

From: Kimberly Coady [KCOA@statoil.com]  
Sent: Friday, May 05, 2017 9:50 AM  
To: Hicks, Darren  
Cc: Stephanie Curran  
Subject: RE: Statoil 2008 EA-Spill Modelling Validation

Darren

Statoil offers the following information in response to DFO comments, ensuring that DFO has complete information on the spill trajectory model and the validation of the effects assessment. Our responses are provided below, following each comment.

**DFO Comment:**

\* Section 2.2.3 Model Uncertainty and Validation (page 7) The statement “When data was lacking, professional judgement and previous experience was used to refine the model inputs” could be clarified.

**Statoil Response:**

While many data sources and data sets have been used in the modeling, it is impossible for there to be all required data at all locations throughout the modeled domain throughout all time. Professional judgement is used to assume that specific values (e.g. temperature, total suspended solids, etc.) are appropriate for given locations and given time periods. As an example, the concentration of total suspended solids was sampled at several discrete locations, however this value was applied across large portions of the ocean. Similarly, when the hydrodynamics dataset was selected, several hydrodynamic data products were considered. The HYCOM dataset provided forcing that was most appropriate for the offshore environment, as opposed to an FVCOM dataset that would have been more appropriate for nearshore releases. In all cases, previous experience in the field of oil spill modeling is applied to produce the best prediction of the potential trajectory and fate of released oil.

**DFO Comment:**

\* Section 2.4. Model Results (page 9) – it is interesting to note that it would appear based on information provided in Table 5 (and also in Figure 4.1 and Table 4.1 (Appendix 1)), for a topside release scenario after 30 days while the surface oil is at 17%, the water column concentration is 27% and also for the 160 day duration of the model, when the surface oil is at 0%, there is still 2% of the oil remaining in the water column.

**Statoil Response:**

Several tables and figures are being compared in the comment. Table 5 in the EA validation document and Table 4-1 from the appendix are identical, providing the single value percentage of the amount of released oil found in each partition at a specific time step (day 30 and day 160) for a single deterministic scenario. This table depicts a light oil that evaporates quickly with a small amount on the surface after 30 days (at which point

oil was still entering the environment from the release). After 160 days, the oil has ceased to flow and surface oil is at 0% as it has either evaporated (46%), decayed (41%), left the modeled domain (11%), or has remained entrained in the water column (2%). Figure 4-1 in the Appendix provides far more information than the table. Rather than looking at the last time step, the figure contains the time history of mass balance. Note that the far right-hand-side of the figure corresponds with the last time step (30 days for the mass balance figure on the left and 160 days for the mass balance figure on the right). These figures show the dynamics of a single deterministic release over the entire modeled duration. In essence, the figure is the detailed time history of the release, while the table is a summary of where oil ended up at the last time step.

**DFO Comment:**

\* Section 3.1 Fish and Fish Habitat (page 16 and 17) - It is not clear if the 3D aspect of the modelling models / predicts the spatial extent of the water column oiling. Juvenile and adult pelagic species will typically occupy pelagic and near surface areas as such it should not be assumed (on page 16) that "...the juvenile stage occurs mostly near bottom." It is also noted on page 16 (3rd paragraph) that "real-time information will assist in deploying spill response measures (e.g. shoreline protection, containment, and recovery) to those areas where there is a potential for shoreline oiling". As a general comment and on a go forward basis are there / will there be mitigation measures relative to oil entrained within the water column. Again as a general comment and a go forward comment with respect to Table 7 (page 17) have the noted "Contingency Plans" and "Spill Response protocols" been developed and if so where can they be found.

**Statoil Response:**

The 3 dimensional modeling does account for the spatial extent of water column oiling. As noted, subsurface release do contain subsurface oil that has a potential to affect organisms at depth. The highest subsurface concentrations will be close (within 100's of meters to a few kilometers (in the horizontal)) from the wellhead. However, the majority of the released oil in both the subsurface and surface releases would be found either at the surface or in the upper tens of meters. Oil is less than water and will float to the surface. Entrainment by wind-induced waves can force oil into the water column, however this will be on the order of meters to tens of meters before resurfacing.

With regard to the statement "...it should not be assumed (on Page 16) that "... the juvenile stage occurs mostly near bottom"" is referring to demersal fish not pelagic fish. The statement in the EA validation is: "Only the subsurface release scenario have potential to interact with juvenile and adult demersal invertebrates and fish, assuming that the juvenile stage occurs mostly near bottom."

As noted above, in the event of a spill the majority of the oil would be found at the surface or in the upper water column. Given that most of the oil would be at the surface, and the limited anticipated impact in the water column, technologies have not been developed to remove entrained oil. Statoil has a "zero tolerance" policy towards

all spills and emphasizes prevention in the design of facilities, procedures employed offshore, and training of personnel. The Company has in place the policies, procedures, equipment, and trained personnel necessary to reduce the probability of oil spill incidents and to minimize the effects of spills should they occur. Regardless, Statoil maintains the capability for an immediate response to an oil spill incident that may occur during drilling operations. Statoil's Oil Spill Response Plan is on file with the C-NLOPB as part of the requirements for an Operations Authorization

**DFO Comment:**

\* Section 3.4 Marine Mammals and Sea Turtles (page 26 and 27) – the sentences / statements “Most marine mammals, with the exception of fur seals, polar bears, and sea otters, are not very susceptible to oiling effects” (1st sentence after table 15 on page 26) and “...and most seals do not exhibit large behavioural or physiological reactions to limited surface oiling, incidental exposure to contaminated food, or ingestion of oil” (last sentence 1st paragraph page 27) should have a reference literature citation.

**Statoil response:**

The relevant citations for the following statements are provided below:

“Most marine mammals, with the exception of fur seals, polar bears, and sea otters, are not very susceptible to oiling effects” (1st sentence after table 15 on page 26)

Doerffer, J.W. 2013. Oil Spill Response in the Marine Environment. Pergamon Press. 395 pp.

“...and most seals do not exhibit large behavioural or physiological reactions to limited surface oiling, incidental exposure to contaminated food, or ingestion of oil” (last sentence 1st paragraph page 27)

St. Aubin, D.J. 1990. Physiologic and toxic effects on polar bears. pp. 235-239. In: J.R. Geraci and D.J. St. Aubin (eds.), Sea mammals and oil: confronting the risks. Academic Press, San Diego. 282 p.

Williams, T.M., G.A. Antonelis and J. Balke. 1994. Health Evaluation, Rehabilitation, and Release of Oiled Harbor Seal Pups. Pp. 227-242. In: T.R. Loughlin (ed.). Marine Mammals and the Exxon Valdez. Academic Press, San Diego, CA. 395 pp.

Regards,

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