Andrew Weaver Information Request No. 1
To Trans Mountain Pipeline
Trans Mountain Expansion Project
File OF-Fac-OII-T260-2013-03 02
Hearing order OH-001-2014

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1 Socio-economic Impact of a Diluted Bitumen Spill

Reference:
i) A3S5Q3, Application Volume 8A, Marine Transportation PDF pages 4-11 of 29
ii) A3S4X1, Ecological Risk Assessment of Westridge Marine Terminal Spills
iii) Federal Government Technical Report – Properties, Composition, and Marine Spill Behaviour, Fate and Transport of Two Diluted Bitumen Products from the Canadian Oil Sands (30 November 2013) – Environment Canada website: http://www.ec.gc.ca/Publications/
iv) Western Canada Marine Response Corporation news post – WCMRC website: http://wcmrc.com/news/federal-government-releases-dilbit-study/
v) A3S5F6, Application Volume 8C Pt.2, General Risk Analysis
vi) A3S4T1, Application Volume 8C Pt. 1, Casualty Data Survey PDF page 9 of 38
vii) A3S5I9, Review of Trans Mountain Expansion Project: Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, Full Report.

Preamble: Reference i) outlines the potential socio-economic impacts of an oil spill

Reference ii) outlines the risk assessment of an oil spill at Westridge Marine Terminal.

Reference iii) is a report by the Canadian Government on research that federal government departments have conducted regarding the potential fate and behavior of diluted bitumen spilled in water

Reference iv) is a post by the Western Canada Marine Response Corporation which recognizes the results of the Canadian Government's report on diluted bitumen in water.

Reference v) discusses total loss scenarios and factors or incidents that can contribute to a total loss.

Reference vi) provides information on the number of world-wide total loss incidents that have occurred between the period of 2002-2011

Reference vii) provides an account of the current and recommended enhancements for oil spill response capacity in light of the Trans Mountain Expansion Project (TMEP).

Request:
a) Please confirm that the results of reference iii) were not factored into the conclusions presented in reference i).

b) Given the results and conclusions of the reference iii), please provide:

b.1) A detailed analysis of the potential socio-economic outcomes of an 8,250 m^3 diluted bitumen oil spill and a credible worst-case 16,500 m^3 diluted bitumen oil spill at hypothetical oil spill scenario location D, the Strait of Georgia.

b.2) A detailed analysis of the potential socio-economic outcomes of an 8,250 m^3 diluted bitumen oil spill and a credible worst-case 16,500 m^3 diluted bitumen oil spill at hypothetical oil spill scenario location E, Arachne Reef.

b.3) A detailed analysis of the potential socio-economic outcomes of an 8,250 m^3 diluted bitumen oil spill and a credible worst-case 16,500 m^3 diluted bitumen oil spill at hypothetical oil spill scenario location G, Race Rocks.

b.4) A detailed analysis of the potential socio-economic outcomes of an 8,250 m^3 diluted bitumen oil spill and a credible worst-case 16,500 m^3 diluted bitumen oil spill at hypothetical oil spill scenario location H, Buoy J.

b.5) A detailed analysis of the potential socio-economic outcomes of an 8,250 m^3 diluted bitumen oil spill and a credible worst-case 16,500 m^3 diluted bitumen oil spill at the Westridge Marine Terminal.

b.6) Recognizing that a total loss scenario is not within the 90^{th} percentile of risk, but given the statistics that show that it is still a viable scenario, please provide a detailed analysis of the potential socio-economic outcomes of a total loss scenario with a complete cargo discharge of all oils at each of the four hypothetical oil spill scenario locations (D, E, G and H). Please assumed only the current oil spill response capacity is applied to this scenario, as outlined in reference vii)

c) Please clarify whether an enhanced oil spill response regime or the current oil spill response regime, as outlined in reference vii), is assumed in the discussion of the socio-economic impacts of an 8,250 m^3 oil spill and a 16,500 m^3 oil spill at each of the four hypothetical oil spill scenario locations (D, E, G and H) presented in reference i), as well as at the Westridge Marine Terminal.

c.1) Regardless of which regime is used, please confirm whether the oil spill response inputs for the model have been collaborated with historical data.

c.1.i) if so, please provide the historical data used to collaborate these inputs

c.2) Please provide an account of how the model inputs for the oil spill response regime have been validated for the Trans Mountain tanker sailing route.

c.3) Please provide a sensitivity analysis of the model that is used for the spill projections with respect to the uncertainty of the spill response capacity inputs used in the model.

2 Population Age and Oil Spill Exposure

Reference:
i) A3S5Q3, Application Volume 8A, Marine Transportation, PDF pages 8-9 of 29
ii) Stats Canada Report – Age and Sex Structure: Subprovincial, 2010, Table 1 (July 1, 2010) – Statistics Canada Website: http://www.statcan.gc.ca/pub/91-209-x/2011001/article/11512-eng.htm
iii) A3S4Y5, Application Volume 8A, Marine Transportation, PDF pages 37 to 43 of 43
iv) A3S4Y6, Application Volume 8A, Marine Transportation, PDF pages 1 to 22 of 34
v) A3S5F6, Application Volume 8C Pt.2, General Risk Analysis
vi) A3S4T1, Application Volume 8C Pt. 1, Casualty Data Survey PDF page 9 of 38
vii) A3S5I9, Review of Trans Mountain Expansion Project: Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, Full Report.

Preamble: Reference i) discusses the human health impacts of an oil spill and the effects of age on sensitivity to chemical exposures.

Reference ii) is a report from Statistics Canada's website outlining the population age demographics for metropolitan cities across Canada.

References iii) and iv), provide a detailed description of four locations along the tanker transit route that were selected for modelling the expected behavior and impacts of spilled oil.

Reference v) discusses total loss scenarios and factors or incidents that can contribute to a total loss.

Reference vi) provides information on the number of world-wide total loss incidents that have occurred between the period of 2002-2011

Reference vii) provides an account of the current and recommended enhancements for oil spill response capacity in light of the Trans Mountain Expansion Project (TMEP).

Request: Please Provide:

a) Please confirm that a person's age and health status can impact the manner and extent to which they respond to COPC chemical exposure, such as would be present in the environment following an oil spill.

b) Please confirm that the young, the elderly and people with compromised health often show heightened sensitivity to COPC exposure, such as what would be present in the environment following an oil spill.

c) A detailed discussion of the potential human health impacts of a smaller, 8,250 m^3 diluted bitumen oil spill at location E, on Victoria, British Columbia's population, given their local age demographics.

d) A detailed discussion of the potential human health impacts of a credible worst-case, 16,500 m^3 diluted bitumen oil spill at location E on Victoria, British Columbia's population, given their local age demographics.

e) A detailed discussion of the potential human health impacts of a smaller, 8,250 m^3 diluted bitumen oil spill at location G, on Victoria, British Columbia's population, given their local age demographics.

f) A detailed discussion of the potential human health impacts of a credible worst-case, 16,500 m^3 diluted bitumen oil spill at location G on Victoria, British Columbia's population, given their local age demographics.

g) Recognizing that a total loss scenario is not within the 90th percentile of risk, but given the statistics that show that it is still a viable scenario, please provide a detailed analysis of the potential human health impacts of a total loss scenario with a complete cargo discharge of all oils at location G on Victoria, British Columbia's population, given their local age demographics.

h) Please clarify whether an enhanced oil spill response regime or the current oil spill response regime, as outlined in reference vii) is assumed in the discussions of oil spill impacts on human health, for all hypothetical oil spill sizes and locations requested above.

3 Local Oil Spill Cleanup Infrastructure and Services

Reference:
i) A3S5Q3, Application Volume 8A, Marine Transportation, PDF page 10 of 29
ii) A3S4Y9, Application Volume 8A, Marine Transportation, PDF pages 21-25 of 28
iii) A3S4Y5, Application Volume 8A, Marine Transportation, PDF pages 37 to 43 of 43
iv) A3S4Y6, Application Volume 8A, Marine Transportation, PDF pages 1 to 22 of 34
v) A3S5F6, Application Volume 8C Pt.2, General Risk Analysis
vi) A3S4T1, Application Volume 8C Pt. 1, Casualty Data Survey PDF page 9 of 38
vii) A3S5I9, Review of Trans Mountain Expansion Project: Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, Full Report.

Preamble: Reference i) states that in the event of a spill, clean up demands will likely be put on local emergency responders, hospitals, social services, etc…

Reference ii) summarizes findings from a Qualitative Human Health Risk Assessment completed for Marine Transportation Spills at Location E: Arachne Reef

References iii) and iv), provide a detailed description of four locations along the tanker transit route that were selected for modelling the expected behavior and impacts of spilled oil

Reference v) discusses total loss scenarios and factors or incidents that can contribute to a total loss.

Reference vi) provides information on the number of world-wide total loss incidents that have occurred between the period of 2002-2011

Reference vii) provides an account of the current and recommended enhancements for oil spill response capacity in light of the Trans Mountain Expansion Project (TMEP).

Request: Please provide:

a) An analysis of the projected demands of, and required response to, an 8,250 m^3 diluted bitumen oil spill and a credible worst-case 16,500 m^3 diluted bitumen oil spill at locations E and G, and the ability of the District of Oak Bay's available emergency responder's and service's to meet these demands.

b) An analysis of the projected demands of, and required response to, an 8,250 m^3 diluted bitumen oil spill and a credible worst-case 16,500 m^3 diluted bitumen oil spill at locations E and G, and the ability of the District of Saanich's available emergency responder's and service's to meet these demands.

c) An analysis of any additional health care resources that will be needed by the District of Oak Bay and the District of Saanich in order to address an 8,250 m^3 diluted bitumen oil spill and a credible worst-case 16,500 m^3 diluted bitumen oil spill at locations E and G.

d) An analysis of the specific human health conditions that could occur following an 8,250 m^3 diluted bitumen oil spill and a credible worst-case 16,500 m^3 diluted bitumen oil spill at locations E and G, and the resources that would be required to treat these conditions.

e) Recognizing that a total loss scenario is not within the 90th percentile of risk, but given the statistics that show that it is still a viable scenario, please provide an analysis of the projected demands of, and required response to, a total loss

scenario with a complete cargo discharge of all oils at locations E and G, and the ability of the District of Oak Bay's available emergency responder's and service's to meet these demands.

f) Recognizing that a total loss scenario is not within the 90th percentile of risk, but given the statistics that show that it is still a viable scenario, please provide an analysis of the projected demands of, and required response to, a total loss scenario with a complete cargo discharge of all oils at locations E and G, and the ability of the District of Saanich's available emergency responder's and service's to meet these demands.

g) Recognizing that a total loss scenario is not within the 90th percentile of risk, but given the statistics that show that it is still a viable scenario, please provide an analysis of any additional health care resources that will be needed by the District of Oak Bay and the District of Saanich in order to address a total loss scenario with a complete cargo discharge of all oils at locations E and G.

h) Recognizing that a total loss scenario is not within the 90th percentile of risk, but given the statistics that show that it is still a viable scenario, please provide an analysis of the specific human health conditions that could occur following a total loss scenario with a complete cargo discharge of all oils at locations E and G, and the resources that would be required to treat these conditions.

i) Please clarify whether an enhanced oil spill response capacity or the current oil spill response capacity, as outlined in reference vii) is assumed in the responses to requests a) – h) presented above.

4 Impact of Oil Spills on Marine Species

4.1 At-risk Species List and Oil Spill Recovery Capability

Reference:

i) British Columbia's endangered species and ecosystems lists - BC Ministry of Environment website: http://www.env.gov.bc.ca/atrisk/red-blue.htm

ii) Government of Canada's wildlife species assessment list – COSEWIC website: http://www.cosewic.gc.ca/eng/sct0/index_e.cfm

iii) US Fish and Wildlife Service endangered species list – Environmental Conservation website: http://ecos.fws.gov/tess_public/pub/listedAnimals.jsp

iv) Washington State Department of Fish and Wildlife species of concern lists – conservation website: http://wdfw.wa.gov/conservation/endangered/All/

v) A3S5Q3, Application Volume 8A, Marine Transportation PDF page 29 of 29

vi) A3S4Y7 Application Volume 8A, Marine Transportation, PDF pages 1-19 of 19
vii) A3S4Y8 Application Volume 8A, Marine Transportation, PDF pages 1-19 of 19
viii) A3S4Y9 Application Volume 8A, Marine Transportation, PDF pages 1-21 of 28
ix) A3S5F6, Application Volume 8C Pt.2, General Risk Analysis
x) A3S4T1, Application Volume 8C Pt. 1, Casualty Data Survey PDF page 9 of 38
xi) A3S5I9, Review of Trans Mountain Expansion Project: Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, Full Report.

Preamble: Reference i) is the British Columbian Government's list of endangered species and ecosystems.

Reference ii) is the Canadian Government's list of endangered species and species-of-concern.

Reference iii) is the United States Government's list of endangered species.

Reference iv) is the Washington State Government's list of species of concern.

References v) – viii) provide a discussion of the potential environmental effects of an oil spill on various marine life and habitats, including the ability of marine species populations to recover from spills.

Reference ix) discusses total loss scenarios and factors or incidents that can contribute to a total loss.

Reference x) provides information on the number of world-wide total loss incidents that have occurred between the periods of 2002-2011

Reference xi) provides an account of the current and recommended enhancements for oil spill response capacity in light of the Trans Mountain Expansion Project (TMEP).

Request:

a) Please confirm whether the conclusions presented in references v) – viii) factored in the most current updated versions of references i) – iv).

b) Please discuss how Trans Mountain took into account the most recent species-of-concern and endangered species lists published by the Canadian Government, the British Columbian Government, the United States Government, and the Washington State Government, when reporting the ability of affected marine life species to recover from a smaller 8,250 m^3 oil spill and/or a credible worst-case 16,500 m^3 oil spill at each of the four hypothetical spill scenario locations (D, E, G, and H).

c) If these lists were not considered in this process, can Trans Mountain please provide:
   - c.1) A detailed analyses of the expected recovery capability of the marine species currently listed as at-risk or endangered, following a diluted bitumen oil spill of 8,250 m^3 at each of the four hypothetical oil spill scenario locations (D, E, G, and H).
   - c.2) A detailed analyses of the expected recovery capability of the marine species currently listed as at-risk or endangered, following a diluted bitumen oil spill of 16,500 m^3 at each of the four hypothetical oil spill scenario locations (D, E, G, and H).
   - c.3) A detailed analyses of the expected recovery capability of the marine species currently listed as at-risk or endangered, following a diluted bitumen oil spill of 8,250 m^3 at Westridge Marine Terminal.
   - c.4) A detailed analyses of the expected recovery capability of the marine species currently listed as at-risk or endangered, following a diluted bitumen oil spill of 16,500 m^3 at Westridge Marine Terminal.

d) Recognizing that a total loss scenario is not within the 90th percentile of risk, but given the statistics that show that it is still a viable scenario, can Trans Mountain please provide a detailed analyses of the expected recovery capability of the marine species currently listed as at-risk or endangered, following a total loss scenario with a complete cargo discharge of all oils at each of the four hypothetical oil spill scenario locations (D, E, G, and H).

e) Please clarify whether an enhanced oil spill response regime or the current oil spill response regime, as outlined in reference xi), is assumed in the analyses of at-risk and endangered marine species recovery capacity following an oil spill, for all hypothetical oil spill sizes and locations requested in questionss b) – d) presented above.

4.2 Marine Species Population Loss Due to Oil Spills

Reference: i) A3S5Q3, Application Volume 8A, Marine Transportation PDF page 24 of 29

Preamble: Reference i) discusses the death of marine birds following the Exxon Valdez Oil Spill and marine bird species listed as "recovering", stating that "only nine carcasses of adult black oystercatchers were recovered…and although the actual number of mortalities may have been several times higher, this represents a small fraction of the population of 1,500 to 2,000… about 1,000 Harlequin duck (about 7 per cent of the wintering population) were killed by oil exposure at the time of the spill."

Request: a) Can Trans Mountain please confirm what percentage of a Marine Species population constitutes a large fraction and what percentage must die from an

oil spill for it to be considered worrisome for population numbers and recovery potential.

a.1) Can Trans Mountain please provide a detailed discussion about how the percentages in request a) were reached.

4.3 Marine Bird Feeding Ground Oiling

Reference:
i) A3S4Y9 Application Volume 8A, Marine Transportation, PDF page 12 of 28
ii) A3S5F6, Application Volume 8C Pt.2, General Risk Analysis
iii) A3S4T1, Application Volume 8C Pt. 1, Casualty Data Survey PDF page 9 of 38
iv) A3S5I9, Review of Trans Mountain Expansion Project: Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, Full Report.

Preamble: Reference i) summarizes the effects of an oil spill on Marine Bird habitats, stating that "the overlap of oil with a colony location does not necessarily indicate that seabirds at nest sites will experience oiling, as their feeding grounds may be located at some distance from the nest site."

