 2/3 offshore oil spill containment system suitable for use in offshore Newfoundland conditions. The system consists of a Framo Transrec 150 weir skimmer and a 400 metre Norlense 1200-R self-inflating boom. The system is identical to the NOFO Norwegian Standard System (see Chapter 2 – Section 2.5.2). The proportion of spilled oil recoverable by physical methods may be estimated by the formula (SL Ross, 1984):

$$F_R = F_{RT} \times F_{TRP} \times F_{SI} \times F_{SE}$$

Where:

F_R = overall fraction of oil removed;
F_{RT} = response time factor (mobilisation time);
F_{TRP} = fraction of time that recovery is possible (daylight, visibility, and sea state);
F_{SI} = fraction of slick intercepted by booms; and
F_{SE} = skimmer efficiency factor.

The acquisition of the Norwegian Standard System with dedicated trailers (see Section 6.3.3) and the review to install permanent deck mounts (see Section 6.4.4) on designated response vessels can greatly improve oil collection capability because:

- Mobilization time will be reduced to a few hours;
- Oil recovery operations will be possible in greater sea states; and
- Skimmer efficiency will be greatly improved in terms of oil capture, pumping rates, and overall control.

6.4.1 Background

The move toward purchase of one Norwegian Standard System was lead by Suncor (then Petro-Canada). The first tangible milestone was the leasing of the Transrec 150 skimmer from Framo to support the Terra Nova FPSO offshore hull cleaning program in the spring of 2006. Petro-Canada recognized that a large scale skimming system and boom provided a better chance to contain oil removed from the FPSO hull. The Hull cleaning operation would last for a defined period, and the sea state would likely be variable. The boom was retained through discussions with partner, Norsk Hydro, who agreed to the loan of two RoBoom 3500's, which was the standard boom used in the NOFO Standard system during that period. At the time, NOFO was in the process upgrading its standard open ocean system by replacing the bulky Transrec 350 with the more efficient Transrec 150 and also upgrading booms from RoBoom 3500 to Norlense 1200-R. Petro-Canada's lease of the Transrec 150 skimmer was negotiated into a hire-purchase arrangement.

The Transrec 150 was refurbished by Framo after the hull cleaning program and was received by Petro-Canada for its long-term use in 2007. The skimmer was used in the 2007, 2008 and 2009 Synergy exercises (see Figure 24). ECRC has been responsible for the storage, maintenance, and operation of the skimmer since its arrival in Newfoundland.

Figure 24 Transrec 150 On The Atlantic Hawk During SYNERGY 2008

In 2009, the new system was completed with the arrival of the Norlense 1200-R Boom and a dual purpose Lamor LLP 200 kW hydraulic power pack. As well, arrangements for the joint ownership of the new equipment were established. The Norlense boom (see Figure 25) was commissioned in early September and the complete system was used in the Synergy 2009 exercise (see Figure 26). ECRC took advantage of the boom commisioning and the Synergy exercise to provide system training to their pool of offshore responders.

Figure 25 Norlense 1200-R Self Inflating Boom

6.4.2 Transrec 150 Weir Skimmer

The Transrec 150 head is a self-adjustable, wave compensated weir skimmer with an archimedean screw-type pump that has a maximum throughput capacity of 350 m^3/hr. The skimmer is equipped with thrusters and annular water injection and has been tested and found capable of handling ASTM Type V oils. The system requires only one operator and can be operated by remote control from anywhere on the ship having line of sight to the skimmer. Overall weight of the Transrec 150 is 14 Tonnes.

6.4.3 Norlense 1200-R Self Inflating Boom

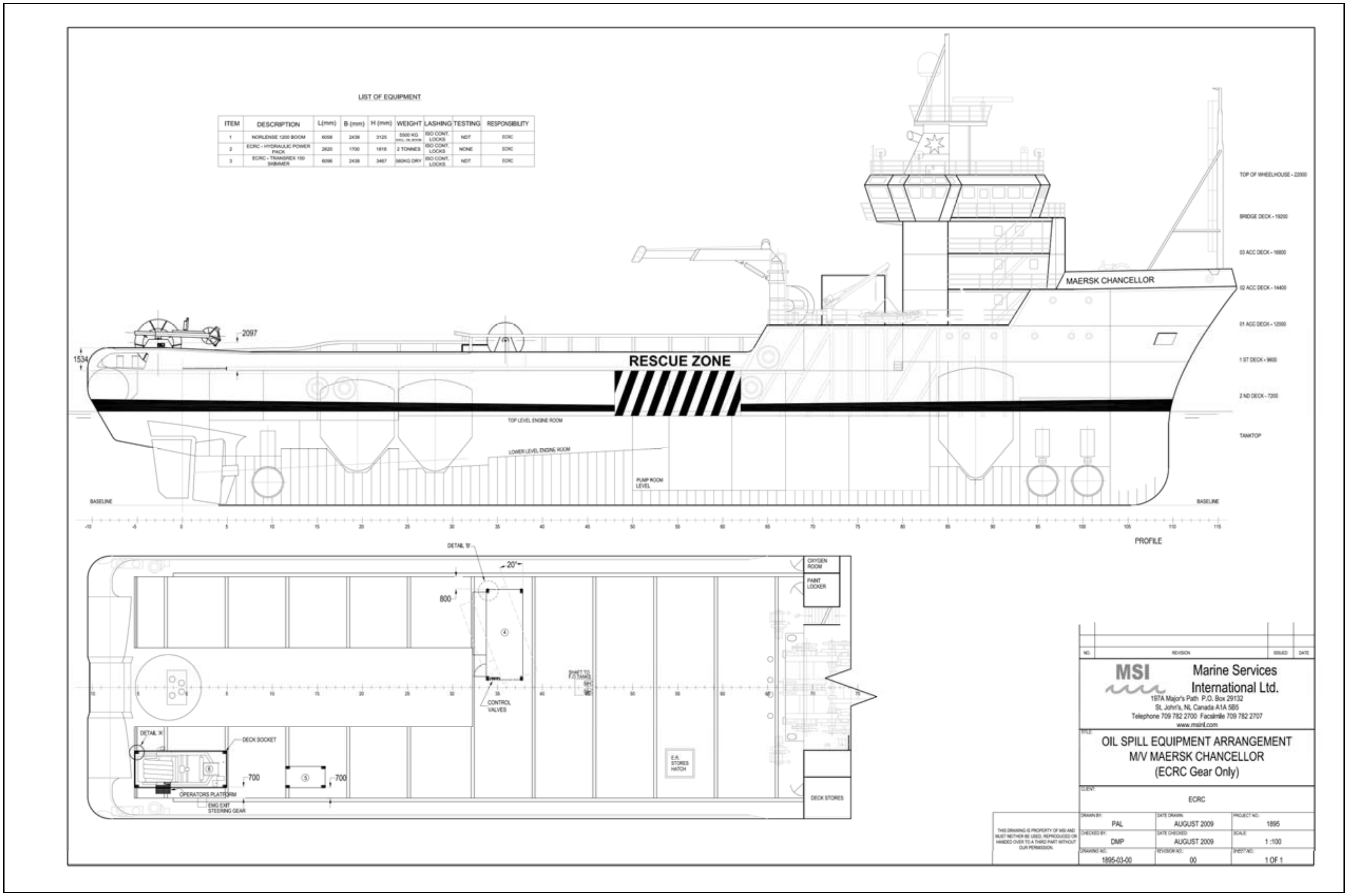
The Norlense 1200-R self-inflating boom has an overall height of 3400 mm, therefore it can operate in sea steaes up to 3-3.5 m Hs making it very well suited for use in offshore conditions. Unlike other available booms, the 1200-R is self inflating, so it negates the need to personnel having to be on back decks of vessels inflating the boom with portable air blowers. Therefore, from a health and safety perspective it is a much improved system over previous Tier 2 booms available for offshore Newfoundland. As well, this allows it to be deployed when sea states are such that it is unsafe for personnel to be on the back deck of the vessel. The flotation chamber is at atmospheric pressure and is formed by pneumatic tubing ribs. The boom reel is swivel-mounted on its base so that a single operator can slew the boom across the drum to ensure tidy re-packing. This self inflation and mechanical slewing reduce the deployment crew to a single operator working closely with the vessel Master. Placement of the reel midway down the work deck increases the safety of boom activities considerably.

Figure 26 NOFO Standard System On Maersk Chancellor

Figure 27 Deploying The Norlense 1200 Boom During SYNERGY 2009

Placement of the Transrec 150 and Norlense 1200R is based on the architecture of the vessel and NOFO Requirements For Oil Recovery Vessels On The Norwegian Shelf (NOFO, 2009A). Figure 28 shows the layout of the system on the Maersk Chancellor as prepared by MSI. Note that that boom, skimmer and power pack fit comfortably on the deck of the same supply vessel, therefore they can be transported together in the event of an incident.

Figure 28 Deck Layout For NOFO Standard System on Maersk Chancellor



6.4.4 Infrastructure For The Norwegian Standard System

To improve the effectiveness of the Norwegian Standard System, it requires efficient mobilization to the spill location. In the past, Tier 2 containment and recovery equipment was custom-installed at the time of the exercise or response. Because of the time required to plan the installation, then load, fasten, and inspect the equipment, mobilization would take at least 12 hours. Grand Banks operators should review the following options to minimize mobilization time:

- Designated long-term charter vessels to be equipped with permanent deck mounts (see Figure 29) that will accept the ISO mounting fittings on the skimmer, boom reel and power pack; and
- All system components are being pre-loaded on flat deck trailers equipped with ISO mounts (see Figure 30) and are ready for transport from ECRC to A. Harvey.

Figure 29 ISO Deck Mounts For NOFO Standard System

For the 2009 Synergy exercise the installation of the ISO mounts on the Maersk Chancellor was considered as a temporary measure under Transport Canada regulations. Husky is currently following up on this installation with the vessel owner and the class society. The next step should be to form a multi-operator team that includes logistics and marine personnel to see if this is the best solution. Once the installation is accepted formally, similar arrangements can be undertaken for vessels designated by the Operators for Tier 2 oil spill response. During the Synergy 2009 exercise, loading and installation of the entire system was reduced to less than an hour with no need for welding or other special provisions.

Figure 30 Dedicated Trailer For The Norlense 1200 Boom

6.5 Other Oil Spill Response Resources

6.5.1 Oil Spill Response

Suncor and HMDC are members of Oil Spill Response (OSR) (2008), a large oil spill response cooperative that specializes in providing global oil spill response services from their bases in Southampton, UK, Bahrain, and Singapore. In addition to the services that OSR can provide directly, Operators also have access to other international oil spill cooperatives such as Clean Caribbean Cooperative in Miami, and Marine Spill Response Corporation throughout the United States through OSR's participation in the Global Alliance.

The OSR equipment pool has been developed and packaged to be efficiently transported by air to any international destination. As a result, the OSR inventory is generally compact and is, therefore, usually rated for more sheltered conditions than the Newfoundland and Labrador offshore area. It is unlikely that OSR would supply containment and recovery equipment in an offshore spill response. The strengths that OSR can provide include:

- Large pool of very experienced personnel;
- Access to GRN resources; and
- Large scale aerial dispersant capability on 24-hour standby.

6.5.2 ECRC Mutual Aid

ECRC has mutual aid agreements with the other ROs in Atlantic Canada (ALERT – Irving and Point Tupper Marine Services (PTMS) in Port Hawkesbury). In the case of ALERT, this arrangement is reciprocating. The arrangement with PTMS, however, only allows resources to flow from ECRC to PTMS and not the other way. Both of these ROs have equipment that complies with CSA standards and so will not be well-suited to offshore conditions (ECRC, 1998).

PTMS used to have response vessels stationed in Sydney and Port Hawkesbury that could be of use in a major spill. These ships were converted trawlers that were permanently equipped with open ocean boom and skimming systems. Before they were sold in 2008, ECRC had an arrangement for use of these vessels (ECRC, 1998).

6.5.3 Northeastern United States

Marine Spill Response Corporation (MSRC) (2001) is an American Oil Spill Removal Organization (OSRO) certified to respond to major spills in the USA and Caribbean. MSRC maintains equipment depots in strategic coastal locations. Of interest to the Newfoundland offshore industry are the 64 metre Responder Class Oil Spill Response Vessels (OSRV). Each MSRC Oil Spill Response Vessel (OSRV) is normally equipped with: one 32 foot support boat; one Transrec 350; one Norwegian Oil Trawl with 110 meters of boom with bottom nets and 95 metres of guiding boom, and 2 sections of 660 foot Sea Sentry boom. MSRC has OSRVs stationed in Portland Maine and Edison, New Jersey. No arrangements are currently in place for the use of these vessels in an offshore response. Like ECRC, however, MSRC is a member of the Global Response Network. It is possible that MSRC resources could be provided to a Newfoundland Operator through the GRN and ECRC.

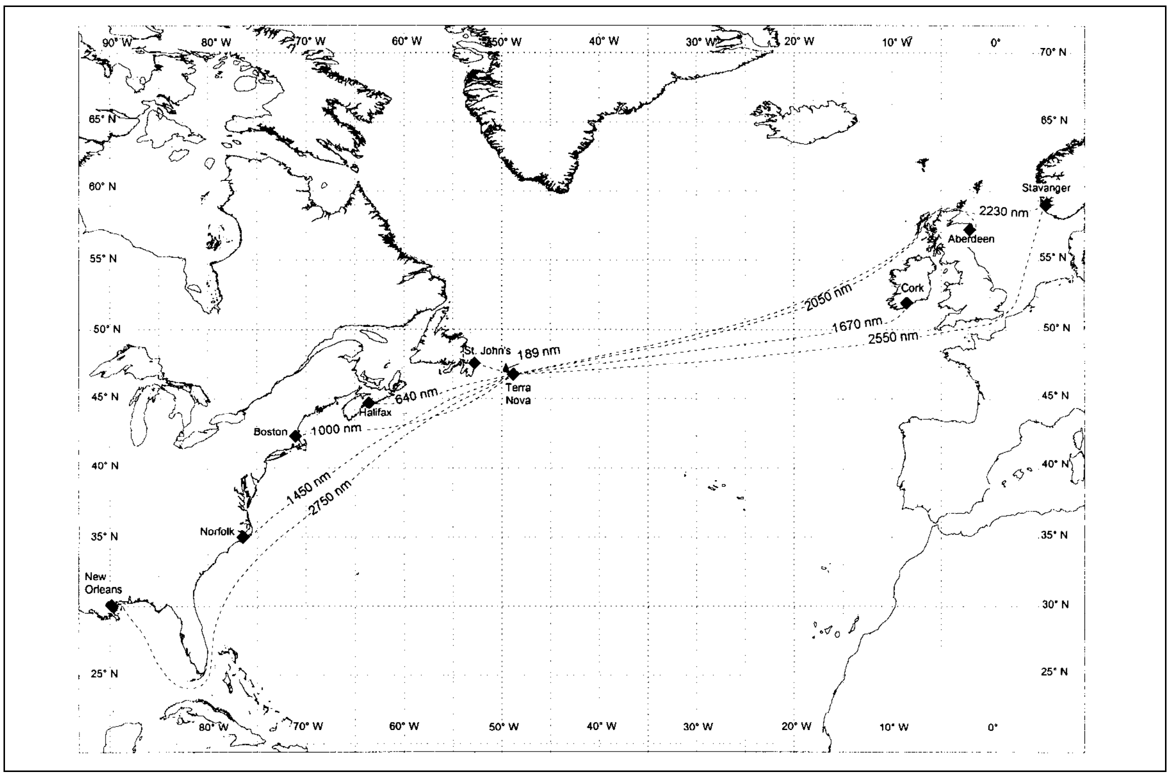
National Response Corporation (NRC) (2003) is another American OSRO with equipment strategically staged throughout the country. NRC is owned by Seacor, a large international shipping company that provides oil spill response services internationally. NRC has responded to spills in eastern Canada through its depots in New England. NRC does not own offshore class vessels, but it does have access to ships through the Marine Response Network (MRN).

7.0 OFFSHORE VESSELS

7.1 Need For Capable Vessels

Regardless of the amount of equipment that is staged at the time of a spill, successful response actions will always depend upon the vessel resources that are available for use within the window of opportunity. Figure 31 (Cormorant, 1998) shows the distances that vessels must travel to reach the Grand Banks from representative offshore supply centres in the North Atlantic Region. In the best case, vessels mobilized from St. John's or Halifax would require 24-60 hours to load equipment and steam to the spill site.

Figure 31 Transit Distances From Representative Offshore Centres



To effectively respond to a spill, it is essential that vessels are available quickly after the spill has occurred. This means that, for all scenarios other than a very large batch spill or an unchecked blow out, these vessels must be available at short notice and be based in Atlantic Canada.

7.2 Availability Of Offshore Vessels

Increasing activity offshore Newfoundland has resulted in the development of a pool of offshore vessels to serve ongoing operations. In the interest of managing the costs of maintaining such a fleet, there has been an increasing move towards sharing between operators and a formalized mutual aid or vessel sharing agreement.

Currently, there are nine offshore supply vessels on long term charter to support the Hibernia, Terra Nova and White Rose production fields. Between mid 2008 to late 2010, this fleet has been supplemented by an additional two vessels which are supporting additional drilling programs undertaken by the MODU Henry Goodrich. Like the rig, responsibility for these supplementary vessels changes each time the rig commences a program for a new operator. For much of 2010, an additional four vessels, bringing the complement to 13, will support the drill ship Stena Carron, first in the Laurentian Basin and later in the Orphan Basin. All of these vessels now have, or will have, a standard Tier 1 capability; ten vessels have a SVSS capability.

7.3 Vessel Assessment

Although vessel availability can be an issue, the industry has demonstrated that it can cope with unusual demands on vessel resources. During the spring of 2009, the core fleet of eleven vessels was temporarily increased to a high of eighteen to meet the following demands:

- A heavier than average ice season that required vessels to be involved in increased ice management operations as well as unscheduled rig moves;
- The grounding of all helicopter traffic to and from the Grand Banks for a period of months required that all personnel travelling offshore had to be moved by vessel;
- A high level of shipyard time for scheduled and unscheduled maintenance of vessels and platforms; and
- The installation of diving and ROV systems to support production field maintenance programs.

To ensure that operations could continue, Logistics Coordinators arranged for the charter of several vessels from throughout Atlantic Canada. While not all of these vessels were capable of assuming full platform supply or standby duties, they were all used in accordance with their design capabilities. In many cases, assigning ice management duties to smaller ships or cargo duties to non-anchor handling vessels allowed the core fleet of the most capable vessels to undertake critical tasks.

Table 3 summarizes the specifications for all of the vessels chartered in 2009. Particular attention has been paid to those characteristics that will be useful for oil spill response. Although they are not currently on charter, almost all of the vessels listed have been equipped with Tier 1 response materials and were provided with the standard Tier 1 operational training (see Section 9.3).

Table 3 Sources of Vessels Suitable For Offshore Oil Spill Response

Vessel	Owner or Operator	Charter Status (August, 2009)	Year Built	Length Overall (m)	Breadth (m)	Draft (m)	Gross Tonnage (T)	Horse Power (BHP)	Bollard Pull (T)	Dynamic Positioning	Paseenger Capacity	Deck Area (m^2)	Ice Class	Fast Rescue Craft	Fire Fighting	Anchor Handling	Oil Spill Response: Oil Recovery Class	Waste Capacity (m^3)	Current SVSS	Current Tier 1	Skimming	Towing	Monitoring
Maersk Nascopie	Maersk / Seabase	1 - Long Term (Hibernia)	1996	82.5	19.0	6.3	3147	9,600	N/A	DP2	27	756	1C	2	FiFi 1	NONE	YES[D]	1000	YES	YES	YES	YES	YES
Maersk Norseman	Maersk / Seabase	1 - Long Term (Hibernia)	1996	82.5	18.8	6.3	3147	9,600	N/A	DP2	27	756	1C	2	FiFi 1	NONE	YES[D]	1000	YES	YES	YES	YES	YES
Maersk Placentia	Maersk / Seabase	1 - Long Term (Hibernia)	1983	71.5	16.0	6.3	2259	10,800	120	NO	10	475	1C	NO	NO[B]	Retrieve only	NO	327	NO[E]	YES	YES	YES	YES
Atlantic Hawk	Atlantic Towing	1 - Long Term (Husky)	2001	75.0	18.0	6.2	3157	14,400	165	DP2	26	550	1C	2	NO	Run & Retrieve	YES[D]	1100	YES	YES	YES	YES	YES
Atlantic Eagle	Atlantic Towing	1 - Long Term (Suncor)	2000	75.0	18.0	6.2	3157	14,400	165	DP2	26	555	1C	2	FiFi 2	Run & Retrieve	YES[D]	1100	YES	YES	YES	YES	YES
Burin Sea	Secunda	1 - Long Term (Suncor)	Rebuilt 1999	82.2	16.0	6.1	2623	10,000	112	DP1	15	583	1C	2	FiFi 1	Retrieve only	NO	300	YES	YES	YES	YES	YES
Atlantic Osprey	Atlantic Towing	1- Long Term (Husky)	2003	80.0	18.0	6.0	3453	16,000	170	DP2	31	230	1C	2	FiFi 2	Run & Retrieve	YES[D]	1100	YES	YES	YES	YES	YES
Maersk Chancellor	Maersk / Seabase	1- Long Term (Husky)	1986 refit 2004	76.4	17.6	6.1	2887	14,400	170	DP1	24	633	1C	2	FiFi 1	Run & Retrieve	YES[C]	1000	YES	YES	YES	YES	YES
Maersk Chignecto	Maersk / Seabase	1- Long Term (Husky)	1986 refit 2004	71.5	16.0	6.3	2259	10,800	120	NO	12	530	1C	2	FiFi 1	Retrieve only	NO	327	YES	YES	YES	YES	YES
Trinity Sea	Secunda	2 - Medium Term (Husky)	Rebuilt 1999	82.0	16.0	6.1	2623	10,000	112	NO	15	590	1C	2	FiFi 1	Retrieve only	NO	300	NO	YES	NO	YES	YES
Atlantic Kingfisher	Atlantic Towing	2 - Medium Term (HGR)[A]	2002	80.0	18.0	6.0	3453	16,000	190	DP2	22	550	1C	2	FiFi 2	Run & Retrieve	YES[D]	1100	YES	YES	YES	YES	YES
Maersk Gabarus	Maersk / Seabase	2 - Medium Term (HGR)[A]	1983	65.5	16.0	6.3	2259	10,880	123	NO	12	443	1C	1	NO	Retrieve only	NO	327	NO	YES	NO	YES	YES
Ryan Leet	Secunda	3 - Short Term (Husky)	1977 refit 1994	66.7	13.0	5.7	1473	8,000	80	DP1	12	120m^2	1C	1	YES	NONE	NO	NO	NO	YES	NO	YES	YES
Anticosti	Cape Harrison Marine	4 - Possible Short Term (NL)	1973	58.2	12.8	5.1	1156	4,600	40	NO	N/A	249	8	NO	NO	NONE	NO	NO	NO	NO	NO	YES	YES
Riverton	Cape Harrison Marine	4 - Possible Short Term (NL)	1975	63.9	13.0	5.1	1293	8,000	75	NO	N/A	309	8	NO	NO	NONE	NO	NO	NO	NO	NO	YES	YES
Ocean Foxtrot	Atlantic Towing	5 - Possible Short Term (NS)	1971	52.1	11.8	3.6	700	5,280	60	NO	3	?	1A	NO	NO	NONE	NO	NO	NO	NO	NO	YES	YES
Alex Gordon	Northern ransportation	5 - Possible Short Term (NS)	1975	62.5	13.7	4.3	1190	7,200	75	NO	3	336	1A	1	NO	NONE	NO	SOME	NO[E]	NO	NO	YES	YES
Jim Kilabuk	Northern ransportation	5 - Possible Short Term (NS)	1975	62.5	13.7	4.3	1190	7,200	75	NO	3	336	1A	1	NO	NONE	NO	SOME	NO	NO	NO	YES	YES
Mariner Sea	Secunda	5 - Possible Short Term (NS)	1996 refit 2003	84.1	18.0	7.2	2904	2,341	N/A	DP1	12	817	?	1	FiFi 1	NONE	NO	240	NO	NO	NO	YES	YES
Sable Sea	Secunda	5 - Possible Short Term (NS)	1977	72.4	15.2	9.2	2341	6,600	N/A	NO	10	570	?	NO	NO	NONE	NO	524	NO	NO	NO	NO	YES

FOOTNOTES
- A *The rig sharing agreement between Husky, Suncor, and Statoil*
- B *Although not certified for firefighting, Maersk Placential has a large vloume, high pressure water cannon suitable for moving small icebergs*
- C *Maersk Chancellor has a cargo handling system that is meets DNV oil recovery class standards*
- D *Maersk Norseman, Maersk Nascopie, and all Atlantic Towing vessels have bulk cargo systems that were built to DNV standards but are currently not in class*
- E *SVSS systems were installed on both the Alex Gordon and the Maersk Placentia during the 2006 Terra Nova FPSO Hull Cleaning program Either vessel would require re-installation of mounts and a portable hydraulic power pack to regain that capability.*

8.0 WASTE MANAGEMENT

8.1 Existing Regulations

Petroleum waste products are regulated by both federal and provincial authorities. The mandate of each level depends on the type of oily wastes and the storage, handling, and disposal considerations.

