

May 31, 2011

Mr. James E. O'Reilly
Manager, Environmental and Regulatory
Hebron Project Team
ExxonMobil Canada Properties
Suite 701 Atlantic Place
215 Water Street
St. John's, NL
A1C 6C9

Dear Mr. O'Reilly:

Subject: Hebron Development Application

The staff of the C-NLOPB has conducted a completeness review of the Hebron Development Plan, the Development Application Summary, and, the Socio-economic Impact Statement and Sustainable Development Report. The completeness review of the Benefits Plan is continuing, the results of which will be communicated in due course.

The purpose of the completeness review is to confirm that the documents contain the information outlined in the Board's development plan guidelines. Once that process is complete, the Board will initiate a public review whereby interested groups will be afforded the opportunity to comment.

The following is a listing of the additional information and items requiring clarification arising from staff's completeness review.

Operations and Safety

1. The number of personnel on board (POB) is given as 230-234. A detailed justification for selecting the POB should be submitted. Experience from certain past projects indicated that the initial selection of POB was not adequate.
2. The development plan is based on conceptual engineering studies and a number of FEED studies that are ongoing. The list of studies that are ongoing should be submitted along with a schedule of when they will be completed.

In addition, it is indicated that a number of studies will be required to progress detailed design and construction. The list of such potential studies should be submitted along with a tentative schedule for completion.

3. Section 7.1.1 indicates that the open-hole gravel pack completions may exceed current technical limits. The process to ensure that the use of new technology or extending current technology is safe should be submitted.
4. Section 8.1.3 indicates that the design, fabrication, installation and operation will conform to all applicable Canadian and Newfoundland and Labrador laws, regulations, codes and standards as well as ExxonMobil Engineering Practices (Global Practices) and Global Security Practices. After FEED studies are completed, it is indicated that the list of codes and standards will be updated. A commitment to submit these codes and standards should be made.

It is also indicated that the most recent edition of applicable codes will be used. In case of conflict between Global Practices and accepted industry practice, normally the most stringent requirements will take priority. A commitment to submit any requirements from Global Practices that are more stringent than the codes and standards referenced in the application should be made.

Finally, since codes and standards are revised from time to time, a commitment to submit a description of the process for considering revisions to codes and standards should be made.

5. Figure 1.7-4 indicates that the OLS includes a vertical riser. In the past, there were challenges with wear on the flexible lines used for an OLS with a vertical riser. A discussion of how the applicant has considered these challenges and how it intends to reduce the risk of wear to the flexible lines should be submitted.
6. Section 9.4.4 indicates that initially the existing tanker fleet operating in the Grand Banks will likely be used to transport the Hebron crude oil to the Newfoundland Transshipment Terminal or direct to market and that the suitability of tanker fleet/standby vessels will be verified during detailed design. Section 10.1.3 of the concept safety analysis (CSA) states that it is assumed that support and standby vessels and shuttle tankers will be suitably ice strengthened to permit their use in most sea ice conditions. This assumption should be reviewed at the design stage to ensure that the possibility of sea ice is considered when selecting evacuation systems. Accordingly, a discussion of ice strengthening of shuttle tankers and standby vessels should be submitted.

7. Sections 1.7 and 1.8 discuss alternatives to proposed project and the preferred concept. Any supporting documents in connection with this matter should be submitted.
8. Section 8 discusses design criteria but does not mention the need to consider multi-directional wave loading on bottom founded structures. A discussion on how the applicant intends to consider multi-directional waves should be submitted.
9. The facilities are designed for 30 years. Table 1.9-1 indicates the life of the field as greater than 30 years. A discussion on the rationale for selecting a design life of 30 years when the life of the field is greater than 30 years should be submitted.
10. Section 8.1.3 states that iceberg impact loads will be calculated with a probabilistic procedure that accounts for the full range of environmental conditions that could influence iceberg loading at the Hebron location. Additional discussion should be submitted on the following items.

Probabilistic analysis

Clarification of the probabilistic procedure should be submitted. To our understanding, distributions are assumed for the various parameters used for generating the iceberg impact loads. Often, it is assumed that larger icebergs move at slower velocities than smaller icebergs. However, observations indicate that large icebergs may move at relatively large velocities.

