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File No: 4186-1

Data File: C:\My Documents\EA Corresp\2006\038.doc

17 February 2006

Ms. Beth Vardy
Canada-Nova Scotia Offshore Petroleum Board
1791 Barrington Street
Halifax, NS B3J 3K9

Dear Ms. Vardy:

RE: Canadian Superior Exploration Activities EAS #2006-038
Marauder (EL2415) & Marconi Blocks (EL2416)

Environment Canada (EC) has reviewed the description of the above-referenced drilling program for the Marauder and Marconi Blocks which was received on 2 February 2006. It is understood that between the years 2006 and 2013, the proponent proposes to drill exploration and delineation wells in water depths ranging from 50 to 400 m. The Marauder block is located 12 km northeast of Sable Island and the Marconi block is located 16 km southeast of the Island.

FEDERAL COORDINATION REGULATION DETERMINATION

Based on the information provided, and as indicated on the attached form (Appendix 1), it is not likely that EC has a power, duty or function in relation to the project which would trigger the *Canadian Environmental Assessment Act* (CEAA). However, EC is in possession of expertise that should be considered in the environmental assessment (EA) of proposed activities. This expertise stems from the department's mandate as set out in various statutes including the *Migratory Birds Convention Act* (MBCA)*, Species at Risk Act* (SARA)*, Department of Environment Act*, *Canadian Environmental Protection Act* (CEPA), and the *Fisheries Act* (Section 36). EC also offers guidance on several pertinent government-wide environmental policies and programs including the Toxic Substances Management Policy and Pollution Prevention: A Federal Strategy for Action. Through the Meteorological Service of Canada, EC has pertinent expertise on weather, climatology, and atmospheric science.

EA REVIEW COMMENTS

Demonstration of provisions for ensuring compliance with environmental protection legislation, and federal environmental policy statements should be described in the EA, as applicable (e.g., Appendix 2). The assessment of potential impacts and identification of necessary mitigation and follow-up could be focused accordingly.

A. Assessment Methods

The Project Description states that the EA will be based on a generic project description, given that the proponent is in early stages of project planning. The number of wells that might be drilled as part of the proposed undertaking is not specified.

A comprehensive understanding of the project, the impacts that could result, and the mitigation and follow-up programs that will be implemented should be a primary goal of the EA effort. Given the uncertainly associated with project activities, the assessment of a maximum level of project activity[1], alternative means of carrying out the project, and 'worst-case' scenarios, will be important. Consideration of these factors should provide the flexibility needed to ensure potential impacts are adequately assessed at this early planning stage.

Best available information and management practices will evolve over the course of the project's lifetime. For example, it is anticipated that changes to SARA-listed species and associated recovery strategies and action plans will be introduced over the next few years. Similarly, new technologies for minimizing discharges and emissions will likely be developed by 2013. The EA should describe how mitigation and follow-up will be managed, so as to ensure provisions for environmental protection remain current and effective.

Alternatives to the Project

The Project Description states that the alternative to the project is to not drill any wells; noting that this option is not feasible because oil and gas production cannot occur in the absence of exploration activities. Other alternatives to the project include energy conservation and the development of alternative energies. These alternatives should also be recognized in the EA.

Alternative Means of Carrying out the Project

The consideration of alternative means of carrying out the project is not mandatory at a screening level of EA, however, it can be instructive in understanding project impacts and feasible mitigation options. The consideration of alternative means is also consistent with the *Offshore Waste Treatment Guidelines* (OWTG), which require a description of "specific pollution prevention measures the operator plans to implement to reduce waste generation and discharge" (NEB *et al*., 2002, 3). It is recommended that alternative means of carrying out the proposed drilling program be assessed and include a consideration of the following:

- means that would reduce greenhouse gases and other emissions to air;
- means that would involve replacing fluids and chemicals with less toxic alternatives;
- means that would modify processes so that less materials enter waste streams, such as
    - opportunities to decrease well diameter or the length of the surface-hole section and
    - alternative means of managing synthetic-based muds[2] such as measures that reduce drilling mud volumes, reduce or substitute the toxic constituents of drilling muds, and alternative means of managing the resulting waste (e.g., re-injection of cuttings, transport to shore) recognizing that technology is being developed to remove oil from cuttings;

[1] For example, the EA should assess the maximum number of wells that could be drilled as part of project activities. Discharges should be assessed with consideration of other projects and activities in the study area.

