Responses to Information Requirements and Clarifications – Round 1 (Parts 1 and 2)

For
Flemish Pass Exploration Drilling Program
(CEAR 80129)

and

Eastern Newfoundland Offshore Exploration Drilling Project
(CEAR 80132)

pursuant to the *Canadian Environmental Assessment Act, 2012*

Equinor Canada Ltd.

ExxonMobil Canada Ltd.

July 2018

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EXXONMOBIL AND EQUINOR

INFORMATION REQUIREMENT – IR-01

(KMKNO-03)

Project Effects Link to CEAA 2012: All –project description relevant to all Section 5 effects.

Reference to EIS Guidelines: Part 2, Section 3, Project Description.

Reference to EIS: Section 1.2.2, Key Project Components and Activities; 2.5.2.3, Offshore Well Drilling; 2.10.1.2, Drilling Installation Selection; 8.3.3, Presence and Operation of Drilling Installations; 13.3.3, Presence and Operation of Drilling Installation (Including Drilling and Associated Marine Discharge).

Context and Rationale

The EIS states that the Project may at times have multiple drilling units operating simultaneously (Sections 2.10.1.2 and 8.3.3) and that the effects assessment considers the operation of up to two drilling installations actively engaged in drilling activities in the Project Area at any one time (Section 2.5.1). It is unclear throughout the effects analysis how simultaneous drilling was considered, as potential overlapping effects of dual sources of noise, sediment deposition, light and other environmental disturbances are not discussed in the analysis of effects.

The EIS states that batch drilling, which is the process of consecutively drilling the top hole portions of a well for multiple wells, may occur (e.g., Sections 1.2.2, 2.5.2.3, 13.3.3). No further information is provided, nor does the effects analysis consider project effects from batch drilling, other than a brief mention of increased frequency of drilling installation movements as compared to drilling a single well at a time (Section 13.3.3).

Specific Question or Information Requirement

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

- Clarify circumstances under which simultaneous drilling and batch drilling could occur.
- Provide additional information on how batch drilling is undertaken, including an explanation of how the integrity of the wellbore is secured prior to moving to the next well.
- Assess the environmental effects of simultaneous drilling and batch drilling on relevant valued components (VCs).

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

Response

It is unlikely to have drilling installations completing exploration drilling in the same area, but there may be efficiency by having a “top hole” installation completing riserless operations while a second installation performs reservoir drilling with blowout preventer (BOP) installed on another well. Operations with two dynamically positioned (DP) drilling installations requires a minimum spacing of 500 metres (m), therefore simultaneous operations on the same well will not occur.

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) operations for exploration drilling have consisted of batch setting of top holes (i.e., conductor and surface hole sections). Advantages associated with the batch approach include:

- Riserless operations are less weather sensitive – complete batch set of top holes during winter season, reservoir drilling during more favorable summer;
- Rhythm / repetition for crews – increased familiarity and efficiency;
- Simplified logistics and pit management / cleaning;
- Opportunity to "hop" (transit with BOP below drilling installation) between wells, reducing BOP running time; and
- Improved health, safety and environment (HSE) associated with reduced BOP / riser running.

Once batch operations are completed, wells are temporarily suspended or permanently abandoned, as outlined in Section 2.5.2.7 of the Environmental Impact Statement [EIS]), as per the Operators management system and in compliance with the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) requirements. The Operators submit a *Notification to Suspend/Abandon* (C-NLOPB 2016) to the C-NLOPB and receive approval for the planned "as-left" condition prior to moving off the well.

The typical sequencing of exploration drilling activity in any exploration licence (EL), is such that an initial well is drilled and its results are analysed and evaluated as part of an operator's decision-making about whether, when, and where to drill any additional exploration or delineation wells in that area. Availability of drilling installations is another factor that significantly reduces the possibility that two drilling installations would operate at the same time in proximity to one another as part of the Project. The environmental effects assessment has, however, included and assessed this potential occurrence, to be conservative and fully inclusive of all such possible scenarios, including the potential for "overlapping" or combined environmental effects to a valued component (VC) resulting from multiple, concurrent drilling campaigns occurring as part of the Project.

In the event that multiple drilling campaigns were to be completed by the Operators concurrently within the Project Area, the nature and scope of each would be in keeping with that described and assessed in the EIS. This includes the characteristics of the drilling methods and equipment and other factors, all of which would be within the scope of the Project considered in the EIS. In addition, the mitigation measures outlined in the EIS would be implemented for each individual well drilled, whether concurrent or consecutive in nature.

The potential for simultaneous drilling activities and the potential for overlapping effects is addressed in the EIS (e.g., Section 8.3.3) and reflected where applicable in the environmental effects analysis presented therein. The possible presence, and resulting effects, of multiple drilling installations is also considered in the effects assessment for the Commercial Fisheries and Other Ocean Users VC. In assessing the potential effects of the "Presence and Operation of Drilling Installation" (Section 13.3.3) on that VC, the EIS states: *"Safety zones will range from an approximate area of 1 km² to 12 km², depending on type of drilling installation (DP vs anchor moorings). As there is the potential for multiple (two) drilling installations to be operating at any one time during the Project, this could increase the total size of the safety zone(s) within the Project Area to approximately 2 to 24 km²."*

In addition, the cumulative effects assessment presented in Chapter 14 of the EIS is focussed on assessing the potential for the environmental zones of influence of individual Project-related activities and those of other projects and activities in the Regional Study Area (RSA) to overlap in space and time to result in combined effects on any VC. This includes the consideration of the localized and short-term nature of the environmental disturbances that are associated with this Project, the resulting limited potential for overlap between activities and effects, and the various measures that are typically implemented to maintain appropriate spatial and temporal separation for operational, regulatory and safety reasons. While the cumulative effects assessment pertained primarily to the potential for the effects of the Project to interact with those of other projects and activities in the region, many of these concepts are also applicable to the avoidance of potential "within Project" cumulative effects resulting from multiple, concurrent Project activities as well.

In summary, although the specific location of individual wellsites and the specific nature and duration of any individual drilling activity carried out as part of the Project cannot currently be defined, any simultaneous drilling activities could be occurring in different parts of the overall Project Area. This inherent spatial and temporal separation, along with the localized and short-term nature of any associated environmental disturbances, means that there is little or no potential for interaction between the environmental zones of influence of each individual and simultaneous drilling campaign, and thus, for resulting combined environmental effects upon any VC. As a result, there would be no difference in the overall nature, magnitude, extent or duration of any predicted environmental effects or required mitigation as a result of a "multiple, concurrent drilling installation scenario" as opposed to a single well being drilled any one time during the Project.

The results of the environmental effects assessment presented in the EIS are therefore fully inclusive of, and thus reflect, the potential use of multiple drilling installations at any one time during the Project.

The EIS also includes and assesses the Operators' potential use of "batch drilling" approaches for the wells to be drilled as part of this Project, including the potential for increase in drilling installation movements. This potential batch drilling approach is specifically referenced in multiple places in the EIS (e.g., Section 1.2.2, 2.5.2.3), as well as in applicable places in the environmental effects assessment. (Section 13.3.3). As noted previously, even with the use of batch drilling techniques, the wells will be completed using the same equipment and drilling techniques and emissions as those described and assessed in the EIS overall, and all the mitigation measures required, identified and committed to for this Project will continue to be implemented.

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.

INFORMATION REQUIREMENT – IR-02

(N/A)

Project Effects Link to CEAA 2012: All – project description relevant to all Section 5 effects.

Reference to EIS Guidelines: Part 2, Section 3.2, Project Activities.

Reference to EIS: Section 2.5.2.3 Project Activities.

Context and Rationale

Section 2.5.2.3, and elsewhere in the EIS, indicates that drilling time is anticipated to be in the range of 35 to 65 days. It is understood that other activities (e.g., well site survey, pre-drill coral survey, demobilization) would require additional time beyond the 35 to 65 days.

It is noted that recent wells offshore of Nova Scotia were estimated to require 120 days of drilling.

Specific Question or Information Requirement

Provide clarification on the 35 to 65 day time frame for drilling:

- Confirm that 65 days is the maximum time potentially required to drill a well.
- Explain how batch drilling may affect drilling timelines.

Response

The 35 to 65-day range was based on experience from ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators), and the range corresponds with wells in shallow and deeper water, respectively. Based on guidance from the Operators Drilling subject matter experts (SMEs), the 35 to 65-day timeframe is typical of wells, however, as mentioned in Section 2.5.2.3 of the Environmental Impact Statement (EIS), the time to drill each well is dependent on a variety of factors (e.g., water depth, well design, depth of reservoir, weather, technical, etc.). There is the potential for the duration to exceed 65 days, which is typically due to technical aspects and/or weather conditions. The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) posts drilling information on their website on the Schedule of Wells section, which includes spud and terminations dates (C-NLOPB 2018). Based on the information on the C-NLOPB website between 2015 and 2017, the average drilling duration for ExxonMobil, including Hibernia Management Development Company Ltd., and Equinor was 42 and 52 days, respectively (C-NLOPB 2018).

Batch drilling, as outlined in Section 13.3.3 of the EIS may reduce the overall duration of the drilling program, and therefore has the potential to have a positive effect on drilling timelines and schedule. Further discussion regarding batch drilling is provided in the response to Information Requirement (IR) IR-01.

References

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2018. Schedule of Wells. Available online: http://www.cnlopb.ca/wells/. Accessed March 2018.

INFORMATION REQUIREMENT – IR-03

(C-NLOPB 1: Conformity Review, Statoil and Exxon)

Project Effects Link to CEAA 2012: All – project description relevant to all Section 5 effects.

Reference to EIS Guidelines: Part 2, Section 3.1, Project Components.

Reference to EIS: Section 1.2.2 Key Project Components and Activities

Context and Rationale

Cutting of well heads by other means of internal cutting using a drill rig has been described in the EIS but has not been included in the description of project components (Section 1.2.2). The EIS states that Construction/Light intervention vessels for wellhead decommissioning activities may be used (p. 49). A full description of proposed activities is required in order to understand the associated potential for environmental effects. In addition, the C-NLOPB has advised that if a particular activity is not described and assessed as part of the environmental assessment, then an application for authorization of that particular activity may not be considered.

Specific Question or Information Requirement

Provide a full description of any project components or activities that are not currently fully described in Section 1.2.2, including a complete listing of all well decommissioning components, and consideration of all phases of the Project.

Update the effects analysis as appropriate.

Response

A description of well head cutting is presented in Section 2.5.2.7, and the associated effects are assessed in Chapters 8 to 13 of the Environmental Impact Statement (EIS). Cutting of wellheads by means of external cutting is planned for water depths greater than 500 metres (m). A number of vessels could be used for this purpose, depending on availability and cost. Inspection, maintenance and repair (IMR) vessels and light intervention vessels (LIV) are two examples of vessels that have the capability and may be employed. The effects assessment would not differ for these vessels as both well head cutting (i.e., wellhead decommissioning) options (i.e., external and internal) have been assessed in Chapters 8 to 13 of the EIS. The final decision regarding the vessel type will be made at the detailed engineering design stage taking vessel availability into account, and will be communicated to the appropriate authorities, including the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) during the *Operations Authorization* (OA) process.

References

N/A

INFORMATION REQUIREMENT – IR-04

(NunatuKavut-16, MMS-1)

Project Effects Link to CEAA 2012: All – project description relevant to all Section 5 effects.

Reference to EIS Guidelines: Part 2, Section 3.2.3, Decommissioning, Suspension or Abandonment of Wells.

Reference to EIS: Section 2.5.2.7, Well Suspension, Abandonment, Decommissioning and Demobilization.

Context and Rationale

Section 2.5.2.7 of the EIS states that wells will be inspected at the time of decommissioning. There is no information provided regarding whether follow-up inspections will be undertaken following well abandonment.

NunatuKavut Community Council has suggested that to ensure safety and protection of the marine environment, there must be frequent monitoring and inspection after the decommissioning occurs. Similarly, Mi'gmawei Mawiomi Secretariat indicated the need to ensure that the techniques used for well decommissioning or suspension are sustainable over time.

Specific Question or Information Requirement

Specify the lifespan of the well decommissioning or suspension techniques. Explain whether they would they be sustainable to ensure the long-term protection of the environment. Provide information on inspection of abandoned wells, including the frequency of inspection, if applicable.

Response

Wells are permanently decommissioned and designed in compliance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (Government of Canada 2014) to ensure long-term environmental protection.

As mentioned throughout the Environmental Impact Statement (EIS), monitoring of abandoned wells consists of completing a remotely operated vehicle (ROV) survey to ensure the areas are free of equipment and obstructions. 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).

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.

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) are required to provide detailed plans for monitoring suspended wells to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), 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.

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 March 2018.

INFORMATION REQUIREMENT – IR-05

(C-NLOPB-1 and -2)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species; 5(1)(a)(iii) Migratory Birds.

Reference to EIS Guidelines: Part 2, Section 3.1, Project Components.

Reference to EIS: Section 8.3.7.1, Geophysical, Geohazard, Wellsite, Seabed and Vertical Seismic Profiling (VSP) Surveys.

Context and Rationale

Section 2 of the EIS refers to wellsite surveys that may be conducted to identify unstable areas beneath the seafloor and VSP surveys to further define the depth of geological features and potential petroleum reserves. In Section 2.5.2.5, the EIS states that geophysical/geohazard/wellsite and seabed surveys typically take between 5 to 21 days to complete but can be shorter (i.e., coral surveys) or longer depending on the area to be surveyed and weather/operational delays. Surveys can involve the mapping of the seabed through the use of seismic sound sources, multi-beam echo sounder, side scan sonar, and sub-bottom and other non-invasive equipment (p. 46).

EIS Guidelines define the Designated Project as including VSP surveys and in-water works (e.g., wellsite surveys) to support the specific exploration wells under consideration, but excluding surveys potentially required to support conduct of the EA (e.g., environmental baseline surveys) and surveys related to the broader delineation of resources.

Section 8 of the EIS states that that wellsite surveys in the area may involve one to four streamers (Section 8.3.7.1). The C-NLOPB has advised that it is typical for a wellsite survey to be two-dimensional (2D) high resolution, implying that there would be one streamer only. It further advised that the length of any VSP or wellsite surveys is typically limited to two to four days. Three dimensional (3D) seismic surveys are typically conducted to enable general understanding of petroleum resources prior to the identification of exploration well locations and are not associated with exploration drilling.

Section 8.3.7.1 of the EIS compares a “single air source array” to an “air source array”. Is it not clear whether the latter is meant to read “double air source array”, which the C-NLOPB has advised is not typically part of activities associated with exploration drilling.

Specific Question or Information Requirement

Clarify the nature, scope, and length of proposed VSP surveys and all other in-water work that are part of the designated project (i.e., are incidental to exploration drilling on exploration licences (ELs) included in the environmental assessment under CEAA 2012).

Clearly identify any components or activities that have been included in Section 2 of the EIS but that would not form part of the designated project under CEAA 2012 (e.g., 3D high resolution survey).

Response

The vertical seismic profile (VSP) survey description in Section 2.5.2.5 of the Environmental Impact Statement (EIS) is accurate regarding the nature, scope, and length planned for the Projects. It is noted that the reference to streamers applies only to wellsite surveys, which may employ a single streamer. A VSP will not employ streamers; the receiver arrays are normally deployed into the wellbore. It is possible that the receiver will be towed away from the drilling installation from a support vessel, however, it is preferred to hang it off the drilling installation. Airgun arrays and source strength associated with VSP are much smaller than those used for surface seismic associated with exploration programs. The duration will range from 12 hours up to 48 hours.

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) confirm that no 3D seismic surveys are proposed in this document.

References

N/A

INFORMATION REQUIREMENT – IR-06

(NunatuKavut-15)

Project Effects Link to CEAA 2012: All –project description relevant to all Section 5 effects.

Reference to EIS Guidelines: Part 2, Section 2.2, Alternative Means of Carrying Out the Project.

Reference to EIS: Section 2.10, Alternative Means of Carrying Out the Project.

Context and Rationale

Section 2.10 identifies formation testing while tripping as one of two preferred options for formation flow testing. No further information is provided about this approach other than that it avoids flaring.

NunatuKavut Community Council has recommended use of alternatives with less environmental effects if they are available for testing with flaring.

Specific Question or Information Requirement

In accordance with Agency guidance on evaluation of alternative means, provide additional information on the alternative means of formation testing while tripping: how it is carried out, how it might interact with the environment, and any potential environmental effects.

Provide further information on when formation testing while tripping might be used instead of formation flow testing with flaring.

Response

As outlined in Section 2.5.2.4 of the Environmental Impact Statement (EIS), formation testing while Tripping (FTWT) is an alternative to formation flow testing with flaring. As outlined in Section 2.10.1.6 of the EIS, both FTWT and formation flow testing with flaring have been accepted by the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). FTWT is a beneficial option as it may be conducted without the requirement for topside production equipment, flaring of hydrocarbons, and exposure of personnel to pressurized equipment containing live hydrocarbons, which is outlined in Section 2.5.2.4 of the EIS. When well fluids are sent through the wellbore and to the drilling installation for testing, it is in a closed casing and does not interact with the surrounding marine environment. Therefore, there are no anticipated environmental effects associated with FTWT.

While FTWT is an option for formation testing, formation flow testing with flaring cannot be ruled out as there are circumstances prescribed by the C-NLOPB where this method is required, in order to address specific information requirements.

Section 52(2) of the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (Government of Canada 2014) (herein referred to as the Regulations) indicates that operators may conduct formation flow tests, however, a detailed testing program is required to be submitted to the C-NLOPB for approval. Section 52(4) of the Regulations indicates that the C-NLOPB shall approve a formation flow test if the operator demonstrations that the test will be conducted safely, without pollution and in accordance with good oil-field practices. This information is also available on the

C-NLOPB website (C-NLOPB 2018). The *Approval to Drill a Well* application (C-NLOPB 2010) requests information regarding formation flow tests for exploration or delineation wells in Section 6.4, and indicates that a separate approval is required for formation flow tests pursuant to Section 52 of the Regulations, which are discussed above.

References

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2010. Approval to Drill a Well. Available online: http://www.cnlopb.ca/pdfs/forms/adw_form.doc. Accessed April 2018.

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2018. Authorizations & Approvals. Available online: http://www.cnlopb.ca/legislation/authapp.php. Accessed April 2018.

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 April 2018.

INFORMATION REQUIREMENT – IR-07

(C-NLOPB-2: Conformity; KMKNO-9)

Project Effects Link to CEAA 2012: All – project description relevant to al Section 5 effects.

Reference to EIS Guidelines: Part 2, Section 2.2, Alternative Means of Carrying Out the Project.

Reference to EIS: Section 2.5.1.1, Drilling Installation Selection and Regulatory Approval Process; 2.9.4, Liquid Wastes; 2.10.1, Identification and Evaluation of Alternatives.

Context and Rationale

The EIS guidelines indicate that the EIS should describe the management or disposal of wastes (e.g., type and constituents of waste, quantity, treatment, and method of disposal). The EIS refers to storage capacity needed for drilling materials and equipment, as well as reagents used for drilling; however, there is no information on the constituents of these reagents nor associated volumes. Likewise, the composition and quantity of liquid wastes such as fire control water, produced water, bilge and deck drainage water, ballast water, grey/black water, cooling water, food waste, testing fluids and liquid wastes such as waste chemicals, cooking oils or lubricating oils, are not discussed.

The EIS Guidelines also state that the proponent should 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 2.10 discusses how the waste will be treated in order to comply with guidelines and/or requirements, but provides no clear discussion of how the Proponent would minimize waste or possible alternatives that would allow achievement of defined objectives.

Specific Question or Information Requirement

With respect to waste generated and disposed of from the exploration activity:

- clarify the agents that may be used as part of the Project and assess associated environmental effects, including accidents and malfunctions, as applicable;
- clarify the volumes of liquid waste that may be generated, as well as the constituents of the waste;
- provide additional information on the alternatives that may have been examined with respect to waste management, and the measures that were considered with respect to minimizing waste generated;
- provide additional information on the treatment process prior to ocean discharge. Explain whether treatment to acceptable levels for ocean discharge can be accomplished on the drilling installation and how it would be determined that all wastes meet guidelines before discharge.

Response

Part 1: Clarify the agents that may be used as part of the Project and assess associated environmental effects, including accidents and malfunctions, as applicable.

The reagents used for drilling have not been determined at this time, however, information is provided below based on exploration drilling programs completed in 2017 by Equinor Canada Ltd. (Equinor). It is noted that ExxonMobil Canada Ltd. (ExxonMobil) has not completed any recent exploration drilling programs, therefore the information outlined below is limited to Equinor's experience.

As outlined in Section 2.10.1.7 of the Environmental Impact Statement (EIS), products that have the potential to be discharged to the marine environment will be selected in accordance with the Offshore *Chemical Selection Guidelines for Drilling & Production Activities on Frontier Land* (NEB et al 2009) (herein referred to as the Guidelines). The purpose of the Guidelines is to minimize the potential environmental impacts from the discharge of chemicals used in offshore drilling and production operations (NEB et al 2009). Assessing the environmental effects of drilling reagents are not required as environmental protection elements are embedded into the Guidelines (NEB et al 2009), which will be followed for all exploration drilling activities. ExxonMobil and Equinor (herein referred to the Operators) will also prepare their own internal Chemical Screening Procedures, which will align with the requirements of the Guidelines at a minimum.

As mentioned above, Equinor completed exploration drilling programs from May to July 2017 and various chemicals were used for drilling including bulk cement, bulk bentonite / barite and drilling fluids (muds). Over 100 chemicals were screened during the 2017 exploration drilling program, and therefore a complete exhaustive list will not be provided in this response, however, select chemicals are listed below. As mentioned above, chemicals that have the potential to be discharged to the marine environment were screened as per the Guidelines and Equinor's internal Chemical Screening Procedure. All chemicals were provided by third party suppliers. Chemicals that may be used in future exploration drilling programs are subject to change from the list below as they are selected on a site-specific basis. Select chemicals used for the Equinor 2017 exploration drilling program included:

- Lime;
- Caustic Soda;
- Soda Ash;
- M-I Gel;
- M-I Bar;
- Drillthin;
- Puredrill IA-35 LV;
- Calcium Chloride;
- D095 Cement Additive;
- M-I-X II (All grades);
- Cement Class G D907; and
- Cement Retarder D110.

The Operators will keep records of chemicals screened (i.e., chemicals that are, or have to the potential to be, discharged to the marine environment), and will make them available to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) upon request.

Part 2: Clarify the volumes of liquid waste that may be generated, as well as the constituents of the waste.

The amount of liquid waste generated during exploration drilling activities are site-specific and depend on a number of factors such as, but not limited to, type of drilling installation, well design and number of personnel on board. Therefore, specific volumes associated with future exploration drilling activities were not included in EIS or the response to this Information Requirement (IR). However, liquid wastes generated during exploration drilling programs completed in 2017 by Equinor are provided below for information purposes. The exploration drilling program completed by Equinor was executed from 11-May-2017 to 13-Jul-2017 (i.e., 63 days) and consisted of drilling two exploration wells. As mentioned in Part 1, ExxonMobil has not completed any recent exploration drilling programs, therefore the information outlined below is limited to Equinor's experience.

As described in Section 1.3.1.2 of the EIS, prior to drilling activities commencing, the Operators are required to obtain an *Operations Authorization* (OA) from the C-NLOPB. To obtain the OA, as outlined in Sections 6(d) and 9 of the *Offshore Newfoundland Drilling and Production Regulations* (Government of Canada 2014), the Operators are required to prepare an Environmental Protection Plan (EPP), which will include detailed information regarding waste management. Some operators choose to prepare separate Waste Management Plans (WMPs). EPPs and supporting documents are required to be submitted to the C-NLOPB for their review and approval as part of the OA application.

As outlined in Section 1.4.2 of the Offshore Waste Treatment Guidelines (OWTG) (NEB et al 2010), the Operators are required to submit monthly compliance reports to the C-NLOPB, which will include volumes of liquid wastes discharged to the marine environment.

As detailed in Section 2.9.4 of the EIS, any waste discharged to the marine environmental from the drilling installation will be in accordance with the OWTG (NEB et al 2010), while liquid wastes generated from vessels will be managed in accordance with the *Ballast Water Control and Management Regulations* (Government of Canada 2017), and the requirements from the International Maritime Organization (IMO).

As mentioned above, Equinor completed exploration drilling programs from May to July 2017. Liquid wastes generated and transferred back to shore for treatment/disposal are outlined in Table 1 below. The type and/or volume of liquid wastes generated for future exploration drilling programs are subject to change as it is specific to the drilling program. It is also noted that Equinor provided the C-NLOPB this information in the 2017 Drilling Campaign Environmental Report, which is required under paragraph 87(2) of the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (Government of Canada 2014). The Operators will be required to submit annual environmental reports, including volumes of liquid waste, to the C-NLOPB for any future exploration drilling programs.

Table 1 Summary of Liquid Waste Generated During the 2017 Exploration Drilling Programs

Waste Category/Type	Unit	May 2017	June 2017	July 2017
Liquid Waste Discharged to the Marine Environment under OWTG				
Ballast water	-	N/A - see note 1		
Bilge water	L	13,800	8,900	9,200
Blow-out preventer (BOP) testing fluids	L	2,934	19,695	4,636
Cooling water	-	N/A - see note 2		
Deck drainage water	L	451,500	1,002,000	338,500
Ecomac associated with BOP testing fluids	L	88	985	232
Food waste	-	N/A - see note 3		
Glycol associated with BOP testing fluids	L	147	1,970	464
Grey/black water	-	N/A - see note 3		
Produced water	-	N/A - see note 4		
Water for testing fire control systems	-	N/A - see note 5		
Well treatment fluids	-	N/A - see note 6		
Liquid Waste Transferred to Shore for Treatment/Disposal				
Antifreeze/glycol	L	410	0	0
Corrosives	L	0	0	0
Empty drum with residual	L	0	180	108
Flammable liquids	L	0	0	0
Lean liquids	L	0	0	0
Non-hazardous sludge	L	205	205	0
Paint/paint sludge	L	0	820	0
Solvents	L	0	0	0
Waste drill mud	L	28,400	165,220	216,600
Waste oil	L	4,431	18,706	63,022
Waste oil and fuel	L	0	0	0
Wastewater	L	3,630	6,300	131,000

Notes:
1. As outlined in Section 2.7 of the OWTG, ballast water is permitted to be discharged without treatment or monitoring, provided it is segregated from bilge water. In 2017, ballast water for the drilling installation was kept in segregated tanks and not mixed with drilling process water or runoff, therefore volumes were not required to be tracked.
2. As outlined in Section 2.11 of the OWTG, cooling water is permitted to be discharged, and there are no specific compliance monitoring or reporting requirements in the OWTG, and therefore volumes were not required to be tracked.
3. As outlined in Section 2.13 of the OWTG, sewage and food waste is macerated prior to discharge. There are no specific compliance monitoring or reporting requirements in the OWTG associated with this waste stream, and therefore volumes were not required to be tracked.
4. Produced water was not generated during the 2017 exploration drilling programs.
5. As outlined in Section 2.14 of the OWTG, water for testing fire control systems is permitted to be discharged without treatment. There are no specific compliance monitoring or reporting requirements in the OWTG associated with this waste stream, and therefore volumes were not required to be tracked.
6. Well treatment fluids were not used/discharged during the 2017 exploration drilling program.

The liquid waste streams permitted to be discharged to the marine environment under the OWTG (NEB et al 2010) are further discussed in the response to Part 4 below.

Part 3: Provide additional information on the alternatives that may have been examined with respect to waste management, and the measures that were considered with respect to minimizing waste generated.

Section 2.10.1 and associated subsections of the EIS provide information regarding alternatives associated with waste management including drilling fluids selection, drilling waste management and location of final effluent discharge points, however, the options in the EIS will be finalized during the OA application phase. The EIS provides additional information regarding each potential alternative including:

- Section 2.10.1.1 – Drilling Fluids Selection
  - Drilling fluids will be selected in accordance with the Offshore Chemical Selection Guidelines for Drilling & Production Activities on Frontier Land (NEB et al 2009).
- Section 2.10.1.3 – Drilling Waste Management
  - Drilling wastes will be managed as per the OWTG (NEB et al 2010). The preferred management option will depend on the drilling fluid selected and will either be disposed at sea, treated and then disposed at sea, shipped to shore for disposal, or re-injected.
  - Using a cuttings transport system (CTS) if required based on the results of the pre-drill coral and sponge survey and risk assessment.
- Section 2.10.1.4 – Water Management and Location of Final Effluent Discharge Point
  - It is not feasible to change or reconfigure the location of effluent discharge points as drilling installations will be provided by third party contractors. However, a Certificate of Fitness is required to be submitted to the C-NLOPB during the OA application phase.
- Section 2.10.1.7 – Chemical Selection
  - Chemicals that have the potential to be discharged to the marine environment will be selected in accordance with the Offshore Chemical Selection Guidelines for Drilling & Production Activities on Frontier Land (NEB et al 2009) to ensure they have a minimal effect on the receiving environment.

As outlined in Section 2.9 of the EIS, the Operators will either incorporate waste management aspects into their EPPs or prepare separate WMPs, which are required to be submitted to the C-NLOPB for their review and approval as part of the OA application. Further details regarding waste minimization initiatives will be included in the EPPs or WMPs and will include reduction, re-use, recycling, and treatment.

Part 4: Provide additional information on the treatment process prior to ocean discharge. Explain whether treatment to acceptable levels for ocean discharge can be accomplished on the drilling installation and how it would be determined that all wastes meet guidelines before discharge.

Section 9(j) of the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (Government of Canada 2014) requires the EPP to include a description of the system for monitoring compliance of discharges to the natural environment. The Environmental Protection Plan Guidelines (NEB et al 2011) refers to Section 9 of the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (Government of Canada 2014) and indicates that operators may choose to prepare a separate document (e.g., ECMP or similar) that provides an overview of the compliance monitoring system.

As outlined in Sections 2.12 and 2.12.3 of the EIS, the Operators will incorporate environmental compliance monitoring aspects into their Environmental Protection and Compliance Monitoring Plans (EPCMPs), which will be submitted to the C-NLOPB for review and approval as part of the OA application. The type of information requested is site-specific and will depend on the drilling installation that will be utilized, and therefore not provided in the response to this IR, however, information is provided below based on the 2017 exploration drilling programs completed by Equinor. As mentioned in Part 1, ExxonMobil has not completed any recent exploration drilling programs, therefore the information outlined below is limited to Equinor's experience. The EPCMP will contain detailed information regarding waste streams that will be discharged to the marine environment including, but not limited to, discharge limits, treatment processes, compliance monitoring requirements, and non-compliance reporting requirements.

All waste discharges from drilling installations are regulated by the C-NLOPB. If waste streams listed in the OWTG (NEB et al 2010) are not in compliance with the discharge limits and/or requirements, then the waste stream will not be discharged to the marine environment. It will either be re-treated offshore until the discharge criteria are in compliance or transported back to shore for disposal.

As mentioned above, Equinor completed exploration drilling programs from May to July 2017 and the sections below provides a summary of the waste streams that were discharged to the marine environment, and compliance monitoring and/or reporting requirements, when applicable. The information below is provided for information only, and details are subject to change for future exploration drilling programs as it depends on the drilling installation selected and activities completed. It is also noted that Equinor provided this information to the C-NLOPB in the 2017 Drilling Campaign Environmental Report, which is required under paragraph 87(2) of the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (Government of Canada 2014), as well as the monthly compliance reports. The Operators will be required to submit monthly compliance and annual environmental reports, including volumes of liquid waste, to the C-NLOPB for any future exploration drilling programs.

Ballast Water

Ballast water on the drilling installation was kept in segregated tanks and not mixed with drilling process water or runoff, and therefore did not have to be treated or monitored, which aligns with Section 2.7 of the OWTG.

If the drilling installation does not keep the ballast water in segregated tanks then it is treated in a similar manner as bilge water (see below). The volumes discharged are required to be included in the monthly compliance reports and annual environmental report submitted to the C-NLOPB.

Bilge Water

During the 2017 exploration drilling program bilge water was sent through an oil-water separator (OWS) prior to discharging to the marine environment. The OWS was designed to treat the bilge water to meet the OWTG requirements of oil in water concentration of less than or equal to (≤) 15 milligrams per litre (mg/L). To ensure that the discharge limit was met, the OWS was equipped with an oil in water analyzer which functioned on a continuous basis, and was also equipped with a detection and high-level alarm.

The discharge of treated water from the OWS was through a dedicated, hard piped, overboard valve and line on the port forward side of the drilling installation's machinery space. Accumulated sludge in the OWS was removed and transported to shore for treatment/disposal by an approved waste management contractor.

Equinor reported volumes of bilge water discharged to the marine environment in the monthly compliance reports and the 2017 Drilling Campaign Environmental Report, which were submitted to the C-NLOPB. The volume of accumulated sludge removed from the OWS and transferred back to shore for treatment/disposal was also reported.

BOP Testing Fluids

During the 2017 exploration drilling program, routine testing of the BOP was completed to ensure it was functioning properly. A function test was completed every 7 days, while a pressure test was completed every 14 to 21 days, depending on the ongoing operations. There are no treatment or discharge limits associated with BOP testing fluids under the OWTG. However, volumes of BOP testing fluids and additives (i.e., Ecomac and glycol in the case of the 2017 exploration drilling program) were reported in the monthly compliance reports and the 2017 Drilling Campaign Environmental Report, which were submitted to the C-NLOPB.

Cooling Water

During the 2017 exploration drilling program, cooling water was extracted from the sea and pumped through heat exchangers to remove heat from processes on the installation before being returned to the sea. The OWTG does not outline any treatment, discharge limits or monitoring requirements associated with cooling water.

Deck Drainage Water

During the 2017 exploration drilling program deck drainage water was sent through an OWS prior to discharging to the marine environment. The OWS was designed to treat the deck drainage water to meet the requirements in Section 2.6 of the OWTG (i.e., oil in water concentration of ≤15 mg/L). To ensure that the discharge limit was met, the OWS was equipped with an oil in water analyzer which functioned on a continuous basis, and was also equipped with a detection and high-level alarm.

The discharge of treated water from the OWS was through a dedicated, hard piped, overboard valve and line on the port forward side of the drilling installation's machinery space. Accumulated sludge in the OWS was removed and transported to shore for treatment/disposal by an approved waste management contractor.

Equinor reported volumes of deck drainage water discharged to the marine environment in the monthly compliance reports and the 2017 Drilling Campaign Environmental Report, which were submitted to the C-NLOPB. The volume of accumulated sludge removed from the OWS and transferred back to shore for treatment/disposal was also reported.

Food Waste and Grey/Black Water

During the 2017 exploration drilling program, food waste and grey/black water were macerated to 6 millimetres (mm) and discharged to the marine environment, in accordance with Section 2.13 of the OWTG. The OWTG does not outline any treatment, discharge limits or monitoring requirements associated with food waste and grey/black water.

Produced Water

Well testing was not completed during the 2017 exploration drilling program, therefore produced water was not generated.

As described in Section 2.9.4 of the EIS, if produced water was generated then it would either be sent to flare, treated until the oil in water concentration was ≤15 mg/L, or transferred to shore for treatment/disposal. If discharged to the marine environment, the volumes would be outlined in the monthly compliance reports and annual environmental report, which are submitted to the C-NLOPB.

Water for Testing Fire Control Systems

As outlined in Section 2.14 of the OWTG, water for testing fire control systems is permitted to be discharged without treatment, and there are no monitoring or discharge limits outlined in the OWTG.

Well Treatment Fluids

Well treatment fluids were not used during the 2017 exploration drilling programs.

If well treatment fluids were generated then they would be treated until the oil in water concentration was ≤15 mg/L or transferred to shore for treatment/disposal. If discharged to the marine environment, the volumes would be outlined in the monthly compliance reports and annual environmental report, which are submitted to the C-NLOPB.

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 April 2018.

Government of Canada. 2017. Ballast Water Control and Management Regulations. Available online: http://laws-lois.justice.gc.ca/PDF/SOR-2011-237.pdf. Accessed April 2018.

NEB (National Energy Board), Canada-Nova Scotia Offshore Petroleum Board and Canada-Newfoundland and Labrador Offshore Petroleum Board. 2009. Offshore Chemical Selection Guidelines for Drilling & Production Activities on Frontier Lands. Available online: http://www.cnlopb.ca/pdfs/guidelines/ocsg.pdf?lbisphpreq=1. Accessed April 2018.

NEB, Canada-Nova Scotia Offshore Petroleum Board and Canada-Newfoundland and Labrador Offshore Petroleum Board. 2010. Offshore Waste Treatment Guidelines. Available online: http://www.cnlopb.ca/pdfs/guidelines/owtg1012e.pdf?lbisphpreq=1. Accessed April 2018.

NEB, Canada-Nova Scotia Offshore Petroleum Board and Canada-Newfoundland and Labrador Offshore Petroleum Board. 2011. Environmental Protection Plan Guidelines. Available online: http://www.cnlopb.ca/pdfs/guidelines/env_pp_guide.pdf?lbisphpreq=1. Accessed April 2018.

INFORMATION REQUIREMENT – IR-08

(ECCC-1; KMKNO-6)

Project Effects Link to CEAA 2012: Air Quality CEAA 5; 5(1)(b) Federal Lands/Transboundary.

Reference to EIS Guidelines: Part 2, Section 6.3.8.1, Air Quality and Greenhouse Gas (GHG) Emissions.

Reference to EIS: Section 2.9.1, Air Emissions; and Section 2.9.1.2, Greenhouse Gas Emissions.

Context and Rationale

GHGs are discussed in section 2.9.1 (Air Emissions) and Section 5.4 (Air Quality) of the EIS. In section 2.9.1.2, the daily GHG emissions of the Project (646 to 928 tonnes of CO2) are compared with the Newfoundland and Labrador's average daily GHG emissions (13.5 kt) and to Canada's average daily GHG emissions (723 kt).

- Environment and Climate Change Canada (ECCC) has advised that the estimated GHG numbers are incorrect using the numbers presented in the EIS. The reference provided (ECCC 2017, full citation provided in Section 5.9 of EIS) appears to cover only the facility reported data and not overall provincial and national data, but even when overall numbers are used, the math does not work out.
- The analysis for GHG emissions associated with flaring is completed separately from other operations estimates, thus the comparison of emissions to the provincial and national averages does not seem to be based on total GHG emissions estimates.
- While information is provided, as required by the EIS guidelines, on the direct and indirect sources of GHGs, and composition and quantity of GHGs, current provincial and national targets for GHG emissions are not provided. Rather, predicted emissions are compared to 2015 reported levels of GHG emissions.

Mitigation measures proposed to minimize GHG emissions are not discussed.

Specific Question or Information Requirement

- Update GHG emissions and provide total potential emissions from all components and activities associated with the Project (i.e., including operational flaring). Provide the references noted as the source of the data.
- Compare total potential GHG emissions estimates (including operational flaring) to:
  - Newfoundland and Labrador's average daily GHG emissions;
  - Canada's average daily GHG emissions; and
  - current emission targets for Newfoundland and Labrador and for Canada.
- Discuss proposed measures to reduce or minimize GHG emissions including use of best available technologies or provide rationale for not including the use of best available technologies, as applicable.

Response

As the Project involves exploration drilling only, the only time flaring would occur is during a formation flow test. It is estimated that five or six wells may include formation flow testing, which may possibly require short-term flaring, as outlined in Section 2.5.2.4 of the Environmental Impact Statement (EIS). Greenhouse gas (GHG) emissions associated with this activity have been calculated and are presented in Section 2.9.1.2 of the EIS, and were calculated on a daily basis. The calculated GHG emissions provided in this response have been converted from daily to annual, for consistency with recent EIS' completed by other operators (e.g., BP and Nexen Energy ULC).

The total annual reported GHG emissions for the province of Newfoundland and Labrador and for Canada, as presented in Section 2.9.1.2 of the EIS, were acquired from Environment and Climate Change Canada's (ECCC) Greenhouse Gas Emissions Reporting Program, 2015 Facility GHG Emissions by province and territory (ECCC 2018). The total annual provincial and national GHG emissions for 2016, as presented in the National Inventory Report, 1990-2016: Greenhouse Gas Sources and Sinks in Canada (ECCC 2018), are 10.8 megatonnes of carbon dioxide equivalents (Mt CO_2 eq) and 704 Mt CO_2 eq, respectively. The total predicted annual equivalent CO_2 emissions for the Project (including the drilling installation, helicopters, and supply vessels) range from 126,214 to 180,869 tonnes of carbon dioxide equivalents (t CO_2 eq) and therefore represent 1.17 to 1.67 percent of Newfoundland and Labrador's average annual GHG emissions and 0.018 to 0.026 percent of Canada's average annual reported GHG emissions. During formation flow testing with flaring, the Project could emit a total of 131,437 to 186,091 t CO_2 eq per year, which would therefore represent 1.22 to 1.72 percent of Newfoundland and Labrador's average annual GHG emissions and 0.019 to 0.026 percent of Canada's average annual reported GHG emissions. These represent the total potential emissions from all components and activities associated with the Project, including flaring.

Federally, industrial facilities that emit more than 10,000 t CO_2 eq per year are required to quantify and report GHG emissions to ECCC (Government of Canada 2018a). This includes sources of GHG from stationary combustion, industrial processes, venting, flaring, fugitives, onsite transportation, waste, and wastewater sources.

There is no federal regulatory requirement to reduce GHGs from a specific industrial facility or sector. The federal government, however, has indicated it will implement federal legislation that will mandate a national carbon pricing program by September 2018, if individual provinces do not do so by then (Government of Canada 2018b). Such a program may impose a carbon tax on fossil fuel use, establish a cap-and-trade mechanism, or other means acceptable to ECCC. Any province that does not set its own carbon price will be mandated to use the federal government's minimum floor price.

The Government of Newfoundland and Labrador Climate Change Action Plan (2011) has set the following GHG reduction targets:

- to reduce regional GHG emissions to 1990 levels by 2010;
- to reduce regional GHG emissions to 10 percent below 1990 levels by 2020; and
- to reduce regional GHG emissions to 75-85 percent below 2001 levels by 2050

The first target for GHG reductions for 2010 was met. The province reported to ECCC that GHG emissions in 2010 (8.9 million tonnes [MT]) were 4 percent below the provincial target of 9.2 MT (Government of Newfoundland and Labrador 2012).

Large industries (i.e., electricity generation, mining, newsprint, offshore oil, and oil refining) are required to contribute to the GHG reduction efforts for the province to meet its targets. Industrial facilities are required to submit an annual report regarding the GHG emissions released; however, offshore oil industries are exempt from this requirement of the *Management of Greenhouse Gas Act* (Government of Newfoundland and Labrador 2016) and are currently not regulated provincially. The Project would comply with any federal or provincial reporting and compliance requirements that come in force.

Proposed mitigation measures include adherence to the *Canadian Environmental Protection Act, 1999* (Government of Canada 1999), and relevant regulations under the International Convention for the Prevention of Pollution from Ships (MARPOL). As described in Section 2.5.1.1 of the EIS, a *Certificate of Fitness* from an independent third-party Certifying Authority will be required for the drilling installation, to provide assurance and verification that it is, among other things, in compliance with the regulations without compromising safety and polluting the environment.

Exploration drilling is temporary and typically carried out by drilling installations and vessels contracted by third-party suppliers, and may vary over the Project life. The use of best available technologies (BAT) will be investigated, however, due to the temporary nature of exploration drilling and the use of existing drilling installations and vessels, which meet safety and operational requirements, it is likely not feasible to alter the technology already installed.

References

ECCC (Environment and Climate Change Canada). 2017. National Inventory Report, 1990-2015: Greenhouse Gas Sources and Sinks in Canada.

ECCC. 2018. Reported Facility Greenhouse Gas Data. Available online: http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=8044859A.

Government of Canada. 1999. *Canadian Environmental Protection Act, 1999*. S.C. 1999, c. 33. Published by the Minister of Justice. Current to April 24, 2018. Last Amended April 2018. Available online: http://laws-lois.justice.gc.ca/PDF/C-15.31.pdf.

Government of Canada. 2018a. Greenhouse gas reporting: facilities. Available online: https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/facility-reporting.html. Accessed March 2018.

Government of Canada. 2018b. Legislative and Regulatory Proposals Relating to the Greenhouse Gas Pollution Pricing Act and Explanatory Notes. Available online: https://www.fin.gc.ca/drleg-apl/2018/ggpp-tpcges-eng.asp. Accessed March 2018.

Government of Newfoundland and Labrador. 2011. Climate Change Action Plan. Available online: http://www.exec.gov.nl.ca/exec/occ/action_plans.html. Accessed March 2018.

Government of Newfoundland and Labrador. 2012. Province Achieves 2010 Greenhouse Gas Reduction Target. Available online: http://www.releases.gov.nl.ca/releases/2012/exec/0416n03.htm. Accessed April 2018.

Government of Newfoundland and Labrador. 2016. *Management of Greenhouse Gas Act*. SNL2016 Chapter M-1.001. Ss.4, 10, 11, 26 & 29 in force - Mar. 7/17; Ss. 6, 19, 25, 28 Á 30 in force - Jul. 28/17. Published by Queens Printer. Available online: http://www.assembly.nl.ca/Legislation/sr/statutes/m01-001.htm.

INFORMATION REQUIREMENT – IR-09

(ECCC-2)

Project Effects Link to CEAA 2012: Air Quality CEAA 5; 5(1)(b) Federal Lands/Transboundary.

Reference to EIS Guidelines: Part 2, Section 6.3.8.1, Air Quality and Greenhouse Gas (GHG) Emissions.

Reference to EIS: Sections 1 to 5; 2.9.1.1, Criteria Air Contaminants; and 2.9.1.2, GHG Emissions.

Context and Rationale

Under Section 3.1 of the EIS Guidelines, the proponent is required to describe “energy supply (source, quantity)”. There appears to be some significant discrepancies in the sulphur dioxide emissions estimates provided in Table 2.15 (i.e., it is not reasonable that the daily estimates from the helicopter are significantly higher than those of the other components).

Specific Question or Information Requirement

Review air emissions calculations and provide the estimated sulphur content of the various fuels expected to be used in the operation. Update emissions calculations and effects predictions accordingly.

Response

The emissions of sulphur dioxide (SO_2) from the operation of the helicopters were overestimated due to the unit conversion used in the calculation of SO_2 emissions in Table 2.15 of the Environmental Impact Statement (EIS). The corrected daily emissions of SO_2 from the operation of helicopters is 0.03 to 0.07 tonnes/day. This calculation assumes that the sulphur content in aviation fuel is 4,000 parts per million (ppm). Table 2.15 is updated and provided below. The effects assessment predictions in the EIS remain valid in consideration of the revised SO_2 numbers below.

Table 2.15 Daily Air Contaminant Emissions for the Drilling Installation, Supply Vessels, Helicopters and Flaring

Project Activity	Air Contaminant	Air Contaminant Emissions (tonnes/day)
Drilling Installation[1]	NO_X	7.14 – 10.5
	CO	3.02 - 4.47
	SO_2	0.44 - 0.65
	PM	0.38 - 0.57
Supply Vessels[2]	NO_X	3.10 - 3.86
	CO	0.26 - 0.32
	SO_2	0.93 - 1.16
	PM_{10}	0.11- 0.14
	$PM_{2.5}$	0.10 - 0.13

Table 2.15 Daily Air Contaminant Emissions for the Drilling Installation, Supply Vessels, Helicopters and Flaring

Project Activity	Air Contaminant	Air Contaminant Emissions (tonnes/day)
Helicopter[3]	NO_X	0.15 – 0.30
	CO	0.01 – 0.02
	SO_2	0.03 - 0.07
	PM	0.003 – 0.007
Flaring	NOx	1.99
	CO	9.05
[1] Emission range based on semi-submersible to a drill ship [2] Emission range, newer vessel (2016) to older vessel (1997) [3] Emission range based on distance to Project Area		

References

N/A

INFORMATION REQUIREMENT – IR-10

(NRCanIR-2)

Project Effects Link to CEAA 2012: 5(1)(b) Federal Lands/Transboundary 5(2) (C-NLOPB).

Reference to EIS Guidelines: Part 2, Section 3.1, Project Components; and 3.2.1, Drilling and Testing Activities.

Reference to EIS: Section 2.5.2.4, Formation Flow Testing with Flaring.

Context and Rationale

The EIS notes the use of high-efficiency burners for flaring the gas. The flare efficiency would impact the presented GHG emissions but also would determine the validity of the emission factors used to estimate criteria air contaminant (CAC) emissions.

Specific Question or Information Requirement

Provide clarification on the efficiency rating of the high-efficiency burner given that this information affects overall emissions estimates.

Response

For clarification purposes, it is noted that burners are provided by the third-party well testing contractor as part of the drill stem test (DST) equipment package and are temporarily installed on the flare boom for the duration of the test. ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) have not selected their third-party well testing contractors, therefore the rating of the high-efficiency burner is not available at this time. However, it is noted that most suppliers for well testing equipment/services have their own burner technology that has been tested and quantified for liquid fallout (i.e., oil phase) and emissions (e.g., carbon monoxide [CO], carbon dioxide [CO_2], nitrogen oxides [NO_x], hydrocarbons, etc.,). Documented fallout and combustion efficiencies for burners on the market from major suppliers are typically 99.9%.

References

N/A

INFORMATION REQUIREMENT – IR-11

(NRCanIR-3)

Project Effects Link to CEAA 2012: 5(1)(b) Federal Lands/Transboundary 5(2) (C-NLOPB).

Reference to EIS Guidelines: Part 2, Section 3.1, Project Components; and 3.2.1, Drilling and Testing Activities.

Reference to EIS: Section 2.9.1.1.2, Supply Vessels.

Context and Rationale

Nitrogen oxide (NO_X), carbon monoxide (CO), and particulate matter (PM) emission factors for offshore supply vessels are presented in Table 2.12. However, the Sulphur dioxide (SO_2) emission factor is blank yet the emission rate summary in Table 2.15 (p. 60) includes SO_2 emissions for supply vessels.

Specific Question or Information Requirement

Provide clarification on the blank SO_2 emission factor for offshore supply vessels.

Response

The emission factor used to calculate the emissions of sulphur dioxide (SO_2) as presented in the summary table (i.e., Table 2.15 of the EIS) is 3.97 grams per kilowatt hour (g/kw-hr) (US EPA 2009).

References

US EPA (United States Environmental Protection Agency). 2009. AP-42 Compilation of Air Pollutant Emission Factors Volume 1: Stationary Point and Area Sources Fifth Edition. Published by the US EPA Office of Air Quality Planning and Standards. Available online: https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors. Accessed April 2018.

INFORMATION REQUIREMENT – IR-12

(NRCanIR-1 and -4)

Project Effects Link to CEAA 2012: 5(1)(b) Federal Lands/Transboundary 5(2) (C-NLOPB).

Reference to EIS Guidelines: Part 2, Section 3.1, Project Components; and 3.2.1, Drilling and Testing Activities.

Reference to EIS: Section 8.3.5, Formation Flow Testing with Flaring; and 2.5.2.4, Formation Flow Testing with Flaring.

Context and Rationale

The EIS states that if a large amount of water is produced from the formation, then the water will be treated and disposed of rather than flared.

Specific Question or Information Requirement

Explain what is considered to be a large amount of produced water from formation flow testing and under what circumstances it would be treated, shipped to shore, or flared.

Response

As discussed in the response to Information Requirement (IR) IR-06, an alternative to formation flow testing with flaring is formation testing while tripping (FTWT). Select advantages of FTWT are outlined in the response to IR-06, and in addition it is noted that produced water is typically not generated during FTWT.

If formation flow testing with flaring is completed, it is difficult to provide an estimated volume of produced water as the maximum volume is dependent on the reservoir properties and the design of the surface well test package.

As outlined in Section 2.9.4 and 8.3.2 of the Environmental Impact Statement (EIS), if a large volume of produced water is encountered it will be treated and discharged in accordance with the *Offshore Waste Treatment Guidelines* (OWTG; NEB et al 2010). If treatment is not feasible, produced water will be transported back to shore for treatment and disposal. Sections 2.5.2.4 and 8.3.5 of the EIS indicate that a small volume of produced water may be sent to a flare, and that volumes associated with exploration drilling are significantly lower than those associated with production facilities. Flaring of a large volume of produced water cannot occur as it would cause the flare to not function properly, which has the potential to release hydrocarbons to the environment.

As mentioned above, and in Sections 2.9.4 and 8.3.2 of the EIS, the amount of produced water that is flared is minimal, and therefore there are no additional effects to consider.

References

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2010. Offshore Waste Treatment Guidelines. Available online: http://www.cnlopb.ca/pdfs/guidelines/owtg1012e.pdf?lbisphpreq=1. Accessed May 2018.

INFORMATION REQUIREMENT – IR-13

(N/A)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.3.1, Fish and Fish Habitat.

Reference to EIS: Section 8.3.8, Supply and Servicing.

Context and Rationale

The EIS states that "(a)t the drill sites, the noise associated with stationed supply vessels and their use of dynamic positioning is generally lower than the underwater noise produced by drilling activities (700-1400 Hz, 184 dB re 1 uPa at 1 m) and therefore will not be in addition to existing noise levels in these areas".

Specific Question or Information Requirement

Provide further explanation/justification for the assertion that vessel noise would not add to noise from the drilling activities.

Response

The Environmental Impact Statement (EIS) assessed the potential effects of underwater noise produced by the operation of the drilling installation (including presence of support vessels during drilling) and the associated use of dynamic positioning (DP) thrusters and hydroacoustic positioning systems for station keeping (Sections 8.3.3.1, 8.5.1, and 10.3.3). Conservatively, it was assumed that DP thrusters will be used continuously for station keeping while drilling. Drilling was estimated to take approximately 35-65 days per well, depending on the water depth and well design. The assessment of sound levels associated with drilling was therefore inclusive of the variety of individual sound producing sources combined that have been reported during comparable drilling operations. At monitoring stations near the Hibernia Platform, oil platforms and associated support vessels were the main noise source (Martin et al. 2017). Although vessels were difficult to detect with multiple noise sources present, they were never considered a dominant sound source (see Appendix C of the EIS) (Martin et al. 2017). For the planned Project, modelled broadband source levels for a drillship or semi-submersible platform was 196.7 dB re 1 µPa @ 1 m whereas support vessels were estimated to be 188.6 dB re 1 µPa @ 1 m. Chapter 8 of the EIS presents a review of potential effects of noise on fish and fish habitat. There is no direct evidence regarding the effect of ship noise on mortality or potential mortality to fish (Popper et al. 2014).

In summary, the predicted environmental effects from underwater noise resulting from the presence and operation of the drilling installation included support vessels during drilling and was considered in the effects assessment. As stated in the EIS, these effects are predicted to be adverse, low in magnitude, localized and certainly within the Project Area, short to medium term duration, occurring regularly and reversible, with these predictions being made with a high level of confidence.

References

Martin, B., J. Quijano, J., and Matthews, M.-N. 2017. Eastern Newfoundland Drilling Noise Assessment: Qualitative Assessment of Radiated Sound Levels and Acoustic Propagation Conditions. Document 01366, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd.

Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D., Bartol, S., Carlson, Th., Coombs, S., Ellison, W.T., Gentry, R., Halvorsen, M.B., Lokkeborg, S., Rogers, P., Southall, B.L., Zeddies, D.G., and Tavolga, W.N. 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.

INFORMATION REQUIREMENT – IR-14

(KMKNO-30, MMS-5)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.4, Mitigation Measures.

Reference to EIS: Section 8.3.2, Summary of Key Mitigation; and 10.3.2, Summary of Key Mitigation.

Context and Rationale

The EIS does not propose passive acoustic monitoring for detecting marine mammals in the vicinity of the Project during vertical seismic profiling and geophysical surveys. Visual monitoring only has been proposed. Deep-diving odontocete species spend most of their time underwater and may be quite difficult to detect when at the surface. The concurrent use of visual and passive acoustic monitoring can increase the likelihood of detecting deep-diving cetaceans. In addition, to increase the probability to accommodate deeper, longer diving behaviour, 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.

Specific Question or Information Requirement

Review the recommendations identified for passive acoustic monitoring and a longer ramp-up observation period, and describe whether and how such recommendations would be included in the mitigation measures for the Project. If the proponent does not believe additional mitigation is required, provide associated rationale.

Response

As discussed in Section 10.3.7 of the Environmental Impact Statement (EIS), typical vertical seismic profile (VSP) survey source array volumes are usually substantially smaller than what is required for 3D seismic surveys. Consisting of between three and six sound source elements, each 150-250 in^3 in volume, VSP and geophysical survey operations are also typically of short duration (less than 48 hours per well for VSP and five to seven days per well for wellsite surveys).

The radius of the zone within threshold values for temporary threshold shift (TTS) or permanent threshold shift (PTS) is relatively small, and the soft start utilizes a very small air gun, therefore the probability that an undetected animal is in close vicinity to threshold levels is very low.

Under these circumstances there is little if any benefit to using passive acoustic monitoring (PAM), therefore PAM is not being planned by ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators). As such, no additional mitigation measures are proposed.

For all times the safety zone is visible, a marine mammal observer (MMO) will continuously observe the safety zone for 30 minutes prior to the start-up of the air source array(s), as recommended in the *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment* (DFO 2007).

References

DFO (Fisheries and Oceans Canada). 2007. Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment. Available online: http://waves-vagues.dfo-mpo.gc.ca/Library/363838.pdf. Accessed April 2018.

INFORMATION REQUIREMENT – IR-15

(MMS-5 and -9)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 8, Follow up and Monitoring Programs.

Reference to EIS: Section 8.6, Environmental Monitoring and Follow-up; 10.6 Environmental Monitoring and Follow-up; and 17.4.1 Follow-up Programs.

Context and Rationale

Sections 8.3.3, 8.3.7.1, 10.3.3, and 10.3.7 of the EIS state that noise from the Project may affect marine species; however, there is no discussion in the EIS on noise follow-up programs to determine the accuracy of effects predictions.

Specific Question or Information Requirement

State whether the proponent intends to verify noise predictions through a follow-up program. 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 certainty/uncertainty related to effects predictions.

Response

A variety of responses by marine fish and invertebrates to anthropogenic sound have been observed as described in Section 8.3.3.1 of the Environmental Impact Statement (EIS). Follow up programs are those that may be required and implemented to address environmental assessment-related issues of uncertainty, such as verifying environmental effects predictions and/or the effectiveness of implemented mitigation measures. Underwater acoustic data was collected in the Flemish Pass in 2014 and 2015 and a quantitative analysis of these results was presented in Appendix D of the EIS. This report characterizes 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 a qualitative comparison of the similarities in environmental properties and expected source levels was presented in Appendix C of the EIS. 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.

Given the transient nature of fish and demonstrated avoidance behaviours of fish to sound, as outlined in Sections 8.3.3.1 and 8.3.7.1 of the EIS, it is unlikely that fish would remain in the immediate area long enough (i.e., 12-48 hrs) to be continuously exposed to levels that would result in temporary threshold shifts (TTS) in hearing (Popper et al. 2014). Many of the studies that demonstrate hearing impairments to sound are based on caged studies where fish and invertebrates are unable to avoid and escape the underwater noises (Popper and Hastings 2009; Popper et al. 2014); this is not the case for species in the natural environment who are free to move at will. Popper et al. (2014) also notes that “there is no direct evidence of mortality or potential mortal injury to fish… from ship noise". Therefore, even in the unexpected event that an individual elected to remain within the potential extended-duration exposure area, the result would still be temporary in nature (i.e., both TTS and recoverable injuries are short-term and reversible outcomes). Additionally, Project activities of relevance to marine fish and invertebrates will be short-term in nature and will occur in an area where no critical habitat for species at risk has been designated further reducing the potential for interactions.

These factors, and the planned application of key mitigation measures during Project activities, 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

Popper, A. N., and M. C. Hastings. 2009. The effects of human-generated sound on fish. Integrative Zoology, 4: 43-52.

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

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.

INFORMATION REQUIREMENT – IR-16 AND 16A

(KMKNO Letter 2, KMKNO-1, KMKNO-2, MTI-2, MTI-3 and MTI-11, DFO-7) and IR-16a (Miawpukek, Sipekne'Katik, Nutashkuan, Ekuanitshit, NunatuKavut, KMKNO, MTI, Elsipogtog, WNNB, Woodstock)

Note:
The responses to IR-16 and IR-16a have been consolidated below as they relate to similar topics and therefore required a similar review of additional information and consideration of these relative to the assessment of the Project on Atlantic salmon (Salmo salar).

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.3.1, Fish and Fish Habitat.

Reference to EIS: Section 8.4.4, Atlantic Salmon; 6.1.7.4, Migratory Atlantic Salmon; 8.5.1, Residual Environmental Effects Summary; and 12.3.2.2.3, Atlantic Salmon; 17.2, Summary of Mitigation and Commitments.

Context and Rationale

IR-16

Section 12.3.2.2.3 of the EIS states that Atlantic salmon have a preferred sea surface temperature range of 4°C to 8°C, and that mean sea surface temperature values greater than 3°C occur between July and November and the preferred range (4°C–8°C) can occur between July and October in the Project area.

KMKNO has requested consideration of additional published research regarding the timing of Atlantic salmon presence in the Project area. Reddin (1985) indicated that "favourable conditions (sea surface temperature of 4°C to 8°C) persist in January to April, implying that the eastern and southern Grand Bank region may represent not only the route by which maturing salmon migrate from the Labrador Sea to their home rivers in eastern Canada and northeastern United States but also a major feeding and overwintering area." The EIS does not provide information regarding the return migration of adult Atlantic salmon to feeding areas as post-spawning adults (kelts). In addition, Lacroix (2013) describes habitat utilization by Atlantic salmon kelts in May and June off Newfoundland and the Grand Banks, and July and August around the Project area.

KMKNO indicated that immature post-smolts that will return to natal rivers as mature sea winter salmon (referred to as grilse) will stay local to the Project area and not migrate to the Labrador Sea; use of the Project area by post-smolts to maturing grilse is therefore probable between June and August to the spring of the following year (June to May). KMKNO has further indicated that mature adult salmon would be least likely to be present in the Project area between October and November, when adult salmon are spawning in their natal streams.

Mi'gmawe'l Tplu'taqnn Incorporated (MTI) has expressed concern that the data provided within the EIS to support Atlantic salmon distribution is from dated sources, specifically that the data does not fully encapsulate impacts that have occurred over time, particularly with population declines and shifting range distributions due to climate change.

The Department of Fisheries and Oceans (DFO) has suggested some recent papers discussing the origin of salmon at the Faroe Islands, where there seem to be more North American fish present than previously thought (Gilbey et al. 2017), and the origin of salmon at west Greenland, Labrador coast and south coast of Newfoundland (Bradbury et al. 2014, 2015).

Regarding the Inner Bay of Fundy population of Atlantic salmon, the EIS notes that "interaction with the Project Area does not occur". While the Inner Bay of Fundy population would not be expected to occur within the Project area, it is not correct to say with certainty that they will "not occur".

Comments from MTI state that Atlantic salmon are known to exhibit avoidance behaviours to light exposure, infrasound, and surface disturbance. In addition, light and sound stimuli can influence swimming depth and speed. MTI stated that researchers have recommended avoiding abrupt changes to visual environment/light exposure, and that salmonids swim with elevated activity (a flight response) after transitions from light-to-dark or dark-to-light environments. MTI further noted that salmon are sensitive to acoustic particle motion at frequencies below 200 hertz (Hz). Infrasound disturbance has short-term effects on fish behaviours and fish typically return to pre-stimulus states. This may cause flight behaviour to lessen over time to all stimuli, so repeated/extensive exposure can lead to habituation (Bui et al., 2013). The EIS provides little analyses on the behavioural response effects to migrating salmon due to light and sound effects of the Project

KMKNO has suggested that drilling activities be avoided when Atlantic salmon are in the area (i.e., between the months of January to August). KMKNO has further advised caution during all drilling activities to avoid effects on maturing post-smolts, which may be present year-round owing to remaining in the Project area for their first winter at sea.

IR-16a

Several Indigenous groups have provided additional information on Atlantic salmon for consideration in the effects analysis. These submissions have been provided in full to the proponents and should be reviewed to ensure consideration of all Atlantic salmon information submitted. A short description of select information submitted by various Indigenous groups is provided below.

As noted in IR-16, the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) provided a stand-alone submission containing information on Atlantic salmon. The submission includes several additional references that should be considered in describing baseline conditions for Atlantic salmon and in the analysis of potential effects from the Projects. Along with the references listed in IR-16, additional references provided by the KMKNO include:

- Crossin, G., Hatcher, B. G., Denny, S., Whoriskey, K., Orr, M. Penney, A., and Whoriskey, F. G. (2016). Condition-dependent migratory behaviour of endangered Atlantic salmon smolts moving through an inland sea, Conservation Physiology, Volume 4, Issue 1, 1 January 2016, cow018, https://doi.org/10.1093/conphys/cow018;
- Reddin, D. G. (1986). Ocean Life of Atlantic salmon (Salmo salar L.) in the Northwest Atlantic. In: Atlantic Salmon: Planning for the Future. [Ed] D. Mills and D. Piggins. Portland: Timber Press, pp483-507.

The Innu First Nation of Nutashkuan advised that anything that risks adversely affecting the productivity of the salmon's diet, from small crustaceans up to capelin as prey, would likely adversely affect the salmon, and that leaks from drilling wells in particular need to be considered.

Wolastoqey Nation in New Brunswick (WNNB) and Woodstock First Nation indicated that a key finding of their technical review is that Atlantic salmon spend more time in the project area than indicated in the EIS, and they advised that the area is likely an important feeding ground for both one sea and multi-sea winter Atlantic salmon from the Outer Bay of Fundy Designatable Unit, not just a migration route. Research currently under peer review for publication was included in the WNNB and Woodstock First Nation submission for the proponents' consideration.

WNNB and Woodstock First Nation indicated that while the EIS is correct in stating that the Outer Bay of Fundy population has no status under the federal Species at Risk Act (SARA) (Section 12.3.2.2.3), the proponent should note that the population is under consideration for listing under SARA. WNNB and Woodstock First Nation indicated that from a biological perspective, this population should be considered endangered for the purposes of effects analysis.

WNNB and Woodstock First Nation noted that as a result of this additional information on Outer Bay of Fundy Atlantic salmon, some tables and figures in the EIS should be updated to ensure accuracy. Table 6.20 does not include the Outer Bay of Fundy population; Table 6.21 does not include potential use of the project area by Atlantic salmon for feeding; and Figure 6-38 does not indicate migration routes of Atlantic salmon through the project area. The Agency further notes that new data from salmon tagging studies, provided by the KMKNO and WNNB and Woodstock First Nation submissions, could be the basis for an additional figure to overlay those data with the project area.

The EIS states that "there have also been large declines in marine survival (for Atlantic salmon), but the mechanism for mortality is poorly understood" (Section 8.4.4). WNNB and Woodstock First Nation indicated agreement that Atlantic salmon have issues with marine survival that are not well understood, and that this uncertainty makes it important to further consider the potential impacts of offshore development. Several Indigenous communities, including Miawpukek First Nation, Sipekne'Katik First Nation, Innu First Nation of Nutashkuan, Elsipogtog First Nation, and NunatuKavut Community Council, expressed similar concerns related to uncertainty around the decline of Atlantic salmon populations in their traditional territories and provided supporting information.

Concerns about the potential adverse effects of noise on Atlantic salmon behavior and migration patterns were described in IR-16, based on comments from Mi'gmawe'l Tplu'taqnn Incorporated (MTI). Similar concerns have also been expressed by other Indigenous groups, including the Innu First Nation of Ekuanitshit and Miawupkek First Nation. Miawpukek First Nation's submission cited additional references for consideration by the proponents (e.g., Cairns, 2001, Friedland et al, 2000, Nedwell et al, 2007, O'Neil et al, 2000).

All Indigenous groups expressed concern about the effects of accidental spills on marine resources, including Atlantic salmon. Several also cited concerns about cumulative effects on declining salmon populations.

Targeted baseline monitoring of salmon movement through the Project Area has not been conducted in support of the EIS, nor is this proposed for follow-up. Miawpukek First Nation has advised that additional baseline data on the migration and behaviour of Atlantic salmon while at sea would contribute to the assessment of the effects of the Projects. It indicated that rather than initiating a new research project, providing funding to support on-going research projects or programs would allow the research protocol for any study to be designed by established organizations and integrated with existing research. Miawpukek First Nation indicated that organizations involved in the tracking of marine fishes include Miawpukek First Nation, the Atlantic Salmon Federation, the Ocean Tracking Network, and Fisheries and Oceans Canada. These organizations are already engaged in projects aimed at understanding the movements of Atlantic salmon while at sea.

Specific Question or Information Requirement

IR-16

Update the analysis of effects on Atlantic salmon, taking into consideration:

- timing of their presence in the Project area as well as probability based on the information provided in Lacroix (2013) and Reddin (1985);
- clarification on the certainty regarding the presence of Atlantic salmon from the Inner Bay of Fundy population in the Project area;
- consideration of the impacts that climate change may have had on the distribution of Atlantic salmon, and whether the Project could potentially contribute to or exacerbate an already declining population of salmon in the region;
- published research on biological and behavioural responses of Atlantic salmon to light and noise, as available; and
- recent papers on Atlantic salmon, including those suggested by DFO.

Update the proposed mitigation and follow-up, as well as effects predictions, accordingly.

Based on the potential for effects on Atlantic salmon, provide a rationale related to the need for additional mitigation measures to avoid or minimize potential effects on adults and mature post-smolts that may overwinter and feed in the area.

IR-16a

Further to IR-16, provide a stand-alone assessment of the effects of the Project on Atlantic salmon using information from the EIS as well as additional references and other information from Indigenous communities, and information from Fisheries and Oceans Canada, as applicable. Consider information about Atlantic salmon provided in submissions by Indigenous communities (including peer-reviewed references) and subsequent dialogue at recent consultation meetings in St. John’s, Moncton, and Quebec City in the updated analysis.

Provide updated figures and tables, as applicable, to reflect the most recent peer-reviewed data, or provide a rationale for excluding information from newer, peer-reviewed references. The analysis should include a discussion of the effects of accidental events and cumulative effects on Atlantic salmon.

Recognizing data gaps regarding the presence of Atlantic salmon in the project area, migration routes, and at-sea mortality, apply the precautionary approach in the updated effects analysis and in the discussion of proposed mitigation.

Taking into consideration any uncertainties regarding potential effects, discuss the need for follow-up related to project-specific or cumulative effects on Atlantic salmon, including participation in future regional initiatives and potential for collaboration with Indigenous communities.

Response

IR-16

Part 1: Update the analysis of effects on Atlantic salmon, taking into consideration timing of their presence in the project area as well as probability based on the information provided in Lacroix (2013) and Reddin (1985).

The additional literature and information provided was reviewed and considered with respect to updating the analysis of effects on Atlantic salmon. The information provides supplemental data on marine movements and habitat utilization, particularly by kelts, but does not alter the utilization, movement patterns and previously described distributions within the Environmental Impact Statement (EIS) (refer to Section 6.1.7.4). As described within the EIS, the Project is not likely to result in significant adverse environmental effects on marine fish and fish habitat, including Atlantic salmon. The implementation of mitigation measures, combined with the short-term nature of activities, a deep-water dynamic environment that rapidly disperses marine discharges, and avoidance behaviours of salmon, results in adverse effects that are negligible to low magnitude, short-term, localized and reversible. Further details are provided below.

The information provided in Reddin (1985) was incorporated into the existing description of known migration and habitat use near and within the Project Area. While Reddin (1985) suggests in the abstract that “favourable conditions (4°C – 8°C) persist for salmon in January and April, implying that the eastern and southern Grand Bank region may represent not only the route by which maturing salmon migrate from the Labrador Sea to their home rivers in eastern Canada and northeastern United States, but also a major feeding and overwintering area”, there is no data within the paper to support this hypothesis. The Grand Bank area was sampled in May of 1979 and 1980 only, with no winter surveys completed. This research did confirm that salmon appear to congregate near the southern Grand Bank which is south of the Project Area (refer to Figure 6-38 in the EIS) prior to spring migration and that sea-surface temperatures (SST) may modify the exact location each year.

Subsequent research after Reddin (1985) indicate that no overwintering has been confirmed by sampling including:

- Reddin and Shearer (1987) “Seasonal oceanographic conditions suggest that Atlantic salmon do not overwinter in the Grand Bank area since the areas covered by warm water is small and variable”.
- Reddin and Friedland (1993) “We hypothesize that factors controlling survival for the North American stock complex of Atlantic salmon are concentrated during the winter months in the habitat formed at the mouth of the Labrador Sea and east of Greenland… Until direct observation on the habits of post-smolts during winter can be made, we can

only speculate that mortality is controlled by the interaction of growth, size, and predation".

- Reddin (2006) "Few sets have been made for salmon during the winter months and these were all to the west of the Grand Bank of Newfoundland in 1985. The zero to low catch rates in the area of the Grand Bank suggest that salmon were located elsewhere at this time. These results suggest, since salmon were found in the Labrador Sea in the fall and then in the following spring, that adult salmon of North American origin probably overwinter there".
- Sheehan et al. (2012) "Non-maturing one-sea-winter (1SW) salmon are assumed to have overwintered in the Labrador Sea".

The Lacroix (2013) paper provides information related to the movement of kelt salmon from the Bay of Fundy (both inner and outer Bay of Fundy populations) using satellite pop-up tags. Kelt are adult salmon that have returned to spawn in their natal river and have survived to re-enter the marine environment to recondition and return to spawn again, either the next immediate fall (consecutive spawning) or the next (alternate spawning). Some of the highest return rates for kelts have been recorded from salmon populations within the inner Bay of Fundy (iBoF) (Jessop 1986; Ritter 1989; Cunjak et al. 1998).

The previous review did include movements; however, Lacroix (2013) provides valuable information, particularly related to salmon stocks from the Bay of Fundy (BoF). The research included tagging kelts on their return to the marine environment. Kelts from the iBoF and the outer Bay of Fundy (oBoF) were tagged and tracked. Individual tracks documented swim direction, speed, water temperature, and depth of activity. Light/dark was also recorded so that estimates of geolocation could be generated. Home ranges were also generated for the iBoF and oBoF salmon.

The kelts from the oBoF and iBoF groups with tracks >60 days at sea generally provided excellent examples of the differences in migration behaviour of inner and outer BoF salmon. IBoF salmon remained mostly in the Bay of Fundy, northern Gulf of Maine, and around the southern tip of Nova Scotia, regardless of season of migration (Lacroix 2013).

The 50% and 75% utilization distributions (UD) within generated home ranges indicated where the majority of kelt activity was concentrated. The oBoF kelt 50% UD extended through the outer BoF and northern Gulf of Maine, around the southern tip of Nova Scotia on the western Scotian Shelf and to some extent onto the eastern Scotian Shelf. The 75% UD extended along the length of the Scotian Shelf to the south coast of Newfoundland. An additional 75% UD was located on the southern edge of the Grand Bank (refer to Figure 13 in Lacroix 2013). For iBoF kelt, their 50% and 75% UDs were limited to the Bay of Fundy, the northern Gulf of Maine extending down the coast of Maine, along the southwest shore of Nova Scotia, and onto the western Scotian Shelf (refer to Figure 13 in Lacroix 2013).

It is also noteworthy in Lacroix (2013) that one of the tagged kelt from the oBoF migrated northward to Labrador via the Grand Bank and a second remained on the eastern edge of the Grand Bank (July) prior to the tag detaching. This area on the eastern edge of the Grand Bank is similar in location to the area of congregating salmon in the spring as they return to their home rivers. This data corroborates that this area may be an area of feeding prior to return migrations. No tags were shown migrating through the Project Area and the 99% UD for oBoF also does not include the Project Area (refer to Figure 13 in Lacroix 2013).