Reference ii) discusses total loss scenarios and factors or incidents that can contribute to a total loss.

Reference iii) provides information on the number of world-wide total loss incidents that have occurred between the period of 2002-2011

Reference iv) provides an account of the current and recommended enhancements for oil spill response capacity in light of the Trans Mountain Expansion Project (TMEP).

Request:
a) Please provide an in depth analyses of the impacts of an oil spill at a marine bird feeding ground on marine bird populations for both an 8,250 m^3 oil spill and a 16,500 m^3 oil spill along the proposed tanker ship route.

b) Recognizing that a total loss scenario is not within the 90^{th} percentile of risk, but given the statistics that show that it is still a viable scenario, please provide an in depth analyses of the impacts of an oil spill at a marine bird feeding ground on marine bird populations for a total loss scenario with a complete cargo discharge of all oils along the proposed tanker ship route.

c) Please clarify whether an enhanced oil spill response regime or the current oil spill response regime, as outlined in reference iv), is assumed in the analyses of the impacts of an oil spill at marine bird feeding grounds on marine bird

populations, for all hypothetical oil spill sizes and locations requested in questions a) and b) above.

5 Effect of Storm Winds on Behaviour of Spilled Oil

Reference:
i) Trans Mountain Report – Meteorological and Oceanographic Data Relevant to the Proposed Westridge Terminal Shipping Expansion (November 2013)
ii) A3S5Q3, A3S4Y7, A3S4Y8, and A3S4Y9 Application Volume 8A, Marine Transportation.
iii) A3S5Q3, Application Volume 8A, Marine Transportation PDF pages 11-12 of 29
iv) A3S5F6, Application Volume 8C Pt.2, General Risk Analysis
v) A3S4T1, Application Volume 8C Pt. 1, Casualty Data Survey PDF page 9 of 38
vi) A3S5I9, Review of Trans Mountain Expansion Project: Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, Full Report.

Preamble: Reference i) discusses the effects of storms and wind energy on the water properties of the Pacific Ocean. It states that "during a storm, the energy from the wind leads to mixing of waters, typically to a depth of tens or even hundreds of metres…This process of wind mixing is illustrated by the progressive deepening of the upper layer during a storm event…"

Reference ii) states multiple times that certain marine species will likely not be impacted, or will be minimally impacted, by an oil spill due to the depths at which they live in the ocean and the tendency for crude oils to remain near the surface of the ocean.

Reference iii) discusses the problem formulation and spatial boundaries used for the ecological risk assessment

Reference iv) discusses total loss scenarios and factors or incidents that can contribute to a total loss.

Reference v) provides information on the number of world-wide total loss incidents that have occurred between the periods of 2002-2011

Reference vi) provides an account of the current and recommended enhancements for oil spill response capacity in light of the Trans Mountain Expansion Project (TMEP).

Request:
a) Please confirm whether Trans Mountain was aware of the findings and conclusions reported by reference i) prior to completing the sections referred to in reference ii).

a.1) If they were not, please provide an update analyses for reference ii), taking into account the findings reported on by reference i).

b) Please confirm whether Trans Mountain was aware of the findings and conclusions reported by reference i) prior to completing the sections referred to in reference iii).

b.1) If they were not, please provide an update analyses for reference iii), taking into account the findings reported on by reference i).

c) Please confirm whether, during the hypothetical oil spill scenarios and the subsequent discussions of the potential ecological impacts of these spills, Trans Mountain factored in the effects of strong storm winds mixing ocean waters up to hundreds of metres. The potential for strong storm winds is plausible all year round, but would be particularly high in the winter months.

c.1) If they did not, please provide a detailed analyses of how high storm winds mixing water to deeper depths could have an effect on the ecological impacts of an 8,250 m^3 diluted bitumen oil spill and a 16,500 m^3 diluted bitumen oil spill.

d) Recognizing that a total loss scenario is not within the 90^{th} percentile of risk, but given the statistics that show that it is still a viable scenario, please provide a detailed analyses of how high storm winds mixing water to deeper depths could have an effect on the ecological impacts under a total loss scenario with a complete cargo discharge of all oils.

e) Please confirm whether Trans Mountain has factored in the impact that strong winds mixing ocean water to higher depths will have on response time and clean up capacity of responders, particularly during winter months when storms are more frequent.

e.1) If not, please provide a detailed analyses of how strong storm winds mixing spilled oil in the ocean to depths of hundreds of meters, could affect the response time and clean up capacity of responders for both an 8,250 m^3 diluted bitumen oil spill and a 16,500 m^3 diluted bitumen oil spill.

f) Recognizing that a total loss scenario is not within the 90^{th} percentile of risk, but given the statistics that show that it is still a viable scenario, please provide a detailed analyses of how strong storm winds mixing spilled oil in the ocean to depths of hundreds of meters, could affect the response time and clean up capacity of responders for a total loss scenario with a complete cargo discharge of all oils.

g) Please clarify whether an enhanced oil spill response regime or the current oil spill response regime, as outlined in reference vi), is assumed for each of the responses provided to requests a) - f) presented above.

6 Economic Impact

6.1 Economic Impact of an Oil Spill

Reference:
i) A3S5Q3, Application Volume 8A, Marine Transportation, PDF pages 6 to 7 of 29
ii) A3S4Y5, Application Volume 8A, Marine Transportation, PDF pages 37 to 43 of 43
iii) A3S4Y6, Application Volume 8A, Marine Transportation, PDF pages 1 to 22 of 34
iv) A3S4X1, Ecological Risk Assessment of Westridge Marine Terminal Spills
v) A3S5F6, Application Volume 8C Pt.2, General Risk Analysis
vi) A3S4T1, Application Volume 8C Pt. 1, Casualty Data Survey PDF page 9 of 38
vii) A3S5I9, Review of Trans Mountain Expansion Project: Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, Full Report.

Preamble: In Reference i), Trans Mountain states that marine spills can have positive effects on local and regional economies over the short- and long-term. Trans Mountain says that "spill response and clean-up creates business and employment opportunities for affected communities, regions, and clean-up service providers, particularly in those communities where spill response equipment is, or would be, staged (Section 5.5). This demand for services and personnel can also directly or indirectly affect businesses and resource-dependent livelihoods. The net overall effect depends on the size and extent of a spill, the associated demand for clean-up services and personnel, the capacity of local and regional businesses to meet this demand, the willingness of local businesses and residents to pursue response opportunities, the extent of business and livelihoods adversely affected (directly or indirectly) by the spill, and the duration and extent of spill response and clean-up activities."

References ii) and iii), provide a detailed description of four locations along the tanker transit route that were selected for modelling the expected behavior and impacts of spilled oil.

Reference iv) outlines the risk assessment of an oil spill at Westridge Marine Terminal.

Reference v) discusses total loss scenarios and factors or incidents that can contribute to a total loss.

Reference vi) provides information on the number of world-wide total loss incidents that have occurred between the period of 2002-2011

Reference vii) provides an account of the current and recommended enhancements for oil spill response capacity in light of the Trans Mountain Expansion Project (TMEP).

Request:

a) Please confirm that Trans Mountain has found positive economic impacts associated with marine oil spills, as stated in reference i).

b) Please provide a full economic cost-benefit analysis for a credible worst case diluted bitumen oil spill of 16,500 m^3 at each of the four hypothetical spill locations described in Section 5.4 (locations D, E, G, & H).

b.1) Please provide a detailed analysis of local, provincial, national and international costs and benefits for each scenario.

c) Please provide a full economic cost-benefit analysis for a smaller volume diluted bitumen oil spill of 8,250 m^3 at each of the four hypothetical spill locations described in Section 5.4 (locations D, E, G, & H).

c.1) Please provide a detailed analysis of local, provincial, national and international costs and benefits for each scenario.

d) Please provide a full economic cost-benefit analysis for a total loss scenario diluted bitumen oil spill at each of the four hypothetical spill locations described in Section 5.4 (locations D, E, G, & H).

d.1) Please provide a detailed analysis of local, provincial, national and international costs and benefits for each scenario.

e) Please provide a full economic cost-benefit analysis for a credible worst case diluted bitumen oil spill of 16,500 m^3 at Westridge Marine Terminal.

e.1) Please provide a detailed analysis of local, provincial, national and international costs and benefits for such a spill at this location.

f) Please provide a full economic cost-benefit analysis a smaller volume diluted bitumen oil spill of 8,250 m^3, at Westridge Marine Terminal.

f.1) Please provide a detailed analysis of local, provincial, national and international costs and benefits for such a spill at this location.

g) Please provide a full economic cost-benefit analysis a total loss scenario diluted bitumen oil spill at Westridge Marine Terminal.

g.1) Please provide a detailed analysis of local, provincial, national and international costs and benefits for such a spill at this location.

h) Please provide an econometric analysis of how the size and extent of a spill impacts the cost-benefit analyses provided in requests b), c), d) and e).

i) Please provide an econometric analysis of how the associated demand for clean-up services and personnel impacts the cost-benefit analyses provided in requests b), c), d) and e).

j) Please provide an econometric analysis of how the capacity of local and regional businesses to meet the demands for clean-up services impacts the cost-benefit analyses provided in requests b), c), d) and e).

k) Please provide an econometric analysis of how the willingness of local businesses and residents to pursue oil spill response opportunities impacts the cost-benefit analyses provided in requests b), c), d) and e).

l) Please provide an econometric analysis of how the extent of business and livelihoods adversely affected (directly or indirectly) by the spill impacts the cost-benefit analyses provided in requests b), c), d) and e).

m) Please provide an econometric analysis of how the duration and extent of spill response and clean-up activities impacts the cost-benefit analyses provided in requests b), c), d) and e).

n) Please clarify whether an enhanced oil spill response regime or the current oil spill response regime, as outlined in reference vii), is assumed in the economic cost-benefit analysis of an oil spill, for all hypothetical oil spill sizes and locations mentioned in requests b) - g) presented above.

o) Please clarify whether an enhanced oil spill response regime or the current oil spill response regime, as outlined in reference vii), is assumed for each of the econometric analyses provided in response to requests h) - m) presented above.

6.2 Economic Impact of Past Oil Spills

Reference: i) A3S5Q3, Application Volume 8A, Marine Transportation, PDF pages 6 to 7 of 29

Preamble: Reference i) discusses positive economic effects of oil spills and specifically mentions that positive spill-related economic effects were documented for major spill clean-up areas following the Exxon Valdez Oil Spill EVOS)

Request: a) Please confirm that Trans Mountain has found that the EVOS had positive economic effects for major spill clean-up areas.

b) Please provide a full economic cost-benefit analysis of the 1989 Exxon Valdez Oil Spill.

c) Please provide a full economic cost-benefit analysis of the July 24, 2007 Kinder Morgan Pipeline oil spill in Burnaby, BC.

d) Please provide a comprehensive list of all oil spills that have occurred along the Kinder Morgan Pipeline route dating back to 1994, excluding the 2007 Burnaby, BC oil spill.

e) Please provide full economic cost-benefit analyses for every oil spill that has occurred along the Kinder Morgan Pipeline route dating back to 1994, excluding the 2007 Burnaby, BC oil spill.

7 Diluted Bitumen Oil Spills

7.1 Problem Formulation for a Diluted Bitumen Spill

Reference: A3S5Q3, Application Volume 8A, Marine Transportation:

i) PDF pages 11-12 of 29
ii) PDF pages 13-26 of 29
iii) PDF pages 26-29 of 29
iv) A3S4Y7, A3S4Y8, and A3S4Y9 Application Volume 8A, Marine Transportation.
v) Federal Government Technical Report – Properties, Composition, and Marine Spill Behaviour, Fate and Transport of Two Diluted Bitumen Products from the Canadian Oil Sands (30 November 2013) – Environment Canada website: http://www.ec.gc.ca/Publications/
vi) Western Canada Marine Response Corporation news post – WCMRC website: http://wcmrc.com/news/federal-government-releases-dilbit-study/
vii) A3S4Y5, Application Volume 8A, Marine Transportation, PDF pages 37 to 43 of 43
viii) A3S4Y6, Application Volume 8A, Marine Transportation, PDF pages 1 to 22 of 34
ix) A3S5F6, Application Volume 8C Pt.2, General Risk Analysis
x) A3S4T1, Application Volume 8C Pt. 1, Casualty Data Survey PDF page 9 of 38
xi) A3S5I9, Review of Trans Mountain Expansion Project: Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, Full Report.

Preamble: Reference i) discusses the problem formulation and spatial boundaries used for the ecological risk assessment

Reference ii) discusses the biological sensitivity ranking factors for each of the four ERA ecological receptor groups.

References iii) and iv) provide BSF ratings for shoreline habitats, marine fish communities, marine birds, and marine mammals for hypothetical spill scenarios at each of the four locations

Reference v) is a report by the Canadian Government on research that federal government departments have conducted regarding the potential fate and behavior of diluted bitumen spilled in water.

Reference vi) is a post by the Western Canada Marine Response Corporation which recognizes the results of the Canadian Government's report on diluted bitumen in water.

References vii) and viii) provide a detailed description of four locations along the tanker transit route that were selected for modelling the expected behavior and impacts of spilled oil.

Reference ix) discusses total loss scenarios and factors or incidents that can contribute to a total loss.

Reference x) provides information on the number of world-wide total loss incidents that have occurred between the periods of 2002-2011

Reference xi) provides an account of the current and recommended enhancements for oil spill response capacity in light of the Trans Mountain Expansion Project (TMEP).

Request:

a) Please confirm that the results of reference v) were not factored into the conclusions presented in references i), ii), vii), and viii).

b) Please provide an updated problem formulation and spatial boundaries assessment that factors in the results and conclusions of the government of Canada's report (reference v)) on the expected behavior of submerged diluted bitumen in water.

c) Factoring in the results of request a) and the Government of Canada's report (reference v)), please provide new biological sensitivity ranking factors (BSF) for each of the four ERA ecological receptor groups listed in reference ii) at each of the hypothetical oil spill scenario locations discussed in references vii) and viii).

c.1) Please provide a detailed analyses comparing and contrasting the original BSF rankings for each ERA receptor group as provided in references ii), iii), and iv) and the new BSF rankings resulting from request b).

c.2) Given the BSF rankings established under request b), please provide a detailed analyses of the ecological impacts of an 8,250 m^3 diluted bitumen oil spill and a 16,500 m^3 diluted bitumen oil spill at each of the hypothetical oil spill scenario locations D, E, G, and H (reference vii) and viii)).

c.3) Given the BSF rankings established under request b), please provide a detailed analyses of the ecological impacts of a total loss scenario hypothetical diluted bitumen oil spill scenario for locations D, E, G, and H (reference vii) and viii)).

d) Please clarify whether an enhanced oil spill response regime or the current oil spill response regime, as outlined in reference xi), is assumed in determining the problem formulation and spatial boundaries assessments of an oil spill, for all hypothetical oil spill locations discussed in references vii) and viii).

e) Please clarify whether an enhanced oil spill response regime or the current oil spill response regime, as outlined in reference xi), is assumed in determining the BSF rankings for each of the four ERA ecological receptor groups listed in reference ii) at each of the hypothetical oil spill locations discussed in references vii) and viii).

7.2 Behaviour of Diluted Bitumen in Water

Reference:

i) A3S5Q3, A3S4Y7, A3S4Y8, and A3S4Y9 Application Volume 8A, Marine Transportation
ii) A3S4Y5, Application Volume 8A, Marine Transportation, PDF pages 37 to 43 of 43
iii) A3S4Y6, Application Volume 8A, Marine Transportation, PDF pages 1 to 22 of 34
iv) Federal Government Technical Report – Properties, Composition, and Marine Spill Behaviour, Fate and Transport of Two Diluted Bitumen Products from the Canadian Oil Sands (30 November 2013) – Environment Canada website: http://www.ec.gc.ca/Publications/
v) Western Canada Marine Response Corporation news post – WCMRC website: http://wcmrc.com/news/federal-government-releases-dilbit-study/
vi) A3S5F6, Application Volume 8C Pt.2, General Risk Analysis
vii) A3S4T1, Application Volume 8C Pt. 1, Casualty Data Survey PDF page 9 of 38
viii) A3S5I9, Review of Trans Mountain Expansion Project: Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, Full Report.

Preamble: Reference i) provides a discussion of the potential environmental effects of an oil spill on various marine life and habitats.

References ii) and iii), provide a detailed description of four locations along the tanker transit route that were selected for modelling the expected behavior and impacts of spilled oil.

Reference iv) is a report by the Canadian Government on research that federal government departments have conducted regarding the potential fate and behavior of diluted bitumen spilled in water.

Reference v) is a post by the Western Canada Marine Response Corporation which recognizes the results of the Canadian Government's report on diluted bitumen in water.

Reference vi) discusses total loss scenarios and factors or incidents that can contribute to a total loss.

