Husky Exploration Drilling Project: Response to Information Requirements and Required Clarifications from Environmental Impact Statement Review

Stantec

Prepared for:
Husky Energy

Prepared by:
Stantec Consulting Ltd.
141 Kelsey Drive
St. John’s, NL A1B 0L2
Tel: (709) 576-1458
Fax: (709) 576-2126

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1.0 RESPONSES TO INFORMATION REQUIREMENTS

1.1 PROJECT DESCRIPTION

1.1.1 Information Requirement: IR-01

Reference to EIS:

Section 2.5.2 Drilling

Context and Rationale

Section 2.5.2 of the EIS states that more than one well may be drilled simultaneously. It is unclear throughout the effects analysis how simultaneous drilling was considered. For example potential overlapping effects of dual sources of noise or light were not assessed in the analysis of effects. No further information is provided, nor does the effects analysis consider project effects from batch drilling.

Elsipogtog First Nation stated that while there is no food, social and ceremonial (FSC) fishery within the project area, species of FSC value may migrate through the study area. It was noted that mitigation measures proposed apply primarily to minimizing direct conflict with harvesters, Elsipogtog First Nation required a discussion of measures to be taken to avoid behavioral impacts to migrating species from numerous mobile offshore drilling units (MODUs) operating simultaneously.

Specific Question of Information Requirement

Provide the following information on the proposed Project and associated environmental effects:

- clarify circumstances under which simultaneous drilling could occur; and
- provide additional information assessing the environmental effects of simultaneous drilling on relevant valued components (VCs).

Update proposed mitigation and follow-up, as well as significance predictions, as applicable.

Response

Simultaneous exploration drilling is not anticipated within any one Exploration Licence (EL) but is likely to occur within the Project Area. The Project Area encompasses the White Rose, Terra Nova, Hibernia, and Hebron development projects as well as multiple ELs and Significant Discovery Licences.

Simultaneous drilling has been assessed as part of the cumulative effects assessment for each of the valued components in 9.2 of the EIS.

References

N/A

1.1.2 Information Requirement: IR-02

Reference to EIS:

Section 2.5.2 Drilling

Context and Rationale

Section 2.5.2 of the EIS states that each well is anticipated to take up to approximately 80 days to drill but can be completed much quicker. No further information is provided on what factors may contribute to drilling more quickly (or slowly).

Specific Question of Information Requirement

Discuss the factors that contribute to the length of time it takes to drill a well, including specific information on the anticipated impacts harsh weather may contribute.

Response

The length of time required to drill a well is influenced by many factors. Some of the main factors are the measured length of the well, the anticipated lithology that will be drilled, the anticipated formation pressures, and the water depth at the spud location.

Weather can influence the time required to drill a well. During unfavourable weather, it may be necessary to take the appropriate steps to secure and disconnect from the well. This would result in "nonproductive time", which would extend the time required to drill a well.

The estimated time required to drill a well was estimated at 80 days based on historical operating data in this region.

References

N/A

1.1.3 Information Requirement: IR-03

Reference to EIS:

Section 2.5.2.3 Chemical Use and Management

Context and Rationale

The EIS Guidelines states the proponent should identify the quantity and type of chemicals (or constituents) that may be used in support of the proposed Project that are:

- included on the Canadian Environmental Protection Act's List of Toxic Substances;
- not included on the OSPAR Pose Little or No Risk to the Environment (PLONOR) list of chemicals and have a PARCOM Offshore Chemical Notification Scheme Hazard Rating of A, B or purple, orange, blue, or white; or
- not included on the PLONOR list of chemicals and have not been assigned a PARCOM Offshore Chemical Notification Scheme Hazard Rating.

In addition, alternatives to the above-referenced chemicals should be discussed.

Section 2.5.2.3 of the EIS lists the maximum amount of reagents and petroleum products potentially stored on Husky's current MODU.

It is not clear that the chemicals and volumes on the current MODU are representative of an exploration drilling project. Alternative chemicals (e.g. through alternative means of operating or use of less-toxic alternatives) are not discussed.

Specific Question of Information Requirement

Provide the rationale for representing the chemicals and volumes for the Project with those that are used on the current MODU. Include a discussion on alternative means or use of less-toxic alternatives.

Revise the reagents and volumes that may be used and assess associated environmental effects, including accidents and malfunctions, as applicable.

Response

The discussion on quantity and type of chemicals used that have components on the CEPA List of Toxic Substances are provided in Table 2.24 and discussed in Section 2.9.2.

The current MODU is fit-for-purpose for current and planned operations in the region. As a result, if a different MODU was used for the scope of this Project, it would have characteristics like the current MODU (i.e. similar tank capacities and bulk storage). As a result, the current MODU is viewed as a reasonable representation of a MODU that may be contracted in the future to execute the scope of this Project.

The chemical and volumes presented reflect those on the MODU currently under contract to Husky for exploration and development wells. These chemicals undergo screening to reduce potential risk before they are permitted for use. Chemicals are substituted regularly for less toxic alternatives, as they become available, but these are the chemicals and volumes currently in use.

A revision of the reagents and volumes that may be used is therefore not required.

References

N/A

1.1.4 Information Requirement: IR-04

Reference to EIS:

Section 2.5.1 Well Site / Geohazard / Geotechnical Surveys

Context and Rationale

Section 2.5.1 of the EIS states that wellsite/geohazard/geotechnical surveys are conducted in advance of initiating drilling to identify and avoid unstable areas and hazards or potential hazards in the immediate vicinity of proposed well locations. The distinction between each of these activities is unclear.

Specific Question of Information Requirement

Provide a detailed description (including objectives, timing, and means) of each of the following:

- wellsite surveys;
- geohazard surveys; and
- geotechnical surveys.

The descriptions for each survey types should encompass all of the activities that may be undertaken by the proponent.

Response

The terms wellsite and geohazard surveys are used interchangeably to describe data collection surveys with the purpose of identifying potential drilling hazards. Specifically, these surveys identify unstable areas beneath the seafloor (e.g., shallow gas deposits) and hazards (e.g., large boulders, debris). These surveys may involve mapping of the seabed through the use of sub-bottom profiler, 2D high resolution seismic, multibeam echo sounder, side scan sonar, remotely controlled vehicles and other non-invasive equipment. Wellsite/geohazard surveys are conducted from a vessel months to years in advance of the well and typically require five to seven days per well site.

Geotechnical surveys are sometimes required to collect information and data on the geology and geomorphology of an area of interest. The geotechnical survey may require borehole drilling and or sediment sampling, if a jack-up rig was to be used, for example. Geotechnical surveys are conducted from a vessel months to years in advance of the well and typically require a few days per well site.

References

N/A

1.1.5 Information Requirement: IR-05

Reference to EIS:

Section 2.5.5 Decommissioning and Abandonment

Context and Rationale

Section 2.5.5 of the EIS states that in the case of well abandonment, Husky's preferred method of wellhead severance is to use a mechanical cutting system but that in some circumstances this method may not be effective and shaped charges must be used. The proponent states:

If shaped charges must be used, then the design objective will be that only the size of charge needed to achieve the task in hand will be used. Use of charges will only be used after the Drilling Superintendent, the C-NLOPB [Canada-Newfoundland and Labrador Offshore Petroleum Board] and any of its relevant advisory agencies thoroughly review the application; approval is granted on a case-by-case basis.

No information is provided on the likely size and type of shaped charges that may be used, nor how recovery would be completed.

Specific Question of Information Requirement

Provide a description of the likely size and type of shaped charges to be used in cases where necessary for well abandonment. Describe recovery of the wellhead after use of shaped charges.

Response

After a review of the currently available technology, Husky no longer considers the use of shaped charges for well decommissioning or abandonment as an option.

References

N/A

1.1.6 Information Requirement: IR-06

Reference to EIS:

Section 6.2.10.3.1.5 Well Abandonment; Section 2.5.5 Decommissioning and Abandonment

Context and Rationale

Section 6.2.10.3.1.5 states “the final design and method for well abandonment has not been finalized; however, all activities and methods regarding well abandonment will be conducted in compliance with all C-NLOPB applicable regulations and guidelines.”

The statement is in contrast to Section 2.5.5 of the EIS, which indicates that the wellhead will be abandoned by plugging using a cement mixture and the well removed so there are no protuberances above the seabed.

In addition, Section 2.5.5 of the EIS describes suspension or abandonment as two possible scenarios for exploratory wells, stating that operators are required to provide detailed plans to the C-NLOPB for monitoring of suspended wells, but that there is no requirement for on-going monitoring of abandoned wells.

The NunatuKavut Community Council stated that monitoring and inspection of abandoned wells would be important to verify the integrity of the wellhead.

Specific Question of Information Requirement

Confirm that all wellheads, when abandoned would be below the surface so that nothing protrudes above the seabed.

With respect to the activities associated with well abandonment and/or suspension, provide the following information:

- Specify the anticipated lifespan of the well abandonment and suspension techniques. Explain whether they would be sustainable to ensure the long-term protection of the environment, describing how integrity of the abandoned or suspended well is ensured.

Describe monitoring, including frequency, of suspended and abandoned wells.

Response

An abandoned well, is a well that has been permanently plugged. A suspended well, is a well in which drilling or production operations have temporarily ceased. All suspension and abandonment cement plug designs are validated by rigorous lab testing to ensure they are fit-for-purpose based on the specific well conditions / environment. Industry lab testing procedures, such as API, are followed. Lab testing results are reviewed and approved prior to wellbore suspension and/or abandonment operations.

Wells are permanently abandoned and designed in compliance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (Government of Canada 2014) to ensure long-term environmental protection. In general, a combination of cement plugs and mechanical plugs are used during suspension and abandonment operations. Cement plugs are designed to be a long-term permanent barrier. They are designed for the wellbore environment (i.e., temperature and pressure) on a well-by-well basis. Well abandonment will involve removing (cutting) the wellhead and any applicable casing(s) at a depth below the natural seabed so that they do not protrude above the seabed.

In the case of a well suspension, cement or mechanical plugs are installed to prevent the influx of formation fluids into the well as an interim measure prior to decommissioning. Operators are required to provide detailed plans for monitoring suspended wells to the Canada-Newfoundland and Labrador Offshore Petroleum Board and are also required to provide information regarding the suspension or abandonment methods to ensure the wells are adequately isolated, which in turn, will prevent hydrocarbons from entering the environment.

Abandonment is intended to be permanent / indefinite and there is no requirement for monitoring, which aligns with the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (Government of Canada 2014).

References

Government of Canada. 2014. *Newfoundland Offshore Petroleum Drilling and Production Regulations*. Available online: http://laws-lois.justice.gc.ca/PDF/SOR-2009-316.pdf. Accessed January 2019.

1.1.7 Information Requirement: IR-07

Reference to EIS:

Section 5.2.3.4 Boundaries

Context and Rationale

Section 5.2.3.4 of the EIS describes spatial boundaries.

The project area is defined as the immediate area within which project activities and components may occur. Well locations have not been identified but will occur within exploration licences (ELs) 1151, 1152 and 1155 within the project area. The spatial boundary of the project area has been delineated to account for all activities related to drilling a well, including transit of Offshore Supply Vessels (OSVs) and helicopter traffic to/from St. John's and vessel traffic associated with geohazard/environmental surveys.

The study area is described as the area within which residual environmental effects from operational activities and accidental events may interact cumulatively with the residual environmental effects of other past, present, and future (certain or reasonably foreseeable) physical activities.

Figure 2.1 shows the project area boundary extending into the St. John's area, reflecting vessel routes. However, the study area does not extend to the Newfoundland coast and is therefore not inclusive of the entire project area. It is not clear how a study area that does not encompass the full project area considers the potential effects of routine shipping activities, as well as potential accidents and malfunctions in the nearshore environment.

Specific Question of Information Requirement

Discuss the rationale for a study area that is not fully inclusive of the project area. Discuss how the area potentially effected by routine shipping activities and potential accidents and malfunctions are accounted for in the spatial boundaries of the environmental assessment.

Response

The Study Area boundary has been corrected to be fully inclusive of the Project Area, by extending the Study Area to the Newfoundland coast (see Figure 1). The EIS has considered the potential effects of routine shipping activities, as well as potential accidents and malfunctions in the nearshore environment, where applicable.

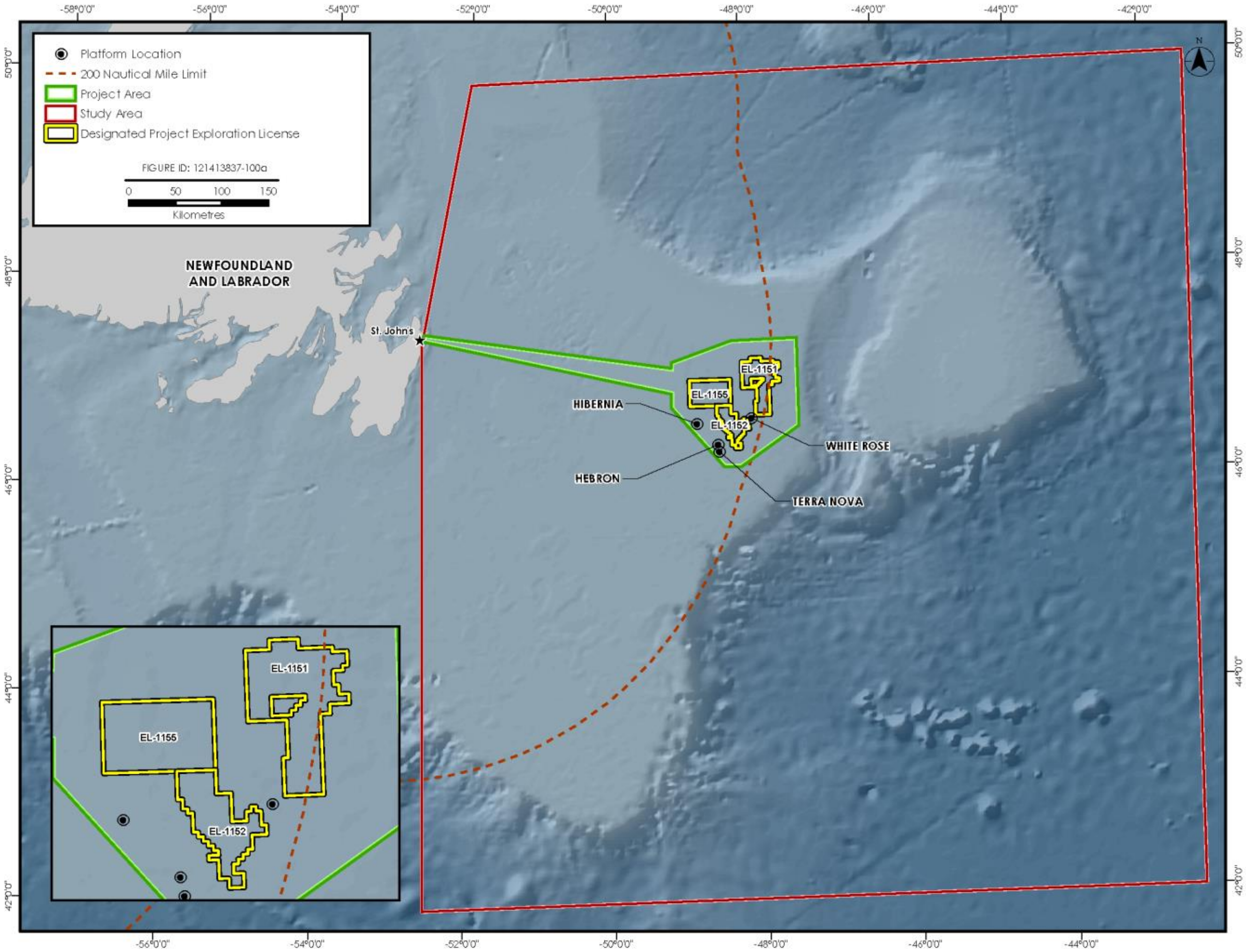


Figure 1 **Husky Exploration Drilling Project Area and Study Area**

References

N/A

1.1.8 Information Requirement: IR-08

Reference to EIS:

Section 1.1 Project Overview

Context and Rationale

Section 1.1 of the EIS states that "[t]hese activities will be supported by Husky's existing infrastructure (Harvey's Marine Base, OSVs, and helicopters)... If a different contractor is selected for supply base services over the duration of this Project, all permitting, and approvals will be the sole responsibility of the supplier and therefore not included in the EIS." Miawpukek First Nation (MFN) indicated that the proponent has not adequately described the vessel traffic, port use and potential navigation impacts in and around other harbours on the south shore of Newfoundland.

Specific Question of Information Requirement

Confirm that potential transit routes would originate only in St. John's, not in other ports in Eastern Newfoundland. If other ports and transit routes are to be included, update the effects analysis and mitigation, as appropriate.

Response

Supporting vessels for the Husky Exploratory Drilling project will use the port of St. John's whenever it is available and able to accommodate the needs of supporting vessels. Should facilities within the port of St. John's be unavailable or unable to accommodate the needs of supporting vessels, other ports may be considered.

References

N/A

1.2 ALTERNATIVE MEANS

1.2.1 Information Requirement: IR-09

Reference to EIS:

Section 2.5.4 Well Testing; Section 2.9.1.5 MODU Lighting and Flaring

Context and Rationale

Section 2.5.4 of the EIS states that wells may be tested by multiple methods to gather additional details on potential reservoir and to assess the commercial potential of a discovery. The proponent states that two drillstem tests may be expected to be required from ten exploration wells.

Other offshore exploration projects within the region have identified (depending on the type of data required) formation testing while tripping as an alternative to well testing, which does not require flaring. This has not been presented by Husky as an alternative.

In addition, it is noted in Section 2.9.1.5 of the EIS that when well flow testing is carried out, flaring is required to safely dispose of hydrocarbons that may come to the surface. It is not clearly explained why flaring is the only option to safely and efficiently dispose of hydrocarbons that come to surface. Clarification is required on the technical feasibility of reduced flaring.

Specific Question of Information Requirement

In accordance with Agency guidance on evaluation of alternative means, provide the following:

- clarification on the technical feasibility of reduced flaring; and
- clarification if well testing while tripping or any other type of test were considered as alternative means.

If reduced flaring and/or well testing while tripping or another type of well test was considered, provide an assessment of the alternative means: how they are carried out, how they might interact with the environment, and potential environmental effects. If well testing while tripping was not considered, provide a justification as to why it was not identified as an alternate to well testing with flaring.

Response

Husky continues to evaluate alternative well test technologies including but not limited to formation testing while tripping. The reservoir information provided by the nominated "well testing" technology will be assessed on a well-by-well basis so that sufficient information is provided to characterize the reservoir (when evaluated along with other data collected during the drilling and formation evaluation phases) to justify the economic investment for a large-scale project.

Should Husky elect to perform a drill stem test, Husky would endeavor to reduce flaring through program optimization, but the facilities used to perform such tests do not have storage capacity to capture produced hydrocarbon fluids. Husky will use a high-efficiency burner for any potential drill stem test. The burner has been extensively tested by a third-party environmental company in Norway and was given a 99.9% efficiency rating.

References

N/A

1.2.2 Information Requirement: IR-10

Reference to EIS:

Section 2.6.2 Other Waste

Context and Rationale

The EIS Guidelines require the proponent to include a discussion on how wastes and potential associated toxic substances would be minimized, and any alternatives that would enable the proponent to achieve waste management objectives, and adopt best practices in waste management and treatment.

Section 2.6.2 of the EIS provides information related to the treatment and testing of waste to ensure compliance with guidelines and/or requirements, but provides no discussion of how the proponent would minimize waste or possible alternatives that would allow achievement of defined objectives.

Specific Question of Information Requirement

With respect to waste generated and disposed of from the exploration activity, provide additional information on the alternatives that were examined with respect to waste management, and the measures that were considered with respect to minimizing waste generated.

Response

Husky is committed to an active program to evaluate waste management alternatives. Husky has an active program to reduce or, where possible, eliminate the discharge of waste to the environment.

The program focuses on the following objectives:

- Use of environmentally favourable chemicals for a specific application where possible within all operations
- Use of the Lowest Effective Concentration of a chemical slated for use in a system that is designed to discharge to the sea

These objectives can be achieved through:

- Annual reviews of material balance of drilling and production chemicals, and on a per well basis
- Risk ranking of chemicals that are discharged under the Husky Chemical Management System to evaluate toxicity
- Reviews of industry best practices in chemical technology
- Management of key drilling and production contracts and contractors

References

N/A

1.3 AIR QUALITY

1.3.1 Information Requirement: IR-11

Reference to EIS:

Section 2.6.3.1. Atmospheric Emissions; Section 6.6.10.3 Characterization of Residual Project-related Environmental Effect

Context and Rationale

The EIS Guidelines require an estimate of the direct greenhouse gas (GHG) emissions associated with all phases of the Project. The proponent is required to justify all estimated emissions and emission factors used, provide the estimation or derivation method, and disclose and describe all assumptions and emission intensity factors used.

Section 2.6.3.1 of the EIS provides emission estimates for the Project based on the White Rose Extension Project (WREP) Air Emissions Study, 2012, and considers them representative of the emissions that could be released from the proposed Project. It is not clear how the WREP emissions data is applicable to estimate the emissions for an exploration drilling project given that WREP was a production project and the current project is for exploration. Items that are unclear include:

- the GHG estimates in the EIS document are for a MODU during operation activities rather than an exploration MODU. Information on emission factors used in the estimation of GHGs from MODU operation (CO_2, CH_4, N_2O) in the EIS document or the corresponding referenced report were not adequately described;
- power generation GHG estimates in Table 3-13 in Appendix B are not included in the list of activities in Table 2.14 of the EIS;
- Section 2.4.3.3 of the EIS states that an average of five helicopter trips per week from St. John's to the MODU is anticipated. However, predicted helicopter air emissions for the WREP are based on three round trip flights per week;
- Section 6.6.10.3 of the EIS states that flaring during exploration drilling is required during a drillstem test, and that two drillstem tests are anticipated over the life of the Project. It is not clear how flaring emissions for an exploration drilling is comparable to the predicted flaring emissions of the WREP; and
- Table 2.14 of the EIS provides the estimated GHG emission values on an annual basis. The assumptions are not clear as to the number of wells to be drilled and the number of drillstem tests to be conducted in that period. Provide assumptions and supporting evidence for emission estimates, including specific emission factors used. Discuss the applicability of using emission estimates from a production project WREP for the current exploration Project.

Specific Question of Information Requirement

Provide the rationale for not including power generation (Table 3-13 in Appendix B) in the GHG emission estimates in the EIS. Update if this is an omission.

Update the predicted GHG emissions as appropriate based on the additional information above and the anticipated number of helicopter trips.

Provide the assumed composition being flared, volumes being flared, and emission factors used to obtain the final total emission rates.

Clarify the units in Table 2.14, explicitly state the number of wells drilled assumed, the number of helicopter trips assumed, the number of vessel trips assumed, the number of drillstem tests assumed, and the amount of power generated assumed. Standardize these units to a specific time frame (e.g. annually).

Response

The WREP environmental assessment included an option for drilling by mobile offshore drilling unit (MODU). With appropriate scaling for the reduction in MODU operational time, the emissions data is directly applicable to the emission estimates for an exploration drilling project.

The GHG emissions from power generation, as presented in Table 3-13 in Appendix B, were not included in Table 2.14 of the EIS as these emissions represent power generation on a gravity-based platform not power generation on a MODU. Emissions from power generation on the MODU were included within the emissions presented in the EIS for the MODU (Section 2.6.3.1.3 Table 2.14 of the EIS).

The GHG emissions presented in Table 2.14 of the EIS for “operation of helicopters” were based on three trips per week. The updated emissions for five trips per week have been included in a revised Table 2.14 (Table 1).

As the Project involves exploration drilling only, the only time flaring would occur is during a drill stem test. During the life of the Project, up to 10 wells could be drilled, each taking up to approximately 80 days to drill to total vertical depth (TVD), and two wells may undergo drill stem testing which would require short-term flaring. The greenhouse gases associated with this activity would be similar to those reported by other offshore operators, including Equinor Canada Ltd. for their proposed Flemish Pass Exploration Drilling Program (Equinor Canada Ltd. 2017). The emissions from flaring during a drill stem test in Table 2.14 of the EIS have been updated (refer to Table 1) and are based on the estimates provided by Equinor (Statoil Canada Ltd. 2017).

The units in Table 2.14 of the EIS have been clarified in Table 1. Details pertaining to the assumptions used to calculate the emissions provided in Table 2.14 of the EIS were included in Appendix B and represent the best available information.

Table 1 Representative Greenhouse Gas Emissions from Offshore Exploration Activities

Activity	**CO_2 (tonnes/yr)**	**CH_4 (tonnes/yr)**	**N_2O (tonnes/yr)**	**CO_{2eq} (tonnes /yr)**
MODU Operation	14,800	0.83	1.01	15,122
Operation of Support Vessel [A]	47,485	0 [(A)]	0 [(A)]	47,485
Operation of Helicopters	672	0.15	0.07	697
Flaring *	26,155		0	26,155
Total	89,112	0.98	1.08	89,459

Source: Husky Energy 2012; Equinor Canada Ltd. 2017
CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_{2eq} = carbon dioxide equivalent units
A Emissions for CH_4 and N_2O have been determined to be minimal
* emission estimates are based on data from “Equinor Canada Ltd. 2017” and assumes that one well could be tested in a year, and that short-term flaring could occur for up to five days (5,223 tonnes CO_{2eq}/day)

References

Husky Energy. 2012. Husky Energy White Rose Extension Project Environmental Assessment. Prepared by Stantec Consulting Ltd., St. John’s, NL, for Husky Energy. St. John’s, NL.

Equinor Canada Ltd. 2017. Flemish Pass Exploration Drilling Program – Environmental Impact Statement.

1.3.2 Information Requirement: IR-12

Reference to EIS:

Section 2.0 Project Description; Section 2.6.3.1 Atmospheric Emissions

Context and Rationale

Section 3.1 (Part 2) of the EIS Guidelines requires the proponent to describe the contributions of the Project on atmospheric emissions, including activities such as routine or upset flaring, routine drilling, testing, shipping, etc. However, volatile organic compound (VOC) emission estimates are not presented in the EIS even though VOC emission factors are readily available.

Specific Question of Information Requirement

Provide an estimate of total VOC emission from the sources identified in Table 2.7, or provide a rationale for the exclusion of the total VOC emissions in the assessment.

Response

There are also no ambient air quality standards for VOCs under the Newfoundland and Labrador *Air Pollution Control Regulations* (Office of the Legislative Counsel Newfoundland and Labrador 2004) or the Canadian Ambient Air Quality Standards (CCME 2014).

Using VOC emission factors, the average annual emissions from the operation of the semi-submersible was estimated to be 18.7 tonnes. This estimate was based on three years of operational data and assumes that the drill rig operates continuously. As the Project entails up to 80 days drilling for each of 10 wells drilled over seven years, this estimate is considered highly conservative and includes all potential sources.

References

CCME. 2014. Canadian Ambient Air Quality Standards (CAAQS). Available online at: https://www.ccme.ca/en/current_priorities/air/caaqs.html.

Office of the Legislative Counsel Newfoundland and Labrador. 2004. *Air Pollution Control Regulations, 2004* under the *Environmental Protection Act* (O.C. 2004-232). Available online at: https://www.assembly.nl.ca/legislation/sr/regulations/rc040039.htm.

1.4 FISH AND FISH HABITAT

1.4.1 Information Requirement: IR-13

Reference to EIS:

Section 4.2.1.2 Phytoplankton

Context and Rationale

The seasonal distribution and abundance of phytoplankton (measured as chlorophyll a concentration) in the project area is not provided in the EIS.

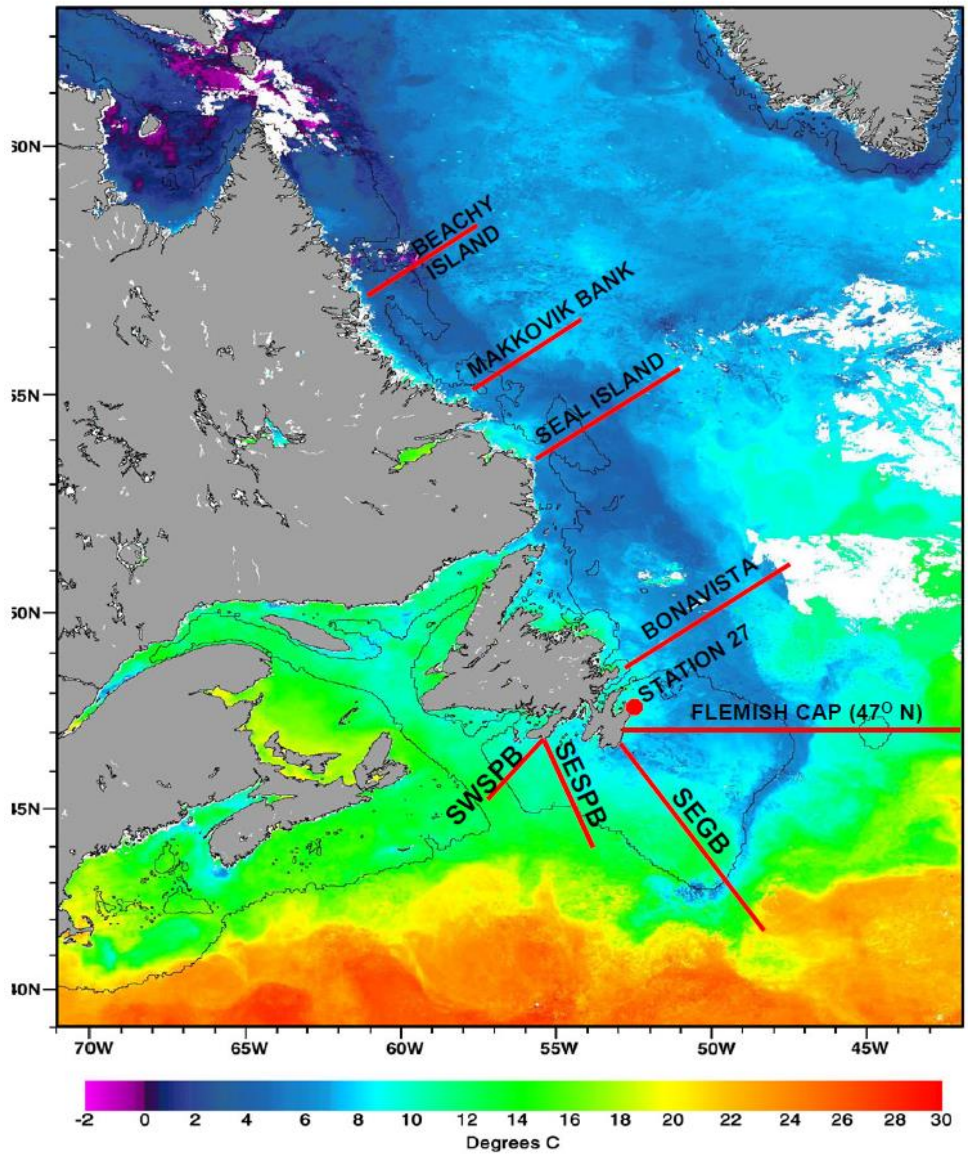
Specific Question of Information Requirement

Provide data showing the seasonal distribution and concentration of phytoplankton in the project area.

Response

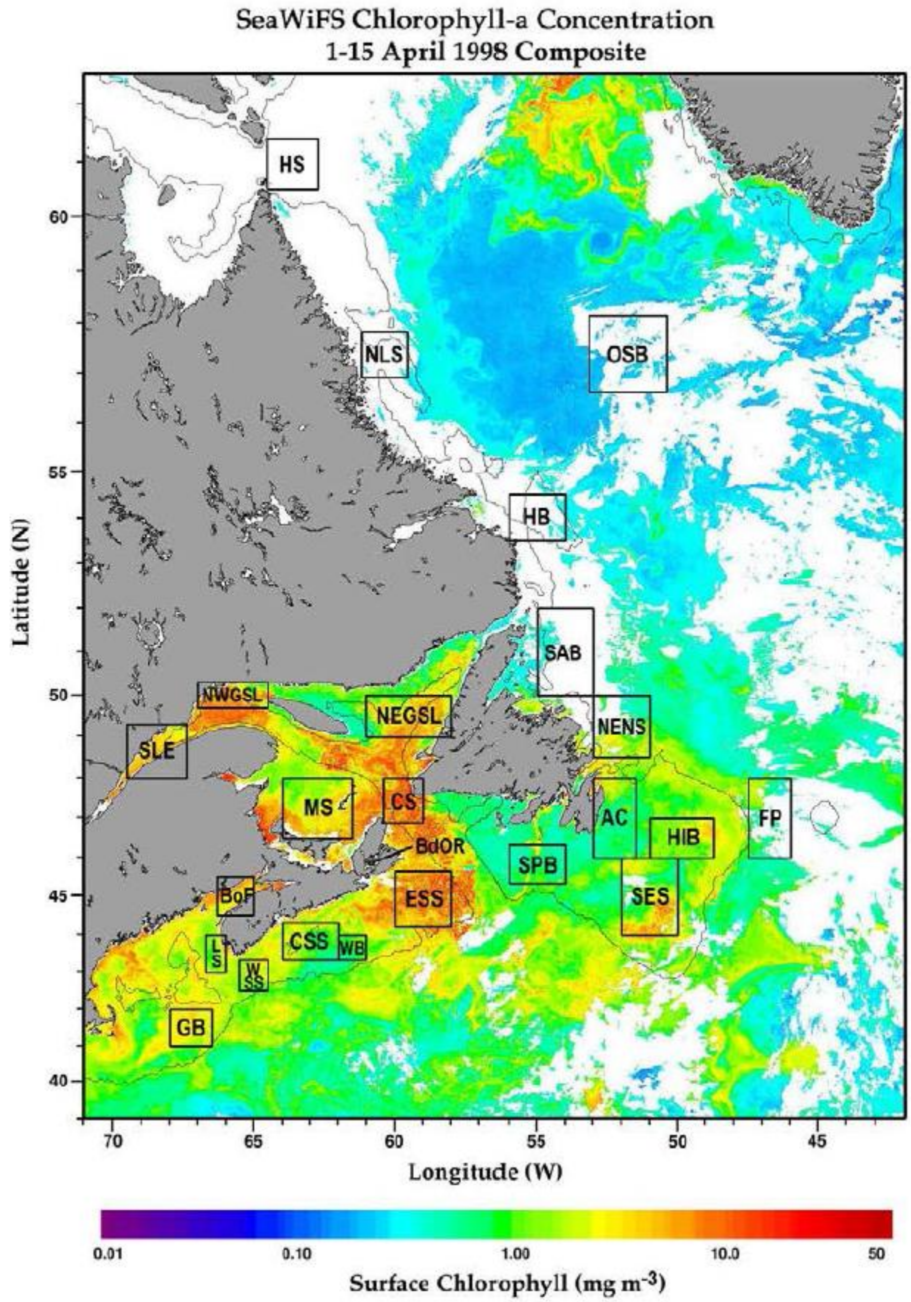
While chlorophyll-*a* concentration is not specified in the EIS, a description of phytoplankton and their seasonal trends are discussed in Section 4.2.1.2. Information pertaining to the distribution and concentration of phytoplankton and/or chlorophyll-*a* directly in the Project Area is limited. The most recent data for chlorophyll-*a* concentrations on the Newfoundland Shelf comes from the Atlantic Zone Monitoring Program (AZMP). Pepin et al. (2017) have described the biological oceanographic conditions on the Newfoundland shelf during 2014-2015 as well as historical mean conditions. The AZMP obtains its information on the state of the marine ecosystem from data collected at a network of sampling stations, which range from high-frequency sampling stations and cross-shelf sections, as well as groundfish surveys (Figure 1). The program also relies on the spatial and temporal analysis of satellite ocean colour data to produce sea surface chlorophyll-*a* concentrations (Figure 2).

Figure 3 depicts sea surface temperature and chlorophyll-*a* concentrations during 2014 and 2015 spring, summer, and fall surveys on the Nova Scotia and Newfoundland and Labrador Shelves. Similar trends can be seen between both years, with a strong spring bloom, followed by a summer senescence and a weaker fall bloom. Figure 4 depicts chlorophyll-*a* concentrations (sea surface to 160 m) in 2014 and 2015 compared to the average concentrations from 1999-2010 from the NL region fixed coastal station (S27). Spring and fall blooms observed during 2015 yielded increased chlorophyll-*a* concentrations (4 mg/m^3 and 0.75 mg/m^3) compared to 2014 (2 mg/m^3 and 0.25 mg/m^3). On average from 1999-2010, the station yielded maximum chlorophyll-*a* concentrations of 4.5 mg/m^3 during the spring and 1.75 mg/m^3 during the fall at depths from 20 to 40 m. Figure 5 illustrates similar patters with those areas found within the Project Area (Pepin et al. 2017).



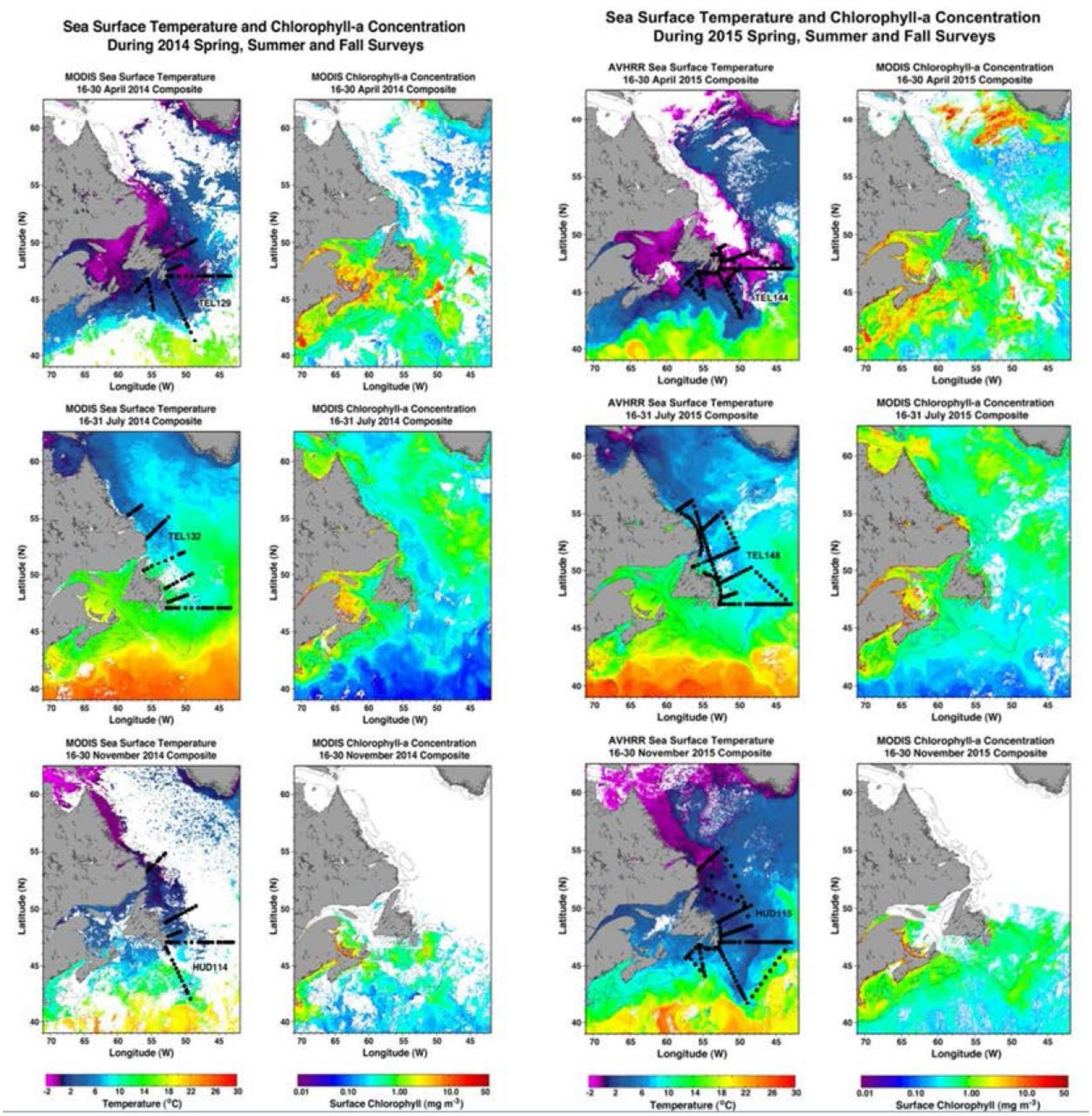
Source: Colbourne et al. 2012.
Note: Sea surface temperatures (ºC) from July 15-31, 2011 are also depicted.

Figure 1 An Overview of the AZMP Cross-shelf Sections Related to the Project Area as well as Fixed Data Collection Station 27



Source: Pepin et al. 2013
Note: Of particular interest to the Project Area are AC – Avalon Channel, HIB – Hibernia, and FP – Flemish Pass.

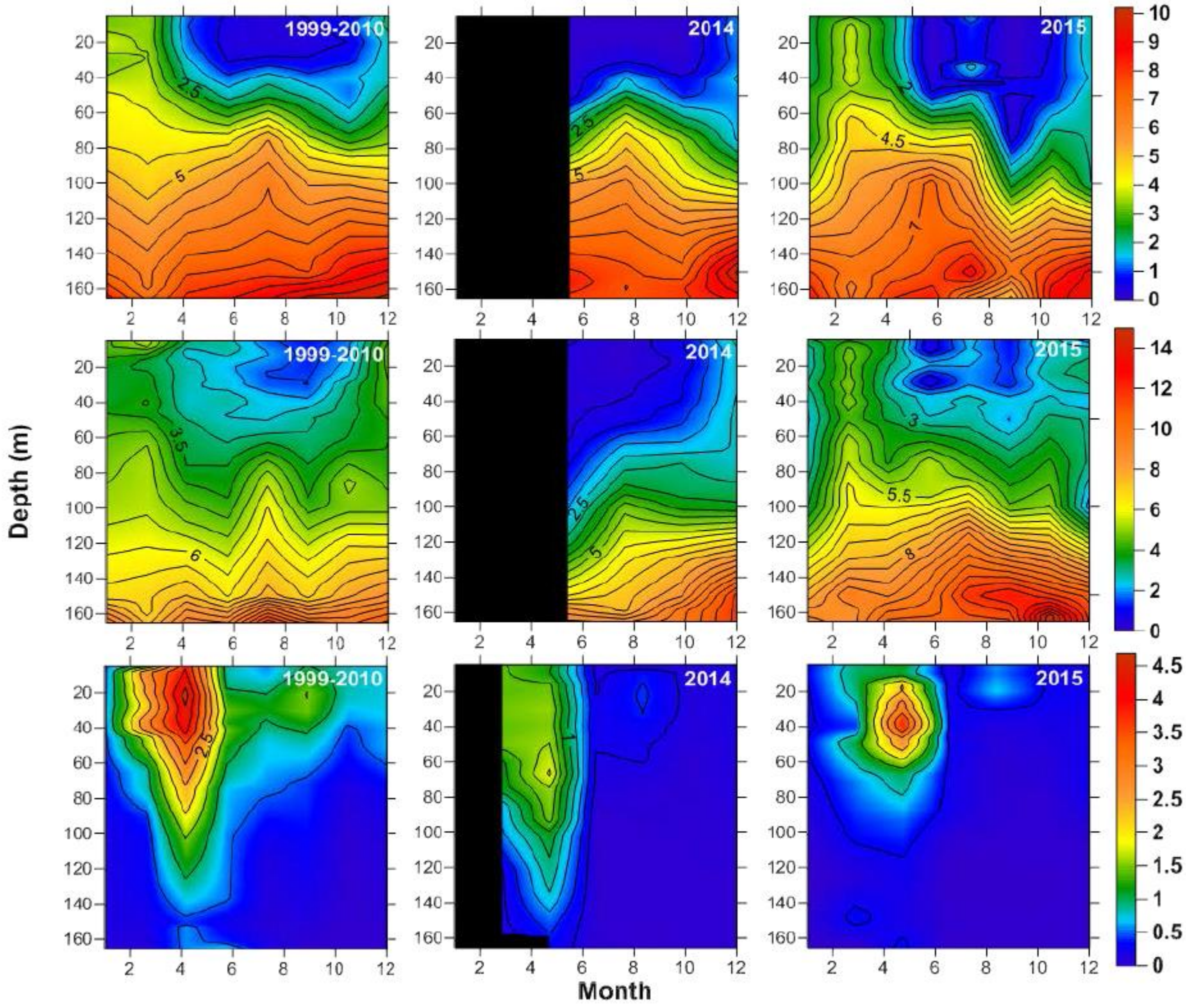
Figure 2 An Overview of the Statistical Sub-regions in the Northwest Atlantic Identified for the Spatial / Temporal Analysis of Satellite Ocean Colour Data



Source: Pepin et al. 2017

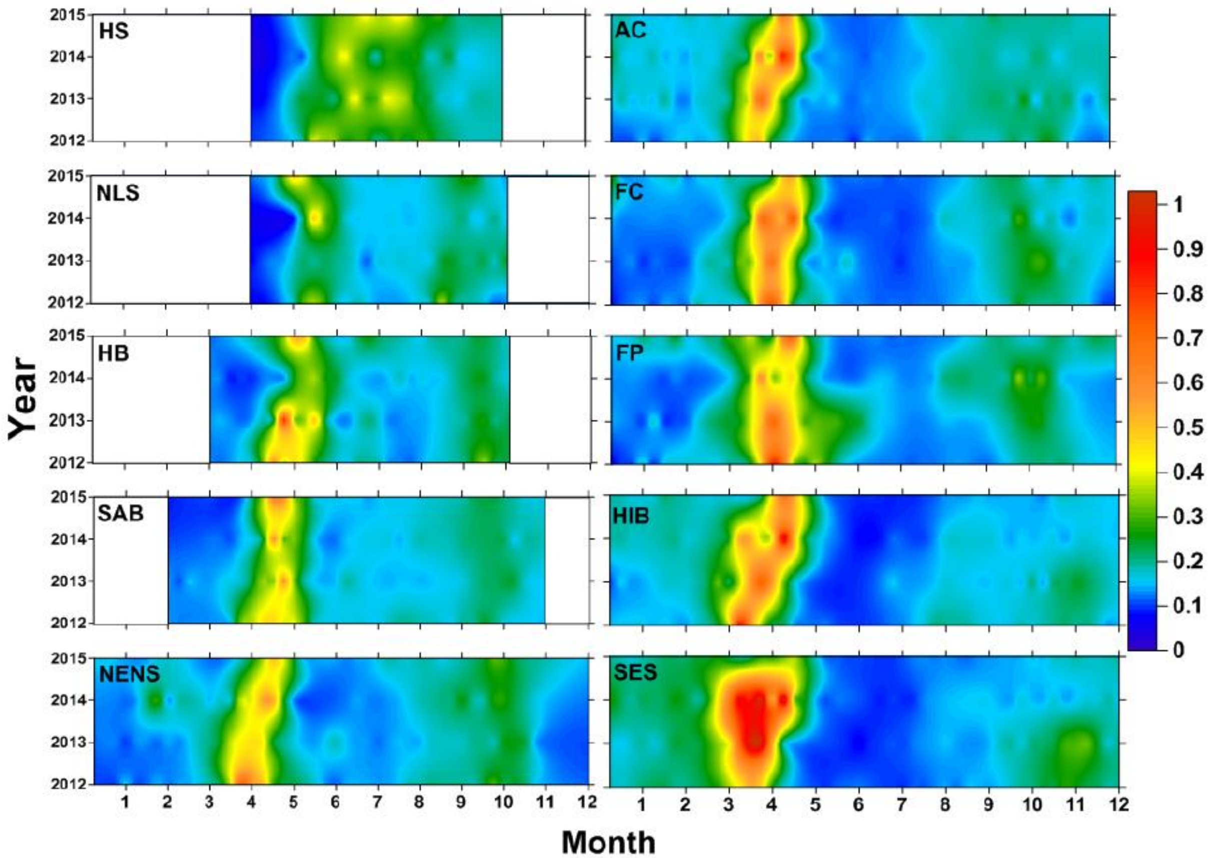
Note: Sampling locations during the 2015 (right panels) spring, summer, and fall section surveys. Within each annual panel (2014 and 2015), the left most panel represents sampling locations (black dots) overlain on top of corresponding sea surface temperatures. The right panel represents corresponding surface chlorophyll-*a* concentration (mg/m³).

Figure 3 - Sampling Locations During the 2014 (left panels) Spring, Summer, and Fall Section Surveys



Source: Pepin et al. 2017
Note: Mean conditions from 1999 to 2010 depicted at the NL region fixed coastal station (S27).

Figure 4 Comparison of Vertical Structure of Nitrate (mmol/m³) (top panels), Silicate (mmol/m³) (middles panels) and Chlorophyll (mg/m³) in 2014 and 2015



Source: Pepin et al. 2017
HIB – Hibernia, FP – Flemish Pass, and AC – Avalon Channel

Figure 5 Time Series of Surface Chlorophyll-a Concentrations (log-transformed +1; mg/m³) from VIIRS Ocean Colour Data along Statistical Sub-regions Across the Newfoundland and Labrador Area During 2012 to 2015

References

Colbourne, E., J. Craig, C. Fitzpatrick, D. Senciall, P. Stead and W. Bailey. 2012. An assessment of the physical oceanographic environment on the Newfoundland and Labrador Shelf during 2011. DFO Can. Sci. Advis. Sec. Res. Doc., 2012/044: iv + 33 pp.

Pepin, P., G. Maillet, S. Fraser, G. Doyle, A. Robar, T. Shears and G. Redmond. 2017 Optical, chemical, and biological oceanographic conditions on the Newfoundland and Labrador Shelf during 2014-2015. DFO Can. Sci. Advis. Sec. Res. Doc., 2017/009: v + 37 pp.

Pepin, P., G. Maillet, S. Fraser, T. Shears and G. Redmond. 2013. Optical, chemical, and biological oceanographic conditions on the Newfoundland and Labrador Shelf during 2011-12. DFO Can. Sci. Advis. Sec. Res. Doc., 2013/051: v + 38 pp.

1.4.2 Information Requirement: IR-14

Reference to EIS:

Section 4.2.4 Marine Fish; Appendix D

Context and Rationale

The EIS Guidelines require that fish within areas that could be affected by the Project be described. There are inconsistencies in the species described in Section 4.2.4 and Appendix D. For example, American Lobster (Table 4.25), shrimp (*Argis* spp.), Silver Hake, Sea Raven, Marlin Spike and Longfin Hake (Table 4.22) are noted in Section 4.2.4, but not described in Appendix D. Black Dogfish and Greenland Shark are described in Appendix D, but are not noted in Section 4.2.4. Further, the majority of species descriptions in Appendix D do not provide the likelihood of occurrence in the study area. Species' relationships with the study area are required to assess the potential effects of the proposed Project.

Specific Question of Information Requirement

Provide descriptions, including the relationship to the study area (e.g., likelihood of occurrence, timing, distribution, abundance), for all fish species that could be affected by the Project. Update the effects assessment, as applicable.

Response

Appendix D of the EIS contained some species that were not listed in Tables 4.23 to 4.25 of the EIS. These species include black dogfish (*Centroscyllium fabricii*), northern sandlance (*Ammodytes dubius*), Greenland shark (*Somniosus microcephalus*), lanternfish (*Symbolophorus barnardi*), pale sea urchin (*Strongylocentrotus pallidus*), basking shark (*Cetorhinus maximus*), spiny dogfish (*Squalus acanthias*), and winter skate (*Leucoraja ocellata*). Tables 4.23 to 4.25 of the EIS have been updated to reflect these inconsistencies and are provided as Tables 1 to 3.

Tables 4.22 and 4.25 of the EIS contained fish species that were not described in Appendix D. These species include: American lobster (*Homarus americanus*), green sea urchin (*Strongylocentrotus droebachiensis*), Capelin (*Mallotus villosus*), longfin hake (*Phycis chesteri*), marlin spike (*Nezumia bairdi*), sea raven (*Hemitripterus americanus*), silver hake (*Merluccius bilinearis*), and shrimp (*Argis* spp.). Species descriptions for these fish (except for *Argis* spp. for which information was not available) can be found below. The relationship of each species with the study area (i.e., species abundance, likelihood of occurrence) can be found in Tables 4.22 to 4.25 of the EIS. As such this information is not required to be repeated within Appendix D. Furthermore, species relationships with the Study Area have been considered (Tables 4.22 to 4.25 of the EIS) within the effects assessment and as a result, the effects assessment does not need further updates.

American Lobster

Lobster can be found along the Atlantic coastline and on the Continental Shelf from Northern Newfoundland to South Carolina. Adult American lobsters are typically found in waters shallower than 300 m, and fished in waters less than 40 m, but have been found at depths up to 750 m. They prefer substrate with rock and boulder shelter so that they can shield themselves from predators and daylight as they are nocturnal animals. They can also be found in areas with sand, gravel or mud substrates (DFO 2015). Lobster can be found along the edges of the shelf; however, they are not fished offshore in the vicinity of the Project (Pezzack et al. 2009). Inshore populations can be found on almost all locations of the nearshore shelf. Lobsters can be found inhabiting waters ranging in temperature from -1.5°C to 24°C (DFO 2015).

Table 1 Groundfish of Commercial, Recreational or Aboriginal Value with Potential to Occur in the Study Area

Common Name	Scientific Name	Potential for Occurrence in the Study Area[1]	Timing of Presence	Timing of Spawning
Acadian redfish[2]	*Sebastes fasciatus*	High	Year-Round	September to December
American plaice[2]	*Hippoglossoides platessoides*	High	Year-Round	April
Atlantic cod[2]	*Gadus morhua*	Moderate	Year-Round	Peaks during spring
Atlantic halibut	*Hippoglossus*	Moderate	Year-Round	December to June
Atlantic wolffish[2]	*Anarhichas lupus*	High	Year-Round	September to December
Barndoor skate	*Dipturus laevis*	Moderate	Year-Round	Winter
Cusk[2]	*Brosme*	Low	Year-Round	May to August
Deepwater redfish[2]	*Sebastes mentella*	High	Year-Round	September to December
Haddock	*Melanogrammus aeglefinus*	Moderate	Year-Round	January to June
Greenland halibut	*Reinhardtius hippoglossoides*	Moderate	Year-Round	July to October
Monkfish	*Lophius americanus*	Moderate	Year-Round	April to September
Northern wolffish[2]	*Anarhichas denticulatus*	High	Year-Round	October to December
Northern Sandlance	*Ammodytes dubius*	High	Year-Round	Winter
Pollock	*Pollachius virens*	Low	Year-Round	September to March
Roughhead grenadier[2]	*Macrourus berglax*	High	Year-Round	Winter and early spring, potentially year-round.
Roundnose grenadier[2]	*Coryphaenoides rupestris*	High	Year-Round	Year-round
Sculpin	*Triglops* spp.	High	Year-Round	Fall to late winter
Smooth skate[2]	*Malacoraja senta*	Moderate	Year-Round	Year-round
Spotted wolffish[2]	*Anarhichas minor*	High	Year-Round	June to November
Thorny skate[2]	*Amblyraja radiate*	High	Year-Round	September to January
White hake[2]	*Urophycis tenuis*	Moderate	Year-Round	Spring to early summer
Witch flounder	*Glyptocephalus cynoglossus*	Moderate	Year-Round	March to June
Yellowtail founder	*Limanda ferruginea*	Moderate	Year-Round	April to June

Source: Scott and Scott 1988; Anderson et al. 1999; Kulka et al. 2003; Maddock-Parsons 2006; DFO 2009, 2010a, 2010b; COSWEIC 2010, 2011; Healey 2010; NOAA 2013a, 2013b, 2013c; Amec 2014.

Note:
1. This qualitative characterization is based on expert opinion and an analysis of understood habitat preferences across life-history stages, available distribution mapping, and catch data for each species within the Study Area.
2. Species at risk or SOCC.

Table 2 Pelagic Fish Species of Commercial, Recreational, or Aboriginal Value with Potential to Occur in the Study Area

Common Name	Scientific Name	Potential for Occurrence in the Study Area[1]	Timing of Presence	Timing of Spawning[3]/Birthing[4]
Albacore tuna	*Thunnus alalunga*	Moderate	July to November	Outside Study Area[3]
Atlantic bluefin tuna[2]	*Thunnus thynnus*	Moderate	June to October	Outside Study Area[3]
Atlantic herring	*Clupea harengus*	Low	Year-round	Spring or Fall[3]
Atlantic mackerel	*Scomber scombrus*	Low	Winter	June and July[3]
Atlantic Salmon[2]	*Salmo salar*	Moderate	June to August	Outside Study Area[3]
American eel[2]	*Anguilla rostrata*	Moderate	March to July - glass eels on the Grand Banks	Outside Study Area[3]
Basking shark[2]	*Cetorhinus maximus*	Low	Year-round	Unknown – Potentially Year Round
Black dogfish	*Centroscyllium fabricii*	Low	Year – round	Winter
Blue shark[2]	*Prionace glauca*	Moderate	June to October	Spring to Fall[4]
Capelin	*Mallotus villosus*	High	Year-round	June to August[3]
Greenland Shark	*Somniosus microcephalus*	Low	Year-round	Unknown – Potentailly Year Round
Lanternfish	*Symbolophorus barnardi*	High	Year-round	Unknown – Potentially Year Round
Porbeagle shark[2]	*Lamna nasus*	Moderate	Year-round	Spring[4]
Spiny dogfish[2]	*Squalus acanthias*	Low	Year-round	Outside Study Area[3,4]
Shortfin mako shark[2]	*Isurus oxyrinchus*	Low	July to October	Outside Study Area[4]
Swordfish	*Xiphias gladius*	Moderate	July to October	Outside Study Area[4]
White shark[2]	*Carcharodon carcharias*	Low	July to October	Outside Study Area[4]
Winter skate[2]	*Leucoraja ocellata*	Low	November to March	Year-round

Source: Scott and Scott 1988; DFO 2012; NOAA 2013a, 2013b, 2013c, 2013d, 2013e, 2013f; Amec 2014

Note: 1 This qualitative characterization is based on expert opinion, and an analysis of understood habitat preferences across life-history stages, available distribution mapping, and catch data for each species within the Study Area.

2 Species at risk or SOCC.

3 Timing of Spawning

4 Timing of Birthing

Table 3 Invertebrate Species of Commercial, Recreational or Aboriginal Value with Potential to Occur in the Study Area

Common Name	Scientific Name	Potential for Occurrence in the Study Area[1]	Timing of Presence	Timing of Spawning
American lobster	*Homarus americanus*	Low	Year-round	July to September
Atlantic surf clam	*Spisula solidissima,*	Low	Year-round	June to August
Propeller clam	*Cyrtodaria siliqua*	High	Year-round	Spring
Green sea urchin	*Strongylocentrotus droebachiensis*	High	Year-round	March to April
Pale sea urchin	*Strongylocentrotus pallidus*	High	Year-round	
Atlantic sea scallop	*Placopecten magellanicus*	Low	Year-round	Late Summer to Fall
Iceland scallop	*Chlamys islandica*	Moderate	Year-round	April and May
Northern shrimp	*Pandalus borealis*	High	May to September	April and May
Snow crab	*Chionoecetes opilio*	High	Year-round	Summer to Fall

Source: Kenchington et al. 2001; DFO 2013a; Amec 2014

Note: 1. This qualitative characterization is based on expert opinion and an analysis of understood habitat preferences across life-history stages, available distribution mapping, and catch data for each species within the Study Area.

During the summer months, lobsters migrate to shallower water to take advantage of warm water temperatures. During the winter season they migrate to deeper waters to avoid winter storms, ice, and extreme cold-water temperatures (DFO 2015). Lobsters are active hunters feeding on a variety of species including crab, mollusks, polychaetes, gastropods, sea stars, sea urchins, and fish. They also act as scavengers and eat the dead remains of animals if they are available (Carter and Steele 1982, in Pezzack et al. 2009; Elner and Campbell 1987, in Pezzack et al. 2009; Gendron et al. 2001, in Pezzack et al. 2009; Jones and Shulman 2008, in Pezzack et al. 2009).

Egg-bearing females will move inshore to hatch their eggs during the late spring to early summer. Once the larvae have hatched, they remain planktonic for approximately four moulting periods that last 10 to 20 days each before settling to the seabed (DFO 2015).

Capelin

Capelin are a cold water pelagic marine fish, typically found in deep waters of the Atlantic on the offshore banks as well as coastal areas (Scott and Scott 1988). The largest concentration in Canadian waters can be found off the Newfoundland and Labrador Coast and are commonly found in the 3NLOP during spring RV surveys and 3K2J in fall RV surveys.

In the Northwest Atlantic spawning typically occurs on beaches. However, there are some deep-water spawning sites such as the Southeast Shoal. Spawning on beaches is marked by an intensive migration inshore during the early spring, with spawning occurring throughout the spring and summer months. After spawning, capelin return to the offshore banks in the fall (Scott and Scott 1988). Capelin are primarily planktonic feeders and are an important prey item for other fish, marine birds and marine mammals.

Green Sea Urchin

Green sea urchins have a circumpolar distribution, ranging into the Arctic regions of both the Atlantic and Pacific Oceans. Urchins live mostly in shallow waters, with a preference for rocky bottom in areas that are not subject to extreme wave action, but they have been found occasionally at depths of more than 1,000 m (Miller and Nolan 2000). Spawning occurs in early spring and the larvae are planktonic for 8 to 12 weeks before settling to the seafloor. Sea urchins predominantly graze on algae but will consume mussels, echinoderms, barnacles, whelks, sponges and fish carcasses (Miller and Nolan 2000).

Longfin Hake

Longfin hake can be found along Labrador to the southern edge of the Grand Bank (Scott and Scott 1988). They are a deep-water species which typically occupies a depth range of 160 to 1,290 m. On the Grand Bank and Flemish Pass, spawning occurs during the fall and winter months. Larvae and juveniles are pelagic with juveniles being prey items for white hake and cod. Longfin hake typically feed on shrimp, euphausiids, and amphipods. They can also be found preying on vertically migrating fish species including lanternfish and hatchetfish (Scott and Scott 1988).

Marlin Spike

The marlin spike is a benthic species which can typically be found inhabiting mud bottoms. The species can be found from the southern Grand Bank to the West Indies (Scott and Scott 1988). In Newfoundland waters, the species is most abundant at depths ranging from 183 to 732 m. Information regarding reproduction is sparse, but the species most likely spawns during the summer and autumn. The marlin spike feeds on benthic euphausiids and amphipods and is commonly preyed upon by swordfish (Scott and Scott 1988).

Sea Raven

The sea raven can be found along the Atlantic coast of North America from Hamilton Inlet, Labrador southward to the Strait of Belle Isle and the Gulf of St. Lawrence (Scott and Scott 1988). The species typically inhabits rock or hard bottom substrates and occasionally wanders to surface waters and are predominantly found in depths ranging from 37 to 108 m.

The species is believed to spawn during the late fall to early winter. Sea ravens are voracious feeders, preying upon benthic invertebrates including crustaceans and molluscs. They have also been observed feeding on herring, sandlance, and silver hake (Scott and Scott 1988).

Silver Hake

Silver hake is a member of the cod family and can be found from southern Newfoundland to South Carolina. The species can be found most commonly at water depths ranging from 150 to 200 m and in temperatures ranging from 5°C to 10°C (DFO 2013b). The species typically moves into shallow water as the summer progresses and waters increase in temperature (Scott and Scott 1988). As the waters cool during the fall, they move offshore in favour of warmer water. Silver hake feed mainly on shrimp, krill, and sand lance, and are prey for monkfish, pollock, Atlantic halibut, cod, and seals (DFO 2013b).

Silver hake spawn from June to September with a peak occurring in July and August. Eggs are buoyant and remain in the water column for a few days before hatching. Larvae measure 2.6 to 3.5 mm in length and are pelagic for three to five months before migrating to the seabed (Scott and Scott 1988).

References

Amec Environment and Infrastructure. 2014. Eastern Newfoundland Strategic Environmental Assessment. Final Report, 2014. Available at: http://www.cnlopb.ca/sea/eastern.php.

Anderson, J.T., E.L. Dalley and E. Colbourne. 1999. Recent trends in the dominant pelagic fish species and environment in the Northwest Atlantic, NAFO 2J3KLNO. DFO Canadian Stock Assessment Secretariat Research Document, 99/114: i + 15 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010. COSEWIC assessment and status report on the Barndoor Skate (*Dipturus laevis*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xiii + 71 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011. COSEWIC assessment and status report on the Atlantic Halibut *Hippoglossus hippoglossus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. ix + 48 pp.

DFO (Fisheries and Oceans Canada). 2009. Northern Shrimp (SFAs) 0-7 and the Flemish Cap: Resource Management Operations. Available at: http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/shrimp-crevette/shrimp-crevette-2007-eng.htm#ann-a.

DFO (Fisheries and Oceans Canada). 2010a. Aquatic Species - Details for Monkfish. Available at: http://www.dfo-mpo.gc.ca/species-especes/aquatic-aquatique/monkfish-baudroie-amerique-eng.htm.

DFO (Fisheries and Oceans Canada). 2010b. Recovery Potential assessment for roundnose grenadier (*Coryphaenoides rupestris*). Available at: http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2010/2010_021_e.pdf.

DFO (Fisheries and Oceans Canada). 2012. Assessment of the Atlantic Mackerel Stock for the Northeast Atlantic (Subareas 3 and 4) in 2011. Canadian Science Advisory Secretariat Science Advisory Report, 2012/031: 17 pp.

DFO (Fisheries and Oceans Canada). 2013a. Facts on Canadian Fisheries: Haddock. Available at: http://www.dfo-mpo.gc.ca/fm-gp/sustainable-durable/fisheries-peches/haddock-aiglefin-eng.htm.

DFO (Fisheries and Oceans Canada). 2013b. 2012 Assessment of 4VWX Silver Hake. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep., 2013/018. Available from: http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2013/2013_018-eng.pdf.

DFO (Fisheries and Oceans Canada). 2015. Underwater World: North American Lobster. Available from: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/project-eng.html?id=20

Healey, B.P. 2010. Greenland halibut (*Reinhardtius hippoglossoides*) in NAFO Subarea 2 and Divisions 3KLMNO: Stock trends based on annual Canadian research vessel survey results during 1978-2009. Northwest Atlantic Fisheries Organization Science Council Research Document, 10/21: 67 pp.

Kenchington, E.L.R., J. Prena, K. Gilkinson, D.C. Gordon, K. MacIsaac, C. Bourbonnais, P. Schwinghamer, T.W. Rowell, D.L. McKeown and W.P. Vass. 2001. Effects of experimental otter trawling on the macrofauna of a sandy bottom ecosystem on the Grand Banks of Newfoundland. Canadian Journal of Fisheries and Aquatic Sciences, 58: 1043-1057.

Kulka, D.W., N.C. Antle and J.M. Simms. 2003. Spatial analysis of 18 demersal species in relation to petroleum licence areas on the Grand Bank (1980-2000). Canadian Technical Report on Fisheries and Aquatic Sciences, 2473: xix + 182 pp.

Maddock-Parsons, D. 2006. Witch flounder in NAFO Divisions 3NO. North Atlantic Fisheries Organization Scientific Council Meeting, June 2006. Northwest Atlantic Fisheries Organization Science Council Research Document, 06/37: 32 pp.

Miller, R.J. and S.C. Nolan. 2000. History and management of the Nova Scotian sea urchin fishery. DFO Canadian Stock Assessment Secretariat Res. Doc., 2000/109: 49 pp.

NOAA (National Oceanic and Atmospheric Administration). 2013a. Fish Watch: Atlantic Pollock. Available at: http://www.fishwatch.gov/profiles/atlantic-pollock.

NOAA (National Oceanic and Atmospheric Administration). 2013b. Fish Watch: Haddock. Available at: http://www.fishwatch.gov/profiles/haddock

NOAA (National Oceanic and Atmospheric Administration). 2013c. Fish Watch: Monkfish. Available at: http://www.fishwatch.gov/profiles/monkfish.

NOAA (National Oceanic and Atmospheric Administration). 2013d. Fish Watch: Atlantic Herring. Available at: http://www.fishwatch.gov/profiles/atlantic-herring

NOAA (National Oceanic and Atmospheric Administration). 2013e. Fish Watch: North Atlantic Albacore tuna. Available at: http://www.fishwatch.gov/profiles/north-atlantic-albacore-tuna

NOAA (National Oceanic and Atmospheric Administration). 2013f. Fish Watch: North Atlantic Swordfish. Available at: http://www.fishwatch.gov/profiles/north-atlantic-swordfish

Pezzack, D.S., C.M. Frail, A. Reeves and M.J. Tremblay. 2009. Offshore Lobster LFA 41 (4X and 5Zc). DFO Can. Sci. Advis. Sec. Res. Doc., 2009/023: vi + 118 pp.

Scott, W.B. and M.G. Scott. 1988. Atlantic fishes of Canada. Can. Bull. Fish. Aquat. Sci., 219: 731 pp.

1.4.3 Information Requirement: IR-15

Reference to EIS:

Section 4.3.2.7.2.2 Salmon

Context and Rationale

Section 4.3.2.7.2.2 of the EIS it states that Atlantic Salmon have a large feeding ground and would only be found in large numbers if high concentrations of prey items circulated through the project area during the spring/summer season. No information is provided on the potential for this to occur.

The EIS also states that it is expected that many individual salmon would not be in the “immediate project area,” but “immediate project area” is not described.

Specific Question of Information Requirement

Discuss the potential for high concentrations of prey items to circulated through the project area during the spring/summer season.

Define the “immediate project area” as used to describe the occurrence of Atlantic Salmon in the project area.

Response

The reference to salmon being found in large numbers if high concentrations of prey items circulated through the Project Area was simply a statement of the expected relationship between salmon at sea in search of prey. Catch rate and survey data suggest that Atlantic salmon tend to congregate at the eastern edge of the Grand Banks (DFO 1993, 1997; Reddin and Friedland 1993). The “immediate Project Area” is defined as the designated exploration licences.

References

DFO (Fisheries and Oceans Canada). 1993. Report of the status of groundfish stocks in the Canadian Northwest Atlantic. Groundfish Stock Status Report. July 1993.

DFO (Fisheries and Oceans Canada). 1997. Scotian shelf and Southern Grand Bank halibut. DFO Science Stock Status Report A3-23. June 1997.

Reddin, D.G. and K.D. Friedland. 1993. Marine environmental factors influencing the movement and survival of Atlantic salmon. International Council for the Exploration of the Sea. C.M. 1993/M:42 Ref. C+H Anadromous and Catadromous Fish Committee.

1.4.4 Information Requirement: IR-16

Reference to EIS:

Section 6.1.10.3.1.3 Waste Management

Context and Rationale

Section 6.1.10.3.1.3 states that water-based mud is “sometimes considered less harmful to the environment, as it contains mainly water and cannot form surface sheens.” However, no further information is provided to explain this statement.

Specific Question of Information Requirement

Provide information to explain the circumstances in which water based mud would be considered less harmful to the environment, defining what “sometimes” means. Provide context to when water-based muds would be less harmful to the environment and when it would be more harmful to the environment.

Response

Water-based muds are considered less harmful because they do not have hydrocarbons in the base fluid. The use of “sometimes” was not appropriate in the sentence.

References

N/A

1.4.5 Information Requirement: IR-17

Reference to EIS:

Section 6.1.10.2 Mitigation; Section 6.1.10.3.1.4 Well Abandonment

Context and Rationale

Section 6.3.10.3.1.4 of the EIS states that shape charges (e.g. explosives) may be used as part of well abandonment. The explosives would be placed below the seafloor and detonated. The EIS states that the seafloor would absorb the shock pulse and energy of the explosion.

The proponent does not provide, in the EIS, information relating to type or size of explosive that may be used. The proponent does not provide information on estimated level or extent of sound pressure that may occur as a result of the use of explosives.

Fisheries and Oceans Canada indicated that the use of explosives in water must be in accordance with applicable Fisheries and Oceans Canada Guidelines (e.g. Wright and Hopky (1998) and http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html). A detailed blasting plan should be prepared and submitted for review prior to any required use of explosives.

Mitigation measures should include measures that will be taken to dissipate the shock wave (e.g. bubble curtains), and if scaring charges will be used to scare fish (prey species for marine mammals) from the immediate area.

Specific Question of Information Requirement

Provide information on the pressure level that may occur as a result of using explosives for well abandonment, specifically its effect on coral and sponges.

Taking into account the information provided by Fisheries and Oceans Canada, update mitigation measures (in addition to the use of marine mammal observers) for fish, marine mammals and sea turtles that may be required in the event of blasting for wellhead removal.

Response

After a review of the currently available technology, Husky no longer considers the use of shaped charges for well decommissioning or abandonment as an option.

References

N/A

1.4.6 Information Requirement: IR-18

Reference to EIS:

Section 6.1.10.3.2.1 Presence and Operation of MODU; Section 6.1.10.3.1.2 Drilling Associated Surveys

Context and Rationale

Section 6.1.10.3.2.1 of the EIS states that the effects of noise are typically temporary on fish, and that noise "is not expected to cause biological or physical effects if experienced outside critical reproductive periods." However, no information was provided on the effects of noise on the reproductive periods of fish.

