Executive Summary

by

and

S.L. Ross Environmental Research Ltd.

Coastal Ocean Associates

for

Canada/Nova Scotia Offshore Petroleum Board

and

Mobil Oil Canada Properties (Proj. Mgr)

Shell Canada Ltd.

Imperial Oil Resources Ltd.

Gulf Canada Resources Ltd.

Chevron Canada Resources

PanCanadian Petroleum Ltd.

Murphy Oil Company Ltd.

Norsk Hydro Canada Oil and Gas Inc.

LGL Report No. TA 2281

August 2000

ENVIRONMENTAL ASSESSMENT OF EXPLORATION DRILLING OFF NOVA SCOTIA

EXECUTIVE SUMMARY

by

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INTRODUCTION

Several hydrocarbon exploration wells are planned to be drilled offshore on the Scotian Shelf in the next few years. Before granting approvals to drill, the Canada/Nova Scotia Offshore Petroleum Board (CNSOPB) must evaluate the potential environmental effects of each well. Similarly, the Canada/Newfoundland Offshore Petroleum Board (CNOPB) must approve wells on the St. Pierre Bank off southern Newfoundland. Given that many technical aspects of offshore exploration drilling are common to all wells, it is appropriate to conduct a *generic assessment* of the common aspects of all offshore exploration wells. Thus, drilling applications for specific wells would only need to address those aspects that were unique to that well or site.

This generic assessment applies to year-round drilling operations. It will be effective for a five-year period beginning with drilling in mid 2000. It is anticipated that the generic assessment will be updated after five years to reflect new information about the receiving environment, new drilling technologies, and new information on the effects of drilling on the environment.

PROJECT DESCRIPTION - Exploration Drilling

Geophysical (seismic) and other types of surveys are used to determine the location and extent of possible oil or gas bearing geological formations. Oil and gas are not present as

large pools located within holes in rock. They are located within porous rock. These porous formations may contain hydrocarbon deposits that are large enough to be developed or they may contain water or only small quantities of hydrocarbons. Exploration drilling is the only sure way to confirm whether hydrocarbons are present and what kind of hydrocarbons are present (gas, oil). Experience in the study area indicates that prospects could contain formation oil, gas, condensate or water or a combination of any of these. There are many kinds of crude oil. Some is thick as tar and some is as light as home heating oil. Condensate is neither crude oil nor condensed gas. It is a very light hydrocarbon resembling gasoline.

Typically, the drilling of a single exploration well in the study area requires from 50 to 100 days depending on the complexity of the well (i.e. rock and reservoir properties), weather, and the depth of the well. In the event that hydrocarbons are found during exploration drilling, testing may be required to further define a prospectís potential for development. Testing a well may include several types of activities and usually requires about 10 - 40 days. Testing within the study area, typically may involve between 1 and 8 individual well tests of different reservoirs traversed by the well. Flow rates and the result of other tests give some indication about whether hydrocarbons may be present in quantities that are economical to develop. Once the presence of hydrocarbons is confirmed by exploratory drilling and associated testing, further appraisal or delineation drilling may be required. The geologists use their survey results to estimate the location and size of hydrocarbon-bearing formations. Delineation wells are then drilled to determine the actual size of a formation and to estimate how much oil may be present.

Drilling exploration wells in offshore areas requires the use of mobile offshore drilling units (MODUs). Types of MODUs include jack-up rigs, semi-submersible rigs, and drill ships. The type of drilling rig used for exploration drilling is determined by water depth. The water depths in the study area range from 10 m to 4000 m.

Drilling rigs need to be supplied with drilling equipment, fuel, food and a myriad of other materials to maintain a crew, vessel and drilling operations. In addition, there are regular crew changes and visitors that need to be carried to and from the platform.

While drilling the hole, a drill bit grinds rock into small pieces called cuttings. If cuttings were left in the hole the drill bit could not turn. Fluids called drilling muds are needed to move the cuttings away from the drill bit and out of the well. It is expected that the significant majority of exploration wells and the majority of footage drilled covered by this assessment will be carried out using water-based drilling muds. In certain situations,

however, technical issues or safety concerns may indicate the preferred use of non-toxic synthetic- or low toxicity mineral oil-based drilling muds. If and when these fluids are used, usage will comply with Board Discharge Policy and the Offshore Waste Treatment Guidelines.

Cleaned cuttings with some residual mud are discharged overboard from a cutting chute, and the mud which was cleaned from the cuttings is reconditioned and reused. Some mud remains with the discharged cuttings. At several stages during drilling and at the end of the drilling process, drilling mud may be discharged over the side.