[2] Although it is stated in the EA that the regulatory limit for SBMs is 6.9 percent oil on cuttings (p. 2-11); this should be recognized as a minimum discharge standard in Atlantic Canada and the CNSOPB can require a more stringent standard.

- means that would promote recovery, recycling and removal of materials that otherwise would go overboard, be incinerated or be taken back to shore for disposal.

The Project Description states that the reinjection of cuttings and muds is not economically viable, but does not provide any basis for this conclusion (p. 19). Given the potential for new technologies to be developed by 2013, could the reinjection of muds and cuttings be feasible before this time?

Data Gaps

The EA should identify any limitations in the availability of data for the project area. Consideration should be given to the importance of data and data collection to the assessment of project impacts.

Public Consultation

It is understood that the importance of public consultation in assessing exploration drilling programs has been recognized and will be a part all screenings (http://www.ceaa-acee.gc.ca/013/nr051117_e.htm). Public consultation that will be conducted as part of the EA for this project should be described.

B. Assessment of Cumulative Effects

Given increasing levels of activity on the Sable Island Bank, the consideration of cumulative effects should be central to the EA of the proposed drilling program. The careful consideration of cumulative effects should include attention to past, existing and proposed projects including the Canadian Superior seismic project currently under review, as well as other seismic and drilling activities, the Sable Offshore Energy Project and the Deep Panuke project proposal. Consideration of regional impact thresholds as well as monitoring needs would be valuable to the discussion. The need for regional monitoring to manage impacts in the area should also be discussed, as appropriate.

C. Consideration of Impacts to Sable Island

The Marauder block is located 12 km northeast of Sable Island, while the Marconi block is located 16 km southeast of the Island. Sable Island is a Migratory Bird Sanctuary and thus managed as a refuge for avian species. The Island is home to species at risk including the Roseate Tern and Ipswich Sparrow, as well as several endemic species. Given its special status, the EA should be shaped in part by the need to conserve and protect ecosystem values supported by the Island.

D. Consideration of Impacts Wildlife Species

Migratory Birds and Avian Species at Risk

Migratory birds are protected under the MBCA. Migratory bird species listed on Schedule 1 of SARA are also protected under that legislation. General prohibitions in the MBCA and SARA are a starting point for any EA. The EA should demonstrate how the general prohibitions will be respected and on how every reasonable effort will be made to protect birds and their habitats. In this regard, every proponent should be guided by a goal of zero bird mortality.

The EA should focus on the principal components of exploration drilling that could result in impacts to migratory birds including species at risk. These components include 1) oil releases (accidental and chronic) and 2) lights and flares. The attraction of, and increase in, predator species as a result of waste disposal practices (i.e., sanitary and food waste) is another potential impact pathway.

Project siting, design and operation practices that will be implemented upfront to avoid or minimize adverse interactions with birds should be emphasized.

Bird species that could occur in the project area should be described in the EA, recognizing the Scotian Shelf provides important bird habitat. However, a focus should be placed on those species most vulnerable to offshore drilling activities (e.g., storm petrels, Dovekies, murres) and on those time periods (e.g., seasons, time of day) when drilling activities could have the greatest impact. Population trajectories (i.e. increasing, decreasing, stable) for focal species should be presented along with an accounting of other existing and foreseeable stress sources (e.g., hunting, fishing, shipping). By assessing project-specific impacts with reference to population trajectories and other stressors (i.e., cumulative effects), impact significance and mitigation and monitoring opportunities can be best appreciated.

Oil Releases

Oil releases of all sizes have the potential to impact birds. Even small spills can have major impacts if large numbers of birds are in the area. Oiling is already a serious cumulative threat to marine bird species (e.g., an estimated 300,000 birds are oiled in Atlantic Canada each year). Impacts on the pelagic seabird community could be among the most significant consequences of oil releases, and therefore, should be a focus of the EA effort. Strategies to minimize or prevent releases should be emphasized in a mitigation program. This is particularly important given that responding to such releases, should they occur, is difficult and costly, and may be of limited value.

