Hearing Order OH-001-2014
Trans Mountain Pipeline ULC (Trans Mountain)
Application for the Trans Mountain Expansion Project (Project)

Written Argument-in-Chief

Name of Intervenor: **Andrew Weaver, MLA**

Table of Contents

1. Introduction

1. The Proponent, Trans Mountain Pipeline ULC (the "Proponent" or "Trans Mountain"), has submitted an Application (the "Application") for a Certificate of Public Convenience and Necessity ("CPCN"), pursuant to section 52 of the NEB Act, for the Trans Mountain Expansion Project (the "Project" or "TMEP").[1] The National Energy Board ("NEB" or the "Board") is therefore tasked with providing the Governor in Council ("GIC") a recommendation as to whether a CPCN should be issued. Furthermore, the Board is responsible for preparing a report with respect to the environmental assessment of the Project, laying out the Board's rationale, conclusions and recommendations, including mitigation measures. The GIC will then make a decision directing the Board to:

   a) Issue a CPCN with respect to the Project, or
   b) Dismiss the Application, or
   c) Reconsider its recommendations

2. In reviewing the Proponent's Application, the Board has determined that it will consider the following issues:[2]

   1. The need for the proposed project.

   2. The economic feasibility of the proposed project.

   3. The potential commercial impacts of the proposed project.

   4. The potential environmental and socio-economic effects of the proposed project, including any cumulative environmental effects that are likely to result from the project, including those required to be considered by the NEB's Filing Manual.

   5. The potential environmental and socio-economic effects of marine shipping activities that would result from the proposed project, including the potential effects of accidents or malfunctions that may occur.

   6. The appropriateness of the general route and land requirements for the proposed project.

   7. The suitability of the design of the proposed project.

   8. The terms and conditions to be included in any approval the Board may issue.

   9. Potential impacts of the project on Aboriginal interests.

   10. Potential impacts of the project on landowners and land use.

   11. Contingency planning for spills, accidents or malfunctions, during construction and operation of the project.

[1] NEB Act
[2] NEB Website – Trans Mountain Expansion Project

12. Safety and security during construction of the proposed project and operation of the project, including emergency response planning and third-party damage prevention.

3. The Board does not intend to consider the environmental and socio-economic effects associated with upstream activities, the development of oil sands, or the downstream use of the oil transported by the pipeline.

1.1 Intervenor's Focus

4. Andrew Weaver (the "Intervenor") applied to participate in the hearing process both as a Member of the Legislative Assembly of British Columbia and as a scientist with a doctorate in applied mathematics and specialty in physical oceanography, atmospheric and climate science.[3] As an MLA, the Intervenor was first elected in May 2013 to represent the constituency of Oak Bay-Gordon Head, which is located along the Trans Mountain Tanker Sailing Route on the South-Eastern tip of Vancouver Island. Given his representative function, the Intervenor has sought to focus on and give voice to the concerns of his constituents as they pertain to the Project.

5. As a scientist, the Intervenor served as Lansdowne Professor and Canada Research Chair in climate modeling and analysis in the School of Earth and Ocean Sciences at the University of Victoria, where he worked for over 20 years. He has been a Lead Author on the United Nations Intergovernmental Panel on Climate Change's 2nd, 3rd, 4th and 5th scientific assessments and has authored and co-authored over 200 peer-reviewed, scientific papers. The Intervenor is a Fellow of the Royal Society of Canada, Canadian Meteorological and Oceanographic Society, the American Meteorological Society, the American Geophysical Union and the American Association for the Advancement of Science. Throughout this process, the Intervenor has applied his scientific expertise in physical oceanography to evaluate the evidence provided by the Proponent.

6. Given his constituency and his background, the Intervenor has chosen to focus particularly on the risks associated with marine oil spills. The Intervenor's argument will therefore focus primarily on the following three issue areas:

5. The potential environmental and socio-economic effects of marine shipping activities that would result from the proposed project, including the potential effects of accidents or malfunctions that may occur.

11. Contingency planning for spills, accidents or malfunctions, during construction and operation of the project.

12. Safety and security during construction of the proposed project and operation of the project, including emergency response planning and third-party damage prevention.

[3] Application to Participate as Expert, Application to Participate as MLA

1.2 Summary of Intervenor's Argument

7. The Intervenor will present his argument in five parts. In Section 2, the Intervenor will unpack the significant shortfalls inherent in TERMPOL 3.15 – General Risk Analysis and Intended Methods of Reducing Risk, and outline how the Proponent has failed to adequately represent the degree of risk associated with the Project. Section 3 will present an analysis and evaluation of the scientific studies presented by the Proponent with regard to the fate and behaviour of diluted bitumen in a marine environment, arguing that Trans Mountain has failed to adequately support its assumption that diluted bitumen will remain positively buoyant in the event of a spill. Section 4 will contain an analysis of the deficiencies inherent in existing and proposed spill response measures. Section 5 will offer an assessment of the human health risk assessment provided by the Proponent, arguing that it does not adequately portray the potential health effects that may occur in the event of an oil spill. Finally, Section 6 will apply these and other points to demonstrate that the Proponent has neglected to represent the full scope of effects the Project could have on local communities, such as the riding of Oak Bay-Gordon Head.

8. Through these five parts, the Intervenor will argue the following: First, Trans Mountain has failed to adequately and accurately represent the full scope of risks and negative effects an oil tanker spill would present to human health, the environment and coastal communities. Second, Trans Mountain has failed to represent a clear and satisfactory ability to respond to an oil spill in a manner that would sufficiently mitigate the negative effects as well as adequately contain and recover the spilled oil. As a result, Trans Mountain has failed to demonstrate that it and its partner organizations have adequately understood, and have the capacity to sufficiently mitigate, the serious risks posed by the Trans Mountain Expansion Project to justify a complete Application or a positive recommendation to the GIC.

9. For these reasons, as detailed below, the Intervenor respectfully submits that the Board should conclude that the Application is incomplete, and should therefore decline to forward a recommendation to the GIC. In the alternative, the Intervenor submits that the Board must recommend to the GIC that the Application be dismissed. Due to the various substantive deficiencies with Trans Mountain's Application set out in the written argument that follows, the Intervenor submits that these are the only courses of action open to the Board. For this reason, the Intervenor has made no submissions as to potential conditions that the Board could impose, as no such conditions could sufficiently remedy the flaws inherent in Trans Mountain's Application.

2. Probability of a Tanker-Based Oil Spill

10. As a part of their Application, Trans Mountain was required to assess the relative additional risk the TMEP would pose in the tanker sailing route. Trans

Mountain made its case, as summarized in sections 5.2 and 5.3 of Volume 8A[4], based primarily on two reports: TERMPOL 3.8 – Casualty Data Survey[5] and TERMPOL 3.15 – General Risk Analysis and Intended Methods of Reducing Risk.[6]

11. Through the Casualty Data Survey produced by Det Norske Veritas (DNV) and filed under TERMPOL 3.8, Trans Mountain provided a comparison of historical accident frequencies of oil tankers and other relevant types of marine vessels based on global, national and local data. In TERMPOL 3.15 Trans Mountain attempts to quantify the probability that an incident involving an oil tanker will occur and the probability that such an incident would result in the discharge of oil.

12. Together, these reports form the basis of Trans Mountain's case regarding the degree of risk posed by the TMEP.

2.1 Casualty Data Survey

13. In TERMPOL 3.8 – Casualty Data Survey, Trans Mountain analyses global, national and regional historic incident data to support three overarching conclusions:[7]

1. The worldwide incident frequency involving oil tankers is among the lowest of all marine vessels;

2. There has been a decline in the number of marine incidents both internationally and in Canadian waters;

3. The low number of incidents involving oil tankers on the West Coast could imply that the current scheme to manage navigation and marine traffic is effective.

14. These conclusions serve as the foundation for Trans Mountain's claims that based on historical data trends, the Board can be confident that oil tanker safety rates have improved sufficiently over time and that the TMEP would not pose significant risk to the marine study area. Yet, contrary to the conclusions Trans Mountain derives, the data provided actually paints a starkly different story. This section will unpack these three conclusions.

2.1.1 Worldwide Incident Frequency Involving Oil Tankers is not among the Lowest of All Marine Vessels

15. Trans Mountain concludes in its Application that "based on the available data, DNV shows that the worldwide incident frequency involving oil tankers is

[4] A3S4Y3, A3S4Y4, A3S4Y5
[5] A3S4T1
[6] A3S5F4, A3S5F6, A3S5F8
[7] A3S4T1

among the lowest of all marine vessels for the period 2002 to 2011"[8]. Trans Mountain has since confirmed that this conclusion is based on analysis of data from only four vessel types: LNG-LPG Tankers, Chemical Tankers, Oil Tankers and Bulk Carriers.[9]

16. Leaving aside the fact that one cannot claim that oil tankers have among the lowest incident frequencies of all marine vessels when a comparison was only made with three other vessel types, the data provided for those other vessel types does not actually support this conclusion.

17. Based on the data in Figure 4-1of TERMPOL 3.8 it is clear that oil tankers have the second highest "total loss" and "not serious" incident rates and the third highest "serious" incident rate of the four vessels types.[10] In fact, LNG-LPG tankers have the lowest overall incident rates, while Oil Tankers and Chemical Tankers rank second or third, depending on the severity of the incident type. To claim that this data places oil tankers among the lowest of all marine vessels is, therefore, a stretch.

2.1.2 No Decline in the Number of Marine Incidents Involving Tankers

18. In its report, DNV concludes that "[t]he casualty data survey shows that there has been a decline in the number of incidents both internationally and in Canadian waters for 2002-2011."[11] While this statement is accurate for all marine vessels for which data is provided, it is not actually representative of the incident rates for oil tankers, specifically.

19. First, an analysis of the international data provided in Figure 4-2 shows that the rate of total loss and serious incidents involving oil tankers has actually increased from 2002 to 2011. In fact, global oil tanker incident rates only decline for "not serious" incidents and DNV itself 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."[12] It is, therefore, reasonable to conclude the perceived decline in global oil tanker incident rates is actually accounted for by a decline in the rate of reporting of "not serious" incidents.

20. Second, an analysis of the Canadian data provided in Figures 5-1 and 5-2 shows that a 40% drop in the number of incidents involving fishing vessels accounts for the majority of the decline in marine incidents in Canadian waters. In fact,

[8] A3S4Y3 - PDF Page 289, emphasis added.
[9] A3Y3W4 – PDF Page 76
[10] A3S4T1
[11] A3S4T1 - PDF Page 36
[12] A3S4T1 - PDF Page 14

the number of incidents involving tankers in Canadian waters stays constant at eleven per year for the entire time period.[13]

21. While it is therefore fair to conclude that the number of incidents involving other types of marine vessels has declined both internationally and in Canada, this conclusion does not hold true for oil tankers.

2.1.3 Incident Rates Involving Oil Tankers on the West Coast is Unknown

22. In its Application, Trans Mountain concludes that "[t]he 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."[14]

23. In order to properly support this conclusion, one would need traffic density data to derive incident frequencies. Without deriving incident frequencies, one cannot actually determine if the number of incidents involving oil tankers is in fact "low" as Trans Mountain concludes or if the perceived low number of incidents is in fact accounted for by a similarly low number of vessels. If the latter is true, then the incident rate could in fact be on par or higher than the global average.

24. Importantly, as DNV notes in the Casualty Data Survey, "[t]here 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."[15] Trans Mountain's conclusion can, therefore, only be read as an unsupported assertion.

25. Meanwhile, the lack of correlated traffic density data poses a much bigger problem for information gleaned from the Casualty Data Survey. Ultimately, the value of global and national incident frequency data for the purpose of this hearing process comes primarily from its ability to shed light on the relative incident rates in the local marine study area. Are local incident rates higher or lower than their national or international counterparts? Are local incident rates on the rise or on the decline and how does that compare with national and international incident rates? The fact that the data is not correlated to traffic density data means that we have no reliable way of comparing local incident rates with national and international rates.

26. As DNV notes, "A common challenge with casualty databases is that there are seldom sufficient data about the traffic density (exposure data) directly related to the area of study. Although global data is good, it cannot be directly applied to a specific location where local traffic could be quite different."[16]

[13] A3S4T1
[14] A3S4Y3 - PDF page 291
[15] A3S4T1 - PDF Page 24
[16] A3S4T1 - PDF Page 8

2.1.4 Interpreting the Casualty Data Survey

27. As demonstrated through the three points above, the data provided by Trans Mountain and DNV does not support Trans Mountain's conclusions. In reality, oil tankers appear on par with the three other vessel types that were compared in terms of incident frequencies; incident rates involving oil tankers have, at best, stayed relatively constant from 2002-2011; and one has no way of ascertaining west coast incident frequencies in order to garner a sense of how the region compares nationally and globally in terms of its safety and incident rates. As such, Trans Mountain's broader arguments—that the Board can be confident that oil tanker safety rates have improved sufficiently over time and that the TMEP would not pose significant risk to the marine study area—also remain unsupported by the data provided.