Reference vii) provides information on the number of world-wide total loss incidents that have occurred between the period of 2002-2011

Reference viii) provides an account of the current and recommended enhancements for oil spill response capacity in light of the Trans Mountain Expansion Project (TMEP).

Request:

a) Please confirm that the results of reference iv) were not factored into the conclusions presented in reference i).

b) Based on the results and conclusions of reference iv), please provide:

b.1) A detailed analysis of the impacts of an 8,250 m^3 spill scenario of diluted bitumen on shoreline habitats for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.2) A detailed analysis of the impacts of a credible worst-case 16,500 m^3 diluted bitumen oil spill on shoreline habitats for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.3) A detailed analysis of the impacts of a total loss scenario with a complete cargo discharge of all oils, including diluted bitumen, on shoreline habitats for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.4) A detailed analysis of the impacts of an 8,250 m^3 spill scenario of diluted bitumen on the Marine Fish Community for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.5) A detailed analysis of the impacts of a credible worst-case 16,500 m^3 diluted bitumen oil spill on the Marine Fish Community for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.6) A detailed analysis of the impacts of a total loss scenario with a complete cargo discharge of all oils, including diluted bitumen, on the Marine Fish Community for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.7) A detailed analysis of the impacts of an 8,250 m^3 spill scenario of diluted bitumen on Marine Birds for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.8) A detailed analysis of the impacts of a credible worst-case 16,500 m^3 diluted bitumen oil spill on Marine Birds for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.9) A detailed analysis of the impacts of a total loss scenario with a complete cargo discharge of all oils, including diluted bitumen, on Marine Birds for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.10) A detailed analysis of the impacts of an 8,250 m^3 spill scenario of diluted bitumen on Marine Mammals for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.11) A detailed analysis of the impacts of a credible worst-case 16,500 m^3 diluted bitumen oil spill on Marine Mammals for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.12) A detailed analysis of the impacts of a total loss scenario with a complete cargo discharge of all oils, including diluted bitumen, on Marine Mammals for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.13) A detailed analysis of the impacts of an 8,250 m^3 spill scenario of diluted bitumen on human health for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.14) A detailed analysis of the impacts of a credible worst-case 16,500 m^3 diluted bitumen oil spill on human health for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

b.15) A detailed analysis of the impacts of a total loss scenario with a complete cargo discharge of all oils, including diluted bitumen, on human health for each of the four hypothetical oil spill scenario locations (locations D, E, G, & H).

c) Please clarify whether an enhanced oil spill response model or the current oil spill response model, as outlined in reference viii), is assumed in the discussion of the potential environmental effects of an oil spill on various marine life and habitats, provided in reference i).

d) Please clarify whether an enhanced oil spill response model or the current oil spill response model, as outlined in reference viii), is assumed for each of the responses provided to requests b.1) - b.15) presented above.

8 Public Consultation

8.1 Design of Stakeholder Engagement Program - Scope

Reference: A3SOR2, Application Volume 3A, Public Consultation

i. Section 1.3.1 Engagement Project Scope – Pg. 33-34

Preamble: In this section, the reference states: "For the purpose of this application, unless otherwise stated, the feedback reported in this volume includes engagement activities conducted up until July 31, 2013. Updates to engagement initiatives that continue to occur, and will do so through the regulatory process, will be provided periodically to the NEB";

and: **"**Overall, engagement scope provides feedback on the following: determining the scope of the environmental and socio-economic assessment (ESA); identifying potential mitigation measures to reduce environmental and socio-economic effects; identifying potential benefits associated with the Project; and routing alternatives where it is not practical to follow the existing TMPL System right-of-way";

and: "Future consultation plans will include providing communities with information on pipeline integrity, safety and emergency response; a topic that has been raised in many communities"

Request: Please provide the following:

a) A copy of Trans Mountains filing schedule or timeline for filing updates to the NEB with regards to engagement Initiatives it conducts after July 31st 2013.

b) A copy of all updates that Trans Mountain has filed with the NEB with regards to engagement Initiatives it has conducted since July 31st 2013.

c) A detailed explanation of why the engagement scope was restricted to these four elements, including how each of them addresses the extensive scope and scale of the Project.

d) Confirmation that future planned engagement is restricted to the four elements described in preamble 2.

e) Please comment on why the engagement scope implicitly assumes the project will be constructed, regardless of input received.

f) A list and description of future consultation sessions planned to take place in island coastal communities, particularly those in Southern Vancouver Island.

8.2 Design of Stakeholder Engagement Program – Phased Activity

Reference: A3SOR2, Application Volume 3A, Public Consultation

i. Section 1.3.5 Phased Activities – Pg. 38

Preamble: In this section the reference states: "The stakeholder engagement program has adopted a phased approach to stakeholder engagement. Each phase has been further developed and refined in response to information gathered from the previous phase as well as identified interests and needs. The stakeholder engagement program consists of six phases, which include:

• Phase 1 Engagement - Stakeholder and issue identification, May 2012 to September 2012;

• Phase 2 Engagement - Public information and input gathering, October 2012 to January 2013;

• Phase 3 Engagement - Community conversations, February 2013 to July 2013;

• Phase 4 Engagement - Feedback to stakeholders and application filing, August 2013 to December 2013;

• Phase 5 Engagement - Regulatory process to in-service, January 2013 to in-service; and

• Phase 6 Engagement - Operational consultation.

Request: Please provide:

a) A detailed table showing how the Island Coastal Communities region was consulted at each phase of the engagement plan that has already occurred.

8.3 Community Events

Reference: A3SOR3, Application Volume 3A, Public Consultation

i. Section 1.4.1.13 Community Events – Pg. 3
ii. Section 1.4.1.14 Speaking Opportunities – Pg.4

Preamble: In reference i) Kinder Morgan provides Table 1.4.12, which identifies all community events attended by Kinder Morgan from the period April 1st 2012 to July 31st 2013

In reference ii) , Kinder Morgan provides Table 1.4.13 which identifies all speaking opportunities by Kinder Morgan from the period April 1st 2012 to July 31st 2013

Request: Please provide the following:

a) An updated list of all community events that Kinder Morgan has attended from Jul 31st 2013 to the latest available data.

b) Confirmation that Kinder Morgan has attended no community events in the Island Coastal Communities stakeholder region established in KMP Stakeholder Engagement Program, and comment on why they did not attend any events. If not confirmed please identify all events that Kinder Morgan attended.

c) A list, including date and location, of any future community events that Kinder Morgan plans to attend in the Island Coastal Community stakeholder region.

d) An updated list of all speaking opportunities that Kinder Morgan has attended from Jul 31st 2013 to the latest available data.

e) Confirmation that Kinder Morgan has attended only one speaking opportunity in the Island Coastal Communities stakeholder region, specifically the one listed in table 1.4.13 that took place on October 12th 2012, and comment on why they did not attend any other events. If not confirmed please identify all events that Kinder Morgan attended.

f) A copy of the speech given by Ian Anderson on October 12th 2012 in Victoria to the Greater Victoria Chamber of Commerce and Greater Victoria Development Agency.

g) A list, including date and location, of any future community events that Kinder Morgan plans to attend in the Island Coastal Community stakeholder region.

8.4 Stakeholder Engagement Activities – Phase 2 Engagement

Reference: A3SOR3, Application Volume 3A, Public Consultation

i. Table 1.5.2 Phase 2 – Open House and Online Engagement Notification Advertising Plan – Pg. 13
ii. Table 1.5.3 Public Open Houses – Locations and Dates – Pg.18

iii. Section 1.5.2.5 Session Dates and Attendance – pg.17
iv. Section 1.5.2.11 Follow-up Newspaper Ads – Pg.23
v. Table 1.5.8 Phase 2 – Thank you Advertisement Placement – pg.23
vi. Section 1.5.2.13 Engagement on Environmental Issues – Pg.25

Preamble: Reference i) contains a list of all the publications that were used as part of the government's Phase 2 newspaper advertising as identified in section 1.5.22, and listed in table 1.5.2.

Reference ii) contains a list of all the public open houses, including location, date and attendance that were part of Phase 2 consultation as identified in section 1.5.25, and listed in table 1.5.3.

Reference iii) states "Trans Mountain chose open house locations based on communities that would be directly affected by the Project as well as feedback. Locations were also determined as a result of initial Trans Mountain Pipeline (ULC) feedback gathered during the introductory meetings conducted with community stakeholders in Phase 1. Table 1.5.3 provides information on the session dates and attendees. Figure 1.5.3 provides an image taken at the Edson Open House on October 16, 2012.

Reference iv) states "Following each open house, Trans Mountain placed an advertisement in local newspapers in communities where the open houses occurred. The advertisement focused on thanking the public for their participation and reminded stakeholders of opportunities to provide feedback online. In addition one of the objectives of the thank you ad was to reach stakeholders that might not have been able to attend or were not aware. It was anticipated that the ad would encourage people to provide their feedback online."

Reference v) contains a list of all the publications that were used as part of the government's Phase 2 "Thank you Advertisement Placement" as listed in table 1.5.8.

Reference vi) states "Research and early conversations guided the scope of engagement with stakeholders on environmental issues in different ways, based on the level of control and responsibility Trans Mountain has over each issue."

Request: Please provide the following:

a) Confirm that the list of print publications contained in Table 1.5.2 are the complete list used for advertising phase 2 engagements. If not confirmed please provide an updated table with the additional print publications clearly identified.

b) Confirm that the Island Tides, Bowen Island Undercurrent, and the Nanaimo News Bulletin are the only print publications that were used as print advertisement as part of Kinder Morgan's phase 2 engagement, that are based in the Island coastal community stakeholder region. If not confirmed please identify which other publications were used in the island coastal stakeholder region, its circulation, and the insertion dates for print ads.

c) Confirm that the dates listed in Table 1.5.2 as insertion dates are the actual dates that the ads were placed

d) Confirm that the term "insertion dates" as used in table 1.5.2 refers to a specific date that a print ad appeared in the associated paper, and ads only appeared in the paper for the specific date identified. If not confirmed please provide an updated table with all the dates that an ad appeared in each paper.

e) Confirm that the only dates a print advertisement appeared in the Island Tides was on November 29th 2012 and December 13th 2012, and that the only time a print advertisement appeared in the Nanaimo News Bulletin was on November 24th 2012 and December 1st 2012.

f) The estimated population included within Kinder Morgan's Island Coastal Communities Stakeholder region, restricted to Canadian territory

g) Any information and/or assessment related to how Kinder Morgan identified which newspapers would be used as part of the Phase 2 newspaper advertisement.

h) A copy of all feedback related to the identification of public open house locations that took place in the Island Coastal Region, and a list of all the names of stakeholders consulted in the Island Coastal Region, including professional title where applicable.

i) A copy of the ads that were placed in the Island Tides on November 29th 2012 and December 13th 2012, a copy of the ads placed in the Bowen Island Undercurrent on November 2nd 2012 and November 9th 2012, and a copy of the ads placed in the Nanaimo News Bulletin on November 24th 2012 and December 1st 2012.

j) Confirm that there was no print ads advertising the Sooke public open house that were inserted in papers located in the island coastal community region, since the one that appeared in Island Tides on December 13th 2012.

k) A list of all advertisements that specifically advertised the Sooke open public open house that took place on January 11th 2013, including the publication and insertion date.

l) A copy of all feedback forms that were completed, both hard copy and digital, for the Public Open Houses in Greater Victoria, Saanich Penisula, Sooke and Saltspring Island.

m) Comment on why the publications identified in table 1.5.8 Phase 2- Thank You Advertisement Placement, differ from those listed in Table 1.5.3 Public Open Houses – Locations and Dates.

n) Comment why Saanich news was not a publication included in the Open House and Online Engagement Notification Advertising Plan which gave notice of the Public Open Houses, but was included as a publication used for the Thank You Advertisement Placement.

o) Comment as to whether Kinder Morgan feels they gave adequate notice of hearings in the Island Coastal Community region, making specific reference to the Open House and Online Engagement Notification Advertising Plan.

p) A list of all research that was used to guide "the scope of engagement with stakeholders" as identified in reference iv).

q) Expand on what is meant by "early conversations" that guided the scope of engagement as identified in reference iv), identifying who these conversations occurred with if possible.

8.5 Stakeholder Engagement Activities – Phase 3 Engagement

Reference: A3SOR3, Application Volume 3A, Public Consultation

i. Section 1.5.3.1 Environmental and Socio-economic Assessment Workshops – Pg.29

ii. Section 1.5.3.9 Other Marin Engagement – Pg.36

A3SOR3, Application Volume 3A, Public Consultation and A3SOR4, Application Volume 3A, Public Consultation – Pg.37

iii. Table 1.5.17 Community Workshops

Preamble: Reference i) provides a list of where regional Environmental and Socio-economic Assessment workshops were located during Phase 3 of the engagement.

Reference ii) states "Engagement with stakeholder groups is continuous, with focused discussions based on prior identified concerns and interests. Examples include:" and proceeds to provide a list of examples.

Reference iii) provides a list of community workshops that took place during the Phase 3 engagement.

Request: Please provide the following:

a) An explanation of how Kinder Morgan determined where the ESA workshops would be held.

b) The parameters by which Kinder Morgan qualifies an individual as a "subject matter expert".

c) The parameters by which Kinder Morgan qualifies people as "stakeholders and environmental subject matter experts from pipeline communities;"

d) The parameters by which Kinder Morgan qualifies people as local subject matter experts (universities/colleges, etc.).

e) Confirm that the Regional Marine ESA workshops held in North Vancouver on May 22nd 2013 and Langford on May 23rd 2013 did not have any members who qualified as local subject matter experts (universities/colleges, etc.), and why this was the case. If not confirmed provide a list of those who were in attendance.

f) A list of all local subject matter experts (universities/colleges, etc.) who were contacted to take part in the Regional Marine ESA workshops.

g) Confirm that the Regional Marine ESA held in Langford, BC did not contain any representatives who qualify as local subject matter experts (universities/colleges, etc.) from the University of Victoria, and why this was the case. If not confirmed provide a list of those who were in attendance.

h) A list of all local subject matter experts (universities/colleges, etc.) who were contacted to take part in the Regional Marine ESA workshop that took place in Langford, BC on May 23rd 2013. If not confirmed provide a list of those who were in attendance.

i) A list of all local subject matter experts (universities/colleges, etc.) based in British Columbia who were invited to participate in an ESA workshop.

j) Examples of how local subject matter experts (universities/colleges, etc.) were engaged as part of the "Other Marine Engagement" alluded to in Reference ii).

k) Confirm that no Community Workshops identified in Table 1.5.17 (Reference iii) took place in the Island Coastal communities region, and provide reasons why this was the case. If not confirmed provide an updated list of community workshops that includes island coastal community workshops.

8.6 Stakeholder Engagement Activities – Phase 4 Engagement

Reference: A3SOR4, Application Volume 3A, Public Consultation
i. Section 1.5.4 Phase 4 Engagement: Feedback to Stakeholders and Application Filing (August to December 2013) – Pg. 41

Preamble: Section 1.5.4 outlines Kinder Morgan's plans for Phase 4 of their engagement strategy

Request: Please provide the following:

a) Confirm that Phase 4 engagement had not begun at the time this section was finalized for application filing. If not confirmed clarify why Phase 4 lacks the detail of previous sections.

b) An update as to what occurred during Phase 4 Engagement activities, in similar detail as that provided in this application for Phase 1-3.

8.7 Stakeholder Engagement Activities – Phase 5 Engagement

Reference: A3SOR4, Application Volume 3A, Public Consultation
i. Section 1.5.5 Phase 4 Engagement: Ongoing Engagement during Regulatory Process through to In Service (January 2014 – In Service) – Pg. 43

Preamble: Section 1.5.4 outlines Kinder Morgan's plans for Phase 4 of their engagement strategy

Request: Please provide the following:

a) Confirm that Phase 5 engagement had not begun at the time this section was finalized for application filing. If not confirmed clarify why Phase 5 lacks the detail of previous sections.

b) An update as to what has occurred during Phase 5 Engagement activities, in similar detail as that provided in this application for Phase 1-3, including any planned future engagement opportunities.

9 Ecological Risk Assessment of Marine Transportation Spills

Reference: A3S4K7, Application Volume 8B, Ecological Risk Assessment of Marine Transportation Spills

i. Executive Summary, pg.2
ii. 1.2 Context of this Preliminary Quantitative Ecological Risk Assessment, pg.17
iii. 3.5 Risk Characterization, pg.22
iv. 4.3 Spatial Boundaries of the PQERA, pg. 26
v. 4.4 Summary of Hypothetical Oil Spill Scenarios , pg. 28
vi. 4.5 Selection of Representative Hydrocarbons, pg. 32
vii. 5.0 Exposure and Hazard/Effects Assessment, pg.51

Preamble: Reference i) states "This document is a Preliminary Quantitative Ecological Risk Assessment (PQERA) Technical Report prepared as supporting information for the Section 52 Application for the Trans Mountain Expansion Project (referred to as "TMEP" or "the Project").

