Canadian Environmental Assessment Agency | Agence canadienne d'évaluation environnementale

Suite 200
1801 Hollis Street
Halifax NS B3J 3N4

Bureau 200
1801 rue Hollis
Halifax, NE B3J 3N4

April 24, 2018

Sent by E-mail

Terry Forkheim
Senior Environmental and Regulatory Advisor
Statoil Canada Ltd.
2 Steers Cove, Level 2
St. John's, NL A1C 6J5
TEFOR@statoil.com

Dear Mr. Forkheim,

SUBJECT: Flemish Pass Exploration Drilling Project – Information Requirements (Part 2)

Dear Mr. Forkheim,

On March 13, 2018, the Canadian Environmental Assessment Agency (Agency) sent 72 information requirements (IRs) and 23 clarifications to Statoil Canada Ltd. (the proponent) based on the technical review by the Agency, other federal government experts, Indigenous groups and the public of the Environmental Impact Statement (EIS) and associated EIS Summary for the proposed Flemish Pass Exploration Drilling Project. Additional information requirements have been prepared which include additional submissions from Indigenous groups and federal authorities, as elaborated in this document. This submission contains IRs and clarifications common to the Flemish Pass Exploration Drilling Project EIS and the Eastern Newfoundland Offshore Exploration Drilling Project EIS.

The Agency requires acceptable responses to the IRs in order to complete its review of the EIS and to proceed with the preparation of its Environmental Assessment Report. Once you have submitted complete responses to all IRs, the Agency will take a period of up to 15 days without the timeline resuming to form an opinion on whether the required information has been provided. If, the Agency determines the responses to be complete, it will commence a technical review of the additional information and the timeline for the environmental assessment will resume the following day. If the responses are determined to be incomplete, you will be notified at that time. If the Agency has not come to a conclusion after 15 days, the timelines will resume the next day. For further information, please consult the Agency document *Information Requests and Timelines*

https://www.canada.ca/en/environmental-assessment-agency/news/media-room/media-room-2016/information-requests-timelines.html.

The responses may be in a format of your choice; however the format must be such that the responses to individual IRs can be easily identified. You may wish to discuss certain IRs with the Agency or others as necessary to obtain clarification or additional information, prior to submission of the responses. Working directly with interested parties prior to responding to the Agency, will help to minimize the potential for additional IRs related to your responses.

The IRs and your responses will be made public on the Canadian Environmental Assessment Registry (CEAR) Internet site. Please note that the Agency may request further information at any time during the environmental assessment process.

Please confirm receipt of this message and contact me if you require further information.

Sincerely,

<Original signed by>

On behalf of:

Shauna O'Brien
Project Manager – Atlantic Region
Canadian Environmental Assessment Agency

Cc: Elizabeth Young, Canada - Newfoundland Labrador Offshore Petroleum Board
Dave Burley, Canada - Newfoundland Labrador Offshore Petroleum Board
Darren Sooley, Fisheries and Oceans Canada
Glenn Troke, Environment and Climate Change Canada
Allison Denning, Health Canada
Jason Flanagan, Transport Canada
Deborah Campbell, Natural Resources Canada
Carla Stevens, Major Projects Management Office

Attachments:

Attachment 1 - Flemish Pass Exploration Drilling Project Information Requirements (IRs) from Environmental Impact Statement Review – Part II: April 24, 2018

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April 24, 2018

INTRODUCTION

On March 13, 2018, the Canadian Environmental Assessment Agency (Agency) sent 72 information requirements (IRs) and 23 clarifications to Statoil Canada Ltd. (the proponent) based on the technical review by the Agency, other federal government experts, Indigenous groups and the public of the Environmental Impact Statement (EIS) and associated EIS Summary for the proposed Flemish Pass Exploration Drilling Project. Additional information requirements have been prepared which include additional submissions from Indigenous groups and federal authorities, as elaborated in this document. This submission contains IRs and clarifications common to the Flemish Pass Exploration Drilling Project EIS and the Eastern Newfoundland Offshore Exploration Drilling Project EIS.

ACRONYMS AND SHORT FORMS

CEAA 2012	*Canadian Environmental Assessment Act, 2012*
DFO	Fisheries and Oceans Canada
EIS	Environmental Impact Statement
HYCOM	Hybrid Coordinate Ocean Model
IR	Information Requirement
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
MBES	multi-beam echosounder
MTI	Mi'gmawe'l Tplu'taqnn Incorporated
NAFO	Northwest Atlantic Fisheries Organization
NOROG	Norwegian Oil and Gas Authority
ROV	remotely operated vehicle
SARA	*Species at Risk Act*
SSS	sidescan sonar
WGESA	Working Group on Ecosystem Science Assessment
WNNB	Wolastoqey Nation in New Brunswick

INFORMATION REQUIREMENTS (IRs) COMMON TO FLEMISH PASS EXPLORATION DRILLING PROJECT EIS AND EASTERN NEWFOUNDLAND OFFSHORE EXPLORATION DRILLING PROJECT EIS

Project Description

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/Information Requirement: 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.

Fish and Fish Habitat

IR-16a (Miawpukek, Sipekne'Katik, Nutashkuan, Ekuanitshit, NunatuKavut, KMKNO, MTI, Elsipogtog, WNNB, Woodstock)

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; 12.3.2.2.3, Atlantic Salmon; and 17.2 Summary of Mitigation and Commitments

Context and Rationale: 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/Information Requirement: 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.

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/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.

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/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.

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/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.

Model Inputs:

- 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.

Model outputs

- 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.

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/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.

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/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.

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/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.

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/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.

Cumulative Effects

IR-86 (CEAA)

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/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[1].

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.

[1] http://www.nr.gov.nl.ca/nr/advance30/

Accidental Events

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/Information Requirement: 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.

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/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.

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/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.

REQUIRED CLARIFICATIONS COMMON TO EASTERN NEWFOUNDLAND OFFSHORE EXPLORATION DRILLING PROJECT EIS AND FLEMISH PASS EXPLORATION DRILL PROJECT EIS

Accidental Events

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.

Specific Question/Information Requirement: Provide references to support the statements in Appendix E and Section 3.2 of the EIS Documents as noted above.

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).

Specific Question/Information Requirement: 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.