2.2 Risk Analysis

28. In TERMPOL 3.15 Trans Mountain conducts a general risk analysis, including intended methods of reducing risk.[17] The analysis attempts to quantify the probability that an incident involving an oil tanker will occur with the addition of the TMEP and the probability that such an incident would result in a discharge of oil. That analysis is based on the Marine Accident Risk Calculation System (MARCS) developed by Det Norske Veritas.

29. According to the MARCS analysis completed for TERMPOL 3.15, the return period for a spill of any size is 309 years at present conditions. With the implementation of the Trans Mountain Expansion Project, the return period drops to once every 46 years. However, with the addition of the extended escort tug and the moving exclusion zone, DNV calculates that the return period will increase to once every 237 years. Trans Mountain uses this general risk assessment and the resulting conclusions to argue that its safety measures will mitigate additional risks sufficiently, such that the TMEP will not significantly increase the degree of risk posed by oil tankers to the marine study area.

30. The Intervenor's scientific background lends him particular expertise in commenting on this general risk analysis. As a former Canada Research Chair in climate modeling and analysis in the School of Earth and Ocean Sciences at the University of Victoria, the Intervenor spent his scientific career developing models to accurately represent climatic processes. He has authored and coauthored over 200 peer-reviewed, scientific papers and was a lead author in the second, third, fourth and fifth scientific assessments of the United Nations International Panel on Climate Change. The Intervenor served as Chief Editor of the Journal of Climate from 2005-2009 and is a Fellow of the Royal Society of Canada, Canadian Meteorological and Oceanographic Society, the American Meteorological Society, the American Geophysical Union and the American Association for the Advancement of Science. The Intervenor therefore brings over 20 years of scientific modeling experience to his analysis of Trans Mountain's risk assessment.

---

[17] A3S5F4, A3S5F6, A3S5F8

31. Based on this expertise, on the information provided by Trans Mountain's Application, and on the responses the Intervenor received to his information requests, the Intervenor is deeply concerned that the results from MARCS do not accurately represent the level of risk posed by the Trans Mountain Expansion Project.

32. The underlying problem with DNV's analysis is that there is no credible way of assessing the validity of the resulting conclusions based on the evidence provided. Given this, the Intervenor argues that the risk analysis provided in TERMPOL 3.15 should not be given any weighting in the Board's consideration and final decision.

2.2.1 Model is Proprietary

33. The underlying problem with the General Risk Analysis is that MARCS is proprietary. As such, the Board and Intervenors have no way of accessing the model itself to conduct an independent assessment of its accuracy in representing the actual level of risk posed by the TMEP. In Section 11 of TERMPOL 3.15, DNV has referenced back-up studies and peer-reviewed studies that were conducted by the US National Academy of Sciences as evidence of the models validity and accuracy, but has not provided any of these studies on record in this hearing process.[18] The Board and Intervenors are, therefore, expected to simply trust DNV and Trans Mountain's assertions. This was the same 'trust us' approach that was given in response to information requests that attempted to secure the evidence necessary to adequately evaluate the model.

34. Given the serious impact a spill could have on the region, it would be irresponsible to accept the assertions provided in Trans Mountain's Application in the absence of evidence.

35. Stemming from this overall lack of evidence, there are four serious concerns that arise with regards to the accuracy of using MARCS for the TMEP's marine study area (i.e. tanker sailing route).

2.2.2 Insufficient Information Provided to Support MARCS Parameters

36. First, it is unclear how representative the parameters used in MARCS are of the marine study area. The fact is that all models are based on basic parameters or assumptions. In order for the model to be accurate, those parameters need to accurately represent real world conditions, in this case as they exist in the marine study area.

37. In Appendix 4 of TERMPOL 3.15, DNV states that "the basic parameters of MARCS represent North Sea average shipping operations in the mid to late

[18] A3S5F6

1990s."[19] The question is, how have these parameters been updated to represent current and local shipping operations in British Columbia and have these updated parameters been validated for their predictive accuracy? When asked about these updates in an information request Trans Mountain refused to provide the information, stating that it was "not required in order to assess the risk of increased tanker traffic as a result of the Project."[20] Yet, without this essential information, one cannot accurately assess whether the basic parameters of MARCS are representative of real world conditions in the marine study area or not.

38. Section 11 of TERMPOL 3.15 does include a brief general discussion of both the sensitivity and validation of MARCS.[21] As described above, DNV references situations where the methods and results of MARCS were subject to third party academic peer review by the US National Academy of Sciences. However, the results of these reviews were not included on record and so it is unclear if the reviews were supportive or critical of MARCS or if they highlighted any significant short-comings or biases in the model. Moreover, no supporting evidence is provided as to the predictive value of the model for the specific marine study area. As will be discussed below, the ability of the model to represent one region or case does not, on its own, imply sufficient predictive abilities for other regions or cases.

39. One is therefore unable to access the model to independently verify whether the assumptions and parameters are representative of the tanker sailing route, and yet Trans Mountain has also refused to provide the information necessary to evaluate the parameters in lieu of access to the model. The only support provided is an assertion that the model is accurate, which this Intervenor argues is wholly inadequate given the risks of this Project.

40. In section 7.5.3 of TERMPOL 3.15, DNV does offer a comparison of the Danish Strait and the Trans Mountain tanker sailing route. DNV uses this comparison to conclude that "[t]he 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."[22] However, even this comparison is relatively brief and only supported by general assertions. When asked for a more exhaustive comparison of the two marine areas, Trans Mountain refused to provide the additional information. Once again, the Intervenor is left with an assertion made based on an absence of evidence with unwillingness from Trans Mountain to provide the additional information necessary to support the conclusion.

41. At the end of this process, one is therefore still left with no ability to properly evaluate the core parameters of MARCS for its predictive accuracy. In the absence of this information, one cannot accurately evaluate the results from the risk analysis that was provided.

---

[19] A3S5F8 - PDF Page 46
[20] A4H9J8 - PDF Page 30
[21] A3S5F6
[22] A3S5F6 – PDF Page 29

2.2.3 Insufficient Information Provided to Support Risk Reduction Measures

42. The second concern is whether the inputs and assumptions that were used by DNV to represent the risk reduction measures in MARCS are actually representative of real world conditions. DNV applied these risk reduction measures in an attempt to ascertain the impact additional mitigation measures could have on reducing the likelihood of an incident. Not a single one of these measures was validated for the marine study area, nor was a sensitivity analysis conducted for any measures.[23]

43. As mentioned above, the general discussion of validation and sensitivity analysis does not provide sufficient information for one to conduct a proper evaluation of the model. Moreover, a proper analysis of the accuracy of risk reduction inputs generally requires separate validations and sensitivity analyses for each input. However, when the Intervenor requested this information, Trans Mountain made it clear that it had not conducted validations or sensitivity analyses for any of its risk reduction measures.[24]

44. In Section 3 of Appendix 4 of TEMPOL 3.15, Trans Mountain provides a discussion on how it arrived at the various risk reduction measures.[25] In some cases, these discussions include literature reviews that attempt to quantify the benefits of various risk reduction measures. While the cited studies at times display a wide range of impacts from a given risk reduction measure, Trans Mountain argues that DNV tended to draw relatively conservative conclusions from the results for input into MARCS. Meanwhile, DNV's description of how it arrived at its model input also makes it clear that the decision relied heavily on expert judgment.

45. While this may constitute a reasonable initial approach to determining risk reduction factors, without evidence of testing or validation of either the expert judgment or the chosen risk reduction factors, one has no way of evaluating the accuracy of each factor.

46. This is particularly true when it comes to interaction effects between risk reduction measures and unexpected outcomes. For instance, when DNV applied the risk reduction factors for VTS and Pilotage, 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 judgment of 2 ex-navigating officers employed by DNV. Taking into account all the available evidence, DNV has made the decision to favour the MARCS*

---

[23] A3Y3W4, A4H9J8, A3S5F4, A3S5F6, A3S5F8
[24] A3Y3W4, A4H9J8
[25] A3S5F8

> *parameters, and these have been further amended to represent all important influences as described below.*[26]

47. It is unclear from the information provided if DNV has in fact addressed this inconsistency in a manner that accurately reflects real world conditions. While DNV makes reference to considering all the available evidence, no information is provided as to what that evidence is. It also leaves open questions, such as, how DNV measured the accuracy of the expert judgment? How were the resulting changes calibrated and quantified? Based on responses to the Intervenor's information requests, it appears that the resulting Performance Shaping Factor (PSF) was never validated to assess its accuracy for the marine study area.[27]

48. Meanwhile, in other instances there were no data or previous studies available to inform chosen PSFs. In these instances, provisional assumptions were made with no clear explanation provided as to how the PSF was chosen. For instance, in justifying the PSF that was used for PPU, DNV notes:

> *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%...This is modeled by an additional PSF (see Section 3.7) of 0.90 applied to human performance errors in powered groundings when at least one pilot is present.*[28]

49. This similar lack of evidence for risk reduction measures holds true for both the extended escort tug applied in case 1a and the moving exclusion zone applied in Case 1b. In both cases, DNV and Trans Mountain fail to provide supporting evidence for the chosen risk reduction factors. For instance, DNV estimates that the moving exclusion zone would "reduce the frequency of encounters with commercial shipping by 90% or more."[29] When supporting evidence and analysis is requested by the Intervenor to justify the chosen factor, Trans Mountain failed to provide that evidence.

50. Collectively, these examples are indicative of an approach used by DNV and Trans Mountain that attempts to fill gaps in evidence with "expert judgment" without then performing the necessary validation to ensure that those judgments are in fact accurate. When Intervenors request the supporting evidence, Trans Mountain declines to provide it, as if opting for a "trust us" approach to this risk analysis.

51. As with the core parameters of the model, one is left with no ability to properly evaluate the risk reduction factors for their predictive accuracy. In the absence of this information, one cannot accurately evaluate the overall results from the risk analysis, nor can one evaluate the relative benefits of the extended escort tug in case 1a and the moving exclusion zone in case 1b.

---

[26] A3S5F8 - PDF Page 49
[27] A3Y3W4, A4H9J8
[28] A3S5F8 - PDF Page 49
[29] A3S5F6 – PDF Page 24

2.2.4 Insufficient Information to Discount Tuning

52. The underlying question that results from all of this uncertainty is: Even if the calculations made by MARCS in previous studies were in fact accurate, how confident can one be that the model did not simply produced the right answer for the wrong reason? This situation is known as 'tuning' and it gets to the core of the predictive abilities of MARCS. As described above, DNV makes the case that the accuracy of MARCS' methods and results have been demonstrated through past Projects, yet no evidence has been provided to demonstrate how MARCS has successfully avoided tuning in order to ensure the model's predictive accuracy in other situations. In other words, the fact that MARCS may have successfully represented past cases is not sufficient evidence to conclude that MARCS can accurately represent future cases, including the TMEP. This is because one can 'tune' over errors and inconsistencies in the model to achieve the desired result, without actually ever addressing those errors.

53. If DNV has 'tuned' over errors to achieve the desired result in the past, then the model itself may actually have little or no predictive ability in this situation. In the absence of model validation, sensitivity analyses and independent, peer-reviewed evidence, one cannot know if MARCS is in fact accurately representing the risks and reductions associated with various inputs, even if past instances may have been accurate.

2.2.5 Total Loss Scenario Excluded

54. Finally, underlying each of the oil spill simulations conducted for the Application is the chosen definition of a Credible Worst Case ("CWC") oil spill as being equivalent to a 16,500 m^3 spill.

55. As a part of TEMPOL 3.15, DNV attempted to calculate the conditional probability of oil spill outflow volumes from an aframax tanker from a grounding incident that leads to a spill and from a collision incident that leads to a spill. From these calculations, DNV defined the mean oil spill outflow volume (equivalent to 50% largest outflow) to be 8,250 m^3 and the CWC outflow volume (equivalent to 10% largest outflow) to be 16,500 m^3. [30] The Proponent then refused to conduct any spill scenarios assuming an outflow volume larger than their defined CWC scenario, which was equivalent to roughly 15% of the cargo of a single aframax tanker.

56. There are three principle problems with this approach.

57. First, the Proponent draws its CWC scenario assumptions specifically from grounding and collision incidents without providing adequate evidence to demonstrate that these assumptions are representative of the full scope of incident types that could occur. Indeed, in Section 9.1.4 of TERMPOL 3.15, DNV excludes foundering from consideration, stating that it is "extremely

[30] A3S5F6 – PDF Pages 35-41

improbable…and therefore not considered a credible event" without providing any evidence to support this assertion.[31]

58. Meanwhile, a similar approach is taken for spills caused by fires and explosions. The report concludes that, based on historical accident data, the probability of a total loss scenario in the event of a fire or explosion could be assumed to be equivalent to a 20% largest outflow event. Such an incident would place a total loss scenario within the 10% largest outflow metric used to define the CWC scenario for collision and grounding incidents. Yet, despite meeting this same criterion, DNV and the Proponent still chose to exclude a total loss scenario of this nature from consideration in simulations provided for the Application. They did so while also failing to provide adequate evidence to support the rationale behind that decision.