In demonstrating a preparedness to respond to accidents and malfunctions involving the release of oil, the EA should identify provisions for ensuring measures are implemented as rapidly as possible to eliminate or minimize resulting sheens or slicks. In any given spill event, practical constraints and other environmental sensitivities will influence the selection and implementation of appropriate response measures. Therefore, spill response planning requires attention to the circumstances under which a given response option will be enacted and the steps that must be taken if the option is to be as effective as possible. The following considerations should be factored into the development of a response plan that would help reduce impacts on seabirds:

- measures for containing and cleaning up spills (of various sizes) either at the drill site or during transport;
- equipment that would be available to contain spills;
- specific measures for the management of large and small spills (e.g., breaking up sheens);
- specific measures on how to keep birds away from oil;
- specific measures in the event that birds were oiled and/or sensitive habitat were contaminated (i.e., if birds were oiled, would the operator do nothing, or capture and kill the birds, or capture and clean the birds?); and
- the type and extent of monitoring that would be conducted in relation to various spill events.

Lights and Flares

In Atlantic Canada, night-flying seabirds are most at risk of attraction to lights and flares. Attraction to lights and flares may result in collision with- and subsequent stranding on the platform/vessel, incineration in flares, and in nocturnal circulation of platforms and the use of energy reserves.

Storm-petrels are a highly pelagic species, common to shelf areas particularly during the summer months. In the winter months, Dovekies may be attracted to lights and flares under certain

environmental conditions. Many species of land birds undertaking over-sea migrations have also been attracted to lights and flares. In summary, particularly sensitive times for impacts include (1) migration periods, (2) during the fall exodus of young Leach's Storm-Petrels and their parents from breeding colonies, and (3) under specific meteorological conditions such as fog at night. Occasionally, conditions may be such that large numbers of birds are attracted to offshore lights.

In assessing the impacts of lights and flares, a focus should be placed on the most vulnerable species and the occurrence of infrequent, but potential large-scale, stochastic events (e.g., associated with weather, migratory seasons). Mitigation should be presented as applicable. Mitigation measures could include extinguishing non-essential lights; down-shading and focussing essential lights on work areas; or changing the colour of lights. Impacts may also be mitigated by avoiding well tests that involve flaring during select times when migratory birds are particularly vulnerable to impacts (e.g., when it is foggy at night, when flocks fly by facilities).

Species at Risk

Roseate Tern

The Project Description recognizes that small numbers of endangered Roseate Terns nest on Sable Island with colonies of Common and Arctic terns, and that terns are present in the *Project area* during the breeding season from May to August, after which their young fledge and they migrate out of the Project area (p. 16). Table 3.3, however, states that Roseate Terns do not breed within the *study area*, and that the "*project area* has not been recognized as critical for this species".

The difference between the terms "project area" and "study area" should be clarified in the EA (i.e., how can Roseate Terns be present in the project area, but not the study area?). Roseate Terns can forge up to 30 km from their breeding grounds. Around Sable Island, Roseate Terns feeds on sand lance in the shallow waters off the tips of the Island. Also, Roseate Tern may be present on Sable Island from **April** until August.

Ivory Gull

Table 3.3 indicates that the Ivory Gull is listed on Schedule 1 of SARA as a species of special concern. It should be noted, however, that recent population surveys have revealed sharp declines in Northern nesting sites. The status of the species will likely be re-evaluated in the near future in light of this new information.

Table 3.3 states that "the Project area has not been recognized as critical for this species", given that the Ivory Gull breeds almost exclusively in high Arctic Coastal areas. While EC agrees with this statement, it is possible that the proponent could encounter one or more individual birds in the project area given that the Ivory Gull is occasionally observed in small concentrations in coastal and offshore areas of Nova Scotia during the winter. In fact, an Ivory Gull was recorded in Halifax Harbour in January 2005. As with most seabirds, the Ivory Gull most commonly occurs in highly productive areas of upwelling.