O'Neil et al. (2000) is a preceding record of an International Workshop completed in June 2000 on research strategies into the causes of declining salmon returns to North American rivers. The workshop re-affirmed that higher mortality is occurring after salmon leave their natal rivers and that higher mortality appears to be common to all North American Atlantic salmon spawning populations.

There was a total of 13 proposals presented for possible research related to declines in salmon returns at the workshop. Of these, four marine proposals were presented for consideration; Salmon distribution (models), Salmon distribution (coastal field studies), Salmon distribution (marine field studies), and marine mammal predation. Each was presented and discussed and appraised by experts and ultimately ranked with all other proposed research. While the proposal summaries are provided along with discussion points related to each, it is not indicated within the report whether any research was completed. Additionally, no follow up report was located; therefore, no additional information was provided with respect to possible migration or habitat use of salmon within or near the Project Area, therefore, no revisions to the existing baseline summary or assessment are considered to be required.

The evaluation of possible causes of the decline in pre-fishery abundance of North American Atlantic salmon was completed in Cairns (2001). The evaluation described a total of over 60 hypotheses for the decline in pre-fishery abundance estimates of Atlantic salmon of North American origin. Of the 12 top-ranked hypotheses, five were related to predation, five to life history, one was related to fisheries, and one to the physical/biological environment. Three of the four highest factors in overall rankings were in the marine phase. The highest marine rank, and the highest overall rank was related to the hypothesis that post-fishery marine mortality is higher than what is presumed by fisheries models. The highest ranking marine factors that could directly cause mortality were bird and mammal predation (ranked third overall) and changes in migration routes due to altered oceanographic conditions (ranked fourth overall).

The potential hypothesis states that major changes in the oceanographic conditions of the North Atlantic have occurred since the 1980s and these changes may have altered the temporal and spatial distribution of preferred habitat for Atlantic salmon (Cairns 2001). Past tagging of salmon was extensive in the 1970s and 1980s and tag returns showed very little transatlantic migration; however, as tagging activities began to slow, greater numbers of recaptured salmon were being reported from the British Isles (e.g., Faeroes), particularly the 1980s and early 1990s (Cairns 2001). Little research is available on the routes used to access suitable marine habitat particularly since the close of the commercial salmon fishery and reduction in tagging experiments (Cairns 2001). No additional information was provided with respect to known migration or habitat use of salmon at the time of the report (2001) nor were any hypothesized alteration to these routes, therefore, no revisions to the existing baseline summary or assessment are considered to be required.

This information provides supplemental data on marine movements and habitat utilization, particularly by kelts, but does not alter the utilization and movement patterns previously described by the literature summarized within Section 6.1.7.4 of the EIS. As outlined in Sections 6.1.7.4 and 12.3.2.2.3 of the EIS, migration routes for Atlantic salmon can be variable based on environmental conditions such as Sea Surface Temperature (SST) which can vary considerably within the marine environment. In terms of habitat preferences, it has been shown that avoidance of lower water temperatures, particularly below 3°C, can play a predictive role in habitat use near the Grand Bank and Flemish Pass. Statistical summaries of sea temperature were derived from the ODI of the Bedford Institute of Oceanography (refer to Tables 5.25 and 5.27 in the EIS) for a rectangular area surrounding the Project Area, querying the period 1900 to 2016 for depths down to 3,000 m. Mean SSTs range from 1.6°C in March to 5.3°C in October. Minimum temperatures at the surface range from -1.8°C in January to 1.1°C in August and September. Maximum SSTs range from 4.0°C in March to 11.8°C in August. This seasonal temperature cycle is observed at depths down to 250 m, where temperatures are higher in the summer than in winter. As shown, mean SSTs values greater than 3oC occur between July and November and the preferred range (4°C-8°C) can occur between July and October. Minimum SSTs for every month are below 3°C. Given the variability of SST and low frequency of preferable conditions within the Project Area, predicted interactions will be limited and overall risk is considered very low to this species. Therefore, the conclusion within the EIS based on existing data remains valid; that spring migration of adults within and near the Project Area is possible; however, the likelihood of interaction, given measured SSTs over the past 7-38 years, remains as low. As a result, the Project is not likely to result in significant adverse environmental effects on marine fish and fish habitat, including Atlantic salmon.

Part 2: Update the analysis of effects on Atlantic salmon, taking into consideration clarification on the certainty regarding the presence of Atlantic salmon from the Inner Bay of Fundy population in the project area.

As described above in Lacroix (2013), recent satellite tags confirm that the general home range of iBoF salmon (kelts) extends to the Gulf of Maine and the southern shores of Nova Scotia. However, it is agreed that given the available data, certainty around marine habitat use and migration pathways cannot be guaranteed. Data on genetic differentiation of stocks contained within both the Labrador coastal fishery (Bradbury et al. 2015) as well as the Saint Pierre and Miquelon fishery off southern Newfoundland (Bradbury et al. 2016) identified a potential iBoF genetic signature in these areas. While the proportion was very low relative to other identified stocks, it does suggest that iBoF salmon may be amongst those adults returning from both staging areas. Both the genetic research and the telemetry studies show that iBoF salmon are primarily limited to the BoF and southern shores of Nova Scotia. However, based on the above information and application of the precautionary principle, the potential for interaction with the Project Area was reconsidered and increased from “does not occur” to “negligible” to account for the uncertainty; however, the conclusion within the EIS based on existing data remains valid; the Project is not likely to result in significant adverse environmental effects on marine fish and fish habitat, including Atlantic salmon.

Part 3: Update the analysis of effects on Atlantic salmon, taking into consideration the impacts that climate change may have had on the distribution of Atlantic salmon, and whether the Project could potentially contribute to or exacerbate an already declining population of salmon in the region.

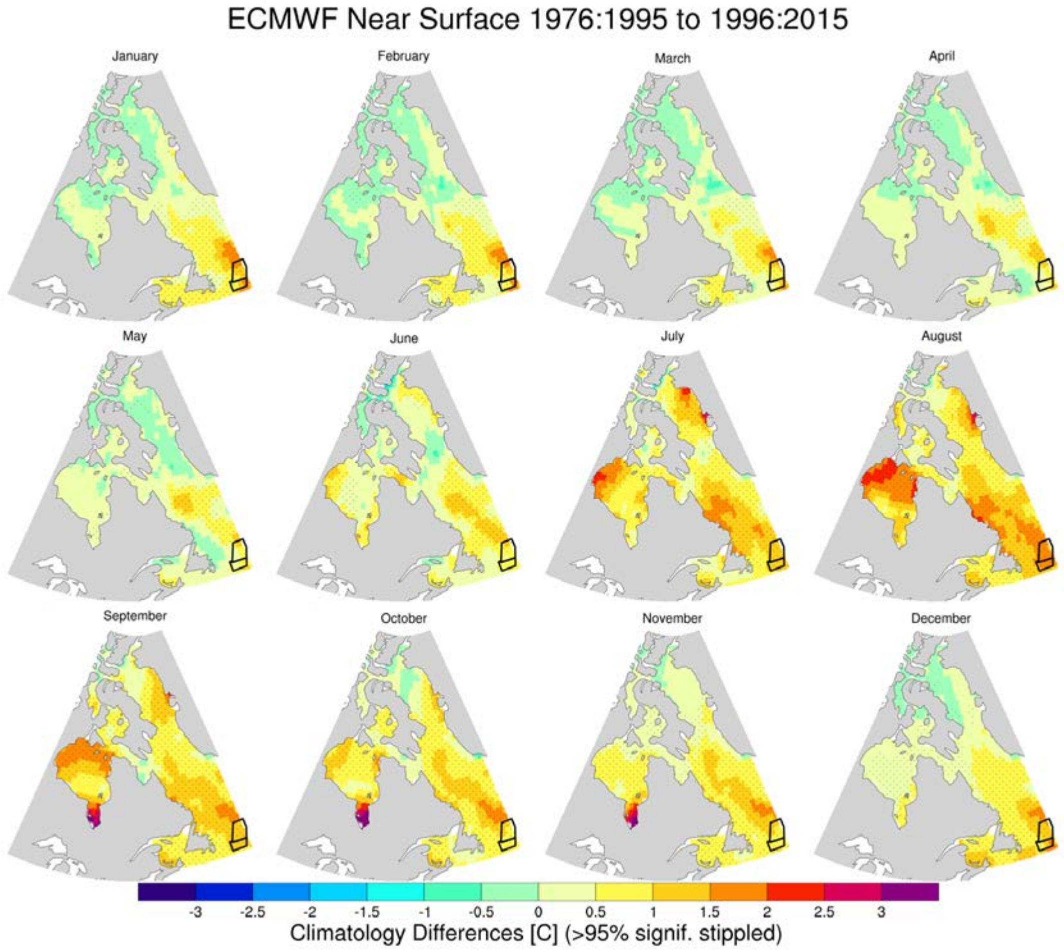
Many facets of Atlantic salmon life history are influenced, if not controlled, by events and conditions during their marine phase (Drinkwater and Pettipas 1996) and ocean climate impacts on survivorship and growth of Atlantic salmon are complex, but still poorly understood (Todd et al. 2008). For example, winter temperatures in the Labrador Sea appear to play an important role in determining both recruitment survival and growth of several salmon stocks (Reddin and Shearer

1987; Todd et al. 2008). The distribution of winter (January-March) habitat defined by the area within 4°C-8°C of the Labrador Sea appear to be critical for North American salmon stocks with higher returns in those years when there was more suitable habitat (Drinkwater and Pettipas 1996). In a similar study in the North Sea, Friedland et al. (2000) showed a link between ocean climate conditions, post-smolt growth, and post-smolt survival for salmon stocks in the North Sea area. They investigated the correlation between SST and post-smolt growth/survival from two long-term tagging studies of wild Atlantic salmon stocks from Norway and Scotland. The authors concluded that the ocean climate variation related to survival of salmon in the North Sea area occurs in spring when the post-smolts first enter the marine environment and occurs in the area of the North Sea and Norwegian coast.

The eastern and western North Atlantic are influenced differently by the subpolar and subtropical gyres, and consequently show differing patterns of decadal variability, but since the early 1970s SST on both sides of the North Atlantic have generally increased (Todd et al. 2008). Large-scale, climate-driven biogeographic shifts in the epipelagic ecosystem are likely to have exerted substantial bottom-up impacts on generalist predators high in the food web including Atlantic salmon (Todd et al. 2008). Notwithstanding the biological complexities, Todd et al. (2008) and Friedland et al. (2005) suggest the general pattern of stock decline throughout the North Atlantic region over the past three decades has likely been a response at least in part, to global climate change.

SST in the eastern North Atlantic has risen at a rate between 0.5-1.5oC per decade since the 1990s (Todd et al. 2008). Given that Atlantic salmon spend most of their time in surface waters (but do undertake brief feeding excursions to colder subsurface depths), and that the preferred oceanic habitat of post smolts in the subpolar gyre lies only within a narrow temperature range, such rates of ocean surface warming are very likely to have marked and possibly detrimental consequences for growth and/or survivorship of salmon at sea (Todd et al. 2008).

As presented in Section 5.8.2.1 of the EIS, Figure 5-69 shows changes in mean monthly water temperature from 1976-1995 to 1996-2015 at depths of approximately five metres, based on European Centre for Medium-Range Weather Forecasts (ECMWF) reanalysis data. The Project Area has experienced warming in each month, although statistically significant warming is most prevalent from late summer to early winter. Warming was also found to be widespread at depths of approximately 45 m (not shown) (Amec Foster Wheeler 2017).



EIS Figure 5-69 Changes in Mean Monthly Water Temperature From 1976-1995 to 1996-2015 at Approximately 5 m, Based on ECMWF Reanalysis Data

Amec Foster Wheeler (2017) found that the ranges of relatively high growth potential of three cod species (as predicted by near-surface water temperature) are expanding northward under climate change. With respect to Atlantic salmon, they may also alter general feeding areas to remain in optimally cool water or could experience changes in condition. Todd et al. (2008) found that condition of returning European Atlantic salmon decreased 11-14% over a decade. Salmon with the lowest condition (approximately 30% under-weight) were found to be returning to spawn with lipid stores reduced by as much as 80%. Stored lipids are essential for egg development and the ovaries alone comprise approximately 30% of the female's total energy reserves at spawning and represent about half the energy expended in maturation, upstream migration and reproduction combined (Todd et al. 2008). While a direct physiological effect of ocean warming on salmon metabolism is possible, other evidence suggests it is more likely that the negative correlations are the result of reduced prey availability from ocean warming (Todd et al. 2008).

The limited interaction between salmon migrating within and near the Project Area and those post-smolt and adults feeding north in the Labrador Sea and kelts along the southern edge of the Grand Bank will most likely remain low given the predicted increases in SSTs (i.e., lower suitability) near the Project Area. As the potential for environmental effects of planned Project activities and overall risk to Atlantic salmon is low, it is predicted that the Project will not contribute to nor exacerbate declines to salmon populations. As a result, the conclusion within the EIS based on existing data remains valid; the Project is not likely to result in significant adverse environmental effects on marine fish and fish habitat, including Atlantic salmon.

Part 4: Update the analysis of effects on Atlantic salmon, taking into consideration published research on biological and behavioural responses of Atlantic salmon to light and noise, as available.

The potential effects of light and noise pollution have been incorporated into the EIS related to plankton and other potential prey species that salmon would utilize during migration to and within staging areas prior to returning to natal systems to spawn (refer to Section 8.3.3.1). The specific references provided in the Information Requirement (Bui et al. 2013 and Nedwell et al. 2001) were reviewed.

Nedwell et al. (2001) described a process to validate the use of dBht(Species) to compare different species in terms of perception of sounds loudness. It standardizes the relative loudness of sound and therefore, is not relevant for assessing the potential effects of sound on a single species such as salmon. The dBht(Species) values correspond to the loudness of sound perceived by various species and provides a way to directly compare effects among different species by standardizing the sound based on species hearing ability. No additional information was provided with respect to the effects of sound on salmon (although salmon were used in lab experiments within the study), therefore, no revisions to the existing baseline summary or assessment are considered to be required.

Bui et al. (2013) provides information specific to light and sound simulations related to avoidance behaviours of Atlantic salmon in sea-cage experiments (aquaculture). This study, and others (refer to McConnell et al. 2010; Stewart et al. 2013; and Bui et al. 2014) identify that artificial light can change the behaviour of aquatic organisms, although the direction of response can be species and life-stage specific. For example, Davies et al. (2014) notes that some species are attracted to artificially lit areas where they may experience increased predation, while others avoid artificially lit areas, and so are displaced from habitats that would otherwise be suitably dark in the absence of artificial light. Bui et al. (2014) concluded that in all light intensities (submerged blue LED source), sound (infrasound at 12.5 Hz), and surface disturbance tests, Atlantic salmon returned to their original swimming depth and speed within 20 minutes. They did conclude that very intense light (immediately turned on in the cage) appeared to cause temporary blindness.

Offshore activities do not emit intense light emissions under water and therefore direct injury to the eyes or physiology of salmon (or any fish) would be highly unlikely. Light from the drilling installation and/or vessels may shine on the near surface of the water but would be quickly attenuated by surface/wave refraction and absorption. Given estimated ranges of light penetration into seawater, conservatively at a 50 m radius from source (refer to Davies et al 2014), effects on migrating Atlantic salmon, if present, would be considered negligible. It is anticipated that currents and life-history (spawning migration to natal rivers) would not be influenced by light from infrastructure.

Infrasound frequency used in the study by Bui et al. (2013) was 12.5 Hz. Salmonids do not have special adaptations for hearing; however, Atlantic salmon are sensitive to acoustic particle motion, particularly at frequencies below 200 Hz (Bui et al. 2013) and avoid infrasound frequencies in freshwater environments (5-10 Hz). In controlled experiments, individual fish responded more strongly to sounds that were lower in frequency, had a more sudden onset, were loud, had similarities to sounds made by predators, and had a larger contribution from particle motion (Normandeau 2012). Estimated frequencies from drilling installations (i.e. 20-1,000 Hz for drillships and 10-4,000 Hz for semi-submersibles) are all capable of producing lower frequency sounds (Peng et al. 2015). It should be noted that the lower frequencies of these drilling installations are similar to other vessels and activities that would also exist in the marine environment as well as the nearshore such as supertankers/container ships (7-70 Hz), medium-sized ships such as ferries (approximately 50 Hz), boats <30m in length (<300 Hz), and smaller ships such as support/supply vessels (20-1,000 Hz) (Peng et al. 2015).

Given the limited behavioural response of infrasounds generated within an enclosed cage, and the recommendation that these stimuli could be used in both freshwater and ocean environments to deter fish from potentially dangerous infrastructures, effects on migrating Atlantic salmon would be considered negligible. It is anticipated that currents and life-history (spawning migration to natal rivers) would not be influenced by noise from infrastructure. Therefore, the effect of the Project on salmon has been fully considered in the effects on marine fish and fish habitat. The conclusion within the EIS based on existing data remains valid; with the application of mitigation measures described in Section 8.3.3.5 of the EIS related to noise and light emissions to marine fish and fish habitat, the environmental effects of routine Project activities on Atlantic salmon are predicted to be not significant.

Part 5: Update the analysis of effects on Atlantic salmon, taking into consideration recent papers on Atlantic salmon including those suggested by DFO.

Consideration of the recent papers on Atlantic salmon suggested by Fisheries and Oceans Canada (DFO) have been incorporated in the above responses (refer to Part 2 in particular). Updates to the effects assessment, where applicable, have been addressed in the above responses

IR-16a

Part 6: Further to IR-16, provide a stand-alone assessment of the effects of the Project on Atlantic salmon using information from the EIS as well as additional references and other information from Indigenous communities, and information from Fisheries and Oceans Canada, as applicable.

Refer to Part 1 response above.

Part 7: Consider information about Atlantic salmon provided in submissions by Indigenous communities (including peer-reviewed references) and subsequent dialogue at recent consultation meetings in St. John's, Moncton, and Quebec City in the updated analysis.

The references referred to by Indigenous communities (including peer-reviewed references) and any relevant consultation information received have been incorporated into the responses for Parts 1 to 4 above.

Part 8: Provide updated figures and tables, as applicable, to reflect the most recent peer-reviewed data, or provide a rationale for excluding information from newer, peer-reviewed references. The analysis should include a discussion of the effects of accidental events and cumulative effects on Atlantic salmon.

Similar to Part 7 above, the additional information provided and reviewed was included in the responses above; however, it does not alter the initial assessment therefore an update of figures and tables were not considered applicable. The information provided adds to the data on marine movements and habitat utilization, particularly by kelts, but does not alter the utilization and movement patterns previously described by the literature summarized within Sections 6.1.7.4 and 12.3.2.2.3 of the EIS. As mentioned in the EIS, migration routes for Atlantic salmon can be variable based on environmental conditions such as SST which can vary considerably within the marine environment and therefore, interactions will be limited and overall risk is considered very low to this species. The conclusion within the EIS based on existing data remains valid; that spring migration of adults within and near the Project Area is possible; however, the likelihood of interaction, given measured SSTs over the past 7-38 years, remains as low. As a result, the Project is not likely to result in significant adverse environmental effects on marine fish and fish habitat, including Atlantic salmon.

The effects of an accidental event on Atlantic salmon was assessed and described in Section 15.5.1 of the EIS. The assessment was based on the detailed results of spill modelling, which included unmitigated worst-case scenarios, the constituents and nature of a potential spill, and the possible responses of Atlantic salmon. As stated in Section 12.3.2.2.3 of the EIS, post-smolt and adult salmon are concentrated throughout the year in the Labrador Sea, which is outside the Project Area, where they feed and overwinter. In the spring, both grilse and multi-sea-winter (MSW) adults appear to congregate in two general locations, both of which are outside the Project Area; near the eastern slope of the Grand Bank of Newfoundland and approximately 480 km east of the Strait of Belle Isle (Reddin and Friedland 1993; Reddin 2006) prior to their spawning migrations back to their natal rivers. Also noted earlier, smolt ages indicate that salmon congregating off the east Grand Bank area are likely from more southern populations from South Newfoundland, a portion of the Gulf of St. Lawrence, as well as Eastern – Southern Nova Scotia and Outer Bay of Fundy. While post-smolt do not likely overwinter in the Flemish Pass area (Reddin and Friedland 1993; Reddin 2006), migration as adults to the east Grand Bank area must occur. Although the exact migration route is not known, it may include areas within and near the Project Area, particularly during time periods when SST are favourable (i.e., over 4°C).

The effects of oil associated with an accidental event on marine fish, including salmon, have principally been described using laboratory studies with farm raised fish or caged fish that are unable to avoid oil exposure (e.g., Barnett and Toews 1977; Thomas and Rice 1987; Fraser 1992; Pineiro et al 1996; Zhou et al 1997; Stagg et al 1998; Meador et al 2006; Stieglitz et al 2016). Many of these studies showed effects on feeding, food conversion, or changes in enzyme levels based on exposure; however, returns to baseline were generally noted in 2-8 weeks (Fraser 1992; Stagg et al. 1998). It is noteworthy that many of the concentrations used in lab studies were very high compared to the results of subsurface blowout modelling described in Appendix E of the EIS. For example, Stagg et al (1998) investigated the effects of the Braer oil spill on the Shetland Isles, Scotland. They characterized reference sites in the north of Shetland as having oil in water concentrations between 2 and 5 micrograms per litre (µg/L) and regarded these as being typical background values for the local inshore environment. No effects on farmed salmon enzyme and protein levels were detected at these concentrations. Barnett and Toews (1977) observed no mortality in post-smolt Atlantic salmon during 96-hour acute lethal bioassays with concentrations up to 3,200 µg/L.

Few studies have been conducted on the avoidance behaviour of returning adult salmon to hydrocarbons in water under natural conditions. Weber et al (1981) conducted a behavioural study on adult Pacific salmon (*Oncorhynchus* sp.) where hydrocarbons that closely approximated the water-soluble fraction of Prudhoe Bay crude oil were added to in one of two fishways as salmon were migrating upriver. They found that migrating salmon substantially avoided (i.e., when 50 percent of fish which were expected to ascend a fishway avoided it) hydrocarbons in the water at concentrations of 3,200 µg/L. Concentrations used in the study ranged from 300 to 6,100 µg/L.

The degree of fish exposure to a spill, and therefore the type and level of any 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. Appendix E of the EIS described and modelled two spill scenarios; a smaller batch spill of hydrocarbons such as diesel fuel, and a larger subsurface blowout of hydrocarbon product. In each spill scenario for the project, the "worst case" was modelled. For example, during a blowout event, no mitigations are applied prior to capping and therefore all oil released is modelled to enter the water column and migrated unimpeded. See Section 15.1.1 of the EIS for details regarding actual spill prevention mitigations as well as those in response to a potential spill event. As outlined in Section 15.3 of the EIS, the probability of a subsurface blowout or other release is very low (i.e., blowouts and other spills from offshore exploratory wells are quite rare).

In addition to spill prevention and response, the likelihood of an actual spill is extremely low.

If a batch spill was to occur, the model results for a 100 L event predicts that total hydrocarbon concentrations (THC) do not exceed 1 µg/L. For the larger release volume (1,000 L), low in-water concentrations (1-5 µg/L) were predicted to extend northeast of the spill site. These concentrations are well below any shown to have behavioural or toxic effects on salmon and are within concentrations considered typical background values for the local inshore environment near the Shetland Islands, Scotland (Stagg et al. 1988).

A large subsurface blowout would be considered an extremely rare event; however, large subsurface blowouts were modelled to determine the fate of any released hydrocarbons. The models were simulated as a 113-day unmitigated release scenario at the Eastern Project Area (EPA) (1,100 m deep) to represent a longer duration response of drilling a relief well and the Northern Project Area (NPA) site (2,700m deep) was modelled as a 36-day release to represent a cap-and-stack response scenario. No other mitigations were applied to the scenarios and as such represent a "worst case". Mapping of THC at any depth in the water column (i.e., the highest concentration at any depth as the oil is released at depth and travels to the surface) was provided in Appendix E of the EIS. As shown in Figure 4-29, the maximum THC modelled for the NPA is 50-500 µg/L and the maximum range modelled for the EPA is 5,000-15,000 µg/L. This larger range is estimated to occur near the blowout location and within the bottom water column at the site. Most of the THC values are <1,500 µg/L. These concentrations are well below any shown to have behavioural or toxic effects on salmon (3,200 µg/L) (Weber et al. 1981; Barnett and Toews 1977).

As described in Section 15.5.1.2.1 of the EIS, potential effects of a batch diesel spill (i.e., 100 and 1,000 L) on marine fish and fish habitat are predicted to be adverse, low to medium in magnitude, short- to medium-term in duration, to occur within the Project Area, reversible and was determined with a moderate level of confidence. The potential effects of a subsurface blowout in the Project Area on marine fish and fish habitat are predicted to be adverse, medium in magnitude, medium to long-term in duration, occur within the Regional Study Area (RSA), and reversible. This was determined with a moderate level of confidence. Although there is the potential for effects on fish and their habitats in the RSA, these are, with appropriate mitigations, not likely to result in an overall, detectable decline in overall fish abundance or change in the spatial and temporal distribution of fish populations in the overall RSA and the predicted residual environmental effects are considered not significant.

In reference to potential cumulative effects (refer to Chapter 14 in the EIS), the Project activities will operate for a short period of time in any one location, resulting in a short-term disturbance within a relatively limited zone of influence. This will reduce the potential for individuals and populations to be affected through multiple interactions with this Project and other activities in the marine environment, and for species to be affected simultaneously and repeatedly by multiple projects and activities. This, along with the other planned Project-related mitigation measures that will be implemented and the low potential for salmon to occupy the Project Area, will reduce the potential for and degree of associated cumulative effects. Refer to the Chapter 14 of the EIS and the response to IR-86 for further information regarding cumulative effects.

The conclusion within the EIS based on existing data remains valid; that the Project will not result in significant adverse cumulative environmental effects on marine fish and fish habitat, including Atlantic salmon in combination with other projects and activities that have been or will be carried out.

Part 9: Recognizing data gaps regarding the presence of Atlantic salmon in the project area, migration routes, and at-sea mortality, apply the precautionary approach in the updated effects analysis and in the discussion of proposed mitigation.

As stated in Sections 6.1.7.4 and 12.3.2.2.3 of the EIS and Part 1 above, post-smolt and adult salmon are concentrated throughout the year in the Labrador Sea, which is outside the Project Area, where they feed and overwinter. In the spring, both grilse and multi-sea-winter (MSW) adults appear to congregate in two general locations, both of which are outside the Project Area; near the eastern slope of the Grand Bank of Newfoundland and approximately 480 km east of the Strait of Belle Isle (Reddin and Friedland 1993; Reddin 2006) prior to their spawning migrations back to their natal rivers. Also noted earlier, smolt ages indicate that salmon congregating off the east Grand Bank area are likely from more southern populations from South Newfoundland, a portion of the Gulf of St. Lawrence, as well as Eastern – Southern Nova Scotia and Outer Bay of Fundy. While post-smolt do not likely overwinter in the Flemish Pass area (Reddin and Friedland 1993; Reddin 2006), migration as adults to the east Grand Bank area must occur. Although the exact migration route is not known, using the precautionary approach it has been conservatively assumed that the route may include areas within and near the Project Area, particularly during time periods when SST are favourable (i.e., over 4°C). Please refer to Part 1 above and Sections 6.1.7.4 and 12.3.2.2.3 for additional details regarding salmon migration and habitat use.

The information provided in Part 1 adds to the data on marine movements and habitat utilization, particularly by kelts, but does not alter the utilization and movement patterns previously described by the literature summarized within the EIS. Migration routes for Atlantic salmon can be variable based on environmental conditions such as sea-surface temperatures and therefore, interactions will be limited and overall risk is considered very low to this species. The conclusion within the EIS based on existing data remains valid; that spring migration of adults within and near the Project

Area is possible; however, the likelihood of interaction, given measured SSTs over the past 7-38 years, remains as low. As a result, the Project is not likely to result in significant adverse environmental effects on marine fish and fish habitat, including Atlantic salmon.

Part 10: Taking into consideration any uncertainties regarding potential effects, discuss the need for follow-up related to project-specific or cumulative effects on Atlantic salmon, including participation in future regional initiatives and potential for collaboration with Indigenous communities.

The additional information identified in the IRs was considered and the potential for Project interactions and effects outlined in the EIS remain valid; the Project is not likely to result in significant adverse environmental effects on marine fish and fish habitat, including Atlantic salmon. However, ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) acknowledge that although the Project is extremely unlikely to effect Atlantic salmon, there are some data gaps regarding migratory routes. The understanding of salmon migration continues to evolve, and additional data on migratory routes of salmon may supplement the broad research ongoing by DFO, Indigenous Groups, Atlantic Salmon Federation, etc. The Operators, in collaboration with research partners (potentially including Indigenous Groups), may consider supporting research on migratory routes within the offshore operations areas. This support could also occur within the context of regional initiatives.

References

IR-16

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Part 5

N/A

IR-16a

Part 6

N/A

Part 7

N/A

Part 8

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Part 10

N/A

INFORMATION REQUIREMENT – IR-17

(KMKNO-3)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.3.1, Fish and Fish Habitat.

Reference to EIS: Section 8.4.4, Atlantic Salmon and American Eel.

Context and Rationale

The EIS indicates that migration routes for American eel do not reside wholly within the Project area and can be variable based on environmental conditions such as sea-surface temperatures. The EIS further states that interactions may be limited and overall risk is considered low to this species, and that Project-related disturbances are also localized and short-term with mitigation measures implemented to reduce potential effects.

Comments from KMKNO state that it is probable that the American eel would be in the exploration areas during migration and would likely be affected by exploration activities.

Specific Question or Information Requirement

Provide additional information on potential avoidance and mitigation measures for the American eel.

Response

Spawning migrations for adult American eels in Canada occur in the fall and follow the continental shelf before travelling across open ocean to the Sargasso Sea (COSEWIC 2012; Béguer-Pon et al. 2015). In tracking studies in Atlantic Canada, adult eels were observed to migrate in two phases. Eels first travel in shallow waters along the continental shelf and edge. Telemetry data indicates that adult eels undergo some exploratory behavior on their way to the Sargasso Sea, which is assumed to be for detection of cues or other migrants (Béguer-Pon et al. 2015). In the second phase of migration, the eels travel in deep waters directly south towards the Sargasso Sea, which includes crossing the Gulf Stream (Béguer-Pon et al. 2015). After spawning from February to April, the larvae in the Sargasso Sea drift north with the Gulf Stream, with some directional swimming (Rypina et al. 2014; Westerberg et al. 2017). Variations in strength of the Gulf Stream and other ocean circulation patterns may influence success rates of larvae reaching coastal waters (Rypina et al. 2016; Westerberg et al. 2017).

Preliminary studies indicate that juvenile and adult American eel showed strong avoidance to lights but were attracted to underwater noise (Hadderingh et al 1992; Patrick et al 1982, 2001). Young American eel larvae in marine environments have avoidance capabilities as demonstrated by leptocephali net avoidance in the Sargasso Sea (Castonguay and McCleave 1987).

The main threats to this species are largely in freshwater systems including habitat degradation and 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). Although 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.

As American eel use the continental shelves for migration, it is possible that adult American eels may travel through the shallow water depths of the Project Area. Mitigation strategies to avoid or reduce potential adverse effects of Project activities on American eel would be similar to mitigation strategies for other secure and at-risk marine fish species. With the application of the following mitigation measures, which are listed in Section 8.3.2 of the Environmental Impact Statement (EIS) and apply to marine fish and fish habitat, the environment effects of planned Project activities on American eel are predicted to be not significant.

- Use of existing and common vessel and aircraft travel routes for vessels and helicopters will be used where possible and practicable.
- Low-level aircraft operations will be avoided where it is not required per Transport Canada protocols.
- Operational discharges will be treated prior to release in accordance with the *Offshore Waste Treatment Guidelines* (OWTG; NEB et al 2010) and other applicable regulations and standards.
- The selection and screening of chemicals to be discharged, including drilling fluids, will be in accordance with the *Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands* (NEB et al 2009).
- During formation flow testing with flaring, produced hydrocarbons and produced water may be flared. If there is a large amount of produced water encountered, it will be treated in accordance with the relevant regulatory requirements prior to ocean discharge, or shipped to shore for appropriate disposal.
- Appropriate handling, storage, transportation, and on-shore disposal of solid and hazardous waste.
- Synthetic based mud (SBM)-related drill cuttings will be returned to the drilling installation and treated in accordance with the OWTG (NEB et al 2010) before being discharged to the marine environment. Water based mud (WBM)-related drill cuttings will be discharged without treatment.
- Use of explosives will not be employed for removal of wellheads.

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INFORMATION REQUIREMENT – IR-18

(MTI-4 and -5)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.3.1, Fish and Fish Habitat.

Reference to EIS: Section 8, Marine Fish and Fish Habitat: Environmental Effects Assessment, and 6.1.7.3, Flemish Cap and Grand Banks Slope (Project Area – Northern and Southern Sections).

Context and Rationale

Section 6.1.7.3 of the EIS states that during their northern migrations, swordfish are likely to remain in areas under the influence of the Gulf Stream and therefore are expected to be at relatively low abundance in the Project area as it is exposed to the Labrador Current. Although the EIS acknowledges the potential presence of swordfish, they have not been included in the list of species known to occur in the Project area.

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 or Information Requirement

Provide additional existing baseline information and a robust effects assessment of potential effects to swordfish, including any existing published research on biological and behavioural responses of swordfish to noise and light. Update the proposed mitigation and follow-up, as well as effects predictions, accordingly.

Response

The potential effects on swordfish has been fully considered in the environmental effects assessment as detailed in Chapter 8 and 12 in the Environmental Impact Statement (EIS). The following provides additional details on this species as requested.

Swordfish (*Xiphias gladius*) are large, highly migratory, pelagic species that occupy Canadian waters for foraging from June to October (DFO 2015) and returns to southern spawning areas from December to June (Govoni et al. 2003; Arocha 2007; Neilson et al. 2009, 2014). The Gulf of Mexico and eastern continental shelf of the United States are suggested to be nursery areas for the pelagic larvae (Govoni et al. 2003; Arocha 2017). In Canadian waters, swordfish primarily feed on squid, Atlantic mackerel, Atlantic herring, and other fishes (Scott and Tibbo 1968; Stillwell and Kohler 1985).

[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.

The distribution assessment of swordfish in Canadian waters is primarily based on information from fisheries (longline and harpoon) observations and tracking with pop-up satellite tags (Neilson et al. 2009, 2014; Andrushchenko et al. 2014). Swordfish populations across the North Atlantic are separate with little evidence of movement between the western and eastern North Atlantic (Neilson et al. 2014). There are also separate northern and southern Atlantic stocks with an approximate boundary around 5^0N latitude. Swordfish associate with thermal fronts indicating they follow the warm Gulf Stream in Canadian waters similar to other large pelagic fishes (Podestá et al. 1993; Sedberry and Loefer 2001). Tagging studies indicate the distribution of immature swordfish (<179 cm) is primarily along the eastern United States from Massachusetts to Florida. Mature swordfish (>179 cm) generally occupied higher latitudes including the eastern Coast of the United States, Atlantic Canada, the Grand Banks, and the Flemish Cap with presence during spawning season in the Gulf of Mexico, Sargasso Sea, and Caribbean Sea (Govoni et al. 2003; Neilson et al. 2013, 2014, Luckhurst and Arocha 2016). The Canadian longline fishery for swordfish generally matches the species distribution from the Georges Bank to the Flemish Cap, however effort is primarily along the Georges Bank, Scotian Shelf and southern Grand Banks (DFO 2011; Lauretta et al. 2014; Andrushchenko et al. 2014; Andrushchenko and Hanke 2015). Swordfish also undergo diel vertical migrations where they occupy surface waters (less than 100 m) during the day and deeper waters (greater than 400 m) at night (Lerner et al. 2013). Occasionally, swordfish bask in surface waters during the day; a behavior more common in colder waters (Dewar et al. 2011; Neilson et al. 2013).

Swordfish are highly visual predators, even in dim light, with specialized mechanisms for warming the brain and eyes that allows for detection of rapidly moving prey (Fritsches et al. 2005; Hazin et al. 2005; Southwood et al. 2008; Ishibashi et al. 2009). Swordfish fisheries are conducted at night with light attractants (light sticks) attached on the longline (Bigelow et al. 1999; Hazin et al. 2005; Orbesen et al. 2017). However, it is unclear whether the light attract prey that attracts swordfish or if the light attracts the swordfish themselves (Hazin et al. 2005). Catch rates of swordfish have been examined in relation to lunar illumination with inconsistent results geographically. Catch rates using the pelagic longline were highest with low lunar illumination in Gulf of Mexico and Reunion Island fisheries and highest with the full moon in the central Atlantic, Portuguese, Hawaii, and eastern Mediterranean Sea fisheries (Orbesen et al. 2017). Low catch rates of swordfish during a gillnet fishery during high lunar illumination was suggested to result from greater net visibility during the full moon (Orbesen et al. 2017). Olfactory or chemosensory cues also play a role in predation as Mejuto et al. (2005) observed presence of prey odors contributed to the strike / no strike decision in swordfish. In comparisons of various bait types, swordfish were more likely to strike baits with prey odors including plastic imitation mackerel stuffed with fish compared to plastic imitation bait with no fish (Mejuto et al. 2005; Southwood et al. 2008). There are few studies on the hearing capabilities for swordfish and as such auditory abilities are inferred from other large pelagic fishes including tunas and sharks (Southwood et al. 2008). Tunas are considered hearing generalists as they lack specialized mechanisms for enhancing hearing and are capable of detecting low frequency sounds (less than 1000 Hz). Yellowfin tuna have been shown to respond to sound cues in the frequency range of 200-700 Hz with higher sensitivity to sounds between 200-400 Hz (Southwood et al. 2008). Sharks are considered low frequency specialists and are attracted to low frequency sounds in the range of 25-1,000 Hz (Southwood et al. 2008). Irregular pulsed sounds may attract shark species as it is similar to what would be generated by struggling prey (Southwood et al. 2008). High intensity sounds results in rapid avoidance behavior in sharks, however they may become habituated to these types of noises (Southwood et al. 2008).

There are a variety of potential effects of petroleum extraction activities on swordfish (de Sylva et al. 2000). The combination of drilling installation colonization opportunities and artificial light emissions from the operating decks and navigation may create a "reef effect" in which fish may aggregate underneath in response to increased foraging and shelter opportunities even in areas of underwater noise around anthropogenic activities in the marine environment (see EIS for review, Franks 2000; Keenan et al. 2007). Swordfish and other pelagic fishes have been shown to be attracted to marine structures termed fish aggregation devices (FAD), including oil platforms, fish farms, and offshore wind turbines (Franks 2000; Fayram and de Risi 2007; Arechavala-Lopez et al. 2013). Swordfish may be attracted to these areas based on increased foraging opportunities and better lighting for predation (Franks 2000; Hazin et al. 2005 Orbesen et al. 2017). As swordfish are highly visual predators and any discharges such as drill cuttings releases may reduce visibility in the water could have effects on this species' ability to capture fish. Attraction to an offshore infrastructure may also expose individual swordfish to the emissions (noise, light) and discharges associated with drilling activities, however, swordfish is a highly mobile species that is likely able to avoid any anthropogenic effects associated with a drilling installation and associated vessels. Based on hearing capabilities of other pelagic fishes, swordfish may be attracted to low frequency noises that are typical of offshore operations, however any high intensity noises will likely cause movement away from the area. This species' seasonal distribution in Canadian waters, combined with their non-schooling behavior also reduces any potential population effects (Arocha 2017) from the Projects. Spawning habitats for swordfish are also distant from the Project Area, reducing potential interactions with important habitats and critical life stages that have less capability of avoidance. With the application of mitigation measures outlined in the response to Information Requirement (IR) IR-17, which are included in Section 8.3.2 of the EIS and apply to marine fish and fish habitat, the environmental effects of routine Project activities on swordfish are predicted to be not significant.

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INFORMATION REQUIREMENT – IR-19

(WM-EM-18)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.3.1, Fish and Fish Habitat.

Reference to EIS: Section 8.5.1, Residual Effects Summary.

Context and Rationale

Section 8.5.1 of the EIS indicates that subsea infrastructure may provide opportunities for colonization and increased distribution of benthic species that have pelagic eggs or larvae. While the effect would be temporary for the length of drill operations, increased colonization opportunities may support faster recovery in an otherwise slow recovering environment.

Concern was raised that the introduction of infrastructure that may help colonize the area, and then removing it, may cause further damage to the distribution of benthic species (Wolfson et al. 1979).

Specific Question or Information Requirement

Provide further rationale and evidence for the conclusion that temporary introduction of infrastructure could have positive effects on benthic habitat recovery.

Response

Artificial structures introduced to environments can have local influences on benthic community structure, species diversity, and abundance through the addition of hard substrate and habitat complexity (Wolfson et al. 1979; Bomkamp et al. 2004; Apolinario and Coutinho 2009; Macreadie et al. 2011; Ajeman et al. 2015). Bottom infrastructure associated with offshore drilling activities are also typically associated with “no fishing” boundaries that may provide refuge for fish species (Macreadie et al. 2011). Introduced infrastructure provides stepping-stone habitat for colonizing benthic species to increase their distribution (Cordes et al. 2016). Deep sea invertebrates use a variety of strategies to promote dispersal including delayed and slower egg development, and planktotrophic larvae with high parental investment (Young et al 2018). As deep-sea larvae have been observed in the upper water column (Young et al 2018), it suggests that certain species are able to disperse widely and take advantage of temporary bottom structures for settling and colonization. These structures may also attract invertebrate and fish species and provide food subsidies through fouling and colonization of infrastructure that may support higher trophic levels (Wolfson et al. 1979; Bomkamp et al. 2014; van der Stap 2016). For example, bivalves that colonize offshore platforms in the Pacific Ocean become dislodged with waves and storm events and form shell mounds underneath the structure. These fallen mussels provide food subsidies to benthic communities and additional hard substrate for other organisms to colonize (Bomkamp et al. 2004; Claisse et al. 2015).

Introduced infrastructure generally support species that are enhanced by addition of hard substrate and potentially negatively affect species that are adapted to mud and low complexity habitats (Wolfman et al. 1979; Davis et al. 1982; Ajemian et al. 2015). Removal of the infrastructure will likely result in a localized decline in sessile or low-mobile invertebrates that were supported by the associated food and habitat subsidies. Bomkamp et al. (2004) observed a difference in predatory gastropods and sea stars that were dependent on the bivalve food subsidies between present and former oil platform sites. Crab species were not different between the sites, indicating that mobile opportunistic species were not negatively affected (Bomkamp et al. 2004). Some small disturbances in deep sea areas are also suggested to enhance diversity in deep sea environments (Grassle and Morse-Porteous 1987).

Potential positive effects would last for the duration of the presence of underwater infrastructure. After removal, sessile species would likely decline but mobile opportunistic species would be supported for a short time. Recovery and recolonization of the area would only be enhanced if the infrastructure supported connectivity to areas that were previously inaccessible by benthic invertebrates. These areas would potentially support succession of the area once the infrastructure was removed. Due to the short-term duration of drilling activities, overall potential positive and negative effects are likely limited. Therefore, recovery of the area would follow typical succession patterns of deep sea areas.

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INFORMATION REQUIREMENT – IR-20

(N/A)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.3.1, Fish and Fish Habitat.

Reference to EIS: Section 8.3.4.1, Water-based Drilling Mud.

Context and Rationale

The EIS states that "the likely distance between individual wells that will be drilled as part of this Project means that there is also little or no potential for these environmental releases [drilling muds and cuttings] from individual wells to interact or accumulate in the LSA".

Specific Question or Information Requirement

Indicate the "likely distance" between individual wells assumed in making the determination that there is no potential for overlap. Clarify what is the closest distance that wells could occur to each other, including exploration and associated delineation wells. Update effects predictions, proposed mitigation, and follow-up accordingly, if applicable.

Response

As outlined in Section 13.3.3 of the Environmental Impact Statement (EIS), there is the potential for two drilling installations to be operating at any one time during the Project, therefore this was taken into consideration in the drill cuttings dispersion modelling in Appendix G of the EIS and detailed below.

The distance between individual exploration well varies as they are dependent on the results from initial wells and geophysical programs. Delineation/appraisal wells are typically completed within a radius of approximately 20 kilometres (km) from the initial exploration well.

As indicated in Section 8.3.4 of the EIS, discharging drill cuttings has the potential to interact with fish and fish habitat. Drilling muds are screened as per the *Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands* (NEB et al 2009). While drill cuttings are managed and discharged in accordance with the *Offshore Waste Treatment Guidelines* (OTWG; NEB et al 2010) as follows:

- Water based muds (WBM) cuttings are discharged without treatment to the marine environment; and
- Synthetic based muds (SBM) cuttings are treated and then discharged to the marine environment.

As outlined in Section 8.3.4.4 and Appendix G of the EIS, drill cuttings dispersion modelling was completed at three sites within the Northern Section (i.e., Northern, Eastern and Southern Project Areas [NPA, EPA and SPA] and one site within the Southern Section (i.e., Jeanne d'Arc Basin [JDB]). The four sites were selected to reflect potential well sites and to account for the range of water depths in the Project Area:

- NPA – 2,700 metres (m):
- EPA – 1,100 m;
- SPA – 362 m; and
- JDB – 89 m.

The model also took into consideration that multiple wells could be drilled at any time during the year, and scenarios incorporated winter, spring, summer and fall seasons, which corresponds to March, June, September and December, respectively, as outlined in Appendix G.

Corals and sponges may be vulnerable to seabed disturbances associated with drill cuttings discharge, therefore ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) have committed to completing a pre-drill survey to identify corals/sponges and undertake a risk assessment to determine if additional mitigation measures and/or monitoring are required. Detailed information regarding corals/sponges is discussed in the responses to Information Requirements (IR) IR-21, -22, and -23.

As mentioned above, the drill cuttings dispersion models took into consideration the scenario of drilling multiple wells at any time during the year in the four sites, and the EIS also outlined requirements regarding protection of sensitive benthic habitat, therefore the effects predictions, proposed mitigation and follow-up monitoring as provided in the EIS remain valid.

References

NEB (National Energy Board), Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2009. Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands. Available online: http://www.cnlopb.ca/pdfs/guidelines/ocsg.pdf?lbisphpreq=1. Accessed March 2018.

NEB, Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board. 2010. Offshore Waste Treatment Guidelines. Available online: http://www.cnlopb.ca/pdfs/guidelines/owtg1012e.pdf?lbisphpreq=1. Accessed May 2018.

INFORMATION REQUIREMENT – IR-21

(CNLOPB-3: ExxonMobil and Statoil, and DFO-1)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.3.1, Fish and Fish Habitat, and 6.4, Mitigation.

Reference to EIS: Table 8.1 Potential Project-Related Environmental Changes and Potential Effects: Marine Fish and Fish Habitat; Section 8.3.3.3, Interaction with Benthic Environment; 8.3.4.4, Project-Specific Modelling of Drilling Discharges; 8.3.4.5, Potential Biological Effects of Drill Cuttings Deposition; 8.5.1, Residual Environmental Effects Summary; and Appendix G Flemish Pass Exploration Drilling Program, Drill Cuttings Modelling (Amec Foster Wheeler, 2017).

Context and Rationale

Appendix G and Section 8.3.4.4 provide predicted mean and maximum thickness for cuttings deposition at various distances from each modelled wellsite. Section 8.3.4.5 identifies two predicted no effect thresholds for burial depths: 6.5 mm, as well as a more conservative 1.5 mm, indicated to coincide with assessments on more sensitive coral species. Results of deposition modelling are compared to both thresholds, but there is no estimate provided for the potential total area of habitat affected by deposition above the identified thresholds. Furthermore, expected distances above thresholds are predicted based on mean deposition thicknesses, rather than maximums. It is unclear whether this is representative of the worst-case scenario.

Section 8.3.3.3 of the EIS indicates that "where there is a predicted deposition greater than/equal to 6.5 mm, and healthy coral colonies are present, a setback of the predicted distance to this threshold value will be maintained, as described in greater detail in Section 8.3.4". However, Section 8.3.4 of the EIS does not contain any further discussion of thresholds and resulting setbacks.

It is unclear how thresholds would be applied when determining mitigation requirements. Section 8.3.3.3 suggests that the 6.5 mm threshold will define setback distances; there is no indication whether the 1.5 mm conservative threshold would be considered. The EIS does not provide sufficient rationale for the use of 6.5 mm as the threshold for deposition of drill cuttings on sensitive benthic coral and sponge species.

Section 8.5.1 indicates that pre-drill coral surveys would be undertaken and the anchor set with a set-back distance of 50 m, where applicable. This is the first reference of this particular set-back distance; Section 2.5.2.1 indicates 50 m as the survey radius around potential anchor points but does not commit to a set-back distance.

Setting back anchors 50 m from corals may not be sufficient as the cables or chains also need to be considered. If corals are in the area where an anchor is to be set, would the anchor be offset so that the anchor and its cable or chain would not come in contact with the corals?

Specific Question or Information Requirement

For a typical well, provide an estimate of the maximum area that could be affected by sediment deposition thicknesses above each of the stated thresholds. Ensure the rationale for selecting representative worst-case data is clearly explained.

Provide more information on how setback distances would be determined for both anchored/moored and dynamic positioned drilling installations, including:

- A rationale for the use of 6.5 millimetres as the threshold for effects on sensitive benthic species given that the reported burial depth of 1.5 millimetres has been suggested as a conservative value for assessing effects related to drilling discharges.
- Additional information on how/if two different thresholds may be used to determine required setback distances. For example, could selection of threshold be dependent on the sensitivity of species identified during the pre-drill survey? If a species could not be identified definitively, would a precautionary approach be taken?
- An explanation of whether distances to threshold would be defined based on average thickness or on maximum thicknesses. If based on average thickness, provide a rationale for how this is protective of benthic habitat.

Consider potential effects of anchors and associated moorings on benthos, including corals and sponges.

Discuss whether following anchor deployment, the anchor placement would be verified with an remotely operated vehicle (ROV) video survey prior to tensioning, and whether anchors would be repositioned via ROV in instances where they have settled on sensitive habitat.

Update proposed mitigation and follow-up and associated effects predictions, as applicable.

Response

As outlined in Section 4.4 of Appendix G of the Environmental Impact Statement (EIS), the estimated areas that may be affected by total drill cuttings (i.e., exceed the predicted no effects threshold [PNET]) are as follows:

- Northern Section
  - Greater than 1.5 millimetres (mm) – 0.025 to 0.103 square kilometres (km^2); and
  - Greater than 6.5 mm – 0.0125 to 0.0325 km^2.
- Southern Section
  - Greater than 1.5 mm – 0.045 to 0.0625 km^2; and
  - Greater than 6.5 mm – 0.01 to 0.025 km^2.

As mentioned in Section 2.5.2.1 of the EIS, ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) have committed to completing pre-drill coral and sponge surveys. Once the pre-drill coral and sponge surveys are complete, the Operators would be in a better position to determine the area of habitat that may be affected by deposition by taking the following aspects into consideration:

- Drill cuttings dispersion modelling;
- Areas where bottom contact occurs (e.g., anchor patterns, any additional subsea infrastructure or equipment); and
- Coral and sponge species identified, and the specific threshold based on this identification.

Expected distances above thresholds were based on mean deposition thickness for the purposes of the EIS as some coral species are more sensitive to sedimentation than others. It is noted that the 1.5 mm threshold is a conservative value that coincides with assessments on more sensitive coral species where injury from sedimentation was observed with sedimentation of less than 6.3 mm, which is outlined in Section 8.3.4.5 of the EIS.

As indicated in Section 2.5.2.1 of the EIS, the Operators have committed to developing *Coral and Sponge Survey Plans*, which will be provided to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) and Fisheries and Oceans Canada (DFO) for their review and acceptance prior to commencing the survey. For clarification purposes, it is noted that the commitment in the EIS did not adequately capture the requirement for completing sponge surveys, however, the survey will include corals and sponges.

As indicated in Sections 2.5.2.1, 8.6 and 17.4.1 of the EIS, the Operators have also committed to developing *Coral and Sponge Survey Results and Risk Assessment Reports*, which will be provided to the C-NLOPB and DFO for their review and acceptance at least 60 days prior to commencing drilling activities. For clarification purposes, it is noted that the commitment in the EIS did not adequately capture the requirement for completing sponge surveys, however, the report will address corals and sponges.

Potential effects associated with anchors and associated moorings on corals and sponges include:

- Sedimentation caused by seabed disturbance; and
- Physical contact with corals and sponges.

The *Coral and Sponge Survey Results and Risk Assessment Reports* will assess the risks associated with the following:

- Sedimentation caused by drill cuttings deposition;
- Sedimentation caused from bottom contact of subsea equipment and/or infrastructure; and
- Physical contact caused by bottom contact of subsea equipment and/or infrastructure.

As detailed in Section 2.5.2.1 of the EIS, the survey area around proposed anchor patterns will be approximately 50 m from the extent of the anchor pattern, and based on the recommended setback distance in the *Monitoring of Drilling Activities in Areas with Presence of Cold Water Corals* (NOROG 2013) (herein referred to as the NOROG Guideline). Following anchor deployment, there is no intent to complete a remotely operated vehicle (ROV) survey to determine if contact was made with corals and/or sponges, as the location of corals and sponges would have been determined during the pre-drill survey, and the anchor pattern would have been adjusted, if determined by the risk assessment.

The purpose of the risk assessment, as identified in the EIS and the NOROG Guideline, is to determine potential mitigation measures and monitoring that is required. The risk assessment, as described in the Section 2.5.2.1 of the EIS, considers the abundance, type and condition of the corals and sponges, and the anticipated effects based on drill cuttings modelling results or distance from mooring/anchoring locations. If additional mitigations are required, they will be identified in the *Coral and Sponge Survey Results and Risk Assessment Report*s, which will be provided to the C-NLOPB and DFO for their review and acceptance in advance of drilling. Additional mitigations will not be known until the survey and risk assessment are complete, and therefore, cannot be included in the EIS.

References

NOROG (Norwegian Oil and Gas Authority). 2013. Monitoring of Drilling Activities in Areas with Presence of Cold Water Corals. Available online: https://www.norskoljeoggass.no/contentassets/13d5d06ec9464156b2272551f0740db0/monitoring-of-drilling-activities---areas-with-cold-water-corals.pdf. Accessed March 2018.

INFORMATION REQUIREMENT – IR-22

(KMKNO-17)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Section 6.1.3, Fish and Fish Habitat, and 8.1, Follow-up.

Reference to EIS: Section 17.4.1, Follow-up Programs.

Context and Rationale

The EIS proposes that a follow-up program to validate and verify cuttings dispersion modelling would only be conducted under specific circumstances, such as the presence of sensitive habitat (Section 17.4.1).

Specific Question or Information Requirement

Explain whether drill cuttings modelling predictions would be verified through a follow-up program in circumstances other than if drilling would occur in the presence of sensitive habitat. Define sensitive habitat that would qualify for follow-up (e.g., species types, abundance, distance from drilling unit).

Response

The Environmental Impact Statement (EIS) predicted that in areas that do not have sensitive habitat there would not be a significant environmental effect from drilling activities on benthic habitat. The presence of sensitive species, particularly corals and sponges, will be identified during the pre-drill coral and sponge survey, as discussed in Sections 2.5.2.1, 8.3.2, 8.3.4.5 and 8.6 of the EIS, and further described in the response to Information Requirement (IR) IR-21. The need for monitoring and/or mitigation would be determined based on the risk assessment carried out as part of the coral and sponge survey.

References

N/A

INFORMATION REQUIREMENT – IR-23

(WM-STAT5, DFO-1 KMKNO–1, KMKNO-31)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species.

Reference to EIS Guidelines: Section 6.1.3, Fish and Fish Habitat, and 6.4, Mitigation Measures.

Reference to EIS: Section 2.5.2.1, Wellsite Surveys – Drill Planning; 6.1.1.4, Use and Adequacy of Existing Environmental Information for EIS Purposes; 8.3.2, Summary of Key Mitigation; 8.3.3.3, Interaction with Benthic Environment; and Table 17.2 Summary of Mitigation and Commitments.

Context and Rationale

There is inconsistent information in the EIS on the circumstances under which a pre-drill coral survey would be conducted. Section 6.1.1.4 of the EIS indicates that the pre-drill coral survey would be carried out at *all* wells drilled as part of the Project, while Section 8.3.3.3 indicates that surveys would occur where coral colonies are likely to be present.

Section 2.5.2.1 outlines proposed pre-drill surveys, which would be based on the Norwegian Oil and Gas Authority guidelines for drilling activities in areas with the presence of cold water corals.

Table 17.2 (item 14) implies that a well would be relocated and/or water-based mud (WBM) cuttings discharge would be redirected to protect sensitive benthic habitat (i.e., corals and sponges). It is not clear whether the mitigation measures proposed to be implemented apply to all sensitive marine benthic habitats, or just if coral and sponge habitat is detected.

Section 8.3.2 of the EIS indicates that, in the event of a discovery of sensitive benthic habitat during the pre-drill coral survey, cuttings discharge may be relocated using a subsea cuttings transport system. This potential alternative means of carrying out the Project, including potential environmental effects, is not addressed in Section 2.10 of the EIS. As required by the EIS Guidelines and the Agency guidance document *Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012*, if more than one alternative means may be used to carry out the designated project, the consideration of effects of multiple alternative means should be brought forward through the environmental assessment.

Specific Question or Information Requirement

Clarify the commitments related to when coral surveys following the Norwegian protocol would be undertaken (i.e., would these be undertaken at all well sites?). If coral surveys are not proposed at all well sites, state if other measures are proposed to mitigate potential effects on sensitive benthic organisms.

Provide further information on the Norwegian survey protocol, specifically methodology that would be followed as well as any potential adaptations that might be incorporated into the approach for the Project.

Clarify whether the surveys would seek to identify only corals and sponges, or whether other habitat features would be included in the definition of sensitive marine habitat. Specify whether the pre-drill survey could be modified to also include species at risk.

Indicate the criteria that would be used to determine selection of mitigation measures. For example, what criteria would guide the decision to move a wellsite versus redirecting cuttings discharge location? Explain whether mitigation would be implemented for all coral and sponge species and abundances.

Provide additional information on the potential mitigations that the proponent would implement if other sensitive marine benthic habitat is detected.

Provide additional information on the subsea cuttings transport system and potential environmental effects of this mitigation measure in the consideration of alternative means of carrying out the Project.

Explain whether a pre-drill coral survey would be conducted if a drill ship is used to account for dynamic positioning (DP) requiring the placement of an array of transponder beacons directly on the seabed.

State whether the proponent intends to share seabed survey footage or results.

Response

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) will complete coral and sponge surveys at each well location, as well as 50 m around each anchor pattern, where applicable. Site-specific survey details will be outlined in the *Coral and Sponge Survey Plans*, which will be provided to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) and Fisheries and Oceans Canada (DFO) for their review and acceptance prior to commencing the survey. After the survey is complete, the Operators will prepare *Coral and Sponge Survey Results and Risk Assessment Reports*, which will be provided to the C-NLOPB and DFO for their review and acceptance at least 60 days prior to commencing drilling.

There is significant experience in identification of cold water corals through surveys and monitoring of potential environmental effects associated with exploration drilling from operations on the Norwegian Continental Shelf (NCS), and the Norwegian Oil and Gas Authority (NOROG) prepared a guideline documented titled *"Monitoring of Drilling Activities in Areas with Presence of Cold Water Corals"* (NOROG 2013) (herein referred to as the NOROG Guideline). The Operators will use the NOROG Guideline to prepare their *Coral and Sponge Survey Plans*, however, modifications will be incorporated, such as the following:

- Coral and sponge species specific to offshore Newfoundland and Labrador area, and information on species that may be present in the drill location, if known;
- Proposed survey methods for hard coral, soft coral and sponges;
- Proposed survey area; and
- Mapping requirements.

The Operators will also prepare *Coral and Sponge Survey Results and Risk Assessment Reports* that will include information on the following:

- Risk classification associated with drill cuttings deposition;
- Risk classification associated with bottom contact of subsea equipment and/or infrastructure;
- Need for monitoring requirements based on conclusion of the risk assessment; and
- Need and type of mitigation measures based on conclusion of the risk assessment.

Surveys will focus on corals and sponges. There are no other known benthic species that are deemed species at risk (SAR) in the Project Area. The pre-drill survey will not focus on SAR, however, if a SAR are observed during the remotely operated vehicle (ROV) survey then the Marine Scientist can record the observation.

Mitigation measures will be finalized in the Operators *Coral and Sponge Survey Results and Risk Assessment Reports*, which will be provided to the C-NLOPB and DFO for their review and acceptance.

Several factors will be considered to determine if mitigation measures are required, which will be detailed in the *Coral and Sponge Survey Results and Risk Assessment Reports*. Factors to take into consideration include, but are not limited to:

- Area of reef-building coral;
- Percentage of living reef-building coral;
- Number of living soft corals per a defined area;
- Condition (health) of hard and soft corals;
- Percentage of sponge coverage;
- Predicted degree of sedimentation; and
- Predicted degree of bottom contact.

If a subsea cuttings transport system (CTS) is required, based on the results of the risk assessment, it will generally consist of the following components (NOROG 2013):

- Wellhead interface module;
- Suction hose with surface or subsea pump;
- Discharge hose; and
- Discharge module.

Potential environmental effects of a subsea CTS would be similar to bottom contact of subsea equipment and/or infrastructure (i.e., sedimentation during installation and physical contact), which have been discussed in the response to Information Requirement (IR) IR-21.

If dynamic positioning (DP) is utilized instead of anchors then the transponder areas would also be subjected to a pre-drill coral and sponge survey as the potential environmental effects would be similar to deploying anchors, however, at a lesser degree due to the size difference (i.e., sedimentation and physical contact). The method of DP will determine the number of transponders required. DP methods include super short base line (SSBL) and ong base line (LBL), with the former requiring one transponder and the latter typically requiring four to five transponders (Chas et al 2018). SSBL tends to lose accuracy with increasing water depths, therefore, LBL is typically utilized in deeper water (Chas et all 2018). Transponders typically do not exceed 1 m in length (Sonardyne 2015). As indicated in Section 2.5.2.2 of the EIS, transponders take approximately 18 hours to install.

As mentioned above, the Operators will prepare *Coral and Sponge Survey Results and Risk Assessments Reports* and provide to the C-NLOPB and DFO, therefore survey results will be shared. If the C-NLOPB and/or DFO requires survey footage, then it can be requested from the Operators.

References

Chas, C. and Garcia, R. 2018. Introduction to Ship Dynamic Positioning Systems. Available online: https://www.researchgate.net/publication/228741102. Accessed March 2018.

NOROG (Norwegian Oil and Gas Authority). 2013. Guideline – Monitoring of Drilling Activities in Areas with Presence of Cold Water Corals. Available online: https://www.norskoljeoggass.no/contentassets/13d5d06ec9464156b2272551f0740db0/monitoring-of-drilling-activities---areas-with-cold-water-corals.pdf. Accessed March 2018.

Sonardyne. 2015. Datasheet – Lodestar – GyroCompatt 6. Available online: https://www.sonardyne.com/app/uploads/2016/06/GyroCompatt.pdf. Accessed March 2018.

INFORMATION REQUIREMENT – IR-24

(KMKNO-20, WM-EM-13 and -34)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.3.1, Fish and Fish Habitat.

Reference to EIS: Section 6.1.7.1 Grand Bank Shelf and Slope (Project Area – Northern and Southern Sections).

Context and Rationale

The EIS Guidelines require that the assessment considers effects on primary and secondary productivity of water bodies and how Project-related effects may affect fish food sources.

The EIS provided limited information as to how the Project may affect food sources. While there is some reference to phytoplankton (primary production), the assessment is insufficient regarding potential effects to zooplankton (secondary production), and how this may affect fish.

Section 6.1.7.1 of the EIS indicates that densities of capelin, a key prey source for many other marine fish, bird and mammal species, are at regionally high levels in the Project area. Section 8.0 of the EIS presents some references specific to capelin, but the analysis of effects is general to fish and fish habitat. Detailed analysis on important indicator species/species groups, such as forage fish, is not provided.

Specific Question or Information Requirement

Discuss how the Project could affect the distribution, abundance or quality of zooplankton, including during regular operations and as a result of accidents and malfunctions. Discuss how such changes could affect marine mammals and sea turtles that rely on this food source, with specific consideration of potential effects on species at risk.

Provide a focused analysis specific to the effects of the Project on forage fish species, such as capelin and herring, with particular consideration of effects of waste discharge, vertical seismic surveys, and accidental events. Update the proposed mitigation and follow-up, as well as effects predictions, accordingly.

Response

An overview of the distribution and composition of plankton including zooplankton, and forage fish is detailed in Section 6.1.4 of the Environmental Impact Statement (EIS). The effects of the routine Project operations and potential accidents and malfunctions on zooplankton and forage fish are detailed in Chapter 8 (Marine Fish and Fish Habitat Effects Assessment) and Chapter 15 (Accidental Events). The following provides a focused background and assessment on zooplankton and forage fish using details from the EIS and additional supplemental information for both routine Project activities and accidental events, as well as potential effects on marine mammals and sea turtles.

Project activities that are predicted to potentially interact with zooplankton and forage fish communities would include the presence and operation of the drilling installation, drilling and associated marine discharges, formation flow testing with flaring, vertical seismic profiling (VSP) surveys, and accidental events (spills). As zooplankton encompasses a variety of species the effects of the Project may vary depending on the responses of each taxonomic group.

Presence and Operation of Drilling Installations

Potential discharges to the marine environment associated with the Project may include drill mud and cuttings (see next section), cement, liquid wastes (e.g., produced water, bilge and deck drainage, ballast water, grey and black water, cooling water, fire control water and Blowout Preventer [BOP] fluids), and food waste; all of which will be discharged in accordance with the *Offshore Waste Treatment Guidelines* (OWTG; NEB et al 2010). In general, zooplankton do not have high avoidance capability to discharges in water as their horizontal movements are controlled by oceanographic conditions. Certain taxa of coastal and estuarine copepods may be an exception to this as they have shown an avoidance behavior to hydrocarbon-contaminated water (Seuront 2010). Exposure experiments with *C. 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 polycyclic aromatic hydrocarbons (PAHs) (Utne 2017). While many forage fish species are motile and capable of avoidance responses, their early life stages likely have low avoidance abilities similar to other plankton. Herring larvae exposed to dispersed PAHs (0.129-6.012 micrograms per litre [µg/L] total PAHs) resulted in deformities and impaired growth compared to control groups (Ingvarsdóttir et al. 2012). Early life stages of capelin have also shown sensitivities to hydrocarbons, with lethal effects on larvae at exposures of 1.3-7.1 milligrams per litre (mg/L) total PAHs (Paine et al. 1992) and decreased egg mortality rates and hatching success at 40 µg/L crude oil (Frantzen et al. 2012). Discharged sewage and food wastes may enhance primary and secondary production (Peterson et al. 1996; Wilewska-Bien et al. 2016).

In summary, the predicted environmental effects of presence and operation of the drilling installation in relation to zooplankton and forage fish species from environmental discharges may result in potential changes to habitat availability and quality, fish mortality/injury risk and fish health, and fish presence and abundance. These effects are predicted to be adverse, low in magnitude, localized and within the Project Area, short to medium term duration, occurring regularly and reversible, with these predictions being made with a high level of confidence.

Drilling and Associated Marine Discharges

The primary interactions from the discharge of drill cuttings in relation to zooplankton and forage fish species includes discharge of drill cuttings, chemical toxicity, and bioaccumulation. The treatment and discharge of drill cuttings will be in accordance with the OWTG (NEB et al 2010). Drilling muds will also be selected in accordance with the *Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands* (NEB et al 2009).

Overall, water-based muds (WBMs) have varied effects on marine organisms, but due to the non-toxic nature of the drilling mud components (Neff 2010), they are not likely to result in toxicity (Holdway 2002; Trannum et al. 2010, 2011; Bakke et al. 2013; Purser 2015). Exposure to WBMs at low concentrations has, for example, not shown toxicity to sea scallops, polychaetes, amphipods, shrimp, and various finfish species (Cranford et al. 1999, Neff 2010). The acute toxicity potential was tested in relatively high concentrations of barite (200-1000 mg/L) and was found to be non-toxic to capelin, snow crab larvae or planktonic jellyfish after 24 hours of continuous exposure (Payne et al. 2006). Conversely, the dissolved constituents in WBMs have been shown to have low acute toxicity in the copepod *C. finmarchicus.* The copepod was observed to rapidly uptake drilling mud particles but slowly excrete particles, resulting in increased sinking of copepods (Farkas et al. 2017).

The relatively high dispersion of drill mud and cuttings particles also indicates that there should not likely be substantial interaction with pelagic species. Discharge of drill cuttings particles may form aggregates with phytoplankton resulting in rapid settling of plankton to the seafloor (Pabortsava et al. 2011). This could have potential effects of zooplankton and forage fish species with reduced food availability. Herring larvae that consumed suspended sediment have also been shown to have reduced feeding rates (Smit et al. 2006). Increases in turbidity from suspended sediments may also reduce foraging effectiveness in fish species (Smit et al. 2006). However, due to the high dispersion of particles, it is unlikely that there will be effects that may adversely affect plankton and forage fish populations.

In summary, the predicted environmental effects of drilling and associated marine discharges on zooplankton and forage fish species are related to change in food availability and quality. Due to the high dispersion of particles, and transient and temporary nature of Project activities, these effects are predicted to be adverse, low in magnitude, localized and certainly within the Project Area, medium to long term in duration, occurring regularly and reversible, with these predications being made with a high level of confidence.

Vertical Seismic Profiling

The Project may include conducting VSP surveys as required throughout the Project life. VSP surveys are described in Section 2.5.2.5 EIS, with additional information provided in Information Requirement (IR) IR-05.

Potential effects on zooplankton and forage fish species are limited for VSP surveys due to the localized and temporary nature of the activity and are addressed in Section 8.3.7.1 of the EIS.

Summary

In summary, there is potential for adverse interactions between zooplankton and forage fish species, and routine Project activities. However, mitigation strategies to avoid or reduce the magnitude of potential adverse effects would be similar to mitigation strategies for marine fish and fish habitat. With the application of the mitigation measures included in Section 8.3.2 of the EIS that apply to marine fish and fish habitat, the environmental effects of routine Project activities on zooplankton and forage fish species are predicted to be not significant.

Accidental events (spills)

The response of zooplankton to oil spills is diverse and largely dependent on exposure, as detailed in Chapter 15. Certain taxa of coastal and estuarine copepods may be an exception to this 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 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).

While many forage fish species are motile and capable of avoidance responses, their early life stages likely have low avoidance abilities similar to other plankton. Herring larvae exposed to dispersed PAHs (0.129-6.012 µg/L total PAHs) resulted in deformities and impaired growth compared to control groups (Ingvarsdóttir et al. 2012). Early life stages of capelin have also shown sensitivities to hydrocarbons, with lethal effects on larvae at exposures of 1.3-7.1 mg/L total PAHs (Paine et al. 1992) and decreased egg mortality rates and hatching success at 40 µg/L crude oil (Frantzen et al. 2012).

In the event of an offshore oil release, some degree of residual adverse effects to marine fish and fish habitat in the area at the time of the event are expected. However, the operator's primary focus is on spill prevention, followed by ensuring that there are efficient response measures to reduce the impacts of the spill. The degree of exposure and thus the type and level of any such 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 15.5.1.2.1 of the EIS, potential effects of a batch spill (100 and 1,000 L) on marine fish and fish habitat are predicted to be adverse, low to medium in magnitude, short- to medium-term in duration, to occur within the Project Area, reversible and was determined with a moderate level of confidence. 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, medium to long-term in duration, occur within the Regional Study Area (RSA), and reversible. This was determined with a moderate level of confidence. Although there is the potential for effects on fish and their habitats in the RSA, these are, with appropriate mitigations, not likely to result in an overall, detectable decline in overall fish abundance or change in the spatial and temporal distribution of fish populations in the overall RSA and the predicted residual environmental effects are considered not significant.

Marine Mammals and Sea Turtles

The effects assessment on marine mammals and sea turtles fully considers changes in food availability or quality resulting from the Project (Chapter 10). Potential effects resulting from the presence and operation of the drilling installation on the health, abundance, and distribution of marine fish species can have secondary effects on marine mammals and sea turtles in terms of food availability and quality. Food availability would be adversely affected if marine mammals and sea turtles need to travel greater distances to locate food, or if prey are distributed in a more disperse (less aggregated) manner, such that foraging efficiencies are reduced. Quality would be considered adversely affected if the health of prey species was diminished, or if the ratio of preferred to less-preferred prey items was altered. Results of the assessment presented in Chapter 8 (Marine Fish and Fish Habitat) and the provided supplemental details above suggest that effects from presence and operation of the drilling installation will be negligible, and as such, secondary effects on change in food availability and quality for marine mammals and sea turtles are not expected, particularly to the degree that would translate into effects on the abundance, distribution, or health of these species.

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INFORMATION REQUIREMENT – IR-25

(KMKNO–28 and -38, MTI-12 and -13, MMS-4)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, 6.3.3 Marine Mammals; and 6.3.4, Marine Turtles.

Reference to EIS: Section 10.0, Marine Mammals and Sea Turtles: Environmental Effects Assessment.

Context and Rationale

The Agency received comments from Indigenous groups about mitigation of effects on marine mammals.

KMKNO has commented that vessels should be required to reduce speeds (10-knot limit) when not in existing shipping lanes and/or whenever a marine mammal or sea turtle is observed or reported in the vicinity. This is particularly important given the recent deaths of North Atlantic right whales attributable to blunt force trauma. It is possible that North Atlantic right whales would occur in the Project area.

Potential Project vessel traffic routes are illustrated on Figure 2-3 (ExxonMobil) and Figure 2-5 (Equinor) as direct lines between the drilling installations and the supply base, only linking up with existing vessel traffic routes where these happen to intersect. KMKNO has recommended that to minimize the risk of collision with marine mammals and sea turtles and to minimize the potential for interference with commercial fisheries, Project vessel traffic routes link up with existing shipping lanes at the earliest practicable opportunity, even where this may result in moderately decreased efficiency.

To reduce the adverse effects of drilling activities on marine mammals, MTI has suggested that additional mitigation measures should be considered. MTI suggested that drilling be avoided during the period in which North Atlantic right whales are more likely to be present in the Project area (May 1 – September 1), as well as that if observations of individual North Atlantic right whales are made within close proximity during drilling activities, drilling should be put on hold.

Specific Question or Information Requirement

Define speed limits that supply vessels operating outside of shipping lanes would adhere to and consider the associated potential for effects on marine mammals.

Discuss where project vessel traffic routes would link up with existing shipping lanes.

Advise whether additional mitigation or follow-up measures are under consideration and would be implemented given the potential effects of the Project on marine mammals.

Response

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) recognize that certain areas in Canada (e.g., the Gulf of St. Lawrence) have defined speed limits and shipping lanes (Transport Canada 2018), however, the offshore Newfoundland area does not have prescribed speed limits or shipping lanes. Speed is set based on environmental conditions (e.g., wind, waves, etc.), distances and fuel efficiency and will follow operational best practices for the area. As standard practice, transits are typically completed at speeds of between 10-12 knots. Occasionally the vessels will transit at best possible speed which will generally be 13-14 knots.

For safety and environmental protection, drilling in offshore environments is preferentially conducted during the summer months, and it is not practical to avoid drilling from May through September. However, as part of the Operators Environmental Protection Plans (EPPs), observations for marine mammals and sea turtles will be conducted during offshore activities and speeds will be reduced if marine mammals and/or sea turtles are observed in close proximity to the installation.