59. Second, only taking into consideration collision and grounding scenarios, the fact that the Proponent's CWC scenario only accounts for 90% of spill outcomes implies that there is a 10% probably that a spill could be larger than the CWC. In fact, the Exxon Valdez spilled roughly 35,000 tonnes of oil - more than double the size of Trans Mountain's CWC scenario. The Atlantic Empress released 287,000 tonnes of crude in 1979 after it caught fire and sank in the Caribbean. In 1983 Castillo de Bellver exploded off the coast of South Africa and released 50,000 to 60,000 tonnes of light crude into the sea. In 2002, Prestige split in half and sank off the coast of Spain releasing 63,000 tonnes. And of course, there are other examples.

60. Third, while it may be true that so far no double-hull tanker has spilled 100% of its oil, this is far from a solid argument. The fact is, policies requiring all new tankers to be constructed with double-hulls are relatively new. It is only within the last 20 years that this has become a mandatory requirement.[32] So, while a total loss incident involving a double-hull tanker has not occurred to date, these ships have not been in use long enough for such a justification to be made with much certainty.

61. Based on these arguments, the Intervenor asked Trans Mountain to provide an analysis of the risks, impacts, and response capacity associated with a total loss scenario in the first round of Information Requests. Trans Mountain refused to provide this information.[33]

62. The Proponent's refusal to consider a total loss scenario—or any scenario larger than a 15% discharge in cargo—is indicative of an approach that fails to consider and prepare for the full scope of risks associated with the Project. Given the catastrophic damage an oil spill could cause the region, economically, socially and environmentally, the Intervenor argues that the Proponent should be required to demonstrate sufficient consideration of spill scenarios larger than its defined CWC scenario. Neglecting to do so should be considered a failure to meet basic requirements of demonstrating that Trans Mountain has adequately

[31] A3S5F6 – PDF Pages 38
[32] Transport Canada - Marine Safety - Operations & Environment – Tankers Background
[33] A3Y3W4

considered the full scope of risks associated with the Project and implemented the necessary mitigation measures to reduce those risks.

2.2.6 Interpreting DNV's General Risk Analysis

63. Through TERMPOL 3.15, Trans Mountain set out to build the case that the additional risk posed by and relating to TMEP oil tankers could be successfully mitigated by additional risk reduction measures, namely the extended escort tug and the moving exclusion zone. In building their case, they attempted to estimate the baseline risk posed by current marine traffic, the additional risk posed by Trans Mountain's tankers and the extent to which the risk reduction measures could help mitigate that additional risk.

64. The accuracy of those estimates depends predominantly on the extent to which MARCS accurately represents real world conditions in the marine study area. The first questions one must ask, therefore, are: Have the baseline parameters of MARCS and the risk reduction factors been validated for the marine study area? Has a sensitivity analysis been conducted on the overall model and on each risk reduction factor? How has the model been calibrated to avoid 'tuning', so as to ensure its predictive abilities?

65. There are two essential ways of answering these questions: One is to have the model be made available to participants in the hearing process so that they may conduct independent analyses of its representative and predictive abilities. The other is to provide the information necessary to answer these questions in the absence of access to the model. At a minimum, one would need any back-up, peer-reviewed and independent evaluations of the model. One would also need the actual validation and sensitivity analyses that were conducted for the overall model and for the individual risk reduction factors. All of this would need to be provided on record.

66. Unfortunately, as was detailed above, MARCS is a proprietary model and, hence, access to the model has been denied. Meanwhile, the back-up studies that were referenced in DNV's report have not been provided, nor have any validations or sensitivity analyses.

67. In the absence of this information, one simply cannot properly evaluate the representative or predictive nature of MARCS as it pertains to the Risk Analysis conducted for the TMEP. Without this ability, one has no way of knowing if the results of the MARCS analysis are accurate or not. It is for this reason that the Intervenor argues that the risk analysis provided in TERMPOL 3.15 should not be given any weighting in the Board's consideration and final decision. Lacking a credible and substantiated risk analysis, the Intervenor argues that Trans Mountain's Application is incomplete.

68. Finally, Trans Mountain's refusal to provide any analyses and simulations assuming a total loss spill scenario should be interpreted as an unwillingness to consider the full scope of risk associated with the Project. It must also be seen

as a failure to meet the basic requirements of demonstrating that Trans Mountain and its partner organizations have the capacity to mitigate the full scope of risk the Project would create.

3. Fate and Behaviour of Diluted Bitumen in Marine Environments

3.1 Assessing the potential risk of and response to a marine spill

69. Trans Mountain based their entire analysis of the fate and behaviour of diluted bitumen (dilbit) in the marine environment on the faulty assumption that dilbit floats. Published evidence[34], together with a Federal government study[35] and an Environment Canada presentation to the Royal Society of Canada's Expert Panel on *The Behaviour and Environmental Impacts of Crude Oil Released into Aqueous Environments*[36], all of which are submitted as evidence to the NEB, clearly conclude otherwise. Unlike other crude oils, dilbit can sink in the presence of suspended particulate matter (e.g. sediment particles in the ocean). Suspended particulate matter is very common in B.C.'s coastal waters, meaning that any dilbit spill would likely lead to submerged oil. Currently there is no ability to effectively clean up oil that sinks below the surface, making dilbit a particularly risky substance to transport.

70. In addition to the present inability to effectively respond to a spill of dilbit in the marine environment, the Intervenor will argue below that the ocean model used to assess potential spill trajectories has not been effectively evaluated for use in highly turbulent tidal channels and in the presence of oceanic frontal systems commonly found in the Salish Sea.

3.1.1 No Capacity to Deal with Sunken and Submerged Oil

71. The Proponent has based the assessment of the fate and behaviour of diluted bitumen in the marine environment on two submissions. The first contained a comparison of the properties of diluted bitumen with other oils[37]. The second commissioned report was entitled *A Comparison of the Properties of Diluted Bitumen Crudes with Other Oils*[38]. This report has been referred to as the so-called Gainford study. The Gainford study undertook tank experiments using saline water (typical of Burrard inlet) that did not include suspended sediments.

72. As noted above there is strong evidence that dilbit could sink in seawater containing sufficient suspended sediments of which there are no shortage in our coastal waters. The Salish Sea receives year round sediment-laden freshwater discharge from the Fraser River. The tank experiments conducted in A4H9A1 where sediments were accounted for noted the following:

---

[34] A4L8R2
[35] A4H9A1
[36] A4L8R4
[37] A3S5G7
[38] A3S5G2, A3S5G4

"*high-energy wave action mixed the sediments with diluted bitumen, causing the mixture to sink or be dispersed as floating tarballs,*"

And,

"*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.*"

73. Similarly, the Environment Canada presentation to the RSC Expert Panel noted that in the presence of fine to medium suspended sediments with fresh to moderate weathering, a large part of the oil sinks as fine oil particles as in the case of what occurred in the Kalamazoo spill.

74. The Intervenor asked the Proponent a number of questions as to whether or not additional tank experiments had been, or were going to be, conducted with conditions more relevant to the Salish Sea. For example, the Intervenor asked whether any tank experiments were conducted:

1. with more saline conditions typical of the Strait of Juan de Fuca? If not, why not?

2. with colder conditions typical of winter? If not, why not?

3. in the presence of strong horizontal and/or vertical sheer? If not, why not?

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

5. in the presence of downwelling conditions with downwelling velocities reaching greater than 40-50 cm/s as observed in [observed tidal fronts in the region]? If not, why not?

75. After not getting satisfactory answers during the first round[39], the Intervenor asked the very specific question during the second round:[40]

Has Trans Mountain conducted any new tank studies or other scientific studies exploring how diluted bitumen behaves in saline water in the presence of suspended particles since the first round of Intervenor information requests were submitted? If no, why not? If yes, please provide a copy of each new study.

76. The Proponent clearly indicated in response to this question that no experiments had been conducted. Unfortunately the Proponent did not respond to the Intervenor's question "why not?"

---

[39] A3Y3W4

[40] A4J5J7

77. Evidence as to why not might be gleaned from the Proponent's response[41] to NEB IR No 1.63a[42]. Here the Proponent states:

> *Trans Mountain believes that a joint industry approach working in cooperation with Federal and Provincial agencies will be the most efficient and effective means to conduct further research in this area.*

78. It is clear that unless required to do so, Trans Mountain has no intention of conducting additional tank and/or field studies to explore the fate and behaviour of diluted bitumen in the coastal environment where sediments are present in the water column. Both the Royal Society of Canada Expert Panel Report: *The Behaviour and Environmental Impact of Crude Oil Released in Aqueous Environments*, and the National Academy of Science's report *Spills of Diluted Bitumen from Pipelines: A Comparative Study of Environmental Fate, Effects, and Response* make it clear that we simply to not know enough to properly assess the risk and potential damages associated with a diluted bitumen spill in the Salish Sea. The Intervenor submits that in light of the glaring gap in scientific understanding, it would be reckless to approve the Trans Mountain project at this time.

79. In fact, given that diluted bitumen is already being loaded onto tankers at the Burnaby facility, it behoves the National Energy Board to recommend an immediate moratorium on any diluted bitumen shipments until such time as scientific understanding is improved as to the fate and behaviour of diluted bitumen in the marine environment.

3.1.2 Incomplete and Uncertain Ocean Modeling Analysis

80. The Proponent has conducted a number of ocean model simulations using the proprietary H3D model[43]. During the first round of requests for information, the Intervenor attempted to understand the model's physics and its numerical discretization / parametrization in H3D[44]. Many of the answers were incomplete or insufficient[45].

81. As also noted by intervenor Dr. David Farmer, FRS, FRSC, who has extensive expertise in ocean physics and, in particular small scale ocean mixing processes, tidal fronts, vortex sheet tilting, breaking internal waves and whirlpools play a key role in mixing and subduction in the Strait of Juan de Fuca. Many of these complex mixing processes are non-hydrostatic and so, the intervenor believes that the use of a hydrostatic model is not appropriate in the present context.

82. The Intervenor also posed numerous questions with respect to the validation of H3D. The Proponent argued several times "The primary validation of an

[41] A3W9H8
[42] A3V8V6
[43] A3S5G9, A3S5H1, A3S5H3, A3S5H4, A3S5H7, A3S5H8, A3S5H9, A3S5I0, A3S5I1
[44] A3W7D6
[45] A3Y3W4

oceanographic model concerns the reproduction of observed tidal heights". This statement is simply incorrect. Tidal heights are easy to reproduce with much simpler models than H3D. For ocean model validation, an assessment is required of the three dimensional velocity, temperature and salinity fields. In the case of oil spill modeling, it's critical to evaluate the three-dimensional current fields.

83. The Proponent discussed only one form of current evaluation in the original submission. Bob Lord fell in the water on July 25, 1993 and his drift was subsequently simulated. In the Intervenor's more than two decades of ocean and climate modeling research, he has never before heard of a person falling out of a ship being used as a data point for model validation. The Proponent submitted further evidence that stated, as the Intervenor had expected, "the greatest uncertainty is associated with the initial location"[46]. It is entirely plausible that the Proponent got a reasonably correct drift trajectory for the completely wrong reasons. The experiment performed by a number of non-government groups wherein plywood drift cards were released in close proximity to each other clearly demonstrates the importance of accurately knowing the initial condition in the highly turbulent surface waters in this region[47]

84. The Proponent eventually provided additional documentation aimed at demonstrating that the model has been successfully evaluated in the study region[48]. While evidence exists to suggest that the model does a reasonable job capturing the magnitude of the long channel flow, the model clearly did not capture the across channel flow. But it is precisely this across channel flow that is critical in assessing where oil ends up if a spill occurs.

85. In addition, no evaluation of vertical flow was provided. This information is critical if one wants to assess the adequacy of the model in capturing the mixing and subduction processes mentioned above. Given that the model employs the Boussinesq approximation, the vertical velocity field w simply arises from convergence of the horizontal flow:

$$w = -\int (u_x + v_y)\, dz$$

86. And given that the model is hydrostatic, there will be no vertical acceleration. As a result the vertical velocity field, and subsequently any vertical advection of tracers, will almost certainly be unrealistic leading one to question the suitability of H3D for this Application in light of the complex oceanography of the region and the unique properties of dilbit.

