

Regulatory Operations and Regions Branch
Environmental Health Program
420-757 West Hastings Street
Vancouver, BC V6C 1A1

October 14th, 2016

Debra Myles
Panel Manager – Roberts Bank Terminal 2 Project
Canadian Environmental Assessment Agency
160 Elgin Street, 22nd Floor
Ottawa, On
K1A 0H3

Sent by email to RobertsBank@ceaa-acee.gc.ca

Subject: Health Canada's comments to the Review Panel on the Sufficiency and Technical Merit of the Environmental Impact Statement and Marine Shipping Addendum for the Roberts Bank Terminal 2 Project – Country Food and Noise Health Risk Assessments

Dear Ms. Myles:

Health Canada is participating in the environmental assessment of the Vancouver Fraser Port Authority's (the Proponent) proposed Roberts Bank Terminal 2 project (the Project), as a Federal Authority under the *Canadian Environmental Assessment Act, 2012* (CEAA, 2012).

As per the Panel's request of June 9th, 2016, Health Canada has conducted a review of the sufficiency and technical merit of the human health risk assessment components relating to the contamination of country (traditional) foods and noise, as provided in the Environmental Impact Statement (EIS) and associated documents. The attached document (2016 10 14 HC Comments RBT2 Sufficiency and Technical Merit – Food and Noise.docx) incorporates and/or adds to comments submitted during the Application Completeness Review (see Registry document # 228). No new comments were identified in relation to the Marine Shipping Addendum (see Registry document #360 for comments submitted during the Application Completeness Review).

A number of proposed information requests are included in Health Canada's comments, related to the provision of:

- a more complete human health risk assessment for marine foods;
- an analysis of potential sleep disturbance due to noise, using a more conservative effect threshold;

- more detailed information on noise effects on outdoor events and activities taking place in the study area, especially those with cultural significance to Indigenous people, both on land and in marine areas;
- additional data on traffic-related and low frequency noise; and
- a quantitative assessment of the noise model uncertainties.

In addition, we also provide general comments to consider for monitoring and follow-up programs, along with specific clarifications to the EIS and associated documents.

If you have any questions or concerns regarding this letter, please contact the undersigned.

Sincerely,

<Original signed by>

Herbert Antill
A/Regional Manager
Health Canada, British Columbia Region
Phone: (604) 666-2808

Attachment: 2016 10 14 HC Comments RBT2 Sufficiency and Technical Merit – Food and Noise.pdf

Cc:

Teresa Laforest, Director, Environmental Health Program and Internationally Protected Persons Program,
Regulatory Operations and Regions Branch, Health Canada
Greg Kaminski, Senior Environmental Health Specialist, Health Canada
Allison Denning, Environmental Assessment Coordinator, Health Canada
Eleanor Setton, Environmental Assessment Coordinator, Health Canada

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Organization (if applicable): Health Canada

General Comments: Health Canada has conducted a review of the sufficiency and technical merit of those sections of the Environmental Impact Statement (EIS) that relate to effects on human health. The comments provided here incorporate some of those made during the completeness reviews of the EIS (project registry document #228, June 15, 2015). No new comments have been identified for the Marine Shipping Addendum in this review – please refer to those submitted during the completeness review (project registry document #360, December 16, 2015).

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Information Source <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	Proposed Information Request	Rationale
TRADITIONAL FOODS		
<p>#1. EIS Section 27 Human Health Effects Assessment (Revised June 2016)</p> <p>Appendix 27-C Shellfish Harvesting Potential and Contaminant-Related Consumption Risks at Roberts Bank Technical Report</p>	<p>PROPOSED INFORMATION REQUEST: A more complete health risk assessment of possible construction and operation impacts on traditional foods and subsequently on human health is required, including full characterization of baseline conditions and project effects associated with emissions to water.</p> <p>This should include any COPCs currently present in marine sediment that could pose a risk to human health via consumption of traditional foods, including metals, PCBs, dioxin/furans, and PAHs, for example, and also that may be associated with leachate from antifouling paint from ships at port, chronic releases of fuel and lubricating oils from various marine vessels, untreated storm water runoff and sewage treatment effluent. In the case of arsenic, it may be advisable to measure the inorganic content present in local crab tissue, given that the analysis in Appendix 27-C demonstrates health risks above 1 per 100,000 for</p>	<p>The health risk assessment for traditional foods is limited to consumption of shellfish in the multi-media model, with only formaldehyde and benzo[a]pyrene included as COPCs via deposition to marine sediments via project emissions to air.</p> <p>Notably, Appendix 27-C is a health risk assessment of existing conditions specific to coal dust contaminants from Westshore Terminals, with a focus on testing bivalve and crab tissues for contaminants related to coal dust. Health Canada recognizes that this is an issue of concern to indigenous people who harvest bivalves and crabs in the RBT area; however, this is not a complete substitute for a health risk assessment for a wider range of contaminants under existing conditions and potential future conditions due to project effects.</p> <p>In EIS Section 27, subsection 27.6.1.4, it is stated that <i>“given that the source of contamination is largely historical, and sediment disturbance and resettlement during construction will not increase seabed levels of contamination, it can be reasonable assumed that existing measured edible bivalve tissue concentrations are not likely to increase as a result of Project construction or operation.”</i></p>