Information on the fish species present in the project area, including the likelihood of occurrence and timing of respective spawning periods, was provided in Appendix D of the EIS. Fish species at risk and species of conservation concern were also highlighted. However, Wolastoqiyik Nation of New Brunswick (WNNB) indicated that while an understanding of fish and fish habitat in the project area was presented, no clear connection between the Project activities and the timing of vulnerable life history stages was made for these fish species. For example, even if the effect of activities is of low magnitude and spatial extent, should an activity occur during a sensitive period, such as at the time of spawning, stress-related impacts on spawning success (e.g. egg hatch) may occur. Under such circumstances, the proponent has not indicated whether project activities would be avoided during sensitive life history time periods for fish species including listed species.

In addition, Fisheries and Oceans Canada noted that the proponent uses the references Sætre and Ona (1996) in the EIS to argue that the use of acoustics would have minimal effects on fish eggs and larvae in a field study using a single air gun. It is unclear how assumed conditions in the simulation are applicable to the proposed vertical seismic profiling (VSP).

Specific Question of Information Requirement

Provide information on the effects of noise on fish during important reproductive periods and vulnerable life stages, as well as the potential mitigation measures that would be implemented if project activities were to occur during sensitive life history stages of fish.

Discuss how assumed conditions in the Sætre and Ona (1996) reference are applicable to the proposed vertical seismic profiling.

Response

Some marine fish, when exposed to sound levels of sufficient magnitude, may exhibit behavioral responses, including temporary displacement (i.e., startle response), however the effect is expected to be reversible once the underwater sound emissions cease.

There are few scientific studies that have directly investigated the effects of low-frequency sound on sensitive life history stages of fishes such as eggs and larvae. Carroll et al. (2017) review all the scientific literature available on the effects of low-frequency sound on marine fishes and invertebrates. With respect to studies with fish eggs and larvae, five studies are reviewed. Of these, three studies found no response to sound energy exposure at realistic exposure levels (Dalen and Knutsen 1987; Booman et al. 1996; Payne et al. 2009) and two studies found a response to unrealistic or unknown exposure levels (Kostyuchenko 1973; Booman et al. 1996). With respect to studies with invertebrate eggs and larvae, four studies are reviewed. Of these, three studies found no response to sound energy exposure at realistic exposure levels (Pearson et al. 1994; Christian et al. 2003; Day et al. 2016) and one study found a response to unrealistic or unknown exposure levels (Aguilar de Soto et al. 2013).

Saetre and Ona's (1996) study was based on a mathematical model of the 'worst-case scenario' for exposure of fish eggs and larvae to seismic energy similar to that of a VSP survey. Results suggested that relative to natural mortality rates, seismic surveys could not be expected to have a measurable effect on recruitment to a fish stock.

References

Aguilar de Soto, N., N. Delorme, J. Atkins, S. Howard, J. Williams and M. Johnson. 2013. Anthropogenic noise causes body malformations and delays development in marine larvae. Sci. Rep. 3.

Booman, C., J. Dalen, H. Leivestad, A. Levsen, T. van der Meeren and K. Toklum. 1996. Effekter av luftkanonskyting på egg, larver og yngel. Undersøkelser ved Havforskningsinstituttet og Zoologisk laboratorium, UIB.

Carroll, A.G., R. Pzeslawski, A. Duncan, M. Gunning and B. Bruce. 2017. A critical review of the potential impacts of marine seismic surveys on fish & invertebrates. Marine Pollution Bulletin, 114: 9-24.

Christian, J.R., A. Mathieu, D.H. Thompson, D. White and R.A. Buchanan. 2003. Effect of Seismic Energy on SnowCrab (*Chionoecetes opilio*). Environmental Funds Project No. 144. Fisheries and Oceans Canada. Calgary, AB. 106 pp.

Day, R.D., R.D. McCauley, Q.P. Fitzgibbon and J.M. Semmens. 2016. Seismic air gun exposure during early-stage embryonic development does not negatively affect spiny lobster *Jasus edwardsii* larvae (Decapoda:Palinuridae). Sci Rep 6, 22723.

Dalen, J. and G. Knutsen. 1987. Scaring effects in fish and harmful effects on eggs, larvae and fry by offshore seismic explorations. Pp. 93-102. In: H. Merklinger (ed.). Progress in Underwater Acoustics. Springer US, pp. 93–102.

Kostyuchenko, L., 1973. Effects of elastic waves generated in marine seismic prospecting on fish eggs in the Black Sea. Hydrobiol. J., 9: 45-48.

Payne, J.F., J. Coady and D. White. 2009. Potential Effects of Seismic Air Gun Discharges on Monkfish Eggs (*Lophius americanus*) and Larvae. National Energy Board, Canada.

Pearson, W.H., J.R. Skalski, S.D. Sulkin and C.I. Malme. 1994. Effects of seismic energy releases on the survival and development of zoeal larvae of dungeness crab (*Cancer magister*). Mar. Environ. Res. 38, 93–113.

Saetre, R. and E. Ona, 1996. Seismic investigations and damages on fish eggs and larvae; an evaluation of possible effects on stock level. Fisken og Havet 1996:1-17, 1-8.

1.4.7 Information Requirement: IR-19

Topic: Fish and Fish Habitat

Reference to EIS:

Section 2.6.2 Other Wastes; Section 6.1.10.3.2.3 Waste Management

Context and Rationale

Section 2.6.2 of the EIS states that cement may return to the seafloor at an estimated volume of 25 cubic metres per well. Section 6.1.10.3.2.3 states that should cement be discharged onto the seafloor, its volume would result in the cement covering the drill cuttings and therefore it would not affect additional benthic habitat. However, while the volume of cement may be less than the volume of drill cuttings no evidence is provided that cement would disperse in the same manner or pattern as drill cuttings, which are predicted to range from 100 metres to 12 kilometres from the drill center (Section 2.6.1.1.1).

Specific Question of Information Requirement

Describe the dispersion of cement versus drill cuttings in the marine environment.

Provide information related to dispersion of cement from the wellsite to provide validity to the statement that cement discharge will cover drill cuttings.

Response

Cement is discharged as a slurry which has similar physical and hydrodynamic properties as drilling mud and cuttings, so it is reasonable to expect cement to settle in the same manner as drilling mud and cuttings.

References

N/A

1.4.8 Information Requirement: IR-20

Topic: Fish and Fish Habitat

Reference to EIS:

Section 6.6.10.3 Characterization of Residual Project-related Environmental Effects

Context and Rationale

Section 6.6.10.3 of the EIS states that the potential exists for swordfish to be found in areas that overlap with the project area. Given the importance of the species, Mi'gmawe'l Tplu'taqnn Incorporated (MTI) raised concerns that the potential environmental effects of the project were not fully considered with respect to Swordfish.

Comments from MTI state that Swordfish are known to only tolerate small environmental changes. Offshore activities have greater detrimental effects on populations when compared to other species (de Sylva et al, 2000)[1].

Specific Question of Information Requirement

Provide an assessment of the potential effects of project activities to Swordfish, including any existing published research on biological and behavioural responses of Swordfish to sound, spills and light. Update the proposed mitigation and follow-up, as well as effects predictions, accordingly.

Response

Swordfish (*Xiphias gladius*) are large pelagic predators that are distributed throughout the tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans. Their use of habitats near the Project Area is thought to be limited to the months with warmer water, when adults migrate north to forage (Trenkel et al. 2014). Adult swordfish are highly mobile and have been observed to travel over 60 km per day (Dewar et al. 2011). Limited information is available on spawning and early life history stages. However, it is thought that spawning occurs in the winter months in the tropical waters of the Caribbean and Sargasso Seas (Neilson et al. 2009).

There is little published research on the biological and behavioural responses of swordfish to sound, spills and light. However, based on the biology and life history of the swordfish, the Project is expected to have little impact at the population level due to the ability of swordfish to avoid undesirable anthropogenic activities, their seasonal distribution in Project Area and non-schooling behavior, reduces any potential population effects from the Project. Therefore, no further mitigation or follow-up is proposed. A rationale for these predictions is provided below.

<u>Sound</u> – The effects of underwater noise on swordfish have not been documented in the scientific literature. It is expected that the highest levels of underwater noise will be generated during drilling and vertical seismic profiling activities. However, given the limited spatial and temporal footprint of these noise-generating activities relative to the larger area of mobility and spatial distribution of adult swordfish, these activities are expected to have minimal impact. Swordfish in the vicinity of the Project Area are anticipated to avoid this area if conditions are unfavorable.

<u>Light</u> – Light will be generated from Project structures and facilities and some of this is expected to penetrate a small footprint of the ocean surface layer at night. Swordfish exhibit vertical diurnal behaviour that suggests they follow the movement of mesopelagic organisms in the deep scattering layer. Thus, in

[1] D.P. de Sylva, W.J. Richards, T.R. Capo and J.E. Serafy. 2000. Potential effects of human activities on billfishes (Istophoridae and Xiphiidae) in the Western Atlantic Ocean. Bulletin of Marine Science, 66(1): 187-198.

northern latitudes they tend to forage in deep water during the day and at night move into the shallower waters of the oceanic mixed layer (Trenkel et al. 2014). As a result, swordfish are known to be attracted to artificial light when they are foraging. However, project-related lights are not projected into the water column far beyond the physical footprint of the MODU or supply vessel, so the potential impact area is limited.

Spills – Should accidental oil spills occur as a result of the Project, the emergency spill response plan and mitigation measures, as detailed in the EIS, will be implemented. Crude oil is considered relatively non-toxic to adult fishes (de Sylva et al. 2000). Should a spill occur, swordfish are expected to limit their exposure to unfavourable conditions.

References

Dewar, H., E.D. Prince, M.K. Musyl, R.W. Brill, C. Sepulveda, J. Luo, D. Foley, E.S. Orbesen, L. Domeier, N. Nasby-Lucau, D. Snodgrass, R.M. Laurs, J.P. Hoolihan, B. Block and L. McNaughton. 2011. Movements and behaviors of swordfish in the Atlantic and Pacific Oceans examined using pop-up satellite archival tags. Fisheries Oceanography, 20(3): 219-241.

de Sylva, D.P., W.J. Richards, T.R. Capo and J.E. Serafy. 2000. Potential effects of human activities on billfishes (Istophoridae and Xiphiidae) in the western Atlantic Ocean. Bulletin of Marine Science, 66(1): 187-198.

Neilson, J.D., S. Smith, F. Royer, S.D. Paul, J.M. Porter and M. Lutcavage. 2009. Investigations of horizontal movements of Atlantic swordfish using pop-up satellite archival tags. Reviews: Methods and Technologies in Fish Biology and Fisheries, 9: 145-159.

Trenkel, V.M., G. Huse, B.R. MacKenzie, P. Alvarez, H. Arrizabalaga, M. Castonguay, N. Goni, F. Gregoire, H. Hatun, T. Jansen, J.A. Jacobsen, P. Lehodey, M. Lutcavage, P. Mariani, G.D. Melvin, J.D. Neilson, L. Nottestad, G.J. Oskarsson, M.R. Payne, D.E. Richardson, I. Senina and D.C. Speirs. 2014. Comparative ecology of widely distributed pelagic fish species in the North Atlantic: Implications for modelling climate and fisheries impacts. Progress in Oceanography, 129: 219-243.

1.4.9 Information Requirement: IR-21

Reference to EIS:

Section 6.6.8 Summary of Existing Conditions for Indigenous People and Community Values

Context and Rationale

Section 6.6.8 of the EIS indicates that migration routes for American Eel are possible through the project area. The Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) indicated that the EIS states that there is little information available on specific migration patterns of American Eel, and if American Eel were to occur within the project area, it is likely that they would be carried by currents on their way either to Greenland, Iceland, or to Newfoundland and Labrador.

Specific Question of Information Requirement

Taking into account comments from the KMKNO provide additional information on the American Eel, including the following:

- a general description of American Eel migration patterns; and
- identification of any mitigation measures required to address concerns with American Eel or a rationale as to why the current assessment and mitigation remain valid.

Response

American eel spawn and hatch in the Sargasso Sea. The larvae move north toward the continental shelf through passive transport via the Gulf stream (COSEWIC 2012). They arrive in Canadian waters in the post-larval stage known as glass eels and remain in this life cycle stage during marine migration towards freshwater rivers in Greenland, Iceland, and Newfoundland and Labrador. Following years in freshwater, maturing silver eels migrate back to the Sargasso Sea to spawn. As the EIS states, the specific migration patterns at the scale required to determine the likelihood of eel presence in the Project Area does not currently exist (Harrison et al. 2014; Miller et al. 2015; Beguer-Pon et al. 2018).

The main threats to the American eel are in freshwater including habitat degradation, fragmentation, food web changes, fisheries and chemical and biological contamination (COSEWIC 2012; Chaput et al. 2014). However, changes and variations in oceanographic processes are considered the main threat to ocean survival of larvae (Knights 2003; COSEWIC 2012; Chaput et al. 2014). Seismic activities are suggested to result in localized stress and mortality of larval stages, Chaput et al. (2014) indicated that there is no indication that the larval densities at sea that may encounter seismic activities would result in effects on the population.

Mitigation strategies to avoid or reduce potential adverse effects of Project activities on American eel would be similar to mitigation strategies for other marine fish species. With the application of mitigation measures, applicable to marine fish and fish habitat, the environment effects of planned Project activities on American eel are predicted to be not significant.

References

Beguer-Pon, M., J.J. Dodson, M. Castonguay, D. Jellyman, K. Aarestrup and K. Tsukamoto. 2018. Tracking anguillid eels: Five decades of telemetry-based research. Marine and Freshwater Research, 69: 199-219.

Chaput, G., T.C. Pratt, D.K. Cairns, K.D. Clarke, R.G. Bradford, A. Mathers and G. Verreault. 2014. Recovery Potential Assessment for the American Eel (*Anguilla rostrata*) for eastern Canada: description and quantification of threats. DFO Canadian Science Advisory Secretariat Research Document. 2013/135. vi + 90 p.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012. COSEWIC assessment and status report on the American Eel Anguilla rostrata in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xii + 109 pp.

Harrison, A.J., A.M. Walker, A.C. Pinder, C. Briand and M.W. Aprahamian. 2014. A review of glass eel migratory behaviour, sampling techniques and abundance estimates in estuaries: implications for assessing recruitment, local production and exploitation. Reviews in Fish Biology and Fisheries, 24: 967-983.

Knights, B. 2003. A review of the possible impacts of long-term oceanic and climate changes and fishing mortality on recruitment of anguillid eels of the Northern Hemisphere. Science of the total Environment, 310(1-3), 237-244.

Miller, M.J., S. Bonhommeau, P. Munk, M. Castonguay, R. Hanel and J.D. McCleave. 2015. A century of research on the larval distributions of the Atlantic eels: Are-examination of the data. Biological Reviews. 90: 1035-1064.

1.4.10 Information Requirement: IR-22

Reference to EIS:

Section 6.1.10.3.1.3 Waste Management

Context and Rationale

Figures 4.23-4.26 provide coral and sea pen recordings from various surveys on the slopes of the Grand Banks, in the Flemish Pass and around the Flemish Cap. However, the ELs for this Project are largely on the Grand Banks. Based on baseline information provided in Table 4.19, the EIS states that sensitive benthic organisms (i.e. coral and sponge species) have been collected by Canadian research vessel surveys and are present in ELs 1151, 1152, and 1155; however no corresponding figures are provided.

Further items with respect to baseline information on corals and sponges presented in Section 4.2.3 that require correction are the following:

- *Asconema* sponges are not mentioned in the EIS. Refer to Murillo et al. 2016 for depth distribution information;
- some soft corals and *Acanella arbuscula*, a gorgonian coral, are also found on soft mud substrates; and
- Figure 4-25 should include small gorgonians (i.e., *Acanella arbuscula*) and recent North Atlantic Fisheries Organization (NAFO) data.

Specific Question of Information Requirement

Provide an updated description, including figures showing the exploration licenses, of corals and sponges in the project area.

Response

Figure 1 depicts data on coral and sponge species observed from within ELs 1151, 1152, and 1151 by Canadian research vessel surveys. Figure 1 also depicts all gorgonian corals (large and small) observed within and near, the Project Area. Descriptions of corals and sponge species outlined in Figure 1 are described in Section 4.2.3 of the EIS. It is noted that some soft corals and *Acanella arbuscular* can be found on soft mud substrates. Section 4.2.3 indicates that within the Study Area, corals and sponges are more abundant on the slopes of the Grand Banks and Flemish Cap at depths ranging from 600 to 1,300 m. This agrees with Guijarro et al. (2016), who indicate that sponge presence was highest between 1,000 to 1,500 m in depth. A literature review of F.J. Murrilo's published literature from 2016 failed to yield literature which specifically mentions *Asconema* sponges. Literature from 2016 indicates the observed and predicted location of sponge species in the Newfoundland and Labrador region, but does not specify species.

Asconema (Class Hexactinellida) is a genus of glass sponges that are important for habitat provision and the only glass sponges identified as structure-forming (Beazley et al. 2013). *Asconema* spp. are thin-walled glass sponges with large oscula or openings where water exits. Individuals can reach 60 centimetres in width by 50 centimetres in height. Beazley et al. (2013) observed that the presence of structure forming sponges was associated with a higher biodiversity and abundance of associated macrofauna compared with non-sponge habitat.

These updates do not affect the findings and conclusions of the EIS.

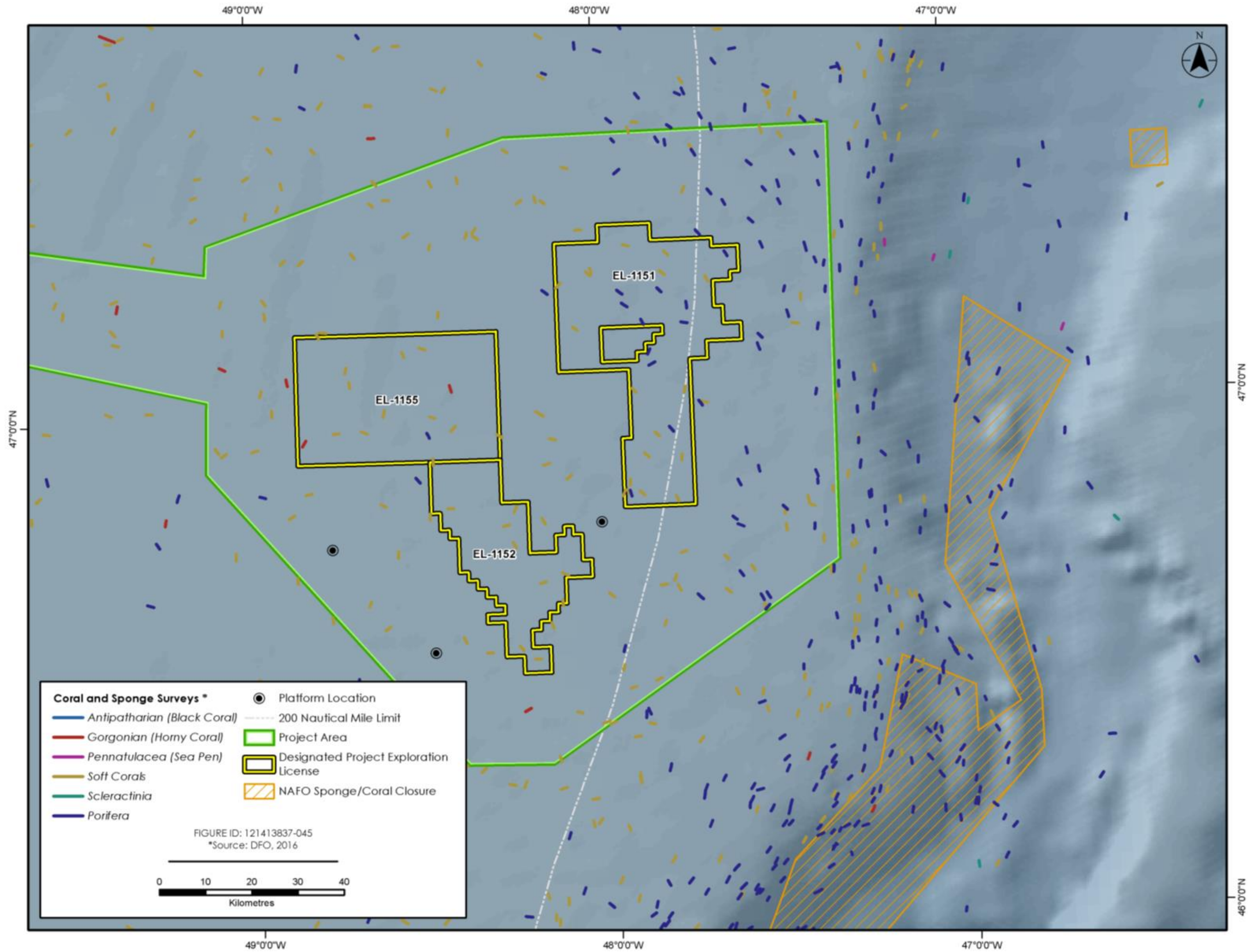


Figure 1 **Coral and Sponge Distributions within the Project Area with Specific Reference to ELS 1151, 1152, and 1155**

References

Beazley, L.I., E.L. Kenchington, F.J. Murillo and M. Sacau. 2013. Deep-sea sponge grounds enhance diversity and abundance of epibenthic megafauna in the Northwest Atlantic. – ICES Journal of Marine Science, 70: 1471-1490.

Guijarro, J., L. Beazley, C. Lirette, E. Kenchington, V. Wareham, K. Gilkinson, M. Koen-Alonso and F.J. Murillo. 2016. Species distribution modelling of corals and sponges from research vessel survey data in the Newfoundland and Labrador region for use in the identification of Significant Benthic Areas. Can. Tech. Rep. Fish. Aquat. Sci., 3171: vi + 126 pp.

1.4.11 Information Requirement: IR-23

Reference to EIS:

Section 2.6.1.1.1 Drill Cuttings Deposition and Dispersion on the Grand Banks; Section 2.6.1 Drilling Waste

Context and Rationale

The EIS states that drill cuttings deposition is represented by modelling conducted in 2012 within the White Rose field which has similar water depths, oceanographic, and biological environments as the project area. However, a rationale of how the methods and specific inputs (water depth, cuttings particle size, well hole size, release depth, volumes released, oceanographic inputs, etc.) used in the drill cuttings dispersion model are each applicable, is not included within the EIS.

The models were initiated for a well site in the center of the project area. It is unclear how dispersion footprints would change if other sites in the project area were selected. For example, would the oceanographic and other model inputs be similar/same throughout the entire project area.

Furthermore, the revised 2015 dispersion model using new inputs for South White Rose Extension Drill Centre is mentioned but the modelling report is not provided.

There is no figure provided showing the location of the modelled drill cuttings deposition sites relative to the project EL areas.

Specific Question of Information Requirement

Provide rationale for how the model and inputs (water depth, cuttings particle size, well hole size, release depth, volumes released, oceanographic inputs etc.) used in 2012 modelling for WREP are each applicable to the current Project.

Provide an analysis of how the dispersion footprints could change if the well sites were in different locations within the project area.

Provide a reference for, or copy of, the original 2015 modelling report.

Provide a figure with sufficient resolution showing the modelled sites for dispersion of drill cuttings in relation to the project area and exploration licences.

Response

One of the scenarios modelled in 2012 for the WREP was drill cutting discharge from a MODU (Amec 2012). The model inputs used in 2012 were the same as would have been used in a cuttings discharge model for a MODU drilling in ELs adjacent to the White Rose field, with a couple of important exceptions.

Firstly, the number of wells drilled per location was different. The WREP modelling was conducted for 16 wells from excavated drill centres at 4 locations within the White Rose field. Whereas each exploration well is drilled from a single location, usually. To ensure the WREP model results were directly applicable to an exploration well scenario, we re-ran the model of cutting discharge for a single well in 2015, when we began preparing for this exploration EIS.

The other difference in the single well per location model run in 2015 was the size distribution of the drill cuttings. As a condition of approval for the WREP, Husky was required to collect grain size data for drill cuttings from the White Rose field. These data were used in the re-run of the WREP model for a single exploration well and are presented in Table 2.6 of the EIS.

Given the duration of a single well during an exploration drilling program, seasonal variation in current direction may influence the orientation of the cuttings deposition footprint, however given the magnitude of difference in mean currents, the extent of the footprint is not expected to vary significantly throughout the Project Area.

The current data used were extracted from a three-year data set collected in the White Rose field and considered the most appropriate data set for modeling purposes, considering the paucity of moored current meter data from elsewhere in the Project Area.

All available information indicates that the magnitude of temporal and spatial variability in current speed and direction within the Project Area, will not alter the impact assessment of drill cuttings dispersion.

The location of the cuttings dispersion model is indicated in Figure 1.

There was no formal modelling report generated in 2015.

References

AMEC 2012. Drill Cuttings and WBM Operational Release Modelling. https://www.cnlopb.ca/wp-content/uploads/whiterose/drillcut.pdf

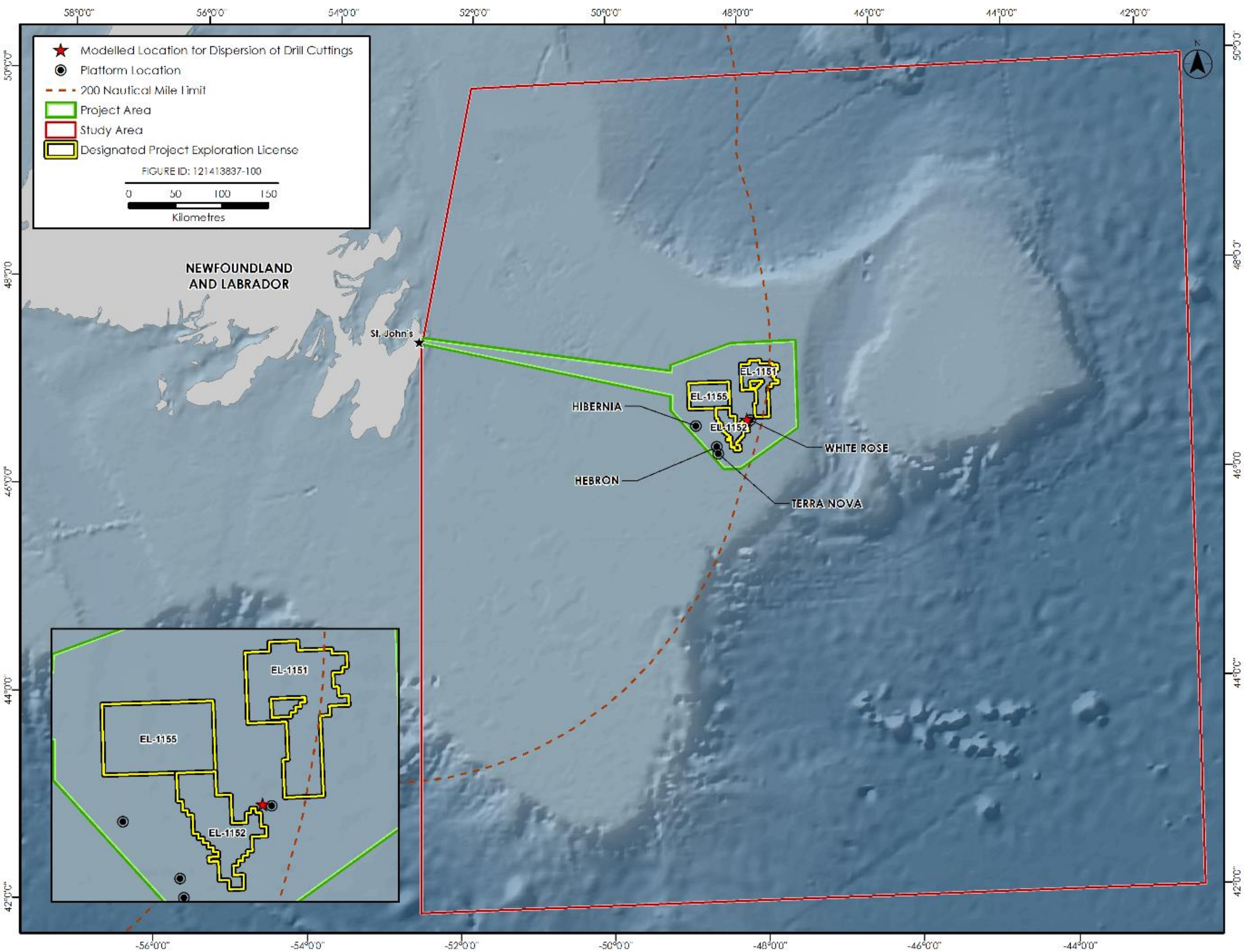


Figure 1 Drill Cutting Dispersion Model Location

1.4.12 Information Requirement: IR-24

Reference to EIS:

Section 2.6.1.1.1 Drill Cuttings Deposition and Dispersion on the Grand Banks; Section 6.1.10.3.1.3 Waste Management

Context and Rationale

Sections 6.1.10.3 of the EIS presents information on the effects of drill cuttings on fish and fish habitat. Section 6.1.10.3.1.3 of the EIS states that for this project, the burial threshold was identified to be 10 millimetres or more and that this is where benthic communities comprised of sedentary or slow-moving species may be smothered. It is unclear what, if any, threshold is applied to the analysis in Section 6.1.10.3.2.3 on change in habitat quality and use.

Section 6.5.10.3.1.3 of the EIS references more conservative thresholds: Smit et al who determined a threshold level of approximately 6.5 millimetres of sediment burial is required to cause mortality to benthic macrofauna and 6.3 millimetres used in Norwegian environmental risk assessment models for drilling activity on the Norwegian Continental Shelf.

Similar exploration drilling projects in the area have noted that average burial depths of 6.5 millimetres are considered to be the predicted no effect threshold for non-toxic sedimentation based on benthic invertebrate species tolerances to burial, oxygen depletion and changes in sediment grain size. Further, some species may be more susceptible to shallower burial depths and a more conservative probable no effect threshold (PNET) of 1.5 millimetres has been applied.

Inconsistent information is provided in the on the thickness and distribution of drill cuttings. For example, Section 6.1.10.3.2.3 (habitat quality) states that "the deposition of drilling waste from each well is similar in that a well-defined cuttings patch covering an area approximately 0.03 to 0.06 square kilometres is located up to 300 metres of the well". However, in Section 2.6.1.1 this is cited as 100-200 metres of the drill centre.

Specific Question of Information Requirement

Discuss the rationale for burial threshold of 10 millimetres versus the more conservation 6.5 millimetres and 1.5 millimetres thresholds.

In a table format, provide percent settled, mean thickness, and maximum thickness, for each well modeled, at distance intervals of zero-10 metres, 10-100 metres, 100-200 metres, 200-500 metres, 500 metres to one kilometre, one-two kilometres, and maximum distance for remaining settling.

Response

Each of the burial thresholds are discussed throughout the effects assessment. Section 6.1.10.3.1.3 provides the rationale for the use of 10 mm:

> *Some sedentary or slow-moving species may experience non-lethal effects at a range of burial depths; for example, Smit et al. (2006a, 2006b) reference a threshold of 6.5 mm where 5% of species are anticipated to be affected. The 50% hazardous level for burial was identified as 54 mm; this value was obtained through a literature review conducted by Smit et al. (2008, in IOGP 2016). For this Project, the burial threshold was identified to be 10 mm or more; this is where benthic communities comprised of sedentary or slow-moving species may be smothered, and the sediment quality will be altered in terms of nutrient enrichment and oxygen depletion (Neff et al. 2000, 2004). A threshold burial depth for deep-water benthos may be lower (IOGP 2016).*

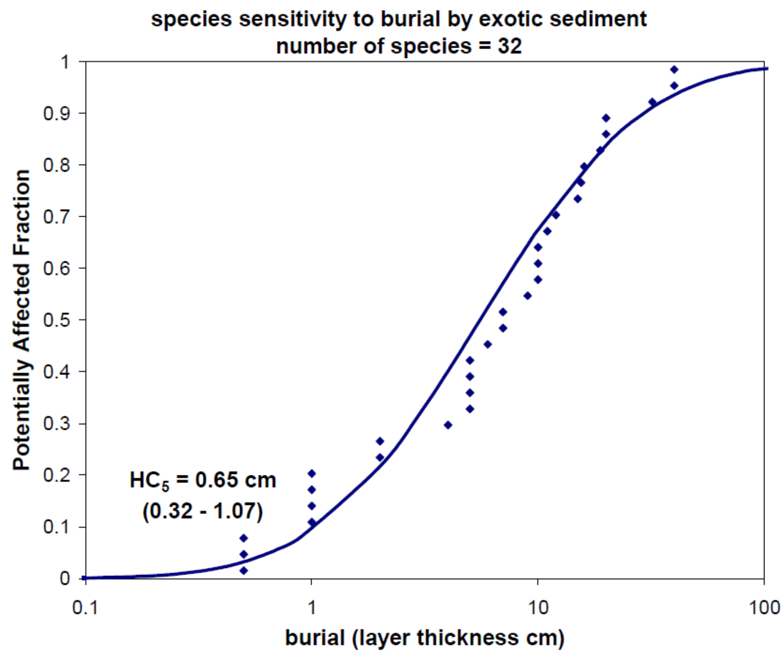
A more detailed review is provided here.

Assessment of the Predicted No-Effects Threshold of 6.5 mm

The Predicted No-Effects Threshold (PNET) of 6.5 mm for burial described in Kjeilen-Eilertsen et al. (2004) and Smit et al. (2006, 2008) was derived using literature information on 32 marine species. Those species (and associated references) are identified in Kjeilen-Eilertsen et al. (2004) and results of the review are reiterated in Smit et al. (2006). The latter also provides thresholds for sediment grain size changes and oxygen depletion, based on other publications (notably Trannum 2004 and Beardlsey and Neff 2004). Smit et al. (2008) is a primary publication based on the more detailed project report by Smit et al (2006). The more conservative threshold of 1.5 mm is discussed in Kjeilen-Eilertsen et al. (2004), but it is not discussed in Smit et al. (2006, 2008).

The objective of the work described in Smit et al. (2006), as well as Kjeilen-Eilertsen et al. (2004), was to derive risk sensitivity distributions for non-toxic stressors for marine communities to be used in the Environmental Impact Factor (EIF) for drilling discharge. The EIF is a risk assessment software tool developed by SINTEF in Norway. Field verification of EIF results have shown that the tool overestimates risk based on the highly conservative assumptions used in calculations (e.g., Durrell et al. 2006; Neff et al. 2006).

The development of risk sensitivity distributions involves collection and analysis of information on the sensitivity of various species to a particular environmental stressor. Del Signore (2015) provides a dissertation on the use and development of species sensitivity distributions in ecological risk assessment. If a large data set with sensitivity values for different taxonomic groups is available, these values can be used to draw a distribution (Smit et al. 2006). Figure 1 provides the species sensitivity distribution to burial by exotic sediment based on the 32 species in Kjeilen-Eilertsen et al. (2004). Note that not one species dictates the threshold. It is obtained by fitting an appropriate distribution to a group of species thought to represent the community.



Source: Smit et al. (2006); Kjeilen-Eilertsen et al. (2004)

Figure 2 Species Sensitivity Distribution of Benthic Species for Burial by Exotic Sediment

The threshold of 0.65 cm (or 6.5 mm) is the drill cuttings thickness where 5% of the species considered will be potentially affected. The threshold is conservative in that it 'protects' 95% of remaining species, although Smit et al. (2006) note that setting the threshold at 5% is arbitrary. The main assumption in the use of species sensitivity distributions in risk assessment is that the distribution is based on a selection of species assumed to representative of all species potentially exposed in the natural environment (Smit et al. 2006 and reference therein; also see Forbes and Calow, 2002, for an extensive critique of species sensitivity distributions).

The following text will attempt to assess if the species sensitivity distribution, and resulting threshold of 6.5 mm, described in Kjeilen-Eilertsen et al. (2004) and Smit et al. (2006) can be applied on the Grand Banks specifically. The suggestion in Kjeilen-Eilertsen et al. (2004) was to run the EIF risk assessment model with the thresholds of 6.5 mm and 1.5 mm to assess the sensitivity of the model to these thresholds[2]. This suggestion was not carried forward in Smit et al. (2006, 2008); nor was it brought forward in subsequent experiments aimed at testing thresholds. Although, as noted by the reviewer, the threshold of 1.5 mm may apply to more sensitive coral species. The threshold for effects on coral species is discussed in response to IR25.

The list of species considered in Kjeilen-Eilertsen et al. (2004) is provided in Table 1. These data were obtained from laboratory experiments on individual species, not communities. Most (72%) of the species considered were bivalves; 16% were crustaceans, 9% were polychaetes; and 3% were gastropods. This contrasts with Grand Banks communities, which are dominated by polychaetes (Kenchington et al. 2001; Husky Energy 2008, and earlier EEM reports). Therefore, the list of species examined in Kjeilen-Eilertsen et al. (2004) violates the main assumption for realistic use of species sensitivity distributions. In general, bivalves are considered sensitive to burial whereas are polychaetes are considered relatively tolerant. Therefore, a community dominated by polychaetes will be more tolerant to burial from drill cuttings than a community dominated by bivalves.

Table 1 Species Use to Establish Sensitivity Threshold in Kjeilen-Eilertsen et al. (2004) and Smit et al. (2006)

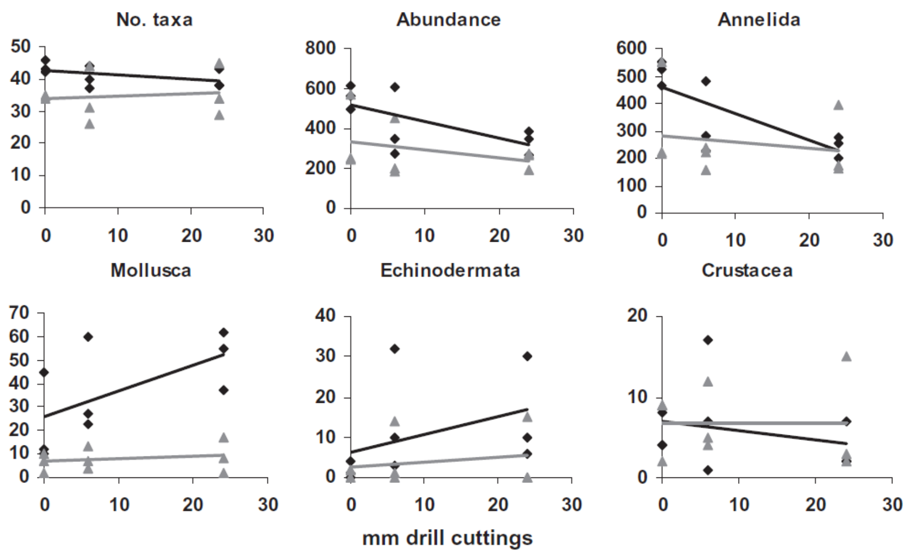
Species number	Species name	Group
1	*Crassostrea virginica*	Bivalve
2	*Hinnities multirugosus*	Bivalve
3	*Modiolus demissus*	Bivalve
4	*Cardita floridana*	Bivalve
5	*Mytilus edulis*	Bivalve
6	*S. laticauda*	Crustacean
7	*Venericardia borealis*	Bivalve
8	*Astarte castanea*	Bivalve
9	*Phaciodes nassula*	Bivalve
10	*Scoloplos fragilis*	Polychaete
11	*Acanthocardia echinata*	Bivalve
12	*Anadara notabilis*	Bivalve
13	*Cerastoderma edule*	Bivalve
14	*Laevicardium crasum*	Bivalve
15	*Gemma gemma*	Bivalve
16	*Astarte undata*	Bivalve
17	*P. longimerus*	Crustacean
18	*Nucula proxima*	Bivalve
19	*Cancer magister*	Crustacean

[2] Kjeilen-Eilertsen et al. (2004) suggested these thresholds because three of the species considered had 0 tolerance to burial. Because data were log-transformed before analysis, those 0 values were replaced by 0.5 (as the logarithm of 0 cannot be obtained). They then suggested that this 0.5 value should be subtracted from the threshold of 6.5 and tested in the EIF tool to see if results were altered.

Species number	Species name	Group
20	*Clinocardium nuttalli*	Bivalve
21	*Yoldia limatula*	Bivalve
22	*Divaricella quadrisulcata*	Bivalve
23	*Codakia orbicularis*	Bivalve
24	*Nereis succinea*	Polychaete
25	*Mercenaria mercenaria*	Bivalve
26	*Ilyanassa obsoleta*	Gastropod
27	*Mya arenaria*	Bivalve
28	*Crangon crangon*	Crustacean
29	*Heteromastus filiformis*	Polychaete
30	*N. sayi*	Crustacean
31	*Ensis directus*	Bivalve
32	*Macoma nasuta*	Bivalve
Source: Modified from Smit et al. 2006		

Nevertheless, since the acceptance of the 6.5 mm threshold for use in EIF risk assessment in Norway, there have been a series of mesocosm or field studies on the effects of drill cuttings on benthic communities that are better representative of the species assemblages found on the Grand Banks. Unless otherwise stated, the studies described below involved communities where polychaetes were among the dominant taxa.

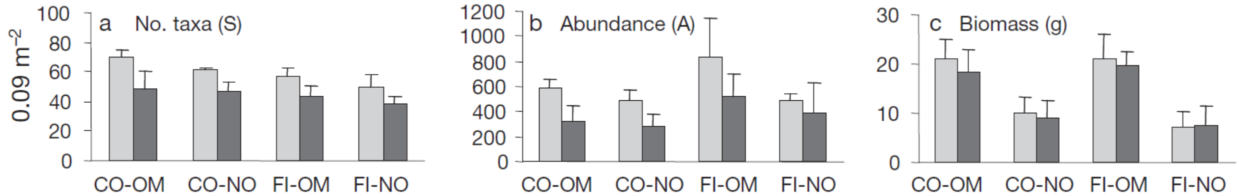
In a 6-month mesocosm experiment, Trannum et al. (2010) noted that 6 mm and 24 mm layers of cuttings depressed species richness, abundance, biomass and diversity and that responses were correlated with cuttings thickness. However, in a similar field experiment with deployed sediment boxes, Trannum et al. (2011a) found that only the 24 mm layer affected benthos. Trannum et al. (2011a) found that field responses in the 24 mm layer were subtle and less than those noted in the mesocosm experiment. They speculated that this difference resulted from stronger water flow in the field situation (which would compensate for any oxygen depletion in the sediment). Selected results from Trannum et al. (2011a) are provided in Figure 2 below. Two sediment types were tested (coarse and fine), and sediment boxes for each treatment were recovered from three sites. Overall, site and sediment grain size effects were stronger than any effect from cuttings (note the variability among sites and between sediment types in Figure 2).



Source: Trannum et al. (2011a)
Note : Gray triangles and lines denote "coarse" sediment and black diamonds and lines denote "fine" sediment.

Figure 2 Taxa Richness, Total Abundance, and Abundance of main taxonomic groups (0.09 m²).

In additional mesocosm experiments, Trannum et al. (2011b) found that a cuttings cap of 6.5 mm caused faunal depletion. Selected results are provided in Figure 3. However, in a subsequent mesocosm experiment, Trannum et al. (2016) noted no alteration of community structure with a cuttings cap of 6.3 mm. Here, they speculated that different mud types, different origins for cuttings, as well as pre-treatment of cuttings to remove glycol in the 2016 experiment might have contributed to the difference in results (glycol is water soluble and would normally not be deposited with cuttings).



Note: Number of (a) taxa (S), (b) abundance (A), and (c) biomass (without echinoids), measured at Day 48 (end of experiment), in response to the addition of test sediment (TS, light bars) and water-based drill cuttings (WB, dark bars) in combination with other experimental values. FI = fine sediment community, CO = coarse sediment community, OM = organic matter, NO = no organic matter. Means per treatment (0.09 m²) + SD.

Figure 3 Selected Results from Trannum et al. (2011b).

Although pre-dating the establishment of the 6.5 mm threshold used in EIF risk assessment, but also in field trials, Bakke et al. (1989) found that 10 mm of water-based drill cuttings did not alter benthic community composition.

With foraminifera, and using the same mesocosm set-up used in Trannum et al. (2010) over 193 days, Hess et al. (2013) found that most species migrated through drill cuttings layers of up to 12 mm thickness, but that a burial depth of 24 mm severely limited migration capability.

Finally, in another mesocosm study with, in this case, a community dominated by bivalves. Schaaning et al. (2008) found no difference in major indices of community structure (richness, abundance, diversity and evenness) between sediments treated with 3 mm of cuttings and control sediments. However, analysis of community composition showed some differences between the treatment and control groups (i.e., some taxa were sensitive).

Summary and Conclusion:

The threshold of 6.5 mm for burial by cuttings in Kjeilen-Eilertson et al. (2004) and Smit et al. (2006, 2008) was developed for use with the EIF risk assessment software and was based primarily on responses from individual bivalves held under laboratory conditions. Nevertheless, the threshold is within the range of 3 mm to 24 mm thresholds noted in mesocosm or field experiments on benthic communities more similar to those found on the Grand Banks. Discrete thresholds are required and useful in modelling tools aimed at simplifying complicated systems. However, the exact community response in the field cannot be anticipated so precisely to date, Dr. Hilde Cecilie Trannum, in Norway, has generated most of the information on the applicability of the 6.5 mm threshold or any other threshold to benthic communities in the offshore. She correctly notes that the relationship between disturbance and community responses is highly complex. Among a variety of other factors, mesocosm or smaller scale laboratory experiments could overestimate the effect of drill cuttings because water flow is reduced compared to field situations; differences in mud type and cuttings could influence results; and the resilience of the receiving benthic community is an important factor. If we assume that field experiments offer more realism than mesocosm experiments, then a general threshold range of 10 to 25 mm based on Bakke et al (1989) and Trannum et al. (2011a) would be appropriate. The use of a fixed threshold to determine effects in the field is not universally applicable, especially one derived from laboratory experiments and a limited species list. Regardless, having 5% of the species affected is relatively subtle when compared to the 50 percent measures of acute effects (i.e., LC50) used to establish sediment quality guidelines.

The percent settled, mean thickness, and maximum thickness data requested are presented in Tables 2 to 4.

Table 2 Total Cuttings Material Settled (%) by Distance from the Wellsite

Well		0-10m	10-100m	100-200m	200-500m	500m-1km	1-2km	Maximum Distance (km)
1	01-Oct	1.6	9.3	12.0	5.0	<0.1	0.0	5.9
2	02-Jan	1.0	13.1	5.7	7.8	0.3	0.6	10.5
3	05-Apr	1.3	16.7	6.8	3.1	<0.1	0.8	7.2
4	07-Jul	4.4	17.5	6.6	4.5	6.6	2.9	5.1
5	08-Oct	1.8	12.4	7.1	6.5	<0.1	0.0	5.2
6	09-Jan	2.0	13.8	7.4	6.4	10.5	14.9	7.0
7	12-Apr	2.8	14.1	5.6	5.2	0.2	1.8	5.5
8	14-Jul	5.0	17.8	4.4	1.1	1.2	1.7	5.0

Table 3 Mean Cuttings Thickness (mm) by Distance from the Wellsite

Well		0-10m	10-100m	100-200m	200-500m	500m-1km	1-2km
1	01-Oct	12	3	1.3	0.2	0.02	0.00
2	02-Jan	7	3	0.5	0.2	0.03	<0.01
3	05-Apr	10	5	0.7	0.1	<0.01	<0.01
4	07-Jul	32	5	0.5	0.1	0.04	0.01
5	08-Oct	13	4	0.8	0.2	<0.01	0.00
6	09-Jan	15	4	0.6	0.1	0.05	0.03
7	12-Apr	21	4	0.5	0.2	0.01	<0.01
8	14-Jul	37	5	0.3	0.0	0.01	<0.01

Table 4 Maximum Cuttings Thickness (mm) by Distance from the Wellsite

Well		0-10m	10-100m	100-200m	200-500m	500m-1km	1-2km
1	01-Oct	12	17	12	3	0.09	0.0
2	02-Jan	7	12	9	9	0.4	0.03
3	05-Apr	10	19	9	1.1	<0.01	0.02
4	07-Jul	32	21	4	0.3	0.3	0.1
5	08-Oct	13	19	8	10	<0.01	0.0
6	09-Jan	15	13	10	0.9	0.3	0.3
7	12-Apr	21	15	9	8	0.4	0.02
8	14-Jul	37	21	4	0.6	0.03	0.05

References

Bakke, T., J.A. Berge, K. Naes, F. Oreld, L.-O. Reiersen and K. Bryne. 1989. Long term recolonization and chemical change in sediments contaminated with oil based drill cuttings. Pp. 521-544. In: F.R. Engelhardt, J.P. Ray and A.H. Gillam (eds.). Drilling Wastes. Elsevier Applied Science.

Beardsley K. and J. Neff. 2004. background document for the establishment of non-toxic (sediment disturbance) thresholds for drilling muds and cuttings - Oxygen depletion. Appendix. In. M.G.D. Smit, M.G.D., J.E. Tamis, R.G. Jak, C.C. Karman, G. Kjeilen-Eilertsen, E. Trannum and J. Neff. 2006. Threshold Levels and Risk Functions for Non-toxic Sediment Stressor: Burial, Grain Size Changes and Hypoxia. Summary. ERMS Report No. 9.

Del Signore, A. 2015. Developing and analyzing species sensitivity distributions in ecological risk assessment. PhD thesis, Radboud University Nijmegen, The Netherlands.

Durrell, G., T.R. Utvik, S. Johnsen, T. Frost and J. Neff. 2006. Oil well produced water discharges to the North Sea. Part I: Comparison of deployed mussels (*Mytilus edulis*), semi-permeable membrane devices and the DREAM model predictions to estimate the dispersion of polycyclic aromatic hydrocarbons. Marine Environmental Research, 62: 194-223.

Forbes V.E. and P. Calow. 2002. Species sensitivity distributions revisited: A critical appraisal. Human and Ecological Risk Assessment, 8(3): 473-492.

Hess, S., E. Alve, H.C. Trannum and K. Norling. 2013. Benthic foraminiferal responses to water-based drill cuttings and natural sediment burial: Results from mesocosm experiment. Marine Micropaleontology, 101: 1-9.

Husky Energy. 2019. White Rose Environmental Effects Monitoring Program 2016. Prepared by Stantec Consulting Ltd. for Husky Energy, St. John's, NL.

Kenchington, E.L.R., J. Prena, K. Gilkinson, D.C. Gordon, K. MacIsaac, C. Bourbonnais, P. Schwinghamer, T.W. Rowell, D.L. McKeown and W.P. Vass. 2001. Effects of experimental otter trawling on the macrofauna of a sandy bottom ecosystem on the Grand Banks of Newfoundland. Canadian Journal of Fisheries and Aquatic Sciences, 58: 1043-1057.

Kjeilen-Eilertsen G., H. Trannum, R.G. Jak, M.G.D. Smit, J. Neff and G. Durell. 2004. Literature report on burial: derivation of PNEC as component in the MEMW model tool. ERMS report 9B.

Neff, J.M., S. Johnsen, T.K. Frost, T. I.R. Utvik and G.S. Durell. 2006. Oil well produced water discharges to the North Sea. Part II: Comparison of deployed mussels (*Mytilus edulis*) and the DREAM model to predict ecological risk. Marine Environmental Research, 62: 224-246.

Schaanning, M.T., H.C. Trannum, S. Øxnevad, J. Carroll and T. Bakke. 2008. Effects of drill cuttings on biogeochemical fluxes and macrobenthos of marine sediments. J. Exp. Mar. Biol. Ecol., 361: 49-57.

Smit, M.G.D., K.I.E. Holthaus, H.C. Trannum, J.M. Neff, G. Kjeilen-Eilertsen, R.G. Jak, I. Singsaas, M.A.J. Huilbregts and A.J. Hendriks. 2008. Species sensitivity distribution for suspended clays, sediment burial, and grain size change in the marine environment. Environ. Tox. and Chem., 27(4): 1006-1012.

Smit, M.G.D., J.E. Tamis, R.G. Jak, C.C. Karman, G. Kjeilen-Eilertsen, E. Trannum and J. Neff. 2006. Threshold levels and risk functions for non-toxic sediment stressor: Burial, grain size changes and hypoxia. Summary. ERMS Report No. 9.

Trannum H.C. 2004. calculation of the PNEC for changed grain size based on data from MOD. ERMS report 9A.

Trannum, H.C., H.C. Nilsson, M.T. Schaanning and S. Øxnevad. 2010. Effects of sedimentation from water-based drill cuttings and natural sediment on benthic macrofaunal community structure and ecosystem processes. J. Exp. Mar. Biol. Ecol., 383: 111-121.

Trannum, H.C., M.T. Schaaning, J.T. Johansen, L. Moodley, S. Westerlund and T. Baussant. 2016. Mesocosm study with thermally treated (TCC) and water-based drill cuttings (WBM). Norwegian Institute for Water Research (NIVA) Report, No. 7033-2016.

Trannum, H.C., A. Setvik, K. Norling and H.C. Nilsson. 2011a. Rapid macrofaunal colonization of water-based drill cuttings on different sediments. Mar. Pol. Bull., 62: 2145-2156.

Trannum, H.C., H.C. Nilson, M.T. Schaanning and K. Norling. 2011b. Biological and biogeochemical effects of organic matter and drilling discharges in two sediment communities. Mar. Ecol. Prog. Ser., 442: 23-36.

1.4.13 Information Requirement: IR-25

Reference to EIS:

Section 2.6.1 Drilling Waste

Context and Rationale

In the EIS, there is no discussion of the probable no effect threshold (PNET) for sedimentation on more sensitive coral and sponge species; how this relates to dispersion modelling results; and specific mitigation measures (e.g. pre-drill benthic surveys, setback distance based on results of dispersion modelling) that are planned to avoid/mitigate impacts to sensitive species that may be present.

With respect to drill cuttings dispersion modelling, the EIS states that "Further assessment is provided where there may be risk to sensitive habitat or vulnerable species (Section 4.2.9)." However, this information is not included.

Specific Question of Information Requirement

Provide an updated effects analysis, including a discussion of the probable no effect thresholds, for fish and fish habitat, including coral and sponge species, and special areas. Relate the analysis to dispersion modelling results, and specific mitigation measures (e.g. pre-drill benthic surveys, setback distance based on results of dispersion modelling) that are planned to avoid and/or mitigate impacts, as well as follow-up and monitoring.

Response

The effects of sedimentation on tropical stony corals have been studied for many years (Allers et al. 2013). Short term exposure to sediment affects these corals by reducing their zooanthellate symbionts' photosynthetic efficiency while increasing respiration, ultimately resulting in bleaching and mortality. The opposite is true for cold-water corals with the effects of sedimentation on these species being poorly understood. Studies to date have focused on *Lophelia pertusa*, which is the most common reef-building scleractinian deep-water coral (Allers et al. 2013). In laboratory studies, Brooke et al. (2009) tested the tolerance of two *L. pertusa* morphotypes to varying levels of sedimentation and concluded that these species were able to tolerate fairly high levels of short-term sedimentation before mortality set it. Sub-lethal effects on *L. pertusa* from exposure to both benthic sedimentation and drill cuttings included the loss of tissues, reduced skeletal growth, as well as reduced larval survival (Allers et al. 2013).

Larsson and Purser (2011) performed burial studies on *L. pertusa* to compare the sensitivity of the species with established threshold levels for sediment burial outlined by Smit et al. (2008). Smit et al. (2008) set a probable no net effect threshold (PNET) of 6.3 mm in which 95% of species were expected to not be impacted by burial. Larsson and Purser (2011) exposed *L. pertusa* to both 6.5 mm and 19 mm of sedimentation to test the species sensitivity to burial under 6.5 and 19 mm of WBM.

Larsson and Purser (2011) observed that *L. pertusa* may suffer damage from burial of 6.5 mm of drill cuttings, although polyp mortality at this threshold was only 0.5%. However, at this threshold it was also observed that 42% of the coral fragment tissue was smothered resulting in a decrease in proportion skeleton covered by living tissues. Loss of these tissues can be detrimental to the species since fouling organisms can colonize bare skeleton. When *L. pertusa* was exposed to 19 mm of sediment, polyp mortality was observed to be 4% and able to clear and reject sediment particles from its tissues. These experiments took place in the absence of flow; in a real-life scenario ocean currents would aid corals in the clearing of sediment from their tissues and as a result, effects may be less pronounced.

It is also noted that the PNET described by Smit et al. (2008), was based on the instantaneous and complete burial of organisms. This would not occur during drilling scenarios because cuttings are slowly released over time. Smit et al. (2008) indicates that due to the differences between the way the exposure was expressed in their experiments and the way the exposure occurs in real life scenarios, the PNET of 6.3 mm is likely an overestimation of effects related to the deposited layer and is thus likely conservative.

Drill cuttings dispersion modelling conducted within the Project Area concluded that there will be a well-defined cuttings patch covering an area which extends 100 -200 m out from the drill center. The patch has a varying thickness ranging from 1-10 mm, with some portions resulting in burial thickness of 25 to 50 mm. Recent research from Larson and Purser (2011) have indicated that cold-water coral species could be affected by burial depths of 6.5 mm. As a result, there is the potential for mortality (albeit low) for coral species within the 100 to 200 m cuttings dispersion zone.

Husky will conduct a visual survey (using a remotely operated vehicle) of the seafloor prior the start of drilling to assess the presence of any aggregations of habitat-forming corals or sponges. If sensitive environmental features are identified during the survey, Husky will move the wellsite to avoid affecting them if it is feasible to do so. If it is not feasible, Husky will consult with the Canada-Newfoundland and Labrador Offshore Petroleum Board and Fisheries and Oceans Canada to determine an appropriate course of action.

The updated statement on residual environmental effects addressed in CL-11 remains valid:

In summary, the Project may result in adverse effects that cause a change in risk of mortality, physical injury or health and a change in habitat quality and use for fish and fish habitat. In consideration of the scientific literature, the effects monitoring programs, implementation of mitigation measures, adherence to industry standards and regulations, the residual effect of a change in risk of mortality, physical injury or health for various Project components and activities is predicted to range from low to moderate in magnitude. Residual project environmental effects for a change in risk of mortality, physical injury or health will be restricted to the Project Area and localized near the source. The duration of effects will vary from short-term regular events (i.e., one day per well for vertical seismic profiling survey or wellhead removal) to longer-term events such as waste management (i.e., residual effects from water-based mud / synthetic-based mud and cuttings discharge). These environmental effects may occur within a disturbed ecological (non-pristine) and socio-economic context (associated with ongoing harvesting of fish species and underwater sound and waste discharge associated with marine shipping and existing oil and gas operations in the Study Area).

Similarly, changes to habitat quality and use for fish and fish habitat are predicted range from low to moderate in magnitude, occur within the Project Area or parts of the Study Area (during wellsite surveys), be short to long-term in duration, be reversible at the completion of the Project, and occur within a disturbed ecological (non-pristine) and socio-economic context.

Table 6.5 summarizes the environmental effects assessment and prediction of residual environmental effects resulting from those interactions between the Project and fish and fish habitat that were identified in Table 6.3.

Table 1 Project Residual Effects on Fish and Fish Habitat

Residual Effect	Residual Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Risk of Mortality, Physical Injury and Health							
Presence and Operation of MODU	A	L	PA	MT	IR	R	D
Drilling-associated Surveys	A	L	PA	ST	IR	R	D
Waste Management	A	M	PA	LT	IR	R	D
Well Abandonment	A	L	PA	ST	S	R	D
Change in Habitat Quality and Use							
Presence and Operation of MODU	A	L	PA	MT	IR	R	D
Drilling-associated Surveys	A	L	SA	ST	IR	R	D
Waste Management	A	M	PA	LT	IR	R	D
Supply and Servicing	A	L	PA	MT	R	R	D
Well Abandonment	A	L	PA	ST	S	R	D

KEY:
See Table 6.2 for detailed definitions
N/A: Not Applicable

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
SA: Study Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

References

Allers, E., R.M. Abed, L.M. Wehrmann, T. Wang, A.I. Larsson, A. Purser and D. de Beer. 2013. Resistance of *Lophelia pertusa* to coverage by sediment and petroleum drill cuttings. Marine Pollution Bulletin, 74. 10.1016/j.marpolbul.2013.07.016.

Brooke, S.D., M.W. Holmes and C.M. Young. 2009. Sediment tolerance of two different morphotyopes of the deep-sea coral *Lophelia pertusa* from the Gulf of Mexico Mar. Ecol. Prog. Ser., 390: 137-144.

Larsson, A.I. and A. Purser. 2011. Sedimentation on the cold-water coral *Lophelia pertusa*: Cleaning efficiency from natural sediments and drill cuttings. Marine Pollution Bulletin, 62. 1159-68. 10.1016/j.marpolbul.2011.03.041.

Smit, M.G.D, K.I.E. Holthaus, H.C. Trannum, J.M. Neff, G. Kjeilen-Eilertsen, R.G. Jak, I. Singsaas, M.A.J. Huijbregts and A.J. Hendriks. 2008. Species sensitivity distributions for suspended clays, sediment burial, and grain size change in the marine environment Environ. Toxicol. Chem., 27: 1006-1012.

1.4.14 Information Requirement: IR-26

Reference to EIS:

Section 2.6.3.2 Noise Emissions

Context and Rationale

While Section 2.6.3.2 describes the extent of noise from continuous noise sources including helicopters, offshore supply vessels and the drill rig, it does not describe the extent of impulsive noise from vertical seismic profiling or blasting, which may be required as part of well abandonment.

The EIS Guidelines require that all sources and extent of noise emissions be described in the EIS.

Specific Question of Information Requirement

Provide a description of the extent of noise from impulsive noise sources from vertical seismic profiling and blasting for wellhead removal.

Response

Similar to seismic surveys, both vertical seismic profile (VSP) and geohazard surveys use air guns as an impulsive sound source, but are much smaller in source levels, have a targeted beam and shorter duration than required during seismic surveys. Consisting of between three and six sound source elements, each 150 to 250 in^3 in volume, VSP and geophysical survey operations are typically day per well for VSP and five to seven days per well for wellsite surveys. Additional details are provided in EIS Section 6.3.10.3.1.2.

After a review of the currently available technology, Husky no longer considers the use of shaped charges for well decommissioning or abandonment, as an option.

References

N/A

1.4.15 Information Requirement: IR-27

Reference to EIS:

Section 2.6.1 Drilling Waste

Context and Rationale

Synthetic-based mud (SBM) cuttings from White Rose were modeled to have a large component (up to 70%) of very coarse material (>9.5 millimetres). In the EIS, the SBM dispersion models did not include large particles and had >50% fines.

Specific Question of Information Requirement

Provide a rationale for the differences between the parameterization for the two studies. Update effects assessment as necessary.

Response

The composition of the drill cuttings is dependent on the stratigraphy of the area, the type of drill bit used, the type of drilling mud used and the nature of the cuttings treatment applied. The White Rose Extension Project model used cuttings grain size characterization from a 1993 Hibernia well, as had most cuttings dispersion models pre-2012. The use of those grain size data was challenged by the Canada-Newfoundland and Labrador Offshore Petroleum Board and Husky committed to collecting cutting grain size data from a White Rose well. The data were collected in 2015 and as noted, the grain sizes characterized were quite different. The 2015 data were used in this EIS model and the effects assessment.

References

N/A

1.4.16 Information Requirement: IR-28

Reference to EIS:

Section 6.2.10.3.1.4 Supply and Servicing

Context and Rationale

The EIS states that underwater sound associated with Offshore Supply Vessel (OSV) traffic is not predicted to result in a change in risk of mortality for fish and fish habitat, and that fish are anticipated to temporarily avoid the immediate area of OSV traffic, thereby reducing the risk of fish mortality or physical injury due to vessel strikes or contact with propeller blades. Therefore, underwater sound associated with OSV traffic is not expected to be at levels that would cause health effects, injury or mortality to fish species. However, no information is provided to support these conclusions.

Further, section 6.2.10.1.1 identifies a pathway of effects on commercial fisheries as underwater sound from supply and servicing potentially causing behavioural effects on fisheries species; however, there is no information provided on project specific effects predictions in section 6.2.10.3.1.4.

Specific Question of Information Requirement

Provide information to support the conclusion that supply and servicing activities will not result in a change in risk of mortality, physical injury, or health of fish.

Based on this information, update the effects analysis, proposed mitigation and follow-up, as well as significance predications, as applicable related to the effect of underwater sound from supply and servicing on commercial fisheries.

Response

Using the guideline for recoverable injuries (170 dB re 1μPa for 48 hr sound exposure level [SEL]) and temporary hearing threshold shift (TTS) (158 dB re 1μPa for 12 hr SEL) for injury to fish, it is unlikely that fish would remain in the immediate area long enough (i.e., 12 to 48 hrs) to be continuously exposed to levels that would result in temporary threshold shifts (TTS) in hearing (Popper et al. 2014). Even in the unexpected event that an individual fish elected to remain within the potential exposure area, the result would still be temporary in nature (i.e., both TTS and recoverable injuries are short-term and reversible outcomes). Furthermore, there is no direct evidence regarding the effect of ship noise on mortality or potential mortality to fish (Popper et al. 2014).

The characterization of the residual project related environmental effects on commercial fisheries from supply and servicing activities was assessed in EIS Section 6.2.10.3.1.4. However, as the reviewer points out, the effects on commercial fisheries from underwater sound from supply and servicing potentially causing behavioural effects on fisheries species, was not specifically assessed in this section. However, Section 6.1.10.3.2.4 does assess the potential behavioural affects to fish that would apply to commercial species and therefore should have been cross referenced in EIS Section 6.2.10.3.1.4. Quantitative metrics or guidelines for assessing behavioural effects of sound on fish are not available, so the assessment is based on the relative sound level exposure to Project activities. The operation of offshore supply vessels (OSVs) will increase vessel traffic within the Project Area, marginally. OSVs responsible for transporting supplies will require one to three trips per week from the supply base to the mobile offshore drilling unit. Thus, the operation of OSVs is not predicted to result in a change fish behavior that would affect commercial fisheries.

As a result, the effects analysis, mitigations, significance predictions and follow-up remain unchanged.

References

Popper, A.N., A.D. Hawkins, R.R. Fay, D. Mann, S. Bartol, Th. Carlson, S. Coombs, W.T. Ellison, R. Gentry, M.B. Halvorsen, S. Lokkeborg, P. Rogers, B.L. Southall, D.G. Zeddies and W.N. Tavolga. 2014. Sound Exposure Guidelines. In ASA S3/SC1. 4 TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI- Accredited Standards Committee S3/SC1 and registered with ANSI (pp. 33-51). Springer, Cham.

1.5 MARINE MAMMALS AND SEA TURTLES

1.5.1 Information Requirement: IR-29

Reference to EIS:

Section 6.3.10 Assessment of Residual Environmental Effects on Marine Mammals and Sea Turtles

Context and Rationale

The EIS Guidelines require a description, assessment, and determination of the significance of potential effects from underwater noise on marine mammals and sea turtles (Part 2, Section 6.3.3, 6.3.4 and 6.6.3). The EIS presents underwater sound modelling results from drilling, helicopters and offshore supply vessel activities at a representative location within the White Rose field, a production project, which lies in the middle of the Husky Energy Exploration Drilling project area. Also, Section 6.3.10 of the EIS uses the results of existing underwater noise modelling completed for other exploration drilling projects to support Husky's effects assessment on marine mammals and sea turtles from the MODU, drilling-associated surveys (vertical seismic profiling), and supply and servicing.

It is not clear how the existing sound effects analysis completed for other projects are representative of underwater sound effects from this project and what the predictions or worst-case scenario are for distances to sound level threshold exceedances for this project.

Specific Question of Information Requirement

Provide the predicted spatial extent of where underwater sound will exceed injury and behavioral thresholds for the Project or a worst-case scenario. Provide the rationale on how previously predicted injury and behavioural thresholds from other exploration projects applies directly to the current project or how the worst-case scenario predictions from other exploration projects applies to Husky.

Update the effects assessment as necessary.

Response

Sound modelling undertaken in the White Rose field for drilling from a concrete gravity structure is not expected to be comparable to mobile offshore drilling unit sound source levels. Therefore, models conducted for other exploration drilling projects were evaluated for this assessment. Source levels for drilling in the Scotian Basin modelling (Zykov 2016) are applicable, but acoustic energy is expected to experience higher transmission loss due to the lack of a strong surface channel. Strong surface channels trap acoustic energy at the surface and therefore reduce the amount of transmission loss. Acoustic modeling conducted for Nexen's Flemish Pass Exploration Drilling Project (JASCO 2018) is considered more analogous to this Project given the similarities in physical and oceanographic environments.

In the absence of formal Canadian thresholds, National Oceanographic and Atmospheric Administration (NOAA's) interim root mean square (RMS) sound pressure levels (SPLs) (NOAA 2015) thresholds have been used to inform the assessment of potential behavioural effects of sound on marine mammals with additional context provided based on outcomes of various available research study and reviewed publications. These threshold values, which have been historically applied generically to both cetaceans and pinnipeds, are 120 dB RMS re 1 µPa for continuous sounds (e.g., shipping and drilling) and 160 dB RMS re 1 µPa for pulse sounds (e.g., seismic surveys and vertical seismic profiling (VSP)). These sound levels have commonly been used in environmental assessments of seismic programs in Atlantic Canada (as well as Pacific Canada, Arctic Canada, and the US) for assessing behavioural effects of anthropogenic underwater sound on marine mammals. Applying these thresholds, distances to behavioural threshold were 7.9 km for the VSP airgun array and 56.8 km for drilling (JASCO 2018), as a worst-case scenario. Considering the injury criteria thresholds for low-frequency cetaceans, the worst-case scenario for VSP surveys was 9.66 km and 3.29 km for drilling (JASCO 2018).

Sound levels generated from operation of vessels and helicopters were modelled within the White Rose field. Sounds levels of 180 to 160 dB re 1 µPA (rms) have been estimated to occur at 5 and 22 m of a typical offshore supply vessel (Matthews and Zykov 2012). The sound levels of a helicopter at an altitude of 91 m hovering over water were modelled and received underwater sound levels are not expected to exceed 157 dB re 1 µPA at depths greater than 3 m (Matthews and Zykov 2012). Sound transfer to the marine environment from helicopters during personnel transport is likely minimal.

No updates to the effects assessment are considered necessary.

References

JASCO. Applied Sciences. 2018. Underwater Sound Propagation Assessment. Prepared for the Nexen Energy ULC Flemish Pass Exploration Drilling Project (2018-2028). https://www.ceaa.gc.ca/050/documents/p80117/122071E.pdf

Matthews M.R. and M.M. Zykov. 2012. Underwater Sound Propagation Assessment for the Environmental Assessment of the White Rose Extension Project. JASCO Document P001162-001. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd.

NOAA (National Oceanic and Atmospheric Administration). 2015. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. In: National Oceanic and Atmospheric Administration and U.S. Department of Commerce. Revised version for Second Public Comment Period. 180 pp. Available at: http://www.nmfs.noaa.gov/pr/acoustics/draft%20acoustic%20guidance%20July%202015.pdf.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd.

1.5.2 Information Requirement: IR-30

Reference to EIS:

Section 6.3.10.3.1.2 Drilling-Associated Surveys

Context and Rationale

Section 6.3.10.3.1.2, page 6.55, states that "in the study area, drilling-associated surveys will include VSP [vertical seismic profiling] and geohazard surveys…" and that "the potential physical and physiological effects of noise from the geohazards equipment are of less concern than air gun pulses from 2D and 3D surveys given their relatively lower source levels, emission in a narrow beam, short duration of the geohazards program, and that some equipment operates at frequencies outside the range of marine mammal and sea turtle hearing abilities." The EIS does however, assume the sound from VSP is the same as that emitted from geohazard equipment and does not provide a comparison between sound from geohazard equipment and VSP equipment nor separate information on expected sound emissions for geohazard equipment. Modelling is provided from Scotian Basin for VSP surveys but no modelling is provided for geohazard surveys.

Specific Question of Information Requirement

Provide a comparison of sound from VSP equipment to that of geohazard equipment or separate information on and assessment of sound levels expected to be emitted from geohazard equipment.

Update the effects assessment as necessary.

Response

Geohazard surveys are used to identify unstable areas beneath the seafloor (e.g., shallow gas deposits) and hazards (e.g., large boulders, debris) so that these hazards can be avoided when drilling. Vertical seismic profile (VSP) surveys are used to further define the depth of geological features and potential petroleum reserves by obtaining high resolution images of the target. VSP surveys differ from surface geophysical surveys in that they are conducted using hydrophones inside the wellbore and a sound source near the surface or near the well. Geohazard surveys involve mapping the seabed through the acquisition of data via several different potential pieces of equipment; these might include single-beam echosounder, multibeam echosounder, side-scan sonar, chirp / pinger sub-bottom profiler, Huntec boomer / sparker sub-bottom profiler, magnetometer, 2D high-resolution multi-channel seismic or video. The exact nature and specifications of the geohazard equipment that will be used for the Project are not known at this time. However, the approach in the effects assessment for both VSP and geohazard surveys was to assess effects associated with impulsive, directionally-focused, short-duration, sound sources using guidelines for effects thresholds from impulsive sounds. Depending on the level of precision required, multibeam echo sounders and side-scan sonars operate at 3-700kHz with source levels of 200-230 dB re 1 µPa @1 m $_{rms.}$ Whereas, a single VSP pulse could produce a source level of 220 to 245 dB re 1 µPa @ 1 m at frequencies of 5 to 300 Hz.