If the regulator (e.g., Fisheries and Oceans Canada [DFO], Transport Canada, etc.) establishes requirements and/or mitigation measures regarding vessel speed and transit routes for the offshore Newfoundland, the Operators will conduct their activities in adherence to any new requirements.

References

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INFORMATION REQUIREMENT – IR-26

(N/A)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, 6.3.3, Marine Mammals; 6.3.4, Marine Turtles; and 6.3.6, Federal Species at Risk.

Reference to EIS: Section 10.3.8, Supply and Servicing and 10.5, Significance of Residual Environmental Effects.

Context and Rationale

The EIS states that vessel transits will "add a small amount of additional vessel traffic and an associated increase in vessel strike risk when travelling through the RSA". The EIS does not discuss how these vessel strikes would be reported to the authorities (e.g., DFO).

Specific Question or Information Requirement

Explain what procedures are in place for notifications of organizations such as DFO and the Canadian Coast Guard in case of a vessel collision with a marine mammal or sea turtle. Explain what types of responses could be expected and who would undertake them should a vessel strike occur. As part of a follow-up program, explain how this information would be used to verify effects predictions or test mitigation effectiveness.

Response

Project-related vessel traffic will be short-term and transient in nature, which limits the opportunity for vessel strikes. Project-related vessels will maintain a steady course and a safe vessel speed and avoid known concentrations of marine mammals and sea turtles whenever possible to reduce the risk of a vessel strike. However, if a vessel strikes a marine mammal or sea turtle, the following notifications will occur:

- The master of the vessel will contact the Canadian Coast Guard (CCG) through the nearest Marine Communications and Traffic Services (MCTS). The CCG will communicate this information to the appropriate regulatory departments.
- The applicable Operator will also inform Fisheries and Oceans Canada (DFO) within 24 hours, as outlined in Section 10.6 of the Environmental Impact Statement (EIS). As outlined on the DFO website (DFO 2018), to report a marine mammal or sea turtle emergency there is a 24-hour number to contact – Whale Release and Strandings Newfoundland and Labrador at 1-888-895-3003.

As outlined on the DFO website (DFO 2018), if assistance is required then the 24-hour number mentioned above will be contacted and details of the incident (e.g., species involved, speed of the vessel at the time of impact, state of the animal) will be recorded and reported. DFO specifically indicates on their website to not touch or move an animal (DFO 2018). The Operators would follow the expertise and guidance of DFO if response is required. Collection and reporting of information in the event of a strike contributes to furthering scientific understanding of the circumstances and frequency of occurrence of marine mammal-vessel strikes and may contribute to improvement of regulatory guidelines and recommended mitigation measures. It is not likely that there will be any impact to marine mammals and sea turtles through interactions with Project activities.

Information Requirement (IR) IR-25 requested information regarding speed limits and shipping lanes related to vessels. As outlined in the response to IR-25, there are no defined speed limits or shipping lanes offshore Newfoundland and Labrador (NL), as there is in the Gulf of St. Lawrence. If the regulator (e.g., DFO, Transport Canada) established mitigation measures associated with preventing vessel strikes during transit that were specific to offshore NL, then the Operators would conduct their work activities in adherence to these requirements.

References

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INFORMATION REQUIREMENT – IR-27

(MTI-14 and -17, KMKNO-25, ECCC-6 and -7)

Project Effects Link to CEAA 2012: 5(1)(a)(iii) Migratory Birds.

Reference to EIS Guidelines: Part 2, Section 6.3.5, Migratory Birds; and 6.6.3, Cumulative Effects Assessment.

Reference to EIS: Section 9.3.3, Presence and Operation of Drilling Installation.

Context and Rationale

Table 14.6 (Cumulative Effects) states that the interactions between the oil platform and migratory birds are anticipated to be confined to within 5 kilometres of the source of lighting, based on Poot et al. (2008). However, Poot et al. (2008) state that their study design could not rule out that birds were attracted to fully lit oil platforms at much greater distances. Environment and Climate Change Canada (ECCC) has advised that the EIS overstates the result of the cited paper, which states: "The impression that we derived from our observations on oil platforms leading up to this study was that birds could be attracted from up to 5 km distance with full lighting (30 kW)… We cannot rule out the possibility that the birds that passed by in this study were already attracted to the experimental lamps from a much greater distance."

The EIS states that "[o]verall… the planned presence and operation for the drilling installation… is anticipated to be a negligible addition to the total amount of lighting in the overall offshore area…". ECCC has advised that drilling operations emit considerable amounts of light and would be detectable to the birds in the area, especially storm-petrels, regardless of the other light sources in the area. Each additional platform would emit lights that would attract birds and should therefore not be considered "a negligible addition". Additionally, the Northern Section of the Project area currently has less light pollution than the more active Southern Section, due to the lack of presence of active oil activity. The Northern Section is largely located in deep waters (greater than 1 kilometre in depth) beyond the continental shelf, and therefore is not as disturbed by other offshore activities (e.g., fishing) to the extent of the Southern Section. The proposed new light source(s) in the Northern Section of the Project area as a result of the Project may have a comparatively larger direct and/or cumulative effect in what is currently a darker environment, compared to a new light source in the Southern Section.

The EIS recognizes the potential effect of lighting on migratory birds, and Section 9.3.3 indicates that the colour of lighting, light intensity, and shielding lights downward have been shown to reduce attraction risks. However, specific mitigation measures related to lighting and bird attraction are not provided.

Section 2.10.1.5 presents alternatives for offshore drilling installation lighting. While standard lighting is shown to be the preferred option over spectral lighting and no lighting, there is no discussion of measures that may be taken to minimize the effects of lighting while using standard lighting.

Specific Question or Information Requirement

Update the assessment of effects of light on migratory birds taking into consideration differences in existing/proposed background lighting in ELs in the two areas.

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 km, discuss implications for the assessment of associated effects.

Describe measures to minimize the effects of lighting from the Project on migratory birds. Include considerations of lighting intensity, colour of lighting and shielding light downward. Consider potential need for additional follow-up related effects on migratory birds.

Update proposed mitigation, follow-up and significance predictions accordingly.

Response

As discussed in Section 9.3.4 of the Environmental Impact Statement (EIS), the potential for attraction of birds to the drilling installation due to lighting is the primary source of interaction between the Project and marine and migratory birds. In particular, because the Northern Section of the Project Area is currently subject to low levels of anthropogenic activity (e.g., fishing), light pollution is low; therefore, the lighting associated with the Project may have a comparatively larger effect on marine and migratory birds in the region relative to the Southern Section. Even in the Southern Section, where current sources of artificial lighting are more numerous, the addition of lighting associated with the Project will result in a cumulative increase in potential for attraction and disorientation of marine and migratory birds, as discussed in Section 14.3.

Information is limited regarding the distance from which birds may be attracted to lighted structures in the offshore environment, and the zone of influence varies with factors such as weather, intensity and position (height) of the light source, and ambient light conditions (Montevecchi 2006). Available studies on attraction of birds to offshore lighting from oil and gas production facilities have demonstrated attraction distances of less than 2 kilometres (km) (Day et al 2015) to as much as 5 km (Poot et al 2008), although attraction from distances of much greater than 5 km could not be ruled out in the Poot study. 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, we are unaware of any studies demonstrating attraction from such large distances.

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to the Operators) do not intend on considering mitigations regarding lighting intensity, color of lighting and/or shielding light in a downward direction during exploration drilling activities due to commercial availability (i.e., drilling installations and vessels that would be utilized are “off the shelf”) and safety concerns associated with helicopter approach and landing. The drilling installations and support vessels used for the Projects will be existing equipment contracted through third-party contractors and will be selected based on safety considerations and technical capabilities. The Operators are not currently aware of any operating vessels and/or drilling installations with modified lighting (e.g., intensity, spectrum, direction) that have the technical capability to support the Projects. The

Operators note that drilling installations have fewer light sources than a production facility, and therefore, the potential for associated attraction effects will be smaller in magnitude.

As discussed in the response to Information Requirement (IR) IR-30, a program will be developed for searches of the drilling installation and vessel decks to be undertaken at regular intervals; this program will document search effort (including the time of day, duration, and areas searched) as well as presence and absence of stranded and/or deceased birds. Accepted protocols for the collection and handling of live and deceased birds, and release of birds that become stranded, will be implemented as required under the *Seabird Handling Permit* from Environment and Climate Change Canada (ECCC) Canadian Wildlife Services (CWS).

In consideration of the above information, the proposed environmental monitoring and follow-up as discussed in Section 9.6 of the EIS (including regular searches of decks for stranded birds) and the significance predictions outlined in Section 9.5 of the EIS remain valid and do not need to be revised.

References

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INFORMATION REQUIREMENT – IR-28

(ECCC-9, MTI-17, KMKNO-25)

Project Effects Link to CEAA 2012: 5(1)(a)(iii) Migratory Birds.

Reference to EIS Guidelines: Section 6.3.5, Predicted Effects on Valued Components – Migratory Birds.

Reference to EIS: Section 9.3.5 Effects Assessment: Formation Flow Testing with Flaring – Flares.

Context and Rationale

The EIS states that the few studies to date have seen little or no bird mortality at flares (p. 897), but the discussion fails to mention how episodic in nature such mortality can be. The studies that have tried to examine mortality at flares may not have documented much mortality because the events are infrequent. The Canaport liquid natural gas facility in 2013 had a flare mortality event where 7,500 birds were estimated to be killed in one flaring event, illustrating episodic mass mortality at flares.

The discussion of potential measures to mitigate effects of flaring is limited.

Specific Question or Information Requirement

Discuss the potential effects for large-scale, episodic mortality in flaring events. The discussion should include consideration of mass mortality events which may occur, albeit infrequently, making them difficult to measure.

Discuss potential measures that could mitigate the effects of flaring on migratory birds, including use of a water curtain around the flare during flaring, minimizing night-time flaring and/or not flaring during periods of bird vulnerability.

Response

Although little studied, avian mass mortality incidents related to flaring at facilities such as the one at the Canaport liquid natural gas facility in Saint John, New Brunswick (NB) that killed approximately 7,500 birds in September 2013, appear to be extremely rare; there have been isolated accounts of mass mortality events (> 100 birds in a night) from Canada and United States associated with oil and gas activities with fewer than five documented occurrences (Bjorge 1987; CWHC 2009), but because these events are so rare, no comprehensive analysis has been published. At least one similar incident has been reported with offshore flares in the North Sea, where a large number (“hundreds to thousands”) of passerines were observed to have been killed in a night by flares (Sage 1979); however, research by Bourne (1979) and Hope Jones (1980) suggests a much lower mortality rate in the North Sea of approximately a few hundred birds per year per platform. While accurate assessment of mortality at offshore facilities may be difficult, no mass mortality events have ever been reported at offshore oil and gas operations in offshore Newfoundland.

While the rarity of such events makes determination of trends difficult, these incidents tend to occur at night during migration season (April-May and September-October). They appear to be associated with a particular set of atmospheric conditions: foggy or misty, with low cloud cover may force birds to fly lower than they ordinarily would. Flares may provide misleading navigational cues to migrating birds, causing them to become disoriented and circle or fly into the light source, particularly in the absence of other visual cues (e.g., moonlight and stars) (Montevecchi 2006).

As noted in Section 2.5.2.4 of the EIS, formation flow testing with flaring, may be carried out on wells where hydrocarbons are discovered and additional reservoir data is needed. However, as discussed in the response to Information Requirement (IR) IR-06, there is the potential to complete formation testing while tripping (FTWT) which is an alternative to formation flow testing with flaring. It is estimated that up to a total of six wells drilled as part of the Projects may require formation flow testing with flaring, however, it is unknown at this time if formation flow testing with flaring or FTWF will be completed. Formation flow testing with flaring may require up to three days of flaring, however, if an extended flow test is required then flaring would last up to five days. From a worst-case scenario perspective, it is assumed that all six wells will require formation flow testing with flaring, therefore the total potential days of flaring is estimated to be between 18 and 30 days over a 10- to 12-year period.

Mitigation for potential effects from flaring on marine and migratory birds include treatment of produced water and shipping it to shore for disposal if it is present in large volumes (see response to IR-12 for additional information on volumes of produced water).

Water curtains are sometimes deployed during flaring operations to protect the drilling installation from the generated heat. The Operators are not currently aware of any literature that suggests that water curtains are effective in preventing attraction of birds.

Routine site monitoring will be conducted to maintain records of bird mortality noted on site, to enable identification of potential issues related to flares and other lighted structures. If it is determined that mass mortalities are occurring, then further mitigative strategies may be required.

References

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INFORMATION REQUIREMENT – IR-29

(N/A)

Project Effects Link to CEAA 2012: 5(1)(a)(iii) Migratory Birds.

Reference to EIS Guidelines: Part 2, Section 6.3.5, Migratory Birds.

Reference to EIS: Section 9.3.3, Presence and Operation of Drilling Installation.

Context and Rationale

Section 9.3.3 provides results of bird searches on board offshore platforms and vessels, over non-continuous timelines between 1998 and 2015. However, more information is required to determine the relevance to the current project's effects assessment.

Specific Question or Information Requirement

With respect to the data provided on the bird searches carried out on Statoil facilities and vessels, between 2012 and 2015:

- Confirm the geographic location of the Statoil facilities: were they located in the region of the Project area under consideration?
- Were bird searches conducted on exploration platforms, or both exploration and production, and did they cover the full range of activity (i.e., periods of flaring)?
- What are the species of birds that did not survive?
- Provide additional information on the time of year that the bird searches were conducted, as it states that most of the strandings occurred in the summer months (June to August), but that the searches were not consistent throughout the year. The time of year that searches were conducted may influence the results with respect to the species of birds stranded and the statement that most strandings occurred in the summer months.
- Provide a reference for the Statoil data.

With regards to the information reported by Husky Energy (2000):

- Is there any additional information available from the Terra Nova vessel that may be relevant?
- The EIS states that Husky Energy reported 52 Leach's storm-petrels were recovered over a three-week period. Were there other species recovered during that time or was the survey focused only on reporting numbers of Leach's storm-petrel? In relation to operations, was the three-week period representative (i.e., how long was the vessel actively drilling? Was the majority of drilling in the summer, or did it span spring and fall?)?

Provide additional information and context on the Baillie et al. (2005) reference, which is quoted in the EIS to have reported 469 stranded birds (mostly Leach's storm-petrels) at offshore installations and vessels off Newfoundland between 1998 and 2002. Additional information should include other species found, time of year covered during the period during which information was collected, and if there were any noted differences in numbers or species composition of birds collected on platforms versus support vessels. Further, provide support for the use of this reference, as the fate of more than half of the birds was not recorded.

With respect to information on bird strandings referred to in the EIS from Ellis et al. (2013) and Environment Canada (2015), confirm if these results were specific to vessels used by the offshore oil and gas industry or were results from monitoring of various vessel types (offshore oil and gas, fishing, research, military vessels, etc.).

Based on the additional information, update the effects analysis, conclusions and proposed mitigation and follow-up, as applicable.

Response

Equinor Canada Ltd. (Equinor) has obtained *Seabird Handling Permits*, as required under Section 19 of the *Migratory Birds Regulations* (Government of Canada 1994), from Environment and Climate Change Canada (ECCC) Canadian Wildlife Services (CWS), for past offshore activities including vessels associated with seismic, geophysical, geotechnical or general support activities, and drilling installations. Equinor has obtained the following permits from ECCC CWS between 2012 and 2015:

- 2012: Permit No. LS 2766 – Valid from 31-Mar-2012 to 31-Dec-2012;
- 2013: Permit No. LS 2766 – Valid from 01-Jan-2013 to 31-Dec-2013;
- 2014: Permit No. LS 2766 – Valid from 13-Jun-2014 to 24-Sept-2014; and
- 2015: Permit No. LS 2766 – Valid from 21-Jan-2015 to 30-Nov-2015.

A condition under the *Seabird Handling Permit* from ECCC CWS is to provide an annual report that includes the number and species of released, salvaged and/or deceased birds, as well as the dates they were observed. Equinor submitted annual reports to ECCC CWS for the period of 2012 to 2015, which is a condition to renew permits for the next year.

Table 1 Select Overview of Marine Birds from 2012 to 2015

Geographic Location	General Activity	Within the EIS Project Area?	Type of Searches Conducted	Deceased Species
2015				
Flemish Pass	Exploration and appraisal well drilling, geophysical survey and geotechnical soil investigation program.	Yes	• Daily searches. • Opportunistic day/night searches.	• One Great Black-backed Gull on 11-Mar-2015
2014				
Jeanne d'Arc Basin and Flemish Pass	Geophysical survey	Yes	• Daily searches. • Opportunistic day/night searches.	• One Leah's Storm-petrel on 17-Jul-2014. • One Leah's Storm-petrel on 18-Jul-2014. • One Leah's Storm-petrel

Table 1 Select Overview of Marine Birds from 2012 to 2015

Geographic Location	General Activity	Within the EIS Project Area?	Type of Searches Conducted	Deceased Species
				on 19-Jul-2014. • One Leah's Storm-petrel on 24-Aug-2014.
2013				
SE Grand Banks and Flemish Pass/Orphan Basin	Exploration drilling	Yes	• Daily searches. • Opportunistic day/night searches.	• One Leach's Storm-petrel on 03-Oct-2013.
2012				
Northern Grand Banks and Flemish Pass	Seismic survey	Yes	• Daily searches. • Opportunistic day/night searches.	• Two Leach's Storm-petrels on 10-Jun-2012. • One Leach's Storm-petrel on 12-Jun-2012. • One Northern Fulmar on 18-Jun-2012. • One Leach's Storm-petrel on 26-Jun-2012. • One Leach's Storm-petrel on 27-Jun-2012. • One Leach's Storm-petrel on 05-Jul-2012. • Two Leach's Storm-petrels on 22-Jul-2012. • One Leach's Storm-petrel on 25-Jul-2012. • One Leach's Storm-petrel on 11-Aug-2012. • One Leach's Storm-petrel on 19-Aug-2012. • One Leach's Storm-petrel on 25-Aug-2012.

Searches for birds between 2012 and 2015 were conducted on exploration platforms and vessels. Equinor does not currently have any production facilities offshore Newfoundland and Labrador.

Between 2012 and 2015, Equinor had one instance of flaring in summer 2015. Bird searches are completed during offshore activities, including flaring. Documentation regarding deceased and released birds during this time are outlined in the report required under the *Seabird Handling Permit*.

Clarification is required as the full intent of the information is not reflected in a portion of the IR above, and reiterated below. Section 9.3.3 states *"Most of these strandings occurred in the summer months (June to August), although the search effort was not consistent throughout the year as drilling operations may not have been continuou*s." Bird searches were conducted consistently when offshore activities were occurring. If offshore activities were not occurring, then searches were not applicable.

- Portion of IR: "Provide additional information on the time of year that the bird searches were conducted, as it states that most of the strandings occurred in the summer months (June to August), but that the searches were not consistent throughout the year. The time of year that searches were conducted may influence the results with respect to the species of birds stranded and the statement that most strandings occurred in the summer months."

The surveys conducted by Husky Energy were not restricted to Leach's Storm-petrels; however, no other species were found during the surveys (Husky Energy 2000). Baillie et al (2005) reported 469 stranded birds (mostly Leach's Storm-petrels) at offshore installations and vessels off Newfoundland between 1998 and 2002, of which 16 (3%) were reported to have died and 344 (74%) were released; the fate of the remaining birds was not reported. The strandings were most common in September and October, and 97% of the birds were Leach's Storm-petrels, which was also the most commonly seen species during seabird surveys conducted from the vessel; other species that were found included Atlantic Puffin, Common Murre, Ruddy Turnstone and Glaucous Gull. In both Ellis et al. 2013 and Environment Canada 2015, Leach's Storm-petrels were the most commonly found species stranded on vessels of various types, including fishing vessels as well as oil and gas-related vessels.

In consideration of this additional information, the analysis of effects, proposed mitigation and follow-up, and significance predictions remain valid and are not required to be updated.

References

Baillie, S.M., Robertson, G.J., Wiese, F.K. and Williams, U.P. 2005. Seabird Data Collected by the Grand Banks Offshore Hydrocarbon Industry 1999-2002: Results, Limitations and Suggestions for Improvement. Canadian Wildlife Service Technical Report Series No. 434. Atlantic Region, Mount Pearl, Newfoundland and Labrador, Canada.

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 Conservation Ecology 8.

Environment Canada. 2015. Best practices for stranded birds encountered offshore Atlantic Canada. Draft 2 – April 17, 2015. Available online: http://www.cnlopb.ca/pdfs/mg3/strandbird.pdf.

Government of Canada. 1994. Migratory Bird Regulations. C.R.C., c. 1035. Published by the Minister of Justice. Current to April 24 2018. Last Amended June 13, 2016. Available online: http://laws.justice.gc.ca/PDF/C.R.C.,_c._1035.pdf

Husky Energy. 2000. White Rose Development Environmental Comprehensive Study. Part I. Husky Oil, St. John's, NL, p. 639.

INFORMATION REQUIREMENT – IR-30

(ECCC-4 and -11, WM-EM-17 and -38, WM-Stat-8, -9 and -19, MTI-18)

Project Effects Link to CEAA 2012: 5(1)(a)(iii) Migratory Birds.

Reference to EIS Guidelines: Section 6.3.5, Predicted Effects on Valued Components – Migratory Birds; Section 8, Follow-up and Monitoring Programs.

Reference to EIS: Section 9.2 Summary of Potential Effects, Table 9.1; 9.3.3 Effects Assessment - Presence and Operation of the Drilling Installation;9.3.5 Effects Assessment - Formation Flow Testing with Flaring;9.3.8 Supply and Servicing;9.5.1 Residual Environmental Effects Summary, Table 9.4 Environmental Effects Assessment Summary: Marine and Migratory Birds – Overall Project; and9.6 Environmental Monitoring and Follow-up.

Context and Rationale

While the proponent has committed to using the Canadian Wildlife Service's Guidance for handling and documenting stranded birds, the document does not outline methods for conducting the searches.

The EIS refers to protocols for handling stranded birds, but handling protocols are distinct from systematic searching protocols. Searching protocols which document searching effort need to be developed by the proponent. ECCC has advised that systematic deck searches for stranded birds conducted by trained observers should be undertaken instead of opportunistic searches. These systematic searches should occur at least daily and have search effort documented and observations recorded (including notes of effort when no birds are found). ECCC should be consulted in the development of systematic monitoring protocols.

It is indicated that a trained Environmental Observer will be on board. It is not clear who would deliver training for the Environmental Observer or what this training would comprise. ECCC has advised that it should conduct training for seabird observations

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 effect. There cannot be a *moderate* to *high* level of certainty that the Project is not likely to result in significant adverse environmental effects on the Leach's storm-petrel, whose populations are in decline.

Specific Question or Information Requirement

Consider whether the "certainty" of effects predictions related to migratory birds requires revision, taking into account advice from ECCC. Explain the associated rationale and update the effects predictions accordingly.

Discuss the follow-up program proposed by ECCC in relation to the potential effects of the Project, taking into consideration the certainty/uncertainty of predictions. Confirm whether the proponent intends to:

- implement a comprehensive, scientifically rigorous and systematic protocol to search for and document stranded birds on the drilling unit and the platform supply vessels for the duration of the drilling program and
- having its Environmental Observers engaged in seabird observations trained by ECCC.

Response

Effects ratings related to strandings and mortalities of birds, and the associated level of certainty, are presented in Sections 9.3 to 9.5 and summarized in Table 9.4 of the Environmental Impact Statement (EIS). The conclusion regarding the overall significance of environmental effects on marine and migratory birds has been determined with a moderate to high level of certainty, in consideration of the short-term nature of disturbance at any one exploration drilling site, as well as our current understanding of the effects of similar projects on marine and migratory birds.

Nonetheless, it is understood that the characterization of effects of certain routine Project activities, including attraction and disorientation due to flaring and Project lighting, has a moderate degree of certainty (Table 9.4), partly because the associated mortality rates are not completely understood. To increase the level of certainty of the effects prediction for light-associated activities on marine and migratory birds, the Operators will obtain information on rates of strandings and mortalities through the surveys that will be completed under the *Seabird Handling Permit* from Environment and Climate Change Canada (ECCC) Canadian Wildlife Services (CWS).

Personnel on board the drilling installation and/or vessels tasked with seabird observations, handling and reporting will be trained in the requirements outlined in the Eastern Canada Seabirds at Sea (ECSAS) protocol (Gjerdrum et al 2012). Prior to implementation of the monitoring program, ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to the Operators) will outline the requirements in their Environmental Protection Plans (EPPs) or Environmental Compliance Monitoring Plans (ECMPs), which are required to be submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) to obtain *Operations Authorizations* (OAs). The seabird monitoring programs outlined in the EPPs or ECMPs will take into consideration the latest information from Environment and Climate Change Canada (ECCC).

As outlined in Section 9.6 of the EIS, if a species at risk is found on the drilling installation or supply vessel a report will be sent to CWS for identification. Also outlined in Section 9.6 of the EIS, the Operators will submit seabird observation reports to the C-NLOPB within 90 days of well suspension and/or decommissioning. An annual report is also required to be submitted to CWS in accordance with the conditions in the *Seabird Handling Permit*.

In consideration of the above information, the proposed environmental monitoring and follow-up as discussed in Section 9.6 of the EIS (including regular searches of decks for stranded birds) and the significance predictions outlined in Section 9.5 of the EIS are considered appropriate to the Project and remain valid.

References

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.

INFORMATION REQUIREMENT – IR-31

(MTI-14 and -16, WM-EM-29, -43,-32, and -50, WM-Stat-8, -9 and -19)

Project Effects Link to CEAA 2012: 5(1)(a)(iii) Migratory Birds.

Reference to EIS Guidelines: Part 2, Section 6.3.5, Migratory Birds.

Reference to EIS: Section 9.3.2, Summary of Key Mitigations.

Context and Rationale

MTI has recommended that onsite observers and/or automated sensors on platforms be utilized to reduce uncertainty related to seabird attraction to platforms, mortality events, and chronic spills and discharges. They reference a paper, which makes further suggestions for monitoring (Fraser and Racine, 2016: https://nlenvironmentnetwork.files.wordpress.com/2016/05/fraser_racine_spills_seabirds-2016.pdf).

Specific Question or Information Requirement

Take into consideration MTI's recommendations, review and provide a rationale related to the potential need for implementation of additional measures to monitor potential effects of the Project on migratory birds and associated economic/technical feasibility of these measures.

Response

The drilling installations and vessels utilized for the Projects will be existing equipment contracted through third-parties and will be selected based on safety considerations and technical capabilities. ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to the Operators) are not currently aware of any operating vessels and/or drilling installations equipped with avian sensors.

As outlined in Section 9.3.2 and Table 9.4 of the Environmental Impact Statement (EIS), the Operators will obtain a *Seabird Handling Permit* from Environment and Climate Change Canada (ECCC) Canadian Wildlife Division (CWS). A condition of the *Seabird Handling Permit* is to record all observed stranded and deceased birds, and whether they were oiled or un-oiled. An additional condition in the *Seabird Handling Permit* is the requirement to contact CWS immediately in the event of an injured or oiled live bird other than storm-petrels, and to transport it to the Suncor Environment Centre in St. John's, Newfoundland and Labrador. In the event of an oiled deceased bird, CWS is contacted immediately and the Operators will transport the bird as per instructions from CWS. As outlined in Section 9.6 of the EIS, a trained observer will be onboard to record marine bird observations during Project activities, which will be completed in accordance with the CWS monitoring protocol from fixed platforms (Gjerdrum et al 2012).

Past Equinor exploration drilling programs had a third party representative responsible for wildlife observation and reporting, which included marine mammals, sea turtles and birds. The Operators intend on continuing with this practice for the exploration drilling program outlined in the EIS, therefore the reviewer's recommendation to have an observer on board will be implemented.

References

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.

INFORMATION REQUIREMENT – IR-32

(ECCC-8, WM-EM-31)

Project Effects Link to CEAA 2012: 5(1)(a)(iii) Migratory Birds.

Reference to EIS Guidelines: Section 6.3.5, Predicted Effects on Valued Components – Migratory Birds.

Reference to EIS: Section 9.3.3, Effects Assessment – Presence and Operation of the Drilling Installation.

Context and Rationale

The EIS states that "… potential disturbance will be short term … between 35 and 65 days …".

ECCC has advised that Leach's storm-petrels breeding on both Gull Island and Baccalieu Island forage in the proposed area during the breeding season. Therefore, effects on breeding birds could be high. Depending on the timing of the disturbance, the potential effects of light attraction caused by the Project has the potential to effect significant numbers of Leach's storm-petrel. For example, if activities take place during the autumn when young birds have left the colonies, numbers would be especially high.

The EIS states that "(t)he drilling installation will be situated several hundred kilometres offshore, which is far from coastal breeding sites and IBAs, and well beyond the foraging range of almost all species that nest in Newfoundland other than the Leach's storm-petrel, which is known to make foraging trips of thousands of kilometres during the breeding season (Pollet et al., 2014). Therefore, effects on most breeding birds will be low" (pp. 893–894).

The EIS has concluded that the effects of the Project on most breeding birds would be low. ECCC has advised that insufficient information has been provided to provide confidence in that conclusion. ECCC has indicated that while the effects on most breeding bird species would be low, the number of individual birds potentially affected may be high. Most breeding birds in eastern Newfoundland are in fact Leach's storm-petrels, with Baccalieu Island alone hosting 4 million breeding individuals.

A submission from the public states that there is concern associated with the disappearance of 2.7 million Leach's storm-petrels and the role of light attraction, platform collision and oiling since offshore production came on line (Wiese et al., 2001). This decline represents 25 to 40 percent of the mature species population (Birdlife International, 2017).

Specific Question or Information Requirement

Taking into account the information provided about the Leach's storm-petrel, including the status of the species, provide further information and analysis on the potential effects of the Project on this species to support the prediction that negative effects on the population would be of low magnitude, and reversible. Update the analysis, potential mitigation, and follow-up, as well as significance predictions, as applicable.

Response

It is acknowledged that populations of Leach's Storm-petrel have declined substantially in the past two decades, which has resulted in a recent International Union for Conservation of Nature (IUCN) designation of "Vulnerable". The decline is believed to be attributable to a number of factors including predation, ingestion of marine contaminants (e.g., mercury), collisions and strandings due to attraction to lighted structures, and contact with hydrocarbons (BirdLife International 2017). Foraging ranges during the breeding season for four of seven major colonies in the western Atlantic colonies overlapped with offshore oil and gas operations, and numbers have declined at three of these colonies in recent decades (Pollet et al 2014).

Section 9.3.3 of the Environmental Impact Statement (EIS), which states that the effects of the Project on most breeding birds will be low, is clarified to read "the effects of the Project on most breeding bird species would be low". The EIS recognizes that the Leach's Storm-petrel is particularly attracted to anthropogenic light sources, and it is further recognized that the species is particularly vulnerable to effects of light attraction due to the Project, including during the breeding season due to their long foraging trips. However, the short-term nature (in any one location) of the Projects, relative to a production facility, means that the effects will consequently be short-term and transient in nature. Further, as noted in the response to Information Requirement (IR) IR-27, drilling installations have fewer light sources than a production facility, and therefore, the potential for associated attraction effects will be smaller in magnitude.

References

BirdLife International. 2017. Hydrobates leucorhous (amended version of assessment). The IUCN Red List of Threatened Species 2017: e.T22698511A119292983. Available online: http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22698511A119292983.en. Accessed April 2018.

Pollet, 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), pp.321-328.

INFORMATION REQUIREMENT – IR-33

(WM-EM-27 and WM-STAT-22)

Project Effects Link to CEAA 2012: 5(1)(a)(iii) Migratory Birds.

Reference to EIS Guidelines: Section 6.1.5, Species at Risk.

Reference to EIS: Section 6.2, Marine and Migratory Birds.

Context and Rationale

The current EIS does not consider avian species listed on the *IUCN Red List of Threatened Species*, such as the Bermuda petrel (*Pterodroma cahow*), and white-tailed tropicbird (*Phaethon lepturus*).

The Bermudan white-tailed tropicbirds have been found in the Project area (Mejías et al., 2017) during the non-breeding season. They are one of the most endangered species of seabirds with a population of 146 mature individuals (BirdLife International, 2016).

Specific Question or Information Requirement

Include a list of bird species classified on the *IUCN Red List of Threatened Species*, which may be found in the Project area along with their status. Assess potential effects of the Project on these species, and update potential mitigation and follow-up, as well as effects predictions, as applicable.

Response

The assessment of potential Project effects on marine and migratory birds necessarily focusses on those species designated under the federal *Species at Risk Act* (Government of Canada 2002) and provincial *Endangered Species Act* (Government of Newfoundland and Labrador 2001) that are likely to frequent the waters off eastern Newfoundland. Nevertheless, it is recognized that species of conservation concern not listed by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or protected under federal or provincial legislation may be present in the Project Area. This potentially includes the Bermuda Petrel, as noted in the Information Requirement (IR).

The Bermuda Petrel nests exclusively in Bermuda and has a population of 142 mature adults; it is listed as “Endangered” by International Union for Conservation of Nature (IUCN) (BirdLife International 2016). In the non-breeding season, they are thought to move north into the Atlantic following the warm waters on the western edges of the Gulf Stream and may potentially occur within the Project Area. The primary threats to the Bermuda Petrel are habitat loss (including competition for nesting habitat from the White-tailed Tropicbird as well as sea level rise and storm activity), exploitation, predation and light pollution from infrastructure near its Bermudan breeding grounds which affects nocturnal courtship.

Four additional marine-associated bird species classified on the IUCN Red List of Threatened Species as “Vulnerable” are known to occur in the Study Area and are discussed in Chapter 4 of the Environmental Impact Statement (EIS); namely, the Long-tailed Duck, Black-legged Kittiwake, Atlantic Puffin, and Leach’s Storm-petrel.

The most recent IUCN assessment considers the White-tailed Tropicbird a species of “Least Concern” (BirdLife International 2017). Species listed by IUCN as “Least Concern” are considered widespread and abundant (IUCN 2017). The Bermudan population of the White-tailed Tropicbird is the largest in the Atlantic, with approximately 3,500 breeding pairs. It is typically found over pelagic waters and the coast in the tropics and subtropics (BirdLife International 2017) but has been reported in the Project Area in the fall and winter months (Mejías et al 2017).

Mitigation measures outlined in Section 9.3.2 that will be implemented to help avoid or reduce potential environmental effects of the Project will benefit all marine and migratory bird species in the Project Area, including the IUCN-listed species described here.

References

BirdLife International. 2016. *Pterodroma cahow*. The IUCN Red List of Threatened Species 2016: e.T22698088A93660004. Available online: http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22698088A93660004.en. Accessed April 2018.

BirdLife International. 2017. *Phaethon lepturus* (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2017: e.T22696645A111235714. Available online: http://dx.doi.org/10.2305/IUCN.UK.2017-1.RLTS.T22696645A111235714.en. Accessed April 2018.

Government of Canada. 2002. Species at Risk Act. S.C. 2002, c.29. Published by the Minister of Justice. Current to April 24, 2018. Last Amended February 2, 2018. Available online: http://laws-lois.justice.gc.ca/PDF/S-15.3.pdf

Government of Newfoundland and Labrador. 2001. Endangered Species Act. Assented to December 13, 2001. Published by Queens Printer. Amended: 2004 cL-3.1 s27; 2004 c36 s11. Available online: http://www.assembly.nl.ca/Legislation/sr/statutes/e10-1.htm

IUCN. 2017. The IUCN Red List of Threatened Species 2001 Categories and Criteria (version 3.1). Available online: http://www.iucnredlist.org/static/categories_criteria_3_1. Accessed April 2018.

Mejías, M.A., Y.F. Wiersma, D.B. Wingate and J.L. Madeiros. 2017. Distribution and at-sea behavior of Bermudan White-tailed Tropicbirds (*Phaethon lepturus catesbyi*) during the non-breeding season. Journal of Field Ornithology. 88(3):184–197.

INFORMATION REQUIREMENT – IR-34

(ECCC-5)

Project Effects Link to CEAA 2012: 5(1)(a)(iii) Migratory Birds.

Reference to EIS Guidelines: Section 6.3.5, Predicted effects on valued components – Migratory Birds.

Reference to EIS: Section 9.2, Potential Environmental Changes, Effects, and Associated Parameters, Table 9.2 Potential Project –VC Interactions: Marine and Migratory Birds.

Context and Rationale

ECCC has advised that the matrix of potential interactions should be updated. Some migratory birds are attracted to oil slicks, and oil has the potential to change habitat quality. Flaring affects behavioural patterns in migratory birds. Seismic surveys (as part of the geophysical surveys) may change food availability, due to prey being impacted by seismic activity.

Specific Question or Information Requirement

Update the effects analysis taking into account the following interactions or provide additional rationale to explain why they were excluded from consideration:

- drilling and associated discharges: avifauna presence and abundance;
- drilling and associated discharges: habitat quality;
- flaring: Behavioural effects; and
- geophysical Surveys: food availability.

Update the analysis of effects, proposed mitigation and follow-up, and significance predictions, as applicable.

Response

The following provides clarification for the potential interactions between marine and migratory birds and the routine Project activities noted in the Information Requirement (IR).

- Drilling and associated discharges - Avifauna presence and abundance – Oil slicks, which are defined as hydrocarbon concentrations at the water's surface greater than 3 micrometres (μm) thickness, are the primary discharge that has potential to adversely affect marine and migratory birds. Oil slicks are not anticipated from routine Project activities, as described in Section 9.2 of the Environmental Impact Statement (EIS); therefore, effects on avifauna presence and abundance resulting from routine drilling and associated discharges are not anticipated.
- Drilling and associated discharges: Habitat Quality - Hydrocarbon sheens that may occur from routine discharges (i.e., hydrocarbon concentrations of 0.01 to 1 μm thickness) may have an effect on habitat quality, albeit in the very short term, dispersing within 24 hours. This is presented in Section 9.3.4 of the EIS.

- Flaring: Behavioural effects - Similarly, the potential behavioural effects associated with flaring are presented in Section 9.3.5 of the EIS (i.e., attraction / disorientation of migrating birds).
- Geophysical Surveys: Food availability – fish are a primary food source for marine and migratory birds in the offshore. As described in Chapter 8, fish resources (and therefore, food availability for marine and migratory birds) are anticipated to be affected by geophysical survey activity. This potential effect is expected to be low in magnitude, localized, sporadic, and short-term.

Therefore, the analysis of effects, proposed mitigation and follow-up, and significance predictions remain valid are not required to be updated.

References

N/A

INFORMATION REQUIREMENT – IR-35

(WM-EM-35 and -38)

Project Effects Link to CEAA 2012: 5(1)(a)(iii) Migratory Birds.

Reference to EIS Guidelines: Section 6.3.5, Predicted effects on valued components – Migratory Birds.

Reference to EIS: Section 15.5.2.3.2, Uncontrolled Well Event.

Context and Rationale

The EIS states that "based on vulnerability indices (French-McCay 2009) the mortality rate would range from 35 to 95 percent for birds that come in contact with the slick in the 0.01–0.1 mm thickness range. Murres and dovekies, which spend most of their time sitting on the water's surface, are most vulnerable (estimated 95 percent mortality), while species that dive or feed at the water's surface for their prey but otherwise spend little time on the water, including Leach's storm-petrels, great shearwaters, and great skuas, are predicted to have a lower mortality rate of 35 percent. Black-legged kittiwakes and Northern gannets, which do often sit on the water but spend more time in the air than Alcids (murres and dovekies), would be expected to have an intermediate mortality rate." It is not clear based on the information provided in the EIS how the vulnerability of various bird species was estimated based on French-McCay (2009) vulnerability indices.

Specific Question or Information Requirement

Provide the vulnerability indices relied upon for the above information and use these indices to provide further rationale that seabirds spending more time in the air are less likely to suffer from water contaminants and oil spills. In light of diving birds being susceptible to surface oil, explain how mortality rates were assumed from the literature. Describe any measures that would be put into place to prevent bird mortality from water contaminants and oils spills.

Response

As described in French-McCay (2009), a species' behaviour affects its likelihood of being oiled; for example, the amount of time spent on water, exhibiting diving behaviour, and having extended flightless periods (e.g., moulting) or roosting on the water can result in increased oiling if a slick is present. Oiled birds are generally assumed to have a very low survival rate (approximately 0 - 5%). French-McCay 2009 calculated vulnerability scores (i.e., the combined probabilities of a) encountering oil and b) mortality once oiled) which are, in effect, the mortality rate of a bird in the area of an oil slick. These scores were calculated by French-McCay (2009) for various wildlife groups which were then applied to species in the Environmental Impact Statement (EIS) (see EIS Section 15.5.2.3.2) including surface diving seabirds and waterfowl (99% combined probability of oil encounter and mortality once oiled), nearshore aerial divers (35% combined probability), and aerial seabirds (5% combined probability).

Among the mitigation measures outlined in Chapter 17.0, spill prevention and response plans will be in place throughout the life of the Project to reduce the risk of a spill occurring and limiting the duration and extent of a spill. As well, adherence to the *Offshore Waste Treatment Guidelines* (OWTG) (NEB et al 2010) will assist in preventing bird mortality and injury.

References

French-McCay, D. 2009. State-of-the-Art and Research Needs for Oil Spill Impact Assessment Modeling. In: Proceedings of the 32nd AMOP Technical Seminar on Environmental Contamination and Response, Emergencies Science Division, Environment Canada, Ottawa, ON, pp. 601-653.

NEB (National Energy Board), Canada-Nova Scotia Offshore Petroleum Board, and Canada-Newfoundland and Labrador Offshore Petroleum Board. 2010. Offshore Waste Treatment Guidelines. Available online: http://www.cnlopb.ca/pdfs/guidelines/owtg1012e.pdf?lbisphpreq=1. Accessed April 2018.

INFORMATION REQUIREMENT – IR-36

(DFO-25)

Project Effects Link to CEAA 2012: 5(1); 79(2) Species at Risk.

Reference to EIS Guidelines: Part 2, 6.3.6, Federal Species at Risk; 6.4, Mitigation; 8.0, Follow-up and Monitoring Programs.

Reference to EIS: Section 5.2, Identification and Selection of Valued Components.

Context and Rationale

The Agency is the responsible authority for the environmental assessment of the Project and therefore must identify the adverse effects of the Project on listed wildlife species and their critical habitat under the *Species at Risk Act* (SARA) and, if the Project is carried out, must ensure that specific measures are taken to avoid or lessen those effects and to monitor them. The measures must be consistent with any applicable recovery strategy and action plans. Furthermore, in recognition of the potential risks to Committee on the Status of Endangered Wildlife in Canada (COSEWIC) species, the Agency requires an assessment of effects on these species as well as an account of measures that could be taken to avoid or lessen effects and to monitor them. The EIS Guidelines require direct and indirect effects on the survival or recovery of federally listed species to be described (Section 6.3.6).

While the EIS provides a description of most species at risk and considers potential effects of the Project on these within other more general valued components, in some cases the analysis pertaining to specific species is limited. For example, while Table 10.4 identifies a high or moderate potential for interaction between the Project and fin and Northern bottlenose whales and the harbour porpoise, no further effects analysis specific to these species is completed. It is not explained how the mitigation measures for general VCs are consistent with applicable recovery strategies and action plans. In some cases, action plans have not been referenced (e.g., bottlenose whale), while in other cases, references to management plans are outdated (e.g., fin whale, Sowerby's beaked whale).

DFO has advised that certain species designated by COSEWIC have not been included in the assessment (e.g., lumpfish [Threatened], white hake [Atlantic and Northern Gulf of St. Lawrence population; Threatened]). In addition, the EIS includes errors in risk categories for species at risk as well as inconsistencies in its descriptions between sections (Appendix A).

Specific Question or Information Requirement

Update information related to species at risk for those species that are predicted to interact with the Project, including:

- a listing of species for which there are recovery strategies or action plans;
- a description of key threats to species at risk as included in applicable recovery strategies and action plans as relevant to the Project, as well as the potential contribution of project activities to these threats.

In addition, with consideration of the high or moderate likelihood of interaction between the Project and the Fin- and Northern bottlenose whales and Harbour porpoise, provide an analysis of potential effects of the Project on these species.

Describe lumpfish and white hake (Atlantic and Northern Gulf of St. Lawrence population) and their habitat within areas that could be affected by the Project. Update the effects assessment, potential mitigation, and follow-up, as appropriate.

Resulting analysis should take into consideration clarifications and corrections described in Appendix A.

Response

Part 1: Update information related to species at risk for those species that are predicted to interact with the Project, including:

- a listing of species for which there are recovery strategies or action plans;
- a description of key threats to species at risk as included in applicable recovery strategies and action plans as relevant to the Project, as well as the potential contribution of project activities to these threats

Table 1 below lists the species at risk (SAR) that may interact with the project, for which recovery strategies or action plans have been developed. It also identifies the key threats included in applicable recovery strategies and action plans and specifies which of these threats Project activities may contribute to.

The marine fish species, with proposed and finalized action plans and recovery strategies, that may interact with the Project are: Atlantic salmon (Inner Bay of Fundy) (DFO 2010; 2016a), Atlantic wolffish, spotted wolffish, and northern wolffish (Kulka 2008). Marine threats (Table 1) identified in action plans and recovery strategies have been considered in the effects assessment (Sections 8.3 and 15.5 of the Environmental Impact Statement [EIS]) for both secure and at-risk species. For various wolffish species, potential threats that are associated with the Project include activities associated with oil and gas exploration and production, ocean dumping, marine pollution, and climate change. While Project activities have the potential to contribute to proposed threats to species of conservation concern, with the implementation of mitigation measures, the residual effect on marine fish and fish habitat is predicted to be not significant, as described in Section 8.5.2 of the EIS.

The marine and migratory bird species, with proposed and finalized action plans and recovery strategies, that may interact with the Project are: Ivory Gull (Environment Canada 2014), Piping Plover (*melodus* subspecies) (Environment Canada 2012), Red Knot (*rufa* subspecies) (Environment and Climate Change Canada 2017), Roseate Tern (Environment Canada 2010, 2015), Common Nighthawk (Environment Canada 2016a), and Olive-sided Flycatcher (Environment Canada 2016b). Of the threats to marine and migratory birds that have been identified in action plans and recovery strategies, the following may be associated with Project activities: chronic oil pollution from oil and gas exploration and production, habitat loss and degradation (i.e., from oil or contaminant spills), and collision with anthropogenic structures (Table 1). The potential for these threats has been considered in the effects assessment (Sections 9.3 and 15.5 of the EIS) for both secure and at-risk bird species. While there may be some increased potential for adverse interactions due to the Project, with the implementation of mitigation measures such as adherence to the *Offshore Waste Treatment Guidelines* (OWTG; NEB et al 2010), the residual effects on marine and migratory birds, including species of conservation concern, is predicted to be not significant, as described in Section 9.5.2 of the EIS.

The marine mammal and sea turtle species, with proposed and finalized action plans and recovery strategies, that may interact with the Project are: beluga whale (St. Lawrence Estuary population) (DFO 2012), blue whale (Atlantic population) (Beauchamp 2009), North Atlantic right whale (DFO 2014,2016b), northern bottlenose whale (Scotian Shelf population) (DFO 2016c, 2017a), and leatherback sea turtle (Atlantic population) (Atlantic Leatherback Turtle Recovery Team [ALTRT] 2006). Of the threats to marine mammals and sea turtles that have been identified in action plans and recovery strategies, the following may be associated with Project activities: contaminants, anthropogenic disturbances (physical presence and noise), degradation of habitat, ship strikes, and toxic spills (Table 1). The potential for these threats has been considered in the effects assessment (Sections 10.3 and 15.5 of the EIS) for both secure and at-risk species of marine mammals and sea turtles. While the Project has the potential to result in interactions with marine mammals and sea turtles, including SAR, with the application of mitigation measures and adherence to published and/or industry standards and best management practices (e.g., OWTG (NEB et al 2010), and *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment* [SOCP; DFO 2007]), overall potential adverse effects to marine mammal and sea turtle species at risk are considered negligible to medium in magnitude, will likely be reversible, and are predicted to be not significant, as detailed in Sections 10.5.2 and 15.5.4.5 of the EIS. Potential for overlap and interaction with Project activities is also likely to be highly transient and temporary for an individual marine mammal or sea turtle, especially in consideration of anticipated large-scale daily and seasonal fluctuations in presence within the assessment areas.

Upon review and consideration of the clarifications and corrections provided in Appendix A to the Information Requirements, the significance conclusions of the three biological valued component assessments (marine fish and fish habitat, marine and migratory birds, and marine mammals and sea turtles) Sections 8.5.2, 9.5.2, 10.5.2 and 15.5.6.5 of the EIS remain valid.

Table 1 Potentially Affected Species for which there are Recovery Strategies or Action Plans, and Potential Threats as Detailed in those Plans

Species	Plans	Potential Threats*	Project Activities that May Contribute to Potential Threats**
Atlantic salmon (Inner Bay of Fundy)	• Proposed Action Plan, (DFO 2016a) • Recovery Strategy (DFO 2010)	• Marine Threats - Aquaculture - Ecological community shifts - Environmental shifts - Fisheries - Depressed population phenomena	No additional contribution to identified potential threats
Atlantic wolffish	• Recovery Strategy (Kulka 2008)	• Fishing - Fishing mortality - Habitat alteration from bottom trawling/dredging • Oil and Gas Exploration and Production - Seismic activities - Accidental oil spills - Drill mud discharge - Produced water discharge • Ocean Dumping - Sewage sludge - Fish waste - Dredging spoils • Military activity • Cables and Pipelines • Marine and Land based Pollution • Global Climate Change • Natural Mortality	• Geophysical surveys • Accidental oil spills • Drill mud discharges • Grey water (sanitary sewer) and food waste • Liquid discharges (bilge/deck drainage, ballast, cooling water, fire control water)
Spotted wolffish	• Recovery Strategy (Kulka 2008)	• Fishing - Fishing mortality - Habitat alteration from bottom trawling/dredging • Oil and Gas Exploration and Production - Seismic activities - Accidental oil spills - Drill mud discharge	• Geophysical surveys • Accidental oil spills • Drill mud discharges • Grey water (sanitary sewer) and food waste • Liquid discharges (bilge/deck drainage, ballast, cooling water, fire control water)

Table 1 Potentially Affected Species for which there are Recovery Strategies or Action Plans, and Potential Threats as Detailed in those Plans

Species	Plans	Potential Threats*	Project Activities that May Contribute to Potential Threats**
		- Produced water discharge • Ocean Dumping - Sewage sludge - Fish waste - Dredging spoils • Military activity • Cables and Pipelines • Marine and Land based Pollution • Global Climate Change • Natural Mortality	
Northern wolffish	• Recovery Strategy (Kulka 2008)	• Fishing • Fishing mortality • Habitat alteration from bottom trawling/dredging • Oil and Gas Exploration and Production • Seismic activities • Accidental oil spills • Drill mud discharge • Produced water discharge • Ocean Dumping • Sewage sludge • Fish waste • Dredging spoils • Military activity • Cables and Pipelines • Marine and Land based Pollution • Global Climate Change • Natural Mortality	• Geophysical surveys • Accidental oil spills • Drill mud discharges • Grey water (sanitary sewer) and food waste • Liquid discharges (bilge/deck drainage, ballast, cooling water, fire control water)
Ivory Gull	• Recovery Strategy (Environment Canada 2014)	• Illegal Shooting • Predation on Nests • Industrial Activities (e.g., mining) • Contaminants • Human Disturbance (monitoring) • Climate Change	• Accidental oil spills • Drill mud discharges • Liquid discharges (bilge/deck drainage, ballast, cooling water, fire control water)

Table 1 Potentially Affected Species for which there are Recovery Strategies or Action Plans, and Potential Threats as Detailed in those Plans

Species	Plans	Potential Threats*	Project Activities that May Contribute to Potential Threats**
		• Oil and Gas Exploration and Production - Chronic oil pollution	
Piping Plover (*Melodus* ssp.)	• Recovery Strategy (Environment Canada 2012)	• Predation • Disturbance or Harm from Human Activities • Habitat Loss or Degradation - Human disturbance - Coastal development - Natural processes • Oil or contaminant spills	• Accidental oil spills
Red Knot (*Rufa* ssp.)	• Recovery Strategy (Environment and Climate Change Canada 2017)	• Residential & commercial development - Housing and urban areas - Commercial/industrial areas - Tourism and recreation areas • Agriculture and aquaculture • Energy production and mining - Mining and quarrying - Renewable energy • Biological resource use - Hunting - Fishing and harvesting aquatic resources • Human intrusions and disturbance (recreational activities) • Natural system modifications • Invasive non-native and problematic native species • Pollution - Household sewage and wastewater - Industrial and military effluents - Agriculture and forestry effluents - Garbage and solid waste • Climate change	• Accidental oil spills
Roseate Tern	• Action Plan	• Predation	• Accidental oil spills

Table 1 Potentially Affected Species for which there are Recovery Strategies or Action Plans, and Potential Threats as Detailed in those Plans

Species	Plans	Potential Threats*	Project Activities that May Contribute to Potential Threats**
	(Environment Canada 2015) • Recovery Strategy (Environment Canada 2010)	• Post-fledging mortality • Shortage of males • Habitat Loss and Degradation • Human Disturbance	
Common Nighthawk	• Recovery Strategy (Environment Canada 2016a)	• Reduced availability of insect prey • Fire suppression • Loss of breeding habitat - Habitat succession - Change in roof construction and materials - Residential and commercial development - Agriculture - Logging and wood harvesting • Loss of non-breeding habitat • Temperature extremes and storms • Habitat shifting and alteration • Collisions with vehicles, planes and human structures • Pesticides • Mercury • Acid precipitation • Problematic native and invasive non-native species	• Accidental oil spills
Olive-sided Flycatcher	• Recovery Strategy (Environment Canada 2016b)	• Reduced availability of insect prey • Fire suppression • Non-breeding habitat - Deforestation and land conversion • Breeding habitat - Forest harvesting and silviculture - Residential and commercial development • Energy and mining (onshore exploration and extraction) • Temperature extremes and storms • Habitat shifting and alteration	• Accidental oil spills

Table 1 Potentially Affected Species for which there are Recovery Strategies or Action Plans, and Potential Threats as Detailed in those Plans

Species	Plans	Potential Threats*	Project Activities that May Contribute to Potential Threats**
		• Collisions with anthropogenic structures and vehicles • Pesticides • Mercury • Acid precipitation • Problematic native and invasive non-native species	
Beluga whale (St. Lawrence Estuary population)	• Recovery Strategy (DFO 2012)	• Hunting and harassment (historical) • Contaminants • Anthropogenic disturbances - Marine traffic and marine life observation activities - Anthropogenic noise • Reduction in the abundance, quality, and availability of prey - Reduced fish abundance - Competition with other predators - Competition with commercial fisheries • Other degradation of habitat - Inshore and offshore development - Introduction of exotic species • Ship strikes • Entanglement in fishing gear • Scientific research activities • Toxic spills • Harmful algal blooms • Epizootic disease	• Underwater noise from geophysical surveys and marine traffic • Accidental oil spills • Drill mud discharges • Grey water (sanitary sewer) and food waste • Liquid discharges (bilge/deck drainage, ballast, cooling water, fire control water) • Potential change in the abundance, quality, and availability of prey • Ship strikes • Accidental oil spills
Blue whale (Atlantic population)	• Recovery Strategy (Beauchamp 2009)	• Whaling (historical) • Natural mortality - Ice entrapment - Predation • Anthropogenic noise - Acoustic environment degradation and changes in blue whale behaviour - Physical harm	• Underwater noise from geophysical surveys and marine traffic • Accidental oil spills • Drill mud discharges • Grey water (sanitary sewer) and food waste • Liquid discharges (bilge/deck drainage, ballast, cooling water, fire control water)

Table 1 Potentially Affected Species for which there are Recovery Strategies or Action Plans, and Potential Threats as Detailed in those Plans

Species	Plans	Potential Threats*	Project Activities that May Contribute to Potential Threats**
		• Food availability • Contaminants • Collisions with vessels • Whale watching • Accidental entanglements in fishing hear • Epizootics and toxic algal blooms • Toxic spills	• Potential change in the abundance, quality, and availability of prey • Ship strikes • Accidental oil spills
North Atlantic right whale	• Recovery Strategy (DFO 2014) • Proposed Action Plan (DFO 2016b)	• Whaling (historical) • Vessel strikes • Entanglement in fishing gear • Disturbance and habitat reduction or degradation - Contaminants - Acoustic disturbances - Vessel presence disturbance - Changes in food supply	• Ship strikes • Accidental oil spills • Grey water (sanitary sewer) and food waste • Liquid discharges (bilge/deck drainage, ballast, cooling water, fire control water) • Potential change in the abundance, quality, and availability of prey • Ship strikes
Northern bottlenose whale (Scotian Shelf population)	• Recovery Strategy (DFO 2016c) • Action Plan (DFO 2017a)	• Impacts of historical whaling • Entanglement in fishing gear • Oil and gas activities • Acoustic disturbance • Contaminants • Changes to food supply • Vessel strikes	• Ship strikes • Accidental oil spills • Grey water (sanitary sewer) and food waste • Liquid discharges (bilge/deck drainage, ballast, cooling water, fire control water) • Potential change in the abundance, quality, and availability of prey • Ship strikes
Leatherback sea turtle (Atlantic population)	• Recovery Strategy (ALTRT 2006)	• Threats in the marine environment - Entanglement in fishing gear - Collisions - Marine pollution	• Ship strikes • Accidental oil spills • Grey water (sanitary sewer) and food waste • Liquid discharges (bilge/deck

Table 1 Potentially Affected Species for which there are Recovery Strategies or Action Plans, and Potential Threats as Detailed in those Plans

Species	Plans	Potential Threats*	Project Activities that May Contribute to Potential Threats**
		- Acoustic disturbances • Threats to the nesting environment - Poaching - Coastal construction - Artificial light - Climate change - Other potential threats	drainage, ballast, cooling water, fire control water) • Potential change in the abundance, quality, and availability of prey • Ship strikes

*Potential threats as identified in the Recovery Strategies / Action Plans

**While Project activities may contribute to the potential threats to species at risk identified in the Recovery Strategies / Action Plans, with the implementation of mitigation measures, overall potential adverse effects to species at risk are considered to be not significant.

Part 2: In addition, with consideration of the high or moderate likelihood of interaction between the Project and the Fin- and Northern bottlenose whales and Harbour porpoise, provide an analysis of potential effects of the Project on these species.

Of the marine mammal and sea turtle species at risk that may occur in the Project Area, those considered qualitatively most likely to occur and interact with the Project are the fin whale (high potential), and the harbour porpoise and northern bottlenose whale (moderate potential).

Fin Whale (Atlantic Population)

The Atlantic population of the fin whale is listed as Special Concern on Schedule 1 of the *Species at Risk Act* (SARA) (Government of Canada 2002) and is also designated as a species of Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Fisheries and Oceans Canada (DFO) released a Management Plan for this population in 2017 (DFO 2017b). Sighting records suggest that fin whales occur regularly in the Regional Study Area (RSA), and within the Project Area. During the summer months, concentrations of fin whales are known to occur on the Scotian Shelf and in the nearshore and offshore waters of Newfoundland and Labrador (COSEWIC 2005). Ninety-five fin whales were observed off Newfoundland in 2007, during the Trans North Atlantic Sightings Survey (TNASS) (Lawson and Gosselin 2009), and DFO opportunistic sightings records report 369 sightings in the RSA (83 within the Project Area – Northern Section and115 within the Project Area – Southern Section) (across multiple decades – see EIS Section 10.4 for full details). Finally, fin whales were determined to be a dominant noise source in the RSA for four to seven months throughout fall, winter, and spring (Quijano et al. 2017). Because of their seemingly regular occurrence in the Eastern Newfoundland offshore area, fin whales may interact with Project activities on a more frequent basis than other species of marine mammals.

Potential environmental effects of the Project for all marine mammals, including fin whales, are change in mortality or injury (underwater noise), change in habitat quality or use (behavioural effects), change in mortality or injury (vessel strikes), change in food availability or quality, and change in health (contaminants). For fin whales specifically, the key threats of concern (as identified in their COSEWIC status report (2005) and DFO Management Plan (2017b)) to which the Project is most likely to contribute are potential for ship strikes and the introduction of underwater noise. The nature of these effects is discussed in detail in Chapter 10 of the EIS and the assessment presented therein remains relevant to fin whales. Fin whales are large baleen whales and mysticetes are known to be more vulnerable to vessel strikes than odontocetes and pinnipeds (Laist et al. 2001, Jensen and Silber 2003, Vanderlaan and Taggart 2007), with historical records indicating that fin whales are one of the most frequently hit species on a per capita basis (Vanderlaan and Taggart 2007). While Project-related marine vessel traffic (support vessels) has the potential for a collision to result in mortality or injury of marine mammals (including fin whales), it is anticipated that the Project will not result in an increase in the number of vessel transits over previous levels (Section 2.5), thus likelihood of strike is also anticipated to remain at current levels. Fin whales are in the low-frequency cetacean hearing group and may experience behavioural disturbance or communication masking during activities that produce underwater noise, such as VSP and other geophysical surveys. Toxic spills would also be of concern in the event of an accident or malfunction (see Chapter 15 of the EIS).

Despite their higher potential for occurrence in the RSA and Project Area, the potential for individual fin whales to overlap geographically, and interact with Project activities, remains likely to be highly transient and temporary, especially in consideration of anticipated large-scale daily and seasonal fluctuations in presence within the RSA. With the application of mitigation measures and adherence to published and/or industry standards and best management practices (e.g., OWTG (NEB et al 2010), SOCP (DFO 2007), and C-NLOPB guidelines), effects to fin whales are not expected to differ from those presented in Table 10.5 of the EIS (i.e., are expected to be adverse, negligible to medium in magnitude, occur within the Project Area, Local Study Area (LSA) or RSA as regular or sporadic events (depending on the Project activity), and be short- to medium-term in duration (depending on the Project activity and phase) and reversible). These effects will occur within an already disturbed context (i.e., existing human development and industrial activity) with additional future offshore development and activities expected within and near the Project Area, LSA, and RSA. Based on the nature and characteristics of the Project and the existing environment for this Valued Component (VC) within the LSA and RSA, and with the planned implementation of mitigation measures, the Project is not likely to result in significant adverse effects on the Atlantic population of fin whales.

Harbour Porpoise (Northwest Atlantic Population)

The northwest Atlantic population of the harbour porpoise is not listed on Schedule 1 of the SARA (Government of Canada 2002) but is listed as Threatened on Schedule 2 and is designated as a species of Special Concern by the COSEWIC. As a result of their current listing status, no Recovery Strategies, Action Plans, or Management Plans have been developed for this population; however, there is a COSEWIC assessment and update status report from 2006 (COSEWIC 2006). Range-wide estimates for the abundance of harbour porpoise in eastern Canada do not exist; however, this population is considered to be abundant in the region (COSEWIC 2006). Opportunistic sighting records suggest that harbour porpoises are occasional visitors to the Project Area and RSA, with 27 reported sightings of harbour porpoise in the Project Area – Northern Section, seven in the Project Area – Southern Section, and 94 sightings throughout the RSA (sightings span multiple decades – see EIS Section 10.4).

Potential environmental effects of the Project for all marine mammals, including harbour porpoise, are change in mortality or injury (underwater noise), change in habitat quality or use (behavioural effects), change in mortality or injury (vessel strikes), change in food availability or quality, and change in health (contaminants). For harbour porpoise specifically, the most important recent and current threat to this population (as identified in their COSEWIC status report (2006)) is reportedly the susceptibility of harbour porpoises to bycatch in fishing gear. The relatively secure status of this population is due, in large part, to measures taken to restore groundfish stocks rather than to conserve harbour porpoises, and it is likely that bycatch will increase substantially if groundfish stocks recover in the region (COSEWIC 2006). Regarding threats towards which the Project is most likely to contribute, the introduction of underwater noise is likely of greatest concern, although this is discussed only briefly in the status report (with the exception of reference to concerns over disturbance from acoustic harassment devices associated with aquaculture activities) (COSEWIC 2006). The status report notes that acoustic harassment or displacement could occur during seismic exploration, particularly if such activities occur relatively close to shore, in preferred feeding areas, or within migration corridors (COSEWIC 2006). Potential effects associated with the introduction of anthropogenic noise in the marine environment is discussed in detail in Chapter 10 of the EIS and the assessment presented therein remains relevant to harbour porpoise.

Harbour porpoise are in the high-frequency cetacean hearing group and may experience behavioural disturbance or communication masking during activities that produce underwater noise, such as VSP and other geophysical surveys. Harbour porpoises are considered one of the most sensitive species to underwater noise and have, for example, demonstrated behavioural responses to air source arrays at levels <145 decibels (dB) re 1 µPa (root mean squared [rms]) (Bain and Williams 2006). Observed behavioural responses have also included demonstrated short-term avoidance responses and decreases in densities at 10 km from commercial 2D seismic surveys in the North Sea (peak-to-peak source sound pressure levels of 242 to 253 dB re 1 µPa at 1 m) (Thompson et al. 2013). Most harbour porpoise returned to the area within a few hours of the cessation of the geophysical activity.

Despite their moderate potential for occurrence in the RSA and Project Area, the potential for individual harbour porpoises to overlap geographically, and interact with Project activities, remains likely to be highly transient and temporary, especially in consideration of anticipated large-scale daily and seasonal fluctuations in presence within the RSA. With the application of mitigation measures and adherence to published and/or industry standards and best management practices (e.g., OWTG (NEB et al 2010), SOCP (DFO 2007), and C-NLOPB guidelines), effects to harbour porpoises are not expected to differ from those presented in Table 10.5 of the EIS (i.e., are expected to be adverse, negligible to medium in magnitude, occur within the Project Area, LSA or RSA as regular or sporadic events (depending on the Project activity), and be short- to medium-term in duration (depending on the Project activity and phase) and reversible). These effects will occur within an already disturbed context (i.e., existing human development and industrial activity) with additional future offshore development and activities expected within and near the Project Area, LSA, and RSA. Based on the nature and characteristics of the Project and the existing environment for this VC within the LSA and RSA, and with the planned implementation of mitigation measures, the Project is not likely to result in significant adverse effects on the Northwest Atlantic population of harbour porpoise.

Northern Bottlenose Whale (Scotian Shelf Population)

The Scotian Shelf population of the northern bottlenose whale is listed as Endangered on Schedule 1 of SARA (Government of Canada 2002) and is also designated as Endangered by COSEWIC. DFO published an updated Recovery Strategy for this population in 2016 (DFO 2016c) and followed this with an Action Plan in 2017 (DFO 2017c). During the 2007 TNASS survey, 42 northern bottlenose whales were observed in Newfoundland waters (Lawson and Gosselin 2009). Based on DFO and Equinor marine mammal observation records, there have been 53 sightings of northern bottlenose whale in the Project Area – Northern Section, 12 in the Project Area – Southern Section, and 78 sightings in the RSA (sightings span multiple decades – see EIS Section 10.4). During a 2014 and 2015 acoustic program to measure the soundscape near drilling operations, northern bottlenose whales were detected acoustically in the Flemish Pass, with occurrence sporadic throughout the study period in each year (Quijano et al. 2017). They were also acoustically active during the geophysical surveys undertaken at this time (Quijano et al. 2017). Exploration Lease (EL)s 1141 and 1142 overlap the Sackville Spur Vulnerable Marine Ecosystem (VME) and Northern Flemish Cap VME. While these VMEs were identified primarily in relation to their benthic fauna, 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 are at least occasional visitors to the Project Area and RSA, and they could conceivably interact with Project activities, particularly those producing underwater noise, such as VSP and other geophysical surveys.

Potential environmental effects of the Project for all marine mammals, including northern bottlenose whales, are change in mortality or injury (underwater noise), change in habitat quality or use (behavioural effects), change in mortality or injury (vessel strikes), change in food availability or quality, and change in health (contaminants). For this species specifically, the key threats of concern (as identified in their DFO Recovery Strategy (2016c) and Action Plan (2017c)) to which the Project is most likely to contribute is the introduction of underwater noise and potential exposure to contaminants. The nature of these effects is discussed in detail in Chapters 10 and 15 of the EIS and the assessments presented therein remain relevant to 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 2016c). 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). With the implementation of standard mitigation measures and best management practices for addressing contaminants (e.g., OWTG), routine discharges of drilling muds, drilling fluid, and cuttings associated with drilling activities, or other routine discharges, are not expected to result in a measurable change in health for northern bottlenose whale. Toxic spills would also be of concern in the event of an accident or malfunction (see Chapter 15 of the EIS).

Despite their moderate potential for occurrence in the RSA and Project Area, 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 presence within the RSA, and the short-term nature of activities of concern (e.g., VSP survey duration is anticipated to be less than 48 hours per well, and five to seven days per well for wellsite surveys). With the application of mitigation measures and adherence to published and/or industry standards and best management practices (e.g., OWTG (NEB et al 2010), SOCP (DFO 2007), and C-NLOPB guidelines), effects to northern bottlenose whale are not expected to differ from those presented in Table 10.5 of the EIS (i.e., are expected to be adverse, negligible to medium in magnitude, occur within the Project Area, LSA or RSA as regular or sporadic events (depending on the Project activity), and be short- to medium-term in duration (depending on the Project activity and phase) and reversible). These effects will occur within an already disturbed context (i.e., existing human development and industrial activity) with additional future offshore development and activities expected within and near the Project Area, LSA, and RSA. Based on the nature and characteristics of the Project and the existing environment for this VC within the LSA and RSA, 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.

Part 3: Describe Lumpfish and White hake (Atlantic and Northern Gulf of St. Lawrence population) and their habitat within areas that could be affected by the Project. Update the effects assessment, potential mitigation and follow-up, as appropriate.

Common Lumpfish

Common lumpfish were assessed in November 2017 as "threatened" and no status or recovery documents have been finalized for this species. Common lumpfish (*Cyclopterus lumpus*) are widely distributed in temperate waters from shallow coastal waters of less than 20 m to depths greater than 300 m (Simpson et al 2016). In Newfoundland and Labrador waters, lumpfish are distributed from inshore bays to the Newfoundland and Labrador Shelf. Across various survey types, lumpfish densities are ≤1 individuals per tow inside the Project Area with areas of highest densities (up to 100-2,010 individuals per tow) south of Newfoundland (Simpson et al 2016). This semi-pelagic species primarily occupies pelagic areas, but adults become demersal during spawning in shallow coastal waters (Simpson et al 2016). Canadian Research Vessel (RV) surveys indicate that this species prefers waters ≤4^0C (Simpson et al 2016).

This species undergoes inshore spawning migrations in spring with spawning occurring from May-June in the subtidal zone (Simpson et al 2016). Tagging studies indicate that this species returns to the same spawning areas each year and adults may make migrations of hundreds of kilometres (Simpson et al 2016). Common lumpfish are batch spawners where the eggs deposited in a nest are fertilized externally. The eggs are secured to hard substrate and guarded by the male. After hatching, larval lumpfish attach themselves to hard substrates, macroalgae and eel grass. Eelgrass beds may be important nursery habitat for lumpfish as with other fish species (Simpson et al. 2016; DFO 2017d; Gauthier et al. 2017). For the first year, juveniles also live in the upper 1 m of the water column and are often attached to floating macroalgae. Juvenile stages in surface waters primarily consume zooplankton (Simpson et al 2016).

Primary potential threats to this species include changes in oceanographic processes, spawning habitat destruction, seal predation, coastal pollution, seismic activities, fishing, and bycatch mortalities (Simpson et al 2016; DFO 2017d). However, there has not been any direct link between suggested potential threats and observed declines in abundance (Simpson et al 2016; DFO 2017d). Currently, no critical habitat or recovery plan has been established for this species, however coastal spawning habitats are considered important for lumpfish recovery and survival (Simpson et al 2016; DFO 2017; Gauthier et al. 2017).

The potential for common lumpfish occurrence in the RSA and Project Area is low to high with the potential for all life stages (egg, larvae, juveniles, and adults) to interact with Project activities. Primary aggregations and spawning habitats for this species are known to occur outside the LSA in coastal waters around southern Newfoundland. With the application of mitigation measures and adherence to published and/or industry standards and best management practices (e.g., OWTG (NEB et al 2010), SOCP (DFO 2007), and C-NLOPB guidelines), potential effects to lumpfish are expected to be adverse, negligible to low magnitude, occur localized or within the Project Area as sporadic to long term events (depending on the Project Activity and phase), and are reversible as detailed in Table 8.13 of the EIS. These effects will occur within an already disturbed context (i.e., existing human development and industrial activity) with additional future offshore development and activities expected within and near the Project Area, LSA, and RSA. Based on the nature and characteristics of the Project and the existing environment for this VC within the LSA and RSA, and with the planned implementation of mitigation measures, the Project is not likely to result in significant adverse effects on common lumpfish.

White Hake

White hake are listed as "threatened" under COSEWIC (2013; DFO 2016d) and are mainly distributed in the Gulf of St. Lawrence, Scotian Shelf, and Southern Newfoundland. Two population designatable units (DU) have been established; the southern Gulf of St. Lawrence (DU1) and the Atlantic and northern Gulf of St. Lawrence (DU2) (COSEWIC 2013). Prior to mid-1990 and over the past three generations, there has been a decline in adult white hake abundance by 70% (COSEWIC 2013).

White hake are associated with fine mud substrates at depths between 50-360 m. Canadian RV surveys indicate that white hake are associated with the shallow slope (250-600 m) depth zone with highest abundances in the Project Area ranging from 5-8 individuals per tow. Along the Southern Grand Banks, highest catch rates are >98 individuals per tow. White hake are not a key fish species in species assemblages on the Flemish Cap (Nogueira et al 2017) and areas of high aggregation and abundance exist outside the Project Area.

This species does not undergo vertical migrations and abundance at depths is linked to fish size as larger adult fish are associated with deeper waters (COSEWIC 2013). Spawning seasons are variable depending on population location with spawning occurring between June to September in the Southern Gulf of St. Lawrence. In offshore areas, spawning is estimated to occur in the spring and in the summer on the Scotian Shelf (COSEWIC 2013). Eggs, larvae and pelagic juveniles may remain planktonic for two to three months depending on environmental conditions and distance to suitable settling areas (COSEWIC 2013). Juvenile and adult hake primarily feed on crustaceans and fish and are prey species for other fish, seabirds, and seals (COSEWIC 2013).

Fishing mortality through directed fishery and by-catch, remains the greatest threat to white hake populations with habitats considered not likely to be a limiting factor to this species survival and recovery (COSEWIC 2013; DFO 2016d,e). Natural mortality from seal predation has also been suggested as a threat for the Gulf of St. Lawrence DU. No critical habitat has been established for this species, however white hake have been observed to aggregate for foraging opportunities in the spring in the Laurentian Channel and Southwest Shelf Edge and Slope Ecologically and Biologically Significant Areas (EBSAs) (Templeman 2007; COSEWIC 2013; DFO 2016d).

The potential for white hake occurrence in the RSA and Project Area is low to high with the potential for all life stages (egg, larvae, juveniles, and adults) to interact with Project activities. Furthermore, as the known areas of high aggregation and importance (Laurentian Channel and Southwest Shelf Edge and Slope EBSAs) are outside the Project Area. With the application of mitigation measures and adherence to published and/or industry standards and best management practices (e.g., OWTG (NEB et al 2010), SOCP (DFO 2007), and C-NLOPB guidelines), potential effects to white hake are expected to be adverse, negligible to low magnitude, occur localized or within the Project Area as sporadic to long-term events (depending on the Project Activity and phase) and reversible as detailed in Table 8.13 of the EIS. These effects will occur within an already disturbed context (i.e., existing human development and industrial activity) with additional future offshore activities expected within and near the Project Area, LSA, and RSA. Based on the nature and characteristics of the Project and the existing environment for this VC within the LSA and RSA, and with the planned implementation of mitigation measures, the Project is not likely to result in significant adverse effects on white hake.

