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September 15, 2016

Robert Hajdu
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Sent by e-mail to: rob.hajdu@ceaa-acee.gc.ca

Subject: Health Canada's Comments on the Burnco Environmental Assessment Certificate Application/Environmental Impact Statement (EAC Application/EIS)[1]

Dear Mr Hajdu:

Health Canada has reviewed the Burnco Environmental Assessment Certificate Application/Environmental Impact Statement for the Burnco Aggregate Project in its capacity as a Federal Authority, as defined by subsection 12(3) of the Former *Canadian Environmental Assessment Act* (1992) in order to document outstanding concerns/comments, as well as any additional deficiencies that the Department has identified to date.

Our comments seek additional information, rationale, or clarification from the Proponent to ensure the EIS presents a reasonable and defensible assessment of the environmental effects that the Project may have on human health from changes to the bio-physical environment. Upon request from CEAA, Health Canada can provide additional comments on any proposed mitigation methods for the Project.

In keeping with our mandate, Health Canada is providing information requests (IRs) in the following tables (Annexes 1, 2 and 3) with respect to the following subject areas: air quality, noise, drinking water quality, country foods contamination, and human health risk assessment. In Annex 1, Health Canada has provided references to specific IRs (and a

[1] Burnco Rock Products Ltd. 2016. Proposed Burnco Aggregate Project Environmental Assessment Certificate Application / Environmental Impact Statement (EAC Application / EIS). July.

summary of the IR response) that correlate with the Agency's questions posed. In Annex 2, Health Canada is providing the full IR with reference to the specific section(s) in the EIS for context. In general, the IRs are presented by Valued Component (VC). In Annex 3, Health Canada is providing more standard advice and/or suggestions to the proponent which are relevant for the protection of human health.

Please note that HC does not verify environmental modelling results (e.g. the validity of predicted future contaminant levels in air, water or country foods) and instead relies on other departments for expertise. HC reviews the predicted impacts to verify comparisons made with health-based guidelines/standards and to determine if scientifically defensible rationales were provided.

If you have any questions regarding HC's response or if you identify any other specific human health concerns with respect to this project on which you would like to learn HC's views, we would be pleased to make available the specialist or expert information or knowledge within the Department's possession.

<Original signed by>

Regional Environmental Assessment Coordinator
Health Canada, Atlantic Region
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Attachment: Commonly Applied Construction Noise Mitigation Measures and Considerations for Noise Reduction

cc: Herbert Antill, A/EHP Regional Manager (BC), Health Canada
Laurence Davidson, A/Manager, Environmental Assessment and Contaminated Sites, Health Canada
Sanya Petrovic, Unit Head, Contaminated Sites Division, Health Canada
Wendy Wilson, Environmental Assessment Officer, Health Canada
Lucille Lukey, Regional EA Coordinator (BC), Health Canada
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Cindy Watson, Vancouver Coastal Health

ANNEX 1: Advice to the Agency – Health Canada Comments – September 15, 2016

Table 1: Advice for the Agency's consideration in its recommendation to the Minister of Environment and Climate Change

Questions	Responses/Comments
• Has the proponent described all project components and activities in sufficient detail to understand all relevant project-environment interactions? If not, identify what additional information is needed.	HC-IR-01 to HC-IR-04 - specific contaminants of potential concern were screened out from further evaluation in the Base Case and Application Case human health risk assessment (HHRA) based on criteria that Health Canada regards as inappropriate. As such, current and future health risks may be underestimated. HC-IR-05 – diesel particulate matter and PAHs, components of vehicle exhaust, were not evaluated in the HHRA. HC-IR-09 – with respect to concentrations of contaminants in seafood tissues, historical contaminants in sediment, which may be re-suspended during project activities in the marine environment (including dioxins and furans) were not assessed for baseline conditions, nor were future sampling programs for specific seafood species recommended, and as such, there is uncertainty regarding existing contamination and no future sampling program proposed to evaluate any changes in seafood contaminant concentrations from project activities HC-IR-11 – one freshwater fish from McNab Creek was sampled and analysed for baseline contamination, which may not represent baseline freshwater fish tissue concentrations from which to compare to future contaminant concentrations HC-IR-12 and HC-IR-14 – Health Canada identified several contaminants of potential concern in the various environmental media that were not included in the HHRA (the only pathway evaluated was recreational human exposure to titanium in surface water while swimming) which may result in an underestimation of health risks HC-IR-15 – no soil deposition rates were presented for the location(s) where the maximum deposition of airborne particles may occur, nor for the nearest community of McNab Strata, which represents an uncertainty with respect to human exposure to contaminants in soil and subsequent uptake by terrestrial country foods and human consumption of these foods HC-IR-26 – there was no discussion about whether groundwater was used as a drinking water source and what impact the project may have on groundwater used for drinking water
• Were the study areas sufficient to predict potential effects from all relevant project-environment interactions, and to consider the effects within a local and regional context?	HC-IR-11 – given that only one fish was sampled in McNab Creek, it is unclear whether the study area selected for sampling was sufficiently large HC-IR-24 – the Local Study Area for noise was 1.5 km surrounding the project site, which includes a portion of Howe Sound. Given that sound does not attenuate significantly over water, additional receptors on the

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Questions	Responses/Comments
	opposite of Howe Sound may be impacted by project-related noise.
• Is the baseline information sufficient to characterize the existing environment, predict potential effects and obtain monitoring objectives? If not, identify what additional information is needed.	HC-IR-01 to HC-IR-04 – Base case risk assessment – existing contaminants were only evaluated in the HHRA if the predicted future case (Application Case) concentrations increased by greater than 10% and the future predicted concentrations exceeded applicable regulatory guideline values. In addition, if a substance had no applicable guideline value, it was screened out of further assessment in the HHRA. As a result, many substances in various media were not evaluated in either the Base Case or Application Case HHRA. This may underestimate baseline and future health risks. HC-IR-09 and HC-IR-10– no crab tissue was analysed for PAHs or dioxins and furans, no mussels were analysed for dioxins and furans and no marine fish or other marine seafood were analysed for any baseline concentrations of contaminants. HC-IR-11 – only one freshwater fish (from McNab Creek) was sampled for metals which is insufficient to determine baseline contaminants in freshwater fish HC-IR-14 – although baseline contaminant concentrations of one freshwater fish, mussels, crabs and berries were analysed, this data was not used to calculate baseline health risks in the HHRA HC-IR-17 – one of the stated purpose of the baseline sampling program was to calculate site-specific bio-accumulation factors which was not done in the report HC-IR-23 – at receptor location NR5 – all noise monitoring data from 8 pm until 1 am were not considered 'valid'. Given that NR5 is the community of McNab Strata, there is no representative baseline data for noise levels during the evening hours HC-IR-26 – although the report indicates that well water is available at the First Nations and community residential locations, there was no baseline sampling of well water quality at these locations
Alternatives Assessment	
• Has the proponent adequately described the criteria it used to determine the technically and economically feasible alternative means? • Has the proponent listed the potential effects to valued components (VCs) within your mandate that could be affected by the	Health Canada did not review the Alternatives Assessment.