Adherence to the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment will be implemented to reduce the risk of effects to marine mammal during geophysical surveys (see Section 6.3.10.2). Furthermore, animals are generally expected to temporarily avoid localized areas subject to seismic noise (LGL 2013) and are therefore unlikely to approach close enough to these sound sources to be exposed to sound levels capable of causing auditory injury. While behavioral disturbance is also possible, responses would also be short term (i.e., a few days spread across multiple years). As such, no change to the conclusions presented in the application are considered necessary.

References

LGL Limited. 2013. Environmental Assessment of Shell Canada Limited's Shelburne Basin 3D Seismic Survey in Exploration Licenses 2423, 2424, 2425, and 2426. Prepared for Shell Canada Limited LGL Rep. SA1175. 127 pp + App.

1.5.3 Information Requirement: IR-31

Reference to EIS:

Section 6 Environmental Effects Assessment

Context and Rationale

It is noted that the Scotian Basin and Nexen sound models, were conducted in relation to operation of a single drilling unit, while multiple drilling units may be operating simultaneously for the Project. The effect of noise from multiple drilling units operating simultaneously is not addressed in the effects assessment.

Specific Question of Information Requirement

Assess the effects of noise from operating multiple drilling units simultaneously, as proposed for the Project.

Response

Simultaneous exploration drilling is not anticipated within any one exploration licence (EL) but is likely to occur within the Project Area. The Project Area encompasses the White Rose, Terra Nova, Hibernia, and Hebron development projects as well as multiple ELs and Significant Discovery Licences.

Simultaneous drilling has been assessed as part of the cumulative effects assessment for the Marine Mammals and Sea Turtles VC in 9.2.5 of the EIS.

The sound model most relevant to Husky Exploration Project is the Nexen shallow water model (JASCO 2018). This excerpt from 6.3.10.3.1.1 speaks to the magnitude of the potential effects:

> *Considering underwater sound level thresholds associated with injury and behavioural effects to marine life, the longest distance from the drilling platform were for high-frequency cetaceans, with 1.88 km from the deep site and 3.29 km for the shallow site (JASCO 2018). Distances to all other injury threshold receptors ((low-frequency cetaceans, mid-frequency cetaceans, phocid pinnipeds in water, and otariid pinnipeds in water)) were no longer than 228 m from the drilling platform from wither the deep-water or shallow-water site.*

The predicted spatial extents of sound levels above thresholds for auditory injury are such that the residual changes in risk of mortality or physical injury from various physical activities are unlikely to overlap spatially or affect extended areas. Furthermore, it is still generally expected that the avoidance of underwater sound levels high enough to cause auditory injury would reduce the likelihood of auditory injury for marine mammals and sea turtles.

With respect to potential change in habitat quality and use (including potential for exceedance of behavioural disturbance thresholds) the following results of acoustic modelling are presented. JASCO analyzed sound pressure level data collected from the Flemish Pass in 2015-2016 as part of a baseline monitoring program, sponsored by the Environmental Sciences Research Fund (ESRF), that involved deploying 20 acoustic monitors along Canada’s east coast (Maxner et al. 2017). One of the acoustic monitoring stations (Station 18) was located within the Project Area, approximately 35 km northeast of the Hibernia production platform, in 80 m of water. Sound pressure levels at Station 18 were recorded as 110 to 120 dB re 1 µPa continuously. As indicated in Section 6.3.10 of the EIS, the National Oceanic and Atmospheric Administration’s (NOAA’s) interim guidelines (NOAA 2015) for threshold levels for broadband underwater root-mean-square (RMS) sound pressure levels to avoid risk of behavioural disruption, which have been historically applied generically to both cetaceans and pinnipeds, are 120 dB RMS re 1 µPa for continuous sounds (e.g., shipping and drilling) and 160 dB RMS re 1 µPa for pulse sounds (e.g., seismic surveys and vertical seismic profiling). Field measurements taken at this acoustic monitoring station already reflect the combined sound levels of multiple offshore oil production projects and associated support vessel traffic. Thus, factoring in the cumulative contributions of multiple simultaneous sound sources in the region, in-field measurements suggest that marine mammals within approximately 35 km of operating offshore production platforms may already be exposed to sound levels capable of causing behavioural disturbance. Whether such behavioural disturbance is occurring, and what form it might take, is unknown.

References

JASCO. Applied Sciences. 2018. Underwater Sound Propagation Assessment. Prepared for the Nexen Energy ULC Flemish Pass Exploration Drilling Project (2018-2028). https://www.ceaa.gc.ca/050/documents/p80117/122071E.pdf

Maxner, E., B. Martin, and K. Kowarski. 2017. Marine Mammals and Ambient Sound Sources in the Flemish Pass: Analysis from 2014 and 2015 Acoustic Recordings. Document 01456, Version 1.0. Technical report by JASCO Applied Sciences for Statoil Canada Ltd.

NOAA (National Oceanic and Atmospheric Administration). 2015. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. In: National Oceanic and Atmospheric Administration and U.S. Department of Commerce. Revised version for Second Public Comment Period. 180 pp. Available at: http://www.nmfs.noaa.gov/pr/acoustics/draft%20acoustic%20guidance%20July%202015.pdf.

1.5.4 Information Requirement: IR-32

Reference to EIS:

Section 6.3.12 Follow-up and Monitoring

Context and Rationale

Section 6.3.12 of the EIS states that given the low probability of encountering marine mammal and sea turtle species at risk, "… no sound monitoring is required for this Project." However, Section 6.3.11 states that there is scientific uncertainty regarding the potential effects of underwater sound on marine mammals and sea turtles and site-specific modelling was not carried out for the Project.

Specific Question of Information Requirement

Provide rationale for the need for a follow up program to verify noise predictions taking into consideration the stated uncertainty with respect to potential effects of underwater sound on marine mammals. If follow-up is not proposed, provide a rationale, including consideration of the potential for underwater noise to have adverse effects on marine species and uncertainty related to effects predictions.

Response

As noted in the context, EIS Section 6.3.11 states that "there is scientific uncertainty concerning the potential *effects* [emphasis added] of introduced underwater sound on sea turtles and marine mammals…"; however, the sentence goes on to say that there is "a reasonable understanding of the effects of exploration drilling and VSP operation on marine mammals and the effectiveness of mitigation measures." To further expand on this, we have a good understanding of the range of potential source levels of underwater sound that would be expected from exploration drilling and VSP operation, as well as potential attenuation rates and distances for these sounds. This is based on a combination of in-field measurements, and acoustic modelling, including from sites within the Study Area. We also have a reasonable understanding of the species that may be present and their general sensitivities to sound. What we lack, scientifically, is an ability to predict with or anticipate with certainty how animals may or may not respond when exposed to underwater noise, or how 'important' their response (observed or not) may be relative to overall life functions and success.

Follow up programs are intended to address environmental assessment-related issues of uncertainty, such as verifying effects predictions and/or the effectiveness of implemented mitigation measures. While there is uncertainty regarding the nature of behavioural responses that marine mammals and sea turtles may (or may not) exhibit in response to an underwater noise, and what factors affect such a response, there is less uncertainty regarding typical sound levels produced from exploration drilling program activities. For example, a report by Maxner et al. (2017), used underwater acoustic data collected in the Flemish Pass in 2014 and 2015 to characterize the baseline soundscape in the Flemish Pass, the soundscape during Equinor's 2014-2016 active exploration drilling programs, and the presence of vocalizing marine mammals. Modelling exercises have also been undertaken for previous projects (e.g., the Scotian Basin Exploration Drilling Project [Zykov 2016]), and results of those programs have been considered in developing the Environmental Impact Statement. Based on the results of these previous quantitative and qualitative analytical studies, the uncertainty levels associated with predicted sound levels during operation of the drilling program are considered low and for this reason no follow up program to verify noise predictions is being proposed. The monitoring conducted during the geophysical surveys will serve to mitigate potential effects as well as record the proximity of mammals to the sound source as an indication of avoidance.

Additionally, Project activities of relevance to marine mammals and sea turtles will be short-term to medium-term in nature and will occur in an area where no critical habitat for species at risk has been designated. These factors, and the planned implementation of key mitigation measures, means that the potential for adverse environmental effects is low, and the overall level of confidence in the effects predictions and in the effectiveness of mitigation is moderate to high. No specific follow-up related to underwater noise is therefore considered necessary in relation to the Project.

References

Maxner, E., B. Martin, and K. Kowarski. 2017. Marine Mammals and Ambient Sound Sources in the Flemish Pass: Analysis from 2014 and 2015 Acoustic Recordings. Document 01456, Version 1.0. Technical report by JASCO Applied Sciences for Statoil Canada Ltd.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd.

1.5.5 Information Requirement: IR-33

Reference to EIS:

Section 6.3.10.2 Mitigation

Context and Rationale

Section 6.3.10.2 of the EIS states that mitigation measures applied during the Project's vertical seismic profiling surveys will be consistent with the *Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment* (SOCP), while Section 6.5.10.2 states that VSP activity will be conducted in consideration of the SOCP and Husky Procedure EC-M-99-X-PR-00121-001. It is unclear whether all mitigation measures in the SOCP will be applied to the Project and what, if any, additional mitigation measures will result from the Husky internal procedure. Specifically, the EIS does not propose passive acoustic monitoring (PAM) for detecting marine mammals in the vicinity of the Project during VSP surveys. Deep-diving onontocete species spend most of their time underwater, and may be difficult to detect when at the surface. The concurrent use of visual monitoring and PAM can increase the likelihood of detecting deep-diving cetaceans. In addition, to increase the probability to accommodate deeper, longer diving behavior, a pre-ramp up watch period of 60 minutes in deep water areas where beaked and other deep diving whales may be present should be considered.

The KMKNO expressed concern with the lack of PAM, in particular during periods of low visibility when mammal observers cannot effectively observe the entire safety zone (i.e. fog, nighttime).

Specific Question of Information Requirement

Identify the mitigation measures related to the SOCP that will be followed by Husky and any additional mitigation, if any, found in the Husky Procedure EC-M-99-X-PR-00121-001. Consider PAM for detecting deep-diving cetaceans in the vicinity of the Project during VSP surveys and the length of the ramp-up observation period. Describe whether PAM and a longer pre-ramp up watch would be included in the mitigation measures for the Project. If the proponent does not believe additional mitigation is required, provide associated rationale.

Response

Water depths within the Husky Project Area are a maximum of 211 m and thus is not considered primary habitat for deep diving cetaceans. Nonetheless, all applicable mitigations measures from the *Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment* (SOCP) will be followed during geophysical surveys, including PAM, as required. In addition to the requirements of the SOCP, Husky's procedure for environmental protection during vertical seismic profiles and well site surveys will be adhered to. In particular:

- Shut down of the seismic source if any marine mammal or sea turtle is observed within the 500 m safety zone
- a marine mammal observer (MMO), as defined by the SOCP, will conduct a monitoring and release program for stranded seabirds Environment and Climate Change Canada's Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada. Birds that arrive on the installation and are oiled, in obvious distress or dead will be handled in accordance with Husky's scientific permit from the Canadian Wildlife Service.
- The MMO will observe and document the presence of marine mammals, sea turtles and seabirds throughout the entirety of a wellsite survey. Monitoring and documentation will follow the "Recommended Seabird and Marine Mammal Observation Protocols for Atlantic Canada (2004)" and the "Eastern Canada Seabirds at Sea Standardized Protocol for Pelagic Seabird Surveys from Moving and Stationary Platforms".

As per the C-NLOPBs Geophysical, Geological, Environmental and Geotechnical Program Guidelines (Canada-Newfoundland and Labrador Offshore Petroleum Board 2018), Husky Energy will submit a Marine Mammal and Seabird Monitoring Report no later than one year after completion of a geophysical survey.

References

Canada-Newfoundland and Labrador Offshore Petroleum Board. 2018. Geophysical, Geological, Environmental and Geotechnical Program Guidelines. vii + 56 pp.

1.5.6 Information Requirement: IR-34

Reference to EIS:

Section 6.3.10.2 Mitigation

Context and Rationale

Section 6.3.10.2 of the EIS states "[s]hutdown procedures (i.e. shutdown of source array) will be implemented if a marine mammal or sea turtle species listed on Schedule 1 of SARA [*Species at Risk Act*], as well as all other baleen whales (i.e., mysticetes) and sea turtles are observed within 500 m of the wellsite..." and "when a member of the eastern Newfoundland (Sackville Spur) population of northern bottlenose whale is sighted within the safety zone." It is not clear whether shutdown would occur if any marine mammal or sea turtle species were present or how an observer will be able to distinguish between species if shutdown will only occur when a particular species is present.

The WNNB expressed concern with the apparent discrepancy between the proposed 500 metre safety zone over which marine mammals will be monitored during VSP surveys and the acoustic modelling which indicated that the threshold for behavioural effects was between 584 metres (winter) to 677 metres (summer). WNNB asked for the modelled data to be used to define the safety zone and requested that the safety zone be larger than the distance to predicted thresholds.

Specific Question of Information Requirement

Confirm how Schedule 1 SARA species such as baleen whales, sea turtles, or northern bottlenose whales would be identified. Clarify why the bottlenose whale is discussed separately. Clarify whether the VSP source array will be shut down as a precaution if there is a question as to the species observed.

Discuss the feasibility of extending the safety zone during vertical seismic profiling.

Response

Marine mammal observers employed on surveys are appropriately trained in marine mammal identification. If there is a question of species identification during the survey, the data will be recorded as an uncertain identification.

Mitigations for northern bottlenose whales were specifically mentioned, given the uncertainty around which population of northern bottlenose whales may be present within the Study Area. The Scotian Shelf population is assessed as Endangered by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and listed as Endangered on Schedule 1 of the *Species at Risk Act* (SARA), but the Davis Strait-Baffin Bay-Labrador Sea population has no status under SARA and is assessed as Special Concern by COSEWIC (COSEWIC 2011). As Fisheries and Oceans Canada points out in IR-47, both populations have potential to occur within the Study Area.

Given the size and duration of the sound source array during vertical seismic profiling surveys, the impact assessment does not warrant an extension of the safety zone beyond 500 m. However, the seismic source will be shut down if any marine mammal or sea turtle is observed within the 500 m safety zone.

References

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011. COSEWIC Assessment and Status Report on the Northern Bottlenose Whale *Hyperoodon ampullatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. xii + 31 pp.

1.5.7 Information Requirement: IR-35

Reference to EIS:

Section 2.4.3.2 Offshore Supply Vessels

Context and Rationale

Section 2.4.3.2 of the EIS states that offshore supply vessels follow established vessel traffic lanes (a straight-line approach to and from port) and that once in the vicinity of the project area, the offshore supply vessel will select the route most appropriate for reaching the destination. The KMKNO expressed concern regarding marine vessel routes and stated that although it may be common practice to follow a straight line approach, this must be altered if supply vessel routes heading in a straight line will unnecessarily affect species breeding grounds, feeding groups, or migration routes.

Specific Question of Information Requirement

Describe under what circumstances, if any, that Husky would deviate from a straight line approach should there be a potential for an interaction between the vessel and marine mammals, sea turtles and/or migratory birds breeding grounds, feeding areas, and/or migration routes.

Response

Project-related vessel traffic will avoid concentrations of marine mammals and sea turtles whenever possible and under the command of the ships Master. An area known to be sensitive habitat for marine mammals would be avoided in compliance to a Notice to Shipping detailing to remain clear of a designated area, or to transit at a maximum speed.

An area may also be avoided in compliance with a Notice to Shipping or Notice to Mariners advising to remain clear of a designated area, or to transit below a maximum speed.

References

N/A

1.5.8 Information Requirement: IR-36

Reference to EIS:

Section 6.3.10.2 Mitigation

Context and Rationale

The KMKNO and MTI expressed concern that the mitigation measure proposed by the proponent that "project-related vessel traffic will avoid concentrations of marine mammals and sea turtles whenever possible. Vessels will maintain a steady course and safe vessel speed whenever possible, as sudden changes in these factors are known to increase behavioural effects in marine mammals" is insufficient. KMKNO has requested that vessel be required to reduce speeds to 10 knots when not in existing shipping lanes and/or when a marine mammal or sea turtle is observed or reported in the vicinity.

Specific Question of Information Requirement

Define "safe vessel speed" and explain which environmental effects these speeds propose to address (e.g. avoidance of marine mammals, fishers). Explain the location of "existing travel routes" and under what circumstances vessels may deviate from these travel routes. Explain under what circumstances it would not be possible to travel at the defined safe vessel speed.

Describe how concentrations of marine mammals and sea turtles would be avoided (e.g. will there be marine mammal observers on all supply vessels) and what would be considered a "concentration" of marine mammals and sea turtles.

Response

Existing travel routes are defined by the Project Area from St. John's to the designated exploration licenses. The Officer on Watch maintains a lookout to determine risk of collision and determines the appropriate course of action to avoid a collision, which may include deviation from course.

Safe speed is defined in the International Regulations for Preventing Collisions at Sea which state: "Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions". There are several factors provided in determining safe speed.

References

N/A

1.5.9 Information Requirement: IR-37

Reference to EIS:

Section 10.1.4 Species at Risk (SAR)/Species of Conservation Concern (SOCC)

Context and Rationale

MTI expressed concern with the proponent's determination that there is a low potential for North Atlantic Right Whales to occur in the study area (Section 10.1.4, Table 10.2 of the EIS). The residual effects significance determination for the marine mammals and sea turtles VC, was based on assumptions associated with limited data. Much is still unknown (particularly for males) on locations where populations migrate (Moses and Finn, 1997). Some models predict that additional/unknown summering grounds may include areas off Newfoundland (Moses and Finn, 1997).

Husky further states that underwater sound may result in some behavioural effects on individuals, but that mortality, injury, and population level effects are unlikely to occur. However, there is very little specific assessment of project-related activities (e.g. drilling, vessel transit, VSP) and components (e.g. MODUs, supply vessels) on the North Atlantic Right Whale. The primary threat facing this species is vessel strikes and noise disturbance can contribute to the likelihood of these events (Committee on the Status of Endangered Wildlife in Canada, 2013). This is particularly important given the recent deaths of North Atlantic right whales attributable to blunt force trauma. Given the lack of certainty and up-to-date data on North Atlantic Right Whale summering range, changes to migratory patterns, and unprecedented mortalities, further information is required to determine the significance of the environmental effects of the project.

Project activities will include considerable marine travel (a minimum of 1 to 3 return transits a day between the onshore supply base and MODUs), and noise from drilling operations will occur 24 hours per day, intermittently between 2019 and 2027 (for periods of up to 80 days per wellsite). MTI is concerned that Husky has not provided a specific assessment on individual whale species. This data would fill the gap and allow for the confirmation that the environmental effects on North Atlantic Right Whales are not significant. MTI requested that the proponent install hydrophones on MODUs to pick up whale occurrences and contribute to species distribution data, additionally it would support the assessment of potential interactions and contribute to on-going monitoring and recovery efforts. MTI requested that this information be shared with interested Indigenous groups, including MTI.

Specific Question of Information Requirement

Discuss any proposed follow up measures planned by Husky to address the uncertainty of North Atlantic Right Whale presence and if the installation of hydrophones on MODUs to determine the number of Right Whales present in the area would be considered.

Provide information on whether and how monitoring data would be shared with Indigenous groups.

Response

The reviewer may have misunderstood the magnitude of marine traffic associated with this Project. Section 2.4.3.2 of the Husky EIS states:

> "During drilling activities, the OSV responsible for transporting supplies will require one to three trips <u>per week</u> from the supply base to the MODU."

Given this level of activity and the low likelihood of North Atlantic right whales occurring in this area, Husky believes additional monitoring is not warranted.

The Project Area has not been designated critical habitat for North Atlantic right whales nor has there been any restrictions placed on vessel access or speed as measures to mitigate potential impacts to whales in this area.

Geophysical surveys will employ the monitoring and mitigation requirement for marine mammals as per the Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment. As per the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (Canada-Newfoundland and Labrador Offshore Petroleum Board 2018), Husky Energy will submit a Marine Mammal and Seabird Monitoring Report no later than one year after completion of the survey.

References

Canada-Newfoundland and Labrador Offshore Petroleum Board. 2018. Geophysical, Geological, Environmental and Geotechnical Program Guidelines. vii + 56 pp.

1.5.10 Information Requirement: IR-38

Reference to EIS:

Section 6.3.10.3.2.4 Well Abandonment

Context and Rationale

Section 6.3.10.3.2.4 of the EIS states "given the depth of the water at the wellhead, the delay of detonation based on MMO observations, the size of the charge, and its detonation below the sea floor, it is very unlikely that there would be exposure to sound pressure levels that would elicit physical injury to marine mammals and sea turtles." However, Husky has not provided an effects assessment of detonation of a shape charge to remove a well head.

Specific Question of Information Requirement

Provide an assessment of the environmental effects of the removal of a wellhead using shape charges on marine mammals and sea turtles. Describe any applicable mitigation measures that would be put in place during wellhead removal using shape charges.

Response

After a review of the currently available technology, Husky no longer considers the use of shaped charges for well decommissioning or abandonment as an option.

References

N/A

1.6 MIGRATORY BIRDS

1.6.1 Information Requirement: IR-39

Reference to EIS:

Section 4.2.7 Migratory Birds; Section 4.2.7.2 Data Sources; Section 4.2.7.4 Significant Areas of Bird Habitat

Context and Rationale

Environment and Climate Change Canada (ECCC) advises that in addition to the Eastern Canada Seabirds at Sea (ECSAS) database and Fifield et al. (2009), there are a number of additional recent scientific studies of tracking data that reveal the project area (specifically the Grand Banks) as an important area for breeding and over-wintering birds regionally, nationally, and internationally. These references are: Fort et al. 2013, Frederiksen et al. 2016, Hedd et al. 2011, Hedd et al. 2018 and McFarlane Tranquilla et al. 2013.

Also, ECCC notes that the statement in Section 4.2.7 of the EIS that "*ECSAS data obtained from EC-CWS cannot be used to calculate densities because they have not been corrected for detectability"* is incorrect. ECCC advised that the capabilities of the ECSAS database have been incorrectly interpreted. The data can be used to calculate densities because distance sampling methods are used. The data allows the proponent to correct for detectability.

References

Fort, J., Moe, B., Strom, H., Grémillet, D., Welcker, J., Schultner, J., Jerstad, K., Johansen, K.L., Phillips, R.A., and Mosbech, A. (2013). Multicolony tracking reveals potential threats to little auks wintering in the North Atlantic from marine pollution and shrinking sea ice cover. *Diversity Distributions.* **19**: 1322-1332.

Fredericksen, M., Descamps, S., Erikstad, K.E., Gaston, A.J., Gilchrist, H.G., Grémillet, D., Johansen, K.L., Kolbeinsson, Y., Linnebjerg, J.F., Mallory, M.L., McFarlane Tranquilla, L.A., Merkel, F.R., Montevecchi, W.A., Mosbech, A., Reiertsen, T.K., Robertson, G.J., Steen, H., Strom, H., and Thorarinsson, T.L. (2016). Migration and wintering of a declining seabird, the thick-billed murre *Uria lomvia*, on an ocean basin scale: Conservation Implications. *Biological Conservation*. **200**: 26-35.

Hedd, A., Montevecchi, W.A., McFarlane Tranquilla, L.A., Burke, C.M., Fifield, D.A., Robertson, G.J., Phillips, R.A., Gjerdrum, C., and Regular, P.M. (2011). Reducing uncertainty on the Grand Bank: tracking and vessel surveys indicate mortality risks for common murres in the North-West Atlantic. *Animal Conservation.* **14**: 630-641.

Hedd, A., Pollett, I.L., Mauck, R.A., Burke, C.M., Mallory, M.L., McFarlane Tranquilla, L.A., Montevecchi, W.A., Robertson, G.J., Ronconi, R.A., Shutler, D., Wilhelm, S.I., and Burgess, N.M. (2018). Foraging areas, offshore habitat use, and colony overlap by incubating Leach's Storm-petrels *Oceanodroma leucorhoa* in the Northwest Atlantic. *PLoS One*. **13**(5): e0194389. https://doi.org/10.1371/journal.pone.0194389

McFarlane Tranquilla, L.A., Montevecchi, W.A., Hedd, A., Fifield, D.A., Burke, C.M., Smith, P.A., Robertson, G.J., Gaston, A.J., Phillips, R.A. (2013). Multiple-colony winter habitat use by murres *Uria* spp. In the Northwest Atlantic Ocean: implications for marine risk assessment. *Marine Ecology Progress Series.* **472**:287-303.

Specific Question of Information Requirement

Taking into account the references and information provided, provide further information on the potential effects of the Project on birds.

Update the effects predictions, potential mitigation and follow-up, as well as significance predictions, as applicable.

Response

We appreciate the references to recent scientific studies. These studies focus on Auks (including little auks (dovekie), thick-billed murre, common murres), and Leach's storm petrels. Murres are discussed generally Section 4.2.7.3 of the EIS, and more specifically in EIS Appendix D, Section 4.1.9. The seasonal distribution of murres within the Study Area is shown in EIS Appendix D, Figure 29. The information in these sections indicates that murres occur throughout the Study Area in all seasons, which is reinforced by the new studies on murres (Hedd et al. 2011; McFarlane Tranquilla et al. 2013; Frederiksen et al. 2016). The dovekie is also discussed in Section 4.2.7.3 of the EIS, and in EIS Appendix D, Section 4.1.8. The EIS indicates that dovekies regularly occur in spring, fall and winter, and are typically absent from the area in the fall. The study by Fort et al. (2013) identified a hot spot for dovekies off the eastern coast of Newfoundland during the non-breeding season, which confirms the information presented in the EIS.

Although these studies provide a greater level of detail regarding species distributions than what was presented in the EIS, they do not provide new information regarding when or if these species are present within the Study Area. As a result, the effects predictions, mitigations, and significance predictions remain valid and do not need to be updated.

Leach's storm-petrel are discussed generally in Section 4.2.7.3 of the EIS, and more specifically in EIS Appendix D, Section 4.1.3. The EIS indicates that this species is present in the waters of eastern Newfoundland in the spring, summer and fall, with few records from the winter. Effects determination, mitigation measures, and significance determination were based on this information. Hedd et al. (2018) provides a more detailed description of foraging areas and off-shore habitat use by Leach's storm-petrels in the Northwest Atlantic. This paper indicates that individual birds travelled, on average, 400 to 830 km from breeding colonies during the incubation period. This range indicates that Leach's storm-petrels from coastal colonies are very likely to occur in the Study Area during the spring incubation period. Figures also indicate that storm-petrels from the Baccalieu and Gull Island colonies are the most likely to be found in the Study Area during the incubation period (Hedd et al. 2018). This information does not change effects assessments, mitigations and significance predictions; therefore, this information in the EIS remains valid.

References

Fort, J., B. Moe, H. Strom, D. Grémillet, J. Welcker, J. Schultner, K. Jerstad, K.L. Johansen, R.A Phillips and A. Mosbech. 2013. Multi-colony tracking reveals potential threats to little auks wintering in the North Atlantic from marine pollution and shrinking sea ice cover. Diversity Distributions, 19: 1322-1332.

Fredericksen, M., S. Descamps, K.E. Erikstad, A.J. Gaston, H.G. Gilchrist, D. Grémillet, K.L. Johansen, Y. Kolbeinsson, J.F. Linnebjerg, M.L. Mallory, L.A. McFarlane Tranquilla, F.R. Merkel, W.A. Montevecchi, A. Mosbech, T.K. Reiertsen, G.J. Robertson, H. Steen, H. Strom and T.L. Thorarinsson. 2016. Migration and wintering of a declining seabird, the thick-billed murre *Uria lomvia*, on an ocean basin scale: Conservation Implications. Biological Conservationm 200: 26-35.

Hedd, A., W.A. Montevecchi, L.A. McFarlane Tranquilla, C.M. Burke, D.A. Fifield, G.J. Robertson, R.A. Phillips, C. Gjerdrum and P.M. Regular. 2011. Reducing uncertainty on the Grand Bank: Tracking and vessel surveys indicate mortality risks for common murres in the North-West Atlantic. Animal Conservation, 14: 630-641.

Hedd, A., I.L. Pollett, R.A. Mauck, C.M. Burke, M.L. Mallory, L.A. McFarlane Tranquilla, W.A. Montevecchi, G.J. Robertson, R.A. Ronconi, D. Shutler, S.I. Wilhelm and N.M. Burgess. 2018. Foraging areas, offshore habitat use, and colony overlap by incubating Leach's storm-petrels *Oceanodroma leucorhoa* in the Northwest Atlantic. PLoS One, 13(5): e0194389. https://doi.org/10.1371/journal.pone.0194389

McFarlane Tranquilla, L.A., W.A. Montevecchi, A. Hedd, D.A. Fifield, C.M. Burke, P.A. Smith, G.J. Robertson, A.J. Gaston and R.A. Phillips. 2013. Multiple-colony winter habitat use by murres *Uria* spp. In the Northwest Atlantic Ocean: Implications for marine risk assessment. Marine Ecology Progress Series, 472: 287-303.

1.6.2 Information Requirement: IR-40

Reference to EIS:

Section 4.2.7 Migratory Birds; Section 4.2.7.3 Seasonal Distribution and Abundance of Marine Birds; Section 4.2.7.3.3 Summer

Context and Rationale

With respect to marine-associated bird species classified on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as "vulnerable", ECCC advises that the EIS does not clearly explain the reason why Leach's Storm-petrel became listed as "Vulnerable" internationally. It is largely due to the fact that the three largest colonies in Newfoundland (Baccalieu Island, Great Island, and Gull Island) have shown declines of 40-50% over the past 20-30 years. It is also important to emphasize that the core foraging areas of the Leach's Storm-petrels breeding at Baccalieu Island and Gull and Great Island in Witless Bay overlap with the project area. Hedd et al 2018 is an important reference to provide additional information for this section.

Section 6.4.8 of the EIS states "the peak seabird density is typically from July to September…" and that "…seabirds are least abundant during fall months, as species leave to migrate south for the winter." ECCC advised that Leach's Storm-petrel strandings peak on offshore installations in September and October, the timing of which coincides with the fledging period of this species. This period (specifically mid-September to mid-October) should not be considered as less important for seabirds, given that millions of Storm-petrels are likely passing through the project area as they cross the Atlantic and migrate south for the winter (Pollett et al. 2014).

Table 4.33 of the EIS (Important Seabird Colonies in Eastern Newfoundland) includes an outdated estimate of the population size of Leach's Storm-petrel for Baccalieu Island. ECCC advises the current estimated population size of Leach's Storm-petrel for Baccalieu Island is 1.98 million pairs.

Section 4.2.7 (pg. 4.100) of the EIS states that "The offshore distribution of birds that breed in nearby areas during the summer months (e.g. Leach's Storm-petrel) is restricted as they become central-place foragers while attending to nests and chicks." However, ECCC stated that although Leach's Storm-petrels are central-place foragers during the breeding season, tagging data has shown that they still range widely at this time of year, including throughout the study area. As a result, the offshore distribution of the Leach's Storm-petrel would not be considered "restricted" during this time of year, as was stated in the EIS.

References

Hedd, A., Pollett, I.L., Mauck, R.A., Burke, C.M., Mallory, M.L., McFarlane Tranquilla, L.A., Montevecchi, W.A., Robertson, G.J., Ronconi, R.A., Shutler, D., Wilhelm, S.I., and Burgess, N.M. (2018). Foraging areas, offshore habitat use, and colony overlap by incubating Leach's storm-petrels *Oceanodroma leucorhoa* in the Northwest Atlantic. PLoS One. 13(5): e0194389. https://doi.org/10.1371/journal.pone.0194389

Pollett, I.L., Hedd, A., Taylor, P.D., Montevecchi, W.A., and Shutler, D. (2014). Migratory movements and wintering areas of Leach's Storm-Petrels tracked using geolocators. *Journal of Field Ornithology*. 85(3): 321-328.

Specific Question of Information Requirement

Taking into account the information provided about the Leach's Storm-petrel, including the status of the species, provide further information on the potential effects of the Project on this species.

Update the effects predictions, potential mitigation and follow-up, as well as significance predictions, as applicable.

Response

It is acknowledged that recent population declines of Leach's Storm-petrels, particularly at the three largest colonies in Newfoundland (Baccalieu Island, Great Island, and Gull Island), have led to the International Union for Conservation of Nature (IUCN) designation of Vulnerable. Threats to this species include predation by both native and introduced predators, a reduction of reproductive success as a result of disturbance, oil pollution, and the presence of offshore oil and gas operations, particularly with regards to artificial lighting and flares associated with these operations (Birdlife International 2019).

It is also acknowledged that the effects of the project on Leach's storm-petrels have broader spatial and temporal boundaries than reported in Sections 6.4.8 and 4.2.7 of the EIS. Although the EIS did indicate that Leach's storm-petrels are present in the Study Area during the spring, summer and fall, the density of species occurring in the fall is likely higher and more important from a conservation perspective than described in the EIS. Leach's storm petrels are present throughout the Study Area in September and October, as fledging occurs and Storm-petrels migrate south for the winter (Pollett et al. 2014). The EIS did indicate that the majority of fledging of leach's storm petrels in Newfoundland occurs between mid-September to late-October (Huntington et al. 1996). The EIS also noted that in other areas in the North Atlantic, it has also been documented that juveniles account for the majority of strandings (Miles et al. 2010).

Nonetheless, the effects assessment for migratory birds presented in the EIS remains valid – residual effects are expected to be low to moderate in magnitude and irregular in nature. Effects will be of medium term duration (i.e., will persist throughout the duration of Project activities) and reversible (Section 6.4.10.3.1.1 of EIS). Mitigation measures presented in Section 6.4.10.2 also remain valid. However, it should be noted that there is more recent guidance regarding stranded birds than was originally reported in the EIS. Husky will adhere to the *Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada* (Environment and Climate Change Canada (ECCC) 2016. In addition, as per the response to IR-109, Husky will consult with the Canadian Wildlife Service prior to the commencement of Project activities to confirm Project-specific monitoring, documentation, and reporting requirements. This will help ensure that stranded birds (or bird mortalities) are properly documented and reported and will reduce the potential for operator error in implementing the protocols from ECCC (2016).

We acknowledge the more recent population estimate for Leach's Storm-petrel for Baccalieu Island is 1.98 million pairs.

References

BirdLife International. 2019. Species factsheet: *Hydrobates leucorhous*. Downloaded from http://www.birdlife.org on 20/01/2019. Recommended citation for factsheets for more than one species: BirdLife International (2019) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 20/01/2019.

ECCC (Environment and Climate Change Canada). 2016. Procedures for handling and documenting stranded birds encountered on infrastructure offshore Atlantic Canada. Available at: https://www.cnlopb.ca/wp-content/uploads/mkiasseis/bestpracbird.pdf.

Environment Canada. 2015. Best Practices for Stranded Birds Encountered Offshore Atlantic Canada. Available at: https://www.cnlopb.ca/wp-content/uploads/mg3/strandbird.pdf.

Huntington, C.E., R.G. Butler and R.A. Mauck. 1996. Leach's Storm-Petrel (*Oceanodroma leucorhoa*). In: A. Poole and F. Gill (eds.). The Birds of North America, No. 233. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Miles, W., S. Money, R. Luxmoore and R.W. Furness. 2010. Effects of artificial lights and moonlight on petrels at St Kilda. Bird Study, 57: 244-251.

Pollet, I.L., A. Hedd, P.D. Taylor, W.A. Montevecchi and D. Shutler. 2014. Migratory movements and wintering areas of Leach's storm-petrels tracked using geolocators. Journal of Field Ornithology, 85(3): pp.321-328.

Williams, U. and J. Chardine. 1999. The Leach’s Storm Petrel: General Information and Handling Instructions. 4 pp. Available at: https://www.cnlopb.ca/wp-content/uploads/whiterose/stormpetmig.pdf.

1.6.3 Information Requirement: IR-41

Reference to EIS:

Section 6.4.10 Assessment of Residual Environmental Effects on Migratory Birds

Context and Rationale

Section 6.4.10 of the EIS states: “The frequency and duration of flaring events will be restricted to the amount necessary to characterize the well potential (DST) and as required to maintain safe operations. Flaring will occur in accordance with the Drilling and Production Guidelines (C-NLOPB and C-NSOPB 2017), which requires a DST not to begin at night. A high-pressure spray of seawater between the MODU and the flare is routinely used as a heat dissipating curtain which will also act as a deterrent to seabirds in the area.”

It is unclear how the frequency and duration of flaring events could be restricted.

In addition, ECCC identified the following mitigation measures that require consideration:

- notification to the C-NLOPB at least 30 days, as per the C-NLOPB’s Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-Newfoundland and Labrador Offshore Area, in advance of flaring to determine whether the flaring would occur during a period of migratory bird vulnerability along with a description of how the proponent plans to prevent harm to migratory birds; and
- avoiding nighttime flaring, flaring during peak Storm-petrel fledging (mid-September to mid-October), and during the day when visibility is low due to fog.

Section 6.4.10.3.11 of the EIS states that “Short-duration flaring by the MODU during well testing may attract migratory birds and result in increased mortality risk through incineration or energy reserve depletion. Seabirds have been observed to circle flares for days, eventually dying of starvation (Bourne 1979).”

Environment and Climate Change Canada noted that the discussion in Section 6.4 “Migratory Birds” is lacking in information regarding the episodic nature of mortality through incineration by flares. Studies have tried to examine mortality at flares, but may have not documented much mortality because these types of events are infrequent. However, the Canaport liquid natural gas facility had a single-event mass mortality of an estimated 7 500 birds in 2013, illustrating the episodic nature of these types of events.

The KMKNO noted that given the reported episodic mortality at flares, mitigation such as the use of flare shields, should be required to minimize the potential effects of flaring on migratory birds.

Specific Question of Information Requirement

Taking into consideration the information provided by ECCC, provide additional information on the measures to be taken to mitigate the effects of flaring on migratory birds, including:

- describe the potential available options to restrict flaring to the minimum required to characterize a well’s hydrocarbon potential and as necessary for the safety of the operation
- describe how flaring will be minimized during nighttime, poor weather conditions, and during periods of bird vulnerability;
- confirm if flare shield will be used during all flaring events;
- confirm if there will be consultation with outside departments, such as the C-NLOPB, with respect to the timing of routine flaring; and
- provide additional information regarding the episodic nature of incineration at flares.

Update proposed mitigation accordingly.

Response

Husky continues to evaluate alternative well test technologies including but not limited to formation testing while tripping. Historically flaring only occurs during a drill stem test (DST) and it is optimized to limit any unnecessary and inefficient flaring. Flaring typically only occurs to dispose of hydrocarbons produced to characterize the reservoir. C-NLOPB approval is required prior to conducting a DST.

During any DST, initial flaring only occurs during daylight hours, but subsequent flaring may occur during night darkness in accordance with the Drilling and Production Guidelines (C-NLOPB and CNSOPB 2017). Offshore DST testing is very infrequent and of a very short duration. During flaring periods water spray from the cooling system will be used as a heat shield.

It is difficult to quantify bird mortality at offshore platforms as a result of flaring, because not all dead birds are recovered (Ellis et al. 2013). Bird mortality as a result of flaring is typically very episodic in nature and can affect both seabirds and landbirds. For example, in 2013, an estimated 7,500 landbirds were killed direct or indirect contact with a natural gas flare at the Canaport LNG facility, in Saint John, New Brunswick. These birds included 26 species of migratory birds, including four Canada warblers, which are an at-risk species (Environment and Climate Change Canada 2015). Episodic mortality events have also occurred in Europe. For example, in the North Sea, there were reports of an event where several hundred birds were killed as a result of collisions and incineration at a flare stack in the early 1970 (Sage, 1979, as cited in Ronconi et al. 2015). In offshore Nova Scotia, a mortality event occurred at the Thebaud platform on October 7, 2008, while flaring was occurring. The Thebaud platform is a part of the Sable Island Offshore Energy Project and is located approximately 10 km from Sable Island. A total of 47 birds were found dead on the platform, of which 46 were blackpoll warblers (*Setophaga striata*). Seventeen of these birds had burnt or singed feathers, indicating that they contacted the flare, while the remaining birds showed trauma from colliding with the platform (Canadian Cooperative Wildlife Health Centre 2009).

Episodic motility events at flares typically occur during the migration period, when large numbers of birds are travelling across offshore areas, and are often travelling in flocks. It is also known that birds are more attracted to artificial light during inclement weather conditions, such as fog or precipitation (Montevecchi 2006). As a result, episodic events typically occur in poor weather conditions (Ronconi et al. 2015). The combination of an increased presence of birds during migration with an increased attraction to light sources can result in a larger magnitude of mortality events caused by flaring. The 2013 event at the Canaport LNG facility exemplifies this fact, as it occurred on a foggy night during the fall migration period.

References

Canadian Cooperative Wildlife Health Centre. 2009. Wildlife Health Centre Newsletter. Spring/Summer 2009. Accessed January 2019 at http://www.cwhc-rcsf.ca/docs/newsletters/newsletter14-1en.pdf

Ellis, J.I., Wilhelm, S.I., Hedd, A., Fraser, G.S., Robertson, G.J., Rail, J.F., Fowler, M., Morgan, K.H., 2013. Mortality of migratory birds from marine commercial fisheries and offshore oil and gas production in Canada. Avian Conserv. Ecol., 8.

Environment and Climate Change Canada. 2015. Flare-Off at natural gas facility that killed migratory birds results in $750,000 penalty to Canaport LNG Limited Partnership. Enforcement Notifications. Accessed January 2019 at https://ec.gc.ca/alef-ewe/default.asp?lang=En&n=2F9B056B-1&wbdisable=true

Montevecchi, W.A. 2006. Influences of artificial light on marine birds. Pp. 94-113. In: C. Rich and T. Longcore (eds.). Ecological Consequences of Artificial Night Lighting. Island Press, Washington, DC. 478 pp.

Ronconi, R.A., K.A. Allard and P.D. Taylor. 2015. Bird interactions with offshore oil and gas platforms: Review of impacts and monitoring techniques, Journal of Environmental Management, 147: 34-45.

1.6.4 Information Requirement: IR-42

Reference to EIS:

Section 6.4.10.3.1.1 Presence and Operation of MODU

Context and Rationale

Section 6.4.10.3 of the EIS states that "assuming a typical offshore platform scenario of 30 kW of artificial lighting, birds may be attracted from distances up to 5 km from the source." ECCC advised that the EIS overstates the result of the cited paper. Poot et al. 2008 states that their study design could not rule out that birds were attracted to fully lit oil platforms at much greater distances.

WNNB noted that the proponent recognized that "The type and intensity of lighting are expected to be important factors in determining the magnitude of adverse effects on migratory birds." (page 6.73 of the EIS). However, alternative means of lighting and flaring, other than standard mitigations of downward pointing lights and a water curtain, that are specifically designed to reduce or eliminate light attraction are not discussed in the EIS. Further, commitments to deploy specific mitigation measures for seabird fatal light attraction, such as spectral lighting, are not provided in the EIS even though its advantages have been well-described (Poot et al. 2008, Marquenie et al. 2014).

WNNB stated that it is unclear whether peer-reviewed literature associated with spectral modified lighting was reviewed and considered by Husky and why the information and recommendations contained within Ronconi et al. 2015, which was referenced in Section 6.4, were not considered.

Specific Question of Information Requirement

Provide evidence to support the statement that bird attraction is limited to five kilometers given that the Poot et al. 2008 study could not eliminate the possibility that birds are attracted at greater distances. If birds could be attracted beyond 5 kilometers, discuss implications for the assessment of associated effects.

Discuss the type and intensity of lighting in relation to potential adverse effects on migratory birds and alternative means of lighting and flaring as mitigation including spectral modified lighting. Provide a discussion on the effectiveness of proposed mitigation in various weather conditions.

Response

There are a limited number of studies available regarding the distance from which birds may be attracted to lighted structures in the offshore environment. In addition, the zone of influence varies with factors such as weather, intensity and position (height) of the light source, and ambient light conditions (Montevecchi 2006). A 2015 study demonstrated attraction distances of less than 2 km to offshore lighting from oil and gas production facilities (Day et al. 2015). The Poot et al. (2008) study demonstrated attraction distances to 5 km, although attraction from distances of much greater than 5 km could not be ruled out. Attraction of marine and migratory birds from greater distances than the 5 km zone of influence assumed in the EIS would result in a greater number of birds potentially affected by artificial lighting associated with the Project; however, to date, Husky is unaware of any studies demonstrating attraction from such large distances.

As per Section 6.4.10.2 of the EIS, lighting on the MODU is designed to comply with requirements stipulated in the *Petroleum Occupational Safety and Health Regulations*. In addition, there will be no extraneous lighting, and all lighting except navigational lighting will be pointed downwards. As is discussed in Section 6.4.10.3.1.1 of the EIS, even with these mitigation measures in place, bird attraction will vary with weather conditions, such as fog (Montevecchi 2006). However, Husky is aware of any operating vessels and/or drilling installations with modified lighting (e.g., intensity, spectrum, direction) that have the technical capability to support this Project.

In consideration of the above information, the proposed mitigation remains valid. Husky will adhere to the *Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic*

Canada (Environment and Climate Change Canada (ECCC) 2016). In addition, as per the response to IR-109, Husky will consult with the Canadian Wildlife Service prior to the commencement of Project activities to confirm Project-specific monitoring, documentation, and reporting requirements. This will help ensure that stranded birds (or bird mortalities) are properly documented and reported and will reduce the potential for operator error in implementing the protocols from ECCC 2016.

References

Day, R.H., J.R. Rose, A.K. Prichard and B. Streever. 2015. Effects of gas flaring on the behavior of night-migrating birds at an artificial oil-production island, Arctic Alaska. Arctic, 68(3), 367-379

ECCC (Environment and Climate Change Canada). 2016. Procedures for handling and documenting stranded birds encountered on infrastructure offshore Atlantic Canada. Available at: https://www.cnlopb.ca/wp-content/uploads/mkiasseis/bestpracbird.pdf.

Environment Canada. 2015. Best Practices for Stranded Birds Encountered Offshore Atlantic Canada. Available at: https://www.cnlopb.ca/wp-content/uploads/mg3/strandbird.pdf.

Montevecchi, W.A. 2006. Influences of artificial light on marine birds. Pp. 94-113. In: C. Rich and T. Longcore (eds.). Ecological Consequences of Artificial Night Lighting. Island Press, Washington, DC. 478 pp.

Poot, H., B.J. Ens, H. de Vries, M.A.H. Donners, M.R. Wernand and J.M. Marquenie. 2008. Green light for nocturnally migrating birds. Ecology and Society, 13: 47.

Williams, U. and J. Chardine. 1999. The Leach’s Storm Petrel: General Information and Handling Instructions. 4 pp. Available at: https://www.cnlopb.ca/wp-content/uploads/whiterose/stormpetmig.pdf.

1.6.5 Information Requirement: IR-43

Reference to EIS:

Section 6.4.10.2 Mitigation; Section 6.4.12 Follow-up and Monitoring

Context and Rationale

ECCC has advised that until an adequate estimate of strandings and mortality at offshore infrastructure is obtained, there is uncertainty as to the level of effects on birds.

Further, WNNB indicate that Husky states that mortality rates are generally considered to be underreported.

Sections 6.4.10.2 and 6.4.12 of the EIS states that routine checks for stranded birds will be conducted on the MODU and OSVs; however, information is lacking concerning how the proponent would implement search protocols and document search efforts for stranded migratory birds. The EIS refers to protocols for handling stranded birds, but handling protocols are distinct from systematic searching protocols.

ECCC advised that systematic deck searches for stranded birds undertaken by trained observers are more effective as mitigation than opportunistic searches. These systematic searches should occur at least daily (preferably at dawn), with search efforts documented and observations recorded (including notes of efforts when no birds are found). ECCC has expertise in this area and is available to be consulted in the development of systematic monitoring protocols.

Additionally, ECCC stated that "Best Practices for Stranded Birds Encountered Offshore Atlantic Canada" (Environment Canada 2015) and the "Leach's Storm-petrel: General Information and Handling Instructions" (Williams and Chardine 1999) are both superseded by

"Procedures for handling and documenting stranded birds encountered on infrastructure offshore Atlantic Canada" (2017). https://www.cnlopb.ca/wp-content/uploads/mkiasseis/bestpracbird.pdf

MTI has recommended additional monitoring and mitigation measures be considered for birds. For example, data on the number of bird strandings and deaths could be used as an adaptive management tool to determine the effectiveness of or need for additional mitigation.

Both WNNB and ECCC indicated an interest in the sharing of data collected not only from the monitoring program, but also related to bird distribution.

Specific Question of Information Requirement

Taking into consideration the information provided by ECCC, describe the design and implementation of a follow-up program in relation to the potential effects of the Project on birds. Confirm whether the proponent intends to:

- develop a systematic monitoring protocol to search for and document stranded birds on the drilling installation and the platform supply vessels for the duration of the drilling program, including search efforts and frequency;
- engage ECCC expertise in the development of systematic monitoring protocols,
- have its Environmental Observers engaged in seabird observations trained by ECCC,
- verify the accuracy of predictions with respect to birds, based on the data collected; and
- annually report monitoring information, including data related to mortality, stranding and injury, and if the information will be shared with responsible government departments and Indigenous groups.

Discuss the need for and feasibility of using bird stranding and mortality data as an adaptive management tool.

Confirm that the document *"Procedures for handling and documenting stranded birds encountered on infrastructure offshore Atlantic Canada" (2017*) would be used in all applicable instances.

Response

Strandings

Husky intends to develop a systematic monitoring protocol to search for and document stranded birds on the drilling installation and the platform supply vessels for the duration of the drilling program. These systematic searches will occur daily at dawn, with search efforts documented and observations recorded (including notes of efforts when no birds are found). Husky will contact Environment and Climate Change Canada prior to the start of the drilling program to further develop monitoring protocols. "*Procedures for handling and documenting stranded birds encountered on infrastructure offshore Atlantic Canada" (ECCC 2016)* will be used in all applicable instances.

Seabird standings, as environmental protection matters per Section 2(b) of the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (SOR/2009-316) will be reported to the C-NLOPB within 90 days of well suspension or abandonment. Seabird stranding and recovery data are also included in an annual report to Canadian Wildlife Service as a condition of Husky's Seabird Handling Permit. These data may then be used as an adaptive management tool as determined by the regulator.

Observations

Husky's seabird observers have been trained in the use of the Eastern Canada Seabirds at Sea protocol and record daily seabird observations within White Rose field. These data are submitted to the C-NLOPB annually. As per the response to IR-45, observations will continue from stand-by vessels during this exploration program.

References

ECCC (Environment and Climate Change Canada). 2016. Procedures for handling and documenting stranded birds encountered on infrastructure offshore Atlantic Canada. Available at: https://www.cnlopb.ca/wp-content/uploads/mkiasseis/bestpracbird.pdf.

1.6.6 Information Requirement: IR-44

Reference to EIS:

Section 6.4.10.3.2.4 Supply Servicing and Servicing

Context and Rationale

Section 6.4.10.3.1.4 of the EIS states that OSVs helicopters will not interact with any bird colonies or Important Bird Areas while conducting supply and servicing operations within the project area, as no such areas are located within the project area or surrounding study area. However, the Agency notes that while the study area, as defined by the proponent in Figure 4-33, does not extend to the coast, there are Important Bird Areas along the eastern coast of Newfoundland in the vicinity of St. John's. No information is provided on the proximity of anticipated helicopter and vessel routes to Important Bird Areas, colonies listed in the table of "larger" colonies identified in Table 4.33, and the coastal Ecologically and Biologically Significant Areas.

ECCC's document, "Seabird and waterbird colonies: avoiding disturbance" (URL: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/seabird-waterbird-colonies-disturbance.html), provides guidelines for buffer distances between vessels and helicopters and bird colonies.

ECCC advises that it is important that helicopters maintain a minimum distance of at least 300 m vertically and horizontally from any island or colony that is occupied by seabirds and waterbirds.

Further, the KMKNO indicated that mitigation proposed by the proponent for marine mammals and sea turtles with respect to vessel speed and helicopter altitude would apply to mitigating effects of the Project on migratory birds.

Specific Question of Information Requirement

Update the effects analysis of operational support vessels and helicopters on Important Bird Areas and Ecologically and Biologically Significant Areas considering a study area that would include the zone of influence of shipping, extending to the shoreline of Newfoundland.

Taking into consideration the information in the document "Seabird and waterbird colonies: avoiding disturbance" describe mitigation measures in relation to potential environmental effects from operation support vessels and helicopter use within the project area and zone of influence. Include information on specific altitude and lateral distance limits that would be used to avoid sensitive sites.

Response

As noted in Table 3.32 of the EIS, there are 17 Important Bird Areas (IBAs) associated with eastern Newfoundland. These coastal IBAs support a variety of species of waterfowl and seabirds, and some IBAs support globally important seabird colonies. For example, the Witless Bay Islands IBA, which is one of the closest IBAs to the Study Area, supports colonies of Atlantic puffins, Leach's storm-petrels, common murres, black-legged kittiwakes, and herring gulls.

Although there is limited potential for interaction, Section 6.4.10.3.2.4 of the EIS describes how the presence of operational support vessels and helicopters can result in an avoidance response from bird colonies. Birds may flush as a result of a disturbance, resulting in expenditures of important energy reserves. Chicks can be particularly vulnerable to disturbance, and may leave the nest too soon, which can result in increased chick mortality. Disturbance of bird colonies can cause birds to abandon their nests or young, which can leave young vulnerable to predators and exposed to adverse environmental conditions (Environment and Climate Change Canada (ECCC) 2017). However, the responses to these types of events are typically short-term (Ward and Sharp 1974) and birds often habituate to disturbance.

Based on ECCC's (2017) document "Seabird and Waterbird Colonies: Avoiding Disturbance", mitigation for avoiding disturbance to bird colonies located in coastal IBAs and EBSAs will include the following:

1. Support vessels maintain a minimum distance of at least 300 m from Cape St. Francis and Witless Bay Islands Important Bird and Biodiversity areas, unless there is an emergency; and

2. Helicopters maintain a minimum distance of at least 300 m vertically and 1000 horizontally from Cape St. Francis and Witless Bay Islands Important Bird and Biodiversity areas, except for approach, take-off and landing maneuvers and if not feasible for safety reasons.

References

ECCC (Environment and Climate Change Canada). 2017. Seabird and Waterbird Colonies: Avoiding Disturbance. Available at: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/seabird-waterbird-colonies-disturbance.html

Ward, J.G., and P.L. Sharp. 1974. Effects of aircraft disturbance on moulting sea ducks at Herschel Island, Yukon Territory, August 1973. Arctic Gas Biological Report Series, 14(2): 1-54.

1.6.7 Information Requirement: IR-45

Reference to EIS:

Section 6.4.12 Follow-up and Monitoring

Context and Rationale

Section 6.4.12 of the EIS states that the proponent's follow-up and monitoring would include routine checks for stranded birds on the MODU and OSVs. For similar projects in the area, commitments have been made to have trained environmental observers on supply vessels for live bird monitoring and observation.

ECCC has developed a pelagic seabird monitoring protocol called the ECSAS program, that is recommended for use by experienced observers for all offshore projects and is available at http://publications.gc.ca/site/eng/389623/publication.html for the proponent's consideration.

ECCC has advised that bird distribution data should be collected during proposed activities. To verify the effects predications, a data collection effort should be designed in consultation with ECCC and be carried out by an individual who is appropriately trained and dedicated to recording marine bird observations. ECCC-CWS can provide training on Eastern Canada Seabirds at Sea (ECSAS) protocol.

Specific Question of Information Requirement

Confirm whether bird distribution data will be collected from vessels and the MODU during project operations and, if not, confirm how follow up monitoring will be carried out to verify effects predictions.

Confirm if the ECSAS protocol will be used when developing a protocol for pelagic seabird monitoring.

Response

As part of Tier 1 oil spill response training, Husky's supply vessel crews are trained in the use of the Eastern Canada Seabirds at Sea (ECSAS) protocol and perform daily stationary platform surveys while on safety stand-by in the White Rose field. This protocol will continue to be used. These data are submitted annually to the Canada-Newfoundland and Labrador Offshore Petroleum Board. The same practice will continue from the safety stand-by vessel during this exploration program and data will be reported under environmental protection matters per Section 87 2(b) of the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (SOR/2009-013), as part of Project follow-up monitoring.

References

N/A

1.6.8 Information Requirement: IR-46

Reference to EIS:

Section 4.2.7 Migratory Birds

Context and Rationale

WNNB states that the information in the EIS is largely based on data from Programme Intégré de Recherches sure les Oiseaux Pélagiques (PIROP) and ECSAS databases and that it is unclear why existing monitoring data from Husky's White Rose project were not provided in support of the EIS.

Specific Question of Information Requirement

Describe monitoring data that may be available from Husky's White Rose project, whether it was utilized in the EIS analysis, and if not, provide a rationale.

Discuss how impact predictions in the EIS will be tested in the absence of baseline data and how potential changes in abundance or distribution of migratory birds in the project or study areas be detected.

Response

Seabird observations are recorded three times daily from an offshore supply vessel (OSV) the White Rose field by a trained observer following Eastern Canada Seabirds at Sea (ECSAS) methodology. These observations were not included in the EIS since they are considered monitoring data rather than baseline data. The Programme Intégré de Recherches sure les Oiseaux Pélagiques and ECSAS databases provide spatial coverage at an appropriate scale for this Project Area. Monitoring data collected in the White Rose field is limited to 300 m from a stationary platform and may be biased to species attracted to ships and offshore structures.

As requested by Environment and Climate Change Canada, systematic searches of the OSV and mobile offshore drilling unit will be conducted for stranded and dead birds during the exploration drilling program as a means of effects monitoring. Daily seabird observations will also be recorded as per the ECSAS protocol. Seabird observations will be reported to the Canada-Newfoundland and Labrador Offshore Petroleum Board within 90 days of well suspension or abandonment. Seabird stranding and recovery data are included in an annual report to the Canadian Wildlife Service as a condition of Husky's Seabird Handling Permit as part of Project follow-up monitoring.

References

N/A

1.7 SPECIES AT RISK

1.7.1 Information Requirement: IR-47

Reference to EIS:

Section 4.2.4.4 Fish Species at Risk and Species of Conservation Concern; Section 4.2.5 Marine Mammals; Section 10.1.4 Species at Risk (SAR)/Species of Conservation Concern (SOCC); Appendix D, Section 2.4.2.3 Northern Bottlenose Whale

Context and Rationale

Section 6.1.5 of the EIS Guidelines requires inclusion of all potential or known federally listed species at risk and species designated by Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and their habitat at the project site and within the areas that could be affected by routine project operations or accidents and malfunctions.

Section 4.2.5 of the EIS indicates that there are two populations of the Northern Bottlenose Whale, the Scotian Shelf Population and the Davis Strait-Baffin Bay-Labrador Sea Population. Table 4.28 has the potential for occurrence in the study area listed as high for Northern Bottlenose Whale, with no differentiation between the two populations. However, Appendix D states that for the purposes of the environmental assessment, it is assumed that the northern bottlenose whales in the study area would belong to the Davis Strait-Baffin Bay-Labrador Sea population.

Fisheries and Oceans Canada has advised that that with respect to the Northern Bottlenose Whale, the Davis Strait-Baffin Bay-Labrador Sea population may not be the only population present in the study area, as discussed in Appendix D of the EIS. Recent work completed in the Flemish Pass area has highlighted the potential presence of the Northern Bottlenose Whale - Scotian Shelf population.

Section 4.2.4.4, Table 4.26 presents information on fish species at risk and of special conservation concern with potential to occur in the study area; however it is incomplete as not all listed Atlantic Salmon populations that may occur in the project area are included.

Specific Question of Information Requirement

Provide additional information about the Northern Bottlenose Whale – Scotian Shelf population, including an analysis of potential effects of the Project on the population with consideration of the likelihood of interaction between the population and the Project. Update the effects assessment as necessary.

Update Table 4.26 to include all Atlantic Salmon populations that may occur in the project area. Update Section 4.2.4.4 as applicable.

Response

Northern Bottlenose Whale (Scotian Shelf Population)

The Scotian Shelf population of the northern bottlenose whale is listed as Endangered on Schedule 1 of the *Species at Risk Act* and is also designated as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2011). Fisheries and Oceans Canada (DFO) published an updated / amended Recovery Strategy for this population in 2016 (DFO 2016) and an Action Plan in 2017 (DFO 2017). The Scotian Shelf and Davis Strait-Baffin Bay-Labrador Sea populations are genetically distinct and show some physiological and ecological differences (e.g., the Scotian Shelf individuals are smaller and are frequently associated with submarine canyons). However, although there are occurrences of northern bottlenose whale in eastern Newfoundland and in the Study Area, these observations are frequently not identified/attributed to a particular population. Some of these records are described below.

During the summer of 2007, as part of the Trans North Atlantic Sighting Survey, DFO conducted a large-scale aerial survey of marine megafauna in the Canadian waters of the Northwest Atlantic Ocean and observed 42 northern bottlenose whales in Newfoundland waters (population(s) not identified) (Lawson and Gosselin 2009). Northern bottlenose whales were also detected acoustically in the Flemish Pass during a 2014 and 2015 acoustic program to measure the soundscape near drilling operations; their occurrence was sporadic throughout the study period in each year and they were also acoustically active during the geophysical surveys undertaken at that time (Quijano et al. 2017). There have been recent sightings (2015 and 2016) of northern bottlenose whales in the Sackville Spur area of the Flemish Cap and a survey team from Dalhousie University observed 50 to 200 individuals along the continental shelf near the Flemish Cap in the summer of 2016 (Gillis 2016). Based on these observations, northern bottlenose whales (of one or more populations) are likely at least occasional visitors to the Project Area.

Potential environmental effects of the Project for all marine mammals (including the Scotian Shelf population of northern bottlenose whales) are, change in habitat quality and use; and change in mortality risk or physical injury. For this species specifically, the key threats of concern (as identified in the Strategy (DFO 2016) and Action Plan (DFO 2017)) to which the Project is most likely to contribute are the introduction of underwater noise and potential exposure to marine contaminants. The nature of these effects is discussed in detail in Sections 6.3 of the EIS and the assessment presented therein remains relevant to the Scotian Shelf population of northern bottlenose whales.

The Scotian Shelf population of northern bottlenose whales was historically subject to whaling removals, from which it may not have recovered (DFO 2016). Northern bottlenose whales, like other beaked whales, are in the mid-frequency cetacean hearing group and are thought to be particularly sensitive to underwater noise. Beaked whales generally avoid approaching vessels (Würsig et al. 1998), sometimes diving for extended periods (Kasuya 1986). Although there is a lack of data specific to geophysical surveys, it is expected that beaked whales would also demonstrate avoidance behaviours in response to geophysical activity. However, northern bottlenose whales in the Gully Marine Protected Area were reportedly not displaced by received sound levels of 145 dB re 1 μPa (rms) generated by a geophysical survey that had been operating for several weeks more than 20 km away (Lee et al. 2005).

The available literature and data suggest that northern bottlenose whales (of any population) likely occur at low densities, possibly year-round, in the deeper waters of the Study Area (COSEWIC 2011). Figure 13 of Appendix D of the EIS represents visual observation data for northern bottlenose whales (not distinguished by population) over a ten-year period (2004 to 2014). The potential for individual northern bottlenose whales to overlap geographically, and interact with Project activities, remains likely to be highly transient and temporary, especially in consideration of anticipated daily and seasonal fluctuations in their presence within the Project Area, and the short-term nature of activities of concern (e.g., VSP less than one day per well; and wellsite survey of 5-7 days per well). With the application of mitigation measures and adherence to published and/or industry standards and best management practices, effects to northern bottlenose whale are not expected to differ from those presented in Table 6.16 of the EIS. Based on the nature and characteristics of the Project and the existing environment for this VC within the Project Area and Study Area, and with the planned implementation of mitigation measures, the Project is not likely to result in significant adverse effects on the Scotian Shelf population of northern bottlenose whale.

Atlantic Salmon Populations

With regards to salmon, Section 4.3.2.7 of the EIS provides a detailed discussion on the status of Atlantic salmon populations. Table 1 provides an update to Table 4.26 of the EIS.

Table 1 Fish Species at Risk and Species of Conservation Concern with Potential to Occur in the Study Area

Common Name	Scientific Name	SARA Status[1]	COSEWIC Designation[1]	Potential for Occurrence in the Study Area[2]	Timing of Presence
Acadian redfish (Atlantic population)	*Sebastes fasciatus*	Not Listed	Threatened	High	Year-round
American eel	*Anguilla rostrata*	Not Listed	Threatened	Moderate	March to July - glass eels on the Grand Banks
American plaice (Newfoundland and Labrador population)	*Hippoglossus platessoides*	Not Listed	Threatened	High	Year-round
Atlantic bluefin tuna	*Thunnus thynnus*	Not Listed	Endangered	Moderate	June to October
Atlantic cod (Newfoundland and Labrador population)	*Gadus morhua*	Not Listed	Endangered	Moderate	Year-round
Atlantic salmon[3]	*Salmo salar*	Various[3]	Various[3]	Moderate	June to August
Atlantic wolffish	*Anarhichas lupus*	Special Concern (Schedule 1)	Special Concern	High	Year-round
Basking shark (Atlantic population)	*Cetorhinus maximus*	Not Listed	Special Concern	Low	Year-round
Blue shark (Atlantic population)	*Prionace glauca*	Not Listed	Special Concern	Moderate	June to October
Cusk	*Brosme brosme*	Not Listed	Endangered	Low	Year-round
Deepwater redfish (Northern population)	*Sebastes mentalla*	Not Listed	Threatened	High	Year-round
Northern wolffish	*Anarhichas denticulatus*	Threatened (Schedule 1)	Threatened	High	Year-round
Porbeagle shark	*Lamna nasus*	Not Listed	Endangered	Moderate	Year-round
Roughhead grenadier	*Macrourus berglax*	Not Listed	Special Concern	High	Year-round
Roundnose grenadier	*Coryphaenoides rupestris*	Not Listed	Endangered	High	Year-round
Shortfin mako	*Isurus oxyrinchus*	Not Listed	Threatened	Low	July to October
Smooth skate (Laurentian-Scotian population)	*Malacoraja senta*	Not Listed	Special Concern	Moderate	Year-round
Smooth skate (Funk Island Deep population)	*Malacoraja senta*	Not Listed	Endangered	Moderate	Year-round
Spiny dogfish (Atlantic population)	*Squalus acanthias*	Not Listed	Special Concern	Low	Year-round
Spotted wolffish	*Anarhichas minor*	Threatened (Schedule 1)	Threatened	High	Year-round
Thorny skate	*Amblyraja radiata*	Not Listed	Special Concern	High	Year-round
White shark	*Carcharodon Carcharias*	Endangered (Schedule 1)	Endangered	Low	July to October

Common Name	Scientific Name	SARA Status[1]	COSEWIC Designation[1]	Potential for Occurrence in the Study Area[2]	Timing of Presence
White hake	*Urophycis tenuis*	Not Listed	Threatened	Moderate	Year-round
Winter skate (Eastern Scotian Shelf-Newfoundland Population	*Leucoraja ocellata*	Not Listed	Endangered	Low	November to March

Sources: Modified from Husky Energy 2012 and BP 2016
Notes:

1. The *Species at Risk Act* establishes Schedule 1 as the official list of wildlife species at risk. However, note that while Schedule 1 lists species that are *extirpated*, *endangered*, and *threatened*, the prohibitions do not apply to SOCC or those on Schedule 2 or 3 regardless of status.
2. This qualitative characterization is based on expert opinion, and an analysis of understood habitat preferences across life-history stages, available distribution mapping, and sightings data for each species within the Study Area.
3. See Section 4.3.2.7 for a detailed discussion on the Atlantic salmon populations.

References

BP Canada Energy Group ULC. 2016. Scotian Basin Exploration Drilling Project Environmental Impact Statement. Volume 1: Environmental Impact Statement. Prepared by Stantec Consulting Ltd., Halifax, NS.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011. COSEWIC Assessment and Status Report on the Northern Bottlenose Whale *Hyperoodon ampullatus* in Canada. Committee on the Status of Endangered Wildlife in Canada, ON. Otta`wa xii + 31 pp.

DFO (Fisheries and Oceans Canada). 2016. Recovery Strategy for the Northern Bottlenose Whale, (*Hyperoodan ampullatus*), Scotian Shelf population, in Atlantic Canadian Waters [Final]. *Species at Risk Act* Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. vii + 70 pp

DFO (Fisheries and Oceans Canada). 2017. Action Plan for the Northern Bottlenose Whale (*Hyperoodon ampullatus*), Scotian Shelf population, in Atlantic Canadian waters. *Species at Risk Act Action* Plan Series. Fisheries and Oceans Canada, Ottawa. iv + 37 pp.

Gillis, M. 2016. Rare bottlenose whales discovered off N.L. already in jeopardy. Article in CBC News. Published Nov 30, 2016. Available at: http://www.cbc.ca/news/canada/newfoundland-labrador/bottlenose-whales-under-threat-from-seismic-blasting-1.3872342?campaign_id=A100

Husky Energy. 2012. Husky Energy White Rose Extension Project Environmental Assessment. Prepared by Stantec Consulting Ltd., St. John's, NL, for Husky Energy. St. John's, NL.

Kasuya, T. 1986. Distribution and behavior of Baird's beaked whales off the Pacific coast of Japan. Sci. Rep. Whales Res. Inst., 37: 61-83.

Lawson, J.W. and J.-F. Gosselin. 2009. Distribution and preliminary abundance estimates for cetaceans seen during Canada's marine megafauna survey – A component of the 2007 Trans North Atlantic Sighting Survey. DFO Canadian Science Advisory Secretariat Research Document, 2009/031: iv + 29 pp.

Lee, K., H. Bain and G.V, Hurley (Editors). 2005. Acoustic Monitoring and Marine Mammal Surveys in the Gully and Outer Scotian Shelf before and during Active Seismic Programs. Environmental Studies Research Funds Report, No. 151.

Quijano, J., M.-N. Matthews, and B. Martin. 2017. Eastern Newfoundland Drilling Noise Assessment: Qualitative Assessment of Radiated Sound Levels and Acoustic Propagation Conditions. Document 01366, Version 2.1. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd.

Würsig, B., S.K. Lynn, T.A. Jefferson and K.D. Mullin, K.D. 1998. Behaviour of cetaceans in the northern Gulf of Mexico relative to survey ships and aircraft. Aquat. Mamm., 24(1): 41-50.

1.7.2 Information Requirement: IR-48

Reference to EIS:

Appendix D, Section 1.4, Species at Risk; Appendix D, Section 2.0, Marine Mammals

Context and Rationale

Section 6.1.5 of the EIS Guidelines requires inclusion of all potential or known federally listed species at risk and species designated by COSEWIC, and their habitat at the Project site and within the areas that could be affected by routine Project operations or accidents and malfunctions. In addition, Section 6.1.5 further requires a discussion of the residences, seasonal movements, movement corridors, habitat requirements, key habitat areas, identified and proposed critical habitat and/or recovery habitat (where applicable) and general life history of species at risk that may occur in the project area, or be affected by the Project.

Appendix D of the EIS provides species descriptions for species at risk, however, Appendix D does not provide the life history of species at risk, in particular for wolffish species, in the context of the characteristics of the project area / study area. The link between the various life history stages of the species and whether the ELs, project area or study area have the features that would support the noted life history stages/requirements are not clearly stated in the EIS.

Specific Question of Information Requirement

Discuss the link between the characteristics of the exploration licences, project area and study area, and the life history requirements or stages of the fish and marine mammal species at risk identified in Appendix D.

Response

EIS Chapter 4 and EIS Appendix D provide the available general life history information on the numerous marine mammal and fish species that may be present in the Project Area. The selection of fish and marine mammal species included in the EIS was based on habitat preferences across life-history stages, available distribution mapping, and catch data for species within the Study Area.

The 40+ fish species discussed in Appendix D of the EIS can generally be categorized into species that may be present in the North Atlantic Ocean throughout their life cycle and those that are seasonally present through migration (see Tables 1 to 3 in response to IR-14). Other than Atlantic salmon, and large pelagic species like the tuna and shark species, most of marine fish species present in the Study Area are known to carry out their full life cycle in the area and are present year-round. Pelagic migratory species would be present in the Project Area seasonally and at the corresponding life-history stage.

Baleen whales generally undergo seasonal migrations between northern temperate foraging areas and lower latitude mating and calving areas. As such, calving would not be expected to occur in the Study Area, but older calves / juveniles would return to this area with adults to forage in the following spring / summer / fall. Many of the smaller toothed whales are year-round residents of eastern Newfoundland and therefore all life stages could be found in the Study Area.

Importantly, the planned mitigation is designed to be generally protective of fishes and marine mammals that may be within the Project Area. Therefore, where data gaps exist with respect to species spatial and temporal distributions relative to the Project Area, the planned mitigation applies a pragmatic level of precaution toward the marine ecological environment.

References

N/A

1.7.3 Information Requirement: IR-49

Reference to EIS:

Section 4.2.4.4 Fish Species at Risk and Species of Conservation Concern; Section 6.1.8 Summary of Existing Conditions for Fish and Fish Habitat

Context and Rationale

Section 6.1.8 of the EIS states there are two species at risk that have a high potential to be present year-round on the Grand Banks and Flemish Cap: Northern Wolffish and Spotted Wolffish. Critical habitat proposed for Northern and Spotted Wolffish is comprised of several discontinuous critical habitat areas that support the life stages of either Northern or Spotted Wolffish. Cumulatively, the critical habitat for both species has approximately 655.80 square kilometers overlap with the project area.

