SCIENCE REVIEW OF THE REVISED (2013) OLD HARRY PROSPECT EXPLORATION DRILLING PROGRAM

Context

- On December 20, 2011, Corridor Resources Inc. filed its updated *Environmental Assessment of the Old Harry Prospect Exploration Drilling Program* along with the *Old Harry Drilling Mud and Cuttings Dispersion Modeling Final Report* and *Modeling in Support of Corridor Resources Old Harry Exploratory Drilling Environmental Assessment* with the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). In January 2012, the Environmental Assessment and Major Projects (EAMP) division of the Ecosystems Management Branch in the Newfoundland and Labrador Region requested that DFO Science undertake a review of these documents with a review deadline of February 17, 2012.
- Given that DFO is not the final advisory body for this request (through the *Canadian Environmental Assessment Act (CEAA)* process), and the short timeline to carry out a review, a DFO Science Special Response Process (SSRP) was undertaken on March 5, 2012. Science expertise within Fisheries and Oceans, across the Newfoundland and Labrador, Quebec, Maritimes, and Gulf Regions, was solicited to address this review and Science advice was provided (DFO 2013).
- In April 2013, the Fisheries Protection Program (FPP) of the Ecosystems Management Branch received a *Revised EA Report and Supporting Documents* that included a Disposition Table of Regulatory Information Requests and Responses, and an *Oil Spill Fate and Behaviour Modelling in Support of Corridor Resources Old Harry Exploratory Drilling Environmental Assessment Report Update.* In May 2013, FPP selected a number of issues from the Disposition Table to create a shortened Disposition Table of select DFO Information Requests and Responses, and requested Science to review this and using the revised EA and related documents for reference, determine if the Proponent's responses were adequate.
- Again, Science expertise within Fisheries and Oceans, across the Newfoundland and Labrador, Quebec, Maritimes, and Gulf Regions, was solicited to address this review. Identified participants provided a review of the documentation to be collated before a draft of the prepared response underwent a group evaluation for consensus upon the final Science Response. It should be noted that DFO Science comments were limited to the areas of the report where expertise was available at the time of the review.
- The objective of this process was to provide review and comment on the relevant documents with respect to the following context:
- *Environmental Assessment of the Old Harry Prospect Exploration Drilling Program* – Is information presented complete and based on the most recent information (and modelling as applicable) available? Does it adequately consider the present state of knowledge, and are the uncertainties adequately described and incorporated in the conclusions?

- *Oil Spill Fate and Behaviour Modelling in Support of Corridor Resources Old Harry Exploratory Drilling Environmental Assessment Report Update* – Is the modelling presented complete and based on the most recent information and models available? Does it adequately describe the present state of knowledge, and are the uncertainties in the model inputs and outputs adequately described and incorporated in the conclusions?
- *Disposition Table of Regulatory Information Requests and Responses* - Are the responses and additional information provided adequate (i.e.: complete and based on the most recent information (and modelling as applicable) available)?
- The review found that overall the quality of scientific content presented in the revised environmental assessment (EA) document has improved from the original document. However, this statement applies only to those areas of the report that were identified by FPP to require this current Science review.
- The review found that the updated Oil Spill Fate and Behaviour Modelling report, has not adequately addressed many of the issues raised by DFO Science during the original review. Science remains concerned that the risks are underestimated and the conclusions are not realistic.
- This Science Response report results from the Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, Zonal Science Special Response Process (SSRP) of July 2013 on the Review of Old Harry Prospect Exploration Drilling Program Revised Environmental Assessment.

Background

- Located in the Gulf of St. Lawrence, the Old Harry geological structure is approximately 30 km long and 12 km wide. Old Harry has the potential to contain significant volumes of hydrocarbon resources, where it is one of the largest undrilled geological structures in Eastern Canada. Two provinces, Québec and Newfoundland and Labrador, each have jurisdiction over a portion of the Old Harry geological structure. Corridor Resources Inc. (Corridor) has applied to the regulator, the Canada- Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), for approval to drill a single exploratory well on the Old Harry structure by the end of 2014. This would be a single exploratory well that would take up to 50 days to drill. On December 20, 2011, Corridor submitted an environmental assessment report to C-NLOPB for this exploratory drilling program (under Exploration License (EL) 1105) in the Newfoundland and Labrador offshore area (of the Gulf of St. Lawrence).
- Unlike areas of the Newfoundland and Labrador Shelves, the oil and gas industry in the Gulf continues to be at its infancy – as is the practice of identifying and addressing the potential impacts of petroleum activities for the area. Allowing for this, as well as the fact that the Gulf of St. Lawrence is documented as a unique semi-enclosed ecosystem that supports many species, and forms the basis for economic activity in key industries such as fishing, aquaculture, marine transportation and tourism, the considerations of potential direct and cumulative impacts surrounding new petroleum activities are many.
- An awareness of the risks inherent in marine petroleum development has been heightened by the extensive coverage of the BP Deep Horizon oil well explosion in the Gulf of Mexico in 2010. It has also been reported that “Any impacts from oil and gas exploration activities [in the Gulf of St. Lawrence] will be amplified due to the small, shallow, enclosed nature of the environment and the high biomass and diversity year-

round" (Moriyasu et al. 2001). In turn, public concern over potential impacts of Old Harry exploration on this unique and productive ecosystem has been significant to date.

- Pursuant to Section 5(1)(d) of the *Canadian Environmental Assessment Act* (CEAA), the C-NLOPB is a Responsible Authority and Federal Environmental Assessment Coordinator and commenced an environmental assessment of the Old Harry Project in January 2012. The environmental assessment submitted by Corridor was reviewed by stakeholders, including DFO, who have broad knowledge of the Gulf and can provide comment and direction on the EA. Factors targeted for consideration within the EA were outlined in the scoping document (C-NLOPB 2011a). Following a Valued Ecosystem Components (VEC) approach, the EA was developed to address potential impacts on the marine ecosystem, the physical environment, species at risk, sensitive areas, commercial fisheries, marine and migratory birds, and accidental events and cumulative effects.
- Fisheries and Oceans Canada plays a significant scientific and regulatory role in the overall management of Canada's oceans. The Gulf of St. Lawrence is multi-jurisdictional in that it borders five Canadian provinces (Québec, Newfoundland and Labrador, New Brunswick, Prince Edward Island, and Nova Scotia) and four DFO Regions (Quebec, Newfoundland and Labrador, Gulf, and Maritimes).
- In March 2012, DFO conducted a Zonal SSRP and provided a comprehensive review of the original 2011 Old Harry Prospect Exploration Drilling Program Environmental Assessment and related documents. The Proponent has since revised these documents and responded to the original DFO comments within a Table of Disposition, and these have been re-submitted for further review.

Analysis and Responses

Review of Environmental Assessment of the Old Harry Prospect Exploration Drilling Program

The DFO Science review of the revised EA report (primarily in terms of the responses provided in the disposition table) can be found in Appendix 1.

General Comments

Overall, many of the comments provided by DFO Science during the review of the original (2011) Environmental Assessment have been adequately addressed within the revised EA document and the disposition table. However, this statement applies only to those areas of the report that were identified by FPP to require the current Science review. It is noted that the depiction of the distribution and migration of marine fish in the southern Gulf of St. Lawrence remains incomplete despite having provided numerous references for these in comments on the draft EA (DFO, 2013).