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Questions	Responses/Comments
technically and economically feasible alternative means? • Has the proponent adequately described why it chose each preferred alternative means? • Are there other alternative means that could have been presented? If so, please describe.	
Environmental Effects Assessment	
• Has the proponent clearly described all relevant pathways of effects to be taken into account under section 16 of the former Act?	It appears that all of the elements from Section 16 of the former CEAA have been presented in the EIS and supporting technical documents.
• Has the proponent identified all potential effects to VCs, including relevant species at risk, within your mandate?	HC-IR-12 and HC-IR-14 – only one exposure pathway was evaluated in the HHRA for human receptors (surface water dermal contact with titanium during swimming), however, Health Canada identified other COPCs in various media that should have been further evaluated in the HHRA. Not evaluating these contaminants and applicable exposure pathways may underestimate human health risks from the proposed project.
• Were all potential receptors considered?	HC-01 – the report indicates that an adult receptor was used to evaluate exposure to carcinogens, whereas a more appropriate receptor would be a lifetime-composite receptor which consists of all life stages HC-IR-13 –no specific information on local Indigenous Peoples consumption patterns was used in determining consumption patterns for terrestrial and aquatic country foods
• Were the methodologies used by the proponent appropriate to collect baseline data and predict effects, why or why not?	HC-IR-01 to HC-IR-04 – screening substances for further evaluation in the HHRA based on whether there is a greater than 10% increase predicted in future concentrations in comparison to baseline is not toxicologically based and not appropriate. In addition, screening out substances in the event that there are no available environmental quality criteria to compare to is also not appropriate. HC-IR-06 and HC-IR-07 – screening substances using less conservative acceptable thresholds from different jurisdictions is also questionable and may result in the screening out of substances that should otherwise be evaluated in the HHRA HC-IR-08- when screening out contaminants in air, the predicted concentrations were compared with the relevant regulatory ambient air quality criteria/guidelines without considering background concentrations

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Questions	Responses/Comments
	which could result in screening out of substances that should otherwise be evaluated in the HHRA HC-IR-09 – crab and mussel tissues were not analysed for dioxins and furans which are known to be present in Howe Sound sediment due to historical industrial activities. Crab tissues were also not analysed for PAHs. No other marine foods (e.g. groundfish) were sampled for contaminants. Not evaluating these contaminants and species may result in potential contaminants of concern not being evaluated in terms of baseline and/or future health risks. HC-IR-11 – only one freshwater fish was sampled for metals which is not sufficient in order to establish baseline fish metals concentrations HC-IR-12 and HC-IR-14 – only one exposure pathway was evaluated in the multi-media HHRA. Given that Health Canada identified other contaminants in other media that should be evaluated in the HHRA, current and potential future health risks may be underestimated HC-IR-13 – fish ingestion rates used in evaluating health risks may not representative of consumption rates for local Indigenous Peoples and do not consider special events where higher volumes may be consumed (e.g. festivals, ceremonies, fishing trips etc.) HC-IR-15 – no predicted soil concentrations were identified for the nearest human receptor locations and given that soil concentrations were used to evaluate increases in contaminants in terrestrial country foods, there is uncertainty associated with potential increases in risk due to soil exposure and future ingestion of local terrestrial country foods HC-IR-16 – no stand-alone baseline human health risk assessment was completed to evaluate current health risks to nearby human receptors; therefore existing risks are not known HC-IR-18 – the magnitude (acceptability) of future risks is not consistent (and is much higher) than Health Canada guidance and therefore risks may be considered 'acceptable' in the report but may be higher than Health Canada's recommended levels for carcinogens and non-carcinogens HC-IR-19 – although game meat was identified as a potential exposure pathway, no baseline game meat samples were collected nor was there a commitment to sample game meat in the future, therefore there is uncertainty with respect to existing contaminant concentrations in game meat and no means of evaluating any changes that may result once the project is operational HC-IR-24 – with respect to noise, given that noise does not attenuate substantially over water, noise levels at receptors on the opposite of Howe Sound may be underestimated, particularly when winds are blowing to the

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Questions	Responses/Comments
• Describe your level of certainty in the predictions based on the methods used. If there is uncertainty, what are the options for increasing certainty in the predictions presented by the proponent in the EIS?	east and there is a moderate temperature inversion HC-IR-26 -No baseline drinking water samples were collected in the community of McNab Strata, therefore, baseline contaminant concentrations are not know and there are no proposed sampling programs to evaluate baseline or future changes that may result once the project is operational HC-01 – an adult receptor was used to evaluate human exposure to carcinogens however a more appropriate receptor would be a lifetime-composite receptor which takes into consideration all life stages HC-02 – future vegetation and game meat contaminant concentrations were not evaluated directly but by using increases in soil concentrations as a surrogate. Increases in soil concentrations were compared to guidelines for residential soils, however, it may be more appropriate to use agricultural soil guidelines given that many of them were derived by evaluating contaminant uptake in plants HC-04 – with respect to noise, several locations are approaching a change in percent highly annoyed of greater than 6.5% (which Health Canada considers to be the point where widespread complaints can be expected) – given model uncertainty, noise levels can be +/- 5 dB, and as such noise levels may be higher than predicted and increased public complaints about noise may occur Baseline contaminant concentrations in air at the site are not known (baseline was assumed to be similar to other locations where sampling stations are present), baseline freshwater fish contaminant concentrations are uncertain because of a lack of samples, baseline dioxin and furan concentrations in marine species are not known, baseline concentrations of contaminants in wild game are not known, baseline contaminant concentrations in well water drinking supplies are not known – to reduce the uncertainty associated with the lack of baseline data in these media, additional baseline sampling can be undertaken With respect to predicted future contaminant concentrations and potential human health risks, all contaminants expected to be emitted by the project should be evaluated in a multi-media human health risk assessment as per HC-IR-12 and HC-IR-14 Based on the HHRA provided, Health Canada is of the opinion that there is substantial uncertainty and current and future human health risks may be underestimated.
• Are the predicted effects described in objective and reasonable terms (e.g., beneficial or adverse, temporary or permanent, reversible or irreversible)?	The predicted effects are presented in objective and reasonable terms and reflect the COPC and toxic effect which is reflective of current scientific understanding