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Information Source <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	Proposed Information Request	Rationale
TRADITIONAL FOODS		
	<p>consumption of crab tissue under assumptions about inorganic arsenic content based on bivalve data from Puget Sound (8.4 per 100,000).</p> <p>In addition, all important traditional foods harvested from the impacted area and consumed by resident populations should be considered in the assessment. If there is knowledge that wild birds, hepatopancreas of crabs, as well as other traditional foods from the impacted area are being consumed, then these should be included as part of the human health risk assessment for traditional foods. While consumption of hepatopancreas may be infrequent and low, their ability to accumulate environmental contaminants results in the potential for this country food to provide a notable contribution to overall dietary exposure.</p> <p>Otherwise, a more complete rationale for the omission of potential sources of contaminants or specific traditional foods (based on detailed food consumption information) is required.</p>	<p>However, one of the effects of the proposed dredging will be to increase total suspended solids (TSS) in the water column. There is concern that the re-suspension of sediments may increase the uptake of contaminants by due to higher concentrations in marine waters until settling occurs.</p> <p>Appendix 27-C includes a discussion of contaminant uptake dynamics (Section 2.3 pg. 14). Specifically, it reports that since bivalves are <i>“filter feeders, sifting large quantities of water in shallow coastal habitats, they are prone to the exposure and accumulation of a variety of ...contaminants.”</i> Similarly, crabs, <i>“like bivalves...can be exposed to contaminants via contact with sediments and sediment pore water, from the water column (especially via respiratory and sensory epithelia...), and via feeding activities and prey items.”</i> Re-suspension of sediments could potentially increase contaminant levels in marine waters temporarily and thus create an exposure pathway for bivalves and crabs, and other wildlife such as marine birds.</p> <p>Appendix 27-C also identifies small scale releases of anti-fouling paint based on leaching from ships at port and chronic releases of fuel and lubricating oils from marine vessels as additional potential sources of contaminants that could reasonably be associated with the project (Pg 3). These are not addressed in any of the provided analyses.</p> <p>The inclusion of a quantitative HHRA will demonstrate the reasonableness of the proponent’s conclusions of negligible impacts to marine foods.</p>