Return period

ISO 19906 indicates that the representative value for actions arising from extreme-level ice events shall be determined based on an annual probability of exceedance not greater than 10^{-2} . Unlike wind and waves, iceberg impact loads do not converge to a limit at an annual probability of 10^{-2} . Sometimes a lesser annual probability is used for such actions. A discussion on the selection of annual probability for iceberg loads should be submitted.

Crushing pressures

The methodology used to generate iceberg impact load uses a pressure area relationship where the average pressure decreases with increase in area. However, some researchers suggest that there is potential for increase in pressures with increase in area for small aspect ratio contact areas. A discussion justifying the use of design loads generated by the first approach should be submitted.

11. The CSA indicates that the quantified risk assessment is based on a risk model that can be refined and updated throughout the life of the project. A discussion on the criteria (trigger) for updating the CSA should be submitted.
12. Reference is made to the Drilling Regulations and the Production and Conservation Regulations in sections 7.1.10, 7.2.10 and 14.6. Reference should be to the *Newfoundland Offshore Petroleum Drilling and Production Regulations*.

Environmental Protection

13. The documentation associated with the Comprehensive Study Report (CSR) pursuant to the Canadian Environmental Assessment Act is intended to fulfill the requirements for an Environmental Impact Statement under the Accord review and as outlined in Chapter 5 of the *Development Plan Guidelines*. Comments on the draft CSR have been provided to the proponent and are in the process of being addressed. A number of the comments made on the CSR are also relevant to the Hebron development application. When CSR issues are resolved, the applicant should, as required, incorporate those changes into the relevant sections of the application so the CSR and the application contain the same information. Examples of common issues are the disposal of water based mud and cuttings, produced water reinjection, flaring and oil spills.
14. The applicant has not mentioned, "... the quantities and composition of atmospheric emissions, including those arising from production fluid combustion and gas flaring" as outlined on page 37 of the development plan guidelines. Atmospheric emissions are dealt with in the CSR but no connection between the CSR and the development application are made.
15. The applicant has not discussed control of biological growth within the facilities seawater systems in the development plan, but has considered the use of sodium hypochlorite for biological control in the CSR. The applicant should make the connection between the CSR and the development plan.
16. Biofouling of the facility or control of biofouling has also not been presented in the application but biofouling has been discussed in the CSR. The applicant should make the connection between the CSR and the development plan.
17. Section 7.1.6.3: The applicant is reminded that use and disposal of completion fluids should be in accordance with the *Offshore Waste Treatment Guidelines*, 15 December 2010.

18. Section 9.1.1: Disposal of interface is subject to review and to the proponent's CSR.
19. Section 9.1.1: The level of detail provided on the storage displacement water system is not sufficient to understand how crude will not be accidentally discharged to sea through the open system, i.e. cell over filled. It is also unclear as to what is meant by "residence time may be reduced to fit void volume in the GBS". Additional detail is required on the system and residence time.
20. Section 9.1.1.6: The applicant mentions intakes but does not mention the location or design of discharges. Both the location and design of discharges are important for dispersion and to minimize other potential effects of the discharge. The applicant also does not mention the need or how biological growth in the facilities various water systems will be accomplished. More detail is required.
21. Section 9.2.3.2: The applicant states gas will; be scrubbed to remove liquids, hydrocarbons and water; and, dehydrated. The applicant should describe what the scrubbing medium is and what happens to the medium after scrubbing. The applicant should also describe how gas will be dehydrated.
22. Section 9.2.3.5: Accompanying the development plan are two reports on reservoir souring: one produced for Chevron and the other for ExxonMobil Canada Properties (EMCP). The latter report was produced because the depletion strategy for the reservoir was changed. This change appears to have altered the souring predication in that the reservoir will sour sooner and that there is little difference between the souring potential of seawater and produced water when used for water flood. One of the reasons the applicant gives for not re-injecting produced water is that, as compared to seawater injection, the souring potential was greater. Since this predication according to the souring study done for EMCP may not be valid, the applicant should review the rational for not re-injecting produced water based on souring potential.
23. Section 11.3: Spill or pollution is not mentioned in the section.
24. Section 14.1.2: The proponent's environmental assessment assesses the probability of an environmental event based on historical data from the local jurisdiction and internationally. Based on these probabilities, the risk to the environment in combination with the associated event is assessed. The assessment is not specific to a facility or its design; it is based on historical performance of all drilling or production facilities. Unlike the environmental assessment, the CSA is for a specific facility and not a generic analysis of the probability of an event occurring. The applicant should reflect the probabilities and mitigations identified

in the project's environmental assessment in the design of the facility. Where it is practical to reduce the probability of an event occurring further, the necessary measures to reduce the probability are to be incorporated into the design of the facility.