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• Has the proponent adequately assessed the potential cumulative environmental effects, including using an appropriate study area and proposing mitigation and follow-up program requirements? Provide rationale.	HC-IR-22 – In addition to particulate matter, the Woodfibre LNG facility is expected to release NO_2 and SO_2. These two substances were not considered in the cumulative assessment of ambient air quality. HC-IR-25 – no cumulative effects assessment was conducted for noise based on the assumption that "*all project-related residual adverse effects were determined to be negligible and requiring no further consideration*". Given the proximity of the project site to other industries, the proximity to the Port of Vancouver and Squamish, and the uncertainty associated with the noise modelling for the project itself, it is unclear why cumulative impacts associated with noise were not evaluated.
• Has the proponent adequately described the potential for environmental effects caused by accidents and malfunctions, including the types of accidents and malfunctions, their likelihood and severity and the associated potential environmental effects? If not, identify what additional information is needed.	HC-IR-27 – with respect to accidental land-based spills and surface water impacts, there was no discussion about the impact of spills on human health, including the potential for direct contact with contaminants or ingestion of contaminants via surface water consumption as a drinking water source. More information is needed to determine the potential for adverse health effects associated with spills and ingestion of contaminated surface water.
• Are you satisfied with the proponent's assessment of effects of the environment on the Project? • Has the proponent characterized the likelihood and severity appropriately? Provide rationale.	Health Canada did not evaluate the assessment of the effects of the environment on the project.
• Has the proponent sufficiently described and characterized the project activities and components as they relate to federal decisions within your mandate? If not, identify what additional information is needed. • Are changes to the environment, as they relate to federal decisions within your mandate, sufficiently described? If not, identify what additional information is needed.	Health Canada is a federal authority and does not have any federal decision with respect to this project.
Mitigation	
• Are the proposed mitigation measures described in sufficient detail to have certainty in their effectiveness? If not, identify what information is needed.	HC-IR-27 – thirteen 'key' mitigation measures were presented with respect to land-based hazardous material spills and the potential to impact surface water quality. No human-health based mitigation measures were presented.

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Questions	Responses/Comments
• Is it clear how each proposed mitigation measure links to each potential pathway of effect?	HC-IR-12 and HC-IR-14 –the conclusion of the HHRA was that there would be no unacceptable risks to nearby human receptors and therefore no specific mitigation measures to be protective of human health were presented. Given the uncertainties surrounding the selection of COPCs and the limited exposure pathways evaluated, depending on the outcome of a revised HHRA that includes the additional COPCs and exposure pathways as described in HC-IR-01 to HC-IR-05, specific, health-based mitigation may be warranted.
• Would you propose different or additional mitigation measures? If so, provide a description of the mitigation measure(s), with rationale.	HC-03 – Health Canada identified additional mitigation measures that could be implemented to reduce construction-related noise and have appended a document outlining these potential additional noise mitigation measures HC-04 –for noise, Health Canada indicated that predicted noise levels may be higher than modelled and it would be appropriate to implement a formalized complaint-response system and implement additional mitigation in the event of public complaints
• Which of the proposed mitigation measures and/or project design elements do you consider to be necessary to reduce the likelihood of significant adverse environmental effects? Provide rationale.	All proposed mitigation measures related to air quality and noise would be important given the limited number of air contaminants evaluated, the uncertainties around the noise model predictions and the proximity of the project to the community of McNab Strata and their use of resources (e.g. food, water) near the project site.
Residual Adverse Environmental Effects	
• Are the identification and documentation of residual environmental effects described by the proponent adequate? If not, what are the aspects for which there is uncertainty and, where possible, indicate how these residual effects can be best described. If there is uncertainty, what are the options for increasing certainty?	HC-IR-01 to HC-IR-05 – certain substances were not evaluated in the HHRA which could underestimate health risks. HC advises that a multi-media baseline (Base Case) and future (Application Case) HHRA be conducted to evaluate those contaminants and exposure pathways identified by Health Canada that were not assessed in the current HHRA.
• Did the proponent provide a sufficiently precise, ideally quantitative, description of the residual environmental effects related to your mandate? Identify any areas that are insufficient.	HC-IR-18 – residual effects for human health were characterized as the basis for determining the significance of potential residual adverse effects which were based on criteria which were identified to assess the magnitude of potential health risks. The proposed acceptable risk levels are much higher than Health Canada guidance for carcinogenic and non-carcinogenic risk and further justification of these levels is needed. HC-IR-21 – with respect to human health, residual effect on human health was considered significant in the event that the project would "*affect the viability of the VC (i.e. the ability of the community to work and function over time within the defined spatial and temporal boundary*". It is unclear what this statement means or how it would be evaluated to determine if a significant effect were to occur.

Table 1: Advice for the Agency's consideration in its recommendation to the Minister of Environment and Climate Change

Questions	Responses/Comments
Determination of Significance	
• Are the conclusions on significance in the EIS supported by the analysis that is provided? • Are the proponent's proposed criteria (magnitude, geographic extent, duration, frequency, reversibility, and social/ecological context) for assessing significance appropriate? This includes how they were characterized, ranked, and weighted. Provide rationale.	The conclusions are based on the analysis contained in the EIS, however, Health Canada has concerns with the methodology used to determine human health effects and the conclusions may change upon completion of an updated HHRA which includes additional substances and exposure pathways HC-IR-20 – with respect to air quality, a significant adverse effect was considered "*when the magnitude of the effect is high (greater than air quality criteria at residences) and an effect that is irreversible*". This definition does not consider human receptors that may be present at the maximum point of impingement (MPOI) and for substances which may have acute or short-term effects (e.g. respiratory irritants) but are reversible once exposure has ceased. This definition may not capture all potential health risks associated with project activities. HC-IR-21 – with respect to human health, residual effect on human health was considered significant in the event that the project would "*affect the viability of the VC (i.e. the ability of the community to work and function over time within the defined spatial and temporal boundary*". It is unclear what this statement means or how it would be evaluated to determine if a significant effect were to occur.
• Were appropriate methodologies used in developing the conclusions on significance?	The conclusions related to human health were based on the results of the HHRA and Health Canada has concerns about how the HHRA was conducted.
• Do you agree with the proponent's analysis and conclusions on significance? Provide rationale.	Unknown. Based on the analysis presented, it is unknown whether the proponent's analysis and conclusions on significance are appropriate or accurate with respect to human health.
Monitoring and Follow-up	
• Does the proposed monitoring and follow-up program verify the predictions of the environmental assessment? Please explain additional monitoring or follow-up needed to address uncertainty in the effects assessment.	HC-05 – no monitoring specifically for drinking water supplies was proposed. If the project may impact local drinking water supplies it would be prudent to monitor baseline conditions and during operations to evaluate any changes HC-06 – surface water monitoring is to be conducted, however, if surface water is used for drinking water, contaminant concentrations should be compared to the Guidelines for Canadian Drinking Water Quality or equivalent provincial drinking water guidelines
• Does the proposed monitoring and follow-up program verify the effectiveness of proposed mitigations? Please explain additional monitoring or follow-up needed to address uncertainty in the	No monitoring or follow-up was proposed specifically for the Public Health VC.