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Information Source <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	Proposed Information Request	Rationale
TRADITIONAL FOODS		
#2. Section 33 and Appendix 33-A	COMMENT: Health Canada advises that a monitoring program for traditional marine foods be developed in consultation with Indigenous peoples harvesting from the study area.	
#3. Appendix 27-A Air Quality HHRA Technical Report	CLARIFICATION: The proponent should provide a justification for excluding the maximum benzo[a]pyrene measured in Macoma clam from the multi-media exposure assessment, or update the HHRA using results based on the maximum measured level.	The concentrations of benzo[a]pyrene in bivalves employed to estimate multi-media exposure are provided on page 25 of Appendix B in volume Appendix 27-A. These appear to be consistent with the highest values measured in samples of the various types of bivalves from Roberts Bank which are provided in Table 4-6 of volume 4 Appendix 27-C, with one exception. The value used for Macoma clam (0.028 ng/g) is not the highest concentration as a value ten-fold higher, 0.296 ng/g, is reported in a Macoma clam sample from RB-1.
#4. Appendix 27-C Shellfish Harvesting Potential and Contaminant-related Consumption Risks	CLARIFICATION: The proponent should clarify what total arsenic concentrations (average or maximum) were used to estimate exposures from bivalves and crab, and either 1) update the HHRA using the maximum levels for crab or 2) provide a rationale if the maximum was used only in the case of bivalves and the average used for crab.	According to the data presented in Appendix 27-C, the proponent appears to have used the average total arsenic concentration in crab muscle tissue (Table 4-14) to estimate potential exposure to arsenic from crab consumption although Tables 5-9 and 5-10 have labelled this concentration as the maximum observed concentration. On pg. 66, it is noted that for bivalves <i>“the maximum observed bivalve soft tissue concentration for each species tested was used to estimate contaminant exposure potential.”</i> The use of the maximum arsenic level would provide the worst-case scenario of potential health risks due to crab consumption.
#5. Appendix 27-C Shellfish Harvesting Potential and Contaminant-related	CLARIFICATION: The proponent should clarify why the sample numbers for bivalves are not considered suitable for making conclusions about the differences between Roberts Bank and the reference site, whereas for crab, the sample	The HHRA approach for existing coal dust contaminants in marine foods for bivalves and crab appears to be inconsistent, and may not present a full characterization of existing conditions.

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Information Source <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	Proposed Information Request	Rationale
TRADITIONAL FOODS		
Consumption Risks	<p>numbers are similar but used for screening out COPCs based on differences between Roberts Bank and the reference site. It is also stated that “it is not possible to preclude interactions between Dungeness crab sub-populations from the Roberts bank sites and the reference site, or movements of individual adult crabs between these sites.” (pg. 25)</p> <p>If the sample numbers and lack of ability to preclude crab movement between the Roberts Bank site and the reference site do not support making conclusions, then a full suite of COPCs should be assessed for crab, as was done for bivalves.</p>	<p>For bivalves, <i>“a larger suite of indicator trace elements was formally assessed...since the available bivalve data are too limited to make any confident conclusions about the statistical significance of differences between ...concentrations at the Roberts Bank locations and the reference sites.”</i> (pg. 66-67 App 27-C). Table 4-2 shows a range of sample numbers by site for each species, several as low as 2 or 3, but many with 5 or more samples.</p> <p>For crab, it is stated on pg 67 <i>“There was no difference in the average tissue muscle concentrations of Bi, Cd, Se or V between either the RBT2 terminal footprint area or ITP and the reference location farther to the north...Based on these results, the only contaminant of potential concern that was formally assessed in the context of crab consumption....was arsenic (As)”</i>. Table 4-13 shows 5 samples were taken at Roberts Bank and 5 at the reference site.</p>
<p>#6. Appendix 27-A Air Quality HHRA Technical Report</p> <p>Appendix 27-C Shellfish Harvesting Potential and Contaminant-related Consumption Risks</p>	<p>CLARIFICATION: The proponent should confirm that food consumption figures used to represent First Nations populations are appropriate.</p>	<p>Receptor characteristics, including food consumption figures, were taken from Health Canada and U.S. EPA references. While these characteristics may be appropriate to represent those of non-Indigenous people, we recommend that the proponent provide a rationale for using these receptor characteristics for the First Nation population(s) that may be impacted by the project.</p> <p>Note also that shellfish ingestion rates for First Nations employed in the multi-media assessment (infant 0 g/day; toddler 19 g/day; child 21 g/day; teenager 27 g/day; adult 28 g/day) are different than those employed in Appendix 27-C Shellfish Harvesting Potential and Contaminant-Related Consumption Risks at Roberts Bank Technical Report (infant 0 g/day; toddler 20 g/day; child 33 g/day; teenager 40 g/day; adult 40 g/day).</p>