Environment Canada is the federal agency responsible for all matters regarding the disposal of petroleum waste products. Legislation falling within Environment Canada's jurisdiction includes the *Fisheries Act* and the *Ocean Dumping Regulations*. Environment Canada will be involved in the following situations only if:

- There is potential for petroleum waste to escape to the marine environment;
- Oily waste is allowed to enter any water body containing a fish population;
- Interprovincial movement of hazardous wastes; and
- Waste oil is spilled or stored on federal lands.

The province of Newfoundland and Labrador will be responsible for regulating the handling and storage, on land, of petroleum wastes resulting from any oil spill response.

8.1.1 Oil Spill Waste Management Experience

In November, 2003, the Newfoundland and Labrador Environmental Industries Association (NEIA) sponsored an international oil spill conference *Learning from Experience – Fostering Leadership*. The need for this conference was identified after several representatives of the Newfoundland environmental community and offshore industry travelled to Spain to review the response to the Prestige oil spill earlier that year. Speakers at the conference were knowledgeable international experts, provincial and federal environment representatives, and local spill response contractors.

As a follow up to that conference, Environment Canada in 2004 commissioned a report that would evaluate the current level of preparedness for oil spill waste management in the province and recommended actions required to develop a comprehensive oil spill waste strategy for the province. The Province of Newfoundland and Labrador is currently implementing many of those recommendations.

Industry personnel actively participated in the conference and in the production of the follow-up report. Much of the current waste management strategy included in Operators' contingency plans is reflected in the report to Environment Canada.

8.2 Liquid Waste Management

Liquid wastes will be generated by any response involving skimming or lightering operations. Depending upon the nature of the original product, the degree of weathering, the method of recovery, and any post-collection treatment, the waste may be oil, oil and water mixture, oil and water emulsion, and either of the above with contaminants (solid wastes, de-emulsification chemicals, etc.).

8.2.1 Collection Vessel Storage

For small volumes of recovered oil, temporary deck tanks can be placed on the work deck of the recovery vessel. ECRC has developed a fleet of 50 m^3 aluminum barges that have been reinforced to act as deck tanks (see Section 6.3.2). These tanks were installed on the three skimming vessel mobilized for the 2006 Terra Nova FPSO Hull Cleaning Program. While these tanks are easy to mobilize and are specifically designed for waste oil storage, there are some logistical constraints:

- They occupy valuable deck space and may interfere with other operations;
- Care is required in filling - subdivided into six baffled compartments; and
- The capacity of each tank is an order of magnitude smaller than ship's internal tankage that may be available for waste oil storage.

During a spill, space available in ship's tanks designated for recovered oil storage must be determined. The NOFO oil recovery vessel standards (NOFO, 2009) stipulate that overall storage capacity should be a minimum of 1500 m^3 and that suitable waste storage could be found in mud tanks, chain lockers, brine tanks, base oil tanks, methanol tanks, and cargo fuel tanks. The NOFO standards also specify requirements for tank heating, ventilation, and discharge piping.

The tankage of all of the vessels now on long-term charter for offshore supply operations has been reviewed as part of each Operator's contingency planning. A summary of this tankage is presented in Table 3.

The Maersk Chancellor is the only vessel classed by DNV (Det Norske Veritas) as an 'oil recovery' or 'pollution class' vessel. It meets NOFO standards for the recovery and temporary storage of waste oil. The Maersk Norseman, Maersk Nascopie, Atlantic Eagle, Atlantic Hawk, Atlantic Kingfisher, and Atlantic Osprey are all built to class, but are currently not in class. At the time of construction, these vessels were fitted with the necessary plumbing and venting for the tanks to meet DNV class standards and have 1000 m^3 waste oil capacity. The Burin Sea, Maersk Chignecto, Maersk Gabarus, and Maersk Placentia are not built to oil recovery class and would have to carry recovered product in standard mud tanks.

The use of internal tankage was identified as an action item following the 2009 Synergy exercise. The Husky Marine Operations Department is conducting preliminary discussions on this matter and intend to bring this to the other Operators for input.

It is very likely that a large proportion of the recovered fluid will be water and storage efficiency will be decreased. Water content can be reduced through decanting prior to loading waste oil storage tanks. It may be possible to discharge decanted water into the boom apex so that any residual oil could be recovered in skimming operations. Although this practice is permitted in other jurisdictions, a permit from Environment Canada would be required (see Section 8.1) in order to carry out this activity. The CCG Environmental Emergencies Unit in Donovan's has a decanting package that has been used in past Synergy Exercises.

8.2.2 Tanker Storage

The limited storage capacity of individual collection vessels may require that wastes be transferred to a tanker offshore during larger oil spill response operations. Any offshore tanker capable of maintaining station for an extended period should be suitable for accepting waste oil from collection vessels. Local tankers that could be considered for this purpose are listed in Table 4.

Test transfers between the offshore supply vessels and Grand Banks shuttle tankers were demonstrated during the 2000, 2001 and 2002 Synergy exercises. While these illustrated how the crew experience and station keeping abilities of each vessel would allow for transfer of waste oil in normal offshore working conditions, they did not prove that higher viscosity weathered oil could be transferred effectively. Currently, the transfer hardware developed for these exercises has not been included in a maintained inventory and would have to mobilized in the event of a spill.

Table 4 Local Tankers Suitable For Offshore Waste Oil Collection

Vessel	Cargo Tankage	Slops Tankage	Station Keeping	Normal Operations
Komatik	133,869 m^3	3,644 m^3	Full DP	Grand Banks shuttle tanker
Mattea	133,869 m^3	3,644 m^3	Full DP	Grand Banks shuttle tanker
Vinland	133,869 m^3	3,644 m^3	Full DP	Grand Banks shuttle tanker
Jasmine Knutsen	154,597 m^3	4,940 m^3	Full DP	Grand Banks delivery tanker
Heather Knutsen	154,597 m^3	4,940 m^3	Full DP	Grand Banks delivery tanker
Catherine Knutsen	155,301 m^3	5,007 m^3	Full DP	Grand Banks delivery tanker
MV Dorsch	11,768 m^3	Minimal	Bow Thrust	Eastern Canada and Arctic Distribution
MV Mokami	3,240 m^3	Minimal	Bow Thrust	Eastern Canada and Arctic
MV Nanny	10,721 m^3	Minimal	Bow Thrust	Eastern Canada and Arctic
MV Sybil W.	1,000 m^3	Minimal	Bow Thrust	Eastern Canada and Arctic
MV Tuvaq	16,217 m^3	Minimal	Bow Thrust	Eastern Canada and Arctic

8.2.3 Storage Of Fluid Waste Onshore

Commercial industrial waste contractors, Crosbie's and Pardy's, can store small volumes of waste oil in the St. John's area and in Pasadena. For larger volumes, a coastal oil terminal will be required to manage fluid waste. The facilities in Table 5 are Oil Handling Facilities designated by Transport Canada under the *Canada Shipping Act*.

Table 5 Waste Storage Capacities Of Local Marine Terminals

Facility	Location	Dedicated Waste Oil Capacity
Imperial Oil	St. John's	Minimal Waste Storage
Irving Oil	St. John's	Minimal Waste Storage
Ultramar	Holyrood	10,334 m^3
Nfld. and Labrador Hydro	Holyrood	7 m^3
Woodward's Oil	Long Pond	1,080 m^3
North Atlantic Refining	Come By Chance	10,494 m^3
NTL/IMTT	Whiffen Head	1,590 m^3

8.2.4 Transportation

Crosbie's Industrial Services and Pardy's Waste Management and Industrial Services operate fleets of vacuum trucks, which have total truck capacities of 425 m^3 and 358 m^3, respectively. Quinnsway and Seaboard Liquid Carriers have fleets of large capacity tanker trucks operating in the province, but have policies not to carry waste oil products.

8.2.5 Liquid Waste Disposal

With proper treatment, waste oil, oil in water, and oil emulsions can be disposed of through industrial burning or recycling. Recycling of waste oil must be done off-island. Crosbie's and Pardy's, on both coasts of the island, operate local waste oil and water treatment facilities. In a very large spill, large volumes of waste oil may have to be delivered to mainland refineries. Based on past experience, the volume that could be accommodated in a refinery waste stream is in the order of less than 150 m^3 per day.

8.3 Solid Wastes

Solid waste materials will consist mostly of sorbent booms used for the collection and recovery of small spills and sorbent pads and sheets used for protection of vessels during field operations. If wildlife is severely impacted by the spill, there may also be biological waste. Other solid wastes might include rags or clothing.

8.3.1 Temporary Solid Waste Storage In The Field

Solid waste streams can be 'contaminated' by materials that require a more expensive form of waste disposal. As a result, care must be taken to ensure proper segregation of wastes at the response site. Offshore supply vessels have been equipped with waste storage containers and bags. When used with the sorbent boom system, these materials are very effective (see Figure 32).

Figure 32 Waste Management During Sorbent Boom Operations

8.3.2 Solid Waste Disposal Issues

There are two principal options for the disposal of oily solid waste: landfill and incineration. The provincial government regulates both options. In the past, considerable volumes of contaminated soil have been deposited in various Newfoundland landfills. Currently, provincial and federal departments have clearly stated that a large volume of waste that could be generated by a major marine oil spill will not be disposed in existing municipal landfill sites.

9.0 OIL SPILL RESPONSE TRAINING

Each Operator has an oil spill response training program that covers:

- Oil Spill Response Management;
- Tier 1 Procedures; and
- Single Vessel Side Sweep (SVSS).

9.1 Modular Training Approach

The oil spill response training program is modular and structured to provide a variety of skills to the team that may be assembled in the event of an offshore oil spill. All personnel who may be employed in the response to an offshore oil spill are expected to receive training that will meet specific standards. An example summary of training modules and potential personnel designated to receive them is presented in Table 6.

Table 6 Generic Oil Spill Response Training Matrix

	Emergency Response Role	**Management**		**Operational Training**				
		Tier 1 Spill Response Orientation	General Spill Response Orientation	Surveillance and Monitoring	Oil Sampling	Seabird Handling and Observations	SVSS System (designated vessels)	Sorbent Boom System
ONSHORE	Incident Commander		X					
	Deputy Incident Commander (2IC)		X					
	HSE		X					
	Operations		X					
	Logistics		X					
	Planning		X					
	Public Relations		X					
	Human Resources		X					
OFFSHORE	Company Representative	X						
	Platform OIM	X						
	Platform HSE Advisor	X		X	X	X		
	Platform Environmental Observer	X		X	X	X		
	Supply/Standby Vessel Crew	X		X	X	X	X	X

9.2 Oil Spill Response Management Training

9.2.1 Tier 1 Oil Spill Response Overview

This session is recommended for offshore platform and supply vessel personnel designated as spill responders offshore. This overview provides an appreciation of:

- The Operator's oil spill response process;
- The nature of offshore oil spills;
- Notification procedures;
- Roles of individual oil spill responders;
- A review of response techniques and the decision process to use them; and
- Determining first response strategies.

9.2.2 General Oil Spill Response Overview

This session is recommended for key members of the onshore emergency response team and is intended to provide onshore personnel with an overview of:

- Introduction to the Operator's Oil Spill Response Plan;
- Nature of marine oil spills;
- Oil spill regulations in Canada;
- Offshore environmental issues;
- Basic concepts of oil spill planning and management;
- Tier 2 oil spill response management; and
- Offshore oil spill response operations.

9.2.3 ECRC Orientation

This session is intended to provide an understanding of the services which ECRC can provide during a spill response. By visiting ECRC's facility, Operator oil spill management personnel have the opportunity to:

- View response equipment and meet response personnel; and
- Review the ECRC Spill Management System.

9.3 Oil Spill Operations Training

Key offshore personnel are required to receive practical instruction in Tier 1 oil spill operations. For single-well drilling programs, training is provided as soon as vessel crews are available at the beginning of the drilling program. For long term charter crews, this training is provided annually. A representative portion of each vessel crew:

- Oil on water observations;
- Use of the sorbent boom;

- Decontamination recommendations;
- Oil and wildlife sampling procedures; and
- Seabird handling and observation protocols.

9.4 SVSS Training

Priorities in each Operator's training program are:

- Generic procedures for the deployment of the SVSS system;
- Specific procedures for the use of the SVSS on designated vessels; and
- Oil recovery operations procedures.

9.4.1 Training Materials

Materials used in Terra Nova, White Rose and Hibernia training include the following:

- SVSS operations manual customized for each specific vessel;
- "Story Board" graphical material (see Figure 33) in SVSS Containers; and
- A training video (Terra Nova and White Rose only).

Figure 33 Story Board And Tool Boxes Next To The SVSS Container

9.4.2 SVSS System Deployment Procedures

Procedures have been developed to ensure competency required by the vessel crew to deploy the system. The procedures are divided into logical and sequential modules from preparation of the system on deck through assembly and operating to final recovery and re-packaging of the system. In addition to detailed procedures, each SVSS manual also includes copies of the story boards, a vessel inventory, and generic Safe Job Analysis forms to be used at tool box talks prior to undertaking each module.

The modules include:

- Setup of equipment stored onboard the vessel;
- Loading the SVSS Container;
- Unpacking and setup of the SVSS Container;
- Outrigger Arm rigging;
- Outrigger Arm deployment;
- Containment boom deployment;
- Skimmer preparation and assembly;
- Hook-up of Skimmer's discharge to ship's tankage;
- Skimmer deployment;
- Skimmer direct operations without remote control;
- Oil spill recovery operations;
- Recovery of equipment; and
- SVSS Container re-packaging.

Wherever possible, crew feedback has been incorporated into the detailed procedures.

9.4.3 Vessel Crew Responsibility

In the event of a significant offshore oil spill, the crew of a designated supply vessel will be tasked with deploying the SVSS. Realistically, the loading, set up, and deployment process may take several hours. Even so, this reponse option is at site while larger is available from shore, should it be required.

An effort is made to provide SVSS training to the crew of every designated SVSS vessel crew each year. With the demands on ship time (see Section 7.2), this has sometimes been a challenge. The 2007, 2008, and 2009 Synergy exercises are a reflection of the effects of continued SVSS training. The implementation of formal training procedures and retained experience in crews that have been working offshore Newfoundland for several years provide a foundation, but it is unreasonable to expect these crews to manage completely on their own.

In the event of a spill, Operator's response management must attempt to mobilize technical personnel to assist the SVSS crew as soon as possible. This has been accomplished in past spills with a positive effect. At present, the roster of contract personnel available for this type of assignment is low but will be addressed through the ECRC integration agreement with Suncor, Husky, and HMDC.

9.5 Joint Operators' Equipment Exercise (Synergy)

All active Operators participate in a full scale equipment deployment exercise near St. John's on an annual basis. The exercise includes mobilization of the Operator and ECRC equipment and personnel.

The exercise is useful as a means to increase the awareness of oil spill response issues, and is an opportunity for Tier 1 and Tier 2 training.

Over the years, there have been many learnings from Synergy that have enhanced the oil spill response capabilities of Grand Banks Operators.

9.6 Conferences

Every year, there are national and international oil spill response conferences that provide opportunities to understand current trends in oil spill response. Some of these include the Arctic Marine Oil Pollution (AMOP) conference sponsored by Environment Canada, Norwegian on-water exercises sponsored by NOFO and NOSCA, and the three-year cycle of:

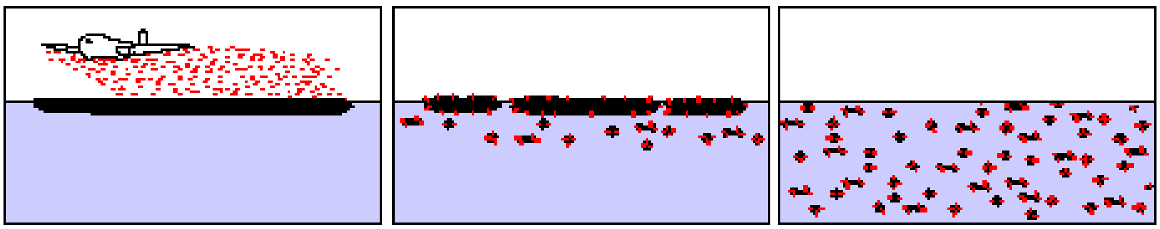
- International Oil Spill Conference (USA);
- InterSpill (Europe); and
- Spillcon (Australia).

10.0 ADDITIONAL TECHNOLOGIES

10.1 Chemical Dispersants

Chemical dispersants belong to a group of chemicals that, when applied to oil slicks, will accelerate the process of natural dispersion (see Figure 34). Spraying dispersants may be the only means of removing oil from the sea surface, particularly when mechanical recovery is not possible. Environmentally, dispersants can reduce the risk posed by offshore spills to offshore marine wildlife or to sensitive shorelines. Operationally, dispersants allow quick response to spills and also broaden the range of sea state conditions under which cleanup operations are practical.

Figure 34 Effect Of Dispersants On Spilled Oil At Sea



The use of chemical dispersants as an oil spill counter measure offshore Newfoundland has been a controversial issue for many years. As discussed in Part 3, Section 6.1, considerable efforts were made in the pre-production period to evaluate the use of dispersants and to establish an offshore Newfoundland chemical dispersant capability. The situation seems to have shifted with the dissolution of ESRI and the advent of production operations offshore. Two areas of contention surround the debate over the use of chemical dispersants offshore Newfoundland:

- The efficacy of chemicals that are on the Environment Canada approved list when used on the crude oils actually being produced offshore Newfoundland; and
- The permitting process which allows the operational use of dispersants.

10.1.1 Efficacy

Factors that affect dispersant effectiveness include:

- Oil composition;
- Slick thickness and oil weathering;
- The type and amount of chemical applied;
- The mixing potential created by sea energy and dispersion volume; and
- Temperature and salinity of the water.

Because of the critical effects of mixing energy, it has been difficult to create a testing protocol that simulates ocean conditions. Table 5 in Section 4.3 of Part 2 of this report lists the programs initiated to test Grand Banks crude oils. Many of these programs were at the laboratory level.

In 2002 and 2006, larger scale testing was undertaken by SL Ross at Ohmsett (SL Ross, 2002 and SL Ross 2006) which provided a practical appreciation of the effectiveness of Corexit 9500 and 9527 on Hibernia, Terra Nova, and White Rose crude oils in cold water. The results, summarized in Table 6 of Section 4.3.1 of Part 2, show that both fresh and partially weathered crude oil from all of these fields are dispersible to some extent. Hibernia (82-95% dispersible) crude is the most amenable to chemical dispersion and White Rose (35-72% dispersible) is the least. In each case, the effectiveness of the chemical as a countermeasure is, at least, as good as and, at best, far better than the effectiveness of containment and recovery in open ocean conditions.

The Ohmsett tests must be put in context. While these results are encouraging, they appear to be inconsistent with the results of tests on the weathering characteristics of Terra Nova and Hibernia crude oils (Guyomarch, 2005). This inconsistency should be addressed as part of industry's ongoing interpretation of dispersant effectiveness. Given that all testing after 1997 was based on samples taken from shuttle tanker cargos, consideration should be given to the effects of the preliminary production process and the effects of additives offshore on each crude oil to better understand the implications of a blow out or a subsea spill.

Recent research into dispersant use has been encouraging in many respects. Effectiveness testing is improving with recent work being done by agencies, consultants and oil company researchers. Between 1999 and 2006, the US Minerals Management Service (MMS) conducted thirteen dispersant test series at Ohmsett to:

- Develop and refine the effectiveness testing protocol and relate Ohmsett results and conditions to those at sea;
- Quantify the conditions that limit dispersant performance;
- Test dispensability of unique oils under unique local environmental conditions; and
- Assess/verify reliability of effectiveness monitoring methods.

There is a substantial body of recent literature on dispersant effectiveness testing in labs, wave tanks, and at sea. A 2009 review of literature related to oil spill dispersants (Fingas & Banta, 2009) is a useful reference.

An emerging position in the international community is that the effects of mixing on dispersant efficacy has not been fully understood and has been underestimated. Recent observations in field conditions suggest that heavier oils may be more amenable to chemical dispersion than previously predicted (Coolbaugh, 2009). The window of opportunity may be longer than first predicted and, with weathered oils, may take days and not hours as was previously thought (Merlin, 2009).

10.1.2 Permitting

Three government agencies regulate dispersant use for the response to oil spills in the offshore industry in Atlantic Canada:

- Environment Canada has jurisdiction over dispersants in all marine waters;
- The Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) for spills from offshore facilities in Nova Scotia waters; and
- C-NLOPB for offshore facility spills in Newfoundland and Labrador waters.

These three agencies cooperate and communicate with each other and other government agencies on dispersant issues through the Regional Environmental Emergency Team (REET). Members of REET must address countermeasure efficacy and environmental impact of dispersants and other decision-making issues when considering dispersant use in offshore spills. Environment Canada dispersant use guidelines (Environment Canada, 1984) provide guidance in the decision-making process and criteria upon which decisions might be based. A Memorandum of Understanding is in place for Newfoundland which addresses cooperation between the C-NLOPB and other agencies for spills from offshore operations in Newfoundland and Labrador. The C-NLOPB/EC MOU also addresses the role of REET during emergencies, but is more general than the CNSOPB/EC agreement and, unlike a parallel arrangement between REET and CNSOPB in Nova Scotia, does not deal specifically with chemical dispersants.

REET must balance the sometimes-conflicting interests of stakeholders, as well as the apparently conflicting intents of legislation. On the one hand, REET is charged, under the *Canadian Environmental Protection Act*, to mitigate the environmental impact of spills, while on the other EC is charged under the *Fisheries Act* that "it shall not deposit" deleterious substances into the marine environment.

When written in 1984, the EC guidelines represented the state-of-the-art in dispersant planning and they undoubtedly aided other nations in dispersant planning in the 1980s and 1990s. The intervening two decades have witnessed considerable spill experience, dispersant research and planning activities that have greatly advanced dispersant planning standards internationally. Environment Canada has moved to keep pace with these advancements but little has changed in terms of preparing for the use of chemical dispersants in an offshore spill response.

10.1.3 Industry Position

Industry generally has a favourable view of the use of chemical dispersants as an offshore oil spill countermeasures technique. Compared with conventional containment and recovery techniques, chemical dispersants can be mobilized quickly and may be more effective in removing oil from the sea surface in offshore conditions. Several initiatives have been undertaken, jointly or independently, by Newfoundland offshore Operators to prepare for the use of dispersants:

- The dispensability of individual Grand Banks crude oils has been tested on multiple occasions (see Part 2, Section 4.3, Table 5);
- In 2000, the Jeanne d'Arc Basin Operators group (JBO) developed a small vessel-borne dispersant capability to deal with potential testing spills;
- In March, 2004, ESRF sponsored a workshop in St. John's to discuss the potential use of dispersants offshore (Trudel, 2004); and

- A favourable Net Environmental Benefit Analysis (NEBA) of dispersant use for cleaning oil spills from production platforms on the Grand Banks has recently been conducted for CAPP (SL Ross, 2008A).

Industry's attitude toward going forward in the development of an operational dispersant capability has been cautious based on the current permitting situation. There is concern for an authorization process which relies upon a case-by-case assessment by C-NLOPB in consultation with REET. It is felt that a timely decision cannot be reliably predicted. This position is based, in part, on the Jeanne d'Arc Basin Operator's actual experiences during a well testing spill. Industry would like to see an improved and streamlined approval process, which includes some level of pre-approval for defined cases.

10.1.4 Dispersant Operations

Prior to applying chemical dispersant to an oil spill, the On Scene Commander must have a tactical dispersant plan. During the initial phase of the oil spill response, observations provide critical information regarding the location, estimated amount, and drift direction of the spill that can be incorporated into the tactical plan.

The key components of this plan include:

- Identification of priorities for areas to be sprayed so that the supply of chemical can be used judiciously;
- Preliminary estimation of the dosage rates required for the actual slick; and
- Selection of spray transects that will allow safe and efficient application of chemical in actual wind and sea state conditions.

During a spray transect, it is critical that the progress be monitored at all times. Progress is defined in terms of:

- The area covered during the spray transect;
- The rate of chemical application; and
- The success in removing of oil from the sea surface.

The application rate for the chemical can be adjusted to meet the requirements of the slick conditions. Chemical application can be adjusted by either adjusting the flow rate of chemical or by altering the speed through the water. The desired application rate is determined by the thickness of the oil where the chemical will be applied. Estimating thickness from the visible appearance of the slick is covered in oil surveillance and monitoring procedures (see Section 6.1.3).

The dispersant to oil ratio (DOR) is the volumetric ratio of the dispersant being used to the oil being treated. Although, in practice, the DOR can vary significantly, a DOR of either 1:20 or 1:25 is typically used for dispersant effectiveness testing as well as for oil spill response contingency planning purposes. The DOR needed to disperse oil in an actual spill response varies, depending on the specific oil, its weathered state, and the dispersant composition.

Application guides are required to determine chemical dispensing rates (liters/min – flow meter gauge reading) as a function of vessel speed and slick thickness for Dispersant to Oil Ratios of 1:10 through 1:50.

Figure 35 shows graphically how slick observation and required dosage for volume of oil present are used to create a tactical dispersant spray plan.

In a small spill, post application monitoring will be limited to visual observations of the effectiveness of the chemical in removing oil from the sea surface. In a larger spill, monitoring may be quite comprehensive and require the use of in situ flourometric surveys to determine the distribution of residual dispersants and discreet water sampling to determine the distribution of dispersed oil.