Additional Comments

5.2.4 Sea Turtles

- "Leatherbacks have been observed foraging in two broad areas of the temperate northwest Atlantic: waters >44 N near Cape Breton, southern Newfoundland and the southern portion of the Gulf of St. Lawrence; and relatively southern waters (<44 N) along the Scotian Shelf, Georges Bank and Mid-Atlantic Bight (Sherrill-Mix et al. 2008)." These are two areas of relatively high aggregation, however, turtles have been observed foraging over a much broader area. As this reads now, it sounds like leatherbacks have only been observed foraging in these two areas within the Canadian Economic Exclusion Zone (EEZ). This should be clarified.

- In regards to the statement: "…major sources of mortality in Canadian waters are incidental capture in fishing gear (COSEWIC 2001; James et al. 2005) and ingestion of plastic which may be mistaken for jellyfish (Mrosovsky et al. 2008)" ingestion of plastic is not a major source of mortality in Canadian waters. Also, the reference date should be 2009.

7.1.5 Underwater Sound Sources Associated with Exploratory Drilling

- The sentence: "Marine mammals and in particular marine mammal species at risk are generally believed to be the group most sensitive to underwater sound." is ambiguous and of uncertain intent. As written it implies that marine mammal species at risk, as individuals within the grouping are more likely to be adversely affected by sound than individuals not at risk.
- Sounds Associated with Well Site Surveys, Vertical Seismic Profiles (VSP) and Drilling. This heading seems to imply that "Well Site Surveys" as distinct from and in addition to VSP surveys are being proposed for the Old Harry drilling site? In the original assessment "Well Site Surveys" i.e. scaled-down and higher frequency conventional seismic surveys to map shallow sediment structures around immediate vicinity of the proposed well-head were not proposed.
- It is unclear why the work of McQuinn and Carrier (2005) and that reported by Lee et al. (2005) is mentioned. This work concerned 3-D exploration seismic sources presumably somewhat stronger than those to be employed for the VSP survey.
- In regards to sound emitted by semi-submersible vs. drillship rigs, presumably the sounds levels emitted by a modern dynamically positioned semi-submersible would be higher than those emitted from a moored semi-submersible? It seems to be implied that propeller cavitation noise from-dynamic positioning drill ship is a major contributor to the higher noise levels characterizing these platforms.
- The numbers in Table 7.5 generally seem reasonable although it should be understood that for broadband noise, measurement bandwidth is very important. Presumably these are RMS levels for the continuous sources and 0-to-peak levels for the impulsive sources?
- In Figure 7.5, the spectral ambient noise levels for the environment alone seem suspiciously low for most open ocean areas – the measurements would have to be made in dead calm at a great distance from any shipping – although the relative levels and the spectral shapes are more likely to be correct. Is there something non-standard in the mode of measurement or the spectral scaling employed?

Review of Oil Spill Fate and Behaviour Modelling in Support of Corridor Resources Old Harry Exploratory Drilling Environmental Assessment Report Update

The DFO Science review of the Oil Spill Fate and Behaviour Modelling Updated Report (primarily in terms of the responses provided in the disposition table) can be found in Appendix 2.

General comments

The Oil Spill Fate and Behaviour Modelling in Support of Corridor Resources Old Harry Exploratory Drilling Environmental Assessment Updated Report, dated December, 2012 has not adequately addressed many of the issues raised by DFO Science during the original review (DFO 2013). Details are provided in Appendix 2. These deficiencies result in increased uncertainties which are not well defined and accounted for and this poses an increased risk that there may be inadequate preparedness to deal with the consequences of an oil spill in this region.

Specific Comments

2.3.3 Water Currents

- The surface current data are from Wu and Tang (2011), not Wu (2011) as reported. Also, the correct citations for Tang et al. (2008) and Wu and Tang (2011) are provided.

3.0 Modelling Results

- The authors should point out and discuss the uncertainties and limits of the model results (modeled trajectories) in the updated report.

Conclusions

It should be noted in these conclusions that the results of this specific review were reliant upon the availability of expertise within the DFO Regions during the requested timeframe for document review. Given the deadline to provide review in the assessment was short, not all subject matter experts were available to provide input to this current review of the revised EA documents. An overview of the key Science comments, that is those outside of those provided on specific inaccuracies, omissions, or recommendations, are as follows:

- Overall the quality of scientific content presented in the revised environmental assessment document has improved from the original document. However, this statement applies only to those areas of the report that were identified by the Fisheries Protection Program to require this current Science review. It is noted that the depiction of the distribution and migration of marine fish in the southern Gulf of St. Lawrence remains incomplete despite having provided numerous references for these in comments on the draft EA (DFO, 2013).
- The Oil Spill Fate and Behaviour Modelling Updated Report, has not adequately addressed many of the issues raised by DFO Science during the original review. Science remains concerned that the risks are underestimated and the conclusions are not realistic. These deficiencies result in increased uncertainties which are not well defined and accounted for and this poses an increased risk that there may be inadequate preparedness to deal with the consequences of an oil spill in this region.

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Date: August, 2013

Sources of information

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Appendix 1: DFO Review of Revised EA Document

SECTION OF EIS	DFO COMMENT /INFORMATION REQUEST (MARCH 2012)	CORRIDOR RESOURCES RESPONSE (MARCH 2013)	DFO RESPONSE JULY 2013 (ADEQUATE OR NOT ADEQUATE)
4.1.7	While the EA acknowledges that "Knowledge of ocean currents is essential to the planning of oil and gas related operations in any area", the section on ocean currents simply states broad facts and shows maps from different sources without any proper interpretation or comparison. The currents that the EA uses in the report are cited but are never shown (i.e. Surface water current fields developed by the Ocean Sciences Division, Maritimes Region of DFO (Tang et al. 2008) were used in the spill trajectory modeling).	The section on ocean currents properly describes the currents of the Gulf. The currents are shown in Figures 4.13, 4.14, and 4.16-4.19 with citations (SLGO 2011; Galbraith et al. 2011; LGL 2005b). Tang et al. 2008 was not referenced in Section 4.1.7. For more information on oil spill modeling, trajectories and the currents used to create these, please refer to the stand alone report conducted by SL Ross.	Inadequate. The section on ocean currents adequately describes long-term averages, but not sporadic wind-driven currents that can be much larger. The point was that the report acknowledges this by using a completely different source of currents in the modelling section, yet it is not presented.
4.1.8	It is not evident that tides were used in spill trajectory modeling within the EA. If this is the case, why not?	Tides were not used in the modelling because their inclusion would not have significantly altered the overall spatial footprint of the oil from the spill scenarios modelled.	Inadequate. The authors could have compared the predicted tidal displacement in the area to the modelled results. The very small footprint of 6 km (Fig 2.12-2.15) is based on the assumption that only 6 hours are required to completely disperse or evaporate the oil, otherwise they would have to factor in accumulation over longer times. At that point precise maximal instantaneous currents would be important to know. As it is, Figs. 2.12-2.15 do not show a month-long release (as stated), but a series of independent 6-hour releases, with no accumulation between them (resetting conditions to pristine after each one).