E. Discharges and Emissions and Effects on Environmental Quality

<u>Discharges to the Marine Environment</u>

OWTG "describe minimum standards for the treatment and disposal of specific waste streams" (NEB *et al*., 2002, 3). The EA should assess the impacts of waste discharges to determine if minimum standards are appropriate, or if more stringent mitigation is required. Discharges resulting from the

exploration drilling program should be discussed in sufficient detail to allow for a full understanding of associated impacts, with an emphasis on the potential use of substances named on Priority and Toxic Substances Lists published under the authority of CEPA. For example, the constituents of discharges (e.g., components of drilling muds) and associated toxicity data will require consideration in the EA for associated impacts to be fully assessed. If specific drilling fluids have not yet been selected, drilling systems and associated toxicity data, representative of what could be reasonably expected, should be presented in an EA and assessed with reference to the previous use of water-based muds or synthetic-based muds in Atlantic Canada.

It is understood that discharges of muds and cuttings will be modeled in support of the EA (p. 15). It will be important that modeling consider worst-case scenarios (e.g., maximum discharge volumes, storm events) and be conducted at sites with the greatest potential for impacts to Sable Island. Consideration of previous and proposed drilling in the area (e.g., existing- and proposed discharges) will likewise be important to the analysis. The Project Description indicates that currents within the Marauder Block will be highly variable (p. 21). How will this variability be taken into account in modeling and in predicting impacts?

Chemical Use

OWTG require the proponent to demonstrate how it has evaluated and selected for use the most environmentally-appropriate chemicals (NEB *et al*., 2002, p.3). A description of the types of chemicals that could be employed during various project phases (e.g., drilling, well testing, well completion) should be included in the EA. When detailed information on chemicals becomes available, it is recommended that these be identified by common name and Chemical Abstracts Service (CAS) number to facilitate verification that chemical use will comply with the intent of CEPA.

In terms of chlorine, specifically, it is recommended that the EA include a discussion of alternatives to chlorine use and whether alternatives are feasible for the proposed project. If chlorine is to be employed, the mitigation and follow-up strategy for the project should include the following elements:

1. identity of the selected chlorine product;
2. confirmation of whether the chlorine product is registered under the *Pest Control Products Act* for use as a biocide in cooling water; and
3. an evaluation of the potential for dechlorination of cooling water prior to discharge.

The Pest Management Regulatory Agency should be contacted with respect to the *Pest Control Products Act* and use of chlorine in any non-closed loop cooling water systems.

<u>Emissions to the Atmosphere</u>

Emissions associated with petroleum exploration and production activities contribute to impacts on air quality. Accordingly, emissions to air require consideration in the EA. These should be assessed in the context of contributions to cumulative environmental effects on air quality taking into account ambient standards and emissions caps. The proponent should be aware that minimizing anthropogenic contributions to climate change (e.g., emissions of greenhouse gases, loss of carbon sinks) is a priority of the Government of Canada. Guidance on the calculation of air emissions from exploration drilling is provided in Appendix 3.

If incineration is proposed, waste separation procedures, the incineration system, associated emissions and any mitigation to reduce these emissions should be described in the EA, along with a justification for on-board incineration. If there is a potential for sour gas to be encountered, this should be considered as part of the assessment.

F. Effects of the Environment on the Project

Offshore operations are often subject to harsh environmental conditions, including extreme weather events. To reduce the potential for accidental events associated with these conditions, the EA should anticipate how the physical environment can affect project operations. Specifically, the consequences of extreme environmental conditions on a project, and the potential for related impacts to environmental components (e.g., water quality, migratory birds) require consideration. Mitigation put in place to prevent the potential for adverse effects should also be discussed (e.g., project design to withstand extreme events, contingency plans in case of spills). Guidance on the assessment of environmental effects on drilling projects is attached in Appendix 4.

G. Accidents and Malfunctions

The assessment of impacts resulting from potential accidents and malfunctions is an important component of any EA of drilling activities. Lessons learned from recent spill events in Atlantic Canada merit careful consideration.

It is understood that the proponent will model spill fate and behaviour for surface well blowouts, deep water blowouts, and small platform or vessel releases. Any modeling conducted in support of the EA should take the following factors into account:

- the proximity of future wells to Sable Island;
- the well location from which discharges are most likely to move toward Sable Island given environmental conditions, and
- the influence of storm events on modeling results.