10.2 Oil-Mineral Aggregation

It has been known for a number of years that clay particles suspended in sea water enhances the natural cleaning of oiled beaches through a clay flocculation process (Bragg and Owens, 1995). In the current literature, this natural process has come to be known as Oil-Mineral Aggretation (OMA). If applicable in offshore conditions, the advantages of an oil dispersion technology based on OMA would be:

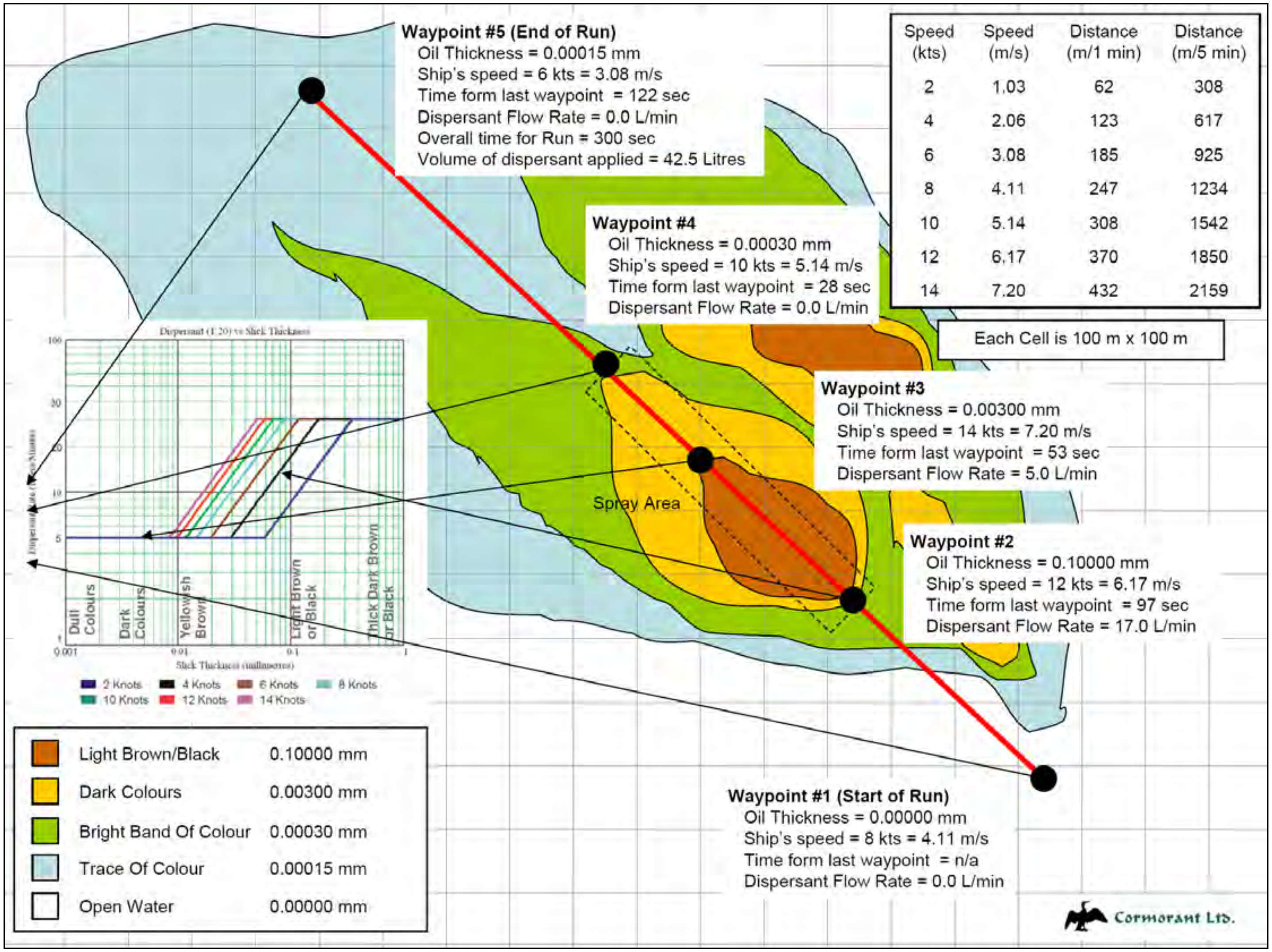
- Enhanced dispersion of oil slicks and stabilization of dispersed oil droplets in the water column;
- Reduction in oil concentrations to below toxic threshold limits;
- Reduced recoalescence of droplets and adhesion properties of the oil; and
- Enhanced oil biodegradation.

10.2.1 Recent Studies

Recent Canadian studies indicate that OMA technology may be effective in cold water open ocean conditions.

Under a contract to the US Minerals Management Service (MMS), the Centre for Offshore Oil, Gas, and Energy Research (COOGER), studied the formation of OMA under laboratory conditions (Lee et. al., 2009). The study had two major components. In the first, a comprehensive laboratory experimental program to determine the effects of several important factors on the formation of OMAs. In particular, the effects of mineral type, mixing energy, and chemical dispersant use were studied for the dispersion of three crude oils. The second study used a large-scale wave tank to evaluate the feasibility of promoting OMA formation as an oil spill counter measure. These studies provide considerable insight into the formation of OMAs. Specifically, it was found that kayolin was the most effective mineral of those tested for oil mineral aggregation. Tank testing indicates that OMA formed under marine hydrodynamic conditions would disperse vertically in the upper section of the water colmn but not settle to the seabed. This suggests minimum impact on benthic communities or groundfish.

Figure 35 Sample Dispersant Run



A field experiment on the St. Lawrence River at Matane, Quebec during the winter of 2007-2008 conducted by the Department of Fisheries and Oceans (DFO) showed that oil spilled within a field of broken ice was effectively dispersed into the water column by the combined action of mineral fine additions and mixing by propeller wash (Lee et. al., 2009 b). Enhanced dispersion of the oil was verified during field operations and an associated 2-month laboratory microcosm study which demonstrated that almost 60% of the spilled oil was degraded over 56 days at a temperature of 0°C.

10.2.2 Possible OMA Application Techniques

If practical, fine sediments may be stockpiled in bags, shipped in containers, and deployed by commercial blowers equipped with shredding loading manifolds. A more desirable application may be to use existing vessel systems and bulk cargo materials. Fine minerals can be loaded as bulk into the dry tanks of a standard offshore supply vessel. It may even be possible that barite and bentonite, powdered minerals already used in drilling applications and stored on supply vessels, may be encourage OMA. These bulk materials can be moved throughout the ship's storage system using compressed air and deployed in a cloud of powder by opening the loading manifold while running into the wind at the quarter of the ship. Greater application coverage may be possible by mixing the powder with water and spraying it with existing fire monitors.

In addition to being a rapid countermeasure in its own right, the application of clay powder may address the residual oil left after the application of dispersants or that cannot be ignited because it is too thin or has too high water content due to emulsification.

10.3 In-Situ Burning

Offshore operations in the Jeanne d'Arc Basin are near the southern limits of the sea ice cover (see Part 2 – Section 3.1.9). There is some potential for sea ice to change drift patterns suddenly and surround an offshore facility. If oil is unintentionally discharged while the facility is in sea conditions, there will be unique challenges to oil recovery (SINTEF, 2009):

- Access to the oil is limited to deployment directly from ships and helicopters;
- In heavy ice cover, oil will be transported together with the ice, in light ice cover oil will drift the same as it would in open waters;
- The oil being recovered may contain pieces of ice or oil may remain on sea ice;
- Oil viscosity increases with cold temperatures which may reduce collection or pumping efficiency;
- Potential for icing and freezing of equipment in cold weather;
- Hazards for response personnel operating in cold conditions;
- Oil detection and tracking is more difficult in broken ice conditions; and
- Conventional containment booms may be damaged of ineffective when working in heavy ice concentrations.

In situ burning may be the only option to remove oil from floating unconsolidated sea ice. The field requirements for burning are:

- Sufficient oil thickness to provide enough fuel for efficient burning;
- Fresh oil or an oil emulsion with a low water content to permit ignition; and
- Sufficient heat to ignite the oil.

For most crude oils, the time window for ignition and sustained burning of weathered oil using conventional ignition technology is restricted by approximately 25% evaporation or 50% water content. (Guenette et. al., 1994, in Nordvik, 1995). Figure 14 shows the oil thickness range that will allow burning of oil on water.

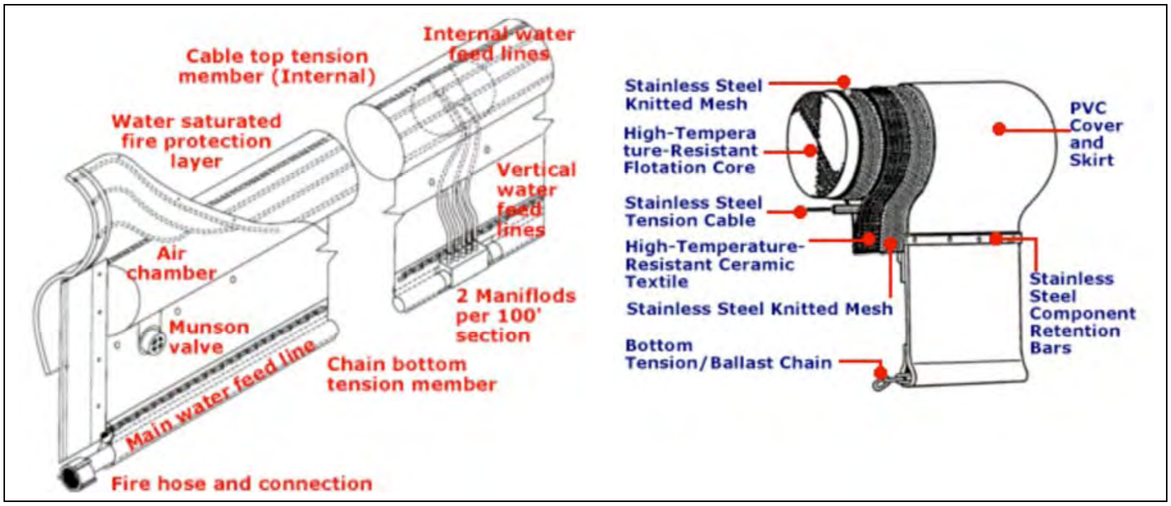
A helicopter-deployed ignition system (heli-torch or drip torch) which applies burning gelled fuel to an oil slick is the usual technology for igniting oil on water. This technology is an established countermeasure at Alaska Clean Seas (ACS – See Part 3, Section 4.0) was used in the Newfoundland Offshore Burn Experiment (NOBE) conducted by Environment Canada in 1993. Helicopter igniters are used by the Newfoundland and Labrador Department of Natural Resources for forest fire control and one system is stored at CCG Environment Response Unit in Donovan's.

In-situ burning can be used in open-water conditions, but only if the oil has been thickened through collection in a fire-resistant boom (see Part 3, Section 4.3). Figure 36 shows a dry fire boom (see Figure 37) in use during the 1993 NOBE field trial and also a cross-section of a representative fire boom currently available commercially.

Figure 36 Use Of Fire-Resistant Boom During NOBE

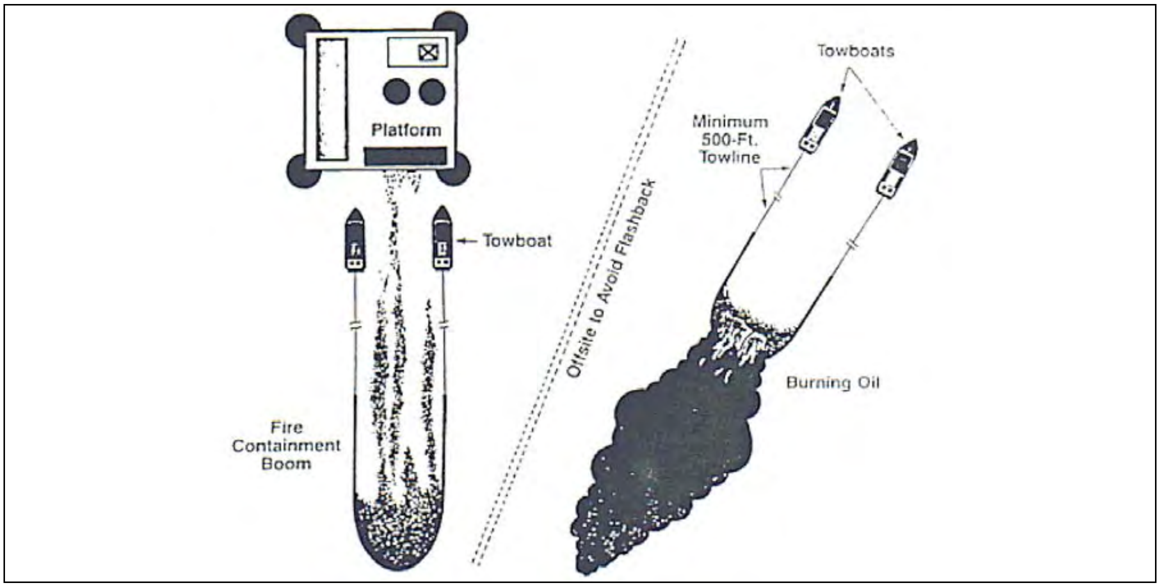
Treating the oil with an emulsion breaker first may result in successful ignition of emulsified oils having water content greater than the normal limits for ignition. The most flexible system for applying an emulsion breaking chemical would be a helicopter-deployed spray applicator like those used for dispersant application. The efficacy of Applying an emulsion breaker to an emulsified oil slick appears to be oil-specific, however for emulsions of 4 of 6 different oil types tested, the maximum ignitable water content increased from 40% to 60% water (Buist, 1998). These results are very encouraging for extending the window of opportunity for in-situ burning.

Figure 37 Water-Cooled And Dry Fire Boom



Fire boom provides a barrier to collect and contain floating oil so that it can be burned at sea. Some booms are water-cooled and are fire resistant along the entire length allowing oil to be eliminated over the largest area possible without fear of damage to any portion of the boom. The temperature of the boom during the burning of oil remains at ambient sea temperature resulting in the ability to reuse the boom. Such an application should be considered when a large amount of oil may be collected during a blow out (Allan, 1995 – see Figure 38). MSRC stockpiles the 32-inch Elastec/American Marine Hydro-Fire boom throughout its network of depots.

Figure 38 ISB Strategy For Response To An Offshore Blow Out



10.4 Air Quality Monitoring

Over time, physical and chemical processes are continuously changing oil composition of the spilled oil and, as a result, on-scene monitoring and predictive modeling will be required to optimize spill countermeasures and ensure responder safety.

Oil spill response organizations are becoming increasingly aware of the chronic affects as a result of exposure to the many hazardous vapours and gases encountered during an oil spill. OSR, as a part of the 2005 International Oil Spill Conference, presented a review of air monitoring instruments, with considerations given to budget, demand and ease of real-time interpretation. The general consensus is that a continuous Photo Ionization Detectors (PID) used in combination with a multi-gas detector or colurmetric ("Draegar) tubes would be the most effective PPE. OSR also highlighted the general lack of real-time air monitoring during a spill-scenario and the lack of conformity with respect to international regulations and guidelines (Grimes and Olden, 2005).

Most offshore supply vessels now on charter have some level of air monitoring equipment on board. For the most part, these monitors have been used in the preparation for confined space entry. There appear to be no protocols in place for the monitoring of atmospheric hydrocarbons prior to spill response activities.

MARINE HYDROCARBON SPILL RESPONSE CAPABILITY ASSESSMENT JEANNE D'ARC BASIN PRODUCTION OPERATIONS

CHAPTER 5 - CONCLUSIONS

Prepared For:

Canadian Association of Petroleum Producers
403, 235 Water Street
St. John's, NL
CANADA
A1C 1B7

On Behalf Of:

Suncor Energy
235 Water Street
St. John's, NL
CANADA
A1C 1B6

Husky Energy
235 Water Street
St. John's, NL
CANADA
A1C 1B6

Hibernia Management and Development Company
Suite 1000, 100 New Gower Street
St. John's, NL
CANADA
A1C 6K3

Prepared By:

Cormorant Ltd.
280 B Water Street
St. John's, NL
CANADA
A1C 1B7

Lorax Environmental
Suite 504, 215 Water Street
St. John's, NL
CANADA
A1C 6C9

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1.0 INTRODUCTION

In the previous chapters of this report, the Newfoundland offshore operator's current oil spill response capability has been viewed in the context of the local working environment and compared to similar international spill response programs. This chapter will discuss activities that Suncor, Husky, and HMDC will consider to enhance that capability.

2.0 CURRENT LEVEL OF PREPAREDNESS

Oil spill response resources suitable to the offshore Newfoundland operating environment are currently available to the offshore industry, both through their own existing equipment and equipment maintained by other response organizations. These resources are described in more detail in Chapter 4 of this report.

2.1 Management

Each operator's oil spill management structure is based on the Company's existing emergency response processes. Suncor, Husky, and HMDC have developed oil spill response plans that describe their three-tiered response to different magnitudes of oil spills. The management structure is comprised of company offshore and onshore emergency response teams that are supported by external resources (ECRC, CCG, OSR, etc.) depending on the size of the spill.

2.2 Tier 1 Response

All facilities and supply vessels currently operating offshore Newfoundland have appropriate resources to quickly and efficiently respond to Tier 1 oil spills. Tier 1 response options include:

- Mechanical dispersion (prop washing or high pressure water spray);
- Containment and recovery (sorbent booms and SVSS systems);
- Surveillance and monitoring (observation protocols and tracker buoys);
- Wildlife measures; and
- Oil and wildlife sampling.

Offshore personnel are also aware of when to rely on natural dispersion and degradation when conditions do not permit an active response.

2.3 Tier 2 Equipment

The Operators have acquired a Norwegian Standard System (see Section 6.4 of Chapter 4). Tier 2 oil spill response equipment, such as booms, power packs, skimmers and transfer pumps is also available through ECRC and the CCG Environmental Emergencies Unit. This equipment is described in greater detail in Section 6.3.2 of this report. The purchase and delivery of the Norwegian Standard System was completed in 2009. This is a new acquisition and is identified as a program enhancement in Section 3.1.1 of this Chapter.

3.0 FUTURE CAPABILITY ENHANCEMENTS

In consideration of the range of meteorological and oceanographic conditions on the Grand Banks and the nature of potential spill scenarios and existing Tier 1 and Tier 2 oil spill response equipment described in this report, this section will describe options to be considered for possible equipment and process upgrades to enhance the oil spill response capability of Suncor, Husky and HMDC.

3.1 Equipment

3.1.1 Norwegian Standard System

The joint acquisition by HMDC, Husky and Suncor of the Norwegian Standard System (Framo Transrec 150 Weir Skimmer, Norlense 1200-R Self-Inflating Boom and Lamor LLP 200 kW Power Pack), was completed in June 2009. This system is considered to be the best equipment available for harsh offshore conditions and has become the new standard for NOFO. The decision to purchase this equipment was based on Operator review of previously existing internal and external offshore oil spill response capabilities in consideration of the physical operating environment on the Grand Banks. The review of historical oceanographic data identified that previously existing Tier 1 and Tier 2 response equipment would only be able to be deployed approximately fifty percent of the time. The addition of the Norwegian Standard System increased the response capability of Newfoundland Operators to approximately eighty-five percent of the time (see Figure 3 in Chapter 2).

When the C-NLOPB issued the condition or letter requiring Operators to submit a report that included a review of their hydrocarbon spill response capability and plans for potential equipment upgrade based on the results of the review, the final decision to purchase the Norwegian Standard System was made by all Operators. In consideration of oceanographic conditions and the level of oil and gas production and exploration activities on the Grand Banks, Newfoundland Operators consider that the acquisition of the Norwegian Standard System equipment enhances the oil spill containment and mechanical recovery to a standard seen in other leading jurisdictions around the world (e.g. Norway). This is supported by SL Ross' 2001 report that recommended one Norwegian Standard System would be required to supplement a primary response strategy of chemical dispersants (SL Ross, 2001). Additional information on chemical dispersants can be found in Section 3.3 of this Part of the report.

The Norwegian Standard System equipment will be maintained on behalf of the operators by ECRC. ECRC will also train responders to operate the equipment in the event of the Tier 2 offshore oil spill response. Additional information on ECRC integration can be found in Section 3.4 of this Chapter of the report.

3.1.2 Other Equipment

In addition to the procurement of the Norwegian Standard System, Suncor, Husky, and HMDC will continue to review, assess and/or trial additional oil spill response equipment as appropriate to determine suitability for Grand Banks operations. Decisions to procure any additional spill equipment will be a risk based process by all operators and must consider if it will enhance their ability to deploy the equipment or the conditions in which it will be used.

One example of additional equipment under consideration by Newfoundland Operators is the Ocean Boom Vane (OBV) manufactured by ORC in Sweden (see Chapter 4, Section 6.2.3.

3.1.3 Deployment and Mobilization

Operators should review opportunities to decrease the deployment time for Tier 1 equipment offshore and the mobilization time for onshore Tier 2 equipment. The successful use of ISO mounts with the Norwegian Standard System in Exercise Synergy 2009 (see Chapter 4, Section 6.4.3) demonstrates how mobilisation time can be significantly reduced on an equipped vessel. The joint operator steering committee (see Section 3.3 below), in consultation with logistics and marine operations personnel in their own organizations, will review the suitability of various deck mounting systems for this application.

3.2 Dispersants

With the procurement of the Norwegian Standard System by Suncor, Husky, and HMDC, the next enhancement to oil spill response capability should be a review of chemical dispersants as a possible countermeasure for oil spills occurring offshore Newfoundland.

Since the 2004 ESRF dispersants workshop (Trudel, 2004) the following activities related to dispersant use have occurred:

- In addition to previous Hibernia crude testing, Terra Nova and White Rose crude oils have been shown to be dispersible in cold water conditions during full scale trials at the Ohmsett test facility;
- A Net Environmental Benefit Analysis (NEBA) study, sponsored by CAPP, to support dispersant use has been completed (SL Ross, 2008A); and
- Recent field research suggests that the mixing energy provided by open ocean conditions considerably increases the window of opportunity.

Ultimately pre-approved or case-by-case permitting will depend upon the Operator's ability to conduct a dispersant program responsibly and effectively. The dispersant discussion should progress in manageable steps to ensure the development of a complete capability. Suggested steps include:

- Meet with the C-NLOPB and Environment Canada to discuss dispersant use on the Grand Banks, including how approval could be obtained and the conditions required for use (e.g. information to be provided to the regulator, effectiveness of Tier 1 and Tier 2 response, oceanographic conditions, etc.);
- Review all past work (see Part 2, Section 5.3) to confirm the efficacy of potential chemicals in dispersing known Grand Banks crude oils;
- Consider the virtues of large (fixed wing), medium (helicopter), and small (vessel) scale application technologies and how they might be practically implemented in the current and future oil spill response programs;
- Consider the requirements for monitoring:

    - Oil detection and distribution;
    - Environmental surveys; and
    - Post application observation and sampling.
- Develop a procedure for determining and delivering appropriate dosage to the target oil; and
- Identify key personnel in the field and the spill management team and develop a training program to ensure competency.

3.3 Joint Operator Steering Committee

Building on recent cooperative activities (acquisition of the Norwegian Standard System, planning and execution of on-water oil spill countermeasures exercises, and the preparation of this report), Suncor, Husky, and HMDC will develop a joint operator steering committee that focuses on oil spill response capability on the Grand Banks. Operators will work together to assess potential changes to their own or joint oil spill preparedness and response programs. These changes may include equipment purchase, modification or maintenance, training, plan/procedure revisions or research and development.

3.4 ECRC Integration

At present, Suncor, Husky, and HMDC are working towards an oil spill preparedness integration agreement with ECRC. The agreement, when fully implemented, will see ECRC conduct inspection, maintenance, storage and training on Operator-owned Tier 1 (sorbent booms, SVSS, tracker buoys, etc.) and Tier 2 (Norwegian Standard System) equipment. For Tier 1 equipment, training will be delivered to Operator vessel crews. Tier 2 equipment training will be delivered to a pool of ECRC oil spill responders. The integration agreement will also more easily facilitate the participation of ECRC in operator led emergency/oil spill response exercises, including the annual Synergy exercise. Partnering with ECRC, a certified Response Organization under the *Canada Shipping Act*, to provide oil spill response preparedness services to Operators will enhance operators' capability to respond to oil spill events.

3.5 Research and Development

In line with their own internal processes, Suncor, Husky, and HMDC will support research and development in the area of oil spill equipment development and deployment.

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

May 21, 2010

[redacted]
Suncor Energy Inc.
Scotia Centre
235 Water Street
St. John's, NL A1C 1B6

Dear [redacted]

Re: Marine Hydrocarbon Response Capability Assessment:, Jeanne d'Arc Production Operations

I refer to the above report, which was submitted to us on November 20, 2009 in response to the condition to the Terra Nova Operations Authorizations.

The report is incomplete in the following respects:

1. Insufficiently Supported Principal Conclusion

The fundamental conclusion to the report is that the single "Norwegian Standard System" (NSS) recently acquired by your organization is a sufficient addition to the previously existing NL equipment repertoire to represent state of the art, as support to a primary response strategy of dispersant application. Despite this, there is no evidence provided to support a contention that dispersant would be effective on certain significant response scenarios, including subsea blowouts. In addition, the Board's acceptance of dispersant usage has not been sought, and your respective oil spill response plans currently do not contain sufficient details of their usage to permit such an evaluation. Currently, your spill response plans are focused principally on containment and recovery, and it is not demonstrated that in this case a single NSS represents a sufficient upgrade to represent a state of the art Tier 2 or 3 response capability.