SECTION OF EIS	DFO COMMENT /INFORMATION REQUEST (MARCH 2012)	CORRIDOR RESOURCES RESPONSE (MARCH 2013)	DFO RESPONSE JULY 2013 (ADEQUATE OR NOT ADEQUATE)
5.2.1.2	The seasonal distributions and migrations need to be described for Atlantic Cod. This should use distribution information from summer surveys in both the southern and northern Gulf (i.e., September survey of the southern Gulf and August survey of the northern Gulf; Summer sentinel trawl surveys in both areas). Migration routes and timing and overwintering distributions should also be described.	Seasonal movements and migrations of each of the Atlantic Cod populations has now been described and incorporated into the EA.	Some inaccuracies remain: 1) Table 5.2, Atlantic cod, Laurentian south DU: "migrates from southern gulf to waters of Cape Breton between May and October". Actually migrates from Cabot Strait area (4Vn) into southern Gulf in April - early May and back again in late Oct - Nov.
5.2.1.2	An increasing proportion of the southern Gulf stock occurs on summer grounds in the region between the Magdalen Islands and northwestern Cape Breton, including waters along the southern slope of the Laurentian Channel. The entire stock migrates through the Cape Breton Trough or along the southern slope of the Laurentian Channel (past EL1105) each spring and fall. The entire stock overwinters in dense aggregations along the south side of the Laurentian Channel, in particular north of St. Paul Island.	Information on the Laurentian South Cod migration movements has been updated.	Inadequate. No information on the summer distribution of southern Gulf cod and the increased use of waters along the southern slope of the Laurentian Channel between the Magdalen Islands and Cape Breton (i.e., in the vicinity of EL1105).
5.2.1.2	The EA refers to the four populations identified by COSEWIC in this section. However, there are only two residents (Laurentian North and South). Incursions of two other Atlantic populations are possible, but this should be distinguished.	Comment noted and resident cod populations have been identified	Adequate

SECTION OF EIS	DFO COMMENT /INFORMATION REQUEST (MARCH 2012)	CORRIDOR RESOURCES RESPONSE (MARCH 2013)	DFO RESPONSE JULY 2013 (ADEQUATE OR NOT ADEQUATE)
5.2.1.2	The legend of Figure 5.10 shows "Atlantic Cod Distribution in the Gulf of St. Lawrence from 1990 to 2002," however, only the result of the August survey in the northern Gulf is presented. The results of the September survey in the southern Gulf should be added with the result representing the two cod stocks in the Gulf. This mistake occurs in several maps of other species.	The most up to date maps from the St. Lawrence Global Observatory have been added to the EA.	Adequate
5.2.1.2	The spawning area for cod in the northern Gulf (3Pn, 4RS) that was identified some time ago off St. George's Bay (west coast of Newfoundland) is not mentioned in the EA. This area is closed to all fishing from April to mid-June and occurs approximately thirty miles east of the drilling area. This information is significant as fertilized eggs of cod are at surface and are therefore very vulnerable to any oil spill.	The Laurentian North Population of Atlantic Cod's spawning area has now been incorporated into the EA.	Adequate

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5.2.1.2	Some key sources of information include: Swain et al. (1998); Chouinard & Hurlbut (2011); Comeau et al. (2002); Benoît et al. (2003); Darbyson & Benoît (2003); and recent CSAS Science Advisory Reports and Research Documents coming from stock assessments.	Up to date Canadian Science Advisory Reports and research documents coming from stock assessments have been reviewed and incorporated into the EA where deemed appropriate.	Inadequate. Reference to information on marine fishes in the southern Gulf remains very spotty. In particular, distribution figures are mostly limited to results from the August survey of the northern Gulf. Results from the September survey of the southern Gulf should also be included in these figures. Fish distributions during the spring and fall migrations and on the overwintering grounds are most relevant to the impacts of work in EL1105, but there are no figures showing these distributions. The proximity of EL1105 to the overwintering grounds and migration routes of cod and other groundfish, as well as the pre-spawning aggregation of witch flounder in the Gulf, is of particular concern.
5.2.1.3	Only general information is presented in this section; not information focused on winter skate in the Gulf. Information is available from Swain et al. (1998); Chouinard & Hurlbut (2011); Comeau et al. (2002); Benoît et al. (2003); Darbyson & Benoît (2003); and recent CSAS Science Advisory Reports and Research Documents coming from stock assessments, as well as CSAS Res Docs 2006/003; 2006/004; Swain et al. 2009 (and the associated supplementary material).	Up to date Canadian Science Advisory Reports and research documents coming from stock assessments have been reviewed and incorporated into the EA where deemed appropriate.	Inadequate. In the Gulf of St. Lawrence, winter skate occurs primarily in the southern Gulf. Yet the distribution map for this species (Fig 5.11) does not include information for the southern Gulf. This figure should include information from the September survey, the August sentinel survey and the July Northumberland Strait survey. References were provided during original EA review.
5.2.1.7	The three recent scientific advices on redfish require mentioning in the EA: Stock Discrimination (CSAS SAR 2008/026), Stock Assessment of Units 1 and 2 (CSAS SAR 2010/037) and Recovery Potential Assessment (CSAS SAR 2011 /044).	Recent scientific advances on redfish have been revisited and incorporated into the EA where deemed appropriate.	Adequate

SECTION OF EIS	DFO COMMENT /INFORMATION REQUEST (MARCH 2012)	CORRIDOR RESOURCES RESPONSE (MARCH 2013)	DFO RESPONSE JULY 2013 (ADEQUATE OR NOT ADEQUATE)
5.2.1.7	Figure 5.13 The information is dated. More recent data exist from the study area. The data from 2003-2011 should be presented to illustrate current distributions.	Information pertaining to the Magdalen Shallows water temperature has been added to the EA.	Adequate
5.2.1.9	Information on seasonal distributions is lacking (see sources listed under cod for information). Winter distribution for plaice that spend the summer on the Magdalen Shallows and move into deep water in the Laurentian Channel is particularly relevant, and is not mentioned within the EA.	The seasonal distribution of American plaice has been added to the EA.	Inadequate. Again, information on plaice distribution in the southern Gulf is lacking in Fig. 5.15. This is a serious omission given that plaice densities are highest on the Magdalen Shallows (in the southern Gulf). The time of year most relevant to impacts on plaice associated with EL1105 is winter. A figure showing distribution in winter (when plaice are concentrated in the Laurentian Channel) should be included to contrast winter distribution with that in summer. References were provided during original EA review.
5.2.1.10	"school to fish" requires clarification. This may refer to predatory schooling behavior, in which case should also be qualified by "CAN cover tens…..	Information pertaining to Striped Bass predatory schooling behaviour has been updated.	Adequate
5.2.1.10	Contrary to the EA, striped bass DO currently exist and spawn in the St. Lawrence Estuary. While extirpated there in the 1960s, they were re-introduced in 2002 and have potentially established a successful spawning population (DFO 2010).	Information pertaining to the St. Lawrence Estuary population of Striped Bass has been updated.	Adequate
5.2.1.10	At a minimum, coastal behaviour at all life stages should be identified, but could be strengthened within the EA easily for the sGSL population by either COSEWIC's (2004) evaluation of Extent of Occurrence and/or its proposed refinement in Douglas and Chaput (2011).	Behaviour at various life stages has been incorporated into the EA Report.	Adequate