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Questions	Responses/Comments
proposed mitigation.	
• Is the objective of the follow-up program clear and measurable? • Does the follow-up program include sufficient detail, and technical merit, for the Agency to achieve the stated objective (e.g., sufficient baseline dataset, monitoring plans, acceptable thresholds of change, contingency procedures)?	No monitoring or follow-up was proposed specifically for the Public Health VC.
• Are you aware of any federal or provincial authorizations or regulations that will achieve the same follow-up program objective(s)? If so, how do these achieve the objective(s)?	Not aware.
Additional comments, views, advice	
• Provide any other comments.	Health Canada has no additional comments.

Annex 2: Information requests directed to the proponent: Burnco Aggregate Project Environmental Assessment Certificate Application/EIS – Health Canada Comments September 15, 2016

IR #	Valued Component	Reference to EIS	Context and Rationale	Specific Question/Request for Information
HC-IR-01	HHRA	EIS Section 9.1.5.1.2 and Applicable Screening Appendices	When comparing predicted maximum concentrations to acute screening criteria, the EIS states that "*if the predicted maximum concentrations were greater than the selected screening criteria and the percent change from Base Case was greater than 10% then the chemical was retained as a COPC and considered further in the acute inhalation assessment*." The use of a change of more or less than 10% to screen substances for further assessment in the HHRA is not appropriate and is arbitrary. This approach is not health-based and no rationale was provided in the report as to how this might impact human health. It is recommended that the report clarify this assumption and provide rationale on a chemical-specific basis to identify whether there may be adverse health impacts associated with an increase of <10% relative to baseline. Health-based guidelines are based on human (and animal) toxicity studies and are intended to be protective of human health, whereas screening substances for inclusion in the HHRA based on a >10% increase from baseline conditions or screening out substances from the HHRA based on a <10% increase from baseline has no human toxicological basis. All substances that exceed their applicable regulatory criteria/guideline value should be further evaluated in the HHRA irrespective of the percentage change in concentrations from Base Case. See Health Canada (2012)[2] for more information about appropriate methods for screening substances for further evaluation in an HHRA.	Additional information is needed to justify screening substances out of further assessment based on a predicted change of less than 10% from baseline conditions. In particular, information about the toxicity of the individual substances needs to be provided to ensure that an increase of less than 10% will not result in adverse human health effects based on the human toxicity of the individual substances. All substances that currently exceed or that are predicted in the future to exceed an applicable health-based guideline value should be further evaluated in the HHRA, irrespective of whether the predicted increase is expected to be more or less than 10% from the Base Case.
HC-IR-02	HHRA (surface water)	EIS Section 9.1.5.6.2 page 9.1-25	With respect to surface water, the EIS states that "*metal concentrations were either predicted to increase by less than 10% from Base Case OR were less than the health-based drinking water guidelines for all parameters with screening criteria. Ammonia, hardness, alkalinity and titanium were predicted to increase by greater than 10% in at least one location.*"	All substances in surface water that exceed an applicable health-based guideline value should be further evaluated in the HHRA, irrespective of whether the predicted increase is expected to be less than 10% from the Base Case because this could result in an underestimation of health risks.

[2] Health Canada. 2012. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0. Ottawa, Ontario: Environmental Health Assessment Services, Safe Environments Program. http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/index-eng.php

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IR #	Valued Component	Reference to EIS	Context and Rationale	Specific Question/Request for Information
			The report did not provide a discussion regarding potential health concerns associated with exceedance of the health-based drinking water guidelines but were less than 10% from the Base Case. Any substance that is predicted to exceed the health-based drinking water quality guidelines should be carried forward in the risk assessment, irrespective of whether it was predicted to increase by less than 10% from Base Case. See Health Canada (2012)[1] for more information about appropriate methods for screening substances for further evaluation in an HHRA. In addition, there is a qualitative discussion about why ammonia and hardness were not further evaluated in the HHRA, however, there was no discussion about why alkalinity was excluded from further assessment.	Further, the report should provide rationale for screening out alkalinity from further assessment in the HHRA.
HC-IR-03	HHRA (soil)	EIS Section 9.1.5.6.2	With respect to soil, the EIS states that "*the predicted metal concentrations (incremental + existing) were less than the applicable environmental soil quality guidelines, with the exception of arsenic. However, soil concentrations of arsenic were not predicted to increase by more than 10% above Base Case concentrations*". See Health Canada (2012)[1] for more information about appropriate methods for screening substances for further evaluation in an HHRA.	All substances in soil that exceed an applicable health-based guideline value should be further evaluated in the HHRA, irrespective of whether the predicted increase is expected to be less than 10% from the Base Case because not doing so could result in an underestimation of health risks. It is requested that the report include an evaluation of the potential health impacts associated with arsenic in soil in the HHRA because not doing so could result in an underestimation of health risks.
HC-IR-04	HHRA (air)	Appendix 9.1B Air Screening	Table 9.1-B-3 indicates that at the maximum point of impingement (MPOI), concentrations of lead in ambient air are projected to exceed a 10% increase at the MPOI but because there are no guideline values, lead was not carried forward in the risk assessment. The lack of a guideline is not a reason for screening out substances. Table 9.1-B-4 identifies several substances that exceed guideline values for the 24-hour Application Case, including beryllium at all receptor locations, and PM2.5, PM10, total suspended particulates (TSP), iron and manganese at the MPOI. Beryllium was not screened into the HHRA because it did not exceed a 10% increase in concentration. As noted in HC-IR-01, it is not appropriate to screen out as substance based on a predicted increase of less than 10% from Base Case. Table 9.1-B-6 indicates that chromium, cobalt and nickel exceed annual guideline values for the Application Case, however they were not screened into the human health risk	Evaluate lead, beryllium (short-term), and cobalt, chromium, nickel (long-term) and any other substances that exceed their guideline values (or have no guideline value) in air in the HHRA. The current report may underestimate potential human health risks as these substances were not included in the HHRA.