The EA should describe how environmental components that may be affected by a spill (e.g., Sable Island, migratory birds) will be taken into consideration in spill response planning.

H. Editorial Comments and Requests for Clarification

- The Project Description states that if project changes are proposed, Canadian Superior will review and discuss them with CNSOPB (p. 19). The proponent should be aware that any substantial changes to the proposed project will likely require consideration under CEAA.
- The Project Description refers to the EA of Exploration Drilling off Nova Scotia (p. 5). The EA should acknowledge that this generic EA is now dated. Any reference to previous EA documents should also acknowledge the accompanying expert review comments.
- The EA should specify the distance that helicopters will remain from Sable Island.
- It is understood that prior to geotechnical site investigations, the drill pipe will be cleaned out using fluids (p. 11). What types of fluids will be used in this process? What will be the ultimate fate of these fluids?
- It is recommended that information on well plugging techniques be provided in the EA. In addition, the report should describe how the integrity of well plugs will be monitored.
- The Project Description refers to “combustible materials” such as oily rags and paint cans (p. 15). EC prefers that such wastes be transported to shore for proper disposal. If on-board incineration of this material is still proposed, justification should be provided as to why it should be permitted.

- The description of the physical environment included in the Project Description is extremely brief. For example, waves, ice and ice accretion are not mentioned. A consideration of these factors will be important to the EA.
- Climate statistics presented in Section 3.1.2 are from the 1961-90 normals publication. More recent normals (1971-2000) are available at http://www.climate.weatheroffice.ec.gc.ca/, and some of the presented statistics can be updated. Usual information sources for climate, ice and wave data can be accessed, if desired (Appendix 4).
- The URL cited for EC 2002 in *Section 4.0: References* is not current. The proponent is referred instead to http://www.climate.weatheroffice.ec.gc.ca/.

I trust these comments will be useful in guiding preparation of the EA report. Should you have any questions, please do not hesitate to contact me at 426-8066.

Yours truly,

Original Signed by Friederike Kirstein

Friederike Kirstein
Environmental Assessment Section
Pollution Prevention Division
Environmental Protection Operations Directorate (Atlantic)

Attachments (4)

cc B. Jeffrey
K. Keddy
J. Roma
M. Thompson
B. Horne
A. Boyne
R. Gautreau
A. Gauthier
M. Hingston
G. Troke

Appendix 1

Federal Coordination Regulations
Environment Canada Section 6 Response

Project Title:	Marauder (EL2415) and Marconi (EL2416) Exploratory Drilling Activities
Location/Province:	Sable Island Bank, Offshore NS
Proponent:	Canadian Superior
Notification Date:	February 1, 2006
EAS #	2006-038

In accordance with the Federal Coordination Regulations (Section 6), under the Canadian Environmental Assessment Act (CEAA), Environment Canada (EC) has reviewed the project description, and wishes to advise you of the following:

☐ EC is likely to be a Responsible Authority (RA), and thus require an environmental assessment under Section 5 of CEAA.

Trigger Type:
☐ Proponent ☐ Land Transfer
☐ Funding ☐ Law List

Law List Item :

OR

☒ EC is NOT likely to be a Responsible Authority (RA).

OR

☐ Additional information (below) is required to determine if EC is likely to be an RA.

☒ EC is in possession of expert and specialist information that is necessary to conduct an environmental assessment of this project.

Original Signed by Friederike Kirstein	(902) 426-8066	17 February 2006
Reviewer, Environment Canada (Atlantic Region)	Telephone	Date

Appendix 2

EC Legislation and Policies

Fisheries Act

The deposit of a deleterious substance into waters frequented by fish is prohibited under Section 36. The *Compliance and Enforcement Policy for the Habitat Protection and Pollution Prevention Provisions of the Fisheries Act* is accessible at http://www.ec.gc.ca/ele-ale/policies/policies_e.asp.

Canadian Environmental Protection Act (CEPA)

CEPA and its complementary management instruments (e.g., agreements, regulations, notices, codes of practice, guidelines, policies, plans) govern such matters as environmental quality, toxic substances, hazardous waste management and disposal at sea. CEPA provisions and associated management instruments which should be taken into account include the following:

- Canadian Environmental Quality Guidelines.
- National Ambient Air Quality Objectives.
- Toxic Substances listed in Schedule 1 of CEPA and any related management instruments.
- New Substances Notification Regulation.
- Environmental Emergency Regulations.