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5.2.3	The EA cites the TNASS 2007 inventory (Lawson and Gosselin, 2009) as the sole source of data to determine the probability of meeting of various species in the study area and the Gulf of St. Lawrence. However, there are other significant sources of information which should be included; Kingsley and Reeves (1998) and Lesage et al. (2007).	Information on blue whales cited in Kingsley and Reeves (1998) and Lesage et al. (2007) is in line with what has been presented in section 5.2.3. Lesage et al. (2007) depicts three combined studies showing no blue whales near or within EL1105.	Not Reviewed
5.2.3	Additionally, the level of information provided on the various marine mammal species is very uneven and inconsistent. The following information should be provided for each species: structure of the stock, seasonal movements, reasons for their presence in the Gulf of St. Lawrence, abundance, probability of meeting in the Gulf and the sector of EL1105, and threats to their recovery identified by COSEWIC or SARA.	A thorough review has been undertaken and text updated as appropriate to improve consistency of the information provided.	Not Reviewed

SECTION OF EIS	DFO COMMENT /INFORMATION REQUEST (MARCH 2012)	CORRIDOR RESOURCES RESPONSE (MARCH 2013)	DFO RESPONSE JULY 2013 (ADEQUATE OR NOT ADEQUATE)
5.2.4	"In general, the EA relies heavily on citing dated literature documents (e.g. COSEWIC report and Recovery Team documents) rather than the available primary scientific literature for sea turtles. The EA contains only slight reference to studies that have specifically focused on leatherback movements in and around the proposed development site and the most recent information available on the biology and distribution of sea turtles in Canadian waters is not integrated into the assessment. Direct consultation of the primary literature is recommended. Notably, the exploration licenses overlap directly with important foraging habitat for leatherbacks – including an area currently being considered critical habitat for the species. Moreover, the exploration site lies directly in line with the route many leatherbacks take in and out of the Gulf of St. Lawrence."	Primary literature has been consulted and Section 5.2.4 has been updated as applicable.	Adequate
5.2.4.1	The COSEWIC document referenced for this section is outdated and precedes most directed research on leatherbacks in Canada. Information of the distribution of leatherbacks in Canadian waters has been published in several articles (e.g., James et al. 2005; James et al. 2006; James et al. 2007).	Section 5.2.4.1 has been updated with primary literature references on the distribution and behavior of, and threats to, leatherbacks in Canadian waters.	Adequate
5.2.4.1	References should include James et al. (2005; for source of mortality in Canadian waters) as well as to recovery documents as posted on the SARA public registry.	Section 5.2.4.1 has been updated with primary literature references on the distribution and behavior of, and threats to, leatherbacks in Canadian waters.	Adequate

SECTION OF EIS	DFO COMMENT /INFORMATION REQUEST (MARCH 2012)	CORRIDOR RESOURCES RESPONSE (MARCH 2013)	DFO RESPONSE JULY 2013 (ADEQUATE OR NOT ADEQUATE)
5.3.3	In general, the main source of information for the corals and sponges section of the EA is Cogswell et al (2009), which focuses on the Maritimes region. Additional important data that is available on coral and sponge distributions has not been included in the report – this includes 2010 and 2011 data from the Gulf (mostly for sea pens) and some of the more recent NL records. As a result, the conclusions that EL1105 location is likely not suitable habitat for corals and sponges (p.155) may not be the case. Kenchington et al. (2010) show significant abundances of sea pens in the Gulf and Laurentian channel that could be considered near EL1105. Sponges also require further consideration and relevance somewhere in this general section of this report.	The main source of information has been updated with information and mapping from Kenchington et al. 2010. Significant locations of corals do occur within the Gulf; however they occur outside of EL1105 on the western Laurentian Channel slope. Information and updated mapping relating to the most recent literature on Sponges has been added to the EA.	The updated mapping related to the most recent literature on corals and sponges does not capture the most recent data which is unpublished but can be obtained from DFO. While recognizing that this area is under-surveyed at present, the fact that there are no records adjacent EL1105 does not mean absence or scarcity of corals/sponges.
5.6.1	Evaluation of abundance and potential presence of species in the study area should be carried out taking into account not only the study of Lawson and Gosselin (2009), but also that of Kingsley and Reeves (1998). Lawson and Gosselin (2009) estimates of abundance (with standard deviation) differ substantially from those obtained by Kingsley and Reeves (1998) very likely due to a delay in entry of animals into the Gulf. This hypothesis is substantiated by observations made on the Scotian Shelf and in U.S. waters during the survey period (see discussion of the paper). Estimates of distribution and abundance of Kingsley and Reeves (1998) are therefore also relevant and cover the area of the EL 1105.	Text has been updated to include abundance and potential presence using Kingsley and Reeves 1998.	Not Reviewed

SECTION OF EIS	DFO COMMENT /INFORMATION REQUEST (MARCH 2012)	CORRIDOR RESOURCES RESPONSE (MARCH 2013)	DFO RESPONSE JULY 2013 (ADEQUATE OR NOT ADEQUATE)
7.1.5	For the impact of noise generated by the work, no modeling of the affected area by the different sources of noise, continuous and impulse, is done to provide realistic estimates of noise levels at different frequencies and to map them on vertical and horizontal plane.	The scoping document doesn't require quantification/modeling of noise. Based on the duration and the location of the project, the qualitative assessment further confirms that a quantitative approach is not required. However, Section 7.1.5 has been substantially revised.	Reviewer unavailable during timeframe
7.1.5	The exploration well is in relatively deep water (~470m). Sound in deep water will propagate to ranges of kilometers to tens of kilometers with less attenuation than characteristic of shallower more typical areas of the Grand Banks or Scotian Shelf – this would be especially so for sound propagating along the axis of the Laurentian Channel.	Comment noted. Section 7.1.5 has been substantially revised.	Adequate
7.1.5.1	The intent of the sentence "The energy levels emitted from the VSP will be considerably less in source (760 in3)." is unclear. Lower source energy normally implies a lower total volume airgun array. The key point should be that VSP sources have a sound pressure level intermediate between sources intended for shallow, local geotechnical type surveys and sources typically used for deep 2 or 3-D exploration seismic surveys.	Section 7.1.5.1 has been extensively revised and these reviewer comments have been taken into consideration during this rewrite.	Adequate