Annex 2: Information requests directed to the proponent: Burnco Aggregate Project Environmental Assessment Certificate Application/EIS – Health Canada Comments September 15, 2016

IR #	Valued Component	Reference to EIS	Context and Rationale	Specific Question/Request for Information
			assessment because they did not exceed a 10% increase from the Baseline Case. As noted above, As noted in HC-IR-01 and above, it is not appropriate to screen out as substance based on a predicted increase of less than 10% from Base Case. These predicted elevated levels of lead, beryllium, cobalt, chromium and nickel in air should be considered in the HHRA and failure to do so may result in an underestimate of human health risk. See Health Canada (2012)[1] for more information about appropriate methods for screening substances for further evaluation in an HHRA.	
HC-IR-05	Air Quality	Appendix 5.7-A, Section 2.4	The air quality parameters selected to evaluate vehicle exhaust emissions were particulates, SO_2 and NO_2. Other substances related to vehicle exhaust, including polycyclic aromatic hydrocarbons (PAHs) and diesel particulate matter may also be relevant for inclusion in the assessment, particularly given that there are ambient air quality criteria for these substances. Some ambient air quality criteria include: Health Canada has recently published a Human Health Risk Assessment for Diesel Exhaust (http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/exhaust-diesel-gaz-echappement/index-eng.php) which identifies a short-term (2-hour) exposure guidance value of 10 mg/m^3 and a chronic exposure guidance value of 5 mg/m^3. The Ontario Ministry of the Environment have published ambient air quality criteria for specific PAHs that could be used for comparison (http://www.airqualityontario.com/downloads/AmbientAirQualityCriteria.pdf). The California Environmental Protection Agency has published an inhalation unit risk and inhalation slope factor for diesel exhaust, which can be found in *Part I: Guidance in Human Health Preliminary Quantitative Risk Assessment (PQRA) Version 2.0, pg. 22*. (http://www.oehha.ca.gov/air/hot_spots/2009/AppendixA.pdf).	Health Canada advises that PAHs (such as naphthalene to represent non-carcinogenic PAHs and benzo[a]pyrene to represent carcinogenic PAHs) and diesel particulate matter be included in the air quality assessment, and that predicted concentrations be compared to appropriate regulatory guidelines. The exclusion of these contaminants during the construction and operation phase may result in an underestimation of human health risk.
HC-IR-06	Air Quality	EIS Table 5.7-1	According to the Table, there are no Federal guidelines for NO_2 or SO_2 in air, which is incorrect. There are existing National Ambient Air Quality Objectives (NAAQOs), however, currently the Government of Canada is in the process of updating the air quality standards for NO_2 and SO_2 that will eventually replace the outdated NAAQOs. It is expected that the new standards for these two pollutants will be substantially lower than the NAAQOs. Therefore, it is suggested that a sensitivity analysis using NAAQS	Federal guidelines for NO_2 and SO_2 currently exist, however, they are in the process of being updated. In the interim, Health Canada advises that predicted future concentrations of these substances be also compared to USEPA NAAQS which are being used to inform new Canadian standards.

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IR #	Valued Component	Reference to EIS	Context and Rationale	Specific Question/Request for Information
			issued by US EPA for NO_2 and SO_2 be conducted for a more meaningful analysis, as the US EPA NAAQS are based on a more current database similar to that being used in Canada to develop the new standards. The USEPA NAAQs can be found at https://www.epa.gov/criteria-air-pollutants/naaqs-table The supporting documents for these NAAQS can be found at: http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=259167#Download (for NO_2); and http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=198843 (for SO_2).	
HC-IR-07	Air Quality	Appendix 9.1-B	As presented in Tables 9.1-B-1 and 9.1-B-2, for SO_2 (10 minute exposure) the ATSDR minimum risk level (MRL) of 26 mg/m^3 and the World Health Organization (WHO) value of 500 mg/m^3 were identified as potential acceptable threshold levels. The WHO threshold was selected with the rationale that it was health- based, it considered several studies involving sensitive individuals and was derived more recently than the ATSDR value. The ATSDR MRL was also derived based on health considerations ("*a minimal lowest observed adverse effect level (LOAEL) of 0.1 ppm for bronchoconstriction in exercising asthmatics*") and is much lower than the WHO value. Given that the ATSDR value is more conservative (more than an order of magnitude lower than the WHO value), it would be more appropriate to use a more conservative value when screening substances for assessment in the HHRA. Health Canada has recently published an HHRA for SO_2,[3] which presents a proposed 10 minute reference concentration of 67 parts per billion (or 175 µg/m^3) in air which is expected to be protective of human health. In addition, the Government of Canada is in the process of revising its air quality objective for SO_2 (see HC-IR-06 for more information) which is expected to be much lower than the current standard.	Given that Health Canada has recently published an HHRA on SO_2, and the Government of Canada is in the process of revising the SO_2 ambient air quality objective, in the interim, it would be appropriate to screen substances based on the most conservative health-based criteria unless there is substantial justification to show otherwise. Provide a discussion about whether or not using the ATSDR MRL to screen in SO_2 in the HHRA would have any impact on the outcome of air quality assessment or associated health risks in the HHRA.
HC-IR-08	HHRA (air)	Appendix 9.1-B	As stated in the Appendix, "*the predicted 1-hour air concentrations for selected receptor locations screened against the selected thresholds are presented*". It does not appear that Base Case values were included with the predicted future concentrations when screening substances for further evaluation in the HHRA. In order to evaluate concentrations that may be present during project operations, it is essential to include background/baseline concentrations in addition to the predicted emissions from the	The report should include the total concentration of the substances that will be elevated in air as a result of project activities (i.e. combining the existing baseline contaminant concentrations with the future predicted concentrations) in order to screen substances for further evaluation in the HHRA. Not including background with future predicted concentrations will underestimate the overall future contaminant concentrations in air and human exposure to air

[3] Health Canada. 2016. Human Health Risk Assessment of Sulphur Dioxide (CAS RN: 7446-09-5). Analysis of Ambient Exposure to and Health Effects of Sulphur Dioxide in the Canadian Population. Water and Air Quatliy bureau, Safe Environments Directorate, Healthy Environments and Consumer Safety Branch, Health Canada. January.