2. Lack of a Plan

The Authorization conditions, and my letter, required that the report include

> ***a plan for any equipment upgrade or acquisition that may be required as a result of the foregoing analysis.***

While Chapter 5 contains several conclusions to the report, it does not represent a plan. No firm commitments, nor timing for any potential initiatives, are provided.

Fifth Floor, TD Place, 140 Water Street, St. John's, NL, Canada A1C 6H6
Telephone (709) 778-1400 Fax (709) 778-1473

3. **Incomplete Linkage to Spill Scenarios**

While we acknowledge that a 100% quantitative assessment of equipment response capability is both unfeasible and unnecessary for planning purposes, the report does not contain either a complete description of Tier 2 / 3 spill scenarios to inform a full assessment of the adequacy of currently available response equipment and procedures, or a complete linkage of these scenarios to the available equipment. The notional planning scenarios should be more explicitly described, and a more direct connection between those scenarios and the existing and potentially available equipment demonstrated.

I enclose a table containing further detailed comments on the report.

Please provide a response to these comments and your plan of action in this regard, not later than June 25, 2010.

Sincerely yours,

[redacted]

Frank Smyth, P. Eng.
Chief Conservation Officer

c.c. [redacted] HMDC
Husky Energy

	Chapter	Section	Page	Comment
1	1	3.0	15	The Han G., 2007 reference appears to be lacking a journal or a report citation.
2	1	3.0	16	The "Lee, K." reference (presumably 2009 – see Chapter 4, section 10.2.1) is incomplete.
3	1	3.0	16-17	Please provide a copy of the referenced reports S.L. Ross 2001, "Response Strategies. . ." and S.L. Ross 2008A, "Net Environmental Benefit Analysis . . ."
4	1	3.0	17	The 1984 S.L. Ross report *Hibernia Oil Spills and their Control* is not proprietary. It was a supporting document for the 1985 Hibernia EIS and was publicly available at the time of that review.
5	2	3.2.4	14	This section could be updated with the results of the recent ESRF/CWS seabird monitoring project, as the report from that project represents a substantial update of the data base for marine bird observations in the area of interest.
6	2	5.3.1	26	Paragraph 2 notes that oil samples all were obtained post-production. To what degree would process chemicals likely have affected the spill-related properties of the samples, and which proportion of the spill scenarios would this represent? As an example, properties altered by such chemicals presumably would not be relevant to a subsea blowout scenario.
7	2	5.3.1	26	Table 6 (also Table 7, page 27): Were Hebron or Ben Nevis crude oils tested?
8	2	5.5	27	Is the sentence ending "survival times of weeks and even months are conceivable" intended to apply to all spills or only those of more substantial volume?
9	2	5.5	28	(a) Why was the ConocoPhillips environmental assessment and its supporting information not referenced directly for the scenario list presented here? (b) The statement that the South West Grand Banks site is "somewhat representative" of the ConocoPhillips licences requires substantiation.

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12	2	5.5.3	32	Figure 16: The NE Grand Banks 1 and Orphan Basin graphics appear to be interchanged.
13	2	5.6	33 ff.	The batch spill example in this section is useful, but for completeness a summary of a large blowout scenario also should be included, with a more explicit discussion of each scenario's implications for the offshore NL preparedness regime described in Chapters 4 and 5.
14	2	5.6.8	37	See comment #5.
15	3	1.0	1	A more accurate description of Tier 1 would not include the phrase "poses the least threat of impact".
16	3	3.2.5	14	What level of training and/or exercises does AMOSC conduct annually?
17	4	2.1.2	3	(a) The section more accurately could be entitled "Regulations and Guidance". (b) Since the report was written, the reference to the *Newfoundland Offshore Petroleum Drilling Regulations* has become obsolete with the promulgation of the *Newfoundland Offshore Petroleum Drilling and Production Regulations*.
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20	4	6	19-45	Section 6.1 describes Tier 1 equipment for exploration drilling and for production, but Section 6.2 describes Tier 1 equipment for production (although potential Tier 2 application also is discussed). This should be clarified.
21	4	6.1.3	21	In the second paragraph, reference is made to Super Puma helicopters however these are not currently in use in NL.
22	4	6.1.3	22	The final sentence "Methods of volume calculation, however, are not consistent among vessel and PAL flight crews" should be explained.
23	4	6.1.6	23	Paragraph 1: The CWS survey technique should be properly referenced.
24	4	6.3.1	31, 32	Table 6.3.2 lists the Vikoma Ocean Pack as "available equipment at both CCG and ECRC Donovans". This equipment dates back to the early 1980's and the assertion of its fitness requires justification.
25	4	6.3.1	34	Table 6.3.2 cites both the GT-260 and the GT-185 skimmers as having a nominal capacity of 100 m3/hr. The ECRC web site (see http://www.ecrc.ca/en/pdf/skimmers/GT-260_GT-185_SKIMMERS.pdf) lists them as having a 90 T/hr and 45 T/hr capacity respectively. The GT-185 figure should be corrected.
26	4	6.4	38	The section cites the calculation for oil removal efficiency F_R, but does not describe how the acquisition of the Norwegian Standard System affects that calculation.
27	4	7.3 and 8.2.1	47-48 and 50	The explanation for the cited six vessels in Table 3 no longer being in DnV Oil Recovery Class should be provided.

28	4	8.1.1	49	The cited November 2003 workshop was funded ($30K) by the Environmental Studies Research Funds (ESRF).
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32	4	8.2.3 – 8.2.5	51-52	When liquid waste is brought to shore, there is limited capability to deal with it locally. The waste storage capacities of local marine terminals listed in Table 5 will not all be available for a spill response. Likewise, the full truck capacities of Crosbie's and Pardy's will likely not be available. The volume of liquid waste that can be accommodated in a refinery waste stream is 150m^3/day. Where would storage of liquid waste take place while waiting for disposal?
33	4	8.3.2	53	Given that existing landfills could not be used for disposal of spill related waste material, where would this material be stored and disposed of? Would this material be incinerated and if so where?
34	4	9.0	54	An explanation should be provided why no training appears to be provided for the Tier 2 and Tier 3 elements

				of the operators' plans.
35	4	9.4.3	57	The statement that "it is unreasonable to expect these [support vessel] crews to manage [SVSS operations] on their own" should be justified. The SVSS cannot properly be described as a Tier 1 countermeasure unless personnel normally at site, vessel crew, are deemed competent in its use.
36	4	10.1	59	Paragraph 2 refers to a discussion in Part 3, Section 6.1 of dispersant evaluation and establishment for offshore NL, but Part 3, Section 6.1 contains no such discussion.
37	4	10.1	59-63	Section 10.1 does not describe any conditions, other than those relating to permitting and to chemical efficacy upon the oil involved, in which dispersant use would be inappropriate. Is it the operators' position that no such circumstances in fact exist?
38	4	10.1.3	61	The ESRF-sponsored dispersant workshop was held in February 2004 and not March 2004.
39	4	10.1.3	62	For completeness, it should be mentioned that, apart from a single application towards the end of the Jeanne d'Arc Basin Operators' program in 2000, no application for pre-approval of dispersant use offshore NL has ever been put forward by an operator.
40	4	10.2	63	The Bragg and Owens (1995) reference does not appear in the reference list in Chapter 1, Section 3.
41	4	10.2.1	65	The "Lee et al. 2009b" reference does not appear in the references list in Chapter 1, Section 3.
42	5	3.1.1	2	The operators state that the majority of the equipment available is suitable for Beaufort 5, which fits into the 50% deployment category and that the remainder of the time only the Norwegian Standard System can be utilized. What is not discussed is for the predicted spill scenarios, is there sufficient equipment to contain and recover oil in a reasonable period. The operators should discuss if the lone Norwegian Standard System is sufficient to contain and recover oil from predicated spill scenarios within a reasonable period.

43	5	3.1.2	3	The reference to the Ocean Boom Vane should be clarified to indicate how many OBVs may be contemplated for acquisition and in what configuration(s).

CANADA-NEWFOUNDLAND
and LABRADOR
OFFSHORE
PETROLEUM
BOARD

May 21, 2010

[redacted]

Husky Energy
Suite 801, Scotia Centre
235 Water Street
St. John's, NL A1C 1B6

Dear [redacted]

Re: Marine Hydrocarbon Response Capability Assessment:, Jeanne d'Arc Production Operations

I refer to the above report, which was submitted to us on November 20, 2009 in response to the condition to the White Rose Operations Authorizations and our October 7, 2008 letter to your organization.

The report is incomplete in the following respects:

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35	4	9.4.3	57	The statement that "it is unreasonable to expect these [support vessel] crews to manage [SVSS operations] on their own" should be justified. The SVSS cannot properly be described as a Tier 1 countermeasure unless personnel normally at site, vessel crew, are deemed competent in its use.
36	4	10.1	59	Paragraph 2 refers to a discussion in Part 3, Section 6.1 of dispersant evaluation and establishment for offshore NL, but Part 3, Section 6.1 contains no such discussion.
37	4	10.1	59-63	Section 10.1 does not describe any conditions, other than those relating to permitting and to chemical efficacy upon the oil involved, in which dispersant use would be inappropriate. Is it the operators' position that no such circumstances in fact exist?
38	4	10.1.3	61	The ESRF-sponsored dispersant workshop was held in February 2004 and not March 2004.
39	4	10.1.3	62	For completeness, it should be mentioned that, apart from a single application towards the end of the Jeanne d'Árc Basin Operators' program in 2000, no application for pre-approval of dispersant use offshore NL has ever been put forward by an operator.
40	4	10.2	63	The Bragg and Owens (1995) reference does not appear in the reference list in Chapter 1, Section 3.
41	4	10.2.1	65	The "Lee et al. 2009b" reference does not appear in the references list in Chapter 1, Section 3.
42	5	3.1.1	2	The operators state that the majority of the equipment available is suitable for Beaufort 5, which fits into the 50% deployment category and that the remainder of the time only the Norwegian Standard System can be utilized. What is not discussed is for the predicted spill scenarios, is there sufficient equipment to contain and recover oil in a reasonable period. The operators should discuss if the lone Norwegian Standard System is sufficient to contain and recover oil from predicated spill scenarios within a reasonable period.

43	5	3.1.2	3	The reference to the Ocean Boom Vane should be clarified to indicate how many OBVs may be contemplated for acquisition and in what configuration(s).

CANADA-NEWFOUNDLAND
and LABRADOR
OFFSHORE
PETROLEUM
BOARD

May 21, 2010

[redacted]
Hibernia Management and
Development Company Ltd
Suite 1000, 100 New Gower Street
St. John's, NL A1C 6K3

Dear [redacted]

Re: Marine Hydrocarbon Response Capability Assessment:, Jeanne d'Arc Production Operations

I refer to the above report, which was submitted to us on November 20, 2009 in response to our October 7, 2008 letter to your organization.

The report is incomplete in the following respects:

1. Insufficiently Supported Principal Conclusion

The fundamental conclusion to the report is that the single "Norwegian Standard System" (NSS) recently acquired by your organization is a sufficient addition to the previously existing NL equipment repertoire to represent state of the art, as support to a primary response strategy of dispersant application. Despite this, there is no evidence provided to support a contention that dispersant would be effective on certain significant response scenarios, including subsea blowouts. In addition, the Board's acceptance of dispersant usage has not been sought, and your respective oil spill response plans currently do not contain sufficient details of their usage to permit such an evaluation. Currently, your spill response plans are focused principally on containment and recovery, and it is not demonstrated that in this case a single NSS represents a sufficient upgrade to represent a state of the art Tier 2 or 3 response capability.

2. Lack of a Plan

The Authorization conditions, and my letter, required that the report include

a plan for any equipment upgrade or acquisition that may be required as a result of the foregoing analysis.

While Chapter 5 contains several conclusions to the report, it does not represent a plan. No firm commitments, nor timing for any potential initiatives, are provided.

3. Incomplete Linkage to Spill Scenarios

While we acknowledge that a 100% quantitative assessment of equipment response capability is both unfeasible and unnecessary for planning purposes, the report does not contain either a complete description of Tier 2 / 3 spill scenarios to inform a full assessment of the adequacy of currently available response equipment and procedures, or a complete linkage of these scenarios to the available equipment. The notional planning scenarios should be more explicitly described, and a more direct connection between those scenarios and the existing and potentially available equipment demonstrated.

I enclose a table containing further detailed comments on the report.

Please provide a response to these comments and your plan of action in this regard, not later than June 25, 2010.

Sincerely yours,

[redacted]

Frank Smyth, P. Eng.
Chief Conservation Officer

c.c. [redacted] Suncor Energy
[redacted] Husky Energy

	Chapter	Section	Page	Comment
1	1	3.0	15	The Han G., 2007 reference appears to be lacking a journal or a report citation.
2	1	3.0	16	The "Lee, K." reference (presumably 2009 – see Chapter 4, section 10.2.1) is incomplete.
3	1	3.0	16-17	Please provide a copy of the referenced reports S.L. Ross 2001, "Response Strategies. . ." and S.L. Ross 2008A, "Net Environmental Benefit Analysis . . ."
4	1	3.0	17	The 1984 S.L. Ross report *Hibernia Oil Spills and their Control* is not proprietary. It was a supporting document for the 1985 Hibernia EIS and was publicly available at the time of that review.
5	2	3.2.4	14	This section could be updated with the results of the recent ESRF/CWS seabird monitoring project, as the report from that project represents a substantial update of the data base for marine bird observations in the area of interest.
6	2	5.3.1	26	Paragraph 2 notes that oil samples all were obtained post-production. To what degree would process chemicals likely have affected the spill-related properties of the samples, and which proportion of the spill scenarios would this represent? As an example, properties altered by such chemicals presumably would not be relevant to a subsea blowout scenario.
7	2	5.3.1	26	Table 6 (also Table 7, page 27): Were Hebron or Ben Nevis crude oils tested?
8	2	5.5	27	Is the sentence ending "survival times of weeks and even months are conceivable" intended to apply to all spills or only those of more substantial volume?
9	2	5.5	28	(a) Why was the ConocoPhillips environmental assessment and its supporting information not referenced directly for the scenario list presented here? (b) The statement that the South West Grand Banks site is "somewhat representative" of the ConocoPhillips licences requires substantiation.

10	2	5.5.1	28	Paragraph 2: Was the wind velocity vector rotated when estimating surface drift of oil?
11	2	5.5.3	30	Table 8: The Northeast Grand Banks 2 scenario appears, from Figure 15, to have shoreline impact, but the respective table entry is "No".
12	2	5.5.3	32	Figure 16: The NE Grand Banks 1 and Orphan Basin graphics appear to be interchanged.
13	2	5.6	33 ff.	The batch spill example in this section is useful, but for completeness a summary of a large blowout scenario also should be included, with a more explicit discussion of each scenario's implications for the offshore NL preparedness regime described in Chapters 4 and 5.
14	2	5.6.8	37	See comment #5.
15	3	1.0	1	A more accurate description of Tier 1 would not include the phrase "poses the least threat of impact".
16	3	3.2.5	14	What level of training and/or exercises does AMOSC conduct annually?
17	4	2.1.2	3	(a) The section more accurately could be entitled "Regulations and Guidance". (b) Since the report was written, the reference to the *Newfoundland Offshore Petroleum Drilling Regulations* has become obsolete with the promulgation of the *Newfoundland Offshore Petroleum Drilling and Production Regulations.*
18	4	2.1.2	3-4	The regulatory quote of extracted from the Safety Plan Guidelines is out of context. The reference as presented in the Safety Plan Guidelines could lead one to believe the section is 51(1)(e) the correct reference should be 51(3)(e). Section 51(3) needs to be read in the context of the applicable Safety or Environmental Protection Plan and that on water oil spill response is not part of the safety plan as serious injury, persons overboard or loss of life is not part of the Environmental Protection Plan. In the context of the safety plan oil spill is dealt with as a threat to the safety of personnel on the facility. The

				regulatory quote should be put in the proper context of responding to mitigating the effects of a spill for the report.
19	4	2.2	4	Paragraph 1, bullet 1: The *Canada Shipping Act* also applies to supply vessels and tankers inside the safety zone.
20	4	6	19-45	Section 6.1 describes Tier 1 equipment for exploration drilling and for production, but Section 6.2 describes Tier 1 equipment for production (although potential Tier 2 application also is discussed). This should be clarified.
21	4	6.1.3	21	In the second paragraph, reference is made to Super Puma helicopters however these are not currently in use in NL.
22	4	6.1.3	22	The final sentence "Methods of volume calculation, however, are not consistent among vessel and PAL flight crews" should be explained.
23	4	6.1.6	23	Paragraph 1: The CWS survey technique should be properly referenced.
24	4	6.3.1	31, 32	Table 6.3.2 lists the Vikoma Ocean Pack as "available equipment at both CCG and ECRC Donovans". This equipment dates back to the early 1980's and the assertion of its fitness requires justification.
25	4	6.3.1	34	Table 6.3.2 cites both the GT-260 and the GT-185 skimmers as having a nominal capacity of 100 m3/hr. The ECRC web site (see http://www.ecrc.ca/en/pdf/skimmers/GT-260_GT-185_SKIMMERS.pdf) lists them as having a 90 T/hr and 45 T/hr capacity respectively. The GT-185 figure should be corrected.
26	4	6.4	38	The section cites the calculation for oil removal efficiency F_R, but does not describe how the acquisition of the Norwegian Standard System affects that calculation.
27	4	7.3 and 8.2.1	47-48 and 50	The explanation for the cited six vessels in Table 3 no longer being in DnV Oil Recovery Class should be provided.

28	4	8.1.1	49	The cited November 2003 workshop was funded ($30K) by the Environmental Studies Research Funds (ESRF).
29	4	8.2.1	50	The limitations on internal tankage discussed in this section could be a limiting factor during a spill response and should be discussed further, either here or in Chapter 5.
30	4	8.2.2	51	The reason why transfer hardware "has not been included in a maintained inventory" should be provided.
31	4	8.2.2	51	Due to limited storage capacity of collection vessels, wastes collected may be required to be transferred to a tanker offshore during a large spill response. It has been shown in exercises that this type of transfer may be possible but it is not proved that transfer of higher viscosity weathered oil could be transferred effectively. Also equipment for transferring is not included in a maintained inventory. In a large spill, storage capacity in the field could be reached quickly and the ability to continue with spill response operations will depend on being able to transfer recovered oil from the spill response vessel(s) allowing that vessel to return to recovery operations. Where will the tanker with the recovered oil offload?
32	4	8.2.3 – 8.2.5	51-52	When liquid waste is brought to shore, there is limited capability to deal with it locally. The waste storage capacities of local marine terminals listed in Table 5 will not all be available for a spill response. Likewise, the full truck capacities of Crosbie's and Pardy's will likely not be available. The volume of liquid waste that can be accommodated in a refinery waste stream is $150m^3$/day. Where would storage of liquid waste take place while waiting for disposal?
33	4	8.3.2	53	Given that existing landfills could not be used for disposal of spill related waste material, where would this material be stored and disposed of? Would this material be incinerated and if so where?
34	4	9.0	54	An explanation should be provided why no training appears to be provided for the Tier 2 and Tier 3 elements

				of the operators' plans.
35	4	9.4.3	57	The statement that "it is unreasonable to expect these [support vessel] crews to manage [SVSS operations] on their own" should be justified. The SVSS cannot properly be described as a Tier 1 countermeasure unless personnel normally at site, vessel crew, are deemed competent in its use.
36	4	10.1	59	Paragraph 2 refers to a discussion in Part 3, Section 6.1 of dispersant evaluation and establishment for offshore NL, but Part 3, Section 6.1 contains no such discussion.
37	4	10.1	59-63	Section 10.1 does not describe any conditions, other than those relating to permitting and to chemical efficacy upon the oil involved, in which dispersant use would be inappropriate. Is it the operators' position that no such circumstances in fact exist?
38	4	10.1.3	61	The ESRF-sponsored dispersant workshop was held in February 2004 and not March 2004.
39	4	10.1.3	62	For completeness, it should be mentioned that, apart from a single application towards the end of the Jeanne d'Arc Basin Operators' program in 2000, no application for pre-approval of dispersant use offshore NL has ever been put forward by an operator.
40	4	10.2	63	The Bragg and Owens (1995) reference does not appear in the reference list in Chapter 1, Section 3.
41	4	10.2.1	65	The "Lee et al. 2009b" reference does not appear in the references list in Chapter 1, Section 3.
42	5	3.1.1	2	The operators state that the majority of the equipment available is suitable for Beaufort 5, which fits into the 50% deployment category and that the remainder of the time only the Norwegian Standard System can be utilized. What is not discussed is for the predicted spill scenarios, is there sufficient equipment to contain and recover oil in a reasonable period. The operators should discuss if the lone Norwegian Standard System is sufficient to contain and recover oil from predicated spill scenarios within a reasonable period.

43	5	3.1.2	3	The reference to the Ocean Boom Vane should be clarified to indicate how many OBVs may be contemplated for acquisition and in what configuration(s).

Hibernia

Management and Development Company Ltd.
Suite 1000, 100 New Gower Street
St. John's, NL A1C 6K3
Fax: (709) 754-1043 Tel: (709) 778-7000

TRIM #: 00002800
Date Rec'd. June 25, 2010
File #:
Canada-Newfoundland & Labrador Offshore Petroleum Board

[redacted]

CONFIDENTIAL

June 25, 2010

Mr. Frank Smyth, P.Eng.
Chief Conservation Officer
Canada-Newfoundland and
Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water Street
St. John's, NL A1C 6H6

Serial No: HSCNOPB2533
File No: 353.3

Dear Mr. Smyth:

Re: Response to C-NLOPB Comments on the Assessment of Marine Hydrocarbon Spill Response Capability Report for Jeanne d'Arc Basin Production Operations

Hibernia Management Development Company (HMDC) would like to provide the following response to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) May 21, 2010 letter regarding the above noted Assessment.

Outlined below is our response to C-NLOPB comments on the Report:

Comment # 1. Insufficiently Supported Principal Conclusion

The fundamental conclusion to the report is that the single "Norwegian Standard System" (NSS) recently acquired by your organization is a sufficient addition to the previously existing NL equipment repertoire to represent state of the art, as support to a primary response strategy of dispersant application. Despite this, there is no evidence provided to support a contention that dispersant would be effective on certain significant response scenarios, including subsea blowouts. In addition, the Board's acceptance of dispersant usage has not been sought, and your respective oil spill response plans currently do not contain sufficient details of their usage to permit such an evaluation. Currently, your spill response plans are focused principally on containment and recovery, and it is not demonstrated that in this case a single NSS represents sufficient upgrade to represent a state of the art Tier 2 or 3 response capability.

.../2

Response # 1.

The NSS was acquired by the three producing operators to enhance the current response capability for containment and recovery. The conclusions included in the report identify other capability enhancement options; the NSS alone was not intended to represent the only Upgrade" (see Chapter 5 of the Report). The action plan identified in Attachment 1 of this letter provides additional details on Operators progress to date on implementation of the conclusions.

At present, dispersants are not part of the primary response strategy as described in HMDC's Oil Spill Response plans. Section 3.2 of the report notes our intention to, review chemical dispersants as a possible counter-measure to oil spills occurring offshore Newfoundland and Labrador. As per discussions on June 4th, 2010 between the C-NLOPB, HMDC, Suncor, and Husky, HMDC formally requests that the C-NLOPB initiate discussions with Operators, Environment Canada and other applicable regulatory agencies on the approval and use of dispersants around Newfoundland and Labrador.

Comment # 2. Lack of a Plan

The Authorization conditions, and my letter, required that the report include a plan for any equipment upgrade or acquisition that may be required as a result of the foregoing analysis. While Chapter 5 contains several conclusions to the report, it does not represent a plan. No firm commitments, nor timing for any potential initiatives, are provided.

Response # 2.

Please see the Recommendations / Action Plan for further Oil Spill Response Equipment Capability Enhancements contained in Attachment 1.

Comment # 3. Incomplete Linkage to Spill Scenarios

While we acknowledge that a 100% quantitative assessment of equipment response capability is both unfeasible and unnecessary for planning purposes, the report does not contain either a complete description of Tier 2 / 3 spill scenarios to inform a full assessment of the adequacy of currently available response equipment and procedures, or a complete linkage of these scenarios to the available equipment. The notional planning scenarios should be more explicitly described, and a more direct connection between those scenarios and the existing and potentially available equipment demonstrated.

Response # 3.

Chapter 2 of the oil spill response capability report includes some potential oil spill scenarios on the Grand Banks. These scenarios are also described in environmental assessments and oil spill response plans. HMDC's Spill Response Plan includes potential scenarios and response strategies. We will review our plan and revise as required to include enhancements to oil spill response capabilities as they become available. A revised oil spill response plan will be submitted to the C-NLOPB by the end of Q4, 2010.

Attachment 2 of this letter provides a detailed response to 34 comments received from the C-NLOPB. Additional time is requested to complete the remaining 9 questions.

Please feel free to contact [redacted] if you have any questions or wish to discuss this information in greater detail.