Reference i) also states "Cold Lake Winter Blend (CLWB) was identified as a representative diluted bitumen for this purpose."

Reference ii) states "This Preliminary Quantitative Ecological Risk Assessment (PQERA) is intended to evaluate and report on the range of environmental effects from hypothetical spills which could potentially occur as a result of spills during marine transportation along the shipping lanes. The nature of the hypothetical spills (location and release volume) evaluated is based on the hazards and risks identified along the sailing route by Det Norske Veritas (DNV 2013) – General Risk Analysis and Intended methods of Reducing Ricks – TERMPOL Report, Volume 8C). The results of the assessment are based on oil spill fate and transport modelling completed by EBA Engineering Consultants Ltd. (EBA 2013) Modeling the Fate and Behaviour of Marine Oil Spills for the Trans Mountain Expansion Project – TERMPOL Report, Volume 8C). The oil spill scenarios presented here consider both credible worst case (CWC) spills and

smaller spills, as well as season-specific behaviour, weather, marine conditions and trajectories.

Reference iii) states: ". The potential negative effects of crude oil exposure are evaluated for four main ecological receptor group/habitat combinations including: shoreline and near shore habitats; marine mammals and supporting habitat; marine birds and supporting habitat; and marine fish and supporting habitat."

Reference iv) states: Spatial boundaries for evaluating the environmental effects of spills originating from marine transportation accidents include the geographic domain where potential environmental effects of spilled crude oil are expected to be measurable i.e., the modelling domain for the stochastic oil spill model. The areas considered in the PQERA are identified as follows…"

Reference v) states: "Nine original locations were reduced to five in a prioritization process which included experts in navigation, oil spill response, environmental effects and socioeconomics."

Reference v) also states: "A total of eight (8) hypothetical spill scenarios were modelled by EBA."

Reference vi) states: "In addition, the diluent in CLWB is condensate (a light hydrocarbon mixture derived from natural gas liquids). As such the CLWB was considered to be a conservative choice for the ecological and human health risk assessments as the volatile and relatively water-soluble hydrocarbons associated with the condensate would present a higher level of risk due to inhalation of volatiles or exposure to dissolved hydrocarbons than would synthetic oil, which is also used as a diluent, but contains fewer volatile and less water soluble constituents."

Reference vii) states: ". The specific methods used here are modified slightly, chiefly to reflect differences in the availability and format of data"

Request: Please provide:

a) An outline of the process that will follow for the Ecological Risk Assessment of Marine Transportation Spills reporting, including confirmation that this preliminary report will be followed by interim and/or a final report, and a timeline for these reports to be made available, including a copy of any subsequent reports filed since this application. If not confirmed, please comment on why no subsequent report on this topic will be completed.

b) The quantity of "Cold Lake Winter Blend (CLWB)" that is currently transported on the existing Trans Mountain Pipeline and the amount projected to be transported if the expansion were to take place.

c) A list of all oil products to be moved on Kinder Morgan's Trans Mountain Pipeline, including their respective chemical properties and the quantity (as a percentage of the total) that is transported on the Trans Mountain Pipeline, as well as the quantity (as a percentage of the total) that is anticipated, were the expansion project to be built.

d) Confirmation that all studies mentioned in Reference ii) have been validated as containing information that is applicable to the marine shipping route in BC, and comment on how each one is applicable. If not confirmed for any or all reports, please comment on why this report was used to support the context of the Ecological Risk Assessment of Marine Transportation.

e) Clarification of what specifically is meant by "supporting habitat" for each of the four main ecological receptor group/habitat combinations listed in Reference iii)

f) Confirmation that the use of only these 4 main ecological receptor group/habitat combinations is consistent to industry best practice, citing examples of their use in comparable projects. If not confirmed, explain the decision to either omit additional receptors, or restrict the ecological receptors to these four combinations.

g) Confirmation that Kinder Morgan received no advice from Subject Matter experts as to the need to include additional ecological receptor group/habitat combinations.

h) Confirmation that the Spatial Boundaries laid out in Reference iv), include the potential of submerged bitumen, and take that into account when establishing the oil spill footprint and regional study area.

i) Identification of the nine original locations cited in Reference v), and provide further details as to how the prioritization process worked, including what factors ruled out 4 of the original 9 from further consideration.

j) Confirmation that each of the 8 hypothetical spill scenarios that were modelled by the EBA received a separate model for each of the seasons, rather than any form averaging. If not confirmed please provide an academic analysis that justifies the use of averaging to provide a seasonally accurate portrayal of the conditions under which oil might spill.

k) If not confirmed comment on why the CLWB was "identified as a representative diluted bitumen", including an exhaustive list of the similarities and differences to the product that is transported, or is projected to be transported on the Trans Mountain Pipeline.

l) Commentary as to the risk of CLWB becoming submerged when it interacts with particulate matter, compared to other diluted bitumen options, relative to the assessment done in choosing it as the "representative diluted bitumen to be used in this report.

m) Details as to what methods were modified, and specifically what evidence, cited in Reference vii), was unavailable.

10 Risk of an Oil Spill

10.1 Global Oil Tanker Incident Frequency

Reference:
i) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 289.
ii) A3S4T1, TERMPOL 3.8, Casualty Data Survey, PDF pages 5-18.
iii) A3S4Z2, Application Volume 8A, Marine Transportation, Appendix B

Preamble: Reference i) states that: "based on the available data, DNV shows that the worldwide incident frequency involving oil tankers is among the lowest of all marine vessels for the period 2002 to 2011…"

Reference ii) gives the corresponding analysis that reference i) is based on.

Reference iii) provides a list of Marine vessel types that are present along the British Columbia coast.

Request: a) Please confirm that the conclusion made in reference i) is based on the data provided in reference ii). In case other data provided in the Application is used to support this conclusion, please identify and source this data.

a.1) Please provide a comprehensive list of marine vessel types for which global incident frequency data is available including those identified in reference iii)

a.2) Please confirm if, when developing the conclusion in reference i), DNV analyzed global incident frequency data for any marine vessel types other than the four listed in Figure 4-1 of reference ii), namely "LNG-LPG Tanker", "Chemical Tanker", "Oil Tanker", "Bulk Carrier". If so, please list

all types of vessels for which this analysis was done and provide the corresponding analysis.

a.3) Please provide a justification for any instance where incident frequency data was available for a marine vessel type but was not incorporated into DNV's analysis in reference ii).

a.4) Please provide the same analysis as was provided in Figures 4-1 and 4-2 of reference ii) for any marine vessel types for which global incident frequency data is available and that was excluded from DNV's analysis. Please include with this analysis corresponding Figures analogous to Figures 4-1 and 4-2 of reference ii) as well as a corresponding data table that breaks down the data according to "total loss", "serious" and "not serious" incidents for each vessel type for each given year.

b) Please confirm that the average number of annual worldwide total loss incidents per 1000 shipyears for the oil, gas, and chemical tankers and bulk carriers for 2002-2011 is 1.06, as is derived from data in Figure 3-1 in reference ii).

c) Please confirm that the average number of total loss incidents for oil tankers per 1000 shipyears for 2002-2011 is 1.1, as is provided for in Figure 4-1 in reference ii).

d) Please confirm that the annual total loss incident frequency of 1.1 incidents per 1000 shipyears for oil tankers is a higher rate than the annual total loss incident frequency of 1.06 incidents per 1000 shipyears for oil, gas and chemical tankers and bulk carriers, taken collectively, as provided in Figures 301 and 4-1 in reference ii).

e) Please provide a data table with the exact corresponding numerical values for each incident frequency represented in Figure 4-2 in reference ii), including the corresponding numerical values for "total loss", "serious" and "not serious" incident frequencies for each vessel type for each given year.

f) Please identify how many shipyears would be equivalent to one year of operations of the fully-completed Kinder Morgan Expansion Project with the expected 408 tankers departing Westridge Marine Terminal annually.

g) Please confirm that according to the data in table 4-1 in reference ii), oil tankers averaged the second highest number of "total loss" and "not serious" incidents for the four vessel types given over the period.

h) In light of the answers to the questions above, please provide a detailed justification for how the conclusion given in reference i) is supported by the data provided in reference ii). In case additional data was used to support the conclusion give in reference i), please provide it.

10.2 West Coast Oil Tanker Incident Frequency

Reference: i) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 291.
ii) A3S4T1, TERMPOL 3.8, Casualty Data Survey, PDF page 24.
iii) A3S4T1, TERMPOL 3.8, Casualty Data Survey, PDF page 19-28.

Preamble: Reference i) concludes that: "The low number of incidents involving oil tankers on the West Coast may suggest the current scheme to manage navigation and marine traffic on the West Coast is effective."

Reference ii) states that: "There is no traffic density data correlated to the TSB data so it is not possible to derive incident frequencies based in terms of number of ship years or sailed nautical miles."

Reference iii) gives the corresponding analysis that reference i) is based on.

Request: a) Please confirm that the conclusion made in reference i) is based on the data provided in reference iii). In case other data provided in the Application is used to support this conclusion, please identify and source this data.

b) In light of reference ii) and the information provided in Table 5-1 of reference iii), please confirm if the conclusion made in reference i) is supported by data on oil tanker incident frequencies that compares the number of tanker incidents to the number of annual transits. If yes, please provide the oil tanker incident frequency data that supports the conclusion made in reference i).

b.1) If no, please confirm that without incident frequency data relating the number of tanker incidents to the number of annual transits, DNV cannot assess whether the number of tanker incidents on British Columbia's coast is in fact a relatively high or low value.

b.2) If the position is that DNV can make this assessment without incident frequency data, please explain how.

10.3 Tanker Incident and Oil Spill Accident Frequencies

Reference: i) A3S4T1, TERMPOL 3.8, Casualty Data Survey, Full Report

Preamble: Reference i) provides the casualty data survey performed as a part of the TERMPOL review process. Most of the data is provided for the period 2002 to 2011, with some variations. Section 8 of the report concludes that: "The casualty data survey shows that there has been a decline in the number of incidents both internationally and in Canadian waters for 2002 – 2011." (PDF page 36)

Request: a) Please provide a justification for choosing the period 2002-2011 when providing the data in sections 1 through 5.3.

b) Please explain the reason for extending the chosen data period back to 1993, for Table 5-1.

c) Wherever possible, please provide corresponding data for all figures and tables in TERMPOL 3.8, dating from 1993 to 2013. Please graph this data in bar charts and include a trend line, including significance intervals, for each chart that represents the number or frequency of a given incident over time.

d) Please provide a trend line, including significance intervals, for the data given in Figures 3-1 and 3-2 for the period 2002-2011.

e) Please provide a trend line, including significance intervals, for the data given in Figures 3-1 and 3-2 for the period 2002-2010.

f) Please plot the data provided in Figure 4-2 on "total loss" incidents in a separate bar chart and include a trend line with significance intervals.

g) Please plot the data provided in Figure 4-2 on "serious" incidents in a separate bar chart and include a trend line with significance intervals.

h) Please confirm that the most significant drop in incident frequency for each type of marine vessel in Figure 4-2 is accounted for in the decline of "not serious" incidents.

i) Please confirm that DNV believes 'not serious' incidents are underreported, as stated in the following quote on PDF page 14: "DNV believes that the reason for that the number of 'not serious incidents' is lower than the number of 'serious incidents' is that the 'not serious incidents' are underreported in the database."

j) Given the responses to requests i) and j) of this section, please confirm that if there is in fact a decline in the number of tanker incidents internationally, that this decline could simply be the result of a lower reporting rate for "not serious" incidents and not a reflection of an actual decline in the incident rate. If not, why not?

k) Please confirm that according to Figure 5-2, the number of tanker incidents in Canadian waters remains constant at 11, and hence tankers do not account for any of the decline in shipping incidents in Canadian waters that is represented in Figure 5-1.

l) Please provide a trend line, including significance intervals, for the data given in Figures 5-7 for the period 2001-2009.

m) Please provide a trend line, including significance intervals, for the data given in Figures 5-7 for the period 2001-2008.

10.4 Underkeel Clearance and Manoeuverability of TMEP Tankers

Reference: i) A3S4S8, TERMPOL 3.6, Special Underkeel Clearance Survey, Full Report.

ii) A3S4S8, TERMPOL 3.6, Special Underkeel Clearance Survey, PDF page 6.
iii) A3S4S8, TERMPOL 3.6, Special Underkeel Clearance Survey, PDF page 16.
iv) A3S4S8, TERMPOL 3.6, Special Underkeel Clearance Survey, PDF page 15.
v) A3S4T7, TERMPOL 3.5 & 3.12, Route Analysis & Anchorage Elements, Full Report
vi) A3S5F6, TERMPOL 3.15, General Risk Analysis and Intended Methods of Reducing Risks, Full Report.

Preamble: Reference i) provides a survey of how a laden Aframax oil tanker could meet Port Metro Vancouver's underkeel clearance requirements. According to the report, "The maximum immersed depth (i.e., draught) for vessels transiting the Second Narrows is limited by [Port Metro Vancouver's Movement Restricted Area] rules to 13.5 m…The limiting depth in First Narrows is 15.2m at low tide." The report identifies the Trans Mountain Expansion Project's intention to use a maximum draught of 13.0m, although conditions are provided within which a tanker could be filled to the maximum draught of 13.5m.

Reference ii) notes that: "The actual draught can vary from the nominal draught due to such effects as vessel squat or wave action. Similarly, the seabed elevation in a channel dredged to a specific nominal depth can vary somewhat due to dredging tolerances and survey accuracy."

Reference iii) notes that: "As vessels enter into shallower water with less underkeel clearance, they become more difficult to manoeuvre due to the effects of increased current drag forces, vessel squat, etc."

Reference iv) notes that: "Apart from intermittent notations on the hydrographic charts indicating the nature of the seabed (eg, rock, mud, etc.) in specific locations, we are not aware of any comprehensive public sources of data that provide for a systematic description of the seabed along the entire vessel route."

Reference v) provides an analysis of the tanker route from Westridge Marine Terminal to Bouy J. The report states that: "One of the main issues in transiting and clearing the First Narrows is interference caused by small pleasure craft fishing at the mouth of the Capilano River. A large ocean going vessel has limited manoeuvring room and has few options once committed to the transit, other than slowing down, the vessel is required to maintain course." (PDF page 13).

Reference vi) provides an analysis of the risk of a tanker incident and oil spill incident. Appendix 1 provides a description of the MARCS model that is used to analyze this risk.

Request: a) Please confirm that the total underkeel clearance of a laden tanker transiting First Narrows could be as little 2.2m under a 13.0m draught scenario, as outlined in reference i).

b) Please confirm that the total underkeel clearance of a laden tanker transiting First Narrows could be as little 1.7m under a 13.5m draught scenario, as outlined in reference i).

c) In light of reference ii), please confirm if it is possible that the actual draught in a 13.5m nominal draught scenario could be significantly more, thereby decreasing the total underkeel clearance of a laden tanker transiting First Narrows to less than 1.7m.

c.1) If yes, please provide the maximum range of the variability between actual and nominal draught that could occur in this scenario and the accompanying analysis.

c.2) If no, please explain why not.

d) Please confirm that once the new maximum draught regulations of 13.5m are fully implemented, as reported in reference i), that it will be up to the discretion of shipping companies whether they adhere to a 13.5m or the 13.0m maximum draught? If not, why not?

e) In light of reference iv), please confirm if a comprehensive source of data exists that provides a systematic description of the seabed, including any and all potential obstacles, from Westridge Marine Terminal through to English Bay. Please identify and describe any gaps in the existing public data sources.

e.1) Please provide an exhaustive account of how this data was incorporated into the MARCS model used in reference vi)

f) In light of references iii), iv) and v) please provide an analysis of a laden Aframax tanker's scope manoeuverability, including turning and stopping, to accommodate unexpected obstacles, including other vessels, when passing through First and Second Narrows at low tide with minimum underkeel clearance of 1.7m.

f.1) Please provide an exhaustive account of how each of the factors described in references iii), iv) and v) and the analysis provided in response to request f) of this section, were incorporated into the MARCS model used in reference vi). Please include a sensitivity analysis of the MARCS model with respect to the uncertainty of each of these factors and an exhaustive account of how the inputs applied in the MARCS for these factors have been validated for the area from Westridge Marine Terminal through to English Bay.

g) In light of reference iv), please confirm if a comprehensive source of data exists that provides a systematic description of the seabed, including any and all

potential obstacles, for segment 5 of the proposed vessel route, as shown in Figure 2-6 of reference v). Please identify and describe any gaps in the existing public data sources.

g.1) Please provide an exhaustive account of how this data was incorporated into the MARCS model used in reference vi)

h) In light of references iii), iv) and v) please provide an exhaustive analysis of an Aframax tanker's scope maneuverability, including turning and stopping, to accommodate unexpected obstacles, including other vessels, when passing through segment 5 of the proposed vessel route, as shown in Figure 2-6 of reference v).

h.1) Please provide an exhaustive account of how each of the factors described in references iii), iv) and v) and the analysis provided in response to request h) of this section, were incorporated into the MARCS model used in reference vi) for segment 5 of the proposed vessel route, as shown in Figure 2-6 of reference v). Please include a sensitivity analysis of the MARCS model with respect to the uncertainty of each of these factors and an exhaustive account of how the inputs applied in the MARCS for these factors have been validated for the given location.

i) Please elaborate on section 3 of reference v) (PDF page 23) to provide a detailed and comprehensive description of any and all key geographic and geological factors along the tanker route that could contribute to a tanker incident or spill. Please also identify any gaps in existing public sources of data pertaining to geographic and geological factors along the tanker route.

j) Please provide an annotated breakdown of all environmental data used in the MARCS model to account for geographical features along the Trans Mountain tanker sailing route, as described on PDF page 77 in reference vi). Please include a sensitivity analysis of the MARCS model with respect to the uncertainty of this data.