Upon completion of drilling, and any well testing activities, the well will be abandoned or suspended. The abandonment/suspension procedure will follow industry practices and procedures and be in accordance with CNSOPB regulations.

Offshore drilling platforms routinely produce a variety of materials that must be disposed of. Many of these are similar to materials produced by ships. They include:

- grey and black water from toilets and sinks,
- ballast water/preload water,
- bilge water,
- deck drainage,
- discharges from machinery spaces,
- garbage, and
- cooling water.

IMPACT ASSESSMENT METHODOLOGY

Many of the potential impacts of exploration drilling can be adequately described using a generic approach. However, evaluations of the potential effects of the discharge of drilling muds and cuttings and the potential impacts of accidental hydrocarbon spills require that site specific information be used. We have used a scenario approach to evaluate impacts of potential oil spills and the discharge of drilling muds and cuttings. Five sites within the study area that are potential exploratory drilling locations were selected as being representative of the types of areas where drilling could occur (Figure 1). These sites included the Sable Bank, Laurentian Channel, the St. Pierre Bank and two locations on the Slope at depths of 789 and 3,000 m.

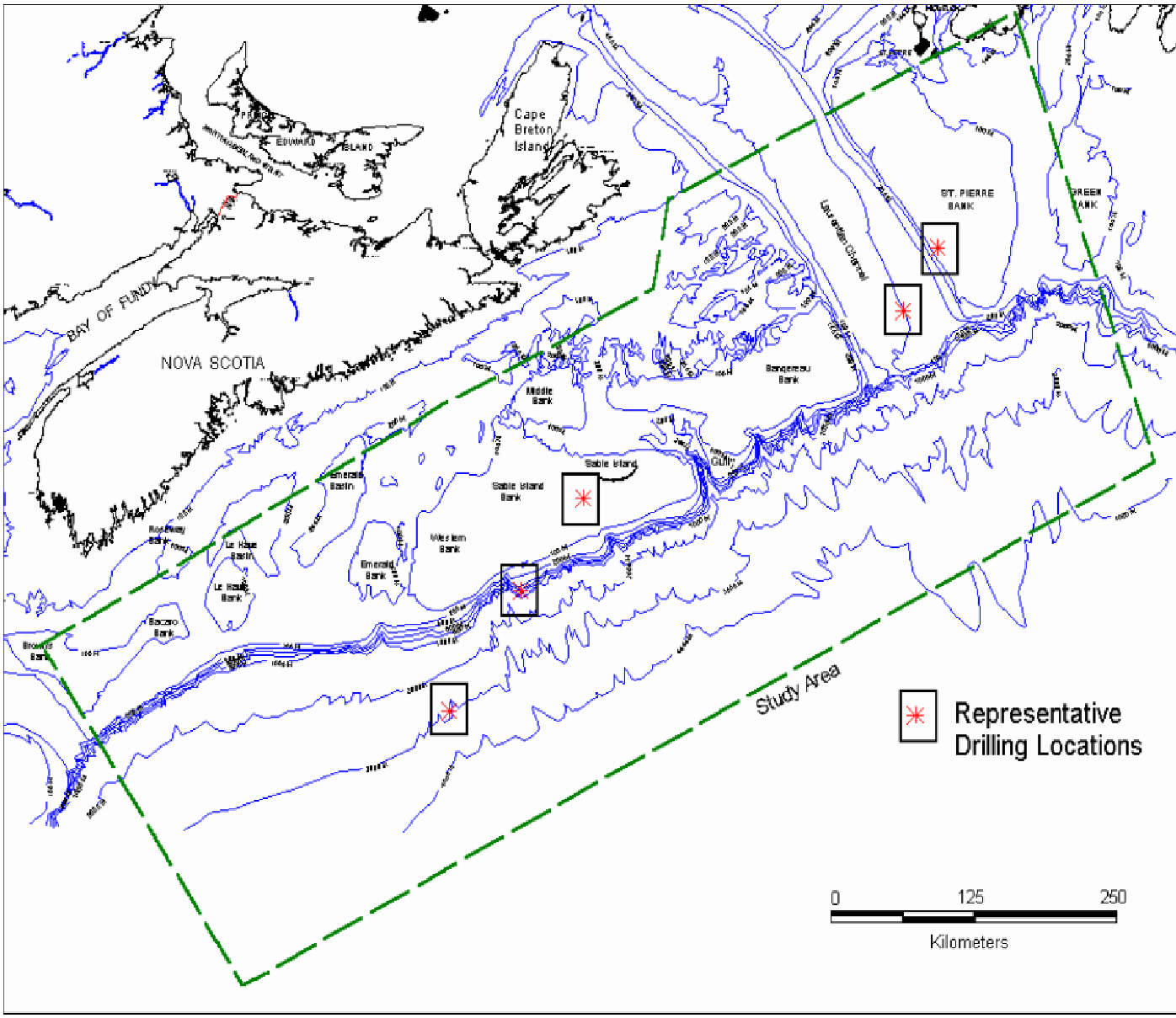

Figure 1. Study area for the Environmental Assessment of exploration drilling on the Scotian Shelf, Laurentian Channel and St. Pierre Bank and locations of representative drilling sites within the study area that were used for the creation of scenarios for oil spills and the release of drilling muds and cuttings.