Detailed information is accessible at http://www.ec.gc.ca/CEPARegistry/regulations. The *Compliance and Enforcement Policy for the Canadian Environmental Protection Act, 1999* can be accessed at http://www.ec.gc.ca/ele-ale/policies/policies_e.asp.

Migratory Birds Convention Act

Migratory birds, their eggs, nests and young are protected under the *Migratory Birds Convention Act* (MBCA) and complementary regulations. Migratory birds include those species listed in the Canadian Wildlife Service Occasional Paper No. 1 *Birds Protected in Canada under the Migratory Birds Convention Act* (1991). The Act and regulations include the following prohibitions:

- "no person shall disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird";
- "no person or vessel shall deposit a substance harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area".
- "no person or vessel shall deposit a substance or permit a substance to be deposited in any place if the substance, in combination with one or more substances, results in a substance - in waters or an area frequented by migratory birds or in a place from which it may enter waters or such an area - that is harmful to migratory birds".

The MBCA, regulations and related guidance are accessible at http://www.cws-scf.ec.gc.ca/enforce/law_1_e.cfm.

The department's *Compliance and Enforcement Policy for Wildlife Legislation,* which includes the MBCA, is accessible at http://www.cws-scf.ec.gc.ca/enforce/pol_1_e.cfm.

Species at Risk Act

The federal *Species at Risk Act* (SARA) is now in force with the exception of the prohibition and penalty provisions which will come into effect in June 2004. SARA affords protection to wildlife species listed in Schedule 1 of the Act.

The goal of the SARA is to prevent endangered or threatened wildlife from becoming extinct or lost from the wild (i.e., extirpated), and to help in the recovery of these species. It is also intended to prevent species of special concern from becoming endangered or threatened. Further information on SARA including listed species is accessible at http://www.sararegistry.gc.ca.

Pollution Prevention - A Federal Strategy for Action

Pollution prevention can be defined as the use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste, and reduce overall risk to human health or the environment. The strategy is accessible at http://www.ec.gc.ca/pollution/strategy/en/p4.cfm.

Appendix 3

Offshore Exploration – Emissions Inventory Template

An estimate of expected emissions is needed to justify whether any further information or actions (e.g., mitigation) are required in the assessment of potential air effects from any project. The following information is offered as a guide to the estimation of air emissions from offshore exploration.

The proponent should use this information to present both an emissions rate, and a total estimate of emissions over the lifetime of the project. As the nature of offshore exploration can result in significant uncertainties in these initial estimates, conservative estimating methods should be used, especially when estimating flaring. Once work is underway, it would be prudent to include provisions to report emissions based on actual operating conditions (e.g., follow-up).

Flaring

If well testing occurs, flaring is the largest likely emission source from exploration drilling, however, it may also be the most difficult to estimate. Emissions estimates from flaring are dependent on the following:

- Estimated flaring rate (cubic metres of gas flared/day);
- Estimated flaring time (hours/days of flaring);
- Estimated gas composition.

Previous work (e.g., the EA of the Devon exploration project) has developed a set of emission factors that are appropriate to use for an initial emissions estimate:

NOx	1.1	kg/1000 m^3
SO_2[1]	0.27*(H_2S in ppmv/100)	kg/1000 m^3
$PM_{2.5}$	0.61	kg/1000 m^3
Benzene	0.0025	kg/1000 m^3
Total PAHs	0.000048	kg/1000 m^3
CO_2 (CO_2E)	1913	kg/1000 m^3
CH_4 (CO_2E[2])	0.04*23	kg/1000 m^3
N_2O (CO_2E[2])	0.04*296	kg/1000 m^3

Notes: 1. Assumes all H_2S is converted to SO_2 in the flare.
2. CO_2 Equivalent – takes differing warming potentials into account.