Figure 4-27 of the EIS illustrates the location of proposed critical habitat for Northern and Spotted Wolffish in relation to the location of the study area and ELs. The resolution of this figure illustrates an area of overlap between a portion of the proposed Spotted Wolffish critical habitat and EL 1151, however, this overlap is not discussed in the text of the EIS.

Specific Question of Information Requirement

Discuss the overlap of the proposed critical habitat for Spotted Wolffish and the project area and EL. If there is an overlap of proposed Spotted Wolffish critical habitat with EL 1151 provide information on the extent to which the areas overlap (area and percent).

Provide a higher resolution map that clearly shows the proposed critical habitat for Spotted Wolffish and any overlap with exploration licence 1151.

Response

Exploration Licence (EL) 1151 overlaps with 50.5 km² of the proposed critical spotted wolffish habitat (Figure 1), which is approximately 0.05% of the proposed critical habitat area. This area also represents approximately 3.6% of EL 1151. Based upon Fisheries and Oceans Canada's (DFO) fall research trawl surveys, spotted wolffish are far more abundant on the continental shelf northeast of Newfoundland and on the Labrador Shelf than in the waters in and around the Project Area (Committee on the Status of Endangered Wildlife in Canada 2012; DFO 2018).

References

Committee on the Status of Endangered Wildlife in Canada. 2012. COSEWIC assessment and status report on the Spotted Wolffish *Anarhichas minor* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. x + 44 pp.

DFO (Fisheries and Oceans Canada). 2018. Recovery Strategy for Northern Wolffish (*Anarhichas denticulatus*) and Spotted Wolffish (*Anarhichas minor*), and Management Plan for Atlantic Wolffish (*Anarhichas lupus*) in Canada [proposed amendment]. Fisheries and Oceans Canada, Ottawa, ON. vii + 82 pp.

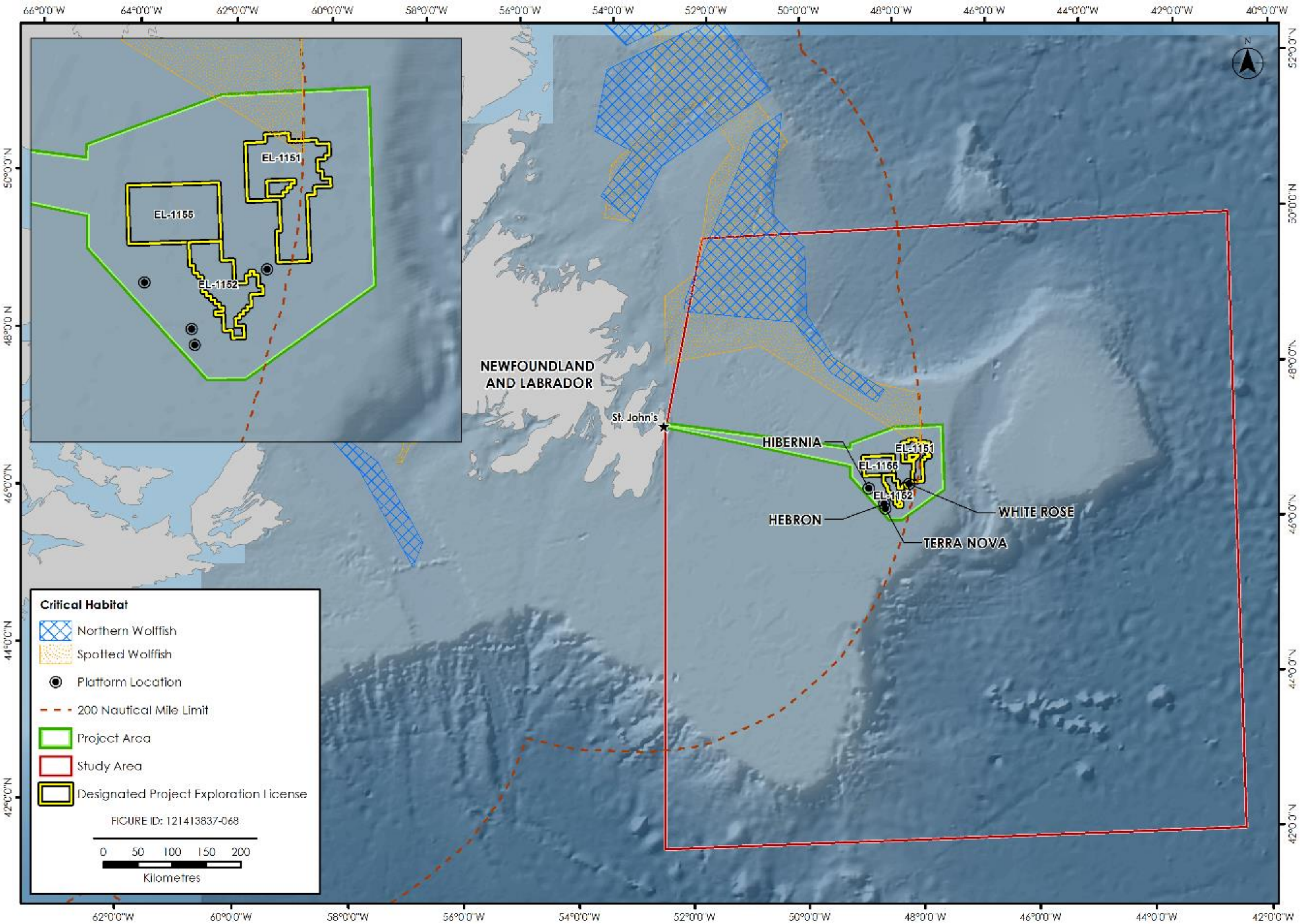


Figure 1 The Overlap Between EL 1151 and the Proposed Spotted Wolffish Habitat

1.7.4 Information Requirement: IR-50

Reference to EIS:

Section 4.2.5.4 Marine Mammal Species at Risk and Species of Conservation Concern; Section 10.1.4 Species at Risk (SAR)/Species of Conservation Concern (SOCC); Appendix D, Section 2.4.1.2 Fin Whale; Appendix D, Section 2.4.2.4 Sowerby's Beaked Whale

Context and Rationale

Fisheries and Oceans Canada noted that more up-to-date Action Plans are available than those that are referenced in section 10.1.4 of the EIS including the:

- Action Plan for the North Atlantic Right Whale (*Eubalaena glacialis*) in Canada: Fishery Interactions, 2016;
- Action Plan for the Northern Bottlenose Whale (*Hyperoodon ampullatus*), Scotian Shelf Population in Atlantic Canadian Waters, 2017; and
- Action Plan for the Leatherback Sea Turtle (*Dermochelys coriacea)* in Atlantic Canada, 2018.

Table 10.2 of the EIS lists the following footnotes for the species at risk listed in the table:

- Action Plan anticipated in 2017;
- Recovery Strategy anticipated in 2017; and
- Management Plan anticipated in 2017.

However, the information in this table is outdated and should be updated accordingly.

Specific Question of Information Requirement

Taking into consideration the Action Plans noted by Fisheries and Oceans Canada, update information related to the Leatherback Turtle (Atlantic population), North Atlantic Right Whale and the Northern Bottlenose Whale (Scotian Shelf population), as necessary.

Provide updated information on the Action Plans, Recovery Strategies and Management Plans of the species at risk listed in Table 10.2 of the EIS.

Update the effects assessment, potential mitigation and follow-up, as appropriate, including a description of how mitigation measures are consistent with applicable action plans.

Response

North Atlantic Right Whale

Fisheries and Oceans Canada (DFO)'s Proposed *Action Plan for the North Atlantic Right Whale (Eubalaena glacialis) in Canada: Fishery Interactions, 2016* (DFO 2016) was developed to address Objective 2 of the North Atlantic right whale Recovery Strategy: "Reduce mortality and injury as a result of fishing gear interactions (entanglement and entrapment)". As such, it was not included in Section 10.1.4 of the EIS, and review of this Action Plan does not alter the assessment or conclusions presented in the EIS. An Action Plan specific to the other Recovery Strategy objectives (e.g., vessel strikes) has not yet been produced.

Northern Bottlenose Whale (Scotian Shelf population)

Footnote 5 beside northern bottlenose whale in Table 10.2 in the EIS was an error. Footnote 5, which states 'Management Plan anticipated in 2017', also appears in the table beside fin whale (Special Concern), and was accurate at the time of writing (i.e., a Management Plan for fin whales was released in 2017 [DFO 2017a]). While the Davis Strait-Baffin Bay-Labrador Sea population is listed as Special Concern by the

Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2011), it is not yet listed under *the Species at Risk Act* (SARA), and thus does not have a Management Plan. The Scotian Shelf population is listed as Endangered, and as noted in the IR, an Action Plan was posted to the Species at Risk Public Registry in April 2017 (DFO 2017b). The four recovery objectives presented in the plan relate broadly to improving understanding of this population (e.g., size, trends, distribution, ecology), its anthropogenic threats and means of mitigation, and increasing stakeholder and public engagement. The Action Plan notes that noise produced by seismic surveys, exploratory drilling and production, as well as increased ship traffic and accidental discharges or spills, could affect northern bottlenose whales. This list of potential effects associated with oil and gas activities is consistent with the assessment and conclusions presented in the EIS, as well as mitigation measures. In addition to implementing the mitigation measures outlined in the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (Canada-Newfoundland and Labrador Offshore Petroleum Board [C-NLOPB] 2018), marine mammal observers (MMOs) will implement shutdown procedures if a northern bottlenose whales is observed within the safety zone (i.e., 500 m) during vertical seismic profiling (VSP) and geophysical surveys.

Leatherback Sea Turtle (Atlantic population)

Leatherback sea turtles are expected to be rare in the Project Area, with moderate potential for occurrence in the southern and eastern portions of the Study Area (see Table 1 [revised Figure 4-31] presented in HCL-09, which identifies sightings of leatherback sea turtles in the Study Area between 2004 and 2014). An Order Amending Schedule 1 to SARA (Part II, Vol. 151, No. 9) was posted to the Species at Risk Public Registry on May 5, 2017. The order replaces the singular leatherback species previously listed on Schedule 1 of SARA with two new designatable units (i.e., Atlantic and Pacific populations). Additionally, a proposed Action Plan for the leatherback sea turtle in Atlantic Canada was posted on September 27, 2018 (DFO 2018). The Action Plan identifies a number of recovery objectives broadly related to improving understanding of threats, life history and habitat characteristics, means of reducing risk reduction, and increasing education and international initiatives. Potential effects associated with oil and gas activities are consistent with those assessed in the EIS (e.g., underwater sound, vessel interactions, debris), as well as mitigation measures, and best management practices. During VSP and geophysical surveys, MMOs will implement shutdown procedures if a sea turtle is observed within the safety zone (i.e., 500 m).

The stated mitigation measures are consistent with applicable action plans. An update to the effects assessment, is therefore not required.

References

Canada-Newfoundland and Labrador Offshore Petroleum Board. 2018. Geophysical, Geological, Environmental and Geotechnical Program Guidelines. vii + 56 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011. COSEWIC Assessment and Status Report on the Northern Bottlenose Whale *Hyperoodon ampullatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. xii + 31 pp.

DFO (Fisheries and Oceans Canada). 2016. Action Plan for the North Atlantic Right Whale (*Eubalaena glacialis*) in Canada: Fishery Interactions [Proposed]. Species at Risk Act Action Plan Series. Fisheries and Oceans Canada, Ottawa. v + 35 pp.

DFO (Fisheries and Oceans Canada). 2017a. Management Plan for the fin whale (*Balaenoptera physalus*), Atlantic population in Canada. Species at Risk Act Management Plan Series, DFO, Ottawa, ON. iv + 38 pp.

DFO (Fisheries and Oceans Canada). 2017b. Action Plan for the Northern Bottlenose Whale (*Hyperoodon ampullatus*), Scotian Shelf population, in Atlantic Canadian waters. Species at Risk Act Action Plan Series. Fisheries and Oceans Canada, Ottawa. iv + 37 pp.

DFO (Fisheries and Oceans Canada). 2018. Action Plan for the Leatherback Sea Turtle (*Dermochelys coriacea*) in Atlantic Canada [Proposed]. Species at Risk Act Action Plan Series. Fisheries and Oceans Canada, Ottawa. v + 29 pp.

1.7.5 Information Requirement: IR-51

Reference to EIS:

Section 6.1.10.4 Summary of Project Residual Effects; Section 6.1.11 Determination of Significance

Context and Rationale

Section 6.1 of the EIS provides an effects assessment of fish and fish habitat, however Fisheries and Oceans Canada noted that it is not clear that the residual effects summary discussion in Section 6.1.10.4 or the determination of significance discussion in Section 6.1.11 includes species at risk (e.g. Northern and Spotted Wolfish).

Specific Question of Information Requirement

Clarify whether the residual effects and determination of significance analysis considered species at risk. If species at risk are not considered, provide an effects assessment and determination of significance on fish and fish habitat species at risk, including Northern and Spotted wolfish.

Response

The residual effects and determination of significance analysis for the fish and fish habitat VC does consider species at risk, including northern and spotted wolffish. As does the assessment of Special Areas. Wolffish are considered in assessment of the Northeast Shelf and Slope EBSA, in particular.

Table 10.2 Species at Risk and/or Species of Conservation Concern Potentially Occurring in the Study Area in the EIS identifies the species considered.

References

N/A

1.8 SPECIAL AREAS

1.8.1 Information Requirement: IR-52

Reference to EIS:

Section 4.2.9 Special Areas; Section 6.5.8 Summary of Existing Conditions for Special Areas

Context and Rationale

The EIS provides information on a total of 24 special areas that may occur in the study area. The Agency and Fisheries and Oceans Canada noted that several special areas that have been updated (e.g. governing bodies have revised the boundaries) are not identified and that some information presented is incorrect, therefore requiring clarification and revision including:

- areas closed to lobster fishing as conditions of fishing licenses, Marine Refuges, and Ecologically and Biologically Significant Areas within the Placentia Bay/Grand Banks Large Ocean Management Area have been updated but the EIS does not include these updates;
- additional Ecologically and Biologically Significant Areas identified by the Conference of the Parties to the Convention on Biological Diversity located outside Canada's Exclusive Economic Zone in the Northwest Atlantic, some of which overlap the Project and study area, are not included (https://www.cbd.int/ebsa/);
- special areas identified as important to marine birds, including nearshore areas (e.g. Eastern Avalon Ecologically and Biologically Significant Area and Baccalieu Island) and offshore areas (e.g. Seabird Foraging Zone in the Southern Labrador Sea Ecologically and Biologically Significant Area), have not been included;
- the location of canyons identified by NAFO (see Section 4.2.9.2.1 Canyons) in an updated figure;
- the statement in section 4.2.9.4 that "there are five marine refuges within the Newfoundland and Labrador Shelves bioregion…" is incorrect; there are ten, including four Lobster Closures and the Hatton Basin Conservation Area (refer to: http://www.dfo-mpo.gc.ca/oceans/oeabcm-amcepz/refuges/index-eng.html); and
- the Bonavista Cod Box is not a coral and sponge closure and should be removed.

In addition, the Agency and Fisheries and Oceans Canada note the following discrepancies:

- Figure 4-34 indicates that the Orphan Spur Ecologically and Biologically Significant Area is located in the study area, however it is not listed as one of the five Ecologically and Biologically Sensitive Areas in the study area in Section 4.2.9.1. Additionally, the Southwest Shelf Edge and Slope Ecologically and Biologically Sensitive Area is listed as within the study area in Section 4.2.9.1, however there is no overlap illustrated in Figure 4-34;
- Section 4.2.9.2.2 of the EIS states that the Beothuk Knoll is in the project area but the corresponding figure (Figure 4-34) shows it as being located in the study area. The EIS also states the "Beothuk Knoll, located southwest of Flemish Cap and approximately 60 km from the nearest EL occupies 183 km² of the project area (Figure 4-34)." Figure 4-34 also shows this special area as being in the study area and not the project area. Table 6.24 lists Beothuk Knoll as being in the study area and a certain distance from the project area. It is not clear whether the Beothuk Knoll is located in the project area; and
- NAFO closures listed in Table 6.24 of the EIS, including Vulnerable Marine Ecosystems, do not align with the description given in section 4.2.9.2 Vulnerable Marine Ecosystems.

Specific Question of Information Requirement

Provide a comprehensive table and related figures with appropriate resolution that identify all special areas by type (e.g. Ecologically and Biologically Significant Areas identified by the Conference of the Parties to the Convention of Biological Diversity, Marine Refuges, Snow Crab Stewardship Exclusion Zones, Preliminary Representative Marine Areas, Canyons identified by NAFO, etc.) that could be affected by the

Project. Include information on the distance from special areas to ELs and terminus of the transit route. The table and related figures should include the following:

- all special areas that occur within the study area including those previously not identified in the EIS;
- special areas that are identified in the EIS but have been updated;
- special areas important to marine birds;
- clarification of whether Orphan Spur and Southwest Shelf Edge and Slope Ecologically and Biologically Significant Areas are located in the study area;
- canyons identified by NAFO;
- clarification of whether the Beothuk Knoll Vulnerable Marine Ecosystem is located in and overlapping with the study area;
- the number of marine refuges in the Newfoundland and Labrador Shelves bioregion and what they are;
- removal of the Bonavista Cod Box as a coral and sponge closure area; and
- NAFO closures including Vulnerable Marine Ecosystems.

With respect to special areas that have not been included in the EIS or have been revised, provide a description, conduct an assessment of potential effects, proposed mitigation and follow-up, for routine activities and potential accidental events.

Response

A comprehensive list of all special areas that are found within the Study Area are listed below in Table 1 and depicted in Figure 1.

Table 1 Special Areas with the Study Area and their proximity to the Project Area and Project ELs

Special Area Name	Special Area Type	Nearest Distance (km)	
		Project ELs	Project Area
Slopes of the Flemish Cap and Grand Bank	CBD EBSA	27	7
Seabird Foraging Zone in the Southern Labrador Sea	CBD EBSA	263	232
Orphan Knoll	CBD EBSA	311	282
Northeast Shelf and Slope	DFO EBSA	Within	Within
Virgin Rocks	DFO EBSA	87	41
Lilly Canyon - Carson Canyon	DFO EBSA	109	87
Southeast Shoal and Tail of the Banks	DFO EBSA	177	155
Orphan Spur	DFO EBSA	240	209
Eastern Avalon	DFO EBSA	283	Within
Southwest Shelf Edge and Slope	DFO EBSA	406	294
Northeast Newfoundland Slope - Tobin's Point 1	Marine Refuge	83	63
Northeast Newfoundland Slope - Tobin's Point 1	Marine Refuge	248	204
Division 3O Coral	Marine Refuge	439	333
Flemish Pass / Eastern Canyon	NAFO Closure Area	47	23
Northwest Flemish Cap	NAFO Closure Area	87	65
Northwest Flemish Cap	NAFO Closure Area	108	78
Sackville Spur	NAFO Closure Area	133	100
Beothuk Knoll	NAFO Closure Area	140	107
Beothuk Knoll	NAFO Closure Area	144	112

Special Area Name	Special Area Type	Nearest Distance (km)	
		Project ELs	Project Area
Northwest Flemish Cap	NAFO Closure Area	161	129
Northern Flemish Cap	NAFO Closure Area	196	164
Northern Flemish Cap	NAFO Closure Area	207	176
Northern Flemish Cap	NAFO Closure Area	222	190
Tail of the Bank	NAFO Closure Area	242	220
Eastern Flemish Cap	NAFO Closure Area	272	247
Eastern Flemish Cap	NAFO Closure Area	274	252
Northeast Flemish Cap	NAFO Closure Area	274	244
Orphan Knoll	NAFO Closure Area	300	275
Newfoundland Seamounts	NAFO Closure Area	302	284
3O Coral Closure	NAFO Closure Area	439	333
8X Exclusion Zone	Snow Crab Exclusion Zone	Within	Within
6C Exclusion Zone	Snow Crab Exclusion Zone	242	Within
6B Exclusion Zone	Snow Crab Exclusion Zone	261	26
8A Exclusion Zone	Snow Crab Exclusion Zone	262	64

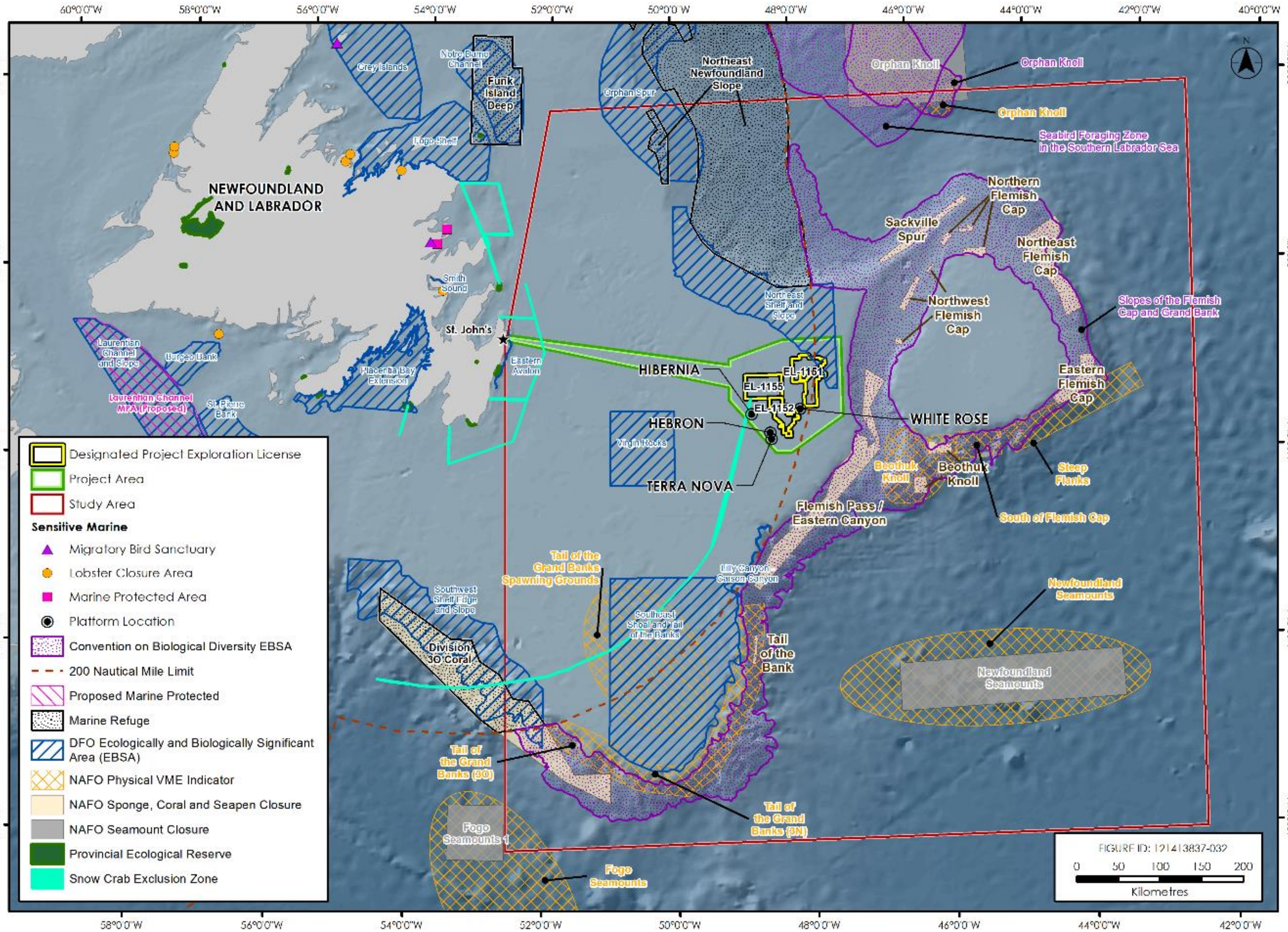


Figure 1 Special Areas in Proximity to the Project

Since the November 2018 submission of the EIS, several types of special areas in the Newfoundland and Labrador offshore have been identified or revised. These included EBSAs identified by the United Nations Convention on Biological Diversity (UNCBD) outside of Canada's Exclusive Economic Zone (EEZ) and Snow Crab Exclusion Zones. Each of these is discussed in the following section.

Newly Identified Special Areas

UN Convention on Biological Diversity EBSAs

In 1992 Canada ratified the UNCBD. The Convention is an important step towards conservation of global biodiversity. Identified EBSAs include ocean habitat areas of eastern Newfoundland and Labrador (UNCBD 2017) (Table 2). The Project Area overlaps with the Seabird Foraging Zone in the Southern Labrador Sea and Slopes of the Flemish Cap and Grand Bank UNCBD EBSAs. The traffic routes overlap with the slopes of the Flemish Cap and Grand Bank UNCBD EBSA.

Table 2 Convention on Biological Diversity EBSAs

EBSA	Rationale for Identification/Designation	Area
Labrador Sea Deep Convection Area	The only Northwest Atlantic site where winter convection exchanges surface and deep ocean waters. Provides mid-water overwintering refuge for pre-adult *Calanus finmarchicus*, a key species for zooplankton populations of the Labrador Shelf and downstream areas. Annual variability in convection results in significant yearly change through ecosystems of the Northwest Atlantic.	Approximately 43,278 km^2. Not a fixed geographic area but delineated annually by physical oceanographic properties
Seabird Foraging Zone in the Southern Labrador Sea	Supports globally important populations of marine vertebrates, including an estimated 40 million seabirds annually. Important foraging habitat for seabirds, including 20 populations of over-wintering black-legged kittiwakes (*Rissa tridactyla*), thick-billed murres (*Uria lombia*) and breeding Leach's storm-petrels (*Oceanodroma leucorhoa*). Encompasses the pelagic zone of the Orphan Basin, continental shelf, slope and offshore waters inside and outside the Canadian EEZ.	152,841 km^2
Orphan Knoll	Seamounts typically support endemic populations and unique faunal assemblages. This seamount is an island of hard substratum with uniquely complex habitats that rise from the seafloor of the surrounding deep, soft sediments of the Orphan Basin. Although close to the adjacent continental slopes, Orphan Knoll is much deeper and appears to have distinctive fauna. Fragile and long-lived corals and sponges have been observed and a Taylor Cone circulation provides a mechanism for retention of larvae.	12,742 km^2
Slopes of the Flemish Cap and Grand Bank	Contains most of the aggregations of indicator species for VMEs in the NAFO Regulatory Area. Includes NAFO closures to protect corals and sponges and a component of Greenland halibut fishery grounds in international waters. A high diversity of marine taxa, including threatened and listed species, are found within the EBSA.	87,817 km^2

Snow Crab Exclusion Areas

Areas closed to snow crab fishing have been established through consultation using a co-management approach with fleet committees in various crab management areas, known as the Snow Crab Stewardship. Snow crab exclusion zones of 0.5 or 1 nm-wide corridors have been identified extending along portions of Crab Fishing Area boundaries. These exclusion zones were established to improve delineation between adjacent Crab Management Areas and to establish no fishing / crab refuge corridors for resource conservation (DFO 2017). The exclusion areas have been included on Figure 1. Table 3 indicates whether the snow crab exclusion zone is located within the Study Area or Project Area.

Table 3 Snow Crab Exclusion Zones and their Presence in the Study Area or Project Area

Exclusion Zone	Overlaps Project Area	Overlaps Study Area
6A Exclusion Zone (Trinity Bay)	No	No
6B Exclusion Zone (Conception Bay)	No	Yes
6C Exclusion Zone (Eastern Avalon)	No	Yes
8A Exclusion Zone	No	Yes
5A Exclusion Zone	No	No
9A Exclusion Zone	No	No
8 Bx Exclusion Zone (Offshore)	Yes	Yes

<u>Revised Special Areas</u>

In 2015, DFO undertook a process to re-evaluate the PB / GB LOMA EBSAs to align with the rest of the Newfoundland and Labrador Shelves Bioregion EBSAs. The 2017 revised PB / GB LOMA EBSA areas have not yet been released publicly (DFO, pers. comm., 2019).

Based on available information, the existing PB / GB LOMA EBSAs have generally increased in area, five new EBSAs have been delineated, two areas are no longer listed as EBSAs and the total combined EBSA area has been increased by 26% (Table 4). The Southeast Shoal EBSA has been reduced in area as a large portion was outside of the EEZ prior to the refinement exercise. Portions of the Northeast Slope and the Lilly Canyon-Carson Canyon EBSAs, beyond the EEZ, are now also considered to be outside of EBSA boundaries, although the overall areas of these EBSAs have been increased within the EEZ. Detailed descriptive information is not yet available for the following newly identified EBSAs: Haddock Channel Sponges, South Coast, St. Mary's Bay, Bonavista Bay and Baccalieu Island.

Table 4 Revised EBSAs in the PB/GB LOMA

EBSA	Approximate Delineated Area (km²)	
	2007	2017
Northeast Slope	13,885	19,731
Virgin Rocks	6,843	7,294
Lilly Canyon-Carson Canyon	1,145	2,180
Southeast Shoal	30,935	15,402
Eastern Avalon	1,683	5,948
Southwest Slope	16,644	25,181
Smith Sound	148	547
Placentia Bay	7,693	13,539
Laurentian Channel	17,140	19,545
Haddock Channel Sponges	N/A	490
South Coast	N/A	6,876
St. Mary's Bay	N/A	3,989
Bonavista Bay	N/A	3,141
Baccalieu Island	N/A	6,922

Clarification on specific special areas within the Study Area are outlined in the following sections.

NAFO Canyons

NAFO Identified several vulnerable marine ecosystem (VME) physical indicator elements that are located outside the Canadian EEZ in international waters along the Newfoundland and Labrador shelves region, including the Grand Banks and Flemish Cap. These VME physical indicator elements are generalized areas often identified by the colloquial name of the bathymetric feature that they fall within and include locations of seamounts, canyons, knolls, spawning grounds, and steep flanks (Table 5). The canyons discussed in Section 4.2.9.2.1 of the EIS are contained within the VME physical indicator elements, as identified on Figure 1: Tail of the Grand Bank (3N), South of Flemish Cap and Tail of the Grand Bank (3O).

Table 5 VME Physical Indicator Elements

Physical Indicator Element	Representative VME
Seamounts	Fogo Seamounts (Div. 3O, 4Vs) Newfoundland Seamounts (Div. 3MN) Corner Rise Seamounts (Div. 6GH) New England Seamounts (Div. 6EF)
Canyons	Shelf-indenting canyon; Tail of the Grand Bank (Div. 3N) Canyons with head >400 m depth; South of Flemish Cap and Tail of the Grand Bank (Div. 3MN) Canyons with heads >200 m depth; Tail of the Grand Bank (Div. 3O)
Knolls	Orphan Knoll (Div. 3K) Beothuk Knoll (Div. 3 LMN)
Southeast Shoal	Tail of the Grand Bank Spawning grounds (Div. 3N)
Steep flanks >6.4°	South and Southeast of Flemish Cap. (Div. 3LM)

Marine Refuges and Lobster Closure Areas

Section 4.2.9.4 of the EIS states that: “there are five marine refuges within the Newfoundland and Labrador Shelves bioregion”. As Lobster Closure Areas are identified as marine refuges, there are ten marine refuges: six Marine Refuge Areas (Division 30 Coral Area, Funk Island Deep Closure, Hopedale Saddle Closure, Hatton Basin Closure, Hawke Channel, and Northeast Newfoundland Slope Closure); and four Lobster Closure Areas (Gander Bay, Gooseberry Island, Glover’s Harbour, and Mouse Island).

Bonavista Cod Box

There is no mention of the Bonavista Cod Box in the Special Areas section of the EIS. It is an historic experimental closure area and is not currently recognized as a formal protected area.

Beothuk Knoll

Beothuk Knoll is located within the Study Area, not the Project Area (see Figure 1).

Eastern Avalon EBSA

Eastern Avalon EBSA is explicitly labelled in Figure 4-34 of the EIS.

Orphan Spur EBSA

The Orphan Spur EBSA is within the Study Area. The Orphan Spur EBSA comprises of an area that extends along the Labrador Slope around the Orphan Basin (see Figure 4-34 of the EIS). A portion of this EBSA overlaps with the Study Area and is approximately 210 km from the Project Area. Water depths within this EBSA range from approximately 400 m to 2,000 m (Wells et al. 2017). The rationale for the designation of this EBSA is primarily due to high concentrations of corals, and densities of sharks and species of conservation concern (e.g., northern, spotted, and striped wolffish, skates, roundnose grenadier, American plaice, redfish). Marine birds, such as murre, storm-petrels, black-legged kittiwake, gulls, skuas and jaegers, northern fulmar, shearwaters, and dovekies have been known to be present in the area. Hooded seals can inhabit the area from August to September, while harp seals are known to feed during the winter (Wells et al. 2017).

Southwest Shelf Edge and Slope

The Southwest Shelf Edge and Slope EBSA is within the Study Area.

References

DFO (Fisheries and Oceans Canada). Personal Communication. 2019. Updated data for the Placentia Bay-Grand Banks Large Ocean Management Area Ecologically and Biologically Significant Areas. Fisheries Newfoundland Regional Headquarters, Northwest Atlantic Fisheries Enquiries, personal communication, January, 2019.

DFO (Fisheries and Oceans Canada). 2017. Integrated Fisheries Management Plan, Snow Crab (*Chionoecetes opilio*) - Newfoundland and Labrador Region Effective February 6, 2015. Available at: http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/snow-crab-neige/snow-crab-neiges2009-eng.htm

UNCBD (United Nations Convention on Biodiversity). 2017. Ecologically or Biologically Significant Areas (EBSAs). Available online: https://chm.cbd.int/. Accessed March 2018.

Wells, N.J., G.B. Stenson, P. Pepin and M. Koen-Alonso. 2017. Identification and Descriptions of Ecologically and Biologically Significant Areas in the Newfoundland and Labrador Shelves Bioregion. DFO Can. Sci. Advis. Sec. Res. Doc., 2017/013: v + 87 pp.

1.8.2 Information Requirement: IR-53

Reference to EIS:

Section 6.5.10.3.1.2 Drilling Associated Surveys

Context and Rationale

The Agency requires an assessment of the potential environmental effects of routine Project operations (e.g. noise, light, water, sediment) on special areas that are both overlapping with the Project and on those to which potential effects may extend. It is not clear whether the potential effects on special areas outside the ELs but within the potential zones of influence for noise, light and cuttings disposal have been assessed.

Qalipu First Nation and the KMKNO expressed concern about the effects of project related activities on special areas, which are adjacent to or overlap with the project area, in particular with respect to sponges and corals as they are easily disturbed and slow to recover.

The NunatuKavut Community Council suggests that as a means by which to reduce the effects of operations on special areas, buffer zones around protected areas should be considered.

Specific Question of Information Requirement

Within the context of the special areas identified above in IR 52, clarify how the analysis considered potential zones of influence of noise, light and routine discharges when identifying the special areas that could be affected by routine operations. If there is potential for effects to extend to special areas, provide an analysis of effects of routine project operations on special areas that, while not directly overlapping the project area or vessel and aircraft transit routes, may be within the zone of influence for effects from noise, light, and drill cuttings disposal.

Response

As recognized by the reviewers, the zone of influence from project activities may extend beyond the boundaries of the EL, depending on the well location. This possibility was recognized and considered throughout the assessment, by establishing a 20 km buffer around Project Exploration Licences (ELs) and the transit corridor to St. John's.

Section 4.2.9 of the EIS includes an assessment of effects on Special Areas that overlap with and are adjacent to, the Project Area, including consideration of effects due to noise, light, and routine discharges on the surrounding environment.

Special Areas that have been updated or modified since the submission of the original EIS are presented in the response to IR-52.

Special Areas that overlap with the Project Area include:

North East Slope EBSA

The Northeast Shelf and Slope Ecologically and Biologically Significant Area (EBSA) is located on the northeastern Grand Banks, starting at the Nose of the Bank, from 48°W to 50°W, and from the edge of the shelf (e.g., 200 m depth contour) to the 1,000 m depth contour. This EBSA is located partially within the Project Area and entirely within the Study Area. This EBSA is not considered unique but supports feeding aggregations of spotted wolffish (Fisheries and Oceans Canada (DFO) 2016c) and Greenland halibut populations, contains two important coral areas at Tobin's Point and Funk Island Spur, and is a known feeding area for marine mammals, particularly harp seals (in the vicinity of the Sackville Spur west), hooded seals (in the vicinity of the Sackville Spur East), and pilot whales (Canadian Parks and Wilderness Society 2009; DFO 2016c).

In their EBSA ranking assessment, DFO (2007a) noted that the Northeast Shelf and Slope EBSA characteristics include:

- aggregations of spotted wolffish in spring (listed as threatened under the *Species at Risk Act*)
- high concentrations of Greenland halibut in spring
- aggregations of marine mammals

This EBSA is ranked ninth of the 11 identified EBSAs as a priority by DFO.

Crab Exclusion Area 8BX and 6C

Snow crab exclusion zones of one-half or one nautical mile wide corridors have been identified extending along the full length of Crab Fishing Area boundaries. These Exclusion Zones were established to improve delineation between adjacent crab management areas and to establish no fishing/crab refuge corridors for resource conservation (DFO 2017). Descriptions of the biological and ecological features of the Exclusion Zones are not publicly available.

Eastern Avalon

Important foraging area for many breeding marine bird species from spring to fall. Cetaceans, leatherback turtles, and seals feed in the area from spring to fall.

References

Canadian Parks and Wilderness Society. 2009. Special Marine Areas in Newfoundland and Labrador: Areas of Interest in Our Marine Backyards. Prepared for CPAWS-NL. Available at: http://cpaws.org/uploads/pubs/report_nlmarineguide.pdf.

DFO (Fisheries and Oceans Canada). 2007. Placentia Bay-Grand Banks Large Ocean Management Area Ecological and Biologically Significant Areas. DFO Canadian Science Advisory Secretariat Research Document, 2007/052: 21 pp.

DFO (Fisheries and Oceans Canada). 2016. Refinement of information relating to Ecologically and Biologically Significant Areas (EBSAs) identified in the Newfoundland and Labrador (NL) Bioregion. DFO Can. Sci. Advis. Sec. Sci. Resp., 2016/032: 18 pp.

DFO (Fisheries and Oceans Canada). 2017. Integrated Fisheries Management Plan, Snow Crab (*Chionoecetes opilio*) - Newfoundland and Labrador Region Effective February 6, 2015. Available at: http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/snow-crab-neige/snow-crab-neiges2009-eng.htm

1.8.3 Information Requirement: IR-54

Reference to EIS:

Section 6.5.10.3.1.3 Waste Management

Context and Rationale

The EIS states that in areas of deep water (greater than 600 metres), where drilling muds and cuttings are more dispersed, ecological recovery begins soon after drilling and can be well advanced within a year. However, the depths of the ELs for the Project range from 87 to 211 metres.

Specific Question of Information Requirement

Given that the depths of the exploration licences in the Project range from 87 to 211 metres, provide information on ecological recovery in shallow drill sites.

Response

Effects resulting from the discharge of drilling muds and cuttings have been shown to be short-term in nature with effects subsiding within one to four years (Bakke et al. 1986, 2011; Hurley and Ellis 2004; Renuaud et al. 2008). Nine field studies, occurring at water depths from 31 to 600 m of water, involving the effects and recovery of benthic communities following the deposition of water-based mud (WBM) cuttings were reviewed recently (International Association of Oil and Gas Producers (IOGP) 2016). In the majority of the field studies, substantial recovery of the benthic community was observed within one to three years after discharged had ceased. Similarly, seven field studies in water depths ranging from 70 to 1,500 m of water were reviewed to determine benthic community recovery following the deposition of treated synthetic-based mud (SBM) cuttings (IOGP 2016). It was observed that the effects of SBM discharges were less severe at water depths >1,000 m than at shallower depths, and therefore recovery was more rapid at greater depths. The most frequent response of the macrofaunal benthic community was a decrease in total abundance, species richness, and diversity. Meiofaunal communities were observed to either increase or decrease near discharge locations. Those studies involving SBM discharges in shallow waters <600 m, indicated benthic community recovery within one to two years post deposition (IOGP 2016).

Results from the ongoing White Rose EEM program, which takes place within the Project Area, have confirmed original assessment and model predictions (Husky Oil Operations Limited 2000, LGL 2007) of no significant environmental effect on fish and fish habitat due to operational discharges. The latest EEM results (2016) (Husky Energy 2019) indicate that there was evidence of project effects on total benthic abundance and biomass, and no evidence of effects on richness. Effects on total abundance remain weak. In 2016, total abundance was reduced in the immediate vicinity (within less than 1 km) of drill centres, similar to what has been noted in previous years. Effects on biomass in 2016 were less spatially extensive than in 2012 and 2014.

Of the individual taxa, the polychaete family Paraonidae remains the most affected, with lesser effects noted on the polychaetes Cirratulidae, Orbiniidae, Spionidae and Pholoidae, and the crustacean Tanaidacea. The threshold distance for effects on Paraonidae in 2016 was estimated at 1.2 km.

Overall, 2016 data suggest that effects on total abundance and biomass are limited to within 1 km; and effects on Paraonidae are limited to 1 to 2 km. As noted in previous EEM reports, the spatial extent of effects on benthic invertebrates at White Rose is generally consistent with the literature on effects of contamination from offshore oil developments. Davies et al. (1984) first described general zones of effects on benthic invertebrates around offshore platforms. The first zone was characterized by a highly disrupted benthic community within approximately 0.5 km of discharge source. The second zone was described as a transition zone in benthic community structure from affected to unaffected. This scheme has been generally used elsewhere. For instance, Gerrard et al. (1999) also describe a zone of approximately 0.5 km from source with a highly disrupted benthic community. Based on their review, the spatial extent of the transition zone from affected to unaffected could extend from 0.2 to 2 km.

Ratings of effects size are provided by Davies et al. (1984) and Kilgour et al. (2005). Davies et al. (1984) describes a highly disrupted community as impoverished and highly modified with abundances at or near zero. In agreement, Kilgour et al. (2005) state that benthic community effects are large when they co-occur with effects on fish and that this normally occurs when the benthic community is reduced to one or two types of organisms, and with either very high (10x more than normal) or very low (10x less than normal) abundances. This is not the condition at White Rose. In 2016, total abundance was reduced to less than 75% of the lower limit of the baseline range of variation at two stations near active drill centres, and the lowest abundance at these stations (900 individuals per m^2) was 63% of that lower limit. Biomass was reduced to less than 75% of the lower limit of the baseline range at five stations near active drill centres (less than the 11 stations noted in 2014) and the lowest biomass at these stations (113 g/m^2) was 41% of that lower limit. Richness levels did not fall to less than 75% of the baseline range at any station in 2016, as in previous years. Overall, richness has remained within the range of values noted in the baseline year (2000).

As noted in Husky's response to regulator comments on the 2014 EEM program, potential effects on benthic communities were assessed within the valued ecosystem component of Fish and Fish Habitat. In general, both the White Rose (Husky Oil Operations Limited 2000) and North Amethyst (LGL 2006) environmental assessments predictions are consistent with observations of both Davies et al. (1984) and Gerrard et al. (1999); highly disrupted communities can be expected near source. According to effect size criteria noted above, none of the stations at White Rose had highly disrupted benthic communities, although total abundance and/or biomass were reduced to less than 75% of the baseline range at six drill centre stations, located at distances ranging from 0.3 to 0.9 km a drill centre. More subtle changes in community structure were noted to 2 km.

Based on these studies, it is predicted that the benthic community structure will return or will be returning to baseline levels within one to four years after drilling activities cease.

References

Bakke, T., A.M.V. Green and P.E. Iversen. 2011. Offshore environmental monitoring in Norway: Regulations, results and developments (Chapter 25). In: K. Lee and J. Neff (eds.). Produced Water, Springer, NY.

Bakke, T., N.W. Green, K. Næs and A. Pedersen. 1986. Drill cuttings on the sea bed: phase 1 and 2. Field experiments on benthic recolonization and chemical changes in response to various types and amounts of cuttings. In: SFT/Statfjord Unit Joint Research Project Symposium, 24-26 February 2006, Trondheim, Norway.

Davies, J.M., J.M. Addy, R.A. Blackman, J.R. Blanchards, J.E. Ferbrache, D.C. Moore, H.J. Somerville, A. Whitehead and T. Wilkinson. 1984. Environmental effects of the use of oil-based drilling muds in the North Sea. Mar. Poll. Bull., 15, 363-370.

Gerrard, S., A. Grant, R. Marsh and C. London. 1999. Drill Cuttings Piles in the North Sea: Management Options during Platform Decommissioning. Centre for Environ. Risk Res., Report No. 31. http://www.uea.ac.uk/~e130/cuttings.pdf

Hurley, G. and J. Ellis. 2004. Environmental Effects of Exploratory Drilling Offshore Canada: Environmental Effects Monitoring Data and Literature Review - Final Report. Prepared for the Canadian Environmental Assessment Agency - Regulatory Advisory Committee.114 pp

Husky Oil Operations Limited. 2000. White Rose Oilfield Comprehensive Study - Part One: Environmental Impact Statement. Submitted to the Canada-Newfoundland Offshore Petroleum Board, St. John's, NL. 639 pp + Appendices.

Husky Energy 2019. White Rose Environmental Effects Monitoring Program 2016. Prepared by Stantec Consulting Ltd. for Husky Energy, St. John's, NL.

IOGP (International Association of Oil and Gas Producers). 2016. Environmental Fate and Effects of Ocean Discharge of Drill Cuttings and Associated Drilling Fluids from Offshore Oil and Gas Operations. Report 543: 143 pp. (including appendices).

Kilgour, B.W., K.R. Munkittrick, C.B. Portt, K. Hedley, J. Culp, S. Dixit and G. Pastershank. 2005. Biological criteria for municipal wastewater effluent monitoring programs. Water Qual. Res. J. Can., 40: 374-387.

LGL Limited. 2006. Husky White Rose Development Project: New Drill Centre Construction and Operations Program Environmental Assessment. LGL Report SA883, by LGL Limited, St. John's, NL, for Husky Energy Inc., Calgary, AB. 299 pp. + Appendices.

LGL Limited. 2007. Husky White Rose Development Project: New Drill Centre Construction and Operations Program Environmental Assessment Addendum. LGL Rep. SA883a. Rep. by LGL Limited, St. John's, NL, for Husky Energy, Inc., Calgary, AB. 126 pp. + Appendices.

Renaud, P.E., Jensen, T., Wassbotten, I., Mannvik, H.P., and Botnen, H. 2008. Offshore Sediment Monitoring on the Norwegian Shelf-A Regional Approach 1996e 2006. Akvaplan-Niva, Tromsø, Norway. Report 3487e003. Available from: http://www.norskoljeoggass.no/PageFiles/6544/Milj%C3%B8overv%C3%A5king%20av%20offshorevirksomheten%20-%20Regional%20sedimentoverv%C3%A5king%201996-2006.pdf.

1.8.4 Information Requirement: IR-55

Reference to EIS:

Section 6.5.12 Follow-up and Monitoring

Context and Rationale

Section 6.5.12 of the EIS states that "no follow-up is proposed to be implemented for routine Project activities" in relation to special areas. However, page 39 of the Agency's EIS Guidelines states that "considerations for developing a follow-up program include whether the project will impact environmentally sensitive areas/VCs or protected areas or areas under consideration for protection." Taking into account that the project area overlaps with the Northeast Shelf and Slope, which is recognized for supporting spotted wolffish and Greenland halibut populations, providing a feeding area for marine mammals, and containing important coral areas, it is not clear why no follow-up program is being proposed.

The KMKNO states that follow-up studies should be completed, including a monitoring program via seabed video and/or benthic sampling to determine infaunal recolonization rates following drilling.

Specific Question of Information Requirement

Provide clarification as to whether a follow-up program would be carried out, should a wellsite be within, adjacent to, or near a special area (taking into account any additional special areas that were identified in IR 52 above) such that effects may occur within or extend to the special area at levels above the biological effects threshold for a species. Further discuss the need for follow-up depending on species types and assemblages as well as based on the mitigation implemented.

Discuss the need for and feasibility of a seabed monitoring program to determine infaunal recolonization rates following drilling.

Response

There is currently no monitoring or follow-up program planned for infaunal recolonization rates following drilling in or outside of a special area. Husky will conduct a visual survey (using a remotely operated vehicle) of the seafloor prior the start of drilling to assess the presence of any aggregations of habitat-forming corals or sponges. If sensitive environmental features are identified during the survey, Husky will move the wellsite to avoid affecting them if it is feasible to do so. If it is not feasible, Husky will consult with the Canada-Newfoundland and Labrador Offshore Petroleum Board and Fisheries and Oceans Canada to determine an appropriate course of action.

Results from previous and ongoing Environmental Effects Monitoring Programs have indicated that there have not been significant environmental effects to fish and fish habitat. Please refer to the response to IR-54 for a detailed discussion.

References

N/A

1.8.5 Information Requirement: IR-56

Reference to EIS:

Section 6.3.10.3.1.3 Supply and Servicing

Context and Rationale

Section 6.3.10.3.1.3 of the EIS states that "single or occasional overflights by helicopters would likely elicit a brief behavioral response by most marine mammals and sea turtles and therefore would be expected to result in a short-term and localized change in habitat quality and use." However, it is not clear whether helicopters would be a regular occurrence over the duration of the Project.

Specific Question of Information Requirement

Specify areas of environmental sensitivity that have been identified in relation to helicopter flight paths and describe the factors that influence helicopter operators' ability to avoid them. Describe the potential environmental effects associated with and anticipated frequency of situations where sensitive areas/components cannot be avoided. Describe if there is any potential mitigation proposed to avoid disturbance to marine mammals and sea turtles.

Provide the number of helicopter flights per day currently in the area and the number of additional helicopter trips required per day for this project.

Response

There are no known bird colonies or Important Bird Areas (IBAs) within the Project Area.

From Section 6.4.10.3.1.4 of the Husky EIS

> "Cougar Helicopters, which logs 4,000 to 5,000 flying hours annually providing helicopter services to Husky and other offshore operators in the Jeanne d'Arc Basin and conducted 1,012 flights in and around the Project Area in 2008 alone, reported a total of five bird strikes during the period from 2005 to 2011(SMS Aviation Safety Inc. 2012). The small, incremental increase in helicopter traffic associated with the Project (i.e., five helicopter trips per week) is not expected to result in a measurable change in risk of mortality or physical injury for migratory birds within the Project Area.

Potential effects of helicopters are described under the Supply and Servicing heading in each VC chapter. The general conclusion from the sound modelling conducted was that "Sound transfer to the marine environment from helicopters during personnel transport is likely minimal." The assessment of effects of helicopters on the biological VCs describe localized temporary behavioural disturbance potential, which did not warrant mitigation.

References

SMS Aviation Safety Inc. 2012. Operational Safety Risk Analysis of Night Helicopter Transportation Operations in the Canada-Newfoundland and Labrador Offshore Industry. Prepared for the C-NLOPB Offshore Helicopter Safety Implementation Team. Available at: http://www.cnlopb.ca/pdfs/ohsi/osrareport.pdf?lbisphpreq=1.

1.9 INDIGENOUS PEOPLES

1.9.1 Information Requirement: IR-57

Reference to EIS:

Section 6.2.10.2 Mitigation

Context and Rationale

In Section 6.2.10.2 of the EIS, the proponent proposes that any Project-related damage to fishing gear will be compensated in accordance with the *Compensation Guidelines Respecting Damages Related to Offshore Petroleum Activity* (C-NLOPB and Canada-Nova Scotia Offshore Petroleum Board).

The proponent further states that “Husky has a gear/vessel damage compensation program to promptly settle claims for loss and/or damage that may be caused by Project-related activities such as drilling–associated surveys or OSV operations.” However, it is not clear if Husky’s compensation program is in addition to the Compensation Guidelines, or if Husky’s compensation program incorporates the *Compensation Guidelines Respecting Damages Related to Offshore Petroleum Activity*.

In addition, Section 6.2.10.2 of the EIS details mitigation measures related to commercial fisheries. Husky states that “Procedures are in place so that any incidents of contact with fishing gear are clearly detected and documented (e.g. time, location of contact, loss of contact, and description of any identifying markings observed on affected gear).”

However, no information with respect to information sharing, the availability of information and who is responsible for recording the information is provided.

In addition, the Fish, Food and Allied Workers /Unifor Union stated concern with the timeframes and procedures required to compensate affected parties adequately, fairly and rapidly under the C-NLOPB/C-NSOPB’s *Compensation Guidelines Respecting Damages Related to Offshore Petroleum Activity.*

Specific Question of Information Requirement

Clarify if Husky’s gear/vessel damage compensation program referenced in the EIS is an addition to the *Compensation Guidelines Respecting Damages Related to Offshore Petroleum Activity*, or if it is developed to incorporate the requirements of the *Compensation Guidelines Respecting Damages Related to Offshore Petroleum Activity.*

With respect to Husky’s compensation program and the *Compensation Guidelines Respecting Damages Related to Offshore Petroleum Activity*, provide the following:

- Describe how harvesters are notified of the compensation plan(s) in place, and confirm that harvesters will be notified of the plans and how to report interactions prior to project activities commencing;
- Provide a description of the procedures for reporting activities, including if reporting can be completed by harvesters as well as individuals on the MODU or operational support vessels;
- Provide an analysis of the frequency and type of interaction between project activities and fishing gear/vessels based on compensation program statistics from other Husky operations, and;
- Provide a discussion on the timelines associated with claims under Husky’s compensation program.

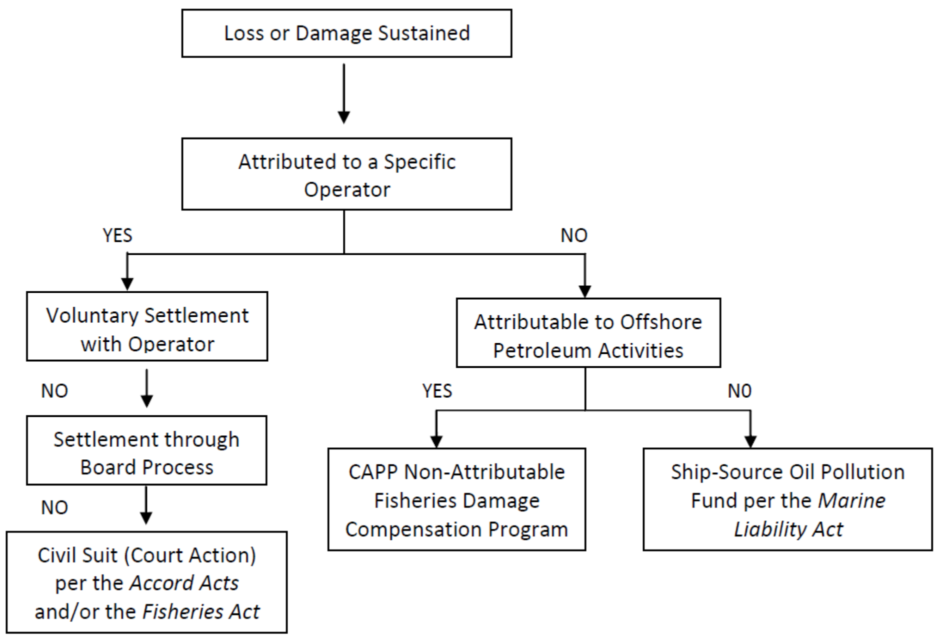
Response

There are three existing options available to a claimant to recover damages if they are attributable to an operator:

1. Voluntary settlement by the operator
2. Application to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) for recovery of damage from the resources made available by the Operator, as part of their Authorization
3. A civil suit for recovery through the appropriate court of law

Reference to Husky's gear/vessel damage compensation program within the EIS was referring to Husky's internal process for reviewing claims under Item 1 above. This process is meant to be the most efficient, but timelines will depend on the nature of the claim. All claims are considered incidents and reported to the C-NLOPB and managed through their authorization process.

An outline of the process to recover damages is provided on the C-NLOPB's website within the document Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity (C-NLOPB and Canada-Nova Scotia Offshore Petroleum Board 2017). The following figure from that report summaries the options.



If claims are not attributable to an operator, the fishing industry can follow as an alternative to making a claim through the courts or other regulatory authorities (Canadian Association of Petroleum Producers 2007).

Compensation program details (frequency and type) of claims are private and confidential.

References

Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board 2017. Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity. Available at: https://www.cnlopb.ca/wp-content/uploads/guidelines/compgle.pdf

Canadian Association of Petroleum Producers 2007. Canadian East Coast Offshore Operators Non-Attributable Fisheries Damage Compensation Program. Available at: https://www.capp.ca/publications-and-statistics/publications/117754

1.9.2 Information Requirement: IR-58

Reference to EIS:

Section 6.2.10.2 Mitigation

Context and Rationale

Section 6.2.10.2 of the EIS states that any project-related damage to fishing gear will be compensated in accordance with the *Compensation Guidelines Respecting Damages Related to Offshore Petroleum Activity* and Husky's gear/vessel damage compensation program. However, the KMKNO and Nunatsiavut Government indicated that there was no information related to how the proponent intends to develop, or has developed, the compensation program in collaboration with potentially impacted parties, including commercial and commercial-communal harvesters. Nunatsiavut Government further indicated they would like to be involved in the development of the compensation program to ensure the protection of the groups interests in the region.

Specific Question of Information Requirement

Discuss if, and how, commercial and communal-commercial harvesters and Indigenous groups will be engaged in the development of Husky's compensation programs.

Response

In order to obtain an Authorization from the C-NLOPB to conduct any work offshore, Husky has had to demonstrate its ability to pay for all actual losses or damages incurred as a result of a spill or debris which includes loss of income, future loss of income and with respect to any Aboriginal peoples of Canada, loss of hunting fishing and gathering opportunities.

There are three existing options available to a claimant to recover damages if they are attributable to an operator:

1. Voluntary settlement by the operator

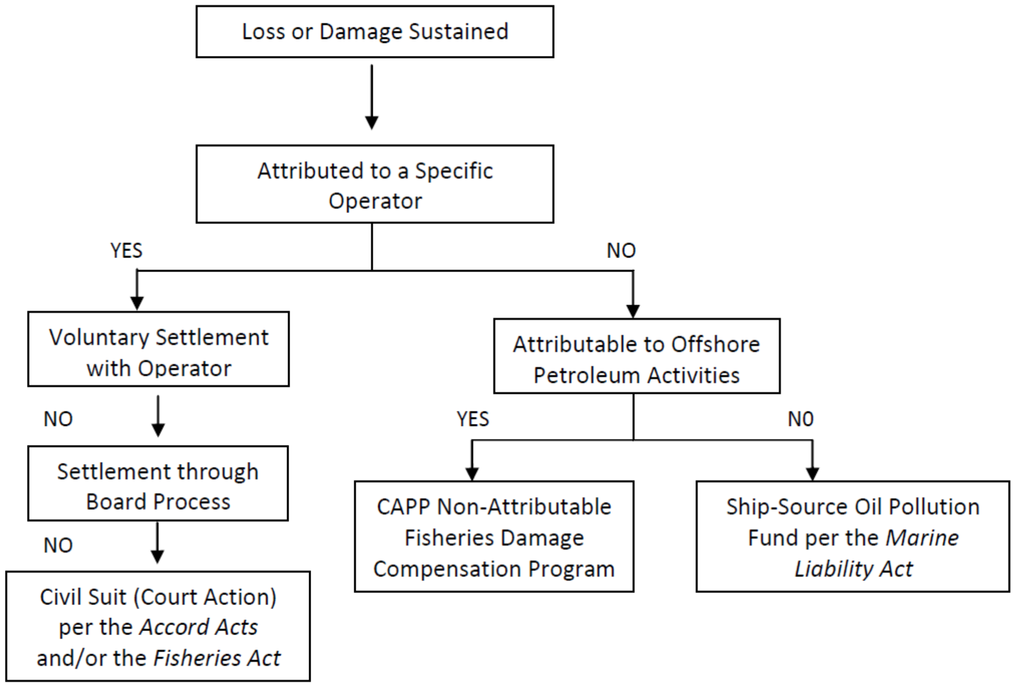
2. Application to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) for recovery of damage from the resources made available by the Operator, as part of their Authorization

3. A civil suit for recovery through the appropriate court of law

Reference to Husky's gear/vessel damage compensation program within the EIS was referring to Husky's internal process for reviewing claims under Item 1 above.

An outline of the existing process to recover damages is provided on the C-NLOPB's website within the document Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity (C-NLOPB and Canada-Nova Scotia Offshore Petroleum Board 2017).

The following figure from that report summaries the options.



References

Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board 2017. Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity. Available at: https://www.cnlopb.ca/wp-content/uploads/guidelines/compgle.pdf

1.9.3 Information Requirement: IR-59

Reference to EIS:

Section 4.3.2.1 Approach and Key Information Sources

Context and Rationale

Section 4.3.2.1 of the EIS states that "where limited information was available on aspects of individual Indigenous communities, such as community health or land and resource use, more general information has been provided at the regional or provincial level." KMKNO indicated that the proponent should explain the rationale for not carrying out specific studies on current use of lands and resources for traditional purposes if limited secondary sources of information were available.

The KMKNO indicated primary sources of information as possibly including traditional land use studies, socio-economic studies, heritage surveys or other relevant studies conducted specifically for the Project and its EIS. Often these studies and other types of relevant information are obtained directly from Indigenous groups. Secondary sources of information could include previously documented information on the area, not collected specifically for the purposes of the project, or desktop literature based information.

Several Indigenous groups have indicated that the EIS does not use Indigenous Knowledge in its valued components baseline information or environmental effects analysis (e.g. in conclusions on interactions with Atlantic Salmon, Bluefin Tuna, swordfish, and the project area) and must be applied to assist in developing mitigation and environmental protection plans; and Project monitoring.

Specific Question of Information Requirement

Provide a rationale for only using secondary sources of information, particularly related to land and resources use, fishing activity, health and socio-economic issues.

Discuss whether Husky is considering collecting further Indigenous knowledge from Indigenous communities and if funding an Indigenous knowledge study is being considered. If so, please advise when this information would be available, and how it would be utilized, including how it could be used in the current assessment, the design and implementation of follow-up and monitoring programs, and further mitigations. If no additional Indigenous knowledge is planned to be collected, provide a rationale for why this would not be necessary.

Response

As required in the EIS guidelines, Husky has incorporated into the EIS, the community knowledge and Aboriginal traditional knowledge to which it has access or that was acquired through engagement with Indigenous groups on this or similar projects. Since 2016, Husky's correspondence invited Indigenous groups to provide Indigenous knowledge related to the Project and its potential effects to Husky or the Agency. Despite all requests, Indigenous groups did not identify or provide additional traditional knowledge applicable to the EIS, other than that described above. However, during the EIS review of this and similar projects, many Indigenous groups did provide very helpful scientific literature references to consider in the effects assessment.

Given the location of the Project, and the absence of potential impacts to human health, socio-economic conditions or resource use, Husky does not view additional studies on traditional land use, socio-economic surveys or heritage surveys as warranted. However, should such knowledge be provided to Husky by Indigenous groups now or in the future, the company will consider and integrate that knowledge, where appropriate.

References

N/A

1.9.4 Information Requirement: R-60

Reference to EIS:

Section 9.2.10 Follow-up and Monitoring

Context and Rationale

The MFN have indicated that it is not evident how the proponent intends to involve Indigenous groups in the development and implementation of spill and contingency plans. It was noted that:

- the proponent should indicate how it will involve Indigenous groups in the development and implementation of the oil spill response plan and other contingency plans, including response, preparedness planning and exercises and training;
- the proponent should indicate if Indigenous groups will be provided with approved versions of contingency and response plans; and
- the proponent should be required notify Indigenous groups in the event of any accidental release.

Section 9.2.10 of the EIS states that "Husky will communicate with indigenous groups, fishers, and other ocean users before, during, and after drilling programs, and details of safety zones will be published in Notices to Shipping and/or Notice to Mariners, as appropriate. This will allow Indigenous groups, fishers and other ocean users to plan accordingly and mitigate potential space-use conflicts or environmental effects." However, there was no information provided to indicate how issues and concerns raised by Indigenous groups would be taken into account.

Specific Question of Information Requirement

Confirm the role of Indigenous groups in the development and implementation of oil spill response plans and other contingency plans, exercises and training. Confirm if Indigenous groups will be provided with versions of these plans when they are finalized.

Clarify the feedback mechanisms in place that will demonstrate how issues and concerns raised by Indigenous groups, fishers and other ocean users will be taken into account during Project execution.

Response

Husky has an existing Oil Spill Response Plan already approved by the Canada-Newfoundland and Labrador Offshore Petroleum Board that will be used for this exploration drilling program. Husky will share the existing plan with Indigenous groups for their information and review. Husky has engaged with Indigenous Groups on oil spill prevention and response during the development of the EIS, and will discuss opportunities for further involvement, where appropriate.

Husky will develop an Indigenous Fisheries Communications Plan for engagement with Indigenous groups that describes a process for providing regular operational updates throughout the exploration drilling program and describes a process for informing Indigenous groups in the case of an emergency. The plan will include appropriate feedback mechanisms for the concerns of Indigenous groups, fishers and other ocean users.

References

N/A

1.9.5 Information Requirement: IR-61

Reference to EIS:

Section 11.4 Monitoring and Follow-up

Context and Rationale

Section 11.4 of the EIS states that given the nature of the Project and existing knowledge of potential environmental effects related to this type of activity from previous environmental effects monitoring and existing literature, monitoring and follow-up requirements are limited. Husky states that they will communicate with Indigenous groups, fishers and other ocean users before, during and after drilling programs, however they do not describe the role of Indigenous groups in monitoring and follow-up programs specifically. EFN and Nunatsiavut Government stated an interest in reviewing the design of and findings from environmental monitoring and follow-up programs.

Specific Question of Information Requirement

Describe the on-going role of Indigenous groups in monitoring and follow-up plans, including for accidents and malfunctions. Provide information regarding the reporting and availability of results of monitoring and follow-up programs.

Response

Husky will develop an appropriate mechanism for sharing the results of environmental monitoring with Indigenous groups as part of a Fisheries Communications Plan (FCP). In consultation with interested Indigenous groups, the FCP will develop a process for providing regular operational updates throughout the exploration drilling program, describe a process for informing Indigenous groups in the case of an emergency (accident or malfunction), as well as the results of any monitoring required by the regulators.

References

N/A

1.9.6 Information Requirement: IR-62

Reference to EIS:

Section 6.3.7 Significance Definition

Context and Rationale

Section 6.3.7 of the EIS Guidelines requires a description and analysis of how changes to the environment caused by the Project will affect current use of resources by Indigenous peoples for traditional purposes, as well as human health and socio-economic conditions (including commercial fishing) of Indigenous communities. Underlying environmental changes to be considered in this analysis include any changes to environmental quality, including perceived disturbance of the environment (e.g. fear of contamination of water or country foods), and assessment of the potential to return affected areas to pre-project conditions.

The EIS states that the probability of an accidental event such as a large batch spill or a blowout occurring is very low, and that in the unlikely event that such an accident did occur, the oil spill modelling predicts a very low probability of oil moving west, thus reaching the shoreline of Atlantic Canada and coming into contact with any Indigenous communities and activities. Nevertheless, Indigenous peoples may change their harvesting or consumption habits following the announcement of such an accidental event.

The KMKNO, and the NunatuKavut Community Council expressed concerns regarding the effects analysis of accidents and malfunctions on the health (both physical and psycho-social well-being) and socio-economics of potentially affected Indigenous communities.

In addition, NCC expressed concerns that given the connection among species and environments in an ecosystem, any potential negative effects on one component or species may have direct or indirect effects on other parts of the ecosystem.

Specific Question of Information Requirement

With consideration of the concerns expressed by Indigenous groups and other sources (e.g. literature, experiences elsewhere) provide additional analysis on the effects of an uncontrolled well event on Indigenous communities and activities, including potential adverse effects on health of Indigenous peoples from the consumption of contaminated species, or justification for the determination that this assessment is not required.

Response

EIS Section 7.3.6 provides a thorough analysis of potential effects of an uncontrolled well event on Indigenous communities and activities. With regard to potential adverse effects on health of Indigenous peoples from the consumption of contaminated species, the reviewer is referred to the relevant valued component sections for a description of the risk for contamination.

Considering that the probability of an uncontrolled well event is very low to begin with, the risk of consumption of contaminated species becomes less, especially when traditionally harvested species are migratory. The extent to which the perception of contamination can persist after an event is very difficult to predict. An effects assessment of that perception would therefore be speculation. In any uncontrolled well event situation, monitoring results would be shared to help alleviate concerns.

References

N/A

1.9.7 Information Requirement: IR-63

Reference to EIS:

Section 2.2.2.4 Technological Innovations and Scientific Knowledge

Context and Rationale

Due to existing data gaps, several Indigenous groups indicated the importance of the proponent actively supporting research opportunities and initiatives related to migratory species of importance to Indigenous groups such as American Eel and Atlantic Salmon. Section 2.2.2.4 of the EIS states that Husky has supported increases in scientific knowledge through funding to the Environmental Studies and Research Fund for numerous studies. It is not clear in the EIS whether Husky may consider supporting research to address these data gaps, potentially in collaboration with research partners, Indigenous groups, or within the context of regional initiatives. The Agency understands that potential collaborations continue to be explored and additional information may now be available on future initiatives.

Specific Question of Information Requirement

Provide an update on research collaborations that have been identified, and agreements that are in place, if any to improve understanding of Atlantic Salmon, American Eel or other migratory species in the marine environment and their potential interaction with oil and gas activity in the offshore of Newfoundland. Elaborate on the research areas that are being studied, by whom, how this data will/may improve certainty with respect to impact predictions, for the current and future projects, and how Indigenous groups may be engaged in developing research plans. Indicate how data will be disseminated, including whether results of research initiatives will be shared with other operators in the Newfoundland offshore, Indigenous communities, and the public.

Response

Husky deployed an acoustic receiver within the White Rose field in August 2018 to record the presence of any tagged species, including Atlantic salmon and American eel. Another receiver is planned to be deployed just outside the White Rose field in April 2019. Data collected from these receivers will be made public through the Ocean Tracking Network.

The *Canada Petroleum Resources Act*, as well the *Canada-Newfoundland Atlantic Accord Implementation Act* and the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act* provide legislative direction to the Environmental Studies Research Fund (ESRF), established in 1983. ESRF funds environmental and social studies pertaining to petroleum exploration, development, and production activities on frontier lands. Annually, lease-holding oil and gas companies active in Canada’s frontier lands pay levies to this fund.

Operator’s such as Husky Energy have requested that the ESRF consider Atlantic salmon as a research priority for 2019. Husky understands that the Minister of Natural Resources must approve the ESRF levy amounts before ESRF priorities can be announced in April 2019.

References

N/A

1.9.8 Information Requirement: IR-64

Context and Rationale

Table 3.5 of the EIS states that "Husky will develop an Indigenous Fisheries Communications Plan with Indigenous groups to provide continued information-sharing throughout the lifecycle of the Project." However, the EIS does not provide any further detail about the Fisheries Communications Plan. More detail about the proposed plan is needed. It is unclear whether this plan would allow adaptive management strategies specifically for Indigenous fisheries should issues arise in the future that were not predicted within the EIS.

Specific Question of Information Requirement

Provide additional information on the Indigenous Communities Fisheries Communication Plan, including a discussion of the following:

- whether the Indigenous Communities Fisheries Communication Plan would include measures to ensure that issues and concerns can be raised by Indigenous groups during the life of the Project and how this could occur;
- whether an adaptive approach would be used to allow for a harvester feedback mechanism to report changes in harvesting (e.g. access, quality, quantity) over the life of the Project and how this could occur; and
- the frequency of updates to Indigenous communities about planned activities given potential for changes in operations, and the potential need for frequent communication over the life of the Project, for example monthly updates throughout Project execution to fishers.

Response

As outlined in Husky's response to IR-60, Husky will develop an Indigenous Fisheries Communications Plan for engagement with Indigenous groups that describes a process for providing regular operational updates throughout the exploration drilling program; and, describes a process for informing Indigenous groups in the case of an emergency. Details of frequency will be discussed with Indigenous groups, according to their preference, during engagement on the plan. The plan will include an appropriate feedback mechanism to address the ongoing concerns of Indigenous groups, fishers, and other ocean users.

References

N/A

1.9.9 Information Requirement: IR-65

Reference to EIS:

Section 6.1.12, 6.2.12, 6.3.12, 6.4.12 and 6.5.12, Follow-up and Monitoring

Context and Rationale

It is noted throughout the EIS (Sections 6.1.12, 6.2.12, 6.3.12, 6.4.12 and 6.5.12) that Husky will provide annual updates to the C-NLOPB, regarding project activities that will be conducted in the project area in a given year. It is stated that the update will include any applicable changes to species of conservation concern, species at risk and critical habitat.

Specific Question of Information Requirement

Discuss the availability of the annual report to Indigenous groups. If the report will not be distributed, confirm if it would be available upon request.

Response

An annual EIS update is provided to the Canada-Newfoundland and Labrador Offshore Petroleum Board and is made available to the public on their website. Notification to Indigenous groups can be provided.

References

N/A

1.10 COMMERCIAL FISHERIES

1.10.1 Information Requirement: IR-66

Reference to EIS:

Section 6.2.10.2 Mitigation

Context and Rationale

As mitigation, to minimize effects on commercial fisheries, in Section 6.2.10.2 of the EIS Husky proposes the implementation of a Vessel Traffic Management Standard to manage communication relevant to the movement of vessels during Project-related activities (including OSVs, survey vessels, and MODU), with operators and fishers.