Sincerely,

[redacted]

c.c. [redacted] Suncor)
[redacted] (HMDC)
[redacted] (Husky)
[redacted]

Husky Energy

Suite 901, Scotia Centre
235 Water Street
St. John's, NL, Canada
A1C 1B6

Phone: (709) 724-3900
Fax: (709) 724-3915

June 25, 2010

Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water Street,
St. John's, NL A1C 6H6

Doc. No.: HUS-CPB-EC-LTR-00149

Attention: Mr. Frank Smyth, P. Eng,,
Chief Conservation Officer

Dear Mr. Smyth;

Subject: Response to C-NLOPB Comments on the Assessment of Marine Hydrocarbon Spill Response Capability Report for Jeanne d'Arc Basin Production Operations

Husky Energy would like to provide the following responses to comments given by the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) in a May 21, 2010 letter (CPB-HUS-EC-LTR-00070) regarding the above noted Assessment.

Comment # 1 - Insufficiently Supported Principal Conclusion

The fundamental conclusion to the report is that the single "Norwegian Standard System" (NSS) recently acquired by your organization is a sufficient addition to the previously existing NL equipment repertoire to represent state of the art, as support to a primary response strategy of dispersant application. Despite this, there is no evidence provided to support a contention that dispersant would be effective on certain significant response scenarios, including subsea blowouts. In addition, the Board's acceptance of dispersant usage has not been sought, and your respective oil spill response plans currently do not contain sufficient details of their usage to permit such an evaluation. Currently, your spill response plans are focused principally on containment and recovery, and it is not demonstrated that in this case a single NSS represents sufficient upgrade to represent a state of the art Tier 2 or 3 response capability.

Response # 1

The NSS was acquired by the three producing operators to enhance the current response capability for containment and recovery. The conclusions included in the report identify other capability enhancement options; the NSS alone was not intended to represent the only Upgrade" (see Chapter 5 of the Report). The action plan identified in Attachment 1 of this letter provides additional details on Operators progress to date on implementation of the conclusions.

At present, dispersants are not part of the primary response strategy as described in Husky's Oil Spill Response Plan (EC-M-99-X-PR-00125-001, Section 4.11). Section 3.2 of the oil spill response capability report notes our intention to, review chemical dispersants as a possible counter-measure to oil spills occurring offshore Newfoundland and Labrador. As per discussions on June 4th, 2010 between the C-NLOPB, Husky, Suncor, and HMDC, Husky formally requests that the C NLOPB initiate discussions with Operators, Environment Canada and other applicable regulatory agencies on the approval and use of dispersants around Newfoundland and Labrador.

Comment # 2 - Lack of a Plan

The Authorization conditions, and my letter, required that the report include a plan for any equipment upgrade or acquisition that may be required as a result of the foregoing analysis. While Chapter 5 contains several conclusions to the report, it does not represent a plan. No firm commitments, nor timing for any potential initiatives, are provided.

Response # 2

Please see the Recommendations / Action Plan for further Oil Spill Response Equipment Capability Enhancements contained in Attachment 1.

Comment # 3 - Incomplete Linkage to Spill Scenarios

While we acknowledge that a 100% quantitative assessment of equipment response capability is both unfeasible and unnecessary for planning purposes, the report does not contain either a complete description of Tier 2 / 3 spill scenarios to inform a full assessment of the adequacy of currently available response equipment and procedures, or a complete linkage of these scenarios to the available equipment. The notional planning scenarios should be more explicitly described, and a more direct connection between those scenarios and the existing and potentially available equipment demonstrated.

Response # 3

Chapter 2 of the oil spill response capability report includes some potential oil spill scenarios on the Grand Banks. These scenarios are also described in environmental assessments and oil spill response plans. Section 4.6 of Husky's Oil Spill Response Plan includes a detailed description of Tier 2/3 capability and the mechanisms for escalation. We will review our plan for the scenarios noted, and revise as required.

Attachment 2 of this letter provides a detailed response to 34 comments received from the C-NLOPB. Additional time is requested to complete nine comments.

Please feel free to contact [redacted] if you have any questions, or wish to discuss this information in greater detail.

Yours sincerely,

HUSKY OIL OPERATIONS LIMITED

[redacted]

sb/st/pk

Attachment 1 - Recommendations/Action Plan for Further Oil Spill Equipment Capability Enhancements

Attachment 2 - Detailed Response to C-NLOPB Comments

cc: [redacted] - Husky Energy
[redacted] – Suncor
HMDC

Attachment 1

Recommendations/Action Plan for Further Oil Spill Equipment Capability Enhancements

Attachment 1 - Recommendations/Action Plan for Further Oil Spill Equipment Capability Enhancements

Further Capability Enhancements	Actions to Date	Target Date	Status
Norwegian Standard System (Norlense 1200-R Boom and FRAMO Transrec 150 Skimmer)	• Equipment purchased in June 2009 by HMDC, Husky and Suncor. • Commissioned in September 2009. • Demonstrated in Synergy 2009 (and demonstrated in on-water oil spill exercise by Chevron in June 2010). • Annual Synergy Exercise scheduled for September 2010.	December 31, 2009	Completed September 2009
Other Equipment	• Husky currently looking to purchase an Ocean Boom Vane in Q3 or Q4 2010. • Suncor and Husky currently reviewing the purchase of an additional NorLense 1200-R boom and Transrec 150 skimmer in 2010 or 2011.	Q4, 2010	Open
Deployment and Mobilization	• Husky has installed ISO mounts on one vessel and currently installing on a second vessel. • Suncor conducting MOC assessment for purchase of an ocean Boom Vane in 2010.	Q3, 2010	Open
	• Suncor considering installation of ISO mounts on two vessels in 2010.	Q4, 2010	Open

Attachment 1 - Recommendations/Action Plan for Further Oil Spill Equipment Capability Enhancements

Further Capability Enhancements	Actions to Date	Target Date	Status
	• HMDC considering installation of ISO mounts on two vessels in 2010.	Q4, 2010	Open
Dispersants	• Dispersant testing has been conducted on Hibernia, White Rose and Terra Nova crudes.		Completed
	• CAPP commissioned S.L. Ross to complete a NEBA study on dispersants.		Completed
	• Jeanne d'Arc Basin Operators formally request that the C-NLOPB initiate discussions with Operators, Environment Canada and other applicable regulatory agencies on the approval and use of dispersants around Newfoundland and Labrador.	Q2, 2010	Completed June 25, 2010
	• Operators will revise their oil spill response plans to include the use of dispersants once they have been approved for use.	Ongoing	Open

Attachment 1 - Recommendations/Action Plan for Further Oil Spill Equipment Capability Enhancements

Further Capability Enhancements	Actions to Date	Target Date	Status
Joint Operator Steering Committee	• Representatives from HMDC, Husky and Suncor meet on a monthly basis to discuss equipment purchase, modification, maintenance and training (December 16, January 29, February 24, March 17, April 7 and May 19 and June 11).	Q4, 2009	Completed
ECRC Integration	• Husky and Suncor signed an oil spill preparedness integration agreement in November 2009 that covers maintenance and training for Tier 1 and Tier 2 oil spill response equipment.	Q4, 2009	Completed November 19, 2009
	• Training and maintenance activities for Husky and Suncor.	Q1, 2010	Completed February 1, 2010
	• HMDC has a contract with ECRC for spill response. A new contract to cover training and equipment maintenance is progressing.	Q3, 2010	Open
Research and Development and Education and Training	• Operators continue to discuss R&D and E&T opportunities associated with oil spill response.	June 25, 2010	Closed

Attachment 2

Detailed Response to C-NLOPB Comments

No.	Comment	Response
1	The Han G., 2007 reference appears to be lacking a journal or a report citation.	Han G., Z. Lu, Z. Wang, J. Helbig, N. Chen and B. deYoung: Seasonal variability of the Labrador Current and shelf circulation off Newfoundland. J. of Geophysical Res., 113, C10013, doi: 10.1029/2007JC004376, 2008.
2	The "Lee, K." reference (presumably 2009 – see Chapter 4, section 10.2.1) is incomplete.	The reference for the OMA paper cited in Section 10.2.1 of chapter 4 is: Lee, K., Zhengkai, L., Haibo, N., Kepkay, P., Zheng, Y., Boufadel, M., Chen, Z. 2009. Enhancement of Oil-Mineral-Aggregate Formation to Mitigate Oil Spills in Offshore and Gas Activities. Final Report - Contract No. M07PC13035 submitted to the US Mineral Management Service.
3	Please provide a copy of the referenced reports S.L. Ross 2001, "Response Strategies. . ." and S.L. Ross 2008A, "Net Environmental Benefit Analysis . . ."	Both the 2001 and 2008 SL Ross reports were commissioned for CAPP. A summary of these reports could be made available to the C-NLOPB upon request.
4	The 1984 S.L. Ross report *Hibernia Oil Spills and their Control* is not proprietary. It was a supporting document for the 1985 Hibernia EIS and was publicly available at the time of that review.	Noted.
5	This section could be updated with the results of the recent ESRF/CWS seabird monitoring project, as the report from that project represents a substantial update of the data base for marine bird observations in the area of interest.	The report from the recent ESRF/CWS seabird monitoring project has not yet been finalized. At present, Canadian Wildlife Service is currently finalizing the report. Operators did not contact the ESRF Management Board to obtain data from CWS prior to the Oil Spill Capability Report being submitted to the C-NLOPB.
6	Paragraph 2 notes that oil samples all were obtained post-production. To what degree would process chemicals likely have affected the spill-related properties of the samples, and which proportion of the spill scenarios would this represent? As an example, properties altered by such chemicals presumably would not be relevant to a subsea blowout scenario.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q-3 2010.
7	Table 6 (also Table 7, page 27): Were Hebron or Ben Nevis crude oils tested?	The three crude oils that were tested at the OHMSETT Facility for dispersability were Hibernia, Terra Nova, and White Rose. As part of this study, Hebron and Ben Nevis crudes were not tested.

Attachment 2 - Detailed Response to C-NLOPB Comments

No.	Comment	Response
8	Is the sentence ending "survival times of weeks and even months are conceivable" intended to apply to all spills or only those of more substantial volume?	This statement is intended to apply to the SL Ross model of a 10,000 m^3 batch spill as described in section 5.5.2 of the Report. The statement is not intended to apply to all spills that could occur from an offshore installation.
9	(a) Why was the ConocoPhillips environmental assessment and its supporting information not referenced directly for the scenario list presented here? (b) The statement that the South West Grand Banks site is "somewhat representative" of the ConocoPhillips licenses requires substantiation.	The scope of this report was the Jeanne d'Arc Basin production operations and therefore, ConocoPhillips drilling operations in the Laurentian Basin were not considered.
10	Paragraph 2: Was the wind velocity vector rotated when estimating surface drift of oil?	The modeling approach included in this report is based on information from environmental assessments that were previously approved by the C-NLOPB. A separate model was not prepared for inclusion in this report.
11	Table 8: The Northeast Grand Banks 2 scenario appears, from Figure 15, to have shoreline impact, but the respective table entry is "No".	There may be one point of contact in the NE Grand Banks 2 April analysis. However, based on the prepared model, the probability of oil reaching the shore was less than 1% and considered insignificant and therefore was not considered to have a shoreline impact. Outliers at the far western point of this trajectory would be approaching 0% near shore.
12	Figure 16: The NE Grand Banks 1 and Orphan Basin graphics appear to be interchanged.	Noted.

Attachment 2 - Detailed Response to C-NLOPB Comments

No.	Comment	Response
13	The batch spill example in this section is useful, but for completeness a summary of a large blowout scenario also should be included, with a more explicit discussion of each scenario's implications for the offshore NL preparedness regime described in Chapters 4 and 5.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q-4 2010.
14	See comment #5.	The report from the recent ESRF/CWS seabird monitoring project has not yet been finalized. At present, Canadian Wildlife Service is currently finalizing the report. Operators did not contact the ESRF Management Board to obtain data from CWS prior to the Oil Spill Capability Report being submitted to the Board.
15	A more accurate description of Tier 1 would not include the phrase "poses the least threat of impact".	Noted.

Attachment 2 - Detailed Response to C-NLOPB Comments

No.	Comment	Response
16	What level of training and/or exercises does AMOSC conduct annually?	In 2010 AMOSC is working towards running assessment based courses. The new courses will include competence based assessment in line with the Australian Quality Training Framework (AQTF). The new interactive elements of the courses are designed to give companies and candidates a more secure feeling in their ability to perform the job required. Training courses offered include: **OIL SPILL AWARENESS COURSE** For personnel from government and industry who would have an interest in the successful response and management to oil spills. **OIL SPILL RESPONSE OPERATIONS COURSE** (Offered 3x in 2010) For personnel from government and industry who could be involved in practical response activities. **OIL SPILL RESPONSE MANAGEMENT COURSE** (Offered 3x in 2010) Managers and supervisors from industry and government who could be involved in the coordination of oil spill response. This workshop is also appropriate for individuals who require further knowledge or development from an Oil Spill Operators Workshop. **OIL SPILL RESPONSE COMMAND CONTROL COURSE** (Offered 2x in 2010) Industry and government individuals who could be asked to fulfill the role of, or assist, the Incident Controller in a marine oil spill incident.
17	(a) The section more accurately could be entitled "Regulations and Guidance".	The Operators agree with the statement that this section could have been titled "Regulations and Guidance".
	(b) Since the report was written, the reference to the *Newfoundland Offshore Petroleum Drilling Regulations* has become obsolete with the promulgation of the *Newfoundland Offshore Petroleum Drilling and Production Regulations.*	The Operators agree that the regulations have changed from the *Newfoundland Offshore Petroleum Drilling Regulations* to the *Newfoundland Offshore Petroleum Drilling and Production Regulations*. At the time this report was submitted, the new *Newfoundland Offshore Petroleum Drilling and Production Regulations* had not been promulgated and were therefore not included in the Report.

No.	Comment	Response
18	The regulatory quote of extracted from the Safety Plan Guidelines is out of context. The reference as presented in the Safety Plan Guidelines could lead one to believe the section is 51(1)(e) the correct reference should be 51(3)(e). Section 51(3) needs to be read in the context of the applicable Safety or Environmental Protection Plan and that on water oil spill response is not part of the safety plan as serious injury, persons overboard or loss of life is not part of the Environmental Protection Plan. In the context of the safety plan oil spill is dealt with as a threat to the safety of personnel on the facility. The regulatory quote should be put in the proper context of responding to mitigating the effects of a spill for the report.	Noted.
19	Paragraph 1, bullet 1: The *Canada Shipping Act* also applies to supply vessels and tankers inside the safety zone.	Noted.
20	Section 6.1 describes Tier 1 equipment for exploration drilling and for production, but Section 6.2 describes Tier 1 equipment for production (although potential Tier 2 application also is discussed). This should be clarified.	Section 6.2, SVSS would be more appropriate as 6.1.8. SVSS equipment is considered to be Tier 1 equipment for production operations.
21	In the second paragraph, reference is made to Super Puma helicopters however these are not currently in use in NL.	At present in St John's NL, Cougar have 4 - Sikorsky S92A and 1 - SK61 Helicopters. In the event of an oil spill these along with any other charter aircraft of opportunity could be utilized for aerial surveillance. The inclusion of the Super Puma helicopter in the report was an error.

Attachment 2 - Detailed Response to C-NLOPB Comments

No.	Comment	Response
22	The final sentence "Methods of volume calculation, however, are not consistent among vessel and PAL flight crews" should be explained.	Vessels and PAL flight crews both use the Thickness Appearance Rating (TAR) method of oil volume calculation. PAL can develop an estimate of the total area of oil on the surface in a single view. It is possible, therefore, to determine the proportional coverage of each color component as a percentage of this overall oiled area. Because of the relatively low elevation and slower survey speed, an observer on a ship can only see a small portion of the overall oiled area at any time. If the oil extends farther than what can be seen in a single view, the observer must make a composite map of the oiled area. The vessel procedure requires the observer to draw the map of the oiled area as a rectangle that will include open water as well as the constituent color components of the slick. In determining the percent coverage, the observer must include the area of open water as part of the overall area of the rectangle. This rectangle method allows for easier estimation of percent coverage and calculation of oil volumes.
23	Paragraph 1: The CWS survey technique should be properly referenced.	At the time of publication of this report, the revised CWS survey procedure had not been finalized. The draft reference is: Wilhelm, S. I., Gjerdrum, C., and Fifield, D. A. (In prep). Standardized protocol for pelagic seabird surveys conducted in eastern Canada from moving and stationary platforms. Atlantic Region, Canadian Wildlife Service Technical Report Series.
24	Table 6.3.2 lists the Vikoma Ocean Pack as "available equipment at both CCG and ECRC Donovan's". This equipment dates back to the early 1980's and the assertion of its fitness requires justification.	This equipment should not have been included in the inventory for the report. After clarification, the Vikoma Ocean Pack is no longer used for spill response at ECRC or at the CCG. ECRC still has the equipment on site but it is not maintained. The CCG has removed this equipment from their inventory.
25	Table 6.3.2 cites both the GT-260 and the GT-185 skimmers as having a nominal capacity of 100 m3/hr. The ECRC web site (see http://www.ecrc.ca/en/pdf/skimmers/GT-260_GT-185_SKIMMERS.pdf) lists them as having a 90 T/hr and 45 T/hr capacity respectively. The GT-185 figure should be corrected.	Noted. The comment is correct; ECRC does advertise the nominal recovery rates of the GT260 and GT 185 to be 90 T/hr and 45 T/hr, respectively.

Attachment 2 - Detailed Response to C-NLOPB Comments

No.	Comment	Response
26	The section cites the calculation for oil removal efficiency F_R, but does not describe how the acquisition of the Norwegian Standard System affects that calculation.	The inclusion of this SL Ross formula was not used as part of the determination to acquire the Norwegian Standard System. The formula should not have been included in the report.
27	The explanation for the cited six vessels in Table 3 no longer being in DnV Oil Recovery Class should be provided.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q-3 2010.
28	The cited November 2003 workshop was funded ($30K) by the Environmental Studies Research Funds (ESRF).	The 2003 NEIA conference was coordinated by NEIA and sponsored from a variety of agencies, including the $30K contribution by ESRF.
29	The limitations on internal tankage discussed in this section could be a limiting factor during a spill response and should be discussed further, either here or in Chapter 5.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q-4 2010.
30	The reason why transfer hardware "has not been included in a maintained inventory" should be provided.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q-3 2010.
31	a) Due to limited storage capacity of collection vessels, wastes collected may be required to be transferred to a tanker offshore during a large spill response. It has	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q-4 2010.

Attachment 2 - Detailed Response to C-NLOPB Comments

No.	Comment	Response
	been shown in exercises that this type of transfer **may be possible** but it is not proved that transfer of higher viscosity weathered oil could be transferred effectively. Also equipment for transferring is not included in a maintained inventory. In a large spill, storage capacity in the field could be reached quickly and the ability to continue with spill response operations will depend on being able to transfer recovered oil from the spill response vessel(s) allowing that vessel to return to recovery operations.	
31b	b) Where will the tanker with the recovered oil offload?	At the time of any oil spill event, the storage capability of the identified terminals / vessels will need to be assessed. As these facilities are working entities, storage space for recovered oil and availability of vessels can change on a daily basis. Ongoing work may need to be done at the time of the incident to determine the availability of facilities in Newfoundland or other areas to accept the recovered oil and water mixture (example - refineries or licensed waste disposal facilities). This responsibility would be addressed by the Operator response teams and may be supported by licensed waste contractors.
32	a) When liquid waste is brought to shore, there is limited capability to deal with it locally. The waste storage capacities of local marine terminals listed in Table 5 will not all be available for a spill response. Likewise, the full truck capacities of Crosbie's and Pardy's will likely not be available.	
	b) The volume of liquid waste that can be accommodated in a refinery waste stream is $150m^3$/day. Where would storage of liquid waste take place while waiting for disposal?	
33	Given that existing [municipal] landfills could not be used for disposal of spill related waste material, where would this material be stored and disposed of? Would this material be incinerated and if so where?	Disposal of oily waste would be treated as any other hazardous waste and would be disposed of through the licensed waste contractor (Newalta) in accordance with applicable legislation. The ultimate disposal of this material will depend on the waste receiver.
34	An explanation should be provided why no training appears to be provided for the Tier 2 and Tier 3 elements of the operators' plans.	Tier 2 and 3 response capability is contracted to certified Response Organizations (ROs). Training frequency for ROs is completed based on the training required for Transport Canada certification. In addition to RO required training, Tier 2 response is tested each year during the annual

No.	Comment	Response
		Synergy exercise. Additional equipment training for the Norwegian Standard System with ECRC locally is funded through the integration agreement with the operators.
35	The statement that "it is unreasonable to expect these [support vessel] crews to manage [SVSS operations] on their own" should be justified. The SVSS cannot properly be described as a Tier 1 countermeasure unless personnel normally at site, vessel crew, are deemed competent in its use.	The statement in the report in incorrect. Crews are trained and competent to mobilize and operate Tier 1 equipment including the SVSS. In the event of a prolonged response, Tier 2 response resources will be mobilized and may support the vessel crew.
36	Paragraph 2 refers to a discussion in Part 3, Section 6.1 of dispersant evaluation and establishment for offshore NL, but Part 3, Section 6.1 contains no such discussion.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q-4 2010.
37	Section 10.1 does not describe any conditions, other than those relating to permitting and to chemical efficacy upon the oil involved, in which dispersant use would be inappropriate. Is it the operators' position that no such circumstances in fact exist?	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q-4 2010.
38	The ESRF-sponsored dispersant workshop was held in February 2004 and not March 2004.	Noted. The workshop was held February 4-5, 2004.
39	For completeness, it should be mentioned that, apart from a single application towards the end of the Jeanne d'Arc Basin Operators' program in 2000, no application for pre-approval of dispersant use offshore NL has ever been put forward by an operator.	As per discussions between the C-NLOPB and HMDC, Husky and Suncor during the meeting on June 4, 2010, Jeanne d'Arc Basin Operators formally request that the C-NLOPB initiate discussions with Operators, Environment Canada and other applicable regulatory agencies on the approval and use of dispersants in the Newfoundland and Labrador offshore area.

Attachment 2 - Detailed Response to C-NLOPB Comments

No.	Comment	Response
40	The Bragg and Owens (1995) reference does not appear in the reference list in Chapter 1, Section 3.	Bragg, J.R. and E.H.Owens, 1995. Shoreline Cleaning by Interactions Between Oil and Fine Mineral Particles in Proceedings of 1995 International Oil Spill Conference, Washington D.C., pp 219-227.
41	The "Lee et al. 2009b" reference does not appear in the references list in Chapter 1, Section 3.	Lee, K., Z. Li, B. Robinson, P. Kepkay, M. Blouin, and B. Doyon, 2009 b, In situ remediation of oil spills in ice-infested waters. Presented at InterSpill 2009 in Marseilles, France.
42	The operators state that the majority of the equipment available is suitable for Beaufort 5, which fits into the 50% deployment category and that the remainder of the time only the Norwegian Standard System can be utilized. What is not discussed is for the predicted spill scenarios, is there sufficient equipment to contain and recover oil in a reasonable period. The operators should discuss if the lone Norwegian Standard System is sufficient to contain and recover oil from predicated spill scenarios within a reasonable period.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q-4 2010.
43	The reference to the Ocean Boom Vane should be clarified to indicate how many OBVs may be contemplated for acquisition and in what configuration(s).	Husky and Suncor pursuing the purchase of an OBV in 2010. It is anticipated that the equipment would be stored on the SeaRose and Terra Nova FPSO and considered to be an alternative to the conventional sweep arm on the SVSS.

SUNCOR ENERGY

TRIM #: 0003700
Date Rec'd. September 29, 2010
File #:
Canada-Newfoundland & Labrador Offshore Petroleum Board

Suite 201, Scotia Centre
235 Water Street
St. John's, NL A1C 1B6
Tel 709 778 3500
Fax 709 724 2901
www.suncor.com

September 29, 2010

PES-CNO-TER-0406-1893

Mr. Frank Smyth, P.Eng.
Chief Conservation Officer
Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water Street
St. John's, NL A1C 6H6

Dear Mr. Smyth:

Re: Q3-2010 Response to C-NLOPB Comments on the Assessment of Marine Hydrocarbon Spill Response Capability Report for Jeanne d'Arc Basin Production Operations

Suncor Energy Inc. is pleased to provide the following response to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) based on comments received on the Marine Hydrocarbon Spill Response Capability Report for Jeanne d'Arc Basin Production Operations on May 21, 2010. The Report, which was submitted on November 20, 2009, was completed in response to Condition 32 of the amended Terra Nova Operations Authorization No. 23001-001.

In the letter to your attention of June 25, 2010 (Suncor Ref.: PES-CNO-TER-0406-1857), Suncor requested additional time to provide answers to nine of the forty-three comments received from the C-NLOPB. Attachment 1 of this letter provides a detailed response to the three comments targeted for Q3-2010.

Please feel free to contact [redacted] if you have any questions or wish to discuss this information in greater detail.