SECTION OF EIS	DFO COMMENT /INFORMATION REQUEST (MARCH 2012)	CORRIDOR RESOURCES RESPONSE (MARCH 2013)	DFO RESPONSE JULY 2013 (ADEQUATE OR NOT ADEQUATE)
7.1.5.1	It has been identified that either a semi-submersible or a drill ship platform may eventually be chosen for the Old Harry exploratory well. As per Table 7.5, semi-submersibles are generally significantly quieter than drill ships. Noise levels emitted by a drill ship are roughly comparable to those emitted by other vessels of similar size; however, a drill ship represents a stationary, long duration noise source (20 – 50 days as per project scheduling) as opposed to a temporary noise source of a passing vessel.	Section 7.1.5.1 has been extensively revised and these reviewer comments have been taken into consideration during this rewrite.	Adequate
7.1.5.1	The statement "...low frequency noise from a drilling platform might be detectable no more than 2 km away near a shelf break.." may be best case scenario given that Table 7.5 identifies noise from a moored drill ship will attenuate to 115 to 120 dB (well above quiet ambient noise levels) at distances of 1 to 10 km. This 2 km detection range for drilling is also mentioned (p. 350) in the context of the avoidance of drill platforms by baleen whales.	Section 7.1.5.1 has been extensively revised and Table 7.5 has been updated.	Adequate
7.1.5.1	Accurate estimates are required. Also, essential measures are not included here: i.e., the levels of ambient noise, noise from the source at the frequencies considered and the estimated losses by propagation. Moreover, to what depths of the water column do we refer?	Section 7.1.5.1 has been extensively revised and these reviewer comments have been taken into consideration during this rewrite.	Reviewer unavailable during timeframe

SECTION OF EIS	DFO COMMENT /INFORMATION REQUEST (MARCH 2012)	CORRIDOR RESOURCES RESPONSE (MARCH 2013)	DFO RESPONSE JULY 2013 (ADEQUATE OR NOT ADEQUATE)
7.1.5.1	Table 7.5 – the "Noise Level (dB re 1µPa)" column contains some error in presentation. Two, and possibly three, quite different acoustic measures are presented in this column without distinction. As such they are misleading for use in making determinations. For example, based on how they are labeled, it is natural to believe these numbers refer to broadband acoustic pressure level measurements at a point in space. However, a numeric level of 60 for "calm seas" appears much too low for a broadband pressure measurement – although is reasonably consistent with a typical power spectral level reported over a 1 Hz bandwidth in the frequency range 10 – 1000 Hz under calm conditions (and the correct units being dB re 1 µPa/Hz1/2. The quantity for "Moderate (not 'Modern' sic) Waves/surf" (100 – 700 Hz) seems to be properly labeled as broadband and 102 dB re 1µPa is not unreasonable. The quantity for "Pile-driving" appears to revert to the originally labeled point measurement of broadband noise (given the observation distance of "1 km"). The original literature should be checked to determine how "Fin whale" (probably source level), island drill rigs, or helicopter levels were measured or defined also. This becomes more important if these numbers are used elsewhere in the report to arrive at conclusions about the Old Harry drilling environmental impacts. For example, the EA notes bad weather ambient noise levels are stated in the range 90 to 100 dB re 1µPa – actually less than the moderate wave and surf levels of Table 7.5	Section 7.1.5.1 has been extensively revised and these reviewer comments have been taken into consideration during this rewrite.	Adequate

SECTION OF EIS	DFO COMMENT /INFORMATION REQUEST (MARCH 2012)	CORRIDOR RESOURCES RESPONSE (MARCH 2013)	DFO RESPONSE JULY 2013 (ADEQUATE OR NOT ADEQUATE)
7.1.5.1	It should be understood and noted that broadband levels are quite dependent on how "broadband" is defined. The "jack-up", "semi-submersible", "moored drill ships", and various specialized vessel noise levels would appear to be acoustic source levels where the broadband acoustic noise levels expected from these devices if measured at a (mathematical only) reference distance of 1 m, the correct acoustic units in this case being dB re 1 µPa @ 1m.	Section 7.1.5.1 has been extensively revised and these reviewer comments have been taken into consideration during this rewrite.	Adequate
7.1.5.1	Table 7.5 – the EA presents the frequency at which the intensity of the sound is observed. However, none of the sources presented is limited to a single frequency; the energy spreads on a band of frequencies, which may be more or less wide according to the sources. A presentation of the SPL with frequencies for each of the sources would have been much more informative to evaluate the impacts of each.	Section 7.1.5.1 has been extensively revised and these reviewer comments have been taken into consideration during this rewrite.	Not Reviewed
7.1.5.1	Table 7.5 – this should specify whether the levels @ 1 m are for discrete sources or other distances (e.g., fin whales, drilling platform)	Section 7.1.5.1 has been extensively revised and these reviewer comments have been taken into consideration during this rewrite.	Reviewer unavailable during timeframe

SECTION OF EIS	DFO COMMENT /INFORMATION REQUEST (MARCH 2012)	CORRIDOR RESOURCES RESPONSE (MARCH 2013)	DFO RESPONSE JULY 2013 (ADEQUATE OR NOT ADEQUATE)
7.1.5.1	Table 7.5 – the statement "Overall broadband sound level did not exceed ambient beyond about 1 km…received levels at 100 m would be approximately 114 dB re 1 µPA." is inconsistent. How can the overall broadband sound level at 1 km be less than ambient levels beyond 1 km, while it is still as high as 114 dB re 1 µPa at 110 km? This reference is probably not applicable here. In the St. Lawrence, the median broadband in the waterway is approximately 112 dB re 1 µPa (Simard et al. 2010).	Section 7.1.5.1 has been extensively revised and these reviewer comments have been taken into consideration during this rewrite.	Reviewer unavailable during timeframe
7.1.5.3	The statement, "The limited studies available suggest that anthropogenic sounds, even from very high intensity sources, might have no effect in some cases …" is incorrect and incomplete. This statement does not match current knowledge. See more references from Hastings, Fay and Popper on the effects of noise on fish.	The statement in question was intended to comment on the varying responses of fish to anthropogenic sounds from various studies and has been edited to provide clarity.	Reviewer unavailable during timeframe

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7.1.5.3	The statements, "Available data suggest that they are capable of detecting vibrations but they do not appear to be capable of detecting pressure fluctuations." and "Crustaceans appear to be most sensitive to sounds of low frequencies (i.e., <10,000 Hz)." require explanation. How does one distinguish the vibrations of pressure fluctuations? These are contradictory. Also, low frequencies are referred to in reference to frequencies up to 10 000 Hz, which is well beyond the usual range of low frequencies.	In water, only those animals can perceive the pressure component of sound which are equipped with pressure to displacement converters. Many species of fish pick up pressure waves with their swim bladder. The pulsation of the swim bladder in the sound pressure field causes a displacement and stimulation of the otocysts, and thus the perception of a sound wave. Most aquatic crustaceans lack any air filled chambers and therefore cannot perceive pressure variation in a sound field. Instead they perceive sound through vibration of mechanorecptors including setae (hair-like) cells on the surface of the body (Wiese 2002). Text in 7.1.5.3 has been clarified.	Reviewer unavailable during timeframe
7.1.5.3	The statements (p.335 and 337), "...masking effects are expected to be negligible for toothed whales." and "The sounds produced by seismic air guns are in the frequency range of low hearing sensitivity for toothed whales." are incorrect. Madsen et al. 2006 shows that the sounds received by the animals reach frequencies of several kHz, audible by odontocetes.	Madsen et al. 2006 reports that the sounds received by odontocetes can reach frequencies of up to 150 KHz. It is also noted that odontocetes produced echolocation and communication in the frequencies from 1 – 150 KHz. Due to the fact that the majority of the energy emitted from seismic sources is in the range of 5 – 300 Hz, with some energy in the range of 500 – 1000 Hz (Low frequency), it is unlikely that odontocetes will be highly affected (both by masking or injury due to hearing) by VSP sound sources.	Reviewer unavailable during timeframe