Valued Ecosystem Components (VECs)

In the context of an environmental assessment, an interaction is defined as a time and/or a place where project activities come into contact with an environmental component. It is not practical, or necessary, to address all potential interactions between project activities and every component of the natural and human environment. Some environmental components are not valued by society or are represented by another environmental component. Zooplankton is not valued by society in of itself. If there was potential for an

effect on zooplankton that would affect fish, then zooplankton would be considered. Thus, this Environmental Assessment (EA), like most others, focuses on Valued Ecosystem Components (VECs). Valued Ecosystem Components include rare or threatened species or habitats; species or habitats that are unique to an area, or are valued for their aesthetic properties; and species that are harvested by people. VECs included:

- Larvae of fish and shellfish
- Fish and shellfish of commercial importance
- Clams, worms and other animals that live in or on the sea floor (benthos) as indicators of environmental pollution and disturbance
- Fish species eaten by mammals and birds (forage fish).
- Fisheries
- Marine mammals
- Marine birds
- Sea turtles
- Special areas
  - Fish Nursery Areas
    - The Gully
  - Right Whale Habitat
    - Sable Island

Valued ecosystem components are described in some detail in the report and appendices. Numerous maps and tables are used to illustrate the descriptions.

Impact Definitions

It is important that the terminology used to describe potential impacts be clear and easily understood and so, precise definitions for the ranking of potential impacts were used in this EA. The first step in the assignment of impact definitions is the definition of impact criteria. Exploration drilling has the potential of affecting VECs directly and the potential for affecting habitat. We have used VEC specific criteria for determining whether or not there was a potential for impact. These criteria are discussed in the relevant impact assessment sections. Once it was determined that there was a potential for impact, then the following definitions were used.

Magnitude of Impacts

Major Impact - An impact is rated major if it is judged to result in a 10%, or greater, change in the size of a population, the commercial harvest, or other attributes of the VEC.

Moderate Impact - An impact is rated moderate if it is judged to result in a 1% to 10% change in the size of a population, the commercial harvest, or other attributes of the VEC.

Minor Impact - An impact is rated minor if it is judged to result in a less than 1% change in the carrying capacity of the size of a population, the commercial harvest, or other attributes of the VEC.

Negligible Impact - Negligible impacts are those that are judged to have essentially no effects.

Scale of Impacts

Regional Impact - A regional impact is an interaction that is judged to have an impact at the regional level. For the purposes of this EA, regions were defined as 1) the Scotian Shelf, 2) the Laurentian Channel, and 3) the St. Pierre Bank.

Local Impact ñA local impact is an interaction that is judged to have an impact at the local level defined here as the areas between 1 to 50 km from the drilling rig.

Sub-Local Impact - An interaction that is judged to have an impact on the biophysical environment in an area within one km of the drilling rig.

Duration of Impacts

Long-Term - Impacts that last for more than five years.

Medium-Term - Impacts that last for periods of one to five years.

Short- Term - Impacts that last for a period of less than one year.

Likelihood of Occurrence

The impact definition will include an estimate of the likelihood of an impact occurring.

Significance of Potential Impacts

No Significant Impact means that an impact is negligible or is minor, short-term, and local or sub-local in nature.

Significant Impact means that the impact rating is major or moderate or that it is minor with a medium or long term and a regional impact.

An important factor considered in the assignment of impact significance is the status of the VEC such as an endangered species or whale sanctuary.

Public Consultation

The Canada/Nova Scotia Offshore Petroleum Board has attempted to insure that the development of this generic EA is an open process with adequate opportunity for various government agencies and interest groups to provide input. To this end, fisheries and environment advisory committee meetings were held at the CNSOPB offices in Halifax prior to and during the preparation of the report. An open public meeting was held in the Spring of 2000 to discuss this draft.

LEVEL 1 INTERACTION MATRIX

The first step in impact evaluation is to identify possible interactions between the environment and exploratory drilling. The interaction matrix showing **possible interactions** between the project and the environment is shown in Table 1. This is a Level 1 Interaction Matrix.