Sincerely,

[redacted]

Attachment 1

Detailed Response to C-NLOPB Comments

Detailed Response to C-NLOPB Comments

No.	Comment	Response
6	Paragraph 2 notes that oil samples all were obtained post-production. To what degree would process chemicals likely have affected the spill-related properties of the samples, and which proportion of the spill scenarios would this represent? As an example, properties altered by such chemicals presumably would not be relevant to a subsea blowout scenario.	Discussions with SL Ross Environmental Research Limited indicate that there should be no significant difference between the spill related properties of oil before or after they are treated with process chemicals, including their dispersion index. As indicated in Table 6 in Chapter 2 of the Report, the physical properties of crude are affected by the degree of weathering. This is supported by testing of treated and untreated Hibernia crude (i.e., post production and subsea), which did not show a significant difference in its spill related properties.
27	The explanation for the cited six vessels in Table 3 no longer being in DnV Oil Recovery Class should be provided.	The *Maersk Norseman* and *Maersk Nascopie* are currently in class for oil recovery. The *Maersk Chancellor*, which is also in class, is expected to go off charter by the end of 2010. The remaining four vessels identified in Table 3 in Chapter 4 of the Report, the *Atlantic Eagle*, *Atlantic Hawk*, *Atlantic Kingfisher* and *Atlantic Osprey* are currently not in class for oil recovery. These vessels were never configured for oil recovery class. Bids are currently being evaluated for four new vessels to support operations: two for Husky and two for the Rig Share 2 Agreement between Husky, Statoil and Suncor. Oil recovery notation has been requested for the four new vessels.

No.	Comment	Response
30	The reason why transfer hardware “has not been included in a maintained inventory” should be provided.	Transfer hardware (e.g., hoses, fittings, flanges, etc.) required to connect skimmers, operator vessels and/or tankers is maintained by ECRC. Transfer hardware associated with the industry-owned (i.e., Hibernia, Husky and Suncor) Transrec 150 skimmer is included as part of its equipment kit and is maintained by ECRC through the ECRC, Husky and Suncor oil spill preparedness integration agreement. As part of the current procurement of an additional Norwegian Standard System, Husky and Suncor are reviewing the need to have a dedicated set of transfer hardware and equipment.

Husky Energy

Suite 901, Scotia Centre
235 Water Street
St. John's, NL, Canada
A1C 1B6

Phone: (709) 724-3900
Fax: (709) 724-3915

TRIM #: DOC-09773
Date Rec'd. Sept 30, 2010
File #:

Canada-Newfoundland & Labrador Offshore Petroleum Board

September 29, 2010

Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water Street,
St. John's, NL A1C 6H6

Doc. No.: HUS-CPB-EC-LTR-00159

Attention: **Mr. Frank Smyth, P. Eng.**
Chief Conservation Officer

Dear Mr. Smyth;

Subject: **Response to the C-NLOPB Comments on the Assessment of Marine Hydrocarbon Spill Response Capability Report for Jeanne d'Arc Basin Production Operations**

Husky Energy would like to provide responses to three comments (6, 27, and 30) received from the Canada-Newfoundland Offshore Petroleum Board (C-NLOPB) in a May 21, 2010 letter (CPB-HUS-EC-LTR-00070) regarding the Marine Hydrocarbon Spill Response Capability Report for Jeanne d'Arc Basin Production Operations.

Husky Energy requested additional time (end of Q3-2010) to provide responses for these three comments in a letter to your attention of June 25, 2010 (HUS-CPB-EC-LTR-00149). Attachment 1 provides detailed responses to the three above referenced comments.

Please feel free to contact [redacted] if you have any questions, or wish to discuss this information in greater detail.

Yours sincerely,

HUSKY OIL OPERATIONS LIMITED

[redacted]

ph/st/pk

Attachment 1 – Detailed Response to C-NLOPB Comments

cc: Kathy Knox, Blake Williams, Jeremy Whittle, Steve, Bettles, Trevor Pritchard, Margaret Allan - Husky Energy
Ken Taylor – C-NLOPB

No.	Comment	Response
6	Paragraph 2 notes that oil samples all were obtained post-production. To what degree would process chemicals likely have affected the spill-related properties of the samples, and which proportion of the spill scenarios would this represent? As an example, properties altered by such chemicals presumably would not be relevant to a subsea blowout scenario.	Discussions with SL Ross Environmental Research Limited indicate that there should be no significant difference between the spill related properties of oil before or after they are treated with process chemicals, including their dispersion index. As indicated in Table 6 in Chapter 2 of the Report, the physical properties of crude are affected by the degree of weathering. This is supported by testing of treated and untreated Hibernia crude (i.e., post production and subsea), which did not show a significant difference in its spill related properties.
27	The explanation for the cited six vessels in Table 3 no longer being in DnV Oil Recovery Class should be provided.	The *Maersk Norseman* and *Maersk Nascopie* are currently in class for oil recovery. The *Maersk Chancellor*, which is also in class, is expected to go off charter by the end of 2010. The remaining four vessels identified in Table 3 in Chapter 4 of the Report, the *Atlantic Eagle*, *Atlantic Hawk*, *Atlantic Kingfisher* and *Atlantic Osprey* are currently not in class for oil recovery. These vessels were never configured for oil recovery class. Bids are currently being evaluated for four new vessels to support operations: two for Husky and two for the Rig Share 2 Agreement between Husky, Statoil and Suncor. Oil recovery notation has been requested for the four new vessels.
30	The reason why transfer hardware "has not been included in a maintained inventory" should be provided.	Transfer hardware (e.g., hoses, fittings, flanges, etc.) required to connect skimmers, operator vessels and/or tankers is maintained by ECRC. Transfer hardware associated with the industry-owned (i.e., Hibernia, Husky and Suncor) Transrec 150 skimmer is included as part of its equipment kit and is maintained by ECRC through the ECRC, Husky and Suncor oil spill preparedness integration agreement. As part of the current procurement of an additional Norwegian Standard System, Husky and Suncor are reviewing the need to have a dedicated set of transfer hardware and equipment.

Hibernia
Management and Development Company Ltd.
Suite 1000, 100 New Gower Street
St. John's, NL A1C 6K3
Fax: (709) 753-1822 Tel: (709) 778-7000

[redacted]

September 30, 2010

Mr. Frank Smyth, P.Eng.
Chief Conservation Officer
Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water Street
St. John's, NL A1C 6H6

File Code: 267.2
Serial #: HSCNOPB 2609

Dear Mr. Smyth:

Re: Follow-up Response to C-NLOPB Comments on the Assessment of Marine Hydrocarbon Spill Response Capability Report for Jeanne d'Arc Basin Production Operations

Hibernia Management Development Company (HMDC) would like to provide the following update to observations 6, 27, and 30 from the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) May 21, 2010 letter regarding the above noted Assessment.

Outlined in Attachment A is our follow-up response. Please feel free to contact [redacted] if you have any questions or wish to discuss this information in greater detail.

Sincerely,

[redacted]

Detailed Response to C-NLOPB Comments

No.	Comment	Response
6	Paragraph 2 notes that oil samples all were obtained post-production. To what degree would process chemicals likely have affected the spill-related properties of the samples, and which proportion of the spill scenarios would this represent? As an example, properties altered by such chemicals presumably would not be relevant to a subsea blowout scenario.	Discussions with SL Ross Environmental Research Limited indicate that there should be no significant difference between the spill related properties of oil before or after they are treated with process chemicals, including their dispersion index. As indicated in Table 6 in Chapter 2 of the Report, the physical properties of crude are affected by the degree of weathering. This is supported by testing of treated and untreated Hibernia crude (i.e., post production and subsea), which did not show a significant difference in its spill related properties.
27	The explanation for the cited six vessels in Table 3 no longer being in DnV Oil Recovery Class should be provided.	The *Maersk Norseman* and *Maersk Nascopie* are currently in class for oil recovery. The *Maersk Chancellor*, which is also in class, is expected to go off charter by the end of 2010. The remaining four vessels identified in Table 3 in Chapter 4 of the Report, the *Atlantic Eagle*, *Atlantic Hawk*, *Atlantic Kingfisher* and *Atlantic Osprey* are currently not in class for oil recovery. These vessels were never configured for oil recovery class. Bids are currently being evaluated for four new vessels to support operations: two for Husky and two for the Rig Share 2 Agreement between Husky, Statoil and Suncor. Oil recovery notation has been requested for the four new vessels.
30	The reason why transfer hardware "has not been included in a maintained inventory" should be provided.	Transfer hardware (e.g., hoses, fittings, flanges, etc.) required to connect skimmers, operator vessels and/or tankers is maintained by ECRC. Transfer hardware associated with the industry-owned (i.e., Hibernia, Husky and Suncor) Transrec 150 skimmer is included as part of its equipment kit and is maintained by ECRC through the ECRC, Husky and Suncor oil spill preparedness integration agreement. As part of the current procurement of an additional Norwegian Standard System, Husky and Suncor are reviewing the need to have a dedicated set of transfer hardware and equipment.

Hibernia
Management and Development Company Ltd.
Suite 1000, 100 New Gower Street
St. John's, NL A1C 6K3
Tel: (709) 778-7000

December 17, 2010

Mr. Frank Smyth, P.Eng.
Chief Conservation Officer
Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water Street
St. John's, NL A1C 6H6

File Code: 267.2
Serial #: HSCNOPB 2673

Dear Mr. Smyth:

Re: Follow-up Response to C-NLOPB Comments on the Assessment of Marine Hydrocarbon Spill Response Capability Report for Jeanne d'Arc Basin Production Operations

Hibernia Management Development Company (HMDC) would like to provide the following update to observations 13, 29, 31, 36, 37, and 42 from the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) May 21, 2010 letter regarding the above noted Assessment.

Outlined in Attachment A is our follow-up response. Please feel free to contact [redacted] if you have any questions or wish to discuss this information in greater detail.

Sincerely,

[redacted]

Attachment A - Detailed Response to C-NLOPB Comments

#	Question	Answer
13	The batch spill example in this section is useful, but for completeness a summary of a large blowout scenario also should be included, with a more explicit discussion of each scenario's implications for the offshore NL preparedness regime described in Chapters 4 and 5.	Any large oil spill, regardless of its origin or duration, would be considered a Tier 3 response and would involve corporate and contract resources, drawn from local, regional, and possibly international sources. Operator Oil Spill Response Plans describe various strategies for the three tiers of response, including blowouts and very large batch spills. The Plans describe a blowout situation as wells as a description of the response (e.g., management, strategy, resources, etc.)
29	The limitations on internal tankage discussed in this section could be a limiting factor during a spill response and should be discussed further, either here or in Chapter 5.	In the event of a spill, operators would access additional equipment, such as tankers, vessels of opportunity, floatable bladders, and portable tanks through tier 2 or 3 response contractors. If necessary, the response would involve corporate and contract resources, drawn from local, regional, and possibly international sources.
31	Due to limited storage capacity of collection vessels, wastes collected may be required to be transferred to a tanker offshore during a large spill response. It has been shown in exercises that this type of transfer may be possible but it is not proved that transfer of higher viscosity weathered oil could be transferred effectively. Also equipment for transferring is not included in a maintained inventory. In a large spill, storage capacity in the field could be reached quickly and the ability to continue with spill response operations will depend on being able to transfer recovered oil from the spill response vessel(s) allowing that vessel to return to recovery operations.	ECRC is contracted by the Operators to supply offshore response equipment that is capable of pumping oils. Pumps such as the GT 260 and TransRec 150 have been proven to pump heavy oils. These pumps utilize annular water injection along with positive displacement to support the operation. Operators have demonstrated the capability to transfer fluids from collection vessels to a tanker.

36	Paragraph 2 refers to a discussion in Part 3, Section 6.1 of dispersant evaluation and establishment for offshore NL, but Part 3, Section 6.1 contains no such discussion.	Noted. The reference is incorrect and should not have been included.
37	Section 10.1 does not describe any conditions, other than those relating to permitting and to chemical efficacy upon the oil involved, in which dispersant use would be inappropriate. Is it the operators' position that no such circumstances in fact exist?	Operators recognize that the application of dispersants is not appropriate under all conditions and that a Net Environmental Benefit Analysis (NEBA) would need to be completed as part of the oil spill response strategy. NEBA is an assessment of spill response options that compares the environmental impacts of cleanup activities (including monitoring) with the damage that would otherwise be caused by the oil. NEBA will determine the most appropriate cleanup methods to ensure maximum environmental benefit. As a part of this analysis, the Operator would evaluate dispersants and their appropriateness for use in a spill event. Listed below are some issues that Operators would consider when applying to regulatory agencies for the use of chemical dispersants (this list is not exhaustive): • 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 • Weather or sea state conditions exceed safe working limits for physical recovery.
42	The operators state that the majority of the equipment available is suitable for Beaufort 5, which fits into the 50% deployment category and that the remainder of the time only the Norwegian Standard System can be utilized. What is not discussed is for the predicted spill scenarios, is there sufficient equipment to contain and recover oil in a reasonable period. The operators should discuss if the lone Norwegian Standard System is sufficient to contain and recover oil from predicated spill scenarios within a reasonable period.	SL Ross' 2001 report recommended one Norwegian Standard System (NSS) system for the offshore of Newfoundland. Operators completed the acquisition of this equipment in 2009. In addition, Suncor and Husky are in the process of procuring another NSS with anticipated delivery to Newfoundland in early 2011. If additional equipment were required, Operators would obtain additional spill equipment through tier 2 or 3 contract resources.

SUNCOR ENERGY

TRIM #: 0004514
Date Rec'd. December 21, 2010
File #: 64150-019-001
Canada-Newfoundland & Labrador Offshore Petroleum Board

Suite 201, Scotia Centre
235 Water Street
St. John's, NL A1C 1B6
Tel 709 778 3500
Fax 709 724 2901
www.suncor.com

December 17, 2010

PES-CNO-TER-0406-1928

Mr. Frank Smyth, P.Eng.
Chief Conservation Officer
Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water Street
St. John's, NL A1C 6H6

Dear Mr. Smyth:

Re: Q4-2010 Response to C-NLOPB Comments on the Assessment of Marine Hydrocarbon Spill Response Capability Report for Jeanne d'Arc Basin Production Operations

Suncor Energy Inc. is pleased to provide the following response to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) based on comments received on the Marine Hydrocarbon Spill Response Capability Report for Jeanne d'Arc Basin Production Operations on May 21, 2010. The Report, which was submitted on November 20, 2009, was completed in response to Condition 32 of the amended Terra Nova Operations Authorization No. 23001-001.

In the letter to your attention of June 25, 2010 (Suncor Ref.: PES-CNO-TER-0406-1857), Suncor requested additional time to provide answers to nine of the forty-three comments received from the C-NLOPB. Attachment 1 of this letter provides a detailed response to the final six comments targeted for Q4-2010.

Please feel free to contact [redacted] if you have any questions or wish to discuss this information in greater detail.

Sincerely,

[redacted]

Attachment 1

Detailed Response to C-NLOPB Comments

Detailed Response to C-NLOPB Comments

No.	Comment	Response
33	The batch spill example in this section is useful, but for completeness a summary of a large blowout scenario also should be included, with a more explicit discussion of each scenario's implications for the offshore NL preparedness regime described in Chapters 4 and 5.	Any large oil spill, regardless of its origin or duration, would be considered a Tier 3 response and would involve corporate and contract resources, drawn from local, regional, and possibly international sources. Operator Oil Spill Response Plans describe various strategies for the three tiers of response, including blowouts and very large batch spills. The Plans describe a blowout situation as wells as a description of the response (e.g., management, strategy, resources, etc.).
50	The limitations on internal tankage discussed in this section could be a limiting factor during a spill response and should be discussed further, either here or in Chapter 5.	In the event of a spill, operators would access additional equipment, such as tankers, vessels of opportunity, floatable bladders, and portable tanks through tier 2 or 3 response contractors. If necessary, the response would involve corporate and contract resources, drawn from local, regional, and possibly international sources.

No.	Comment	Response
51	Due to limited storage capacity of collection vessels, wastes collected may be required to be transferred to a tanker offshore during a large spill response. It has been shown in exercises that this type of transfer may be possible but it is not proved that transfer of higher viscosity weathered oil could be transferred effectively. Also equipment for transferring is not included in a maintained inventory. In a large spill, storage capacity in the field could be reached quickly and the ability to continue with spill response operations will depend on being able to transfer recovered oil from the spill response vessel(s) allowing that vessel to return to recovery operations.	ECRC is contracted by the Operators to supply offshore response equipment that is capable of pumping oils. Pumps such as the GT 260 and TransRec 150 have been proven to pump heavy oils. These pumps utilize annular water injection along with positive displacement to support the operation. Operators have demonstrated the capability to transfer fluids from collection vessels to a tanker.
59	Paragraph 2 refers to a discussion in Part 3, Section 6.1 of dispersant evaluation and establishment for offshore NL, but Part 3, Section 6.1 contains no such discussion.	Noted. The reference is incorrect and should not have been included.

No.	Comment	Response
59-63	Section 10.1 does not describe any conditions, other than those relating to permitting and to chemical efficacy upon the oil involved, in which dispersant use would be inappropriate. Is it the operators' position that no such circumstances in fact exist?	Operators recognize that the application of dispersants is not appropriate under all conditions and that a Net Environmental Benefit Analysis (NEBA) would need to be completed as part of the oil spill response strategy. NEBA is an assessment of spill response options that compares the environmental impacts of cleanup activities (including monitoring) with the damage that would otherwise be caused by the oil. NEBA will determine the most appropriate cleanup methods to ensure maximum environmental benefit. As a part of this analysis, the Operator would evaluate dispersants and their appropriateness for use in a spill event. Listed below are some issues that Operators would consider when applying to regulatory agencies for the use of chemical dispersants (this list is not exhaustive): • 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; and • Weather or sea state conditions exceed safe working limits for physical recovery.

No.	Comment	Response
2	The operators state that the majority of the equipment available is suitable for Beaufort 5, which fits into the 50% deployment category and that the remainder of the time only the Norwegian Standard System can be utilized. What is not discussed is for the predicted spill scenarios, is there sufficient equipment to contain and recover oil in a reasonable period. The operators should discuss if the lone Norwegian Standard System is sufficient to contain and recover oil from predicated spill scenarios within a reasonable period.	SL Ross' 2001 report recommended one Norwegian Standard System (NSS) system for the offshore of Newfoundland. Operators completed the acquisition of this equipment in 2009. In addition Suncor and Husky are in the process of procuring a second complete NSS. Delivery to Newfoundland is anticipated in early 2011. If additional equipment were required, Operators would obtain additional spill equipment through tier 2 or 3 contract resources.

Husky Energy

Suite 901, Scotia Centre
235 Water Street
St. John's, NL, Canada
A1C 1B6

Phone: (709) 724-3900
Fax: (709) 724-3915

August 6, 2011

Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water Street,
St. John's, NL A1C 6H6

Doc. No.: HUS-CPB-EC-LTR-00198

Attention: **Mr Frank Smyth, P. Eng**
Chief Conservation officer

Subject: **Response to C-NLOPB Comments on the Assessment of Marine Hydrocarbon Spill Response Capability Report for the Jeanne d'Arc Basin Production Operations**

Dear Mr Smyth:

Husky Energy would like to provide responses to six comments (13, 29, 31,36, 37, 42) received from the Canada-Newfoundland Offshore Petroleum (C-NLOPB) in a May 21, 2010 letter (CPB-HUS-EC-LTR-00070) regarding the Marine Hydrocarbon Spill Response Capability Report for Jeanne d'Arc Basin Production Operations.

Please feel free to contact [redacted] if you have any questions or wish to discuss the information in greater detail.

Yours Sincerely,

HUSKY OIL OPERATIONS LIMITED

[redacted]

JW/JH

cc: [redacted] - Husky Energy
Ken Taylor – C-NLOPB

TRIM #: 0007100
Date Rec'd: August 9/2011
File #:
Canada-Newfoundland & Labrador Offshore Petroleum Board

No.	Comment	Response
13	The batch spill example in this section is useful, but for completeness a summary of a large blowout scenario also should be included, with a more explicit discussion of each scenario's implications for the offshore NL preparedness regime described in Chapters 4 and 5.	Any large oil spill, regardless of its origin or duration, would be considered a Tier 3 response and would involve corporate and contract resources, drawn from local, regional, and possibly international sources. Operator Oil Spill Response Plans describe various strategies for the three tiers of response, including blowouts and very large batch spills. The Plans describe a blowout situation as wells as a description of the response (e.g., management, strategy, resources, etc.)
29	The limitations on internal tankage discussed in this section could be a limiting factor during a spill response and should be discussed further, either here or in Chapter 5.	In the event of a spill, operators would access additional equipment, such as tankers, vessels of opportunity, floatable bladders, and portable tanks through tier 2 or 3 response contractors. If necessary, the response would involve corporate and contract resources, drawn from local, regional, and possibly international sources.
31	Due to limited storage capacity of collection vessels, wastes collected may be required to be transferred to a tanker offshore during a large spill response. It has been shown in exercises that this type of transfer may be possible but it is not proved that transfer of higher viscosity weathered oil could be transferred effectively. Also equipment for transferring is not included in a maintained inventory. In a large spill, storage capacity in the field could be reached quickly and the ability to continue with spill response operations will depend on being able to transfer recovered oil from the spill response vessel(s) allowing that vessel to return to recovery operations.	ECRC is contracted by the Operators to supply offshore response equipment that is capable of pumping oils. Pumps such as the GT 260 and TransRec 150 have been proven to pump heavy oils. These pumps utilize annular water injection along with positive displacement to support the operation. Operators have demonstrated the capability to transfer fluids from collection vessels to a tanker.

No.	Comment	Response
36	Paragraph 2 refers to a discussion in Part 3, Section 6.1 of dispersant evaluation and establishment for offshore NL, but Part 3, Section 6.1 contains no such discussion.	Noted. The reference is incorrect and should not have been included.
37	Section 10.1 does not describe any conditions, other than those relating to permitting and to chemical efficacy upon the oil involved, in which dispersant use would be inappropriate. Is it the operators' position that no such circumstances in fact exist?	Operators recognize that the application of dispersants is not appropriate under all conditions and that a Net Environmental Benefit Analysis (NEBA) would need to be completed as part of the oil spill response strategy. NEBA is an assessment of spill response options that compares the environmental impacts of cleanup activities (including monitoring) with the damage that would otherwise be caused by the oil. NEBA will determine the most appropriate cleanup methods to ensure maximum environmental benefit. As a part of this analysis, the Operator would evaluate dispersants and their appropriateness for use in a spill event. Listed below are some issues that Operators would consider when applying to regulatory agencies for the use of chemical dispersants (this list is not exhaustive): • 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 • Weather or sea state conditions exceed safe working limits for physical recovery.

No.	Comment	Response
42	The operators state that the majority of the equipment available is suitable for Beaufort 5, which fits into the 50% deployment category and that the remainder of the time only the Norwegian Standard System can be utilized. What is not discussed is for the predicted spill scenarios, is there sufficient equipment to contain and recover oil in a reasonable period. The operators should discuss if the lone Norwegian Standard System is sufficient to contain and recover oil from predicated spill scenarios within a reasonable period.	SL Ross' 2001 report recommended one Norwegian Standard System (NSS) system for the offshore of Newfoundland. Operators completed the acquisition of this equipment in 2009. In addition Suncor and Husky are in the process of procuring a second complete NSS. Delivery to Newfoundland is anticipated in Q3 2011. If additional equipment were required, Operators would obtain additional spill equipment through tier 2 or 3 contract resources.

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

March 8, 2012

[redacted]

Hibernia Management and
Development Company Ltd.
Suite 1000,
100 New Gower Street
St. John's NL A1C 6K3

Dear [redacted]

Subject: Marine Hydrocarbon Spill Response Capability Assessment

This letter is in reply to the responses your organization provided on June 25, September 29 and December 17, 2010 to our review of the report, entitled *Marine Hydrocarbon Spill Response Capability Assessment, Jeanne d'Arc Basin Production Operations*, that you submitted to us on November 29, 2009.

We have been mindful of the level of review and scrutiny placed upon marine oil spill response operations worldwide since the report's preparation, particularly in light of experiences from the April 2010 blowout and subsequent spill at the Macondo well site in the Gulf of Mexico. In finalizing our response, we have considered this emerging experience, including but not limited to our review of the January 2011 report of the US *National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling* and the recommendations of the Government of Newfoundland and Labrador's *Review of Offshore Oil-spill Prevention and Remediation Requirements and Practices in Newfoundland and Labrador*, released in April 2011.

I have enclosed a table that contains our original detailed comments on the report, your responses to the comments, and our views on each of those responses. I also have the following general observations:

1. **Containment and Recovery Equipment and Chemical Dispersants**

We agree with the report's conclusion that operators' acquisition of a "Norwegian Standard System", recently supplemented by a second such system, represents the current state of the art for physical containment and recovery, and that it likely also represents a considerable increase in the proportion of time that this type of response equipment may productively be deployed offshore NL. However, as I stated in my May 15, 2010 letter to you, the report also implies that the quantity of this equipment that is considered sufficient for spill response offshore NL is related to the assumption that dispersant use forms a substantial part of the overall response. While potential dispersant use deserves further examination, as I will discuss in my next point, it currently is not accepted as an effective countermeasure for Jeanne d'Arc Basin crude oils. Furthermore, you have not provided supporting documentation indicating how dispersant use would modify the overall quantity of physical containment and recovery equipment that otherwise would be required.

We believe that the sufficiency of physical countermeasures equipment for large-scale response operations should be assessed in its own right, without the presumption of assistance from chemical countermeasures. Accordingly, we require information from you that demonstrates how you have assured yourself of the sufficiency of local resources, and where relevant, national and international resources, to mount an effective response to a major pollution event at your facilities.

2. **Use of Chemical Dispersants**

We acknowledge the request from the three Grand Banks producing operators to initiate a process for the review and potential acceptance of dispersant use as part of spill response operations. We agree that this issue deserves close scrutiny, particularly in light of the apparent effectiveness of dispersants in the Macondo response, and in the response to the Montara incident offshore Australia.