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Information Source <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	Proposed Information Request	Rationale
NOISE		
#7. Appendix 9.3-A, Section 2.1	PROPOSED INFORMATION REQUEST: Provide an analysis of sleep disturbance using the more conservative threshold of 40 dBA ($L_{\text{night, outside}}$) (annual average).	<p>The criteria used to evaluate potential for sleep disturbance in the EIS (45 dBA L_n) is cited as the World Health Organization (WHO) 1999 Guidelines for Community Noise. This is based on a nighttime equivalent sound level of 30 A-weighted decibels (dBA) indoors, and corresponds to an outdoor noise level of 45 dBA when accounting for a 15 dBA reduction from outdoors to indoors through partially open windows.</p> <p>This proposed threshold has been updated in the WHO (2009) Nighttime Noise Guidelines for Europe which states that <i>“the 1999 guidelines are based on studies carried out up to 1995....new information has made more precise assessment of exposure-effect relationship. The thresholds are now known to be lower than LA_{MAX} of 45 dB for a number of effects”</i>. In addition, the WHO (2009) states that for outdoor noise levels above 55 dB, <i>“the situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a sizeable proportion of the population is highly annoyed and sleep disturbed. There is evidence that the risk of cardiovascular disease increases”</i>, and for noise levels between 40-55 dB, <i>“adverse health effects are observed among the exposed population. Many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected”</i>. The WHO (2009) recommends a nighttime noise guideline of 40 dB ($L_{\text{night, outside}}$), which is considered to be the threshold for adverse health effects (A-weighted, annual average).</p> <p>With a more conservative threshold, there may be an increased number of residences that will be affected by the increased noise as a result of the project and should be consulted during the construction and operation phases of the project.</p>

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Information Source <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	Proposed Information Request	Rationale
NOISE		
<p>#8.</p> <p>Appendix 27-B revised (page 12)</p> <p>Appendix 9.3-A – Appendix H (Table H-3, Figures H-1 and H-3) Appendix G (Figures G-1 and G-3)</p>	<p>PROPOSED INFORMATION REQUEST: Provide a discussion of outdoor events (i.e., community events, important ceremonial uses at specific times of the year, fishing and harvesting frequency, and other times of known high frequency use, etc.) regularly taking place on land and in marine areas within study boundaries and the frequency of use in context with expected outdoor noise levels at these times, acceptable noise levels for those activities, and the effectiveness of proposed mitigation actions to reduce noise levels to acceptable thresholds.</p>	<p>The analyses of noise effects focus on long-term exposure (pg. 12, App. 27-B Revised). However, given the proximity of the project site to the Tsawwassen First Nation Lands, there may be outdoor activities during which there is a higher expectation of peace and quiet in the daytime and/or nighttime. In this case, excluding short-term exposure, and use of the criteria selected to evaluate the acceptability of outdoor noise levels for speech intelligibility (55dBA) may not be appropriate.</p> <p>The WHO (1999) Table 1 (Guideline values for community noise in specific environments) for outdoor living areas indicates that at 55 dBA, there is expected to be serious annoyance during the daytime and evening, and at 50 dBA, there is expected to be moderate annoyance during the daytime and evening. In addition, the WHO (1999) states that “for full sentence intelligibility in listeners with <i>normal hearing</i>, the signal-to-noise ratio (i.e. the difference between the speech level and the sound level of the interfering noise) should be at least 15 dBA” and “the sound pressure level of normal speech is about 50 dBA”. Therefore, for full speech intelligibility with a background noise level of 55 dBA, a speaker’s voice would need to be at least 15 dBA greater, or 70 dBA. Importantly, those with impaired hearing as well as the young and the elderly may be more affected by impacts to speech intelligibility due to noise than those with normal hearing.</p> <p>Speech comprehension and annoyance thresholds are predicted to be exceeded and effects may be experienced over sub-chronic and acute exposure times:</p> <ul style="list-style-type: none"> • Appendix 9.3-A, Table H-3 shows Ld levels in areas east of the project exceed 55 dBA during construction, • Figures in Appendix 9.3-A indicate that the amount of land and marine area where sound levels greater than 50 dBA are expected to expand substantially in the future with the project compared to existing levels (Figures G-3 and G-