Table 1. Level 1 interaction matrix showing possible interactions between project activities and valued ecosystem components.

	Project Activity											
VEC	Presence of Structures	Lights	Flares	Noise/ Disturbance - Boats	Noise/ Distubance - Aircraft	Noise/ Disturbance - Drill rigs	Grey and Black Water	Cooling Water	Garbage and Waste	Oily Wastes	Ballast Water	Muds and Cuttings
Benthic Communities												X
Eggs and Larvae							X	X		X	X	
Commercially Important Invetebrates												X
Fish	X			X		X	X	X		X	X	X
Invertebrate Fisheries	X											X
Finfish Fisheries	X			X		X	X	X		X	X	X
Sea Turtles	X			X		X	X	X		X	X	
Toothed Whales	X			X	X	X	X	X		X	X	
Baleen Whales	X			X	X	X	X	X		X	X	
Seals in Water	X			X	X	X	X	X		X	X	
Seals on Land				X	X	X						
Sea-associated Birds	X	X	X	X	X	X	X	X		X	X	
Seabird Colonies				X	X							
Important Areas												
Fish Nursery Areas	X			X		X	X	X		X	X	X
The Gully				X		X				X	X	X
Whale Sancuaries	X			X	X	X	X	X		X	X	
Sable Island				X								

The matrices show interactions only and make no assumptions about possible impacts of the interactions. In the report, all of the interactions in the matrix were evaluated for their potential to cause impact using the methods described therein.

It is not possible or necessary to address the potential interactions between every project activity and every component of the natural and human environment. Many of these potential interactions are impossible, inconsequential or trivial. This EA focuses on

interactions between project activities and important issues and questions concerning Valued Ecosystem Components (VECs).

IMPACTS OF ACTIVITIES

The EA addresses the potential impacts of routine operations and discharges associated with exploration drilling. Routine activities include the operation of the drilling rig, supply boats and helicopters which can cause disturbance to marine animals, and the discharge of wastes, other materials and drilling muds and cuttings. The potential effects of an accidental spill of condensate are also discussed.

Table 2 summarizes the predicted impacts on bottom dwelling worms, clams and other animals, fish, fisheries, marine mammals, sea turtles, and sea-associated birds. Impacts are evaluated after application of appropriate regulations and after accounting for standard industry operating procedures that already address many of environmental concerns. A series of area-specific mitigation measures are then applied. The residual impacts after application of these measures are then determined (Table 2). After all mitigation, impacts are predicted to be *not significant* for all 5 representative sites, according to the definitions adopted earlier in the assessment. There are, however, some special cases that are identified below under Procedures for Individual Assessments.

This assessment has assumed that the most likely hydrocarbon to be found in the study area is a combination of natural gas and condensate. If future wells in the study area discover oil, then it would be necessary to revisit the conclusions of this EA with respect to the potential impacts of an accidental release of hydrocarbons on sea-associated birds. In the unlikely event that there is an oil blowout, the potential consequences for birds could be more serious than the consequences of the condensate blowout considered in this report.

Cumulative Impacts

Assessment of cumulative effects is a very difficult task since there are few relevant data from existing situations and it is difficult to know what effects might be expected from planned and future projects. Cumulative effects caused by exploration drilling may be nil, additive, or synergistic. In the present case, cumulative effects include the combined effects of exploration drilling plus the effects of other existing and planned activities in the study area, including fishing, shipping, Sable Offshore Energy Project, and future projects.

The Environmental Studies Research Fund (ESRF) is planning to examine the cumulative impacts of oil and gas exploration and initial production on the Canadian East Coast. The format of the ESRF study has not yet been determined. It will likely examine cumulative effects in much more detail than is possible in the present EA. The results of the ESRF study may be relevant to future drilling applications.

Table 2. Impact summary showing all interactions listed in the Level One Matrix and the predicted impacts of the interactions. Impacts were assessed after consideration of standard regulatory and industry mitigation measures and before and after application of area-specific mitigation measures.

	Impact			
Interaction	Magnitude	Duration	Area	Mitigation
res				
Mortality	Negligible			
Attraction	Negligible			
Attraction	Minor	Short	Sub-local	
Exclusion	Minor	Short	Sub-to local	
Attraction/Mortality	Minor	Short	Sub-local	Release stranded birds
Boats				
Disturbance	Minor	Short	Sub-to local	
Effects on health	Negligible			
Reduction in catch	Negligible			
Disturbance	Minor	Short	Sub to local	Avoid whale sanctuaries
Disturbance	Minor	Short	Sub to local	Avoid whale sanctuaries
Disturbance	Minor	Short	Sub to local	Avoid Sable Island
Disturbance	Negligible			
Disturbance/Mortality	Min-mod	Medium	Local	Avoidance
Disturbance	Minor	Short	Sub-local	
Aircraft				
Disturbance	Minor	Short	Sub-local	Altitude, Avoid whale sanctuaries
Disturbance	Minor	Short	Sub-local	Altitude, Avoid whale sanctuaries