87. It is the expert opinion of the Intervenor that the proprietary ocean model that has been used to predict the fate and behavior of a potential dilbit spill in the Salish Sea is not the appropriate tool to address the questions being asked. The ocean model cannot capture the complex mixing and subduction processes that

[46] A3Y3W6
[47] Salish Sea Spill Map
[48] A4A2A1

are known to exist in the Salish Sea. The model is hydrostatic and the vertical velocity fields, and hence the vertical distribution of tracers, will almost certainly be poorly represented. Model evaluation clearly shows an inability of the model to capture across-channel flow and there has been no drifter testing of model predictions.

4. Proposed and Existing Oil Spill Response and Recovery Capacity

88. Issue eleven of the list of issues to be considered in the hearing process states that the National Energy Board will consider "[c]ontingency planning for spills, accidents or malfunctions, during construction and operation of the project", while issue 12 states that the Board will consider "[s]afety and security during construction of the proposed project and operation of the project, including emergency response planning and third-party damage prevention." [49]

89. To address this consideration, Trans Mountain has presented a "Future Oil Spill Response Approach Plan" by Western Canada Marine Response Corporation[50] (WCMRC) and a report by EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company, and WCMRC titled "Trans Mountain Expansion Project Oil Spill Response Simulation Study, Arachne Reef and Westridge Marine Terminal."[51] These reports form the basis of the oil spill preparedness and response sections of Trans Mountain's Application.[52]

4.1 Future Oil Spill Response Approach Plan

90. Western Canada Marine Response Corporation's "Future Oil Spill Response Approach Plan" outlines WCMRC and Trans Mountain's proposal for enhancing existing oil spill response capacity in the event that the TMEP is approved.[53] It should be noted the enhancements detailed in the Future Oil Spill Response Approach Plan only constitute a proposal at this stage, with no guarantee of implementation.

91. Currently, WCMRC is required under the *Canada Shipping Act, 2001* to maintain sufficient capacity to respond to a 10,000 tonne spill.[54] Under proposed enhancements, WCMRC would increase its capacity such that it is certified to respond to a 20,000 tonne spill.

92. While the proposed enhancements would certainly constitute a significant improvement, the Intervenor argues that even with those enhancements, insufficient capacity will exist to adequately respond to a spill.

---

[49] NEB Website: Trans Mountain Pipeline ULC – Trans Mountain Expansion Project
[50] A3S5I9
[51] A3S5J0
[52] A3S4Y6, A3S5Q3, A3S4Y9, A3S4Z0
[53] A3S5I9
[54] Canada Shipping Act, 2001

4.1.1 No Capacity to Deal with Sunken and Submerged Oil

93. In Section 3, the Intervenor made the case that diluted bitumen can sink or submerge in the presence of suspended particulate matter. Given the prevalence of suspended particulate matter along the tanker sailing route, an effective spill response regime would require the ability to recover submerged and sunken oils.

94. Based on the information provided, it is clear that WCMRC currently has no capacity to recover submerged or sunken oils. Furthermore, not a single proposed enhancement, as laid out in the Future Oil Spill Response Approach Plan, would add this capacity. [55]

95. Without the ability to recover submerged and sunken oil, response organizations will be unable to mitigate a significant risk resulting from the TMEP. By neglecting to address this substantial short-coming in its Application, Trans Mountain has failed to substantiate its case for how it could mitigate the full scope of potential effects from an oil spill incident.

4.1.2 Unprepared for Total Loss Scenario

96. The Intervenor believes it is unacceptable for TMEP Tankers and related response organizations to rely on unpredictable equipment sources for purposes of emergency oil spill response. Yet this is precisely what would happen in the event of a total loss scenario since even under the proposed enhancements, WCMRC would only have the capacity to respond to roughly 20% of the spilled oil (equivalent to roughly 105,000 m^3).[56]

97. As WCMRC notes, "[i]n 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."[57]

98. Not only have Trans Mountain and WCMRC failed to certify sufficient resources to respond to a Worst Case Discharge, or total loss scenario (as detailed in Section 2), they have also failed to adequately outline the scope, ability and potential complications associated with cascading in the additional equipment that would be required under this scenario. In fact, in response to an information request, Trans Mountain describes the significant uncertainty that surrounds cascading equipment in due to complications from concurrent responses, the need for approvals and the availability of equipment that surpasses minimum requirements of donor organizations. In fact, the uncertainly was so great that Trans Mountain was unable to provide an estimate of how much additional capacity could be cascaded in within a one-, a four- and a ten-day period.[58]

---

[55] A4E2V5, A4E2V4, A4E2V3, A3Y3W4, A4H9J8, A3S5I9
[56] A3S5I9
[57] A3S5I9 - PDF Page 29
[58] A4H9J8 - PDF Page 60

99. To depend on such an unpredictable source of equipment for response efforts is both reckless and irresponsible.

4.1.3 Actual Recovery Rates vs. Stated Response Capacity

100. Finally, the fact that WCMRC would have the capacity to respond to a 20,000 tonne spill does not mean that it could recover all 20,000 tonnes of spilled oil in the event that a spill occurred. Actual recovery rates are far less than capacity levels. As the Federal Canadian Tanker Safety Expert Panel concludes in its report, "[e]vidence suggests that mechanical recovery rates, in optimal conditions, are usually only between 5% and 15% of the oil spilled." [59] A large spill would be economically, environmentally and socially devastating to the coastal communities and the province more broadly. Without the ability to respond more effectively to a spill, the Intervenor argues that this project should not go forward.

101. These concerns are all further highlighted in the oil spill response simulation study conducted by EBA and WCMRC in order to evaluate proposed response potential.

4.2 Trans Mountain Expansion Project Oil Spill Response Simulation Study

102. EBA and WCMRC's "Trans Mountain Expansion Project Oil Spill Response Simulation Study, Arachne Reef and Westridge Marine Terminal" offers two hypothetical oil spill scenarios, one at Arachne Reef near Turn Point and one at Westridge Marine Terminal.[60] Whereas the scenario at Arachne Reef is intended to simulate a spill from a tanker that is in transit through the Marine Study Area, the scenario at Westridge Marine Terminal is intended to simulate a spill while a tanker is docked at the terminal. Together, these simulations are used to provide "an assessment of the spill response enhancements"[61] proposed by Trans Mountain and WCMRC.

103. As a Member of the Legislative Assembly of British Columbia, representing the constituency of Oak Bay-Gordon Head, the Intervenor is focusing particularly on the risks associated with oil spills from tankers transiting the Strait of Juan de Fuca, as those spills present the most immediate risk to the Intervenor's constituency. For that reason, this portion of the Intervenor's argument will focus specifically on the Arachne Reef simulation, which is used to compare the results of a single spill event from a transiting tanker with and without spill response mitigation.

104. The Arachne Reef scenario is based on what Trans Mountain terms its "credible worst case" spill scenario, equivalent to 16,500 m^3 of spilled oil. As Trans Mountain argues that a "credible worst case" spill at Westridge Marine Terminal

[59] Report: A Review of Canada's Ship-Source Oil Spill Preparedness and response Regime - PDF Page 14
[60] A3S5J0
[61] A3S4Y9 – PDF Page 25

is equivalent to 103 m^3 and hence only simulated a 160 m^3 spill at that location, the Arachne Reef scenario represents the only simulation of an oil spill that was larger than 160 m^3 that was conducted for Trans Mountain's Application. As such, this scenario and the corresponding results also form "the basis of the mitigation analysis"[62] that Trans Mountain uses to support its claim that the proposed spill response enhancements are sufficient to offer effective response to an oil tanker spill.

105. The Arachne Reef oil spill scenario was run for four days, applying both current and proposed equipment and terminals, as described in Trans Mountain's enhanced spill response regime. At the end of the four-day period, 44.5 per cent of the total oil outflow was recovered from outside the boom line and 18.6 per cent of the oil was recovered from within the containment area. Moreover, nearly all of the oil inside the containment boom had been recovered or had evaporated, while less than 10 per cent of the spilled oil remained on water and only 15.8% remained on shore.[63]

106. The Intervenor will make the case that collectively the assumptions applied to this simulation are not adequately representative of conditions that response crews will likely encounter in the event of a spill along the Trans Mountain Tanker Sailing Route. The representativeness of a scenario's assumptions influences the accuracy of the results as evaluative or representative outputs. By not applying sufficiently representative assumptions to the simulation, the authors were able to derive better-than-average results that would likely not be representative of real world conditions. This could help explain why, in the simulation, 64% of oil was recovered, despite the Federal Canadian Tanker Safety Expert Panel's conclusion that "[e]vidence suggests that mechanical recovery rates, in optimal conditions, are usually only between 5% and 15% of the oil spilled." [64]

4.2.1 Proposed vs. Current Spill Response Capacity

107. First, the simulation assumes the presence of the enhanced spill response capacity without conducting a similar scenario assuming current response capacity. The Intervenor is concerned that in doing so, the simulation paints a potentially unrepresentative picture of the response capacity that would exist should Trans Mountain's Project be approved.

108. Oil spill response requirements, as legislated under the *Canada Shipping Act, 2001*, only mandate roughly half the capacity that is being proposed by Trans Mountain. While it is commendable of Trans Mountain to propose increasing existing response capacity, at this stage there is no guarantee the proposal will be implemented. In the absence of guaranteed and enforced implementation of

[62] A3S4Y9 – PDF Page 26
[63] A3S4Z0 – PDF Page 7
[64] Report: A Review of Canada's Ship-Source Oil Spill Preparedness and response Regime - PDF Page 14

the enhanced regime, prudency would require that only current response capacity be considered.

109. If, as a part of its Application, Trans Mountain wished to also demonstrate the added capacity that could result from the proposed enhancements, then one would expect that demonstration to be presented in addition to a demonstration of the current capacity.

110. However, in lieu of conducting a simulation with existing response capacities, the authors have simply provided an estimate of what the current recovery rate may be. Given the significant damage a spill could cause, unsubstantiated estimates of current capacity simply do not provide a reasonable or acceptable basis for assessing spill response capacity.

111. The fact is, based on the information provided by Trans Mountain, one has no way of evaluating how effective current response resources—the only guaranteed resources that exist—would be in responding to a spill. Trans Mountain has therefore failed to provide a credible argument to show that capacity exists to respond to a spill, should one occur.

4.2.2 Assumes No Sunken or Submerged Oils

112. Second, the simulation assumed that all oil floated on the surface during the response efforts. As noted in Section 3, heavy oils like diluted bitumen can sink in the presence of suspended particulate matter. Suspended particulate matter is common along the tanker sailing route meaning that some submerged or sunken oil is a realistic outcome in the event of a spill. By applying assumptions that led all oil to remain on the surface, the report selected another best-case condition that allowed the response outcome to be unimpeded by the fact that WCMRC currently has no capacity to recover submerged or sunken oil.

4.2.3 Twenty Hours of Daylight, Ideal Weather and Other Best-Case Conditions

113. Third, in the report, EBA and WCMRC argue that the scenario applied "[r]ealistic environmental scenarios, based on high-accuracy numerical models for currents and oil spill behaviour…"[65] Many of these assumptions are laid out in Section 2.5 of the report, while others are noted in other sections. Collectively these assumptions are not necessarily representative of conditions that response crews will likely encounter in the event of a spill along the Trans Mountain Tanker Sailing Route.

114. For instance, the report states that: "Since the scenario occurs during the month of August, almost 20-hours of daylight exist to benefit the efficiency of the response."[66] According to the US Naval Observatory Astronomical Applications Department, there is not a single day in the year when Arachne Reef experiences close 20 hours of daylight. In fact, the spill would have had to occur in the

[65] A3S5J0 - PDF Page 12
[66] A3S5J0 - PDF Page 14

Arctic Ocean around the same latitude as Tuktayuktuk for there to exist any day in August with 20 hours of daylight. Representative conditions for August would have assumed 15 hours of daylight, thereby limiting the efficiency of the response.

115. Similarly, it was assumed that "adverse weather conditions did not prevent or complicate a response."[67] It appears that the reason this assumption was applied was in relation to the decision to run the simulation in the summer season. According to the report:

> *The selection was based on the representativeness of the resulting spill in terms of environmental and human-health damages: the summer season was selected for the mitigation simulation, as warmer water and air temperatures would facilitate more rapid dissolution and/or volatilization of lighter pseudocomponents into water or air, respectively. This is conservative, as the concentration in water or air would be increased by rapid dissolution and/or volatilization. At the same time, generally lower wind speeds during the summer would result in less wave action (hence, less vertical mixing of the water column, and higher concentrations of dissolved hydrocarbons in the surface water layer), as well as less dilution of vapours in air.*[68]

116. The Intervenor will address these assumptions from a human health and environmental standpoint in Sections 5 and 6. The problem with these assumptions as far as spill response is concerned is that in applying these assumptions, EBA and WCMRC have chosen conditions that, while perhaps conservative in terms of some human and environmental impacts, are also absolutely ideal for spill response. In preparing a simulation that was intended to assess the spill response capacity, Trans Mountain has chosen conditions that do not adequately represent the range of wave and wind conditions that occur throughout the tanker sailing route and that can significantly limit, or even entirely prevent, spill response from occurring. Consequently, the authors were able to derive better-than-average results that would likely not be representative of real world conditions.