25. The applicant has not established a target level of safety for risk of damage to the environment in the application or the CSA. Nor has the applicant defined "significant" or "not significant". The application does not adequately demonstrate how section 43 of the *Newfoundland Offshore Petroleum Installations Regulations* and section 4.1 of the *Development Plan Guidelines* will be achieved, for environmental risks.

Resource Management

26. References are provided in the Geology section and the Petrophysics section. References should also be provided in the Reservoir Engineering section, Reserve Estimates section, Reservoir Exploitation section as well as the Drilling and Completions section.

Geology and Geophysics

27. The application discusses trapping configuration for Hebron (3 way fault dependent trap) but not West Ben Nevis and Ben Nevis fields. Is the configuration the same in these fault blocks?
28. Figure 2.21 shows all of the trapped hydrocarbons at Hebron. Additional maps to show the individual pools and prospects from the Figure 2.21 map should be provided to better illustrate size and distribution.
29. On page 2-24 it is hard to distinguish between use of the Avalon Formation in the formal stratigraphic sense and the "lumped" reservoir unit which includes the Eastern Shoals Formation and the A Marker as defined on page 2-21. For example, if the base of the Avalon is a sequence boundary, is this the base of the Avalon Formation only, or the base of the whole lumped unit? Terminology needs to be strict (always referring to the "Avalon reservoir unit" where appropriate) to avoid confusion. This should be updated to ensure common terminology.
30. Page. 2-31: Shoreline trending "northeast to southwest" is the opposite of what is depicted in Fig.2.2-8. Please clarify.
31. The petrophysical criteria and log-cut offs used to define the Ben Nevis and Avalon reservoir facies, should be provided in a format similar to Table 2.2-1 page 2 -42.

32. A paleogeography map for the Jeanne d’Arc formation is to be provided.
33. The petrophysical criteria and log-cut offs used to define the Jeanne d’Arc reservoir facies should be provided in a format similar to Table 2.2-1 page 2-42.
34. A depth migrated or converted seismic volume or Petrel velocity model is required.
35. The resolution and scale of seismic sections is insufficient to determine character of interpreted horizons and surface well ties. For example, in Figure 2.4-2, log character, or the well picks, cannot be distinguished.
36. The top and base Avalon seismic horizon interpretation in time and depth (ASCII format) should be provided.
37. The fault interpretation at the Jeanne d’Arc level in time and depth (ASCII and Petrel Format) should be provided.
38. On page 2-76, Fig. 2.4-3 the green and red lines on the map should be defined in the caption.
39. Section 2.4.3.7.3 – there appears to be an inconsistent use of the acronym “low water large tide” (LLWLT). Later in the text, reference is made to LLWT. Is this the same reference?
40. It appears that the caption for Figure 2.4-23 does not accurately depict what is in the figure. Please clarify.
41. Page. 2-84, Fig. 2.4-14: Provide a gas-down-to contact for the Ben Nevis Block on this map.
42. Net pay isopach maps for Pools 1, 4H, 4B and 3 should be provided.
43. A net pay isoporosity map for Pool 4H is required.
44. Page 2-104, Fig. 2.5-6 and page 2-108, Fig. 2.5-11: Both maps have a legend labeled “Thickness”, when it should be “% porosity”.
44. A hydrocarbon pore volume map of Pool 5 should be provided.

45. Copies of all maps are to be submitted to the Board in digital form (ASCII format or high resolution format) so that they can be reviewed in detail. Color scale for some isochore and HCPV maps is insufficient - for example Figure 2.5-14 has no color variation.
46. Tables in the Hebron Development Plan are required in a digital format other than jpeg to facilitate analysis by Board staff. MS Excel format would be acceptable.
47. The workflow for Pools 1, 2 and 3 geological models need to be described in more detail similar to the GOCAD Earth Model reports for Pools 4 and 5 that are in the Part II document. The workflow reports for Pools 1, 2 and 3 should address the following points:
- Discussion on base, low and high cases, including a detailed explanation of the methodology, parameters, and statistical populations.
 - Discussion on the five rock types, including how they relate to the six lithofacies, 4 petrofacies and 6 EODs defined in Section 2.2.2.1.2
 - EOD maps should be included for each zone.
 - Discussion on the porosity trends for each rock type and how they were estimated.
 - What is the perm/porosity transform? How was permeability modeled? (e.g. what is the algorithm? Is it the same for both fault blocks? Was the permeability co-kriged with the porosity or was it calculated using a porosity model?)
 - How are the contacts captured in the model—are they transitional or distinct?