Disturbance	Minor	Short	Sub-local	Altitude
Disturbance	Minor	Long	Local	Altitude, Avoid Sable Island
Disturbance	Neg to Minor	Short	Sub-local	Altitude
Disturbance/Mortality	Mod to Maj	Long	Local	Altitude, Avoidance
Disturbance	Minor	Short	Sub-local	

Table 2. Continued.

	Impact				
	Interaction	Magnitude	Duration	Area	Mitigation
Stationary Source					
	Disturbance	Negligible			
	Effects on health	Negligible			
	Reduction in catch	Negligible			
	Disturbance	Neg to Minor	Short	Sub-local	
	Disturbance	Neg to Minor	Short	Sub-local	
	Disturbance	Neg to Minor	Short	Sub-local	
errestrial Birds	Disturbance	Negligible			
	Disturbance	Minor	Short	Sub-local	
ter					
	Effects on health	Negligible			Primary treatment
	Effects on health	Negligible			
	Effects on health	Negligible			
	Effects on health	Negligible			
l Garbage	No Interaction				None discharged - returned to

	Injury/Mortality	Negligible			Treatment prior to discharge
	Injury/Mortality	Negligible			Treatment prior to discharge
	Injury/Mortality	Negligible			Treatment prior to discharge

Table 2. Continued.

		Impact			
	Interaction	Magnitude	Duration	Area	Mitigation
	Injury/Mortality	Negligible			Treatment prior to discharg
	Injury/Mortality	Negligible			Treatment prior to discharg
	Injury/Mortality	Negligible			Treatment prior to discharg
	Injury/Mortality	Negligible			Treatment prior to discharg
nent Water	No Interaction				
Cuttings					
	Sub lethal effects	Minor	Short	Local	Effect on shallow banks onl
	Reduction in catch	Negligible			
	Mortality	Negligible			Use of water-based muds
s	Injury/Mortality	Minor	Medium	Sub-local	and/or Board Policy and Wa
s	Reduction in catch	Negligible			Treatment Guidelines
s	Injury/Mortality	Neg. to Minor	Short	Sub-local	
tant Benthic					
	Injury/Mortality	Neg. to Minor	Short	Sub-local	
s	Reduction in catch	Neg. to Minor	Short	Sub-local	
n	Injury/Mortality	Neg. to Minor	Short	Sub-local	
	Effects on the Fishery	Minor	Short	Sub to local	
	Injury/Mortality	Minor	Short	Sub to local	
	Tainting-reduced catch	Min-Mod	Short	Sub to local	Compensation
	Injury/Mortality	Minor	Short	Sub to local	

Mortality	Minor	Short	Sub to local

Cumulative Impacts of the Project

Noise and Disturbance

Ambient noise is the background noise in the ocean. Distant shipping noise dominates the ambient noise spectrum at low frequencies (20 to 300 Hz) in the worldís oceans. In coastal regions, the combined noise of many distant fishing vessels can contribute significantly to ambient noise (Richardson et al. 1995). During the period 1993 to 1997, there was an average of 310,000 landings per year reported by fishing vessels. This represents a significant amount of vessel traffic. The study area also includes major shipping routes to Halifax, the Gulf of St. Lawrence and Seaway, and southern Newfoundland. The incremental sound made by supply boats and individual drilling rigs would not add significantly to existing ambient noise levels in the study area. The noise effects from several concurrent exploration wells would increase the number of site-specific areas exposed to somewhat increased noise levels, but they would not add significantly to the overall noise on a regional level. Mitigation measures included in this EA will ensure that vessels and aircraft avoid the proximity of seabird colonies and seal haulouts and that whale sanctuaries are not routinely transited by supply boats.

Operational Discharges of Oil

Most of the oil entering the worldís oceans does so through small accidental or deliberate discharges from ships, river runoff, atmospheric deposition and natural seeps. Melville Shipping Limited (in Thomson et al. 1991) estimated that there were about 225 inshore and 100 offshore operational discharges of oil or oily water per year off the East Coast of Canada (adjusted for under-reporting, all industries on shore that dump into the ocean and all ships or other activities that could dump oil). This number does not include accidents. The mitigation measures included in the design of offshore exploration wells reduce operational discharges to a negligible amount and will not add significantly to the current input from other discharges.