117. WCMRC's Future Oil Spill Response Approach Plan notes that:

> *Booming and skimming operations are most effective up to Sea State 2 (maximum wave height of 1 m) and with wind speeds less than 10 knots (Beaufort Scale 3)…Although WCMRC equipment is capable of operating in sea states greater than 2, the effectiveness of those countermeasures is reduced. For example, at Sea State 3 (Beaufort Scale 4) wave heights exceed 1 m and the wind velocities range from 11 to 16 knots. At this magnitude, containment booming and skimming is difficult to*

[67] A3S5J0 - PDF Page 14
[68] A3S5J0 - PDF Page 18

execute and become less effective. Additionally, wave agitation may emulsify water and oil into a thick mousse making oil recovery from the water surface more difficult…Conditions preventing mechanical recovery generally occur at sea states greater than 3 (greater than Beaufort Scale 4). At that intensity, with significant wave heights above 1.5 m and wind velocities greater than about 16 knots, skimming and booming operations would be suspended limiting the response to equipment and personnel mobilization.[69]

118. The report also notes that "regulations only require response organizations and oil handling facilities to plan response operations up to and including Beaufort Scale 4."[70]

119. Based on this information, it can be derived that the Arachne Reef simulation assumed conditions equivalent to Beautfort Scale 1 to 3 (Sea State 0-2), as a Beaufort Scale of 4 or greater (Sea State of 3 or greater) would have either complicated or prevented response efforts.

120. Data provided by Trans Mountain in response to Weaver A. IR 2.09.a[71] offers a breakdown of the relative portion of the year that wind and wave conditions match each Beaufort Scale category.

121. The two closest data points to Turn Point are at Saturna Island and Kelp Reefs. At Saturna Island, wind and wave conditions would prevent mechanical recovery 12.66% of the year and would complicate recovery operations a further 20.55% of the time for a total of 33.21%. At Kelp Reefs, conditions would prevent mechanical recovery 13.01% of the year and would complicate recovery operations a further 26.59% of the year for a total of 39.6%. These two locations are in the relatively protected portion of the route. At more exposed areas, such as Race Rocks, wave conditions would prevent mechanical recovery 37.12% of the year and would complicate recovery operations a further 21.44% of the year for a total of 58.56%.

122. Trans Mountain has made the case that wind and wave conditions are realistic for summer months. While that is true, these statistics demonstrate that for a significant portion of the year (between 30% and 60%), recovery efforts along the tanker sailing route will be difficult if not impossible due to wind and wave conditions. If the purpose of the simulation was to test the success of recovery efforts, then at the very least some degree of complication or prevention of response efforts should have been factored in.

123. In fact, it appears that in many ways, EBA and WCMRC have applied relatively ideal conditions from a spill recovery standpoint. In addition to assuming 20 hours of daylight and no adverse wind and wave conditions, "[f]rom a health and safety standpoint, it was assumed that the spill site atmosphere in each of

[69] A3S5I9 - PDF Page 34-35
[70] A3S5I9 - PDF Page 35
[71] A4H9J8 – PDF Page 58

the scenarios presented no toxic or explosive hazards to first responders and that the site may be immediately approached."[72] As such, clean-up crews were able to approach quickly and work both efficiently and for longer hours to ensure a better recovery rate.

124. Similarly, as noted above, current federal legislation only requires response organizations to be certified to respond to a spill as large as 10,000 tonnes. Should a 16,500 m^3 spill occur, WCMRC may not have the equipment necessary to respond without cascading equipment in. Cascading in equipment can present its own challenges and significantly delay response efforts while the equipment is negotiated and transported to the spill site. In the case of the Arachne Reef scenario, equipment shortages could have significantly complicated containment efforts and therefore recovery rates. By assuming the enhanced response capacity, in conjunction with the assumptions described above, the authors could guarantee the timely arrival of equipment, without having to apply any complications from cascading equipment in.

125. As noted by WCMRC and EBA, the speed of containment of a spill is a significant determinant of success of recovery efforts.[73] Should wind and wave conditions, responder approach time, or equipment availability prevent recovery efforts for hours or even days, it could significantly impede containment efforts and therefore recovery rates. None of these complications were simulated in Trans Mountain's Application. While individually each of these assumptions could be argued to represent a "realistic" condition, collectively they paint an unrepresentatively ideal scenario from a spill response standpoint.

126. In contrast, in the United States, vessels must be certified as having sufficient spill response resources, assuming complications by adverse weather.[74]

127. Recognizing that no single scenario will fully represent the range of conditions experienced along the tanker sailing route, Trans Mountain could have included an additional scenario representing "conservative assumptions" from a spill response stand point. Additional scenarios were requested of Trans Mountain by the Intervenor for this purpose, but those requests were denied.[75]

128. Given these points, the Arachne Reef simulation can only be read as a best-case scenario from a spill response perspective. Should conditions be as ideal as possible, one could perhaps hope for 64% of spilled oil to be recovered, leaving roughly 10% (1,650 m^3) on the water and 15.8% (2,607 m^3) on the shore after 4 days. Yet, more likely, adverse conditions of some kind would complicate recovery efforts significantly reducing the success rate. Based on the evidence reviewed by the Federal Canadian Tanker Safety Expert Panel, that rate would likely be as low as 5% to 15%.[76]

---

[72] A3S5J0 - PDF Page 14
[73] A3S5J0
[74] A3S5I9 - PDF page 29
[75] A3Y3W4 – PDF Page 146
[76] Report: A Review of Canada's Ship-Source Oil Spill Preparedness and response Regime - PDF Page 14

129. Since Trans Mountain has denied a request that it provide an additional study that could represent a worst-case scenario from a response and recovery perspective, one does not have sufficient information to judge the range of recovery rates that may occur throughout the year under different conditions. One is therefore unable to make a comprehensive judgment, based on the information provided by Trans Mountain, as to the effectiveness of current or proposed spill response capacity, except to derive that the success rate would likely be significantly lower than that resulting in the Arachne Reef scenario.

4.2.4 The Absence of a Total Loss Scenario

130. Finally, the Intervenor presented a case in Section 2 for the critical importance of considering total loss scenario in which all of the oil carried by a single tanker is discharged during a spill. Considering a total loss scenario is necessary for identifying the scope of impact the TMEP could have on the region and the relative capacity that exists to manage that scope of impact.

131. Indeed, as WCMRC notes, "[i]n 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."[77] In the case of a Worst Case Discharge, or total loss scenario, even Trans Mountain's proposed spill response enhancements would only account for roughly 20% of the capacity required to respond to a 105,000 m^3 spill. Response organizations would be required to cascade equipment in.

132. Yet, in these simulations, Trans Mountain has provided no account of how relying on cascaded equipment to respond to a total loss scenario would affect recovery rates. When the intervener requested that Trans Mountain provide a simulation assuming a total loss scenario, Trans Mountain denied that request.

133. Given the catastrophic damage a total loss scenario would cause to the region, it is unacceptable for Trans Mountain to fail to even consider the effectiveness of current and proposed response capacities under such conditions.

5. Human Health Risk Assessment of Facility and Marine Spill Scenario Technical Report

134. In filings A3Y1E9, A3Y1F0, A3Y1F1 and A3Y1F2 Trans Mountain submitted the Human Health Risk Assessment of Facility and Marine Spill Scenarios Technical Report (HHRA) for the Trans Mountain Expansion Project. These filings outlined the potential human health effects associated with a number of simulated marine and facility oil spill scenarios. These tests were conducted in order to provide "a more detailed analysis of the potential health effects that might occur in relation to each of the simulated oil spill scenarios than the earlier

[77] A3S5I9 - PDF page 29

qualitative assessments in order to further enhance awareness and understanding of the nature and extent of such effects."[78]

135. Similar to concerns laid out in other sections, the Intervenor is concerned that Kinder Morgan has failed to adequately represent the actual impact a spill would have, and that the HHRA is structured in such a way that the parameters chosen limit the exposure pathways that are considered.

136. Trans Mountain has thus far failed to meet its requirements to address issues 5 and 12 on the approved issues list, as they pertain to the HHRA. This is particularly the case in the marine spill scenario. The inadequacies of the HHRA are laid out below.

5.1 Failed to Represent an Accurate Spill Scenario

137. One of the key criticisms of the HHRA conducted by Trans Mountain is that it fails to establish a truly credible worst case scenario or even a sufficiently conservative scenario that portrays the actual risks to human health.

5.1.1 Heavy Oil

138. The potential for heavy oil to become submerged in the presence of suspended particulate matter is a critically important question to be considered in testing whether the HHRA adequately represents the health impacts that may be experienced by a spill. As has been shown in the evidence, heavy oil has a greater propensity to become submerged when it comes into contact with particulate matter.

139. The spill simulated for the sake of the HHRA seems to have assumed that no oil sank or submerged during the scenario. This situation is very concerning, particularly given the prevalence of suspended particulate matter throughout the marine study area, as the lack of consideration limits the extent to which this HHRA can be applied to other scenarios.

5.1.2 Weather at Arachne Reef

140. A critical concern with the HHRA Technical report is whether the conditions used in modeling the marine spill adequately portray the inhalation exposure potential of the exposure pathway.

141. The National Energy Board raised similar concerns in filing ID A3Z4T9, their Information Request Round Two questions. Specifically, the NEB made the following argument:

[78] A3Y1E9 – PDF Page 3

The reference states that, for the Westridge spill scenario, Trans Mountain assumed a hypothetical incident to occur at 22:00 on 21 August 2012, which was based on the environmental conditions from the 368 stochastic modeling for a summer spill event. The reference further states that the summer season was selected for the deterministic modeling because warmer water and air temperatures would facilitate more rapid dissolution and/or volatilization of lighter pseudo-components into water or air, respectively. The reference states that the majority of benzene is transported to the west of the terminal, due to the predominance of easterly winds at the beginning of the spill when fluxes were highest. The Board notes that the deterministic simulation for CALPUFF air dispersion modeling considered a single moment in time with an assumption of easterly winds to predict the amount of exposure that could happen. The Board is concerned that the modeling does not consider other scenarios, such as westerly winds, that could drive airborne concentrations toward residential areas.[79]

142. The NEB would subsequently ask Trans Mountain to "re-run the model with additional wind conditions and provide the results", subsequently provided by Trans Mountain in filing ID A4A7S1.

143. Looking at Filings A3Y1F0, A3Y1F1 and A3Y1F2, it would seem that similar concerns to those highlighted by the NEB with regards to the Westridge terminal spill need to be raised for the oil tanker spill scenario. Indeed, there too, the wind conditions applied to the scenario see most of the airborne concentrations driven away from populated areas.

144. It is hard to make the case that the inhalation pathway has been adequately tested, given the majority of the projected impacts are modeled away from population centers. This point seriously calls into question whether the conclusions of the HHRA are truly representative of a realistic spill scenario as conditions that lead to inhalation exposure over population centers are common and would likely have far different results.

5.1.3 Credible Worst Case Spill

145. The use of the term "credible worst-case" (CWC) to represent the largest potential spill that could take place is an unsatisfactory metric, and artificially creates spill scenarios that may in fact be more manageable than a total loss scenario. In particular, the use of a CWC for the Marine Transportation Spill Scenario, representing a spill of 16,500m^3, is of concern to the Intervenor, as has been laid out in Sections 2 and 4.

[79] A3Z4T9 – PDF Page 65

146. It is critically important that the concerns as to whether the CWC of 16,500m^3 truly constitutes a worst case scenario are taken seriously given the implications for public health.

147. Submission A4A7S1, a Technical Memo laying out the "Assessment of the Potential Human Health Effects Associated with the Additional CALPUFF Modeling Completed in Response to National Energy Board Information Request No. 2.024b", notes that:

> *…the intensity of the effects would be greatest for the larger spill sizes because of the higher concentrations of the chemical vapours that could be encountered and the longer durations of exposure.*[80]

148. Furthermore, the conclusions of the HHRA technical report note that:

> *"As might be expected, the coverage and spatial extent of the exceedances was influenced by spill size, with the overall size of the area within which exceedances occurred and the outward distances from the spill source to which the exceedances extended being greater for the CWC spill scenarios than for the corresponding smaller-size spill scenarios."*[81]

149. Trans Mountain's own evidence makes it clear that the size of a spill is directly related to what type of exceedances took place. References to the HHRA's "conservatism" can be found throughout the HHRA technical report, but the assumptions that underpin the scenarios that were provided—especially the critical question of the size of the spill—call into question whether we have robustly examined the potential health impacts of a spill.

150. Trans Mountain's own evidence suggests that 10% of spills are larger than their description of a CWC. Without considering a far higher bar, such as a total loss scenario, it is difficult to see how this HHRA represents an honest depiction of the scope of health impacts that may be experienced in the case of an oil spill.