Reservoir Engineering

47. Fluid Analysis for Pool 2 in the West Ben Nevis should be provided and discussed.
48. Reference to the injectivity studies that are presented in the Part II document: Hebron Water Injection Study should be provided. Also, a copy should be provided of the study mentioned in the Part II document Meng et al. "Feasibility Evaluation of Sea Water Injection on Hebron" Nov 2002.
49. Saturation functions and SCAL work for Pool 2 in the West Ben Nevis should be provided and discussed.

Reserve Estimates

50. Economic justification for the 30 year field life presented in the production forecasts should be provided.

51. In-place estimates have only been provided for oil. In-place gas estimates distinguishing between solution gas, gas-cap gas and non associated gas for each of the pools is also to be provided.
52. Oil reserve estimates have been presented. Gas and NGL resource estimates are also to be provided for each pool.
53. The information that was used in Excel and @risk software should be provided for each pool. Sensitivity value ranges for each of the parameters that impact the reserve estimates should also be provided.
54. The reserves estimates for each alternative production scenario should be provided.

Reservoir Exploitation

55. The base case list of drilling well sequence together with the rationale should be provided. This information should be supplemented with a map showing the well location in each block or pool to illustrate the proposed drilling sequence.
56. The Prosper inputs/results for different tubing sizes to understand the sensitivities of sizes and well inflow is required.
57. A description of future well workovers in terms of type of completions and a base case estimate of their frequency should be provided.
58. The reservoir simulation results of the impact of production rate(s) on ultimate oil recovery are required for each pool.
59. Section 6.5.2: Pool 3 Base Case Depletion Plan discusses the three approaches being considered for development. The applicant has mentioned it is currently being studied. The timing of completion of this study should be discussed.
60. The timing and approximate location for an appraisal well to initiate the development approach for Pool 3 should be provided.
61. Production forecasts for oil, gas and water for each of the pools should be provided in MS Excel format.

62. The oil, gas and water production forecast for each well for each of the pools should also be provided in MS Excel format.
63. "Gcf" is referenced in section 6.8.2.6. Please define.
64. Figures of reservoir simulation models (such as Figure 6.2-1) need to include reference points such as north direction, well locations and layer depth.
65. Additional figures of reservoir simulation model base case results for each of the Pools should be provided, such as cross sections north-to-south or east-to-west, top of reservoir unit and bottom of reservoir unit. As well, time sequence snapshots of base case should be presented at time $t=0$, $t= 5$ years, $t= 10$ years and $t=30$ years to understand sweep efficiency.
66. Maps showing the most likely areas for each of the discovered resources and potential prospects listed in the report are required.

Drilling and Completion

67. The applicant states that 41 wells are necessary to fully exploit the resource for the main reservoir. A three dimensional map of the well locations shown in Figure 7.1-1a and Figure 7.2-1 should be provided.
68. Section 7.1.6.2 discusses multi-function well bores; please provide more information on the types and use of these well bores in the context of the Hebron project.
69. The Development Plan references non aqueous based drilling fluids. The type of drilling fluids being considered should be provided.

Development and Operating Cost Data

70. Any quantitative economic assessments performed in respect of the alternatives described in Table 1.8-1 should be provided.

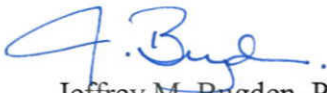
Socio-economic Impact Statement

With respect to the Socio-economic Impact Statement and Sustainable Development Report, staff has concluded that the applicant has addressed the information requirements of the development plan guidelines; therefore, this report is considered complete.

Staff is available to provide clarification on any of matters listed above. Please do not hesitate to contact us if there are any questions.

Please note that additional clarification may be sought from the applicant during the course of staff's review of the merits of the application.

Yours sincerely,



Jeffrey M. Bugden, P.Eng.,
Manager, Industrial Benefits,
Policy and Regulatory Coordination