In order to enable and to facilitate this review, you should submit a draft amendment to your oil spill response plan that demonstrates how you would incorporate dispersant use into response operations. Supporting documentation to this amendment should include, but not necessarily be limited to, the following:

i. A "Net Environmental Benefits Analysis" that demonstrates how, where, and under what conditions, dispersant usage is justified from an environmental protection standpoint.

ii. A detailed description of tests that were performed to evaluate the effectiveness of the proposed dispersant formulation(s) in dispersing the crude oil(s) that you produce. The description should clearly indicate any assumptions or limitations of these tests.

iii. A description of the application technologies planned for use.

iv. A description of monitoring techniques that would be used during a dispersant-assisted spill response to evaluate the effectiveness of the applications on an ongoing basis. Consideration of recent experience, including the Macondo response, in using the "SMART" protocols for this purpose should inform the description.

v. A description of how the training, competency and safety of personnel involved in dispersant application will be assured.

We intend to request the technical advice of the Regional Environmental Emergencies Team (REET) in reviewing the information described above. Your organization should be prepared to present one or more of the items above to the appropriate members of the REET and to engage in further follow-up discussions with them, as part of the regulatory review. The C-NLOPB will facilitate and participate in these meetings.

In light of the considerable public interest in matters relating to spill contingency planning, we also encourage you to engage with and inform interested parties within the general public, particularly fisheries interests, as you progress this initiative.

3. **<u>Assessment of Alternate Response Technologies – In-Situ Burning</u>**

We note that the report includes a short description and analysis of in-situ burning, however it is not clear how your organization views its relevance as a countermeasure for Jeanne d'Arc Basin spill response operations, nor does your forward planning include any plans for its further analysis, nor for relevant equipment evaluation or acquisition. This aspect of the report should be clarified.

4. **<u>Action Plan for Further Response Capability Enhancements</u>**

I acknowledge the provision, with your letter of June 25, 2010, of an action plan for further oil spill response capability enhancements, and note that, since this submission, progress has been made on some of the elements contained within it.

We believe that such planning should be "evergreen" in nature and welcome the opportunity for further discussions with staff of your organization and of the other producing operators. We also believe that the status of this planning should form part of the report submitted

annually to C-NLOPB pursuant to paragraph 87(b) of the *Newfoundland Offshore Petroleum Drilling and Production Regulations*.

Thank you for your attention to this important issue. I look forward to our continuing engagement in furthering the effectiveness of spill response operations offshore Newfoundland and Labrador.

Sincerely yours,

[redacted]

Frank Smyth, P.Eng.
Chief Conservation Officer

cc: [redacted] Suncor Energy
Husky Energy

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

March 8, 2012

[redacted]
Suncor Energy
Suite 201
235 Water Street
St. John's, NL
A1C 1B6

[redacted]

Dear [redacted]

Subject: Marine Hydrocarbon Spill Response Capability Assessment

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Sincerely yours,

[redacted]

Frank Smyth, P.Eng.
Chief Conservation Officer

cc: [redacted] Hibernia Management and Development Company Ltd.
[redacted] Husky Energy

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

March 8, 2012

[redacted]
Environment and Quality
Husky Energy
Suite 901
235 Water Street
St. John's, NL
A1C 6K3

Dear [redacted]

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Sincerely yours,

[redacted]

Frank Smyth, P.Eng.
Chief Conservation Officer

cc: [redacted] Hibernia Management and Development Company Ltd.
[redacted], Suncor Energy

No.	Comment	Operators' Response	C-NLOPB Response
1	The Han G., 2007 reference appears to be lacking a journal or a report citation.	Han G., Z. Lu, Z. Wang, J. Helbig, N. Chen and B. deYoung: Seasonal variability of the Labrador Current and shelf circulation off Newfoundland. J. of Geophysical Res., 113, C10013, doi: 10.1029/2007JC004376, 2008.	Acknowledged.
2	The "Lee, K." reference (presumably 2009 – see Chapter 4, section 10.2.1) is incomplete.	The reference for the OMA paper cited in Section 10.2.1 of chapter 4 is: Lee, K., Zhengkai, L., Haibo, N., Kepkay, P., Zheng, Y., Boufadel, M., Chen, Z. 2009. Enhancement of Oil-Mineral-Aggregate Formation to Mitigate Oil Spills in Offshore and Gas Activities. Final Report - Contract No. M07PC13035 submitted to the US Mineral Management Service.	Acknowledged.
3	Please provide a copy of the referenced reports S.L. Ross 2001, "Response Strategies. . ." and S.L. Ross 2008A, "Net Environmental Benefit Analysis . . ."	Both the 2001 and 2008 SL Ross reports were commissioned for CAPP. A summary of these reports could be made available to the C-NLOPB upon request.	S.L. Ross 2001 is cited as the sole reference for justifying the level of countermeasures equipment considered adequate for the purposes of the review. Without submission of this or similar information we consider the conclusion reached in the report on this topic to be inadequately supported. S.L. Ross 2008A, or the detailed information and/or analysis it presumably contains, will need to be supplied with any application relating to dispersant usage.
4	The 1984 S.L. Ross report *Hibernia Oil Spills and their Control* is not proprietary. It was a supporting document for the 1985 Hibernia EIS and was publicly available at the time of that review.	Noted.	Acknowledged.

No.	Comment	Operators' Response	C-NLOPB Response
5	This section could be updated with the results of the recent ESRF/CWS seabird monitoring project, as the report from that project represents a substantial update of the data base for marine bird observations in the area of interest.	The report from the recent ESRF/CWS seabird monitoring project has not yet been finalized. At present, Canadian Wildlife Service is currently finalizing the report. Operators did not contact the ESRF Management Board to obtain data from CWS prior to the Oil Spill Capability Report being submitted to the C-NLOPB.	Personnel from the Grand Banks operators were well aware of the progress of the report and could readily have approached ESRF to request access to these data.
6	Paragraph 2 notes that oil samples all were obtained post-production. To what degree would process chemicals likely have affected the spill-related properties of the samples, and which proportion of the spill scenarios would this represent? As an example, properties altered by such chemicals presumably would not be relevant to a subsea blowout scenario.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q3-2010. *Update, September 30, 2010*: Discussions with SL Ross Environmental Research Limited indicate that there should be no significant difference between the spill related properties of oil before or after they are treated with process chemicals, including their dispersion index. As indicated in Table 6 in Chapter 2 of the Report, the physical properties of crude are affected by the degree of weathering. This is supported by testing of treated and untreated Hibernia crude (i.e., post production and subsea), which did not show a significant difference in its spill related properties.	The reports describing the testing of treated and untreated crude should be supplied in support of the September 30, 2010 response.
7	Table 6 (also Table 7, page 27): Were Hebron or Ben Nevis crude oils tested?	The three crude oils that were tested at the OHMSETT Facility for dispersability were Hibernia, Terra Nova, and White Rose. As part of this study, Hebron and Ben Nevis crudes were not tested.	The review comment was not specific to OHMSETT. Some work was done on Hebron crudes at lab scale and this work since has been summarized in the Hebron Comprehensive Study Report. For completeness this should be discussed in terms of any potential changes to response strategies in the report.
8	Is the sentence ending "survival times of weeks and even months are conceivable" intended to apply to all spills or only those of more substantial volume?	This statement is intended to apply to the SL Ross model of a 10,000 m^3 batch spill as described in section 5.5.2 of the Report. The statement is not intended to apply to all spills that could occur from an offshore installation.	Acknowledged.

No.	Comment	Operators' Response	C-NLOPB Response
9	(a) Why was the ConocoPhillips environmental assessment and its supporting information not referenced directly for the scenario list presented here?	The scope of this report was the Jeanne d'Arc Basin production operations and therefore, ConocoPhillips drilling operations in the Laurentian Basin were not considered.	If SW Grand Banks is not intended to be covered in the report then the reference cited in comment 9(b) should be removed.
	(b) The statement that the South West Grand Banks site is "somewhat representative" of the ConocoPhillips licenses requires substantiation.		
10	Paragraph 2: Was the wind velocity vector rotated when estimating surface drift of oil?	The modeling approach included in this report is based on information from environmental assessments that were previously approved by the C-NLOPB. A separate model was not prepared for inclusion in this report.	Acknowledged. The question, nevertheless, should be answered.
11	Table 8: The Northeast Grand Banks 2 scenario appears, from Figure 15, to have shoreline impact, but the respective table entry is "No".	There may be one point of contact in the NE Grand Banks 2 April analysis. However, based on the prepared model, the probability of oil reaching the shore was less than 1% and considered insignificant and therefore was not considered to have a shoreline impact. Outliers at the far western point of this trajectory would be approaching 0% near shore.	Unless the shoreline impact is exactly zero then the table entry shall be "yes". The reference otherwise is untrue. Any comments on the level of probability associated with impact may be added if desired.
12	Figure 16: The NE Grand Banks 1 and Orphan Basin graphics appear to be interchanged.	Noted.	Acknowledged.

No.	Comment	Operators' Response	C-NLOPB Response
13	The batch spill example in this section is useful, but for completeness a summary of a large blowout scenario also should be included, with a more explicit discussion of each scenario's implications for the offshore NL preparedness regime described in Chapters 4 and 5.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q4-2010. *Update, December 17, 2010:* Any large oil spill, regardless of its origin or duration, would be considered a Tier 3 response and would involve corporate and contract resources, drawn from local, regional, and possibly international sources. Operator Oil Spill Response Plans describe various strategies for the three tiers of response, including blowouts and very large batch spills. The Plans describe a blowout situation as wells as a description of the response (e.g., management, strategy, resources, etc.)	The existing blowout scenarios should be examined to ensure they remain relevant in consideration of recent experience arising from the Montara and Macondo incidents.
14	See comment #5.	The report from the recent ESRF/CWS seabird monitoring project has not yet been finalized. At present, Canadian Wildlife Service is currently finalizing the report. Operators did not contact the ESRF Management Board to obtain data from CWS prior to the Oil Spill Capability Report being submitted to the Board.	Personnel from the Grand Banks operators were well aware of the progress of the report and could readily have approached ESRF to request access to these data.
15	A more accurate description of Tier 1 would not include the phrase "poses the least threat of impact".	Noted.	Acknowledged.

No.	Comment	Operators' Response	C-NLOPB Response
16	What level of training and/or exercises does AMOSC conduct annually?	In 2010 AMOSC is working towards running assessment based courses. The new courses will include competence based assessment in line with the Australian Quality Training Framework (AQTF). The new interactive elements of the courses are designed to give companies and candidates a more secure feeling in their ability to perform the job required. Training courses offered include: **<u>OIL SPILL AWARENESS COURSE</u>** For personnel from government and industry who would have an interest in the successful response and management to oil spills. **<u>OIL SPILL RESPONSE OPERATIONS COURSE</u>** (Offered 3x in 2010) For personnel from government and industry who could be involved in practical response activities. **<u>OIL SPILL RESPONSE MANAGEMENT COURSE</u>** (Offered 3x in 2010) Managers and supervisors from industry and government who could be involved in the coordination of oil spill response. This workshop is also appropriate for individuals who require further knowledge or development from an Oil Spill Operators Workshop. **<u>OIL SPILL RESPONSE COMMAND CONTROL COURSE</u>** (Offered 2x in 2010) Industry and government individuals who could be asked to fulfill the role of, or assist, the Incident Controller in a marine oil spill incident.	Acknowledged.

No.	Comment	Operators' Response	C-NLOPB Response
17	(a) The section more accurately could be entitled "Regulations and Guidance".	The Operators agree with the statement that this section could have been titled "Regulations and Guidance".	Acknowledged.
	(b) Since the report was written, the reference to the *Newfoundland Offshore Petroleum Drilling Regulations* has become obsolete with the promulgation of the *Newfoundland Offshore Petroleum Drilling and Production Regulations*.	The Operators agree that the regulations have changed from the *Newfoundland Offshore Petroleum Drilling Regulations* to the *Newfoundland Offshore Petroleum Drilling and Production Regulations*. At the time this report was submitted, the new *Newfoundland Offshore Petroleum Drilling and Production Regulations* had not been promulgated and were therefore not included in the Report.	Acknowledged.
18	The regulatory quote of extracted from the Safety Plan Guidelines is out of context. The reference as presented in the Safety Plan Guidelines could lead one to believe the section is 51(1)(e) the correct reference should be 51(3)(e). Section 51(3) needs to be read in the context of the applicable Safety or Environmental Protection Plan and that on water oil spill response is not part of the safety plan as serious injury, persons overboard or loss of life is not part of the Environmental Protection Plan. In the context of the safety plan oil spill is dealt with as a threat to the safety of personnel on the facility. The regulatory quote should be put in the proper context of responding to mitigating the effects of a spill for the report.	Noted.	Acknowledged.
19	Paragraph 1, bullet 1: The *Canada Shipping Act* also applies to supply vessels and tankers inside the safety zone.	Noted.	Acknowledged.

No.	Comment	Operators' Response	C-NLOPB Response
20	Section 6.1 describes Tier 1 equipment for exploration drilling and for production, but Section 6.2 describes Tier 1 equipment for production (although potential Tier 2 application also is discussed). This should be clarified.	Section 6.2, SVSS would be more appropriate as 6.1.8. SVSS equipment is considered to be Tier 1 equipment for production operations.	Acknowledged.
21	In the second paragraph, reference is made to Super Puma helicopters however these are not currently in use in NL.	At present in St John's NL, Cougar have 4 - Sikorsky S92A and 1 - SK61 Helicopters. In the event of an oil spill these along with any other charter aircraft of opportunity could be utilized for aerial surveillance. The inclusion of the Super Puma helicopter in the report was an error.	Acknowledged.
22	The final sentence "Methods of volume calculation, however, are not consistent among vessel and PAL flight crews" should be explained.	Vessels and PAL flight crews both use the Thickness Appearance Rating (TAR) method of oil volume calculation. PAL can develop an estimate of the total area of oil on the surface in a single view. It is possible, therefore, to determine the proportional coverage of each color component as a percentage of this overall oiled area. Because of the relatively low elevation and slower survey speed, an observer on a ship can only see a small portion of the overall oiled area at any time. If the oil extends farther than what can be seen in a single view, the observer must make a composite map of the oiled area. The vessel procedure requires the observer to draw the map of the oiled area as a rectangle that will include open water as well as the constituent color components of the slick. In determining the percent coverage, the observer must include the area of open water as part of the overall area of the rectangle. This rectangle method allows for easier estimation of percent coverage and calculation of oil volumes.	Noted.

No.	Comment	Operators' Response	C-NLOPB Response
23	Paragraph 1: The CWS survey technique should be properly referenced.	At the time of publication of this report, the revised CWS survey procedure had not been finalized. The draft reference is: Wilhelm, S. I., Gjerdrum, C., and Fifield, D. A. (In prep). Standardized protocol for pelagic seabird surveys conducted in eastern Canada from moving and stationary platforms. Atlantic Region, Canadian Wildlife Service Technical Report Series.	Acknowledged.
24	Table 6.3.2 lists the Vikoma Ocean Pack as "available equipment at both CCG and ECRC Donovan's". This equipment dates back to the early 1980's and the assertion of its fitness requires justification.	This equipment should not have been included in the inventory for the report. After clarification, the Vikoma Ocean Pack is no longer used for spill response at ECRC or at the CCG. ECRC still has the equipment on site but it is not maintained. The CCG has removed this equipment from their inventory.	Acknowledged.
25	Table 6.3.2 cites both the GT-260 and the GT-185 skimmers as having a nominal capacity of 100 m3/hr. The ECRC web site (see **http://www.ecrc.ca/en/pdf/skimmers/GT-260_GT-185_SKIMMERS.pdf**) lists them as having a 90 T/hr and 45 T/hr capacity respectively. The GT-185 figure should be corrected.	Noted. The comment is correct; ECRC does advertise the nominal recovery rates of the GT260 and GT 185 to be 90 T/hr and 45 T/hr, respectively.	Acknowledged.
26	The section cites the calculation for oil removal efficiency F_R, but does not describe how the acquisition of the Norwegian Standard System affects that calculation.	The inclusion of this SL Ross formula was not used as part of the determination to acquire the Norwegian Standard System. The formula should not have been included in the report.	Regardless of whether the formula, or the quantitative evaluations in which it is used, were used in past decision-making, its use in the current report would be informative, and its intended deletion should be reconsidered.

No.	Comment	Operators' Response	C-NLOPB Response
27	The explanation for the cited six vessels in Table 3 no longer being in DnV Oil Recovery Class should be provided.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q3-2010. *Update, September 30, 2010*: The *Maersk Norseman* and *Maersk Nascopie* are currently in class for oil recovery. The *Maersk Chancellor*, which is also in class, is expected to go off charter by the end of 2010. The remaining four vessels identified in Table 3 in Chapter 4 of the Report, the *Atlantic Eagle*, *Atlantic Hawk*, *Atlantic Kingfisher* and *Atlantic Osprey* are currently not in class for oil recovery. These vessels were never configured for oil recovery class. Bids are currently being evaluated for four new vessels to support operations: two for Husky and two for the Rig Share 2 Agreement between Husky, Statoil and Suncor. Oil recovery notation has been requested for the four new vessels.	Response acknowledged. This being the case, the report should describe the degree to which the cited vessels are suitable for spill response and what capabilities (e.g., deck tankage) would require addition to accomplish this. This matter should continue to be tracked on an "evergreen" basis.
28	The cited November 2003 workshop was funded ($30K) by the Environmental Studies Research Funds (ESRF).	The 2003 NEIA conference was coordinated by NEIA and sponsored from a variety of agencies, including the $30K contribution by ESRF.	Noted.

No.	Comment	Operators' Response	C-NLOPB Response
29	The limitations on internal tankage discussed in this section could be a limiting factor during a spill response and should be discussed further, either here or in Chapter 5.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q4-2010. *Update, December 17, 2010:* In the event of a spill, operators would access additional equipment, such as tankers, vessels of opportunity, floatable bladders, and portable tanks through tier 2 or 3 response contractors. If necessary, the response would involve corporate and contract resources, drawn from local, regional, and possibly international sources.	Noted.
30	The reason why transfer hardware "has not been included in a maintained inventory" should be provided.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q3-2010. *Update, September 30, 2010:* Transfer hardware (e.g., hoses, fittings, flanges, etc.) required to connect skimmers, operator vessels and/or tankers is maintained by ECRC. Transfer hardware associated with the industry-owned (i.e., Hibernia, Husky and Suncor) Transrec 150 skimmer is included as part of its equipment kit and is maintained by ECRC through the ECRC, Husky and Suncor oil spill preparedness integration agreement. As part of the current procurement of an additional Norwegian Standard System, Husky and Suncor are reviewing the need to have a dedicated set of transfer hardware and equipment.	Acknowledged.

No.	Comment	Operators' Response	C-NLOPB Response
31	a) Due to limited storage capacity of collection vessels, wastes collected may be required to be transferred to a tanker offshore during a large spill response. It has been shown in exercises that this type of transfer **may be possible** but it is not proved that transfer of higher viscosity weathered oil could be transferred effectively. Also equipment for transferring is not included in a maintained inventory. In a large spill, storage capacity in the field could be reached quickly and the ability to continue with spill response operations will depend on being able to transfer recovered oil from the spill response vessel(s) allowing that vessel to return to recovery operations.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q4-2010. *Update, December 17, 2010:* ECRC is contracted by the Operators to supply offshore response equipment that is capable of pumping oils. Pumps such as the GT 260 and TransRec 150 have been proven to pump heavy oils. These pumps utilize annular water injection along with positive displacement to support the operation. Operators have demonstrated the capability to transfer fluids from collection vessels to a tanker.	Acknowledged.
	b) Where will the tanker with the recovered oil offload?	At the time of any oil spill event, the storage capability of the identified terminals / vessels will need to be assessed. As these facilities are working entities, storage space for recovered oil and availability of vessels can change on a daily basis. Ongoing work may need to be done at the time of the incident to determine the availability of facilities in Newfoundland or other areas to accept the recovered oil and water mixture (example - refineries or licensed waste disposal facilities). This responsibility would be addressed by the Operator response teams and may be supported by licensed waste contractors.	Acknowledged. We note that a Regional Environmental Emergencies Team committee currently is finalizing detailed guidance on marine oily waste management. The existing plans should be examined in detail with reference to this guidance once it is finalized.

No.	Comment	Operators' Response	C-NLOPB Response
32	a) When liquid waste is brought to shore, there is limited capability to deal with it locally. The waste storage capacities of local marine terminals listed in Table 5 will not all be available for a spill response. Likewise, the full truck capacities of Crosbie's and Pardy's will likely not be available. b) The volume of liquid waste that can be accommodated in a refinery waste stream is 150m^3/day. Where would storage of liquid waste take place while waiting for disposal?	[*see response to 31b*]	See response to 31b.
33	Given that existing [municipal] landfills could not be used for disposal of spill related waste material, where would this material be stored and disposed of? Would this material be incinerated and if so where?	Disposal of oily waste would be treated as any other hazardous waste and would be disposed of through the licensed waste contractor (Newalta) in accordance with applicable legislation. The ultimate disposal of this material will depend on the waste receiver.	See response to 31b.
34	An explanation should be provided why no training appears to be provided for the Tier 2 and Tier 3 elements of the operators' plans.	Tier 2 and 3 response capability is contracted to certified Response Organizations (ROs). Training frequency for ROs is completed based on the training required for Transport Canada certification. In addition to RO required training, Tier 2 response is tested each year during the annual Synergy exercise. Additional equipment training for the Norwegian Standard System with ECRC locally is funded through the integration agreement with the operators.	Operators nevertheless should assure themselves that the level of competency respecting Tier 2 and 3 operations is adequate. It is not clear how the operators ensure that appropriate members of support vessel crews receive training in Tier 2-3 procedures, other than through the annual Synergy exercise, and whether the rotation of crews/vessels through the Synergy exercises is tracked to monitor this.

No.	Comment	Operators' Response	C-NLOPB Response
35	The statement that "it is unreasonable to expect these [support vessel] crews to manage [SVSS operations] on their own" should be justified. The SVSS cannot properly be described as a Tier 1 countermeasure unless personnel normally at site, vessel crew, are deemed competent in its use.	The statement in the report in incorrect. Crews are trained and competent to mobilize and operate Tier 1 equipment including the SVSS. In the event of a prolonged response, Tier 2 response resources will be mobilized and may support the vessel crew.	Acknowledged.
36	Paragraph 2 refers to a discussion in Part 3, Section 6.1 of dispersant evaluation and establishment for offshore NL, but Part 3, Section 6.1 contains no such discussion.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q4-2010. *Update, December 17, 2010:* Noted. The reference is incorrect and should not have been included.	Noted.

No.	Comment	Operators' Response	C-NLOPB Response
37	Section 10.1 does not describe any conditions, other than those relating to permitting and to chemical efficacy upon the oil involved, in which dispersant use would be inappropriate. Is it the operators' position that no such circumstances in fact exist?	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q4-2010. *Update, December 17, 2010:* Operators recognize that the application of dispersants is not appropriate under all conditions and that a Net Environmental Benefit Analysis (NEBA) would need to be completed as part of the oii spill response strategy. NEBA is an assessment of spill response options that compares the environmental impacts of cleanup activities (including monitoring) with the damage that would otherwise be caused by the oil. NEBA will determine the most appropriate cleanup methods to ensure maximum environmental benefit. As a part of this analysis, the Operator would evaluate dispersants and their appropriateness for use in a spill event. Listed below are some issues that Operators would consider when applying to regulatory agencies for the use of chemical dispersants (this list is not exhaustive): • 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 • Weather or sea state conditions exceed safe working limits for physical recovery.	Acknowledged. See also additional observations in covering letter.

No.	Comment	Operators' Response	C-NLOPB Response
38	The ESRF-sponsored dispersant workshop was held in February 2004 and not March 2004.	Noted. The workshop was held February 4-5, 2004.	Acknowledged.
39	For completeness, it should be mentioned that, apart from a single application towards the end of the Jeanne d'Arc Basin Operators' program in 2000, no application for pre-approval of dispersant use offshore NL has ever been put forward by an operator.	As per discussions between the C-NLOPB and HMDC, Husky and Suncor during the meeting on June 4, 2010, Jeanne d'Arc Basin Operators formally request that the C-NLOPB initiate discussions with Operators, Environment Canada and other applicable regulatory agencies on the approval and use of dispersants in the Newfoundland and Labrador offshore area.	Acknowledged.
40	The Bragg and Owens (1995) reference does not appear in the reference list in Chapter 1, Section 3.	Bragg, J.R. and E.H.Owens, 1995. Shoreline Cleaning by Interactions Between Oil and Fine Mineral Particles in Proceedings of 1995 International Oil Spill Conference, Washington D.C., pp 219-227.	Acknowledged.
41	The "Lee et al. 2009b" reference does not appear in the references list in Chapter 1, Section 3.	Lee, K., Z. Li, B. Robinson, P. Kepkay, M. Blouin, and B. Doyon, 2009 b, In situ remediation of oil spills in ice-infested waters. Presented at InterSpill 2009 in Marseilles, France.	Acknowledged.