5.1.4 Ability to Respond to a Spill

151. The HHRA Technical report makes repeated mention of the numerous elements of conservativism that were used in the assessment to ensure that it was creating a scenario where human health impacts could take place. One of these measures was the length of time it took first responders to arrive:

> *It is expected that the coverage and spatial extent of the exceedances would be diminished had the assessment allowed for the various spill and emergency response measures that will be taken by Trans Mountain, the WCMRC and other authorities to quickly isolate, contain and recover the spilled oil as*

[80] A4A7S1 - PDF Page 13
[81] A3Y1E9 – PDF Page 57

described in Volumes 7 and 8A. As already mentioned, as part of the conservatism incorporated into the work, the assessment was performed without regard for these response measures in order to avoid overlooking or understating the potential health effects that people might experience.[82]

152. Furthermore, Trans Mountain notes in their response to the Intervenor in IR 2 that:

> *The comparable response time for an oil spill in open marine waters was expected to be 18 hours. Both response times are much less than the 61-hour period used for spill modeling purposes and to represent the time people would remain the area.*[83]

153. It is also worth noting that the weather conditions used in the scenarios modeled in this report, while supposedly providing for the greatest possible short term inhalation exposure, are also ideal conditions from a spill-response perspective.

154. However it is not clear that these conditions truly represent a worst case scenario, even for the inhalation exposure pathway, if we consider what we know about the ability and effectiveness of spill response measures.

155. The WCMRC lays out the oil spill response approach plan in filing ID A3S5I9, specifically highlighting the concern of the Intervenor about spill response effectiveness:

> *Although WCMRC equipment is capable of operating in sea states greater than 2, the effectiveness of those countermeasures is reduced. For example, at Sea State 3 (Beaufort Scale 4) wave heights exceed 1 m and the wind velocities range from 11 to 16 knots. At this magnitude, containment booming and skimming is difficult to execute and become less effective. Additionally, wave agitation may emulsify water and oil into a thick mousse making oil recovery from the water surface more difficult…Conditions preventing mechanical recovery generally occur at sea states greater than 3 (greater than Beaufort Scale 4). At that intensity, with significant wave heights above 1.5 m and wind velocities greater than about 16 knots, skimming and booming operations would be suspended limiting the response to equipment and personnel mobilization.*[84]

156. Without the ability to deploy any skimming and booming operations in waves higher than 1.5m, there are certainly periods of the year where exposure would extend well beyond even the 61 hours planned for in this scenario.

---

[82] A3Y1E9 – PDF Page 57
[83] A4H9J8 – PDF Page 36
[84] A3S5I9 – PDF Page 34

157. Furthermore, if we look at the previous scenarios conducted by WCMRC and EBA (Filing A3S4Z0)—scenarios which the Intervenor argues can only be interpreted as ideal-case scenarios—we can see that under the best conditions, up to 25% of the oil remained on shorelines after 15 days, in the case of a Credible Worst Case spill at Arachne Reef.[85] Finally, the Federal Tanker Safety Expert Panel noted that, on average, only 5-15% of oil is ever recovered under optimal conditions in the case of a spill. In all of these circumstances, exposure would continue well beyond the 61-hour time period applied in the HHRA.

158. This means that even the extended window of exposure modeled in the HHRA is not representative of a conservative spill scenario. Coupled with the lack of consideration for alternative exposure pathways (discussed below), this is further evidence that the HHRA is not accurately representative of a conservative oil spill, nor is it representative of the scope of conditions that could occur in the event of a spill and that could therefore impact human health. Therefore, the conclusions of the HHRA can only be considered a best-case scenario and cannot be used to properly assess the human health impacts a real-world spill would likely present.

159. The lack of consideration of heavy oil, the weather conditions used in the scenario, Trans Mountain's limited view of what a CWC would look like, and the limitations on Trans Mountain's ability to respond to an oil spill are all, individually, points of concern when looking at whether Trans Mountain has modeled an accurate spill scenario with which to explore potential human health impacts. Collectively, these issues amount to nothing less than to discredit the HHRA that has been conducted. Unless a realistic and conservative oil spill scenario is used, the conclusions of an HHRA are restricted to the unique and unrealistic scenario found in the report. This is of little use to the Board in gauging the risks associated with the Project and to authorities, who must use this information to plan their responses.

5.2 Limited Exposure Pathways and Report Flaws

160. The other major area of concern is the process by which the inhalation exposure pathway was chosen as the only significant pathway for human health impacts to be experienced.

161. These issues can be largely found in the approach taken in the report to lay out the potential exposure pathways. The HHRA Technical report notes:

> *The choice of exposure scenarios to be examined principally revolved around identifying the circumstances under which reasonable opportunity for exposure of people in the area to the chemicals contained in the spilled oil would be expected to exist.*[86]

[85] A3S4Z0 – PDF Page 7
[86] A3Y1E9 – PDF Page 26

162. While this rationale appears to offer an inclusive review of all the possible exposure pathways, including those that may occur over a longer time frame through multiple exposure pathways, the report goes on to restrict the scope of the HHRA to a short term inhalation exposure pathway.

> *After considering the various possible exposure opportunities that could exist, it was determined that the assessment would focus on the chemical exposures that people might experience during the early stages of the oil spill incident, when they could be unaware of its occurrence and before the arrival of first responders and the implementation of emergency and spill response measures…Further analysis suggested that the most likely avenue of exposure during this time would be via inhalation of the chemical vapours released from the surface of the oil slick.*[87]

163. The technical report does outline the reasons why other pathways were excluded in a subsequent section (4.1.5 Identification of Exposure Pathways). This section notes that:

> *In addition to the implementation of the emergency and spill response measures discussed above (see Section 4.1.2 Identification of Exposure Scenarios) and described in Volumes 7 and 8A of the Application, if conditions warrant, local, provincial and/or federal authorities can implement controls or issue advisories to protect public health. Examples of such controls include closure of commercial and recreational fisheries, beach closures, forced evacuation of people off-shore and/or on-shore if public health and safety are threatened, and the issuance of fish, shellfish or other seafood consumption advisories.*[88]

164. While this paragraph does address the considerations that went into limiting the scope of this technical report to a short term inhalation pathway, the Intervenor submits that this paragraph, lacking in any citations, is not sufficient to eliminate the consideration of alternative exposure pathways over different time frames. Furthermore, the assumptions used to model the oil spills in the HHRA raise significant questions as to whether they are properly representative of a spill that could occur.

165. In fact, the decision to consider the short term inhalation exposure pathway as the primary exposure pathway, and the only one examined in any detail in this report, takes place prior to determining the condition in which an oil spill would be taking place.

166. This is a significant issue. In the HHRA Technical report, it is noted that:

---

[87] A3Y1E9 – PDF Page 26
[88] A3Y1E9 – PDF Page 32

Selection centered on the summer season as warmer water and air temperatures facilitate more rapid dissolution and volatilization of lighter hydrocarbons into water and air, respectively. At the same time, generally lower wind speeds during the summer months result in less wave action (and hence, less vertical mixing of the water column and higher concentrations of dissolved hydrocarbons in the surface water layer) as well as less dilution of any hydrocarbon vapours released from the surface of the oil slick into the air. The combination of these factors will contribute to greater opportunity during the summer months for people in the area at the time of the oil spill to be exposed to the hydrocarbon vapours compared to other times of the year.[89]

167. While the HHRA Technical report appears to maximize the potential for the airborne exposure pathway, the obvious question is whether scenarios that include high wind and wave conditions, and/or the presence of particulate matter in the marine environment, may result in more oil becoming submerged, evading containment booms, ending up on shorelines, or becoming ingested by aquatic organisms. Should any of these instances occur, they would present two additional pathways, ingestion or physical contact, for human exposure that are not dealt with in a sufficiently rigorous manner in this report, while the question of submerged oil appears to be ignored all together.

168. The underlying issue here is whether or not the conditions chosen for the spill limit the exposure pathway to the inhalation pathway in such a way that other, quite viable exposure pathways are eliminated from consideration. This is explored further below.

5.2.1 Heavy Oil, Weathering and Exposure Pathways

169. Section 4.1.5, "Identification of Exposure Pathways" lays out the rationale that Trans Mountain considered in identifying their exposure pathway. It notes that:

Direct physical contact with the spilled oil was considered unlikely. The actions taken by first responders will include securing the area, restricting access, and containing the oil slick. Appropriate regulatory authorities will be immediately notified and the public will be advised to avoid the area. In the event that oiling of the shoreline occurs, beach and shoreline closures will be announced, if conditions warrant.[90]

170. In dismissing "direct physical contact" as a viable exposure pathway, this explanation makes no mention of the unpredictability of submerged oil arriving on shorelines, weather events displacing oil into other regions, or other unpredictable scenarios. This is particularly relevant in the event of a marine tanker spill as it would be taking place in a

[89] A3Y1E9 – PDF Page 34
[90] A3Y1E9 – PDF Pages 31-32

populated region with significant shoreline broken up between islands. This geography increases the potential for oil to reach isolated yet populated shorelines, suggesting that physical contact with oil is a legitimate exposure pathway.

171. Ultimately, "direct physical contact" is but one example of additional exposure pathways that were not considered, and yet become far more likely in a scenario where spill response is limited, heavy oil becomes submerged, or weather conditions are moving oil in unforeseen ways.

172. As laid out above, the HHRA conducted by Trans Mountain does not appear to have taken into account the way heavy oil can interact in an aquatic environment, specifically the increased likelihood that it becomes submerged.

173. Given the uncertainties about how submerged heavy oil behaves, the Intervenor questions whether the decision to not conduct a scenario that included the possibility of submerged oil accurately represents the potential for other exposure pathways to exist, and whether the inhalation pathway has been sufficiently represented.

174. The lack of consideration or evidence of how submerged oil might behave, how this may affect the HHRA, and the fact that the selected conditions appear to create a scenario focused on a chosen exposure pathway rather than exploring how different conditions may affect different exposure pathways call into question whether the HHRA conducted by Trans Mountain accurately explores or represents the health impacts that are likely in a spill scenario.

5.3 Interpreting the Human Health Risk Assessment of Facility and Marine Spill Scenario Technical Report

175. The HHRA conducted by Trans Mountain is insufficient for modeling the potential human health impacts that may be experienced in a spill scenario. This is particularly true in the oil tanker spill scenario off the coast of Vancouver Island.

176. Specifically, the HHRA fails on two major fronts:

> 1. It fails to represent what a marine spill is likely to look like, including weather conditions, ability to respond, the interaction of heavy oil in a marine environment and what a credible worse case spill would look like.
>
> 2. The report is structured in such a way that the exposure pathways considered are limited by the conditions applied to the report, without considering other realistic exposure pathways that may present themselves in a spill scenario.

177. These two failings are related. In failing to represent what a spill would actually look like, Trans Mountain was able to limit the exposure pathways to a single pathway by the conditions they chose in modeling a spill.

178. The report glosses over any possibility of oil becoming submerged, weather conditions moving oil to different locations or limiting response measures, the possibility of a far larger spill than Trans Mountain's definition of a CWC.

179. Without taking these into account, this Intervenor is left questioning whether the conclusions reached in the HHRA can be extended to any scenario beyond the idealized scenario envisioned by Trans Mountain. As such, Trans Mountain has thus far failed to meet its requirements to address issues 5 and 12 on the approved issues list, as they pertain to the HHRA.

6. Community Impacts from a Marine Oil Spill

180. As previously noted, Trans Mountain was required to assess the potential environmental and socio-economic effects of marine shipping activities that would result from the Project, including the potential effects of accidents or malfunctions that may occur.

181. In their assessment and subsequent discussion, Trans Mountain made two significant assertions.[91]

> 1. The potential impacts of a marine oil spill on local communities and marine life have been adequately assessed.
>
> 2. All relevant marine oil spill scenarios along the tanker route, and their potential socio-economic and environmental impacts on local communities, have been sufficiently analyzed and appropriate capacity exists to fully respond to such a spill.

182. This section will address the extent to which Trans Mountain adequately represented the scope of impacts the Project will have on local communities and on the British Columbian electoral constituency of Oak Bay-Gordon Head in particular.

183. The Intervenor will argue that the Proponent has not provided sufficient evidence or justification to support the assertions outlined above. In particular, Trans Mountain has failed to adequately represent the significant and specific socio-economic and environmental impacts that local communities could experience as a result of an oil spill. Moreover, the Proponent has also failed to demonstrate sufficient capacity to mitigate these impacts. For both of these reasons, the Intervenor will argue that Trans Mountain has not met the requirements for a complete and successful Application.

6.1 Local Human Health and Marine Species Impacts of a Marine Oil Spill

[91] A3S5Q3, A3S4Y7, A3S4Y8, A3S4Y9

184. In order to fully assess the potential environmental and socio-economic effects that would result from the proposed Project and any potential marine oil spills, one must also look at the specific impacts that these activities would have on local communities and marine life situated along the shipping route.