Influence on the Benthos

Drilling operations will cause some disruption of bottom dwelling animals (benthos) through smothering by mud and cuttings very near the drill site and through the effects of water-based muds to distances of a few hundred metres from the drill site. From 1985 to 1991, fishing boats have trawled or dredged 4.3 million km of seabed on the eastern Canadian seaboard (Messieh et al. 1991). In this context, the small areas of benthos affected by even several exploration wells would result in very small increases in the amount of bottom perturbation that already exists.

There may be some minor sub lethal effects on deep-sea corals. However, fishing is the major cause of mortality of these animals (Breeze et al. 1997). There is unlikely to be mortality caused by smothering from a small number of deepwater wells because the drilling mud is well dispersed by the time it reaches the bottom.

Garbage and Waste Materials

These will not be discharged and so will not contribute to cumulative impacts.

Accidental Spills of Oil

The probability of a blowout involving condensate is very low. Should such a blowout occur, its effects would be limited to offshore waters. Condensate is light and evaporates and disperses quickly. The area of effects would be very limited in extent. Such a blowout would not have the same type of spectacular effects noted for spills of heavy crude or Bunker C in nearshore waters. Birds would be the VEC most heavily affected by a blowout. Mortality of birds from such a blowout would not cause a significant impact on populations.

Thomson et al. (1991) estimated that 21,000 seabirds are killed annually by operational discharges from ships on the Canadian East Coast. Many are killed by large nearshore spills such as those caused by the *Arrow* and *Irving Whale*.

Mortality of birds in fishing gear, especially gillnets and drift nets is a major concern (Tull et al. 1972; King 1984). Thousands of birds die annually in these kinds of nets. In addition, there is large scale hunting of several species, particularly murres in Newfoundland. An incremental mortality of birds caused by an occasional blowout of condensate would not add significantly to existing levels of bird mortality. However, in the highly unlikely event of a condensate blowout mitigation measures would be considered (which may include efforts to scare birds away from an area).

MITIGATION AND MONITORING

Routine Discharges

Many mitigation measures are built into the project design. Some of these are legislated and others are part of modern oil exploration equipment and/or operating procedures that have been designed with due regard for environmental protection. These measures include:

- Grey and Black Water
  - Typically the grey and black water is collected via a vacuum /gravity septic system whereupon it is treated, tested for compliance, and discharged.
  - Sanitary and food waste is macerated to a particle size of 6 mm or less and then discharged as per the Offshore Waste Treatment Guidelines.
  - In some circumstances additional treatment will be required.

- Cooling Water
  - For some systems, seawater is pumped through heat exchangers and discharged overboard without additives or treatment.
  - For other drilling rig systems, cooling is via a closed loop system. Fluids used in closed loop cooling systems are tested for compliance prior to discharge.
  - If chlorine is used restrictions may be imposed on the level of residual chlorine in the water being discharged.
  - Proposals for the use of biocides, other than chlorine, will be submitted to the regulators.

- Waste Materials
  - Excess chemicals or chemicals in damaged containers will be returned to shore on a supply boat.
  - Spent or excess acid will be disposed of in a manner approved by the CNSOPB or its designate.
  - No waste material that is hazardous to marine life will be discharged over the side.

- Garbage and Waste
  - No garbage will be discharged over the side.
  - Garbage, suitable for incineration may be incinerated, if a suitable incinerator is available on board.

- All non-combustible material and garbage, if not incinerated, will be transferred ashore for disposal.
- Combustible materials (e.g. oily rags, paint cans) will be placed in separate hazardous materials containers and transferred ashore.
- Most rigs have routine recycling programs; an estimated 5-10% of all garbage is identified and handled as recyclable materials.

- Deck Drainage
  - The deck drainage system on drilling rigs is separate from the system used to collect waste from machinery spaces.
  - Deck drainage is typically collected via pollution pans located under the rig floor. Drainage is routed to a skimmer tank and discharged via single point.
  - Deck drainage that is contaminated with oil is treated to 15 mg/l or less of oil.
  - Rigs are equipped with drip trays, curbs and gutters and other devices to prevent spilled or leaked materials from entering the water. Waste material from drip pans and work spaces will be collected in a closed system designed for that purpose; the material will be returned to the process cycle, recycled, burned, or transferred ashore by a supply boat.

- Ballast Water
  - On floating drill rigs and supply boats, ballast water is stored in dedicated ballast tanks. On fixed (jackup) drill rigs, preload water is stored in dedicated tanks. No oil is present or stored in ballast or preload tanks; thus, none will be present in the discharged ballast/preload water. If oil is suspected to be in the water, it will be tested and, if necessary, treated to ensure that oil concentrations in the discharge do not exceed 15 mg/l.
- Bilge Water
  - Prior to discharge, bilge water is treated to contain 15 mg/l or less of oil.