No.	Comment	Operators' Response	C-NLOPB Response
42	The operators state that the majority of the equipment available is suitable for Beaufort 5, which fits into the 50% deployment category and that the remainder of the time only the Norwegian Standard System can be utilized. What is not discussed is for the predicted spill scenarios, is there sufficient equipment to contain and recover oil in a reasonable period. The operators should discuss if the lone Norwegian Standard System is sufficient to contain and recover oil from predicated spill scenarios within a reasonable period.	Response to this question will take more time to complete than allotted. The Operators formally request an extension from the C-NLOPB on the completion date. This question will continue to be worked by the Operators and an update will be provided by the end of Q4-2010. *Update, December 17, 2010:* SL Ross' 2001 report recommended one Norwegian Standard System (NSS) system for the offshore of Newfoundland. Operators completed the acquisition of this equipment in 2009. In addition, Suncor and Husky are in the process of procuring another NSS with anticipated delivery to Newfoundland in early 2011. If additional equipment were required, Operators would obtain additional spill equipment through tier 2 or 3 contract resources.	See response to 3.
43	The reference to the Ocean Boom Vane should be clarified to indicate how many OBVs may be contemplated for acquisition and in what configuration(s).	Husky and Suncor pursuing the purchase of an OBV in 2010. It is anticipated that the equipment would be stored on the SeaRose and Terra Nova FPSO and considered to be an alternative to the conventional sweep arm on the SVSS.	Acknowledged.

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Canada-Newfoundland & Labrador Offshore Petroleum Board

SUNCOR ENERGY

Suite 201, Scotia Centre
235 Water Street
St. John's, NL A1C 1B6
Tel 709 778 3500
Fax 709 724 2901
www.suncor.com

November 1, 2012

PES-CNO-TER-0406-2276

Mr. Jeff O'Keefe, P. Eng., P. Geo.
Manager, Resource Management
& Chief Conservation Officer
C-NLOPB
5th Floor, TD Place
140 Water Street
St. John's, NL A1C 6H6

Dear Mr. O'Keefe:

RE: Report to the C-NLOPB on the Assessment of Marine Hydrocarbon Spill Response Capability for Jeanne d'Arc Basin Production Operations and Status of Continual Improvement Plan

Further to your letter of March 8, 2012, Suncor Energy Inc. would like to provide the following update with respect to the Marine Hydrocarbon Spill Response Capability Assessment Report that was submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) on November 20, 2009, including the status of implementation of the continual improvement plan contained in the Capability Report.

Enhancement	Comments
Equipment	Containment and Mechanical Recovery As outlined in the Capability Report, Suncor along with Hibernia Management Development Company (HMDC) and Husky Energy Inc. (Husky) completed the joint acquisition of the Norwegian Standard System (NSS) including a Framo Transrec 150 Weir Skimmer, Norlense 1200-R Self-Inflating Boom and Lamor LLP 200 kW Power Pack in June 2009. In August 2011, the acquisition and commissioning of a second NSS was completed. The second NSS, which was procured by Suncor and Husky, included a Transrec 150 system with both a weir skimmer and a HiVisc skimmer. The two NSSs were purchased to significantly enhance the capacity of local Tier 2 oil spill response equipment as defined in Suncor's Oil Spill Response Plan (TN-IM-EV03-X00-004). The two NSSs should not be considered in isolation as they form part of the overall complement of oil spill countermeasures that could be used during oil spill response, including: • Tier 1 equipment maintained offshore on the Terra Nova FPSO

Enhancement	Comments
	and support vessels (i.e., Single Vessel Side Sweep system, absorbent booms, etc.); • Tier 2 equipment maintained onshore locally at the Eastern Canada Response Corporation (ECRC) and Canadian Coast Guard (CCG); and • Tier 3 equipment accessible through Oil Spill Response Limited (OSRL) and the Global Response Network. As defined in the Oil Spill Response Plan, the response strategy or the Tier of countermeasure implemented will depend on many factors including but not necessarily limited to the type of oil spilled, operating conditions at the time of a spill, environmental resources at risk, availability of response equipment, etc. <u>In-Situ Burning</u> During the preparation of the Capability Report it was determined that the use of in-situ burning as an oil spill countermeasure for offshore Newfoundland operations would generally not be practical because of sea states. However, should a spill occur and the environmental conditions were suitable to employ in-situ burning, Suncor would mobilize expertise through OSRL and/or other third party expert to coordinate burn activities. <u>Mobilization and Deployment</u> As discussed in the Capability Report, the installation and use of ISO mounts with the NSS significantly reduces mobilization and deployment time. Suncor has installed the ISO mounts on all of its long term charter vessels (i.e., *M/V Atlantic Eagle*, *M/V Atlantic Raven* and *M/V Burin Sea*). In addition, when the NSSs were purchased, dedicated transport trailers were also procured to decrease the time it would take to mobilize equipment to the vessel. <u>Well Capping and Containment</u> Suncor is currently working with other East Coast operators, the Canadian Association of Petroleum Producers (CAPP) and the Subsea Well Response Project (SWRP) to evaluate options for response to a subsea well incident. Regular updates on this initiative have been provided to the C-NLOPB. Suncor is also conducting a comprehensive assessment of capping technologies in the context of its offshore operations in Canada and internationally.
Dispersants	As discussed in the Capability Report, Suncor considers the next response improvement for offshore oil sector in Newfoundland is the use of chemical dispersants as a oil spill countermeasure. This

Enhancement	Comments
	enhancement was also supported in the *"Review of Offshore Oil-spill Prevention and Remediation Requirements and Practices in Newfoundland and Labrador"* that was conducted for the Government of Newfoundland and Labrador in 2010. Suncor has conducted extensive testing of its East Coast oils to determine the effectiveness of dispersants, including: • 2002 – Testing by S.L. Ross Environmental Research Ltd.; • 2006 – OHMSETT Wave Tank Testing by S.L. Ross; • 2011 – Dispersant Gel testing by ExxonMobil; and • 2012 – Swirling Flask Test by S.L. Ross. Suncor, through CAPP with other East Coast Operators, have engaged S.L. Ross to update a Net Environmental Benefits Analysis (NEBA) Report for dispersant usage. S.L. Ross prepared a NEBA for East Coast Operators in 2008. In 2011, East Coast Operators contracted S.L. Ross to review and update the 2008 NEBA Report to include new crude and dispersant testing results and current information on dispersant usage. It is anticipated that the revised NEBA will be finalized in early 2013. A copy of the NEBA, which includes the results of dispersant testing, will be provided to the C-NLOPB when finalized. As noted in the C-NLOPB letter of March 8, 2012, East Coast Operators have initiated discussions with various stakeholders regarding the use approval and use of dispersants. To date, through One Ocean, East Coast Operators have stated to local fishery stakeholders that the use of dispersants would enhance oil spill response capability in the region. Operators have asked fishery interests what information they need to help them better understand dispersants and their usage. To date, fisheries have not responded with a specific request; however, Operators have indicated that they are able to present to a meeting of fishers early in 2013. Upon completion of the NEBA and stakeholder engagement, Suncor will draft an amendment to its Oil Spill Response Plan that includes a section on how dispersants could be used for submission to and review by the C-NLOPB.
Joint Operator Steering Committee	Since the submission of the Capability Report, East Coast Operators have developed a joint working group through CAPP to look at oil spill response issues and improvements. Operators have worked together to assess potential changes to their own or joint oil spill preparedness and response programs including dispersant

Enhancement	Comments
	usage, equipment enhancements and purchases, modification or maintenance, exercises, training, plan/procedure revisions and research and development.
ECRC Integration	Since 2009, Suncor and Husky have entered into an oil spill preparedness integration Agreement with ECRC. The scope of the Agreement consists of ECRC conducting inspection, maintenance, storage and training on Operator-owned Tier 1 (sorbent booms, SVSS, tracker buoys, etc.) and Tier 2 (Norwegian Standard System) equipment. For Tier 1 equipment, training is delivered to Operator vessel crews. Tier 2 equipment training is delivered to a pool of ECRC oil spill responders. The integration agreement more easily facilitates the participation of ECRC in operator led emergency/oil spill response exercises, including the annual Synergy exercise. Partnering with ECRC, a certified Response Organization under the *Canada Shipping Act* provides oil spill response preparedness services to Operators that enhances operators' capability to respond to oil spill events.
Research and Development	Through research organizations such as the Environmental Studies Research Funds (ESRF) and Petroleum Resources Newfoundland and Labrador (PR-NL), Suncor continues to support research and development projects relating to oil spills, including environmental effects, trajectory modelling, technology development, dispersant effectiveness, etc.

Going forward, Suncor will provide the C-NLOPB with regular updates on continual improvement enhancements to oil spill response capability during the annual environmental reporting process.

If you have any questions or require additional information, please feel free to contact the undersigned at [redacted]

Regards,

[redacted]

Husky Energy

Atlantic Region
Suite 901, Scotia Centre
235 Water Street
St. John's, NL, Canada
A1C 1B6

Bus: (709) 724-3900
Fax: (709) 724-3915

November 20, 2012

Canada-Newfoundland and Labrador Offshore Petroleum Board
5th Floor, TD Place
140 Water Street,
St. John's, NL A1C 6H6

Doc. No.: HUS-CPB-AR-LTR-00058

Attention: **Mr. Jeff O'Keefe, P. Eng., P. Geo.**
Manager, Resource Management
& Chief Conservation Officer

Dear Mr. O'Keefe;

Subject: **Report to the C-NLOPB on the Assessment of Marine Hydrocarbon Spill Response Capability for Jeanne d'Arc Basin Production Operations and Status of Continual Improvement Plan**

Further to your letter of March 8, 2012, Husky Energy would like to provide the following update with respect to the Marine Hydrocarbon Spill Response Capability Assessment Report, as submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) on November 20, 2009, including the status of implementation of the continual improvement plan contained in the Capability Report.

Husky will continue to use its Oil Spill Response plan as the primary document to update and communicate changes to response capability and philosophy. Revisions to the document will be communicated to the C-NLOPB in line with existing practice.

Containment and Mechanical Recovery / Preparedness Exercise

As outlined in the Capability Report, Husky along with Hibernia Management Development Company (HMDC) and Suncor Energy Inc. (Suncor) completed the joint acquisition of the Norwegian Standard System (NSS) including a Framo Transrec 150 Weir Skimmer, Norlense 1200-R Self-Inflating Boom and Lamor LLP 200 kW Power Pack in June 2009. In August 2011, the acquisition and commissioning of a second NSS was completed. The second NSS, procured by Husky and Suncor, includes the addition of a HiVisc skimmer.

Husky, similar to other local operators, have taken measures to significantly reduce mobilization time through the fitting of ISO mounting system on designated vessels and the development of vessel specific mobilization plans. Currently the Atlantic Hawk, Maersk Dispatcher and the Maersk Detector are fitted with the ISO deck mounting system.

In 2011, Husky made changes to its contracted support fleet which included the replacement of the Maersk Chignecto and Maersk Chancellor with the Maersk Detector and Maersk Dispatcher with the Maersk Detector, as part of the technical specification, holds full oil recovery notation from its nominated classification society. The vessel has approximately 1000m3 of internal storage that can be made available for the storage of recovered oil.

Operator response capability is demonstrated annually through the conduct of the joint oil spill exercise, commonly referred to as Synergy, in 2012 the exercise was hosted by Husky with support from ECRC. During this year's exercise, Husky exercised Tier 1, 2 and components of a Tier 3 response during a large-scale exercise that involved more than 100 participants with support and representation from the following:

- Husky's Atlantic Region Onshore Emergency Response Team;
- SeaRose FPSO;
- Support Vessels Maersk Detector and Burin Sea;
- Eastern Canada Response Corporation (ECRC);
- Provincial Aerospace (fixed wing surveillance);
- Oil Spill Response Limited (OSRL);
- Other East Coast Operators including Exxon, Suncor, Statoil and Chevron; and
- Canada Newfoundland Offshore Petroleum Board.

Eastern Canada Response Corporation (ECRC)

In late 2009, Husky entered into an oil spill preparedness Agreement with ECRC. The scope of the Agreement consists of ECRC conducting inspection, maintenance, storage and training on Operator-owned Tier 1 (sorbent booms, SVSS, tracker buoys, etc.) and Tier 2 (Norwegian Standard System) equipment.

The preparedness agreement compliments Husky's offshore operator subscription agreement with ECRC to allow for efficient integration of ECRC into spill response efforts. Husky routinely interfaces with ECRC during the conduct of exercises, quarterly steering meetings and through conduct of oil spill exercises.

In-Situ Burning

During the preparation of the Capability Report, it was determined that the use of in-situ burning as an oil spill countermeasure for offshore Newfoundland operations would generally not be practical because of sea states. Should the nature of a spill and environmental make in situ burning feasible, Husky would source equipment and expertise through a Tier 3 response organization such as OSRL.

Well Capping and Containment

Husky is currently working with other East Coast Operators, the Canadian Association of Petroleum Producers (CAPP) and the Subsea Well Response Project (SWRP) to evaluate options for response to a subsea well incident. Regular updates on this initiative have been provided to the C-NLOPB.

Dispersants

Husky view chemical dispersants as a valuable oil spill counter measure and consider the integration of chemical dispersants into oil spill response plans as an improvement to oil spill response capability.

Husky, through CAPP along with other East Coast Operators, have engaged S.L. Ross to update the 2008 Net Environmental Benefits Analysis (NEBA) Report for dispersant usage. In 2011, East Coast Operators contracted S.L. Ross to review and update the 2008 document to include; but not limited to, new crude and dispersant testing results, current information on dispersant usage and legislative changes.

Recent dispersant testing of the White Rose Field crude samples at the Ohmsett facility have confirmed that the crude is dispersible in both summer and winter conditions using corexit 9500.

It is expected that the NEBA will be finalized in early 2013 and subsequently made available to the C-NLOPB for review and discussion.

Joint Operator Steering Committee

Through CAPP, Husky and other East Coast Operators have formed a working group to discuss spill response issues and potential response improvements. The current focus of the working group is the finalization of the NEBA report referenced above.

Research and Development

Husky explores and supports research and development opportunities through organizations such as the Environmental Studies Research Funds (ESRF) and Petroleum Resources Newfoundland and Labrador (PR-NL).

If you have any questions or require additional information, please feel free to contact the undersigned at [redacted]

Yours sincerely,

HUSKY OIL OPERATIONS LIMITED

[redacted]

JW/st/pk

cc: [redacted] - Husky

Hibernia
Management and Development Company Ltd.
Suite 1000, 100 New Gower Street
St. John's, NL A1C 6K3
Tel: (709) 778-7000 Fax: (709) 753-1822

TRIM # 2013-COR-01386
Date Rec'd: March 20, 2013
File # 64150-019-001
Canada-Newfoundland & Labrador Offshore Petroleum Board

[redacted]

March 20, 2013

Mr. Jeff O'Keefe
Chief Conservation Officer
Canada- Newfoundland and Labrador
Offshore Petroleum Board
5th Floor, TD Place
140 Water Street
St. John's, NL A1C 6H6

Re: Marine Hydrocarbon Spill Response Capability Assessment
File Code: 267.2

Dear Mr. O'Keefe:

Hibernia Management & Development Company Ltd. (HMDC) would like to summarize the following information with respect to the Marine Hydrocarbon Spill Response Capability Assessment Report, as submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) on November 20, 2009.

This letter serves as a formal response to the C-NLOPB's March 8, 2012 letter regarding the above noted subject. Please note, HMDC provided a response to the C-NLOPB on July 31, 2012.

HMDC will continue to utilize its Oil Spill Response Procedure, an Appendix to the Hibernia Emergency Response Plan HS-O-O-X-A00-XX-1002.001, as the primary document to update and communicate changes to our response capability and philosophy. Revisions to the document will be communicated to the C-NLOPB in line with current practice. HMDC believes this letter should serve as closure on the discussion of the subject report due to its dated information. We welcome the evaluation and assessment of our Oil Spill Response Procedure and further discussions with the C-NLOPB as oil spill response planning is 'evergreen'.

1. **<u>Containment and Recovery Equipment and Chemical Dispersants</u>**

HMDC is satisfied with the available local resources and maintain the ability to mobilize local, national and international resources. In addition to the on-site equipment noted in the Procedure, HMDC has access to the following equipment through ownership, mutual aid agreements and subscriptions:

- 8 - Sorbent Booms
- 14 - Side Vessel Sweep Systems
- 8750m of offshore boom
- 157 - Skimmers
- 2 – Busters
- 1 – Subsea Containment Assembly

In addition, HMDC has accessibility to a significant amount of equipment via the major oil and gas operators that are co-venturers within HMDC. HMDC would have access to resources to mount an effective response to a major pollution event at our facilities; a response that would be equivalent to a response in any other offshore jurisdiction.

2. **Use of Chemical Dispersants**

HMDC, through CAPP and with the other Newfoundland and Labrador operators has formed a dispersant working group to support the inclusion of dispersants within the respective Emergency Response Plans. The objectives of this working group align with the expectations expressed by C-NLOPB in the subject March 8, 2012 letter.

It would be beneficial to HMDC and the CAPP dispersant working group in developing work plans if the C-NLOPB could provide the expected timing for the NEEC (National Environmental Emergency Centre) technical review. We can then ensure we are prepared to engage in meaningful discussions with NEEC members and the C-NLOPB.

3. **Assessment of Alternate Response Technologies – In-Situ Burning**

HMDC does not consider in-situ burning a primary counter measure due to the sea states experienced offshore Newfoundland and Labrador. If the nature of a hydrocarbon spill and environmental conditions made in-situ burning feasible, HMDC would source equipment and expertise via response organizations and ExxonMobil's global corporate response team.

4. **Action Plan for Further Response Capability Enhancements**

HMDC's Emergency Response Plan is submitted annually to the C-NLOPB for your review and assessment. The plan includes HMDC's Oil Spill Response Procedure. HMDC's preference would be to include updates on our oil spill response capability within that plan, with a reference included in the annual environmental report.

We trust that the above information addresses your March 8, 2012 letter and look forward to continued discussion with you in the future concerning our oil spill response plan. Please feel free to contact Kimberley Pearce (709-778-7408) if you have any questions or wish to discuss this information in greater detail.

Sincerely,

[redacted]

cc. [redacted] Suncor)
[redacted] (HMDC)
[redacted] Husky)

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

April 2, 2013

[redacted]
Husky Energy
Suite 901, 235 Water Street
St. John's NL A1C 6K3

Dear [redacted]

Subject: Marine Hydrocarbon Spill Response Capability Assessment

Thank you for your November 20, 2012 letter in response to my March 8, 2012 letter to you concerning your assessment of marine hydrocarbon spill response capability.

I acknowledge your clarification of the sufficiency of your existing mechanical containment and recovery capability in the current absence of a clear legal framework for dispersant usage as part of response planning. Similarly, I acknowledge your clarification of your views on the applicability of in-situ burning as a countermeasure for Grand Banks operations.

In consideration of these clarifications, and that the *Marine Hydrocarbon Spill Response Capability Assessment: Jeanne d'Arc Production Operations* report has become increasingly dated since its issuance in 2009, I consider the review of that document now to be completed. I believe that a regional/sectoral strategic review initiative of this type, over and above individual operators' normal response planning revisions and updates, is a useful exercise, and encourage you to consider it as part of your own continuous improvement processes.

Thank you as well for your update on operators' joint initiative to prepare documentation to support evaluation of potential dispersant usage. In consideration of changes since my May 2012 letter in Environment Canada's Regional Environmental Emergencies Team (REET) structure, we will be providing such documentation directly to the relevant government departments for technical review. The time required for this review may be affected by the volume and nature of information contained within a particular submission; that said, I anticipate we would request the provision of review comments within a 4-6 week period. We look forward to receiving the Net Environmental Benefits Analysis report relating to this matter in Q2 2013.

As I previously have stated, I believe that the status of initiatives to maintain and improve spill response capability should be reviewed at least on an annual basis, and look forward to discussing this with you and other operators, individually or collectively, in the future.

Sincerely yours,

[redacted]

Jeff O'Keefe, P.Eng., P.Geo.
Chief Conservation Officer

CANADA-NEWFOUNDLAND
and LABRADOR
OFFSHORE
PETROLEUM
BOARD

April 2, 2013

[redacted]
Suncor Energy
Suite 201, 235 Water Street
St. John's NL A1C 1B6

Dear [redacted]

Subject: Marine Hydrocarbon Spill Response Capability Assessment

Thank you for your November 1, 2012 letter in response to my March 8, 2012 letter to you concerning your assessment of marine hydrocarbon spill response capability.

I acknowledge your clarification of the sufficiency of your existing mechanical containment and recovery capability in the current absence of a clear legal framework for dispersant usage as part of response planning. Similarly, I acknowledge your clarification of your views on the applicability of in-situ burning as a countermeasure for Grand Banks operations.

In consideration of these clarifications, and that the *Marine Hydrocarbon Spill Response Capability Assessment: Jeanne d'Arc Production Operations* report has become increasingly dated since its issuance in 2009, I consider the review of that document now to be completed. I believe that a regional/sectoral strategic review initiative of this type, over and above individual operators' normal response planning revisions and updates, is a useful exercise, and encourage you to consider it as part of your own continuous improvement processes.

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Sincerely yours,

[redacted]

Jeff O'Keefe, P.Eng., P.Geo.
Chief Conservation Officer

CANADA-NEWFOUNDLAND and LABRADOR OFFSHORE PETROLEUM BOARD

April 2, 2013

[redacted]
Hibernia Management and Development Company Ltd.
Suite 1000,
100 New Gower Street
St. John's NL A1C 6K3

Dear [redacted]

Subject: Marine Hydrocarbon Spill Response Capability Assessment

Thank you for your March 20, 2013 letter in response to my March 8, 2012 letter to you concerning your assessment of marine hydrocarbon spill response capability.

I acknowledge your clarification of the sufficiency of your existing mechanical containment and recovery capability in the current absence of a clear legal framework for dispersant usage as part of response planning. Similarly, I acknowledge your clarification of your views on the applicability of in-situ burning as a countermeasure for Grand Banks operations.

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As I previously have stated, I believe that the status of initiatives to maintain and improve spill response capability should be reviewed at least on an annual basis, and look forward to discussing this with you and other operators, individually or collectively, in the future.

Sincerely yours,

[redacted]

Jeff O'Keefe, P.Eng., P.Geo.
Chief Conservation Officer

CAPP
CANADIAN ASSOCIATION
OF PETROLEUM PRODUCERS

E-MAILED Oct. 4, 13

2013-COR-05729 2013-RFI-310

Registered 10/10/2013

October 4, 2013

Mr. Trevor Bennett
Access to Information Coordinator and
Information Resources Manager
C-NLOPB
5th Floor, TD Place
140 Water St.
St. John's, NL A1C 6H6

Dear Mr. Bennett:

Re: NL Spill Capability Assessment Report

CAPP, on behalf of producing operators in the Newfoundland and Labrador offshore area, Hibernia Management and Development Company Ltd., Suncor Energy and Husky Energy ("Operators"), is writing in response to your letter related to the C-NLOPB's intention to respond to an information request related to the 2009 *Marine Oil Spill Capabilities Assessment of the Newfoundland and Labrador Offshore Area ("2009 Assessment").* This assessment, initiated jointly by the Operators, was prepared by Cormorant Ltd. and Lorax Environmental with CAPP providing overall coordination of the process leading to the final report.

The Operators support the C-NLOPB making the 2009 Assessment available to the requestor, subject to redactions of personal information as specified in separate communications to you from each of the Operators. However, since the report represents only a snapshot in time and does not reflect the full extent of current spill response capability we ask that you include this letter with the 2009 Assessment in order to provide additional necessary context.

Since the 2009 Assessment, the Newfoundland and Labrador offshore industry has further enhanced spill response capability by:

- Purchasing a second NorLense 1200-R spill containment boom and TransRec 150 skimming system – equipment that is capable of functioning in harsh sea states.
- Installing mounting systems on offshore supply and standby vessels to enable rapid mobilization and deployment of shore-based response equipment.
- Providing information to regulatory agencies on the suitability and effectiveness of chemical dispersants as a spill response option for offshore Canada.

- Forming a joint operator steering committee to promote a cooperative approach to response preparedness.
- Contracting the federally certified spill response entity Eastern Canada Response Corporation (ECRC) to maintain the existing response equipment cache and provide spill response training.
- Subscribing to international agreements to provide access to well capping and containment technologies and a global chemical dispersant stockpile.
- Supporting research that examines the effects of oil spills and the development of new technologies to enhance response.

Some of the enhancements outlined above relate specifically to recommendations in the 2009 Assessment while others relate to continuous improvement opportunities Operators applied based on research and advancements in technology.

In recognition of the regulatory responsibilities and authority of the C-NLOPB, Operators are in regular communication with the C-NLOPB related to spill prevention and response, including continuous improvement opportunities. The C-NLOPB is also included as an evaluator in our annual on-water "Synergy" spill response exercises.

Preventing spills from occurring in the first place has always been a priority focus area. The Operators actively work to prevent spills by:

- Identifying and analyzing potential spill sources and designing then implementing engineering controls or establishing procedures to reduce or eliminate spill sources.
- Monitoring and maintaining operating equipment.
- Applying comprehensive inspection, testing and audit programs for facilities, equipment and processes.
- Training workers to recognize and respond to potential emergencies.
- Applying global best practices and global standards in management systems, engineering controls, and training.
- Evaluating and implementing new research and technology as it becomes available.

The Operators are committed to conducting operations in a responsible manner and will continue to work to prevent spills and enhance environmental protection measures as research and technology continues to advance.

Sincerely,

R Paul Barn

R. Paul Barnes
Manager, Atlantic Canada