The following guidance should be used in estimating flaring rates and volumes:

- If previous wells have been drilled in the area, the maximum flaring rate of these well should be used as the estimated flaring rate. If there has not been any previous drilling in the area, the design capacity of the flaring equipment should be used as a conservative estimate.
- When estimating the total emissions for the project, the maximum flaring time should be used. If work is taking place in an area where previous exploration has occurred, the local maximum may be an appropriate surrogate.
- Where possible, H_2S concentrations in the flared gas should be estimated using maximum values found as part of previous exploration in the area. Otherwise an industry average may be used, along with a description of the H_2S range that might be expected.

Drilling Platform

Emissions from the drilling platform and associated equipment (generators etc.) would likely be the next largest emissions source. A reasonable estimate of emissions from this source can be derived from the horsepower (kilowatts) of power being used on the platform. This information should be readily available as

part of the rig specifications. A conservative estimate would use a 100% power load for the equipment, however, if operating conditions are better defined this may be adjusted appropriately.

Emission rates for all of the pollutants have been derived from empirical data using regression techniques (see note at end for reference). With the exception of sulphur dioxide (SO_2), this analysis has produced emission rates in the form:

Emissions Rate (g/kW-hr) = a(fractional load)$^{-x}$ + b.

(Note: as we are assuming a 100% fractional load, the term (fractional load)$^{-x}$ would be equal to 1 and is somewhat redundant – in this case it is an artifact of the equation).

Values for the variables are given in the table below.

Emission Factor Variables

Pollutant	Coefficient (a)	Exponent (x)	Intercept (b)
Carbon dioxide (CO_2)	44.1	1	648.6
Carbon monoxide (CO)	0.8378	1	n/s
Nitrogen oxides (NO_x)	0.1255	1.5	10.4496
Particulate Matter (PM)	0.0059	1.5	0.2551

n/s - not statistically significant

Sulphur dioxide emissions are dependent on the sulphur content of the fuels being used. If the sulphur content of the fuel to be used is not known, it would be appropriate to use 2.7% for heavy fuel oil and 0.5% for diesel. An estimate of these emissions therefore requires a factor of a slightly different form:

Emissions Rate in g/kW-hr = 2*(Sulphur Content * 219.83).

The emissions rates are then multiplied by the power rating and the appropriate operating time to come up with an emissions estimate.

Supply Vessels

It is now recognized that marine vessels can make a significant contribution to total emissions. Emission estimates from these vessels can be made quite simply based on the horsepower (kilowatt) ratings and operating modes. The operating mode and corresponding fractional loads are as follows:

Cruise	80%
Slow cruise	40%
Maneuvering	20%.

Emission rates for all of the pollutants have been derived from empirical data using regression techniques (see note at end for reference). With the exception of sulphur dioxide (SO_2), this analysis has produced emission rates as a function of fractional load in the form:

Emissions Rate (g/kW-hr) = a(Fractional Load)$^{-x}$ + b.

Values for the variables are given in the table below.

Emission Factor Variables

Pollutant	Coefficient (a)	Exponent (x)	Intercept (b)
Carbon dioxide (CO_2)	44.1	1	648.6
Carbon monoxide (CO)	0.8378	1	n/s
Nitrogen oxides (NOx)	0.1255	1.5	10.4496
Particulate Matter (PM)	0.0059	1.5	0.2551

n/s - not statistically significant

Sulphur dioxide emissions are dependent on the sulphur content of the fuels being used. If the sulphur content of the fuel to be used is not known, it would be appropriate to use 2.7% for heavy fuel oil and 0.5% for diesel. An estimate of these emissions therefore requires a factor of a slightly different form:

Emissions Rate in g/kW-hr = 2(Sulphur Content)((14.12/Fractional Load) + 205.71).

The emissions rates were then multiplied by the power ratings of the ship (both propulsion and auxiliary power) and the appropriate times to come up with an emissions estimate.

General Transportation

While transportation (helicopter) of people and supplies to and from the exploration platform is likely to represent only a small percentage of the total emissions, they should be given some recognition in the EA document. Detailed emission calculations for this source are not required, however, the estimated number of trips (crew changes, supplies) and the type of aircraft (i.e. helicopter type) planned for use should be indicated.