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INFORMATION REQUIREMENT – IR-37

(N/A)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.3.1, Fish and Fish Habitat; 6.3.6, Species at Risk.

Reference to EIS: Table 8.12

Context and Rationale

Table 8.12 indicates marine fish species at risk likely to be encountered within the Project area and summarizes potential interactions. All species are indicated as having a "limited potential for interaction" with the Project due to mobility of species, project mitigation, and absence of critical habitat. Species abundance and seasonal presence in the Project area does not appear to have been considered in assigning potential for interaction.

The table also identifies four species for which there is "potential for long term adverse effects with accidental events". There is no indication of why this potential has been identified for these four species, or why it has not been indicated for any of the other species.

Specific Question or Information Requirement

Provide additional rationale for the summary of potential interactions identified in Table 8.12, considering:

- How abundance, timing of presence (i.e., infrequent occurrence versus year-round presence), and life-cycle (i.e., spawning/presence of eggs/larvae/rearing) may be indicative of varying potential for interaction with the Project.
- Define the criteria used to determine which species have the potential for long-term adverse effects from accidental events, and ensure the criteria are consistently applied to each species listed in Table 8.12.

Update effects predictions accordingly, if applicable.

Response

The potential interactions and effects on species at risk (SAR) are presented in Table 8.12 with further details presented in Sections 8.4.1 to 8.4.6 of the Environmental Impact Statement (EIS). Potential interactions with life-cycle or life history stage is presented in Table 8.11 of the EIS. Further requested information is presented below including details on abundance and timing of presence to clarify potential interactions with planned activities. Interactions of species of conservation concern has been fully considered in the effects assessment for Marine Fish and Fish Habitat (Chapter 8).

It is recognized that in the occurrence of an accidental event (See Section 15 of the EIS) long term adverse effects to some species may result. As detailed in Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessments, those species that are the most susceptible to long-term adverse environmental effects for accidental events would be those with life history characteristics of slow growth, late maturity, relatively lower mobility, and concentration of abundance. SAR in the Project Area that have these traits include roundnose grenadier, roughhead grenadier, deepwater redfish, Acadian redfish, spiny dogfish, Atlantic wolffish, spotted wolffish and northern wolffish. Table 8.12 from Section 8.4 of the EIS has been updated and is provided below.

As with secure fish species, SAR may interact with Project activities based on occupation of various habitats at different life history stages and the same planned mitigation measures will be used to avoid or reduce such adverse interactions.

Table 8.12 Marine Fish Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	Conservation Status*	Summary of Presence and Potential Interactions**
Atlantic wolffish (*Anarhichas lupus*)	SARA: Special Concern COSEWIC: Special Concern	• Long lived and slow growing species that mainly inhabit bottom habitats. Common between 150-350 m depths • Year-round presence in the Project Area. Average migrations <8 km to several hundreds of kilometres • Spawns September and October. May undergo seasonal spawning migrations; Egg clusters laid on the bottom and are guarded by adults. Pelagic larvae • Abundant (approximately 6 individuals per Canadian RV tow) in Flemish Pass and on continental slopes in Project Area • Potential life stage interactions include eggs (demersal), larvae (pelagic), and juveniles/adults (demersal) • No critical habitat established for this species • Limited potential for interaction (mobile species, Project mitigation measures, no critical habitat)
Northern wolffish (*Anarhichas denticulatus*)	SARA: Threatened COSEWIC: Threatened	• Long lived and slow growing species that mainly inhabit bottom habitats. Common between >500-1,000 m depths • Year-round presence in the Project Area. Aggregated in Flemish Pass and northeast slopes. Areas of high abundance (approximately 1 individual per Canadian RV tow) in Project Area • Average migrations <8 km to 800 kilometres • Spawns September through November. Pelagic larvae and relatively pelagic adults • Potential life stage interactions include eggs (demersal), larvae (pelagic), and juveniles/adults (demersal) • No critical habitat established for this species • Limited potential for interaction (mobile species, Project mitigation measures, draft critical habitats on continental slopes)
Spotted wolffish	SARA: Threatened	• Long lived and slow growing species that

Table 8.12 Marine Fish Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	Conservation Status*	Summary of Presence and Potential Interactions**
(*Anarhichas minor*)	COSEWIC: Threatened	mainly inhabit soft bottom habitats. Common between 200-750 m depths • Year-round presence in the Project Area. Common on Flemish Cap, eastern Grand Banks, and Newfoundland Shelf. Areas of high abundance (<1 individual per Canadian RV tow) in Project Area • Spawning aggregations on the Northeast Shelf and Slope EBSA in the spring. Spawns from June, July, and August. Egg clusters laid on the bottom and are guarded by adults. Pelagic larvae • Potential life stage interactions include eggs (demersal), larvae (pelagic), and juveniles/adults (demersal) • No critical habitat established for this species • Limited potential for interaction (mobile species, Project mitigation measures, no critical habitat)
American eel (*Anguilla rostrata*)	NL ESA: Vulnerable COSEWIC: Threatened	• Catadromous species. Adults undergo oceanic spawning migrations in the fall along the continental shelf to spawning areas in the Sargasso Sea • Seasonal/Intermittent presence in Project Area. Adults / larvae may pass through Project Area or interact with vessels during migrations to or from spawning areas • Larvae drift along the Gulf Stream to coastal areas before migrating into freshwater. Larvae and juveniles are concentrated in the water column in the upper 140 m at night and 350 m during the day • Potential life stage interactions include larvae (pelagic) and juveniles/adults (pelagic) • No critical habitat established for this species • Limited potential for interaction (mobile species, Project mitigation measures, no critical habitat)
Atlantic cod (*Gadus morhua*)	COSEWIC: Endangered (Newfoundland and Labrador population)	• Adult cod occupy a diverse range of habitats with no particular depth or bottom substrate preferences. Mainly observed at depths <500 m offshore • Year-round presence in the Project Area. Localized area of high abundance (approximately 63 individuals per Canadian RV tow) in Project Area. Distributed on the northeast and southeast tips of the Grand Bank and on the Flemish Cap • Broadcast spawner. Eggs in the water column from April to November. Pelagic

Table 8.12 Marine Fish Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	Conservation Status*	Summary of Presence and Potential Interactions**
		larvae • May pass through Project Area during seasonal migrations • No critical habitat established for this species • Potential life stage interactions include eggs (pelagic), larvae (pelagic), and juveniles/adults (demersal) • No critical habitat established for this species • Limited potential for interaction (mobile species, Project mitigation measures, no critical habitat)
Cusk (*Brosme brosme*)	COSEWIC: Endangered	• Cusk prefer habitats that have rocky substrates and are predominately found between 100-400 m depth, but have been observed at depths over 1,100 m • Intermittent presence in the Project Area. Irregular occurrence on the Grand Bank, around Flemish Cap. Mainly distributed in the Gulf of Maine • Spawning on Scotian Shelf from May to August. Pelagic eggs and larvae • Limited seasonal movements • Potential life stage interactions include eggs (pelagic), larvae (pelagic), and juveniles/adults (demersal) • No critical habitat established for this species • Limited potential for interaction (mobile species, Project mitigation measures, high abundance areas outside the Project Area, no critical habitat)
Roughhead grenadier (*Macrourus berglax*)	COSEWIC: Special Concern	• Roughhead grenadiers are long lived and slow growing benthopelagic species. These characteristics indicate this species may have lesser potential for recovery in response to adverse effects • Captured at depths between 200 and 2,000 m and mainly observed between 400-1,200 m • Year-round presence in Project Area. Limited dispersal and movements. Areas of high abundance (approximately 52 individuals per Canadian RV tow) in Project Area • Mainly distributed on northeast and eastern slopes of the Grand Banks. Spawning grounds suggested to lie on the southern and southeastern slopes of the Grand Bank • Spawning occurs in winter and early spring. Pelagic eggs • Potential life stage interactions include eggs

Table 8.12 Marine Fish Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	Conservation Status*	Summary of Presence and Potential Interactions**
		(pelagic), larvae (pelagic), and juveniles/adults (demersal) • Potential for long-term adverse effects with large-scale accidental events • No critical habitat established for this species • Limited potential for interaction (mobile species, no critical habitat, Project mitigation measures)
Roundnose grenadier (*Coryphaenoides rupestris*)	COSEWIC: Endangered	• Roundnose grenadiers are long lived and slow growing benthopelagic species. These characteristics indicate this species may have lesser potential for recovery in response to adverse effects • Year-round presence in Project Area. Limited dispersal and movements. Areas of high abundance (approximately100 individuals per Canadian RV tow) in Project Area • Captured at depths between 180 and 2,200 m and mainly observed at 400-1,200 m depths • Common on the Flemish Cap and nose of the Grand Banks • Spawning occurs throughout the year. Mesopelagic eggs and juveniles • Potential life stage interactions include eggs (pelagic), larvae (pelagic), and juveniles/adults (demersal) • Potential for long-term adverse effects with large-scale accidental events • No critical habitat established for this species • Limited potential for interaction (mobile species, no critical habitat, Project mitigation measures)
American plaice (*Hippoglossoides platessoides*)	COSEWIC: Threatened (Newfoundland and Labrador population)	• Juvenile and adult stages associated with soft bottom habitats. Juveniles typically occur at 100-200 m and adults typically occur 100-300 m • Year-round presence in the Project Area and may seasonally migrate through Project Area. Areas of high abundance (approximately 231 individuals per Canadian RV tow) in Project Area. Common on the north and south areas of the Grand bank and on the Flemish Cap • Spawning timing varies geographically, with spawning occurring mainly between April to May on the Grand Banks. St. Pierre Bank, the "Haddock box" on the Scotian Shelf and the Nose and Tail of the Grand Bank are

Table 8.12 Marine Fish Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	Conservation Status*	Summary of Presence and Potential Interactions**
		potential nursery areas • Potential life stage interactions include eggs (pelagic), larvae (pelagic), and juveniles/adults (demersal) • No critical habitat established for this species • Limited potential for interaction (mobile species, Project mitigation measures, no critical habitat)
Spiny dogfish (*Squalus acanthias*)	COSEWIC: Special Concern	• Epibenthic shark species that are typically found in large schools above the seabed • Species has slow growth rate, long gestation periods, and late age to maturity. These characteristics indicate this species may have lesser potential for recovery in response to adverse effects • Seasonal/intermittent presence in the Project Area with inshore (summer-fall) to offshore (winter-spring) migrations • Resides in Canadian waters mainly on the southwest Scotian Shelf, Bay of Fundy, and Georges Bank. Observed on the Grand Bank including the Flemish Pass, their presence is limited (highest abundance 100 individuals per Canadian and American research survey tow) • Dogfish mate in the late fall and early winter. Internal fertilization with 18-24 month gestation period • No critical habitat established for this species • Potential life stage interactions include juveniles/adults (demersal) • Potential for long-term adverse effects with large-scale accidental events • Limited potential for interaction (mobile species, Project mitigation measures, no critical habitat, main population outside of project area, seasonal presence)
Thorny skate (*Ambylaraja radiata*)	COSEWIC: Special Concern	• Slow-growing species that occupies depths of 18-1,400 m and inhabits a broad range of substrates including sand, shell, gravel and mud • Year-round presence in the Project Area. Undergoes limited seasonal migrations (approximately 100 km) • Areas of high abundance (approximately 17 individuals per Canadian RV tow) in Project Area. Widespread species on Grand Banks in shelf and slope areas • Skates lay egg capsules on the seafloor

Table 8.12 Marine Fish Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	Conservation Status*	Summary of Presence and Potential Interactions**
		year-round and all life stages occupy demersal habitats • No critical habitat established for this species • Potential life stage interactions include eggs (demersal), larvae (demersal), and juveniles/adults (demersal) • Limited potential for interaction (project mitigation measures, no critical habitat)
Atlantic salmon (*Salmo salar*)	COSEWIC: Threatened (South Newfoundland Population); Special Concern (Quebec Eastern North Shore, Quebec Western North Shore, Inner St. Lawrence, Gaspe-Southern Gulf of St. Lawrence); Endangered (Eastern Cape Breton, Nova Scotia Southern Upland, Outer Bay of Fundy, Anicosti Island)	• Anadromous species; spawns in freshwater, growth phase in marine environments • Intermittent presence in Project Area. May migrate through the project area or interact with coastal and offshore service vessels. Mainly occupies upper 5-10 m of water column with some deeper feeding migrations • Sampling near the Flemish Pass in winter and summer-autumn captured no salmon. Low catches (over 0.0-1.0 fish per mile-hour of drift gillnet) of adult salmon were recorded during the spring • Post-smolt from rivers in Maine, Bay of Fundy, Atlantic coast of Nova Scotia, and some rivers in Newfoundland migrate near the coast of eastern Newfoundland, arriving near the Funk Islands in the southern Labrador Sea in early August • Adult salmon have been found in abundance in two general locations during their spring spawning migration; approximately 480 km east of the Strait of Belle Isle and slightly east of the 200 m isobath (depth contour) along the eastern edge of the Grand Bank • No critical habitat established for this species • Potential life stage interactions include juveniles/adults (demersal) • Limited potential for interaction (mobile species, Project mitigation measures, no critical habitat)
Acadian redfish (*Sebastes fasciatus*)	COSEWIC: Threatened (Atlantic population)	• Prefers the shelf slopes and deep channel areas, but undergoes large vertical diurnal migrations • Year-round presence in the Project Area. Areas of high abundance (approximately 2,700 individuals per Canadian RV tow for *S. fasciatus* and *S. mentella*) along the slopes of the Newfoundland Shelf in the Project Area. Common on the Northeast Newfoundland Shelf and Flemish Cap • Internal fertilization. Larval release between spring and summer and are primarily found

Table 8.12 Marine Fish Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	Conservation Status*	Summary of Presence and Potential Interactions**
		in surface waters • No critical habitat established for this species. Habitats made up of anemones and coral beds may be linked to redfish survival • Potential life stage interactions include larvae (pelagic), and juveniles/adults (pelagic) • Limited potential for interaction (mobile species, project mitigation measures) • Species has long life span with slow growth and therefore considered to have low resilience to adverse effects. Potential for long-term adverse effects with accidental events
Deepwater redfish (*Sebastes mentella*)	COSEWIC: Threatened (Northern Population)	• Prefers the shelf slopes and deep channel areas, but undergoes large vertical diurnal migrations • Year round presence in the Project Area. Areas of high abundance (approximately 2,700 individuals per Canadian RV tow for *S. fasciatus* and *S. mentella*) along the slopes of the Newfoundland Shelf in the Project Area. Common on the Northeast Newfoundland Shelf and Flemish Cap • Internal fertilization. Larval release between spring and summer and are primarily found in surface waters • No critical habitat established for this species. Habitats made up of anemones and coral beds may be linked to redfish survival • Potential life stage interactions include larvae (pelagic), and juveniles/adults (pelagic) • Limited potential for interaction (mobile species, project mitigation measures) • Species has long life span with slow growth and therefore considered to have low resilience to adverse effects. Potential for long-term adverse effects with accidental events
Atlantic bluefin tuna (*Thunnus thynnus*)	COSEWIC: Endangered	• Seasonal/intermittent presence in Project Area. May migrate through Project Area in search of food. Tuna move southward in the fall for spawning • Individuals captured in continental shelf waters of the Gulf of St. Lawrence, Scotian Shelf and the Grand Bank • May form schools of <50 individuals • No critical habitat established for this species • No known spawning or rearing habitats for early life stages in Canadian waters

Table 8.12 Marine Fish Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	Conservation Status*	Summary of Presence and Potential Interactions**
		• Potential life stage interactions include juveniles/adults (pelagic) • Limited potential for interaction (mobile species, project mitigation measures)
Basking shark (*Cetorhinus maximus*)	COSEWIC: Special Concern	• Seasonal/intermittent presence in Project Area. May migrate through Project Area with summer feeding migrations in Canadian waters • Aggregates in areas where zooplankton are concentrated • Basking sharks occur throughout Atlantic continental shelf including the Bay of Fundy, Scotian Shelf, and Grand Banks. This species has also been captured from the Flemish Cap and the Northeast slope of the Newfoundland Shelf • No critical habitat established for this species • Potential life stage interactions include juveniles/adults (pelagic) • Limited potential for interaction (mobile species, project mitigation measures)
Shortfin mako (*Isurus oxyrinchus*)	COSEWIC: Special Concern (Atlantic Population)	• Seasonal/intermittent presence in Project Area. May migrate through Project Area with summer feeding migrations in Canadian waters • Associated with warm waters (17-22^{o}C) in and around the Gulf Stream including the continental shelf of Nova Scotia, Grand Banks and the Gulf of St. Lawrence • Sharks in Canadian waters are at the northern extent of the population and considered a small portion of the total population • No critical habitat established for this species • Potential life stage interactions include juveniles/adults (pelagic) • Limited potential for interaction (mobile species, project mitigation measures)
White shark (*Carcharodon carcharias*)	SARA: Endangered (Atlantic Population) COSEWIC: Endangered (Atlantic Population)	• Occurs in inshore to offshore waters • Seasonal/intermittent presence in Project Area. May migrate through Project Area with summer feeding migrations in Canadian waters • Recorded in Newfoundland waters from the Northeast Newfoundland Shelf and the St. Pierre Bank. Individuals have been tracked to the Flemish Cap • No critical habitat established for this species • Potential life stage interactions include

Table 8.12 Marine Fish Species at Risk: Analysis of Potential Environmental Interactions and Effects

Species	Conservation Status*	Summary of Presence and Potential Interactions**
		juveniles/adults (pelagic) • Limited potential for interaction (mobile species, project mitigation measures)
Porbeagle (*Lamna nasus*)	COSEWIC: Endangered	• Abundant on the continental shelf of the Grand Bank. Rarely captured at surface or depths >200 m • Seasonal/intermittent in presence in Project Area. Distribution spans the Project Area on the continental shelf • No critical habitat established for this species. However, mating grounds are present off Southern Newfoundland, the entrance to the Gulf of St. Lawrence and the Georges Bank • Mating occurs during the summer and early fall and sharks migrate to pupping grounds in the Sargasso Sea • No critical habitat established for this species • Potential life stage interactions include juveniles/adults (pelagic) • Limited potential for interaction (mobile species, project mitigation measures)
*SARA designation is per Schedule 1 **References for “Summary of Presence and Potential Interactions” are detailed in the Environmental Impact Assessment.		

References

Refer to the EIS for references associated with “Summary of Presence and Potential Interactions”.

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(KMKNO-29)

Project Effects Link to CEAA 2012: 5(1); 79(2) Species at Risk.

Reference to EIS Guidelines: Part 2, Section 6.1.5, Species at Risk; 6.1.6, Marine Mammals; 6.1.7, Marine Turtles.

Reference to EIS: Table 17.2 Summary of Mitigation and Commitments; Section 10.3.2, Summary of Key Mitigation.

Context and Rationale

Table 17.2 of the EIS states that there will be "shut down of the seismic source array if a marine mammal or sea turtle listed as endangered or threatened on SARA Schedule 1 is sighted within the safety zone", while Section 10.3.2 of the EIS states that "MMOs will implement a pre-ramp up watch of 30 minutes prior to the start of the air source. Ramp-up will be delayed if marine mammal or sea turtle is sighted within the safety zone." It is unclear whether shutdown would occur if any marine mammal or sea turtle is sighted or only if endangered or threatened species are sighted.

KMKNO has asked about the feasibility of extending the safety zone during VSP (e.g., to a radius of 1 kilometre from the installation).

Specific Question or Information Requirement

Describe seismic source array shut down procedures should marine mammals or sea turtles be sighted during ramp up. Explain whether shut down would occur upon sighting of any marine mammal or sea turtle or only if they are a SARA listed species. Should shut down only occur on sighting of listed species, provide an explanation of how these species would be identified.

Discuss the need for and feasibility of extending the safety zone during VSP.

Response

As indicated in Section 10.3.2 of the Environmental Impact Statement (EIS), ramp-up of the array will be delayed if a marine mammal or sea turtle is observed within the safety zone. This is consistent with the *Statement of Canadian Practice with respect to the Mitigation of Geophysical Sound in the Marine Environment* (SOCP) (DFO 2007).

During a geophysical survey, and in accordance with the SOCP, the air-source array will be shut down if a marine mammal or sea turtle species at risk enters the safety zone.

As indicated in Sections 10.3 and 10.6, and Tables 10.5 and Table 17.2 of the EIS, trained marine mammal observers (MMOs) will be used to monitor and report on marine mammal and sea turtle sightings during vertical seismic profile (VSP) and geophysical surveys where seismic arrays are used.

Extending the safety zone would be challenging and unnecessary to protect the marine species in this area for two reasons:

1) Based on current technology, the MMOs to reliably scan an area greater than 500 metres (m) around the source and identify species at that distance from the vantage point of platform is very limited
2) VSP sound sources are smaller than 2D and 3D seismic sound sources and modelling done in this area demonstrate that a 500 metre (m) safety zone is appropriate even for the larger sources (Quinjano, J. et al 2017).

References

DFO (Fisheries and Oceans Canada). 2007. Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment. Available online: http://waves-vagues.dfo-mpo.gc.ca/Library/363838.pdf. Accessed April 2018.

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.

INFORMATION REQUIREMENT – IR-39

(DFO-12, -16, -17 and -18)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 1.1, Project Location.

Reference to EIS: Section 6.1.10 Special Areas of Importance to Marine Fish, 6.4.2.3 Fisheries Closure Areas within Canada's Exclusive Economic Zone.

Context and Rationale

There are inconsistencies between Tables 6.23, 6.46, and 6.48; and Figure 9-96, and some marine refuges and EBSAs were not included.

Gander Bay Lobster and Gooseberry Island Lobster Closures fall within the Regional Study Area, but are not addressed in the EIS

http://www.dfo-mpo.gc.ca/oceans/conservation/achievement-reussite-eng.html

A new *Fisheries Act* Closure, the Northeast Newfoundland Slope Closure/Marine Refuge area, has been established for sensitive benthic habitat. Bottom contact fishing is prohibited in this area, which overlaps with the Northern Section of the Project Area.

There are several additional Ecologically and Biologically Significant Areas (EBSA) 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 Regional Study Area and project area. These areas include: Southeast Shoal and Adjacent Areas on the Tail of the Grand Bank; Slopes of the Flemish Cap and Grand Bank; Orphan Knoll; Seabird Foraging Zone in the Southern Labrador Sea; and Labrador Sea Deep Convection Area. Relevant documents can be found at:

- http://www.dfo-mpo.gc.ca/oceans/oeabcm-amcepz/refuges/index-eng.html
- http://www.dfo-mpo.gc.ca/oceans/oeabcm-amcepz/refuges/northeastnewfoundlandslope-talusnordestdeterreneuve-eng.html
- https://chm.cbd.int/database/record?documentID=204104
- https://chm.cbd.int/database/record?documentID=204102
- https://chm.cbd.int/database/record?documentID=204101

Some areas are included in the analysis but their status requires further consideration (e.g., the Orphan Knoll EBSA https://chm.cbd.int/database/record?documentID=204103

Specific Question or Information Requirement

Provide updated tables and related figure with listings of all special areas that could be affected by the Project. Indicate distance to ELs and potential for vessels to transect special areas. Where analysis in relation to specific special areas has not been included in the EIS (e.g., Gander Bay Lobster and Gooseberry Island Lobster Closure; Northeast Newfoundland Slope Closure Marine Refuge Area; Slopes of Flemish Cap and Grand Bank EBSA, Seabird Forage Zone in Southern

Labrador Sea and the Labrador Sea Deep Convection Area EBSA), conduct an assessment of potential effects, proposed mitigation and follow-up, as well as effects predictions, for routine activities and accidental events.

Response

Chapter 6 of the Environmental Impact Statement (EIS) includes separate sections to describe the existing environment for Marine Fish and Fish Habitat, Marine and Migratory Birds, Marine Mammals and Sea Turtles and Special Areas. The Special Areas Section (Section 6.4) presents descriptions, tables and figures (including Table 6.46, Table 6.48, and Figure 6.96) to describe all identified special areas within the extents of the mapping windows (including the Regional Study Area [RSA]) to show overlaps between the Project Area and identified special areas as well as proximity of all special areas within the larger Eastern Newfoundland offshore area for regional context.

Table 6.23 describes special areas of importance to marine fish and fish habitat within and near the Project Area. It does not include the Laurentian Channel Marine Protected Area (MPA), the Gilbert Bay MPA, the Notre Dame Bay Channel Ecologically and Biologically Significant Area (EBSA), Placentia Bay Extension EBSA, St. Pierre Bank EBSA, Laurentian Channel and Slope EBSA, Gilbert Bay EBSA, Hamilton Inlet EBSA, the Southern Coast of Burin Peninsula and Southeastern Placentia Bay Preliminary Representative Marine Area (PRMA) or Northwest Atlantic Fisheries Organization (NAFO) Fisheries Closure Area (FCA) Fogo Seamounts (2) as these sites are all more than 300 km from the Project Area and 85 km from either potential vessel or aircraft traffic route. The currently identified special areas that were not included in the EIS (i.e., Marine Refuges, Lobster Area Closures, and United Nations Convention on Biodiversity EBSAs) are discussed below. However, it is noted that this information was not available at the time the EIS was submitted in December 2017.

Since the December 2017 submission of the EIS, several types of special areas in the Newfoundland and Labrador offshore have been identified or revised. These include areas closed to lobster fishing as conditions of fishing licenses, Marine Refuges and EBSAs identified by the United Nations (UN) Convention on Biological Diversity outside of Canada’s Exclusive Economic Zone (EEZ). They also include Snow Crab Stewardship Exclusion Zones and refinement of the EBSAs within the Placentia Bay/Grand Banks (PB/GB) Large Ocean Management Area (LOMA). These amendments to Special Areas are presented in the following sections.

EBSAs in the PB/GB LOMA

As discussed in the EIS, a number of EBSAs have been identified in marine areas off Eastern Newfoundland. In 2015, Fisheries and Oceans Canada (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 (N. Wells pers comm 2018).

Based on the information that is currently available, 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 1). Figure 1 shows the draft revised boundaries and new EBSAs in the PB/GB LOMA. Portions of the PB/GB LOMA EBSAs that extended beyond the Canadian EEZ into the NAFO regulatory area are no longer considered to be within EBSA boundaries (though they may still be identified and/or protected through international processes). 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 though 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, St. Mary's Bay, Bonavista Bay, Baccalieu Island and South Coast. The Project Area and potential traffic routes intersect with the Northeast Slope EBSA and the traffic route overlaps with the Eastern Avalon EBSAs.

Table 1 Refined PB/GB LOMA EBSAs

EBSA	Approximate Delineated Area	
	2007	2017
Northeast Slope	13,885 km^2	19,731 km^2
Virgin Rocks	6,843 km^2	7,294 km^2
Lilly Canyon-Carson Canyon	1,145 km^2	2,180 km^2
Southeast Shoal	30,935 km^2	15,402 km^2
Eastern Avalon	1,683 km^2	5,948 km^2
Southwest Slope	16,644 km^2	25,181 km^2
Smith Sound	148 km^2	547 km^2
Placentia Bay	7,693 km^2	13,539 km^2
Laurentian Channel	17,140 km^2	19,545 km^2
Haddock Channel Sponges	Not applicable	490 km^2
South Coast	Not applicable	6,876 km^2
St. Mary's Bay	Not applicable	3,989 km^2
Bonavista Bay	Not applicable	3,141 km^2
Baccalieu Island	Not applicable	6,922 km^2
Source: Wells (2018)		

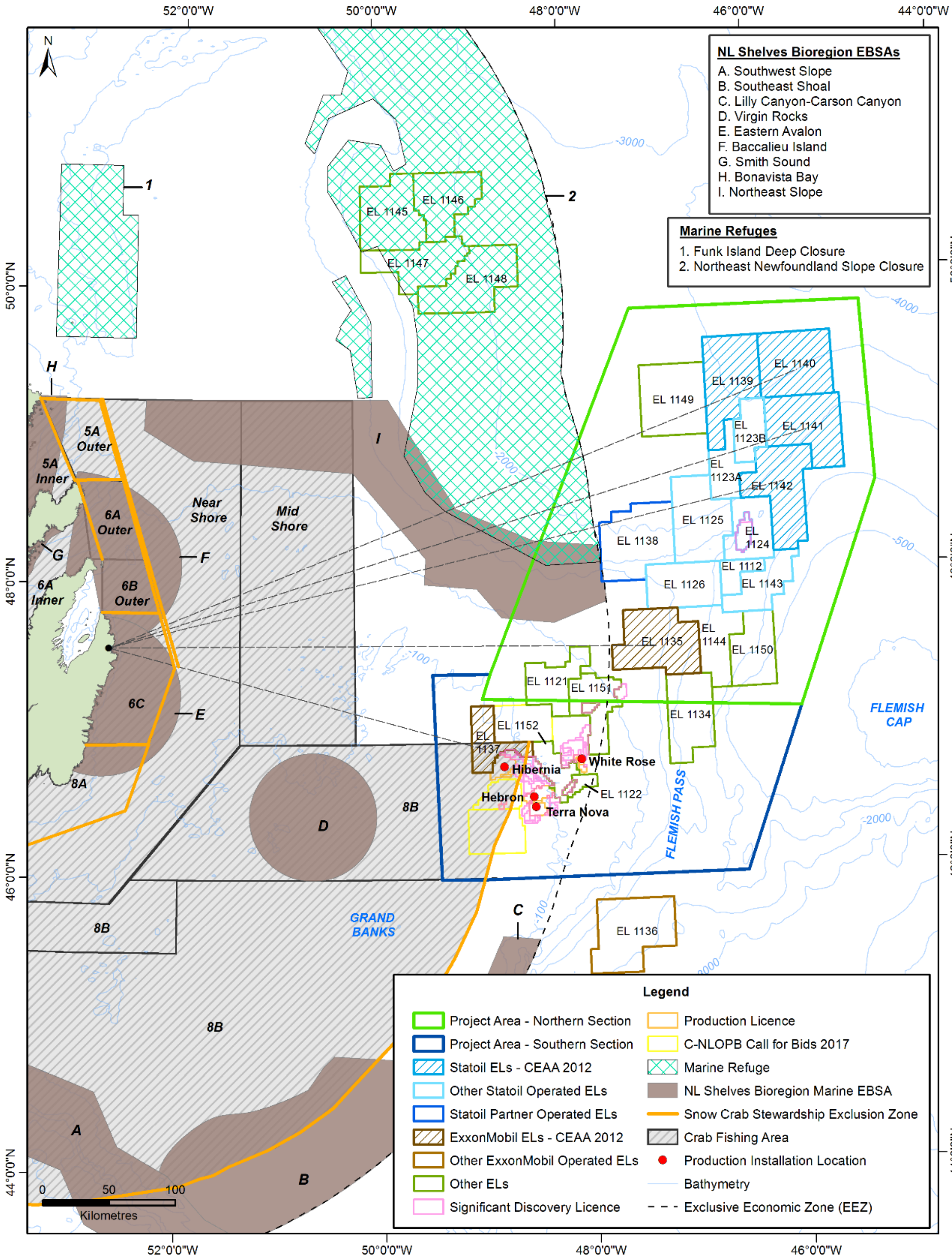

Figure 1 **Refined EBSAs, Marine Refuges, Lobster Area Closures and Snow Crab Stewardship Exclusion Zones**

Marine Refuges

In December 2017, after the EIS was submitted, DFO designated seven Marine Refuges off the coast of Nunavut and Newfoundland and Labrador to help protect portions of sensitive and productive habitat (DFO 2018). Three of these Marine Refuges are located off eastern Newfoundland (Table 2 and Figure 1). The Project Area and the traffic route overlap with the Northeast Newfoundland Slope Closure Marine Refuge.

Table 2 Marine Refuges

Marine Refuge	Rationale for Identification/Designation	Area
Northeast Newfoundland Slope Closure (formerly known as Tobin's Point)	Dense aggregations of large, structure-forming cold-water corals provide niche space for other organisms. Prohibitions for all bottom contact fishing activities.	46,833 km^2
Hawke Channel Closure	The Hawke Channel seafloor is an important habitat for groundfish including Greenland halibut. The Refuge also protects habitat of depleted species such as Atlantic wolffish. Bottom trawl, gillnet and longline fishing activities are prohibited.	8,837 km^2
Funk Island Deep Closure	Conserves seafloor habitat important to Atlantic cod. Bottom trawl, gillnet and longline fishing activities are prohibited.	7,274 km^2
Source: DFO (2018)		

Lobster Area Closures

Within the Canadian EEZ, a number of marine areas off Eastern Newfoundland have been closed, by DFO, to particular types of fishing activities through various means including voluntary closures, co-management approaches, licencing restrictions and/or under the *Fisheries Act* (Government of Canada 1985) to protect and conserve productive fish and shellfish habitat for commercially important species (Figure 1). Fisheries closures off eastern Newfoundland include inshore areas closed to fishing activities to protect sensitive and productive habitat for lobster (Table 3) (DFO 2017). The Lobster Area Closures do not overlap with the Project Area or Traffic Routes.

Table 3 Lobster Area Closures

Closure	Rationale for Identification/Designation
Mouse Island	Lobster fishing is prohibited in seven areas (totaling 94 km^2) around coastal Newfoundland to protect lobster spawning habitat and increase egg production. Five of these Lobster Area Closures are located in Eastern Newfoundland but are outside of the Project Area and traffic routes.
Glover's Harbour	
Gander Bay	
Gooseberry Island	
Penguin Islands	
Source: DFO (2017)	

Snow Crab Stewardship Exclusion Zones

Fisheries closures include several portions of NAFO 3LNO that have been closed to snow crab fishing. These Stewardship Exclusion Zones are 0.5 or 1.0 nautical mile (NM) wide corridors along the length of crab fishing area boundaries to delineate fishing areas and provide a refuge area for snow crab (DFO 2015). The Project Area and potential traffic routes overlap with the Exclusion Zones in Crab Fishing Area 8BX, 6C and Near Shore (Table 4).

Table 4 Snow Crab Stewardship Exclusion Zones

Closure Area	Rationale for Identification/Designation
Crab Fishing Area 5A Inner	Snow crab fishing is prohibited in various Stewardship Exclusion Zones including portions of Bonavista Bay, Trinity Bay, Conception Bay, the Eastern Avalon and St. Mary's Bay as well as near shore fishing areas.
Crab Fishing Area 5A Outer	
Crab Fishing Area 6A Inner	
Crab Fishing Area 6A Outer	
Crab Fishing Area 6B	
Crab Fishing Area 6C	
Crab Fishing Area 8A	
Crab Fishing Area – 8BX	
Crab Fishing Area 9A	
Crab Fishing Area Near Shore	
Source: DFO (2015)	

UN Convention on Biological Diversity EBSAs

In 1992 Canada ratified the UN Convention on Biological Diversity, which came into force in December 1993. The Convention is an important step towards conservation of global biodiversity. Identified EBSAs include ocean habitat areas of eastern Newfoundland and Labrador (Table 5, Figure 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 5 Convention on Biological Diversity EBSAs

EBSA	Rationale for Identification/Designation	Area
Labrador Sea Deep Convection Area	The only North-West 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 North-West 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 significant 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
Source: UNCBD (2017)		

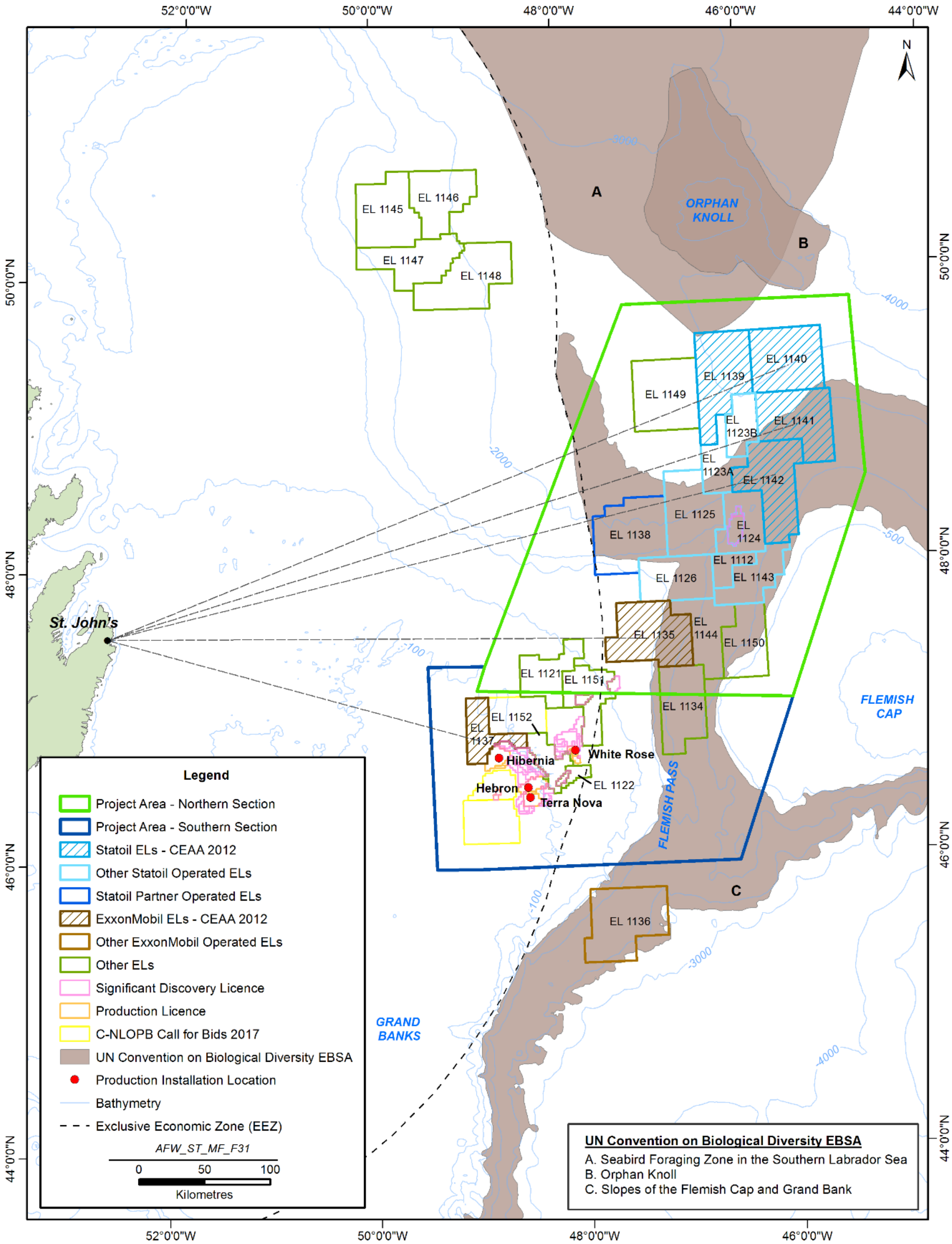

Figure 2 United Nations Convention on Biological Diversity EBSAs

Environmental Effects Assessment of Additional Special Areas

Most of the special areas identified in Eastern Newfoundland, as described in Chapter 11 of the EIS, are located on land or in coastal and nearshore areas, outside of the Project Area. The additional specials areas identified in this section, Lobster Area Closures and most of the Snow Crab Stewardship Exclusion Zones are located in inshore and near shore areas. Additional special areas in mid shore and offshore locations off Eastern Newfoundland include Canadian Marine Refuges and revised EBSAs inside the Canadian EEZ. In addition, UNCBD EBSAs have been identified outside the EEZ in the NAFO regulatory area. None of the special areas have associated prohibitions of petroleum exploration and development activities within their boundaries.

The environmental effects assessment for the additional special areas is an extension of the effects assessment presented in Chapter 11 of the EIS. The method involves identifying special areas and describing the rationale for their designation (and protection, where applicable) along with recent or known upcoming changes to their status or their defined boundaries. The assessment also includes obtaining the most comprehensive and current geo-spatial data related to each of the types of marine and coastal special areas and incorporating it into a geodatabase to measure and illustrate their location and extents in relation to the Project Area. Like the previously identified special areas, the potential effects on these special areas will be avoided and/or managed through mitigations used to address effects on marine fish and fish habitat, marine and migratory birds and marine mammals and sea turtles.

The defining features of each of the types of special areas in marine areas off eastern Newfoundland include the presence of species and sensitive habitats for marine fish and marine and migratory birds and in some cases also marine mammals and sea turtles. Therefore, key mitigation measures that will be implemented to help avoid or reduce potential environmental effects on special areas will be those used for environmental effects on marine fauna and habitats (Chapters 8, 9 and 10 of the EIS).

Notwithstanding the overall size and extent of the Project Area itself, exploration drilling activity carried out as part of this Project will occur within the boundaries of an EL. Table 6 provides a summary of the minimum distance between the edge of the Project ELs and the various relevant special areas identified and mapped above. As indicated, routine Project activities will occur in an offshore marine area that is several hundred kilometres from the shoreline of Eastern Newfoundland. These routine Project activities will therefore not occur within, or otherwise interact directly with any of the Lobster Area Closures, each of which is at least 500 km away from the closest EL. While some of the Canadian EBSAs and Marine Refuges occur in the offshore area, none intersect with the Project ELs. Various ELs overlap with three special areas: a Snow Crab Stewardship Exclusion Zone and two UNCBD EBSAs.

Table 6 Special Areas: Summary of Minimum Distances from the Project ELs

Special Area	Project ELs - Minimum Distance (in km)					
	1135	**1137**	**1139**	**1140**	**1141**	**1142**
Refined PB / GB LOMA EBSAs						
Northeast Slope	14	67	111	167	148	114
Virgin Rocks	205	77	360	416	395	355
Lilly Canyon-Carson Canyon	211	124	391	443	410	343

Table 6 Special Areas: Summary of Minimum Distances from the Project ELs

Special Area	Project ELs - Minimum Distance (in km)					
	1135	1137	1139	1140	1141	1142
Southeast Shoal	338	225	519	573	543	481
Eastern Avalon	327	219	435	488	477	446
Southwest Slope	506	374	672	728	705	658
Smith Sound	424	336	492	538	536	513
Placentia Bay	462	357	559	609	602	574
Laurentian Channel	682	558	815	869	856	821
Haddock Channel Sponges	500	375	637	692	676	641
South Coast	717	614	800	847	845	820
St. Mary's Bay	437	329	544	595	586	555
Bonavista Bay	438	355	481	523	526	511
Baccalieu Island	330	238	406	454	451	425
Marine Refuges						
Northeast Newfoundland Slope Closure	40	113	93	141	137	112
Hawke Channel Closure	665	665	568	602	632	649
Funk Island Deep Closure	420	375	426	468	475	466
Lobster Area Closures						
Mouse Island	619	545	645	686	692	680
Glover's Harbour	607	533	633	675	681	668
Gander Bay	539	469	568	610	614	601
Gooseberry Island	458	363	534	580	578	553
Penguin Islands	707	602	794	841	837	812
Snow Crab Stewardship Exclusion Zones						
Crab Fishing Area 5A Inner	423	345	477	521	521	500
Crab Fishing Area 5A Outer	389	313	442	485	488	465
Crab Fishing Area 6A Inner	398	309	473	521	517	492
Crab Fishing Area 6A Outer	358	270	433	480	476	452
Crab Fishing Area 6B	342	245	432	481	475	447
Crab Fishing Area 6C	331	225	434	487	476	445
Crab Fishing Area 8A	355	244	477	530	517	483
Crab Fishing Area – 8BX	84	X	258	313	286	234
Crab Fishing Area 9A	464	344	593	629	634	599
Near Shore	328	222	431	483	473	442
UN Convention on Biological Diversity EBSAs						
Labrador Sea Deep Convection Area	1,036	1,076	869	886	930	961
Seabird Foraging Zone in the Southern Labrador Sea	202	318	X	13	56	88
Orphan Knoll	252	365	38	27	77	113
Slopes of the Flemish Cap and Grand Bank	X	98	15	X	X	X
Note: X indicates that the EL and special area intersect.						

As described for the biophysical VC chapters of the EIS (Chapters 8 to 10), the Project is not expected to result in significant adverse effects upon the overall and defining physical, biological and socioeconomic environments within these areas including related marine fish, birds, mammals, sea turtles, species at risk or their habitats. It will therefore not adversely affect the ecological features, processes and integrity of marine or coastal locations that are designated as special areas, nor their human use and societal value. This is also the case for these additional special areas. Many of the offshore activities and associated disturbances that will occur as a result of this Project will be relatively localized and of a short-term nature at a specific location, and the implementation of the various mitigation measures outlined throughout this EIS will reduce direct or indirect potential effects on the existing environmental characteristics and conditions of these special areas. For instance, the Operators propose to complete a pre-drilling coral identification/mapping program and risk assessment.

In addition, the various environmental monitoring and follow-up initiatives outlined in the EIS in relation to relevant components of the biophysical environment will be indirectly applicable to special areas. Detailed design of a follow-up monitoring program will be based on the pre-drill coral survey, potential zone of influence as estimated in the drill cuttings dispersions modelling, location of the well in proximity to the sensitive benthic habitat, other site-specific information collected during planning and industry experience in conducting similar monitoring programs (e.g., Norwegian Continental Shelf experience).

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INFORMATION REQUIREMENT – IR-40

(N/A)

Project Effects Link to CEAA 2012: All – Special Areas.

Reference to EIS Guidelines: Part 2, Section 6.3.8.3, Special Areas.

Reference to EIS: Section 15.5.4.5, Determination of Significance.

Context and Rationale

Section 6.3.8.3 of the EIS Guidelines requires consideration of the effects of the Project on special areas, including, but not limited to the use of dispersants, and change to habitat quality (e.g., noise, light, water, sediment quality). The EIS identifies several special areas within the regional study area, but does not consider the effects of noise, light, or water, and sediment quality in relation to special areas as required by the EIS Guidelines. The EIS indicates that the analysis of effects on special areas is covered in other valued component sections; however, it is not clear where and how routine effects on special areas have been fully considered.

Section 15.5.4.5 of the EIS concludes that the effects of accidents on special areas will not be significant, but also states that "(i)n the extremely unlikely event of a subsurface blowout occurring within a Special Area, significant effects may result, depending on the nature of the Special Area, and the extent and duration of the spill event". The rationale for this apparent contradiction is not clear; the worst-case scenario should be used to evaluate a single significance determination for special areas.

Specific Question or Information Requirement

Assess 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. Focus the assessment on the defining features of the special areas (e.g., components linked to "special" status).

Explain how significance criteria ratings were assigned to the potential for a worst-case accidental event on sensitive areas (including potential for accident to occur in a sensitive area). Provide a single determination of significance of effects of worst-case accidental events on special areas.

Response

Part 1: Assess 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. Focus the assessment on the defining features of the special areas (e.g., components linked to "special" status).

Certain marine and coastal areas in Newfoundland and Labrador have been designated as protected under provincial, federal, or other legislation and processes, or have otherwise been identified as being special or sensitive due to their ecological, historical, and/or socio-cultural characteristics and importance. Special areas have been selected as a valued component (VC) for this Environmental Impact Statement (EIS) due to their importance for environmental, economic, and/or socio-cultural reasons and associated regulatory and/or Indigenous and stakeholder interests in these areas and their intrinsic ecological or anthropogenic value.

Special areas in offshore Newfoundland have been identified based on defining environmental features including the presence of sensitive habitats and species such as marine fish and fish habitat, and marine and migratory birds. The effects of the Project on marine fish and fish habitat, and marine and migratory birds, including those from routine operations (e.g., noise, light and sediment) are discussed in the Chapters 8 and 9 of the EIS respectively. In many cases, these special areas in marine and coastal environments have also been identified and/or protected based on socioeconomic interests including reducing the effects of bottom-contact fishing to support the long-term sustainability of commercial fisheries. The effects of the Project on Commercial Fisheries are addressed in Chapter 13 of the EIS.

Most of the special areas identified are located on land or in coastal and nearshore areas, which are outside of the Project Area. Special areas in offshore locations off eastern Newfoundland include various Fishing Closure Areas (FCAs) that protect sensitive benthic habitats from bottom fishing activities, but with no associated prohibitions of petroleum exploration and development activities within their boundaries. Other identified special areas include Vulnerable Marine Ecosystem (VME) areas identified by the Northwest Atlantic Fisheries Organization (NAFO) for their high ecological or biological activity, portions of which may eventually be designated as FCAs. In addition, Ecologically and Biologically Significant Areas (EBSAs) are ecologically important or sensitive areas identified through the *Canadian Oceans Act* (Government of Canada 1996).

These and other types of special areas, were identified, mapped, and described in detail in Section 6.4 of this EIS, and in other sections that describe the existing biophysical and socioeconomic environments (refer to Chapters 6 and 7). Where the potential effects of the Project on special areas are discussed in this Information Requirement (IR) response, these potential effects are based on applicable information presented in the relevant sections of the EIS as noted.

Following submission of the EIS, additional special areas have been identified and these were discussed and illustrated in the response to IR-39. These special areas include Marine Refuges, Lobster Area Closures, Snow Crab Stewardship Exclusion Zones, refined Placentia Bay/Grand Banks (PB/GB) Large Ocean Management Area (LOMA) EBSAs and United Nations (UN) Convention on Biological Diversity (CBD) EBSAs. In addition, exploration licence (EL) 1134 is now included within the scope of this Project and special areas overlapping with that EL are also included in this discussion.

Special Areas Overlapping with Project Area ELs

As presented in the EIS, Project activities may have direct effects on important ecological or biological features and aspects of special areas that overlap with the Project. In particular, certain special areas overlap with Project ELs where such activities will occur. Table 11.4 from the EIS has been updated below. The defining features of these special areas are discussed in the following sections.

Table 11.4 Special Areas Overlapping with Project Exploration Licences

Exploration Licence	Overlapping Special Areas
EL 1134	• Slopes of the Flemish Cap and Grand Bank UN CBD EBSA • Flemish Pass/Eastern Canyon (2) NAFO FCA • Southern Flemish Pass to Eastern Canyons VME
EL 1135	• Slopes of the Flemish Cap and Grand Bank UN CBD EBSA
EL 1137	• Crab Fishing Area 8BX Stewardship Exclusion Zone
EL 1139	• Seabird Foraging Zone in the Southern Labrador Sea UN CBD EBSA
EL 1140	• Slopes of the Flemish Cap and Grand Bank UN CBD EBSA
EL 1141	• Slopes of the Flemish Cap and Grand Bank UN CBD EBSA • Sackville Spur (6) NAFO FCA • Northern Flemish Cap VME • Sackville Spur VME
EL 1142	• Slopes of the Flemish Cap and Grand Bank UN CBD EBSA • Sackville Spur (6) NAFO FCA • Northern Flemish Cap (9) NAFO FCA • Northwest Flemish Cap (12) NAFO FCA • Northern Flemish Cap VME • Sackville Spur VME
Note: The Northeast Shelf and Slope EBSA has been refined as the Northeast Slope EBSA and no longer intersects with the Project ELs.	

Snow Crab Stewardship Exclusion Zone: Crab Fishing Area – 8Bx

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 2015). Descriptions of the biological and ecological features of the Exclusion Zones are not publicly available.

NAFO Fisheries Closure Area: Sackville Spur (6)

The Sackville Spur is an elongate sediment drift feature that extends from the Grand Banks across the northern limit of the Flemish Pass and along the northern slope of the Flemish Cap. Its southern flank gently slopes toward the 900 metres (m) isobath in the Flemish Pass, and steeper northern flank extends to the floor of the Orphan Basin at 2,500 m depth. The upper limit of the sponges is at about 1,300 m depth and extending down to about 1,800 m (NAFO 2015, 2018; FAO 2016).

This area was closed to protect the extensive sponge population on the Sackville Spur. Dominant sponge species are demosponges of the order Astrophorida. Geodiids (mostly *Geodia barretti*) and *Stelletta normani*, and *Stryphnus ponderosus* occur in the deeper water. These large-sized sponges, sometimes grow to more than 25 centimetres (cm) in diameter. These sponge grounds host a high diversity and abundance of associated megafaunal species. The Sackville Spur is closed to protect high coral and sponge concentration areas from bottom fishing activities (NAFO 2015, 2018; FAO 2016).

NAFO Fisheries Closure Area: NAFO Coral Closures

NAFO Coral Closures include 14 high concentration areas for sponges and corals around the slopes of the Flemish Cap, which have been closed to bottom fishing due to habitat sensitivity. These include Flemish Pass/Eastern Canyon (2), Northern Flemish Cap (9) and Northwest Flemish Cap (12), which all overlap with Project ELs. The Flemish Cap is located at the 500-m isobath with depths of less than 150 m at its centre, separated from the Grand Banks by the approximately 1,200 m deep Flemish Pass. The Cap is a plateau of approximately 200 kilometres (km) radius mostly covered with muddy-sand and sandy-mud with a patch of sand at its centre in the shallower water (NAFO 2015, 2018; FAO 2016).

A system of sea pens has been identified extending around the edge of the Flemish Cap. Sea pens are key biophysical components of soft-bottom VME indicator elements in the NAFO regulatory area. Aggregations of sea pens, known as “fields”, provide important structure in low-relief sand and mud habitats where there is little physical habitat complexity. These fields provide refuge for small planktonic and benthic invertebrates that may be preyed upon by fish. Crinoids and cerianthids and black corals also have been found associated with this sea pen system (NAFO 2015, 2018; FAO 2016).

UN Convention on Biological Diversity EBSA: Slopes of the Flemish Cap and Grand Bank

Identification of the Convention on Biological Diversity EBSAs are part of an initiative to conserve global diversity. The Slopes of the Flemish Cap and Grand Bank EBSA contains most of the aggregations of indicator species for VMEs in the NAFO Regulatory Area. The 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 (UNCBD 2017).

UN Convention on Biological Diversity EBSA: Seabird Foraging Zone in the Southern Labrador Sea

The Seabird Foraging Zone supports globally significant populations of marine vertebrates, including an estimated 40 million seabirds annually. The area is an 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*). This EBSA encompasses the pelagic zone of the Orphan Basin, continental shelf, slope and offshore waters inside and outside the Canadian Exclusive Economic Zone (EEZ) (UNCBD 2017). As outlined in Figure 2 in the response to IR-39, the Seabird Foraging Zone in the Southern Labrador Sea overlaps with a very minor portion of EL 1139 (i.e. approximately 16 km^2 or 0.6 percent of the total 2,682 km^2), however, from a conservative approach, it was included the assessment below.

Vulnerable Marine Ecosystem: Sackville Spur

Nine general areas in offshore Eastern Newfoundland have been identified as VMEs. The Sackville Spur areas is recognized for its high density of sponges (WG-EAFM 2008; FAO 2016).

Vulnerable Marine Ecosystem: Northern Flemish Cap

The Northern Flemish Cap VME has a high density of sea pens, soft corals and black corals and, to a lesser extent, solitary stony corals and small gorgonians. Vulnerable fish species include northern wolffish and spiny dogfish (WG-EAFM 2008; FAO 2016).

Vulnerable Marine Ecosystem: Southern Flemish Pass to Eastern Canyons

The Southern Flemish Pass to Eastern Canyons VME includes large gorgonians and high density of sponges. Vulnerable fish species in the area include striped wolffish, redfish, spiny tailed skate, northern wolffish, some black dogfish and deep-sea cat shark (WG-EAFM 2008; FAO 2016).

Effects Assessment for Special Areas

The defining features of the special areas that overlap with Project ELs are mostly important benthic habitats such as sponge and coral grounds and sea pen fields, which are sensitive areas because of their high biological activity. These areas may have also been identified and/or protected because of their importance to productive commercial fisheries and because of the effects of bottom-fishing activity. As mentioned above, a minor portion of the Seabird Foraging Zone in the Labrador Sea overlaps with a very minor portion of EL 1139 and is incorporated in the assessment below (refer to Figure 2 in the response to IR-39). The potential effects of the Project on commercial fisheries were discussed in Section 13.3 of the EIS. The following sections describe the potential effects of the Project on the defining features of these special areas.

Presence and Operation of Drilling Installations

As described in Section 2.1 of the EIS, the Project will include the drilling of exploration wells on licences within the Project Area using one or more drilling installations over the defined temporal scope. The presence and operation of the drilling installation may result in associated noise and vibrations and lighting that may affect marine fish through disturbance or changes to feeding activity. Potential interactions between marine and migratory birds and the drilling installation include the possible attraction of birds due to lighting, avoidance of the drilling installation due to sensory disturbance, and the creation of new foraging opportunities for predator species.

Anthropogenic noise that may be associated with drilling activities and vessel traffic and other equipment used during exploration activities can be transmitted through water and may result in disturbances to marine biota. The Northern Flemish Cap VME and the Southern Flemish Pass to Eastern Canyons VME that overlap with Project ELs are noted for the presence of various fish species. Relevant research has not shown direct evidence of mortality to fish resulting from continuous underwater noise and typical sound levels from drilling activities are below estimated exposure guidelines for injury to fish. Given the known behavioural (avoidance) responses of some fish species to underwater noise, mobile species that may be present within the Project's zone of influence are likely to move out of the area if they are disturbed by the Project. The presence of the drilling installation and associated lighting may also result in the attraction of some individual fish. Lighting around the drilling installation may attract prey and thus cause predators to aggregate around production platforms because of foraging opportunities in the associated well-lit surrounding waters. Other potential emissions and discharges associated with the Project will include sewage and food waste, which may attract fish species for foraging opportunities.

The drilling installation will be situated several hundred kilometres offshore, which is far from coastal Ecological Reserves, MBSs and IBAs, and well beyond the foraging range of most species that nest in Newfoundland. In the offshore, the Seabird Foraging Zone in the Southern Labrador Sea has been identified as an area that supports an estimated 40 million seabirds annually, including 20 populations of over-wintering black-legged kittiwakes, thick-billed murres and breeding Leach's storm-petrels. This area encompasses the pelagic zone of the Orphan Basin, continental shelf, slope and offshore waters inside and outside the Canadian EEZ off southern Labrador. None of the bird species listed in relation to the Foraging Zone are species at risk.

Research on marine and migratory birds around offshore platforms show both avoidance and attraction and sometimes this behaviour is noted for the same species. Researchers have documented avoidance behaviours of birds (mainly alcids such as puffins, dovekies, northern fulmar, shearwaters, and storm-petrels) that tend to occur in lower densities around platforms and vessel traffic. The effect of habitat displacement on marine-associated birds is considered likely to be minor in the eastern Newfoundland offshore area, where there are four production platforms and one to two drilling installations operating at any one time. Any disturbance will be short-term and transient in nature. As well, because the area of displacement is small relative to the total areas of the highly productive feeding grounds within the local study area (LSA) and the overall ranges of these species, foraging activities will not be disrupted. Implementation of mitigation measures to reduce levels of sound, atmospheric emissions and wastes and adherence to appropriate performance targets will further reduce the degree to which marine and migratory birds are displaced.

Marine-associated birds are known to be attracted to offshore platforms, which may result in direct mortality or injury through collisions with facility infrastructure, or through disorientation, which may lead to vulnerability. Studies off eastern Newfoundland indicate that though a high number of Leach's Storm-petrels become stranded on offshore platforms, these are successfully released resulting in low levels of mortality. On-board lighting will be required for Project activities that occur at night and during periods of reduced visibility, and to meet safety and regulatory requirements. Overall, the planned presence and operation of the drilling installation in the Project Area is anticipated to be a negligible addition to the total amount of lighting in the overall offshore area, especially as compared to existing offshore activities such as fishing vessels, other petroleum exploration and production facilities, commercial traffic and other vessel movements that regularly move to and through the Project Area. Further, the nature of the potential disturbance will be short-term in any location, as it is estimated that the drilling installation will be on location between 35 and 65 days to drill one well at a specific location. The distance at which Project-related lighting in the offshore environment will be visible (and thus, its likely zone of influence) may be up to 5 km, however, this will be influenced by site and time specific factors, as such disturbances appear to occur most frequently during periods of drizzle and fog and in overcast conditions.

The presence of offshore platforms can also provide new habitats for marine-associated birds. Structures may be used as roosting and resting sites by gulls, as stopover locations for migrating land birds, or even potentially as hunting grounds for predatory species. Foraging opportunities may be enhanced around platforms because of increased organic waste and the structures may become artificial reefs around which new invertebrate and fish assemblages are established. The creation of new habitats and increased food availability will be short term at a Project drilling location, and may result in both positive and adverse effects on marine and migratory birds. Enhancement of the food supply and provision of roosting and resting sites that attracts birds may be offset by increased risk of collision with the drilling installation, predation or energetic costs due to deviation from normal movement/migration patterns. Proper waste management, particularly disposal of organic wastes, will reduce the degree to which foraging opportunities are enhanced by the presence and operation of the drilling installation.

In summary, the predicted environmental effects of presence and operation of the drilling installation on special areas that include sensitive benthic habitats around the Flemish Cap and in the Flemish Pass and the Seabird Foraging Zone in the Southern Labrador Sea are primarily related to noise and light emissions. Benthic habitats are not anticipated to be adversely affected by noise and light due to distance to the seafloor. However, light and noise have the potential to affect marine and migratory birds such as mortality/injury or effects on the health, presence and abundance of avifauna, and habitat and food availability and quality. Effects on marine and migratory birds are predicted to be adverse, low in magnitude, localized and certainly within the Project Area, short to medium term duration, occurring regularly and reversible, with these predictions being made with a moderate to high level of confidence.

Drilling and Associated Marine Discharges

As described in Section 2.5.1 of the EIS, drilling installations in shallow water depths may involve use of anchoring/mooring systems. The placement of wells and anchors may disturb bottom habitats and cause injury or mortality to benthic invertebrates, including corals and sponges such as those found in the following special areas:

- NAFO FCAs: Sackville Spur (6), Flemish Pass/Eastern Canyon (2), Northern Flemish Cap (9) and Northwest Flemish Cap (12);
- UN CBD EBSA: Slopes of the Flemish Cap and Grand Bank; and
- VMEs: Vulnerable Marine Ecosystem: Sackville Spur, Northern Flemish Cap and Southern Flemish Pass to Eastern Canyons.

For this Project, potential interactions with drilling installation anchors will be restricted to shallow waters (typically up to 500 m), where the drilling installation will be anchored to maintain position, rather than using a dynamic positioning (DP) system.

Various types of special areas have been identified as overlapping with Project ELs and these are portions of the Flemish Pass and the slopes of the Flemish Cap. While information to describe depths are not available for some of the special areas, NAFO information indicates that sponge grounds in the Sackville Spur and area are at depths of between 1,300 and 1,800 m deep and benthic habitats of the slopes of the Flemish Cap and in the Flemish Pass are between the 500 m and 1,200 m isobaths. Thus, it is anticipated that these special areas will not directly be affected by anchors used in this Project. In cases where DP is used, the interaction would be limited to the location of the wellsite as moorings are not required, thereby the potential interaction with benthic habitats is limited to the area of the well site. As outlined in Section 2.5.2.1 of the EIS, pre-drill coral and sponge surveys will be completed prior to drilling, and mitigation measures will be implemented if identified by the risk assessment.

Initial drilling involves a large diameter hole for the first part of the well and installation of a surface casing and conductor using seawater or a water based drilling fluids and muds (WBM) with cuttings discharged directly to the seabed. Drilling wells may disturb bottom habitats and cause injury or mortality to benthic invertebrates, including corals and sponges such as those found in the identified special areas. The ecological function and environmental importance of these species necessitates avoiding or reducing the potential for adverse effects. In addition, if effects did occur they would be localized given the small footprints involved, however, recovery of species is often slow in cold water environments. As outlined in Section 2.5.2.1 of the EIS, pre-drill coral and sponge surveys will be completed prior to drilling, and mitigation measures will be implemented if identified by the risk assessment.

Expected and potential environmental emissions and discharges associated with the Project will include drill cuttings and cement, other liquid wastes (e.g. produced water, bilge and deck drainage, ballast water, sewage, cooling water, and fire control water), atmospheric emissions, and solid wastes including food and other non-hazardous waste, which are outlined in Section 2.9.3 of the EIS.

The discharge of drill cuttings represents one of the primary potential interactions with benthic habitats during offshore drilling programs. The potential effects of drill cuttings deposition include: seabed disturbance (burial and smothering), chemical toxicity, and bioaccumulation (uptake of contaminants by fish and the presence or perception of taint). To mitigate such effects, treatment and discharge of drill cuttings will be in accordance with the *Offshore Waste Treatment Guidelines* (OWTG) (NEB et al 2010) and the *International Convention for the Prevention of Pollution from Ships* (MARPOL). In addition, chemicals used in drilling muds will be selected in accordance with the *Offshore Chemical Selection Guidelines for Drilling & Production Activities on Frontier Lands* (NEB et al 2009).

Cuttings dispersion modelling was conducted as part of the EIS, which incorporated predicted no effect thresholds (PNETs) of 6.5 mm and 1.5 mm. As mentioned in Section 2.5.2.1, pre-drill coral and sponge surveys will be completed prior to drilling, and mitigation measures will be implemented if identified by the risk assessment. Where there is a predicted deposition of greater than/equal to the PNET and benthic habitats are present, a setback will be maintained to ensure a safe distance from cutting deposition, as described in Section 8.3.4 of the EIS.

Waste liquids will be treated as required and discharged in accordance with the OWTG (NEB et al 2010) and MARPOL, thereby reducing any potential effects on the marine environment. Bilge and deck drainage water that contact drilling installations or equipment may become contaminated with oil. The bilge and drainage water will be treated prior to discharge (e.g., oil-water separator). Grey water from the galley, washing and laundry facilities and black water from accommodations will be macerated prior to discharge. Although discharges of organic wastes may lead to localized organic enrichment, no adverse effects are anticipated as volumes would be quite small at each drill site.

As mentioned above, the primary interactions from the discharge of drill cuttings may include: cuttings deposition and potential seabed disturbance (smothering habitat); chemical toxicity; and bioaccumulation (uptake of contaminants by fish and the presence or perception of taint). The effects of exploration drilling on invertebrate density and diversity were confined to the extent of the cuttings pile itself. Once drilling commences, WBM cuttings will be discharged and SBM cuttings will be returned to the drilling installation for recovery and reuse or treatment and discharge. Drilling cuttings will be managed in accordance with the OWTG (NEB et al 2010). This activity is considered to have low adverse effects within the Project Area all of which will be reversible with eventual recovery and recolonization of the area.

Due to the presence of high currents, cuttings piles are more likely to disperse in a shorter timeframe. Bottom currents will likely further aid in cuttings dispersion in this area, reducing potential for long term effects due to burial by sediments. As discussed, these special areas are also at depths of 500 m to 1,800 m, which may be distant from the location of deposition. As some of the special areas are characterized deep-sea cold-water organisms that are generally slow growing and long lived, recovery after disturbance may take a decade or more. As discussed, drill cuttings sedimentation is estimated to be relatively low for this Project. This, combined with mitigation to reduce potential effects on corals/sponges, indicates limited effects on these special areas.

As mentioned above, the Seabird Foraging Zone in the Southern Labrador Sea is an important area for seabirds, however, only a minor portion of this area overlaps with EL 1139. Drilling wastes discussed above will be released near the seafloor, and will be far below the maximum diving range of any seabird, and therefore will not interact with marine-associated birds and their habitats. The deepest-diving seabirds found in the Project Area rarely reach depths of 200 m. In addition, and discussed above, chemicals used for drilling muds will be screened as per the *Offshore Chemical Selection Guidelines for Drilling & Production Activities on Frontier Lands* (NEB et al 2009).

Atmospheric emissions associated with the Project include exhaust from power and heat generation from drilling installations, and from vessels and aircraft traffic. It is unlikely that such emissions will have any measurable effect on marine and migratory birds, as the emissions will be within regulatory standards, transient in nature, and short-term at one location. Atmospheric emissions are not anticipated to have an effect on corals and sponges due to distance to the seafloor.

In summary, the predicted environmental effects of drilling and associated marine discharges on special areas identified for sensitive benthic habitats are primarily related to potential sedimentation and burial of benthic species, however, as discussed above and in Section 2.5.2.1, pre-drill coral and sponge surveys will be completed and mitigation measures, if feasible, will be implemented prior to drilling (e.g., relocating wellsite, using a cuttings transport system) if identified by the risk assessment. The predicted environmental effects on the Seabird Foraging Zone in the Southern Labrador Sea are primarily related to release of organic wastes. These effects are predicated to be adverse, low in magnitude, localized and certainly within the Project Area, short to long term in duration, occurring sporadically to regularly and reversible, with these predictions being made with a moderate to high level of confidence. With the implementation of appropriate mitigation measures, the overall magnitude of the effect of drilling and other marine discharges on these special areas is anticipated to be low.

Formation Flow Testing with Flaring

As described in Section 2.5.2 of the EIS and the response to IR-06, formation flow tests can be undertaken with or without flaring, depending on the type of data required. The amount of produced water potentially encountered during exploration drilling is typically minor and will either be sent to flare, treated for disposal in accordance with the OWTG, or shipped to shore; this is also discussed in the response to IR-12. For this Project, flaring is not required for routine operations and will only be carried out if a formation flow test with flaring is required, however, as mentioned in the response to IR-06, formation flow test can be completed without flaring, however, it depends on the data required. As outlined in Section 2.5.2.4 of the EIS, it is estimated that five to six wells over the duration of the Project (i.e., 10-12 years) may require a formation flow test. Typical tests with flaring may include up to three days of flaring, however, depending on data requirements, an extended test could last up to 5 days.

Formation flow tests with flaring will be short-term (i.e., five to six tests over the 10-12 year Project, and lasting a maximum of 5 days). Therefore, light emissions associated with formation flow test with flaring are considered low. Atmospheric emissions may be released as a result of formation flow testing with flaring with overall low effects due to the infrequent and short durations. Furthermore, emissions levels will adhere to relevant legislation and regulations discussed in Section 2.9.1 of the EIS. Although it may add to the overall lighting levels and air emissions from the drilling installation during periods of flaring activity, this activity is not expected to interact with special areas for benthic habitats due to distance to the seafloor.

The effects of flaring on the Seabird Foraging Zone in the Southern Labrador Sea will be mainly related to particular types of marine and migratory birds. Nocturnal migrants, and night-flying seabirds such as Leach's storm-petrels, which are common in the Seabird Foraging Zone, are the migratory birds most at risk of attraction to flares. As outlined in Section 9.6 of the EIS, ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) will obtain *Seabird Handling Permits* from Environment and Climate Change Canada – Canadian Wildlife Services (ECCC-CWS) and regular searches for stranded and/or deceased birds will be undertaken. This information is reported to the ECCC-CWS through an annual report, which is a requirement under the *Seabird Handling Permit*. As outlined in Section 9.3.5 of the EIS, various studies in offshore Newfoundland and the North Sea have shown that though birds approach flares, mortality is low.

Mitigation measures for flaring will be adhered to throughout the Project, and are outlined in Section 9.3.2 of the EIS. The Operators are required to notify the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) if a formation flow test will be conducted. The C-NLOPB then consults with ECCC-CWS to determine a safe timeline to proceed to minimise effects on migrating birds. The effects of formation flow testing with flaring on marine associated birds are therefore anticipated to be negligible.

In summary, the predicted environmental effects of formation flow testing with flaring on special areas are primarily related to light and atmospheric emissions. Sensitive benthic habits are not anticipated to be adversely affected by light and atmospheric emissions due to distance to the seafloor. However, light and atmospheric emissions have the potential to affect marine and migratory birds (e.g., attraction of birds to flares which may result in injury or mortality). Effects to marine and migratory birds are predicted to be adverse, low in magnitude, localized within the Project Area, short term duration, occurring sporadically and reversible, with these predictions being made with a moderate to high level of confidence.

Wellhead Decommissioning

As outlined in Section 2.5.2.7 of the EIS, when drilling of a well is complete the well may be suspended or abandoned as per the requirements in the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (Government of Canada 2014). Well suspension and abandonment involves the isolation of the wellbore by placing cement plugs and/or mechanical devices, at various depths. In addition to the information in the EIS, the responses to IR-03 and IR-04 contain additional information regarding wellhead decommissioning.

The Operators have also developed a wellhead removal strategy, which is outlined in Section 2.5.2.7 of the EIS, and discussed below.

Wellhead removal in water depths less than 500 m uses conventional wellhead removal methods, which result in minimal environmental disturbance, given the localized and short-term (likely 1 to 2 days) nature of these activities. Wellhead removal will use an internal cutting tool and therefore will occur within the wellhead itself. Special areas identified for benthic habitats are typically at a minimum of 500 m below the water surface, therefore disturbance will likely not occur.

Wellhead removal in water depths between 500 m and 1,500 m are typically cut using remotely operated vehicles (ROVs). A portion of the casing (maximum of 0.85 m) may be left above the seafloor. ROVs have little effects on the environment as there is no additional disturbance of the seabed associated with this activity. In addition, ROVs can avoid areas containing sensitive benthic habitats. Although wellhead cutting may produce some noise emissions that result in temporary avoidance of the area by noise-sensitive fish occurring on or close to the seabed, such effect may be minimized by previous avoidance of the area by noise-sensitive species during the overall drilling phase. These disturbances would again be localized and short term in nature, and the type and level of underwater noise or other environmental disturbances will be negligible.

In water depths greater than 1,500 m, wellheads will remain in place and will not be removed. Wellheads that are not removed, or only partially removed as mentioned above, may provide localized increased habitat structure in a relatively barren and soft bottom habitat. Deep-sea habitats are generally limited by available areas for corals and sponges to colonize and wellhead structures may provide a stepping stone for range expansion. Within the Project Area, colonization of subsea infrastructure would likely be faster in the special areas in the Flemish Pass and slopes of the Flemish Cap where there are relatively higher concentrations coral and sponge species.

In summary, the predicted environmental effects of wellhead decommissioning are primarily related to subsurface operation of ROVs and are not anticipated to affect benthic habitats as ROVs have the ability to avoid areas of corals and sponges. Due to this activity occurring on the seafloor, it is not anticipated to have an effect on the Seabird Foraging Zone in the Southern Labrador Sea. These effects are predicted to be adverse, negligible to low in magnitude, localized, short term duration, occurring sporadically and reversible, with these predictions being made with a high level of confidence.

Geohazard/Wellsite and Vertical Seismic Profile Surveys

Wellsite/geohazard surveys are used to identify unstable areas beneath the seafloor (e.g., shallow gas deposits) and hazards (e.g., large boulders, debris) so as to avoid these hazards when drilling. These surveys may involve mapping of the seabed through the use of multibeam echo sounder, side scan sonar, video and other non-invasive equipment.

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 in the wellbore using hydrophones inside the wellbore and a sound source near the surface or near the well. VSP is smaller in size and volume, and duration, compared to a surface geophysical survey.

The possible effects from underwater noise in the marine environment by marine fish species may be behavioural (avoidance, other changes in distribution or activities) or involve injury to or mortality of individual fish though these effects are typically not experienced more than several metres from the source. Although overall knowledge and understanding of the effects of geophysical and other noises on marine fish and invertebrates are incomplete in some areas, the effects of geophysical activities and other noise sources have been documented in a variety of fish and invertebrate species in numerous studies. Although a variety of physiological and behavioural responses by marine fish to sound from geophysical surveys have been reported, studies indicate that such effects vary by species, life stage, intensity of sound, distance from geophysical source and other factors.