185. As a Member of the Legislative Assembly of British Columbia, representing the constituency of Oak Bay-Gordon Head, the Intervenor is focusing particularly on the impacts associated with an oil spill in the Strait of Juan de Fuca, as those spills would have the most immediate impact on the Intervenor's constituency. For that reason, this portion of the Intervenor's argument will focus specifically on the Arachne Reef simulation.[92]

186. These concerns build upon those raised in Section 5 on the HHRA, to offer illustrative examples of the approach taken by the Proponent to consider community impacts. The Intervenor will argue that local community and marine life impacts from a spill incident in this area have only been assessed in a general manner, that the assessments do not adequately represent the full scope or degree of impacts that could be experienced and that the conclusions reached do not adequately prepare governments and other authorities to respond to a potential oil spill.

6.1.1 Age and Health Demographics

187. The Intervenor is concerned that Trans Mountain's scenario at Arachne reef has not adequately represented the scope of local conditions in communities located along the proposed route in their analysis of the impacts of a potential oil spill. As an illustrative example, in their response to the Intervenor's round one information requests, Trans Mountain confirmed that both age and health status can have an impact on the manner and extent to which people respond to exposure to an oil spill.[93] The Intervenor further provided data to show that areas along Trans Mountain's tanker route have a higher than average senior population, making these populations more susceptible to potential health problems.[94] When the Intervenor asked the Proponent to incorporate this data into their analysis and discussion of the potential human health impacts of a marine oil spill in these areas, Trans Mountain asserted that this wasn't necessary. Instead, Trans Mountain stated that:

> *People, including those with heightened sensitivity to chemical exposure, are considered generically so that they are representative of the range of health effects that could result from a large oil spill at almost any location along the tanker route. With this approach, differences in local age demographics would not affect the assessment conclusions, and there is no need to conduct analysis at other scenario locations.*[95]

[92] A3S5Q3, A3S4Y7, A3S4Y8, A3S4Y9
[93] A3Y3W4 - PDF Page 5
[94] A3Y3W4 - PDF Page 4
[95] A3Y3W4 - PDF Page 5

188. The problem is, the Proponent has failed to provide sufficient evidence to demonstrate that their approach does in fact achieve the outcome that they claim it does.[96] A generic analysis does not necessarily take into account local conditions that may occur at different locations along the tanker route. Instead, it incorporates average demographics and exposure reactions and uses these to predict how specific communities may react. In an area such as the one that the Intervenor represents, the population consists of an abnormally large senior population.[97] This population can be more susceptible to chemical exposure, such as that which would result from a marine oil spill.[98] This means that the impacts of a spill in this area could be much more severe than they would be in an area with a more representative population distribution. A general study would be of limited use to a government needing to respond to the specific impacts their community is facing.

189. The Proponent has similarly neglected to provide adequate evidence to show that the analysis sufficiently represents a conservative 'worst-case' account of negative effects that could occur along the tanker route, including when population factors such as age and health status are considered. A conservative 'worst-case' scenario, although perhaps not as representative of the average expected outcome, would provide a more realistic sense of the severity of outcomes that could occur, given realistic age and health demographics that exist in communities along the tanker sailing route. Such a study would provide a point from which to compare the range or scope of human health impacts that could occur in the event of a spill.

190. The Intervenor offers this example in addition to the points made in Section 5, as it is illustrative of an approach taken by Trans Mountain whereby the Proponent has constructed a scenario to study health impacts that fails to accurately represent the potential conditions that are likely to be present during an oil spill. In considering only a single exposure pathway, and without depicting the full scope of scenarios that could occur, the Proponent has offered only a limited understanding of the human health impacts that will occur in conditions that differ from the scenario provided. Consequently, the Proponent, its partner organizations and local and provincial governments will also be hindered in their ability to respond to spills occurring under different conditions.

6.1.2 Local Marine Species Impacts

191. Similarly, the Intervenor is concerned that Trans Mountain has not provided sufficient evidence to demonstrate that it has adequately represented the scope or degree of impacts an oil spill would have on local marine species along the tanker route. Here, Trans Mountain similarly applies a single, generic simulation to provide an assessment of the range of possible ecological receptors.[99] While

[96] A3Y3W4
[97] Saanich, BC Population Demographics, Oak Bay Population Demographics
[98] A3Y3W4
[99] A3S5Q3, A3S4Y7, A3S4Y8, A3S4Y9

this type of assessment can provide an overview of how a broad spectrum of marine life may be impacted by an oil spill, it does not necessarily distinguish between which species would be present at various locations, the current status of these species, or how these species may react depending on their location and status.[100] General studies, especially ones that are not incorporating up to date information do little to ensure that governments, the Proponent's partner organizations and other authorities are able to respond effectively to mitigate impacts on effected species.

192. The Intervenor argues that considering local species populations is important, particularly as it pertains to at-risk and endangered species. If local species are at-risk or endangered, an oil spill could have a much more severe impact than Trans Mountain's analysis has determined, particularly if that analysis did not incorporate the most current data on species of concern and endangered species.

193. Knowing that a number of marine species along the proposed tanker route fall into the categories "at-risk" or "endangered", and knowing the potentially serious repercussions that an oil spill could have on these species, the Intervenor requested that Trans Mountain incorporate up-to-date species of concern and endangered species lists from Canada, British Columbia, the United States and Washington State into their analysis.[101] However, Trans Mountain did not accommodate this request and instead responded by saying:

> *The ecological receptors considered in the ecological risk assessment of credible worst case and smaller spills are treated generically. They are not intended to be an exact representation of the species present at the hypothetical spill location…*[102]

194. The Intervenor received the same response after requesting a more detailed analysis of the potential effects of marine feeding ground oiling, as the discussion provided in the Application simply stated 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.*[103]

195. While the overlap does not necessarily indicate that seabirds at nest sites will experience oiling, this outcome could still be very plausible and potentially serious. Yet, once again, a single, generic simulation cannot fully address the scope or degree of impacts of feeding ground oiling on marine life. Many factors could impact how marine birds react to such oiling, including the types of

[100] A3Y3W4 – PDF pages 10-15
[101] British Columbia's endangered species and ecosystems lists - BC Ministry of Environment website, Government of Canada's wildlife species assessment list – COSEWIC website, US Fish and Wildlife Service endangered species list – Environmental Conservation website, Washington State Department of Fish and Wildlife species of concern lists – conservation website
[102] A3Y3W4 - PDF Page 12
[103] A3S4Y9 - PDF Page 12

marine birds present at the various locations and the status of those birds on at-risk and endangered species lists. Due to the many variables at play when it comes to understanding and predicting how marine species will react to an oil spill in their environments, it is essential to provide additional, more "conservative" scenarios, which are modeled on the real factors on the ground, not simply a single generic scenario.

196. In an area that is as vast and diverse as the communities and marine environments along the Juan de Fuca Strait, no one scenario can likely provide a full and realistic assessment of the potential socio-economic impacts that would result from an oil spill in this area. Given the concerns raised above, the Intervenor asserts that a complete Application would, at least, have included a second, more conservative 'worst-case' scenario to better represent the scope or degree of impacts that could occur.

6.2 Demands on Local Communities

6.2.1 Health and Emergency Services

197. In terms of local community impacts, one of the Intervenor's big concerns is around the projected demands a diluted bitumen oil spill will place on local communities and first/emergency responders.[104] In seeking information about this concern, the Intervenor asked Trans Mountain to provide a discussion of the projected demands of a spill along the tanker route and the capacity of local communities to respond to these demands.[105] Unfortunately, Trans Mountain simply replied by saying:

> *The needs for fire, police and health services vary greatly depending on the type of emergency. Given the many variables and uncertainties surrounding any particular incident, there is no credible way of predicting specific emergency service requirements. As such, these items were not identified for the hypothetical credible worst case and smaller marine spill scenarios. In the unlikely event of an oil spill emergency occurring, Unified Command under Incident Command System will work co-operatively with the municipal first/emergency responders.*[106]

198. While the Intervenor understands that a number of variables and uncertainties surround any spill, this is also precisely why it is important to have some understanding of how much demand will be required from local communities in the event of a spill. At this time we have no idea if local communities will have the capacity to respond to any size or type of oil spill along their coastlines, let alone a large-sized spill of diluted bitumen. Whether it be need for additional police forces to quarantine areas, extra burden placed on fire departments, or

[104] A4Q1K1
[105] A3Y3W4
[106] A3Y3W4 - PDF Page 8

increased demand on hospitals, each of these local resources comes with costs and limited means.

199. Instead, communities are left to rely on Trans Mountain's assertions that outside services will provide any and all support the communities will need and that these services themselves have the capacity to respond to all possible spill scenarios.

200. However, as the Intervenor noted in section 4, Trans Mountain has only proposed to implement sufficient capacity to respond to a 20,000 m^3 spill, equivalent to roughly 19% of an aframax tanker's cargo.[107] In the event of a larger spill, additional response resources will need to be cascaded in. As previously noted, Trans Mountain has provided no assessment of how long cascading will take or how effective it will be.[108] In the meantime, additional burden will likely fall on local health care and emergency responders.

201. Furthermore, should the diluted bitumen sink or submerge Trans Mountain and its partner organizations would currently have no means of recovering that oil.[109] Such a situation could lead to delays and/or complications in response efforts. Meanwhile, the longer it takes to clean up an oil spill, the farther the oil will spread and the larger the area that will ultimately be affected.[110] Should the spilled oil sink below the ocean's surface as it spreads, the scope of marine life impacted by the spill could be far greater than anticipated. This is because those species that reside in the deeper depths of the ocean and that may otherwise avoid oiling during a spill could now be at greater risk of contamination. Similarly, submerged oil may take longer to resurface increasing the time-length of human exposure pathways.[111]

202. All of these scenarios could see greater burden placed on local health care resources and emergency responders. By refusing to consider larger spills or sunken oils, the Proponent has failed to adequately account for these potential costs and impacts in the Application, arguably leaving local and provincial governments with insufficient information for their own planning purposes.

203. In their own attempt to determine local government marine oil spill preparedness and response capability, the Georgia Strait Alliance conducted a report assessing these issues in the Georgia Strait Region. This report presented a number of concerning conclusions, including one of the report's major themes that, according to the government members themselves, "local governments are unprepared and unable to effectively engage in marine oil spill preparation and response activities."[112] It went on to discuss a number of other troublesome findings:

---

[107] A3S5I9
[108] A3S5I9
[109] Oil Spill Response Analysis
[110] Oil Spill Response Analysis
[111] Oil Spill Response Analysis
[112] A4Q1K1 - PDF Page 13

- "In BC, a lack of clarity regarding the role of local government continues to limit local government involvement in preparing for, responding to and recovering from a marine oil spill."[113]
- "Local governments in the Georgia Strait region reported little or no engagement with WCMRC or other marine oil spill regime leaders regarding local government involvement in preparation for, response to and recovery from a marine oil spill."[114]
- "The local governments in the Georgia Strait region who participated in this study generally see themselves as unprepared for a marine oil spill. They are mostly unclear about their roles before, during and after a marine oil spill. They feel unsupported in their efforts to gain clarity about their roles. Operationalized procedures for local government involvement in activities regarding marine oil spills in the Georgia Strait region are largely absent, presenting barriers for local governments to being prepared for involvement in a marine oil spill."[115]

204. It is suggested through the Georgia Strait Alliance's report, and Trans Mountain's response to the Intervenor's request for a more in-depth discussion of the expected demands on local governments and emergency responders, that local communities may not be adequately equipped to deal with the consequences of a marine oil spill along their coastlines.[116]

205. The area which the Intervenor represents is home to a diverse marine habitat[117] and an economy that relies heavily on its ecotourism and fishing industries.[118] An oil spill along this coastline would not only have devastating short-term and long-term impacts on the local marine life, as witnessed in other oil spill locations, but could also have serious negative impacts on local economies and business.[119] In fact, Trans Mountain's Application acknowledges some of these costs:

> *A marine spill, particularly a large one that affects one or more important commercial fishing areas, would likely result in loss of commercial fishing income due to regulated or voluntary closures and possibly reduced demand due to concerns about fish quality.*[120]

And,

> *In the event of a spill, recreational fishing, boating and beach use may be restricted or prohibited near…voluntary and regulated changes in recreational use patterns could extend until affected areas and resources are stable or recovered. In*

[113] A4Q1K1 - PDF Page 15
[114] A4Q1K1 - PDF Page 16
[115] A4Q1K1 - PDF Page 16
[116] A4Q1K1
[117] Marine Species in the CRD
[118] Regional Economic Analysis
[119] Long-Term Ecosystem Response to the Exxon Valdez Oil Spill
[120] A3S5Q3 - PDF Page 7

addition, resident and non-resident visits to spill-affected areas may decrease due to lack of available business services such as accommodations and charter boats.[121]