However, the proponent provides limited detail related to the communication mechanisms, and the frequency of communication. For example, the proponent does not indicate whether there will be communication with fishers through One Ocean, FFAW-Unifor, the NAFO Secretariat, or whether a single point of contact would be established.

Procedures for communication in the Vessel Traffic Management Standard are required to enable evaluation of effects assessment.

Specific Question of Information Requirement

Provide a description of the components of the Vessel Traffic Management Standard, including the frequency of reporting, possible communication mechanisms to be utilized and identification of parties that will be involved in and notified through the Vessel Traffic Management Standard.

Response

All vessels under contract to Husky Energy will abide by the *Canada Shipping Act*, the International Regulations for Preventing Collisions at Sea, and all other applicable legislation and regulations.

Each year, Husky's plans for exploration drilling are provided to regulators and fishing industry during the annual EA review process. Annual EA reviews are posted on the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB's) website. Husky's participation in One Ocean also provides the opportunity to discuss upcoming plans for exploration drilling with the fishing industry throughout the year.

Prior to any tow of the mobile offshore drilling unit outside the White Rose field, a Notice to Shipping is issued directly to One Ocean, FFAW-Unifor, seafood harvesters operating offshore, the C-NLOPB, the Canadian Coast Guard and the Fisheries Broadcast.

References

N/A

1.10.2 Information Requirement: IR-67

Reference to EIS:

Section 6.2.10.3.1.5 Well Abandonment

Context and Rationale

Section 2.5.5 (Decommissioning and Abandonment) of the EIS indicates that following drilling, wells may be suspended or abandoned. If suspended, the suspension cap protrudes above the seabed.

Section 6.2.10.3.1.5 of the EIS discusses wellhead abandonment, and the potential effects on commercial fisheries, however there is no discussion on the potential effects on commercial fisheries if the well is suspended.

Specific Question of Information Requirement

Discuss the potential effects of a suspended wellhead on commercial fisheries, as well as any mitigation measures that may be implemented to minimize effects.

Response

Once wells are drilled, they are temporarily suspended or permanently abandoned as per the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (Government of Canada 2014) and in compliance with the requirements of the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). A well may be temporarily suspended if there is a perceived requirement for well testing or further evaluation at a later period in the project schedule. An operator of a well must submit a Notification to Suspend / Abandon (C-NLOPB 2016) to the C-NLOPB, as well as detailed plans for monitoring suspended wells and information regarding the methods used to suspend or abandon a well so that they are adequately isolated to prevent the release of hydrocarbons into the environment. The C-NLOPB must provide approval for the planned "as-left" condition before the drilling rig can move off the well.

The locations of suspended wells are communicated to appropriate authorities, commercial fishers and other ocean users through Notices to Mariners to mitigate the risk to bottom trawl fishing, the majority of which occurs north of the Project Area (EIS Figure 4-43).

Husky is not aware of any specific concerns raised by fishing industry participants (during consultation and engagement related specifically to this or other Projects) related to notifications about wellheads temporarily left in place.

References

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2016. Notification to Abandon / Suspend. Available online: http://www.cnlopb.ca/pdfs/forms/notif_ab_sus.doc. Accessed April 2018.

Government of Canada. 2014. *Newfoundland Offshore Petroleum Drilling and Production Regulations*. SOR/2009-316. Published by the Minister of Justice. Current to June 10, 2018. Last amended on December 31, 2014. Available online: http://laws-lois.justice.gc.ca/PDF/SOR-2009-316.pdf.

1.10.3 Information Requirement: IR-68

Reference to EIS:

Section 4.3.1.2 Historic Overview of Domestic Fisheries (Eastern Grand Banks)

Context and Rationale

Section 6.1.9.2 of the EIS Guidelines require baseline information to describe current and historical use of waters, including commercial fisheries activities. Figures 4-35 and 4-36 in the EIS illustrate data from 1990-2010. Up to date data is available from 2011-2016 and should be represented in the figures.

In addition, Section 4.3.1.2 of the EIS indicates that there is overlap between the study area and NAFO Divisions 3Kf, 3Kg, and 3Kk, however data from NAFO Division 3K is not represented in Figures 4-35 and 4-36, which illustrate harvest from NAFO Divisions 3LMN between 1990 and 2010.

Further, Fisheries and Oceans Canada noted that in Table 4.46 in the EIS the reported total quantities of species harvested appear to represent catch for 3LMNO and 3K, but the title only refers to 3LMNO.

Specific Question of Information Requirement

Revise Figures to include all available data up to and including 2016, for all NAFO Divisions which overlap with the project area and study area.

Confirm if the data presented in Figure 4-35, Figure 4-36 and in Table 4.46 includes harvest from NAFO Division 3K. If catch data from NAFO Division 3K has not been included, revise the related figures and tables, to present information on the harvest from all NAFO Divisions which overlap with the study area.

Response

The source of data for Figures 4-35 and 4-36 is the NAFO STATLANT 21A database. Data from 2011-2016 were erroneously not included in the figures in the original EIS. Figure 1 (revised EIS Figure 4-35) and Figure 2 (revised EIS Figure 4-36) use data from all NAFO units that intersect the Study Area (3KLMNO). Figure 1 was modified slightly to show fish harvest both from Canada and other nations in order to be more consistent with the updated Section 4.3.1.1 as presented in the response to IR-69.

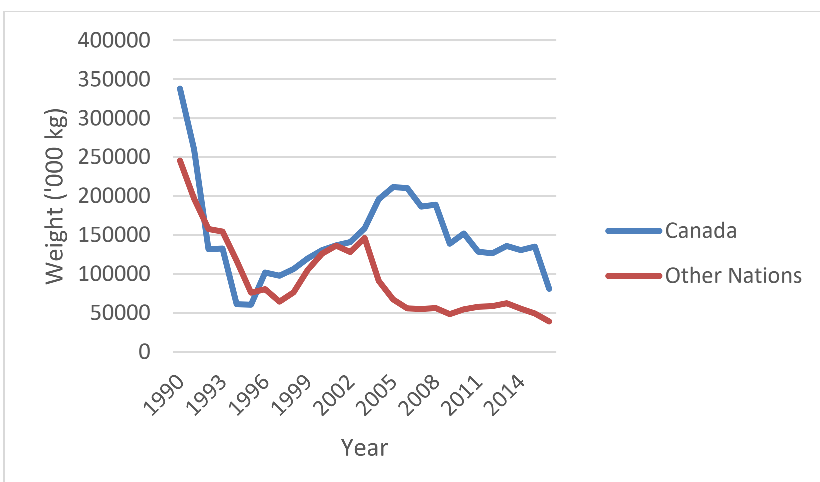


Figure 1 Northwest Atlantic Fisheries Organization Divisions 3KLMNO Harvest, All Species, 2011 to 2016

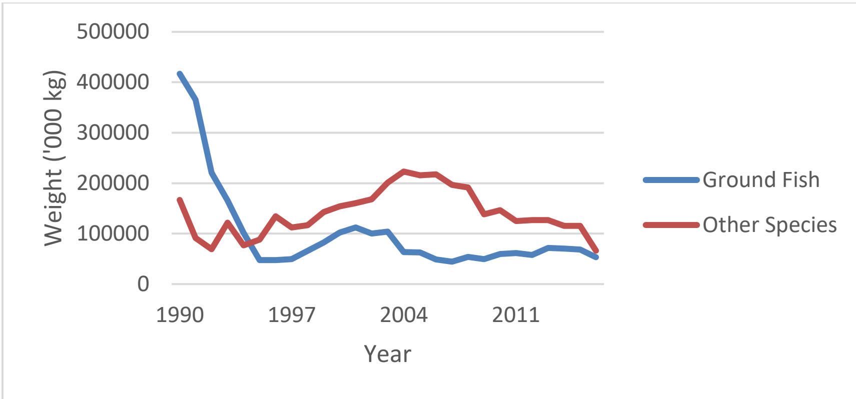


Figure 2 **Northwest Atlantic Fisheries Organization Divisions 3KLMNO Harvest, Groundfish vs. Other Species, 2011 to 2016**

Table 1 updates EIS Table 4.46 to report on quantities of species harvested by NAFO unit area and includes the values for those that are in NAFO unit 3K. Catches by other countries have been updated and are provided as Table 2 in IR 69.

Table 1 **Primary Harvested Species by Quantity (t), Divisions 3KLMNO 2012 to 2016**

Species	2012	2013	2014	2015	2016	Total
Queen Crab	41,930	42,494	42,348	42,158	29,484	198,414
Northern Prawn	48,327	44,134	37,828	40,892	8,185	179,366
Capelin	22,240	23,695	23,149	25,072	19,916	114,072
Atlantic Redfishes (ns)	18,557	20,797	19,718	23,530	23,296	105,898
Atlantic Cod	13,073	18,720	19,528	17,730	18,017	87,068
Greenland Halibut	12,151	11,477	12,843	11,749	10,917	59,137
Yellowtail Flounder	3,214	10,537	7,970	6,894	6,826	35,441
Skates (ns)	4,476	4,406	4,552	3,394	3,526	20,354
Atlantic Herring	3,385	5,459	4,455	5,184	651	19,134
Great Blue Shark	6,345	6,940	3,315	0	2,354	18,954
American Plaice	1,490	2,455	1,635	1,336	1,194	8,110
Surf Clam	0	276	0	766	6,944	7,986
Pink Shrimps	1,259	636	2,604	0	0	4,499
Witch Flounder	568	601	707	747	830	3,453
Atlantic Halibut	399	544	875	842	746	3,406

References

N/A

1.10.4 Information Requirement: IR-69

Reference to EIS:

Section 4.3.1.1 International Fisheries; Section 4.3.1.5 Fishing Gear and Vessels; Section 6.2.8 Commercial Fisheries

Context and Rationale

Section 4.3.1.1 of the EIS states that fish catch data are sourced from the NAFO STATLANT 21A database, which provides fishing information in relation to year, species, unit area, country and weight. However, the terminology and discussion related to NAFO's STATLANT data is not clear throughout the EIS. For example, it is unclear if table 4.45 and figure 4-58 in the EIS are referring to catches only by non-Canadian vessels in the NAFO Regulatory Area or otherwise. The discussion on international fish catches focus primarily on harvested species in 3LMNO, which includes Canadian-managed fisheries, then back to NAFO (discussing vulnerable marine ecosystems).

Fisheries and Oceans Canada noted that STATLANT database reports Canadian catches both inside and outside the Exclusive Economic Zone (EEZ) and that in Section 4.3.1.1 in the EIS, it is unclear whether the catch data presented from STATLANT was considered in the assessment to include Canadian catch data from both inside and outside the EEZ. Examples of inaccuracies observed include:

- the statement "These data indicate that Canadian fleets have been harvesting more than any other NAFO state within the NRA [NAFO Regulatory Area]", appears to attribute to the assumption that NAFO's STATLANT data includes Canadian catches outside the EEZ only;
- the statement that "the principle fisheries harvested by NAFO states [Contracting Parties] include northern shrimp and groundfish species." However, Northern shrimp in 3L has been under a directed fishing moratorium since 2015, and Northern Shrimp in 3M has been under a directed fishing moratorium since 2011. Similarly, it was noted that Section 6.2.8 incorrectly states an active commercial northern shrimp fishery in 3L; and
- Figure 4-57 in the EIS, which is intended to show the harvest of NAFO managed stocks by Canadian vs international fleets within the NRA and shows greater catches by Canada versus the other nations. Most of the Canadian fishing activity for NAFO-managed stocks occurs within the Canadian EEZ.

If it was assumed that the STATLANT data includes catches only outside the EEZ, then this may impact the analysis and conclusions outlined in this section.

Fisheries and Oceans Canada noted that the NAFO Annual Compliance Review (https://www.nafo.int/Fisheries/Compliance) may provide key overview information on number of vessels, gear type, fishing activity in the NAFO Regulatory Area.

Specific Question of Information Requirement

Address inaccuracies identified, and provide clarity regarding the use of NAFO's STALANT data to describe international fisheries. Confirm if the Canadian harvest data included harvest from within the EEZ. If harvest from the EEZ was included, indicate the percent or quantity of harvest that was within the EEZ, and revise statements related to harvest, as necessary.

Review information in relevant sections of the EIS, related to the stock status and current management of Northern Shrimp, to ensure information presented is the most recent, in particular with respect to areas under moratorium.

Based on the re-analysis of the data, update effects analysis, proposed mitigation and follow-up, as well as significance predications, as applicable.

Response

Upon evaluation of the Northwest Atlantic Fisheries Organization (NAFO) STANTLANT 21A and 21B datasets and the NAFO annual compliance review, it is recognized that the assumption that the dataset only contains entries that are outside the EEZ in the NAFO Regulatory Area (NFA) is incorrect.

EIS Section 4.3.1.3 (Current Domestic Fisheries within the Study Area) is inclusive of Canadian fisheries both inside and outside the Canadian Exclusive Economic Zone (EEZ); therefore, duplicate information on fisheries landings was provided EIS Section 4.3.1.1. To rectify this discrepancy, landings attributed to Canadian fleets have been removed. The following section highlights changes to EIS Section 4.3.1.1 (International Fisheries). The modifications to this section do not impact the conclusion made in the effects analysis, proposed mitigation and follow-up, as well as significance predications, as presented in Section 6.2.10.3.1 of the EIS.

4.3.1.1 Fishing by Other Nations

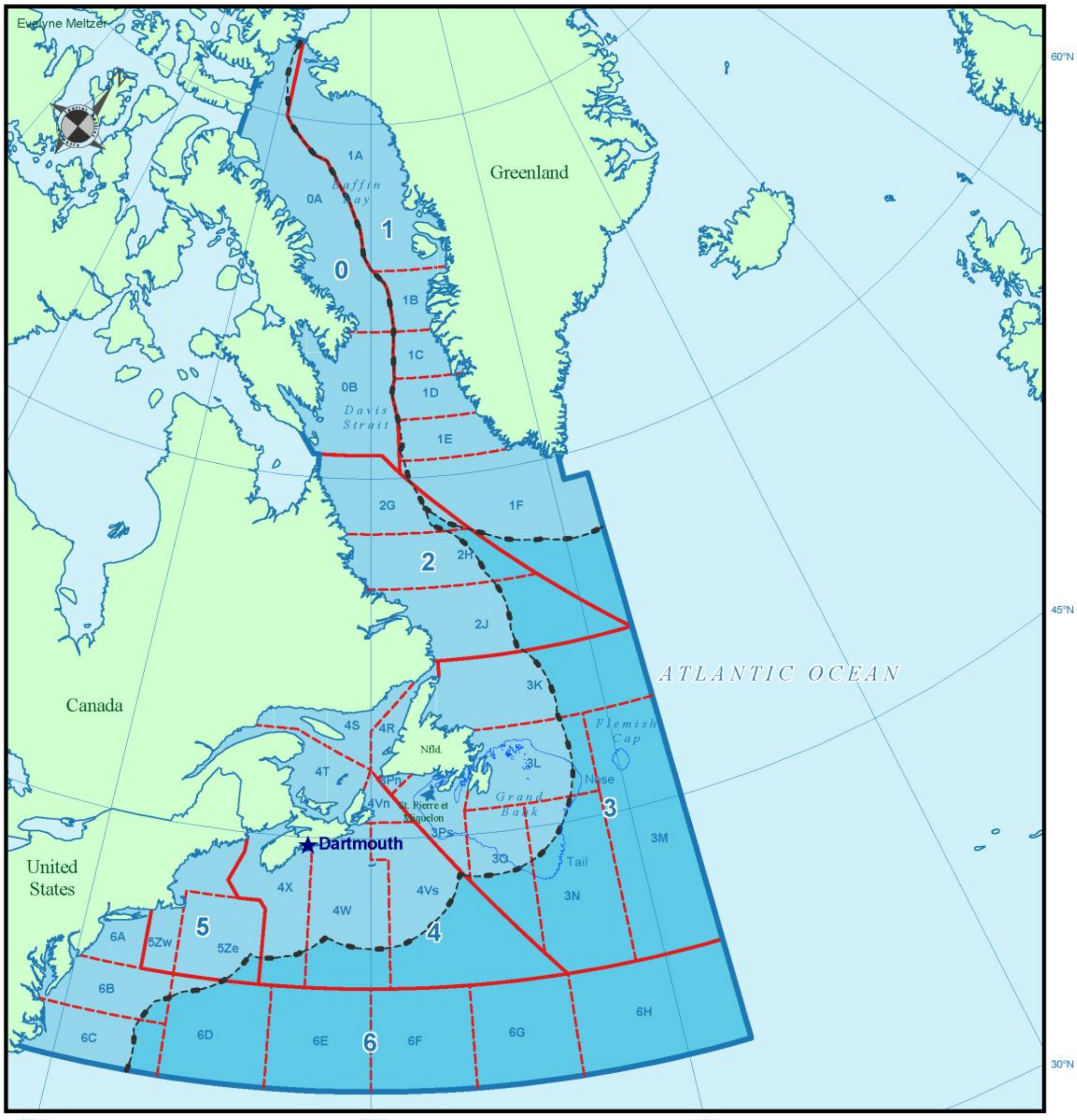
Multiple NAFO Convention nations take part in the harvesting of fish stocks in waters adjacent to Canada's EEZ. The primary fishing areas typically take place in NAFO Division 3M, closely followed by 3L, 3N, 3O. There is very little fishing activity by other nations in 3K (Table 1). As these are non-Canadian vessels, it is expected that this fishing is taking place outside the Canadian EEZ and within the NRA. The NRA is approximately 2,707,895 km² and comprises approximately 40% of the NAFO Convention Area (which spans the NAFO areas adjacent to the EEZs of Canada, the United States, St. Pierre et Miquelon, and Greenland). Figure 1 shows the boundaries for Regional Fisheries Management Organizations; however, NAFOs regulatory authority is restricted to waters within the NRA (NAFO 2016).

Table 1 International Fish Catches ('000kg) by Other Nations for NAFO Divisions 3KLMNO, 2012 to 2016

NAFO Division	2010	2011	2012	2013	2014	2015	2016	Total
3K	1	8	0	0	0	3	0	12
3L	14204	12948	11687	10659	10068	9824	7676	77066
3M	20583	24725	25885	27596	25795	21930	18071	164585
3N	12424	12441	12899	13704	8617	6345	4831	71261
3O	7331	7527	7957	10414	10858	10874	8301	63262

Based on NAFO STATLANT 21A data, the top five nations that have vessels fishing in NAFO zones 3KLMNO are Portugal, Spain, Russia, Faroe Islands and Estonia (Figure 2). Since 2012, landings by Spain have decreased, with no landings recorded for 2016. The principal fisheries harvested by NAFO states between 2010-2016 are dominated by groundfish species, including Atlantic redfish, Atlantic cod, Greenland halibut, and skates (Table 2). Redfish has become an important commercial fishery for various states, with consistent landings between 2010 and 2016. Species of shark and shellfish have declined in the past two years, with no landings recorded for 2015 or 2016.

The seasonality of harvesting effort from International fleets within Divisions 3KLMNO is illustrated in Figure 3. The data were extracted from the STATLANT 21B dataset, which lists landings by country, species and month. The harvest is constant throughout the year with light increases during the spring time in March and also in July.



For illustration purposes only.
Map Projection : Lambert Conf. Conic
Standard Parallels : 49°N, 77°N
Central Meridian : 60°W

Global Overview of Straddling and Highly Migratory Fish Stocks. Evelyne Meltzer: working copy 04/2005

Northwest Atlantic Fisheries Organization (NAFO)

★ Headquarters: Dartmouth, Nova Scotia, Canada

- RFMO Boundary NAFO Convention Area
- NAFO Regulatory Area
- 200 mile limit
- NAFO Scientific and Statistical Subareas
- NAFO Scientific and Statistical Divisions

Figure 1 NAFO Regulatory Area

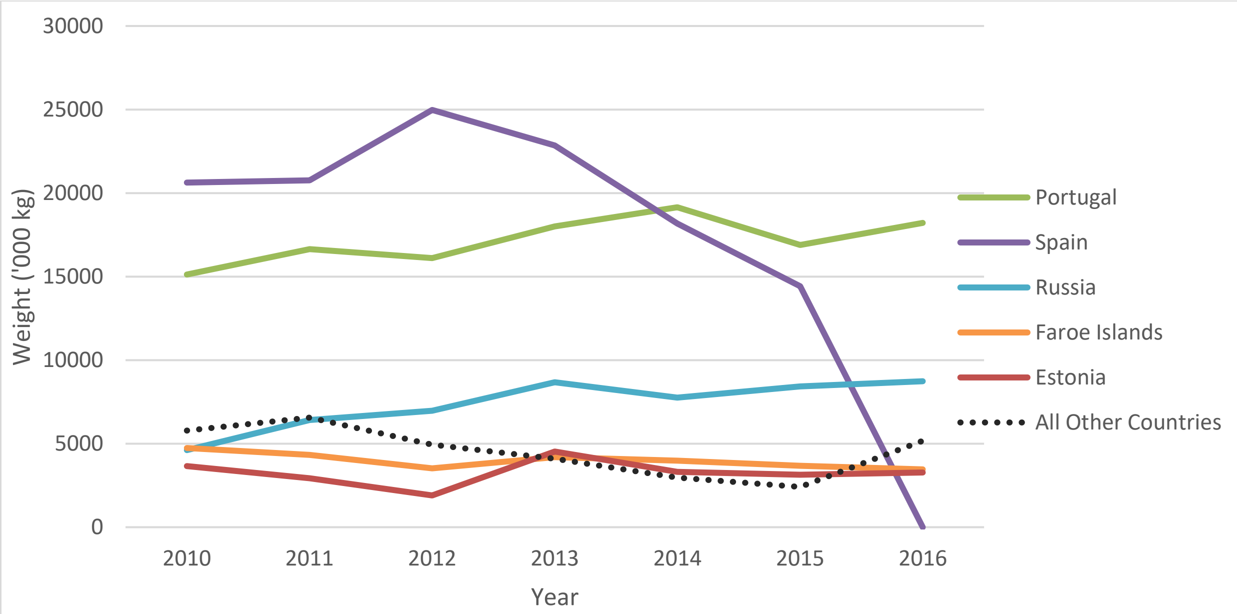


Figure 2 International Harvest from Other Nations for Divisions 3KLMNO, 2010 to 2016

Table 2 International Fish Catches ('000kg) by Other Nations for NAFO Divisions 3KLMNO, 2010 to 2016

Species	Group	2010	2011	2012	2013	2014	2015	2016	Total
Atlantic Redfishes (ns)	Groundfish	17462	15686	17573	17990	17846	18813	16960	122330
Atlantic Cod	Groundfish	5995	10890	9947	14530	14724	13397	12535	82018
Greenland Halibut	Groundfish	9151	9613	9108	8983	8374	8335	4419	57983
Skates (ns)	Groundfish	5567	5672	4280	4385	4549	3389	586	28428
Great Blue Shark	Shark	2471	2633	6345	6940	3315	0	0	21704
Northern Prawn	Shellfish	8508	3746	2129	1813	520	0	0	16716
Yellowtail Flounder	Groundfish	1222	1283	1419	2593	1168	1312	1984	10981
American Plaice	Groundfish	886	855	1219	1409	888	892	722	6871
Roughhead Grenadier	Groundfish	745	904	1283	378	555	210	67	4142
Beaked Redfish(deep-water)	Groundfish	0	3838	9	116	0	0	0	3963
Witch Flounder	Groundfish	766	584	540	449	588	352	308	3587
Silver Hake	Groundfish	0	8	117	71	716	937	585	2434
Swordfish	Pelagic	222	274	990	530	311	0	0	2327
Roundnose Grenadier	Groundfish	505	456	710	246	140	93	36	2186
Atlantic Halibut	Groundfish	124	134	181	221	384	473	337	1854
All Other Species	N/A	919	1073	2578	1719	1260	773	340	8662

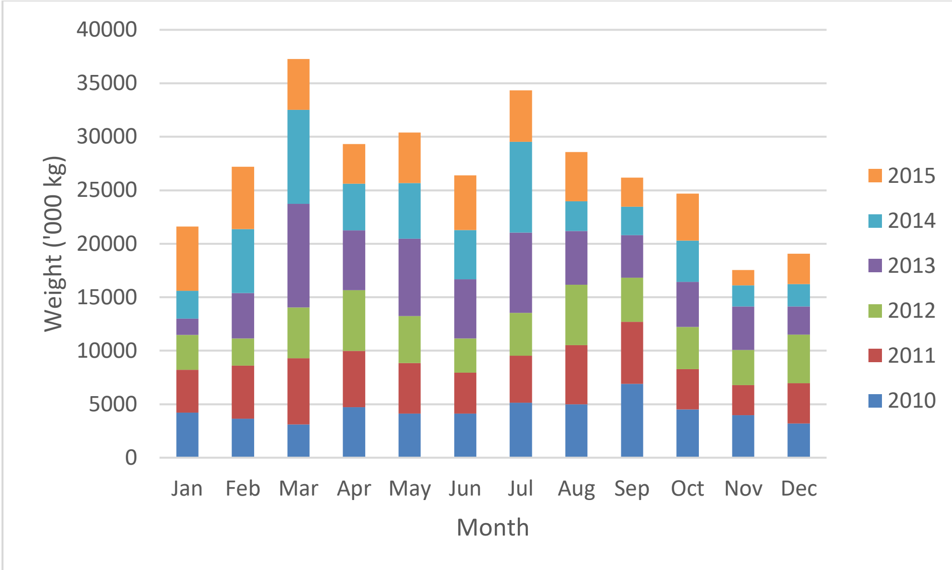


Figure 3 International Fishing by Other Nations by Month, Divisions 3KLMNO, All Species, 2010 to 2015

References

NAFO (North Atlantic Fisheries Organization). 2016. NAFO – The NAFO Fishing Footprint. Available at: http://www.nafo.int/fisheries/frames/fishery.html. Accessed on August 4, 2016.

1.11 ACCIDENTS AND MALFUNCTIONS – DESCRIPTIONS, TYPES OF ACCIDENTS

1.11.1 Information Requirement: IR-70

Reference to EIS:

Section 7.2 Accidental Event Probabilities and Models

Context and Rationale

Section 7.2 of the EIS states that two categories of accidental events were assessed, batch spills and blowouts, as they represent the most consequential scenarios. The EIS does not describe other types of accidents and malfunctions related to the project, such as equipment loss or structural stability.

Specific Question of Information Requirement

Comment on the probability of other potential types of accidents and malfunctions, including a dropped object, and provide an analysis of associated environmental effects.

Response

Husky's approach to the EIS was to assess accidental events with potential environmental consequences. Besides batch spills and blowouts, the Husky EIS (Section 7.2.2) does assess a spill of synthetic-based mud (SBM) from the following four scenarios:

- surface tank discharge
- riser flex joint failure (two scenarios, two fall velocities) and
- blowout preventer disconnects.

In the event of an incident, including a dropped object, Husky Energy would prepare an incident investigation report for the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). The C-NLOPB would consult other relevant agencies and determine a course of action. Husky would then implement those decisions as required, including dropped object recovery, if technically and safely achievable. Dropped objects in the marine environment are considered a low probability event and benign unless the incident resulted in a spill of crude, diesel or SBMs as assessed.

References

N/A

1.12 ACCIDENTS AND MALFUNCTIONS – DESCRIPTIONS, BLOWOUTS

1.12.1 Information Requirement: IR-71

Reference to EIS:

Section 7.2.1.2 Blowouts During Drilling

Context and Rationale

Section 7.2.1.2 of the EIS describes the 2010 well blowout of the Macondo well in the Gulf of Mexico, where an estimated 5,000,000 bbl were spilled over 91 days. The EIS states that the investigation resulted in lessons learned in terms of improved technology, operational, safety and environmental procedures.

Specific Question of Information Requirement

Discuss lessons learned from Macondo and their specific application to Husky Oil Operations Limited's offshore exploratory drilling projects, generally and specifically in the offshore of eastern Newfoundland.

Response

Lessons learned from Macondo have been incorporated into Husky gated well planning procedure, which ensures the appropriate level of engineering assurance and risk assessment / identification has occurred prior to drilling each exploration well. Also, well designs are subject to Peer Review(s) to ensure applicable best practices are incorporated into the well design and planned operations. Using the latest available fit-for-purpose technology, blowout well control scenario(s) are assessed during the well planning stage to ensure the planned exploration well is fit-for-purpose.

References

N/A

1.12.2 Information Requirement: IR-72

Reference to EIS:

Section 7.2.1.3 Shallow Gas Versus Deep-well Blowout

Context and Rationale

Section 7.2.1.3 states that the vast majority of blowouts and well releases are of the shallow gas variety; however, other possible causes of blowouts, i.e. loss of well control, are not described, nor is there a discussion of the likelihood of encountering shallow gas or the other factors that may cause a blowout in the Newfoundland and Labrador offshore.

Section 7.2.1.3 states that shallow gas blowout frequencies in the North Sea and in the Gulf of Mexico have been on the decline in recent years; however, the relevance to the proposed Project of a source focused on the North Sea and Gulf of Mexico is not explained. Data from 1980 to 1997 is presented.

Section 7.2.1.3 of the EIS is titled Shallow Gas versus Deep-well Blowout; however, there is no discussion or comparison made. The comparison between shallow gas and deep well blowout is not clear.

Specific Question of Information Requirement

Describe the potential causes of loss of well control that result in a blowout, including encountering shallow gas.

Explain why shallow gas blowout frequencies in the North Sea and in the Gulf of Mexico have been on the decline in recent years, and the applicability to the proposed Project. Consider updated information (post 1997) if available.

Clarify the comparison between shallow gas versus deep-well blowout and applicability to the proposed Project.

Response

A blowout is an uncontrolled release of fluids from a reservoir formation and is caused when the hydrostatic pressure of fluid in the well bore is lower than the formation pressure, resulting in an influx of formation fluids into the well bore. If this influx is not safely removed from the wellbore, and if the blowout preventer (BOP) equipment is ineffective, a blowout may occur. A shallow gas blowout occurs in shallow formations before the BOP is installed on the well. A deep-well blowout refers to a blowout that occurs after the BOP is installed on the well.

A recent spill probability assessment (SL Ross 2017) attributed blowout frequency decline in recent years to the use of a blowout preventer (BOP) including use of the shear ram and two-barrier principle. Most recently available data indicates the blowout frequency for the US OCS as 3.62×10^{-3} per well drilled and 3.1×10^{-4} per well drilled in the North Sea.

References

SL Ross 2017. Spill Probability Assessment for Nexen Energy ULC Flemish Pass Exploration Drilling Environmental Assessment. 20 pages. https://www.ceaa-acee.gc.ca/050/documents/p80117/122072E.pdf

1.12.3 Information Requirement: IR-73

Reference to EIS:

Section 7.2.1 Oil Spill Risk and Probabilities

Context and Rationale

Section 7.2.1 of the EIS, includes a categorization of hydrocarbon spill sizes in Table 7.2, defined as:

- extremely large – greater than 23,850 cubic metres
- very large – greater than 1,590 cubic metres
- large – greater than 159 cubic metres
- small – less than 0.159 cubic metres.

However, the EIS does not discuss the sources and causes of large spills.

Specific Question of Information Requirement

With respect to large spills as defined in the EIS, discuss the following:

- the sources and causes of large spills, based on records for Atlantic Canada; and
- the plausible worst-case scenario release volume for each of crude oil, hydraulic oil, diesel and formation fluids, and mixed oil.

Response

Table 1 provides a list of large (1,000 to 10,000 L) hydrocarbon spills for Newfoundland and Nova Scotia offshore areas from production and exploration activities (Canada-Newfoundland and Labrador Offshore Petroleum Board (2019); Canada-Nova Scotia Offshore Petroleum Board (2019)).

Table 1 List of Large (1,000 to 10,000 L) Hydrocarbon Spills for Newfoundland and Nova Scotia Offshore Areas from Production and Exploration Activities

Year	Volume (L)	Type	Source
2014	1,000	Synthetic-based mud (SBM)	Annulus
2014	1,000	Condensate	Produced water system
2013	6,000	Crude	Offloading system
2011	2,087	SBM	BOP kill line
2011	4,000	SBM	Mud system
2008	4,470	Crude	Offloading system
2007	1,089	SBM	BOP kill line
2006	3,000	SBM	Riser slip joint
2005	4,030	SBM	Riser slip joint
2004	3,500	Diesel	Generator fuel filter
2004	2,496	SBM	Riser slip joint
2004	9,000	SBM	Sand Trap
2003	4,400	SBM	Riser slip joint
2003	2,000	SBM	Riser slip joint
2001	5,000	SBM	Solids Control Centrifuge

Year	Volume (L)	Type	Source
2000	1,100	SBM	Shale Shaker
2000	1,830	SBM	Shale Shaker
1999	1,500	SBM	Shale Chutes
1999	2,000	SBM	Shale Chutes
1999	3,840	SBM	Shale Chutes
1998	2,080	Diesel	Flare
1998	1,000	Oily Water	Drain Tank Overflow
1998	2,000	SBM	Unknown
1997	1,000	Crude	Drain Tank Overflow

The plausible worst-case scenario for a diesel spill is the 5,000 m^3 volume carried by an offshore supply vessel.

The plausible worst-case scenario for crude oil, which would include formation fluids, is the 6,435 m^3/day resulting from an uncontrolled blowout.

The plausible worst-case scenario for hydraulic oil is 4 m^3 and 13 m^3 for mixed oil, as these are the maximum volumes on board the mobile offshore drilling unit at any given time.

References

Canada-Newfoundland and Labrador Offshore Petroleum Board. 2019. Oil Spill Incident Data: NL Offshore Area. Available at: https://www.cnlopb.ca/wp-content/uploads/spill/spgt1l.pdf. Accessed February 5, 2019

Canada-Nova Scotia Offshore Petroleum Board. 2019. Incident Reporting: Spills to the Sea. Available at: https://www.cnsopb.ns.ca/environment/incident-reporting. Accessed February 5, 2019.

1.13 ACCIDENTS AND MALFUNCTIONS – DESCRIPTIONS, BATCH SPILLS

1.13.1 Information Requirement: IR-74

Reference to EIS:

Section 7.2.1.4 Platform Spills Involving Small Discharges

Context and Rationale

Section 7.2.1.4 of the EIS states that small spills are the most probable spill events that could occur during a drilling program. These spills include crude oil, hydraulic oil, diesel, diesel and formation fluids and mixed oil. The EIS provides the frequency of small spills in four size ranges (less than on bbl, 1 to 49.9 bbl, 50 to 99 bbl, and 99.1 to 500 bbl) from exploration platforms for the Newfoundland and Labrador offshore from 1997 to 2016; however, neither sources nor causes of the spills are identified.

The EIS states that half of the spills in the 1 to 49.9 bbl range occurred in the first three years that spills were recorded. It is unclear if the proponent has drawn a conclusion from this.

In addition, the EIS did not assess the potential for the spill of whole SBM in Table 7.9.

Specific Question of Information Requirement

Discuss the following:

- sources and causes of batch spills of crude oil, hydraulic oil, diesel, diesel and formation fluids and mixed oil;
- typical sources of releases, based on the records for Atlantic Canada;
- potential impacts to the modelling results if a greater spill volume was considered; and
- plausible worst-case scenario release volume of batch spills of each of crude oil, hydraulic oil, diesel, diesel and formation fluids, and mixed oil

Clarify the conclusion drawn, if any, from the statement that half of the spills in the 1 to 49.9 bbl range occurred in the first three years that spills were recorded.

Provide an expanded analysis of the potential effects of a whole SBM spill on relevant valued components, including sensitive benthic species. Provide information related to the behavior of spilled SBM and the potential maximum area that could be affected by a large-scale spill.

Response

Based on statistics from the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), batch spills during exploration drilling between 1997 through 2017, were of synthetic-based mud (SBM) origin 95.6% of total volume spilled, 2.1% crude oil, 2.1% diesel and jet fuel, 0.1% hydraulic/lubricating oil and 0.1% other oils, by volume. The source of every incident has been identified in the C-NLOPB database (https://www.cnlopb.ca/wp-content/uploads/spill/spgt1l.pdf). The most frequent incidents are crude oil (37.3%), hydraulic and lubricating oils (23.7%), and synthetic fluids (18.6%) (https://www.cnlopb.ca/wp-content/uploads/spill/anexpinc.pdf).

As outlined in Section 7.2.2 of the EIS, the common sources of SBM spills are surface tank discharge, riser flex joint failure and blowout preventer disconnect. A common source of crude during exploration is from the flare. A common source of hydraulic spills are due do leaks in the controlling arms of the remotely operated vehicles (ROVs) or a hydraulic hose on the mobile offshore drilling unit.

Additional information is provided in response to IR-73. Probable worst-case scenarios were modelled in the EIS.

The observation that half of the spills in the 1 to 49.9 bbl range occurred in the first three years that spills were recorded was simply an observation of the data presented.

In addition to the assessment of potential effects of an SBM spill that was provided in the EIS, an expanded effects analysis on relevant valued components (VCs) is outlined below using three case studies.

May 2003 – Gulf of Mexico – SBM Spill in 1,841m Water Depth

In May 2003, an offshore operator was completing drilling activities in approximately 1,841 m of water (US Department of the Interior, Minerals Management Service (USDOI MMS) 2004). Approximately 390 m^3 of SBM was released from two locations where the riser parted (USDOI MMS 2004). The SBM consisted of approximately 58% synthetic base oil, and therefore the actual amount of synthetic base oil released was approximately 226 m^3 (USDOI MMS 2004).

As outlined in USDOI MMS (2004), remotely operated vehicle (ROV) surveys observed fish, sea cucumbers, a probable sea pen, and possible anemones. The release of SBM would likely affect benthic species by smothering and/or creation of anoxic environment; however, mobile marine species would likely be able to avoid burial (USDOI MMS 2004).

USDOI MMS (2004) did not indicate an affected area; however, it was determined that partial recovery of benthic community would occur within weeks or months of the release, and a generally full recovery within one to two years. It was concluded that the release would not result in a significant impact on the benthic communities (USDOI MMS 2004).

August 2004 – Offshore Nova Scotia – SBM Spill in 2,067 m Water Depth

In August 2004, an offshore operator was completing exploration drilling activities approximately 60 km south of Sable Island, which is located offshore Nova Scotia, and in approximately 2,067 m water depth (Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) 2005). Approximately 354 m^3 of SBM was released from the riser flex joint at 17.6 m above the seafloor (CNSOPB 2005). The SBM consisted of approximately 57% synthetic base oil, and therefore the actual amount of synthetic base oil released was approximately 202 m^3 (CNSOPB 2005).

Based on the environmental assessment completed by the operator in 2002, several benthic species were present in the area including brittle stars, clams, snails, sponges, and corals; however, there was no evidence of dense aggregations of corals (CNSOPB 2005). Pelagic and demersal fish species were also present in the area (CNSOPB 2005).

As outlined in Section 4.2.2 of CNSOPB (2005), an ROV collected observational data, which showed SBM settled on the seafloor and flowed down slope from the wellhead in narrow ribbons. The total area of SBM, assuming a 1 cm thickness, was estimated to be 35,000 m^2 and appeared to form a layer above the natural sediment (CNSOPB 2005).

In addition to the ROV observations, sediment samples were collected from four areas on the seafloor near the wellhead (CNSOPB 2005). It is noted in CNSOPB (2005) that samples were collected with the ROV, and the technique may lack scientific rigor; however, due to the depth (i.e., 2,067 m), there was limited available equipment options to collect the samples. Sediment samples were analysed for barium and total extractable hydrocarbons (TEHs). Background samples were collected as “Sample 3” and barium and TEH concentrations were reported as 360 to 540 mg/kg and 1 to 3 mg/kg, respectively (CNSOPB 2005). Samples 1, 2, and 4 reported concentrations above background levels, and reported a barium range of 560 to 82,000 mg/kg and TEH range of 16 to 230,000 mg/kg (CNSOPB 2005).

Fish and mobile invertebrates are capable of avoiding SBM and were not expected to be negatively impacted (CNSOPB 2005). Benthic organisms and marine species that depend on retrieving food from sediment and species that have larvae settle within the sediment would likely be negatively affected by the SBM spill (CNSOPB 2005). As outlined in CNSOPB (2005), it was determined that the recovery of the benthic environmental and the effects of the SBM was expected to take approximately five years. Due to the low toxicity of SBM, CNSOPB (2005) determined that the environmental impact of the spill was expected to be minor and no remediation was recommended.

June 2018 – Offshore Nova Scotia – SBM Spill in 2,800 m Water Depth

In June 2018, an offshore operator was completing exploration drilling activities approximately 330 km offshore Nova Scotia, and in approximately 2,800 m water depth (CNSOPB 2018a). Approximately 136 m^3 of SBM was released from piping that forms part of the mud system (CNSOPB 2018a). The SBM consisted of approximately 50 to 65% synthetic base oil (CNSOPB 2018b), and therefore the actual amount of synthetic base oil released was approximately 68 m^3 to 82 m^3. Based on the information posted to date by CNSOPB, there has been no indication of the area that the SBM release covered, and it is unknown whether this information would be available in the environmental fate and effects analysis that the operator is required to complete (CNSOPB 2018c).

Prior to commencing drilling activities, the operator completed a pre-drilling ROV survey 500 m around the wellsite to determine the presence or absence of any aggregations of habitat-forming corals or sponges, or any other environmentally sensitive features (CNSOPB 2018d). It was concluded by a third-party Marine Scientist that no aggregations of habitat-forming corals and sponges, or any other environmentally sensitive features were identified on the seafloor in the survey area (CNSOPB 2018d).

As outlined in CNSOPB (2018c), the operator was required to complete an environmental fate and effects analysis; however, a copy of this report was not publicly available at the time of preparing the response to this IR. It is noted in CNSOPB (2018c) that SBM would settle to the seabed and therefore there is minimal potential for surface impacts to marine mammals or seabirds. CNSOPB (2018c) further describes that SBM has a low toxicity, and therefore it is not expected to have an impact on fish or other marine species in the water column. However, settled SBM may result in physical smothering of the seabed (CNSOPB 2018c), and could therefore impact benthic species, if present.

SBM Spills in Shallow Water

The three case studies outlined above are all applicable to deep-water environments. Husky could not find available literature associated with a release of SBM in shallow water; however, the effects are anticipated to be similar to those associated with deep-water locations (i.e., potential impact to benthic species by smothering, limited impact to pelagic species in the water column due to their mobility, and no anticipated impact to marine and migratory birds.

References

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). Statistical Information. Available online: http://www.cnlopb.ca/information/statistics.php#environment. Accessed February 2019.

CNSOPB (Canada Nova Scotia Offshore Petroleum Board). 2005. Investigation Report – Discharge of Synthetic-Based Drilling Mud during Abandonment of the Crimson F-81 Exploration Well by Marathon Canada Petroleum ULC. Available at: https://www.cnsopb.ns.ca/publications/investigation-report-discharge-synthetic-based- drilling-mud-during-abandonment-crimson.

CNSOPB (Canada Nova Scotia Offshore Petroleum Board). 2018a. Incident Bulletins. Available at: https://www.cnsopb.ns.ca/media/incident- bulletins.

CNSOPB (Canada Nova Scotia Offshore Petroleum Board). 2018b. Drilling Mud Composition for BP's Exploration Well. Available at: https://www.cnsopb.ns.ca/sites/default/files/pdfs/Drilling_Mud_Composition_for_BP_Well.pdf.

CNSOPB (Canada Nova Scotia Offshore Petroleum Board). 2018c. Drilling Mud Questions & Answers. Available at: https://www.cnsopb.ns.ca/sites/default/files/pdfs/Drilling_Mud_Questions_and_Answers.pdf.

CNSOPB (Canada Nova Scotia Offshore Petroleum Board). 2018d. Pre-Drilling Video Survey of the Seabed Area around BP Canada Well Location. Available at: https://www.cnsopb.ns.ca/sites/default/files/pdfs/Pre-Drilling_Video_Survey_of_BP_Canada_Well_Location.pdf.

USDOI MMS (US Department of the Interior, Minerals Management Service). 2004. Fate and Effects of a Spill of Synthetic-Based Drilling Fluid at Mississippi Canyon Block 778. Available at: https://www.boem.gov/BOEM-Newsroom/Library/Publications/2004/2004- 039.aspx.

1.14 ACCIDENTS AND MALDUNCTIONS – DESCRIPTIONS, SBM SPILLS

1.14.1 Information Requirement: IR-75

Reference to EIS:

Section 7.2.2 Synthetic-based Whole Mud Spill Trajectory Modelling

Context and Rationale

Table 7.10 of the EIS presents the number and volume of spills from exploratory wells in Newfoundland and Labrador of synthetic-based drilling fluids. This table does not account for spills from exploratory wells in Nova Scotia such as the Marathon Crimson spill which, if included, would show spills with greater volumes (i.e. 354,000 litres).

BP Canada Energy Group ULC (BP Canada) reported on June 22, 2018, an unauthorized discharge of synthetic based drilling mud (SBM) from the West Aquarius Drilling Unit. A preliminary estimate of the volume discharged is approximately 136 cubic metres (136,000 litres).

Section 7.2.2 describes the synthetic-based mud spill trajectory modelling completed for the White Rose Extension Project approximately 50 kilometres from the exploration licenses for this Project, however, no figure is provided. The EIS states that the potential synthetic-based muds spill release scenarios modeled were the following: surface tank discharge, riser flex joint failure, and blow-out preventer disconnect. The Agency notes that the cause of the June 2018 spill from BP Canada's West Aquarius drilling installation has been determined to be a loose connection in the mud booster line. With respect to potential synthetic-based mud spills, Section 7.2.2 describes the four release spill scenarios that were modeled. Section 7.3.4.3.3 states "Synthetic-based whole mud spills, if they accidentally occur, have some potential to form a sheen on the water's surface. However, the most likely scenario would be a release at depths greater than usually used by migratory birds."

This suggests releases at depth would be flex joint failure or Blowout Preventer (BOP); however, no explanation of why the flex joint failure and blowout preventer disconnect scenarios are more likely than a surface tank discharge is provided.

Specific Question of Information Requirement

Provide a figure with the synthetic-based mud spill location modelled for the White Rose Extension Project in the project area of the proposed Project and in relation to the project ELs.

Considering the recent spill of whole SBM from the West Aquarius Drilling Unit, discuss the following:

- what volume of whole synthetic based mud is within the drilling system at any given time;
- what volume would be considered a plausible worst-case scenario release;
- potential scenarios (other than those described in Section 7.2.2 of the EIS), including a malfunction in the connection of the mud booster line, that could release a "greater" volume ("worst-case scenario" volume), and the likelihood of their occurrence in this Project; and
- qualitative evaluation of anticipated impacts to the modelling results if a greater spill volume had been used.

Provide an explanation of why subsurface synthetic-based whole mud spills are more likely than a surface tank discharge.

Response

Figure 1 illustrates the synthetic-based mud (SBM) spill model location in relation to the project Exploration Licences.

In order to characterize the most likely modes of accidental SBM releases, industry reports and spill statistics from the Canada-Newfoundland and Labrador Offshore Petroleum Board, Canada-Nova Scotia Offshore Petroleum Board, and the United States Bureau of Ocean Energy Management Regulation and Enforcement were reviewed to identify the most probable modes of accidental release.

The data show that synthetic-based fluid spills occurred most often at the sea surface from leaks from mud pits, tanks, shale shakers, slip joints, and hoses. Underwater SBM spills can occur along the marine riser, kill lines, choke lines, boost lines and blowout preventer control lines. Shallow water wells as proposed in this EIS, have smaller volumes of SBM at risk underwater than deep water wells. A malfunction in the connection of the mud booster line would trigger a low-pressure alarm and a shutdown with a potential SBM release of 1 to 2 m^3.

As presented in Table 7.11 of the EIS, the four SBM spill scenarios considered plausible worst-case for this project (i.e. shallow water wells) have release volumes between 49 to 60 m^3. Total volume within an active SBM system would range between from 35 to 50 m^3 while drilling.

A qualitative evaluation of greater spill volumes is presented in response to IR-74.

Subsurface SBM whole mud spills are perhaps more likely than a surface tank discharge due to the mud being under pressure within a mud circulation system with several connection points.

References

N/A

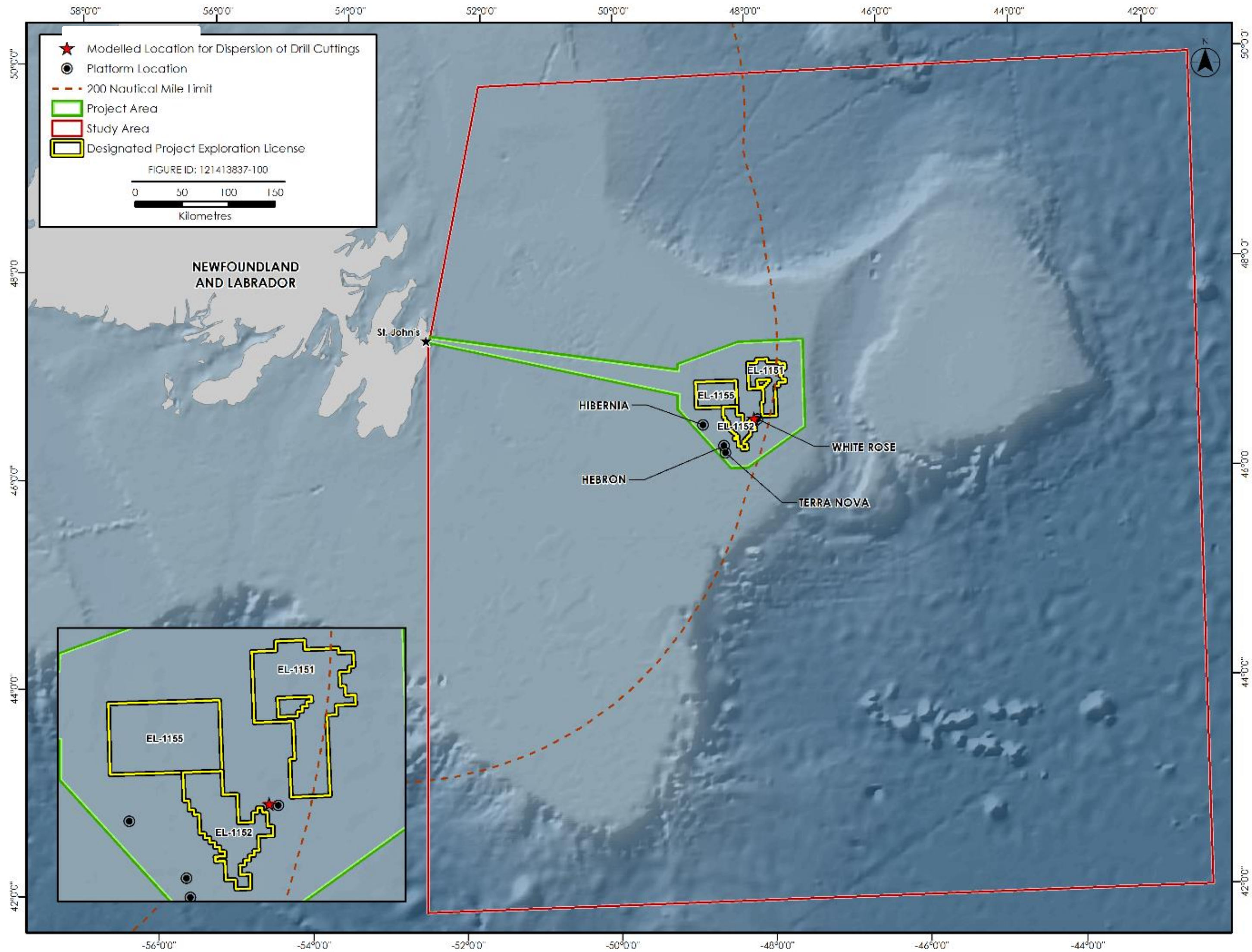


Figure 1 Synthetic-based Mud Spill Model Location

1.14.2 Information Requirement: IR-76

Reference to EIS:

Section 7.2.2 Synthetic-based Whole Mud Spill Trajectory Modeling

Context and Rationale

Synthetic-based whole mud spill trajectory modeling for the White Rose Project (Husky 2012) were presented in the environmental impact statement stating that “As all the ELs in this assessment are on the Grand Banks in similar water depths as the WREP, the likely dispersion of whole SBM from an accidental release is applicable to the ELs in this assessment.” Fisheries and Oceans Canada advised that while the modelled spill sources are only approximately 17 to 48 kilometers from the centroid of the ELs under assessment, ocean conditions (e.g., currents) may change considerably in the region.

Model equations in this report (i.e., pages 14-15 in Husky 2012) are unclear and results cannot be assessed.

Specific Question of Information Requirement

Discuss differences in ocean conditions (e.g. currents) between the proposed Project and the White Rose site with respect to the synthetic-based whole mud spill trajectory modeling, and provide a qualitative evaluation of anticipated impacts to the modelling results based on ocean conditions in the ELs.

Provide the equations for the completed synthetic-based mud spill trajectory modeling for the White Rose Extension Project.

Response

Indeed, there is inherent variability within the currents over the Project Area. However, the models of currents over the scale of the Project Area indicate currents on the northeast Newfoundland Shelf are mainly towards a southerly direction with fluctuations from southeast to southwest at different locations and that the variability in mean current speeds has a strong seasonal component (EIS Figure 4-13; Han and Wang 2006).

As presented in the synthetic-based mud (SBM) Accidental Release and Dispersion Modelling report, (Amec 2012 https://www.cnlopb.ca/wp-content/uploads/whiterose/dispersassess.pdf), the current data used were extracted from a three-year data set collected in the White Rose field and considered the most appropriate data set for modeling purposes, considering the paucity of moored current meter data from elsewhere in the Project Area.

All available information indicates that the magnitude of temporal and spatial variability in current speed and direction within the Project Area, will not alter the impact assessment of an SBM spill event. Below are excerpts from the SBM modelling report containing the formulas used.

The modelling procedure included splitting the full spill volume into discrete collections of droplets over the duration of the release. Since the input current series had a time resolution of 10 minutes, the currents were linearly interpolated so that each collection of packages experienced the most up-to-date set of current conditions. To calculate the horizontal trajectory of the droplets, it was necessary to compute the time they would spend in each o the three depth layers. Based on an analysis of the ADCP data, the surface layer was defined as extending from 0 to 30 m depth (25% of the water column), while the bottom layer was taken from the seafloor to 12 m above the seafloor (10% of the water column). The mid-depth currents were applied to the middle 65% of the water column. The destination at the seafloor for each collection of droplets experiencing a set of current conditions [(u_s, v_s),(u_m, v_m),(u_b, v_b)] is computed according to the following equations:

$$x = x_0 + u_s \times t_s + u_m \times t_m + u_b \times t_b$$

$$y = y_0 + v_s \times t_s + v_m \times t_m + v_b \times t_b$$

Where the subscripts s. m. b stand for surface, mid-depth and bottom, respectively. The time spent in each of the three layers is defined in terms of the initial height above the seafloor, $H_{release}$, and the settling velocity, $w_{setting}$, as follows

$$t_s = \frac{H_{release}}{w_{settling}} \times 0.25;$$

$$t_m = \frac{H_{release}}{w_{settling}} \times 0.65;$$

$$t_b = \frac{H_{release}}{w_{settling}} \times 0.10\ .$$

For the surface release, and in the following manner for the subsea release scenarios:

$$t_s = \frac{H_{release}}{w_{settling}} \times 0\ ;$$

$$t_m = \frac{H_{release}}{w_{settling}} \times 0.40;$$

$$t_b = \frac{H_{release}}{w_{settling}} \times 0.60\ .$$

Each set of east and north destination components (*x,y*) were fit within a horizontal grid with a 30-m resolution, and the amount of SBM within each grid cell was counted for the full duration of the spill event. Any model grid cell that received any amount of SBM was included within the spill area. The thickness of the initial SBM layer on the seafloor was computed on the assumption that the SBM was equally distributed across the area of each cell. In order to capture the full range of seasonal conditions, approximately 13,000 independent spill events were simulated for each of the four seasons. The distance from the release site, as well as the size of the footprint of each spill event, was recorded separately, and the most probable and extreme seasonal statistics were derived for each modelled scenario.

References

Amec Environment & Infrastructure. 2012. Environmental Impact Assessment White Rose Extension Project SBM Accidental Release and Dispersion Modelling. Prepared for Stantec Consulting Ltd., St. John's, NL. Available at: https://www.cnlopb.ca/wp-content/uploads/whiterose/dispersassess.pdf

Han G., and Z. Wang, 2006. Monthly-mean circulation in the Flemish Cap region: A modeling study, Estuarine and Coastal Modeling, ASCE, 138-154.

1.15 ACCIDENTS AND MALFUNCTIONS – MODEL INPUTS, BLOWOUTS

1.15.1 Information Requirement: IR-77

Reference to EIS:

Section 7.3 Accidental Events Environmental Effects Assessment

Context and Rationale

Figures provided in the EIS with respect to the spill trajectory probabilities are truncated by the boundaries of the numerical domain (Figures 7-12 – 7-14). No further information is provided in the EIS on the when ecological thresholds are reached, nor the probability of shoreline oiling is reached.

In addition, Section 7.3 of the EIS states that "subsea and surface blowout rates of 40,476 bopd were modelled for 120 days or until the oil evaporated and dispersed from the surface." If oil was discharging for 120 days, then presumably, oil would require more than 120 days for evaporation and dispersion. The text for the worst-case scenario is unclear.

Specific Question of Information Requirement

Provide a rationale for the selection of boundaries for stochastic modelling. Discuss the limitations of the truncated spatial extent of spill dispersion results, including the implications for shoreline contact, including Sable Island and any international lands.

Provide a discussion on the selection of duration of model simulations, including details on time required for oil to evaporate and disperse. Provide a rationale for not having a model duration in excess of spill duration.

Response

Instead of a stochastic approach of selecting a few random dates from which to originate an oil spill, we used models of oil releases every six-hours for 57 years, from 1954 to 2010. Those resulting 83,220 individual trajectory scenarios were analyzed for spatial coverage and shoreline contact probabilities. The probability of shoreline oiling on the island of Newfoundland was determined to be 0.04 percent, as described in EIS Section 7.2.1.4.2. No oiling predicted on Sable Island or any international lands.

We don't see any limitations to the spatial extent of the model since, as described in EIS Section 7.2.1.4.3:

> *Trajectories have been run for 120 days or until the oil evaporates and disperses from the surface or the average oil concentration on the surface has dropped below 1 g/25 m². This level of contamination of highly weathered crude is considered innocuous to wildlife (French-McCay 2004, in Husky Energy 2012a).*

Time for oil to evaporate and disperse are presented in EIS Tables 7.20 and 7.21.

The model was run for 120 days past the date of the last spill trajectory originating.

References

N/A

1.15.2 Information Requirement: IR-78

Reference to EIS:

Section 7.2.1 Offshore Spill Model Scenarios

Context and Rationale

The Proponent states that "At the exploration stage it is not possible to define all possible factors needed to calculate blowout rates, blowout duration, and expected release volume." The EIS does not contain rationale of how the model represents a "worst case" scenario.

Specific Question of Information Requirement

Provide a rationale of how the model represents a "worst case" scenario.

Response

The model uses the maximum worst case flow rate using the oil properties of crude samples from the White Rose field. These oil property data remain the most current and relevant characteristics for modelling oil spill trajectories in adjacent ELs. EIS Section 7.2.1 outlines how the model represents a worst-case scenario for exploration wells within this project area:

> *As a worst-case accidental event scenario, a subsea and surface blowout rate of 40,476 bopd for 120 days was used based on reservoir data from the White Rose field. A duration of 120 days was selected as the worst-case scenario since it is the estimated time required to drill a relief well, in the event that all other attempts to shut in the well have failed. This blowout rate is considered worst-case for adjacent exploration licences.*

References

N/A

1.16 ACCIDENTS AND MALFUNCTIONS – EMERGENCY PLANNING AND RESPONSE

1.16.1 Information Requirement: IR-79

Reference to EIS:

Section 2.4.3 Logistical Support

Context and Rationale

The EIS explains that Husky is the operator of the White Rose development project also off the east coast of Newfoundland. It involves a floating production, storage, and offloading (FPSO) facility, the S*eaRose FPSO*.

Section 2.4.3 of the EIS states that Husky currently maintains logistical support to the *SeaRose FPSO* facility and to MODUs operating within the White Rose field and Table 7.1 (Oil Spill Response Equipment) states that Tier 1 response equipment, out-rigger arms, booms, skimmers and spill tracker buoys, are stored on the *SeaRose FPSO*.

Section 7.1.8 of the EIS states that Tier 2 response level equipment, including producing operator-owned equipment such as the Norweigan Standard System, are available. However, the location of producing operator-owned equipment is unclear with respect to this project.

With respect to the necessary equipment and services for emergency first response, it is unclear what will be made available from the *SeaRose FSP*O versus the proposed Project drilling installation.

Specific Question of Information Requirement

Clarify what emergency response equipment and services will be made available from the SeaRose FPSO versus the drilling installations and vessels of the proposed Project.

Response

Section 7.1.7 of the EIS describes containment and recovery options suitable for a Tier 1 oil spill response and identifies the stored location of the Single Vessel Sidesweep System (SVSS) which is a requirement of production operations. The primary mode of Tier 1 response, available on all vessels is the sorbent boom array. In the event of a Tier 1 spill during exploration, the decision to deploy the SVSS to the exploration site will be made in consultation with the C-NLOPB.

Tier 2 response equipment is housed in St. John’s.

References

N/A

1.16.2 Information Requirement: IR-80

Reference to EIS:

Section 7.1.3.2 Net Environmental Benefit

Context and Rationale

The EIS Guidelines require that the environmental effects of spill response measures outlined in the emergency response plan be considered (Section 6.6.1).

Section 7.1.3.2 of the EIS states that a Net Environmental Benefit Analysis will be used to assess and compare the feasibility and environmental and socio-economic impacts of employing different oil spill response techniques (including but not limited to dispersant application) to prevent or reduce contact of the oil with resources most likely to be affected. However, the EIS does not explain how the Net Environmental Benefits Analysis is conducted, what is included in the assessment, how it enables spill responders and stakeholders to choose the best response option, nor how it achieves the objectives of maximizing benefits and minimizing potential environmental effects.

The EIS also states that a Net Environmental Benefits Analysis was submitted jointly by Husky, Suncor and ExxonMobil to the C-NLOPB in December 2013 and that the operators are currently preparing a response to review comments received from the C-NLOPB in 2016 (refer to Section 7.1.10.3.3).

Specific Question of Information Requirement

Describe the Net Environmental Benefits Analysis, including the following information:

- explain how a Net Environmental Benefits Analysis is conducted;
- explain what is included in the assessment;
- explain how it enables spill responders and stakeholders to choose the best response option;
- identify who the stakeholders are;
- explain how it achieves the objectives of maximizing benefits and minimizing potential effects to the environment;
- describe the updates to the joint Husky, Suncor and ExxonMobil NEBA based on the 2016 comments from the C-NLOPB; and
- describe what measures for shoreline protection will be included in the Net Environmental Benefits Analysis, and provide information on the engagement of assessment teams for systematic surveys of impacted shorelines, who will determine appropriate clean-up tactics and when this would take place.

Response

A Net Environmental Benefits Analysis (NEBA) takes into consideration the advantages and disadvantages of specific spill response actions and their impact on the environment. Some response methods have the potential to cause adverse environmental impacts but may be justifiable because of overriding benefits and/or avoidance of further, more serious, impacts.

Three steps to ensuring that a positive Net Environmental Benefit is achieved include:

1. Identify and prioritize resources at risk according to environmental sensitivity

2. Compare available response options to each other and to the effects of an unmitigated spill

3. Select the response options that result in the greatest environmental benefit and/or least adverse effects on key resources

The NEBA process is analogous to the Spill Impact Mitigation Assessment (SIMA) process which was recently described (IPIECA 2018) as:

1. Compile and evaluate data for relevant oil spill scenarios including fate and trajectory modelling, identification of resources at risk and determination of feasible response options. This would include:
    a. Collect information on the physical and biological environmental conditions as well as the human use of the area of interest.
    b. Review previous spill case histories and experimental results which are relevant to the area and to the available response methods.
2. Predict outcomes/impacts for the 'no intervention' (or 'natural attenuation') option as well as the effectiveness (i.e. relative mitigation potential) of the feasible response options for each scenario.
    a. On the basis of previous experience and professional judgement, predict the likely outcomes if the proposed response is used.
3. Balance trade-offs by weighing and comparing the range of benefits and drawbacks associated with each feasible response option, including no intervention, for each scenario.
    a. Compare and weigh the advantages and disadvantages of all potential response options against the outcome of using no intervention.
4. Select the best response option(s) to form the strategy for each scenario, based on the combination of techniques that will minimize the overall ecological, socio-economic and cultural impacts and promote rapid recovery.

The NEBA is normally conducted using a risk matrix which evaluates the predicted interaction and risks of potential response options with the ecological resources. There are a wide range of potential factors that can influence risk management decisions associated with an oil spill response including: political issues; ecological issues; social issues; technological feasibility; regulatory and legal issues; cost and benefit. The analysis would normally be conducted at the regional level with key regulatory agencies to understand the individual areas of responsibility and inform the risk matrix of potential trade-offs between environmental, social, economic or aesthetic concerns. However, other interested stakeholders and Indigenous groups could be involved during the review of the Oil Spill Response Plan.

If there is a potential for oiling, shoreline protection is always considered in the assessment of oil spill response. Measures for shoreline protection and response are outlined in Section 7.1.4.4 of the EIS.

A NEBA was submitted to the C-NLOPB in December 2013 to evaluate suitability of dispersant application to spills of crude oil from production and drilling installations on the Newfoundland Grand Banks. A revised dispersant NEBA is planned for submission to the Canada-Newfoundland and Labrador Offshore Petroleum Board in 2019.

References

IPIECA 2018. IOGP Report 593. Guidelines on Implementing Spill Impact Mitigation Assessment (SIMA). London, UK

1.16.3 Information Requirement: IR-81

Reference to EIS:

Section 7.3 Accidental Events Environmental Effects Assessment

Context and Rationale

Section 7.3 of the EIS describes the potential environmental effects of diesel batch spills, hydrocarbon blowouts and synthetic-based mud spills.

Section 7.1.2 of the EIS states that spill response options include surveillance and monitoring, testing and application of a spill treating agent; mechanical dispersion, containment and recovery, and wildlife measures. However, any differences in the applicability of the identified response options to the three accidental event scenarios (i.e. diesel batch spills, hydrocarbon blowouts and synthetic-based mud spills), is not described.

The EIS states that Husky has an established corporate Incident Coordination and Response Management Plan (EC-M-99-X-PR-00003-001) and an Oil Spill Response Procedure - East Coast Oil Spill Response Plan (EC-M-99-X-PR-00125-001). It is not clear whether these are existing documents for the existing Husky development project or documents that will be prepared for the proposed exploratory project.

Specific Question of Information Requirement

Describe the spill response tactics to be utilized in the event of a synthetic-based mud spill.

Discuss the differences in spill response equipment and strategies to be utilized in the event of a diesel spill versus a hydrocarbon spill vs a synthetic-based mud spill.

Clarify what emergency management documents will be individually prepared or the proposed Project versus documents that exist for the proponent in a broader sense.

Response

Any unauthorized discharge of hydrocarbon, regardless of the source or type, is considered a spill requiring an appropriate level of response, as outlined in the EIS Section 7.1. The risk parameters to be considered in selecting the appropriate level of response and response options include:

- oil volume at risk of release
- oil type and properties and spill situation details
- environmental and operational conditions at the time of the spill
- event priorities, resource availability/location and hazards present

This assessment will allow responders to determine the best course of action to minimize potential environmental effects as effectively and safely as possible.

If there was a risk to shorelines from a diesel spill, for example, countermeasures to divert hydrocarbons from potentially impacting environmentally sensitive coastal shorelines and socio-economic sensitive coastal areas will be initiated.

Husky’s primary emergency management documents (Oil Spill Response Plan and Incident Coordination and Response Management Plan) apply to all offshore operations conducted under authorization from the C-NLOPB. However, risk assessments are conducted to identify and address potential hazards to personnel, environment, assets, and the public for each separate activity.

References

N/A

1.16.4 Information Requirement: IR-82

Reference to EIS:

7.1.4.4.3 Oiled Wildlife Response

Context and Rationale

Section 7.1.4.4.3 of the EIS states “Husky maintains an oiled seabird treatment facility, along with a number of trained responders and a wildlife veterinarian. For longer-term rehabilitation, Husky sponsors a local rehabilitation facility.”

Environment and Climate Change Canada advises that the facility mentioned in the above statement is only permitted to host up to 10 affected individuals at one time.

The discussion in Section 7.14.4.3 Oiled Wildlife Response only focuses on measures to be taken with respect to avian species.

Specific Question of Information Requirement

Provide information on how a potential incident that would affect more than 10 recoverable individuals would unfold as the carrying capacity of the local rehabilitation facility is limited to 10 affected individuals at one time.

Provide information on the response measures to be taken for non-avian species following an accidental event.

Response

If an incident potentially exceeded the capacity of the oiled seabird treatment facility or if oiled non-avian species were recovered, Husky would mobilize a third-party contractor to establish a temporary wildlife response centre.

References

N/A

1.16.5 Information Requirement: IR-83

Reference to EIS:

Section 7.1 Spill Prevention and Response; 7.1.4.4.3 Oiled Wildlife Response

Context and Rationale

Section 7.1.4.4.3 of the EIS discusses oiled wildlife responses. Environment and Climate Change Canada that all emergency incidents can potentially affect wildlife and that during these incidents ECCC acts as a Resource Agency, which sets wildlife emergency response standards and guidelines related to Migratory Birds and Species at Risk under its jurisdiction. As such, Wildlife Response requires a Wildlife Emergency Response Plan (WERP), which is a component of the Incident Command System for pollution incidents affecting wildlife, and should address all of the various procedures and strategies required to mount an effective wildlife response. No information on Wildlife Emergency Response Plans is provided in the EIS.

At minimum, a WERP must include the following information:

1. Information on the wildlife potentially at risk in the area;
2. Mitigation measures to deter non-affected wildlife from affected areas;
3. Mitigation and response measures to be undertaken if wildlife and/or sensitive habitats become contaminated by the incident (including treatment of oil-affected wildlife); and
4. The type and extent of wildlife monitoring that would be conducted during and following a pollution incident.

In these situations, Environment and Climate Change Canada advises that in Tier 2 and Tier 3 responses a third-party wildlife response organization with trained and dedicated observers should be used to implement the Wildlife Response Plan, including conducting at-sea surveys, implementing deterrence measures, and oiled wildlife capture and treatment, under the oversight of Environment and Climate Change Canada.

ECCC advises that it should be consulted when developing WERPs and that they are available to review WERPs prior to their implementation.

Specific Question of Information Requirement

Describe the preparations of a Wildlife Emergency Response Plan, including the timing of its preparation, standard content including likely mitigation measures, and how data and information collected during its implementation would be used.

Describe how Wildlife Emergency Response Plans would be implemented during Tier 2 and 3 responses.

Response

Husky's Wildlife Response Plan (WRP) has been developed and was submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board on January 28, 2019. Previously, wildlife emergency response provisions were incorporated within Husky's Oil Spill Response Plan.

The WRP has been developed to enable timely, coordinated, and effective protection, rescue, humane treatment, and rehabilitation of wildlife resources to minimize potential impacts that may result from a spill incident.

This WRP includes general planning considerations and measures, protocols for wildlife recovery and care, specific response strategies, and key resources to guide spill response operations in providing protective measures for seabirds, marine mammals, and sea turtles.

Although incident specific approaches and techniques will be identified and developed at the time of an incident, strategies for the protection of wildlife during a response operation are readily available at both the national and international level. As a result, this WRP has considered and incorporated existing guidance and standards.

Wildlife response activities will be triggered, and associated wildlife response activities will commence once the Oil Spill Response Plan is activated.

There are three emergency response phases recognized in the Incident Command System:

- Emergency phase - Emergency safety and stabilization of the event are priority
- Reactive phase - Regional Response Management Team providing support to the emergency response
- Proactive phase - Managed onshore by the Regional Response Management Team

The wildlife response plan will be activated after the emergency phase of the oil spill, when life safety has been addressed, and the event is stabilized.

References

N/A

1.17 ACCIDENTS AND MALFUNCTIONS – DISPERSANTS, CAPPING STACK, RELIEF WELL AND OTHER RESPONSE OPTIONS

1.17.1 Information Requirement: IR-84

Reference to EIS:

7.1.9.3 Tier 3 Response to a Well Blowout

Context and Rationale

The EIS describes the timelines involved with the mobilization and installation of a capping stack, but no information has been provided on their expected operational lifespan, the timing of decommissioning, nor on any follow-up monitoring activities that would be required if the capping stack is removed from a wellhead.

It is important to understand the lifespan and decommissioning implications for wells that may become compromised due to blowout events so as to better understand and characterize any longer-term environmental effects that may occur, and may therefore need to be monitored for, at blowout-affected well sites.

Specific Question of Information Requirement

Given that a capping stack may have to remain affixed to a wellhead for an extended period of time should dynamic well kill measures prove unsuccessful, provide information on the operational lifespan of capping stacks and any contingencies in place to either extend their service or replace them.

Provide information on when a capping stack system may be decommissioned and describe any potential wellhead integrity monitoring efforts that would follow, including expected timeframes of such.