Operational procedures, such as the use of a gradual “ramp-up” or soft-start procedure over a minimum period allows mobile marine species to move away from the area if they are disturbed by the underwater sound levels associated with the geophysical survey, will be implemented for this Project. This will help to further avoid fish injury or morality, as will the planned shut-down of the sound array (reduction to the smallest source element, firing intermittently) during required maintenance activities. This will also reduce startle effects and resulting stress on fish in the nearby area. These, along with the relatively localized and short-term nature of required use of geophysical sound as part of the Project, will reduce potential for fish injury or mortality. While there may be some short-term behavioural effects to individual fish in the immediate vicinity of the survey activity, it is therefore unlikely that fish will be displaced from key habitats or disrupted during key activities over extended areas or periods, or be otherwise affected in a manner that causes negative and detectable effects to fish populations in the region.

Based on available literature, there are no studies that have tested the levels of sound (and especially, underwater noise) that cause injury to marine birds such as those found in the Seabird Foraging Zone in the Southern Labrador Sea special area, although temporary hearing impairment can occur in avifauna that are exposed to sound in air. Studies have found that avian species vary in their susceptibility to hearing damage due to noise exposure, although they are generally more resistant to damage than mammals and evidence suggests that the underwater hearing of birds is poorer than in air. Seabirds are not known to communicate vocally underwater, and a heightened auditory sensitivity in water is thus unlikely to have developed. Available information and previous research suggests that there are no substantial behavioural effects of underwater sound on birds.

Underwater noise from surveys could adversely affect surface-feeding and diving seabirds indirectly, through potential changes in the presence, abundance or concentration of prey and potential displacement from key foraging areas. As significant effects to fish resources are not expected to occur because of the Project, and so changes in the availability, location, or quality of food sources for marine birds are not likely.

These activities will have a short duration (a few days to weeks), and those which involve contact with the seabed will have a small footprint, well below the maximum diving depths of any bird found in the Project Area. These surveys will typically be conducted opportunistically from support/supply vessels or in some cases may require the use of dedicated vessels and equipment. In either case, the associated potential for negative interactions from these activities will be negligible. No change in mortality or injury levels, or to avifauna presence and abundance, is therefore anticipated. Changes in habitat and food availability and quantity from these surveys are likewise not anticipated because the activity will be extremely localized and short-term, with negligible environmental interactions.

In summary, the predicted environmental effects of the above describes surveys on special areas such as benthic habitats are primarily related to noise. These effects are predicted to be adverse, negligible to low in magnitude, occurring within the Project Area, short-term in duration, occurring sporadically and being reversible, with these predictions being made with a high level of confidence.

Geological, Geotechnical and Environmental Surveys

Geological, geotechnical, environmental, and other marine survey activities will also be conducted within the Project Area. Most of these planned and potential marine survey activities will not result in physical contact with the seabed, and will therefore not directly interact with or disturb benthic species or their habitats and thus not have an adverse effect on such special areas. Any underwater noise or light emissions associated with this equipment would be negligible, localized and short term, and thus would have little or no attraction or avoidance effects on fish species. Although seabed samples may also be acquired using the required equipment, these activities likewise have a short duration, and those which involve contact with the seabed will have a small footprint. ROVs are also capable of avoiding known areas of corals/sponges.

These activities will have a short duration (a few days to weeks), and any with bottom contact would be well below the maximum diving depths of any bird found in the Project Area. These surveys will typically be conducted opportunistically from support/supply vessels or in some cases may require the use of dedicated vessels and equipment. In either case, the associated potential for negative interactions with the Seabird Foraging Zone in the Southern Labrador Sea will be negligible. No change in mortality or injury levels, or to avifauna presence and abundance, is anticipated. Changes in habitat and food availability and quantity from these surveys are likewise not anticipated because the activity will be extremely localized and short-term, with negligible environmental interactions.

In summary, the predicted environmental effects of these types of activities are primarily related to ROV operation and associated biological and seabed sampling. Due to ROV being capable of avoiding known areas of corals and sponges, it is not anticipated to adversely affect sensitive benthic habitat. The predicted environmental effects of survey activities are primarily related to noise and light exposure from vessels and these may result in changes in presence and abundance of avifauna, and potentially short-term injury in the Seabird Foraging Zone in the Southern Labrador Sea. These effects are predicted to be adverse, negligible to low in magnitude, localized, short term in duration, occurring sporadically and reversible, with these predictions being made with a high level of confidence.

Supply and Servicing

The Project will involve vessel and aircraft use, including supply and support traffic to, from and within the Project Area at any time of year throughout the Project duration. At the drilling location, support vessels will maintain their location through DP, which will avoid direct interactions with benthic habitats and related special areas but which can also be a source of underwater noise at the drilling location.

The anticipated volume of vessel traffic represents a negligible contribution to the overall vessel traffic offshore Newfoundland, and Project-related supply vessel traffic will use existing and established routes wherever possible. Given the nature and frequency of required aircraft support to the active drilling installations (refer to Section 2.5.2 of the EIS), and the planned avoidance of low level flights wherever possible, no adverse environmental effects on fish and fish habitat are anticipated to result from these activities.

Marine traffic may affect seabirds through lighting, noise and other associated environmental emissions and discharges. The various bird species that occupy the Seabird Foraging Zone in the Southern Labrador Sea will not likely be disturbed by Project-related vessel activity or associated aircraft use, due to its transitory nature and thus, its short-term presence at any one location, and because it is generally in keeping with the overall marine traffic that has occurred throughout the region for years. In addition to vessel traffic, the Project will require helicopter use within the Project Area at various times of year throughout its duration. The primary interaction associated with helicopter use is the possible disturbance effects of aircraft overflights on birds. These include a possible temporary loss of useable habitat and increased energy expenditure of birds due to escape reactions, increased heart rate, and lower food intake due to interruptions. Helicopter noise can disturb nesting seabirds at colonies, although seabird reactions to helicopters and other aircraft depend on various factors including species, previous exposure levels, and the location, altitude, and number of flights. In terms of behavioural effects of helicopter noise on birds, flushing of breeding birds from the nest in response to loud noises is perhaps the most obvious and can have immediate adverse consequences including predation of eggs and chicks and decreased incubation and brooding. Nestlings may also be vulnerable to exposure, and adults may inadvertently knock eggs and flightless young from the nest, which is of concern for cliff- nesting species. Other behavioural effects may include reduced foraging and provisioning rates. Noise may also deter birds from favourable habitats and may alter migration paths, resulting in greater energy expenditure. Research has shown that overt behavioural responses in response to aircraft traffic, such as flushing, may occur at a distance of 366 m for common murres, although there is inherent variability in behavioural responses between and even within species.

Overall, interactions between Project-related supply and servicing activities and bird species are anticipated to be minor due to the localized, short-term, and mobile (transitory) nature of these activities, and because it is generally in keeping with the overall marine traffic that has occurred throughout the region for years. Vessel traffic for supply and servicing of the drilling installations represents a negligible contribution to the overall vessel traffic offshore Newfoundland, and Project-related supply vessel traffic will use existing and established routes wherever possible. Helicopters will be used for crew transfers and other purposes as required, but these are anticipated to be infrequent. Helicopters will avoid coastal seabird colonies during the nesting season as per the *Seabird Ecological Reserve Regulations, 2015* (Government of Newfoundland and Labrador 2015).

Negative interactions with and effects on coastal breeding colonies and IBAs are also unlikely. In accordance with standard practices, vessels will transit in a straight line approach from port, unless the presence of pack ice or other environmental phenomena requires routes to be altered, and the helicopter routes that will be used have been commonly used by the offshore oil and gas industry over the past 20 years. Therefore, the amount of time these vessels are near coastal habitats will be reduced. The amount of helicopter traffic will be reduced to the lowest level practical for the Project, and low-level aircraft operations will be avoided, as appropriate. Known and observed bird colonies, large aggregations of avifauna, critical habitats and protected or sensitive areas and times will also be avoided wherever possible. This includes avoidance of helicopter use near seabird breeding colonies during the period from May 1st to August 31st (with an end-date of September 30th for Northern Gannet Colonies).

During Project operations offshore, regular searches of vessel decks will be undertaken and accepted protocols for the collection and release of birds that become stranded will be implemented by qualified and experienced personnel, in accordance with applicable regulatory guidance and requirements and the *Seabird Handling Permit*.

In summary, the predicted environmental effects of Project-related supply and servicing on special areas are primarily related to potential disturbance from marine vessel and aircraft noise. This activity is not anticipated to affect sensitive benthic habitat due to the distance to the seafloor. Effects from vessels and aircraft associated with marine and migratory birds are predicted to be adverse, low in magnitude, localized, short term in duration, occurring regularly and reversible, with these predictions being made with a high level of confidence.

Conclusion

In terms of the various special areas that overlap with the Project Area and potential vessel and aircraft traffic routes, the overall and defining physical, biological, and socio-economic environments within these areas will not be adversely affected by the Project. Many of the offshore activities and associated disturbances that will occur as a result of this Project will be relatively localized and of a short-term nature at a specific location, and the implementation of the various mitigation measures outlined throughout this EIS will reduce direct or indirect potential effects on the existing environmental characteristics and conditions of these special areas.

In consideration of the present knowledge of special areas within the Project Area the predicted effects on sensitive benthic habitat and marine and migratory birds are considered to be not significant. Oil and gas exploration activities such as those being proposed as part of this Project are not prohibited within special areas that overlap with the Project Area or planned vessel and aircraft traffic routes. For the special areas that do overlap or otherwise interact with planned Project activities and emissions, the overall and defining physical, biological, and socioeconomic environments within these areas will not be adversely affected by the Project. As described and summarized above, the Project is therefore not likely to result in significant adverse residual environmental effects on special areas.

Part 2: Explain how significance criteria ratings were assigned to the potential for a worst-case accidental event on sensitive areas (including potential for accident to occur in a sensitive area). Provide a single determination of significance of effects of worst-case accidental events on special areas.

In the EIS, the Determination of Significance for special areas was a combination of the anticipated environmental effects of accidental events from the preceding biological VC chapters in which the worst-case scenario was anticipated to be the result of a potential subsurface blowout on marine birds. When the EIS was submitted, all identified seabird habitats were near the coastline and the modelling showed no or limited effects and over a longer period of time within which any spill could be addressed. After the EIS was submitted additional and revised special areas were identified including the UN Convention on Biological Diversity Seabird Foraging Zone in the Southern Labrador Sea, which intersects with the area that would be affected most immediately and with the highest oil concentrations especially from a winter subsurface blowout in the Northern Flemish Pass modelling scenario. A single Determination of Significance, based on the worst-case scenario and in light of an adjacent special area for marine birds, is presented below.

In consideration of the present knowledge of special areas within the regional study area (RSA) (some of which have been identified based on the presence of important habitats including seabird overwintering areas), the known effects of oil spills, the result of spill modelling exercises, and planned mitigation, the predicted residual environmental effects from an accidental subsurface blowout event scenario on special areas is considered to be significant depending on the specific occurrence and nature and degree of the event, recognizing that such events are extremely unlikely to occur.

In the unlikely event of an offshore oil release, some degree of residual adverse effects to special areas that are within or near the zone of influence of the spill are expected. The degree of exposure and thus the type and level of any such effects would depend on the type and size of spill, time of year, the location relative to special areas (especially those that include important marine bird habitats) and other factors such as the numbers and types of species present during such an event. For the subsurface blowout scenarios, environmental effects could be significant if they lead to a change in key characteristics and processes for which a special area is defined and valued by society. Although there is the potential for effects on these special areas and their associated features these effects are, with appropriate mitigations, not likely to result in an overall, adverse change in one or more of the important and defining ecological and socio-cultural characteristics of such an area, resulting in a decrease in its integrity, value or use over the long term. Spill prevention techniques and response strategies will be incorporated into the design and operations for all Project activities as part of contingency planning, which will further help to ensure that such events do not occur, and in the unlikely event they do, that they will not have significant adverse effects on special areas.

References

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

INFORMATION REQUIREMENT – IR-41

(N/A)

Project Effects Link to CEAA 2012: 5(2)(b)(i) Health and Socio-economic Conditions

Reference to EIS Guidelines: Part 2, Section 6.1.9.2, Human Environment.

Reference to EIS: Section 7.1.3.3, Potential Vessel and Aircraft Traffic Route.

Context and Rationale

Section 7.1.3.3 of the EIS states that while offshore fisheries are mainly snow crab, Northern shrimp, and some groundfish, there are other commercially important species within the vessel support transit routes (local study area (LSA) and/or regional study area (RSA)), including pelagic fisheries (capelin and herring) and coastal shellfish species (urchins, scallops, clams, and whelks). However, information on the value, location and size of harvest was not provided for these fisheries. As illustrated by Figure 7-27 (Fixed Gear Domestic Harvesting Locations, All Species, 2011–2015), and Figure 7-28 (Mobile Gear Domestic Harvesting Locations, All Species, 2011–2015), depending on locations of transit routes, there may be potential for interaction between support vessels and commercial fisheries.

Specific Question or Information Requirement

Conduct an assessment of potential interactions between commercial fisheries that may be operating within transit routes and vessel traffic. Update proposed mitigation and follow-up and effects predictions, as applicable.

Response

A description of the commercial fisheries for snow crab, northern shrimp, and multiple groundfish species was provided in Section 7.1 of the Environmental Impact Statement (EIS), as they are the predominant species being commercially harvested offshore, and within the Project Area and Regional Study Area (RSA). Other species harvested commercially, such as capelin, herring, and other molluscs and crustaceans were included to provide a general context of other commercial fisheries that occur in the waters off Newfoundland. These fisheries are smaller in scale compared to those for crab, shrimp, and groundfish, and information on timing, size, and location of harvest is limited due to confidentiality policies that Fisheries and Oceans Canada (DFO) has in place to protect the identity and sensitive information of commercial fish harvesters who operate in such fisheries. In instances where there are a low number of harvesters for a specific species, a low number of licences to fish in a certain area, or a low number of buyers for the catch, DFO will suppress the data as per the confidentiality policies.

An assessment of potential interactions between commercial fisheries that may be operating within supply vessel transit routes and vessel traffic was conducted in Section 13.3.7 of the EIS, where the potential effects of supply vessels and servicing are assessed. The potential interactions are similar to interactions that would occur in the Project Area, primarily through potential for direct interference and damage to some types of fishing gear as a result of supply vessel transits. The highest potential for an interaction is related to fixed fishing gear (such as crab pot moorings used in the snow crab fishery) which was assessed. Fixed gear is primarily undertaken between the Project Area and St. John's Harbour (Figures 7-27 and 7-28 of the EIS); the potential effects of interactions with supply vessel traffic are presented in Section 13.3.7 of the EIS. The potential for interaction with the referenced fisheries (i.e., capelin, herring, urchins, scallops, clams, and whelks) is low because these fisheries do not use fixed gear. Regardless of this, the proposed mitigation measures provided in Section 13.3.2 of the EIS will apply to both fixed gear and mobile gear commercial fisheries, further reducing the potential effects.

The mitigation measures discussed in the effects assessment, specifically those regarding timely and ongoing communication with the commercial fishing industry, issuance of Notices to Shipping and Mariners, and the implementation of a compensation program for gear damage, are applicable to commercial fisheries occurring along potential vessel transit routes, including the referenced fisheries, as the interactions between supply vessels and commercial fish harvesters are the same within the Project Area and along the proposed transit routes.

The effects predictions described in Section 13.3.7 and 13.4 of the EIS apply to commercial fisheries that may be operating along the transit routes remain valid.

References

N/A

INFORMATION REQUIREMENT – IR-42

Project Effects Link to CEAA 2012: 5(2)(b)(i) Health and Socio-economic Conditions.

Reference to EIS Guidelines: Part 2, Section 6.3.8.2, Commercial Fisheries.

Reference to EIS: Section 13.3.5 Wellhead Decommissioning.

Context and Rationale

In the discussion of the wellhead decommissioning, the EIS states that in 2016, following consultation with fishery stakeholders, Statoil cut and removed four wellheads in the Project area; the height of the pipe remaining after wellhead removal ranged from 0.05 to 0.65 metres.

Section 13.3.5 indicates that planned wellhead removal in shallower areas, such as those found in the Project Area – Southern Section may take place within the safety zone, upon the completion of drilling and testing, and so no interactions with commercial fishing activity are expected. However, it also indicates that wellhead removal may take place at a later date, and would result in a short-term (i.e., few days) safety zone. It is unclear why the wellhead removal may occur later, and how much time could lapse before the wellhead is removed. Additional information is also required with respect to any concerns associated with commercial fisheries access if the wellhead is not removed immediately following drilling/testing.

Specific Question or Information Requirement

Provide clarification and additional information related to wellhead removal if it may be carried out at a later date. Describe possible timeline of wellhead removal if it is not completed immediately, the need for presence of a safety zone prior to wellhead removal, and potential reasons for delaying wellhead removal.

Provide an analysis of the potential effects of leaving wellheads in place for a period of time prior to removing them, with consideration of specific ELs under consideration and various water depths. The analysis should include information (statistics if available) on whether there has been damage to fishing gear in Atlantic Canada or elsewhere due to the presence of wellheads awaiting removal. It should also include information on whether there have previously been concerns raised by the fishing industry following the notification of the wellheads that were temporarily left in place.

Response

As outlined in Section 2.5.2.7 of the Environmental Impact Statement (EIS), there are circumstances where a wellhead may be left for 1 or 2 years (and possibly longer). The reason for this are outlined below.

In deep water, wellheads are typically:

- Larger in size than shallow water wells (36” outside diameter [OD] versus 30” OD);
- Thicker than shallow water wells (2” thick rather than 1” thick); and
- Higher strength than shallow water wells (80 kilopounds per square inch [ksi] versus 56 ksi).

The duration the wellhead is left in place is based on two main factors:

1) The availability of the remotely operated vehicle (ROV) vessel, light invention vessel (LIV) or inspection, maintenance and repair (IMR) vessel and cutting equipment. Vessels capable of working at deep-water locations and with the equipment required are not always readily available and require some procurement and mobilization time.
2) The time of year the well was drilled. The vessels have limited weather operational windows meaning that the summer season is most efficient and safest time to perform the operation.

During operations offshore, the drilling installation or vessel performing the work would maintain a safety zone as described in Section 13.3.3 of the EIS.

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) will provide locations for each decommissioned well to the Canadian Hydrographic Service (CHS). CHS will then issue a *Notice to Shipping* or *Notice to Mariners*, depending on the circumstances. If a potential hazard is temporary and is expected to be present for less than 6 months then CHS will issue a *Notice to Shipping* (DFO 2017). However, if a potential hazard is temporary and expected to be present for more than 6 months, or permanent, then CHS will issue a *Notice to Mariners* (DFO 2017).

The Operators are not aware of any issues regarding wellheads left in place in the offshore Newfoundland.

Section 13.3.5 of the EIS addresses the potential effects of wellhead removal on the fishing industry. The delay in wellhead removal described does not change the effects assessment; the effects of the planned wellhead decommissioning strategy will be of low magnitude, limited extent, and of long-term duration.

References

DFO (Fisheries and Oceans Canada). 2017. Explanatory Note Regarding CHS Temporary and Preliminary Notices to Mariners (NOTMAR) Practice. Available online: http://www.charts.gc.ca/help-aide/notice-avis/2013/2013-10-17-eng.asp. Accessed May 2018.

INFORMATION REQUIREMENT – IR-43

(DFO-10)

Project Effects Link to CEAA 2012: 5(1)(c)(iii) Current Use of Lands and Resources for Traditional Purposes by Aboriginal Groups.

Reference to EIS Guidelines: Part 2, Section 6.1.8, Indigenous Peoples.

Reference to EIS: Section 7.3.1.5, Miawpukek First Nation.

Context and Rationale

The EIS Report notes that, "Miawpukek First Nation holds nine enterprises that permit access to 3KL. They hold three tuna commercial-communal licences that permit access to 3LN." DFO has advised that the Miawpukek First Nation holds fifteen enterprises that permit access to 3KL and six tuna commercial-communal licences that permit access to 3LN.

Specific Question or Information Requirement

Correct the information regarding the number of licences held by the Miawpukek First Nation. Based on the updated information provided by DFO, update the effects analysis, proposed mitigation and follow-up, as well as effects predictions accordingly.

Response

During the preparation of the Environmental Impact Statement (EIS), ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) engaged with the Miawpukek First Nation (MFN) to inform the community of the Projects and to gain information regarding their commercial-communal licences that may overlap with the Project Area. Table 3.6 in Section 3.3.4.4 of the EIS provides an overview of engagement activities with the MFN up to 21-Oct-2017, however, it is noted that the Operators continue engage with the MFN. A summary of that engagement is provided:

- 11-Jul-2016: MFN and Equinor had a phone discussion regarding commercial fishing license, as well as other aspects of the Project (i.e., current activities and engagement in the environmental assessment [EA] process). MFN indicated that their fishing license overlap with the Project Area, however, no fishing currently occurs in the area.
- 10-Feb-2017: MFN and Equinor had a phone discussion and MFN indicated that they had no commercial fishing interested in the Project area.
- 07-Mar-2017: MFN provided an email to Equinor that confirmed that they do not have commercial fishing activity in the Project, and therefore do not have any concerns (MacDonald, S. [2017, March 7]. Email communication).

The information provided in the EIS regarding the number of enterprises and commercial-communal tuna licences held by the MFN, were provided by the MFN. The Operators acknowledge the information provided by Fisheries and Oceans Canada (DFO) in the context and rationale associated with this Information Requirement (IR), however, taking into consideration the change in enterprises and commercial communal licenses, with the implementation of migrations outlined in the EIS for commercial fisheries (Section 13.3.2), the effects assessment remains valid.

References

MacDonald, S. 2017, March 7. Email communication.

INFORMATION REQUIREMENT – IR-44

(C-NLOPB-5: Statoil/-6: ExxonMobil)

Project Effects Link to CEAA 2012: Multiple VCs – Accident and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.4, Mitigation Measures.

Reference to EIS: Section 15.1.2.3.2 /15.1.2.2.2, Response Contractors and Agencies.

Context and Rationale

The EIS states that, in the event of a spill, the proponent may use Eastern Canada Response Corporation (ECRC) expertise and equipment. The C-NLOPB has advised that ECRC may be limited in their ability to respond outside the 200 nm Exclusive Economic Zone (EEZ).

Specific Question or Information Requirement

Confirm that organizations (such as ECRC) whose equipment and expertise may be used in case of a spill would have the ability to respond outside of the 200 nm EEZ. Update the discussion of responses to accidental events, taking into account any potential situation in which ECRC or alternative contractor is not able to respond.

Response

All Equinor Canada Ltd. (Equinor) licenses are outside the 200 nautical mile (NM) exclusive economic zone (EEZ), as illustrated in Figure 1-1 in the Environmental Impact Statement (EIS). As detailed in the Schedule of Wells on the Canada – Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) website (C-NLOPB 2018), Equinor has executed drilling activities since 2008; all but one of which were outside the 200 NM EEZ. ExxonMobil Canada Ltd. (ExxonMobil) has not completed recent exploration drilling activities outside the 200 NM EEZ, but did operate through its affiliate, Esso, three wells outside the 200 NM EEZ between 1979 to 1986.

Prior to drilling activities commencing, operators are required to obtain an *Operations Authorization* (OA) from the C-NLOPB. An Oil Spill Response Plan (OSRP) is one of the documents required to be submitted to the C-NLOPB to obtain an OA.

Equinor has a number of related contractual arrangements established to ensure a full Tier 2 oil spill response (OSR) capability, within the Canada EEZ and on the high seas on the outer Canadian continental shelf (outside of the EEZ). It is acknowledged that the Geographic Area of Responsibility for Eastern Canada Response Corporation (ECRC) (as a Transport Canada approved Response Organization under the *Canada Shipping Act* [Government of Canada 2001]) precludes ECRC sub-contracted personnel and ECRC owned equipment from mobilizing for spills originating outside of Canada's EEZ, unless specifically authorized by Transport Canada to do so. To ensure an equivalent, or better, Tier 2 OSR capability, Equinor has the contractual arrangements outlined in the following paragraph in place (note: these same arrangements have been in place for previous Equinor Operated Drilling programs in Offshore Newfoundland).

In addition to the current valid Subscription Agreement with ECRC (Ref: E004-00036), Equinor has made specific arrangements for contractual access to Production Operator owned Tier 2 OSR equipment (contractual arrangement with Grand Banks Production Operators – Suncor, Husky and Hibernia Management Development Company) and ECRC qualified sub-contractors for deploying and operating this equipment. The onshore command post-spill response management by ECRC is unaffected by the location of the spill (inside or outside of the EEZ), however specific arrangements are in place for both the mobilization of equipment and personnel to the locations outside of the EEZ. With respect to equipment, Equinor has an operator sharing agreement in place for the Grand Banks Production Operators). Under this agreement, ECRC maintains and stores this Operator owned equipment without any limitations associated with the *Canada Shipping Act* (Government of Canada 2001) for location of use. The support vessels used to deploy the equipment would be under direct contract to Equinor and are not limited by any aspect of the *Canada Shipping Act* (Government of Canada 2001) or spill location. With respect to the offshore ECRC 'pool of resources', ECRC utilizes qualified sub-contractors as Supervisors on the Operator provided vessels to deploy and supervise the use of Operator owned Tier 2 equipment, with the assistance of the vessel crews. These same sub-contractors, as used by ECRC, are contracted through a third-party arrangement (not directly through ECRC) so that they may be deployed outside of the EEZ, without limitations. The management by ECRC is the same, however their approved and qualified sub-contractors are sub-contacted to Equinor via an alternate third-party. The process is seamless, and in practical terms would achieve the same outcomes as if the spill originated within the EEZ. Please note that Equinor has a separate contract in place with ECRC for training of vessel crews for Tier 1 OSR, again using Operator owned equipment maintained on each vessel.

OSRPs will be prepared for the OAs associated with any future exploration drilling activities executed by the Operators. The OSRPs will outline the arrangements made to utilize ECRC's pool of contracted resources outside of the 200 NM EEZ. ECRC maintains Operator owned Tier 2 Spill Response Equipment which is not limited by the constraints of the *Canada Shipping Act* (Government of Canada 2001) with the EEZ of Canada.

As mentioned above, arrangements have been made with ECRC for past offshore exploration activities to provide spill response resources and services, if required, outside the 200 NM EEZ, and similar arrangements will be secured for future offshore activities. The Operators can also draw on resources from other operators via the Grand Banks Mutual Emergency Assistance Agreement, CCG Environmental Emergencies Branch and Oil Spill Response Limited (OSRL). Based on these numerous response options there is no requirement to update Section 15 of the EIS.

References

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2018. Schedule of Wells. Available online: http://www.cnlopb.ca/wells/. Accessed March 2018.

Government of Canada. 2001. Canada Shipping Act, 2001. S.C. 2001, c. 26. Published by the Minister of Justice. Current to April 24, 2018. Last Amended December 12, 2017. Available online: http://laws-lois.justice.gc.ca/PDF/C-10.15.pdf

INFORMATION REQUIREMENT – IR-45

(ECCC-12)

Project Effects Link to CEAA 2012: 5(1)(a)(iii) Migratory Birds.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.1.2.3.6, Oiled Wildlife Response.

Context and Rationale

Though the suggested three-tiered oiled wildlife response approach is adequate, ECCC has recommended that it be expanded so that it can handle accidents broader than its current focus on oiled wildlife.

Specific Question or Information Requirement

In addition to current commitments, confirm the primary responses would include (i) surveillance to *identify migratory birds potentially at risk of being affected by incident*; and (ii) *removal of oil* (as well as deflecting it away from areas of high sensitivity).

In addition to current commitments, state whether tertiary response would also include: *removal and storage of deceased oiled wildlife*.

If these commitments would not be included in the oiled wildlife response approach provide a rational on why it is not deemed necessary.

Response

Spill response and response to oiled seabirds will be as described in the oil spill response plans (OSRPs) developed by ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) required for the *Operations Authorization* (OA) application, which is submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) for review and approval. Surveillance for migratory seabirds having the potential to be impacted by an incident will be conducted from standby/supply vessels in the field and aerial surveillance.

With respect to oiled seabirds that are collected in a live and weakened condition, they will be handled in accordance with the conditions outlined on the Environment and Climate Change Canada (ECCC) Canadian Wildlife Services (CWS) *Seabird Handling Permit* and in consultation with CWS and a wildlife response contractor. The storage and handling procedures described in *The Leach's Storm-Petrel: General Information and Handling Instructions* will also be adhered to.

Oiled seabirds that can be readily, and safely, collected will be approached. Oiled and deceased wildlife observed in the water at site offshore or while in route to or from the Project Area will be collected from the water when weather and safety conditions permit and provided to CWS.

All reporting and handling protocols for project interaction with seabirds will be included as part of the Operators OA which will be approved by the C-NLOPB prior to drilling. Notification and shipment of oiled birds will be completed in accordance with conditions in the *Seabird Handling Permit*. The cleaning of oiled seabirds must be conducted by skilled responders. Any process utilized for cleaning birds will be based on the guidelines established by the CWS for the establishment and operation of a treatment facility for oiled birds.

The following wildlife monitoring activities will be undertaken in the event of an offshore spill:

- Downwind aerial and vessel surveillance in advance of the drifting slick to identify seabirds and mammals at risk.
- Employment of bird hazing techniques to deter seabirds from the affected area, using vessels, aircraft, and noise making devices.
- Recovery, evaluation and appropriate treatment for affected seabirds and delivery of birds to a central location for shipment to shore, and then to CWS.

Wildlife deterrent techniques can be used to encourage wildlife to move from, or avoid, locations that are in the projected pathway of the spill. All deterrent techniques will be determined in consultation with CWS.

Hazing techniques can also be used to deter wildlife from entering into spill areas. Hazing should be carefully planned and executed, with guidance from CWS, since hazed wildlife could move into other areas of the spill.

Potential hazing techniques include:

- Noise, including pyrotechnics, shotgun or pistol-launched projectiles, air horns, motorized equipment, and recorded bird alarm sounds.
- Scare devices, including deployment of Mylar tape, helium-filled balloons, and scarecrows (either human or predator effigies) on affected beaches.
- Herding wildlife using aircraft, boats, or other vehicles.
- Hazing by human presence.

Deterrent programs should consider the potential effects of human activity and disturbance on sensitive habitats and species. Disturbance of breeding areas should be avoided if possible.

Oil removal from the ocean would be conducted as conditions allow using the tiered response approach. In the open ocean deflection of oil would be extremely limited. Deflection could be used in coastal areas as conditions allow.

References

N/A

INFORMATION REQUIREMENT – IR-46

(C-NLOPB-7 and -8)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.3.2.2, Probability of Blowouts.

Context and Rationale

The EIS mentions two blowouts: the 1979 Ixtoc I well blowout and the DWH spill (2010 Macondo MC252 well blowout). The August 21, 2009 Montara blowout is not included.

Specific Question or Information Requirement

Provide a discussion of the August 21, 2009 Montara blowout and update the discussion of potential accidents and malfunctions accordingly.

Response

The Montarra release occurred in August 2009, when the West Atlas drilling installation resumed operations on a previously drilled well in the Montara oilfield in the Timor Sea, off the northern coast of Western Australia. The drilling installation was operated by PTT Exploration and Production (PTTEP) Australasia. The blowout released as much as 23.5 million litres (L) of light crude oil over 74 days. The Australian Maritime Safety Authority (AMSA) monitored the spill and applied approximately 183,000 L of dispersant to break up and control the spread of the oil. Approximately 10% of the light crude oil was estimated to have been recovered by booming operations when the conditions at sea were favourable.

Several rapid assessments were performed in early October 2009 and these identified high abundance and diversity of birds and sea life in the region, although several oiled birds and dead sea snakes were found. Overall, the lack of carcasses made the assessment of spill effects difficult. Studies of bony fishes taken in the region exhibited increased biomarkers of hydrocarbon exposure that declined with time from the spill as well as distance from the platform.

Oil spill effects in Indonesia were determined from observations and harvest statistics from the District of Rote Ndao which likely received the most oil from the spill. The harvest of seaweed declined 23% in 2009, the year of the spill, and 72% in 2010, the following year. Landing statistics from fisheries in two Southern Indonesia districts experienced dramatic reductions in four species in 2010, but it should also be noted that the harvests had varied widely from year to year.

The cause of the spill was determined in a government inquiry (Report of the Montara Commission of Inquiry 2010). The causes included:

- The cemented casing shoe was not tested when it was installed and it failed.
- Two secondary well control barriers pressure containing anti-corrosion caps (PCCC) were scheduled for installation and only one was installed.
- The PCCC is not designed as a barrier against uncontrolled release of hydrocarbons.

- The PCCC that was installed was never tested.
- The personnel on the West Atlas drilling installation did not follow their own Well Construction Standards.
- The Well Construction Standards that were in placed did not adequately address the type of drilling that the installation had undertaken.

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) utilize established Safety Management Systems (SMS) which include completing risk assessments, establishing safe work procedures and operations procedures, completing robust inspections at the work site, and completing audits. Implementing an established SMS is a proactive measure that assists in preventing incidents from occurring. The Montara release could have been prevented if an established SMS was developed and implemented, however, it is evident that there were management issues, which lead to inadequate implementation of the requirements. Based on this, and taking into consideration the Operators established SMS, the Montara release should be viewed as a standalone incident that does not increase the overall probability of a well release in the offshore Newfoundland area.

References

Report on the Montara Commission of Inquiry, prepared by Commissioner David Borthwick. 2010. Available online: http://www.iadc.org/wp-content/uploads/2016/02/201011-Montara-Report.pdf. Accessed April 2018.

INFORMATION REQUIREMENT – IR-47

(NunatuKavut-7)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Section 6.6.1, Effects of Potential Accidents or Malfunctions; Section 6.3.5 Migratory Birds.

Reference to EIS: Section 9.4, Species at Risk: Overview of Potential Effects and Key Mitigation; 15.2.2, Vessel Collision; 15.2.2.1, Transit to and from Project Area.

Context and Rationale

The EIS Guidelines state that there should be a consideration of effects of accidents in the near-shore environment, including effects on species at risk and their critical habitat, colonial nesters, and concentrations of birds and their habitat. Additionally, the EIS Guidelines require that direct and indirect adverse effects on migratory birds, that could result from project activities, including effects of spills in the nearshore (i.e., from vessel transit) or that reach land on land bird species, are discussed.

Section 15.2.2 of the EIS discusses the potential for vessel collisions and groundings on the transit route, and concludes that there is a very low potential for these events to occur, and that previous analysis indicated that a nearshore spill event would result in oil moving to the east and not contacting the shoreline; however, no further information on this is provided.

The EIS does not provide analysis of the effects of a nearshore spill from vessel traffic. The extent of oiling and time to reach shore from a nearshore spill along the transit route could have different environmental implications for coastal resources (e.g., bird colonies and other sensitive areas, coastal communities, nearshore fisheries) than from a spill originating offshore. There is also an absence of information in the EIS of the effects of an accident or malfunction on nearshore and coastal birds.

Specific Question or Information Requirement

a) Provide a brief overview of the analysis that indicated that a nearshore spill event would result in oil moving to the east and not contacting the shoreline, including an explanation of how the analysis is applicable to the Project).
b) Provide an assessment of the effects of accidents and malfunctions from a nearshore vessel spill on relevant valued components.

Response

The Environmental Impact Statement (EIS) investigated direct and indirect effects associated with project activities in the defined Project Area. Oil spill trajectory and fate modelling was used to determine the likely movement and behaviour of released hydrocarbons in the environment, following multiple release types (subsurface blowouts, surface releases of marine diesel) under the range of environmental conditions throughout and across multiple years. The analysis included both a stochastic assessment investigating the probability and minimum time to threshold exceedance as well as a deterministic assessment of representative 95th percentile "worst case" scenarios. Appendix E within the EIS includes detailed analyses of the trajectory and fate modelling, which highlights the areas where surface oil may exceed specific thresholds (e.g., surface floating oil that may affect birds) should there be an accidental release. Included in the spill modelling assessment were 95th percentile (ExxonMobil) and 98th percentile (Equinor) "worst case" scenarios for predicted shoreline effects were assessed. Note that the specific trajectories, fates, and resulting effects of any oil spill will vary for any release based upon the exact location of the release, the environmental conditions present at the time of the release, and the volume of oil that is released. The potential effects to migratory birds were discussed in Section 6.2 of the EIS. The spatial distribution of migratory bird sighting data encompassed the Project Area as well as the broader area offshore Newfoundland between land and the Project Area.

Section 15.2.2.1 of the EIS indicates that the supplying and offloading of Project-related vessels will occur within an existing industrial port facility, which handles supply vessel activity associated with multiple offshore operations. There have been no near-shore supply vessel groundings or spills over the more than 30 years of oil and gas exploration in the Newfoundland offshore area. ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to the as the Operators) approach to spill trajectory modelling was to focus on worst-case scenarios (i.e., subsea blow outs) and realistic smaller scale batch spills (e.g., 100 litres [L and 1,000 L of diesel). However, the Operators acknowledge that another operator (i.e., Nexen Energy ULC) completed spill modelling involving a release of 750,000 L from a vessel collision between St. John's, Newfoundland and Labrador and their project area, which is in the Flemish Pass. Similar to the subsea blowouts and batch spills that were modelled by the Operators, the vessel collision release is predicted to migrate to the east and did not cause any shoreline oiling (Nexen Energy ULC 2018).

References

Nexen Energy ULC. 2018. Flemish Pass Exploration Drilling Project (2018-2028). Environmental Impact Statement. Available online: http://ceaa-acee.gc.ca/050/documents/p80117/122066E.pdf. Accessed May 2018.

INFORMATION REQUIREMENT – IR-48

(MTI-21)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.2, Potential Accidental Event Scenarios.

Context and Rationale

The EIS outlines the potential accidental event scenarios identified for the Project based on historic industry trends and incidents (Section 15.2). Spill scenarios identified for modelling were batch diesel spills and subsurface blowouts. Synthetic-based mud spills are identified in Section 15.2.6 as a potential accidental release but were not modeled. Insufficient rationale and analysis is provided for this exclusion especially since the EIS reports that 95.5 percent of the volume of spills from exploration drilling in Newfoundland and Labrador between 1995 and 2015 were synthetic oils and fluids (Table 15.4 of EIS).

MTI has asked about the cumulative effects of multiple drilling fluid releases on species important to MTI, including swordfish, Atlantic salmon and Bluefin tuna.

Specific Question or Information Requirement

Provide additional rationale and analysis as to why modelling of a worst-case synthetic drilling fluid spill is not required to understand associated environmental effects or consider this potential scenario in modelling. If modelling is conducted, ensure that the rationale for volume selected is clearly presented, taking into consideration historical spills. Update the effects assessment accordingly, taking into account special areas and vulnerable species (e.g., corals and sponges).

Response

A summary of synthetic based drilling fluid spills reported to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) between 1997 and 2017 are outlined in Table 1 below (C-NLOPB 2017).

Table 1 Summary of Synthetic Based Drilling Fluid Spills that Occurred Offshore Newfoundland and Labrador Between 1997 and 2017

	# of spills	% of spills	volume (L)	% of volume
0-1,000 L	30	60.0%	7,666.1	2.5%
1,000 - 5,000 L	13	26.0%	37,283.0	12.4%
5,000 - 10,000 L	1	2.0%	9,000.0	3.0%
10,000 - 20,000 L	2	4.0%	26,755.0	8.9%
20,000 - 30,000 L	2	4.0%	50,100.0	16.6%
30,000 - 40,000 L	0	0.0%	0.0	0.0%
40,000 - 50,000 L	0	0.0%	0.0	0.0%

Table 1 Summary of Synthetic Based Drilling Fluid Spills that Occurred Offshore Newfoundland and Labrador Between 1997 and 2017

	# of spills	% of spills	volume (L)	% of volume
50,000 - 60,000 L	0	0.0%	0.0	0.0%
60,000 - 70,000 L	0	0.0%	0.0	0.0%
70,000 - 80,000 L	1	2.0%	74,000.0	24.6%
80,000 - 90,000 L	0	0.0%	0.0	0.0%
90,000 - 100,000 L	1	2.0%	96,600.0	32.0%
Total	**50**	**100.0%**	**301,404.1**	**100.0%**

Based on the information in Table 1, 50 synthetic drilling fluid spills were reported between 1997 and 2017 with a total of 301,404.1 litres (L). As outlined in Table 1, the majority of spills (i.e., 86.0%) were less than 5,000 L, with 60% of those being less than 1,000 L.

The following scenarios were modelled, and are outlined in Appendix E of the Environmental Impact Statement (EIS):

Subsea Blowouts

1) Subsea blowout in the Northern Project Area (NPA) – 179,280 cubic metres (m^3)
2) Subsea blowout in the Eastern Project Area (EPA) – 1,695,000 m^3
3) Subsea blowout in the Southern Project Area (SPA) – 2,803,000 m^3
4) Subsea blowout in the Jeanne d'Arc Basin (JDB) – 471,000 m^3

Batch Releases

5) Batch spill of marine diesel in the NPA – 100 L
6) Batch spill of marine diesel in the NPA – 1,000 L
7) Batch spill of marine diesel in the EPA – 100 L
8) Batch spill of marine diesel in the EPA – 1,000 L
9) Batch spill of marine diesel in the SPA – 100 L
10) Batch spill of marine diesel in the SPA – 1,000 L
11) Batch spill of marine diesel in the JDB – 100 L
12) Batch spill of marine diesel in the JDB – 1,000 L

The types of scenarios modelled were selected to reflect range of volumes and products, areas with varying water depths and areas containing potential sensitive benthic habitat. The Environmental Impact Statement (EIS) guidelines indicate that the EIS must include the worst-case scenario as well as smaller spills. The above scenarios were considered worst-case (i.e., subsea blows) and smaller spills (i.e., diesel). Effects of a synthetic based fluid spill, regardless of the source, were assessed in Section 15.5.1.2 of the the EIS. While a model of a synthetic based fluid spill would provide a footprint of the likely area to be potentially affected, the resulting environmental effects as assessed in the EIS would not change.

Although modelling of the worst-case synthetic based fluids was not completed, as mentioned above, the effects were assessed in Section 15.5.1.2 of the EIS, and therefore not required to be updated.

References

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2017. Statistical Information – Spills Greater than 1 Litre (1997-2017). Available online: http://www.cnlopb.ca/pdfs/spill/spgt1l.pdf?lbisphpreq=1 Accessed April 2018.

INFORMATION REQUIREMENT – IR-49

(CNLOPB Conformity)

Project Effects Link to CEAA 2012: Multiple VCs - Accidents and Malfunctions.

Reference to EIS Guidelines: Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.2, Potential Accidental Event Scenarios.

Context and Rationale

Section 15.2.3 of the EIS discusses the potential accidental event of dropped objects. The EIS concludes that the probability of such an occurrence is low, and that environmental effects would not be significant; however, there is no analysis describing what the potential environmental effects might be.

Section 8.3.7.2 of the EIS describes geological surveys that may be undertaken using a towed or ROV-mounted seabed camera / video system, grab samplers, gravity or piston core, box corer, and other sampling gear. There is no discussion in Section 15.2.3 of the EIS of the potential effects of accidental events associated with the loss of equipment, including if it is not recovered.

Specific Question or Information Requirement

Provide information on the potential environmental effects of a riser loss to substantiate the conclusion that associated effects would not be significant.

Provide an explanation of potential accidents and malfunctions that may occur as a result of the Project that were not identified or excluded. Comment on the probability for a marine riser-loss, and include an analysis of the potential environmental effects associated with the loss of equipment from geological surveys.

Response

The conclusion in the Environmental Impact Statement (EIS) that a loss would not be significant is due to the riser being an inert segment of pipe that would lie on the seafloor, which may also encourage habitat for benthic species as discussed in Information Requirement (IR) IR-19. Leaving the riser in place also aligns with decisions made in a similar situation that occurred offshore Nova Scotia, which is discussed below.

In March 2016 an operator in the Nova Scotia offshore area experienced a riser loss. The Canada-Nova Scotia Offshore Petroleum Board (C-NSOPB), in conjunction with Fisheries and Oceans Canada (DFO) and Environment and Climate Change Canada (ECCC) , reviewed the operators' decision to leave the riser on the seafloor and concluded the following:

- C-NSOPB determined that leaving the riser in place does not contravene the legislation or regulations that C-NSOPB is responsible to enforce.
- DFO determined that leaving the riser in place will not result in serious harm to fish, which is not permitted under Subsection 35(1) of the *Fisheries Act* (Government of

Canada 1985), and it will not contravene Sections 32, 33 of 58 of the *Species at Risk Act* (Government of Canada 2002).

- ECCC determined that a *Disposal at Sea Permit* will be required under Section 122.(1)(f) of the *Canadian Environmental Protection* Ac (Government of Canada 1999).

If a riser was lost, ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) would work directly with the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), prepare an incident investigation report, and implement decisions made by the C-NLOPB and other applicable regulators (e.g., DFO, ECCC, etc.). If other equipment was lost, every effort would be made to retrieve the equipment.

The Operators have robust risk management systems, which include completing a comprehensive risk assessment prior to commencing work scopes. A risk assessment would be completed prior to executing exploration drilling. If inert objects such as, but not limited to, remotely operated vehicles (ROVs), sampling equipment, etc. are lost then every effort would be made to retrieve the equipment, however, if the equipment could not be retrieved for technical or safety reasons, then the equipment would be deemed inert and sit on the seabed. The Operators intend on taking a proactive approach and ensuring that adequate mitigation measures are identified to prevent dropped objects.

Based on the information presented in Section 15.2.3 of the EIS, dropped objects were determined to be a low probability event with no significant environmental effect.

References

C-NSOPB (Canada-Nova Scotia Offshore Petroleum Board). 2017. News Release: CNSOPB Announces Results of Review into Shell Riser Decision. Available online: https://www.cnsopb.ns.ca/news/cnsopb-announces-results-review-shell-riser-decision. Accessed March 2018.

Government of Canada 1985. *Fisheries Act*. R.S.C., 1985, c. F-14. Published by the Minister of Justice. Current to April 24, 2018. Last Amended April 5 2016. Available online: http://laws-lois.justice.gc.ca/PDF/F-14.pdf

Government of Canada. 1999. *Canadian Environmental Protection Act, 1999*. S.C. 1999, c. 33. Published by the Minister of Justice. Current to April 24, 2018. Last Amended April 4, 2018. Available online: http://laws-lois.justice.gc.ca/PDF/C-15.31.pdf

Government of Canada. 2002. *Species at Risk Act*. S.C. 2002, c.29. Published by the Minister of Justice. Current to April 24, 2018. Last Amended February 2, 2018. Available online: http://laws-lois.justice.gc.ca/PDF/S-15.3.pdf

INFORMATION REQUIREMENT – IR-50

(ECCC-15)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions

Reference to EIS: Section 15.1.2.1.1, Source Control; 15.2.6.1, Subsurface Blowout; 15.3, Spill Risk and Probabilities; 15.4.1, Study Area and Scenarios; Appendix H Spill Prevention and Response; Section 1.2, Spill Response and Recovery; 2.1, Response Planning Basis. In addition, in the Flemish Pass Exploration Drilling Project EIS: Section 15.1.2.2, Well Capping and Containment Plan; and Section 5.1, Relief Well Drilling Overview.

Context and Rationale

Statoil indicates the following metrics that are relevant to the scenario of a subsurface blowout:

- Water depths at drilling locations: 1100 metres and 2700 metres.
- Time to drill individual exploratory wells: 35 to 65 days.
- Estimated relief well drilling time: 100 to 113 days.

ExxonMobil indicates the following metrics that are relevant to the scenario of a subsurface blowout:

- Water depths at drilling locations: 89 metres and 362 metres.
- Time to drill individual exploratory wells: 35 to 65 days.
- Estimated relief well drilling time: 113 days.

Both EISs indicated that the estimated time to drill individual exploratory wells ranges from only 35 to 65 days.

Specific Question or Information Requirement

Provide a rationale as to why the estimated timeframe of 113 days to drill a relief well is up to three times longer than the indicated 35 to 65 days required to drill a typical exploratory well. Explain whether the MODU used for exploration drilling could remain operational after a blowout and could therefore be utilized to drill a relief well.

Response

The trajectory model in Appendix E of the Environmental Impact Statement (EIS) included a worst-case scenario of a 113-day unmitigated release due to a subsea blowout. Appendix H of the EIS includes information on spill prevention and response and the capping and containment plan, which includes drilling a relief well.

The 35 to 65 days to drill an exploration well considers that the drilling installation is on site. A subsea blowout is a significant incident, therefore, the drilling installation would likely experience damage and may not be in a position, from a integrity and safety perspective, to drill the relief well, therefore another drilling installation would be required and mobilized to site. The time of 113 days for a relief well considers the mobilization time to site, time for regulatory permitting (e.g., inspections, customs, *Certificate of Fitness*, etc.) and technical considerations. If a relief well is required to be drilled, ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) will evaluate transit and mobilization times for the drilling installation and provide to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) in advance of drilling operations.

References

N/A

INFORMATION REQUIREMENT – IR-51

(NRCanIR-5)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 3.1, Project Components; and 3.2.1, Drilling and Testing Activities.

Reference to EIS: Section 15.0, Accidental Events; and 15.4.3, Model Input Data.

Context and Rationale

The EIS shows the contents of crude oil "residuals" that are stated to be hydrocarbons that boil at temperatures >380°C and consist of aromatics ≥ 4 rings and aliphatics > C20 that are neither volatile nor soluble.

Specific Question or Information Requirement

This description of the crude oil heavy ends is not sufficient to predict the fate of the oil in terms of degradability and tendency to sink. Further explanation is needed to demonstrate why model outputs show oil degradability appearing to increase with increasing residuals contents when biodegradation studies demonstrate that oil degradability decreases with increasing residuals contents.

Response

Oils spilled at sea eventually are altered in their chemical compositions and physical-chemical properties through a variety of weathering processes including evaporation, dissolution, dispersion, emulsification, biodegradation, photo-oxidation, sedimentation, and shoreline interactions. These changes usually take place at different time scales and result in amendment of the distribution of oil components in the environmental compartments, such as water column, surface layer, atmosphere, or sediments.

The "pseudo-component" approach is used to simplify the tracking of thousands of chemicals comprising oil for modelling (Payne et al., 1984; 1987; French et al., 1996a; Jones, 1997; Lehr et al., 2000). Chemicals in the oil mixture are grouped by physical-chemical properties, and the resulting component category behaves as if it were a single chemical with characteristics typical of the chemical group. In this component breakdown, aromatic (AR) groups are treated as both soluble (i.e., dissolve into the water column) and volatile (i.e., evaporate to the atmosphere), while the aliphatic (AL) groups are only volatile. The total hydrocarbon concentration (THC) within the boiling range of volatile components is the sum of all AR and AL components. The remainder of the oil is considered to be residual oil, which does not dissolve or volatilize but will degrade over time.

Degradation rates for each component and compartment (surface, upper water column, lower water column, and sediments) were based on biodegradation rates obtained from literature reviews that included estimates for compounds and/or components of crude oil generally. For the semi-volatile components, degradation in floating oil would be considerably slower than volatilization.

The rates for residual oil are consistent with studies by Zahed et al. (2011) and Atlas and Bragg (2009).

Through the modelled processes, the density and viscosity of the oil has a tendency to increase as it weathers. It is possible for the weathered oil, especially in the presence of suspended particulate matter in the water column, to become denser than water and sink. In addition, the oil (including the residual fraction) does continue to degrade over time within the model. In addition, one must consider that the hypothetical long-term releases of oil (many months) continues to add fresh oil, which will increase the total amount of oil through time that will degrade. As time progresses, residual oil is all that remains of the early portions of the release while whole fresh oil continues to be released in later stages. In total, this may appear as though degradation rates are increasing, but is rather a function of the static degradation rate and the increasing amount of oil (a portion fresh oil) through time.

A recent comprehensive model update with literature review of over a dozen of the most recent studies on oil degradation rates validating the use of modelled Spill Impact Model Application Package (SIMAP) degradation rates was conducted for work following the Deepwater Horizon Natural Resource Damage Assessment (French et al, 2015) as well as for the United States Bureau of Ocean Energy Management (BOEM) (French et al, 2018a,b).

The long-term weathering and degradability of an oil (including microbial degradation, photo-oxidation, and other process that may break down compounds or components of oil) and may increase the tendency of an oil to sink are active research areas that are highly dependent upon the type of oil released and the environmental conditions of the receiving environment. A large amount of work is currently being undertaken to develop scientific consensus in this area, however, it is understood that compounds with a boiling temperature >380°C degrade slowly and that these compounds are difficult to measure. The modelled bulk disappearance is quite slow and would conservatively overestimate the effects following a release as oil would remain in the model. The inclusion of compound specific degradation would increase the degradation and reduce the amount of oil remaining in the model, therefore skewing results towards less effects.

References

Atlas, R. and Bragg, J. 2009. Bioremediation of marine oil spills: when and when not – the Exxon Valdez experience. Microbial Biotechnology 2(2):213-221.

French, D., Reed, M., Jayko, K., Feng, S., Rines, H., Pavignano, S.., Isaji, T. Puckett, S., Keller, A. French III, F.W., Gifford, D., McCue, J., Brown, G., MacDonald, E., Quirk, J., Natzke, S., Bishop, R. Welsh, M. Phillips, M., and Ingram B.S. 1996. Final Report, The CERCLA Type A Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAM/CME), Technical Documentation, Vol. I - V., Office of Environmental Policy and Compliance, U.S. Department of the Interior, Washington, DC, Contract No. 14-0001-91-C-11.

French McCay DP, Jayko K, Li Z, Horn M, Kim Y. 2015. Technical Reports for Deepwater Horizon Water Column Injury Assessment–WC_TR14: Modeling Oil Fate and Exposure Concentrations in the Deepwater Plume and Cone of Rising Oil Resulting from the DWHOS. DWH NRDA Water Column Technical Working Group Report. Prepared for National Oceanic and Atmospheric Administration by RPS ASA, South Kingstown, RI.

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Payne, J.R., Kirstein, B.E., Clayton, Jr., J.R., Clary, C., Redding, R. McNabb, Jr., G.D. and D., Farmer, G. 1987. Integration of suspended particulate matter and oil transportation study. Final Report. Minerals Management Service, Environmental Studies Branch, Anchorage, AK. Contract No. 14-12-0001-30146, 216 p.

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Zahed, M. A., Aziz, H.A., Isa, M.H., Mohajeri, L., Mohajeri, S. and Kutty, S.R.M. 2011. Kinetic modeling and half-life study on bioremediation of crude oil dispersed by Corexit 9500. Journal of Hazardous Materials 185(2-3):1027-1031.

INFORMATION REQUIREMENT – IR-52

(N/A)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.0, Accidental Events.

Context and Rationale

There is no rationale provided for selection of 100 litres and 1000 litres as plausible "worst-case" scenarios for batch diesel spills, given the EIS states that average spills of this type have a volume less than 200 barrels (i.e., approximately 31,800 litres). Table 15.5 further indicates that 10 percent of diesel spills are in the range of 10 to 99 barrels (approximately 1590 litres to 15,740 litres).

Specific Question or Information Requirement

Update worst-case spill modelling and associated analysis for batch spills, taking into consideration the volume of diesel in past spills in offshore Newfoundland, or provide a robust rationale for the data inputs used in the oil spill models, including how they represent a worst-case scenario. Update the assessment of effects of accidents and malfunctions on relevant valued components, as applicable.

Response

A summary of batch diesel spills reported to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) between 1997 and 2017 are outlined in the Table 1 below (C-NLOPB 2017).

Table 1 Summary of Batch Diesel Spills that Occurred Offshore Newfoundland and Labrador Between 1997 and 2017

	# of spills	% of spills	volume (L)	% of volume
0-10L	13	48.1%	68.6	1.4%
10-100 L	6	22.2%	386.0	8.0%
100-500 L	5	18.5%	1,120.0	23.2%
500-1,000 L	2	7.4%	1,178.0	24.4%
1,000 - 5,000 L	1	3.7%	2,080.0	43.0%
Total	**27**	**100.0%**	**4,832.6**	**100.0%**

Based on the information in Table 1, 27 diesel spills were reported between 1997 and 2017 with a total of approximately 4,833 litres (L). The majority of spills (i.e., 96.3%) were below 1,000 L, with 70.3% being below 100 L.

The following diesel batch spill scenarios were modelled, and are outlined in Appendix E of the Environmental Impact Statement (EIS):

1) Batch spill of marine diesel in the Northern Project Area (NPA) – 100 litres (L).
2) Batch spill of marine diesel in the NPA – 1,000 L.
3) Batch spill of marine diesel in the Eastern Project Area (EPA) – 100 L.
4) Batch spill of marine diesel in the EPA – 1,000 L.
5) Batch spill of marine diesel in the Southern Project Area (SPA) – 100 L.
6) Batch spill of marine diesel in the SPA – 1,000 L.
7) Batch spill of marine diesel in the Jeanne D'Arc Basin (JDB) – 100 L
8) Batch spill of marine diesel in the JDB – 1,000 L.

Between 1997 and 2017 one spill occurred that was greater than 1,000 L, which represents 3.7% of the diesel spills that occurred. Based on this, the maximum volume selected for the modelling adequately aligns with diesel spills that have occurred offshore and therefore additional modelling is not required.

References

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2017. Statistical Information – Spills Greater than 1 Litre (1997-2017). Available online: http://www.cnlopb.ca/pdfs/spill/spgt1l.pdf?lbisphpreq=1. Accessed April 2018.

INFORMATION REQUIREMENT – IR-53

(ECCC-13)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.5.2.2.2, Effects of Dispersants on Marine and Migratory Birds (Flemish Pass Exploration Drilling Project); Section 15.5.1.2.2, Effects of Dispersants on Marine Fish and Fish Habitat (Eastern Newfoundland Offshore Exploration Drilling Project).

Context and Rationale

The EIS provides contradictory statements about the effectiveness of dispersants in oil degradation: the first paragraph of Section 15.5.2.2.2 states “(a)pplication of chemical dispersants reduces the risk of adverse effects on marine and migratory birds at the water’s surface, and results in a far greater rate of biodegradation of oil to a matter of weeks rather than of years (Baelum et al, 2012)”, while Section 15.5.1.2.2 states “ (a)lthough it is generally agreed that dispersants increase the availability of the oil to the microbes in the water column by reducing the oil droplets size, there still remains some debate on the its effects on oil degradation rates (Brakstad et al., 2014, 2015; Kleindienst et al., 2015; Seidal et al., 2016)”.

ECCC has offered a synthesis paper (Fingas, 2017) which summarizes more recent publications (from 2014–2017), wherein the authors found that “(t)he effect of dispersants on biodegradation is still a matter of dispute, however all but one study in the current series, showed dispersants inhibit biodegradation”.

Specific Question or Information Requirement

Update the discussion of biodegradation of oil with and without chemical dispersants taking into consideration information from Fingas (2017).

Fingas, M. (2017) *A Review of Literature Related to Oil Spill Dispersants 2014-2017*. Prince William Sound Regional Citizens’ Advisory Council (PWSRCAC), Anchorage, Alaska. Pp. 264.

Response

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) recognize that research related to dispersants is constantly progressing and there are new research papers generated on a regular basis, such as the paper brought forward by the reviewer (herein referred to as the Fingas paper). Subject matter experts (SMEs) within the Operators organizations reviewed the Fingas paper and do not support the conclusions as it appears that select aspects of the test protocols used were not representative of an actual spill (e.g., initial concentration of oil in seawater, mixing time, settling time, collection and storage of samples).

As mentioned above, the Operators recognize that the topic of dispersants is progressing, and with this often comes differing scientific opinions, which the Fingas paper also identifies. For example, the paper titled *Chemical Dispersants Enhance the Activity of Oil and Gas Condensate Degrading Marine Bacteria* found that the addition of dispersants to crude oil enhanced oil degradation rates (Trembley et al 2017).

Since the Operator SMEs do not support the Fingas paper, the discussion of biodegradation of oil with and without chemical dispersants will not be updated. However, the Operators will develop detailed Spill Impact Mitigation Assessments (SIMAs), which will consider new research, deemed valid by SMEs, regarding biodegradation with and without dispersants. Further details regarding the SIMA are discussed in the subsequent sections.

As identified in Sections 2.12 and 15.1.2.3.3 of the Environmental Impact Statement (EIS), the Operators are required to develop SIMAs as part of their Oil Spill Response Plans (OSRPs) during the *Operations Authorization* (OA) approval process. Both documents are submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) prior to drilling activities commencing. The SIMA compares the various spill response measures to determine response strategies that will result in the lowest overall effect on the environment. Further to the submission of the SIMA, the Operators are required to obtain approval from the C-NLOPB's Chief Conservation Officer prior to application of dispersants, as outlined in Section 15.1.2.3.4 of the EIS.

ExxonMobil intends on developing a Flemish Pass specific SIMA, or may choose to collaborate with another operator. As outlined in Section 15.1.2.3.3 of the EIS, Equinor developed a SIMA for the 2017 exploration drilling program, which will be reviewed and updated for this Project. An overview of the SIMA developed by Equinor for the 2017 exploration drilling program is provided below and is intended to provide an overview of typical content in a SIMA, however, it is noted that the content in the SIMAs that will be developed and/or updated by the Operators for the Project may be subject to change.

Contents of the SIMA typically include the following topics, however, as noted above, content is subject to change:

- Background – Overview of the SIMA process and objective.
- Project Overview – Overview of the geological area of interest, physical environment and spill scenarios.
- Response Options – Response options are evaluated (i.e., benefits and limitations) for each spill scenario identified. The SIMA developed for the 2017 exploration drilling program identified the following response options: natural attenuation, on-water mechanical recovery, on-water in-situ burning, surface dispersant application, and subsea dispersant injection.
- Resources of Concern – Key resources are identified using physical, biological and socioeconomic data about the Project Area, which is outlined in the EIS. The SIMA developed for the 2017 exploration drilling program identified the following resources of concern: birds, fish, marine mammals, sea turtles, corals and sponges, commercial fisheries and responder safety.
- Risk Assessment – A risk assessment is completed by taking into consideration the response options, spill scenarios and resources of concern. The risk assessment uses a methodology developed by the American Petroleum Institute (API), IPIECA and International Oil and Gas Producers (IPIECA 2018).

As mentioned above, the Operators will evaluate spill response options in the SIMA, which may include natural attenuation and use of dispersants. The SIMA will be provided to the C-NLOPB during the OA phase.

References

IPIECA (International Petroleum Industry Environmental Conservation Association). 2018. Guidelines on Implementing Spill Impact Mitigation Assessment (SIMA). Available online: http://www.ipieca.org/resources/awareness-briefing/guidelines-on-implementing-spill-impact-mitigation-assessment-sima/?search= Accessed June 2018.

Tremblay, Julien & Yergeau, Etienne & Fortin, Nathalie & Cobanli, S.E. & Elias, Miria & King, Thomas & Lee, Kenneth & Greer, Charles. 2017. Chemical dispersants enhance the activity of oil- and gas condensate-degrading marine bacteria. The ISME Journal. 11. 10.1038/ismej.2017.129.

INFORMATION REQUIREMENT – IR-54

(N/A)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.5, Environmental Effects Assessment.

Context and Rationale

The use of dispersants to transform the surface oil to the water column for biodegradation is listed as a key mitigation measure. However, the effectiveness of dispersants in cold water may differ from those in warmer waters.

Specific Question or Information Requirement

Discuss the efficacy of dispersants in cold water.

Response

The response to Information Requirement (IR) IR-53 provides a high-level discussion of the Spill Impact Mitigation Assessment (SIMA) including the purpose, development, submittal to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), and typical contents based on a SIMA that was developed by Equinor Canada Ltd. (Equinor) for the 2017 exploration drilling program. As noted in IR-53, the SIMA will provide information on the physical environment, which may include air and water temperatures. In addition, the spill scenarios are typically selected to include seasonal variation (i.e., winter and summer), therefore, colder water temperatures may be taken into consideration in the SIMA. Monthly sea surface temperatures were included in the SIMA developed by Equinor for the 2017 exploration drilling program and indicated that mean sea surface temperatures ranged from 3.8°C to 6.5°C in winter and 8.4°C to 13.7°C in summer; with averages of 5.1°C and 11.3°C, respectively.

Dispersants do not remove oil from the environment and are meant to assist in the dispersion of oil slicks from the sea surface to the water column and results in accelerated microbial degradation of spilled oil (Lee et al 2013; AORSRT-JIP 2014; Coelho et al. 2017). Oil degradation is dependent on many factors including the biotic (e.g., microbial growth, enzymatic activity), abiotic (e.g., water temperature, water salinity, wind and wave energy, oxygen and nutrient levels), and quantity and type of hydrocarbons spilled (Coelho et al. 2017). These factors are applicable regardless of the spill response option implemented (e.g. natural attenuation, dispersant application).

Environment and Climate Change Canada (ECCC) approved two dispersants for use in Canada (i.e., Corexit® EC9500A and Corexit® EC9580A), which are outlined in the *Regulations Establishing a List of Spill-treating Agents (Canada Oil and Gas Operations)* (Government of Canada 2016). As mentioned in the response to IR-53, research on dispersants continues to progress, and there are some research papers that conclude that cold water inhibits dispersant effectiveness, while other papers conclude the opposite; some of which are mentioned below. It is evident that this topic has been, and continues to be, subject to scientific debate.

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor (herein referred to as the Operators) are aware of a recent study that focused on the biodegradation of crude oil, with and without dispersants, in arctic waters with temperatures of -1°C, which is colder than mean sea surface temperatures in the Project Area (i.e., range from 0.6 to 5.2°C in the Northern Section and 0.6 to 10.9°C in the Southern Section as outlined in Sections 5.5.4.1 and 5.5.4.2 of the EIS). The study concluded that there was evidence that the dispersant initially stimulated oil biodegradation and that the dispersant did not inhibit biodegradation (McFarlin et al 2014). However, the Operators acknowledge that research on this topic is evolving, and will consider new research deemed valid by subject matter experts (SMEs) when developing the SIMAs.

References

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.

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.

Government of Canada. 2016. Regulations Establishing a List of Spill-treating Agents (Canada Oil and Gas Operations Act). Available online: http://laws-lois.justice.gc.ca/PDF/SOR-2016-108.pdf. Accessed June 2018.

Lee, K., T. Nedved, R.C. Prince and D. Palandro. 2013. Lab tests on the biodegradation of chemically dispersed oil should consider the rapid dilution that occurs at sea. Marine Pollution Bulletin., 73(2013):314-318.

McFarlin, K. M., Prince, R. C., Perkins, R., & Leigh, M. B. 2014. Biodegradation of dispersed oil in arctic seawater at -1°C. Public Library of Science ONE, 9(1), e84297.

INFORMATION REQUIREMENT – IR-55

(KMKNO-54)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.0, Accidental Events.

Context and Rationale

As described in the EIS (p. 1199), dispersants can be applied at surface (aerially or from vessels) or through subsea dispersant injection; however, the assessment of potential effects of dispersants on applicable VCs does not distinguish between these applications, which may present considerably different risks, effects, and benefits.

Specific Question or Information Requirement

Discuss differences in potential effects between subsea dispersant injection and surface dispersant application.

Response

The response to Information Requirement (IR) IR-53 provides a high-level discussion of the Spill Impact Mitigation Assessment (SIMA) including the purpose, development, submittal to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), and typical contents based on a SIMA that was developed by Equinor Canada Ltd. (Equinor) for the 2017 exploration drilling program. As noted in IR-53, the SIMA will provide information on response options, which may include surface dispersant application and subsea dispersant injection (SSDI).

Surface dispersant application typically involves using aircraft, spray-boom vessels, or booms mounted on the drilling installation to spray dispersants directly on the water surface (Coelho et al 2017). Due to the application method, and with sufficient wave action, which is common in the Project Area, oil should disperse into the upper 10 metres (m) of the water column rapidly (Coelho et al 2017).

SSDI is used when oil is released from a subsea fixed point (Coelho et al 2017). SSDI is typically completed from a vessel equipped with dispersant storage, pumps and tubing that deliver dispersants to the release point (Coelho et al 2017). Due to the injection occurring at the seafloor, the dispersed oil will dilute vertically and horizontally over a greater volume of water; this rapid dilution results in lower concentrations of dispersed oil compared to surface application (Coelho et al 2017).

The EIS did not consider the effects of tactical spill response methods as the spill trajectory modelling was completed for worst-case, unmitigated scenarios. However, there are environmental aspects associated with dispersant application that may be considered when determining the most effective and efficient spill response measure. All response options, including applying dispersants at the surface and SSDI, have benefits and limitations.

Potential environmental considerations associated with dispersant use, including surface application and SSDI, are outlined in Table 15.1 of the EIS. In addition to the information presented in the EIS, the following points should also be taken into consideration:

- Mechanical recovery and in-situ burning are limited by environmental conditions (e.g., increased wave height), while dispersants are more effective in these conditions (Nedved 2012).
- Mechanical recovery, in-situ burning and surface application of dispersants are limited to day light hours due to safety considerations and oil slick tracking. SSDI, however, is not limited to daylight hours (Nedved 2012).
- SSDI reduces the amount of oil coming to the surface, which reduces response workers exposure to potential volatile components (Nedved 2012). This would also reduce the exposure to marine and migratory birds in the area of the spill.
- SSDI requires less dispersant compared to surface application, and dispersants are known to be more effective on fresh oil (Nedved 2012).
- SSDI is known to be more precise compared to surface application (Nedved 2012).
- SSDI treats all escaping oil from a single release point (Nedved 2012).

As mentioned in the response to IR-53, and as outlined in Section 15.1.2.3.3 of the EIS, the SIMA will include a risk assessment section that takes into consideration the response options, which may include surface dispersant application and SSDI, spill scenarios, and resources of concern (e.g., birds, fish, marine mammals, sea turtles, corals and sponges, commercial fisheries, responder safety). The risk assessment uses a methodology developed by the American Petroleum Institute, International Petroleum Industry Environmental Conservation Association and International Oil and Gas Productions (API-IPIECA-IOGP) (IPIECA 2018). The risk assessment uses a single comparative matrix that provides a qualitative prediction of how each response option might mitigate the overall impacts to the resources of concern (Coelho et al 2017). The Operators will develop SIMAs and complete risk assessments on each response option, which may include surface dispersant application and SSDI, and the potential effects of resources of concern (e.g., birds, fish, marine mammals, sea turtles, corals and sponges, commercial fisheries, responder safety) will be further determined in the SIMAs.

References

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.

IPIECA (International Petroleum Industry Environmental Conservation Association). 2018. Guidelines on Implementing Spill Impact Mitigation Assessment (SIMA). Available online: http://www.ipieca.org/resources/awareness-briefing/guidelines-on-implementing-spill-impact-mitigation-assessment-sima/?search= Accessed June 2018.

Nedved, T., Coolbaugh, T. and Demarco, G. 2012. The Value of Dispersants for Offshore Oil Spill Response. Offshore Technology Conference. OTC 23359.

INFORMATION REQUIREMENT – IR-56

(N/A)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.5.1.5, Determination of Significance.

Context and Rationale

The EIS states "(a)s model predictions indicate minimal interactions with benthic habitats, it is expected there will be limited residual adverse effects on fish habitat and benthic species including sensitive coral and sponge species. However, eventual break down of oil material in marine environments may become transported to benthic habitats through microbial and plankton pathways through sinking and flocculation. In the context of applied mitigations, these adverse environmental effects are considered unlikely and therefore not predicted to have any significant effects on fish habitat."

However, the EIS does not consider the potential for chemical dispersants increasing the production of "marine snow" and increasing sedimentation of oil to the seafloor – potentially affecting benthic invertebrates and deep water coral. For example, it has been estimated that up to 14 percent of released oil from the Deepwater Horizon accident was settled on the seafloor due to marine snow sedimentation (Daley et al., 2016).

Specific Question or Information Requirement

Discuss the potential for chemical dispersants to increase 'marine snow' and sedimentation of oil to the seafloor, including how this could affect valued components, including benthic invertebrates and corals.

Response

Section 15.5.1.2.2 of the Environmental Impact Statement (EIS) addresses the potential for dispersants to increase sedimentation and the effects on benthic invertebrates and select information is provided in the subsequent paragraph.

Dispersant use after a spill has the potential to increase the exposure to the water column (e.g., plankton, pelagic fish) and eventually benthos (e.g., demersal fish, benthic invertebrates). Certain concentrations and ratios of oil to dispersants have been shown to reduce the effectiveness of certain degradation pathways related to the formation of microbial marine snow (Passow 2016; Seidel et al. 2016). Chemically dispersed oil can affect early life stages of fish and invertebrates (e.g., eggs and larvae) (Cordes et al. 2016; DeLeo et al. 2016), and are more toxic to coral than untreated oil solutions (DeLeo et al. 2016). However, marine oil snow that is deposited on the seabed after effective dispersant use would likely be highly degraded, which aligns with observations from the assessments complete following the Deepwater Horizon incident (Stout and Payne 2016).

As indicated in Section 15.1.2.3.3 of the EIS, ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) will prepare Spill Impact Mitigation Assessments (SIMAs), which will evaluate benefits and drawbacks of different spill response tactics, including the use of dispersants. The SIMAs will be included as part of the Operators Oil Spill Response Plans (OSRPs) during the *Operations Authorization* (OA) approval process with the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). The Operators are also required to obtain approval from the C-NLOPB Chief Conservation Officer (CCO) prior to the application of dispersants, as indicated in Section 15.1.2.3.4 of the EIS.

References

DeLeo, D.M., Ruiz-Ramos, D.V., Baums, I.B. and Cordes, E.E. 2016. Response of deep-water corals to oil and chemical dispersant exposure. Deep Sea Research Part II: Topical Studies in Oceanography, 129, pp.137-147.

Passow, U., Ziervogel, K., Asper, V. and Diercks, A., 2016. Marine snow formation in the aftermath of the Deepwater Horizon oil spill in the Gulf of Mexico. Environmental Research Letters, 7(3), p.035301.

Seidel, M., Kleindienst, S., Dittmar, T., Joye, S.B. and Medeiros, P.M., 2016. Biodegradation of crude oil and dispersants in deep seawater from the Gulf of Mexico: Insights from ultra-high resolution mass spectrometry. Deep Sea Research Part II: Topical Studies in Oceanography, 129, pp.108-118.

Stout, S.A., and Payne, J.R., Macondo oil in deep-sea sediments: Part 1 – sub-sea weathering of oil deposited on the seafloor. Marine Pollution Bulletin, 111 (2016) 365-380.

INFORMATION REQUIREMENT – IR-57

(ECCC-13)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.5.2.2.2, Effects of Dispersants on Marine and Migratory Birds.

Context and Rationale

It is not known what the effects of dispersants alone may have on birds, and in particular on their plumage; dispersants are a surfactant and therefore may compromise the waterproofing of feathers in a similar manner to that of oil. The synthesis of the effects of dispersants on marine and migratory birds should be made more robust.

Specific Question or Information Requirement

Provide a thorough assessment of the effects of dispersants on migratory birds, including recent studies.

Response

Section 15.1.2.3.4 of the Environmental Impact Statement (EIS) addresses the potential effects of dispersants on marine and migratory birds and select information is provided in the subsequent paragraph.

Dispersant use has a net environmental benefit for marine and migratory birds that could encounter surface oil, however, it is acknowledged that dispersants may reduce surface tension at the feather-water interface which can reduce the capacity of insulation provided by feathers. The magnitude of these effects depends on the proximity of wildlife during dispersant application, as well as the effectiveness of the dispersant on the surface oil (National Research Council 2005). Section 15.5.2.2.2 of the EIS provides additional information regarding the effects of dispersants on marine and migratory birds and reiterates the potential benefits of dispersant use with respect to marine and migratory birds as the exposure to floating oil on the sea surface is reduced. It is concluded that dispersants mitigate the potential adverse effects of oil on marine and migratory birds compared to untreated oil.