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Information Source <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	Proposed Information Request	Rationale
NOISE		
		<p>13 for example over land, and Figures H-1 and H-3 for marine areas respectively).</p> <p>This suggests that people engaging in important outdoor activities may experience speech intelligibility impacts and moderate to severe annoyance at more locations than are currently affected, in the absence of mitigation.</p>
#9. Appendix 9.3-A – Section 2.3.1.4	PROPOSED INFORMATION REQUEST: Provide an evaluation of low frequency noise (LFN) during daytime to evaluate the differences in LFN between day and night, and to validate the assumption that LFN from the terminal is more prominent at night than during the day.	<p>The EIS states that for LFN, “<i>while the measurements were conducted over periods of either 24 or 48 hours, only the data from midnight to 5:00 am were analysed</i>”.</p> <p>The rationale was that LFN from the marine terminal is more prominent during the overnight period when other noise sources are lower.</p> <p>This suggests that daytime LFN levels may be higher if other sources are present that produce LFN. A full characterization of LFN baseline conditions, both at night and during the day are required to fully assess the effects.</p>
#10. EIS Section 27.0 – Revised June 2016 Section 27.6.3.1	PROPOSED INFORMATION REQUEST: Provide the predicted future noise levels in comparison to existing noise levels in the 1/3 octave band spectra.	<p>Section 27.6.3.1 (Sleep Impairment from Continuous Noise) – states “<i>the minor increase in noise levels (less than 3 dBA) will not likely be perceptible by these individuals</i>”.</p> <p>If the spectra differ substantially, changes in noise levels of less than 3 dB may be perceptible and any increase in noise levels may result in increased annoyance and adverse health effects.</p> <p>Depending on whether the baseline spectra matches the projected related change in noise spectra, even a 1 dB change will be noticed.</p>

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Information Source <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	Proposed Information Request	Rationale
NOISE		
#11. Appendix 9.3-A	<p>PROPOSED INFORMATION REQUEST: Provide a quantitative assessment of the possible error range and/or model sensitivity, based on the limitations identified in Section 4.2 and also considering the following aspects:</p> <ul style="list-style-type: none"> • Traffic (regular and heavy duty) volumes were not measured – the model used an assumed day/night split. • Sound level meter microphones were placed at 1.7m above ground, which may not represent receptors at higher levels (i.e., second floor of buildings in the study area). • The use of variable wind directions to predict future noise levels at the nearest human receptor locations rather than assuming continual down-wind conditions. 	<p>Increases in noise are of particular concern to Tsawwassen First Nation, and the analyses provided demonstrate there may be increased exceedances of thresholds for sleep impairment and speech intelligibility.</p> <p>A quantitative assessment of model uncertainty will provide a fuller understanding of possible noise levels.</p> <p>Health Canada notes that:</p> <ul style="list-style-type: none"> • Traffic noise levels were not measured but instead were based on assumptions related to types of vehicles and frequency of use during day and night-time hours which may not be representative of actual traffic volumes on these roads. • Sound level meter microphones were placed at 1.7 m above ground. This height is not representative of noise levels that could be experienced via a higher storey window. The Ontario Environmental Noise Guideline (NPC-300)¹ states that noise monitoring location “<i>should be a minimum of 1.5 metres above ground for a first storey window, a minimum of 4.5 metres above ground for a second storey window, a minimum of 7.5 metres above ground for a third storey window</i>”. • The EIS indicates that wind direction was variable and when modelling wind, correction factors were applied to account for upwind and cross-wind conditions. The report states that “<i>for this study a crosswind correction value</i>

¹ Ontario Ministry of the Environment. - Stationary and Transportation Sources - Approval and Planning. <https://www.ontario.ca/page/environmental-noise-guideline-stationary-and-transportation-sources-approval-and-planning>

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Information Source <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	Proposed Information Request	Rationale
NOISE		
		<p><i>of -1.5 dBA, and an upwind correction value of -10 dBA were used."</i></p> <p>Based on ISO 1996-2:2007(E)², conditions for favourable sound propagation include:</p> <ol style="list-style-type: none"> 1) when the wind is blowing from the dominant sound source to the receiver (down-wind); 2) the wind speed, measured at a height of 3 to 11 m above ground, is between 2 m/s and 5 m/s during the daytime or more than 0.5 m/s at night-time; and 3) no strong, negative temperature gradient occurs near the ground (e.g. when there is no bright sunshine during the daytime).
#12. Appendix 9.3-A- Section 2.3.3.3	PROPOSED INFORMATION REQUEST: Measure actual traffic volumes in order to validate the assumptions used in the model regarding traffic noise.	With respect to annual average daily traffic volumes, assumptions were made about vehicle volumes for 41B Street and Tsawwassen Drive North given a lack of real data. It would be useful to measure traffic volumes on these streets in order to ensure the assumptions used in the noise modelling reflect actual volumes. This is particularly important for the evening and over-night hours so that heavy truck traffic is not underestimated in noise modelling.
#13. Appendix 9.3-A	PROPOSED INFORMATION REQUEST: Provide measures of low frequency noise (LFN) on the Tsawwassen First Nation Lands.	The Tsawwassen First Nation has indicated low frequency noise (LFN) is a concern. Actual measures of LFN at Site 4 (or a location identified by the Tsawwassen First Nation) would be useful to establish baseline conditions rather than relying on noise modelling to do so. The collection of baseline LFN levels would also be useful in the event of public complaints about LFN during construction and/or operations as LFN could be measured in the future and compared to baseline levels to evaluate any changes and validate model predictions.