10.5 Risk Analysis for Tanker Incidents and Oil Spill Accidents

Reference:

i) A3S5F4, TERMPOL 3.15, General Risk Analysis and Intended Methods of Reducing Risks, Full Report.
ii) A3S5F6, TERMPOL 3.15, General Risk Analysis and Intended Methods of Reducing Risks, Full Report.
iii) A3S5F6, TERMPOL 3.15, General Risk Analysis and Intended Methods of Reducing Risks, PDF page 17.
iv) A3S4S8, TERMPOL 3.6, Special Underkeel Clearance Survey, PDF page 15.
v) A3S5F8, TERMPOL 3.15, General Risk Analysis and Intended Methods of

Reducing Risks, Full Report.

Preamble: References i), ii) and v) provide the general risk analysis of a marine incident, including an oil spill under various conditions. The report also offers methods for reducing risks and calculates the projected impact such measures would have on the overall risk assessment. It offers a description of the MARCS model used to calculate the risk assessments and the parameters and inputs used by this model.

Reference iii) identifies the four factors used in MARCS to estimate the probability that an incident leads to an oil spill accident. The following criteria are quoted: " [1] Ship Structure, whether it is a single or double hull (all Trans Mountain tankers are double hull). / [2] The probability of grounding on rocky shore versus soft bottom shore. This probability distribution is equal to the presence of distribution of rocky shoreline versus soft bottom shoreline as shown in Figure 13), grounding on rocks will increase the likelihood of a loss of containment. / [3] Wave and wind affects the probability that a grounding incidents leads to an oil spill. Wave height also affects the probability for a structural failure leading to foundering. / [4] In case of collision, the momentum of a colliding ship affects whether the incident becomes an oil spill accident."

Reference iv) notes that: "Apart from intermitted notations on the hydrographic charts indicating the nature of the seabed (eg, rock, mud, etc.) in specific locations, we are not aware of any comprehensive public sources of data that provide for a systematic description of the seabed along the entire vessel route."

Reference v) includes "Appendix 4: Effectiveness of Risk Reduction Options" in which DNV provides an account of the risk reduction inputs they used in the MARCS model.

Request: a) Please confirm that Appendix 2 in reference ii) offers the full and comprehensive list of hazards identified through the HAZID workshop, as described in Section 4 of reference i) (PDF page 36). If no, please provide a list of any other hazards identified in the process that are not included in Appendix 2.

b) Please confirm if any of the hazards listed in Appendix 2 and in response to request a) were directly incorporated into the MARCS model.

b.1) If yes, please provide a detailed point-by-point list of each individual hazard that was incorporated into the MARCS model, along with a comprehensive account of how each hazard was factored into the model. Please include any calculations or weighting that was used for each individual hazard and the accompanying analysis that was conducted to support this given input. Please clearly identify if and how each individual hazard was validated specifically for Trans Mountain

tanker sailing route and provide a sensitivity analysis of the MARCS model with respect to the uncertainty of each hazard input.

c) For those hazards that were listed in request a) but not in request b.1) of this section, please provide a detailed and comprehensive account of how the MARCS model already factored in each individual hazard or a justification for not including each individual hazard. For those hazards already factored into the model, please include any calculations or weightings used for each hazard as well as the accompanying analysis. Please clearly identify if and how each individual hazard was validated specifically for the Trans Mountain tanker sailing route and provide a sensitivity analysis of the MARCS model with respect to the uncertainty of each hazard input.

d) According to PDF page 3 of reference ii), the MARCS analysis assumes all tankers are Aframax size. Please identify any and all other classes of oil tanker that could service Westridge Marine Terminal.

d.1) Please provide a description of how inputting the given parameters of each of the tankers listed in response to request e) would likely impact the outcome of the risk analysis, including whether, how and why it would increase or decrease the likelihood of a spill.

e) On PDF page 11 of reference ii) the report states that: “DNV is unaware of a grounding incident which has occurred with a tethered tug in attendance, so a reduction factor of 100 times reduction is applied to the mechanical failure rate of tethered tankers.” Please provide any and all analysis and model validation that was done when determining a reduction factor of 100 times for the mechanical failure rate for tethered tankers.

e.1) Please confirm if the 100-time risk reduction factor has been validated for the Trans Mountain tanker sailing route. If yes, please provide this validation. If no, please explain why not.

e.2) Please provide a sensitivity analysis of the MARCS model with respect to the uncertainty of the 100-time reduction factor for the mechanical failure rate of tethered tankers.

f) On PDF page 11 of reference ii) the report states that: “A tethered escort tug may also respond to prevent a powered grounding incident. In previous work, DNV has assessed the benefit of this as a reduction by a factor of 2.” Please provide any and all analysis and model validation that was done when determining a reduction factor of 2 times for the powered grounding incident rate for tethered tankers.

f.1) Please confirm if the 2-time risk reduction factor has been validated for the Trans Mountain tanker sailing route. If yes, please provide this validation. If no, please explain why not.

f.2) Please provide a sensitivity analysis of the MARCS model with respect to the uncertainty of the 2-time reduction factor for the powered grounding incident rate of tethered tankers.

g) In section 2.3 of Appendix 4 in reference v), the report states that: “Base case parameters were derived mainly from work in the North Sea (for incident probabilities) and from worldwide oil spill incident data (for oil spill event tree parameters). DNV believes that because shipping is a predominantly international business, parameters derived from the North Sea are applicable worldwide. This assumption has been made for many of our international navigational risk assessments.” Please provide the following:

g.1) A sensitivity analysis of the MARCS model risk analysis with respect to uncertainty in its parameters in general.

g.2) A sensitivity analysis of the MARCS model risk analysis with respect to uncertainty in its parameters for the Trans Mountain tanker sailing route.

g.3) A probability distribution function of risk in the MARCS model risk analysis.

g.4) A comprehensive error analysis of the MARCS model including calculation of a probability density function of the overall cumulative risk.

g.5) An account of how the MARCS model has been validated for the Trans Mountain tanker sailing route.

h) In section 3 of Appendix 4 in reference v), the report states that: “As discussed in Section 2.3 above, the basic parameters in MARCS represent North Sea average shipping operations in the mid to late 1990s.” Please provide an exhaustive account of how the MARCS model has been updated to represent current and local shipping operations in British Columbia since 2010, including the process of validating the model for these conditions.

i) Section 3.1 of Appendix 4 in reference v) provides an account of the studies that inform the risk reduction factor used in the MARCS model for Vessel Traffic Service (VTS). Given the large discrepancy in risk reduction factors associated with VTS globally, please provide:

i.1) An account of how the assumed Performance Shaping Measure (PSF) of 0.8 (equivalent to a reduction of 20% in groundings and collisions) applied to the MARCS model has been validated for the Trans Mountain tanker sailing route.

i.2) A sensitivity analysis of the MARCS model with respect to the uncertainty in the PSF applied to VTS.

j) Section 3.2.2 of Appendix 4 in reference v) provides an account of the studies that inform the PSF and risk reduction factor used in the MARCS model for pilotage. Given the large discrepancy in risk reduction factors associated with pilotage globally, please provide:

j.1) An account of how the PSFs and corresponding risk reductions applied to the MARCS model for pilotage have been validated for the Trans Mountain tanker sailing route.

i.2) A sensitivity analysis of the MARCS model with respect to the uncertainty in the PSF applied to pilotage.

k) In section 3.2.3 of Appendix 4 in reference v) the report states that: “When the discussion in Sections 3.1 and 3.2 were first compared it was noticed that the analysis predicted that VTS is a more effective risk reduction option than the presence of a pilot on the bridge. This observation is inconsistent with the parameters in MARCS derived from SAFECO. It is also inconsistent with the expert judgement of 2 ex-navigating officers employed by DNV. Taking into account all available evidence, DNV has made the decision to favour the MARCS parameters, and these have been further amended to represent all important influences as described above.” Please provide the following:

k.1) An exhaustive description of any and all amendments that were made to the MARCS model or the PSFs of the risk reduction options referred to in request k) of this section in response to the inconsistency mentioned in request k) of this section.

k.2) All analyses that were done as a result of noting the inconsistency identified in request k) of this section, to ensure that the MARCS model itself was not inaccurate.

k.3) An account of how the MARCS model has been validated for the Trans Mountain tanker sailing route after addressing the inconsistency described in request k) of this section.

k.4) A sensitivity analysis of the MARCS model with respect to the uncertainty that stems from both the inconsistency and the corresponding amendments described in request k) of this section.

l) In section 3.2.3 of Appendix 4 in reference v) the report states that: “In the absence of any data, it is provisionally assumed that a PPU will improve the pilot’s human error performance with respect to powered groundings by a further 10%.” Please provide:

l.1) A sensitivity analysis of the MARCS model with respect to the uncertainty of this risk reduction input, given the “absence of data” surrounding the impact of a PPU on human error performance.

l.2) An account of how the PSF applied in the MARCS model for PPUs has been validated for the Trans Mountain tanker sailing route.

m) Please confirm that all aframax tankers servicing Westridge Marine Terminal are equipped with functioning Differential Global Position Systems (DGPS). If no, please provide an estimated percentage of tankers servicing Westridge Marine Terminal that are equipped with DGPS.

n) In section 3.3.2.2 of Appendix 4 in reference v), the report states that: "…there are no known studies that provide a comparison between incident rates with DGPS, stand-alone GPS and conventional (non-GPS) navigation." The report then goes on to state in the same section that "in the absence of a direct estimate of the benefits" of DGPS, a risk reduction of 8.4% is "very uncertain, and so it is rounded to 8%." Please provide:

n.1) A sensitivity analysis of the MARCS model with respect to the uncertainty of the DGPS PSF, in light of the "very uncertain" data and absence of any known studies that provide a comparison between incident rates with DGPS and conventional navigation.

n.2) An account of how the PSF applied in the MARCS model for DGPS has been validated for the Trans Mountain tanker sailing route.

o) In section 3.3.3.2 of Appendix 4 in reference v), the report states that: "In the absence of any useful data, it is judged that use of AIS AtoNs in addition to AIS coverage in an area may reduce the powered grounding frequency on ships with AIS receivers by 5%." Please provide:

o.1) A sensitivity analysis of the MARCS model with respect to the uncertainty of this PSF applied for AIS receivers, given the "absence of data" described in the section.

o.2) An account of how the PSF applied in the MARCS model for AIS receivers has been validated for the Trans Mountain tanker sailing route.

p) Section 3.3.4.2 of Appendix 4 in reference v) provides an account of the studies that inform the PSF and risk reduction factor used in the MARCS model for the effects of Electronic Chart Display and Information Systems (ECDIS). Given the large discrepancy in risk reduction factors associated with ECDIS, please provide:

p.1) An account of how the PSFs and corresponding risk reductions applied to the MARCS model for ECDIS have been validated for the Trans Mountain tanker sailing route.

p.2) A sensitivity analysis of the MARCS model with respect to the uncertainty in the PSF applied to ECDIS.

q) When quantifying the effects of improving conventional Aids to Navigation (AtoN) in section 3.3.5 of Appendix 4 in reference v) the report states that: “There is no obvious baseline (i.e. risk without AtoN) that could be used for comparison…[I]n the absence of a direct estimate of the benefits, [a reduction of 6.4%] is very uncertain, so it is rounded to 6%.” Please provide:

q.1) A sensitivity analysis of the MARCS model with respect to the uncertainty of the PSF applied for AtoN.

q.2) An account of how the PSF applied in the MARCS model for AtoN has been validated for the Trans Mountain tanker sailing route.

r) In section 3.4 of Appendix 4 of reference v) the report attempts to quantify the effect of ship routing measures for the MARCS model. Please provide:

r.1) A sensitivity analysis of the MARCS model with respect to the uncertainty of the PSF applied for ship routing measures.

r.2) An account of how the PSF applied in the MARCS model for ship routing measures has been validated for the Trans Mountain tanker sailing route.

s) In section 3.5 of Appendix 4 of reference v), the report attempts to quantify the effect of port state controls for the MARCS model. Please provide:

s.1) A sensitivity analysis of the MARCS model with respect to the uncertainty of the PSF applied for port state controls.

s.2) An account of how the PSF applied in the MARCS model for port state controls has been validated for the Trans Mountain tanker sailing route.

t) In section 3.7 of Appendix 4 of reference v), the report addresses the overlap of risk reduction options when applied collectively. Please provide:

t.1) A sensitivity analysis of the MARCS model with respect to the uncertainty of the overlapping risk reduction effects inherent in the MARCS model.

t.2) An account of how the controls for overlapping risk reduction effects inherent in the MARCS model have been validated for the Trans Mountain tanker sailing route.

u) Please confirm if any other risk controls, aside from those accounted for in Appendix 4 of reference v), were factored into the MARCS model when conducting the case 0, case 1 and case 2 risk analyses in references i), ii) and v).

u.1) If yes, please provide a comprehensive list of every other risk control not fully accounted for in Appendix 4 of reference v). For each risk control, please provide:

u.1.i) A detailed account of any analysis and research used to determine the appropriate PSF for each individual risk control.

u.1.ii) A sensitivity analysis of the MARCS model with respect to the uncertainty of the PSF used for each risk control.

u.1.iii) An account of how each risk reduction factor and its associated PSF has been validated for the Trans Mountain tanker sailing route.

v) Please provide an analysis of the risk of a tanker incident and of an oil spill incident, resembling that provided in TERMPOL 3.15 in references i), ii) and v), with the following conditions applied:

- Remove any risk control PSFs from the MARCS model where a note has been made in Appendix 4 of reference v) to the absence of data. This includes: DGPS, AIS, and AtoN.
- Input into the MARCS model the PSF value for each risk control that is equivalent to the minimum risk reduction percentage wherever a range of risk reductions estimates were given. This includes: Coastal VTS; Pilotage; ECDIS; Ship Routing Measures; Port State Control.
- Control for the maximum likely overlap between risk reduction factors, as described in section 3.7 of Appendix 4 in reference v).

w) Regarding reference iii), please provide a detailed and comprehensive account of how each input (ship structure, rocky vs. soft shoreline, wave and wind affects, and collision momentum), was factored into the model, including any calculations or weighting that was used for each input. Please also provide a detailed account of how each input was validated for the Trans Mountain tanker sailing route.

w.1) Please confirm if any factors were used in MARCS, other than the four identified in reference iii), to estimate the probability that an incident leads to an oil spill accident. If yes, please provide a list of all factors that were used for this purpose. For each factor, please provide a detailed and comprehensive account of how the factor was incorporated into the model, including any calculations or weighting that was used for the factor. Please also provide a detailed account of how each factor was validated for the Trans Mountain tanker sailing route. Finally, please provide a sensitivity analysis of the MARCS model with respect to the uncertainty of each of these factors.

x) In light of reference iv), please confirm if the probability of grounding on rocky or soft seabed was factored into the analysis. If yes, please provide a detailed and comprehensive account of how it was factored into the model, including any calculations or weighting that was used. Please also detail the process that was used to validate the input for the Trans Mountain tanker

sailing route. Please also provide a sensitivity analysis of the MARCS model with respect to the uncertainty of any seabed inputs.

y) In references i), ii) and v), please confirm if any risk control measures are applied in the risk analysis performed for Case 1a that are not applied in the risk analysis performed for Case 1, with the exception of the additional escort tug. If yes, please list these risk controls.

z) Please confirm if the additional use of tugs proposed under Case 1a in reference ii) would be tethered or untethered escort tugs.

aa) Please provide the PSF and risk reduction factor applied to the MARCS model for the additional escort tug in Case 1a in reference ii). Please also provide:

> aa.1) A detailed account of any analysis and research used to determine the appropriate PSF and risk reduction factor applied to the MARCS model for the additional escort tug in Case 1a.
>
> aa.2) A sensitivity analysis of the MARCS model with respect to the uncertainty of the PSF and risk reduction factor applied to the MARCS model for the additional escort tug in Case 1a.
>
> aa.3) An account of how the PSF and risk reduction factor applied to the MARCS model for the additional escort tug in Case 1a have been validated for the Trans Mountain tanker sailing route.

bb) Please provide the information requested in requests aa), aa.1), aa.2) and aa.3) of this section for any other risk control listed in response to request y) of this section.

cc) Section 7.3.2 of reference ii) offers a risk assessment for Case 1b with the addition of both the extra tug escort already applied in Case 1a and as well as a moving exclusion zone around a laden tanker. Please:

> cc.1) Confirm the anticipated size of the moving exclusion zone and describe how such a zone would be enforced.
>
> cc.2) Provide an analysis of the effectiveness of a moving exclusion zone relative to the size of such a zone.
>
> cc.3) Please provide all PSFs and risk reduction factors applied to the MARCS model for the moving exclusion zone in Case 1b in reference ii). Please also provide:
>
> > cc.3.i) A detailed account of any analysis and research used to determine the appropriate PSFs and risk reduction factors applied to the MARCS model for the moving exclusion zone in Case 1b.

cc.3.ii) A sensitivity analysis of the MARCS model with respect to the uncertainty of the PSFs and risk reduction factors applied to the MARCS model for the moving exclusion zone in Case 1b.

cc.3.iii) An account of how the PSFs and risk reduction factors applied to the MARCS model for the moving exclusion zone in Case 1b have been validated for the Trans Mountain tanker sailing route.

cc.4) In references i), ii) and v), please confirm if any risk control measures are applied in the risk analysis performed for Case 1b that are not applied in the risk analysis performed for Case 1a, with the exception of the moving exclusion zone. If yes, please list these risk controls.

cc.4.1) Please provide the information requested in requests cc.3), cc.3.i), cc.3.ii), and cc.3.iii) of this section for any other risk control listed in response to request cc.4) of this section.

cc.5) In section 7.3.2 of reference ii) the report states that: "The effect of VTS mandating a moving exclusion zone around laden outbound Trans Mountain tankers is estimated to reduce the frequency of encounters with commercial shipping by 90% or more, assuming the measure is applied in a professional way." Please explain what conditions or criteria need to be met to address the assumption that the moving exclusion zone is applied "in a professional way".

dd) In section 7.5.2 of reference ii), the report compares incident frequencies to conclude that under Case 1b, the incident frequency of Trans Mountain tankers will be below the global average for the past 10 years. Given that the parameters of Case 1b are not a certainty for the project, please provide an analysis of the annual projected oil cargo spill accident frequency for Trans Mountain tankers under Case 0, Case 1, Case 1a and Case 2.

ee) In section 7.5.3 of the reference ii), the report compares the Danish Strait to the Salish Sea, concluding that "the sailing route is relatively similar to the Trans Mountain tanker sailing route" and therefore that the "likelihood of a marine transit incident and the likelihood for an oil cargo spill accident are therefore considered relatively low [along the Trans Mountain tanker sailing route] compared with other well established sailing routes." Please provide:

ee.1) An exhaustive comparison of the oceanographic observations in the Danish Strait and along the entire Trans Mountain tanker sailing route, in support of this conclusion.

ee.2) An exhaustive comparison of the meteorological observations in the Danish Strait and along the entire Trans Mountain tanker sailing route, in support of this conclusion.

ee.3) An exhaustive comparison of the topographic observations in the Danish Strait and along the entire Trans Mountain tanker sailing route, in support of this conclusion.

ee.4) An exhaustive comparison of the risk controls in place in the Danish Strait and along the entire Trans Mountain tanker sailing route, in support of this conclusion.

ee.5) An exhaustive comparison of the navigational hazards in the Danish Strait and along the Trans Mountain sailing route, in support of this conclusion.

ff) On PDF page 73 of reference ii), the report states that: "MARCS calculates the accident risk in stages. It first calculates the location dependent frequency of critical situations (the number of situations which could result in an accident – "potential accidents"—at a location per year; a location is defined as a small part of the study area, typically about 1 nautical mile square, but dependent on the chosen calculation resolution)". Please provide the following:

ff.1) The chosen calculation resolution for the risk assessment conducted in references i), ii) and v).

ff.2) A complete list of the location dependent frequencies of critical situations throughout the entire study area for each separate risk analysis (including Case 0, Case 1, Case 1a, Case 1b and Case 2) conducted in TERMPOL 3.15. (references i), ii) and v))

gg) PDF page 76 of reference ii) describes the internal operational data used by MARCS to analyze the risk of an incident. Please provide a complete annotated list of all types of "internal data" used by MARCS. Please also note which data was sourced from British Columbia's west coast.

hh) Section 11 of reference ii) (PDF pages 52-53) offer a discussion of the sensitivity of the methods and the MARCS model validation. Based on these discussions, please explain in detail:

hh.1) If MARCS algorithms are not calibrated with historical data, then how can one know if they are grounded in reality?

hh.2) How does MARCS ensure that a in, a particular case, one is not getting the "right answer" for the "wrong reason" (i.e. Tuning)?

hh.3) In light of questions hh.1) and hh.2), how can one have confidence in the reliability of predictions made by the MARCS model?

11 Science Underpinning Analysis of Fate and Behavior of Diluted Bitumen in Water

Reference:

i) A3S5G2, A3S5G4 A Study of Fate and Behaviour of Diluted Bitumin Oils on Marine Waters
ii) A3S5G7 A Comparison of the Properties of Diluted Bitumen Crudes with Other Oils
iii) A3S5G9, A3S5H1, A3S5H3, A3S5H4, A3S5H7, A3S5H8, A3S5H9, A3S5I0, A3S5I1 Modelling the Fate and Behaviour of Marine Oil Spills for the Trans Mountain Expansion Project (including figures and appendices)
iv) A3S4V5, A3S4V6 Section 5. Fate and Behaviour of a Hydrocarbon release.
v) A3S4Y5 Section 5.4: Fate and Behaviour of an Oil Spill in a Marine Environment
vi) Baschek, B., D.M. Farmer and C. Garrett, 2006: Tidal fronts and their role in air-sea gas exchange. *Journal of Marine Research*, **64**, 483-515.
vii) Johannessen, S.C., D. Masson and R.W. Macdonald, 2006: Distribution and cycling of suspended particles inferred from transmissivity in the Strait of Georgia, Haro Strait and Juan de Fuca Strait. *Atmosphere-Ocea*n, **44(1)**, 17-27.
viii) Farmer, D.W., E.A. D'Asaro, M.V. Trevorrow and G.T. Dairiki, 1995: Three-dimensional structure in a tidal convergence zone. *Continental Shelf Research*, **15(13)**, 1649-1673.
ix) Farmer, D., R. Pawlowicz, R. Jiang, 2002: Tilting separation flows: a mechanism for intense vertical mixing in the coastal ocean. *Dynamics of Atmospheres and Oceans*, **36**, 43-58.
x) Federal Government Technical Report: Properties, composition and marine spill behavior, fate and transport of two diluted bitumen products from the Canadian oil sands. November 30, 2013, ISBN 978-1-100-23004-7, 85pp.
xi) White, B.L. and K.R. Helfrich, 2013: Rapid gravitational adjustment of horizontal sheer flows. *Journal of Fluid Mechanics*, **721**, 86-117.
xii) Zhang, Z., O. B. Fringer, and S. R. Ramp (2011), Three-dimensional, nonhydrostatic numerical simulation of nonlinear internal wave generation and propagation in the South China Sea. *Journal of Geophysical Research*, **116**, C05022, doi:10.1029/2010JC006424
xiii) http://wcmrc.com/news/federal-government-releases-dilbit-study/

Preamble:

Reference [iv] presents the evidence put forward with respect to the physical, chemical and weathering properties of hydrocarbons released in a marine environment. It draws heavily on the tank experiments in the Gainford Study (reference [i]) and provides cursory information on the interaction between oil and particulates suspended in the water column. This is interaction is expanded upon slightly in section 5.4.1.1.4 and section 5.4.1.1.6 of reference [v] where the potential for tar ball formation is also mentioned. Reference [ii] compares and contrasts the properties of dilbit with other oils.

Reference [v] provides further information on the potential fate and behavior of diluted bitumen (dilbit) spilled into a marine environment. It too heavily relies upon the Gainford Study. Reference [v] also describes the numerical modelling simulations detailed in reference [iii] that were undertaken in order to determine the fate and behavior of dilbit spilled in any one of a number of potential marine locations.

The Gainford study undertook tank experiments using saline water that did not include suspended sediments. It is clear from the recently completed Federal study (reference [x]) that in the presence of suspended sediments "high-energy wave action mixed the sediments with diluted bitumen, causing the mixture to sink or be dispersed as floating tarballs" (page 5 of reference [x]). In addition, on page 6 of reference [x] it states:

"Under conditions simulating breaking waves, where chemical dispersants have proven effective with conventional crude oils, a commercial chemical dispersant (Corexit 9500) had quite limited effectiveness in dispersing dilbit.

Application of fine sediments to floating dilbit was not effective in helping to disperse the products."

Western Canada Marine Response Corporation has recognized these conclusions (reference [xiii]). Reference [vii] clearly documents the presence of suspended particles in Strait of Georgia, Haro Strait and Juan de Fuca Strait, yet it is unclear how this information was incorporated in the submission.

Some of the parameters used in the numerical model (reference [iii]) were determined based on the analyses outlined in references [i] and [ii]. It is unclear how the model, used to predict the path of oil spills, was validated in light of the prevalence of very complex oceanographic conditions in the Strait of Georgia, Haro Strait and Juan de Fuca Strait (references [vi, viii, ix, xi]). In particular, a hydrostatic model was used that may not be able to represent the complex downwelling conditions, tidal fronts and whirlpools which are common features in the region. Reference (xii) provides an example of a non-hydrostatic numerical model that has been used recently.

Request:

a) The following requests pertain to reference [i] and hence the reliance upon reference [i] in references [iv] and [v]:

a.1) Please provide an explanation of how Trans Mountain interprets the results of reference [i] in light of the disclaimer on page ii.

a.2) As a result of the fact that "limited empirical observations have been recorded about how these [dilbit] products reacted when spilled into the environment" and so "the literature review was forced to rely largely on available information on other heavy

crude oils" (page 1), and in light of the publication of reference [x], do Trans Mountain plan to undertake:

a.2.i) any more tank experiments with water containing suspended sediments typical of the Strait of Georgia, Haro Strait and Juan de Fuca Strait? If not, why not?

a.2.ii) any field experiments in the Strait of Georgia, Haro Strait or Juan de Fuca Strait? If not, why not?

a.3) The literature review resulted in only six studies which focused on dilbits (page 5, lines 12-13).

a.3.i) Please list these six studies with URLs so that I can access them.

a.3.ii) Do any of these studies appear in the peer-reviewed scientific literature?

a.4) The tank experiments were all conducted with conditions claimed to be typical of Burrard Inlet. Have any tank experiments been conducted:

a.4.i) with more saline conditions typical of the Strait of Juan de Fuca? If not, why not?

a.4.ii) with colder conditions typical of winter? If not, why not?

a.4.iii) in the presence of strong horizontal and/or vertical sheer? If not, why not?

a.4.iv) in the presence of whirlpools? If not, why not?

a.4.v) in the presence of downwelling conditions with downwelling velocities reaching greater than 40-50 cm/s as observed in references [vi] and [ix]. If not, why not?

a.5) To what extent does Trans Mountain believe that the Oil Distribution In the Water Column measurements of section 4.4 have any relevance to conditions present in the highly turbulent, sediment laden, dynamic, tidally-mixed Strait of Georgia, Haro Strait and Juan de Fuca Strait?

a.6) In light of the statement "Like many other heavy crude oils with only slightly positive buoyancy after weathering, these oils could become submerged with the addition of sediment and negatively buoyant particulates, or after contact with the shoreline where they may attach to particulate matter" (page 41), why did Trans Mountain not commission additional follow-up tank experiments in water laden with suspended sediments?

a.7) How much of the recommended future research in section 7 has been done or will be done?

a.8) Table 8.1 on page 63 contains a list of Frequently Asked Questions.

a.8.i) Why does the first question not address the relevant question “Does dilbit sink in highly turbulent marine conditions near the outlow of a sediment laden major river”?

a.8.ii) The third question suggests that chemical dispersants could be effective on dilbit spills. How does one reconcile the given answer with the result found in reference [x] and given above, namely “Under conditions simulating breaking waves, where chemical dispersants have proven effective with conventional crude oils, a commercial chemical dispersant (Corexit 9500) had quite limited effectiveness in dispersing dilbit”?

b) The following requests pertain to reference [ii] and hence the reliance upon reference [ii] in references [iv] and [v]:

b.1) In the abstract on page 1 the following conclusion is given: “Laboratory and mesoscale weathering experiments show dilbits have physical properties very much aligned with a range of intermediate fuel oils and other heavy crude oils and generally, depending the initial blend and the state of weathering, and are not characterized as nonfloating oils [sic].” In light of the new findings in reference [x], how should this conclusion be revised?

b.2) On page 5, the report states: “Only after extensive weathering, or mixing with suspended particulate material, may some portion of weathered dilbit become submerged or sink.”

b.2.i) What evidence is used to substantiate this assertion?

b.2.ii) Are there any observations of whirlpools, downwelling zones, convective instabilities or fronts in the Strait of Georgia, Haro Strait or Juan de Fuca Strait?

b.2.iii) How are the observations in references [vi], [viii], [ix] and [xi] consistent or inconsistent with this statement?

b.3) On page 8, the report states: “The resin and asphaltene content determine the likelihood of tar-ball formation”. How likely is this to occur in the Strait of Georgia, Haro Strait or Juan de Fuca Strait in light of reference [x]?

b.4) How would the results of the cited evaporation studies (on page 10 immediately below Table 6), which showed that “the first hours of exposure to air result in rapid loss of portions of the diluent with resulting increases in density and viscosity” change if suspended sediments or other particulates were located throughout the water column.

b.5) On page 11, Tsaprailis et al 2013 is the only study cited with respect to penetration of various types of oil into sand.

b.5.i) Is this study peer reviewed?

b.5.ii) Is this study published in a scientific journal?

b.5.iii) Are there any peer reviewed scientific journal studies that have examined dilbit penetration into sands? If so, please list them.

b.5.iv) Have any vertical sand penetration studies been done as part of the Trans Mountain submission?

b.6) On page 13 and on page 21 the report provides its "most significant" observation that "the behavior of dilbits tested or spilled are consistent with Group 3 and 4 crude oils: they float on water until oil densities change through weathering and/or sediment uptake."

b.6.i) What evidence is used to substantiate this assertion?

b.6.ii) Are there any peer-reviewed scientific journal publications that substantiate this statement?

b.6.iii) How would the observations in references [vi], [viii], [ix] and [xi] affect this statement?

b.6.iv) How would the observations in reference [vii] affect this statement?

b.6.v) What conclusions can be drawn about the properties of dilbit versus other Group 3 or 4 oils in light of reference [x]?

b.6.vi) What conclusions can be drawn about the properties of dilbit versus other Group 3 or 4 oils spilled in the Strait of Georgia, Haro Strait or Juan de Fuca Strait in light of references [vi], [vii], [viii], [ix], [x] and [xi]?

c) The following requests pertain to reference [iii] and hence the reliance upon reference [iii] in references [iv] and [v]:

c.1) Please provide an explanation of how Trans Mountain interprets the results of reference [iii] in light of the disclaimer on page ix.

c.2) What was the rationale and justification for choosing the spill locations listed in Table 2.1.1 on page 2?

c.3) Why was a catastrophic worst case not considered?

c.4) Please provide modelling results for a catastrophic worst case spill where the entire volume of marine-transported dilbit in a tanker is released in each of the locations listed in Table 2.1.1 on page 2.

c.5) On Page 3, the H3D model is described as "proprietary" (line 1).

c.5.i) Is the model code used (including all parametrizations) available to the public?

c.5.ii) If the answer to c.5.i is no, how can Trans Mountain feel confident in the implementation and appropriateness of subgrid scale processes if it can not be independently examined?

c.6) Please provide information on the order, dispersion, stability and numerical dissipative properties of the semi implicit timestepping scheme that is used.

c.7) As noted on page 6, the representation of vertical and horizontal mixing within the model (section 3.1.6) is critical in terms of "determining the correct distribution of velocity and scalars such as temperature and salinity". Could an analysis of the sensitivity of the model results to its representation of internal mixing please be conducted?

c.8) In section 3.1.7, the initial conditions for the model are discussed.