As indicated in Section 15.1.2.3.3 of the EIS, ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) will prepare Spill Impact Mitigation Assessments (SIMAs), which will evaluate benefits and drawbacks of different spill response tactics, including the use of dispersants. The SIMAs will be included as part of the Operators Oil Spill Response Plans (OSRPs) during the *Operations Authorization* (OA) approval process with the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). The Operators are also required to obtain approval from the C-NLOPB Chief Conservation Officer (CCO) prior to the application of dispersants, as indicated in Section 15.1.2.3.4 of the EIS.

References

National Research Council. 2005. Understanding Oil Spill Dispersants: Efficacy and Effects. National Academy Press, Washington, DC. 396 pp.

INFORMATION REQUIREMENT – IR-58

(MMS-02)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15, Accidental Events.

Context and Rationale

Mi'gmawei Mawiomi Secretariat has asked about the probability that oil from a vessel spill or well blowout could reach the Gulf of St. Lawrence and the Gaspé Peninsula coast, even at concentrations below the ecological threshold.

Specific Question or Information Requirement

Discuss the probability that oil from a vessel spill or well blowout could reach the Gulf of St. Lawrence and the Gaspé Peninsula coast and describe the potential environmental effects.

Response

Trajectory modelling was completed for the following unmitigated scenarios, which are also outlined in Appendix E of the Environmental Impact Statement (EIS):

Subsea Blowouts

1. Subsea blowout in the Northern Project Area (NPA)
   - Water depth – 2,700 metres (m)
   - Continuous release for 36 days, which represents the time to mobilization and install the capping stack
   - Total volume released – 179,280 cubic metres (m^3)
   - Model simulation – 160 days

2. Subsea blowout in the Eastern Project Area (EPA)
   - Water depth – 1,100 m
   - Continuous release for 113 days, which represents the necessary time to drill a relief well
   - Total volume released – 1,695,000 m^3
   - Model simulation – 160 days

3. Subsea blowout in the Southern Project Area (SPA)
   - Water depth – 362 m
   - Continuous release for 113 days, which represents the necessary time to drill a relief well
   - Total volume released – 2,803,000 m^3
   - Model simulation – 160 days

4. Subsea blowout in the Jeanne d'Arc Basin (JDB)
   - Water depth – 89 m
   - Continuous release for 113 days, which represents the necessary time to drill a relief well
   - Total volume released – 471,000 m^3
   - Model simulation – 160 days

Batch Releases

5. Batch spill of marine diesel in the NPA
   - Water depths – 2,700 m
   - Total volume released – 100 litres (L)
   - Model simulation – 30 days

6. Batch spill of marine diesel in the NPA
   - Water depths – 2,700 m
   - Total volume released – 1,000 L
   - Model simulation – 30 days

7. Batch spill of marine diesel in the EPA
   - Water depths – 1,100 m
   - Total volume released – 100 L
   - Model simulation – 30 days

8. Batch spill of marine diesel in the EPA
   - Water depths – 1,100 m
   - Total volume released – 1,000 L
   - Model simulation – 30 days

9. Batch spill of marine diesel in the SPA
   - Water depths – 362 m
   - Total volume released – 100 L
   - Model simulation – 30 days

10. Batch spill of marine diesel in the SPA
    - Water depths – 362 m
    - Total volume released – 1,000 L
    - Model simulation – 30 days

11. Batch spill of marine diesel in the JDB
    - Water depths – 89 m
    - Total volume released – 100 L
    - Model simulation – 30 days

12. Batch spill of marine diesel in the JDB
    - Water depths – 89 m
    - Total volume released – 1,000 L
    - Model simulation – 30 days

The above scenarios were also modelled during winter and summer seasons. Various pieces of geographic and habitat data were also incorporated into the model (e.g., shoreline habitat, ice cover, wind, currents, water temperature, water salinity, etc.). These spill scenarios are considered representative of credible worst-case spill scenarios with no mitigations that could result from an accidental event.

As detailed in Section 4.2.3 of Appendix E of the EIS, the probability of shoreline oil exposure was very low as less than 1% of the annual scenarios reached the shoreline. If shoreline oil exposure was predicted it was limited to the Avalon Peninsula and southern shores near Burgeo, both of which are in Newfoundland. There are various reasons for shoreline oil exposure being determined to be low such as, but not limited to, predominately westerly winds transporting oil to the east, variable surface currents, and release sites are approximately 500 kilometres (km) offshore, therefore there is more time for oil to evaporate and degrade.

Based on the modelling of the various scenarios mentioned above, shoreline oil exposure greater than 1 gram per metre squared (g/m^2) is not anticipated to reach the Gulf of St. Lawrence and the Gaspé Peninsula coast, therefore there are no potential environmental effects to incorporate into the EIS.

References

N/A

INFORMATION REQUIREMENT – IR-59

(KMKNO-07)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Appendix H Capping Stack Technology Details; Section 3.1, Well Capping Overview; and 3.2.2, The Capping Stack System (CSS) (Flemish Pass Exploration Drilling Project). Appendix H Spill Prevention and Response; Section 2.2.1, Well Intervention Options (Eastern Newfoundland Offshore Exploration Drilling Project).

Context and Rationale

The Newfoundland and Labrador government launched a plan to double offshore oil production by 2030 and the oil industry’s target is to include more than 100 new exploration wells. A number of offshore exploration drilling projects are currently being proposed.

Specific Question or Information Requirement

Discuss the economic and technical feasibility of options for decreasing capping stack response times, taking into consideration: the potential to use other capping stacks, establishing a capping stack facility in eastern Canada, or having a capping stack available on a vessel for rapid deployment.

Response

A capping stack system (CSS) and the associated ancillary equipment are highly specialized tools, and are prepared and maintained by a third party (i.e., Oil Spill Response Limited [OSRL]) at four strategic locations around the world. OSRL selects locations for CSSs based on their own internal requirements and processes, and proximity to global offshore drilling activities. The OSRL facilities are set up such that the equipment can be quickly modified and prepared for shipment based on the specific requirements of an incident. Additionally, there are a number of activities that would occur prior to installing a CSS on a well, including site assessment/preparation and debris removal. While having a CSS in Eastern Canada or on a vessel could result in quicker mobilization of the equipment in the event of an incident, the ability to modify the equipment for the specific incident would be limited and other activities (e.g., site assessment/preparation, debris removal) would still be in progress to ensure safe installation of the CSS. In summary, it is unlikely that having a CSS in Eastern Canada would reduce the overall time to install a capping stack.

References

N/A

INFORMATION REQUIREMENT – IR-60

(ECCC-17)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Appendix H Capping Stack Technology Details; Section 3.1, Well Capping Overview; 3.2.2, The Capping Stack System (CSS) (Flemish Pass Exploration Drilling Project). Appendix H Spill Prevention and Response; Section 2.2.1, Well Intervention Options (Eastern Newfoundland Offshore Exploration Drilling Project).

Context and Rationale

The EIS states that a capping stack is a specialized piece of equipment used to "cap" (i.e., stop or divert) well flow while work is being undertaken to permanently kill the well (e.g., through relief well drilling). Both Statoil and ExxonMobil have provided technical details regarding the mobilization, deployment, and mechanics of capping stacks, but no information has been provided on their expected operational lifespan, the timing of decommissioning, or on any follow-up monitoring activities that would be required after a capping stack has been 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, at blowout-affected well sites.

Specific Question or 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 OSRL's 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

As per the Technical Specifications of the Oil Spill Response Limited (OSRL) capping stack, the design life of the system is 6 months (flowing) or 2 years (shut in) (OSRL 2017). This design basis is sufficient to enable subsequent plug and abandonment (P&A) of the capped well, which would likely be done by drilling a relief well to intersect the wellbore to complete P&A activities. At the appropriate time during/after P&A operations, the capping stack would be removed and any final decommissioning (i.e., wellhead removal) would be completed. Removal of equipment and any subsequent monitoring required would be undertaken in accordance with the requirements set out in the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (Government of Canada 2014).

References

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OSRL (Oil Spill Response Limited). 2017. Global Assets. Technical Library. Available online: https://www.oilspillresponse.com/globalassets/technical-library/information-sheets/capping-stack-system-aug-2017.pdf. Accessed April 2018.

INFORMATION REQUIREMENT – IR-61

(ECCC-16)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Appendix H, Capping Stack Technology Details; and Section 3.2.1, The Subsea Incident Response Toolkit (SIRT) (Flemish Pass Exploration Drilling Project). Appendix H Spill Prevention and Response (Eastern Newfoundland Offshore Exploration Drilling Project).

Context and Rationale

Statoil's EIS indicates that, in preparation for the deployment of a capping stack, OSRL maintains the Subsea Well Intervention Service (SWIS) capping toolbox suite of equipment that includes the Subsea Incident Response Toolkit (SIRT), which is "stored in ready-for-shipment mode". However, no deployment timeframe has been provided. Likewise, there is no indication in the Eastern Newfoundland Offshore Exploration Drilling Project EIS of timelines related to the mobilization of the response toolkits.

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 in order to help inform a determination of significance of any residual effects.

Specific Question or Information Requirement

Provide the estimated timeframe for emergency deployment of the Subsea Incident Response Toolkit or alternate response toolkit to the project area in the event of an accidental event. Discuss implications of this timeframe for emergency response and effects predictions.

Response

The notification from Oil Spill Response Limited (OSRL) to mobilize the subsea incident response toolkit (SIRT) would occur at the same time that the notification to mobilize the capping stack system (CSS) was provided. While the final decision on the specific SIRT equipment to be mobilized would depend on the nature of the incident, all SIRT equipment is maintained 'response ready' for air freight to the required location. The SIRT would be mobilized from Norway and could be mobilized to Newfoundland within 24-48 hours, pending transportation availability, after the equipment was requested. Use of the SIRT would commence prior to arrival of the CSS. The deployment of the SIRT is only one part of spill response and other measures and equipment would be activated and deployed immediately following an incident as outlined in Section 15.0 of the Environmental Impact Statement (EIS). Additional details will be outlined in the ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) Oil Spill Response Plans (OSRPs) included in the *Operations Authorization* (OA) application, which will be submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) for review and approval.

The estimated timeframe for deployment of SIRT and CSS would be 30 to 36 days and these effects were assessed with the unmitigated spill duration provided in Appendix E of the EIS. The estimated timeframe for drilling a relief well would be 113 days and these effects were assessed with the unmitigated, worst-case spill duration provided in Appendix E of the EIS.

References

N/A

INFORMATION REQUIREMENT – IR-62

(N/A)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Section 6.6.1, Effects of Potential Accidents or Malfunctions; Section 6.3.5, Migratory Birds.

Reference to EIS: Section 15.4.4.5, Summary of Modelling Results; 15.5.2.3.2, Uncontrolled Well Event; 15.5.6.3.2, Uncontrolled Well Event.

Context and Rationale

Section 6.6.1 of the EIS Guidelines requires the proponent to identify areas that could potentially be affected by a worst-case scenario for each accident type. Section 15.4 of each EIS summarizes the potential for shoreline oiling as follows:

- For Flemish Pass Exploration Drilling Project: "If shoreline contact was predicted to occur, it would likely be localized to small portions of shoreline, but could occur from the Avalon Peninsula and the southeast coast of Newfoundland to the northern shores of Newfoundland, southeastern shores of Labrador and Sable Island, depending on the conditions."
- For Eastern Newfoundland Offshore Exploration Drilling Project: "If contact with shoreline did occur, it was predicted to be localized to regions of the Avalon Peninsula, southeast coast of Newfoundland, and Sable Island."

With the exception of some information on bird colonies and special areas in eastern Newfoundland and some marine mammal sightings on the eastern Avalon Peninsula, the EIS does not provide baseline data on the above identified areas, nor does Section 15.0 provide analysis of the effects of oil reaching these nearshore areas.

Section 15.5.2.3.2 notes that in a worst-case scenario, oil in concentrations between 100–500g/m^2 could interact with areas of the Southern Avalon and south coast of the island near Burgeo. However, the EIS does not include any baseline information or effects analysis for piping plovers in the Big Barasway Wildlife Reserve. While exposure is unlikely, it is noted that the exposure would be serious, particularly on the Avalon Peninsula. Table 9.3 states: "Piping plovers are unlikely to be affected by typical project activities due to their preference for coastal habitats, but accidental spills near breeding habitat could potentially be harmful." An effects analysis of nearshore spill for coastal seabird ecological reserves such as Baccalieu, Funk Island, Cape St. Mary's, and Witless Bay has not been included in the EIS.

Specific Question or Information Requirement

At a level commensurate with the potential for a spill to contact the shoreline, provide a general description of key valued components in nearshore areas potentially affected by a worst-case scenario spill, and a consideration of potential effects of worst-case shoreline oiling, including effects on applicable components (e.g., special areas, migratory birds, fish and fish habitat, socio-economic VCs).

Response

The potential for an oil spill to contact the shoreline is very low (see Appendix E of the Environmental Impact Statement [EIS] for a shoreline contact probability mapping). Spill prevention techniques and response strategies will be incorporated into the design and operations for all Project activities as part of contingency planning, which will greatly reduce the likelihood of such effects occurring. If a worst-case oil spill were to occur, modelling has indicated that surface oil would take at least 29 days to reach the eastern shoreline of Newfoundland (See EIS Appendix E), at which point it will be highly weathered and discontinuous; given this and the application of mitigation and response measures, it is unlikely that the overall abundance, distribution, or health of affected coastal areas would be significantly affected. The following sections provide a general description of the valued components in nearshore / coastal areas that could potentially be affected by a worst-cast spill scenario at a level commensurate with the potential for interaction.

Fish and Fish Habitat

The potential effects of an oil spill on Marine Fish and Fish Habitat are assessed in Section 15.5.4.3.2 of the EIS. In the event of an oil spill reaching a shoreline, plankton, macroalgae and sea grasses (*Zostera marina*) and the fish and invertebrates that inhabit these areas along the coast could be potentially affected.

A description of the plankton, marine plants, and macroalgae communities present in the Project Area, and generally in the marine environment of eastern Newfoundland, is provided in Section 6.1.4 of the EIS. The majority of primary plankton productivity occurs in the light-infused epipelagic zone (0-200 m water depth) (Licandro et al. 2015). Phytoplankton are considered the most dominant marine plant in the coastal regions with higher productivity in nutrient upwelling areas such as nearshore and along the edge of the continental shelf (Stantec 2012). On the Atlantic coast of Canada, including the coasts of Nova Scotia and Newfoundland and Labrador, less than a dozen species comprise 80-95% of the macroalgae biomass in the photic zone and include brown (e.g., *Laminaria sp., Agarum clathratum, Fucus sp*.), red (e.g., *Chondrus crispus, Palmira palmata, Lithothamnion sp*.) and green (e.g., *Ulva lactuca*) algae (South and Cardinal 1970, South 1984, Stantec 2012, Bundy et al. 2014). Sea grasses are primarily found in shallow, protected coastal areas (Encana 2002). These plant species occupy a variety of habitats but are primarily found in intertidal and subtidal areas and are attached to hard substratum (Bundy et al. 2014). Kelps (brown algae, *Laminaria sp*.) are important components of nearshore benthic habitats and are among the most productive marine ecosystems worldwide (Merzouk et al 2011).

Macroalgae and sea grasses are important components of coastal environments in their role as food, habitat, and nursery areas (Cote et al 2003; Merzouk et al 2011, MacLean et al 2013, Amec 2014). In the highly unlikely event of an unmitigated oil spill scenario that potentially affected macroalgal and seagrass species, there would likely be potential adverse effects related to the changes in fish habitat quality, changes in food abundance and quality and injury and mortality of early life history stages of fish and invertebrates. Depending on the timing of the spill, shoreline contact may also have adverse effects on beaches where capelin spawn (Trenkel et al 2014). Capelin have great ecological importance as they are a primary prey species of predatory fish, marine mammals, and seabirds (Davoren and Montevecchi 2003; Rose 2005; Dawe et al 2012; Maxner et al 2016) and adverse effects to this forage fish species would have implications for higher trophic levels. Further details on the potential effects on early life history stages of fish and invertebrates are detailed in Section 15.5.1.2.1.

Spill prevention techniques and response strategies will be incorporated into the design and operations for all Project activities as part of contingency planning, which will greatly reduce the likelihood of such effects occurring. In the unlikely event of an oil spill reaching a shoreline, it will be highly weathered and discontinuous; given this and the application of mitigation and response measures, it is unlikely that the overall abundance, distribution, or health of affected coastal areas would be significantly affected.

Marine and Migratory Birds

In the unlikely event of shoreline oiling, particularly at or near the seabird colonies of the Avalon Peninsula and for coastal seabird ecological reserves such as Baccalieu, Funk Island, Cape St. Mary's, and Witless Bay, there is potential for marine and migratory birds present and breeding in these areas to experience an increase in mortality, injury or health effects due to ingestion of hydrocarbons during preening, loss of insulation and/or buoyancy associated with oiled plumage, and / or potential ingestion of oiled prey. It is probable that only a small proportion of local populations would be affected.

As stated in Section 9.4 of the EIS, two marine-associated avian species at risk / species of conservation concern (SAR / SOCC) are known to occur in the in the Regional Study Area (RSA) and seven more occur in coastal habitats in Newfoundland and Labrador during at least part of the year. Of these, the only SAR / SOCC that uses habitat which could come into contact with shoreline oil is the Piping Plover (*Charadrius melodus melodus*). The Piping Plover nests on two beaches on the south coast of Newfoundland within the Big Barasway Wildlife Reserve (Burgeo and Seal Cove), which are designated as critical habitat (Table 6.34 in the EIS).

Although Sable Island is outside the RSA, there is a low potential for its coast to experience shoreline oil in the event of a spill. Two additional avian SAR, the Roseate Tern (*Sterna dougallii*) and Savannah Sparrow (*Passerculus sandwichensis*) (Ipswich subspecies) nest on Sable Island, which is designated as critical habitat for the Roseate Tern.

If an oil spill were to reach the shoreline, marine bird SAR / SOCC which nest along in coastal habitats, such as the Piping Plover (in Newfoundland), or Roseate Tern and Savannah Sparrow (in Sable Island) could potentially experience a change in mortality or injury levels and health effects. However, without application of mitigation and response measures, surface oiling would take at least 29 days to reach the shoreline of Newfoundland (more than 78 days to reach Sable Island), and would be highly weathered and patchy by this time. As well, the risk of adverse effects on avian SAR / SOCC will be mitigated by incorporation of spill prevention techniques and response strategies for all Project activities as part of contingency planning to help to ensure that effects do not occur, and to reduce the potential for significant adverse effects to species at risk.

Marine Mammals and Sea Turtles

The effects of an oil spill on marine mammals and sea turtles are assessed in Section 15.5.3.3.2 of the EIS. The degree of exposure and thus the type and level of any such 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. With respect to an oil spill reaching a shoreline, marine mammal species that haul out on the potentially affected shorelines (e.g., grey seals [*Halichoerus grypus*]; Section 15.5.3.3.2 of the EIS) are those most likely to interact with hydrocarbons, conceivably experiencing a change in mortality or injury or a change in health; however, it is probable that only a small proportion of local populations would be affected. Predatory marine mammals that prey on seals (e.g., killer whales [*Orcinus orca*]) may also experience changes in mortality, injury, or health following consumption of oiled prey species. Spill prevention techniques and response strategies will be incorporated into the design and operations for all Project activities as part of contingency planning, which will greatly reduce the likelihood of such effects occurring. In the event of an oil spill reaching a shoreline, it will be highly weathered and discontinuous; given this and the application of mitigation and response measures, it is unlikely that the overall abundance, distribution, or health of affected marine mammal species or sea turtle species would be significantly affected.

Special Areas

In the event of an oil spill, surface oiling would take at least 29 days to reach the Newfoundland shoreline, at which time the oil would be highly weathered and patchy. As well, the risk of adverse effects on shoreline components of the special areas will be mitigated by implementing response strategies as part of contingency planning. The potential effects of an oil spill on coastal Special Areas are assessed in Section 15.5.4.3.2 of the EIS.

Socio-economic Valued Components (VCs)

In the event of an oil spill, surface oiling would take at least 29 days to reach the shoreline of Newfoundland, by which time the oil would be highly weathered and patchy. As well, the risk of adverse effects on shoreline components of socio-economic VCs will be mitigated by implementation response strategies as part of contingency planning

The potential effects of an oil spill on Indigenous Communities and Activities are assessed in Section 15.5.5.2 of the EIS, and the potential effects of an oil spill on Commercial Fisheries and Other Ocean Users are assessed in Section 15.5.6 of the EIS. These assessments were conducted at a level commensurate with the likelihood of an oil spill to interact with the VCs.

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INFORMATION REQUIREMENT – IR-63

(NRCanIR-6)

Project Effects Link to CEAA 2012: Potential effects to 5(1)(b) Federal Lands /Transboundary.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.1.2.1, Contingency Planning; 15.1.2.3.3, Spill Response Tactics and Spill Impact Mitigation Assessment; Table 15.1 Spill Response Tactics.

Context and Rationale

The EIS Guidelines require that the environmental effects from emergency response burns should be considered in the assessment of effects from potential oil spills and blowouts (Section 6.6.1).

In Section 15.1.2.1 of the EIS, controlled in-situ burning of thick oil on water surface is identified as a possible response to an oil spill. The EIS notes that authorization is required from the CNLOPB prior to implementing in-situ burning. Table 15.1 of the EIS identifies potential air quality effects of in-situ burning, but indicates that air quality monitoring is unlikely to be required due to the distance from human receptors. No further information on potential environmental effects is provided.

Natural Resources Canada has advised that in-situ burning of crude oils could result in incompletely combusted oil in the water.

Specific Question or Information Requirement

Provide a general discussion of the potential environmental effects of in situ burning on valued components.

Describe the potential for incomplete burning and resulting oil in the water and assess associated effects. Describe proposed mitigation and follow-up and update effects predictions, as applicable.

Response

Part 1: Provide a general discussion of the potential environmental effects of in situ burning on valued components.

The response to Information Requirement (IR) IR-53 provides a high-level discussion of the Spill Impact Mitigation Assessment (SIMA) including the purpose, development, submittal to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), and typical contents based on a SIMA that was developed by Equinor Canada Ltd. (Equinor) for the 2017 exploration drilling program. As noted in IR-53, the SIMA will provide information on response options, which may include in-situ burning.

In-situ burning is similar to mechanical recovery and typically involves collecting oil on the surface using vessels and fire-resistant booms (Coelho et al 2017). The oil is collected until it reaches a thickness that supports combustion (typically between 2 and 5 millimetres [mm]), and is ignited using flares, torches or other devices (Coelho et al 2017). Smoke plumes are produced that consist of small carbon particles that disperse into the atmosphere, and air monitoring may be required due to the proximity of response workers, however, the plumes would dissipate before reaching any land mass (Coelho et al 2017). As mentioned in Table 15.1 of the Environmental Impact Statement (EIS), ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) are required to obtain authorization from the C-NLOPB prior to implementing in-situ burning.

The EIS did not consider the effects of tactical spill response methods as the spill trajectory modelling was completed for worst-case, unmitigated scenarios. However, potential environmental considerations associated with in-situ burning are outlined in Table 15.1 of the EIS. In addition to the information presented in the EIS, there are environmental aspects associated with in-situ burning that may be considered when determining the most effective and efficient spill response measure, including, but not limited to, the information below.

Atmospheric Emissions

When in-situ burning occurs, the burned oil is typically converted to the following (Ferek et al 1997):

- 85 to 95% - carbon dioxide and water;
- 5 to 15% - not efficiently burned due to lack of oxygen and becomes particulate; and
- 1 to 3% - combustion by-products (e.g., nitrogen dioxide, sulphur dioxide, carbon monoxide, etc.).

As mentioned above, air monitoring may be required due to the proximity of response workers, however, due to the distance from the Project Area to land, the plumes are anticipated to dissipate before reaching any land masses (Coelho et al 2017).

The Newfoundland Offshore Burn Experiment (NOBE) was completed in the Grand Banks area in August 1993, and in conjunction with various Canadian and American regulatory agencies (e.g., Environment Canada, Canadian Coast Guard, United States Environmental Protection Agency, United States Coast Guard, etc.), operators (e.g., Imperial Oil Limited, Hibernia Management Development Company Ltd., etc.) and associations/institutes (e.g., American Petroleum Institute, Canadian Association of Petroleum Producers, etc.) (Fingas et al 1994). More than 200 sensors or samplers were deployed to collect quantitative data associated with the NOBE, which determined that emissions produced were less than anticipated (Fingas et al 1994). The measured parameters were determined to be below occupational health exposure levels within 150 m from the burn (Fingas et al 1994).

Burn Residue

When in-situ burning occurs there is typically an oil residue that remains on the surface. A controlled test burn during the tanker incident in Alaska spill resulted in a burn residue that remained on the sea surface and was easily removed (Allen 1990), however, burn residues from a tanker incident in Italy were found to sink (Moller 1992). There was another test burn completed in Alaska and it was observed that the burn residue floated initially and sank when cool (Buist 1995). 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 affected from smothering (NOAA 2018).

Direct Temperature Effect

The NOBE, which is mentioned above, collected temperature data at several points on the fire-resistant boom using thermocouples, and concluded that there was no increase in water temperatures, even though the temperatures at the top of the boom reached 1000°C (Fingas et al 1994).

Water Column Toxicity

The NOBE, mentioned above, analyzed water under the burn and determined that concentrations of parameters of concern were low and similar to background levels (Fingas et al 1994). Toxicity testing of the water was also completed, but was too low to be measured using currently available toxicity tests (Fingas et al 1994). Environment Canada, however, completed additional experiments in a laboratory testing and concluded that toxicity of water under the burn area increased, however, it was determined that the increase was similar to the toxicity of an unburned oil slick (Daykin et al 1994).

Effect on Surface Microlayer

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., fish eggs/larvae) (ADEC et al 2008). Most of studies on the surface microlayer have been completed in areas nearshore, however, some studies have focused on areas offshore and found that densities of larvae were similar to those found in nearshore environments (ADEC et al 2008). If in-situ burning occurs the area would be relatively small, compared to the remainder of the offshore environment, and therefore it is expected that a rapid renewal of the surface microlayer from adjacent areas would occur, and the long-term net loss of biomass would likely be minimal or non-existent (ADEC et al 2008).

Part 2: Describe the potential for incomplete burning and resulting oil in the water and assess associated effects. Describe proposed mitigation and follow-up and update effects predictions, as applicable.

If in-situ burning is implemented as a response measure then the Operators would ensure that weather conditions are favourable at the time and that 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. If incomplete burning occurs and oil remains present on the sea surface then other response measures (e.g., mechanical recovery) could be implemented to complete the response.

Part 3: Summary

As mentioned in the response to IR-53, the SIMA will include a risk assessment section that takes into consideration the response options, which may include in-situ burning, spill scenarios, and resources of concern (e.g., birds, fish, marine mammals, sea turtles, corals and sponges, commercial fisheries, responder safety). The risk assessment uses a methodology developed by the American Petroleum Institute, International Petroleum Industry Environmental Conservation Association and International Oil and Gas Productions (API-IPIECA-IOGP) (IPIECA 2018). The risk assessment uses a single comparative matrix that provides a qualitative prediction of how each response option might mitigate the overall impacts to the resources of concern (Coelho et al 2017). The Operators will develop SIMAs and complete risk assessments on each response option, which may include in-situ burning, and the potential effects of resources of concern (e.g., birds, fish, marine mammals, sea turtles, corals and sponges, commercial fisheries, responder safety) will be further determined in the SIMAs.

References

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INFORMATION REQUIREMENT – IR-64

(NRCanIR-7)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 3.1, Project Components; and 3.2.1, Drilling and testing activities.

Reference to EIS: Section 15.0, Accidental Events; 15.4.4.2.2, Water Column Exposure Cases.

Context and Rationale

The EIS states that the majority of the oil entrainment in the water column is due to wind-induced surface-breaking waves. There are multiple reasons for oil components to become suspended in the water column, and even sink. Crude oils are known to be persistent following a blowout scenario.

Specific Question or Information Requirement

Provide additional analysis of the portion of the crude oil that would persist in the environment, including an analysis of the effects of the persistent components on VCs, and possible follow up monitoring.

Response

The Spill Impact Model Application Package (SIMAP) model is a state-of-the-art oil trajectory, fate, and effects model that is constantly being developed based upon the growing body of field and laboratory data associated with releases of oil in many different environments. The model has been validated against many real-world release including the Deepwater Horizon oil spill, where it was used in the US Government's Natural Resource Damage Assessment. In this specific example, a small portion of the released oil may have sank as a result of the interaction of released oil with sediments, drilling muds, and other material used in response efforts such as procedures used to seal a leaking well. These are currently areas of active research. While there are additional fates processes that may result in slight differences in the ultimate fate of oil, these processes are known to have relatively lower effects on the total volume of oil in each environmental compartment (on the order of single percentages different, depending on the release and receiving environment) as compared to the fates processes such as entrainment, which are already being modelled. The science and algorithms that may be used to model these processes have not been developed in the scientific community to the point of a consensus or use in modelling. Ongoing research topics currently underway include the formation of marine oil snow (MOS), photo-degradation, droplet size distributions, and other research areas. These and other projects are multi-year research projects and other ongoing research is being worked on and considered for incorporation in modelling nearly constantly. Due to these topics being in the research phase, the Operators are not in a position to analyse the effects on the valued components (VCs) or develop follow-up monitoring programs at this time. However, in collaboration with research partners the Operators may consider research on this topic if prioritized as per the processes established within the collaborative research organizations such as the Environmental Studies Research Fun (ESRF) and Petroleum Research Newfoundland and Labrador (PRNL).

References

N/A

INFORMATION REQUIREMENT – IR-65

(KMKNO-22, -23, -27 and -28, NunatuKavut-1)

Project Effects Link to CEAA 2012: All – Mitigation.

Reference to EIS Guidelines: Part 2, Section 6.3.8.3, Special Areas; Part 2, Section 6.4, Mitigation measures.

Reference to EIS: Section 4.3.3, Environmental Effects Assessment and Mitigation.

Context and Rationale

The EIS Guidelines require that the mitigation measures included in the EIS be specific, achievable, measurable and verifiable, and described in a manner that avoids ambiguity in intent, interpretation, and implementation (Section 6.4). Mitigation measures are to be written as specific commitments that clearly describe how the proponent intends to implement them and the environmental outcome the mitigation measure is designed to address.

Overall, the EIS does not explain how mitigation would be implemented and the specific environmental effects that each mitigation measure is meant to address. Section 4.3.3 of the EIS briefly explains how technically and economically feasible mitigation has been integrated into the effects assessment; however, it does not explain the effectiveness of mitigation in a clear and defined way.

Some specific examples are included below:

- The EIS provides a partial list of mitigation from the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (SOCP) (DFO 2007). It is unclear why only a partial list is included and whether the proponent intends to implement all mitigation included in the document (Section 10.3.2).
- The EIS states that “project associated vessel traffic will be approximately eight to ten trips per month to service one drilling installation. Use of existing and common travel routes will be used where possible and practical. Vessels will maintain a steady course and safe vessel speed whenever possible.” Safe vessel speeds are not defined and it is not explained under what circumstances vessels would have to deviate from existing travel routes.
- The EIS state that “low-level aircraft operations will be avoided where it is not required per Transport Canada protocols”. Additional clarity is needed to better understand the potential for adverse effects arising from project- related helicopter traffic and how it is proposed to mitigate those effects.

Specific Question or Information Requirement

Review proposed mitigation measures in relation to all valued components and provide an updated list of mitigation measures that are specific, achievable, measurable and verifiable, and described in a manner that avoids ambiguity in intent, interpretation, and implementation. Ensure proposed mitigation measures are linked to the environmental effect(s) that they are meant to address and to proposed follow-up programs, as applicable.

In addition, address the specific questions below to enable a robust understanding of proposed commitments:

- Describe the specific mitigation measures that the proponent intends to implement that are described in the Statement of Canadian Practice with respect to the Mitigation of Geophysical Sound in the Marine Environment (DFO 2007).
- Define safe vessel speed and explain which environmental effects these speeds proposed 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.
- Provide additional information to explain how "low-level aircraft operations will be avoided where it is not required per Transport Canada protocols". 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. Include information on specific altitude and lateral distance limits that would be used to avoid sensitive sites (e.g., bird colonies) and disturbance to marine mammals and sea turtles. Define "low-level aircraft operations".

Response

The response to Information Requirement (IR) IR-65 is structured to respond to each item of the "Specific Question or Information Requirement".

Proposed Mitigation Measures

As required under Section 19(1)(d) of the *Canadian Environmental Assessment Act 2012* (CEAA 2012) (Government of Canada 2012) and in the Environmental Impact Statement (EIS) Guidelines, the EIS identifies and proposes "mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the designated project", which the Act defines as: *Measures for the elimination, reduction or control of the adverse environmental effects of a designated project, and includes restitution for any damage to the environment caused by those effects through replacement, restoration, compensation or any other means* (Government of Canada 2012).

These are presented throughout the environmental effects assessment sections of the EIS (Chapters 8 to 13), and are summarized in Section 17.2 and Table 17.2. These include general and issue-specific mitigation measures that have been identified and proposed based upon current industry best practices and standards, applicable regulatory requirements, those suggested through ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) engagement with regulatory authorities, stakeholders and Indigenous groups (Chapter 3), and as defined through the professional judgment of the Operators and EIS study team. The application of these mitigation measures is considered in a fully integrated manner in the environmental effects assessment, and the EIS identifies and commits to mitigations that are intended to help avoid or reduce any and all predicted adverse effects (whether potentially significant or not) wherever possible and feasible.

A detailed list of the planned mitigation measures that will be implemented during the Project to avoid or reduce adverse environmental effects is provided in Table 17.2 of the EIS, which the Operators maintain are “specific, achievable, measurable and verifiable”, and which are therefore not considered to be general or “ambiguous” in nature. In terms of the request that the Operator “ensure proposed mitigation measures are linked to the environmental effect(s) that they are meant to address and to proposed follow-up programs, as applicable”, it should be noted that in most cases any one proposed mitigation measure will be relevant to avoiding or reducing multiple – and in some cases, all – of the predicted effects of the Project on any particular valued component (VC). For example, the mitigation commitment that “operational discharges will be treated prior to release in accordance with the Offshore Waste Treatment Guidelines (OWTG; NEB et al 2010)) and other applicable regulations and standards” (see Section 8.3.2 for example) will be relevant to mitigating all of the potential effects on marine fish and fish habitat and on many of the other VCs that were considered in the EIS. It is therefore typically not required to attempt to link each individual mitigation measure to a particular predicted environmental effect. The “Summary of Mitigation and Commitments” provided in Table 17.2 does however, link particular mitigation measures to individual VCs, where possible and applicable. The Operator is also developing and will use an “EA Commitments Tracking Register” to identify and track the implementation of each of the mitigation measures and other commitments made in the EIS and/or which may otherwise be required as a result of the Environmental Assessment (EA) review of the Project.

Geophysical Surveys

Geophysical activities for the Project will be planned and conducted in consideration of the *Statement of Canadian Practice with respect to the Mitigation of Geophysical Sound in the Marine Environment* (SOCP) (DFO 2007). The SOCP specifies the minimum mitigation requirements that must be met during the planning and conduct of marine geophysical surveys, in order to reduce effects on life in the oceans. These mitigation measures can be applied to vertical seismic profiling (VSP) operations. These 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. In terms of the reviewer’s request that the EIS describe the specific measures the Operators intend to implement during the Project geophysical surveys, and as noted in the EIS, mitigation protocols are described in detail in the SOCP (DFO 2007). As outlined in Sections 10.6 and 17.4.2 of the EIS, during a geophysical survey involving an air source array, visual monitoring for marine mammals will be undertaken based on the protocols outlined in the SOCP and the Environmental Sciences Research Fund (ESRF) marine mammal monitoring protocol. A marine mammal and sea turtle monitoring plan will be submitted to the applicable regulators for review at least 30 days prior to the commencement of the first geophysical survey. If VSP is required, specific details of the VSP operations for the Project will depend on the geological target and the objectives of the VSP in question.

Vessel Operations

In terms of vessel speeds, there are no defined vessel speed limits that are formally imposed on the operations. As standard practice, transits are typically completed at speeds of between 10-12 knots. Occasionally the vessels will transit at best possible speed which will generally be 13-14 knots. Reducing vessel speed has been shown to reduce the number of marine mammal deaths and severe injuries due to vessel strikes (Vanderlaan and Taggart 2007; Vanderlaan et al. 2008, 2009; van der Hoop et al. 2012). Lethal strikes are considered infrequent at vessel speeds less than 25.9 km/hour (i.e., 14 knots) and rare at speeds less than 18.5 km/hour (i.e., 10 knots) (Laist et al. 2001). Optimum vessel speeds are determined based on environmental conditions, fuel efficiency and safety considerations. With regard to possible supply vessel routes, there are likewise no defined shipping lanes in the area. Section 2.5.2.6.2 of the EIS states that: "Supply *vessels supporting the Project will transit in a straight-line approach to and from a port to a drilling installation, a common industry practice for energy efficiency employed for over 30 years by operators with facilities offshore Newfoundland. … Supply and support vessel traffic routes servicing the existing production facilities, and a potential traffic route to the Project Area, are illustrated in Figure 2-5. The potential route is representative only and the route will change depending on the location of the drilling installation. If operators shared supply vessels, the vessel could transit from St. John's to one facility and then transit to another facility; however, the transit out of and to St. John's will be similar to that shown in Figure 2-5. During the ice season, the routes will likely be altered to avoid pack ice along the transit route."*

In addition, as outlined in the EIS, ongoing communications with fisheries stakeholders and the Single Point of Contact (SPOC) processes will further facilitate communication and coordination between supply vessels, fishers, and the Operators when multiple vessels are present in the region.

It should also be reiterated that while the environmental effects assessment considers Project-related vessel and aircraft traffic to and from the offshore Project Area, the effects predictions are not based specifically and exclusively on particular identified (and notional) routes or particular vessel speeds, but rather are inclusive of the concepts and potential deviations noted in the EIS and summarized above.

Helicopter Traffic

All helicopter flights are anticipated to be routed direct from the St. John's Airport (YYT) to the Operators project sites (i.e., locations in the Flemish Pass and Eastern Newfoundland areas for Equinor and ExxonMobil respectively) and operated by third-party suppliers. As outlined in Section 2.5.2.6.3, aviation is regulated by Transport Canada and includes regulations and operational requirements for helicopter traffic.

Based on experience, standard altitude profiles are between approximately 610 metres (m) (or 2,000 feet) and 2,743 m (or 9,000 feet), with an odd number altitude being flown on the eastbound flight, and an even number altitude being flow on the westbound flight for separation purposes. During the approach phase to an offshore installation, the helicopter is typically only below 152 m (or 500 feet) for three to six minutes, or approximately 2% of a total round trip flight, assuming the flight is 4.5 hours. Onshore approaches to YYT are flown at the same approach points and altitudes as commercial air traffic.

References

DFO (Fisheries and Oceans Canada). 2007. Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment. Available online: http://www.dfo-mpo.gc.ca/oceans/management-gestion/integratedmanagement- gestionintegree/seismic-sismique/statement-enonce-eng.asp. Accessed April 2018.

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CLARIFICATIONS – ROUND 1 (PART 1)

EXXONMOBIL AND EQUINOR

CLARIFICATION – CL-01

(N/A)

Project Effects Link to CEAA 2012: All – project description relevant to all Section 5 effects.

Reference to EIS Guidelines: Part 2, Section 3, Project Description.

Reference to EIS: Section 2.2.5 (Environmental Impact Statement – Summary); Section 2.5.2.6.2, Offshore Supply Vessels; 5.3, Climatology; and 5.5, Oceanography.

Context and Rationale

Section 2.2.5 of the EIS Summary states "[s]upporting vessels that are involved in project activities will travel in an essentially straight line between the drilling installation in the Project Area and an established port facility in Eastern Newfoundland, a practice which is common in the oil and gas industry that has been active in this region for several decades".

Elsewhere, the EIS illustrates or refers to transit routes specifically from St. John's (e.g., Figure 2-5, Sections 2.5.2.6.2, 5.3, and 5.5).

Required Clarification

Confirm that potential transit routes would originate only in St. John's, not in other ports in Eastern Newfoundland.

Response

Supporting vessels associated with offshore activities have utilized the established port in St. John's, Newfoundland and Labrador (NL) for decades. Supporting vessels associated with ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) offshore activities would also utilize the established port in St. John's, NL. Transit routes would primarily be to/from the shore base location in St. John's. Should the facilities in the port of St. John's be inaccessible or if the port facility cannot service the Project, other existing supply facilities in the province may be used.

References

N/A

CLARIFICATION – CL-02

(N/A)

Project Effects Link to CEAA 2012: All – project description relevant to all Section 5 effects.

Reference to EIS Guidelines: Part 2, Section 3, Project Description.

Reference to EIS: Section 2.1, Project Scope.

Context and Rationale

The EIS refers to delineation and appraisal wells.

Required Clarification

Confirm that the terms delineation and appraisal wells are used interchangeably and intended to refer to the same activity. If there are differences between the two activities, describe the differences and associated environmental effects.

Response

Delineation and appraisal wells refer to the same activity. The appraisal phase follows a successful exploration drilling program and consists of drilling delineation wells to determine the size of the oil or gas field (Schlumberger 2018).

The provincial *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act* does not contain a definition for 'appraisal well', however, the following definition is provided for 'delineation well' (Government of Newfoundland and Labrador 2015) *"a well that is so located in relation to another well penetrating an accumulation of petroleum that there is a reasonable expectation that another portion of that accumulation will be penetrated by the first mentioned well and that the drilling is necessary in order to determine the commercial value of the accumulation"*.

The federal *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act* does not contain a definition for "appraisal well" or "delineation well" (Government of Canada 2017).

References

Government of Canada. 2017. *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act*. S.C. 1987, c. 3. Published by the Minister of Justice. Current to April 24, 2018. Last Amended June 22, 2018. Available online: http://laws-lois.justice.gc.ca/PDF/C-7.5.pdf. Accessed March 2018.

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Schlumberger (Schlumberger Limited). 2018. Oilfield Glossary. Available online: http://www.glossary.oilfield.slb.com/Terms/a/appraisal.aspx. Accessed March 2018.

CLARIFICATION – CL-03

(N/A)

Project Effects Link to CEAA 2012: All – project description relevant to all Section 5 effects.

Reference to EIS Guidelines: Part 1, Section 3.1, Project Components; Part 2, Section 3, Project Description.

Reference to EIS: Section 2.3, Project Location and Designated Project Area.

Context and Rationale

The Project Area described in the EIS is a 100 800 km^2 area that extends well beyond ELs that are part of the designated project(s), which are subject to environmental assessment under CEAA 2012.

Required Clarification

To enable reviewers to understand the Project subject to environmental assessment under CEAA 2012, provide a map and text describing a project area, that is consistent with the designated project described in Part 1, Section 3.1 of the EIS Guidelines for the Project.

Response

It is recognized that the Project Area presented in the Environmental Impact Statement (EIS) is an overall polygon that encompass a larger area than the various Operator held exploration licences (ELs) for which planned drilling activity as part of the Project is considered a designated project under the *Canadian Environmental Assessment Act 2012* (CEAA 2012) (Government of Canada 2012). As noted in the EIS (Section 2.3), "*The Project Area is defined as the overall geographic area within which all Project-related components and activities will take place, [which] includes "CEAA 2012-designated project" ELs … where exploration drilling activities may be conducted between 2018 and 2027. The Project Area also encompasses other existing …licences and partner operated licences. The Project Area includes a surrounding area to account for planned and potential ancillary and support activities at and around the wellsites themselves. It should be noted that while this overall Project Area covers an offshore area of approximately 100,800 km² and encompasses all defined Project-related activities, the planned drilling activities will take place within the boundaries of the ELs."* The Project Area was intentionally larger to allow for consideration of inclusion of future licenses or operatorship changes.

Throughout the EIS, clear reference is made to the scope of the Project for environmental assessment (EA) purposes (e.g., Section 4.1, which also cites the relevant parts of the EIS Guidelines), and all mapping in the document that shows the Project Area clearly distinguishes the various "CEAA 2012 ELs" for which planned drilling activity as part of the Project is considered a designated project under CEAA 2012 versus other parts of the Project Area (including other ELs within it) which do include proposed activities that are not part of the designated project.

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

CLARIFICATION – CL-04

(N/A)

Project Effects Link to CEAA 2012: All – project description relevant to all Section 5 effects.

Reference to EIS Guidelines: Part 1, Section 3.1, Project Components; Part 2, Section 3, Project Description.

Reference to EIS: Section 2, Project Description, Sections 8 to 13.

Context and Rationale

Boundaries of the Local Study Areas for valued components (VCs) do not match the predicted effects of the designated project subject to environmental assessment under CEAA 2012.

The EIS describes the local study area as the "predicted environmental zone of influence of the Project's planned components and activities, within which Project-related environmental changes to the VC (valued component) in question may occur and can be assessed and evaluated" (p. 156). For most VCs,[2] all routine effects are predicted to occur within 10 kilometres of Project activities and components (e.g., drilling unit, transportation corridor). However, the local study areas illustrated for VCs in Sections 8 to 13 include or exceed the Project Area illustrated in Figure 2-1, rather than 10 kilometres beyond ELs included as part of the Designated Project under CEAA 2012 and associated transportation corridors, within which routine Project effects are predicted to occur.

Required Clarification

Provide an updated definition of the local study area in accordance with the designated project under CEAA 2012.

Response

Please see the response to Clarification (CL) CL-03 regarding the definition of the overall Project Area for the Environmental Impact Statement (EIS) and its relationship to the various "CEAA 2012 ELs" for which planned drilling activity as part of the Project is considered a designated project under the *Canadian Environmental Assessment Act 2012* (Government of Canada 2012).

In terms of the Local Study Area (LSA), as described in Section 4.3.1.1 of the EIS, this area is likewise an overall polygon that has been defined for the purposes of providing an overall "study area" for the purposes of the environmental effects assessment for each valued component (VC). The LSA is not in and of itself intended to reflect the overall likely geographic extent of the environmental disturbances and resulting effects of the designated Project, but rather, to fully (and conservatively) encompasses the overall geographic area over which all planned Project-related activities and associated environmental interactions (including any emissions, discharges, and other disturbances) are predicted to occur, and within which Project-related environmental changes to the VC in question may occur and can be assessed and evaluated. While it is recognized that in many cases these environmental changes and resulting effects may occur only within a portion of

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[2] It is noted that effects on marine mammals are predicted to occur within 150 km of ELs

the LSA itself, the LSA for each VC has been defined to comprehensively and conservatively account for the overall zone of influence of potential Project activities at any one location within the Project Area, including any Project activities that could conceivably occur on the edges of the Project Area boundary and thus extend beyond it.

To further account for the fact that any particular environmental effect will likely occur only within a very specific part of the overall LSA (which is again an overall study area for the VC for environmental assessment [EA] purposes), all predicted environmental effects are described in the effects assessment according to a number of criteria, which includes defining the anticipated "geographic extent" of any such individual effect.

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

CLARIFICATION – CL-05

(DFO-02)

Project Effects Link to CEAA 2012: Multiple VCs –Regional Study Area (Accidents and Malfunctions).

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 4.3.1.1, Study Areas.

Context and Rationale

The EIS Guidelines require that the spatial boundaries will identify the areas that could potentially be affected by a worst-case scenario for each accident type. Figure 4-1 shows the boundaries of the RSA which should encompass the areas that could be affected by an accidental event. The EIS notes that, "the RSA also encompasses the predicted zone of influence of a potential oil spill event, as summarized in Section 15.4 and modelled in detail in Appendix E, and specifically, the maximum cumulative surface oil thickness for the 95th percentile surface oil exposure case." Based on information provided in Appendix E, Figure 4-20, the maximum cumulative surface oil for the 95th percentile extends beyond the boundaries depicted in Figure 4-1 (Regional Study Area).

Required Clarification

Update the map and text describing the Regional Study Area, taking into consideration spill modelling results.

Response

Using the thresholds listed in Table 2.2 of the Trajectory Modelling Report (Appendix E of the Environmental Impact Statement [EIS]), the ecological threshold for oil floating on water surface oiling is 10 grams per square metre (g/m^2), which equals 0.01 millimetres (mm) (as per Table 2.2 footnote: 1 g/m^2=1 µm (=0.001 mm)). That is depicted by the dark brown sheen in Figure 4.20 of Appendix E, which is within the defined Regional Study Area (RSA).

The referenced EIS text is therefore clarified as follows: *"The RSA also encompasses the predicted zone of influence of a potential oil spill event, as summarized in Section 15.4 and modelled in detail in Appendix E, and specifically, the maximum cumulative surface oil thickness for the 95th percentile surface oil exposure case* ***at the ecological threshold of 10 g/m^2 (0.01 mm)****."* The RSA does not require updating based on this clarification.

Also, please note that the RSA "…considers and describes environmental components and potential effects that may extend outside this area where relevant…." (e.g., EIS Section 4.3.1.1).

References

N/A

CLARIFICATION – CL-06

(N/A)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat 5(1)(a)(ii) Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.1.3, Fish and Fish Habitat.

Reference to EIS: Section 6.1.6, Benthic Environment.

Context and Rationale

Table 6.10 – EL 1137 states that there are no sponges in this EL; however, Figure 6-14 clearly has two identified location of sponges.

Required Clarification

Update Table 6.10 to provide information on the sponge occurrences depicted for EL 1137 in Figure 6-14.

Response

Table 6.10 is updated and provided below. Sponges are present in exploration licence (EL) 1137 and the immediate surrounding area, however they are sparsely distributed on the Newfoundland Shelf (Guijarro et al. 2016, Knudby et al. 2013). Due to the fragility of sponges, they are often not identified to species, as such the exact species in the Project Area are not known. Knudby et al. (2013) indicated an absence of Geodid sponges near EL1137 based on multispecies trawl information and associated modelling.

Table 6.10 Summary of Known and Potential Coral / Sponge Occurrence in the ELs that Comprise the Project

Exploration Licence	Known Presence and Distribution Based on Existing Information	Data Sources(s)	Summary of Known or Potential Presence and Distribution
EL 1135 (200-1,100 m)	*Sponges* • Demosponges • *Geodia* sp. *Corals* • soft corals • sea pens	• Canadian RV Data • Knudy et al (2013) • Guijarro et al (2016) • Wareham (2009)	• Distribution modelling indicates depth as main predictor for coral presence. • Depth and minimum bottom salinity key predictors for *Geodia* sp. presence. • Sponge and coral species distributed at species specific depths along the slope areas.
EL 1137 (<200 m)	*Sponges* • unidentified species *Corals* • soft corals • gorgonian corals	• Canadian RV Data • Guijarro et al (2016) • Wareham (2009)	• Distribution modelling indicates depth as main predictor for coral presence. • Sponge and coral species distributed at species specific depths along the slope areas.
EL 1139	*Sponges* • unidentified species	• Carter et al	• Regional datasets indicate presence of sponges (unidentified species) on

Table 6.10 Summary of Known and Potential Coral / Sponge Occurrence in the ELs that Comprise the Project

Exploration Licence	Known Presence and Distribution Based on Existing Information	Data Sources(s)	Summary of Known or Potential Presence and Distribution
(2,700-3,400 m)		(1979) • d'Entremont et al (2008)	rocks and small boulders.
EL 1140 (2,500-3,400 m)	*Sponges* • unidentified species	• Carter et al (1979) • d'Entremont et al (2008)	• Regional datasets indicate presence of sponges (unidentified species) on rocks and small boulders.
EL 1141 (1,100-2,900 m)	*Sponges* • Demospongiae • Astrophorida • *Geodia* sp. *Corals* • Sea pens • Solitary stony corals	• Canadian RV Data • Murillo et al (2012) • Knudy et al (2013) • Beazley et al (2015) • Wareham (2009)	• Distribution modelling indicates depth as main predictor for coral presence. • Sponge and coral species distributed at species specific depths along the slope areas. • Depth and minimum bottom salinity key predictors for *Geodia* sp. presence. • Special Area: Sackville Spur VME and Sackville Spur (6) NAFO FCA – area of extensive sponge grounds associated with warm, salty water mass that occurs between ~1,300 and 1,800 m. • Special Area: Northern Flemish Cap VME and Northern Flemish Cap (8) NAFO FCA – area of higher sea pen concentrations.
EL 1142 (800-2,600 m)	*Sponges* • Geodia sp. *Corals* • Sea pens • Soft coral • Solitary stony corals • Black-wire corals	• Canadian RV Data • Knudy et al (2013) • Beazley et al (2015) • Wareham (2009)	• Distribution modelling indicates depth as main predictor for coral presence. • Sponge and coral species distributed at species specific depths along the slope areas. • Depth and minimum bottom salinity key predictors for Geodia sp. presence. • Special Area: Sackville Spur VME and Sackville Spur (6) NAFO FCA – area of extensive sponge grounds associated with warm, salty water mass that occurs between ~1,300 and 1,800 m. • Special Area: Northern Flemish Cap VME, Northwest Flemish Cap (12) and Northern Flemish Cap (9) NAFO FCAs – area of higher sea pen concentrations.

References

Guijarro, J., Beazley, L., Lirette, C., Kenchington, E., Wareham, V., Gilkinson, K., Koen-Alonso, M., and Murillo, F.J. 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. Canadian Technical Report of Fisheries and Aquatic Science. 3171: vi + 126p.

Knudby, A., Kenchington, E., and F.J. Murillo. 2013. Modeling the Distribution of Geodia Sponges and Sponge Grounds in the Northwest Atlantic. Public Library of Science one 8(12): e82306. doi:10.1371/journal.pone.0082306

CLARIFICATION – CL-07

(DFO-24)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.1.5, Species at Risk.

Reference to EIS: Section 6.1.7.1, Grand Bank Shelf and Slope.

Context and Rationale

Section 6.1.7.1 of the EIS states that "[w]hile redfish is abundant relative to many species, they are not in high density in the region (Figure 6-19)" (p. 336).

This statement is contrary to Figure 6-19 (p. 341), which shows high density in the project area, in particular in EL 1135.

Required Clarification

Provide clarification on the presence and density of redfish.

Response

Comments provided for Section 6.1.7.1 in the Environmental Impact Statement (EIS) are correct. Deepwater redfish show areas of high densities within Project Area as detailed in Figure 6-19. In a review of the 2008-2012 Canadian research vessel (RV) surveys, redfish comprised 29 percent of the catch in the Northern Section of the Project Area and was the dominant species along the shallow slope (250-600 metres [m]). Redfish comprised 14 percent of the catch in Canadian RV surveys in the Southern Project Area and was the dominant species along the shallow (250-600 m) and middle (601-1,000 m) slopes. Capelin (Northern and Southern Section) and sand lance (Southern section) have relatively higher abundance than redfish. Regionally in the Western North Atlantic, redfish primarily occur along the continental slope with lower abundances on shallow areas of the Newfoundland Shelf. There are high densities along the slopes in the Project Area, and higher densities and abundances of redfish along the slopes of the Southern Grand Bank.

References

N/A

CLARIFICATION – CL-08

(DFO-24)

Project Effects Link to CEAA 2012: All.

Reference to EIS Guidelines: Section 6.6.1, Effects of potential accidents or malfunctions.

Reference to EIS: Section 15.5.5.2, Residual Environmental Effects Assessment and Evaluation.

Context and Rationale

The EIS states that "(i)n situ experiments indicate that salmon in natural conditions (not in a lab or a cage) can likely detect hydrocarbons at concentrations approximately ten percent of those shown to cause mortality and avoid them. "A specific reference is not provided for these experiments but if one looks through references provided in Section 15.5.5.2 only Weber et al. 1981 fits the description. More recent work is not cited.

Required Clarification

Provide the reference(s) for the *in situ* experiments that indicate the level of hydrocarbon concentration that salmon can likely detect.

Response

The following references were reviewed in reference to the level of hydrocarbon concentrations that salmon can likely detect:

Barnett, J. and D. Toews. 1977. The effects of crude oil and the dispersant, Oilsperse 43, on respiration and coughing rates in Atlantic salmon (*Salmo salar*). Canadian Journal of Zoology. 56: 307-310.

Carls, M.G., G.D. Marty, and J.E. Hose. 2002. Synthesis of the toxicological impacts of the Exxon Valdez oil spill on Pacific herring (*Clupea pallasi*) in Prince William Sound, Alaska, U.S.A. Canadian Journal of Fisheries and Aquatic Science. 59: 153-172.

Fraser, A., 1992. Growth and food conversion by Atlantic salmon parr during 40 days exposure to crude oil. Transactions of the American Fisheries Society 121(3): 322-332.

Incardona, J.P. 2017. Molecular Mechanisms of Crude Oil Developmental Toxicity in Fish. Archives Environmental Toxicology, 73: 19-32.

Meador, J.P., F.C. Sommers, G.M. Ylitalo, and C.A. Sloan. 2006. Altered growth and related physiological responses in juvenile Chinook salmon (*Oncorhynchus tshawytscha*) from dietary exposure to polycyclic aromatic hydrocarbons (PAHs). Canadian Journal of Fisheries and Aquatic Sciences. 63: 2364-2376.

Melbye, A.G., O.G. Brakstad, J.N. Hodstad, I.K. Gregersen, B.H. Hansen, A.M. Booth, S.J. Rowland, and K.E. Tollefsen. 2009. Chemical and Toxicological Characterization of an Unresolved Complex Mixture-Rich Biodegraded Crude Oil. Environmental Toxicology and Chemistry, 28(9): 1815-1824.

Nevissi, A. 2016. Effect of Prudhoe Bay crude oil on the homing of coho salmon in marine waters. North American Journal of Fisheries Management, 11(2): 160-166.

Pineiro, M.E.A., M.A.L. Yusty, S.T.C. Gonzales-Barros, and J.S. Lozano. 1996. Aliphatic Hydrocarbon Levels in Turbot and Salmon Farmed Close to the Site of the Aegean Sea Oil Spill. Bulletin of Environmental Contamination and Toxicoloty. 57: 811-815.

Stagg, R.M., C. Robinson, A.M. McIntosh, and C.F. Moffat. 1998. The Effects of the “Braer” Oil Spill, Shetland Isles, Scotland, on P4501A in Farmed Atlantic Salmon (*Salmo salar*) and the Common Dab (*Limanda limanda*). Marine Environmental Research, 46(1-5): 301-306.

Stieglitz, J.D., M.M. Edward, R.H. Hoenig, D.D. Benetti, and M. Grosell. 2016. Impacts of Deepwater Horizon Crude Oil Exposure on Adult Mahi-Mahi (*Coryphaena hippurus*) Swim Performance. Environmental Toxicology and Chemistry, 35(10): 2613-2622.

Thomas, R.E. and S.D. Rice. 1987. Effect of water-soluble fraction of Cook Inlet crude oil on swimming performance and plasma cortisol in juvenile coho salmon (*Oncorhynchus kisutch*). Comparative Biochemistry and Physiology, 87(1): 177-180.

Weber, D.D., D.J. Maynard, W.D. Gronlund, and V. Konchin. 1981. Avoidance Reactions of Migrating Adult Salmon to Petroleum Hydrocarbons. Canadian Journal of Fisheries and Aquatic Sciences. 38:779-781.

Zhou, S., H. Heras, and R.G. Ackman. 1997. Role of adipocytes in the muscle tissue of Atlantic salmon (*Salmo salar*) in the uptake, release and retention of water-soluble fraction of crude oil hydrocarbons. Marine Biology, 127: 545-553.

References

N/A

CLARIFICATION – CL-09

(N/A)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.5.1.3.2, Uncontrolled Well Event; 15.5.2.3.2, Uncontrolled Well Event; 15.5.3.3.2, Uncontrolled Well Event; 8.4, Species at Risk: Overview of Potential Effects and Key Mitigation.

Context and Rationale

On several occasions throughout Sections 8–17, the EIS refers to species as "... in LSA and/or RSA"; for example, p. 1273 states that there are "19 fish species in LSA and/or RSA". This may lead to confusion on potential effects as effects may be different depending on whether the species is in the LSA or the RSA.

Required Clarification

Clarify the number of fish species in the LSA, RSA, and two areas combined.

Response

The following table clarifies the number of fish species of conservation concern in the Local Study Area (LSA) and the Regional Study Area (RSA). As the LSA is within the RSA, the total number of species of conservation concern in the two areas concerned is the same as the total species of conservation concern in the RSA. There are 19 species of conservation concern in the LSA, 25 species in the RSA, and 25 species in the combined area.

Table 1 Species inside the LSA, RSA, and the two areas combined

Species	LSA	RSA
Acadian redfish	●	●
American eel	●	●
American plaice	●	●
Atlantic bluefin tuna	●	●
Atlantic cod	●	●
Atlantic salmon	●	●
Atlantic wolffish	●	●
Basking shark	●	●
Bigeye tuna		●
Common lumpfish		●
Cusk	●	●
Deepwater redfish	●	●
Northern wolffish	●	●

Table 1 Species inside the LSA, RSA, and the two areas combined

Species	LSA	RSA
Porbeagle	●	●
Roughhead grenadier	●	●
Roundnose grenadier	●	●
Shortfin mako	●	●
Smooth skate		●
Spiny dogfish	●	●
Spinytail skate		●
Spotted wolffish	●	●
Thorny skate	●	●
White hake		●
White shark	●	●
Winter skate		●
Total Species	19	25

References

N/A

CLARIFICATION – CL-10

(DFO-03)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.1.2, Marine Environment.

Reference to EIS: Section 5.6.2, Soundscape by Band.

Context and Rationale

The EIS Guidelines require that the EIS describe the acoustic environment within areas that could be affected by the Project. The EIS statement that "[s]tation 5 could be considered an example of typical drilling installation sound levels for deep-water operations, with the highest sound pressure levels of 103 dB re 1 μPa …" (p. 238) is misleading as it under-represents the sound pressure levels that can be expected from typical drilling installations. The source sound pressure levels at 1 metre from typical drilling operations, as reported in Appendix C, are in the range of 188.6 to 196.7decibels re 1uPa. The sound pressure levels at the drilling installation should be described.

Required Clarification

Provide the sound pressure levels at the source to describe sound levels typical of drilling installations.

Response

The quoted sound levels of 103 dB re 1 μPa were recorded at a distance of 13 kilometres (km) from the Stena IceMAX. The back-propagated broadband source levels were between 185.8 dB and 187.7 dB re 1 μPa, which is within the range of the source levels described in the Environmental Impact Statement (EIS) (Section 10.3.3). Acoustic modelling conducted for the Scotian Basin Exploration Drilling Project (results of which were referenced in the EIS) conservatively assumed broadband source levels for a drillship and semi-submersible to be approximately 197 dB re 1 μPa @ 1 m (Zykov 2016).

References

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. February 2010.

CLARIFICATION – CL-11

(DFO-31)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.1.5, Species at Risk; and Section 6.1.6, Marine Mammals.

Reference to EIS: Section 10.5.1, Residual Environmental Effects Summary, Table 10.5; Section 6.3.2, Overview, Table 6.37.

Context and Rationale

The number of cetaceans, mysticetes and odontocetes is not consistent between Tables 10.5 and 6.37.

Required Clarification

Confirm the number of cetaceans, mysticetes and odontocetes referred to in the Summary of Existing Conditions and Ecological and Social Context: Project Area/LSA (Table 10.5) or provide clarification for discrepancies with Table 6.37.

Response

Marine mammals and sea turtles that are found in the Regional Study Area (RSA) include: an estimated 23 species of cetaceans (whales, dolphins, and porpoises), of which 7 are mysticetes (baleen whales) and 16 are odontocetes (toothed whales); 4 species of phocids (seals); and 4 species of sea turtles. Of these species, 11 are designated at risk or otherwise have special conservation status.

Tables 6.37 and 6.38 contain a list of all marine mammal and sea turtle species that may occur in the Project Area and surrounding marine environment, regardless of their status. Table 10.4 is a subset of Table 6.37 only including the 11 species at risk (SAR)/species of conservation concern (SOCC).

The note in Table 10.5 is updated as follows: "*Species that may interact with the Project include: 23 species of cetaceans (whales, dolphins, and porpoises), of which seven are mysticetes (baleen whales) and 16 are odontocetes (toothed whales); four species of phocids (seals); and four species of sea turtles.*"

References

N/A

CLARIFICATION – CL-12

(DFO-28)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.1.5, Species at Risk.

Reference to EIS: Section 8.4, Species at Risk: Overview of Potential Effects and Key Mitigation.

Context and Rationale

In the last sentence, the EIS states that "[s]pecies that have been identified as being of special conservation concern by COSEWIC or under other processes that are not likely to overlap with the Project activities and are primarily concentrated outside the Project Area are not discussed".

Table 6.20 (pp. 375–377) lists marine fish species at risk that are known to or may occur within the project area. The ten species omitted in Section 8.4 were included in Table 6.20. Consequently, the justification to omit species based on potential for overlap with the Project is unclear.

Required Clarification

Explain the rationale for the omission of species.

Response

There are 29 species with conservation designations listed in Table 6.20 of the Environmental Impact Statement (EIS). Ten species were not further discussed in Section 8.4. Species were omitted based on low conservation designations in Canadian waters, or at-risk populations that do not occur in the Project Area. Table 1 provides the reason species were omitted from discussion in Section 8.4 of the EIS.

Table 1 Marine fish species at risk and rationale for omission from Section 8.4

Species	Status / Designation*				Rationale for omission
	SARA	NL ESA	COSEWIC	IUCN	
Atlantic hagfish				Least Concern	Low conservation designation
Atlantic halibut			Not at risk	Endangered	Low conservation designation in Canadian waters
Barndoor skate			Not at risk	Endangered	Low conservation designation in Canadian waters
Black dogfish				Least Concern	Low conservation designation
Blue shark			Not at risk	Near Threatened	Low conservation designation in Canadian waters
Lanternfish				Least Concern	Low conservation

Table 1 Marine fish species at risk and rationale for omission from Section 8.4

Species	Status / Designation*				Rationale for omission
	SARA	NL ESA	COSEWIC	IUCN	
					designation
Smooth skate			Hopedale Channel population - Data deficient Funk Island Deep population - Endangered Nose of the Grand Bank population - Data deficient Laurentian-Scotian population – Special concern	Endangered	Low conservation designation (data deficient) in population that overlaps with Project Area.
Spinytail skate				Global: Near threatened, Northwest Atlantic: Vulnerable	No conservation designation in Canadian waters
Winter skate			Gulf of St. Lawrence population - Endangered Eastern Scotian Shelf - Newfoundland population - Endangered Western Scotian Shelf - Georges Bank population - Not at risk		Not present in project Area. Occurs primarily on Scotian shelf.
** Species at Risk Act (SARA), Schedule 1 (Government of Canada 2002), Newfoundland and Labrador Endangered Species Act (NL ESA) (Government of Newfoundland and Labrador 2001), Committee on the Status of Endangered Wildlife in Canada (COSEWIC), International Union for the Conservation of Nature (IUCN).*					

References

Government of Canada. 2002. Species at Risk Act. S.C. 2002, c.29. Published by the Minister of Justice. Current to April 24, 2018. Last Amended February 2, 2018. Available online: http://laws-lois.justice.gc.ca/PDF/S-15.3.pdf

Government of Newfoundland and Labrador. 2001. Endangered Species Act. Assented to December 13, 2001. Published by Queens Printer. Amended: 2004 cL-3.1 s27; 2004 c36 s11. Available online: http://www.assembly.nl.ca/Legislation/sr/statutes/e10-1.htm

CLARIFICATION – CL-13

(NRCan 04)

Project Effects Link to CEAA 2012: 5(1)(b) Federal Lands/Transboundary 5(2) (C-NLOPB).

Reference to EIS Guidelines: Part 2, Section 3.1, Project Components; and 3.2.1, Drilling and Testing Activities.

Reference to EIS: Section 8.3.5, Formation Flow Testing with Flaring; and 2.5.2.4, Formation Flow Testing with Flaring.

Context and Rationale

The EIS states that some produced water will be flared with the gas. Liquid loading could affect flaring performance and studies suggest that salts can affect the flame chemistry and potentially form chlorinated hydrocarbons.

Required Clarification

Clarify whether the potential flaring of produced water refers to liquid droplets entrained in the flare gas after a separator or does this mean that there will be no separation, and heavy liquid loading could occur.

Response

As mentioned in the response to Information Requirement (IR) IR-12, flaring of a large volume of produced water is not likely as it would cause the flare to not function properly, which has the potential to release hydrocarbons to the environment. Flaring is this case does refer to liquid droplets entrained in the flare gas.

References

N/A

CLARIFICATION – CL-14

(N/A)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(2)(b)(i) Health and Socio-economic Conditions.

Reference to EIS Guidelines: Part 2, Section 6.1.9.2, Human Environment.

Reference to EIS: Section 7.1.3, Current Domestic Fisheries (Flemish Pass Exploration Drilling Project).

Context and Rationale

Section 7.1.3.1 (Project Area – Northern Section) of the EIS states "…as noted in Figures 7-4 and 7.5 total weight of landings in the Project Area –Northern Section increased from 2,772 t in 2011 to 3,394t in 2015. Within the same timeframe, the value of landings increased from $13,140,355 to $18,483,487." However, Figure 7-4 (Quantity of Harvest by Year, Project Area and RSA, All Species, 2011 to 2015) shows that there was a decrease in the weight harvested between 2011 and 2015. Likewise, Figure 7-5 (Value of Harvest, Project Area and RSA, All Species, 2011 to 2015), shows a level or slightly decreasing trend for value of harvest in the Northern Project Area. The inconsistency between the text and the Figures leads to confusion within this section.

Required Clarification

Clarify harvest levels Project Area – Northern Section.

Response

The harvest levels in the Project Area – Northern Section as presented in Section 7.1.3.1 of the Environmental Impact Statement (EIS) are clarified as follows: "As noted in Figures 7-4 and 7-5, total weight of landings in the Project Area - Northern Section decreased from 8,981 t in 2011 to 3,394 t in 2015. Within the same timeframe, the value of landings decreased from $23,731,234 to $18,483,487."

Figures 7-4 and 7-5 remain unchanged.

References

N/A

CLARIFICATION – CL-15

(C-NLOPB-6: Statoil)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.1.2.3.2, Response Contractors and Agencies Page (Flemish Pass Exploration Drilling Project). Section 15.1.2.2.2, Response Contractors and Agencies (Eastern Newfoundland Offshore Exploration Drilling Project).

Context and Rationale

The EIS discusses the C-NLOPB's interactions with other government agencies, which may provide science or other advice, in the event of a spill (e.g., Canadian Coast Guard, National Emergencies Centre).

Required Clarification

Provide a description of how advice and services required in case of a spill would be obtained without reliance on the C-NLOPB to provide advice or service.

Response

Prior to drilling activities commencing, ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) will obtain an *Operations Authorization* (OA) from the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). An Oil Spill Response Plan (OSRP) is one of the documents required to be submitted to the C-NLOPB to obtain an OA. The purpose of the OSRP is to outline the management, countermeasures and strategies that will be implemented in the event of a spill originating inside the safety zone at any exploration drilling site. The Operators have OSRPs for past and current activities that will be reviewed and revised prior to any future exploration drilling activities commencing (Statoil 2017 and ExxonMobil 2017).

In past offshore activities, the Operators have not relied on the C-NLOPB for advice or service. Overall, the Operators are responsible for any spills that originate within the designated safety zone of the facility. Important elements of the OSRP are as follows:

- Operators have pre-established Emergency Response Teams, or similar.
- Tier 1 response equipment/supplies are available on support vessels (e.g., spill tracking buoys, sorbent boom, oil sampling kit, etc.).
- Operators either own or have access to Tier 2 response equipment/supplies, which is is maintained by Eastern Canada Response Cooperation (ECRC).
- Refer to Clarifications (CL) CL-21 (ExxonMobil) and CL-22 (Equinor) for details regarding the Grand Banks Operators Mutual Emergency Assistance Agreement.
- Refer to IR-44 for details regarding ECRC arrangements.
- If available, equipment and trained personnel can be utilized from the Canadian Coast Guard (CCG) Environmental Emergencies Branch.

- Operators are participant members with Oil Spill Response Limited (OSRL) which provides immediate access to Tier 3 technical advice, expertise and resources 365 days a year on a 24-hour basis.
- ECRC and OSRL are members of the Global Response Network, therefore, the Operators could leverage off other international spill cooperatives, if required.

The C-NLOPB is designated as the lead regulatory agency in offshore spill incidents under the National Environmental Emergencies Contingency Plan and the CCG Environmental Response Marine Spills Contingency Plan – National Chapter. The C-NLOPB has overall responsibility to ensure that the operator is taking all reasonable measures to prevent further spillage and to mitigate the effects and impacts of the spill. If the C-NLOPB determines that an operator is not taking reasonable measures then the C-NLOPB's Chief Conservation Officer (CCO) can direct those measures taken or can take over the management of the response effort. The C-NLOPB also has the authority to call upon Environment Canada and Climate Change (ECCC) National Environmental Emergencies Centre (NECC) for expert advice.

References

ExxonMobil (ExxonMobil Canada Ltd.). 2017. Oil Spill Response Plan.

Statoil (Statoil Canada Ltd.). 2017. Offshore Newfoundland Oil Spill Response Plan.

CLARIFICATION – CL-16

(ECCC-18)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.4.3, Model Input Data, and Table 15.14 Physical Properties for the Two Oil Products Used in Modelling, and Table 15.15 Fraction of the Whole Oil Comprised of Different Distillation Cuts for the Two Oil Products.

Context and Rationale

With respect to the Bay du Nord (BdN) crude oil properties and composition, ECCC has advised that the assumptions and measurements of the model oil used by the proponent appear to be reasonable with historical data for Eastern Canada offshore oils, as taken from the ECCC oil property database. ECCC is generally satisfied with the choice of oil used for model inputs.

ECCC notes, as shown in the table below, that the properties of oil in the area change with both location and over the production life of a well, so it is helpful to maintain a dataset of the characteristics of any oils found in the area. For example, a data portal is maintained by the Canadian Association of Petroleum Producers (CAPP) for oils produced in Western Canada at CrudeMonitor.ca.

Please see attached Table 1 from ECCC which illustrates the relevance.

	Density (g/mL) @15 C	**Dynamic Viscosity (cP) @15 C**	**TPAH (mg/g oil) Resolved compounds**
Hebron (1999)	0.9189	154	8500
Hibernia (1999)	0.8504	35	13000
Terra Nova (1999)	0.8560	22	12000
White Rose (1999)	0.8738	30	14000
Scotia Light (1999)	0.7655	1	5200
Terra Nova (2011)	0.8624	17.5	11500
BdN (2016)	**0.8455***	**5****	**10000 (assumed)**

Required Clarification

Confirm whether samples/characteristics of any oil found for the purposes of emergency response and contingency planning would be made available to ECCC.

Response

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) have previously provided hydrocarbon samples to Environment and Climate Change Canada (ECCC). If hydrocarbons with different properties from previously supplied samples are discovered then the Operators will provide to ECCC, if requested.

References

N/A

CLARIFICATION – CL-17

(N/A)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.3.2, Probabilities of Spills from the Project.

Context and Rationale

Section 15.3.2 of the EIS provides a discussion of probability of various spill scenarios considered in the assessment but does not explain how probability was calculated. In some part of the EIS and Summary, the terms frequency and probability appear to be used interchangeably.

Required Clarification

Clarify how probability was calculated and provide clarification on use of terms and units.