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8.7.1.1	The EA states (p.402) "…Perhaps the species of greatest concern would be redfish as the Project Area overlaps a potential redfish mating area. Redfish typically mate in the fall; however, eggs are hatched within the female and are not extruded until the following April to July (Section 5.2.1.7). An oil spill would not affect redfish larvae, as the potential larvae extrusion area is outside (to the north, in the Cabot Strait) of the Study Area (Figure 5.56)." However, this paragraph suggests the project area overlaps a potential redfish mating area, then goes on to suggest a potential larval extrusion area is outside the Study area. Is this speculation or is there a publication to reference for these claims? It is also possible that the project area is also a potential larval extrusion area.	A reference has been added to support the redfish larval extrusion area.	The reference provided was from another consultants EA report (i.e., LGL Limited. 2007. Western Newfoundland and Labrador Offshore Area Strategic Environmental Assessment amendment. Prepared for the Canada-Newfoundland and Labrador Offshore Petroleum Board.) This is not an original citation; it is the original citation that should be provided.
8.7.5	There is evidence following the recent well blow-out in the Gulf of Mexico (Deepwater Horizon) that hydrocarbon spills can be debilitating and lethal for sea turtles. Suggest including technical reports from NOAA, other sources here, as the impact is not negligible and should be recognized within the assessment.	The reviewer's comment is noted in that the environmental effects on sea turtles from oil exposure is not negligible and which is noted in Section 8.7.1.3. Unlike the circumstances of the Deepwater Horizon blow-out and the existing conditions in the Gulf of Mexico where sea turtles are likely more prevalent over the course of a year, the occurrence of sea turtles in the Project Area or Study Area is limited to feeding during the warmer months of the year in the Gulf of St. Lawrence. Therefore the probability of a high risk of exposure from a blow-out combined with the presence of sea turtles at the same time would be much lower than that in the Gulf of Mexico.	The authors are referred to the following CSAS report (http://www2.mar.dfo-mpo.gc.ca/science/rap/internet/SAR 2012_036_E.pdf) (DF0 2011). It is recommended that the text be changed to "July through October" (rather than the warmer months of the year), and this will safely cover the vast majority of turtle reports

Appendix 2: DFO Review of Oil Spill Fate and Behaviour Modelling Report Update

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Supporting Document - Modeling in Support of Corridor Resources Old Harry Exploratory Drilling Environmental Assessment	In general, the scenarios in this document were not clearly described. The subsurface transport of dispersed oil (majority of the total oil) was not sufficiently modeled. The model only considered the re-entrained oil from surface in a 30m layer and did not consider the dispersion into water column during the rise of oil while oil was released from 470m. Overall, the results were not clearly presented. Notably, the document did not take the expertise gained from the oil spill in the Gulf of Mexico into consideration for the Gulf of St. Lawrence which shares a good deal of similarities. We do not have the specific oil category that is to be extracted in the Gulf of St. Lawrence. However, the indications show that we expect it to be on the lighter side of the crude, close to the category of the one in the Gulf of Mexico. In short, the nature of the crude and the physical setting of both areas, a semi-enclosed sea, make it appropriate to use the expertise gained in the Gulf of Mexico to project the potential risks in the Gulf of St. Lawrence. As such, it is recommended to project the potential risks in the Gulf of St. Lawrence using the results of the oil spill in the Gulf of Mexico.	See Section 2.1.2 in the SL Ross report (SL Ross 2011a, updated 2012) for a description of the behaviour of the oil and gas from a shallow water subsea blowout. In general, significant entrainment of oil in the water column is unlikely during its rise to the surface in the gas bubble driven plume. The behaviour of a shallow water blowout (minimal hydrate formation) will be different from a deep water event (extensive hydrate formation) such as the Deep Water Horizon event in the Gulf of Mexico. The formation of gas hydrates depletes the hydrocarbon plume of the high energy natural gas and the driving buoyancy of the plume is essentially lost. In the case of a shallow water blowout, the gas is preserved in the plume and the high energy bouyancy effect is maintained. The overall impact is that the hydrocarbon plume travels very rapidly to the sea surface with little or no oil dispersed into the water column during its rise to the surface. The expected oil to be encountered at Old Harry is a very light 45-56 degree API oil/condensate (see response for DFO-06), in contrast to the much heavier oil encountered at Macondo (~35 degree API oil). The Old Harry site is located in 470 m water depth, which is much shallower that the 1520 m of water depth at the Macondo site. A subsea blowout at the Old Harry site is expected to behave like a	Inadequate. The use of the top 30 meters of the surface waters to dilute the oil is not warranted by observations: 1. Based on a report from United States Coast Guard (2005) fact sheet on small diesel fuel spills, the authors extended the conclusions to open ocean crude oil spill conditions (see Sec. 8.5 of revised EA); 2. The authors used the mixed layer of the surface waters in the Gulf of St. Lawrence to conclude that the oil would mix over the whole mixing layer. It is true that the surface mixed layer is 30 meters (Drinkwater and Gilbert 2004), but there are two conditions that are not met in case of oil spill. The difference of density of the observed waters over 30 meters is very small. It ranges typically from 1.023 to 1.025 (g/cm3) (SGDO), while the density of oil ranges from 0.790 to 0.837 (g/cm3) (Table 2.14 of revised EA). It is much more difficult to mix a larger difference in density. Mixing oil of density 0.8 (g/cm3) with water of density of 1.023 (g/cm3) would not occur under a typical storm and the oil would reach a shoreline before it would mix thoroughly over 30 meters; 3. The second condition that is not met is that the mixed layer is the result of a number of storms over a season. It is not instantaneous. The top layer of the waters stays on the top until a storm mixes the