Response

The capping stack system that Husky has subscribed to has ram-type blowout preventers (BOPs), not unlike those that are found in the BOPs that are regularly used on wells lasting 100 days or more. Should a capping stack require replacement, Husky has access to multiple capping stacks through its current capping stack provider.

A capping stack system would be decommissioned once the blowout has been controlled and the well has been abandoned. The wellhead would then be removed from the well as part of abandonment operations.

References

N/A

1.17.2 Information Requirement: IR-85

Reference to EIS:

Section 7.1 Spill Prevention and Response

Context and Rationale

Section 7.1 (Spill Prevention and Response) of the EIS provides information related to the complement of tools and strategies for spill response. However, in several instances additional information is required.

Figure 7-3 (Capping Stack Installation Timeline) outlines "best response timeline" and "nominal response timeline". The meaning of "nominal" in this context is unclear. Factors that would contribute to the difference in "best response" versus "nominal" timelines are not described.

The EIS does not describe whether additional equipment would be required to be brought to the site for the subsea or debris clearance activities.

The EIS states that the mobilization of the capping stack from Norway to the wellsite is expected to range from 13 to 24 days; however, the assumptions made in calculating this range are not described. Further, the EIS does not describe the steps included in mobilization (e.g. final equipment preparation and testing, shipment to a port facility; loading on a vessel) in Norway, and what the timeframes may be for each step.

Figure 7-3 of the EIS shows the mobilization of the capping stack would begin on day one post-incident. However, no further discussion is provided confirming that the decision to initiate mobilization of the capping stack from Norway taken immediately.

It is important to understand the response measure timeframes involved with the deployment of all subsea incident response apparatus so that well control preparation activities and associated timeframes can be fully appreciated and the magnitude of environmental effects resulting from any extended timelines can be properly determined and characterized to the greatest extent possible.

Specific Question of Information Requirement

Provide information on steps and timeframes involved in the deployment of subsea incident response equipment, such as the capping stack, including the following:

- describe the difference in the "best response timeline" and "nominal response timeline" presented in Figure 7-3, and discuss the factors that are likely to influence the timeline in an actual event, including harsh weather;
- describe the worst-case response timeline;
- clarification on whether additional equipment would be required to be brought to the wellsite after a blow-out for use before the capping stack can be installed (e.g. for debris removal);
- a description of the decision making processes and timeline associated with the deployment of the capping stack;
- clarification on whether a contingency capping stack is available in another location.

Response

EIS Figure 7.3 describes "best response timeline" and "nominal response timeline" as an illustration of the range in timeline for each stage of the response, as described in EIS Section 7.1.9.3. Factors that can influence the duration of each stage include but are not limited to; the nature of the initial incident, whether the mobile offshore drilling unit is on the well location, how much debris resulted from the incident, whether subsea intervention required, whether subsea spill treating agents are required to ensure safe working conditions on the surface and of course, weather. The worst-case response timeline arises when all the factors that can delay each stage occur.

The subsea incident response toolkit (SIRT) may be required for debris removal before the capping stack can be installed. The final decision on the specific SIRT equipment to be mobilized would depend on the nature of the incident. However, all SIRT equipment is maintained 'response ready' for air freight to the required location. The SIRT would be mobilized from Norway to Newfoundland within 48 hours, pending transportation availability. Use of the SIRT would commence prior to arrival of the capping stack system.

With knowledge of the nature of the incident, an evaluation of whether to deploy a capping stack would begin immediately. The process for evaluating the need for a capping stack is described in EIS Section 7.1.9.3. The actual decision to deploy the capping stack could be made at any point in the evaluation process. The timeline for deployment is presented in EIS Figure 7.3.

As a member of the Oil Spill Response Limited network, Husky does have access to a contingency capping stack.

References

N/A

1.17.3 Information Requirement: IR-86

Reference to EIS:

Section 2.3 Project Location

Context and Rationale

The EIS Guidelines require a discussion on the use and feasibility of a capping stack to stop a blowout and resultant spills. Section 2.3 of the EIS states that water depths range from approximately 87 meters to 211 meters within the project area. While the proposed wells are located in shallow water, less than 500 meters, there is no discussion of the possible limitations of the capping stack in shallow water, or the additional equipment that may be required when affixing a capping stack in shallow waters.

Specific Question of Information Requirement

Provide additional information on the technology available to cap a shallow-water well, including information available to support the effectiveness of the technology, with respect to the potential shallow depths in the ELs.

Discuss limitations associated with the use of a capping stack in particular in shallow water environments, including any differences in the steps taken to affix a capping stack in shallow water that may not be required when capping a deep water well (e.g. use of dispersants to reduce flow rate). Explain how the limitations of the technology could affect the length of time it may take to effectively cap a well.

If applicable, update the effects analysis to reflect these additional considerations.

Response

The are no limitations to the use of a capping stack in shallow water per se and there are no differences in the steps taken to affix a capping stack in shallow water compared to deeper water. There are no limitations with the capping stack technology associated with water depth.

In the event of a blowout where the area directly above the well was unsafe for workers due to air quality, mitigative measures may be taken such as the injection of dispersants subsurface. There is also an option to deploy the capping stack from an offset location, when vertical access over the well is not possible. The requirements for a safe capping stack deployment will be part of the early evaluation of the incident.

References

N/A

1.17.4 Information Requirement: IR-87

Reference to EIS:

Section 7.1.9.3 Tier 3 Response to a Well Blowout

Context and Rationale

Section 7.1.9.3 of the EIS describes the mobilization and installation of a capping stack as the response to a subsea blowout; however, while Section 7.1 states that relief well plans are within the scope of the contingency plan, no description is presented in the EIS on relief wells as a response option.

Specific Question of Information Requirement

Provide information on relief wells as a response option to a subsea blowout, including the following:

- circumstances under which a relief well would be considered;
- factors considered in the decision to drill a relief well;
- timelines for drilling a relief well, including securing and mobilizing a rig transit;
- site preparation; and
- factors that are likely to influence the timeline in an actual event, including harsh weather.

Response

A relief well is drilled in response to a subsea blowout and is the primary means of killing a well (i.e. stemming the flow of hydrocarbons through the well bore). Capping as a means of source control prevents hydrocarbons from being released at the well head while the relief well is drilled. Source control response operations including survey, intervention, debris clearance and capping stack installation run simultaneous to relief well preparation. The assessment of a blowout lasting 120 days was selected as the worst-case scenario since it is the estimated time required to drill a relief well if a mobile offshore drilling unit (MODU) had to be mobilized from outside the Newfoundland offshore region.

The timeline for drilling a relief well is subject to, but not limited to; the nature of the initial incident, whether a MODU is available in the Newfoundland offshore, approval to drill a relief well from the C-NLOPB, well site preparation requirements and of course, weather.

References

N/A

1.17.5 Information Requirement: IR-88

Reference to EIS:

Section 7.1.9.3 Tier 3 Response to a Well Blowout

Context and Rationale

Section 7.1.9.3 of the EIS states that a capping stack could be mobilized from Norway to the wellsite within 13 to 24 days from initiation. The KMKNO stated that recent innovations have resulted in the design of a lighter capping stack that can be transported via aircraft, the RapidCapTM Air Mobil Capping Stack. The KMKNO indicated that the lightweight capping stack can be flown from Houston within 24 hours, decreasing the time to cap a well, and it can be deployed by a locally available vessel of opportunity with suitable crane capacity.

Specific Question of Information Requirement

Discuss the economic and technical feasibility of options for decreasing capping stack response times, taking into consideration the possibility of shipping a capping stack by air. Also, discuss if there has been any recent or ongoing innovations in capping stack technology and availability, and application to the Project.

Response

As a member of Oil Spill Response Limited (OSRL), Husky has access to the world's largest supply of oil spill response equipment. OSRL have recently developed equipment and processes to transport their systems by air, similar to the Rapid Cap ™. However, it should be noted that transportation of the capping stack is not the rate determining step in stopping the flow of oil in a subsea blowout scenario. As described in EIS Section 7.1.9.3, there are five phases of a response to a subsea blowout that are required before the capping stack can be deployed. Having a capping stack flown to, or on standby in St. John's, would not accelerate the progress of any one of those phases.

References

N/A

1.17.6 Information Requirement: IR-89

Reference to EIS:

7.1.9.4 Dispersants; 7.3.4.3 Assessment of Residual Environmental Effects on Migratory Birds; 7.3.4.3 Assessment of Residual Environmental Effects on Migratory Birds; 7.3.4.3.2 Subsea and Surface Hydrocarbon Blowout

Context and Rationale

Section 7.1.9.4 of the EIS states the following: "In general, results showed that in an event of an accidental event, the use of dispersants offered a clear net environmental benefit in all cases (SL Ross and LGL Limited 2013). An untreated spill in the Grand Banks pose a substantial risk to globally important populations of a number of marine bird species and commercially important fisheries, as well as some risk to marine mammals and very limited risk to local finfish and shellfish populations. In summary, the risks to bird, mammal, turtle species, and in certain cases commercial fisheries can be greatly reduced by using dispersants."

This section discusses the net environmental benefits of dispersants with reference to SL Ross and LGL Limited (2013), which indicated a net benefit for birds. However, Environment and Climate Change Canada advises that since this report, there are new studies indicating possible negative impacts of dispersants on birds, including Fiorello et al. 2016 and Whitmer et al. 2018.

Further, Section 7.3.4.3 of the EIS states the following: "While surface dispersant operations may not be 100% effective, subsea injection of dispersants can be expected to be more effective. Even if dispersant operations are only 50% to 70% effective, they will reduce the anticipated large impact on birds by 50% to 70% (SL Ross and LGL Limited 2013 (draft))."

The EIS presents an estimated number of affected birds by group of species, along with a proportion of affected population for different blowout scenarios (i.e. by time of year and whether dispersants are used or not); however, the draft document cited (SL Ross and LGL Limited 2013), is not available for review.

References

Fiorello, C.V., Freeman, K., Elias, B.A., Whitmer, E., and Ziccardi, M.H. (2016). Ophthalmic effects of petroleum dispersant exposure on common murres (*Uria aalge)*: An experimental study. *Marine Pollution Bulletin*. **113**:387-391.

Whitmer, E.R., Elias, B.A., Harvey, D.J., and Ziccardi, M.H. (2018). An Experimental Study of the Effects of Chemically Dispersed Oil on Feather Distribution and Waterproofing in Common Murres (*Uria aalge*). *Journal of Wildlife Diseases*. **54**(2): 315-328

Specific Question of Information Requirement

Taking into consideration information and references provided by Environment and Climate Change Canada, update the effects assessment of dispersants on birds, including mitigation and follow-up, as applicable.

Provide SL Ross and LGL Limited (2013) for review.

Response

It is acknowledged that some recent studies have shown potential negative effects of dispersants on migratory birds. For example, Fiorello et al. (2016) conducted a study which involved exposing common murres to a dispersant (Corexit EC9500a), a crude oil, or a combination. Ophthalmic examinations were subsequently performed on all birds. Results indicated that exposure to both the dispersant and the oil was related to the development of conjunctivitis. In addition, birds exposed to a higher concentration of crude oil (either alone or in combination with the dispersant) were more likely to develop corneal ulcers.

A 2018 paper by Whitmer et al. conducted a similar study, where common murres were exposed to a dispersant (Corexit 9500), Prudhoe Bay crude oil, or a combination, to investigate the effect on feather structure and waterproofing. Results indicated that both dispersant, oil, and a combination of the two have negative effects on murre waterproofing. Waterproofing was negatively affected in a similar, dose-dependent manner by both crude oil, and chemically dispersed crude oil.

Although these studies have highlighted some potential negative effects of dispersants on birds, they do not suggest that a net negative effect on bird populations in the event of an oil spill. For example, Whitmer et al. (2018) states that dispersant use can lead to a decreased overall concentration of oil that birds may be exposed to. As such, the net environmental effects of dispersants on birds likely remains positive. Based on this information, the conclusions provided in the EIS related to dispersants remains valid.

The document referred to as SL Ross and LGL Limited (2013) is undergoing revision and planned to be resubmitted to the C-NLOPB in 2019. More recent literature, including Whitmer et al. (2018) and Fiorello et al. (2016) will be reviewed prior to submission.

References

Fiorello, C.V., K. Freeman, B.A. Elias, E. Whitmer and M.H. Ziccardi. 2016. Ophthalmic effects of petroleum dispersant exposure on common murres (*Uria aalge*): An experimental study. Marine Pollution Bulletin, 113: 387-391.

SL Ross Environmental Research and LGL Limited. 2013. Net Environmental Benefit Analysis of Dispersant Use for Responding to Oil Spills from Oil and Gas Facilities on the Newfoundland Grand Banks. Prepared for the Canadian Association of Petroleum Producers, St. John's, NL. xvii + 192 pp.

Whitmer, E.R., B.A. Elias, D.J. Harvey and M.H. Ziccardi. 2018. An experimental study of the effects of chemically dispersed oil on feather distribution and waterproofing in common murres (*Uria aalge*). Journal of Wildlife Diseases, 54(2): 315-328.

1.17.7 Information Requirement: IR-90

Reference to EIS:

Section 7.1.9.4 Dispersants

Context and Rationale

The EIS Guidelines require that the environmental effects of measures outlined in the emergency response plan should also be considered in the EIS. While Section 7.1.9.4 of the EIS outlines effects of dispersant use, the EIS does not discuss other possible response options that may have effects, such as in-situ burning.

Specific Question of Information Requirement

Provide a discussion of the potential environmental effects of response measures on VCs.

With respect to in-situ burning specifically, describe the potential for incomplete burning and resulting oil in the water and assess associated effects.

Describe proposed mitigation and follow-up, as applicable for response measures

Response

Controlled in-situ burning (ISB) can be used to quickly and efficiently reduce the volume of oil on the water surface that could otherwise reach shorelines and nearshore sensitive receptors. ISB is similar to mechanical recovery in that it involves collecting and containing oil on the surface using vessels and booms (Coelho et al. 2017). The oil is typically contained within a fire-resistant boom and ignited using a hand-held igniter or an igniter suspended from a helicopter. The burn will continue if the oil is thick enough to support combustion (usually approximately 2 to 3 mm [1/10 of an inch]).

ISB was successfully demonstrated by Environment and Climate Change Canada (ECCC) in 1993 in a large-scale field experiment called the Newfoundland Offshore Burn Experiment (NOBE), which was undertaken to verify the results of 10 years of research on ISB regarding the effectiveness of burning and fate of burn products and residues (Fingas et al. 1995, 1996, 1999), as well as by BP in 2010 in response to the Deepwater Horizon oil spill (Allen et al. 2011; Mabile 2013). The NOBE reported that under favourable conditions, ISB is a fast, efficient, and relatively simple way of removing spilled oil from the water. It also greatly reduces the need for storage and disposal of the collected oil and the waste it generates. This response tactic is most effective for fresh oil and spill locations away from populated areas and can only be conducted under certain meteorological conditions (i.e., calm seas and light winds).

Potential environmental effects associated with ISB include the generation of atmospheric emissions and burn residue, direct temperature effects, water column toxicity, and a temporary localized effect on the surface microlayer.

ISB releases emissions to the atmosphere that are approximately 85% to 95% composed of carbon dioxide and water; approximately 5% to 15% composed of particulates (mostly soot); and approximately 1% to 3% composed of nitrogen dioxide, sulphur dioxide, carbon monoxide, polycyclic aromatic hydrocarbons, ketones, aldehydes, and other by-products of combustion (Ferek et al. 1997; Lee et al. 2015). Emissions associated with the burning of oil on water generally seem to be similar to the emissions associated with the burning of oil in a furnace or in a car, except that the oil is burned less efficiently due to lack of oxygen and therefore generates black soot particulates that create black smoke.

ISB should not be conducted close to human populations, shorelines, wildlife areas, or other sensitive receptors. Air monitoring may be required due to the proximity of spill response workers; however, due to the distance of the Project Area from land, the plumes are anticipated to dissipate before reaching any land masses (Coelho et al. 2017).

During the NOBE, more than 200 sensors or samplers were deployed to collect quantitative data associated with ISB. The data collected indicated that ISB produced fewer emissions than anticipated (Fingas et al. 1994), and measured parameters were determined to be below occupational health exposure levels within 150 m of the ISB site (Fingas et al. 1994).

Some oil residue (approximately 1-5% of the starting oil; Lee et al. 2015) typically remains on the surface following ISB. The composition of this burn residue is generally similar to that of the original oil except that burn residues tend to have less volatile hydrocarbons and are more viscous and denser than unburned oil. Burn residues may either float or sink. For example, in a controlled test burn during the *Exxon Valdez* spill, an estimated 15,000 to 30,000 gallons of Prudhoe Bay crude oil were burned. Following this burn, approximately 300 gallons of “stiff, taffy-like burn residue” remained on the sea surface and was easily removed (Allen 1990). However, during the 1991 Haven tanker incident near Genoa, Italy, the remaining burn residues sank (Moller 1992). In some cases, the residues may stay afloat while warm but sink as they cool, as was observed during a series of test burns in Prudhoe Bay, Alaska, using Alaska North Slope crude (Buist 1995). The sunken residues formed a brittle solid, while the residues that stayed afloat were semi-solid tar (Buist 1995). These examples suggest that prompt collection of the residues may help prevent the residues from sinking in some cases. According to the National Oceanic and Atmospheric Administration (NOAA) Office of Response and Restoration, burn residues have little to no acute aquatic toxicity; however, benthos may be smothered by sunken oil (NOAA n.d.).

Data collected from thermocouple probes during the NOBE showed no increase in water temperatures associated with the burn, even though temperatures at the top of the fire-resistant book reached 1000ºC (Fingas et al. 1994). It appears that the burning layer may not remain over a given water surface long enough to change the temperature because the ambient temperature seawater is continually being supplied below the oil layer as the boom is towed.

Environment Canada (now ECCC) coordinated a series of laboratory and field studies to determine whether ISB causes water column toxicity beyond that attributable to allowing the slick to remain on the surface of the water (Daykin et al. 1994). Results from these studies indicated that, although toxicity increased in water samples collected beneath oil burning on water, this increase was generally no greater than that caused by the presence of an unburned oil slick on water. Chemical analyses performed along with the biological tests reflected low hydrocarbon levels in the water samples (Daykin et al. 1994).

The Alaska Department of Environmental Conservation (ADEC), United States Coast Guard and United States Environmental Protection Agency developed the *In Situ Burning Guidelines for Alaska*, and outlined the importance of the surface microlayer, which is the upper millimetre or less of the water surface that is deemed habitat for many sensitive life stages of marine organisms (e.g., eggs and larval stages of fish and crustaceans [including cod, sole, flounder, hake, anchovy, crab, and lobster], and reproductive stages of other plants and animals) (ADEC et al. 2008). Although most studies of the surface microlayer have been completed in nearshore areas, some studies have focused on offshore areas and found that densities of larvae were similar to those in nearshore environments (ADEC et al 2008). ISB would kill any organisms present in the surface microlayer in the area of the burn. However, when considering the small area affected by ISB, the rare nature of this event, and the rapid renewal of the surface microlayer from adjacent areas, the long-term biomass loss is negligent (Shigenaka and Barnea 1993; ADEC et al. 2008).

Husky would only implement ISB as a response measure if weather conditions are favourable at the time and the thickness of the concentrated oil supports combustion. However, if the burn had to be extinguished due to changing weather conditions or safety reasons, or an insufficient oil thickness occurred, then an incomplete burn situation could occur. Other response measures (e.g., mechanical recovery) could be implemented to complete the response in the event that incomplete burning occurs and oil remains present on the sea surface.

Follow-up monitoring of potential effects of ISB would be part of a spill monitoring program.

References

ADEC (Alaska Department of Environmental Conservation), United States Coast Guard and United States Environmental Protection Agency. 2008. In Situ Burning Guidelines for Alaska. Available at: https://dec.alaska.gov/media/8436/in-situ-burning.pdf. Accessed January 2019.

Allen, A.A. 1990. Contained controlled burning of spilled oil during the *Exxon Valdez* oil spill. Pp. 305-313. In: Proceedings of the Thirteenth Arctic and Marine Oil Spill Program Technical Seminar, June 6-8, 1990, Edmonton, AB.

Allen, A. A., N.J. Mabile, D. Jaeger and D. Costnzo, 2011. The use of controlled burning during the Gulf of Mexico Deepwater Horizon MC-252 oil spill response. In: Proceedings of the 2011 International Oil Spill Conference. Paper No. 194: 13 pp.

Buist, I.A. 1995. Demulsifiers and modified heli-torch fuels to enhance in-situ burning of emulsion. Final Report, Ottawa: S.L. Ross Environmental Research.

Coelho, G.M., A.G. Slaughter and J.C. Staves 2017. Spill Impact Mitigation Assessment in Support of Statoil Canada Ltd Drilling Program in the Flemish Pass. Sponson Group Inc., Mansfield, TX. Sponson Group Technical Report, 17-02: v + 71 pp.

Daykin, M., G. Sergy, D. Aurand, G. Shigenaka, Z. Wang and A. Tang. 1994. Aquatic toxicity resulting from in-situ burning of oil-on-water. Pp. 1165-1193. In: Proceedings of the Seventeenth Arctic and Marine Oil Spill Program Technical Seminar, Vancouver BC.

Ferek, R. A. Allen and J.H. Kucklick. 1997. Air quality considerations involving in-situ burning. Marine Preservation Association, Scottsdale, AZ. 29 pp.

Fingas, M.F., F. Ackerman, K. Li, P. Lambert, Z. Wang, M.C. Bissonnette, P.R. Campagna, P. Boileau, N. Laroche, P. Jokuti, R. Nelson, R.D. Turpin, M.J. Trespalacios, G. Halley, J. Belanger, J. Pare, N. Vanderkooy, E.J. Tennyson, D Aurand, and R. Hiltabrand. 1994. The Newfoundland offshore burn experiment-NOBE, preliminary results of emission measurement. Pp. 1099-1163. In: Proceedings of the Seventeenth Arctic and Marine Oil Spill Program Technical Seminar, Environment Canada, Vancouver, BC.

Fingas, M.F., G. Halley, F. Ackerman, R. Nelson, M. Bissonnette, N. Laroche, Z. Wang, P. Lambert, K. Li, P. Jokuty, G. Sergy, E. Tennyson, J. Mullin, L. Hannon, R. Turpin, P. Campagna, W. Halley, J. Latour, R. Galarneau, B. Ryan, D. Aurand and R. Hiltabrand, 1995. The Newfoundland offshore burn experiment – NOBE, 1995. Pp. 123-132. In: 1995 International Oil Spill Conference Proceedings, Long Beach, CA.

Fingas, M.F., P. Lambert, K. Li, Z. Wang, F. Ackerman, S. Whiticar, M. Goldthorp, S. Schutz, M. Morganti, R. Turpin, R. Nadeau, P. Campagna and R. Hiltabrand, 1999. Studies of emissions from oil fires. In: 1999 International Oil Spill Conference, Paper #133.

Fingas, M.F., K. Li, F. Ackerman, P. Campagna, R. Turpin, S. Getty, M. Soleki, M. Trespalacios, Z. Wang, J. Paré, J. Bélanger, M. Bissonnette, J. Mullin and E. Tennyson, 1996. Emissions from mesoscale in situ oil fires: The mobile 1991 experiments. Spill Sci. Technol. Bull., 3: 123-137.

Lee, K., M. Boufadel, B. Chen, J. Foght, P. Hodson, S. Swanson and A. Venosa. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

Mabile, N. J. 2013. Considerations for the Application of Controlled In-Situ Burning. Society of Petroleum Engineers, SPE/APPEA International Conference on Health, Safety, and Environment in Oil and Gas Exploration and Production, Perth, Australia, 11–13 September 2012, revised for publication and approved December 2012.

Moller, T.H. 1992. Recent experience of oil sinking. Pp: 11-14. In: Proceedings of the Fifteenth Arctic and Marine Oil Spill Program Technical Seminar, June 10-12, 1992, Edmonton, AB.

NOAA (National Oceanic and Atmospheric Administration) Office of Response and Restoration. n.d. (no date provided). Residues from In Situ Burning of Oil on Water. Available online: https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/residues-insitu-burning-oil-water.html. Accessed January 2019.

Shigenaka, G. and N. Barnea. 1993. Questions about in-situ burning as an open-water oil spill response technique. 1993. HAZMAT Report 93-3. Seattle: Hazardous Material Response and Assessment Division, NOAA.

1.17.8 Information Requirement: IR-91

Reference to EIS:

Section 7.1.9.3 Tier 3 Response to a Well Blowout

Context and Rationale

Section 7.1.9.3 of the EIS states that both injection (subsea) and application (surface) of dispersants may be used as a response tool in the event of a blowout. However, no description is provided of when one versus the other may be required.

The assessment of potential effects of dispersants on applicable VCs does not distinguish between injection and surface application of dispersant, which may present considerably different risks, effects, and benefits.

Specific Question of Information Requirement

Describe subsea versus surface use of dispersants, including likely scenarios when one method versus the other may be considered. Discuss differences in potential effects between subsea and surface dispersant application.

Response

The primary factor determining the application method of dispersants is origin of the spill. Subsea dispersant injection would only be used in the case of a sustained subsea release. Surface application of dispersants may be applied to any incident resulting in oil on the sea surface.

Subsea dispersant injection reduces the amount of oil coming to the surface, and therefore the amount of exposure to volatiles experienced by spill responders. Preventing oil from coming to the surface also reduces the likelihood of oil exposure to marine and migratory birds in the area of the spill.

Dispersants cause a greater amount of the released oil to break into small oil droplets that will be dispersed, diluted and biodegraded in the water column, unlike the larger oil droplets that will float up to the sea surface. Once dispersants are applied, the nature of potential effects is the same between surface and subsurface applications. By dispersing the oil into the water column as small oil droplets, it allows rapid colonization by petroleum degrading microorganisms that will substantially biodegrade the majority of the oil within days and weeks (International Petroleum Industry Environmental Conservation Association and the International Association of Oil and Gas Producers 2015). Further discussion of potential effects of dispersant application is provided in Section 7.1.9.4.1 of the EIS.

References

International Petroleum Industry Environmental Conservation Association and the International Association of Oil and Gas Producers. 2015. Dispersants: Subsea Application. Available from: http://www.iogp.org/pubs/533.pdf

1.17.9 Information Requirement: IR-92

Reference to EIS:

Section 7.1.9.4.1 Dispersant Effects

Context and Rationale

Fisheries and Oceans Canada advises that deep-water corals have not fully recovered following the Macondo blowout (Girard and Fisher 2018). Many of the observed effects are attributed to the use of dispersants, but such effects have not been addressed in the EIS.

Specific Question of Information Requirement

Discuss potential effects of dispersants on sensitive benthic habitat/species.

Response

During the Deepwater Horizon blowout, both the use of dispersants and the physics of the release resulted in much of the oil remaining at depth, forming a deep-water plume that persisted for months (Girard and Fisher 2018). The surfaced oil contributed to a large marine snow formation event, which may have also been affected by the presence of dispersants. Both the large plume of oil and the sinking marine snow had the potential to affect vulnerable deep-sea communities. Three months after the well was capped, an impacted coral community was discovered 13 km away from the wellhead (Girard and Fisher 2018). Two additional impacted sites were also discovered 6 and 22 km from the wellhead. A monitoring study was initiated in 2010 to assess the long-term impacts of dispersed oil on benthic habitats and on coral species, in particular.

Observations from 2011 to 2017 illustrated that overall recovery of corals from the Deepwater Horizon spill was slow. The recovery of coral is a complex process that can be influenced by a combination of factors including environment, predation, competition, size, age, and morphology (Girard and Fisher 2018). Corals are modular organisms that are made up of replicated modules (polyps), which are capable of individual physiological functions but are interconnected, meaning that a change in one part of the colony is likely to affect the entire colony. The ability of individual branches to recover is dependent on the degree to which to colonies were impacted, indicating a long-term non-acute effect from the spill (Girard and Fisher 2018). Trends in the data indicate that subacute effects are increasing over time at the deepest impacted site. Overall, the results indicate that many more years will be required for moderately to heavily impacted corals to recover, if at all.

References

Girard, F. and C.R. Fisher. 2018. Long-term impact of the Deepwater Horizon oil spill on deep-sea corals detected after seven years of monitoring. Biological Conservation, 225: 117-127.

1.18 ACCIDENTS AND MALFUNCTIONS – EFFECTS AND MITIGATION

1.18.1 Information Requirement: IR-93

Reference to EIS:

Section 7.3.1.1 Project Pathways for Effects

Context and Rationale

Section 7.3.1.1 of the EIS discusses potential effects of an accidental event on plankton including phytoplankton and zooplankton. Fisheries and Oceans Canada has advised that additional information should be provided on potential effects given literature following the Deepwater Horizon oil spill. Some literature suggests that the effects of oil spills on phytoplankton and the microbial food web can vary in response to the specific composition of crude oil from a site. Additionally, Fisheries and Oceans Canada has indicated that mixing depth of the water column and water temperature are a concern as they can interact to affect the length of time needed for microbial action to degrade crude in the water column.

Specific Question of Information Requirement

Provide additional discussion on the effects of oil spills on zooplankton and phytoplankton.

Response

The Deepwater Horizon (DWH) blowout was the largest accidental oil spill in US history. Ozhan et al. (2014) conducted a literature review on the findings of how the spill impacted phytoplankton communities in the region. Studies have indicated that the DWH spill may have stimulated the growth of phytoplankton, as expressed by increases in concentrations of Chlorophyll *a* resulting from intense bacterial growth within the photic zone following the spill.

Alternatively, field-based data suggests that the spill could have been toxic to phytoplankton (Ozhan et al. 2014). Various laboratory studies have indicated that different phytoplankton species can have differing tolerance levels to oil and dispersants. For example, dispersed oil (oil + Corexit) was associated with a decrease in chlorophyll *a* concentration but an increase photosynthetic efficiency. Overall the addition of DWH oil and Corexit was found to decrease the number of sensitive species, while increasing resilient species (Ozhan et al. 2014). Different crude oils may affect phytoplankton differently due to their unique compositions.

The response of zooplankton to oil spills is diverse and largely dependent on exposure. Certain taxa of coastal and estuarine copepods may be an exception as they have shown an avoidance behavior to hydrocarbon-contaminated water (Seuront 2010). Laboratory exposure studies have shown lethal and sublethal effects of oil on zooplankton (Seuront 2010; Almeda et al. 2012; AOSRT-JIP 2014) with few documented mass mortality events related to oil slick episodes (Seuront 2010). Sublethal effects range from physiology, feeding and fecundity to behavioral responses related to predator avoidance (Almeda et al. 2012). Laboratory exposure studies comparing arctic and temperate-boreal copepod species have found that Arctic species are less sensitive to oil exposure (Hansen et al. 2011; Gardiner et al. 2013) but this may be related to a delayed response time for the Arctic species (Hansen et al. 2011). Exposure experiments with *Calanus finmarchicus* and *C. hyperboreus* to water soluable fractions of hydrocarbons did not affect hatching success. However, nauplii of *C. hypderboreus* showed sensitivity to temperature treatments when exposed to PAHs (Utne 2017).

Effects would depend on the type and size of spill, time of year, and the number, location and species of animals within the affected area. As described in Section 7.3.1.3 of the EIS, potential effects of a batch spill on marine fish and fish habitat are predicted to be adverse, moderate in magnitude, short-term in duration, to occur within the Study Area, and reversible. The potential effects of a subsurface blowout at the Project Area release site on marine fish and fish habitat are predicted to be adverse, medium in magnitude, short to medium-term in duration, occur within the Study Area, and reversible.

References

Almeda, R., Z. Wambaugh, Z. Wang, C. Hyatt, Z. Liu and E.J. Buskey. 2013. Interactions between zooplankton and crude oil: toxic effects and bioaccumulation of polycyclic aromatic hydrocarbons. Public Library of Science one, 8(6), p.e67212.

AOSRT-JIP (Arctic Oil Spill Response Technology Joint Industry Program). 2014. Environmental Impacts of Arctic Oil Spills and Arctic Spill Response Technologies: Literature Review and Recommendations. 205 pp.

Gardiner, W.W., J.Q. Word, J.D. Word, R.A. Perkins, K.M. McFarlin, B.W. Hester, L.S. Word and C.M. Ray. 2013. The acute toxicity of chemically and physically dispersed crude oil to key Arctic species under Arctic conditions during the open water season. Environmental Toxicology and Chemistry, 32(10), pp.2284-2300.

Hansen, B.H., D. Altin, S.F. Rørvik, I.B. Øverjordet, A.J. Olsen and T. Nordtug. 2011. Comparative study on acute effects of water accommodated fractions of an artificially weathered crude oil on *Calanus finmarchicus* and *Calanus glacialis* (Crustacea: Copepoda). Science of the Total Environment, 409(4), pp.704-709.

Ozhan, K., L. Michael, L. Parsons, and S. Bargu. 2014. How were phytoplankton affected by the Deepwater Horizon Oil Spill? Bioscience. 64: 829-836.

Seuront, L. 2010. Zooplankton avoidance behaviour as a response to point sources of hydrocarbon-contaminated water. Marine and Freshwater Research. 61(3): 263-270.

Utne, K. 2017. Effects of produced water components on the early life stages of *Calanus finmarchicus* and *Calanus hyperboreus* reared at different temperatures (Master's thesis, NTNU).

1.18.2 Information Requirement: IR-94

Reference to EIS:

Section 7.3.1.3.1 Diesel Batch Spill from MODU and OSV

Context and Rationale

Section 7.3.1.3.1 of the EIS discusses the residual environmental effect on fish and fish habitat, however Fisheries and Oceans Canada has indicated that most of the analysis regarding effects of a diesel spill is focused on benthic organisms. There is little discussion in the EIS as to how a diesel spill would affect pelagic organisms.

Specific Question of Information Requirement

Discuss potential effects of a diesel spill on pelagic organisms.

Response

Diesel oil is one of the most toxic oil types due in part, to its relatively low viscosity which helps increase the bioavailability of its water-soluble fractions. Pelagic species would be at higher risk to the dispersed and dissolved water-soluble fractions of diesel.

However, adult-stage individuals are highly mobile and able to avoid oiled areas (Irwin 1997; Law et al. 1997). Larval and juvenile stage individuals are at a greater risk of exposure, being less mobile and having a higher sensitivity to hydrocarbons because of an under-developed physiology that would allow hydrocarbon metabolism (Rice 1985; Carls et al. 1999; Incardona et al. 2013; Lee et al. 2015). Various experimental studies have shown sub-lethal toxic effects of hydrocarbons on early life stages of pelagic fish (Marty et al. 1997; Peterson and Kristensen 1998; Carls et al. 1999; Heintz et al. 1999; Couillard 2002; Pollino and Holdway 2002; Colavecchi et al. 2004; Incardona et al. 2004; Hendon et al. 2008; Incardona et al. 2013).

Effects on phytoplankton and zooplankton vary by species, with mortality more dependent on exposure time (some zooplankton have been shown to avoid spills) than hydrocarbon concentration (Abbriano et al. 2011; Seuront 2010).

The characteristics of a batch fuel spill has been described in Section 7.2.1.5 of the EIS. The worst-case scenario would be a batch diesel spill occurring in the winter months. In such a scenario, winter dispersed plumes of diesel could potentially grow to widths ranging from 0.3 to 10.2 km and travel distances of 10 to 130 km from the origin prior to dissipating to concentrations of 0.1 ppm. The in-water concentration of 0.1 ppm of total petroleum hydrocarbon is the exposure concentration below which no significant biological effects are expected.

References

Abbriano, R.M., M.M Carranza, S.L. Hogle, R.A. Levin, A.N. Netburn, K.L. Seto, S.M. Snyder and P.J.S. Franks. 2011. Deepwater Horizon oil spill: A review of the planktonic response. Oceanography, 24(3): 294-301.

Carls, M.G., S.D. Rice and J.E. Hose. 1999. Sensitivity of fish embryos to weathered crude oil: Part 1. Low-level exposure during incubation causes malformations, genetic damage, and mortality in larval Pacific herring (*Clupea pallasi*). Environ. Toxicol. Chem., 18: 481-493.

Colavecchia, M.V., S.M. Backus, P.V. Hodson and J.L. Parrott. 2004. Toxicity of oil sands to early life stages of fathead minnows (*Pimephales promelas*). Environ. Toxicol. Chem., 23: 1709-1718.

Couillard, C.M.A. 2002. Microscale test to measure petroleum oil toxicity to mummichog embryos. Environ. Toxicol., 17: 195-202.

Heintz, R.A., J.W. Short and S.D. Rice. 1999. Sensitivity of fish embryos to weathered crude oil. Part 2. Environ. Toxicol. Chem., 18: 494-503.

Hendon, L.A., E.A. Carlson, S. Manning and M. Brouwer. 2008. Molecular and developmental effects of exposure to pyrene in the early life-stages of *Cyprinodon* variegatus. Comparative Biochemistry and Physiology, 147: 205-215.

Incardona, J.P., T.K. Collier and N.L. Scholz. 2004. Defects in cardiac function precede morphological abnormalities in fish embryos exposed to polycyclic aromatic hydrocarbons. Toxicol. Appl. Pharm., 196: 191-205.

Incardona, J.P., T.L. Swartsa, R.C. Edmundsa, T.L. Linboa, A. Aquilina-Becka, C.A. Sloana, L.D. Gardnerb, B.A. Blockb and N.L. Scholza. 2013. *Exxon Valdez* to Deepwater Horizon: Comparable toxicity of both crude oils to fish early life stages. Aquatic Toxicology, 142-143: 303-316.

Irwin, R.J. 1997. Environmental Contaminants Encyclopedia Crude Oil Entry. National Park Service, Water Resources Divisions, Water Operations Branch, CO.

Law, R., C. Kelly, K. Graham, R. Woodhead, P. Dyrynda and E. Dyrynda. 1997. Hydrocarbons and PAH in Fish and Shellfish from Southwest Wales following the *Sea Empress* Oil Spill in 199. Available from: http://ioscproceedings.org/doi/pdf/10.7901/2169-3358-1997-1-205.

Lee, K., M. Boufadel, B. Chen, J. Foght, P. Hodson, S. Swanson and A. Venosa. 2015. Expert Panel Report on the Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments. Royal Society of Canada, Ottawa, ON.

Marty, G.D., J.E. Hose, M.D. McGurk, E.D. Brown and D.E. Hinton. 1997. Histopathology and cytogenetic evaluation of Pacific herring larvae exposed to petroleum hydrocarbons in the laboratory or in Prince William Sound Alaska, after the *Exxon Valdez* oil spill. Can. J. Fish Aquat. Sci., 54: 1846-1857.

Petersen, G.I., and P. Kristensen. 1998. Bioaccumulation of lipophilic substances in fish early life stages. Environ. Toxicol. Chem., 17: 1385-1395.

Pollino, C.A, and D.A. Holdway. 2002. Toxicity testing of crude oil and related compounds using early life stages of the crimson-spotted rainbowfish (*Melanotaenia fluviatilis*). Ecotox. Environ. Safe., 52: 180-189.

Rice, S.D. 1985. Effects of oil on fish. Pp. 157-182. In: Engelhardt, F.R. (ed.). Petroleum Effects in the Arctic Environment, Elsevier Science Publishing Co., NY. xxiv + 282 pp.

Seuront, L. 2010. Hydrocarbon contamination decreases mating success in a marine planktonic copepod. PLoS ONE, 6(10): e26283.

1.18.3 Information Requirement: IR-95

Reference to EIS:

7.3.2.3.2 Subsea and Surface Blowout

Context and Rationale

Section 7.3.2.3.2 of the EIS indicates that in the event of unmitigated subsea or surface blowout, a slick would likely reach an active fishing area, and that fishing would likely be halted because of the possibility of fouling gear and fishing vessels. It is stated that "if the release site is some distance from snow crab fishing groups, there would be time to notify fisheries of the occurrence and prevent the setting or hauling of gear and thus prevent or reduce gear damage." However, there is no detail on the timeline for this, nor is there is a discussion of alternatives if gear can not be hauled.

Specific Question of Information Requirement

Provide information related to what 'some distance' may be defined as, if there is not a pre-determined distance, discuss the factors that would be considered when determining if gear could be hauled.

Discuss the measures to be taken if there is insufficient time, or if other factors result in gear not being able to be hauled. Discuss how this scenario would be addressed in any developed fishery compensation plans, and the effects of the spill on a target species if gear could not be retrieved.

Response

There is no set distance identified within which fixed fishing gear may be hauled in the event of an unmitigated subsea or surface blowout, since ether are many variables. Factors would include volume of oil spilled, the spill trajectory, the proximity of fishers to their gear, the proximity of fishing gear to the spill location, and the oceanographic conditions at the time.

Communication between the Husky representatives and the fishing industry will be an important mitigation measure when determining whether fishing gear is able to be hauled to avoid interactions. In the event of an incident, Husky would notify One Ocean as part of its emergency response notification process. One Ocean would then inform the fishing industry. The Indigenous Fisheries Communications Plan would outline the notification protocol for Indigenous groups. Broader issuance of Notices to Shipping and Mariners would be issued through the Canadian Coast Guard. Subsequent communication on response measures to the fishing industry would be through One Ocean.

As noted in Section 7.3.2.2 of the EIS, a compensation program is in place for fishers who may suffer losses or damage to gear and/or vessels resulting from a Project-related spill or debris. Losses and damages include loss of income, future loss of income and, with respect to any Indigenous peoples of Canada, loss of hunting, fishing, and gathering opportunities.

References

N/A

1.18.4 Information Requirement: IR-96

Reference to EIS:

7.3.1 Fish and Fish Habitat

Context and Rationale

The KMKNO expressed concerns with the indirect effects of oil spills on fish and fish habitat. Concerns included:

- Effects of oil spills on primary and secondary productivity of water bodies, which in turn may affect fish food supply; and
- Effects of an accidental event on water quality including changes to chemical composition, temperature, oceanographic conditions, etc.

Specific Question of Information Requirement

Provide an expanded discussion of the potential for contamination of fish and fish habitat following an oil spill though indirect pathways, such as decreased water and contamination in the food chain.

Response

The reviewer is referred to responses to IR 93 and IR 94 for a summary of effects of a spill on primary and secondary productivity.

Furthermore, water quality, in terms of its physical and chemical properties, may be altered within the footprint of the spill and subsequently affect primary and secondary production in the spill area. A large oil spill can have a localized short-term effect on primary production around the spill because the oil would inhibit photosynthesis. However, the nature of primary production is such that there is continuous generation of new phytoplankton and microorganisms, so as soon as the oil evaporates, dissipates or biodegrades from the surface, proximate primary production may resume. Within a season, secondary production often overlaps with areas of primary production, so would be similarly affected by a spill. Effects up the food chain are not anticipated given the duration of effects from a spill, the short generation times for primary producers, and the migratory foraging nature of most fish species. Further information on the effects of an accidental event on the chemical composition of water and primary and secondary production is addressed in EIS Section 7.3.1.3.

References

N/A

1.18.5 Information Requirement: IR-97

Reference to EIS:

Section 4.1.6 Climate Change

Context and Rationale

Section 4.1.6 of the EIS provides information on the effects of climate change on concentration of greenhouse gases in the atmosphere, increasing temperature, and an increase in sea levels, storm intensity, sea surface temperatures and the number of icebergs observed. The EIS also states an increase in the number of hurricanes and tropical storms in hitting the province of Newfoundland and Labrador. However, there is no discussion throughout the EIS regarding the influence that an increase in storm frequency and intensity may have on the potential for accidental events.

Specific Question of Information Requirement

Discuss the effect of climate change, and storm frequency and intensity and the potential for accidental events.

Response

The concept of Representative Concentration Pathways (RCPs) is used in most climate projection literature and data summaries. The RCPs are possible trajectories (but not predictions) of atmospheric greenhouse gas concentrations (not emissions) adopted by the Intergovernmental Panel on Climate Change (IPCC 2014). The IPCC considers two pathways for storm track density: the RCP4.5 pathway (intermediate mitigation, global warming less than 2.6°C, carbon dioxide (CO_2) concentration 480 to 580 ppm) and the RCP8.5 pathway (mitigation not specified, very high greenhouse gas emissions, warming less than 5°C, CO_2 concentration 750 to greater than 1,000 ppm).

The storm track density projections for the Flemish Pass, for 2081 to 2100, suggest that there would be little change under the RCP4.5 pathway. In contrast, under the RCP8.5 pathway; the storm track density is projected to be lower in 2081 to 2100, meaning that less storms are projected for that region with a likely increase in storm intensity for that period (IPCC 2014). One metric used to assess extreme weather events related to precipitation is a measurement of the precipitation that occurs over a period of five consecutive days, and the maximum value of this metric over a given time period of 10 or more years. The projected change in the maximum five-day precipitation for the North Atlantic region for 2081 to 2100, relative to 1980 to 2000, is 5% to 10% for the Intermediate Concentration Pathway and 15% to 20% for the Maximum Concentration Pathway (Collins et al. 2013).

Climate change, specifically an increase in extreme weather event intensity (i.e., storms, winds, waves, and tsunamis), has the potential to limit Project operations and activities. Although offshore infrastructure and vessels are certified to operate in extreme weather, the frequency of events could result in operational delays. Having an appropriate forecasting and monitoring program in place would help mitigate this type of risk.

The effects of severe weather can be further mitigated through:

- Careful and considered design in accordance with factors of safety, best engineering practice, and adherence with standards and codes
- Engineering design practices that will consider predictions for climate and climate change
- Inspection and maintenance programs that will reduce the deterioration of the infrastructure and will help to maintain compliance with applicable design criteria and reliability of the transmission system
- Adaptation of the Ice Management Plan

In addition to design with consideration of climate change and ongoing inspection and maintenance, as outlined in EIS Section 7.1, Husky will implement several measures and preventative actions into the daily operation and maintenance of a mobile offshore drilling unit to mitigate the risk of a spill and/or dropped equipment. For example, there will continue to be frequent maintenance, testing and inspection of all equipment, best practices evaluation, good communication, audits of facilities and regular employee training to minimize the likelihood of an accident or malfunction.

References

Collins, M., R. Knutti, J. Arblaster, J.-L. Dufresne, T. Fichefet, P. Friedlingstein, X. Gao, W.J. Gutowski, T. Johns, G. Krinner, M. Shongwe, C. Tebaldi, A.J. Weaver and M. Wehner. 2013. Long-term Climate Change: Projections, Commitments and Irreversibility. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC (Intergovernmental Panel on Climate Change). 2014. Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Intergovernmental Panel on Climate Change,

1.19 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

1.19.1 Information Requirement: IR-98

Reference to EIS:

Section 8.2.2.1 Extreme Weather Conditions

Context and Rationale

On November 16, 2018 the SeaRose production platform experienced a loss of pressure from the subsea flowline while preparing to restart production. At the time of restarting, waves were recorded at 8.4 metres. Based on data from Table 4.9 in the EIS, an 8.4 metre high wave would occur less than every 10 years in November.

Section 8.2.2.1 of the EIS details the 100-year extreme significant wave height ranges and describes how extreme weather conditions such as waves and wind may affect the Project. Section 8.2.2.1.1 states that extreme wave and wind conditions could result in suspension or delay of Project activities.

However, there is no information pertaining to specific extreme weather condition parameters (e.g. wind speed or wave height) that could affect Project activities through either suspension or delays. It is also not clear under what conditions Project activities would be modified as a result of extreme weather conditions.

Specific Question of Information Requirement

Discuss parameters for extreme weather conditions for which Project activities could be modified, suspended or delayed. Include limits for routine operations in extreme weather conditions, superstructure icing, sea ice and icebergs.

Response

The drilling rigs used offshore Newfoundland and Labrador are designed and certified to operate in the North Atlantic environment and the limits to drilling operations will vary from task to task. Design tolerances for weather and ice conditions may vary from rig to rig and will need to be assessed on a rig-specific basis. All Operators will have specific adverse weather guidelines to follow in event of hurricanes, post-tropical storms or other weather-related events. It is the responsibility of the Offshore Installation Manager to decide if the operations will continue whenever the motion limits are reached during extreme weather or based on the prevalence, thickness and track of approaching sea ice and icebergs.

References

N/A

1.19.2 Information Requirement: IR-99

Reference to EIS:

Section 8.2.2.1. Extreme Weather Conditions

Context and Rationale

Section 8.2.2.1.1 of the EIS states that in the unlikely event of a spill, extreme weather could affect spill response operations. This section also refers to Section 7.1 as this section details how delays due to weather or sea states have been included in the estimated maximum timeline for response to accidental events. However, the information as to how weather and sea states impact spill response timing does not appear to be located in this section.

On November 16, 2018, a spill event occurred at the SeaRose production facility and spill response measures had to be carried out during extreme weather.

Specific Question of Information Requirement

Taking into consideration the spill event of November 16, 2018, provide additional information on the effects of extreme weather on spill response based on the learnings from this event (e.g. limitations and delays on spill response). Provide timelines and responses and lessons learned, where applicable.

Response

Husky's Oil Spill Response Plan (OSRP) identifies the operational limitations of oil spill response countermeasures and equipment. The OSRP also identifies the parameters (e.g., oil volume spilled, environmental conditions, available resources in the field) for Tier 1 countermeasure application, including:

1. Operational safety
2. Operational integrity
3. Operational effectiveness

The OSRP's guidance considers environmental conditions (weather and sea state), oil volume on surface of sea, oil spill trajectory modelling, and oil fate and effects modelling. Weather, especially wave heights, determine when spill response measures are safe and effective, so a response to an oil spill can be delayed by weather.

Immediately after the spill occurred on November 16, 2018, Husky activated its OSRP procedures, including deployment of tracker buoys from the supply vessel *Atlantic Hawk* and from the *SeaRose FPSO* production vessel. Data from these buoys were used to develop search patterns for oil sheens and to inform wildlife and environmental monitoring. Sea states were outside operating limits for spill response and recovery equipment during the initial days following the spill.

Spill modelling was conducted during the early hours of the spill on November 16, 2018. Models were run for a much larger volume of oil than believed to have been involved in the spill (1,000 m^3 versus the 250 m^3 believed to have been spilled). This modelling indicated that there was no risk of the oil reaching land, and that more than 90% of the volume would disperse within the first 24 hours.

Daily monitoring of the spill site has been ongoing using a combination of satellite, on water, and remotely operated vehicle observations, and will continue at least until the flowline connector is recovered and the flowline plugged. There have been no sheens observed on the surface of the water since November 18, 2018.

While there were no immediate sightings of impacted wildlife, Husky made plans to activate the onshore seabird rehabilitation centre, and later opened the centre to clean several oiled seabirds. Husky has a dozen staff trained to help managed impacted birds and also engaged the services of Tristate Bird Rescue from Delaware, USA.

Post-response, Husky has revised its Wildlife Response Plan to reflect updated guidance from Environment and Climate Change Canada.

References

N/A

1.19.3 Information Requirement: IR-100

Reference to EIS:

Section 8.3.3 Sea Ice and Icebergs

Context and Rationale

On March 29, 2017 an iceberg came within 180 metres of the SeaRose production platform. CNLOPB completed a report on the incident and found that Husky did not:

- follow its Ice Management Plan, including disconnecting;
- ensure that the Ice Management Plan was followed; and
- have the order given by the Offshore Installation Manager to disconnect the production platform in accordance with the Ice Management Plan.

The CNLOPB report also identified numerous contributing factors.

The EIS does not provide information pertaining to this incident nor the changes to Husky's procedures and protocols that resulted from it.

Specific Question of Information Requirement

Describe any changes made to the Ice Management Plan and emergency response plans as a result of the March 29, 2017 incident and their applicability to the proposed Project.

Provide details related to lessons learned resulting from the incident.

Response

A comprehensive review of Husky's ice management and emergency response plans was conducted, and further improvements were made and implemented. The emergency response plan reinforces that the *SeaRose FPSO* must be disconnected if a threatening iceberg enters the 0.25 nm ice exclusion area and that there can be no exceptions.

The updated ice management plan, issued in January 2018, included:

- A new Hazard Based Emergency Response Scenario (HaBERS) was developed for threatening ice, including a threat assessment flowchart. The previous plan merged both ice management and the HaBERS for risk of collision
- Clear delineation of authority for Offshore Installation Manager and others
- New threat assessment flowchart, including when to activate Regional Response Management Team

Some research and development work started immediately after the incident in 2017 including design and fabrication of new heavy weather nets with sensors and development of a Common Operating Picture on Husky's contracted GIS software module including ice flight information, location, drift models, and pack ice drift model runs. Husky now has a dedicated ice management room onshore, which mirrors the offshore and allows for real-time monitoring of field operations. Additional research and development activity related to ice management is continuing.

All learnings from the 2017 ice near miss and subsequent updates to technology and procedures will be applied to future exploration drilling activities.

References

N/A

1.19.4 Information Requirement: IR-101

Reference to EIS:

Section 8.3.3.3 Physical Management

Context and Rationale

C-NLOPB advises that the discussion of physical measures to manage pack-ice is not appropriate in the context of a semisubmersible MODU (column-pontoon rigs) unless it is “ice-classed” in accordance with the class society rules (ex. *ABS Rules for Building and Classing Steel Vessels, Part 6 Optional Items and Systems or the ABS Guide for Building and Classing Vessels Intended for Navigation in Polar Waters*). These installations will generally depart the well site prior to the arrival of pack ice.

Specific Question of Information Requirement

Confirm if Husky intends to utilize an ice-classed MODU. If not, provide a description of sea ice management practices appropriate for semisubmersible MODUs that are not ”ice-classed”.

Response

Husky will act in accordance with its Ice Management Plan which states:

> *The MODU is moved where threat of ice coming in contact with the rig exists, when safe to do so. This is managed by utilizing the Ice management resources available for advance warning, weather forecasting and anchor handling vessel resource allocation. The T_{Time} Calculator includes not only time to secure the well and disconnect, but the time to recover mooring lines including vessel mobilization.*

References

N/A

1.19.5 Information Requirement: IR-102

Reference to EIS:

Section 8.2.1 Marine Geology - Sediment and Seafloor Instability

Context and Rationale

Section 8.2.1 of the EIS discusses slope instability, seismicity, sediment loading, venting of shallow gas, gas hydrates, seabed instabilities and ice scour; however, Natural Resources Canada advises that the importance of elevated or excess pore pressure in slope stability is not included. Examples of slope instability are provided for the Orphan Basin, Flemish Pass, and the Storegga slide in Norway on page 8.2. The connection the between Storegga slide and the proposed Project is unclear.

Specific Question of Information Requirement

Discuss the role of elevated or excess pore pressure in slope stability for the proposed Project. Clarify the applicability of the examples of slope instability at the Orphan Basin, Flemish Pass, and the Storegga slide in Norway for proposed Project.

Response

The seabed within Exploration Licences (ELs) 1151, 1152, and 1155 occurs within the low-dipping shelf region of the Grand Banks. The example areas of slope stability risk on the south side of the Orphan Basin, the northern Flemish Pass, and the Storegga slide area in Norway are not analogous to the relatively flat exploration licence area under review (approximately 0.2° to 0.5° slope angle within ELs 1151, 1152, and 1155) and therefore were referenced in error.

References

N/A

1.19.6 Information Requirement: IR-103

Reference to EIS:

Section 8.2.1 Marine Geology - Sediment and Seafloor Instability

Context and Rationale

Section 8.2.1 of the EIS discusses seafloor stability, however Natural Resources Canada advises that post slope failure where the sediment may appear to be stable has not been considered. There are numerous instances where these failures have been re-mobilized. In order to assess the slope stability, the proponent should determine the slope angle, unit weight and shear strength of the sediment at a minimum.

NRCan has provided a paper (Loloi, 2004) which presents an analysis of sediment slope instability of the southern part of the Orphan Basin for consideration.

Specific Question of Information Requirement

Discuss the probability of any re-mobilization of the slope failures and present information on the slope stability. Discuss factors including slope angle, unit weight and shear strength of the sediment expected at the proposed drilling sites.

Response

The seabed in within Exploration Licences (ELs) 1151, 1152, and 1155 occurs within the low-dipping shelf region of the Grand Banks. The example “vicinity” areas of slope stability risk on the south side of the Orphan Basin, the northern Flemish Pass, and the Storegga slide area in Norway are not analogous to the relatively flat exploration licence areas under review (approximately 0.2° to 0.5° slope angle within ELs 1151, 1152, and 1155). The Loloi (2004) study, for example, analyzed the effect of multi-degree slopes: “… the slope of the seabed in the vicinity of the core 019 is about 3°. A maximum slope angle of approximately 6° exists upslope of the core site and a range of slope angles of 1° to 6° will be used for slope stability analyses” Page 43 Loloi (2004).

References

Loloi, M. 2004. Slope Instability Analysis of a Part of Orphan Basin Off Newfoundland. PhD Thesis, Dalhousie University, Dalhousie, NS. 220 pp.

1.19.7 Information Requirement: IR-104

Reference to EIS:

Section 8.2.2.3 Seismic Events and Tsunamis

Context and Rationale

Section 8.2.2.3 of the EIS states the probability of a major seismic event or tsunami occurring during the life of the Project is considered low. Notwithstanding, there is the possibility that an earthquake or landslide outside of Canadian waters could generate a tsunami. The effects of a tsunami on the Project should be considered and discussed.

Specific Question of Information Requirement

Provide a discussion of whether long distance tsunami waves would break when they hit the relatively shallow waters on the Grand Banks and the effects this would be expected to have on the Project.

Response

Tsunamis generated by earthquakes generally originate from what is referred to as far-field sources; they are sometimes called teletsunamis. Tsunamis resulting from the deformation of the sea floor caused by an earthquake can travel far, while tsunamis generated by other mechanisms generally dissipate quickly, only affecting areas close to the source. Not all earthquakes generate tsunamis.

For Newfoundland and the Grand Banks, the most relevant far-field sources are the Azores-Gibraltar Ridge zone, the Mid-Atlantic Ridge and the north side of the Caribbean Arc. Tsunamis generated by other mechanisms generally originate from near-field sources such as the Laurentian Channel, origin of the 1929 Grand Banks tsunami.

Tsunamis are an infrequent event in Atlantic Canada. Given the historical record of probable or confirmed tsunamis in Newfoundland noted above, and the historical record of earthquakes of tsunamigenic potential in the Atlantic region, over these periods on the order of 300 to 400 years, one might therefore estimate a tsunami return period on the order of 50 to 100 years, or longer for a destructive M7.2 tsunami like the 1929 event.

The wave height of a passing tsunami offshore is small, on the order of 1 m or less and, should a tsunami occur, is not expected to be an issue for the offshore operation, particularly given the long period of the waves. Associated current speeds up to 70 cm/s could possibly be a concern for moorings and hawsers. Tsunamis Warning Systems are aimed at managing coastal risk; however, they may also provide useful mitigative information for offshore. Given the low likelihood of tsunamis occurrence and the anticipated low consequence should they occur, no tsunamis effects offshore are anticipated.

References

N/A

1.20 CUMULATIVE EFFECTS

1.20.1 Information Requirement: IR-105

Reference to EIS:

Section 9.2.5 Assessment of Cumulative Environmental Effects on Marine Mammals and Sea Turtles (including SAR and SOCC)

Context and Rationale

Section 9.2.5 of the EIS states that underwater sound may temporarily reduce, habitat availability within the study area (i.e. due to the potential for temporary avoidance of multiple areas at once) and that this may disrupt reproductive, foraging and feeding, and/or migratory behavior of marine mammals and sea turtles if the availability of important habitat areas is affected, the likelihood of this cumulative interaction is considered low given the localized nature of potential residual project effects. No further information is provided to support the statement that effects would be localized. Underwater sound can travel hundreds of kilometres.

Consideration should be given to how mapping could be used to illustrate the potential for overlapping cumulative effects on valued components as a result of several projects exerting discrete areas of influence simultaneously.

The Agency's Technical Guidance document on Assessing Cumulative Effects under CEAA 2012 (April 2017 draft) identifies methodological options for analysis of cumulative effects, including quantitative models and spatial analysis.

Specific Question of Information Requirement

Update the assessment of potential cumulative environmental effects on marine mammals using appropriate methodology (e.g. mapping, quantification and/or otherwise) taking into account:

- the spatial extent of effects from activities (e.g. noise on whales) and associated cumulative effects of creating multiple zones of avoidance in the project area;
- the spatial range of populations of marine mammals, recognizing that effects on individuals from the same population in different areas would result in cumulative effects to the species; and
- that marine mammals would be affected by multiple activities (e.g. noise from drilling units, production facilities and seismic operations, as well as vessel interactions).

Include consideration of various underwater noise sources occurring at the same time (e.g. multiple exploration units operating simultaneously, exploration drilling occurring at the same time as geophysical activities, marine shipping etc.) and associated cumulative effects on marine mammals, including how and where thresholds for behavioral modifications or injury may be exceeded. Consider the potential accessibility of unaffected corridors between areas of influence on marine mammals and provide figures to illustrate potential projects/activities and associated zones of influence (e.g. range of effects) to which they could be exposed.

Discuss the need for mitigation and monitoring or follow-up, and update predictions regarding the significance of effects accordingly.

Response

Approach to Cumulative Environmental Effects Assessment

Past and ongoing projects and activities and their environmental effects are reflected in the existing (baseline) environmental conditions that are described in EIS Chapter 4 and summarized in EIS Chapter 6 for each valued component (VC) (for the Marine Mammals and Sea Turtles VC, refer to EIS Sections 4.2.5, 4.2.6, and 6.3.8). The cumulative effects assessment (CEA) considers:

- how these existing environmental conditions may change as a result of Project-related residual environmental effects
- whether and how the residual environmental effects of other ongoing and certain or reasonably foreseeable future physical activities may affect the same VCs through direct overlap in space and time and/or by affecting the same individuals or populations

The CEA also considers mitigation measures to avoid or reduce potential cumulative environmental effects and evaluates the significance of predicted residual cumulative environmental effects on each VC.

As specified in Sections 9.1.1.3 and 9.2.2 (including Table 9.9) of the EIS, the following physical activities were considered in the CEA for each VC, as relevant:

- Geophysical survey programs
- Offshore exploration drilling and production projects
- Commercial fisheries
- Other ocean users

The spatial and temporal distributions of these activities and their associated environmental disturbances are key considerations in assessing the potential for cumulative environmental effects and the nature and characteristics of such effects. Available information on the overall spatial and temporal characteristics of these physical activities were presented and considered in the CEA (see EIS Table 9.8). Further information on potential effects of these physical activities was also presented in the VC-specific sections and tables in Chapter 9 of the EIS.

Figure 1 provides an overview of physical activities in and around the Study Area, including fixed production facilities, existing marine shipping and transit routes, and commercial fishing intensity (based on data available from Fisheries and Oceans Canada [DFO] indicating the number of fishing records in the dataset for each grid square during the period of 2012 to 2016). While the format of the data provided by DFO does not allow for a detailed, quantitative analysis of fishing intensity in the region, the mapping does provide at least a general indication of key fishing areas throughout the Study Area and their spatial relationship to planned Project activities. However, the dynamic nature of fisheries over time makes it difficult to generalize the spatial and temporal patterns of fishing activity, or whether the data reflect fishing patterns in the future, over the life of the Project.

The CEA in the EIS considered all the physical activities that are depicted on Figure 1 and listed in Table 1 to the extent that they were relevant to the VC in question, not just those that are "mappable" or for which the approximate minimum distance to Project ELs is measurable. The CEA made specific reference to the locations of other activities with known locations (other offshore oil and gas activities) and considered their relationship to the Project Area and associated ELs as part of the analyses. The CEA also considered that marine vessel traffic from fisheries, research surveys, and other activities has potential to occur throughout the Study Area, although such traffic is inherently transient and variable in occurrence.

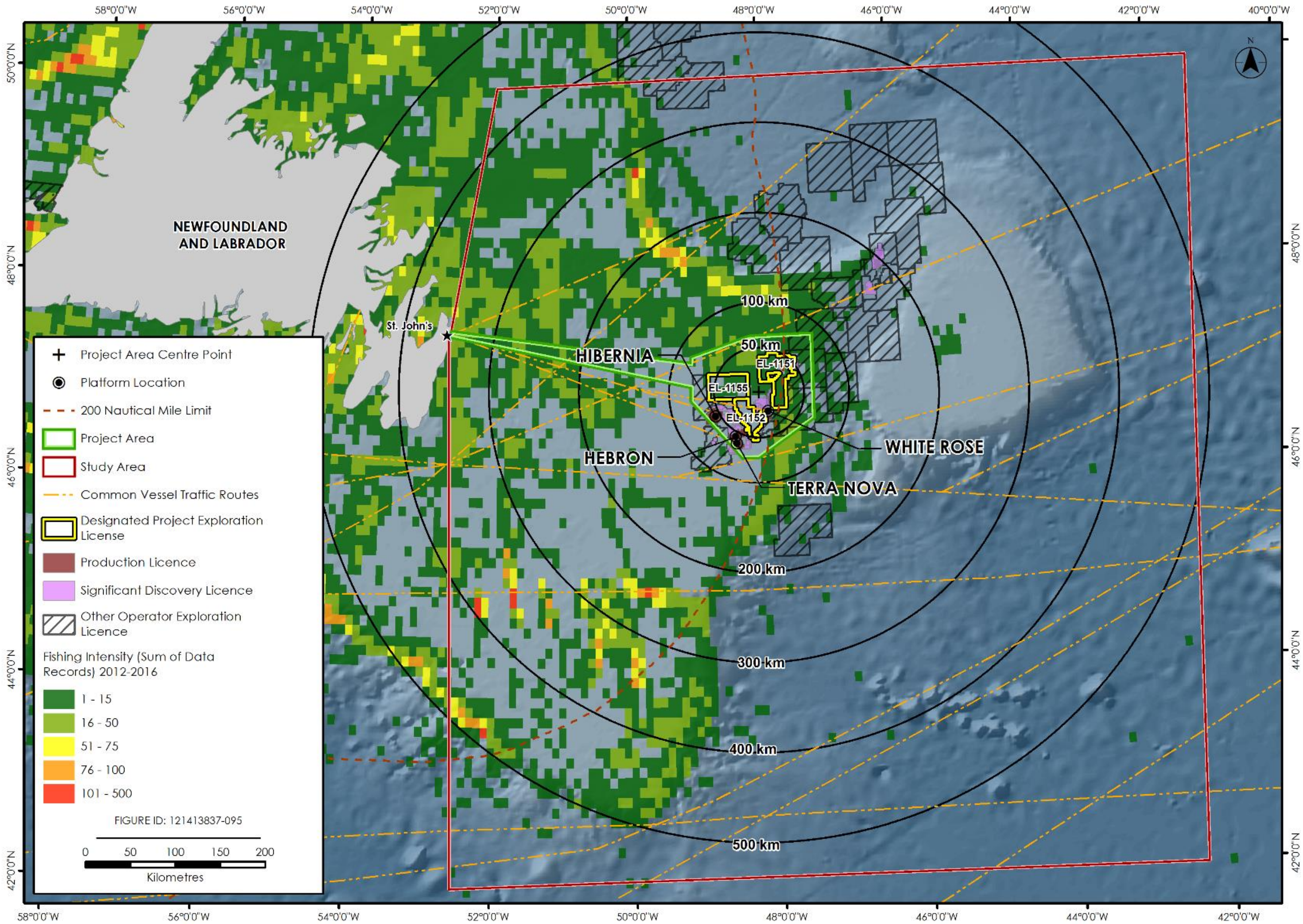


Figure 1 Some Other Physical Activities Considered in the Cumulative Effects Assessment (Including Distances from the Project Area)

Table 1 Projects and Activities Considered in the Cumulative Effects Assessment and Their Distances from the Project

Other Physical Activity	Approximate Minimum Distance to Project ELs (km)		
	EL 1155	EL 1152	EL 1151
Geophysical Survey Programs	Unknown		
Offshore Exploration Drilling Projects	Unknown		
Offshore Production Projects			
Hibernia Oilfield	18.5	22.8	62.3
Hebron Oilfield	41.4	13.2	51.8
Terra Nova Oilfield	49.0	17.1	55.7
White Rose Oilfield	25.8	5.0	6.0
Commercial Fishing Activity (medium- and high-intensity areas, as shown in yellow, orange, and red on Figure 1)	98.2	115.9	62.6
Other Marine Vessel Traffic (Common Vessel Traffic Routes identified on Figure 1)	1.5	Intersects (OSV traffic)	Intersects (OSV traffic)

As noted in Table 1, key activities that occur in the Study Area include geophysical survey programs and other offshore exploration drilling projects. However, these EAs are typically conducted intermittently over multiple years (up to 10 years), with relatively large overall project areas, so exactly location of the activity cannot be determined in advance. Exploration (seismic and drilling) programs are typically planned approximately one to two years in advance, with subsequent programs contingent on the results of the previous program. Exploration programs are also commercially sensitive, so would not be known by any outside party in advance of a public notice. The CEA therefore conservatively assumed, in all cases, that there is potential for interaction between the effects of multiple, independent projects and activities in the region.

Project-related exploration drilling activities are short-term and intermittent over eight years. Given that Husky owns many of the other licences within the Project Area and that some of the other owners of exploration and significant discovery licences are also operating production facilities, drilling activities within the Project Area may be limited by MODU availability.

As described in Section 6.3 of the EIS, routine Project activities have the potential to interact with marine mammals and sea turtles as well as their habitat. A primary pathway of effect is from underwater sound emissions produced by operation of the mobile offshore drilling unit (MODU), offshore support vessel (OSV) and helicopter transport, and drilling-associated surveys. OSV traffic also presents a risk of collision with marine mammals and sea turtles, potentially resulting in physical injury or mortality to individuals. The Project could also result in changes in availability, distribution, or quality of marine mammals' and sea turtles' prey items and/or prey habitat (refer to EIS Section 6.1 for an assessment of effects on prey species). In consideration of these potential interactions, the potential residual effects of the Project on marine mammals and sea turtles include a change in habitat quality and use, and a change in risk of mortality or physical injury. The CEA in the EIS also acknowledges that the widespread and often migratory nature of some VCs increases the likelihood that individuals of some populations may be separately exposed to the residual environmental effects of the Project and one or more other physical activities in the Study Area. Cumulative environmental effects are therefore possible even when there is limited potential for the direct "footprint" or environmental zones of influence of Project-related residual effects to overlap with those of other physical activities.

As requested, an expanded discussion of potential cumulative environmental effects on marine mammals is provided below.

Updated Assessment of Cumulative Environmental Effects on Marine Mammals

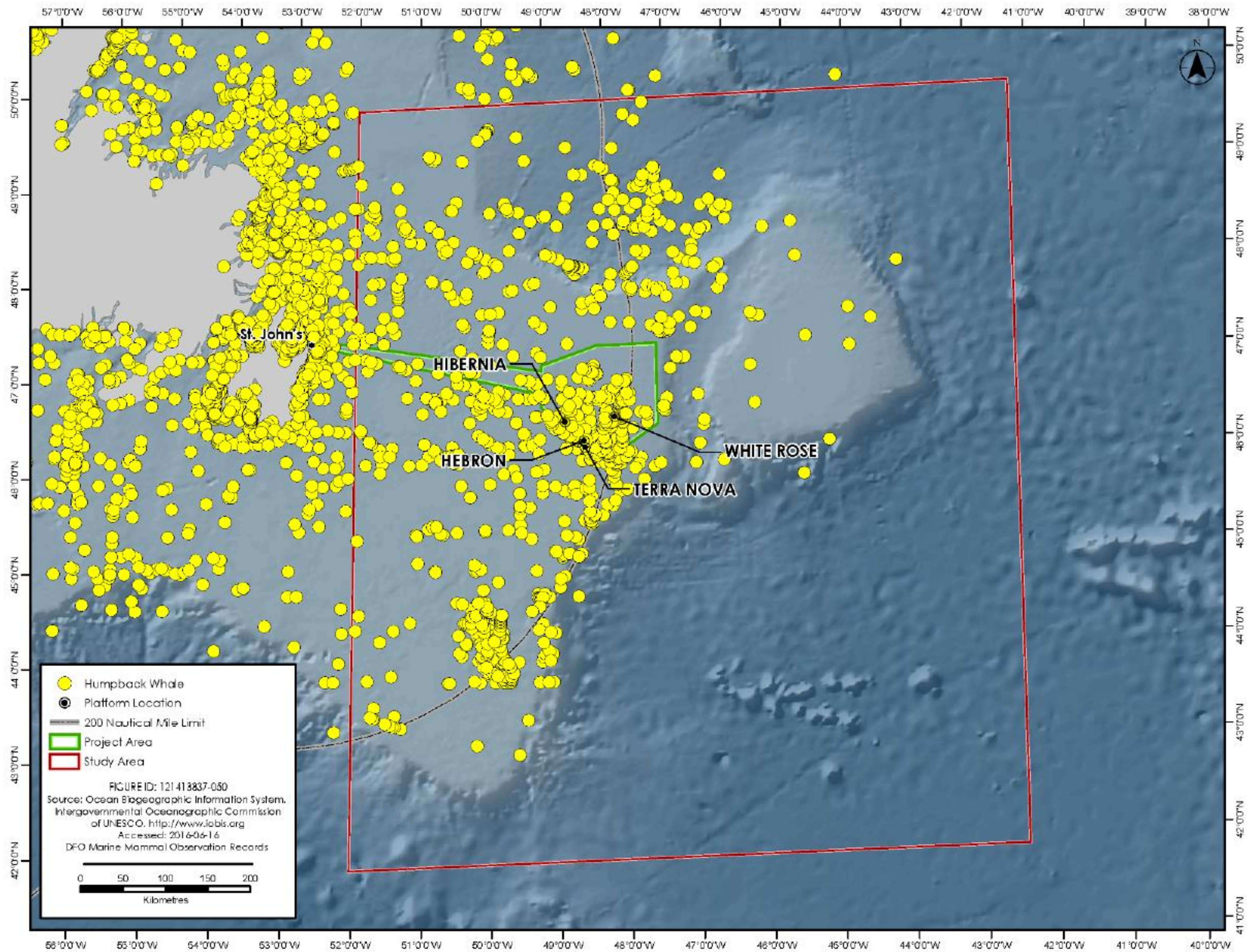
In order to assess the potential for overlapping zones of influence as recommended by the reviewer, we will rely on the very conservative thresholds for behavioural disturbance of cetaceans and pinnipeds by continuous sounds of peak sound pressure levels (SPLs) of 120 dB re 1 µPa and a threshold for auditory injury of 160 dB re 1 µPa for pulse sounds (e.g., seismic surveys and VSP) (NOAA 2015).