Response

The probability of various spill scenarios was considered in assessment based upon the work of Dr. Dagmar Schmidt Etkin of Environmental Research Consulting. The goals of the assessment were to determine the likelihood or probability that a well blowout or other well release would occur, and the potential oil spillage volumes that might occur and the probabilities that the spill will be a large-scale spill. Historical analyses of anthropogenic sources of oil to the Newfoundland and Labrador Offshore environment were conducted including releases from offshore exploration and production facilities including well spillage, offshore supply vessel spillage, and operational discharges. A fault tree analysis and Monte Carlo simulation were used in this assessment. This methodology allows for the incorporation of uncertainty in fault tree estimate inputs as well as the incorporation of distributions of probabilities of various outcomes. The fault tree analysis methodology is based on Boolean logic and combines a series of lower-level failure event to determine the likelihood of a "system failure." With the exploration wells and drilling process, the system functions properly when there is no spillage. That is, there are no errors or other precipitating events that could potentially cause a spill or blowout to occur. If one of the components of the system "fails", there is the possibility of oil spillage. The Monte Carlo simulation includes an analysis of some level of uncertainty and variability in the probabilities that are incorporated into the fault tree analysis. By including a Bayesian statistical approach, the variability and distributions of inputs, as opposed to point values for probabilities, is included. The Monte Carlo simulation was applied using Decisioneering Oracle Crystal Ball® software. The likelihood of spills was then calculated based upon project-specific variables to determine spill volume distribution.

References

N/A

CLARIFICATION – CL-18

(C-NLOPB-7: ExxonMobil and Statoil)

Project Effects Link to CEAA 2012: Newfoundland Offshore Petroleum Drilling and Production Regulations SOR/2009, Sections 6 and 9.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions; 6.4, Mitigation Measures.

Reference to EIS: Section 15.3.1.2, Canada–Newfoundland and Labrador Offshore Spill Data.

Context and Rationale

Table 15.3 of the Statoil EIS indicates the number of oil spills between 1997 and 2015 in the Newfoundland and Labrador offshore during exploration and production. Table 15.3 in the ExxonMobil EIS has the same title, as well as text leading up to and following the table; however, the numbers in the tables are different. There are differences in the number of spills during exploration, development, and production, and total numbers. For example, for the total number of hydrocarbon spills, Statoil indicates that there were 517 total spills (465 hydrocarbon and 52 synthetic-based muds), whereas ExxonMobil has 519 spills (458 hydrocarbon and 61 synthetic-based mud). Likewise, the total number of barrels spilled differs.

In addition, the EIS presents spill stats provided from the C-NLOPB up to 2015 although 2016 dates are available on the C-NLOPB's website.

Required Clarification

Provide updated spill statistics taking into consideration inconsistencies in the EISs related to 1997-2015 data. Update the spill statistics taking into consideration 2016 spill data.

Response

Based on statistics from the Canada – Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) (C-NLOPB 2017), offshore exploration and production facilities have spilled a total of approximately 3,099 barrels (bbl) of oil (i.e., hydrocarbons and synthetic-based drilling fluids) was spilled between 1997 and 2017 in the Canada-Newfoundland and Labrador (NL) offshore area.

As shown in Table 15.3, of the 527 incidents, 60 (11.4%) occurred during exploration and 467 (88.6%) occurred during development and production. Also outlined in Table 15.3, of the approximately 3,099 bbl spilled, approximately 811 bbl (26.2%) was released during exploration and approximately 2,288 bbl (73.8%) was during development and production.

Of the oil spilled during exploration drilling between 1997 through 2017, 95.6% of the total volume spilled was synthetic oils and fluids, and 2.1% was crude oil. The most frequent incidents were of crude oil (and condensate), followed by hydraulic and lubricating oils. The percentages of volumes and incident numbers are summarized in Table 15.4.

Table 15.3 Newfoundland and Labrador Offshore Exploration and Production Oil Spills (1997-2017)

Year	Exploration						Development & Production						Total					
	Spill Number			Bbl			Spill Number			Bbl			Spill Number			Bbl		
	HC	SBM	All	HC	SBM	All	HC	SBM	All	HC	SBM	All	HC	SBM	All	HC	SBM	All
1997	1	0	1	0.25	0.00	0.25	10	0	10	10.64	0.00	10.64	11	0	11	10.89	0.00	10.89
1998	4	0	4	20.10	0.00	20.10	22	2	24	3.70	12.63	16.33	26	2	28	23.80	12.63	36.43
1999	24	0	24	12.36	0.00	12.36	14	9	23	5.67	46.37	52.04	38	9	47	18.03	46.37	64.40
2000	1	0	1	1.01	0.00	1.01	4	5	9	0.40	29.56	29.96	5	5	10	1.40	29.56	30.97
2001	0	0	0	0.00	0.00	0.00	15	2	17	0.82	35.22	36.04	15	2	17	0.82	35.22	36.04
2002	1	0	1	0.01	0.00	0.01	23	2	25	0.19	77.05	77.24	24	2	26	0.19	77.05	77.24
2003	3	1	4	0.92	27.68	28.60	17	4	21	1.52	167.48	169.00	20	5	25	2.44	195.15	197.60
2004	0	0	0	0.00	0.00	0.00	50	6	56	1,043.50	679.95	1,723.46	50	6	56	1,043.50	679.95	1,723.46
2005	0	0	0	0.00	0.00	0.00	38	2	40	1.19	25.35	26.54	38	2	40	1.19	25.35	26.54
2006	3	1	4	0.10	3.77	3.87	29	5	34	3.87	19.06	22.93	32	6	38	3.97	22.84	26.81
2007	0	1	1	0.00	465.45	465.45	37	1	38	0.61	6.85	7.46	37	2	39	0.61	472.30	472.91
2008	1	0	1	0.00	0.00	0.00	34	1	35	30.25	0.63	30.88	35	1	36	30.25	0.63	30.88
2009	4	1	5	0.06	0.01	0.07	35	1	36	1.80	0.00	1.80	39	2	41	1.86	0.01	1.87
2010	3	0	3	0.02	0.00	0.02	16	0	16	1.16	0.00	1.16	19	0	19	1.19	0.00	1.19
2011	2	4	6	0.25	180.78	181.03	34	4	38	3.43	28.94	32.37	36	8	44	3.69	209.72	213.41
2012	0	1	1	0.00	0.17	0.17	7	0	7	0.07	0.00	0.07	7	1	8	0.07	0.17	0.24
2013	0	0	0	0.00	0.00	0.00	11	2	13	39.33	1.40	40.73	11	2	13	39.33	1.40	40.73
2014	0	1	1	0.00	5.41	5.41	10	3	13	1.44	6.76	8.21	10	4	14	1.44	12.17	13.61
2015	1	1	2	0.00	92.8	92.8	1	1	2	0.02	0.90	0.92	2	2	4	0.02	93.71	93.73
2016	1	0	1	0.013	0	0.013	3	0	3	0.00	0.00	0.0	4	0	4	0.015	0.00	0.015
2017	0	0	0	0	0	0	6	1	7	0.007	0.015	0.022	6	1	7	0.007	0.015	0.022
Total	**49**	**11**	**60**	**35.09**	**776.04**	**811.13**	**416**	**51**	**467**	**1,149.62**	**1,138.17**	**2,287.80**	**465**	**62**	**527**	**1,184.70**	**1,914.26**	**3,098.99**
Avg	2.3	1	2.85	1.67	38.95	38.63	19.8	2.4	22.2	54.7	54.2	108.94	22	3	25	56.4	91.1	147.6

Data extracted from C-NLOPB spill statistics [http://www.cnlopb.ca/information/statistics.php#environment]
HC = Hydrocarbon
SBM = Synthetic-based [drilling] mud

Table 15.4 Oil Types in Spills in Offshore Newfoundland-Labrador

Oil Type[1]	Exploration		Development & Production	
	% Incidents	% Total Volume	% Incidents	% Total Volume
Synthetic Oils / Fluids	18.6%	95.6%	10.7%	49.6%
Crude Oil / Condensate	37.3%	2.1%	27.5%	49.3%
Hydraulic / Lubricating Oil	23.7%	0.1%	36.0%	0.8%
Diesel and Jet Fuel	10.2%	2.1%	6.3%	0.2%
Other Types (Oil)	10.2%	0.1%	19.4%	0.1%

[1] The "Other Hydrocarbon" category (Tables 15.4, 15.5, and 15.6) incorporates crude, diesel / jet fuels, hydraulic / lube oils, and "other types". In C-NLOPB data presentations, the term "other hydrocarbons" is used instead of what is termed "other types" in this report. A distinction is made herein to avoid confusion.

References

C-NLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board). 2017. Statistical Information. Available online: http://www.cnlopb.ca/information/statistics.php#environment. Accessed March 2018.

CLARIFICATION – CL-19

(ECCC-19 DFO Conformity)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.4.4, Model Input Data (Eastern Newfoundland Offshore Exploration Drilling Project). Section 15.4.3, Model Input Data (Flemish Pass Exploration Drilling Project).

Context and Rationale

The EIS does not provide sufficient rationale for the selection of the oceanographic inputs in the models used compared to other available datasets, including inputs employed for the spill trajectory model.

With respect to the use of data from the HYCOM circulation model, the EIS states that "[f]or this study, daily current data were obtained for the period January 2006 through December 2010 for the North Atlantic region". It further states that "[a]s with any hydrodynamic model, there is the potential that local currents may deviate from predictions based upon grid resolution and small scale variability in ocean circulation dynamics. However, it is believed that the data that was used is sufficient for this type of modelling."

Required Clarification

Provide a robust rationale for the use of daily current data from January 2006 through December 2010 in the models, and whether they are best suited to modelling in the project area, with consideration of predicted future conditions in order to provide a degree of certainty or validation in the predictions made. Provide a margin of error associated with the predictions.

Clarify the statement: "However, it is believed that the data that was used is sufficient for this type of modelling."

Identify potential differences had a block of more recent current data been used in the modelling scenarios.

Response

A metocean analysis of the offshore Newfoundland region was conducted to investigate the use of the Hybrid Coordinate Ocean Model (HYCOM) hydrodynamic current dataset and Climate Forecast System Reanalysis (CFSR) wind dataset (Tajalli-Bakhsh et al. 2018). Results from this assessment were presented to federal regulators at an in-person meeting in St. John's, Newfoundland on 7 February 2018. This assessment investigated the spatial and temporal variability of currents and winds in the study area. The predominant oceanic and meteorological conditions over time were investigated to assess the general circulation, as well as the level of natural variability at specific areas of interest over time. The analysis provides the predominant current and wind regimes that dominate the Study Area as well as the variability.

Assessments of currents and winds were made at multiple time scales (annual averages, monthly averages, and instantaneous snapshots) at two scales within the Study Area. First, analyses were conducted over the entire model domain to understand the spatial variability. Second, to characterize the natural variability in the environmental conditions at a representative point within the region, metocean datasets were analyzed at a specific location, close to the modelled hypothetical oil spill release locations. An assessment was also conducted at a "Comparison Site" that fell with the Project Area. Finally, comparisons were made with in situ current measurement data from drifter buoys and gliders as well as wind data from St. John's International Airport (YYT) and Newfoundland.

Through the use of current roses, monthly statistics of average and 95th percentile wind speeds, and comparisons to field measurements of wind and current speed and direction, it was found that the HYCOM Reanalysis current data and CFSR wind data were adequately resolving the speed and direction of natural oceanic features and winds in the North Atlantic. In addition, because CFSR winds were one of the main driving forces used in the HYCOM Reanalysis model, an additional level of consistency was maintained.

References

Tajalli-Bakhsh, T., Horn, M., Monim, M. 2018. Metocean Analysis Offshore Newfoundland: An investigation of HYCOM currents and CFSR winds. Prepared for ExxonMobil Canada Ltd., Nexen Energy ULC, and Statoil Canada Ltd. 9 February 2018. 35p.

CLARIFICATION – CL-20

(ECCC-20)

Project Effects Link to CEAA 2012: Multiple VCs – Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Appendix E Oil Spill Trajectory Modelling; Section 3.4, Wind Data; and Section 3.5, Currents.

Context and Rationale

In Section 3.4 of the EIS, the proponent notes the spatial and temporal resolution of the wind input used to force the oil spill model: "CFSR [Climate Forecast System Reanalysis] time series acquired for this study was available at 0.5° horizontal resolution at 6-hourly intervals". It also notes that the CFSR winds were used in the hydrodynamic modelling as described in Section 3.5. In Section 3.5 of the EIS, the proponent notes the forcing field used to drive the hydrodynamic model: "[s]urface forcing is derived from 1-hourly CFSR wind data with a horizontal resolution of 0.3125°". There was no rationale provided for why there were differences in the temporal and spatial resolution of the wind forcing used between the two different models.

Required Clarification

The proponent stated that the CFSR was the source of wind inputs for both the oil spill model and the hydrodynamic model (HYCOM). Provide the rationale as to why a lower resolution data set was used for the oil spill model versus a higher one for the HYCOM model when the apparent source of data (CFSR) was the same. Was it a limitation of the oil spill model? Or was the wind field used in the HYCOM model at a different reference height than that used in the oil spill model, which might account for the different resolutions of the CFSR data?

Response

The Hybrid Coordinate Ocean Model (HYCOM) and Climate Forecast System Reanalysis (CFSR) datasets are two separate models that were used to characterize currents and winds, respectively, in the oil spill modelling. The two models are developed by different organizations, used to address different processes (wind vs. currents), and were not developed specifically for these exact environmental assessments. Therefore, it is expected that the spatial and temporal resolution of these models/datasets would be different.

The HYCOM model is a community ocean model that is widely used in ocean researches, ocean prediction systems, and is coupled with other models including atmospheric, ice and bio-chemical models. HYCOM has been extensively validated by many researchers and efficiently benefits from data assimilation techniques. It is also being used by the United States National Oceanic and Atmospheric Administration (NOAA), the United States Coast Guard (USCG), and the United States Navy in environmental applications including maritime safety, fisheries, offshore industry, and ocean management matters.

As CFSR is the forcing used for HYCOM Reanalysis, it is the best wind forcing selection for use in this project, as it is consistent with the boundary conditions of the HYCOM Reanalysis hydrodynamics used for the previous studies. The CFSR was designed and executed as a global, high-resolution, coupled atmosphere-ocean-land surface- sea ice system to provide the best estimate of these coupled domains (Saha et al., 2010). The CFSR includes the coupling of atmosphere and ocean, an interactive sea-ice model, and an assimilation of satellite radiances.

The use of these two models is not a limitation to the oil spill modelling. Rather, they are two different sources of inputs used to drive two different processes (wind and currents). In fact, the use of HYCOM, which itself is forced with CFSR winds to generate a portion of the currents, provides an additional level of consistency.

References

Saha, S. and Coauthors, 2010. The NCEP climate forecast system reanalysis. American Meteorological Society. 91: 1015-1057. Available online: http://journals.ametsoc.org/doi/pdf/10.1175/2010BAMS3001.1. Accessed April 2018.

INFORMATION REQUIREMENTS – ROUND 1 (PART 2)

EXXONMOBIL AND EQUINOR

INFORMATION REQUIREMENT – IR-78

(Miawpukek 4.2.11)

Project Effects Link to CEAA 2012: 5 (1) Environmental Effects

Reference to EIS Guidelines: Part 2, Section 3.1 Project components.

Reference to EIS: Section 2.9.4 Liquid Wastes.

Context and Rationale

Section 2.9.4 of the EIS states that biocides may be used in cooling water to control growth of microorganisms in drilling machinery. Miawpukek First Nation has expressed concern that the EIS does not discuss the use of biocides in the effects analysis. It is unclear what biocides would be used and in what volumes.

Specific Question or Request

Provide further information on the types and amounts of biocides to be used.

Assess the environmental effects of biocides on relevant valued components. Discuss potential effects of routine use and discharge, as well as accidental spills.

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

Response

The type of biocides to be used for exploration drilling have not been determined at this time, however, information associated with the exploration drilling programs completed in 2017 by Equinor Canada Ltd. (Equinor) is provided below. It is noted that ExxonMobil Canada Ltd. (ExxonMobil) has not completed any recent exploration drilling programs, therefore the information below is limited to Equinor's experience.

As stated in the Environmental Impact Statement (EIS) (e.g., Sections 2.9, 2.9.4, 2.10.1.7), products that have the potential to be discharged to the marine environment will be selected in accordance with the *Offshore Chemical Selection Guidelines for Drilling & Production Activities on Frontier Lands* (NEB et al 2009) (herein referred to as the Chemical Selection Guidelines). The Chemical Selection Guidelines provide a procedure and criteria for offshore chemical selection, and the objective is to promote the selection of lower toxicity chemicals to reduce the potential environmental effects of a discharge where technically feasible. ExxonMobil and Equinor (herein referred to as the Operators) will also prepare their own internal Chemical Screening Procedures, which will align with the requirements of the Guidelines at a minimum.

As mentioned above, Equinor completed exploration drilling programs from May to July 2017. A biocide (i.e., Myacide™GA25) was screened under the process outlined above but was not required to be used and therefore a volume is not applicable. The type of biocides, if required, used for future exploration drilling programs is subject to change as it will be specific to the drilling installation.

Prior to drilling activities commencing, the Operators are required to obtain an *Operations Authorization* (OA) from the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). To obtain the OA, and outlined in Section 6(d) and 9 of the *Offshore Newfoundland Drilling and Production Regulations* (Government of Canada 2009), the Operators are required to prepare Environmental Protection Plans (EPPs), which are submitted to the C-NLOPB for their review and approval as part of the OA process. Sections 2.11 of the OWTG (NEB et al 2010) further outlines the requirement to identify any biocide, and concentrations, that may be discharged to the sea in cooling water in their EPP. Section 2.13 of the OWTG (NEB et al 2010) also requires that the operator describes any biocide, and concentrations, that may be discharged to the sea in sewage; this section does not specifically state that the information must be included in the EPP, however, the Operators intend on incorporating it into the EPP, if applicable.

Further assessing the environmental effects of cooling water containing biocides in the EIS would be duplicative as environmental protection elements are embedded into the Chemical Selection Guidelines and OWTG. Therefore, proposed mitigation measures and follow-up measures are not required to be updated.

References

Government of Canada. 2010. Newfoundland Offshore Petroleum Drilling and Production Regulations. Available online: http://laws-lois.justice.gc.ca/PDF/SOR-2009-316.pdf.

National Energy Board (NEB), Canada-Nova Scotia Offshore Petroleum Board (C-NSOPB) and Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). 2009. Offshore Chemical Selection Guidelines for Drilling & Production Activities on Frontier Lands. Available online: http://www.cnlopb.ca/pdfs/guidelines/ocsg.pdf?lbisphpreq=1.

NEB, C-NSOPB and C-NLOPB. 2010. Offshore Waste Treatment Guidelines. Available online: http://www.cnlopb.ca/pdfs/guidelines/owtg1012e.pdf?lbisphpreq=1.

NEB, C-NSOPB and C-NLOPB. 2011. Environmental Protection Plan Guidelines. Available online: http://www.cnlopb.ca/pdfs/guidelines/env_pp_guide.pdf?lbisphpreq=1.

INFORMATION REQUIREMENT – IR-79

(DFO-32)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.3.1 Fish and Fish Habitat.

Reference to EIS: Section 2.5.2.1, Wellsite Surveys – Drill Planning; 6.1.1.6, Video Surveys of Previous Statoil Exploration Wellsites in the Project Area.

Context and Rationale

The EIS states that pre-drill surveys would be conducted using multi-beam echosounder (MBES) and sidescan sonar (SSS) at a resolution of 0.5 metres x 0.5 metres. Fisheries and Oceans Canada has advised that this scale is not fine enough to detect coral and sponge community types found in this region that are acoustically invisible using these methods. NOROG (Norwegian Oil and Gas Authority) Guidelines or best practices approach for industry (2013) are not entirely relevant for the benthic communities found in the Flemish Pass. These guidelines were developed in Norway, to mitigate impacts upon Lophelia, the largest known cold water coral reef systems in the world.

The NOROG Guidelines apply to Lophelia reefs and coral gardens. Fisheries and Oceans Canada has indicated that no encounters with living Lophelia have been documented in the Flemish Pass region; however, data is biased by substrate with hard bottom representation limited to sporadic remotely operated vehicle (ROV) surveys. It is possible that living colonies exist based on sub-fossilized pieces of Lophelia documented on the northeast Flemish Cap (NEREDIA Survey 2009-2010). In addition, living colonies have been recorded in adjacent regions such as the Stone Fence (Nova Scotia, Canada) and southern tip of Greenland. Examples of coral gardens in the Flemish Pass include Sea Pen fields, Acanella meadows, Geodia sponge grounds, and bamboo and sponge thickets. For the latter, the composition of the community may change with depth.

The NOROG Guidelines state that experience has proven that resolution of <1 metre has high accuracy. Fisheries and Oceans Canada has indicated that this holds true for Lophelia reefs in the northeast Atlantic and Glass Sponge reefs in the northeast Pacific but it may not be the best approach for the corals and sponges potentially found within the project site. Lophelia is a reef-forming coral with new animals growing on top of dead ones. Off Norway, these reefs are kilometres in length and metres in height and, consequently, can be detected using MBES and SSS.

Fisheries and Oceans Canada has indicated that examples of habitat-forming communities found in this region that cannot be detected using MBES and SSS include:

- Geodia sponge grounds (i.e., Boreal “Ostur” and Cold water “ostur”). These are comprised of Geodia/Stryphnus/Stelletta sponges with the difference being the species composition of each. These sponges are globular and/or spherical in shape, and can be massive in size and weight. As a result, encounters are easily detected in Canadian trawl survey data and the majority have been identified at depths <1,500 metres (see NAFO WGESA, 2008 2017).

- Glass sponges (Asconema spp.) and bamboo coral (Keratoisis sp. kerD2d) communities. These have not been well studied but have been identified in the Flemish Pass (Canadian Multispecies Survey) and northeast Flemish Cap (ROPOS 2010 Survey). Note for the latter, community assemblages changed with depth with deeper communities dominated by bamboo corals and sponges, to a mix with Geodia, to a Geodia-dominated community at shallower sites in the northeast Flemish Cap.
- 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. Based on the current methodology, Asconema would not be captured due to their light weight.
- Keratoisis is one genus of bamboo coral found in the region with at least two species:
  - Keratoisis grayi (=K. ornata) is a thick-branched coral that requires hard substrates for attachment and is found predominantly from the southwest Grand Banks to Scotian Shelf. Individual colonies can reach 1.5 metres in height and 1 metres in width (Baker et al. 2012).
  - Keratoisis sp. (kerD2d = Keratoisis cf. flexibilus; Saucier 2016) is a thinly branched coral that forms dense 'thickets' with individual colonies indistinguishable (Neves et al. 2013; Saucier 2016). Dense patches (55 metres in length x 1 metres in height) have been documented in two locations in Flemish Pass, mixed with Asconema glass sponge.
- Sea pens fields can be comprised of many species or dominated by one or two. Sea pens fields documented in Desbarre Canyon (622 colonies in video segment) spanned several kilometres and were dominated by Pennatula species with adults <30 centimetres in height (Baker et al. 2012). Based on the criteria (individuals >30 centimetres in height), such significant biotic habitats would not be avoided within the scope of this plan.
- Similar to sea pens, Acanella arbuscula can also characterize large coral fields with maximum colony height <30 centimetres (Baker et al. 2012). Acanella is a bamboo coral that only inhabits soft substrates. It is very light and fragile and distributed within Flemish Pass (NAFO SCS Doc. 13/024; NAFO SCS Doc. 14/023; NAFO SCS Doc. 16/021).

Fisheries and Oceans Canada noted that coral gardens are defined in the NOROG Guidelines as dense aggregations of colonies covering an area greater than 25 square metres. However, the EIS indicates that different criteria were used for video surveys of previous Statoil well sites in the project area; during those surveys, coral and sponge aggregations were defined as five or more corals larger than 30 centimetres in height or width (Section 6.1.6.6). Fisheries and Oceans Canada advised that coral garden species are non-reef builders but can form extensive sea pen fields, Acanella meadows, and bamboo and sponge thickets. Pennatula sea pen fields are dominated by Pennatula species (P. aculata). The maximum size of P. aculata is less than 30 centimetres, which means that important coral habitats would not be considered to be coral colonies based on the criteria stated in Section 6.1.6.6 of the EIS. Additionally, for bamboo thickets, the colonies are so inter-tangled that it is extremely difficult to quantify individuals. Clarification is required on which criteria will be used for pre-drill coral surveys, and how those criteria will take into account important habitats generated by smaller species (less than 30 centimetres in height) known to be present in the general area.

The MBES primarily collects depth data, and would reveal seabed features such as ice scouring plough marks, but can also have sufficient resolution to reveal potential coral features. Fisheries and Oceans Canada has used MBES and SSS to assess sites prior to ROV dives. Both can be used very well to determine abiotic sea bed features and also some biotic features (i.e., Lophelia and reef forming glass sponges); however, coral structures down to 1 square metre are not detectable with MBES or modern SSS. Possible new emerging technologies such as Synthetic Aperture Sonar are currently testing resolutions down to 3 centimetres scale; but testing is occurring in Lophelia type habitats in the northeast Atlantic and would require further testing on representative communities found in this region.

Specific Question or Information Requirement

Taking into consideration information from Fisheries and Oceans Canada, discuss how the proposed pre-drill coral surveys using MBES and SSS would detect the species identified by Fisheries and Oceans Canada.

Fisheries and Oceans Canada recommended that criteria for defining coral aggregations take into account important habitats generated by smaller species (less than 30 centimetres in height), known to be present in the general area. Discuss how this would be accommodated in the proposed pre-drill coral surveys.

Fisheries and Oceans Canada recommended that the contact and/or impact sites should be ground-truthed using ROV. Discuss the feasibility of conducting a pre-drill survey with ROV around each wellsite prior to drilling, taking into consideration technical and economic feasibility, as well as environmental considerations, to confirm the predictions made based on MBES/SSS surveys

Response

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) recognize that multi-beam echo sounder (MBES) and side scan sonar (SSS) alone do not adequately detect cold water corals (CWC), including smaller species, and sponge distributions in the Project Area. However, the Operators recognize that survey methods and risk assessment aspects will progress, evolve and improve over time due to a variety of factors, such as, but not limited to, new technology, operational experience, results of scientific research and best practices developed by regulators (e.g. Fisheries and Oceans Canada [DFO]). This is also acknowledged in Section 2.5.2.1 of the Environmental Impact Statement (EIS).

MBES and SSS data may be used to determine/map seabed characteristics and morphology, and identify areas where CWC may be located. The acoustic data will map anomalies on the seabed, and these anomalies may be inspected (i.e., ground truthed) using equipment such as a remotely operated vehicle (ROV) equipped with a high definition (HD) camera. Until data is available on the efficacy of acoustic data collected offshore Newfoundland and Labrador (NL), the Operators will survey the area using equipment such as a ROV with a HD camera. If no anomalies are detected where seabed contact is likely, together the acoustic and visual data may provide information on presence of CWC in areas where seabed contact (e.g., moorings, drill location) are likely.

Regarding sponges, the Operators recognize they cannot be detected with MBES/SSS and in areas where seabed contact is likely, the areas will be investigated with equipment such as a ROV with a HD camera to collect visual data.

As mentioned in Section 2.5.2.1 of the EIS, the Operators will collaborate with the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) and DFO to develop the details of the final coral and sponge survey requirements that will be applied to each survey. To support this collaboration, the Operators will prepare Coral and Sponge Survey Plans for individual surveys and submit to the C-NLOPB and DFO for their review and acceptance prior to implementing the survey. The Coral and Sponge Survey Plans will contain detailed, site-specific information, which may include the following:

- Survey methodology (e.g., equipment used and specifications, resolution and ROV targets);
- Survey schedule (e.g., anticipated start date and duration);
- Survey team (e.g., geophysical mapping technician, ROV technicians and marine biologist/scientist.);
- Survey area around wellsites, moorings and anchors, and rationale for determining the survey area (i.e., utilizing information from the drill cuttings dispersion modelling); and
- Documentation (e.g., species, abundance, condition, size and substrate conditions).

As mentioned in Section 2.5.2.1 of the EIS, the Operators will also prepare Coral and Sponge Survey Results and Risk Assessment Reports for individual surveys, which will be submitted to the C-NLOPB and DFO for review and acceptance prior to drilling. Detailed information in the Coral and Sponge Survey Results and Risk Assessment Reports may include the following:

- Overview of the results including mapping;
- Risk assessment based on the data collected, predicted degree of sedimentation, and predicted physical contact;
- Proposed mitigation measures (e.g., relocating the wellsite, redirecting cuttings); and
- Proposed monitoring requirements.

In summary, as outlined above and in Section 2.5.2.1 of the EIS, the Operators will submit individual, site-specific Coral and Sponge Survey Plans and Coral and Sponge Survey Results and Risk Assessment Reports to the C-NLOPB and DFO for review and acceptance prior to implementing the surveys and drilling programs, respectively. Completing individual Coral and Sponge Survey Plans and Coral and Sponge Survey Results and Risk Assessment Reports provides the Operators the opportunity to improve and refine their processes, which supports continual improvement on this relatively new topic, and also ensures that the C-NLOPB and DFO are reviewing site-specific survey plans and results/risk assessment reports in an efficient and effective manner.

References

N/A

INFORMATION REQUIREMENT – IR-80

(DFO-40)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Section 15.5.1.2.1, Effects of Hydrocarbons on Marine Fish and Fish Habitat.

Context and Rationale

The EIS presents information from follow-up surveys after the Deep Water Horizon spill (Section 15.5.1.2.1). Regarding a survey site 13 kilometres to the southwest of the Macondo wellhead, the EIS states that the "…follow up survey 16 months later indicated that recovery was occurring." Fisheries and Oceans Canada indicated that this statement is misleading because it fails to mention the condition and health of the corals. Coral colonies impacted by the Deep Water Horizon spill showed bare branches with dead tissue were recolonized with parasitic hydroids (Fisher et al. 2014; Hsing et al. 2013).

Fisheries and Oceans Canada indicated that the Deep Water Horizon spill provides valuable information on the effects of oil spills on benthic ecosystems, and that relevant papers should be incorporated and further discussed, including:

- Hsing et al. (2013). Evidence of lasting impact of the Deepwater Horizon oil spill on a deep Gulf of Mexico coral community. Elem Sci Anthr 1:0000012.
- Mauricio Silva, Peter J. Etnoyer and Ian R. MacDonald (2015). Coral injuries observed at mesophotic Reefs after the Deepwater Horizon oil discharge. Deep-Sea Research Part II, http://dx.doi.org/10.1016/j.dsr2.2015.05.013.
- Fisher, C. R., Hsing, P.-Y., Kaiser, C. L., Yoerger, D. R., Roberts, H. H., Shedd, W. W., and Brooks, J. M. (2014). Footprint of Deepwater Horizon blowout impact to deep-water coral communities. Proceedings of the National Academy of Sciences 111(32): 11744–11749, https://doi.org/10.1073/pnas.1403492111.
- Baguley, J., Montagna, P., Cooksey, C., Hyland, J., Bang, H., Morrison, C., … and Ricci, M. (2015). Community response of deep-sea soft-sediment metazoan meiofauna to the Deepwater Horizon blowout and oil spill. Marine Ecology Progress Series 528: 127–140.
- Hourigan, T. F., Etnoyer, P. J., and Cairns, S. D. (2017). The State of Deep-Sea Coral and Sponge Ecosystems of the United States. NOAA Technical Memorandum NMFS-OHC-4. Silver Spring, MD. 467 pp.

Specific Question or Information Requirement

Update the assessment of effects of accidental spills on corals and sponges, taking into account the references provided by Fisheries and Oceans Canada.

Response

Section 15.5.1.2.1 of the Environmental Impact Statement (EIS) has been updated to take into account the references provided by the reviewer and outlined in the context and rationale section of this Information Requirement (IR).

The effects of hydrocarbons on corals are typically assessed in situ using visual indicators of stress (White et al. 2012). Visual indicators of coral stress related to the Deep Water Horizon (DWH) spill included partial tissue loss, excessive mucus production, retracted polyps, partial coverage of brown flocculant sourced to the spill, and death (Ragnarsson et al. 2017). Follow-up studies on the DWH spills have shown a patchy distribution of the effects of the spill which are highly site specific. Hsing et al. (2013) surveyed an area 11 kilometres (km) southwest of DWH with five visits over a 17-month span after the DWH spill to quantify the impacts and recovery of gorgonian corals that were partially covered in brown flocculant material. The corals that were not covered in flocculent seemed to recover more quickly and signs of hydroid colonization of the corals (a sign of coral deterioration) was first observed in the second survey five months after the capping of the DWH spill. Fisher et al. (2014) found similar results with hydroid colonization on the areas of the corals that were previously covered with flocculent patches at sites 6 km and 22 km from the DWH spill site indicating that the spill had effects further, and at deeper depths, than was originally thought. The 6 km closer site was observed to be more impacted with 90% of the corals showing visible signs of being affected by the spill but both sites showed visible signs of being impacted 16 months after the DWH spill was capped. Some recovery had occurred 16 months after the spill and the brown flocculent was gone but the dead patch areas on the corals had been taken over by the hydrozoans (Fisher et al. 2014). Similarly, 86% of corals showed signs of injuries including brown flocculent patches in a site 11 km southwest of DWH eight months after the spill (Hourigan et al. 2017). The results from these high-resolution monitoring studies were synthesized to parameterize and validate an annual, impact-dependent, state-structured matrix model to estimate the time to recovery for each coral colony (Girard et al. 2018). The model predicted that the majority of corals that were impacted would be fully recovered within a decade with the more heavily impacted corals taking up to three decades to reach a state where all remaining branches appear healthy (Girard et al. 2018). The available information on the effects on sponge communities after DWH is more limited (Vad et al. 2018), but there are some indications that diversity and abundances of many taxa (including sponges) were less at sites within the trajectory of the subsea plume associated with the spill (Valentine and Benfield 2013). It is important to note that these DWH studies do not necessarily predict the exact impacts on corals and sponges in the Flemish Pass area but rather provide context on the potential ecological effects on similar coral and sponge taxa that found in the Flemish Pass and northwest Atlantic.

Most of the research associated with DWH and corals has focused on deep sea coral reefs, but mesophotic reefs (65-90 m depth) were also studied in terms of DWH effects (Hourigan et al. 2017, Silva et al. 2015). Six sites with mesophotic reefs around 100 km from DWH spill site were observed and sampled via remotely operated vehicle (ROV) (Silva et al 2015). They found detectable petroleum hydrocarbons in corals and visual stress indicators ranging from biofilms covering the sea fan branches (most common indicator) to bare coral skeletons and broken branches (uncommon).

Other changes to corals and deep-sea habitat in general have been found by using meiofauna (size range; refers to small benthic invertebrates) as an indicator of change. Baguley et al. (2015) measured meiofaunal abundance, diversity, and nematode to copepod ratio with distance from the DWH wellhead. It was found that nematode diversity increased significantly near the wellhead which may have been due to the organic enrichment (Baguley et al. 2015). However, 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) making it difficult to extrapolate these specific findings at the DWH on meiofauna to potential effects in the Flemish Pass and northwest Atlantic.

The effects and significance predictions of hydrocarbons on corals and sponges were included in Sections 15.5.1.2.1 and 15.5.1.5, respectively, of the EIS, and the additional sources provided by the reviewer align with the information contained in the EIS, therefore the proposed mitigation and follow-up, and significance predictions remain valid.

References

Baguley, J., Montagna, P., Cooksey, C., Hyland, J., Bang, H., Morrison, C., and Ricci, M. 2015. Community response of deep-sea soft-sediment metazoan meiofauna to the Deepwater Horizon blowout and oil spill. Marine Ecology Progress Series 528: 127–140.

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Hourigan, T.F., Etnoyer, P.J., and Cairns, S.D. 2017. The State of Deep-Sea Coral and Sponge Ecosystems of the United States. NOAA Technical Memorandum NMFS-OHC-4. Silver Spring, MD. 467 pp.

Hsing, P. Y., Fu, B., Larcom, E. A., Berlet, S. P., Shank, T. M., Govindarajan, A. F., Lukasiewicz, A.J., Dixon, P.M. and Fisher, C. R. 2013. Evidence of lasting impact of the Deepwater Horizon oil spill on a deep Gulf of Mexico coral community. Elementa: Science of the Anthropocene, 1:12.

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Ragnarsson, S. Á., Burgos, J. M., Kutti, T., van den Beld, I., Egilsdóttir, H., Arnaud-Haond, S., and Grehan, A. 2017. The Impact of Anthropogenic Activity on Cold-Water Corals. Marine Animal Forests: The Ecology of Benthic Biodiversity Hotspots, 1-35.

Valentine, M.M. and Benfield, M.C. 2013. Characterization of epibenthic and demersal megafauna at Mississippi Canyon 252 shortly after the Deepwater Horizon Oil Spill. Marine pollution bulletin, 77(1-2), pp.196-209.

Vad, J., Kazanidis, G., Henry, L.A., Jones, D.O., Tendal, O.S., Christiansen, S., Henry, T.B. and Roberts, J.M. 2018. Potential Impacts of Offshore Oil and Gas Activities on Deep-Sea Sponges and the Habitats They Form. Advances in Marine Biology.

White H.K., Hsing P.Y., Cho W., Shank T.M., Cordes E.E, Quattrini A.M, Nelson R.K., Camilli R., Demopoulos A.W., German C.R., Brooks J.M., Roberts H.H, Shedd W., Reddy C.M., Fisher C.R. 2012. Impact of the Deepwater Horizon oil spill on a deep-water coral community in the Gulf of Mexico. Proceedings of the National Academy of Sciences of the United States of America 109:20,303-20,308.

INFORMATION REQUIREMENT – IR-81

(DFO-36, -37, -49, -50, -51, -52, -53, -54, -55, and -56)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii), Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.3.2, Marine Environment; Section 6.3.1, Fish and Fish Habitat.

Reference to EIS: Section 5.5.2, Ocean Currents; Appendix G: Drill Cuttings Modelling.

Context and Rationale

Fisheries and Oceans Canada identified several issues with the cutting dispersion model inputs and design. Given that the results of modelling will be used in determining pre-drill coral survey areas, the resolution of modelling results is an important consideration.

Model Inputs:

Fisheries and Oceans Canada indicated that the progressive vector plots presented in Figures 5-34 and 5-35 are misleading. A particle cannot be followed for several months based on the currents measured at its original position. As soon as a particle leaves it original location, it is subject to different conditions.

Hibernia data presented in Section 5.5.2.2 of the EIS are averaged in monthly means, without mention of the original sampling frequency. Fisheries and Oceans Canada indicated that higher frequency motions are likely more important for dispersion and should be discussed.

For the 'maximum' velocity, it is not clear whether it is the maximum from the raw sampling frequency or if it is the maximum monthly mean of the 2015-2016 period. The data in Tables 5 22 (especially minimum) suggests it is the maximum and minimum from the raw time-series. But in this case, the sampling frequency must be specified, otherwise it means very little. The same comment applies to Figures 5-37 to 5-39, where the sampling frequency is not specified.

The statement "…where currents are generally weak (less than 10 centimetres per second) and southwards and dominated by wind-induced and tidal current variability" (Section 5.5.2.3) suggests that current variability may be dominated by higher frequency motions (tides, winds). This confirms, as previously stated, that monthly averages in ocean current completely miss a large part of the variability that may dominate for dispersion or advection of tracers.

Model design and limitations:

With respect to drill cutting models, Appendix G states that, "a 65-day duration was chosen for the Northern Project Area and a 35-day duration for the other three locations." It is stipulated that the drilling schedule is not determined.

Fisheries and Oceans Canada noted that no stochastic analysis was performed for drilling cuttings dispersion modelling (only four simulations argued to be representative of each season), which is a limitation of the modelling.

Appendix G states that "(t)he temporal coverage of the current data record allows application of the drilling well sequences and provides some statistical reliability of conclusions drawn from analysis of the current data." Fisheries and Oceans Canada noted that since only four simulations are considered (see previous comments re: no stochastic analyses); it cannot be stated that the study provides "statistical reliability of conclusions."

Fisheries and Oceans Canada indicated that in the discussion in Section 3.2.2 of Appendix G regarding changes in the settling velocity as the particles encounter "bottom stress" (including breaking up of the flocs and resettling), it is not clear which mechanisms are taken into account. Fisheries and Oceans Canada stated that it is unclear whether processes at the benthic boundary layer have been considered. If not, the values selected for the model runs should not be called a "conservative estimate." By neglecting this parameterization, the model neglects re-settling/re-suspension mechanisms that would create a plume/cloud near the bottom. Fisheries and Oceans Canada indicated that this issue should be addressed, as it is critical for benthic biology (e.g., Cranford and Gordon 1992).

Fisheries and Oceans Canada stated that that current measurements used to force the model appear to be very scarce. For example, multiple different sources are used. Appendix G states a short time-series was used (25 July 1986, 15:00:00, to 31 October 1986, 17:00:00), which was "replicated to fill the periods with no data for near-surface, mid-depth and near-bottom depth levels." Fisheries and Oceans Canada indicated that it was unclear whether winter data are filled with data from other seasons. If this is not the case, clarification is required. If it is the case, Fisheries and Oceans Canada questioned how filling this gap with non-existing data was justified. The use of homogeneous datasets such as global hindcasts (e.g., GLORYS or HYCOM) would solve the problem.

Section 3.2.3 of Appendix G states, "(i)t is assumed that the currents are generally representative of conditions at the drilling locations and are uniform over the deposition grids modelled." Fisheries and Oceans Canada noted that this assumption does not hold far from the release point: currents vary in time and space, thus the need for time-varying and space-varying current input. This assumption may hold over a very small distance, but it is stipulated further (Section 4.0 of Appendix G) that some cuttings travelled as far as 20 kilometres 200 kilometres. This is especially true for the fine fraction (silts and clays which are by far the largest fraction in the release; see Table 3-2) that remains in the water column for a longer period.

Fisheries and Oceans Canada has indicated that in Section 3.2.5 of Appendix G, there are problems with the turbulent diffusion term (Rx,Ry,Rz in [-1,1]):

- x', y', z' are not defined;
- it is not clear why vertical (Rz) and horizontal (Rx,Ry) "diffusivity" coefficients are the same order of magnitude, and whether there is scientific justification for this;
- this scheme appears to be totally dependent on the model horizontal and vertical grid resolution (which has the advantage of reducing the problem raised in b); and
- the scientific rationale for imposing the range [-1,1] is not clear. If interpreted correctly, the equation means that the particle can move at most by one grid cell per time step.

Fisheries and Oceans Canada noted that advective-diffusive equations are a very standard and simple modelling procedure and would produce higher resolution results.

In Appendix A-1 to Appendix G, current roses for some stations (e.g., Figures p114, Appendix G) display surprisingly steady and slow currents. Fisheries and Oceans Canada questioned whether this might be an effect of the reconstruction method used. Moreover, it is not clear why they would represent the year 2017, since the report was submitted even before the end of that year.

Fisheries and Oceans Canada indicated that some results (Section 4.0 of Appendix G) seem physically unrealistic and illustrate that there may be a problem with the numerical domain, the discretization, or the forcing of models. For example, in Appendix G, Figures 4-1 and 4-3, the cuttings from a single source form numerous little patches.

Specific Question or Information Requirement

Provide a rationale for the modelling used to predict dispersion of disposed drill cuttings, and discuss the limitations of the model, including the points identified below.

<u>Model Inputs:</u>

- Clarify the rationale for data used in progressive vector plots.
- Specify sampling frequency for data presented in Section 5.5.2.2 and discuss the influence of higher frequency motions on dispersion.
- Provide a rationale for use of monthly means or use higher frequency data.
- Model design and limitations:
- Provide a rationale for the selection of durations for cuttings dispersion modelling, indicating why the maximum drill time of 65 days was not modelled for all locations. Discuss potential limitations of this approach.
- Incorporate stochastic analysis in drill cutting dispersion scenarios or provide a rationale for use of four simulations.
- Explain whether the dispersion model has considered processes at the benthic boundary layer. If this is not addressed by the model, discuss the implications for model results.
- Provide additional information and rationale regarding data used to fill gaps.
- Provide a justification for the assumption that currents are uniform over the deposition grids modelled.
- Provide a rationale for the model selected and discuss the limitations of modelling without the use of advective-diffusive equations.
- Provide additional information on the reconstruction method and clarify the time-period of the data.

<u>Model outputs</u>

Provide additional explanation of the modelling results, including a discussion of the patchy nature of the results.

Given the potential limitations of the model approach, indicate how a conservative approach to interpreting results would be taken when identifying areas for pre-drill coral surveys.

Response

Part 1: Provide a rationale for the modelling used to predict dispersion of disposed drill cuttings, and discuss the limitations of the model, including the points identified below.

The drill cuttings model used in Appendix G of the Environmental Impact Statement (EIS) is the AMEC Advection Dispersion Model (ADM) developed based on corporate experience and modelling algorithms including those from the Terra Nova (Hodgins and Hodgins 1998) and White Rose (Hodgins and Hodgins 2000) cuttings fate modelling studies. The ADM has been used, and accepted, for numerous offshore operators including the following: Hebron Project Comprehensive Study Report modelling study (AMEC 2010), Hebron Project Environmental Assessment Amendment (Amec Foster Wheeler 2017), and White Rose Extension Project (now West White Rose Project) (AMEC 2012, Amec Foster Wheeler 2016).

Additional discussion on model inputs, design and limitations, and outputs in response to the questions raised above are presented below as Parts 2, 3 and 4.

Part 2a: Model Inputs – Clarify the rationale for data used in progressive vector plots.

The progressive vector plots included in Section 5.5.2 of the EIS were not used as inputs for the model in Appendix G, however, they were used for visualization of the currents in the Project Area – Northern Section.

Part 2b: Model Inputs – Specify sampling frequency for data presented in Section 5.5.2.2 and discuss the influence of higher frequency motions on dispersion.

The monthly statistics in Section 5.5.2.2 of the EIS are for illustration/characterization of conditions. The original data were 4 minute averages every 20 minutes from a 300 kHz Acoustic Doppler Current Profiler (ADCP). For the drill cuttings modelling at the Jeanne d'Arc Basin (JDB) location, hourly averages of these currents were used. These are also the data with which the Section 5.5.2.2 current roses were prepared. Regarding other comments on Section 5.5.2.2, this section is for description of ocean current conditions, and is not meant to be a definition of input currents used in the drill cuttings modelling, That information is found in Appendix G (Section 3.2.3) and for each of the four modelled locations: JDB in the Project Area –Southern Section location, and the three Project Areas – Northern Section locations: Northern Project Area (NPA), Southern Project Area (SPA) and Eastern Project Area (EPA).

Part 2c: Model Inputs – Provide a rationale for use of monthly means or use higher frequency data.

Monthly means were used when some filling/reconstruction of currents was required at the NPA and SPA locations. The means were applied to scale the hourly current time series employed to that time of year.

A more detailed discussion regarding the use of monthly means is contained in Part 3d.

Part 3a: Model Design and Limitations – Provide a rationale for the selection of durations for cuttings dispersion modelling, indicating why the maximum drill time of 65 days was not modelled for all locations. Discuss potential limitations of this approach.

The durations (discharge schedule) are established to simulate over what periods of time the release of the cuttings to the sea take place. The well durations employed, for each location, are based on the best estimates of drilling schedule from ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators). The duration at the NPA is 65 days, while the EPA, SPA and JDB were 35 days. The longer drilling times (comprised of drilling all four well hole sections) translate into the material being released over a greater total duration and longer elapsed period of time and as a result the material may experience greater dispersion (e.g., discharge of top two sections occurs over 9 days at NPA and 4 days at the other locations [Appendix G, Table 3-1]). Potential limitations, for any location, are that as noted above the materials will see greater or lesser dispersion based on the distance duration.

The response to Information Requirement (IR) IR-02 also contains information regarding the drilling duration.

Part 3b: Model Design and Limitations – Incorporate stochastic analysis in drill cutting dispersion scenarios or provide a rationale for use of four simulations.

While stochastic analysis may help gain some statistical significance in the interpretation of output predictions, the four deterministic scenarios completed do consider seasonal ocean current conditions which should provide a reasonable prediction of the most likely possible direction and extent of the cuttings footprints, which is the primary objective for the modelling. A comparison of a SPA December scenario with a) the deterministic run commencing 15 Dec and b) 60 ensembles run each day from 16 Nov to 14 Jan, is shown below in Figures 1 and 2. These are water-based mud (WBM) cuttings from seabed release. While Figure 2 shows a slightly greater distance and greater spread to the south-southwest, the general footprint picture is similar. Figure 4 is a superposition of runs 1 to 60 with the most recent runs (e.g., runs 57, 58, 59, and 60) are the four footprints plotted last (on top).

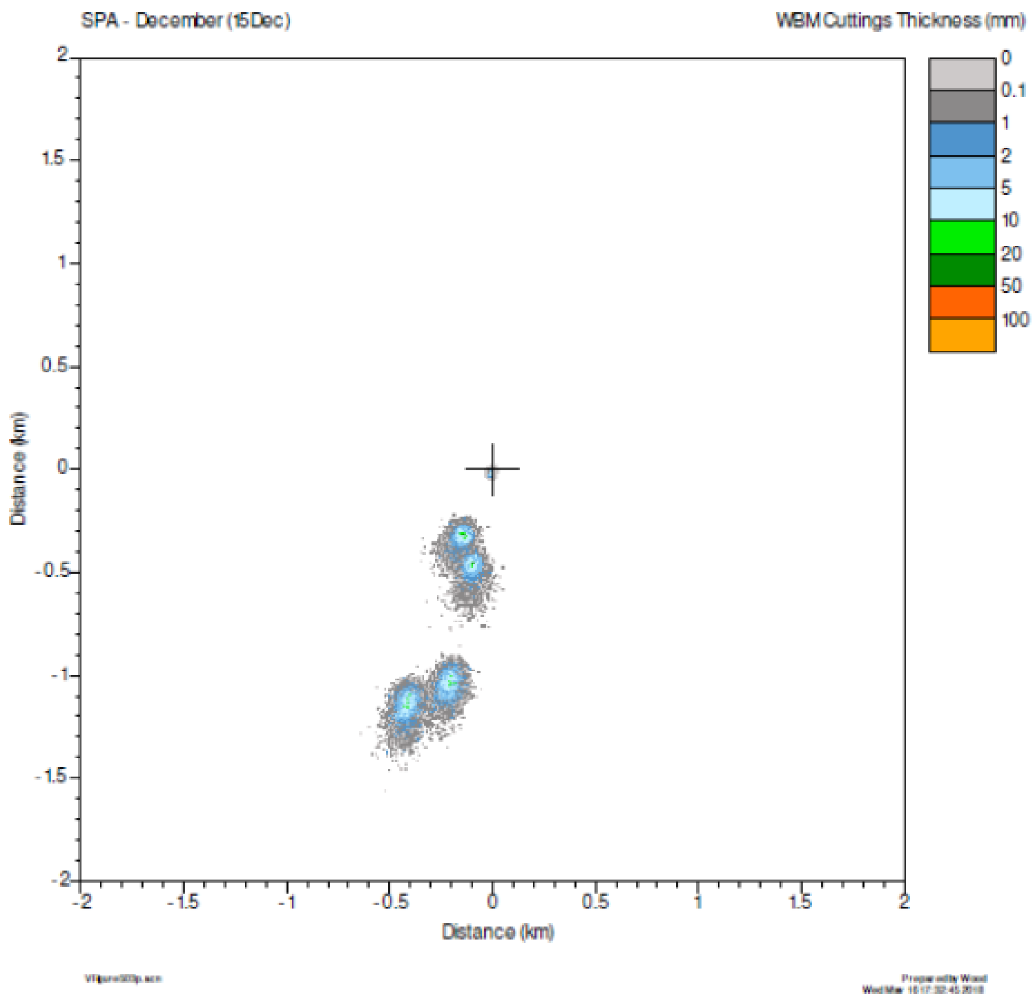

Figure 1 **WBM Drill Cuttings Deposition, SPA, December, One Simulation (15 Dec)**

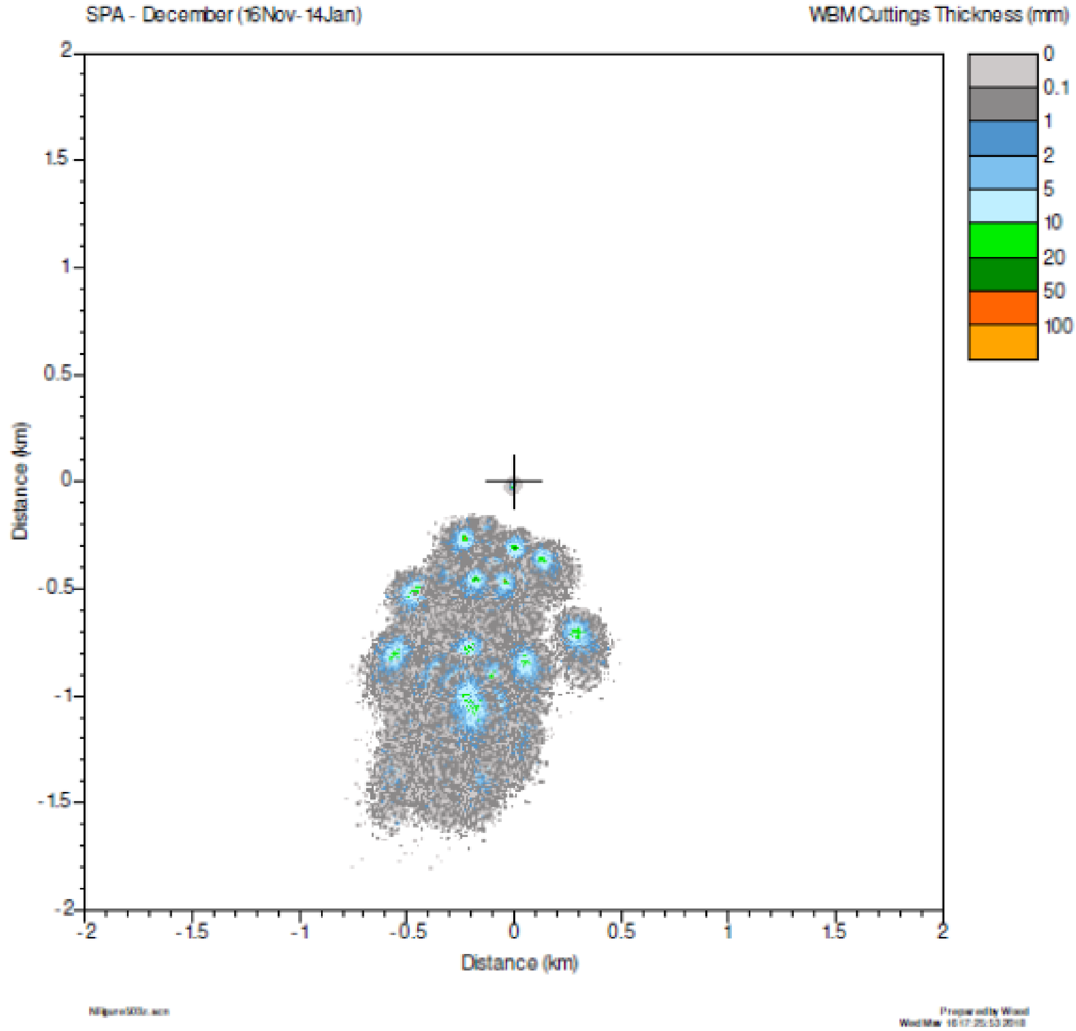

Figure 2 WBM Drill Cuttings Deposition, SPA, December, 60 Simulations (16 Nov-14 Jan)

Part 3c: Model Design and Limitations – Explain whether the dispersion model has considered processes at the benthic boundary layer. If this is not addressed by the model, discuss the implications for model results.

The dispersion model does not consider processes at the benthic boundary layer. This could include resuspension of cuttings with the potential for sediment mobilization based on current speed
(e.g., clays and fines, potentially mobilizing at lower current speeds, sands requiring higher speeds to move). Breakup of flocculates might be expected to reduce near-bottom concentrations (i.e., particles resuspend and are advected away by the ambient currents). Bioturbation is another process and it is difficult to quantify the intensity and rate of reworking that might take place at any of the locations. These post-depositional processes are difficult to model and data are scarce. The implications of not modelling these processes can result in over-prediction of benthic impacts (IOGP 2016) and so using the predicted no effect threshold (PNET) values as a guide to areas

potentially affected is likely conservative. This means that in practice the subsequent resuspension and further transport of cuttings due to post-depositional processes would likely make the deposited thicknesses smaller.

Part 3d: Model Design and Limitations – Provide additional information and rationale regarding data used to fill gaps.

The model employs a year-long, hourly, time series from which input currents are selected for each scenario. Monthly mean currents were not employed for the modelling. Where available, ocean current measurements have been used (e.g., ADCP measurements from Hibernia near the JDB location); however, measured currents are limited for the three locations in the Project Area - Northern Section with approximately 2 months at the NPA location, approximately 3 months at the SPA location, and no measurements near the EPA location.

To address these gaps two approaches were taken: a) fill/reconstruct (for NPA and SPA); and b) model for EPA.

The fill/reconstruct method consisted of replicating the several months of measured currents to fill the periods with no data for each of the near-surface, mid-depth and near-bottom depth levels. The monthly mean speeds at the three depth levels were adjusted and scaled accordingly using mean current values close to the three depth levels from the Nalcor Energy Exploration Strategy System (NESS) cells closest to the NPA or SPA location. These steps ensure that the full year representative current data include relevant non-tidal signature from the measurements and reflect the annual cycle observed for the mean current speeds in the region.

Modelled currents were prepared at the EPA from seasonal (four seasons: Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec) average currents using the WebDrogue Canadian East Coast Ocean Model (CECOM) model (DFO 2015a), and tidal predictions for a full year derived from the WebTide model (DFO 2015b). The WebDrogue provides for five depths: surface, 100 m, 500 m, 1000 m and bottom. For the ADM three current depths are employed, near-surface, mid-depth and near-bottom and the following WebDrogue associations were selected at EPA: 100 m, 500 m and 1000 m.

Wu et al. (2012) conducted an extensive comparison of the CECOM model results and 11 years of observational data, including both qualitative visual comparisons, and quantitative methods based on statistical analysis. Their comparisons indicated that the main circulation features from the observations were successfully reproduced by the model. Furthermore, the comparison indicated particularly good levels of agreement between model and observations in the regions of the Labrador Shelf, Newfoundland Shelf, and the Flemish Pass, with a mean correlation coefficient in the of 0.91 (ideal value is 1) across all seasons and depths within the Flemish Pass, and an average ratio of kinetic energy difference to the observations of 0.12 (where a lower value is better, and the value of 0.5 indicates "a fair agreement").

Part 3e: Model Design and Limitations – Provide a justification for the assumption that currents are uniform over the deposition grids modelled.

Figures 3 and 4 provide plan view visualizations of the WebDrogue modelled currents (see also Part 3d) for the region for fall, when bottom currents are largest. These indicate currents are generally uniform over the 32 km (approximately 0.5° longitude, approximately 0.25° latitude) grid modelled. Outside of these distances, at EPA, for the one June scenario where materials do not settle within 32 km, based on a sensitivity run with current speeds set to half, one can estimate their distance on reaching the seabed to be about 40 km and at thicknesses of 1 mm or less; at SPA, as noted in the modelling report, with slow settling times of the very fine sand, silts and clay cuttings particles released near the surface those particles might be expected to take on the order of 4 days to settle and, at an assumed mean current speed of 15-20 cm/s, travel greater than 50 km; at the deep (2,700 m) NPA location, those particles might be expected to take on the order of 31 days to settle and, with an assumed mean current speed of 10 cm/s, travel over 200 km, at which point those materials would be very widely dispersed. It would be impractical to attempt to track these fine materials to much greater distances. Over the scale of 4 km used to capture the WBM cuttings released at the seabed, the currents at each of the locations can be safely assumed to be generally uniform.

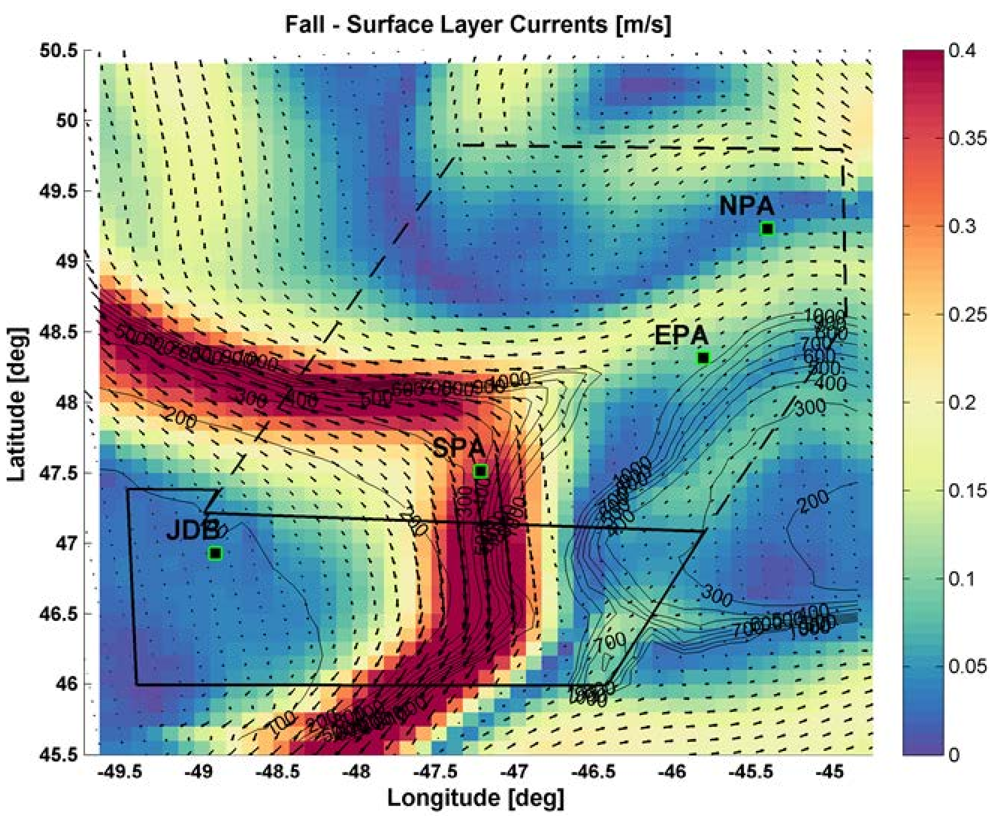

Figure 3 Fall, Surface Currents

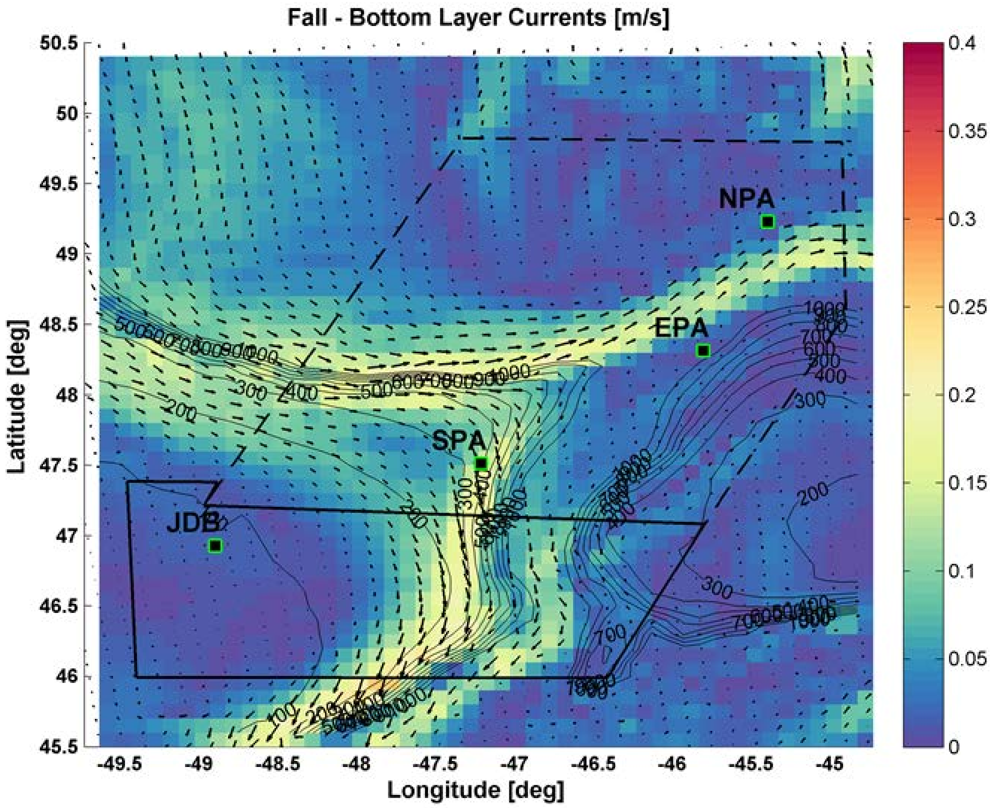

Figure 4 Fall, Bottom Currents

Part 3f: Model Design and Limitations – Provide a rationale for the model selected, and discuss the limitations of modelling without the use of advective-diffusive equations.

The ADM employed is an advective-diffusion model: the dispersion of cuttings released from a single point is governed by advection and turbulent diffusion in the horizontal and vertical planes. The governing transport-diffusion equation is solved using a particle tracing technique. A set of discrete particles is released over time, and each particle has an associated mass. Each particle is defined by its position (x,y,z) with location at time t=n+1 given by equations 6-8 (EIS Appendix G, Section 3.2.5). This type of model has been used, and accepted, in other EIS efforts for offshore activities including those noted in Part 1.

The turbulent part of the flow field arises from subgrid scale motions that are not resolved in the tidal+non-tidal current data and lead to a random diffusion of particles within the grid. For a particle which moves a distance that is a uniformly distributed random (hence the R in [-1,1] term) displacement in the range (-x', …, x') in time step Δt its solution of the diffusion equation gives x',y'=(6AhΔtp)1/2, with Ah a turbulent eddy diffusivity coefficient set=0.1 m2/s. The model integration time step Δt depends on settling velocity. Values for x' for coarse sand to fine silts and clays range from 6 m to 46.5 m. For example, at any time for a coarse particle, the x'R term might range from say -6 m to 6 m. Grid cell sizes simply determine where particles are within the grid, and e.g., in which grid cell they are placed when they reach the seabed, but have no effect on the diffusion. There is similar treatment for y'R. The z' component is a uniformly distributed random displacement in the vertical, in the range +0.05*w*Δt, i.e., an uncertainty of +5% in the distance fallen each time step.

Part 3g: Model Design and Limitations – Provide additional information on the reconstruction method and clarify the time-period of the data.

Refer to the response provided in Part 3d.

Part 4a: Model Outputs – Provide additional explanation of the modelling results, including a discussion of the patchy nature of the results.

The modelling results include maps of predicted thickness footprints, including PNET scales, and tabulations of the amount of material settled and mean and maximum thicknesses. The patchiness seen is due to: a) the variation in the (hourly) ambient ocean current encountered - since the cuttings are discharged in time steps ranging from 1 minute to 1 hour (depending on particle type) over a period of days as per the assumed discharge schedule, they will encounter different currents and hence experience different displacement; and b) the randomness of the dispersion components (in x, y, and z directions). Each sequence of these currents determines where the material settles and given that the materials are in effect released in sequence, there will to varying degree be some corresponding grouping together or patchiness observed.

Part 5: Given the potential limitations of the model approach, indicate how a conservative approach to interpreting results would be taken when identifying areas for pre-drill coral surveys.

The Operators recognize that the drill cuttings model has limitations, which is the case with any model. In addition to the limitations, the model also assumed a number of parameters such as, but not limited to, well location, time of year, duration of drilling, volume of cuttings, cuttings discharge schedule, cuttings particle size characteristics and ocean currents. The Operators acknowledge that the drill cuttings model is a prediction tool and will be considered when developing the Coral and Sponge Survey Plans, which will be submitted to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) and Fisheries and Oceans Canada (DFO) for acceptance prior to commencing the survey, as outlined in Section 2.5.2.1 of the Environmental Impact Statement (EIS).

References

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INFORMATION REQUIREMENT – IR-82

(DFO-05, NunatuKavut-04, and KMKNO-19)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.3.1, Fish and Fish Habitat.

Reference to EIS: Section 8.3.3.1, Underwater Noise and Vibrations; 8.3.7.1, Geophysical, Geohazard, Wellsite, Seabed and VSP Surveys; Appendix C: Eastern Newfoundland Drilling Noise Assessment: Qualitative Assessment of Radiated Sound Levels and Acoustic Propagation Conditions (Quijano et al. 2017); and Appendix D: Marine Mammals and Ambient Sound Sources in the Flemish Pass: Analysis from 2014 and 2015 Acoustic Recordings (Maxner et al. 2017).

Context and Rationale

The EIS Guidelines require an analysis of the effects of underwater noise and vibration emissions on fish health and behaviour.

Section 8.3.3.1 of the EIS refers the reader to Appendix C for additional information on anticipated underwater noise emissions. However, in assessing potential noise effects on fish and fish habitat, Section 8.3.3.1 of the EIS refers to "typical sound levels" rather than referencing the source levels and predictions included in Appendix C (i.e., for the Scotian Basin Exploration Drilling Project). It is not clear why specific sound emissions predictions are not used to support the assessment of effects on fish.

The EIS states that "(t)ypical sound levels from drilling activities are below estimated exposure guidelines for injury to fish, including recoverable injuries (170 dB re 1μPa for 48 hr SEL) and temporary hearing threshold shift (158 dB re 1μPa for 12 hr SEL) (Popper et al. 2014)." However, typical source levels of drilling activities are reported to be greater than 187 dB re 1 μPa based on information presented in Appendix C and D; this is above the thresholds indicated for effects on fish. It is unclear to what distance the levels would be expected to be above thresholds.

Specific Question or Information Requirement

Update the assessment of effects of noise on fish, using sound levels from Appendix C that are intended to be representative of project conditions. As part of this assessment, include:

a. a discussion of how the at-source sound levels predicted in Appendix C compared to the selected noise thresholds for injury and behavioural effects in fish, and
b. estimates of the distance from source at which sound levels would be expected to be above thresholds for fish injury and behavioural effects.

Update the effects analysis, proposed mitigation and follow-up, as well as effects predictions accordingly.

Response

The key factors associated with the effects of noise on fish is the type and level of sound, pressure level, distance, duration and whether the fish use their swim bladder for hearing. While typical sound levels at a drilling installation would exceed recoverable thresholds over specific time periods, the exposure time and proximity to this noise would be very limited and would change rapidly as the fish would move away after the initial sound was generated.

Popper et al. (2014) published recommended sound exposure guidelines for fishes exposed to various types of impulsive sound sources (i.e., explosions, pile driving, seismic airguns, naval sonar) as well as a limited number of metrics for certain types of fish exposed to continuous sound sources (e.g., shipping, drilling). Guidelines for continuous sounds were based on a minimal number of studies, the recognition that fish will respond to sound, and their hearing sensitivity (Popper et al. 2014). Numeric values for continuous sound sources were only developed for recoverable injury (170 dB [decibel] root-mean-square [rms] for 48 hours [h]) and temporary threshold shifts (i.e., TTS; a temporary reduction in hearing ability) (158 dB rms for 12 h) for fish species that have swim bladders involved in hearing (e.g., Atlantic cod, herring). Quantitative metrics or guidelines for assessing behavioural effects of sound on fish do not exist, and the aforementioned metrics do not apply to fish species with no swim bladder (e.g., flatfish) or those with swim bladders that are not involved in hearing (e.g., Atlantic salmon).

Source levels presented in Appendix C of the Environmental Impact Statement (EIS) (Quijano et al. 2017) were based on previously modelled source levels for a drill ship, drilling platform, and support vessel (i.e., 197, 197, and 189 dB re 1 µPa @ 1 m, respectively; Zykov 2016). However, it is important to note that both the duration of exposure and the distance from the sound source must be considered prior to comparing the numeric values of a sound source and the threshold guidelines. Root-mean-square sound pressure refers to the average of the square of the sound signal pressure over a given duration, and for Popper et al.'s (2014) continuous sound level guidelines to apply, an animal would have to be within the range of these levels for the guideline stated durations. Therefore, in fishes with swim bladders involved in hearing, TTS may be expected to occur following 12 continuous hours of exposure to sound pressure levels of 158 dB (rms), and recoverable injuries may occur following 48 hours of continuous exposure to sound levels of 170 dB (rms) (Popper et al. 2014). Furthermore, the source levels for the drilling activities (i.e., 189-197 dB re 1 µPa) reflect the predicted sound pressure levels at a distance of one metre, and sound levels would dissipate (decrease) rapidly with increasing distance from the source. Given the transient nature of fish and demonstrated avoidance behaviours of fish to sound (refer to EIS Section 8.3.3.1 and Section 8.3.7.1) it is unlikely that fish would remain in the immediate area long enough (i.e., 12-48 hrs) to be continuously exposed to these levels. Many of the studies that demonstrate hearing impairments to sound are based on caged studies where fish and invertebrates are unable to avoid and escape the underwater noises (Popper and Hastings 2009; Popper et al. 2014); this is not the case for species in the natural environment who are free to move at will. Popper et al. (2014) also notes that "there is no direct evidence of mortality or potential mortal injury to fish…from ship noise". Thus, even in the unexpected event that an individual elected to remain within the potential extended-duration exposure area, the result would still be temporary in nature (i.e., both TTS and recoverable injuries are by definition short-term and reversible outcomes).

In consideration of the information provided above, the effects assessment in Section 8.3.3 of the EIS, including the analysis of effects, proposed mitigation and follow-up, and significance predictions remain valid.

References

Popper, A. N., and M. C. Hastings. 2009. The effects of human-generated sound on fish. Integrative Zoology, 4: 43-52.

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

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INFORMATION REQUIREMENT – IR-83

(DFO-47 and -48)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii), Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Appendix E – Model Results.

Context and Rationale

Fisheries and Oceans Canada noted that for many figures provided on stochastic results, the spatial extent of the statistics are truncated by the boundaries of the numerical domain. Fisheries and Oceans Canada further noted that the stochastic footprints reported are therefore incomplete.

Fisheries and Oceans Canada noted that the figures in Appendix E depicting shoreline contact are unclear. As an example, Figure 4 12 (Eastern Newfoundland Offshore Exploration Drilling Project; annual probability of dissolved hydrocarbon concentrations in the water column for 113 days) suggests that there is 1 percent probability that oil reaches the entire southern shores of Newfoundland, as well as Nova Scotia. However, Figure 4-18 (Eastern Newfoundland Offshore Exploration Drilling Project; annual probability shoreline contact 113 days) suggests that only Sable Island would be affected. Fisheries and Oceans Canada questioned whether the low grid cell resolution near the coast prevents the oil from reaching the coast.

Specific Question or 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. Provide additional explanation for discrepancies between figures depicting stochastic modelling results.

Response

As noted by Fisheries and Oceans Canada (DFO), a portion of the model results are truncated by the extent of the model domain. This fact is explained by the extended duration of the modelling (160 days) in relation to the velocity of winds and currents in the area. Each set of stochastic figures is provided as a set, with the top figures depicting the probability of highly conservative thresholds including 0.04 micrometres (µm) surface oil thickness (the first sign of a barely visible sheen), 1 part per billion (ppb) of total hydrocarbons in the water column, and 1 gram per metre squared (g/m²) (shoreline oiling), and the bottom figures depicting the minimum time that a threshold is predicted to be exceeded from all 116 model simulations. Stochastic footprints have been provided for the entire 160-day modelled simulation. The use of such conservative thresholds tends to serve as more of a binary “yes/no” on whether any contaminant has passed through each identified area. Should a higher stochastic threshold be used (e.g., a biological or socio-economic threshold), the predicted probability footprint would be much smaller. The oil that was predicted to be transported out of the domain would typically do so on time scales greater than 50 days following the release (see bottom figures), traveling at a minimum of 700 kilometres (km) away from the hypothetical release location. Based upon weathering rates, measured on time scales of hours to days and weeks for more persistent less toxic compounds, the oil that would be transported outside of the model domain is predicted to be highly weathered.