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		shallow water event with minimal hydrate formation whereas hydrate formation at Macondo was likely extensive.	waters.
2. Oil Spill Scenarios and Modelling Inputs	Regarding the trajectories of the oil spill, the trajectories presented in the document are unrealistic and do not serve the purpose. They should be redone with realistic winds and surface currents. The model used to generate the surface current fields (Tang et al. 2008) is a good one. However, the oil-spill trajectories are calculated using seasonal mean surface water velocities (2.3.3. Water Currents on page 16). This choice of currents is completely unrealistic. There are no tides, no wind induced currents, and no influence of the surface outflow from fresh water runoff. The latter part is surprising given that the seasonal mean surface currents were used. Since in a typical oil spill, all of these components are present, the trajectories should be calculated with the hourly outputs of the model driven with realistic winds from Meteorological Service of Canada outputs. Within this section, a blow out from the surface is illustrated. However, a blowout from the bottom is not illustrated. The Gulf of Mexico spill did not behave as a text book spill as the blow out was from the bottom; it was not at the surface. Some of the oil did not reach the surface, and a good portion of it stayed near the bottom. There is a need to determine where that oil would go using the hourly bottom currents of the ocean model. The document should therefore track the oil	The surface water current data utilized provides the seasonal average trends in water movement in the region. When this is combined with the 52 years of MSC50 wind data used in the trajectory assessments the variation in trajectories possible from the drilling location are well represented for the purposes of environmental impact assessment, especially for a spill of non-persistent light oil/condensate. Tidal variations would also not significantly alter the probable footprint of the oil spills. With respect to the wind data used, the MSC50 hind cast wind set used in the modeling is a long term data set with good spatial resolution over the entire Atlantic region. The data was developed by the Climate Research Division of Environment Canada and the Federal Program of Energy Research and Development. In the research paper describing the data set, the authors state that “The wind and wave data are considered to be of sufficiently high quality to be used in the analysis of long return period statistics, and other engineering applications”. As such, we contend that this data set is the best available for offshore spill trajectory and behavior modeling. The use of land-based weather data from a single weather station, suggested by the reviewer, does not necessarily accurately portray the winds offshore.	Inadequate. The trajectories of the oil spill are not calculated under realistic conditions. The main forces are tidal currents and hourly observed winds. Neither was used - only Seasonal mean surface water velocity and climate averaged surface winds (Sec. 2.3.3 (Water Current) and Sec. 2.3.5 (Wind) of Oil Spill Fate Report Update). The assessment that: Tidal currents were not considered in the assessment since their oscillatory movement results in little long-term net movement of surface oil is unrealistic. It is the interaction of hourly winds and tidal currents on the surface oil that provides a realistic trajectory.

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	spills using near bottom currents.	Sub-surface water currents were not considered in the subsea oil release because the strong, buoyant gas-bubble plume that would result from a shallow subsea release (see response to DFO-309) would overwhelm such currents and result in minimal deflection of the developed plume (see page 8 and 9 of full spill modeling report for additional description of the models used). For example, a sea bottom current of 3 kts (~0.15 m/s) is significantly weaker than the vertical velocities that can be acheived in a gas bubble plume (2-10 m/s). A description of the likely behaviour of the oil and gas from a subsea blowout from this project is provided in section 2.1.2 of the SL Ross oil fate modelling report ((SL Ross 2011a, updated 2012) (see also response to Comment #371). A shallow water blowout from the seabed is illustrated in Figure 3 of the report. Due to the strong buoyancy effect of the natural gas in the hydrocarbon plume for a shallow water subsea blowout, all of the oil is predicted to reach the surface.	
2.1.2 Subsea Blowouts	The name of the model for this study is given here, but a description of the formulation, capability, and limitation of the model is not provided. It is unclear if the processes described in section 2.1.2 have been fully or partially included in SLROSM. Justifications need to be provided on why this model (SLROSM) was used instead of other models (published and probably more advanced models, such as Deep Blow by SINTEF,	"SLROSM utilizes the algorithms developed by Fannelop and Sjoen for shallow subsea blowouts as identified in the report on page 10. These are the same algorithms used by SINTEF in their shallow water discharge model and this approach has been validated against the IXTOC blowout event, a more representative blowout for this spill scenario than the Deep Water Horizon event.	While the Table provides a brief description of the oil spill model (SLROSM), the related content was not included in the revised document. Regarding the justification for selecting the SLROSM model instead of SINTEF, OILMAPDEEP, and CDOG it is noted that the other models were used for deep waters, whereas the SLROSM is validated in shallow water cases. The authors should point out any limits of the model

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	OILMAPDEEP by ASA, or CDOG by Clarkson University). It is important to demonstrate that the selected model is technically sound for the proposed modeling work. Figure 3 – the illustration of vertical profile is inaccurate. With the presence of currents, the plume will be deflected rather than straight upwards.	Supplementary modelling completed by ASA (submitted to C-NLOPB on September 21, 2012) to compare the oil mass balance for surface, evaporated and entrained oil for two different oil specifications (Cohasset crude and diesel) shows that oils with similar properties have similar on-water persistence predictions when using SLROSM and OILMAP With respect to Figure 3, because of the strong gas bubble plume, the oil would rise to the surface very quickly, and there would be minimal deflection of the plume by subsea cross-currents. Any potential minimal deflection would not result in a significant change in the surface oil footprint (a few hundreds of metres at most).	due to water depth as the water depth at the area is 400-500 m.
2.3.2 Discharge Volumes and Flow Rates	Blowout scenarios were not clearly described in this section or in Table 3. Only the flow rate was provided but did not state the blowout period (10 days, or 3 months, etc.). Such information is key to the extent of oil covered area.	Descriptions of surface and subsea blowout behaviour are provided in Sections 2.1.2 and 2.1.3 in the SL Ross Report (SL Ross 2011a, updated 2012). These descriptions in the SL Ross report have been expanded upon since the DFO review. The blowout periods modelled are for one month (30 days).	Adequate
2.3.3 Water Currents	It was stated that surface water current was used in the modeling. The surface only case is fine for the surface spill scenarios, but it is insufficient in modeling subsurface blowout. Although the 470m depth was classified as shallow in terms of hydrate formation it is deep enough that the subsurface current can play an important role to deflect and affect the plume behaviors. The deep/subsurface	The extensive experience of SL Ross with oil spill modelling over 25 years indicates that the strong gas bubble plume will bring oil to the surface quickly and there would be minimal deflection of the plume by subsea cross-currents (a few hundreds of metres at most). Any minor deflection of the gas bubble plume by cross-currents will result in only minor changes in the surface foot print of oil.	Inadequate. The original comment was that using only the surface current is not sufficient to describe the spill behavior in the water column. The deep current is important as well especially considering the drill site is in a channel. The model calculation should include the current in the subsurface layer. The authors responded that the gas bubble would rise to surface very quickly and there would be

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	currents are particularly important for the study of dispersed oil transport process in the water column. The deep current is important considering the drill site is in a channel	Because of the strong gas bubble plume, the oil would rise to the surface very quickly and there would be little loss of oil to the surrounding waters.	little loss of oil to the surrounding waters according to 25-year modelling experience. The response did not answer the velocity, magnitude and implications of ignoring the subsurface current at this study site. The subsurface current may be important because the direction of the surface current is opposite to that at the deep layer at the study site of the report according to numerical results of Wu and Tang (2011). It is recommended that the authors recalculate the model using the deep layer current field.
3. Modelling Results	The duration of the trajectories presented in the document is unrealistic. The choice to stop the trajectories at a given level of ppm concentration is not documented. It is implied that all oil spills will be dispersed and absorbed in the environment at that level. In fact, a greater spill would make the oil go further and eventually reach a coastline. The document did not consider this issue which is a serious flaw. It is recommended to use the results from the ocean model under the proper conditions and ensure that the duration is long enough to show the coastline potentially at risk	The reviewers indicated that the choice to stop the trajectories at a given level of concentration in the water column was not documented. The extent of the sub-surface dispersed oil plumes was stopped at 0.1 ppm (the concentration considered no longer harmful to marine life) as indicated on page 24 along with references for justification. For the batch diesel spills of fixed volume (1000 and 10,000 litres), the dispersed oil in the upper 30 m of the water column was tracked until the oil concentration dropped to 0.1 ppm. For the subsea and surface blowouts, the models were run for one month (30 days) and the dispersed oil in the upper 30 m of the water column was tracked until the oil concentration dropped to 0.1 ppm. The light Cohasset crude oil/condensate will evaporate or disperse to a concentration of 0.1 ppm before impacting any coastline no matter how long the models are run.	Inadequate. See previous comments re: Supporting Document - Modeling in Support of Corridor Resources Old Harry Exploratory Drilling Environmental Assessment
3.1 Batch	The modeling was conducted in average	Statistical wind data was used for	Inadequate. See previous response re:

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Diesel Spill Fate Modeling	wind conditions, what about under worst case scenarios without wind? This scenario is missing. It is stated that "The subsurface oil also diffuses laterally as it is moved away from the spill site by the prevailing surface water currents". Again, this is very confusing that subsurface oil is dispersed by surface current. It is stated that "It has been assumed that the oil will mix in the upper 30 m of water as this is the minimum surface water mixing depth reported in the literature for the region (Drinkwater & Gilbert 2004)". Why assume the mixing depth while there are models available to simulate the 3D (including vertical) transport behaviors? This simplification (30m mixing) may cause overestimate of concentration in some areas and underestimations in other areas.	Environmental Assessment purposes. Average weather conditions were modelled to provide the most likely behavior of these small diesel spills to meet the requirements of the EA. As the dispersed oil cloud moves with the prevailing currents, it also diffuses and dilutes as it moves with the water body. The 30 m mixing depth provides a reasonable estimate of in-water oil concentration for Environmental Assessment purposes.	OIL SPILL SCENARIOS AND MODELING INPUTS
3.2 Subsea Blowout Fate and Behaviour Modeling	Without knowing the blowout period, it is difficult to interpret the results. It was stated that between 16 and 29% will evaporate and the remainder will disperse, but the associated time step was not given as the mass balance will continue to change with continuous blowout (maybe month long). Therefore the results in Table 7 only represent the condition at a given time point but the evolution with time is missing. Furthermore, very little has been presented here about the fate of dispersed oil (84 to 71% of total oil, majority), including the vertical distribution. A contour plot of horizontal	The blowout period modelled was one month, or 30 days, and oil was 'released' at 6 hour time steps. Note that releasing the volume of 6 hours of oil flow at one instant will take longer to evaporate and disperse than a continuous flow of oil for 6 hours. The dispersed oil plume will diffuse and dilute as it moves away from the spill site and the zones of influence in Table 7 represent the maximum likely extent of significant surface and sub-surface oiling with a continuous release of oil under average environmental conditions. Therefore, the model does provide for the evolution of a potential spill with time. The dispersed oil was tracked	Adequate

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	and vertical area should be provided, as should the depths where 0.1 ppm concentrations are found. Also, without the use of deep currents, the distances in Table 7 are questionable as the deflection of plumes was not considered. The bathymetry around the site is not provided, which may also affect the behaviors of dispersed oil, but there is no discussion on this subject. One important factor that affects the fate of dispersed oil is the droplet size distribution. What distribution was used and how was it calculated?	in the upper 30 m of the water column until the concentration dropped to 0.1 ppm. Table 7 shows the maximum likely distance from source for the dispersed oil. Other sections in the SL Ross report describe how the oil footprints may vary considering historical wind data. Deep currents will not affect the dispersed oil in the upper 30 m of the water column. Further, the gas bubble plume will move the oil to the surface very rapidly (as with any other shallow water subsea event) with minimal deflection of the plume and little loss of oil to the water column (see response provided for DFO-309 and DFO-313). The oil was moved to the surface by a gas bubble plume not by oil drop buoyancy so the oil drop size distribution is not required (see response for DFO-309).	
3.3 Surface Blowout Fate and Behaviour Modelling	The document refers to "throughout the blowout period". How long is the period? This is not provided anywhere. Section (4) provides this information for surface oil trajectory, but it was stated there that "This does not represent a scenario that would actually occur in a continuous blowout situation but rather provides a reasonable worst-case assessment of spill behaviour", it is unclear if this "every 6-hr batch for a month" release case used in section 4 was also used in section 3.	The blowout period modelled was one month, or 30 days. Additional text has been provided in Section 4.0 to add clarity to that section.	Adequate
4.2 Typical Monthly Surface Oil Slick Trajectories	The document states, "Each one of these six-hour quantities of oil has been tracked until the surface oil is completely evaporated and dispersed from the surface." However, have the	The light oil/condensate being modelled does not form a water-in-oil emulsion, based on the data in the Environment Canada oil database and previously conducted tests on the Cohassett-Panuke	Adequate

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	emulsification process been modeled? Although this may not be important in summer conditions, it cannot be neglected in winter conditions as a fraction of emulsion may stay on surface much long and transport far beyond the modeled 3-4 km radii (Fig 5).	oil. Condensates in general are not susceptible to water-in oil-emulsion formation.	
5.1 Introduction	The title is “dispersed oil plume trajectories”, however, this section only covers the re-entrained oil from above surface release as mentioned in page 33 “In these simulations, the quantity of oil that would be released from six hours of a continuous above sea blowout has been introduced on the surface at the exploration site as a batch spill every six hours over month-long periods” The behaviour of near bottom release and mass in the water column will be entirely different and are not covered here.	As described in the response to DFO-311, all oil released at the seabed for a shallow water, subsea blowout will travel quickly to the surface with the strong gas/water/oil plume (that is driven by the rising gas bubbles) to the surface (i.e. it is likely that no oil would trapped near the bottom or in the water column). All of the oil would rise to the surface and either evaporate or disperse. The dispersed plume trajectories were tracked until the concentration dropped to 0.1 ppm.	Inadequate. The authors have not addressed the behaviours of the spill near the bottom and even over the whole water column
5.2 Typical Monthly Dispersed Oil Plume Trajectories	The document states, “The initial movement of the dispersed oil plume is assumed to be due to a combination of winds and surface water currents. The prevailing surface water currents alone are assumed to drive the dispersed oil plume once the surface slick is depleted.” As discussed before, once the oil is entrained into water column, surface current should not be used, as the high amplitude of surface current may cause over flushing/dilution and underestimate oil concentration.	Oil concentration estimates based on a completely mixed, upper ocean mixing region provide adequate estimates of in-water oil concentration for Environmental Assessment purposes. Any additional resolution, either temporally or spatially, would be of limited use given the spatial and temporal knowledge of the resources that the dispersed oil could impact.	Inadequate. The authors did not provide information to support using surface water currents to represent the whole water column.

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ISSN 1919-3769

Correct Citation for this Publication:

DFO. 2013. Science Review of the Revised (2013) Old Harry Prospect Exploration Drilling Program. DFO Can. Sci. Advis. Sec. Sci. Resp. 2013/018.

Aussi disponible en français :

MPO. 2013. Examen scientifique du programme de forage d'exploration de la zone prometteuse de Old Harry révisé (2013). Secr. can. Rép. sci. du MPO. Rép. des Sci. 2013/018.