² International Standards Organization (ISO). 2007. ISO1996-2. Second Edition. Acoustics – Description, measurement, and assessment of environmental noise – Part 2: Determination of environmental noise levels. Switzerland: ISO.

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Information Source <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	Proposed Information Request	Rationale
NOISE		
#14. Section 33 and Appendix 33-A	<p>COMMENT: Health Canada advises that the environmental and follow-up plans for noise, in addition to including a formalized complaint response and resolution plan, should consider:</p> <ul style="list-style-type: none"> • any additional noise mitigation measures that will be implemented to protect the expected peace and quiet of any outdoor events or activities identified; • monitoring specifically for the number, frequency and duration of impulsive noise events during the evening and over-night hours to confirm predictions and in the event of public complaints about impulsive noises; • engaging in an ongoing dialogue with the identified residents prior to project commencement and during project construction, operations and decommissioning to ensure that project-related activities do not result in increased sleep disruption and/or sleep disturbance • work slow-downs or stoppages during specific conditions (e.g. winds blowing down-wind, temperature inversions, night-time, etc.) in the event complaints are registered; and • implementing all technically and economically feasible noise mitigation measures, such as those found in the New South Wales Construction Noise document (Appendix A), in addition to the specific measures presented in EIS Section 27.7.2. 	<p>The EIS reports local communities are already concerned about existing noise levels, and while the project is predicted to contribute only small increases in noise levels, any increase may be considered a significant impact by residents.</p> <p>Note that Section 27.6.3.1 of the EIS states that <i>“Individuals who do have increased levels of sleep impairment may experience symptoms associated with lack of sleep such as increased tiredness, fatigue, and lack of focus”</i>; and that Section 27.10.3.1 of the EIS states that <i>“detailed analysis of predicted sound levels across the entire LAA indicates that a total of 11 homes are predicted to have future Ln levels greater than 55 dBA. Of these, 9 homes are located on TFN lands and 2 homes are located on non-aboriginal lands”</i>.</p> <p>In a literature review conducted as part of a Health Canada study on wind turbine noise and health, it was stated that <i>“sleep loss has been implicated in a variety of negative health outcomes including cardiovascular abnormalities, immunological problems, psychological health concerns, and neurobehavioral impairment that can lead to accidents. Sleep loss may be related to total sleep time restriction and/or reduced sleep quality in the sleep time obtained. Sleep disorders such as insomnia and obstructive sleep apnea are associated with an increased incidence of hypertension, heart failure, and stroke. Sleep can clearly be disrupted with noise. It has long been recognized that electroencephalography (EEG) arousals can be induced with external environmental stimuli, but are modulated by sleep state”</i>.³</p> <p>Sleep disruption and disturbance can therefore not only have adverse effects such as <i>‘increased tiredness, fatigue and lack of focus’</i> but can lead to longer-term health effects which should be seriously considered rather than considering them</p>

³ Michaud, D. S. et al. 2016. Effects of Wind Turbine Noise on Self-Reported and Objective Measures of Sleep. *Sleep*: 39:1. Doi: <http://dx.doi.org/10.5665/sleep.5326>.

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Information Source <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	Proposed Information Request	Rationale
NOISE		
		'reversible' assuming that the individuals affected would find it acceptable to change their sleep behaviours to close windows and use ear plugs. Sleep aids not only include ear plugs but also potentially prescription medication, which can lead to day-time drowsiness and other effects such as decreased productivity and increased traffic accidents ⁴ which can impact not only the individual but also the community.
#15. Appendix 9.3-A, section 2.3.4.2 and Table 2-1	CLARIFICATION: Section 2.3.4.2 indicates that low frequency noise was measured at Site 4 on the Tsawwassen First Nation Lands. This is incorrect as per Appendix 9.3-A, Table 2.1.	