- Produced Fluids
  - Produced gas and fluids will be separated on the rig.
  - Gas, condensate, and produced water, if present, will be flared on the rig. The flare boom contains a special burner that atomizes the oil and/or gas and mixes it with produced water, if present, and air allowing for relatively complete combustion and minimizes air pollution.
  - Produced water found in excess of the flare capacity will be separated from the gas and condensate and treated on site, and will be passed

through a hydrocyclone to reduce the oil content to 40 mg/l or less, averaged over a 30 day period.

- Drilling Muds and Cuttings
  - It is expected that the significant majority of exploration wells and the majority of total footage drilled, would be carried out using water-based muds (WBM). In some cases, technical or safety issues may necessitate the use of non-toxic synthetic- or low toxicity mineral oil-based mud. These fluids will be treated and handled according the Offshore Waste Treatment Guidelines and the CNSOPB discharge policy.
  - Once onboard the rig, the drill cuttings are removed from the mud in successive separation stages. Each stage of separation progressively removes smaller cuttings through shale shakers, hydrocyclones, and centrifuges. After passing through the solids control system, the cleaned cuttings are then discharged overboard from a cutting chute and the mud is reconditioned and reused.

- Abandonment
  - On completion of drilling and any well testing activities, the well will be abandoned or suspended. The abandonment/suspension procedure will follow industry wide practices and procedures and be in accordance with CNSOPB regulations. The objective is to prevent the contamination of potential aquifers by hydrocarbons and to prevent the flow of hydrocarbons to the surface. This is achieved by plugging the well bore and physically isolating zones known to contain moveable hydrocarbons with cement plugs and mechanical barriers.
  - If the well is to be abandoned the well casing will be cut and removed just below the level of the seabed, and all equipment previously installed on the seabed will be removed. The casing is typically removed from at least 3 m below the seabed.
  - In the event that the well is suspended for possible future use as a production well, the well will be plugged below the sea-floor as in the case of permanent abandonment but the casing "stub" will be secured with a well-protection cap and marked in order to ensure safety of mariners.
  - After abandoning/suspending the well, a remotely operated vehicle (ROV) seabed inspection will be performed to check for seabed obstructions. This survey will also be used to identify any cutting piles on the seabed.

Project Specific Mitigation Measures

This EA identifies additional mitigation measures that are specific to exploration drilling in the study area. These measures are summarized below.

- Supply Vessels
  - Supply vessels will avoid passing close (within 2 km) to seabird colonies.
  - Acoustic impacts on marine mammals can be reduced if supply boats maintain a steady course and speed, whenever possible.
  - Except in emergencies, supply boats will avoid traversing whale sanctuaries (e.g. The Gully, Roseway Basin).

- Aircraft
  - Aircraft will fly at a minimum altitude of 600 m, whenever possible.
  - All of Sable Island will be avoided by over-flying project aircraft.
  - Aircraft will be prohibited from flying low over wildlife in order for passengers to "get a better look" or for photography.
  - Aircraft will avoid whale sanctuaries.
  - Pilots will be instructed to avoid repeated overflights of concentrations of birds and/or important bird habitats.
  - Guidelines for avoiding major seabird colonies will be based on Nettleship (1980). These Canadian Wildlife Service guidelines recommend that aircraft not approach closer than 8 km seaward and 3 km landward of a seabird colony from 1 April to 1 November.

- Birds on Structures
  - Project personnel that find seabirds and migratory birds on the drill rig or supply boats will attempt to ensure that the birds are safely released offshore.
  - Given the uncertainties and the lack of hard data on the effects of the presence of drill rigs and supply boats on birds, project personnel may be designated to monitor for birds attracted to the lights on the rig.

Accidental Spills of Condensate

Spill Response

Spills of light condensate are essentially self-containing. The slick areas are relatively small and the oil will disperse and evaporate within 24 h. In addition, the nature of this type of blowout and of the condensate precludes the use of dispersants because the oil is

already dispersed. These slicks are too thin to burn and burning may pose a hazard if there is gas and evaporated condensate in the air above the water. Burning would definitely present a hazard in the case of a surface blowout.

Booms would not contain the very thin slicks of this light hydrocarbon. Spills resulting from blowouts at the representative drilling sites will not come ashore or affect sensitive areas such as the Gully. Countermeasures may not be effective for spills discussed in this EA and are likely to be of limited value.