> c.8.i) Were annual mean temperature and salinity used in the initial condition? If not, what was used?
>
> c.8.ii) What evidence is there to support 9 months as being the appropriate spin-up time for the model?
>
> c.8.iii) What evidence is there to suggest that the initial conditions are consistent with the 2011 -2012 forcing conditions?

c.9) The model is run from September 2011 to October 2012. (page 4)

> c.9.i) What was the underlying North Pacific seasonal climate during this period?
>
> c.9.ii) Was this during an El Niño, La Niña, or not?
>
> c.9.iii) What was the magnitude of the Fraser river outflow during this period relative to the previous decade?
>
> c.9.iv) What evidence is there to suggest that the ambient conditions during September 2011 to October 2012 are representative of prior or future years?
>
> c.9.v) Have Trans Mountain considered any potential changes in Fraser River outflow, seasonal climate or extreme weather events as a consequence of future climate change in their modelling studies?

c.10) On page 7, section 3.2.1 starts with the statement "The primary validation of an oceanographic model concerns the reproduction of observed tidal heights".

> c.10.i) Please provide evidence to support this statement.
>
> c.10.ii) How are the validation of 3-D ocean temperature, salinity and velocity fields evaluated using tidal heights?
>
> c.10.iii) Is there any evidence to suggest H3D would simulate better tidal heights than commonly used barotropic or 2-layer tidal models?
>
> c.10.iv) How important are the nonlinear terms in the Navier Stokes equations and the tracer advection equations that are solved in H3D?

c.10.v) Please provide a comparison of simulated and observed temperature and salinity fields or transects (where available) at snapshots throughout the period September 2011 to October 2012.

c.10.vi) Please provide a comparison of simulated and observed mixed layer depths throughout the study region at snapshots throughout the period September 2011 to October 2012.

c.10.vii) Please provide observational evidence to support the evaluation of the validity of the sub grid scale mixing schemes used.

c.11) On page 8 the Bob Lord Drift is used as a tool for the evaluation of the ocean model. Bob Lord fell in the water on July 25, 1993. The model is run over the period September 2011 to October 2012.

c.11.i) How can event that occurred in 1993 be used to evaluate the model for future use?

c.11.ii) How can the results of the GF9 model be used to evaluate the H3D model?

c.11.iii) Please provide the reference unpublished Seaconsultant report to the Canadian coast guard on which the Bob Lord Drift analysis is based?

c.11.iv) Why is the surface drift evaluation relying on an unpublished report?

c.11.v) What is the uncertainty in Bob Lord's initial position?

c.11.vi) What is the uncertainty in Bob Lord's drift trajectory?

c.11.vii) If Bob Lord's initial position was off by 200 m in any direction how would his drift trajectory change?

c.11.viii) What was Bob Lord's weight, height, density, drag coefficient and surface tension?

c.11.ix) How do the answers in c.11.viii compare to various oil products?

c.11.x) Were any surface drifter observations used to validate the model? If not, why not?

c.11.xi) Were any subsurface drifter observations used to validate the ocean model? If not, why not?

c.11.xii) On page 9 it states: "It is clear from these results that the calculations with the full three-dimensional model were able to reliably hindcast Mr. Lord's drift..". Please provide evidence to justify this statement. Please also provide evidence to suggest that Mr. Lord's initial position and trajectory were known sufficiently well to justify this statement.

c.12) How would the oil spill model Spillcalc handle the formation and subsequent advection of tarballs?

c.13) How would the oil spill model Spillcalc handle the mixing and subsequent sinking of dilbit in water laden with suspended sediments?

c.14) How has the method of oil-sediment interactions been validated in Spillcalc?

c.15) Has Spillcalc been evaluated against observations of mixing and subsequent sinking of dilbit in water laden with suspended sediments?

c.16) Has Spillcalc been evaluated against observations in regions known to contain whirlpools, numerous oceanic fronts and downwelling situations?

c.17) Why was 07:00 on August 23, 2013 assumed to be the date that a spill occurred at Arachne Reef (section 9.1)?

c.18) Would spills on other dates be expected to lead to similar results? If so, please provide a justification for this.

c.19) Please provide the information that was supposed to be included in section 9.3 on page 45.

c.20) In the Executive Summary it states: “H3D, a three dimensional circulation model calibrated and validated in the area of study, to generate surface currents”

c.20.i) In light of the discussion above (and in d below), please justify the claim that the model has been “calibrated and validated in the area”.

c.20.ii) Please explain the justification for use of the word “credible” in the first paragraph of page iii.

d) The following requests pertain to Appendix A of the report Modelling the Fate and Behaviour of Marine Oil Spills for the Trans Mountain Expansion Project (A3S510) of reference [iii] and hence the reliance upon reference [iii] in references [iv] and [v]:

d.1) Please explain the ramifications of using “a simpler turbulence scheme in the vertical” (page 1 of Appendix A)

d.2) Please justify the use of the Bousinessq approximation in the model at the scales it is used at.

d.3) Please justify using a hydrostatic model to examine the relevant circulation critical to understanding the fate and behavior of an oil spill in this highly complex region when non-hydrostatic models (e.g. reference [xii]) are now available?

d.4) Please justify the rationale for using the Smagorinsky 1963 shear-dependent mixing formulation (page 4 of Appendix A).

d.5) On page 5 of Appendix A, the report states: “if data is available for calibration, these ratios can be adjusted based on comparisons between modeled and observed data”.

d.5.i) Were data available for calibration? If not, why not?

d.5.ii) Were values of the ratio of vertical eddy diffusivity to viscosity and horizontal eddy diffusivity to velocity of 0.75 and 1.0, respectively, used? If so, what is the justification for this?

d.5.iii) Are there any observations in the Strait of Georgia, Haro Strait and Juan de Fuca Strait that support the chosen use of mixing coefficients?

d.5.iv) What effect would uncertainty in mixing parameters have on the model results?

d.6) Please provide a quantification of the magnitude and spatial variability in the three dimensional fields of artificial numerical diffusion associated with the use of the flux-corrected transport algorithm (Zalesak, 1979) [mentioned on page 5 of Appendix A].

d.7) Why is there a description of a sea ice model included on page 6 of Appendix A? Did sea ice form in the Strait of Georgia, Haro Strait and Juan de Fuca Strait in any simulations?

d.8) Please provide a detailed comparison between the oceanographic conditions in the Strait of Georgia, Haro Strait and Juan de Fuca Strait and the water conditions in Okanagan Lake.

d.9) Please provide a detailed comparison between the internal wave fields in the Strait of Georgia, Haro Strait and Juan de Fuca Strait and Okanagan Lake.

d.10) Please provide a detailed comparison between the tides and frontal dynamics in the Strait of Georgia, Haro Strait and Juan de Fuca Strait and Okanagan Lake.

d.11) Please provide a detailed comparison between the topography in the Strait of Georgia, Haro Strait and Juan de Fuca Strait and Okanagan Lake.

d.12) In light of the answers to d.8 to d.11, please justify how validation of the model in Lake Okanagan is relevant to its validation in the Strait of Georgia, Haro Strait and Juan de Fuca Strait.

e) The following requests pertains to reference [v]:

e.1) On page 8A-559 it states: “ H3D’s ability to simulate both summer and winter cooling has been rigorously verified in simulations done for freshwater lakes, where adequate temperature data is more routinely available over several years (Zaremba et al., 2005)”.

e.1.i) Zaremba et al (2005) is a conference proceedings. Please describe the review process involved.

e.1.ii) Zaremba et al (2005) is a study of Okanagan Lake. Please describe the other freshwater lakes for which H3D has been verified.

e.1.iii) What does it mean to "verify" a model?

e.1.iv) The H3D model was 'calibrated' to Lake Okanagan in Zaremba et al (2005). Please explain what is meant by 'calibrated'.

e.1.v) How was the H3D model 'calibrated' for use in the Strait of Georgia, Haro Strait and Juan de Fuca Strait?

e.1.vi) What differences were made to the model in terms of internal parameters or parameterizations between its calibration in Lake Okanagan and its use in the Strait of Georgia, Haro Strait and Juan de Fuca Strait?

12 Marine Aspects of Project Operations Phase

12.1 Marine Air Emissions: Primary Emissions of Criteria Air Contaminants

Reference: i) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 27-28 of 294.

Preamble: Reference i) states that "The increase in ambient ground-level concentrations of CACs is considered to have a negative impact balance. As shown in Table 4.3.3.5 point 1(a), the increase in ambient ground-level concentrations of CACs is confined to the Marine Air Quality RSA. Marine emissions are expected to change ambient concentrations of CACs periodically (*i.e.*, approximately twice daily) when Project-related marine vessel traffic enters and travels through the Marine Air Quality RSA. The change will be long-term in duration, reversible in the short-term as the marine vessel traffic leaves the Marine Air Quality RSA, and the magnitude is expected to below. The probability of this occurring is high, and confidence in the residual effects assessment is moderate."

Reference i) also states that confidence in the residual effects assessment is moderate due to limited "vessel-specific data".

Request: a) Please submit the necessary vessel-specific data, including tugs, required to make a higher confidence assessment.

b) Please confirm any changes to the residual effects assessment resulting from the incorporation of vessel-specific data, including tugs.

12.2 Marine Air Emissions Indicator: Primary Emissions of Volatile Organic Compounds

Reference: i) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 28-29 of 294.

Preamble: Reference i) states "The increase in ambient ground-level concentrations of VOCs is considered to have a negative impact balance. As shown in Table 4.3.3.5 point 2(a),

the increase in ambient ground-level concentrations of VOCs is confined to the Marine Air Quality RSA. Marine emissions are expected to change ambient VOC concentrations periodically when Project-related marine vessel traffic travels through the Marine Air Quality RSA. The change will be long-term in duration, reversible in the short-term as the Project-related marine vessel traffic leaves the Marine Air Quality RSA, and the magnitude is expected to be medium.

Reference i) also states that confidence in the residual effects assessment is moderate due to limited "vessel-specific data".

Request: a) Please submit the necessary vessel-specific data, including escort tugs, required to make a higher confidence assessment.

b) Please confirm any changes to the residual effects assessment resulting from the incorporation of vessel-specific data, including tugs.

12.3 Increase in Ambient Ground-Level Concentrations of Secondary Particulate Matter

Reference: i) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 29-30 of 294.

Preamble: Reference i) states "The increase in ambient ground-level concentrations of secondary PM is considered to have a negative impact balance. As shown in Table 4.3.3.5 point 3(a), the increase in ambient ground level concentrations of secondary PM is confined to the photochemical model domain or LFV. Some of the marine emissions will contribute chemical pre-cursors for secondary pollutants periodically when Project-related marine vessel traffic travels through the Marine Air Quality RSA. The change will be long-term in duration, reversible in the short-term as the Project related marine vessel traffic leaves the Marine Air Quality RSA, and the magnitude is expected to be low. The probability of this occurring is high, and confidence in the residual effects assessment is moderate".

Reference i) also states that confidence in the residual effects assessment is moderate due to limited "vessel-specific data".

Request:

a) Please submit the necessary vessel-specific data, including escort tugs, required to make a higher confidence assessment.

b) Please confirm any changes resulting from the inclusion of all vessel-specific data into the assessment of the formation of secondary particulate matter and ozone resulting from Project operation.

12.4 Increase in Ambient Ground-Level Concentrations of Ozone

Reference: i) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 30 of 294.

Preamble: Reference i) states, "The increase in ambient ground-level concentrations of ozone is considered to have a negative impact balance. As shown in Table 4.3.3.5 point 3(b), the increase in ambient ground-level concentrations of ozone is confined to the photochemical model domain or LFV. Some of the marine emissions will contribute

chemical pre-cursors for secondary pollutants periodically when Project-related marine vessel traffic travels through the Marine Air Quality RSA. The change will be long-term in duration, reversible in the short-term as the marine vessel traffic leaves the Marine Air Quality RSA, and the magnitude is expected to be low. The probability of this occurring is high, and confidence in the residual effects assessment is moderate."

Reference i) also states that confidence in the residual effects assessment is moderate due to limited "vessel-specific data".

Request: a) Please submit the necessary vessel-specific data, including escort tugs, required to make a higher confidence assessment.

b) Please confirm any changes to the assessment of ambient ground-level concentrations of ozone resulting from the inclusion of all vessel-specific data, including tugs.

12.5 Combined Effects on Formation of Secondary Particulate Matter and Ozone Indicator

Reference: i) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 30-31 of 294.

Preamble: Reference i) states "The combined effects of marine air emissions on the indicator of formation of secondary particulate matter and ozone indicator are considered to have a negative impact balance. As shown in Table 4.3.3.5 point 3(c), the increase in ambient ground-level concentrations of secondary PM and ozone is confined to the photochemical model domain or LFV. Some of the marine emissions will contribute chemical pre-cursors for secondary pollutants periodically when Project-related marine vessel traffic travels through the Marine Air Quality RSA. The change will be long-term in duration, reversible in the short-term as the marine vessel traffic leaves the Marine Air Quality RSA, and the magnitude is expected to be low. The probability of this occurring is high, and confidence in the residual effects assessment is moderate".

Reference i) also states that confidence in the residual effects assessment is moderate due to limited "vessel-specific data".

Request: a) Please submit the necessary vessel-specific data, including escort tugs, required to make a higher confidence assessment.

b) Please confirm any changes to the assessment resulting from the inclusion of all vessel-specific data, including tugs.

12.6 Marine Air Emissions Indicator – Visibility

Reference: i) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 31-32 of 294.

Preamble: Reference i) states that, "Reduced visibility is considered to have a negative impact balance. As shown in Table 4.3.3.3 point 4(a), the increase in reduced visibility is

confined to the LFV. Some of the marine emissions will contribute chemical pre-cursors that could lead to the formation of aerosols periodically when Project-related marine vessel traffic travels through the Marine Air Quality RSA. The change will be long-term in duration, reversible short-term as the marine vessel traffic leaves the Marine Air Quality RSA, and the magnitude is expected to be medium. The probability of this occurring is high and confidence in the residual effects assessment is moderate".

Reference i) also states that confidence in the residual effects assessment is moderate due to limited "vessel-specific data".

Request:

a) Please submit the necessary vessel-specific data, including escort tugs, required to make a higher confidence assessment.

b) Please confirm any changes to the visibility assessment resulting from the inclusion of all vessel-specific data, including tugs.

12.7 Combined Effects on Marine Air Emissions

Reference: i) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 31-32 of 294.

Preamble: Reference i) states that, "The combined effects on the marine air emissions indicators is considered to have a negative impact balance. Effects are assessed with a setting of high volume vessel activity within the Marine Air Quality RSA and with the standards set by the existing regulatory framework. The results of the marine air emissions assessment does not contradict any management objectives of established regional marine conservation plans. As shown in Table 4.3.3.5 point 5(a), the combined effects on the marine air emissions indicators are confined to the LFV for the photochemical products (visibility, ozone and PM2.5), which includes the Marine Air Quality RSA. Marine emissions are expected to change ambient concentrations intermittently when tanker traffic travels through the Marine Air Quality RSA. The change will be long-term in duration, reversible short-term as the Project-related marine vessel traffic leaves the Marine Air Quality RSA, and the magnitude is expected to be medium. The probability of this occurring is high, and confidence in the residual effects assessment is moderate".

Reference i) also states that confidence in the residual effects assessment is moderate due to limited "vessel-specific data".

Request:

a) Please submit the necessary vessel-specific data, including escort tugs, required to make a higher confidence assessment.

b) Please confirm any changes to the assessment of combined effects on Marine Air Emissions resulting from the inclusion of all vessel-specific data, including all escort tugs.

c) Please confirm whether the updated assessment of the combined effects on Marine Air Emissions contradict any management objectives of established regional marine conservation plans.

12.8 Summary

Reference: i) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 33 of 294.

Preamble: Reference i) states that, "As identified in Table 4.3.3.5, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on marine air emissions of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of increased Project-related marine vessel traffic on marine air emissions will be not significant".

Reference i) also indicates that the assessments identified in Table 4.3.3.5 were conducted without the vessel-specific data required to make an above-moderate confidence assessment.

Request: a) Please submit the necessary vessel-specific data, including escort tugs, required to make a higher confidence assessment.

b) Please confirm any changes to the summary of the assessment of the probability of permanent or long-term residual environmental effects on marine air emissions resulting from the inclusion of all vessel-specific data, including tugs.

13 Oil Spill Response and Recovery

13.1 Oil Spill Response and Recovery Plan

Reference: i) A3S4Y6, Application Volume 8A, Section 5.5
ii) A3S5Q3, Application Volume 8A, Section 5.5
iii) A3S5I9, Review of Trans Mountain Expansion Project: Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, Full Report.
iv) A3S5J0, TMEP Oil Spill Response Simulation Study, Arachne Reef and Westridge Marine Terminal, Full Report.
v) Federal Government Technical Report: Properties, composition and marine spill behavior, fate and transport of two diluted bitumen products from the Canadian oil sands. November 30, 2013, ISBN 978-1-100-23004-7, 85pp.
vi) A3S4Y3, Application Volume 8A, Table 5.2.2

Preamble: References i) and ii) detail current and recommended oil spill preparedness and response regimes for the Trans Mountain tanker sailing route.