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			project to evaluate overall health risks.	contaminants. In order to adequately assess potential health risks it is important to assess not only project-related exposure in the absence of background, but total exposure; failure to do so may underestimate potential risks.
HC-IR-09	HHRA	EIS Section 9.1.3.3.1	The EIS indicates that crab tissue was analysed for metal concentrations and mussel tissue was analysed for background concentrations of metals and PAHs. Given the historical contamination of Howe Sound which includes dioxins and furans from current and historical industrial operations (e.g. the former pulp mill at Woodfibre) and the fact that marine sediment will most likely be disturbed during construction activities in the marine environment (which could remobilize existing contaminants), it is unclear why these marine species were not also analysed for background concentrations of dioxins and furans. In addition, no marine fish (such as species consumed by local people - e.g. flounder) were analysed as part of the baseline program. No rationale was provided for this.	Additional justification is needed in order to explain why no marine fish (or other edible species from this area) were sampled and why dioxins and furans were not analysed in both crabs and mussels in the recent baseline sampling program given the historical contamination in Howe Sound. Dioxin and furan concentrations should be assessed in baseline samples for marine species that are likely to be consumed by people given the historical contamination of Howe Sound and the possible re-suspension of sediments during project activities in the marine environment. Consider monitoring other edible species (e.g. marine fish) for metals, PAHs, and dioxins and furans.
HC-IR-10	HHRA	Appendix 9.1C, Section 4.2.1	In Section 4.2.1, the report states that crabs were analysed for metals, however, this section concludes that "*in general, concentrations of metals and PAHs in crab in muscle and organ tissues collected at the reference site and the Project area, were quite similar*." Given that no crabs were analysed for PAHs and no PAH results were presented, it is unclear how this conclusion could be reached.	Provide a rationale for the conclusion that concentrations of PAHs in crabs in the Project Area and reference site were similar given that no data was presented in the report regarding concentrations of PAHs in crabs.
HC-IR-11	HHRA	EIS Section 9.1.3.3.1 and Appendix 9.1C, Section 4.2.1	Section 9.1.3.3.1 of the EIS states that "*fish tissue data… were used to gain a better understanding of baseline conditions at the site*." Section 4.2.1 of Appendix 9.1C indicates that baseline fish data (freshwater fish only) was based on a single sample that was collected from McNab Creek. Analysis of one fish is not sufficient to determine baseline conditions, nor is it possible to determine baseline health risks or future health risks based on one fish sample. EIS Section 9.1.3.3.6 states that First Nations have reported harvesting all five species of salmon, steelhead and Dolly Varden char in McNab Creek. As such, it appears that additional fish species may be present in McNab Creek. In order to acquire sufficient numbers of the various species of fish expected to be present in McNab Creek, it would be useful to collaborate with local people who consume fish from this area to obtain samples for analysis.	Health Canada advises that additional samples of fish tissue be collected and analysed in order to ensure an adequate baseline value for chemicals of potential concern (COPCs) in fish to reduce the uncertainty associated with the current baseline metals in fish data which is based on one fish sample only.

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HC-IR-12	HHRA	EIS Table 9.1-9	With respect to the exposure pathways considered in the multi-media assessment, the only exposure pathway considered valid was recreational receptor exposure to titanium in surface water from Pit Lake. Health Canada has concerns related to the screening methods used to determine the COPCs to be evaluated in the HHRA, and this Table needs to be revised to reflect the additional substances and exposure pathways that should have been screened in for further evaluation based on Health Canada's other IRs presented above.	Evaluate all substances that exceed regulatory guideline values (either currently or during project construction and operation) for each relevant exposure pathway in the HHRA. Where no guideline values exist, evaluate any substance in any media where concentrations may increase due to project activities (for both baseline and future scenarios).
HC-IR-13	HHRA	Appendix 9.1C Table 9.1-C-3	Table 9.1-C-3 provides the input values and sources used to calculate fish and shellfish screening levels. For fish and shellfish ingestion rates Health Canada (2007)[4] is cited. This consumption rate may not be representative of local Indigenous Peoples consumption rates for fish and shellfish. The First Nations Food Nutrition and Environment Study (FNFNES)[5] should be consulted (in addition to any other dietary surveys or consumption studies for local Indigenous Peoples) in order more accurately determine local consumption rates/patterns and those values should be used in screening equations to determine the COPCs to be evaluated in the HHRA. In addition, using consumption rates from Health Canada (2007) does not take into consideration the potential for very high rates of consumption for short periods of time, such as during a weekend fishing trip or a ceremonial event.	Consider using more site-specific consumption patterns (including factors such as seasonality of exposure) when evaluating acceptable contaminant concentrations in fish and shellfish which are more representative of actual consumption rates/patterns for local Indigenous Peoples. Given that fish and shellfish screening levels were derived using the Health Canada (2007) ingestion rates, not using more site-specific values may result in an underestimation of potential health risk and may result in the screening out of substances which could be relevant from a human health perspective.
HC-IR-14	HHRA	EIS Section 9.1.3 and Appendix 9.1-C	The Base Case HHRA evaluated only those substances that were "*screened into the human health risk assessment (i.e. parameters for which the Proposed Project was expected to result in a change to environmental concentrations that people may be exposed to and which exceeded a health-based standard or guideline)*". Health Canada identified additional substances that may increase as a result of project activities and should be evaluated in the HHRA (see HC-IR-02 to HC-IR-05). Failure to include these in the baseline HHRA may result in an underestimation of human health risk. Section 9.1.3.3.3 of the EIS states that "*health risks were evaluated based on the existing (i.e. Base Case) and predicted (i.e. Application Case) quality of soil, water and*	Conduct a multi-media Base Case and Application Case HHRA which includes exposure to all relevant COPCs for both current and potential future increases in contaminant concentrations in both terrestrial and aquatic country/traditional foods which utilizes reasonable assumptions related to consumption rates by local Indigenous Peoples. It is requested that the assessment of consumption rates consider the amount of time people actually spend at the MPOI as well as the potential that people may collect/harvest country foods near the project site and bring them back to their communities to consume over a longer period of time.