⁴ Hansen, R.N. et al. 2015. Sedative Hypnotic Medication Use and the Risk of Motor Vehicle Crash. American Journal of Public Health: August 2015, Vol. 105, No. 8, pp. e64-e69. doi: <http://dx.doi.org/10.2105/AJPH.2015.302723>

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Appendix A. Commonly Applied Construction Noise Mitigation Measures and Considerations for Noise Reduction

The measures below have been adapted from the New South Wales Construction Noise Guideline (August 2008 draft for consultation), Department of Environment and Climate Change, New South Wales, Australia.

General Mitigation Measures

- Include in tenders, employment contracts, subcontractor agreements and work method statements clauses that assure the minimization of noise and compliance with directions from management to minimize noise.
- Give preference to the use quieter technology or other mitigation measures rather than lengthening construction duration (i.e. it is not recommended to lower noise by having fewer pieces of equipment running at a time thereby leading to extended construction duration).
- Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways that minimize noise.
- Ensure that site managers periodically check the site, nearby residences and other sensitive receptors for noise problems so that solutions can be quickly applied.
- Avoid the use of radios and stereos outdoors and the overuse of public address systems where neighbours can be affected.
- Avoid shouting, and minimize talking loudly and slamming vehicle doors.
- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours and other relevant practices (e.g. minimizing the use of engine brakes and periods of engine idling).

Night-time Mitigation Measures

- Avoid the use of equipment that generates impulsive noise.
- Minimize the need for reversing alarms.
- Avoid dropping materials from a height.
- Avoid metal-to-metal contact on equipment.
- If possible, schedule truck movements to avoid residential streets.
- Avoid mobile plant clustering near residences and other sensitive receptors.
- Ensure that periods of respite are provided in the case of unavoidable maximum noise level events.

Consultation and Notification

The community is more likely to be understanding and accepting of project noise if related information is provided and is frank, and does not attempt to understate the likely noise level, and if commitments are respected.

Notification Before and During Construction

Provide advance notification to people concerning construction duration, defining activities that are expected to be noisy and their expected duration, what noise mitigation measures are being applied, and when noise respite periods will occur.

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

For night-time work, receptors may be informed in two stages: two weeks prior to construction and then two days before commencement.

Provide information to neighbours before and during construction through media such as letterbox drops, meetings or individual consultation. In some areas, the need to provide notification in languages other than English may be considered. A Web site may also be established for the project.

Use a site information board at the front of the site with contact details, hours of operation and regular information updates.

Facilitate contact with people to ensure that everyone can see that the site manager understands potential issues, that a planned approach is in place, and that there is an ongoing commitment to minimize noise.

Plant and Equipment

In terms of both cost and results, controlling noise at the source is one of the most effective methods of minimizing the noise impacts from any construction activities.

Quieter Methods

Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting, and controlled blasting such as penetrating cone fracture.

Consider alternatives to diesel and gasoline engines and pneumatic units such as hydraulic or electric-controlled units where feasible and reasonable. When there is no electricity supply, consider using an electrical generator located away from residences.

Examine and implement, where feasible and reasonable, alternatives to transporting excavated material from underground tunnelling off-site at night-time. (i.e. stockpile material in an acoustically treated shed during the night and load out the following day).

Examine and implement, where feasible and reasonable, alternatives to pile driving using a diesel hammer, such as hydraulic hammer, hydraulic press-in, or vibratory pile driver.

To reduce the impact of backup alarms, examine and consider implementing, where feasible and reasonable, ambient sensitive backup alarms, signal workers, turning circles and side loading/unloading trucks.

Quieter Equipment

Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine (i.e. rubber-wheeled tractors can be less noisy than steel-tracked tractors).

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Pneumatic equipment is traditionally a problem. Consider selecting super-silenced compressors, silenced jackhammers and damped bits where possible.

When renting (or purchasing) equipment, select quieter pieces of plant and construction equipment where feasible and reasonable. As well, select the most effective mufflers, enclosures and low-noise tool bits and blades. Always seek the manufacturer's advice before making modifications to any equipment to reduce noise.

Reduce throttle settings and turn off equipment when it is not being used.