Reference iii) provides an account of the recommended enhancements for oil spill response capacity in light of the Trans Mountain Expansion Project (TMEP). These are recommendations only and their implementation is not guaranteed under the TMEP.

Reference iv) provides a simulation of a "credible worst-case" oil spill scenario at Arachne Reef and at Westridge Marine Terminal, assuming, among other things, the full implementation of the recommended enhanced spill response capacity.

Reference v) is a federal government technical report on the properties, composition and marine spill behavior, fate and transport of two diluted bitumen products from the Canadian oil sands. The study shows that diluted bitumen will sink in the presence of suspended particulate matter.

Reference vi) is a table outlining the locations that were considered for modeling a possible oil spill accident in volume 8A of the Trans Mountain Expansion Project application.

Request: a) In section 5.5.1.2 of reference i) the report states that "With respect to personnel, WCMRC maintains a team of full-time and part-time employees, and has more than 20 contractor and 30 advisory agreements in place at any time." (PDF page 29). Please provide:

a.1) A full detailed list of all full-time positions held by WCMRC employees, broken down by location and including the number of full time staff in each position and the training and responsibilities associated with each position.

a.2) A full detailed list of all part-time positions held by WCMRC employees, broken down by location, and including the number of full time staff in each position, and the training and responsibilities associated with each position.

a.3) The detailed contractual stipulations for both full-time and part-time employees with regards to overtime and availability requirements for responding to oil spill accidents. Where contract stipulations vary between positions, please provide the stipulations for each variance, including the number of employees operating under each variance.

a.4) A detailed account of each of the 20 contracts, including, but not limited to, the name of the contracted entity, the purpose the contract intends to fulfill, a list of the contracted services to be provided including the scope of services contracted, the length of time services will be offered under the contract and whether or not plans already exist to renew each contract once it expires. Please also list and describe all contractual stipulations for each contract with regards to responding to oil spill accidents.

a.5) A detailed account of each of the 30 advisory agreements, including, but not limited to, the name of the entity providing advisory services, the purpose the agreement intends to fulfill, a list of the advisory services to be provided including the scope of services agreed to and the length of time each service will

be offered under the agreement as well as whether or not plans already exist to renew each agreement once it expires. Please also list and describe all stipulations for each agreement that pertain to responding to oil spill accidents.

b) PDF page 6 of reference iii) makes it clear that the recommended enhancements to WCMRC's oil spill response capacities, and therefore to the enhanced response capacities proposed for the Trans Mountain Expansion Plan, are not guaranteed. The adoption of the enhancements is contingent on a number of factors. Please provide a detailed and annotated list of each factor that could influence whether or not the enhanced capacities are adopted and provided a detailed description of what Trans Mountain is doing to address each factor. Please also identify which, if any, factors Trans Mountain has direct control over.

c) Please confirm if there is any foreseeable scenario in which a single-hulled oil tanker could service Westridge Marine Terminal. If yes, please describe the scenario(s).

d) Section 2 of reference iii) outlines current oil spill response capacities. Please provide a single table that includes all oil spill response equipment currently owned by WCMRC. Please include the following information in the table:

- The storage locations of each piece of equipment
- The quantity of each piece of equipment at each location
- The quantity of each piece of equipment that, under current standards, could be reallocated to a different part of the province to respond to an oil spill without undermining the minimum capacity requirements at any point along the coast.
- The range of meteorological and oceanographic conditions within which each piece of response equipment can be deployed, including the point at which the equipment begins to be less effective in each condition. Please reference and site all known studies that support any claim about the effectiveness of equipment in a given condition.
- The effectiveness of each piece of equipment at recovering submerged diluted bitumen. Please reference and site all known studies that support any claim about the effectiveness of a given piece of equipment at recovering submerged dilulted bitumen.

e) On PDF page 32 of reference i) the report states that: "The study concluded that, given the appropriate safety, environmental and operating conditions, dispersants may be effective within the first day of a spill before weathering results in oil that is too viscous to effectively disperse." However, page 6 of reference v) states that: "Under conditions simulating breaking waves, where chemical dispersants have proven effective with conventional crude oils, a commercial chemical dispersant (Corexit 9500) had quite limited effectiveness in dispersing dilbit. Application of fine sediments to floating dilbit was not effective in helping to disperse the products."

Please revise the statement made on PDF page 32 of reference i) in light of the quote in reference v).

f) On PDF page 32 of reference i) the report states that: “With respect to in-situ burning, the study concluded that, given the appropriate safety, environmental and operating conditions, in-situ burning might be effective but likely only for a short time, during the first 12 to 24 hours of a spill…”. Please revise this statement in light of reference v), which demonstrates that dilbit will sink in the presence of suspended particulate matter.

g) Section 3.2 of reference iii) recommends a voluntary “Tier 5” response level that would exceed the Canadian Coast Guard guidelines. Please outline what guarantees would be in place to ensure that this voluntary standard is consistently and constantly implemented and maintained, should the Trans Mountain Expansion Project be approve and should the Tier 5 response level remain a voluntary level.

g.1) Please confirm that the 20,000 tonne response capacity described in Tier 5 is a significant part of the enhanced spill response regime proposed in reference iii).

g.2) Please provide a financial analysis, including a list of all additional financial costs, associated with implementing and maintaining a voluntary “Tier 5” capacity, compared to a baseline “Tier 4” capacity.

g.3) Please provide an analysis of the number of additional full-time and part-time employees that would be required to maintain a voluntary “Tier 5” response level.

g.4) Please estimate the total annual cost of hiring the additional employees identified in request g.3) of this section?

g.5) Please outline any additional services or capacity gaps that would be filled through contracts and advisory agreements. Please include the anticipated costs of these contracts and agreements, the anticipated scope of services and the spill response capacity to be obtained through contracts and agreements. Please provide any available information on the points requested in request a.4) and a.5) of this section, for the anticipated additional contracts and agreements.

g.6) Please detail where the funding required to cover each costs listed in g.2), g.4) and g.5) will be sourced from. Please also identify which of these funding sources have been guaranteed and which still need to be guaranteed.

h) Section 3.2.1 of reference iii) states that according to DNV’s calculations, the probability of a worst case oil spill (a “total loss” scenario) is so low that it does not represent a “credible worst case discharge scenario”. The report then sites the fact that to date, there has not been a total loss incident with a double-hulled tanker. As such, the report does not consider a total loss scenario as a credible worst case scenario for the purposes of the report. Please:

h.1) Provide a list of all total loss incidents involving tankers in the past 50 years.

h.2) Confirm the length of time, in years, that the expanded Trans Mountain pipeline would operate.

h.3) Confirm the number of years that double-hulled oil tankers have been considered an industry standard?

i) Section 3.3 of reference iii) (PDF page 14) notes that: “An analysis of crude oil properties” and “simulation of oil fate and behavior at points along the tanker route” were considered when determining the enhanced response times. Please provide an updated consideration of adequate enhanced response times in light of both the findings in reference v) and the answers provided to the information requests detailed in Section 11 of this information request.

j) In section 3.4 of reference iii) (PDF page 15), the report states that: “During the course of the ten days test the diluted bitumen floated on the water and could be retrieved effectively using conventional skimming equipment.” Please revise this statement in light of both the findings in reference v) and the answers provided to the information requests detailed in Section 11 of this information request.

k) Section 3.4 of reference iii) describes the importance of a 10-day timeline for on-water recovery operations, from the date of the oil spill accident. Please detail the conditions under which oil spill response and recovery could be delayed.

l) Please provide a comprehensive analysis of the meteorological or oceanographic conditions that would prevent or impede the use of WCMRC equipment.

l.1) Please provide an analysis of the average number of days in a given year in which each condition described in response to request l) of this section occurs. Please provide this analysis for all locations used for oil spill accident modeling in reference vi).

m) Table 5-2 of reference iii) provides information on the proposed additional response bases. Please provide an analysis of the costs of implementing and maintaining each response base, including, but not limited to, staffing and equipment costs. Please identify which costs are already being incurred and which ones would be additional.

n) On PDF page 29 of reference iii), the report states that: “In the United States, the vessel or planholder must certify resources for the removal of the Worst Case Discharge (WCD), defined as the loss of the ship’s entire cargo and fuel complicated by adverse weather.” Please explain why Trans Mountain does not feel it necessary to consider what would be required for, or to prepare for, a response capacity sufficient to cover a total loss scenario in adverse weather, as is required in Washington State?

o) In table 7-1 of reference iii), it is stated that none of the crude oils transported within the Trans Mountain Expansion Project sink upon spilling. Therefore it is

implied that no capacity is required to deal with sunken oils. Please revise this statement and the spill response plan in light of both the findings in reference v) and the answers provided to the information requests detailed in Section 11 of this information request.

o.1) If, after revising the statement in light of the abovementioned findings, it is concluded that the capacity to recover sunken oils is still not a necessary requirement, please justify this conclusion in light of the fact that Washington State has determined it is a necessary requirement for vessels operating in their jurisdiction, as described in table 7-1 of reference iii).

p) In table 7-1 of reference iii) it is noted that "Wildlife Rehabilitation" is "under planning and review." Please provide details about the current status of the planning and review process, including when it is scheduled to be concluded. Please also provide details on the goals, the parameters of what is being considered and the methods of the planning and review process.

q) Section 8.2 of reference iii) explains that in sea states greater than 2, the effectiveness of WCMRC equipment declines. Please provide:

q.1) An analysis of how many days (complete or partial) out of the year the sea state is 2 or greater (equivalent to 3 or higher on the Beaufort Scale) at each of the locations used for oil spill accident modeling in reference vi).

q.2) An analysis of how many days (complete or partial) out of the year the sea state is 3 or greater (equivalent to 4 or higher on the Beaufort Scale) at each of the locations used for oil spill accident modeling in reference vi).

q.3) An analysis of how many days (complete or partial) out of the year the sea state is 4 or greater (equivalent to 5 or higher on the Beaufort Scale) at each of the locations used for oil spill accident modeling in reference vi).

r) Reference iii) describes the plan to transfer equipment from one site to another as required during an oil spill accident in order to meet the proposed 20,000 tonne response capacity. It also notes that some equipment will need to be stationary in order to maintain baseline response capacities at all locations along the coast. Please explain how WCMRC would meet a 20,000 tonne response capacity in the Salish Sea if Unit 3, as listed in Table 12-2 of reference iii), is out of service?

r.1) Please provide a similar explanation for the event that units 1 or 2 or Burrard Cleaner No. 18 is out of service.

s) Reference iii) outlines the proposed future oil spill response capacities under the Trans Mountain Expansion Plan. Please provide a single table that includes all additional oil spill response equipment to be purchased by WCMRC under this scenario. Please include the following information in the table:

- The storage locations of each piece of equipment
- The quantity of each piece of equipment at each location

- The quantity of each piece of equipment that, under current standards, could be reallocated to a different part of the province to respond to an oil spill without undermining the minimum capacity requirements at any other point along the coast.
- The range of meteorological and oceanographic conditions within which each piece of response equipment can be deployed, including the point at which the equipment begins to be less effective in each condition. Please reference and site all known studies that support any claim about the effectiveness of equipment in a given condition.
- The effectiveness of each piece of equipment at recovering submerged dilbit. Please reference and site all known studies that support any claim about the effectiveness of a given piece of equipment at recovering submerged dilbit.

13.2 Oil Spill Response Scenario: Arachne Reef

Reference:

i) A3S5J0, TMEP Oil Spill Response Simulation Study, Arachne Reef and Westridge Marine Terminal, Full Report.
ii) A3S4T7, TERMPOL 3.5 & 3.12 Route Analysis & Anchorage Elements, Full Report
iii) A3S5I9, Review of Trans Mountain Expansion Project: Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, Full Report.

Preamble: Reference i) provides a simulation of a "credible worst-case" oil spill scenario at Arachne Reef and at Westridge Marine Terminal, assuming, among other things, the full implementation of the recommended enhanced spill response capacity.

Reference ii) provides a description of the Trans Mountain tanker sailing route.

Reference iii) provides an account of the recommended enhancements for oil spill response capacity in light of the Trans Mountain Expansion Project (TMEP). These are recommendations only and their implementation is not guaranteed under the TMEP.

Request: a) Given that reference ii) describes significant differences in the nature of the route east and west of Race Rocks, and given that reference iii) describes the need to prepare a spill response plan that accommodates the differences east and west of Race Rocks, please provide an oil spill scenario comparable to what is provided in reference i) for a spill that occurs west of Race Rocks.

b) Given that reference iii) makes it clear that the enhanced oil spill response scenario is not a guaranteed scenario under the Trans Mountain Expansion Project, please provide a separate oil spill scenario for the two locations given in reference i), plus the third location west of Race Rocks as requested in request a) of this section,

applying the condition that only current equipment response capacity is enlisted, with no new or enhanced capacity applied.

c) PDF page 14 of reference i) lays out the assumption that “spill site atmosphere in each of the scenarios presented no toxic or explosive hazards to first responders.” Please provide a justification for applying this assumption.

d) PDF page 14 of reference i) lays out the assumption that: “Adverse weather conditions did not prevent or complicate a response.” Please justify this assumption in light of the responses given to requests l), l.1), and q) from Section 13.1 of this information request.

e) Please explain why August was chosen for the timing of the scenario run in reference i).

f) Please confirm that the meteorological and oceanographic conditions applied to the study in reference i) are approaching “best-case scenario”. If not, why not? If yes, please explain why a near best-case scenario was chosen for the spill model?

g) Please explain why a comparable spill scenario to that conducted in reference i) was not conducted for the winter months, given the significant oceanographic and meteorological variance that can occur between summer and winter months.

h) Please confirm that the model used in reference i) assumes that the spilled oils will float and hence there are no sunken oils in the study. If no, please provide a detailed and comprehensive explanation of how specifically sunken oils were accounted for in the model and under what conditions the oils sank.

i) Please provide a separate oil spill scenario for the two locations given in reference i), plus the third location west of Race Rocks as requested in request a) of this section, applying typical winter storm conditions throughout the response period and including parameters for sunken oil.

j) Please provide a separate oil spill scenario for the two locations given in reference i), plus the third location west of Race Rocks for a total loss scenario in which the entire cargo capacity of the aframax tanker is discharged. Although this is an unlikely scenario, it is possible and has happened, so it is a scenario that needs to be addressed.

k) Please provide a justification for inputting a rate of release that took 13 hours to discharge the total spill volume in the Arachne Reef scenario, as stated on PDF page 18 of reference i). What analysis or research was used to inform this rate of release?

l) In the Arachne Reef Scenario on PDF page 19 of reference i) the report states that: “The 4 days length period was selected based on the slick thickness on water, which then becomes too thin to be efficiently recoverable after the end of the fourth day.” Please confirm if this 4-day timeline is based off of any existing studies of diluted bitumen in marine environments. If yes, please provide a list of references and explain why a standard 10-day response period is still being proposed instead of a

four-day response period, given these studies. If no, please explain why this parameter was used in the model if it does not reflect a scientific understanding of diluted bitumen.

m) The model run at Arachne reef in reference i) only recovered 44.5% of spilled oil, despite the enhanced spill response capacity and ideal weather conditions. Does Trans Mountain feel this result demonstrates a successful oil spill recovery?

n) Please explain why 55.5% of the oil spilt was not recovered?

o) Please provide a comprehensive socio-economic and environmental impact assessment for the likely impacts that would result if such a scenario were to occur in real life.

p) Does Trans Mountain expect to recover a higher or lower rate of spilled oil if an oil spill accident were to occur? Please explain.

q) Please provide a detailed list of every major oil spill that has occurred in the past 30 years and the corresponding rate of recovered oil from each spill.

r) Please provide a comprehensive list of every oil spill that has occurred, both on land and in a marine environment, involving oil that was transported through the Trans Mountain pipeline over the past 50 years. Please include with each spill, the corresponding rate of recovery during clean-up and note if the spill occurred on land or in a marine environment.

s) Table 4-2 of reference i) provides an estimate of the mitigation outcomes under the current level of response assets. Please confirm that according to this table, after 4 days only 2911 m^3 of oil (equivalent to 17.64% of total oil spilled) would have been recovered. If no, please explain.

s.1) Is Trans Mountain concerned about this low recovery rate, given that oil tankers carrying diluted bitumen from the Trans Mountain pipeline are already transiting the Salish Sea?

s.2) Please provide the entire analysis done to calculate the estimated results that are presented in table 4-2 of reference i).