[4] Health Canada. 2007. Human Health Risk Assessment of Mercury in Fish and Health Benefits of Fish Consumption. Available from: http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/nutrition/merc_fish_poisson-eng.pdf

[5] Chan, L., Receveur, O., Sharp, D., Schwartz, H., Ing, A., and Tikhonov, C. 2011. First Nations Food, Nutrition and Environment Study (FNFNES): results from British Columbia (2008/2009). Prince George: University of Northern British Columbia. http://www.fnfnes.ca

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			air". There was no evaluation of country/traditional foods, despite the fact that samples of fish, mussels, crabs and berries were collected and analysed for baseline contaminant concentrations. As presented in Appendix 9.1-C, for fish, baseline arsenic, chromium, lead and mercury exceeded the calculated fish screening levels (for the one fish sampled). For shellfish, concentrations of arsenic, copper, mercury and strontium exceeded the shellfish screening values in one or more samples. For mussels, concentrations of arsenic, cadmium, copper, lead and zinc exceeded the calculated screening levels in one or more samples. Contaminant concentrations may increase in marine and freshwater species due to project activities such as construction in the marine environment, ship traffic and sediment re-suspension, and discharges from the project to the marine environment via McNab Creek. As such, it is expected that aquatic foods be evaluated in the HHRA for future project-related scenarios as this is expected to be an operable exposure pathway. In addition, the baseline multi-media HHRA did not evaluate human exposure to contaminants in any terrestrial country foods. Given the potential for deposition of airborne particulates containing elevated levels of metals on plants and soil, and given that future impacted soil concentrations were not evaluated at the MPOI or the community of McNab Strata (approximately 500 m from the project boundary) (see HC-IR-15), the impact of the project on terrestrial country foods has not been adequately evaluated and there is a potential that human health risks have been underestimated.	
HC-IR-15	Soil	Appendix 9.1-D	Tables 9.1-D-1 to D-4 identify the locations where predicted annual deposition rates were calculated. There were no predicted soil concentrations presented for the location(s) where the highest deposition of airborne particulates could occur. It also does not appear that the nearest community (McNab Strata community) was evaluated with regard to increases in concentrations of substances in soil as a result of deposition of airborne particulate matter during project operation. In addition, there are two locations (Unknown First Nations and Unknown Residence) that were not identified either on a map or by geographical coordinates. Failure to evaluate soil at the nearest receptor locations may result in underestimation of potential human health risks associated with project activities.	Current and predicted future soil concentrations at the MPOI and at the community of McNab Strata should be presented in the EIS in order to ensure that the worst-case scenario for exposure to soil and associated terrestrial country foods is evaluated. In addition, the two unknown locations should be identified as to their geographical location(s) and proximity to the project site. Given that changes to soil quality were also used to determine whether there would be changes in concentrations of substances in edible vegetation and game meat, failure to evaluate soil concentrations at these locations will affect the assessment of foods and may result in underestimation of potential health risks.

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HC-IR-16	HHRA	EIS Section 9.1.3.3.1	The report states that *"unlike other disciplines, field data were not used to directly measure existing risks to public health, and a stand-alone baseline assessment was not conducted*". There is no explanation as to why no stand-alone baseline assessment was conducted.	In order to fully understand baseline health risks prior to project commencement, it is necessary to conduct a site-specific, multi-media human health risk assessment which includes exposure to COPCs in air, soil, water, and foods (particularly given that country/traditional foods were analysed as part of the baseline sampling program). See HC-IR-14 for more information.
HC-IR-17	HHRA	Appendix 9.1A, Section 1.0, and EIS Section 9.1	The Appendix states that "*the purpose of the [baseline] sampling program was to provide site-specific chemistry results that will be used to determine baseline exposure concentrations and calculate site-specific bioaccumulation factors as a part of the public health assessment*". There was no discussion of bioaccumulation factors and no evaluation of the baseline risk from consumption of terrestrial or aquatic country foods in the Public Health Assessment (EIS Section 9.1).	Given that Health Canada has identified additional substances that should be assessed as part of the HHRA (as noted in comments above), as well as the potential for bioaccumulation of certain contaminants (e.g. mercury, PCDDs/PCDFs), it requested that the report provide a discussion about possible bioaccumulation of contaminants and the impact of increased levels of those substances on human health.
HC-IR-18	HHRA	EIS Section 9.1.3.3.4 and Table 9.1-4	Table 9.1-4 presents the authors proposed magnitude (i.e. acceptability) of risk for both non-carcinogens and carcinogens. However, the proposed 'acceptable' risks are not consistent with Health Canada guidance. The report identifies that for non-carcinogens, a low and likely to be negligible risk is defined as being a hazard quotient (HQ) of 1.0 to ≤10 and a potentially elevated risk is defined as an HQ>10. The report did not provide a rational on a chemical-specific basis as to whether there may be potential health risks associated with a HQ >1. The report identifies that for carcinogens, a low and likely to be negligible risk is defined as an incremental lifetime cancer risk (ILCR) of $1x10^{-5}$ to ≤$1x10^{-4}$, and a potentially elevated risk is an ILCR >$1x10^{-4}$. These target risk values are higher than Health Canada's negligible target HQ of <1 and Health Canada's acceptable ILCR of <$1x10^{-5}$. No rationale was provided to identify how levels above the targets identified by Health Canada would be protective of health.	The report should present rationale on a chemical-specific basis as to whether there may be health risks associated with an HQ greater than 1.0 for non-carcinogens (including non-site-related exposure) or 0.2 (for site-specific exposures), and/or an ILCR greater than 1×10^{-5} for carcinogens (as per Health Canada, 2012[6]).

[6] Health Canada. 2012. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0. Ottawa, Ontario: Environmental Health Assessment Services, Safe Environments Program. http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/index-eng.php