Examine and consider implementing, where feasible and reasonable, the option of reducing noise from metal chutes and bins by placing damping material in the bin.

Equipment Maintenance

Regularly inspect and maintain equipment to ensure that it is in good working order, including the condition of mufflers.

For machines with enclosures, verify that doors and door seals are in good working order and that the doors close properly against the seals.

Return any leased equipment that is causing noise that is not typical for the equipment. The increased noise may indicate the need for repair.

Ensure that air lines on pneumatic equipment do not leak.

Site Mitigation Measures

Barriers and acoustic sheds are most suited to long-term fixed works as in these cases, the associated cost is typically outweighed by the overall time savings.

Equipment Location

Place as much distance as possible between the equipment and residences and other sensitive receptors.

Restrict areas in which mobile plants can operate so that they are away from residences and other sensitive receptors at particular times.

Locate site vehicle entrances away from residences and other sensitive receptors.

Carry out noisy fabrication work at another site (e.g. within enclosed factory premises) and then transport products to the project site.

Alternatives to Reversing Alarms

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Avoid the use of reversing alarms by designing the site layout to avoid reversing, such as by including drive-through for parking and deliveries.

When applicable legislation permits, consider less annoying alternatives to the typical 'beeper' alarms. Examples include smart alarms that are adjustable in volume depending on the ambient level of noise, and multi-frequency alarms that emit noise over a wide range of frequencies.

Maximize Shielding

Re-use existing structures rather than demolishing and reconstructing.

Use full enclosures, such as large sheds, with good seals fitted to doors to control noise from night-time work.

Use temporary site buildings and material stockpiles as noise barriers.

Schedule the construction of permanent walls so that they can be used as noise barriers as early as possible.

Use natural landform as a noise barrier. Place fixed equipment in cuttings or behind earth berms.

Take note of large reflecting surfaces on- and off-site that might increase noise levels, and avoid placing noise-producing equipment in locations where reflected noise will increase noise exposure or reduce the effectiveness of mitigation measures.

Work Scheduling

Schedule noisy work during periods when people are least affected.

Provide Respite Periods

Consult with schools to ensure that noise-generating construction works in the vicinity are not scheduled to occur during examination periods, unless other acceptable arrangements (such as relocation) can be made.

When night work near residences cannot be feasibly or reasonably avoided, restrict the number of nights per week and/or per calendar month that the work is undertaken.

Schedule Activities to Minimize Noise Impacts

Organize work to be undertaken during the recommended standard hours where possible.

If the construction site is in the vicinity of a sports venue, consider scheduling work to avoid times when there are special events.

When work outside the recommended standard hours is planned, avoid scheduling it on Sundays or public holidays.

Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Schedule work when neighbours are not present (e.g. commercial neighbours, college students and school students may not be present outside business hours or on weekends).

Schedule noisy activities around times of high background noise (i.e. when local road traffic or other local noise sources are active) where possible to provide masking or to reduce the amount that the construction noise intrudes above the background noise.

Deliveries and Access

Nominate an off-site truck parking area away from residences for trucks arriving prior to gates opening and schedule deliveries only during specified periods.

Optimize the number of vehicle trips to and from the site. Movements can be organized to amalgamate loads rather than using a number of vehicles with smaller loads.

Designate access routes to the site through consultation with potentially noise-affected residences and other sensitive receptors, and inform drivers of nominated vehicle routes.

Provide on-site parking for staff and on-site truck waiting areas away from residences and other sensitive receptors. Truck waiting areas may require walls or other barriers to minimize noise.

Noise Transmission Path

Physical methods to reduce the transmission of noise between construction locations and residences or other sensitive receptors are generally suited to construction projects in which there is long-term noise exposure.

Reduce the line-of-sight noise transmission to residences and other sensitive receptors using temporary noise barriers.

Temporary noise barriers can be constructed from boarding (plywood boards, panels of steel sheeting or compressed fibre cement board) with no gaps between the panels at the site boundary. Stockpiles and shipping containers can be effective noise barriers.

Erect temporary noise barriers before work commences to reduce noise from construction as soon as possible.

Where high-rise dwellings adjoin the construction site, the height of a barrier may not be sufficient to effectively shield the upper levels of the residential building from construction noise. Find out whether this is a consideration for the project and examine alternative mitigation measures where needed.