Reservoirs in the Laurentian Channel and St. Pierre Bank may contain heavier hydrocarbons than have been assumed in this EA. These hydrocarbons may be more amenable to standard oil spill countermeasures. Previous to drilling, proponents will make arrangements with the Eastern Canada Response Corporation (ECRC) so that, in the event of a spill, countermeasures can be deployed effectively and with minimum response time.

Contingency Plans

Contingency plans to monitor and clean up large spills of condensate have been prepared for the SOEP project (S.L. Ross 1998). These plans can be used with slight or no modification when responding to a blowout from an exploration well.

Monitoring

In the case of a blowout, monitoring should be conducted to verify that the slick behaves as predicted by the model and to identify environmental impacts. This should include sampling of eggs, larvae, benthos, sediments and surveys of birds and marine mammals. In addition measurements of wind and currents will be used to determine the location and extent of the slick.

Adult commercial species should also undergo laboratory and taste-panel tests to determine whether fish are tainted. If fish are tainted or if there is a loss to the fishery because of the perceived tainting of fish, then compensation may be paid to the affected fishers.

Environmental Protection Plan

CNSOPB regulations specify that an operator shall develop and submit an Environmental Protection Plan (EPP) that provides for the protection of the natural environment and includes:

- A description of the equipment and procedures for treatment, handling and disposal of waste material; and

- Compliance monitoring programs to ensure that the composition of spilled [discharged] waste material is in accordance with the limits specified in the EPP.

The elements of an EPP for exploration drilling are itemized in the generic EA.

APPLICABILITY OF THE GENERIC EA

This Generic Environmental Assessment provides an evaluation of the potential effects of a typical exploration drilling program conducted anywhere in the study area. It is designed to serve as background material for future site-specific Environmental Assessments of single exploration wells that will be required by the regulatory agencies, such as the CNSOPB and CNOPB. This section outlines those situations to which the generic EA is applicable and those cases that are not covered.

This generic EA assesses potential impacts that can be expected from exploration drilling on the Scotian Shelf, Laurentian Channel and St. Pierre Bank. It covers only the area shown in Figure 1. It applies to drilling conducted year-round. The assessment covers exploration drilling conducted from jackup rigs, semisubmersible rigs, and drill ships that use the methods described in the project description. Thus, drilling programs that fall outside any of these parameters, may not be fully addressed in the generic EA.

There are some situations where a detailed program-specific assessment is particularly important, even when the proposed program fully meets the criteria of this generic assessment. These situations are related to geographic areas that are known to be particularly important. Situations that have been identified to date include the whale sanctuaries at the Gully and Roseway Basin. The Gully supports significant populations of sperm whales and northern bottlenose whales and is considered to be a unique area on

the Scotian Shelf. The Gully is excluded from consideration in this EA but expanded treatment would be required for an individual EA for an exploration drilling program near the Gully Area of Interest. The Roseway Basin whale sanctuary is designed to protect the highly endangered northern right whale during the July-November period. Any exploration drilling program planning to operate in this sanctuary during this period should complete an expanded detailed individual EA for the program. Exploration programs in or near the Gully Area of Interest and Roseway Basin should have specific monitoring and research components.

If an exploratory drilling program is to be conducted in an area that is close enough to shore or to Sable Island that there is a possibility of shorelines or sensitive nearshore areas being contaminated by oil from a blowout, then a site-specific environmental protection plan that details a site-specific oil spill response program should be prepared.

The CNSOPB needs to consider the number of concurrent exploration drilling programs that can be conducted on the Scotian Shelf. Projects on separate parts of the Scotian Shelf would have negligible impacts on fisheries or other VECs. However, if adjacent drilling programs are proposed, then the individual EA should consider the combined or cumulative impacts.

This generic EA should be updated late in 2005; i.e. after a five year period. The update should focus on new information on effects of drilling and on new and refined drilling techniques and mitigation measures. If a new drilling technique is introduced before 2005, then this generic EA should be updated to assess the new technique. Similarly, an update may be necessary if significant new data on the resources or on the effects of exploration drilling become available. In particular, an update is required if oil, as opposed to condensate and natural gas, is discovered in the study area. The presence of oil would change the analyses of the effects of accidental spills on sea-associated birds.

In order to resolve potential conflicts between the fishing industry and exploration operations, the site-specific approval process should include consultations with the fishermen in the designated exploration area. The consultations in Nova Scotia waters should be facilitated by the CNSOPB Fisheries Advisory Committee and should include any other representatives of the fishing industry and persons who would be fishing in the specific exploration area. Operators should insure early consultations, notices to mariners, and a fair and efficient damage claim process.

When site-specific EAs are prepared for individual drilling programs, the EAs should document that they meet the parameters of this generic assessment. If all parameters are met, then the individual EA can focus on conditions that are specific to that site.

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