Malfunctions and Accidental Events

Release of emissions to the atmosphere is included among environmental impacts of malfunctions or accidental events. The EA should include a discussion of potential emissions resulting from these events in conjunction with estimated duration times.

Note: The emission calculations for the drilling platform and for the supply ships were derived from the US EPA's Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data – EPA420-R-00-002, February 2000.

Appendix 4

Guidance on the Consideration of the Effects of the Environment on a Drilling Project

Description of the Physical Environment

The description of the physical environment in an EA should focus on extreme events, as it is these conditions that require consideration in project design. Adequate climate and/or ice information should be provided to validate environmental impact statements. Some reliance on existing documents to support the impact analysis is appropriate; providing that each EA contains sufficient information to provide readers with an understanding of extreme meteorological conditions (i.e., each EA must ultimately be a 'stand alone' report). The following elements will require particular attention in the EA of offshore exploration projects:

- wind
- waves
- sea ice and ice bergs
- ice accretion (i.e., from freezing spray and freezing precipitation).

Other meteorological elements are also important for exploration drilling. Freezing spray, for example, is partially dependent on air- and water temperatures. Water temperatures and salinity would likely affect spill and sediment transport and corresponding data may therefore be required to support impact predictions.

For each relevant climate and/or ice element, an EA should discuss its influence on and importance to the project (e.g., sensitivity of the project to variations of the element). The utility of available data, (e.g. quality, record length, representativeness) and corresponding influence on impact predictions should also be considered.

Analysis of the Effects of the Physical Environment on the Project

An EA for an exploration drilling project should demonstrate how the potential for extreme environmental events has been taken into account in project planning. Specially, an impact analysis should include attention to:

(1) how the physical environment can adversely affect project operation;
(2) how this could have consequences for the environment, infrastructure and human health; and
(3) related mitigation that should be in place.

As an example, the impact analysis could include information on the operating window required to safely conduct specific exploration activities (e.g., thresholds for wind and wave conditions suitable for operation). This analysis could be linked to a discussion of potential environmental consequences of extreme events, related mitigation and contingency plans in case of accidental events.

Effects of Climate Change on the Project

Although exploration drilling is a short-term activity, it could be acknowledged that extreme events may be becoming more severe. If projects are designed to accommodate more extreme events, this should be noted in the EA.

Data Sources

Climatological data can be found on the World Wide Web at http://www.climate.weatheroffice.ec.gc.ca/, and value-added data can be obtained by consulting EC's Atlantic Climate Centre. Contact:

Atlantic Climate Centre
77 Westmorland Street, Suite 260
Fredericton, New Brunswick E3B 6Z3

Phone: New Brunswick: (506) 451-6006
Phone: Nova Scotia and Prince Edward Island: (902) 426-9226
Phone: Newfoundland and Labrador: (709) 772-4695
Fax: (506) 451-6010
E-Mail: climate.atlantic@ec.gc.ca

Hydrometric station data, both archived and real time, can be found on the World Wide Web at http://www.wsc.ec.gc.ca/, or by contacting:

Guy R. Leger CET
77 Westmorland Street, Suite 260
Fredericton, New Brunswick E3B 6Z3

Phone: (506) 452-4021
Fax: (506) 452-3003
E-mail: guy.leger@ec.gc.ca

Sea ice data can be obtained by contacting EC's Canadian Ice Service. The Ice Service website is http://ice-glaces.ec.gc.ca/, or one can contact:

Canadian Ice Service - Client Services
373 Sussex Drive, Block E, Third Floor
Ottawa, Ontario K1A 0H3

Phone: (613) 996-1550 or toll-free in Canada 1-800-767-2885
Fax: (613) 947-9160
E-Mail: cis-scg.client@ec.gc.ca

Wave data can be obtained from MEDS (Marine Environmental Data Service). The MEDS website is http://www.meds-sdmm.dfo-mpo.gc.ca/, or one can contact:

Marine Environmental Data Service
Department of Fisheries and Oceans
W12082 - 200 Kent Street
Ottawa, Ontario, Canada K1A 0E6

General Inquiries: (613) 990-6065
Request Services: (613) 990-0243
Fax: (613) 993-4658
E-mail: services@meds-sdmm.dfo-mpo.gc.ca