Results from the Scotian Basin Exploration Drilling Project's underwater noise modelling predicted that cumulative sound exposure levels (SELs) from operating drilling installations would decrease to below threshold values for potential marine mammal auditory injury at distances between 120 and 470 m from the source (Zykov 2016). Similarly, peak sound pressure levels (SPLs) were predicted to decrease to below threshold values for auditory injury at distances greater than 10 m from the operating drilling installation. For vertical seismic profiling (VSP) surveys, Zykov (2016) predicted that sound levels would decrease below peak SPL threshold values for onset of auditory injury at distances greater than 140 m for high-frequency cetaceans and at distances greater than 40 m for low- and mid-frequency cetaceans and pinnipeds. Distance to thresholds for this Project are likely shorter than those for the Scotian Basin project, due to the lack of a strong surface channel in the Project Area resulting in greater attenuation with distance. Thresholds for auditory injury are therefore localized to the immediate area of Project-related activities and unlikely to overlap given the inherent spatial separation between offshore activities.

JASCO Applied Sciences (Canada) Ltd. (JASCO) analyzed SPLs data from 20 acoustic monitors along Canada's east coast during 2015 to 2016 (Maxner et al. 2017). One of the acoustic monitoring stations (Station 18) was located within the Project Area, approximately 35 km northeast of the Hibernia production platform, in 80 m of water. SPLs at Station 18 were recorded as 110 to 120 dB re 1 µPa, continuously, likely reflecting the combined sound levels of multiple sources including drilling activities, seismic surveys, and vessel traffic. Thus, marine mammals in the Project Area are exposed to sound levels at or above the level where behaviour disruption may occur.

However, there is no indication of this level of activity and associated sound levels, causing avoidance behaviour in a common offshore marine mammal species, the humpback whale (Figure 2). In fact, observations from 2004 to 2014 clearly show an aggregation of sightings within the Project Area, near the production projects.

Since there is no indication of avoidance, unaffected corridor mapping would not indicate preferred areas.



Data Source: OBIS 2016; J. Lawson, DFO, pers. comm., 2016

Figure 2 Observation Data for Humpback Whales (2004 to 2014)

The updated information and additional analysis provided above does not materially change the results of the original CEA for marine mammals and sea turtles, as presented in the EIS. The following CEA summary and conclusion from Section 9.2.5 of the EIS generally remains valid, except in consideration of the acoustic monitoring data presented in Maxner et al. (2017), that residual cumulative effects could potentially extend beyond the Project Area if Project activities occur less than 40 km from the Project Area boundary:

> *In summary, the residual cumulative effects on marine mammals and sea turtles (i.e., change in risk of mortality or physical injury and change in habitat quality and use) are predicted to be low to moderate in magnitude, limited in extent to the Project Area, short- to medium-term in duration, reversible, sporadic to regular in frequency, and will occur in a context of moderate disturbance.*
>
> *In consideration of the various physical activities that have been, are being, and will be carried out in the Study Area, the Project is expected to result in a relatively small, incremental increase in cumulative residual environmental effects on marine mammals and sea turtles in comparison with the future scenario without the Project. With the application of proposed Project-related mitigation and environmental protection measures, residual cumulative environmental effects on marine mammals and sea turtles are predicted to be not significant. This conclusion has been determined with a moderate level of confidence based on a limited understanding of the effects of introduced underwater sound on sea turtles and marine mammals (particularly with respect to species-specific behavioural effects), but a reasonable understanding of the general effects of exploration drilling and drilling-associated surveys on marine mammals and the effectiveness of mitigation measures. No additional mitigation measures are proposed to mitigate potential cumulative environmental effects on marine mammals and sea turtles. Given the nature of the Project (i.e., exploration drilling), and the existing knowledge of potential cumulative environmental effects related to this type of activity gained through existing literature, no additional monitoring and follow-up requirem*ents are proposed for marine mammals and sea turtles.

References

Government of Canada. 2012. *Canadian Environmental Assessment Act, 2012*. S.C. 2012, c.19, s. 52. Published by the Minister of Justice. Current to April 24, 2018. Last Amended June 22, 2017. Available online: http://laws-lois.justice.gc.ca/PDF/C-15.21.pdf.

Maxner, E., B. Martin and K. Kowarski. 2017. Marine Mammals and Ambient Sound Sources in the Flemish Pass: Analysis from 2014 and 2015 Acoustic Recordings. Document 01456, Version 1.0. Technical report by JASCO Applied Sciences for Statoil Canada Ltd.

NOAA (National Oceanic and Atmospheric Administration). 2015. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. In: National Oceanic and Atmospheric Administration and U.S. Department of Commerce. Revised version for Second Public Comment Period. 180 pp. Available at: http://www.nmfs.noaa.gov/pr/acoustics/draft%20acoustic%20guidance%20July%202015.pdf.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. Document Number JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd. Available at: http://www.ceaa.gc.ca/050/documents/p80109/116305E.pdf.

1.20.2 Information Requirement: IR-106

Reference to EIS:

Section 9.23 Assessment of Cumulative Environmental Effects on Fish and Fish Habitat (including SAR and SOCC)

Context and Rationale

Section 9.23 of the EIS concludes that the residual cumulative environmental effects on fish and fish habitat are predicted to be not significant and that the conclusion has been determined with a high level of confidence based on an understanding of the general environmental effects of exploration drilling and other physical activities in the study area, as well as the effectiveness of standard mitigation measures. Fisheries and Oceans Canada has advised that no analysis is provided to support this statement.

Several Indigenous groups, Premiere Nation des Innus de Nutashkuan, Conseil des Innus de Ekuanitshit, and Elsipogtog First Nation, expressed concern related to the cumulative effects of the Project on fish and fish habitat, in particular the cumulative effects associated with sediment contamination from multiple projects.

Specific Question of Information Requirement

Provide an updated analysis to support the conclusion that the residual cumulative environmental effects on fish and fish habitat are predicted to be not significant and that the conclusion has been determined with a high level of confidence.

Response

As summarized below, a high level of confidence is possible in the prediction of cumulative environmental effects on fish and fish habitat because of the degree of related research and monitoring that has been conducted.

Section 9.2.3 of the EIS included over three pages of analysis regarding the potential for underwater sound emissions and routine discharges from the Project to interact with the residual effects of other physical activities in the Study Area and contribute to a cumulative change in risk of mortality or physical injury and/or a cumulative change in habitat quality and use affecting marine fish and fish habitat. This included the following analysis of the results of Project-specific drill waste dispersion modelling:

> *The deposition of Project-related drill muds and cuttings may smother marine benthos within a localized area around the wellhead. Although drill waste dispersion modelling results (Section 2.6.1.1 [of the EIS]) indicate that dispersed sediment from Project-related discharge of drill muds and cuttings may extend up to a maximum distance of 12 km from the release site (at a deposition thickness of 0.1 mm), cuttings thicknesses are expected to remain below 1 mm at distances beyond approximately 200 to 250 m from the Project drill centres. This sediment thickness is well below the 9.6 mm threshold (Neff et al. 2004) for average burial depth at which there will likely be no net adverse effects to benthic organisms attributable to sedimentation. Similar radii for benthic smothering are expected around each well. These affected areas from different drilling projects will not likely overlap spatially but could result in additive effects for benthic fish species in the Project Area, thereby potentially contributing to a cumulative change in risk of mortality or physical injury.*
>
> *The predicted 200 to 250 m radius in which sediment thicknesses of ≥ 1 mm may occur is within the safety zone around the MODU. Other third-party physical activities are excluded within this safety zone, thereby limiting potential cumulative interactions between Project-related drill muds and cuttings. Project-related discharges of drill muds and cuttings will be at such low water column concentrations outside of the safety zone that any potential*

cumulative change in habitat quality and use caused by interaction with the discharges of other physical activities would be negligible. It is similarly expected that any potential cumulative change in habitat quality and use caused by interaction between Project-related drill waste discharges and the sediments temporarily suspended during commercial fishing activity outside of the safety zone would be negligible based on the localized nature and duration of the activity.

In considering the residual cumulative environmental effects on fish and fish habitat, it is important to consider that the Project Area is approximately 19,366 km^2. The southern boundary of the project area is approximately 180 km long; the northern boundary is approximately 140 km long; and each side is approximately 95 km long. Husky is proposing 10 wells over this area in 8 years. Given that Husky owns many of the other licences within the Project Area and that the other owners of exploration and significant discovery licences are also operating production facilities, drilling activities within the Project Area may be limited by mobile offshore drilling unit availability. Development projects like Hibernia, Hebron, Terra Nova, and White Rose will continue to contribute the majority of wells in this Project Area, but because they are drilled from drill centres or fixed platforms, the footprint of wells overlap.

As noted in Section 6.1.12 of the EIS, to date, Husky has conducted seven post-drilling environmental effects monitoring (EEM) programs since 2004, with results compared to baseline data collected in 2000 and 2001. The EEM program includes sediment, water, and biological (commercial finfish and invertebrate species) components. The environmental effects from exploratory drilling are well understood with nine environmental assessments completed in six years and numerous publications to assess environmental effects from similar drilling activities.

The environmental changes associated with the discharge of drill muds and cuttings are detectable during the earlier phases of drilling within a localized area (e.g., within a 500-m radius), but these effects subside with time, generally one to four years (Bakke et al. 1986; Hurley and Ellis 2004; Renaud et al. 2008; Bakke et al. 2011; Bakke et al. 2013). Given the distances between the Project and other third-party physical activities occurring in the offshore, Project-related discharge footprints will not overlap. While it is acknowledged that each production or exploration well is contributing to a localized effect on marine fish habitat, each of these the environmental effects are reversible, once drilling ceases.

As indicated in Section 9.2.3 of the EIS, routine discharges from the Project and from other third-party physical activities will comply with the requirements of the Offshore Waste Treatment Guidelines (National Energy Board et al. 2010) and/or the International Convention for the Prevention of Pollution from Ships (MARPOL) (as applicable), at levels that are intended to be protective of the marine environment, including fish and fish habitat.

Considering the scale of the Project Area in relation to the potential effects associated with drilling activities on fish and fish habitat, the following CEA summary and conclusion from Section 9.2.3 of the EIS remains valid:

In summary, the residual cumulative environmental effects on fish and fish habitat (i.e., change in risk of mortality or physical injury and change in habitat quality and use) are generally predicted to be low to moderate in magnitude, limited in extent to the Project Area (for change in risk of mortality or physical injury) or Study Area (for change in habitat quality and use), short- to medium-term in duration, reversible, sporadic to regular in frequency, and to occur in a context of moderate disturbance. A cumulative change in risk of mortality or physical injury associated with underwater sound is also considered unlikely to occur from the varying spatial and temporal scale of drilling associated surveys. The cumulative change in risk of mortality or physical injury associated with the deposition of Project-related drill muds and cuttings is predicted to be primarily limited to the wellsite and Project Area and to be short-term in duration. The cumulative change in habitat quality and use associated with the deposition of Project-related drill muds and cuttings is predicted to be primarily limited to the wellsite and Project Area.

In consideration of the various physical activities that have been, are being, and will be carried out in the Study Area, the Project is expected to result in a relatively small, incremental increase in cumulative residual environmental effects on fish and fish habitat in comparison with the future scenario without the Project. With the application of proposed Project-related mitigation and environmental protection measures, the residual cumulative environmental effects on fish and fish habitat are predicted to be not significant. This conclusion has been determined with a high level of confidence based on an understanding of the general environmental effects of exploration drilling and other physical activities in the Study Area, as well as the effectiveness of standard mitigation measures. No additional mitigation measures are proposed to mitigate potential cumulative environmental effects on fish and fish habitat. Given the high level of confidence, the nature of the Project (i.e., exploration drilling), and the existing knowledge of potential cumulative environmental effects related to this type of activity gained through existing EEM and existing literature, no additional monitoring and follow-up requirements are proposed for fish and fish habitat.

References

Bakke, T., A.M.V. Green and P.E. Iversen. 2011. Offshore environmental monitoring in Norway: Regulations, results and developments (Chapter 25). In: K. Lee and J. Neff (eds). Produced Water, Springer, NY.

Bakke, T., N.W. Green, K. Næs and A. Pedersen. 1986. Drill cuttings on the sea bed: phase 1 and 2. Field experiments on benthic recolonization and chemical changes in response to various types and amounts of cuttings. In: SFT/Statfjord Unit Joint Research Project Symposium, 24-26 February 2006, Trondheim, Norway.

Bakke, T., J. Klungsøyr and S. Sanni. 2013. Environmental impacts of produced water and drilling waste discharges from the Norwegian offshore petroleum industry. Marine Environmental Research, 92: 1154-169.

Hurley, G. and J. Ellis. 2004. Environmental Effects of Exploratory Drilling in Offshore Canada: Environmental Effects Monitoring Data and Literature Review-Final Report. Prepared for the Canadian Environmental Assessment Agency-Regulatory Advisory Committee. 61 pp. + App.

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2010. Offshore Waste Treatment Guidelines. vi + 28 pp. Available at: https://www.cnsopb.ns.ca/pdfs/owtg_redraft.pdf.

Neff, J.M., G. Kjeilen-Eilersten, H. Trannum, R. Jak, M. Smit and G. Durell. 2004. Literature Report on Burial: Derivation of PNEC as Component in the MEMW Model Tool. ERMS Report No. 9B. AM 2004/024. 25 pp.

Renaud, P.E., T. Jensen, I. Wassbotten, H.P. Mannvik and H. Botnen. 2008. Offshore Sediment Monitoring on the Norwegian Shelf-A Regional Approach 1996-2006. Akvaplan-Niva, Tromsø, Norway. Report 3487-003. Available at: https://www.norskoljeoggass.no/contentassets/fe1ce15cf7364de5af76231b9d13e57d/miljooverva king-av-offshorevirksomheten---regional-sedimentovervaking-1996-2006.pdf.

1.20.3 Information Requirement: IR-107

Reference to EIS:

Section 9.2.1.2 Offshore Exploration Drilling and Production Projects; Table 9.4 Potential Residual Effects Associated with Offshore Exploration Drilling and Production Projects in the Study Area

Context and Rationale

Environment and Climate Change Canada has advised that it is important to acknowledge that in addition to migratory birds being attracted to offshore exploration and production facilities, the cumulative effects of artificial light have created a significant footprint[1] in the offshore which did not exist a few decades ago. The deterioration of the physical offshore environment due to light pollution needs to be considered beyond the immediate vicinity of each individual installation. The addition of the Project's exploration drilling MODUs will contribute to the overall footprint of projects in the Newfoundland and Labrador offshore that produce artificial light that attract migratory birds. More specifically, the cumulative impact of multiple artificial light footprints in a previously pristine environment needs to be taken into account, particularly with respect to how this may be altering the behaviour of nocturnal species (e.g. millions of Leach's Storm-petrels that regularly forage in and migrate through the area).

Consideration should be given to how mapping could be used to illustrate the potential for overlapping cumulative effects on valued components as a result of several projects exerting discrete areas of influence simultaneously.

[1]Reference: Cizano, P., Falchi, F., and Elvidge, C.D. (2001). The first World Atlas of the artificial night sky brightness. *Monthly Notices of the Royal Astronomical Society*. 328(3): 689-707.

Specific Question of Information Requirement

Taking into account the information provided by Environment and Climate Change Canada related to cumulative effects of artificial light, update the assessment of potential cumulative environmental effects on migratory birds with how the presence of the new MODUs and other support vessels in the project area will contribute to the overall amount of artificial light currently present in the offshore, and how this increase could impact migratory birds.

Identify mitigation measures and monitoring or follow-up if needed, and update predictions regarding the significance of effects accordingly.

Response

As noted by Environment and Climate Change Canada (ECCC), the addition of artificial night lighting from the Project's mobile offshore drilling unit (MODU) and offshore support vessels (OSVs) will contribute to the overall footprint of light pollution from projects in the Newfoundland and Labrador offshore area. The Project's contribution to the cumulative increase artificial lighting from multiple sources is considered in the following excerpt from Section 9.2.6 of the EIS (Assessment of Cumulative Environmental Effects on Migratory Birds):

> *Artificial night lighting associated with the Project will contribute to the total amount of night lighting from various sources in the Study Area, including lighting on survey and support vessels, OSVs and facilities for offshore exploration drilling and production projects, fishing vessels, and the vessels of other ocean users. Each of these sources of artificial night lighting can attract and/or disorient migratory birds, thereby resulting in a cumulative change in risk of mortality or physical injury due to potential stranding and increased opportunities for predation, collisions, exposure to vessel-based threats, and emissions. Limited flaring by the MODU during Project activities (e.g., well testing) may similarly attract migratory birds and result in increased mortality due to the lighting-related hazards*

identified above, as well as the risk of incineration. Project-related flaring will contribute to the bird mortality risk already associated with flaring from other offshore exploration drilling and production projects.

Routine checks for stranded birds on the MODU and OSVs and appropriate procedures for release (i.e., the protocol outlined in Best Practices for Stranded Birds Encountered Offshore Atlantic Canada *[Environment Canada 2015]* and* The Leach's Storm Petrel: General Information and Handling Instructions *[Williams and Chardine 1999])* will be implemented to mitigate the environmental effects of Project-related artificial night lighting and flaring on birds. Lighting on Project infrastructure is used as required to comply with regulations and to ensure worker safety. Flaring will only be undertaken during the Project as necessary to characterize the well potential and maintain safe operations and will be carried out in accordance with C-NLOPB Drilling and Production Guidelines. Project lighting and flaring (conducted for approximately two wells within the Project Area taking between 1.5 and 2 days) will represent only a small increase over existing levels of lighting and flaring in the Study Area, will be temporary and localized, and will occur by licence areas from other light sources. Residual lighting and flaring effects of the Project are therefore not anticipated to contribute to those of other third-party physical activities within the Study Area in such a way that causes a substantive cumulative increase in mortality or injury affecting migratory birds.*

*Procedures now updated *ECCC (Environment and Climate Change Canada). 2016. Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada*

In addition to the potential cumulative change in risk of mortality or physical injury that is considered in Section 9.2.6 of the EIS and above, Project-related artificial night lighting also has potential to contribute to a cumulative change in habitat quality and use for migratory birds. Some migratory bird species may be attracted to artificial night lighting associated with the Project and other physical activities, while other species may be deterred (e.g., ducks and other birds that prefer to sleep at night). Sensory disturbance from artificial night lighting may cause behavioural responses such as temporary changes in activity state (e.g., feeding, resting, or travelling). Migratory bird species that are attracted to artificial night lighting from projects and activities in the Study Area may subsequently be exposed to additional sources of sensory disturbance related to those projects and activities (e.g., atmospheric sound, underwater sound, routine discharges and emissions) that elicit behavioural responses. The cumulative environmental effects of Project-related artificial night lighting in combination with the artificial night lighting associated with other physical activities may therefore include a temporary reduction in the amount or quality of habitat available within the Study Area (i.e., due to avoidance of multiple areas at once or attraction to areas that are subject to various sensory disturbances or otherwise degraded habitat quality).

There may be some benefit to the aggregated spatial grouping of the Project with existing offshore production facilities in the Project Area. Although the widespread and migratory nature of many marine bird species increases the potential for individuals and populations to be exposed to various sources of artificial lighting from multiple physical activities, these mobile species likewise have capability for avoidance, and individuals could elect to avoid or pass through this area during periods of disturbance. No protected or critical habitat for migratory birds has been designated in the Project Area or Study Area. The Project Area represents a very small percentage of the vast ranges of most migratory bird species expected in the area. Many species show large annual migrations and the composition of individual birds in the area (and thus their availability for exposure to cumulative sources of artificial lighting) is expected to change seasonally and even daily.

ECCC also noted that artificial lighting from various sources has cumulatively created a substantial "footprint" of artificial night lighting in the Newfoundland and Labrador offshore area that did not exist prior to the introduction of human activities in that area. This is consistent with the findings of Cinzano et al. (2001), who used radiance-calibrated high-resolution satellite data from the United States Air Force Defence Meteorological Satellite Program (DMSP) Operational Linescan System (OLS) and modelled light propagation in the atmosphere to develop a "World Atlas" of the zenith artificial night sky brightness at sea level. The DMPSP-OLS satellite data that was used by Cinzano et al. (2001) recorded artificial lighting in areas where offshore oil and gas production projects are active. The resultant Atlas illustrates the spatial distribution of artificial night sky brightness from anthropogenic sources and led Cinzano et al. (2001) to conclude that light pollution is a global-scale problem affecting nearly every country. The Atlas also reveals detectable artificial brightness levels from the outward propagation of light pollution in many areas that were previously believed to be unpolluted because they appear completely dark in night-time satellite images (Cinzano et al. 2001).

Although the cumulative impact of multiple footprints of artificial night lighting certainly needs to be considered, it would be inaccurate to suggest that the additional footprint of artificial night lighting associated with the Project will be introduced to a previously pristine environment. Rather, it will occur in a context of moderate disturbance and represent only a small, incremental increase in artificial lighting in the Project Area that is temporary (short-term in duration for flaring and medium-term in duration for artificial night lighting), localized (lighting attraction effects are anticipated to be confined to within approximately 5 km [Poot et al. 2008] to 16 km [Rodríguez et al. 2014, 2015] of the source), and reversible. However, offshore exploration drilling and production projects are not the only sources of artificial night lighting in the offshore environment. For example, Cinzano et al. (2001) identified fishing fleets as another offshore source of the artificial night lighting recorded in the DMSP-OLS satellite data. Project-related artificial night lighting is therefore not anticipated to substantially increase the total spatial extent or footprint of artificial night lighting in the Study Area. Since there are many mobile sources of artificial light from cargo and fishing vessel traffic to consider alongside the short duration of exploration drilling, a static map may would only be a snapshot into the assessment of potential overlapping cumulative effects.

The additional analysis provided above does not materially change the results of the original cumulative effects assessment (CEA) for migratory birds, as presented in the EIS. The CEA summary and conclusion from Section 9.2.6 of the EIS generally remains valid. As noted in response to IR-109, in recognition of the importance of properly and systematically documenting and reporting any stranded birds (or bird mortalities) to Canadian Wildlife Service (CWS) during the drilling program, and to reduce the potential for operator error in implementation of the Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada, Husky will consult with CWS prior to the commencement of Project activities to confirm Project-specific monitoring, documentation, and reporting requirements. No other additional mitigation measures or monitoring or follow-up are proposed.

References

Cinzano, P., F. Falchi and C.D. Elvidge. 2001. The first World Atlas of the artificial night sky brightness. Monthly Notices of the Royal Astronomical Society, 328(3): 689-707.

ECCC (Environment and Climate Change Canada). 2016. Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada. Available at: https://www.cnlopb.ca/wp-content/uploads/mkiasseis/bestpracbird.pdf.

Environment Canada. 2015. Best Practices for Stranded Birds Encountered Offshore Atlantic Canada. Available at: https://www.cnlopb.ca/wp-content/uploads/mg3/strandbird.pdf.

Poot, H., B. Ens, H. de Vries, M. Donners, M. Wernand and J. Marquenie. 2008. Green light for nocturnally migrating birds. Ecology and Society, 13(2).

Rodríguez, A., G. Burgan, P. Dann, R. Jessop, J.J. Negro and A. Chiaradia. 2014. Fatal attraction of short-tailed shearwaters to artificial lights. PLoS ONE 9(10): e110114.doi:10.1371/journal.pone.0110114

Rodríguez, A., B. Rodriguez and J.J. Negro. 2015. GPS tracking for mapping seabird mortality induced by light pollution. Sci. Rep., 5, 10670; doi: 10.1038/srep10670.

Williams, U. and J. Chardine. 1999. The Leach's Storm Petrel: General Information and Handling Instructions. 4 pp. Available at: https://www.cnlopb.ca/wp-content/uploads/whiterose/stormpetmig.pdf.

1.20.4 Information Requirement: IR-108

Reference to EIS:

Section 9.2.6 Assessment of Cumulative Environmental Effects on Migratory Birds (including SAR and SOCC)

Context and Rationale

Section 9.2.6 of the EIS provides an assessment of the cumulative environmental effects of the Project on Migratory Birds, including SAR and SOCC. With respect to the analysis, WNNB indicated that potential changes or alterations to seasonal migration routes were not considered in the EIS. WNNB indicated that birds use a variety of sensory and environmental cues during migration and can be impacted by changes to visual, auditory or olfactory cues (Newton 2008). As such, the numerous existing offshore projects in the project area, along with additional Project-related MODU and drilling activities, have the potential to interfere with these cues. Altered or disturbed migration routes can impact migratory bird populations.

Specific Question of Information Requirement

Discuss the potential cumulative environmental effects of the Project on migratory birds, with respect to how migration routes could be altered or disturbed of birds travelling through the study area.

Response

Several species of migratory birds have potential to occur in the Study Area during migration (refer to Section 4.2.7 of the EIS). As noted by the reviewer, birds use a variety of sensory and environmental cues during migration and can be impacted by changes to visual, auditory, or olfactory cues (Newton 2007). The Project and various third-party physical activities in the Study Area introduce sources of sensory disturbance such as the presence of vessels, aircraft, and offshore infrastructure (e.g., oil and gas exploration drilling and production platforms) and associated artificial night lighting, atmospheric sound emissions, air emissions, and routine operational discharges. These sources of sensory disturbance may contribute to a cumulative change in habitat quality and use for migratory birds. Interactions with migratory birds are anticipated to be confined to within approximately 5 km (Poot et al. 2008) to 16 m (Rodríguez et al. 2014, 2015) of the source for lighting attraction effects. Effects associated with operational discharges and vessel and aircraft traffic are more localized (Rojek et al. 2007; Hoang 2013).

In considering potential cumulative effects, we must consider that the Hibernia, Terra Nova, White Rose and Hebron development projects are within the Project Area, so there is potential for multiple influences on migrating birds. However, the distance between projects will allow birds to pass between projects without being influenced, if they so choose. For example, the *SeaRose FPSO* is approximately 50 km from each of the other projects. The total Project Area is approximately 19,366 km^2. The southern boundary of the project area is approximately 180 km long; the northern boundary is approximately 140 km long; and each side is approximately 95 km long.

Section 9.2.6 of the EIS (Assessment of Cumulative Environmental Effects on Migratory Birds) considers how artificial lighting will contribute to the total amount of night lighting from various sources in the Study Area, and how each of these sources of artificial night lighting can attract and/or disorient migratory birds. The response to IR-107 further considers how the residual effects associated with artificial night lighting from Project and non-Project sources may interact to cause a cumulative change in habitat quality and use for migratory birds in the Study Area. The potential for occurrence of such a cumulative effect is considered low and the magnitude of such a cumulative effect would be predicted to be low if it did occur, given that the residual effects of Project-related artificial night lighting are anticipated to be very short-term, localized, and reversible.

The CEA summary and conclusion from Section 9.2.6 of the EIS remains valid.

References

Hoang, T. 2013. A Literature Review of the Effects of Aircraft Disturbances on Seabirds, Shorebirds and Marine Mammals. Report Presented to NOAA, Greater Farallones National Marine Sanctuary and The Seabird Protection Network, August 2013.

Newton, I. 2007. The Migration Ecology of Birds. Elsevier Ltd. 984 pp.

Poot, H., B. Ens, H. de Vries, M. Donners, M. Wernand and J. Marquenie. 2008. Green light for nocturnally migrating birds. Ecology and Society, 13(2).

Rodríguez, A., G. Burgan, P. Dann, R. Jessop, J.J. Negro and A. Chiaradia. 2014. Fatal attraction of short-tailed shearwaters to artificial lights. PLoS ONE 9(10): e110114.doi:10.1371/journal.pone.0110114

Rodríguez, A., B. Rodriguez and J.J. Negro. 2015. GPS tracking for mapping seabird mortality induced by light pollution. Sci. Rep., 5, 10670; doi: 10.1038/srep10670.

Rojek, N.A, M.W. Parker, H.R. Carter and G.J. McChesney. 2007. Aircraft and vessel disturbances to Common Murres *Uria aalge* at breeding colonies in Central California, 1997-1999. Marine Ornithology, 35: 61-69.

1.20.5 Information Requirement: IR-109

Reference to EIS:

Section 9.2.6 Assessment of Cumulative Environmental Effects on Migratory Birds (including SAR and SOCC)

Context and Rationale

Section 9.2.6 of the EIS states that "in consideration of the various physical activities that have been, are being, and will be carried out in the study area, the Project is expected to result in a relatively small, incremental increase in cumulative residual environmental effects on migratory birds in comparison with the future scenario without the Project. With the application of proposed Project-related mitigation and environmental protection measures, residual cumulative effects on migratory birds are predicted to be not significant. This conclusion has been determined with a high level of confidence based on an understanding of the general environmental effects of exploration drilling and other third party activities in the study area, as well as the effectiveness of standard mitigation measures." Evidence regarding the effectiveness of mitigation measures has not been provided.

Specific Question of Information Requirement

Provide a rationale supporting the appropriateness of the selected mitigation measures, or identify a broader range of potential mitigation measures to address potential cumulative effects on birds.

Response

Section 6.4.10.2 of the EIS identifies the following mitigation measures that will be employed to reduce the potential environmental effects of the Project on migratory birds:

- Lighting on the mobile offshore drilling unit (MODU) is designed to comply with requirements stipulated in the *Petroleum Occupational Safety and Health Regulations* to provide safe operations. There is no extraneous lighting. All lighting except navigational lighting is pointed downward.
- The frequency and duration of flaring events will be restricted to the amount necessary to characterize the well potential (i.e., drill stem test) and as required to maintain safe operations. Flaring will occur in accordance with the Drilling and Production Guidelines (Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB)) and Canada-Nova Scotia Offshore Petroleum Board 2017), which requires a drillstem test not to begin at night. A high-pressure spray of seawater between the MODU and the flare is routinely used as a heat dissipating curtain which presumably will also act as a deterrent to seabirds in the area.
- Daily checks for stranded birds will be conducted on the MODU and offshore supply vessels (OSVs) and appropriate procedures for release will be implemented. If stranded birds are found during inspections, they will be handled using the protocol outlined in *Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada* (Environment and Climate Change Canada (ECCC) 2016) and those included in the associated permit from Canadian Wildlife Service (CWS). Activities will comply with the requirements for documenting and reporting any stranded birds (or bird mortalities) to CWS during the drilling program.
- A ramp-up procedure (i.e., gradually increasing seismic source elements over a period of approximately 30 minutes until the operating level is achieved) will be implemented before any wellsite and vertical seismic profiling activity begins.
- Refer to the waste management mitigation measures identified in the fish and fish habitat VC (EIS Section 6.1.10.2).

Specifically, with respect to potential cumulative environmental effects, Section 9.2.6 of the EIS indicates that routine checks for stranded birds on the MODU and OSVs and appropriate procedures for release will be implemented to mitigate the environmental effects of Project-related artificial night lighting and flaring on birds. Lighting on Project infrastructure is used as required to comply with regulations and to ensure worker safety. Flaring will only be undertaken during the Project as necessary to characterize the well potential and maintain safe operations and will be carried out in accordance with C-NLOPB Drilling and Production Guidelines. Project lighting and flaring (conducted for approximately two wells within the Project Area taking between 1.5 and 2 days) will represent only a small increase over existing levels of lighting and flaring in the Study Area, will be temporary and localized, and will occur by licence in areas typically away from other light sources. Residual lighting and flaring effects of the Project are therefore not anticipated to contribute to those of other third-party physical activities within the Study Area in such a way that causes a substantive cumulative increase in mortality or injury affecting migratory birds.

Daily monitoring for the presence of marine birds form the drilling installation using trained observers following ECCC's *Eastern Canada Seabird at Sea Standardized Protocol for Pelagic Seabird Surveys from Moving and Stationary Platforms* (Gjerdrum et al. 2012) will help determine the effectiveness of these mitigation measures.

References

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) and (Canada-Nova Scotia Offshore Petroleum Board). 2017. Drilling and Production Guidelines. 124 pp. Available at: https://www.cnsopb.ns.ca/publications/drilling-and-production-guidelines.

ECCC (Environment and Climate Change Canada). 2016. Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada. Available at: https://www.cnlopb.ca/wp-content/uploads/mkiasseis/bestpracbird.pdf.

Gjerdrum, C., D.A. Fifield and S.I. Wilhelm. 2012. Eastern Canada Seabirds at Sea (ECSAS) standardized protocol for pelagic seabird surveys from moving and stationary platforms. Canadian Wildlife Service Technical Report Series No. 515 (Atlantic Region): vi + 37 pp.

1.20.6 Information Requirement: IR-110

Reference to EIS

Section 6.2.10.1.1 Change in Availability of Fisheries Resources

Context and Rationale

Section 6.2.10.1.1 identifies multiple pathways of effects on commercial fisheries including underwater sound, water and sediment quality and use of explosive charges; however, there is no information provided on cumulative effects predictions in section 9.2.4 of these effects pathways.

Specific Question of Information Requirement

Discuss the potential cumulative effects on commercial fisheries from underwater sound, water and sediment quality and use of explosive charges.

Response

As described in Section 6.2.10.1.1 of the EIS, a change in availability of fisheries resources for commercial fisheries may occur as a result of:

- the presence and operation of the mobile offshore drilling unit (due to fisheries exclusion within the safety zone and the generation of underwater sound emissions that have potential to affect commercially fished species)
- the discharge of drill muds and cuttings (due to potential effects on water and sediment quality and associated potential effects on commercially fished species)
- drilling-associated surveys (due to the generation of underwater sound emissions that have potential to affect commercially fished species)
- waste management (due to potential effects on water and sediment quality and associated potential effects on commercially fished species)
- supply and servicing operations (due to the generation of underwater sound emissions that have potential to affect commercially fished species)
- well abandonment (due to the potential use of shaped charges and their associated potential effects on commercially fished species)

Section 6.2.10.1.1 of the EIS also indicates that damage to fishing gear, and the resulting economic effects from loss of catch, can occur during regular offshore supply vessel operations or other activities such as drilling-associated surveys. In addition, as noted in Section 6.2.10.1 of the EIS, fishers have stated that a lack of understanding of oil industry protocols has had a negative economic effect on their operations because fishing vessels are forced around exclusion zones to get from one quota area to the next, rather than being able to transit through the area while maintaining a safe distance.

The assessment of cumulative environmental effects on commercial fisheries that is provided in Section 9.2.4 of the EIS focuses on how commercial fisheries may be cumulatively affected by the direct residual effects of the Project and other physical activities on commercial fishing activity itself (i.e., a cumulative change in the availability of fisheries resources due to potential displacement from fishing areas, associated space-use conflicts and competition between fishers over productive fishing grounds, and increased risk of gear loss or damage).

The residual effects of the Project and other physical activities may also interact to result in indirect cumulative effects on commercial fisheries through physical or behavioural effects on targeted fish species, and there is potential for the Project's contributions to a cumulative change in the risk of mortality or physical injury for fish and/or a cumulative change in habitat quality and use for fish to cumulatively affect the availability of fisheries resources (e.g., due to changes in fish health, quantity, or quality and fish avoidance of customary fishing grounds) if commercially important fish species are affected. Although not explicitly stated in Section 9.2.4 of the EIS (Assessment of Cumulative Environmental Effects on Commercial Fisheries), these potential indirect cumulative effects on commercial fisheries are considered in the context of the assessment of cumulative environmental effects on fish and fish habitat that is provided in Section 9.2.3 of the EIS.

Section 9.2.3 of the EIS (Assessment of Cumulative Environmental Effects on Fish and Fish Habitat) assesses the potential cumulative change in risk of mortality or physical injury and cumulative change in habitat quality and use that could affect fish as a result of interactions between the residual effects of the Project (particularly those related to underwater sound emissions, changes in water quality, and the dispersion and deposition of drill muds and cuttings) and the residual effects of other physical activities in the Study Area. The response to IR-106 provides further consideration of potential cumulative effects on fish and fish habitat from sediment contamination associated with routine discharges from the Project and other offshore oil and gas exploration drilling and petroleum production projects in the Study Area. Since the potential cumulative effects that are considered in Section 9.2.3 of the EIS and the response to IR-106 apply equally to commercially fished species and non-targeted species, these sources should be referred to for the "[discussion of] potential cumulative effects on commercial fisheries from underwater sound, water and sediment quality" that was requested by the reviewer. However, the topic of potential cumulative effects associated with the use of explosive charges (if required) during well abandonment is not specifically considered in Section 9.2.3 of the EIS, or in the response to IR-106 and after a review of the currently available technology, Husky no longer considers the use of explosive shaped charges for well decommissioning or abandonment, as an option.

Table 9.4 in Section 9.2.1 of the EIS (Context for Cumulative Environmental Effects in the Study Area) provides a brief overview of how the residual environmental effects associated with offshore oil and gas exploration drilling and production projects in the Study Area (including the Project) that could affect fish and fish habitat. Some of the underwater sound emissions generated by geophysical survey programs, offshore exploration drilling and production projects, commercial fisheries, and other ocean users during vessel transiting and other activities (e.g., depth sounding, bottom profiling, naval or side scan sonar, airgun arrays) generate sound levels that may be harmful to fish at close ranges (refer to Table 9.6 in the EIS). It is similarly expected that the presence of an approaching vessel or drilling activity will locally displace some species from the area around operating VSP, seismic, sounding, profiling, or sonar sound sources before they are exposed to high sound levels close to those sound sources. Most species will respond behaviourally to avoid underwater sound at lower levels than those at which injury or mortality might occur.

Sound levels generated by some Project and non-Project activities (e.g., seismic surveys), may be high enough to cause a potential cumulative change in risk of mortality or physical injury to fish eggs/larvae within a few metres of the respective source, although an effect of this magnitude would be in the range of the natural variability of mortality (not affecting population recruitment). Fish eggs / larvae are passive drifters and are therefore more susceptible to harm very close to these sources than other life stages of fish. However, the sources between projects are far enough apart that, even if there was some temporal overlap of activities, it is expected that there would be no spatial overlap of residual environmental effects on fish eggs / larvae. The safety zone around drilling activities, within which non-Project activities are excluded, will further reduce potential cumulative interactions between underwater sound from Project-related and third-party physical activities generating high sound levels in the Study Area.

Various activities in the Study Area contribute underwater sound at levels that are not expected to cause a change in risk of mortality or physical injury for fish but may still affect fish and fish habitat (potentially including commercially important species and their habitats) through different types of sensory disturbance. For example, routine activities associated with marine transportation generate underwater sound and operational discharges that have potential to cause a change in habitat quality and use for fish. Outside of the zone of influence for potential physical harm to fish, underwater sound from Project-related blasting may result in temporary sensory disturbance for fish. This sensory disturbance could interact cumulatively with the sensory disturbance caused by other third-party physical activities in the Study Area. However, any cumulative change in habitat quality and use resulting from such an interaction would be transient, extremely short in duration, and reversible.

Various activities in the Study Area also result in physical alteration of benthic fish habitat (potentially including benthic habitat used by commercially important fish species), most notably the use of mobile bottom contact fishing gear by commercial fishers. Offshore oil and gas exploration drilling and production projects in the Study Area will contribute to the physical alteration of benthic fish habitat within the Study Area; however, this alteration will be highly localized as well as temporary. These characteristics, along with the planned and required distances between Project activities, other oil and gas exploration drilling and production projects, commercial fisheries, and other third-party physical activities (due to large exploration licence areas and associated boundaries and safety zones, as discussed in detail in the EIS) will reduce the potential for interactions between the residual benthic habitat alteration effects of multiple physical activities and/or the magnitude of any such interactions, and thus, will reduce the potential for occurrence of cumulative environmental effects and/or the magnitude of the cumulative environmental effects that do occur.

As indicated in Section 9.2.3 of the EIS, species whose ranges cover a large extent of the Study Area may encounter various sources of sensory disturbance and various areas of altered benthic habitat throughout their life cycle. The Project will introduce an additional source of sensory disturbance and habitat alteration that these individuals have potential to encounter. Fish (potentially including commercially important species) may temporarily avoid localized areas subject to sensory disturbance and altered habitat. The cumulative environmental effects of the Project in combination with other physical activities may therefore include a temporary reduction in the amount of habitat available within the Study Area (i.e., due to temporary avoidance of multiple areas at once). This cumulative change in habitat quality and use has potential to disrupt reproductive, foraging and feeding, and/or migratory behaviour for fish if the availability of important habitat areas is affected. However, this is considered unlikely given the concentration of the Project and various offshore petroleum production projects within the Project Area, and the distance of the Project Area from most of the designated special areas in the Study Area.

As with the potential cumulative effects that are considered in Section 9.2.3 of the EIS and the response to IR-106 with respect to underwater sound emissions and changes in water and sediment quality, the potential cumulative effects that are considered above apply equally to commercially fished species and non-targeted species. However, as noted in Table 9.4 of the Cumulative Environmental Effects Chapter of the EIS, the effects of offshore oil and gas exploration drilling and production projects (including the Project) on fish and fish habitat are generally not expected to be of sufficient magnitude, duration, or extent to affect catch rates or otherwise cause a change in availability of fisheries resources for commercial fisheries; this includes effects related to underwater sound emissions and changes in water and sediment quality.

The additional analysis provided above does not materially change the results of the original cumulative effects assessment for commercial fisheries, as presented in the EIS. The cumulative effects assessment summary and conclusion from Section 9.2.4 of the EIS generally remains valid.

References

N/A

2.0 REQUIRED CLARIFICATIONS

2.1 PROJECT DESCRIPTION

2.1.1 Clarification Requirement: CL-01

Reference to EIS:

Section 1.3.1 Offshore Petroleum Regulatory Regime; Section 1.3.3 Other Applicable Requirements and Resources; Section 6.5.2 Regulatory and Policy Setting; Section 7.1.9.4 Dispersants

Context and Rationale

Table 1.1 of the EIS (Summary of Key Relevant Offshore Legislation and Guidelines) lists relevant regulations and guidelines that fall under the jurisdiction of the C-NLOPB. However, the list is incomplete.

Similarly, Table 1.2 Summary of Key Relevant Federal Legislation does not refer to the *Canada Shipping Act, 2001* and regulations, which govern marine transportation, including requirements for safety and protection of the environment, and the Canadian Aviation Regulations.

Section 6.5.2 of the EIS states “Regulatory protection of marine sensitive areas is provided by Canada’s *Oceans Act* which authorizes DFO [Fisheries and Oceans Canada] to provide enhanced protection to marine areas of ecological or biological importance”. This statement requires further clarification as there are other legislative mechanisms, outside of Fisheries and Oceans Canada, which may be used to protect marine sensitive areas (e.g. Parks Canada Agency National Marine Conservation Areas, marine components of National Parks, Environment and Climate Change Canada National Wildlife Areas and Marine National Wildlife Areas).

Required Clarification

Revise Table 1.1 to refer to other guidelines relevant to the Project environmental assessment, including but not limited to:

- Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-Newfoundland and Labrador Offshore Area;
- Safety Plan Guidelines;
- Incident Reporting and Investigation Guidelines; and
- Physical Environmental Programs Guidelines.

Revise Table 1.2 to include the *Canada Shipping Act,* the *Canadian Aviation Regulations*, and any other relevant federal regulations.

Provide information related to any legislative mechanisms, in addition to Canada’s *Oceans Act*, which may be used to protect marine sensitive areas.

Response

Updated EIS Tables 1.1 and 1.2 are provided as Tables 1 and 2, respectively.

Reference

N/A

Table 1 Summary of Key Relevant Offshore Legislation and Guidelines - Updated

Legislation/Guideline	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
Canada-Newfoundland Atlantic Accord Implementation Act (S.C. 1987, c. 3) and the Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act (R.S.N.L. 1990, c. C-2)	Natural Resources Canada / Newfoundland and Labrador Department of Municipal Affairs and Environment	The Accord Acts give the C-NLOPB the authority and responsibility for the management and conservation of the petroleum resources offshore Newfoundland and Labrador in a manner that protects health, safety and the environment while maximizing economic benefits. The Accord Acts are the governing legislation under which various regulations are established to govern specific petroleum exploration and development activities.	The regulatory approvals identified below may be required pursuant to section 142 of the *Canada-Newfoundland Offshore Petroleum Resources Accord Implementation Act*, section 135 of the *Canada-Newfoundland Offshore Petroleum Resources Accord Implementation* (Newfoundland and Labrador) *Act,* and the regulations made under the Accord Acts.
Newfoundland Offshore Petroleum Drilling and Production Regulations (and associated Guidelines)	C-NLOPB	These regulations outline the various requirements that must be adhered to when conducting exploratory and or production drilling for petroleum.	The primary regulatory approvals necessary to conduct an offshore drilling program are an Operations Authorization (Drilling) and a Well Approval (Approval to Drill a Well) pursuant to the Accord Acts and these regulations.
Newfoundland Offshore Certificate of Fitness Regulations	C-NLOPB	These regulations outline the associated requirements for the issuance of a Certificate of Fitness to support an authorization for petroleum exploration and or production drilling in the Newfoundland offshore area. More specifically, the Regulations are implemented to require that the equipment and/or installation of exploratory or production equipment is fit for the purposes for which it is intended to be used and may be operated safely without posing threat to persons or the environment in a specified location and timeframe.	A Certificate of Fitness will be required in support of the Project.

Legislation/Guideline	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
OWTG	NEB / C-NLOPB / CNSOPB	These guidelines outline recommended practices for the management of waste materials from oil and gas drilling and production facilities operating in offshore areas regulated by the C-NLOPB and CNSOPB. The OWTG were prepared in consideration of the offshore waste/effluent management approaches of other jurisdictions, as well as available waste treatment technologies, environmental compliance requirements, and the results of environmental effects monitoring programs in Canada and internationally. The OWTG specify performance expectations for the following types of discharges (NEB et al. 2010): • emissions to air • produced water and sand • drilling muds and solids • storage displacement water • bilge water, ballast water and deck drainage • well treatment fluids • cooling water • desalination brine • sewage and food wastes • water for testing of fire control systems • discharges associated with subsea systems • naturally occurring radioactive material.	Compliance with OWTG
OCSG	NEB / C-NLOPB / CNSOPB	These guidelines provide a framework for chemical selection that minimizes the potential for environmental effects from the discharge of chemicals used in offshore drilling and production operations. The framework incorporates criteria for environmental acceptability that were originally developed by the Oslo and Paris Commissions for the North Sea. An operator must meet the minimum expectations outlined in the OCSG as part of the authorization for any work or activity related to offshore oil and gas exploration and production. The OCSG includes the following requirements (NEB et al. 2009): • the quantity of each chemical used, its hazard rating, and its ultimate fate (e.g., storage, discharge, onshore disposal, downhole injection, abandonment in the well, or consumption by chemical reaction) must be tracked and reported	Compliance with OCSG

Legislation/Guideline	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
		• all products to be used as biocides must be registered under the *Pest Control Products Act* and used in accordance with label instructions • all chemicals other than those with small quantity exemptions must be on the Domestic Substances List of approved substances pursuant to the *Canadian Environmental Protection Act, 1999* (CEPA, 1999), or must be assessed under the New Substances Notification process to identify any restrictions, controls, or prohibitions • any chemicals included on the List of Toxic Substances under Schedule 1 of CEPA, 1999 must be used in accordance with CEPA, 1999 risk management strategies for the substance and alternatives must be considered for any substances on the CEPA, 1999 Virtual Elimination List • any chemicals intended for discharge to the marine environment must - be included on the Oslo and Paris Commissions Pose Little or No Risk (PLONOR) to the Environment List - meet certain requirements for hazard classification under the Offshore Chemical Notification Scheme - pass a Microtox test (i.e., toxicity bioassay) - undergo a chemical-specific hazard assessment in accordance with UK Offshore Chemical Notification Scheme models - and/or have the risk of its use justified through demonstration to the C-NLOPB that discharge of the chemical will meet OCSG objectives.	
Compensation Guidelines Respecting Damage Relating to Offshore Petroleum Activity (Compensation Guidelines)	C-NLOPB / CNSOPB	These guidelines describe compensation sources available to potential claimants for loss or damage related to petroleum activity offshore Newfoundland and Labrador and Nova Scotia; and outline the regulatory and administrative roles which the Boards exercise respecting compensation payments for actual loss or damage directly attributable to offshore operators.	Compliance with Compensation Guidelines
Environmental Protection Plan Guidelines	C-NLOPB / CNSOPB / NEB	These guidelines assist an operator in the development of an environmental protection plan that meets the requirements of the Accord Acts and associated regulations and the objective of protection of the environment from its proposed work or activity.	Compliance with Environmental Protection Plan Guidelines

Legislation/Guideline	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (SOCP)	Fisheries and Oceans Canada (DFO) / Environment and Climate Change Canada (ECCC) / C-NLOPB/CNSOPB	The SOCP specifies the minimum mitigation requirements that must be met during the planning and conduct of marine seismic surveys, in order to reduce effects on life in the oceans. These mitigation measures can be applied to walk-away vertical seismic profiling operations and wellsite surveys. These mitigation requirements focus on planning and monitoring measures to avoid interactions with marine mammal and sea turtle species at risk where possible and reduce adverse effects on species at risk and marine populations.	Compliance with SOCP
Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-Newfoundland and Labrador Offshore Area	C-NLOPB	The Measures developed by the C-NLOPB include: • Conditions of authorization (with advice and input from ECCC-CWS) • Requirement for operators to reduce their use of light, taking into consideration crew safety • Requirement to notify the C-NLOPB of plans to flare so that a safe timeline to proceed can be proposed (with advice and input from ECCC-CWS) • Drill rig personnel trained in seabird and marine mammal sighting is sufficient for monitoring / reporting purposes (unless there is evidence of flagrant disregard for the regulatory requirements) • Requirement for operators to hold a valid permit authorized under *the Migratory Bird Conventions Act* and *Migratory Bird Regulations*	Compliance with Measures
Safety Plan Guidelines	C-NLOPB / CNSOPB / NEB	These guidelines were developed to assist an operator in the preparation a safety plan that takes all reasonable precautions for the continued safety of its operations; an operator must reduce risk to a level that is as low as reasonably practicable. The Safety Plan must protect workers by describing the procedures, practices, and resources that will be provided to ensure the safety of the proposed work or activity. The Safety Plan must also describe the sequence of key safety-related activities and monitoring measures that will be put in place	Development of and adherence to a Project-specific Safety Plan, to be filed with C-NLOPB

Legislation/Guideline	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
Incident Reporting and Investigation Guidelines	C-NLOPB / CNSOPB	These guidelines were developed to assist operators, employers and other workplace parties in the reporting and investigation of Incidents and other events that occur in the offshore area, which comply with the requirements of the Accord Acts and the associated Regulations terms and conditions of C-NLOPB's approvals and authorizations. The guidelines provide direction on: • what constitutes an incident and other events that are reportable to the C-NLOPB • the process for reporting an incident and other events • the C-NLOPB's expectations for Incident investigations • the process for submitting associated reports	Compliance with Incident Reporting and Investigation Guidelines
Offshore Physical Environmental Guidelines	C-NLOPB / CNSOPB/ NEB	These guidelines provide a set of clear and precise program and best practice procedures to clarify the requirements for the operators of drilling (or production) installations concerning the observing, forecasting and reporting of physical environmental data pertaining to meteorology, oceanography, and ice observation and management, including collection specifications and equipment requirements.	Compliance with Offshore Physical Environmental Guidelines

Table 2 Summary of Key Relevant Federal Legislation - Updated

Legislation	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
Canada Oil and Gas Operations Act (R.S., 1985, c. O-7)	Natural Resources Canada	The Act is intended to promote, in respect of the exploration for and exploitation of oil and gas: (a) safety, particularly by encouraging persons exploring for and exploiting oil or gas to maintain a prudent regime for achieving safety; (b) the protection of the environment; (b.1) the safety of navigation in navigable waters; (c) the conservation of oil and gas resources; (d) joint production arrangements; and (e) economically efficient infrastructures.	No specific permitting requirements are anticipated under this legislation although new legislation (*Energy Safety and Security Act*; *Regulations Establishing a List of Spill-treating Agents)* will have implications for spill prevention and response (see below).
CEPA, 1999	ECCC	CEPA, 1999 pertains to pollution prevention and the protection of the environment and human health to contribute to sustainable development. Among other items, CEPA, 1999 provides a wide range of tools to manage toxic substances, and other pollution and wastes, including disposal at sea.	Disposal at Sea Permits (under the *Disposal at Sea Regulations* pursuant to CEPA, 1999) have not been required in the past for exploration drilling projects. Therefore, such a permit is not anticipated to be required in support of the Project.
Energy Safety and Security Act (S.C. 2015, c. 4)	Natural Resources Canada	The *Energy Safety and Security Act* aims to strengthen the safety and security of offshore oil production through improved oil spill prevention, response, accountability, and transparency and amends the Accord Acts and the *Canadian Oil and Gas Operations Act* with the intent of updating, strengthening and increasing the level of transparency of the liability regime that is applicable to spills and debris in the offshore areas.	Financial Responsibility and Financial Resources requirements have increased. Specific additional relevance to be determined, but likely to have specific implications for spill prevention and response. It establishes a legal framework to permit the safe use of spill-treating agents in specific circumstances.
Fisheries Act	DFO ECCC (administers section 36, specifically)	The *Fisheries Act* contains provisions for the protection of fish, shellfish, crustaceans, marine mammals, and their habitats. Under the *Fisheries Act*, no person shall carry on any work, undertaking, or activity that results in serious harm to fish that are part of a commercial, recreational, or Aboriginal fishery, or to fish that support such a fishery, unless this activity has been authorized by the Minister of Fisheries and Oceans. Section 36 of the *Fisheries Act* pertains to the prohibition of the deposition of a deleterious substance into waters frequented by fish.	Authorization from the Minister of Fisheries and Oceans under section 35(2) of the *Fisheries Act* has not been required in the past for offshore exploration drilling projects. Therefore, such an authorization is not anticipated to be required in support of the Project.
Migratory Birds Convention Act, 1994	ECCC	Under the *Migratory Birds Convention Act, 1994*, it is illegal to kill migratory bird species not listed as game birds or destroy their eggs or young. The Act also prohibits the deposit of oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds.	The salvage of stranded birds during offshore Project operations would require a handling permit under section 4(1) of the *Migratory Birds Regulations* pursuant to the *Migratory Birds Convention Act, 1994*.

Legislation	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
Navigation Protection Act (NPA)	Transport Canada	The NPA is intended to protect specific inland and nearshore navigable waters (as identified on the list of "Scheduled Waters" under the NPA) by regulating the construction of works on those waters and by providing the Minister of Transport with the power to remove obstructions to navigation.	No applicable permitting requirements under the NPA have been identified for the Project, as the Project Area is located offshore, outside of the Scheduled Waters specified in the NPA.
Oceans Act	DFO	The *Oceans Act* provides for the integrated planning and management of ocean activities and legislates the marine protected areas program, integrated management program, and marine ecosystem health program. Marine protected areas are designated under the authority of the *Oceans Act*.	No applicable permitting requirements under the *Oceans Act* have been identified for the Project.
Species at Risk Act (SARA)	DFO/ECCC/ Parks Canada	SARA is intended to protect species at risk in Canada and their "critical habitat" (as defined by SARA). The main provisions of the Act are scientific assessment and listing of species, species recovery, protection of critical habitat, compensation, and permits and enforcement. The Act also provides for development of official recovery plans for species found to be most at risk, and management plans for species of special concern. Under the Act, proponents are required to complete an assessment of the environment and demonstrate that no harm will occur to listed species, their residences or critical habitat or identify adverse effects on specific listed wildlife species and their critical habitat, followed by the identification of mitigation measures to avoid or minimize effects. All activities must comply with SARA. Section 32 of the Act provides a complete list of prohibitions.	Under certain circumstances, the Minister of Fisheries and Oceans may issue a permit under section 73 of SARA authorizing an activity that has potential to affect a listed aquatic species, any part of its critical habitat, or the residences of its individuals. However, such a permit is not anticipated to be required in support of this Project.
Regulations Establishing a List of Spill-treating Agents (SOR/2016-108)	ECCC	The Minister of the Environment has determined that certain spill treating agents (as listed in the Regulations) are acceptable for use in Canada's offshore. As a result, the C-NLOPB is able to authorize the use of one or more of the two spill-treating agent products listed in Schedule 1 of the Regulations to respond to an oil spill.	Specific implications for spill prevention and response, should Husky decide to use dispersants in the unlikely event of an oil spill.
Canada Shipping Act (S.C. 2001, c. 26)	Transport Canada	The *Canada Shipping Act, 2001* (and its Regulations) describes the requirements for safety and environmental protection for Canadian vessels and their operators.	Compliance with the relevant requirements of the Act and its Regulations.

Legislation	Regulatory Authority	Relevance	Potentially Applicable Permitting Requirement(s)
Canadian Aviation Regulations (CARs) (SOR/93-433)	Transport Canada	The *Air Regulations* and Air Navigation Orders were consolidated into the CARs, a comprehensive eight-part publication of revised and updated existing regulations and standards under the *Aeronautics Act*. Each of the parts discusses specific components related to aeronautics and included specific standards that are applied. He eight parts are: • Part I: General Provisions - Definitions, general administrative and compliance provisions, regulatory authorities and fees for services provided by the Department. • Part II: Identification, Registration and Leasing of Aircraft - Regulates registration, marking and leasing of aircraft and identification of aeronautical products. • Part III: Aerodrome and Airports - Regulations respecting aerodromes and airports, and requirements for certification of airports. • Part IV: Personnel Licensing and Training - Regulations governing the training and licensing of flight crew, aircraft maintenance engineers and air traffic controllers. • Part V: Airworthiness - Regulates airworthiness of aircraft from the design and type certification stage to the maintenance of aircraft in use. Includes requirements respecting export, manufacture, and distribution of aircraft and aeronautical products, and requirements respecting continuing airworthiness. • Part VI: General Operating and Flight Rules - General rules applicable to all aircraft operations, including regulations respecting special types of operations such as air shows, parachuting and balloon operations. • Part VII: Commercial Air Services - Rules governing the use of airplanes and helicopters in commercial air services, including airworthiness rules relating specifically to commercial operations. Reflects the evolution of the aviation industry in Canada with respect to operations such as aerial work, air taxi and commuter operations. Also takes into account the way commercial air service regulations are structured internationally. • Part VIII: Air Navigation Services - Regulations respecting the provision of air navigation services	Helicopters used for the Project are operated by a third-party; Husky assumes the third-party will comply with all relevant parts of the CARs

2.1.2 Clarification Requirement: CL-02

Reference to EIS:

Section 2.5.4 Well Testing

Context and Rationale

Section 2.5.4 of the EIS states that wells may be tested by multiple methods to gather additional details on any potential reservoir. The proponent then states that two drillstem tests may be expected to be required from 10 exploration wells. It is unclear if any wells tested will be tested by drillstem testing or if there are other tests (e.g. core sampling or well logging) that may be utilized to determine the if there are enough hydrocarbons to produce the well.

Required Clarification

Confirm if any formation flow testing methods, other than drillstem testing will be conducted to determine the presence and quantity of hydrocarbons. If so, confirm whether those other methods would require flaring.

In addition, confirm if Husky Energy would limit its number of well tests to two drillstem tests or is there a possibility that additional drillstem tests may be conducted.

Response

Husky will be using standard suites of logging while drilling and wireline tools to collect basic information on the presence of porous reservoir (e.g. density, neutron and sonic tools) and hydrocarbons (e.g. resistivity tools), along with local collection of conventional and sidewall cores in those wells that encounter sufficient evidence of hydrocarbon-bearing reservoir rock.

Regarding formation flow testing; Husky may also use downhole fluid sampling equipment deployed on pipe (flow-testing while tripping) or by wireline (e.g. modular formation dynamics tester customizable into various operational designs such as Quicksilver Probe, mini- drillstem tests (DST), vertical interference testing) equipment. These methodologies do not require flaring.

Two DST is an estimate of the number required during this exploration program, not a limit.

Reference

N/A

2.1.3 Clarification Requirement: CL-03

Reference to EIS:

Section 1.2.1 Offshore Experience

Context and Rationale

Section 1.2.1 of the EIS states that Husky has drilled a total of 87 wells to date. However, It is not clear whether these wells are within the Newfoundland and Labrador Offshore Area, or elsewhere.

Required Clarification

Confirm whether the referenced 87 wells were drilled in the Newfoundland and Labrador offshore. If a portion of the 87 wells were drilled elsewhere, indicate how many wells Husky has drilled in the Newfoundland and Labrador offshore region.

Response

If partnerships are included, Husky has acted as the operator on a total of 98 wells in the Newfoundland and Labrador offshore, since 1983 (Canada-Newfoundland and Labrador Offshore Petroleum Board 2019).

Reference

Canada-Newfoundland and Labrador Offshore Petroleum Board. 2019. Summary of Wells. Available at: https://www.cnlopb.ca/wp-content/uploads/wells/wells_summary.xlsx. Accessed February 2019

2.1.4 Clarification Requirement: CL-04

Reference to EIS:

Section 2.1 Project Purpose, Rationale, and Need; Section 2.4.2 Offshore Exploration Wells

Context and Rationale

Section 2.4.2 of the EIS states that up to 10 single vertical and/dual side-tracked wells are proposed within the project area, and that the number of wells is contingent on geophysical/ geotechnical surveys, drilling results and whether new ELs are acquired. However, no further information is provided on side-tracking.

Under Section 2.1 of the EIS Guidelines, the designated Project is the mobilization, operation and demobilization of MODU(s) designed for year-round operations for the drilling, testing and abandonment of up to ten wells (exploration or delineation).

Required Clarification

Provide the following information on Project activities:

- a description of the project component side-tracking; and
- confirm whether 10 wells is the maximum number of wells that would be drilled.

Update the effects analysis as appropriate.

Response

An exploration well may be sidetracked to bypass an unusable section of the original wellbore if an object becomes stuck, or if the well collapses. Ten wells is the maximum planned under this designated Project. An update to the effects analysis is therefore not required.

Reference

N/A

2.2 FISH AND FISH HABITAT

2.2.1 Clarification Requirement: CL-05

Reference to EIS:

Section 4.2.2 Benthic Habitat

Context and Rationale

Based on Table 4.19, EL 1155 does not contain many of the species present in Els 1151 and 1152. The statement "[a]s shown in Table 4.19, the benthic organisms within the ELs are similar among the three licence areas…" is not consistent with the information in Table 4.19.

Fisheries and Oceans Canada advises that there are many errors in Table 4.19. The table should include taxon, not spp., as many taxa are identified to high levels only.

Required Clarification

Clarify the species likely to be present in ELs 1151, 1152, and 1155.

Response

A revised EIS Table 4.19 is provided as Table 1, which replaces species with taxon to clarify those taxa likely to be present within the exploration licences (ELs). Table 1 now reflects species caught within the ELs based on the most recent Research Vessel surveys within the ELs. Based on Table 1, the benthic organisms are noted to be similar within ELs 1152 and 1155. EL 1151 contains far fewer taxa than its neighbouring ELs. ELs 1152 and 1155 share similar geology with one another, displaying more coarse sediment as compared to EL 1151 (Figure 4-1, Section 4.1 of the EIS). This may be the predominant reason for a difference in benthic community structure.

Table 1 Benthic Organisms Collected during Research Vessel Surveys (2016-2017) in Exploration Licences 1151, 1152 and 1155

Taxa	Licence		
	EL 1151	EL 1152	EL 1155
Seasnail (*Liparidae*)	x	x	x
Gelatinous Seasnail (*Liparis fabricii*)	-	x	x
Dusky Seasnail (*Liparis gibbus*)	-	x	x
Sea Anenome (*Actinaria*)	x	x	x
Icelandic Scallop (*Chlyamys islandica*)	-	x	x
Polychaeta	-	x	x
Amphipoda	-	x	x
Hyperiidea	-	x	x
Gammaridea	x	x	x
Shrimp (*Eualis macilentus*)	x	-	-
Shrimp (*Eualis gaimardii gaimardii*)	-	x	x
Shrimp (*Spirontocaris spinnus*)	-	x	x
Shrimp (*Lebbeus microceros*)	-	x	x
Shrimp (*Pandalus montagui*)	x	x	x

Taxa	Licence		
	EL 1151	EL 1152	EL 1155
Shrimp (*Sclerocrangon Boreas*)	-	x	x
Shrimp (*Sabina septemcarinata*)	-	x	x
Shrimp (*Sabina sarsi*)	-	x	x
Shrimp (*Argis dentata*)	x	x	x
Toad Crab (*Hyas coarctatus*)	-	x	x
Sea Urchin (*Strongylocentrotus droebachiensis*)	x	x	x
Sand Dollar (*Cylpeasteroida*)	x	x	x
Sand Dollar (*Echinarachinius parma*)	-	x	x
- = No Taxa Present within EL X = Taxa Present within EL			

Reference:

N/A

2.2.2 Clarification Requirement: CL-06

Reference to EIS:

Section 4.2.2 Benthic Habitat

Context and Rationale

Benthic species presence-absence data are presented in Table 4.19 of the EIS. Data are trawl-derived and aggregated over long distances. Fisheries and Oceans Canada advises that while in many cases trawl-derived benthos data are all that are available, it should be recognized that this sampling method underestimates both benthic abundance/biomass and species richness. In an earlier study on sandy bottoms of the Grand Banks, only approximately 0.5% of standing benthic biomass is captured by the trawl. More accurate estimates of benthic biomass on the Grand Banks can be found from grab samples collected during the course of a three-year trawl impact experiment (Prena et al. 1999, Kenchington et al. 2001) and a three year grab sampling program (Gilkinson 2013).

Required Clarification

Taking into consideration the referenced grab samples, discuss benthic abundance/biomass and species richness. Provide an updated effects assessment, as applicable.

Response

EIS Table 4.19 has been modified and the reviewer is encouraged to refer to Table 1 in the response to CL-05. It is noted that the use of trawling techniques is not ideal for sampling all benthic taxa, particularly for meiofaunal species. The use of otter trawl techniques has been shown to capture only 0.5% of standing benthic biomass (Prena et al. 1999) and limit the capture of meiofaunal species. The most dominant benthic species caught in Fisheries and Oceans Canada (DFO) trawl studies using otter trawls and benthic sleds include the sand dollar, brittle star, sea urchin, snow crab, soft coral (*Gersemia sp.*), and the molluscs *Magarites sordidus, Clinocardium cilatum, and Cyclocardia novangliae (*Prena et al. 1999). Grab sampling revealed 246 invertebrate species or species groups including 67 polychaete species, 51 crustacean species, 23 bivalve species, 52 gastropod species, and 12 echinoderm species (Kenchington et al. 2001). Furthermore, studies conducted by DFO using a deeper penetrating benthic grab (Gilkinson 2013) identified that three phyla (Annedlida, Anthropoda, and Mollusca) made up 86% of the recorded taxa.

While trawl surveys lack the biomass caught by using grab sampling techniques the species outlined within the revised Table 4.19 overlap with those taxa outlined within the research papers discussed above. As a result, the effects of the project on benthic habitat and the species inhabiting the benthos remains unchanged.

Reference

Gilkinson, K. 2013. Recent DFO (Newfoundland and Labrador Region) studies on the Grand Banks benthos at small and large spatial scales. DFO Can. Sci. Advis. Sec. Res. Doc., 2012/114: v + 30 pp.

Kenchington, E.L.R., J. Prena, K. Gilkinson, D.C. Gordon, K. Macisaac, C. Bourbonnais, P.J. Schwinghamer, T.W. Rowell, D.L. McKeown and W.P. Vass. 2001. Effects of experimental otter trawling on the macrofauna of a sandy bottom ecosystem on the Grand Banks of Newfoundland. Canadian Journal of Fisheries and Aquatic Sciences, 58: 1043-1057. 10.1139/cjfas-58-6-1043.

Prena, J., P. Schwinghamer, T.W. Rowell, D.C. Gordon, K. Gilkinson, W.P. Vass and D.L. McKeown. 1999. Experimental otter trawling on a sandy bottom ecosystem of the Grand Banks of Newfoundland: Analysis of trawl bycatch and effects on epifauna. Marine Ecology Progress Series, 181: 107-124.

2.3 MARINE MAMMALS AND SEA TURTLES

2.3.1 Clarification Requirement: CL-07

Reference to EIS:

Section 4.2.5 Marine Mammals

Context and Rationale

The EIS Guidelines require baseline information on marine mammals that may be present, including the times of year they are present.

Some information in Table 4.27 is inconsistent with other parts of the EIS. For example:

Potential of occurrence in the study area is low for Northern Bottlenose Whale, Sperm Whale, Harbour Porpoise and Killer Whale in Table 4.27; however, Figures 9 (page D-37), 15 (page D-51), 16 (page D-53) and 17 (page D-55) suggest a greater potential of occurrence.

Potential occurrence for Minke Whale in Table 4.27 is noted as High is not consistent with information presented within Appendix D which notes that "none have been observed within the area from 2004-2014".

Time of presence for the Hooded Seal is December to April in Table 4.27, but on D-43, it is noted that these seals may be present in the study area up to June.

Potential for Occurrence for the Northern Bottlenose Whale is low in Table 4.27, but high in both Table 4.28 and 6.12. The description provided in Appendix D (see Figure 8) would suggest that occurrence is likely low.

Required Clarification

Clarify the information in Table 4.27, Table 6.12 and Appendix D to remove inconsistencies.

Response

It is important to note that the marine mammal sighting figures presented in Appendix D of the EIS present survey observations over a 10-year-period (2004 to 2014), only. Many marine mammals are difficult to spot or identify during surveys. Some mammal species may only be present outside survey periods. Potential for occurrence noted is qualitative and considers habitat preference, migratory range, historical sightings, recovery documents and scientific literature.

The following clarifications are made to the aforementioned species' predicted occurrence in the Study Area.

Bottlenose whale - available literature and data suggest that northern bottlenose whales are likely to occur in the Study Area at low densities.

Sperm whale - available literature and data suggest that sperm whales are likely to occur in the Study Area at low densities.

Harbour porpoise - available literature and data suggest that harbour porpoise are likely to occur in the Study Area at low densities.

Killer whale - available literature and data suggest that killer whales are likely to occur in the Study Area at low densities.

Minke whale - available literature and data suggest that minke whales are likely to occur in the Study Area at low densities.

Hooded seal - available literature and data suggest that hooded seals are likely to occur in the Study Area at low densities, with the highest number of sightings expected from December through April.

References

N/A

2.3.2 Clarification Requirement: CL-08

Reference to EIS:

Section 4.2.5 Marine Mammals

Context and Rationale

With respect to Grey Seal, Table 4.27 notes potential occurrence in the study area to be "low to moderate" while information presented within Appendix D notes that Grey Seal are rare in the area.

Required Clarification

Clarify the potential occurrence of Grey Seal in the study area.

Response

The grey seal can be found on both sides of the North Atlantic, and is subdivided into three populations, one of which occurs in eastern Canada. The eastern Canadian population of grey seals (i.e., the western North Atlantic stock) ranges from Labrador to New Jersey, but segregates into three breeding herds during their January breeding season: Sable Island, Gulf of St. Lawrence, and the Nova Scotia coastline. The abundance estimate for the three Canadian herds is 505,000 individuals (95 percent Confidence Interval: 329,000 to 682,000; Fisheries and Oceans Canada (DFO) 2014). Following breeding, grey seals disperse widely, although they are considered non-migratory (Lesage et al. 2001) and may therefore occur year-round in eastern Canada.

Phocid sightings, including grey seals, are rarely recorded and/or reported during surveys. Grey seals are not recorded in the DFO opportunistic sightings database for example, and there are insufficient records to produce sighting tables or distribution figures for the Study Area. Understanding of general distributions and potential for occurrence in the Study Area is therefore based primarily on published literature. The range of 'low to moderate' presented in EIS Table 4.27 was intended to conservatively reflect this uncertainty. The number of grey seals to occur in the Study Area or Project Area is unknown but is likely small given that their preferred habitat is outside the Study Area.

Reference

DFO (Fisheries and Oceans Canada). 2014. Stock assessment of Canadian grey seals (Halichoerus gyrpus). DFO Can. Sci. Advis. Sec. Sci. Rep., 2014/010.

Lesage, V. and M.O. Hammill. 2001. The status of the grey seal, *Halichoerus grypus*, in the Northwest Atlantic. Canadian Field-Naturalist, 115(4): 653-662.

2.3.3 Clarification Requirement: CL-09

Reference to EIS:

Section 4.2.6 Sea Turtles

Context and Rationale

Figure 4-31 of the EIS shows sea turtle sightings in the study area; however, does not present data on a per species basis and therefore does not show species-specific range and occurrence.