In the example of Figure 4-12, there is a question regarding whether or not the shorelines of Newfoundland would be oiled. There were no problems with grid cell resolution, which was 1.8 km x 2.5 km and extended to the coastline, from limiting shoreline oiling. Figure 4-12 is a depiction of dissolved hydrocarbons within the water column. This modelled soluble fraction of oil is predicted to be dissolved in the water itself and would therefore not pose a risk of oiling shorelines. To better understand the likelihood of potential oiling of shorelines, we suggest referring to figures depicting surface oil, as this refers to the total hydrocarbon fraction (whole oil) on the water surface. Figures 4-1 through 4-6 highlight the probability of surface oil from Exploration Licence (EL) 1135, which are not predicted to reach shore. For the modelled releases at EL 1137, surface oil had a higher probability near the shore (Figure 4-19 through 4-24) due to the closer proximity to Newfoundland. A higher likelihood of shoreline oiling was predicted for this second release location.

References

N/A

INFORMATION REQUIREMENT – IR-84

(NunatuKavut-9, MTI-1, -9, -25, -26 and WNNB-CR-4)

Project Effects Link to CEAA 2012: 5(1)(c)(iii) Current Use of Lands and Resources for Traditional Purposes.

Reference to EIS Guidelines: Part 2, 6.3.7, Indigenous Peoples.

Reference to EIS: Section 12.0, Indigenous Communities and Activities Environmental Effects Assessment.

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 would affect current use of resources by Indigenous peoples for traditional purposes.

Section 12.4.1 of the EIS concludes that, with respect to potential for indirect effects of the Project on Indigenous communities and activities, "(t)he environmental effects analysis also indicates there is limited potential for marine associated species that are known to be used by the identified Indigenous groups to occur within the Project Area / local study area prior to moving to any area of traditional use. The implementation of the mitigation measures outlined throughout this EIS will reduce direct or indirect potential effects on these resources. The Project will not have a significant adverse effect on the availability or quality of resources that are currently used for traditional purposes by Indigenous groups to a nature and to a degree that would alter the nature, location, timing, intensity or value of these activities or the health or heritage of Indigenous community."

Several Indigenous groups have expressed concern with the approach taken in evaluating effects on current use for traditional purposes, indicating that a precautionary approach is warranted when determining the degree to which there is a connection between project area effects and resource availability in Indigenous communities. MTI raised concern related to the data gaps and additional clarification required to understand project effect interactions on Atlantic salmon and swordfish. It was noted that without additional analysis there remains uncertainty surrounding potential impacts to salmon populations that may be harvested by MTI members.

Agency IRs (IR-16, IR-16a, IR-18, and IR-87) have identified the need for additional analysis for routine operations and accidental events on Atlantic salmon, swordfish and Bluefin tuna. Subsequently, indirect effects on resources currently used or valued by Indigenous groups also require additional analysis.

Specific Question or Information Requirement

Utilizing the updated effects analysis required in IR-16, IR-16a, IR-18, and IR-87, update the effects assessment, including cumulative effects assessment, for routine project operations and accidental events on the current/future use of Atlantic salmon, swordfish and Bluefin tuna by Indigenous peoples. Include consideration of additional information obtained during consultation meetings in

Moncton (April 12, 2018), Quebec City (April 18, 2018), and St. John's (April 20, 2018), as applicable.

For harvest (or potential harvest, in the case of Atlantic salmon that are currently not being harvested due to population status) that occurs outside the project area, ensure a fulsome discussion of potential indirect effects on Indigenous communities via changes to resource availability or quality as a result of the Project.

The Agency understands that the proponents are currently, or are considering, collecting further traditional knowledge from Indigenous communities. Please advise when this information will be available, and how it will be utilized, including how it could be used in the design and implementation of follow-up and monitoring programs and further mitigations.

Response

Note: For clarification purposes, the Context and Rationale and Specific Question or Information Requirement sections above references IR-87, however, IR-87 is regarding spill magnitude and IR-88 is associated with Bluefin tuna.

Part 1: Utilizing the updated effects analysis required in IR-16, IR-16a, IR-18, and IR-87, update the effects assessment, including cumulative effects assessment, for routine project operations and accidental events on the current/future use of Atlantic salmon, swordfish and Bluefin tuna by Indigenous peoples. Include consideration of additional information obtained during consultation meetings in Moncton (April 12, 2018), Quebec City (April 18, 2018), and St. John's (April 20, 2018), as applicable.

As mentioned by the reviewer, a series of meetings occurred in Moncton, New Brunswick, Quebec City, Quebec and St. John's, Newfoundland and Labrador in April 2018 and included representatives from Indigenous Groups and organizations, offshore operators, including ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators), and regulatory agencies (e.g., Canadian Environmental Assessment Agency [CEA Agency], Fisheries and Oceans Canada [DFO], Canada-Newfoundland and Labrador Offshore Petroleum Board [C-NLOPB], Environment and Climate Change Canada [ECCC]).

In recent meetings, through exchange of correspondence and review of written submissions from Indigenous Groups and organizations to the CEA Agency on the Environmental Impact Statement (EIS), it has been communicated that Indigenous interests and concerns extend beyond potential interactions and effects on commercial communal and food, social and ceremonial (FSC) fishing practices. Atlantic salmon (and other species) are important to Indigenous peoples as a food source, in cultural and traditional medicine practices, and as a keystone biological component that contributes to the overall health of a sustainable ecosystem (Denney 2018). Atlantic salmon is integral to culture as the means for cultural expression. The continuation of the practice of salmon fishing through traditional means creates opportunities for knowledge sharing, transmission, and adaptation, expression of values of sharing catches to provide for the community, and other uses specific to salmon that cannot be replaced by fishing other species (Denny et al., 2013; Denny & Fanning 2016).

Based on the discussions and questions brought forward by Indigenous Groups during these meetings, it was clear that Atlantic salmon, Swordfish and Bluefin tuna are species of interest, and Indigenous Groups want to ensure that the Project will not have an impact on these species. Concerns regarding Atlantic salmon, Swordfish and Bluefin tuna were also further communicated to the Operators through Information Requirements (IRs) IR-16/16a, IR-18 and IR-87, respectively. As outlined in the responses to these IRs, there are no predicted impacts to these species of interest related to routine operations. As for potential accident events, the likelihood of impacts is very low, and therefore no effects are predicted for current or future use of Atlantic salmon, Swordfish and Atlantic Bluefin tuna by Indigenous peoples. However, a summary of each IR is provided below, and cumulative effects is addressed in the response to IR-86.

IR-16 and IR-16a: Atlantic Salmon

The response to IR-16 and IR-16a included a large amount of additional information including, but not limited to, supplemental literature regarding migration routes, supplemental literature regarding the Inner Bay of Fundy population, potential impacts that climate change has had on salmon distribution, supplemental literature on effects of light and noise on salmon, accidental events, cumulative effects and data gaps regarding migration routes. The information provided by the reviewer was taken into consideration, however, the predictions in the EIS remain valid; the Project is not likely to result in significant adverse environmental effects on marine fish and fish habitat, including Atlantic salmon.

IR-18: Swordfish

The response to IR-18 included additional baseline information on Swordfish and also included potential effects of routine operations, including light and noise. Taking this information into consideration, along with the mitigation measures outlined in Section 8.3.2 of the EIS, the Project is not likely to result in significant adverse effects on Atlantic Bluefin tuna. The determination of significance outlined in Section 15.5.1.5 of the EIS remains valid for fish and fish habitat, including Swordfish; the predicted environmental effects from an accidental event scenario is considered not significant.

IR-88: Atlantic Bluefin Tuna

The response to IR-88 included additional information on Atlantic Bluefin tuna including migration routes, spawning areas and effects of hydrocarbons. Based on available research, it was determined that there are no known spawning and rearing habitats for early life stages of Atlantic Bluefin tuna in Canadian waters, and therefore the Project Area. It was also determined that the potential for individual Atlantic Bluefin tuna to overlap geographically and interact with oil spill events remains unlikely, especially in consideration of anticipated seasonal fluctuations in presence within the regional study area, wide distributions, and high migratory capabilities.

Effects from routine operations to Atlantic Bluefin tuna are not anticipated to differ from those outlined in the EIS for marine fish and fish habitat, and the Project is not likely to result in significant adverse effects on Atlantic Bluefin tuna. The determination of significance outlined in Section 15.5.1.5 of the EIS remains valid for fish and fish habitat, including Atlantic Bluefin tuna; the predicted environmental effects from an accidental event scenario is considered not significant.

Part 2: For harvest (or potential harvest, in the case of Atlantic salmon that are currently not being harvested due to population status) that occurs outside the project area, ensure a fulsome discussion of potential indirect effects on Indigenous communities via changes to resource availability or quality as a result of the Project.

For traditional harvest (or potential harvest, in the case of Atlantic salmon that are currently not being harvested due to population status) that occurs outside the Project Area, there are no potential indirect effects that would result in a change to either resource availability or quality as no salmon (to our knowledge) are currently harvested. The low salmon populations are a regional issue and population declines have occurred over a long period of time due to a number of factors; oil and gas activity has not been identified as a contributor to this decline. Based on the information in the EIS, the Project is not likely to result in significant adverse environmental effects on marine fish and fish habitat, including Atlantic salmon, and therefore it is not predicted that there will be a change to resource availability or quality because of the Project. Operators will consider opportunities to work with Indigenous Groups to improve understanding of salmon migration in the offshore area.

Part 3: The Agency understands that the proponents are currently, or are considering, collecting further traditional knowledge from Indigenous communities. Please advise when this information will be available, and how it will be utilized, including how it could be used in the design and implementation of follow-up and monitoring programs and further mitigations.

In addition to Indigenous Knowledge (IK) already provided to the Operators through meetings, correspondence and Indigenous Group's written submissions to the CEA Agency on the EIS, the Operators anticipate receiving IK focused on species of interest in August 2018. Upon review of that information, the Operators will be able to advise further on this matter. The Operators expect that a Regional Environmental Assessment conducted by the CEA Agency will continue to build on existing IK, and expect that future projects will be further informed in this regard. IK will be considered and incorporated as appropriate in activities and operations going forward, including follow-up and monitoring programs.

References

Denny, S., Denny, A., Christmas, K., & Paul, T. 2013. Plamu Mi'kmaq Ecological Knowledge: Atlantic Salmon in Unama'ki. Unama'ki Institute of Natural Resources.

Denny, S. & Fanning, L. 2016. A Mi'kmaw perspective on advancing salmon governance in Nova Scotia, Canada: Setting the stage for collaborative co-existence. *International Indigenous Policy Journal* 7(4).

Denny, S. 2018. Review of the Overview of Salmon Populations in Support of Statoil Canada Ltd – Flemish Pass Exploration Drilling Project. Unama'ki Institute of Natural Resources.

INFORMATION REQUIREMENT – IR-85

(KMKNO-40, -41, MTI-24, Miawpukek-4.3.1 and -4.3.2)

Project Effects Link to CEAA 2012: 5(1)(c)(i) Aboriginal Peoples Health/ socio-economic conditions.

Reference to EIS Guidelines: Part 2, Section 5 Engagement with Indigenous Groups and Concerns Raised.

Reference to EIS: Section 13.3.2 Summary of Key Mitigation.

Context and Rationale

As a primary measure to mitigate potential effects on Indigenous Communities and Activities, the EIS proposes to develop an Indigenous Communities Fisheries Communication Plan through which the proponent would communicate an annual update of planned activities, including timing of exploration activities and locations of planned wells.

The EIS states that each Indigenous community would be involved in the development of the Indigenous Communities Fisheries Communication Plan; however, 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 this EIS.

Specific Question or 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
- given potential for changes in operations, discuss the sufficiency of providing annual updates to Indigenous communities about planned activities and the potential need for more frequent communication over the life of the Project.

Response

ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators) will develop Indigenous Communities Fisheries Communication Plans (herein referred to as the Plans) in consultation with Indigenous Groups. The Plans will include a protocol for regular, ongoing operational communications between the Operators and Indigenous Groups during routine exploration drilling operations as well as in the unlikely case of a major spill. The Plans will also contain a feedback mechanism for Indigenous harvesters, which will allow the

Operators to consider adaptive management strategies should issues arise that were not predicted in the Environmental Impact Statement (EIS).

In addition, if monitoring is undertaken and once environmental monitoring data is available, the Operators commit to meet with interested Indigenous Groups to share and discuss the results of environmental monitoring programs.

Frequency of ongoing communications, contact points and an appropriate feedback mechanism will be determined through engagement by the Operators with Indigenous Groups.

References

N/A

INFORMATION REQUIREMENT – IR-86

(N/A)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii) Aquatic Species; 5(1)(a)(iii) Migratory Birds; 5(1)(b) Federal Lands /Transboundary; 5(1)(c)(i) Aboriginal Peoples Health/ socio-economic conditions; 5(1)(c)(ii) Aboriginal Physical and Cultural Heritage; 5(1)(c)(iii) Current Use of Lands and Resources for traditional purposes; 5(1)(b) Federal Lands /Transboundary.

Reference to EIS Guidelines: Part 2, Section 6.6.3, Cumulative effects assessment.

Reference to EIS: Section 14.0, Cumulative Environmental Effects.

Context and Rationale

The cumulative effects assessments for all valued components conclude that the cumulative effects of the Project and other projects and activities are unlikely to be significant. The analysis and conclusions are based partly on the limited spatial interactions/geographical overlap of environmental disturbances from the Project and other activities. As recognized by the EIS, cumulative effects can occur as a result of the large ranges of species as well as the mobile nature of individuals.

The EIS states that underwater noise from the drilling unit in excess of behavioural thresholds for marine mammals could extend tens of kilometers from the drilling unit. During the summer of 2017, the JASCO study found that sound from seismic surveys over 100 kilometers from recorders were still a dominant sound source. Noise emissions from existing production facilities and reasonably foreseeable exploratory drilling programs, as well as seismic activity operating simultaneously may not overlap specifically, but could result in cumulative effects by creating multiple zones of avoidance for marine species or masking of marine mammal communication throughout the project area.

Figures 14-1 and 14-2 illustrate petroleum projects as well as some fishing activity in the Northern and Southern project areas. While this is helpful in presenting some of the cumulative effects to which valued components may be exposed, it is does not consider all projects and activities (e.g., marine shipping), nor does it account for the extent of effects (e.g., the results from the modelling from the Scotian Basin Project, referenced in the EIS and Appendix C, found that noise from the drilling unit could extend 150 km from the drilling unit). Further consideration should be given to how mapping could be expanded 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 or Information Requirement

Update the assessment of potential cumulative environmental effects on migratory birds (specifically Leaches Storm Petrel) and marine mammals using appropriate methodology (e.g., mapping, quantification and/or otherwise) taking into account:

- the spatial extent of effects from key activities (e.g., noise on whales, lights on birds) and associated cumulative effects of creating multiple zones of avoidance in the project area;
- the spatial range of populations, recognizing that effects on individuals from the same population in different areas would result in cumulative effects to the species;
- that some valued components would be affected by multiple activities (e.g., noise from drilling units, production facilities and seismic operations, as well as vessel interactions); and
- the Government of Newfoundland and Labrador's recent announcement of Advance 2030: A Plan for Growth in the Newfoundland and Labrador Oil and Gas Industry, including the vision of a 100 new exploration wells drilled by 2030 .

For migratory birds, focus the assessment on Leaches Storm Petrel, as a key indicator species, given the status of this species and potential sensitivity to lighting.

With respect to the analysis of underwater noise on marine mammals, 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 the species, 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 influences (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

As required under Section 19(1) of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012; Government of Canada 2012) and specified in the Environmental Impact Statement (EIS) Guidelines, the EIS assessed and evaluated any cumulative environmental effects that are likely to result from the Project in combination with other physical activities that have been or will be carried out, as well as the significance of these potential effects.

Past and on-going projects and activities and their environmental effects are reflected in the existing (baseline) environmental conditions for each valued component (VC) (refer to EIS Chapters 6 and 7). The cumulative effects assessment (CEA) considered how this existing environmental condition may be changed by the Project, and then, whether and how the effects of other on-going and future projects and activities that have a high degree of certainty (i.e., will be executed or carried out) would affect the same VCs through direct overlap in space and time and/or by affecting the same individuals or populations. The assessment also included consideration of mitigation measures to avoid or reduce potential environmental (including cumulative) effects and evaluated the significance of predicted cumulative effects on each VC.

As specified in Section 14.1.3 and Table 14.2 of the EIS, the following other projects and activities were considered in the CEA for each VC, as relevant:

- Hibernia Oilfield;
- Terra Nova Oilfield;
- White Rose Oilfield and Extension Project;
- Hebron Oilfield;
- Offshore Petroleum Exploration – Drilling;
- Offshore Petroleum Exploration - Geophysical and Other Exploration Activities;
- Fishing Activity;
- Other Marine Vessel Traffic; and
- Hunting Activity.

As noted by the reviewer, a key consideration in assessing the potential for - and the nature and characteristics of - any cumulative effects resulting from the Project in combination with these other projects and activities relates to the spatial and temporal distributions of these and their associated environmental disturbances. This includes, in particular, the potential for the environmental zone of influence of the Project to overlap or otherwise interact with those of one or more of these other projects and activities. Where information was available on the overall spatial and temporal characteristics of these other projects and activities, this was presented and considered in the CEA (see for example EIS Table 14.2). Any further, available information on the known and likely effects of these projects and activities (and especially, their spatial and temporal characteristics) was also presented in the VC-specific sections and tables in Chapter 14 (see for example Table 14.4, which summarizes the result of environmental effects monitoring [EEM] programs completed for the various production projects, as relevant to the CEA for fish and fish habitat).

Figures 14-1 and 14-2 in the EIS provided an overview of select other projects and activities, and focused on fixed production facilities and commercial fisheries locations based on data available from Fisheries and Oceans Canada (DFO). Other projects and activities that are listed above such as exploration drilling, geophysical programs and supporting activities, other marine vessel traffic, and hunting are not outlined in Figures 14-1 and 14-2. Refer to Table 1 and the subsequent paragraph for information regarding the omission from these Figures.

Updated versions of Figures 14-1 and 14-2 are provided below (Figures 1 and 2), which include the recently released 2016 fisheries data from DFO, with six years of fisheries data shown as cumulative “intensity” maps based on the number of fishing “records” over the six-year time period in the dataset for each grid square. 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 RSA and their relationship to planned Project activities.

It should be reiterated, however, that as described in Chapter 7 of the EIS, a variety of commercial fisheries occur within the RSA throughout the year, and the region is characterized by a complex spatial and temporal pattern of fishing activity that is changing according to feedback from local fish harvesters (refer to EIS Chapters 3 and 7). In addition, the rather dynamic nature of the fishery over time (as emphasized during EIS consultations; refer to EIS Chapter 3), makes it difficult to generalize about the spatial and temporal patterns of fishing activity, and therefore its effects, that will occur over the next decade.

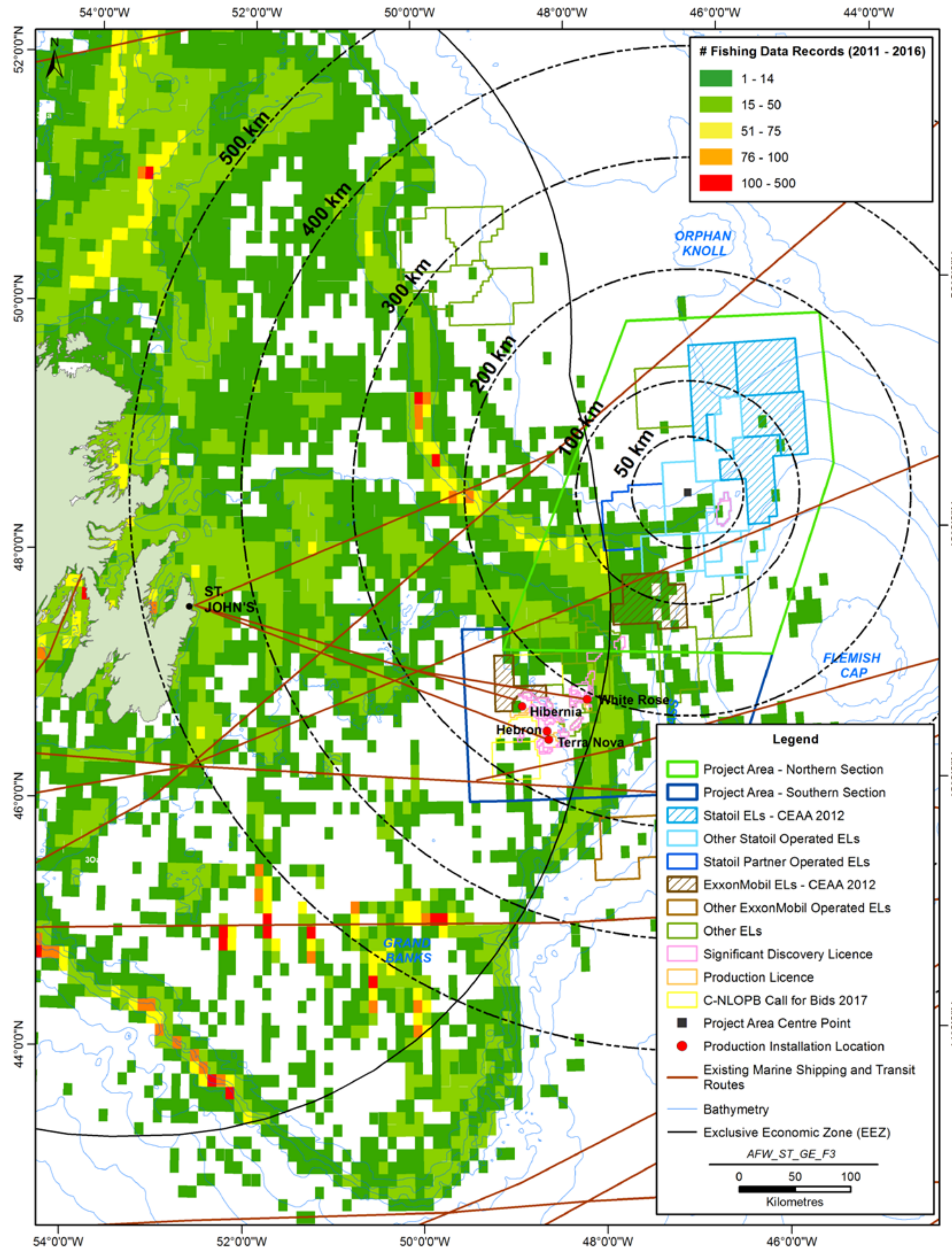

Figure 1 **Some Other Projects and Activities Considered in the Cumulative Effects Assessment (Including Distances from Project Area – Northern Section)**

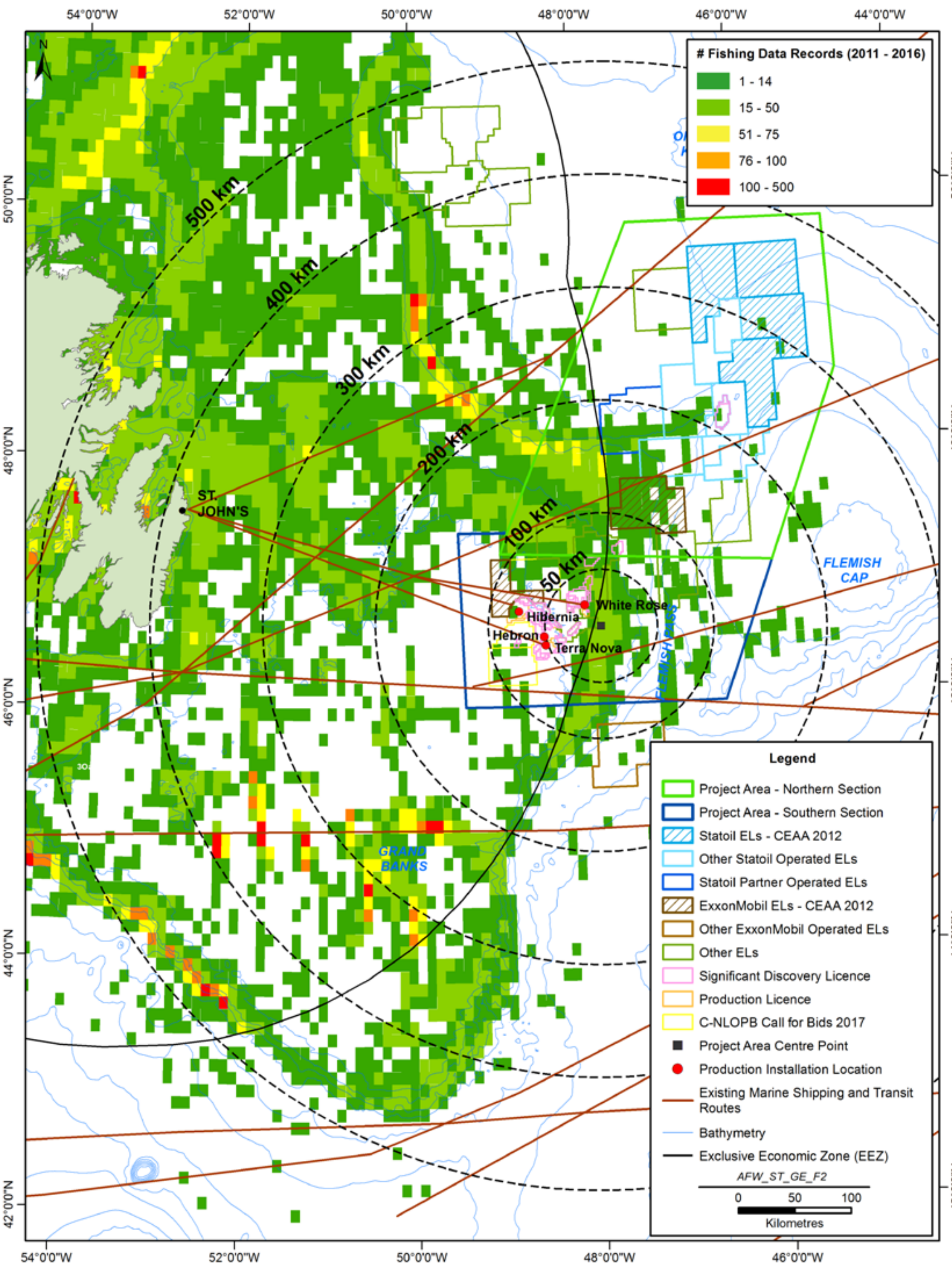

Figure 2 Some Other Projects and Activities Considered in the Cumulative Effects Assessment (Including Distances from Project Area – Southern Section)

The Project Area covers an offshore area of approximately 100,800 kilometres squared (km^2), which is slightly smaller than the island of Newfoundland (108,860 km^2). The anticipated area for exploration drilling activities will depend on the type of drilling installation selected and could be 1 km^2 if a drill ship is used, or up to 12 km^2 for a semi-submersible. Project activities therefore will only occur in a small portion of the overall Project Area.

For further illustration, Table 1 below provides a summary of the distances between those other projects and activities that have defined (or at least somewhat definable) locations and distributions and each of the ELs that comprise the Project.

Table 1 Other Projects and Activities Considered in the Cumulative Effects Assessment and Their Distances from the Project

Project / Activity	Minimum Distance to Project ELs (kilometres [km])					
	EL 1135	EL 1139	EL 1140	EL 1141	EL 1142	EL 1137
Hibernia Oilfield	110	284	339	312	261	8
Terra Nova Oilfield	118	298	351	322	264	38
White Rose Oilfield and Extension Project	71	251	304	273	214	37
Hebron Oilfield	112	292	346	316	259	30
Offshore Petroleum Exploration - Drilling	N/A – see below					
Offshore Petroleum Exploration –Geophysical and Other Exploration Activities	N/A – see below					
Fishing Activity (Medium and High Intensity Areas, as shown in yellow, orange and red in Figures 1 and 2)	12	123	180	156	118	100
Other Marine Vessel Traffic (Identified Vessel Traffic Routes)	Intersecting	6	31	47	3	Intersecting
Hunting Activity (Coastal Areas)	372	463	510	514	483	270

Where known and defined, the CEA presented in the EIS made specific reference to, and considered, the locations of these other projects and activities (such as the four existing production projects and any core fishing areas) and their relationship to the Project Area and associated ELs as part of the analyses. The CEA also noted that marine vessel traffic from fisheries, research surveys and other activities also occurs in these offshore areas, although these are inherently transient in nature and required to remain specified distances from active offshore exploration drilling and geophysical programs in the region.

It should be highlighted that the CEA considered all other projects and activities listed above as relevant to the VC in question, not just those that are "mappable" and shown in the original EIS Figures 14-1 and 14-2 and the updated versions provided in this response (Figures 1 and 2).

As noted in the Table 1, a key activity that occurs in the RSA is other offshore geophysical and exploration drilling programs. For these programs, there is information available from the environmental assessment (EA) related documents submitted for these programs by their respective proponents under CEAA 2012 and/or the Canada-Newfoundland and Labrador Offshore Petroleum Board's (C-NLOPB's) EA review processes (see EIS Table 14.2, with associated links to these projects' EA documentation at http://www.cnlopb.ca/assessments). This EA information was accessed and reviewed in detail as part of the preparation of the CEA for the EIS. These EAs are typically conducted for multiple programs occurring seasonally over 1 or more years (typically up to 10 years in duration) with relatively large overall project and EA study areas. The short-term nature of exploration programs is very different than a long term production project where the project location is singular and well defined and the timelines are long-term. Exploration programs are typically planned and budgeted for approximately 1 to 2 years in advance. Subsequent programs are often planned based on the results of the previous program. It is impossible for an operator to provide specific program location and timing details years in advance. Therefore, at the time of EA preparation there is typically little information available and reported on the specific planned location and precise timing of these exploration activities on which to base a detailed spatial or temporal analysis as part of a CEA.

Each year, the C-NLOPB requires operators who will be conducting programs offshore to provide an "EA Update" for review and approval. The EA Update typically provides more specific information regarding the locations and timing (along with other relevant information) of the proposed program for that year and confirms the planned activities are within the scope of the approved EA. Any available EA Updates for projects in the area over the planned Project timeframe were also accessed and reviewed as part of the CEA. These EA Updates provide information related to the proposed program for that year, and typically do not provide future specific location and timing of activities that would be relevant for the Project time frame. However, the EA and EA Updates provide context for the approximate size, duration and activities associated with typical programs as well as historical and potential future activity levels in the area, which was considered as part of the CEA in the EIS.

The EIS recognized that other oil and gas exploration and production activities have had and may have similar effects on the VCs within their respective zones of influence, and the CEA conservatively assumed in all cases that there is potential for interaction between the effects of multiple, independent projects and activities in the region (see for example, EIS Table 14.5). The CEA also noted that the EAs and/or associated EEM programs for such oil and gas related projects indicate that these have localized environmental effects, which in the case of exploration activities are short-term and transient in nature at any particular location. This, along with the planned and required distances between Project activities and other oil and gas programs (due to large EL areas and associated boundaries and safety zones, as discussed in detail in the EIS), will decrease the potential for interactions between the effects of multiple activities, and thus, for cumulative environmental effects to occur. It is also important to consider that the overall Project Area is very large (i.e., 100,800 km^2) in which these other projects and activities are occurring, and the area associated with exploration drilling activities is a smal portion of the overall Project Area (i.e., up to 12 km^2).

It is also noted that exploration drilling and supporting activities are short-term and transient, and will also be spread out over a time period of 10 to 12 years, with activities occurring at any time during the year, therefore multiple exploration drilling programs will likely not occur at the same time, or in the same area, as there are limited resources (e.g., vessels, drilling installations, personnel, etc.). It is also noted that Equinor operates the majority of exploration licences (ELs) in the Project Area, which decreases the possibility of other operators completing simultaneous exploration drilling activities nearby.

As also noted above, the CEA considered other on-going or proposed offshore oil and gas exploration programs within the RSA that were in progress or being subject to EA review or recently approved as of the time of EIS writing (see http://www.cnlopb.ca/assessments). In terms of the reviewer's suggestion that the CEA take into account "the Government of Newfoundland and Labrador's recent announcement of Advance 2030: A Plan for Growth in the Newfoundland and Labrador Oil and Gas Industry, including the vision of a 100 new exploration wells drilled by 2030", we would note that the current focus of the CEA on actions that are on-going or that have been actually and specifically proposed by a proponent is considered appropriate, and is aligned with the CEA Agency's Operational Policy Statement entitled "Assessing Cumulative Environmental Effects under CEAA 2012", which states that:

> *Temporal boundaries for assessing a selected VC should take into account past and existing physical activities, as well as future physical activities that are certain and reasonably foreseeable. They should also take into account the degree to which the environmental effects of these physical activities will overlap those predicted from the designated project*
>
> *…A cumulative environmental effects assessment of a designated project must include future physical activities that are certain and should generally include physical activities that are reasonably foreseeable….These concepts are defined as follows:*
>
> ***Certain**: the physical activity will proceed or there is a high probability that the physical activity will proceed, e.g., the proponent has received the necessary authorizations or is in the process of obtaining those authorizations.*
>
> ***Reasonably Foreseeable**: the physical activity is expected to proceed, e.g., the proponent has publicly disclosed its intention to seek the necessary EA or other authorizations to proceed*

In terms of the potential processes of accumulation and interaction that may lead to cumulative effects, the CEA also recognizes that while there is limited potential for the direct "footprint" or environmental zones of influence of many Project-related disturbances or effects to accumulate with those of other projects and activities, the widespread and often migratory nature of some marine-associated species and/or human activities increases the potential for individuals / populations and activities to be affected by multiple perturbations, and therefore, for cumulative environmental effects to occur. At the same time, many (especially benthic invertebrate) species are relatively immobile or sessile, which limits the potential for interactions with multiple projects and disturbances. Mobile fish, birds, marine mammals and sea turtle species that have higher potential to interact with multiple projects also have higher capability for avoidance of potential effects. Therefore, the typical movement patterns and ranges of many marine species, coupled with the availability of alternative habitats during short periods and localized extents of Project-related disturbance, limits the potential for cumulative effects to occur. However, there is the potential for displacement from key habitats or disruption during key activities over extended areas or periods, such that these species are (cumulatively) affected in a manner that causes negative and detectable at a population or regional level.

As requested, the sections below provide expanded CEA discussions for Marine and Migratory Birds and Marine Mammals.

Marine and Migratory Birds

Potential interactions with, and effects on, marine and migratory birds as a result of the Project and other projects and activities in the region relate primarily to possible attraction effects associated with Project lighting, particularly where these may affect the same individuals or populations. Section 9.3.3 of the EIS provides a detailed summary of the existing and available literature on the potential effects of offshore lighting on marine-associated avifauna. Available studies on attraction of birds to offshore lighting from oil and gas facilities have demonstrated attraction distances of less than 2 km for gas flaring (Day et al 2015) to 5 km for a production platform with full lighting (30 kilo watts [Kw]) (Poot et al 2008), although attraction from distances of greater than 5 km could not be ruled out in the Poot et al (2008) study. It is of note that the Project activities will emit less light than a fully lit production platform, and therefore, the spatial extent of lighting attraction will likely be smaller (see EIS Chapter 9).

The Leach's Storm-Petrel, a species recently designated Vulnerable by the International Union for Conservation of Nature (IUCN), has been noted to be particularly susceptible to attraction to artificial light sources, as stated in Section 6.2 of the EIS. This species is found in the offshore waters of eastern Newfoundland throughout the year; unlike most seabirds nesting in eastern Newfoundland, breeding adults are known to forage within the Project Area, hundreds of kilometres offshore (Hedd et al 2018). Populations of four of seven major Atlantic Canadian colonies have decreased; this has been attributed to several factors including predation, ingestion of marine contaminants such as mercury, collisions and strandings due to attraction to lighted structures, and contact with hydrocarbons (BirdLife International 2017). A recent tracking study undertaken by Hedd et al (2018) provides insight into the foraging areas utilized by these seven colonies and presents the locations of these foraging areas with respect to existing production platforms off Newfoundland and Labrador (NL) and Nova Scotia (NS). The core foraging areas of four colonies overlapped with the production facilities; three of these colonies are declining (Baccalieu Island NL, Gull Island in Witless Bay NL, and Country Island NS), and population trends are unknown for the fourth (Bird Island NS). The peripheral foraging range of petrels nesting on Bon Portage Island NS intersects with production platforms off NS, but the core foraging area does not. The fourth colony which has shown a declining population trend, Middle Lawn Island in NL, does not forage around existing production platforms. Population trends for two colonies that do not forage around existing production platforms, Bon Portage Island (NS) and Kent Island (NB), are unknown. The core foraging areas for these Leach's Storm-petrel colonies are extremely large, with foraging trips averaging more than 1,400 km per round trip and more than 500 km from the colonies (Hedd et al

2018). The foraging tracks illustrated in the study did not show evident clustering around the production areas, although this was not quantified in the report.

As discussed in Chapters 9 and 14 of the EIS, potential interactions with marine birds as a result of the Project will entail a localized and short-term disturbance at any one location and time, which reduces the potential for individuals and populations to be affected repeatedly through multiple interactions with the Project, as well as the potential for, and degree and duration of, overlap between the effects of this Project and other activities in the marine environment. These potential interactions may, however, be particularly relevant to species like Leach's Storm-petrels which are vulnerable due to high potential for attraction to lights. Species with greater wintering site fidelity such as Common Murres nesting in the northwest Atlantic, whose wintering area is concentrated on the Grand Banks, may be more vulnerable than species with greater intercolonial and interannual diversity in wintering areas such as Thick-billed Murres (McFarlane Tranquilla et al 2014). However, because the foraging and wintering grounds of marine bird species are so large, if there is an interaction between the Project and marine birds the attraction and/or displacement effects due to the proposed Project and other ongoing projects will potentially disrupt only a small percentage of individuals. The effects are likely to be transient and temporary in nature without significant adverse cumulative effects on individuals or populations.

The potential for cumulative effects to occur within the Northern Section of the Project Area would depend on the spatial and temporal interaction between the Project, other offshore exploration activities, other marine traffic and commercial fishing activity which may occur throughout the region. The Northern Section of the Project Area is currently subject to lower levels of anthropogenic activity (e.g., fishing). Hunting pressure on birds that frequent the Project Area also has potential to contribute to cumulative effects, particularly in the case of murres which are subject to the annual turr hunt in Newfoundland. Waterfowl are more commonly found in coastal habitats and less prone to interaction with the Project. The current production projects (i.e., Hibernia, Terra Nova, White Rose, and Hebron) are located 40 km or more from EL 1135 and 1337 (with the expectation of Hibernia, which is 8 km from EL 1137), and from 214 to 350 km from each of ELs 1139 to 1142, and with the possible exception of associated vessel transits, environmental disturbances that are relevant to this VC resulting from Project activities (including light emissions that may attract and/or disorient night-flying birds) in this area will not overlap with those of the current production projects.

Artificial light levels in the Project Area – Northern Section are currently low relative to the Project Area - Southern Section (see below) due to the comparatively low level of anthropogenic activities. The environmental effects of on-going or planned exploration activities in the region will also be localized and short-term in nature, including those resulting from offshore geophysical surveys, which result in a temporary and short-term environmental disturbance (including lights and other emissions) at a given location and time. Exploration drilling activity may only take place in accordance with an approved EL issued by the C-NLOPB, which gives the operator the exclusive right to conduct exploration drilling within that geographic area for a defined time period. It also worth noting that Equinor operates the majority of ELs in the Project Area, which decreases the possibility of other operators completing simultaneous exploration drilling activities nearby. This, along with the relatively limited geographic zone of influence associated with the environmental disturbances (including lights) that result from offshore drilling (see Section 9.3 of the EIS), means that there is little potential for overlap and interaction between disturbances, and for effects on the same individuals. Unlike other seabird species, which undertake comparatively short daily movements during the breeding season individual Leach's Storm-petrels, in their extremely long foraging trips, could potentially be exposed to more than one source of disturbance.

In the Southern Section of the Project Area, there is potential for cumulative effects to result from the combined effects of the Project and other offshore exploration and production activities, marine traffic, and commercial fishing activity. The Hibernia, Terra Nova, White Rose, and Hebron Oilfields are located within this section of the Project Area. Although these are long-term operations with similarly long term environmental disturbances, the localized nature of these effects, and the short-term and localized environmental disturbances that may result from adjacent activities associated with this Project, will reduce the potential for cumulative effects to occur as stated above.

The Project is not anticipated to result in significant adverse effects on marine-associated avian species at risk, and therefore, is unlikely to contribute to cumulative effects on these species. There is no identified and designated critical habitat for avian species at risk within the Project Area / LSA or RSA, and Ivory Gull and Red-necked Phalarope are the only such species that have the potential to be found in the area on a regular basis. The Ivory Gull is generally associated with pack ice, and as such, it is more likely to occur in the northern regions of the Project Area - Northern Section. The primary threats identified in the species' Recovery Strategy include predation at the nest site, illegal shooting and other human disturbances, industrial activities, introduction of contaminants, climate change, and chronic oil pollution (Environment Canada 2014); of these, the latter may be contributed to by the Project as well as other projects and marine vessels within the regional study area. During fall migration, there is some potential for Peregrine Falcons and nocturnally migrating landbird species at risk to pass through, but the risk of interactions with this and other projects in the area is low.

Marine Mammals

As described in Section 10.3 of the EIS, the potential effects of human activities on marine mammals and sea turtles include possible hearing impairment or permanent injury or mortality from exposure to loud underwater noise, as well as behavioural effects (avoidance) due to these or other disturbances, which may alter the presence, abundance and distribution of these species and their health, movements, communications, feeding and other activities. The migratory nature of most species and their overall sensitivity to certain types of disturbance somewhat increases the potential for individuals to be affected by multiple environmental disturbances, and thus, for cumulative effects to occur. This is reflected in the fact that many species have been designated as being at risk or are otherwise of conservation concern.

Potential interactions with marine mammals and sea turtles as a result of this Project relate primarily to possible injury or disturbance (behavioural effects) from the noise, lights and possible waste materials associated with the drilling installation and other related vessel and aircraft traffic. Potential for Project-VC interactions is likely to be highly transient and temporary for individuals, especially in consideration of the large-scale daily and seasonal fluctuations in presence within the assessment areas and the alternative habitats available. It is also important to again consider that the overall Project Area in which these other projects and activities are occurring is very large (i.e., 100,800 km^2), and the area associated with exploration drilling activities is a small portion of the overall Project Area (i.e., up to 12 km^2). Mitigation measures will be applied across a number of

Project components and activities and will help prevent or reduce potential interactions with this VC.

Other on-going and future activities which may affect marine mammals and sea turtles in the RSA include commercial fisheries, general vessel traffic and other offshore oil and gas exploration and development activities. Based on previous studies, most potential effects as a result of these activities occur within relatively close proximity (several kilometers) of the source, although this propagation of underwater noise in the marine environment results in some potential for overlap and interactions between individual disturbances. Behavioural effects as a result of most such activities would however be temporary in nature, and this along with the expected spatial distribution of these activities will reduce the potential for, and degree and duration of, interaction or accumulation between the effects of the Project and other activities in the marine environment. The CEA therefore concluded that Marine Mammals and Sea Turtles will not likely be displaced from key habitats or during important activities in the RSA, or be otherwise affected in a manner that causes adverse and detectable effects to populations.

As discussed in the EIS and summarized above, the widespread, mobile, and migratory nature of marine mammals means that individuals may be exposed to multiple sources of underwater noise while in the RSA; this is true with or without the addition of Project activities. Based on the results of underwater noise modelling and acoustic field programs, activities associated with offshore drilling are expected to increase ambient sound levels in the marine environment. For example, mean sound levels from an operating semi-submersible drill rig have been measured at 13 dB above baseline levels in the Flemish Pass (see Maxner et al. 2017 in Appendix D of the EIS). However, the limited distances over which sound levels are predicted to exceed thresholds for auditory injury to marine mammals, also limit the potential for cumulative effects of this nature. Other limiting factors for cumulative effects are the temporary and transient nature of exploratory drilling activities, and the limited portion of the overall Project Area (i.e., 100,800 km^2) that will be associated with exploration drilling activities (i.e., up to 12 km^2).

Results from the Scotian Basin's underwater noise modelling predicted that cumulative sound exposure levels (SELs) from operating drilling installations over 24 hours would decrease to below threshold values for potential marine mammal auditory injury at distances between 120 and 470 m from the source (Zykov 2016; Appendix C of the EIS). 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 geophysical 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 also likely to be smaller than those for the Scotian Basin project, due to broadband levels that are approximately 2 dB lower for this Project's proposed VSP array (see Appendix C of the EIS).

Since marine mammals are not expected to remain in such close proximity (i.e., within 500 m) of either an operating drilling installation or active VSP survey over the course of 24 hours, auditory injury (using either the SEL or SPL metric) is predicted to be unlikely. Moreover, and as previously noted, offshore oil and gas production fields and exploration drilling installations have established safety zones, where other activities are excluded. These required distances will help reduce the degree to which the potential noise emissions may overlap and interact in space and time,

particularly with respect to thresholds for auditory injury and the limited distances discussed (i.e., within 500 m of the source). Other projects are also anticipated to require standard mitigation measures
(e.g., geophysical survey best practices), reducing the potential for individual marine mammals to be temporarily exposed to high SPLs. Therefore, even in the event of multiple underwater noise sources occurring simultaneously (e.g., multiple exploration units operating simultaneously, exploration drilling occurring at the same time as geophysical activities, marine shipping etc.), the predicted spatial extents of sound levels above thresholds for auditory injury are such that overlap and extended zones of potential effect are considered unlikely. As previously noted, exploration drilling activities may also only take place in accordance with an approved EL issued by the C-NLOPB, which gives the operator the exclusive right to conduct exploration drilling within that geographic area for a defined time period. Since Equinor operates the majority of the ELs in the Project Area, the possibility of other operators completing simultaneous exploration drilling activities nearby is limited. In the unlikely event this did occur, these multiple sources of noise may still contribute to expanded areas of behavioural disturbance; the potential for which was considered in the EIS.

To summarize the soundscapes around the Project Area, JASCO analyzed sound pressure levels from a data collection program conducted in 2015-2016 (Maxner et al. 2017 in Appendix D of the EIS). One of the hydrophones monitored (Station 18) was located 35 km from the Hibernia platform in the existing Jeanne d'Arc Basin development area in 80 m of water, and sound pressure levels here were recorded as 110–120 dB re 1 μPa continuously (NOAA's marine mammal behavioural disturbance threshold is 120 dB re 1 μPa). It is important to recognize that field measurements taken at this hydrophone station already reflect the combined sound levels of multiple production platforms and the support vessel traffic associated with their activities. Thus, factoring in the cumulative contributions of multiple simultaneous sound sources in the region, in-field measurements suggest that marine mammals within 35 km of operating 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.

Table 14.2 in the EIS and Table 1 above provide an overview of other projects and activities considered in the CEA, including their approximate distances to the closest Project EL. In the Project Area's Northern Section, the closest Project EL to the nearest active offshore production platform (i.e., EL 1135) is more than 40 km away, while ELs 1139 to 1142 are more than 214 away. With the exception of EL 1135, which is within a known fishing area, most commercial fishing activity also occurs well outside the boundaries of most of the ELs for which exploration drilling may occur as part of this Project. The potential for cumulative effects between the Project and these current underwater noise sources is therefore considered to be minimal.

In the Project Area's Southern Section, the Hibernia oilfield, Hebron oilfield, Terra Nova oilfield, and the White Rose oilfield and Extension Project are each less than 40 km from the closest Project EL (refer to Table 1). Thus, when timing of activities aligns, underwater noise from these projects (all sources) and other future development in this area may act cumulatively with Project activities to increase the potential for behavioral disturbance of marine mammals. Marine vessel traffic from fisheries, surveys, and other activities, also occurs in this offshore area, although inherently transient in nature. As described in Section 7.1 of the EIS, fixed gear fishing activity is focused on the slope of the Grand Banks and occurs throughout this portion of the Project Area, while the available data shows little current mobile gear use in the Southern Section of the Project Area in general, and particularly, within the ELs for which exploration drilling may occur as part of this Project.

Other on-going or planned petroleum exploration activities in this region, such as offshore VSP and geophysical surveys and associated vessel traffic, will also contribute to the potential cumulative effects of underwater noise. However, these Project activities will operate for a short period of time in any one location, resulting in a limited-duration and relatively localized potential for cumulative interaction with other sound sources. Overall, there may be some biological benefit to the aggregated spatial grouping of offshore production facilities. Although the widespread and often migratory nature of many marine mammal species increases the potential for individuals and populations to be affected by multiple perturbations, these mobile species likewise have capability for avoidance, and individuals could elect to avoid or pass through this area during periods of disturbance. No critical habitat for marine mammals has been designated in or near the Project Area. The Project Area represents a very small percentage of the vast ranges of most marine mammal species expected in the area. Many species show large annual migrations and the composition of individual animals in the area (and thus their availability for exposure to cumulative sound sources) is expected to change seasonally and even daily.

Within the Project Area – Northern Section there are no stationary, long-term oil and gas production facilities. The projects and activities located in the Project Area – Northern Section are short-term (e.g., exploration drilling and geophysical surveys) or transient in nature (e.g., fishing vessel). It is not possible to determine whether these activities will be ongoing at the same time as the proposed Project, and whether they would be in proximity. Moreover, the concept of a 'corridor', as suggested in the Reviewer's comments, is not supported by the Operators as it implies large-scale near-overlapping areas of disturbance out of which animals will be funnelled, a scenario that is not expected. Given the highly-mobile, transient nature of both the noise-producing activities (e.g., a transiting vessel [whether fishing or VSP]) and the marine mammals that would potentially be exposed (many of whom can travel 100 km in a day), the situation is too fluid, dynamic, and unpredictable to be mapped. The Project Area location itself (i.e., offshore open ocean) also does not lend itself well to this type of characterization, since there are such large areas of potential alternative habitat (i.e., as compared to noise sources operating in a confined channel).

While there is some potential for overlap and interaction between underwater noise from the Project and other projects and activities, effects are likely to be transient and temporary in nature without significant adverse cumulative effects on individuals or populations.

Summary

The updated information and additional analysis provided above do not change the results of the original CEAs as presented in Chapter 14 of the EIS. The Project is not likely to result in significant adverse cumulative environmental effects to either VC in combination with other projects and activities that have been or will be carried out. Moreover, the relative contribution of this Project to any such cumulative effects within the RSA will be low.

Mitigation and monitoring or follow-up programs identified as part of the Project-specific effects assessment (Chapters 8 to 13 in the EIS) would be applicable to cumulative effects, in that they are relevant to addressing the Project's potential contribution to cumulative effects in the region. No additional or revised mitigation, monitoring or follow-up is required or proposed related specifically to cumulative environmental effects as the predictions made in the EIS remain valid.

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INFORMATION REQUIREMENT IR–87

(MTI-30)

Project Effects Link to CEAA 2012: Multiple Valued Components - Accidents and Malfunctions.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of potential accidents or malfunctions.

Reference to EIS: Section 15.1.2.1, Contingency Planning.

Context and Rationale

The EIS states that depending on the magnitude of an offshore spill event, Incident Action Plans will be developed and may include a variety of response measures (Section 15.1.2.1). MTI has noted that although these response measures are listed in the EIS, it is unclear what criteria would be used to determine which measures would be implemented for various spill magnitudes.

Specific Question or Request

Clarify what "magnitude" means in relation to the range of accident types that can occur, and criteria that would be used to determine potential responses measures in relation to each magnitude range.

Response

As indicated in Section 2.12 of the Environmental Impact Statement (EIS), prior to drilling activities commencing, ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) are required to obtain an *Operations Authorization* (OA) from the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). To obtain the OA, and outlined in Section 6(j) of the *Offshore Newfoundland Drilling and Production Regulations* (Government of Canada 2009), the Operators are required to prepare contingency plans to mitigate the effects of any reasonably foreseeable event that might compromise safety or environmental protection. To satisfy this requirement, the Operators will prepare Oil Spill Response Plans (OSRPs), which will be submitted to the C-NLOPB for review and approval during the OA phase. OSRPs typically to include the management, countermeasures and strategies that will be used in the event of a spill. Response measures will vary depending on the magnitude of the spill, and can include, but are not limited to, the use of a mechanical recovery, natural dispersion, dispersants and capping stack system. Spill response strategies are also outlined in each EIS (i.e., Section 15.1.2.2 for ExxonMobil and Section 15.1.2.3 for Equinor).

The Operators divide the magnitude of potential oil spills into three levels, or Tiers, in their OSRPs. This classification allows for an appropriate initial response to each level of spill, and provides escalation of the response should the potential impact of the spill increase. The parameters that are considered in selection of the appropriate level, or Tier, of response include, but are not limited to:

- Size and nature of the oil spill;
- Environmental and operational conditions at the time of the spill;

- Vessel and equipment availability; and
- On-site waste oil storage.

The three Tiers recognized by the Operators are as follows:

- Tier 1 – spill poses the least threat of impact and can be managed using resources available on site.
- Tier 2 – spill response requires local shore-based support and contract resources in addition to those already on site.
- Tier 3 – spill has the potential to significantly affect the environment and involve considerable corporate and contract resources drawn from local, regional and international sources.

Further detailed information will be outlined in the Operators OSRPs.

References

N/A

INFORMATION REQUIREMENT – IR-88

(MTI 6)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat.

Reference to EIS Guidelines: Part 2, Section 6.3.1, Fish and Fish Habitat.

Reference to EIS: 15.5.1.2.1 Effects of Hydrocarbons on Marine Fish and Fish Habitat.

Context and Rationale

MTI has advised that oil spills are known to impact cardiac tissues of Atlantic Bluefin tuna. Exposure to polycyclic aromatic hydrocarbons (PAHs) from crude oil spills disrupts cardiac function in Bluefin tuna (affects the regulation of cellular excitability, which can cause life-threatening arrhythmias) (Brette et al, 2014). The assessment in the EIS of effects on tuna is relatively limited, particularly in the context of spills. The EIS suggests that occurrence likelihood of tuna is low, and therefore effects on this species are negligible.

Specific Question or Information Requirement

Provide a robust assessment of how a spill could affect both individuals and populations of Atlantic Bluefin tuna in the event that a spill occurs when individuals are present. Discuss the potential biological effects of a spill on tuna.

Response

Atlantic bluefin tuna (*Thunnus thynnus*) migrate to Canadian waters in summer in search of food and move southward in the fall. The commercial fishery in Atlantic Canada occurs primarily from July to November as the tuna migrate into Canadian waters (DFO 2012). This species may form schools of less than 50 individuals (COSEWIC 2011). Atlantic bluefin tuna return to the Gulf of Mexico to spawn from April-June (Galuardi et al. 2009, Wilson and Block 2009). They are also known to spawn in the open ocean east of the mid-Atlantic states of the United States based on occurrence of larvae and embryos in the area (Lutcavage et al. 1999; Richardson et al. 2016; Muhling et al. 2017). There are no known spawning and rearing habitats for early life history stages of Atlantic bluefin tuna in Canadian waters. Known distribution of Atlantic bluefin tuna in Canadian waters is based on commercial fisheries that have captured individuals in continental shelf waters of the Gulf of St. Lawrence, the Scotian Shelf, and the Grand Bank (COSEWIC 2011). Trans-Atlantic migrating bluefin tuna have also been tracked to the Flemish Cap area from summer to autumn (Walli et al. 2009). Within the western North Atlantic, areas around the Grand Banks, Flemish Cap, and Gulf of Maine are considered foraging “hotspots” for Atlantic bluefin tuna species (Walli et al 2009; Wilson and Block 2009). However, for most seasons, habitat utilization studies indicate that Atlantic Bluefin tuna from the western Atlantic are largely outside the Project Area (Walli et al 2009).

Exposure to polycyclic aromatic hydrocarbons (PAHs) have been shown to result in reduced growth rates, and various developmental impairments in Atlantic bluefin and yellowfin tuna eggs and larvae (Incardona et al. 2014), and impaired cardiac function in juveniles of yellowfin and Pacific bluefin tuna (Brette et al. 2014, 2017).

As PAHs weather, they become enriched in phenanthrenes and become proportionally more toxic to fish hearts (Brette et al. 2017). Brette et al. (2017) showed that phenanthrene exposure to mackerel and juvenile tuna hearts resulted in cardiac contractile failure and abnormal contractile rhythm. Direct effects of PAHs on adult tuna are less understood (Hazen et al. 2016), however, preliminary work has indicated that toxic metals and polyhalogenated aromatic hydrocarbons (PHAHs) can have reproductive alterations on large pelagic fishes such as Atlantic bluefin tuna (Fossi et al. 2002). Studies on other fish species have also shown that hydrocarbon exposure to adult fish has led to reduced swimming performance (Stieglitz et al. 2016), reduced immune defences (Suzuki et al. 2018), increased physiological stress (Klinger et al. 2015).

The response of tuna to oil spills is largely dependent on timing and exposure, as detailed for marine fish species in Section 15.5.1.2.1 of the EIS. Conclusions regarding potential toxic effects of treated or untreated oil on large pelagic fish species are often based on uncontrolled field exposures following accidental events (e.g., Deepwater Horizon spill). Eggs and larvae of Atlantic bluefin tuna are the primary life stage sensitive to hydrocarbon and weathered crude oil exposure (Muhling et al. 2012; Incardona et al. 2014; Hazen et al. 2016), however. the closest tuna spawning area to the Project Area is the open ocean areas east of the mid-Atlantic states of the United States, referred to as the Slope Sea (Richardson et al. 2016), which is more than 500 kilometres (km) from the Project Area. Based on modelled unmitigated spill scenarios (Appendix E of the EIS), spawning individuals on the Slope Sea (Richardson et al. 2016) have a low probability (<10 percent) to encounter dissolved hydrocarbon concentrations in excess of 1 micrograms per litre (µg/L). Therefore, early life stages of Atlantic bluefin tuna are not likely to interact with the weathered crude oil from an oil spill event in the Project Area. Furthermore, multiple spawning sites (Slope Sea and Gulf of Mexico) for this species potentially reduces population level effects (Richardson et al. 2016). Tuna spawning in the Slope Sea are younger individuals with migration patterns that span the east coast of the US and generally remain outside Canadian waters (Richardson et al. 2016). Adult tuna in Canadian waters are generally larger individuals that undertake large migrations to spawn in the Gulf of Mexico (DFO 2012; Richardson et al. 2016). Trans-Atlantic migrating adult tuna that forage on the Flemish Cap (Walli et al. 2009; Wilson and Block 2009) have a higher probability (90 percent) of encountering dissolved hydrocarbon concentrations in excess of 1 µg/L. As this is a main foraging area for Atlantic bluefin tuna, hydrocarbon exposure in the area may reduce abundance of prey. However, overall effects on this species are limited considering this species has ocean-basin distributions and can move at scales of approximately 100 km per week, thus limiting interactions with hydrocarbons (Hazen et al. 2016). The majority of fishery captures for Atlantic bluefin tuna are in the Gulf of St. Lawrence and off Nova Scotia, outside the modelled spill trajectory, indicating limited interactions with the fishery. The modelled unmitigated oil spill trajectories and distributions are considered a worst-case scenario as a conservative approach to environmental assessment. The duration of a blowout, and therefore the resulting volume spilled and geographic extent affected, will be limited due to the implementation of emergency response measures as outlined in Section 15.1.2 of the EIS, and further limits the potential effects on Atlantic bluefin tuna.

The potential for individual Atlantic bluefin tuna to overlap geographically and interact with oil spill events, remains unlikely, especially in consideration of anticipated seasonal fluctuations in presence within the regional study area (RSA), wide distributions, and high migratory capabilities. Furthermore, potential effects of hydrocarbons are mainly adverse to early life stages of Atlantic bluefin tuna that do not occur within the Project Area. With the application of mitigation measures and adherence to published and/or industry standards and best management practices, effects to Atlantic bluefin tuna are not expected to differ from those presented in Table 15.18 of the EIS for marine fish and fish habitat. Potential accidental event-related environmental effects are predicted to be adverse, of low to medium magnitude, ranging from within the Project Area to within the RSA and / or beyond, of short to long term duration, unlikely to occur to occurring sporadically, reversible and made with a moderate level of confidence. Based on the nature and characteristics of the Project and with the planned implementation of mitigation measures, the Project is not likely to result in significant adverse effects on Atlantic bluefin tuna.

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INFORMATION REQUIREMENT – IR-89

(NunatuKavut-3, KMKNO-35, MTI-23, Ekuanitshit 13-17, Miawpukek-4.2.13, and Sipekne'katik-03)

Project Effects Link to CEAA 2012: Section 5(1)(c) (i) Aboriginal Peoples Health/ socio-economic conditions.

Reference to EIS Guidelines: Part 1, Section 6.3.7, Indigenous peoples.

Reference to EIS: Section 15.5 Indigenous Communities and Activities.

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 Guidelines also require that the proponent provide justification if it is determined that an assessment of potential for contamination of country foods is not required.

Section 15.5.5 of the EIS provides an analysis of potential effects of accidental events on Indigenous communities and activities. The EIS states that in the event of an uncontrolled well event, due to a limited potential for any degree of connection between individual fish, mammals, or birds affected by a spill and individuals harvested by Indigenous communities, there is "little potential for any effects on marine-associated species in general (and individuals in particular) to translate into a detectable effect on the use of such species for traditional purposes by an Indigenous group elsewhere in Eastern Canada. Adverse effects on the health of Indigenous peoples are also not predicted to occur as a result of the Project factors, and given the imposition of a temporary harvesting closure around the affected area."

Sipekne'katik First Nation noted that despite the limited potential for connection cited by the proponent, it is perceived that if an accidental event or malfunction occurred, there would be potential effects on species that are present, spawn, or migrate through the surrounding area, potentially impacting upon rights.

Several Indigenous communities have raised concerns about the effects of a major blowout on traditionally harvested species, including the Innu First Nation of Ekuanitshit, which asked for additional effects analysis of potential contamination of species harvested by the Innu First Nation of Ekuanitshit (Atlantic salmon, the common eider, the Canada goose and pinnipeds), either directly via contact with spilled oil, or indirectly via food chain effects.

MTI, KMKNO, Miawpukek First Nation and 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. The

Agency notes that there is no discussion in Section 15.5.5 of the EIS of the potential for contamination of traditionally harvested species, either through direct contact with oil (including potential oiling on inshore or near shore environments) or through bioaccumulation in the food chain. Although taint is briefly discussed in the analysis of effects of accidents and malfunctions on commercial fisheries (Section 15.5.6), it is not clearly linked in the discussion of effects on Indigenous communities. Moreover, there is no discussion of the effects of perceived contamination after a spill event, either on communities themselves or on the marketability of commercial catches.

Section 15.5.2.5 of the EIS indicates that a precautionary conclusion was drawn when predicting significant residual adverse effects of accidents and malfunctions on marine and migratory birds. It is unclear what the assumptions of this precautionary approach were and why this approach was taken for birds only. It is also unclear whether this predicted significant adverse effect on birds was carried through the assessment of effects of accidental events on Indigenous communities and activities.

Specific Question or Information Requirement

With consideration of the concerns expressed by Indigenous groups, provide additional analysis about the effects of an uncontrolled well event on Indigenous communities and activities, including:

- an expanded discussion of the potential for contamination of fish, bird and marine mammal species harvested by Indigenous communities, either directly through contact with spilled oil, or indirectly through the food chain;
- 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; and
- potential adverse effects of perceived contamination of country foods by Indigenous peoples, including effects of lack of access to traditional harvest species, and dietary changes if country foods are avoided and replaced with foods of lower nutritional content.

Response

A series of meetings occurred in Moncton, New Brunswick, Quebec City, Quebec and St. John's, Newfoundland and Labrador in April 2018 and included representatives from Indigenous Groups and organizations, offshore operators, including ExxonMobil Canada Ltd. (ExxonMobil) and Equinor Canada Ltd. (Equinor) (herein referred to as the Operators), and regulatory agencies (e.g., Canadian Environmental Assessment Agency [CEA Agency], Fisheries and Oceans Canada [DFO], Canada-Newfoundland and Labrador Offshore Petroleum Board [C-NLOPB], Environment and Climate Change Canada [ECCC]). During these meetings, Indigenous Groups and organizations communicated their concerns regarding spills from Project activities. Concerns regarding spills were also outlined in written submissions from Indigenous Groups and organizations to the CEA Agency on the Environmental Impact Statement (EIS).

Probability analyses associated with batch spills, including diesel and synthetic based drilling fluids and muds (SBM), and subsea blowouts were completed in Sections 15.3.2.1 and 15.3.2 of the EIS and it was determined that the probability of a subsea blowout or other release is very low. Probabilities of subsea blowouts are outlined in Table 15.10 of the EIS. The probability of an uncontrolled well event for 35-day and 65-day exploration drilling programs is 0.0000069 and 0.000013 per well, respectively.

As mentioned above, and in Section 15.3 of the EIS, the probability of an uncontrolled well event is very low. If an uncontrolled well event occurs, it does not necessarily mean that a release of hydrocarbons will occur. As outlined in Section 15.2.5 of the EIS, the drilling installation will be equipped with well control equipment (e.g., blowout preventer [BOP], choke manifold), which may prevent the release of hydrocarbons. The spill trajectory modelling, which included worst-case unmitigated scenarios, provided in Appendix E of the EIS, demonstrates that for the most part the predicted direction of a release would travel to the east, away from land. In certain scenarios, the model indicated that there was less than a 10 percent probability of reaching shore, without mitigation in place. The spill trajectory modelling includes numerous scenarios, all of which are unmitigated releases to simulate a worst-case scenario. However, in an actual event spill response measures enacted would likely reduce both the magnitude and duration of a spill. In addition to the likely direction of a potential release (i.e., eastward), spill response measures would limit the geographic extent and magnitude of potential environmental effects.

As mentioned above, the probability of an uncontrolled well event and subsequent release is very low, and therefore the probability of contamination of fish, bird or marine mammals harvested by Indigenous communities (either directly through contact or indirectly through the food chain) is even lower due to aspects outlined in the above paragraph. For transient species that may encounter spilled materials offshore, the low likelihood of a spill coupled with the probability that a transient species would intersect spilled materials and then travel to an onshore, or nearshore location makes any direct contact or impact unlikely. Therefore, an assessment of potential adverse effects on the health of Indigenous peoples from consumption of contaminated species is not required as there is no credible pathway for an interaction.

Due to the probability of an uncontrolled well event and subsequent release being very low, the likelihood of contamination is even lower, therefore and an analysis of lack of access to traditional harvest species, dietary changes resulting from replacement of country foods with lower quality foods is not required.

References

N/A

CLARIFICATIONS – ROUND 1 (PART 2)

EXXONMOBIL AND EQUINOR

CLARIFICATION – CL-24

(DFO-42)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii), Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Appendix E – Ice Cover.

Context and Rationale

Section 3.2 (Eastern Newfoundland Offshore Exploration Drilling Project)/3.3 (Flemish Pass Exploration Drilling Project) of Appendix E states "(o)il trapped in or under sea ice will weather more slowly than oil released in open water."

Also, section 3.2 (Eastern Newfoundland Offshore Exploration Drilling Project)/3.3 (Flemish Pass Exploration Drilling Project) of Appendix E states "From 0 to ~30% coverage, the ice has no effect on the advection or weathering of surface floating oil. From approximately 30 to 80% ice coverage, oil advection is forced to the right of ice motion in the northern hemisphere, surface oil thickness generally increases due to ice-restricted spreading, and evaporation and entrainment are both reduced by damping/shielding the water surface from wind and waves. Above 80% ice coverage, surface oil moves with the ice and evaporation and entrainment cease." Fisheries and Oceans Canada has indicated that this may only be true for landfast ice. In the open ocean, the oil may disperse faster because of an increased effect of wind on the ice compared to an oil slick alone. A reference should be provided to support these statements.

Required Clarification

Provide references to support the statements in Appendix E and Section 3.2 of the EIS Documents as noted above.

Response

Ice coverage information available in coupled hydrodynamics and ice models (e.g., Canadian Ice Service) is typically resolved at relatively large scales (>1 km). While detailed information regarding ice coverage and conditions are not available from these models, the information provided can be used as an indicator of whether oil would move predominantly with the surface water currents or with the ice. A rule of thumb followed by past modeling studies is that oil will generally drift with ice when ice coverage is greater than 30% (Drozdowski et al., 2011; Venkatesh et al., 1990). A recent review by experts on oil transport in ice-covered waters (CRRC, 2016) concluded that at up to 30% ice coverage, oil moves as though it is in open water, and at 80% and higher ice coverage oil transport is almost totally controlled by the ice. There is not agreement on how oil moves with intermediate ice coverage between 30% and 80%, i.e., in the marginal ice zone (MIZ). There is no specific field calibration for this guidance, although theoretical arguments have been made (Venkatesh et al., 1990; CRRC, 2016). "The presence of frazil or brash ice between larger floes would increase control of the oil as compared to open water." (CRRC, 2016).

In the presence of sea ice, weathering processes (e.g., evaporation and emulsification) and physical processes such as spreading and entrainment are slowed (Spaulding, 1988). Wave-damping, the limitations on spreading dictated by the presence of sea ice, and temperature appear to be the primary factors governing observed spreading and weathering rates (Sorstrom et al., 2010).

The OILMAP and SIMAP models use the ice coverage data (at the available resolution) to determine whether floating (or ice-trapped) oil is transported by the surface water currents or the ice. Immobile landfast ice that seasonally extends out from the coast may act as a natural barrier where oil can collect. In the model, when oil encounters landfast ice it is assumed to trap at or move along the ice edge (depending on the current and wind directions at the location and time). If oil becomes entrapped within landfast ice (by surfacing there or as landfast ice extends over the area), it remains immobile until the ice retreats. When landfast ice is no longer present at the location of trapped oil, the oil is released back into the water as floating oil.

Laboratory and field studies have shown that oil weathering properties are strongly influenced by the low temperature, reduced oil spreading, and reduced wave action caused by moderate to high ice coverage (Brandvik et al., 2010a; Brandvik and Faksness, 2009; Faksness et al., 2011). The weathering processes (e.g., evaporation and emulsification) in pack ice conditions, in particular, were shown to be considerably slower in terms of evaporation, water uptake, and viscosity and pour point changes. In OILMAP and SIMAP, in ice coverage within the marginal ice zone, a linear reduction in wind speed from the open-water value to zero in pack ice is applied to simulate shielding from wind effects. This reduces the evaporation, volatilization, emulsification, and entrainment rates due to reduced wind and wave energy.

In the oil in ice experiments by Brandvik et al. (2010a,b), the evaporative loss of oils showed a significant difference between different ice conditions. The results indicate the difference in evaporative loss is mainly caused by the difference in oil film thickness, reflective of reduced spreading rate with oil slick thickening under higher ice coverage. Thus, this reduction in evaporative loss is reflected in model results via the reduced rate of spreading and constraints on surface area imposed by the ice cover.

SINTEF Sea Lab experiments (FEX2009, Brandvik et al., 2010b) showed that the presence of high ice coverage (90%) considerably slowed the rate and extent of the emulsification process as indicated from the percentage water uptake, presumably due to the significant wave damping and hence a reduction in wave mixing energy available for creating emulsions.

Degradation of subsurface and ice-bound oil occurs during all ice conditions, at rates occurring at the location (i.e., floating versus subsurface) without ice present. The rates are model inputs; biodegradation rates developed by French McCay et al. (2015, 2016, 2017) based on literature review are typically used.

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CLARIFICATION – CL-25

(DFO-43 and -46)

Project Effects Link to CEAA 2012: 5(1)(a)(i) Fish and Fish Habitat; 5(1)(a)(ii), Aquatic Species.

Reference to EIS Guidelines: Part 2, Section 6.6.1, Effects of Potential Accidents or Malfunctions.

Reference to EIS: Appendix E – Currents.

Context and Rationale

Section 3.4 (Eastern Newfoundland Offshore Exploration Drilling Project) and Section 3.5 (Flemish Pass Exploration Drilling Project) of Appendix E states "(t)he boundary where these two currents converge produces extremely energetic and variable frontal systems and eddies on smaller scales, on the order of kilometers (Volkov, 2005). Due to these eddies, local transport may advect parcels of water in nearly any direction." Fisheries and Oceans Canada indicated that it is unclear whether the numerical simulations have enough spatial resolution to resolve these 'extremely energetic eddies', or whether the currents used (daily average) have enough temporal resolution to resolve these eddies.

Appendix E states, "…oil transport was defined by the daily currents throughout each modelled simulation". Sections 3.3/3.4 (Wind Data) state, "(b)ecause winds can change on time-scales of minutes to hours, it is best to acquire data at the highest temporal resolution possible (typically every six hours for large global models, or at the very least daily averages)." This also applies to currents and is thus a major limitation that should be quantified and discussed. Daily currents do not resolve high-resolution motions such as inertial or tidal currents (e.g., trapped diurnal tide known to travel around Flemish Cap; Wright and Xu, 2004).

Required Clarification

Provide a discussion of whether the numerical simulations have enough spatial and temporal resolution to resolve the 'extremely energetic eddies' referred to in Appendix E. The limitations of using lower-resolution data should be discussed, including implications for effects predictions.

Response

The spatial extent of boundary current eddies can be on the order of kilometers. The 1/12° equatorial resolution of the Hybrid Coordinate Ocean Model (HYCOM) hydrodynamic gridding provides gridded ocean data with an average spacing of approximately 7 km between each point. Several studies have demonstrated that at least 1/10° horizontal resolution is required to resolve boundary currents and mesoscale variability in a realistic manner (Hurlburt and Hogan, 2000; Smith and Maltrud, 2000; Chassignet and Garaffo, 2001). For eddies that are of a smaller scale than approximately 7 km, the HYCOM model would not directly capture these features. However, from a broader-scale trajectory perspective, this is not required. The movement of water within an eddy is circular by nature. Therefore, while the rate of circulation (i.e., velocity of water) may be greater than that of the general circulation outside of the eddy, it is irrelevant to the broader scale modelled transport processes as oil in the eddy would tend to be trapped, circulating within the grid cell. The general circulation (i.e., movement of the eddy itself) would be resolved by the average current within the single grid cell. In addition, the randomized advective dispersion accounts for the variability in currents below the spatial and temporal resolution of each dataset. Because HYCOM does not resolve the trapping of oil in these small-scale features results of the modelled simulations would tend to have a higher degree of dispersion and would therefore cover larger areas. For eddies that are larger than approximately 14 km in diameter, the HYCOM gridding could capture the circular nature of the circulation in the multiple grid points that would be used to model it.

In general, the resolution of underlying forcing data has the potential to influence the results of trajectory and fates simulations. If extremely coarse resolution gridding is used, intricate flow paths may be straightened, and velocities would tend to be closer to the mean. If extremely fine resolution gridding is used, smaller scale features will be resolved. However, there is a balance and a “law of diminishing returns” when modelling these processes. When higher spatial and temporal resolutions are used, larger amounts of data are required, the number of time steps must increase (i.e., shorter time steps are required with higher spatial resolution data to account for the distance travelled in each time steps to ensure particles do not skip grid cells), and the amount of time required to model also increases.

A metocean study was conducted to investigate the forcing mechanisms used in the modelling (i.e., currents and winds). Through the use of current roses, monthly statistics of average and 95th percentile wind speeds, and comparisons to field measurements of wind and current speed and direction, it was found that the HYCOM Reanalysis current data and Climate Forecast System Reanalysis (CFSR) wind data were adequately resolving the speed and direction of natural oceanic features and winds in the North Atlantic (EMODNET, 2018; BIO 2018). In addition, because CFSR winds were one of the main driving forces used in the HYCOM Reanalysis model, an additional level of consistency was maintained.

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