And,

Marine spills could potentially damage marinas, boats, and business/commercial establishments and infrastructure, resulting in costs for individuals and lost income for affected neighbourhood businesses. Municipalities may also incur infrastructure repair and replacement costs.[122]

6.2.2 Financial Costs of an Oil Spill

206. Concerned about the additional economic burden that could be placed on local communities, the Intervenor asked the Proponent to provide an estimate of the expected oil spill clean-up costs associated with various-sized oil spills at Arachne Reef, as well as their best estimate of where the financial costs would come from (ie: Trans Mountain, or Federal, Provincial or Municipal governments).[123]

207. In response, the Intervenor was told that:

As noted in response to Weaver A IR No. 2.03a, Trans Mountain is not liable for a marine spill as described, and has not estimated any costs. Responsibility for such an event lies with the tanker owner.[124]

208. The Proponent goes on to say:

The recovery of costs of such a spill is subject to the Marine Liability Act; the compensation regime is described in Volume 8A, Section 1.4.1.6 (Filing ID A3S4X3) of the Application. The regime features three tiers of financial coverage of spill costs including the tanker owner's insurance under the 1992 Civil Liability Convention (CLC), the International Oil Pollution Compensation Fund (IOPCF) and Canada's Ship-source Pollution Fund (SOPF). As Canada has ratified all conventions associated with the IOPCF, it has access to both the 1992 IOPC Fund and the 2003 Supplementary Fund. Claims by governments (national, provincial, local) are eligible for financing through these sources. To date, no single spill has generated eligible claims that have exceeded the resources available through these sources.[125]

---

[121] A3S5Q3 - PDF Page 7
[122] A3S5Q3 - PDF Page 8
[123] A4H9J8 – PDF Page 19
[124] A4H9J8 – PDF Page 20
[125] A4H9J8 – PDF Page 20

209. However, currently the maximum compensation for a persistent oil spill from tankers in Canada is $1.54 billion.[126] In the 1989 Exxon Valdez oil spill, Exxon spent an estimated $2 billion cleaning up the spill and a further $1 billion to settle related law suits, thus resulting in an estimated $3 billion cost for clean-up and legal claims.[127]

210. Ultimately, the Intervenor's point is that it is very reasonable to expect that the costs of a tanker spill could exceed the maximum oil spill compensation requirements, particularly given the potential complications detailed above. Should this happen, there is no guarantee the responsible entity would be able to cover the additional costs. Trans Mountain has neglected to account for this scenario and for the consequent burden that could be placed on local and provincial governments, in its Application. As a result, the Intervenor submits that Trans Mountain has failed to adequately represent the full scope of socio-economic and community impacts that could result from the Project.

6.2.3 Net Effects on Communities

211. The concerns above are perhaps most evocatively exemplified in Trans Mountain's statement that "oil spills can have both positive and negative effects on local and regional economies." Taking that point even further, they say that "spill response and cleanup creates business and employment opportunities for affected communities, regions, and clean-up service providers."[128]

212. Trans Mountain includes this statement without once adequately analyzing the economic impact of a marine-based oil spill resulting from the Project. While the Proponent briefly discusses some of the possible positive and negative impacts an oil spill could have on a community, as well as some of the specific industries and businesses that might experience economic boosts or losses, they fail to provide a full economic cost-benefit analysis of a spill to substantiate this claim.[129] When the Intervenor requested such an analysis, Trans Mountain stated that:

> *[An] economic cost-benefit analysis is an analytical tool sometimes used to inform whether a planned activity, policy or investment is beneficial to the economy and society. A spill is not a planned activity: it is an accident…spills are not part of the economic benefits analysis undertaken for the Project.*[130]

213. Trans Mountain instead claims their discussion of the potential economic impacts of an oil spill is based on a "growing body of literature" that "shows that both positive and adverse effects can occur" from a spill.[131]

---

[126] Transport Canada Spill Prevention Website
[127] Exxon Valdez Oil Spill Trustee Council
[128] A3S5Q3 - PDF Page 7
[129] A3S5Q3 - PDF Page 7-8
[130] A3Y3W4 - PDF Page 21
[131] A3S5Q3 - PDF page 6

214. According to one study from this literature, most of these "positive effects" benefit businesses and sectors that help clean up spills or that house temporary workers who travel to the spill location to assist in response efforts.[132] Yet, as it turns out, this growing body of literature clearly demonstrates that the net overall effect of a spill is negative.[133]

215. The Proponent's approach in portraying the positive economic impacts of an oil spill without adequately representing the full, net scope of negative effects reflects a mindset that is simply out of touch with the values of British Columbians. In a process where the Proponent provides insufficient evidence in support of its assertions, examples such as these further support the point that a 'trust us' approach to managing the serious risks of this Project is simply not good enough.

6.3 Interpreting Local Community Impacts

216. The fact of the matter is that Trans Mountain has not provided sufficient evidence to support its claims that it has provided a representative analysis of the full scope of socio-economic and environmental impacts a spill could have on local communities. As such, the Intervenor has no assurance that population demographics and health statuses have been sufficiently represented in its human health assessments or that impacts on at-risk and endangered species have been sufficiently represented in its environmental assessments.

217. Furthermore, by not adequately accounting for baseline costs to health care and emergency services that may be incurred by local communities in the event of a spill, Trans Mountain has failed to account for the initial scope of impacts the Project could have on local communities. By neglecting to consider larger spill scenarios and the possibility of submerged and sunken oils, Trans Mountain has also failed to account for a reasonable range of complications that could incur additional costs and burdens on local governments.

218. In the absence of this evidence, Trans Mountain appears to be asking the Board and British Columbians to simply 'trust' that their assertions are true. Given the significant and potentially catastrophic impacts a spill could have, the Intervenor argues that this approach is neither sufficient nor acceptable.

7. Conclusion

219. For the reasons outlined above, the Intervenor submits that Trans Mountain has advanced an incomplete Application that fails to adequately and accurately represent the full risks and negative effects the Project would present to the region, while also failing to substantiate its position that the Proponent and its

[132] Assessment of the Impact of the Exxon Valez Oil Spill on the Alaska Tourism Industry
[133] Assessment of the Impact of the Exxon Valez Oil Spill on the Alaska Tourism Industry, Exxon Valdez Oil Spill Restoration plan

partners could sufficiently mitigate any negative effects that may result from an oil tanker spill.

220. In evaluating the risks of an oil tanker spill, Trans Mountain failed to present a risk analysis that upheld even basic scrutiny by the Intervenor. Insufficient evidence was provided by the Proponent to demonstrate the representative and predictive accuracy of MARCS for applicability to the marine study area. Back-up studies evaluating the model were never provided on record, insufficient evidence was provided to discount 'tuning' and neither the core parameters of MARCS nor the risk reduction inputs were supported with validation or sensitivity analyses. In light of this, the Intervenor has argued that the risk analysis provided in TERMPOL 3.15 should not be given any weighting in the Board's consideration. Lacking a credible and substantiated risk analysis, the Intervenor argues that Trans Mountain's Application is incomplete.

221. Moreover, data provided in TERMPOL 3.8 Casualty Data Survey, the other principal document provided in the Application to represent the risk of a tanker incident, does not support Trans Mountain's conclusions that oil tanker incident frequencies are: (1) among the lowest of all marine vessels worldwide; (2) declining both internationally and domestically; and (3) suggesting that the low number of incidents involving oil tankers on the West Cost could imply that the current scheme to manage navigation and marine traffic is effective. Instead, the data provided demonstrates that oil tanker incident frequencies are (1) on par with other vessel types that were compared and (2) holding relatively constant for the period 2002 to 2011. In addition, the lack of incident frequencies in west coast incident data means the Proponent has no way of knowing whether the number of tanker incidents is high or low. TERMPOL 3.8 therefore fails to demonstrate sufficiently low incident risk from increased oil tanker transportation.

222. Trans Mountain based their entire analysis of the fate and behaviour of diluted bitumen (dilbit) in the marine environment on the faulty assumption that dilbit floats. Several lines of independent evidence clearly conclude otherwise. Unlike other crude oils, dilbit can sink in the presence of suspended particulate matter (e.g. sediment particles in the ocean). Suspended particulate matter is very common in B.C.'s coastal waters, meaning that any dilbit spill would likely lead to submerged oil. Currently there is no ability to effectively clean up oil that sinks below the surface, making dilbit a particularly risky substance to transport. It is clear that unless required to do so, Trans Mountain has no intention of conducting additional tank and/or field studies to explore the fate and behaviour of diluted bitumen in the coastal environment where sediments are present in the water column. Until such time as these studies are available, it is simply not possible to properly assess the risk and potential damages associated with a diluted bitumen spill in the Salish Sea. The Intervenor submits that in light of the glaring gap in scientific understanding, it would be reckless to approve the Trans Mountain project at this time.

223. In addition to the present inability to effectively respond to a spill of dilbit in the marine environment, the Intervenor submits that the ocean model used to assess potential spill trajectories has not been effectively evaluated for use in

highly turbulent tidal channels and in the presence of oceanic frontal systems commonly found in the Salish Sea. It is the expert opinion of the Intervenor that the proprietary ocean model is not the appropriate tool to address the questions being asked. The ocean model cannot capture the complex mixing and subduction processes that are known to exist in the Salish Sea. The model is hydrostatic and the vertical velocity fields, and hence the vertical distribution of tracers, will almost certainly be poorly represented. Model evaluation clearly shows an inability of the model to capture across-channel flow and there has been no drifter testing of model predictions.

224. Furthermore, Trans Mountain has neglected to demonstrate that it and its partner organizations have sufficient capacity to respond to a diluted bitumen tanker spill. First, there has been no demonstrated capacity to contain and recover sunken and submerged oils. Second, the Proponent showed a complete disregard for consideration of any spill larger than 15% of an oil tanker's cargo capacity. Whereas vessels in the United States have to be certified to respond to a total loss-equivalent spill, complicated by adverse weather, Trans Mountain has only considered a 15% discharge of a tanker's cargo under ideal environmental conditions. The unwillingness to consider a larger spill, let alone a total loss scenario, and the refusal to apply adverse weather and other complications to its simulations, is demonstrative of an approach that neglects to consider and prepare for the full scope of risks associated with the Project. Given this, the Arachne Reef spill scenario can only be considered a best-case scenario under ideal conditions and not a realistic outcome under either average or worst-case conditions. Meanwhile, although the proposed enhanced response capacity is a step in the right direction, it remains insufficient to deal with a diluted bitumen spill that could result in submerged and sunken oil. The Intervenor therefore argues that the proposed enhancements must be viewed as incomplete for the purposes of this Application.

225. The HHRA conducted by Trans Mountain fails to meet the requirements to address issues 5 and 12 on the approved issues list, and contributes to the Application being incomplete. Specifically, the HHRA failed on two fronts:

> 1. It fails to represent what a marine spill is likely to look like, including weather conditions, response capacity, fate and behaviour of heavy oil in a marine environment and the parameters of a credible worse case spill.
>
> 2. The report is structured in such a way that the exposure pathways that are considered are limited by the pre-selected conditions, without adequately considering other realistic exposure pathways that may present themselves in a spill scenario. Insufficient justification and supporting evidence is provided to justify both the selection and the subsequent omission of these exposure pathways.

226. The Intervenor does not feel that the conclusions reached in the HHRA can be considered to have any representative or predictive value outside of the narrow parameters of the specific scenario that was modeled in the report. This approach limits responders' and governments' ability to establish the necessary human health risk related plans, putting people at unnecessary risk.

227. Finally, as outlined in Section 6, the Proponent also has not provided sufficient evidence to support its claims that it has provided a representative and complete analysis of the full scope of socio-economic and environmental impacts a spill could have on local communities. This is true in terms of human health impacts and local marine species impacts, as well as in terms of general demands that would be placed on community services, including health and emergency services, in the event of a spill. Without sufficient information, local governments will be unable to adequately prepare for and therefore mitigate any potential spill that may occur, particularly should any complications occur.

228. For the reasons outlined above, the Intervenor cannot support approval of the Project. Furthermore, based on the substantive deficiencies elaborated in this written submission, the Intervenor respectfully submits that the Board must conclude that the Application is incomplete, pursuant to the threshold requirement of s. 52(1) of the *NEB Act,* and therefore decline to forward a recommendation to the GIC. In the alternative, the Intervenor requests that the Board recommend to the GIC that the Application be dismissed. The Intervenor submits that no conditions could sufficiently remedy the flaws inherent in the Application and therefore makes no submissions as to potential conditions that may be imposed.

All respectfully submitted on January 8th, 2016.

Andrew Weaver

Member of the Legislative Assembly of British Columbia
Representing Oak Bay-Gordon Head
Rm. 027, Parliament Buildings
Victoria, B.C. V8V 1X4
Phone: 250.387.8347
Email: Andrew.Weaver.MLA@leg.bc.ca