Required Clarification

Provide information to support Figure 4-31 to allow for species-specific sea turtle analysis.

Response

A revised Figure 4-31 of the EIS identifying sea turtle sightings by species is provided as Figure 1.

Reference

N/A

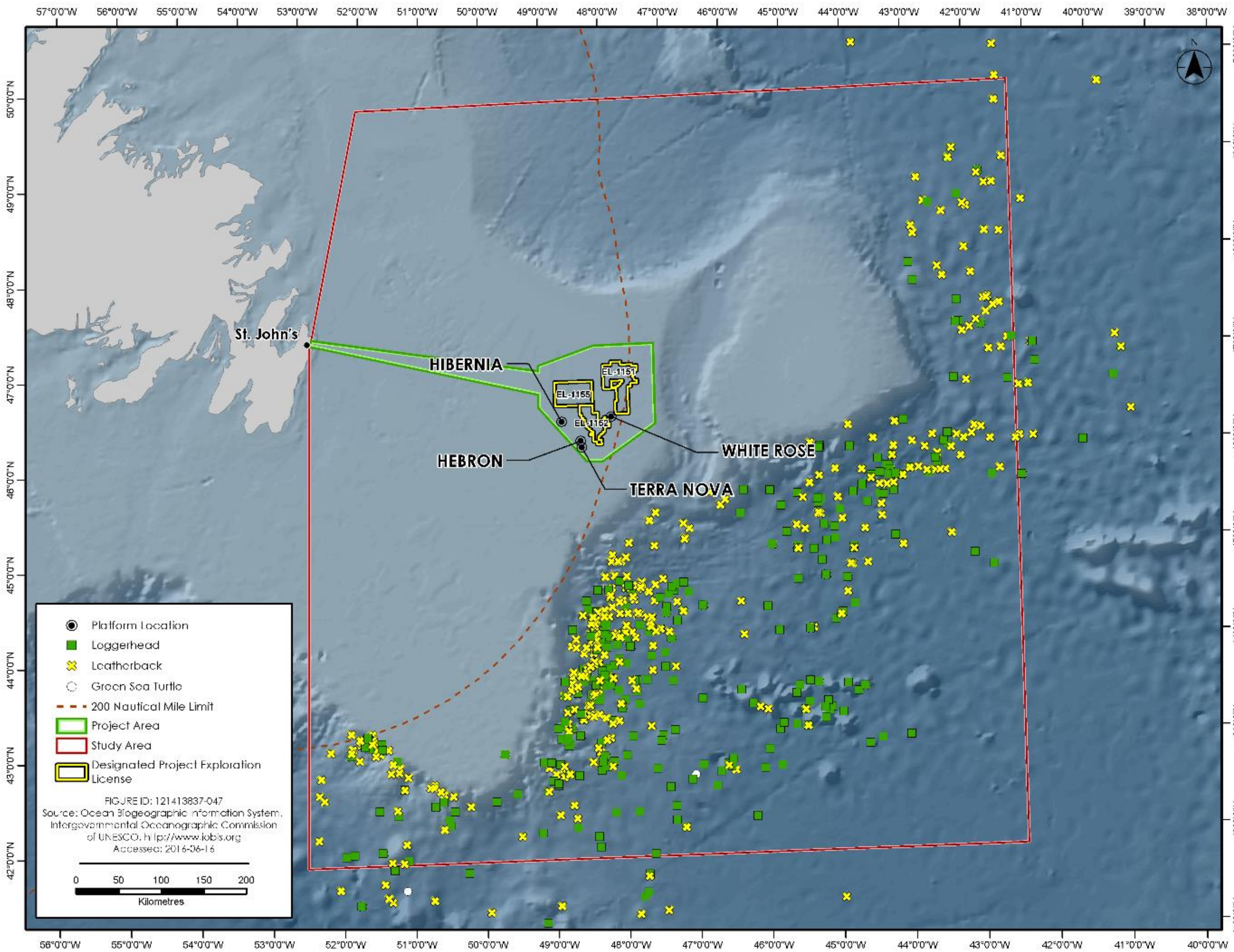


Figure 1 **Sea Turtle Sightings in the Study Area (2004 to 2014) [revised]**

2.3.4 Clarification Requirement: CL-10

Reference to EIS:

Section 6.3.10.4 Summary of Project Residual Environmental Effects; Section 11.3 Residual Environmental Effects

Context and Rationale

Fisheries and Oceans Canada noted that Table 6.16 Project Residual Effects on Marine Mammals and Sea Turtles found in Section 6.3.10.4, shows that the frequency of the presence and operation of the MODU is an irregular event (IR). However, the presence and operation of the MODU will be on a regular basis throughout drilling for each well, as stated in the EIS on page 6.53, Section 6.3.10.3.1.1 Presence and Operation of MODU "These activities could occur at any time of the year and would be continuous during the time it takes to drill each well."

Effects on habitat quality and use including effects on prey species, behavioral changes and physical injury (i.e. hearing impairment through temporary threshold shift) from noise are possible for the duration of the drilling operation.

Required Clarification

Clarify the residual effects characterization for the presence and operation of MODU as R (regular) and confirm that this characterization was considered in the effects analysis.

Response

As discussed in Section 5.2.3.5 of the EIS, in the Residual Effects Characterization process, effects are characterized according to (amongst other things) their frequency, which refers to how often the residual effect occurs, and how often it occurs during the Project. The individual characterization terms are defined in greater detail in EIS Table 6.2, wherein frequency may be characterized as either a 'single event', 'multiple irregular event' (i.e., effect occurs at no set schedule), 'multiple regular event' (i.e., effect occurs at regular intervals) or 'continuous'. The difference between an irregular and a regular event is therefore not the number of times an event is expected to occur during a given project phase, but the regularity or predictability of intervals that is anticipated between consecutive events. The fact that "these activities could occur at any time of the year" (as opposed to on a set schedule) is the reason for the designation of frequency as multiple irregular events (IR) in Table 6.16 of the EIS. Based on these definitions, no modifications to the assessment or conclusions are considered necessary.

Reference

N/A

2.3.5 Clarification Requirement: CL-11

Reference to EIS:

Section 6.1.10.3.2.3 Waste Management

Context and Rationale

The C-NLOPB indicated that there are inconsistences in Section 6.1.10.3.2.3 of the EIS with respect to the magnitude of residual environmental effects associated with waste management and change in habitat quality and use for fish and fish habitat.

Section 6.1.10.3.2.2, page 6.21 of the EIS states that residual environmental effects associated with waste management on a change in habitat quality and use for fish and fish habitat are predicted to be moderate in magnitude. However, table 6.5 states that these effects will be low in magnitude.

Page 6.22 of the EIS states that changes to habitat quality and use for fish and habitat are predicted to be low in magnitude; however residual environmental effects of waste management are predicted to be moderate in magnitude on page 6.21

Required Clarification

Provide clarification of the predicted magnitude of residual environmental effects associated with waste management on a change in habitat quality and use for fish and fish habitat.

Revise the summary statement on page 6.22 to accurately reflect the magnitude of project residual environmental effects, if required.

Response

In the EIS, the characterization of residual Project-related environmental effects, specifically, the change in risk of mortality, physical injury or health as it relates to waste management (Section 6.1.10.3.1.3 of the EIS), concludes that Project effects will be low in magnitude. This requires correction because the drill cutting dispersion modelling has indicated that there will be a well-defined drill cuttings patch found within 100 to 200 m of the wellsite. Within this patch, cuttings thickness will generally range between 1 to 10 mm in thickness, with some portions ranging from 25 to 50 mm. In areas where the drill cuttings deposition is >10 mm, slow-moving benthic species may be smothered and the sediment quality will be altered in terms of nutrient enrichment and oxygen depletion. This change in mortality would be greater than that of natural variability; therefore, the magnitude of Project-related effects from waste management on the change in risk of mortality, physical injury or health should be ranked as moderate in magnitude. The residual environmental effects associated with waste management on a change in risk of mortality, physical injury and health for fish and fish habitat is predicted to be moderate in magnitude, restricted to the Project Area, long-term in duration and reversible (i.e., low benthic mortality rates are not predicted to result in irreversible changes to local populations).

Section 6.1.10.3.2.3 of the EIS is correct in stating that the residual environmental effects associated with waste management on a change in habitat quality and use for fish and fish habitat is predicted to be moderate in magnitude, restricted to the Project Area, long-term in duration and reversible (i.e., low benthic mortality rates are not predicted to result in irreversible changes to local populations and ecological recovery is expected).

As a result, the summary statement on page 6.22 of the EIS is corrected to state:

In summary, the Project may result in adverse effects that cause a change in risk of mortality, physical injury or health and a change in habitat quality and use for fish and fish habitat. In consideration of the scientific literature, the effects monitoring programs, implementation of mitigation measures, adherence to industry standards and regulations, the residual effect of a change in risk of mortality, physical injury or health for various Project components and activities is predicted to range from low to moderate in magnitude. Residual project environmental effects for a change in risk of mortality, physical injury or health will be restricted to the Project Area and localized near the source. The duration of effects will vary from short-term regular events (i.e., one day per well for VSP survey or wellhead removal) to longer-term events such as waste management (i.e., residual effects from WBM / SBM and cuttings discharge). These environmental effects may occur within a disturbed ecological (non-pristine) and socio-economic context (associated with ongoing harvesting of fish species and underwater sound and waste discharge associated with marine shipping and existing oil and gas operations in the Study Area).

Similarly, changes to habitat quality and use for fish and fish habitat are predicted range from low to moderate in magnitude, occur within the Project Area or parts of the Study Area (during wellsite surveys), be short to long-term in duration, be reversible at the completion of the Project, and occur within a disturbed ecological (non-pristine) and socio-economic context.

Table 1 (Table 6.5 of the EIS) summarizes the environmental effects assessment and prediction of residual environmental effects resulting from those interactions between the Project and fish and fish habitat that were identified in Table 6.3 of the EIS.

Table 1 Project Residual Effects on Fish and Fish Habitat

Residual Effect	Residual Effects Characterization						
	Direction	**Magnitude**	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Ecological and Socio-economic Context**
Change in Risk of Mortality, Physical Injury and Health							
Presence and Operation of MODU	A	L	PA	MT	IR	R	D
Drilling-associated Surveys	A	L	PA	ST	IR	R	D
Waste Management	A	M	PA	LT	IR	R	D
Well Abandonment	A	L	PA	ST	S	R	D
Change in Habitat Quality and Use							
Presence and Operation of MODU	A	L	PA	MT	IR	R	D
Drilling-associated Surveys	A	L	SA	ST	IR	R	D
Waste Management	A	M	PA	LT	IR	R	D
Supply and Servicing	A	L	PA	MT	R	R	D
Well Abandonment	A	L	PA	ST	S	R	D

Residual Effect	Residual Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
KEY: See Table 6.2 for detailed definitions N/A: Not Applicable **Direction:** P: Positive A: Adverse N: Neutral **Magnitude:** N: Negligible L: Low M: Moderate H: High	**Geographic Extent:** PA: Project Area SA: Study Area **Duration:** ST: Short-term MT: Medium-term LT: Long-term			**Frequency:** S: Single event IR: Irregular event R: Regular event C: Continuous **Reversibility:** R: Reversible I: Irreversible **Ecological/Socio-Economic Context:** D: Disturbed U: Undisturbed			

Reference

N/A

2.4 SPECIES AT RISK

2.4.1 Clarification Requirement: CL-12

Reference to EIS:

Section 4.2.6 Sea Turtles; Appendix D, Section 3.0, Sea Turtles

Context and Rationale

Some information in Table 4.29 is inconsistent with text found in Appendix D of the EIS, in relation to what is known about sea turtles:

- Table 4.29 indicates moderate potential occurrence for the Leatherback Sea Turtle, but page D-59 states that they are uncommon in the study area; and
- Table 4.29 indicates low potential occurrence for the Loggerhead Sea Turtle, but page D-61 states that they are common in the far eastern portion of the study area.

Based on footnote 2 of Table 4.29, some information in this table is outdated and should be updated accordingly.

Required Clarification

Provide updated information in relation to sea turtles that corrects inconsistencies between the information presented in Section 4 and Appendix D. Where there are inconsistencies between information, update to reflect the most recent available information.

Update the effects analysis following the information update, as required.

Response

Please see Figure 1 (revised EIS Figure 4-31) in the response to CL-09, which identifies sightings of sea turtles in the Study Area between 2004 and 2014 (sightings now identified to species). Both loggerhead and leatherback sea turtles are expected to be rare in the Project Area, with moderate potential for occurrence in the southern and eastern portions of the Study Area. There are no observation records of Kemp's ridley and only a handful of sightings of green sea turtles over a 10-year period in the Study Area. Little is known about the distributions of these two species in eastern Canada, but they are generally considered rare at these latitudes.

An Order Amending Schedule 1 to the *Species at Risk Act* (Part II, Vol. 151, No. 9) was posted to the Species at Risk Public Registry on May 5, 2017. The order replaces the singular leatherback species previously listed on Schedule 1 of SARA with two new designatable units (i.e., Atlantic and Pacific populations). Additionally, a proposed Action Plan for the leatherback sea turtle in Atlantic Canada was posted on September 27, 2018 (Fisheries and Oceans Canada 2018).

A revised and updated EIS Table 4.29 is provided as Table 1.

Table 1 Sea Turtle Species with Potential to Occur in the Study Area [revised]

Common Name	Scientific Name	SARA Status	COSEWIC Designation	Potential Occurrence in Study Area[1]	Timing of Presence
Leatherback sea turtle (Atlantic population)	*Dermochelys coriacea*	Endangered (Schedule 1)	Endangered	Moderate	April to October
Loggerhead sea turtle	*Caretta caretta*	Endangered (Schedule 1)	Endangered	Moderate	April to October
Kemp's ridley turtle	*Lepidochelys kempii*	Not Listed	Not Listed	Low	June to October
Green sea turtle	*Chelonia mydas*	Not Listed	Not Listed	Low	June to October

Source: Modified from Husky Energy 2012, BP 2016, and Equinor Canada 2017
Note:

1. This qualitative characterization is based on expert opinion, and an analysis of habitat preferences across life-history stages, available distribution mapping, and sightings data for each species within the Study Area.

Reference

BP Canada Energy Group ULC. 2016. Scotian Basin Exploration Drilling Project Environmental Impact Statement. Volume 1: Environmental Impact Statement. Prepared by Stantec Consulting Ltd., Halifax, NS.

Fisheries and Oceans Canada. 2018. Action plan for the Leatherback Sea Turtle (*Dermochelys coriacea*) in Atlantic Canada [Proposed]. *Species at Risk Act* Action Plan Series. Fisheries and Oceans Canada, Ottawa, ON. v + 29 pp.

Husky Energy. 2012. Husky Energy White Rose Extension Project Environmental Assessment. Prepared by Stantec Consulting Ltd., St. John's, NL, for Husky Energy. St. John's, NL.

Equinor Canada 2017. Flemish Pass Exploration Drilling Program – Environmental Impact Statement.

2.4.2 Clarification Requirement: CL-13

Reference to EIS:

Section 7.3.1.3.1 Diesel Batch Spill from MODU and OSV

Context and Rationale

With respect to the effects of a diesel batch spill, Section 7.3.1.3.1 of the EIS states that "[p]roposed critical habitat has been identified for the wolffish in the study area; however, any effects from a diesel spill is expected to be minimal." Fisheries and Oceans Canada noted that there is not sufficient rationale to support the conclusion.

While Fisheries and Oceans noted that proposed critical habitat for wolffish is characterized by depth, and benthic and temperature features rather than surface or pelagic features that would more likely be affected by a surface MODU or OSV diesel spill, it is not clear that this is associated with the statement that a batch diesel spill is expected to have minimal effect on wolffish.

Required Clarification

Provide a rationale to support the conclusion stated regarding the minimal effects of a diesel batch spill on proposed Northern and Spotted Wolffish critical habitat.

Response

Proposed critical habitat for wolffish is located primarily north of the Project Area, with EL 1151 overlapping a small portion for the spotted wolffish (please see response to IR-49).

Spill modelling for this Project and others in the region has determined that many slick trajectories will follow a predominantly easterly path. Batch spill trajectory modelling conducted by Husky in 2012 depict diesel batch spills travelling in an east-southeast direction with in-water column mixing to be a maximum of 30 m. Diesel fuel will evaporate 36% to 38% of the volume spilled during the summer and 25% to 27% during winter months, within 48 hours. Dissolved hydrocarbons from spilled diesel would be limited to the surface and mixed layer of the water column and travel away from proposed critical habitat.

Reference

N/A

2.5 SPECIAL AREAS

2.5.1 Clarification Requirement: CL-14

Reference to EIS:

Section 6.5 Special Areas

Context and Rationale

In the EIS, the residual effects summary **with respect to special areas** does not always provide the same information as that presented in the Residual Effects Summary Tables. Examples include:

- Section 6.5.10.4 states that the Project will occur within an undisturbed ecological and socio-economic setting and Table 6.26 indicates that the Project will be within a disturbed setting;
- residual effects of MODU operation are predicted to be medium-term on page 6.92 and medium-long term in Table 6.26;
- residual effects of waste management on a change in habitat quality are predicted to be low-to-moderate in magnitude on page 6.95, but negligible magnitude in Table 6.26;
- residual effects of waste management on a change in habitat quality are predicted to be medium-long term, but medium-term in Table 6.26; and
- residual effects of well abandonment on a change in habitat quality are predicted to be negligible in magnitude on page 6.96, but low in magnitude in Table 6.26.

Required Clarification

Confirm the residual effects conclusion with respect to special areas.

Response

The following sections of text have been revised to incorporate the responses to the Clarification Request above. Table 6.26 of the EIS has also been adjusted to reflect these changes and is provided as Table 1.

> ***Summary of Project Residual Environmental Effects***
>
> *As a result of characterizing the above potential interactions between Project activities and special areas, the Project has potential to result in adverse residual effects through a change in habitat quality, and associated social-cultural effects, for special areas that exist within the Project Area, including the Northeast Shelf and Slope Ecologically and Biologically Significant Area. With the implementation of applicable mitigation measures and adherence to industry standards for offshore oil and gas activities in Newfoundland and Labrador, the residual adverse environmental effects are considered to be negligible to low in magnitude for most Project components and activities, short to medium-term in duration, reversible, and primarily occur within a disturbed ecological and socio-economic setting (Table 1).*
>
> *Residual environmental effects associated with waste management on a change in habitat quality, and associated social-cultural effects, for special areas is predicted to be low to moderate in magnitude, occurring irregularly as there is no set drilling schedule and medium-term in duration (continuous over the length of the drilling program), and reversible (baseline conditions are anticipated to return once the drilling program is completed).*

Residual environmental effects associated with well abandonment on a change in habitat quality, and associated social-cultural effects, for special areas is predicted to be negligible to low in magnitude, localized to the wellsite in the Project Area, short-term in duration, irregular (once per well with no set schedule), and will be reversible.

Table 1 Project Residual Effects on Special Areas

Residual Effect	Residual Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Change in Habitat Quality							
Presence and Operation of MODU	A	N-L	PA	ST-MT	IR	R	D
Drilling-associated Surveys	A	N-L	PA	ST	IR	R	D
Waste Management	A	L-M	PA	MT	IR	R	D
Supply and Servicing	A	N-L	PA	ST-MT	IR	R	D
Well Abandonment	A	N-L	PA	ST	IR	R	D

KEY
See Table 6.23 for detailed definitions

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
SA: Study Area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term

N/A: Not applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

Reference

N/A

2.6 COMMERCIAL FISHERIES

2.6.1 Clarification Requirement: CL-15

Reference to EIS:

Section 6.2.8 Summary of Existing Conditions for Commercial Fisheries

Context and Rationale

The statement that Roughhead Grenadier is a main foreign fishery in 3L is inconsistent with information provided in Table 4.46 in the EIS.

Required Clarification

Provide clarification with respect to the main foreign fishery in 3L. If Roughhead Grenadier is a main foreign fishery in 3L, include information available on the harvest quantity of Roughhead Grenadier in Table 4.46.

Response

The following statement from Section 6.2.8 of the EIS has been edited to the following:

> *Most commercial fish harvesting in NAFO Area 3L occurs along the edge and slope of the continental shelf for snow crab, northern shrimp, and other benthic invertebrates and pelagics. The main foreign fisheries in 3L consist of northern shrimp, snow crab, and groundfish species such as Greenland halibut and redfish, which are found in the deeper waters of the Flemish Pass outside the 200 nm limit.*

Reference

N/A

2.6.2 Clarification Requirement: CL-16

Reference to EIS:

Section 4.3.1.6.3 Groundfish

Context and Rationale

There are several locations throughout the EIS that refer to halibut, not specifying if it should be Atlantic Halibut or Greenland Halibut/Turbot. For example, it is stated on page 4.147 "…likely for deepwater species such as Halibut and Grenadier."

Required Clarification

Review the EIS for references to "halibut," and clarify if the information presented is related to Greenland Halibut / Turbot or Atlantic Halibut, or both.

Response

The instances in the EIS where halibut is mentioned, but not specified, have been noted below and modified to indicate whether Atlantic halibut or Greenland halibut is the species in question.

<u>EIS Section 4.3.1.6.3 – Groundfish (Page 4.147)</u>

> *"Groundfish harvesting that has taken place within the Project Area has been concentrated within small portions of the Flemish Pass, and on the edges of the Flemish Cap, likely for deep-water species such as Greenland halibut and redfish."*

<u>EIS Section 4.3.2.2 – Newfoundland and Labrador Indigenous Groups (Page 4.171)</u>

> *"Innu Nation holds several commercial communal licenses for groundfish, mackerel, capelin, shrimp, Atlantic halibut, and Greenland halibut."*

<u>EIS Section 4.3.2.7.2 – Food, Social, Ceremonial Fisheries (Page 4.232)</u>

> *"As noted in Sections 4.3.2.2 to 4.3.2.6, there are various species harvested by Indigenous groups for FSC purposes, including, but not limited to gaspereau, trout, Atlantic salmon, bass, mackerel, eel, shad, groundfish (e.g., flounder, Atlantic and Greenland halibut, pollock), Arctic char, smelt, blue shark, herring, mussel, clams, periwinkle, soft-shell clams, squid, tomcod, quahaug, razor clams, lobster, crab and scallops."*

Reference

N/A

2.6.3 Clarification Requirement: CL-17

Reference to EIS:

Section 4.3.1.6.3 Groundfish

Context and Rationale

Table 4.44 includes the status of existing groundfish moratoria in offshore Newfoundland and Labrador and indicates the "Last Year of Assessment." The table indicates that assessments between 2010 and 2016 were considered for Atlantic Cod, American Plaice, Witch Flounder, Grenadier, and Haddock. Fisheries and Oceans Canada noted that more recent stock assessments have been published for several of these stocks, including but not limited to Atlantic Cod.

Similarly, the management area for Greenland Halibut is 2+3KLMNO, this TAC is not the most recent, and if using the NAFO quota table as a source should refer to Divisions 3LMNO only.

Required Clarification

Recognizing that there are up to date stock assessments available for some of the species listed in Table 4.44, confirm that results of the new assessment do not have an impact on the commercial fisheries effects assessment for these species.

Response

Table 4.44 of the EIS has been adjusted to reflect the more recent stock assessments that have been conducted these species; these are provided as Table 1.

Table 1 Status of Existing Groundfish Moratoria in Offshore Newfoundland and Labrador Species

	Stock	Managing Authority	Last Year of Assessment	Result
Atlantic Cod	2J3KL	DFO	2018	No timeline for commercial fishery
	3NO	NAFO	2018	No directed fishery for 2019 to 2021
American plaice	3LNO	NAFO	2018	No directed fishery for 2019 to 2021
	3M	NAFO	2017	No directed fishery for 2018 to 2020
Witch Flounder	3NO	NAFO	2018	No directed fishery for 2019 and 2020
	3KL	NAFO	2016	No directed fishery for 2017-2019 (3KL)
Grenadier	Subarea 0, 2, 3	DFO	2010	No recommendations available
Haddock	3LNO	DFO	2018	No recommendations available
Sources: DFO 2014; NAFO 2019a				

The following text from Section 4.3.1.6.3 of the EIS has also been modified in reflection of more recent quota numbers for Greenland halibut:

> *Greenland halibut is managed by NAFO for stocks in Divisions 2J+3LMNO. In 2010, NAFO adopted a Management Strategy Evaluation for the fishery, which looked at a survey-based harvest control rule to set quotas for the species which will be assessed on an annual basis. The most recent TAC for 2019 was 12,242 t (NAFO 2019b).*

This updated information does not affect the conclusions in the assessment of commercial species in the EIS.

Reference

DFO (Fisheries and Oceans Canada). 2014. Groundfish Species – Northwest Atlantic Fisheries Organization (NAFO) Divisions 2+3KL – Effective: 2013. Available at: http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/groundfish-poisson-fond/groundfish-poisson-fond-div2-3KL-eng.htm.

NAFO (North American Fisheries Organization). 2019a. NAFO Science Advice – Latest Stock Advice. Available at: https://www.nafo.int/Science/Stocks-Advice

NAFO (North American Fisheries Organization). 2019b. NAFO Conservation and Enforcement Measures – Quota Tables. Available at: https://www.nafo.int/Science/Stocks-Advice

2.6.4 Clarification Requirement: CL-18

Reference to EIS:

Section 4.2.4.1 Groundfish

Context and Rationale

Fisheries and Oceans Canada noted that the European Union also conducts RV surveys annually in the summer, which include NAFO Division 3M and the portions of NAFO Divisions 3L, 3N and 3O which are outside Canada's 200 mile limit, however the data from the surveys was not considered in Table 4.23.

Required Clarification

Consider and discuss data available from the European Union RV surveys in the analysis of occurrence and timing of groundfish species in the study area that are of commercial, recreational or Aboriginal value.

Response

Research Vessel (RV) survey results from multiple Northwest Atlantic Fisheries Organization member states for 2014 to 2017 were retrieved from the NAFO database (https://www.nafo.int/SearchResults?sb-search=sampling&sb-inst=0_dnn_avtSearch&sb-logid=16012-cjozc7sx1bp7dkrk&sb-cat=EXCEL) and considered for the discussion of groundfish species within the Study Area. Based on the biological sampling results, the addition of eelpout was made to Table 4.23 of the EIS (see Table 1). Many of the species recorded during international RV sampling were already included within Table 4.23 of the EIS, likely due to the proximity of international and domestic RV surveys within the same NAFO Subdivisions. References to these documents have been added to Table 1.

Table 1 Groundfish of Commercial, Recreational or Aboriginal Value with Potential to Occur in the Study Area

Common Name	Scientific Name	Potential for Occurrence in the Study Area[1]	Timing of Presence	Timing of Spawning
Acadian redfish[2]	*Sebastes fasciatus*	High	Year-Round	September to December
American plaice[2]	*Hippoglossoides platessoides*	High	Year-Round	April
Atlantic cod[2]	*Gadus morhua*	Moderate	Year-Round	Peaks during spring
Atlantic halibut	*Hippoglossus*	Moderate	Year-Round	December to June
Atlantic wolffish[2]	*Anarhichas lupus*	High	Year-Round	September to December
Barndoor skate	*Dipturus laevis*	Moderate	Year-Round	Winter
Cusk[2]	*Brosme*	Low	Year-Round	May to August
Deepwater redfish[2]	*Sebastes mentella*	High	Year-Round	September to December
Eelpout	*Lycodes sp.*	Moderate	Year-Round	Summer
Haddock	*Melanogrammus aeglefinus*	Moderate	Year-Round	January to June
Greenland halibut	*Reinhardtius hippoglossoides*	Moderate	Year-Round	July to October
Monkfish	*Lophius americanus*	Moderate	Year-Round	April to September
Northern wolffish[2]	*Anarhichas denticulatus*	High	Year-Round	October to December

Common Name	Scientific Name	Potential for Occurrence in the Study Area[1]	Timing of Presence	Timing of Spawning
Pollock	*Pollachius virens*	Low	Year-Round	September to March
Roughhead grenadier[2]	*Macrourus berglax*	High	Year-Round	Winter and early spring, potentially year-round.
Roundnose grenadier[2]	*Coryphaenoides rupestris*	High	Year-Round	Year-round
Sculpin	*Triglops* spp.	High	Year-Round	Fall to late winter
Smooth skate[2]	*Malacoraja senta*	Moderate	Year-Round	Year-round
Spotted wolffish[2]	*Anarhichas minor*	High	Year-Round	June to November
Thorny skate[2]	*Amblyraja radiate*	High	Year-Round	September to January
White hake[2]	*Urophycis tenuis*	Moderate	Year-Round	Spring to early summer
Witch flounder	*Glyptocephalus cynoglossus*	Moderate	Year-Round	March to June
Yellowtail founder	*Limanda ferruginea*	Moderate	Year-Round	April to June

Source: Scott and Scott 1988; Anderson et al. 1999; Kulka et al. 2003; Maddock-Parsons 2006; DFO 2009, 2010a, 2010b; COSWEIC 2010, 2011; Healey 2010; NOAA 2013a, 2013b; Amec 2014; NAFO 2015, 2016, 2017, 2018)

Note:
1. This qualitative characterization is based on expert opinion and an analysis of understood habitat preferences across life-history stages, available distribution mapping, and catch data for each species within the Study Area.
2. Species at risk or species of conservation concern.

Reference

Amec Environment and Infrastructure. 2014. Eastern Newfoundland Strategic Environmental Assessment. Final Report, 2014. Available at: http://www.cnlopb.ca/sea/eastern.php.

Anderson, J.T., E.L. Dalley and E. Colbourne. 1999. Recent trends in the dominant pelagic fish species and environment in the Northwest Atlantic, NAFO 2J3KLNO. DFO Canadian Stock Assessment Secretariat Research Document, 99/114: i + 15 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010. COSEWIC assessment and status report on the Barndoor Skate (*Dipturus laevis*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xiii + 71 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011. COSEWIC assessment and status report on the Atlantic Halibut *Hippoglossus hippoglossus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. ix + 48 pp.

DFO (Fisheries and Oceans Canada). 2009. Underwater World: Atlantic Halibut-Estuary and Gulf of St. Lawrence (Canadian East Coast). Available at: http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/atlantichalibut-fletanatlantique-eng.html.

DFO (Fisheries and Oceans Canada). 2010a. Aquatic Species - Details for Monkfish. Available at: http://www.dfo-mpo.gc.ca/species-especes/aquatic-aquatique/monkfish-baudroie-amerique-eng.htm.

DFO (Fisheries and Oceans Canada). 2010b. Recovery Potential assessment for Roundnose Grenadier (*Coryphaenoides rupestris*). Available at: http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2010/2010_021_e.pdf.

Healey, B.P. 2010. Greenland halibut (Reinhardtius hippoglossoides) in NAFO Subarea 2 and Divisions 3KLMNO: stock trends based on annual Canadian research vessel survey results during 1978-2009. Northwest Atlantic Fisheries Organization Science Council Research Document, 10/21: 67 pp.

Kulka, D.W., N.C. Antle and J.M. Simms. 2003. Spatial analysis of 18 demersal species in relation to petroleum licence areas on the Grand Bank (1980-2000). Canadian Technical Report on Fisheries and Aquatic Sciences, 2473: xix + 182 pp.

Maddock-Parsons, D. 2006. Witch flounder in NAFO Divisions 3NO. North Atlantic Fisheries Organization Scientific Council Meeting, June 2006. Northwest Atlantic Fisheries Organization Science Council Research Document, 06/37: 32 pp.

NAFO (Northwest Atlantic Fisheries Organization). 2015. Scientific Council Meeting – June 2015: List of Biological Sampling Data for 2014. NAFO SCS Doc. 15/11. Available at: https://www.nafo.int/Library/Documents/Scientific-Council-SC/Scientific-Council-SC-SCSs/2015-scientific-council-summary-scs-documents

NAFO (Northwest Atlantic Fisheries Organization). 2016. Scientific Council Meeting – June 2016: List of Biological Sampling Data for 2015. NAFO SCS Doc. 16/16. Available at: https://www.nafo.int/Library/Documents/Scientific-Council-SC/Scientific-Council-SC-SCSs/2016-scientific-council-summary-scs-documents

NAFO (Northwest Atlantic Fisheries Organization). 2017. Scientific Council Meeting – June 2017: List of Biological Sampling Data for 2016. NAFO SCS Doc. 17/14. Available at: https://www.nafo.int/Library/Documents/Scientific-Council-SC/Scientific-Council-SC-SCSs/2017-scientific-council-summary-scs-documents

NAFO (Northwest Atlantic Fisheries Organization). 2018. Scientific Council Meeting – June 2018: List of Biological Sampling Data for 2017. NAFO SCS Doc. 17/14. Available at: https://www.nafo.int/Library/Documents/Scientific-Council-SC/Scientific-Council-SC-SCSs/2018-scientific-council-summary-scs-documents

NOAA [National Oceanic and Atmospheric Administration]. 2013a. Fish Watch: Atlantic Pollock. Available at: http://www.fishwatch.gov/profiles/atlantic-pollock.

NOAA [National Oceanic and Atmospheric Administration]. 2013b. Fish Watch: Haddock. Available at: http://www.fishwatch.gov/profiles/haddock

Scott, W.B. and M.G. Scott. 1988. Atlantic Fishes of Canada. Canadian Bulletin of Fishery and Aquatic Sciences, 219: 731 pp.

2.6.5 Clarification Requirement: CL-19

Reference to EIS:

Section 4.3.3 Marine Research

Context and Rationale

Section 4.3.3 of the EIS provides an overview of research surveys conducted by Fisheries and Oceans Canada and fishing industry representatives (through FFAW-Unifor), both inside and outside Canada's EEZ.

Required Clarification

Provide a discussion of research that may be conducted inside or outside Canada's EEZ, that may be conducted by organizations other than Fisheries and Oceans Canada or FFAW.

Response

The following text is provided to include a discussion on different research activities that could potentially be conducted by organizations other than Fisheries and Oceans Canada or FFAW-Unifor:

In addition to fisheries-related research, the potential exists for other research activities to be conducted in offshore Newfoundland and Labrador throughout different times of the year. These research activities can include those that may be carried out or funded by educational institutions, other industries (including oil and gas), non-profit organizations, and/or government agencies. Organizations that have supported or conducted research work in offshore Newfoundland and Labrador include, but are not limited to: Petroleum Research Newfoundland and Labrador, C-CORE, Provincial Aerospace Ltd., Memorial University of Newfoundland and Labrador, and Marine institute, Environmental Science Research Fund, and the Natural Sciences and Engineering Research Council. Research that may occur in offshore Newfoundland and Labrador can vary each year due to the amount of funding available and the number of research projects planned or proposed. The extent and duration of these research activities will also depend on the scope and nature of the activity itself.

Reference

N/A

2.7 ACCIDENTS AND MALFUNCTIONS

2.7.1 Clarification Requirement: CL-20

Reference to EIS:

Section 7.3.4.4 Determination of Significance

Context and Rationale

Tables reporting a summary of residual project-related environmental effects on valued components have the frequency of diesel batch spills from OSV and MODUs, of 10 bbl and 100bbl in size as single events. However the data provided in Table 7.6, 7.7 or 7.10 is not refined to confirm the frequency. In addition, while the number of spills and total volumes are presented, the number of wells drilled in the given year are not presented.

Section 7.3.4.4 refers to "infrequent batch spills", with no definition of "infrequent".

Required Clarification

Provide information on the number of spills per year less than 10 bbl, rather than presenting data as 1 to 49 bbl.

In addition where data is provided on the number of spills and/or spill volume, provide the number of wells drilled in the corresponding year.

Define "infrequent" as used to discuss the frequency of batch spills.

Response

The number of wells (Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) 2019a) and corresponding spills per year (<10 bbl (1,560 L)) (C-NLOPB 2019b), are presented in Table 1.

Table 1 Number of Spills <10 Barrels and Corresponding Number of Wells Drilled

Year	# Spills <10 bbls (1,560 L)	# Exploration / Delineation Wells
1997	1 exploration	2 exploration wells started in 1997, ended in 1998
1998	3 exploration	2 exploration wells started in 1997, ended in 1998; same well / rig as 1997
1999	21 (4 during exploration / 17 during delineation)	5 exploration and 3 delineation wells drilled; 10 spills at two delineation wells and 3 spills at two exploration wells using same rig; 8 spills at three delineation wells using same rig
2000	1 delineation	2 exploration and 2 delineation wells drilled
2001	0	0 exploration / delineation wells drilled
2002	0	2 exploration and 1 delineation wells drilled
2003	1 exploration; 2 delineation	2 exploration and 2 delineation wells drilled
2004	0	0 exploration / delineation wells drilled
2005	0	2 exploration and 3 delineation wells drilled
2006	4 exploration	5 exploration and 8 delineation wells drilled; all spills at one exploration well
2007	1 delineation	1 exploration and 4 delineation wells drilled
2008	0	5 exploration and 2 delineation wells drilled

Year	# Spills <10 bbls (1,560 L)	# Exploration / Delineation Wells
2009	2 exploration	3 exploration wells drilled
2010	1 exploration	4 exploration and 1 delineation wells drilled
2011	5 exploration; 1 delineation	4 exploration and 1 delineation wells drilled; 3 spills at one exploration well, all spills from same rig
2012	0	2 exploration wells drilled
2013	1 delineation	6 exploration and 3 delineation wells drilled
2014	1 exploration	2 exploration and 1 delineation wells drilled
2015	0	8 exploration wells drilled
2016	1 exploration	4 exploration wells drilled
2017	0	2 exploration and 1 delineation wells drilled
2018	0	1 exploration well drilled

The term “infrequent” is not defined but used as a qualitative descriptor.

Reference

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2019a. Schedule of Wells Newfoundland Offshore Area: Schedule of Wells Summary – Updated December, 2018. Available at: https://www.cnlopb.ca/wp-content/uploads/wells/wells_summary.xlsx

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2019b. Environmental Statistics - Spill and Discharge Information by Operator: Spills Greater than 1 Litre (1997-2018): Available at: https://www.cnlopb.ca/wp-content/uploads/spill/spgt1l.pdf

2.7.2 Clarification Requirement: CL-21

Reference to EIS:

Section 7.2.3 Nearshore Marine Diesel Spill Model; Section 7.2.1 Offshore Spill Model Scenarios

Context and Rationale

The diesel properties for the nearshore spill model which are provided in Appendix G differ from the diesel properties listed in Table 7.17 “Oil Property Parameters Used in Spill Modelling”. There is no explanation provided why diesel fuels with different properties were modelled for the nearshore and offshore.

Required Clarification

Provide an explanation for the differences in diesel properties for the nearshore and offshore batch spill modelling scenarios.

Response

As indicated in Section 2.1 of Appendix G of the EIS, data from Environmental Science and Technology Centre were unavailable at the time the inshore modelling was conducted. Whereas, the offshore model used data from the Environmental Science and Technology Centre. The difference in diesel properties would not affect the outcome of the model nor the environmental impact assessment resulting from the spill.

Reference

N/A

2.7.3 Clarification Requirement: CL-22

Reference to EIS:

Section 7.2.1 Offshore Spill Model Scenarios

Context and Rationale

Results of the White Rose Extension Project's batch fuel oil (diesel) spill modeling presented in the EIS are inconsistently presented:

- Section 7.2.1.1 of the EIS states instantaneous batch spills of 1.6, 16, 100, and 350 cubic metres were modeled for marine diesel for the White Rose Extension project.
- Table 7.18, Spill Flow Rates and Volumes Used in Modelling, lists 1.6, 0.16, 100 and 350 cubic metres.
- Section 7.2.1.5 states spill volumes of 1,600, 16,000, 100,000, and 350,000 litres were modeled.

Figure 7-16 presents spill volumes of 16, 16, 100 and 300 cubic metres.

Required Clarification

Provide correct batch fuel oil spill volumes.

Provide a figure showing the White Rose Extension Project modelled sites for fuel oil spills in the project area of the Project and in relation to the project ELs.

Response

Instantaneous batch spills of 1.6, 16, 100, and 350 cubic metres (m^3) were modelled for marine diesel for the White Rose Extension Project.

- Table 7.18: 0.16 volume was incorrect, it should be 16 m^3
- Section 7.2.1.5: volumes are correct, but for consistency should be 1.6, 16, 100, and 350 m^3
- Figure 7-16: the first volume is incorrect, it should be 1.6 m^3

The origin of the spill modeling in the Project Area (and in relation to the Project ELs) is provided as Figure 1.

Reference

N/A

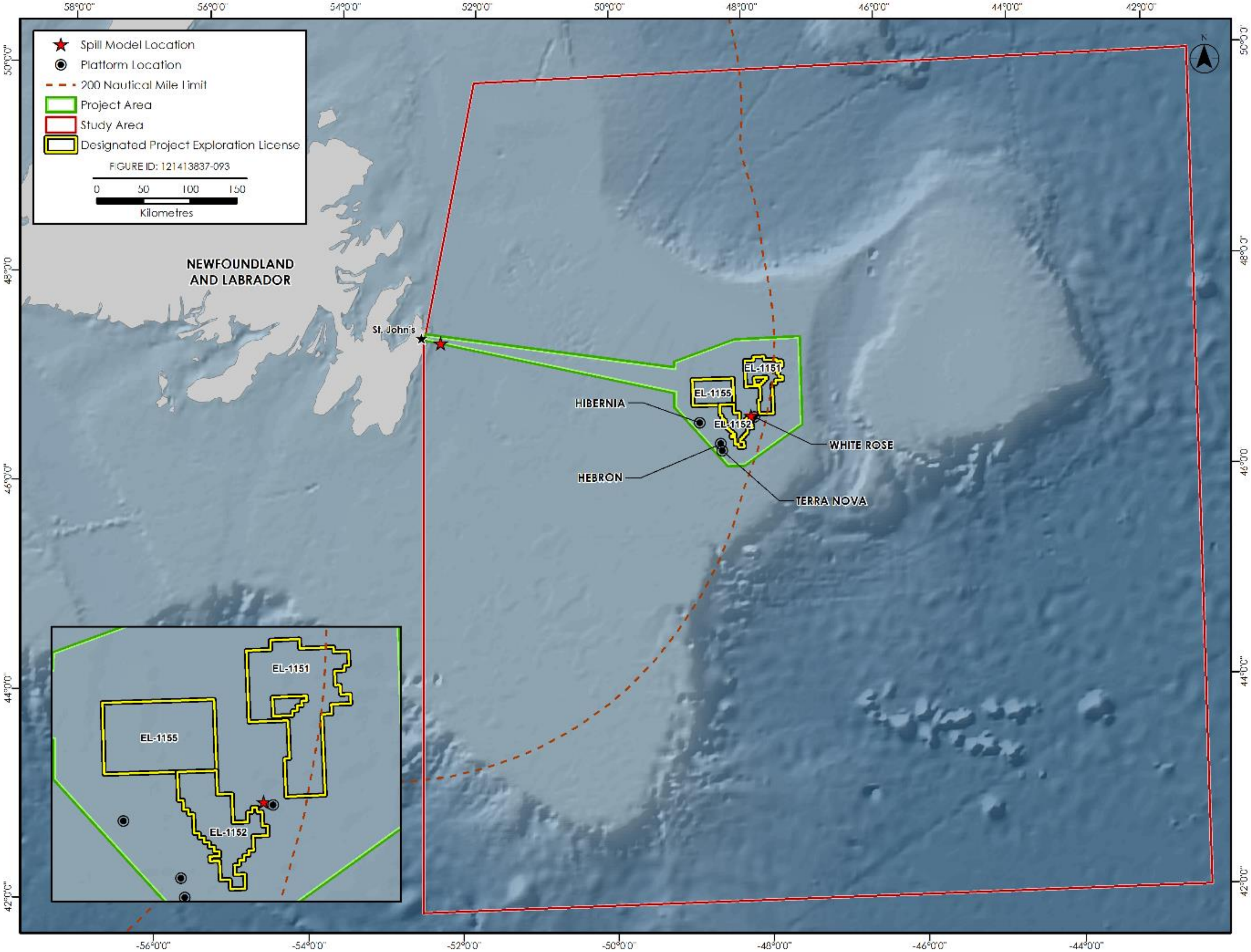


Figure 1 Oil Spill Model Locations

2.7.4 Clarification Requirement: CL-23

Reference to EIS:

Section 7.2.1.4 Historical Spill Trajectory Assessment

Context and Rationale

Section 7.2.1 of the EIS states that White Rose Extension Project model originates near the middle of the current Project, with the centres for the proposed Project ELs each approximately 45 kilometres from the modeled spill source; however, no figure is provided showing the location of the modelled spill scenario sites relative to the project EL areas.

Required Clarification

Provide a figure showing the White Rose Extension Project modelled sites for blowout scenarios in the project area of the Project and in relation to the project ELs.

Response

See Figure 1 for location of White Rose Extension Project modelled oil spill blowout scenarios location in the Project Area and in relation to the Project Exploration Licences.

Reference

N/A

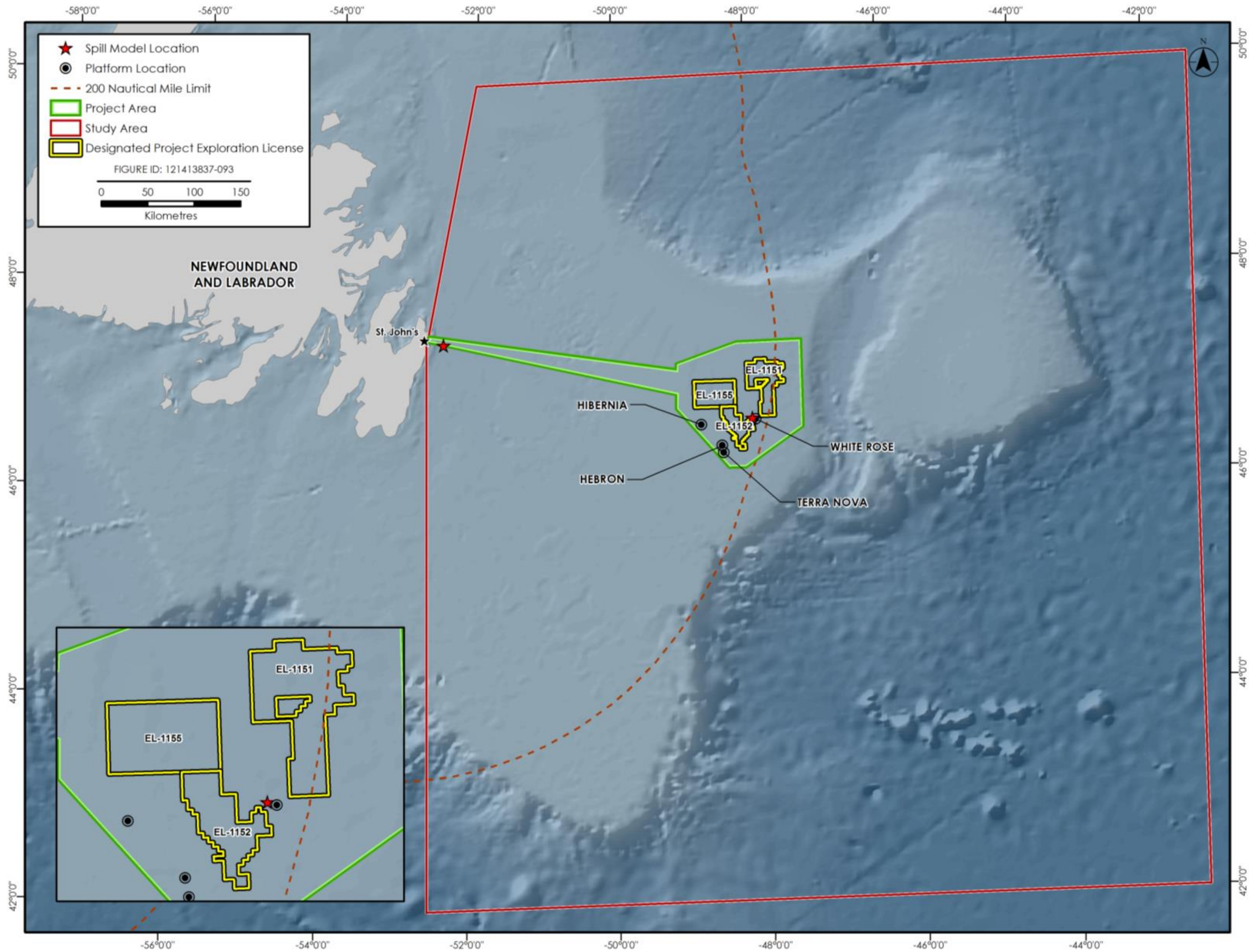


Figure 1 **White Rose Extension Project Blowout Spill Location in Relation to Project Area and Exploration Licences**

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2.8 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

2.8.1 Clarification Requirement: CL-24

Reference to EIS:

Section 8.2.2.3 Seismic Events and Tsunamis

Context and Rationale

Table 8.1 and Figure 8.1 in Section 8.2.2.3 in the EIS provide a description of earthquakes within 500 kilometres of the White Rose field from 1988 to 2010. This section also provides information related to the earthquake that was recorded on September 2, 2018, however the proximity of this event to the Project is not clear.

Required Clarification

Confirm whether the earthquake from September 2, 2018, was within 500 km of the White Rose Field. Update Table 8.1 and Figure 8.1 with earthquake data from 2010 to present, as applicable.

Response

The earthquake on September 3, 2018 (292 km NE of Bonavista), is just outside the Study Area, approximately 430 km from White Rose. The updated earthquake locations are listed in Table 1 and illustrated in Figure 1.

Reference

Natural Resources Canada. 2018. Search of the Earthquakes Canada Database. Available at; http://www.earthquakescanada.nrcan.gc.ca/stndon/NEDB-BNDS/bull-en.php

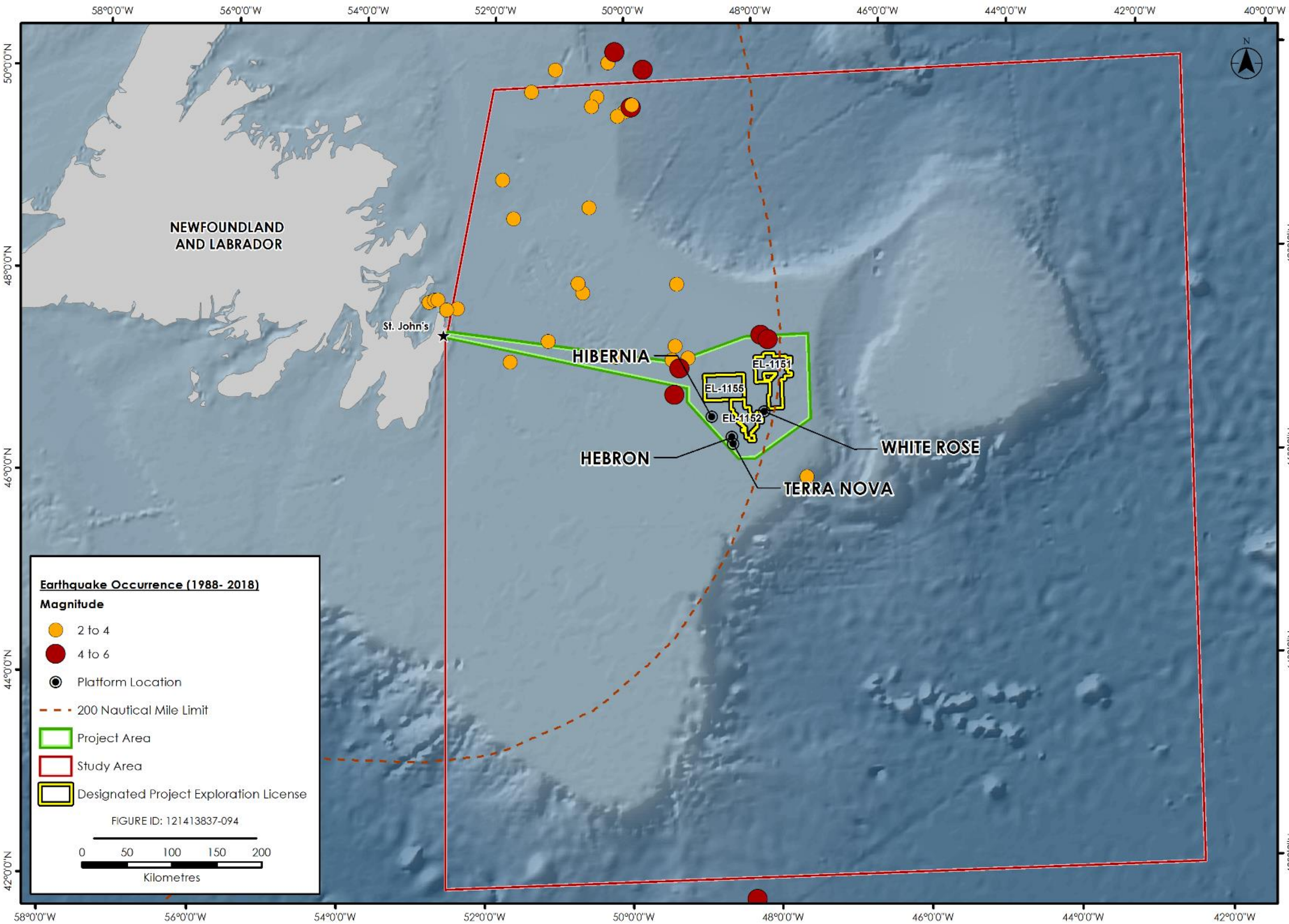
Table 1 Seismic Activity within the Study Area, 1988 to 2018

Date	Time(UT)	Latitude	Longitude	Depth	Magnitude	Distance (km)	Region and Comment
2018/10/28	07:36:12	49.813	-50.001	18.0g[A]	3.5ML[B]	261	NE from Bonavista
2018/09/11	00:22:23	50.306	-50.244	18.0g	3.6ML	278	NE from Bonavista
2018/09/03	01:43:02	50.413	-50.139	18.0g	4.1ML	292	NE from Bonavista
2018/06/08	08:21:56	47.897	-52.938	18.0g	2.1MN[B]	28	NE from Carbonear
2017/12/29	06:05:21	47.525	-51.167	18.0g	3.6MN	118	E from St. John's
2017/02/05	14:32:02	50.847	-49.234	18.0g	4.7ML		Offshore Newfoundland
2015/02/18	23:58:59	50.936	-50.971	18.0g	4.1ML		Offshore Newfoundland
2013/08/29	08:56:24	47.554	-48.029	18.0g	4.5ML	354	E from St. John's
2013/08/29	04:47:26	47.508	-47.925	18.0g	4.3ML	362	E from St. John's
2013/04/11	00:07:51	49.771	-50.105	18.0g	2.9ML		Offshore Newfoundland
2013/03/29	06:17:46	49.860	-49.898	18.0g	4.3ML		Offshore Newfoundland
2012/09/10	13:59:22	50.016	-51.432	18.0g	3.7MN	195	E from Musgrave Harbour
2012/01/25	04:30:07	47.921	-52.858	18.0g	3.0ML	35	NE from Carbonear
2010/12/01	03:35:32	48.859	-50.552	18.0g	3.3ML	190	E from Bonavista
2010/01/12	22:47:18	48.007	-50.652	18.0g	2.7MN	164	E from St. John's
2008/12/17	07:20:22	47.925	-52.807	18.0g	3.2MN	37	NE from Carbonear
2008/11/18	00:15:29	50.233	-49.699	18.0g	4.2ML		Offshore Newfoundland
2008/10/30	05:34:37	49.965	-50.420	18.0g	2.9ML	245	NE from Bonavista
2008/06/12	12:34:51	48.102	-50.723	18.0g	3.1MN	162	E from St. John's
2007/02/06	01:27:51	48.084	-49.251	18.0g	2.9MN		Grand Banks
2005/04/05	15:07:13	49.869	-50.504	18.0g	3.3ML	234	NE from Bonavista
2003/04/20	10:30:25	50.235	-51.061	18.0g	2.6MN	320	N from St. John's
2002/03/02	07:37:39	49.134	-51.867	18.0g	3.1MN	185	N from St. John's
2001/04/06	21:09:48	48.749	-51.692	18.0g	3.1MN	150	NE from St. John's
1998/09/08	19:13:53	40.080	-52.518	18.0g	3.9ML		Laurentian Fan
1995/01/22	06:46:20	47.840	-52.517	18.0g	2.4MN	34	NE from St. John's
1994/12/01	09:32:25	47.315	-51.725	18.0g	2.6MN		Offshore Newfoundland

Date	Time(UT)	Latitude	Longitude	Depth	Magnitude	Distance (km)	Region and Comment
1994/08/11	18:13:49	47.827	-52.673	0.0g	3.1MN		St. John’s, NL
1992/08/10	11:31:52	47.343	-49.110	18.0g	3.4MN		Grand Banks
1992/07/17	04:20:22	46.118	-47.438	18.0g	3.9MN		Eastern Margin of Grand Banks
1992/07/06	16:58:16	47.326	-49.346	18.0g	3.0ML		Grand Banks
1992/01/13	06:07:28	47.244	-49.236	18.0g	4.0MN		Southern Grand Banks
1991/07/23	11:23:01	47.364	-50.167	18.0g	3.2MN		Grand Banks
1990/04/24	21:40:04	41.918	-48.341	18.0g	4.7ML	718	SE from St. John's
1989/12/03	05:15:40	46.980	-49.317	18.0g	4.2ML		Offshore Newfoundland
1988/08/09	00:16:45	47.463	-49.293	18.0g	3.1ML		Grand Banks
1988/01/09	07:15:43	49.880	-49.883	18.0g	3.5ML		Offshore Newfoundland

A g = Peak ground acceleration

B ML refers to `local magnitude` which was originally defined for California by Charles Richter. However, this does not apply to eastern North America, where seismic waves attenuate differently. Otto Nuttli developed a formula for measuring seismicity of eastern Canada, Nuttli Magnitude or MN



Source: Natural Resources Canada 2018

Figure 1 Seismic Activity within the Study Area, 1988 to 2018

2.8.2 Clarification Requirement: CL-25

Reference to EIS:

Section 8.3.2.2 Seismic Events and Tsunamis

Context and Rationale

Section 8.3.2.2. of the EIS states that drilling installations have the capability to disconnect the riser from the well in a “very short time period.” It is not clear what constitutes a very short time period.

Required Clarification

Define “very short time period” in reference to disconnecting the riser from a well.

Response

The time required to disconnect the riser depends on the drilling activity underway. If drilling is underway, the well would need to be secured by providing pressure integrity at the seabed, prior to disconnect. Riser disconnect can occur in a matter of hours if the well has been secured in advance.

Reference

N/A

2.8.3 Clarification Requirement: CL-26

Reference to EIS:

Section 4.1.4.2 Icebergs

Context and Rationale

Section 4.1.4.2 of the EIS states that “A monthly analysis (Figure 4-19) shows that icebergs have been spotted within the region from January to September and they are most prominent during the month of May.” This is inconsistent with Figure 4-19, which shows April to be the most prominent.

Required Clarification

Clarify the month in which icebergs are most prominent, and update the text and figure appropriately.

Response

Section 4.1.4.2 of the EIS is revised as follows: “A monthly analysis (Figure 4-19) shows that icebergs have been spotted within the region from January to September and they are most prominent during the month of April.” This should now be consistent with Figure 4-19 of the EIS, which depicts April as having the most frequent sightings and largest overall size of icebergs.

Reference

N/A

2.8.4 Clarification Requirement: CL-27

Reference to EIS:

Section 4.1.2.1 Wind Climatology;

Context and Rationale

Section 8.2.2 Atmospheric and Physical Oceanography Environment

Environment and Climate Change Canada has requested clarification on the stated number of grid points used for the calculation of wind speeds.

Section 4.1.2.1, page 4.9 of the EIS states that "[m]ean wind speed statistics are provided in Table 4.1. Wind roses of the annual wind speed for Grid Points 12214 and 11422 are presented in Figures 4-5 and 4-6, respectively. As indicated in Table 4.1, wind speeds are consistent for **all four** grid points in each month."

Likewise, Section 8.2.2.1 (page 8.3) of the EIS states that "[a]s noted in Table 4.1 in Section 4.1.2.1, the wind speeds recorded at MSC50 grid point 12214 and 11422 are consistent for each grid points in each month. The mean monthly wind speed varied by 0.1 to 0.2 m/s between **all four** sites."

While the proponent makes a reference to four grid points in these two sections (page 4.9 and 8.3) there are only two MSC grid points chosen in the study.

Required Clarification

Confirm if the number of MSC grid points chosen in the study.

Response

There are two MSC grid point (12214 and 11422) selected for this study. The text should read:

Section 4.1.2.1 of the EIS: Mean wind speed statistics are provided in Table 4.1. Wind roses of the annual wind speed for Grid Points 12214 and 11422 are presented in Figures 4-5 and 4-6, respectively. As indicated in Table 4.1, wind speeds are consistent for both grid points in each month.

Section 8.2.2.1 of the EIS: As noted in Table 4.1 in Section 4.1.2.1, the wind speeds recorded at MSC50 grid point 12214 and 11422 are consistent for each grid points in each month. The mean monthly wind speed varied by 0.1 to 0.2 m/s for both sites.

Reference

N/A

2.8.5 Clarification Requirement: CL-28

Reference to EIS:

Section 4.1 Existing Marine Physical Environment; Section 4.1.2.1 Wind Climatology

Context and Rationale

In Section 4.1 of the EIS, the proponent presents wind statistics (Table 4.4) and wave height statistics (Table 4.7). Environment and Climate Change Canada noted that each table contains data for two MSC grid points and two offshore platforms within the project area. However, the proponent did not provide any metadata (or references) for the data used in the statistical analysis from either of the two offshore platforms (i.e. Terra Nova and White Rose).

Required Clarification

Provide the metadata or references for the operational conditions, including:

For the wind analysis the proponent should reference operational conditions including the following additional information:

1. instrument location (i.e. latitudinal and longitudinal coordinates of the offshore platform) for wind analysis and wave statistics,
2. number of observations used in the analysis and/or the frequency of measurements for the period of coverage for both wind analysis and wave statistics,
3. anemometer height for wind analysis, and
4. sampling time of the wind measurements.

Response

Table 1 lists the requested references for instrument location, anemometer height, and sampling period that pertains to Table 4.1 (Mean Wind Speed (m/s) Statistics) of the EIS.

Table 1 Instrument Location, Anemometer Height, and Sampling Period for Mean Wind Speed Statistics

Location	Latitude	Longitude	Anemometer Height (m)	Period	Number of Observations
SeaRose FPSO	46.8°N	48.0°W	42	Nov 04, 2005 – Jun 07, 2016	9,148
Terra Nova FPSO	46.4°N	48.4°W	50	Aug 12, 2007 – Jun 07, 2016	22,722
Glomar Grand Banks	46.5°N	48.4°W	82.5	Dec 31, 1998 - Jul 02, 2000	4,359
GSF Grand Banks	46.7°N	48.0°W	82.5	Aug 01, 2007 – Aug 31, 2015	14,709
Henry Goodrich	46.4°N	48.6°W	95	Feb 23, 2000 - Jun 30, 2009	21,303
Hibernia	46.7°N	48.7°W	139	Jan 01, 1999 – Jun 06, 2016	46,507
ICOADS	46°10'N -	046°30'W -	_	Jan 1986-	172,728

Location	Latitude	Longitude	Anemometer Height (m)	Period	Number of Observations
	47°40 ‘N	049°20’W		Dec 2015	
MSC50 Grid Point 12214	47.3°N	48.3°W	_	MSC50 operated continuously from 1954-2013	525,960
MSC50 Grid Point 11422	46.9°N	48.2°W	_	MSC50 operated continuously from 1954-2013	525,960

Table 2 lists the requested references for instrument location (as well as Sampling Period) for Table 4.7 (Mean Significant Wave Height Statistics (m)) of the EIS.

Table 2 Instrument Location and Sampling Period for Mean Significant Wave Height Statistics

Location	Latitude	Longitude	Number of Observations
Terra Nova	46.4°N	48.4°W	401,839
White Rose (2003-2007)	46.8°N	48.0°W	55,648
White Rose (2007-2015)	46.8°N	48.0°W	138,143
MSC50 Grid Point 12214	47.3°N	48.3°W	512,997
MSC50 Grid Point 11422	46.9°N	48.2°W	516,358

Reference

N/A

2.9 CUMULATIVE EFFECTS

2.9.1 Clarification Requirement: CL-29

Reference to EIS:

Section 9.2.1.2 Offshore Exploration Drilling and Production Projects

Context and Rationale

Section 9.2.1.2 of the EIS describes potential exploration drilling projects in the Newfoundland and Labrador offshore that may result in cumulative effects; however, ExxonMobil's Southeastern Newfoundland Offshore Exploration Drilling Project is not included. Also, EL 1134 is not included as part of ExxonMobil's Eastern Newfoundland Offshore Exploration Drilling Project.

Table 9.8 of the EIS provides information related to potential spatial and temporal overlap between the Project and other physical activities including exploration drilling and production projects; however, not all exploration projects identified in Section 9.2.1.2 are included in the discussion of spatial and temporal overlap.

Required Clarification

Update the description of spatial and temporal overlap of potential effects of the proposed project and residual effects of each of the past, present and future exploration and production projects outlined in Section 9.2.1.2 (including ExxonMobil's Southeastern Newfoundland Offshore Exploration Drilling Project and EL 1134 as part of ExxonMobil's Eastern Newfoundland Offshore Exploration Drilling Project). Include a figure showing the proposed project in relation to the exploration and production projects, as well as information on the distances between the proposed project and the ELs of the present and future exploration and production projects.

Response

Offshore oil and gas activities have occurred in the Study Area, including offshore exploration since the late 1950s (Canada-Newfoundland and Labrador Offshore Petroleum Board No Date), and oil production since 1997.

In addition to Husky's exploration drilling Project, an updated list of proposed offshore exploration drilling projects in the Study Area are provided below and in Figure 1:

- Equinor Canada Ltd. (Equinor; formerly Statoil Canada Ltd) and its partners are planning to undertake an exploration drilling program in the Flemish Pass during the period from 2018 to 2028. The area within which Equinor may conduct exploration drilling encompasses Exploration Licences (ELs) 1125, 1139, 1140, 1141, and 1142.
- ExxonMobil Canada Ltd. (ExxonMobil) and its co-venturers are planning to undertake an exploration drilling program in the Flemish Pass and Jeanne d'Arc Basin during the period from 2018 to 2030. The area within which ExxonMobil may conduct exploration drilling encompasses ELs 1134, 1135, and 1137.
- ExxonMobil's southeastern Newfoundland offshore exploration drilling project (2020-2029) in EL 1136.
- CNOOC Petroleum North America ULC (CNOOC) (formerly Nexen Energy ULC) is planning to undertake an exploration project in the Flemish Pass from 2018 to 2028. The area within which CNOOC may conduct exploration drilling encompasses ELs 1144 and 1150.
- BP Canada Energy Group ULC (BP) is planning to undertake an exploration project in the Orphan Basin from 2019 to 2026. The area within which BP may conduct exploration drilling encompasses ELs 1145, 1146, 1148, and 1149.

- Chevron Canada Limited (Chevron) is planning to undertake an exploration project in the west Flemish Pass area during a 10-year period beginning in 2021. The area within which Chevron may conduct exploration drilling encompasses EL 1138.
- The 2018 Land Bid resulted in three operators acquiring five licences (see Figure 1):
  - BHP Billiton Petroleum (New Ventures) Corporation (BHP) acquired EL 1157 and EL 1158 in the northern Flemish Pass Area
  - Equinor acquired EL 1159 and EL 1160 in the Flemish Pass area
  - Suncor Energy Offshore Energy Partnership (Suncor) acquired EL 1161 in the Jeanne d'Arc Basin

Table 1 provides the distance from other Exploration Drilling Projects (nearest EL) to the Husky Project Area and nearest EL.

Table 1 Other Exploration Drilling Projects and Distance to Husky Project Area and Nearest EL

EL #	Operator	Project	Distance to Project EL (km)	Distance to Project Area (km)
1157	BHP	Future Exploration	122	100
1158	BHP	Future Exploration	89	69
1145	BP	Exploration CEAA 2012	341	316
1146	BP	Exploration CEAA 2012	341	317
1148	BP	Exploration CEAA 2012	280	257
1149	BP	Exploration CEAA 2012	181	156
1138	Chevron	Exploration CEAA 2012	69	48
1159	Equinor	Exploration CEAA 2012	Adjacent	Overlaps
1160	Equinor	Exploration CEAA 2012	Adjacent	Overlaps
1156	Equinor	Exploration	64	31
1154	Equinor	Exploration	115	83
1143	Equinor	Exploration	92	62
1139	Equinor	Exploration CEAA 2012	184	153
1140	Equinor	Exploration CEAA 2012	237	204
1141	Equinor	Exploration CEAA 2012	207	174
1142	Equinor	Exploration CEAA 2012	150	119
1136	ExxonMobil	Exploration CEAA 2012	77	57
1134	ExxonMobil	Exploration CEAA 2012	34	14
1135	ExxonMobil	Exploration CEAA 2012	6	Overlaps
1137	ExxonMobil	Exploration CEAA 2012	Adjacent	Overlaps
1122	Husky		Adjacent	Within
1147	Navitas Petroleum Canada Ltd.	Exploration	309	284
1144	CNOOC	Exploration CEAA 2012	61	29
1150	CNOOC	Exploration CEAA 2012	83	62
1161	Suncor	Future Exploration	15	0
NA	Equinor and Husky	Bay du Nord Development	99	66

References

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). No Date. Exploration Newfoundland and Labrador. Available at: http://www.cnlopb.ca/pdfs/exp_brochure.pdf?lbisphpreq=1.

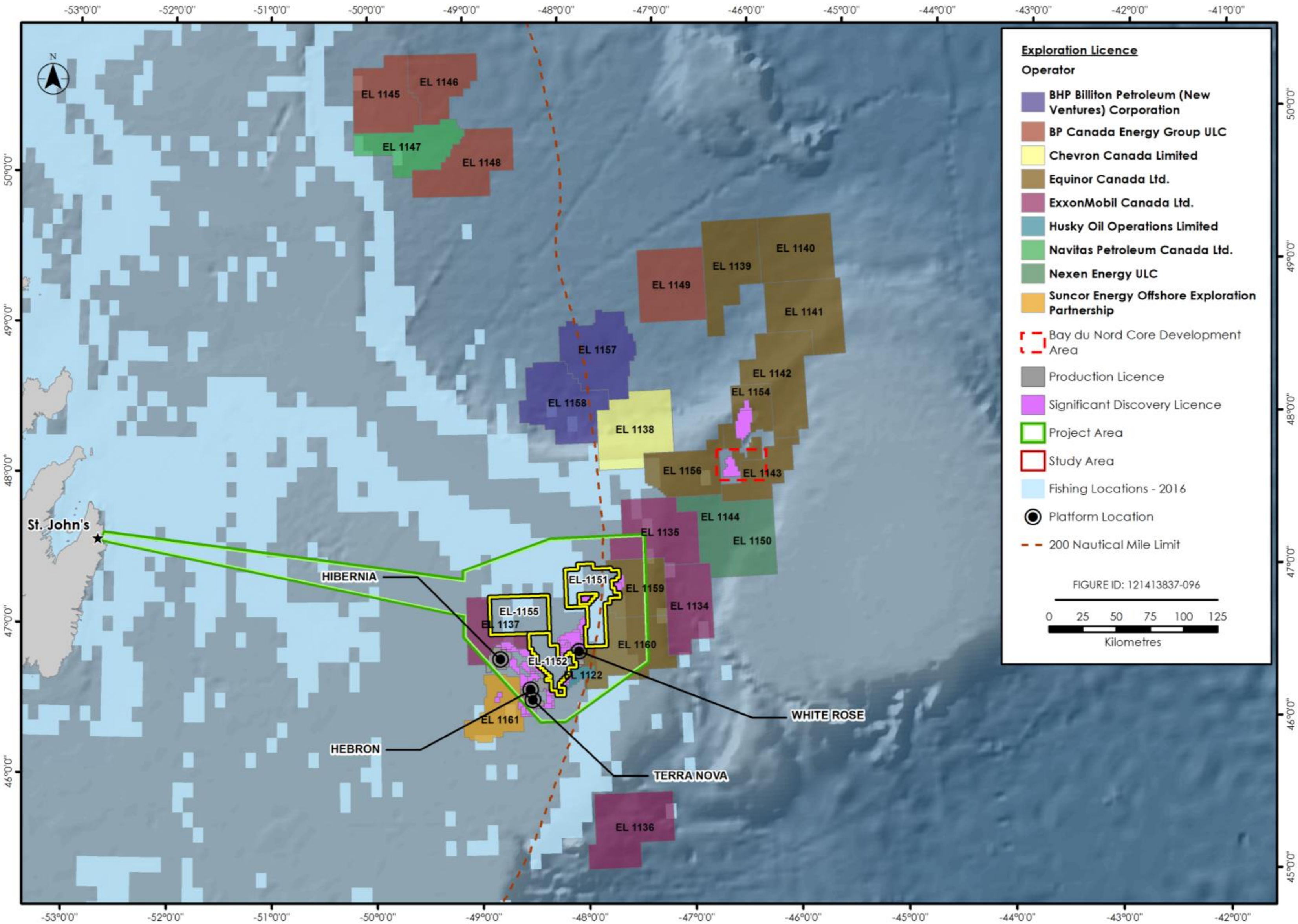


Figure 1 Exploration Licences in Newfoundland Offshore Area in Relation to Husky Project Area and ELs

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