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HC-IR-19	Soil Screening Criteria to Evaluate Foods	EIS Section 9.1.5.6.2	With respect to screening game meat and plants using soil quality guidelines, Health Canada would prefer that any contaminants of potential concern (COPCs) that are expected to be released as a result of project-related activities (and where uptake to plants or other terrestrial country foods may occur); that these substances be screened in for further assessment in a multi-media HHRA (for both Base and Application Cases) irrespective of whether the contaminant concentrations in soil are predicted to exceed soil quality guidelines, as site-specific differences in the soil matrix may impact the modelling. This is particularly relevant given that baseline vegetation sampling has been undertaken. It was noted in Table 9.1-9 that ingestion of game meat was considered a potential exposure pathway, however, no game meat was collected or analysed as part of the baseline sampling and no background data from literature was identified.	Consider evaluating all COPCs that are expected to be released to the environment and may be taken up by terrestrial country foods for the Base Case, Application Case and cumulative effects assessments to evaluate potential health risks associated with existing conditions, project-related conditions and overall increases in health risks to human receptors in the vicinity of the project. If there is sufficient concern or uncertainty related to the lack of game meat samples, baseline sampling for game could also be undertaken.
HC-IR-20	Air Quality	EIS Section 5.7.5.5.2.1	A significant effect was determined to be "*when the magnitude of the effect is high (greater than air quality criteria at residences) and an effect that is irreversible*". The significance definition does not consider risks at the MPOI nor does it evaluate exposure to substances such as some non-carcinogenic risks, where adverse effects may occur but are not irreversible (e.g. respiratory irritants which may have acute effects but which can be reversed once exposure has ceased).	The definition of significance should include receptors at the location(s) of the highest potential exposure (e.g. MPOI) and should include any adverse effect whether it is irreversible or not.
HC-IR-21	HHRA	EIS Section 9.1.3.3.5	A residual effect on human health was considered to be significant if the effect of the proposed project would "*affect the viability of the VC (i.e. the ability of the community to work and function over time within the defined spatial and temporal boundary)*". It is unclear what this statement means.	Provide additional explanation of the meaning of this statement, including examples, to provide context.
HC-IR-22	Air Quality	EIS Table 5.7-17	According to the Table, the proposed Woodfibre LNG facility may result in emissions of TSP, PM_{10} and $PM_{2.5}$. In addition to these, LNG facilities are also likely to release SO_2 and NO_2. These substances should be considered in the cumulative assessment of health risks.	Include all relevant COPCs from other proposed projects in the cumulative assessment of human health risks.
HC-IR-23	Noise	Appendix 9.2A – Table 11	According to the Table, all data from 8 pm until 1 am at NR5 was considered '*not valid*'. Thus, there is no understanding of what typical baseline noise levels would be during the evening hours at NR5 (McNab Strata community). The uncertainty associated with this baseline sample should be discussed and a rationale for why the data was not valid should be provided.	Given that NR5 is the closest human receptor location to the project (approximately 500 m from the project fenceline), it is important to have valid baseline noise data for all time periods to compare to future predicted or measured noise levels to evaluate any changes. Discuss the potential implications of this uncertainty in terms of future predicted noise levels and

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				provide a rationale for why the data was not considered valid. Consider collecting additional baseline noise data, particularly for the evening and night-time period.
HC-IR-24	Noise	Appendix 9.2A – Section 2.0	The Local Study Area (LSA) was defined as extending out 1.5 km in all directions from the project fence line/boundary (which is based on the *British Columbia Noise Control Best Practices Guideline*). This LSA includes not only land but also the surface water of Howe Sound. According to Schomer and Sanders (1978)[7], "*community noise problems are generally worse when the sound propagates over water*". Given that there are human receptors across Howe Sound, that prevailing winds are from the west/southwest, and that very little attenuation of noise is expected because of the presence of Howe Sound, predicted noise levels at these receptor locations may be underestimated. Noise from the facility may be even more apparent in downwind and/or calm conditions with a strong temperature inversion (where cold air underlies warmer air at higher altitudes) (ISO 9613-2; 1996).[8]	Given the potential for noise levels to be higher than predicted at receptor locations on the other side of Howe Sound, Health Canada advises that the LSA be expanded to include additional receptors near this shore. In addition, noise management and noise monitoring plans, including a formalized complaint response and resolution plan, should be included as part of an Environmental Management Plan.
HC-IR-25	Noise	EIS Section 9.2.5.7	No cumulative effects assessment was undertaken for noise, based on the assumption that "*all potential Project-related residual adverse effects were determined to be negligible and requiring no further consideration. No residual effects were carried forward to a cumulative effects assessment*." Given that there are other industrial activities occurring in the vicinity of the project (including logging), it is unclear why no cumulative assessment of noise was undertaken.	Undertake a cumulative effects assessment of noise on nearby human receptors or provide additional justification as to why this was not considered necessary.
HC-IR-26	Groundwater	EIS Table 9.1-3 and EIS Table 9.1-9	Surface water ingestion is considered to be an exposure pathway, however, groundwater ingestion is not evaluated. Table 9.1-9 states that well water is available at the First Nations and community residential locations, however, there is no discussion about what impacts the project may have on groundwater as a drinking water source.	If groundwater is likely to be ingested, explain how the project may or may not impact groundwater-sourced drinking water supplies. If changes to the quality of drinking water as a result of project activities are possible, this pathway should be evaluated in the HHRA.
HC-IR-27	Accidental Spills	EIS Table 15-5	With respect to land-based hazardous material spills and the potential to impact surface water quality, thirteen "key" mitigation measures are presented. No human health-based mitigation measures were presented. In the event of chemical spills to surface water,	Provide mitigation measures that are relevant from a human health perspective or provide justification as to why additional mitigation measures are not necessary (e.g. surface water is not expected to be consumed by

[7] Schomer, P.D. and Sanders, E. (1978). A comparative study of sound propagation over land and water. J. Acoust. Soc. Am. 64: S172.
[8] ISO (International Organization for Standardization). 1996. ISO 9613-2:1996. Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation. December 1996.

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			drinking water supplies may be impacted (if applicable) and fish and other aquatic foods consumed by Indigenous Peoples may also be impacted.	people).

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HC-01	Appendix 9.1C, Section 4.2	Section 4.2 states that for carcinogenic parameters, adult body weight and ingestion rates were used. In order to evaluate all life-stages in the calculation of carcinogenic risks, a more appropriate receptor would be the composite lifetime receptor, which includes the infant, toddler, child, teen and adult with life expectancy of 80 years, 60 of which are as an adult (Health Canada, 2012[1] and 2013[9]).	Consider utilizing a composite lifetime receptor when evaluating risk from exposure to carcinogens which takes into consideration all life stages and provides a more technically accurate estimation of risk (see Health Canada, 2012; 2013).
HC-02	EIS Section 9.1.5.6.2	The EIS states that "*in the absence of screening criteria for these media (game meat and plants), changes to soil quality as the result of aerial deposition was used as a surrogate to determine whether there would be potential for changes in vegetation and game meat concentrations*". According to Section 7.3 of the CCME (2015)[10] scientific criteria document for Canadian soil quality guidelines for nickel, "*exposure from direct soil contact is the primary derivation procedure used for calculating environmental quality guidelines for residential/parkland, commercial and industrial land uses. Exposure from direct soil contact as well as soil and food ingestion are considered in calculating guidelines for agricultural land use, with the lower of the two values generated from these derivation procedures being recommended as the environmental soil quality guideline for this land use*" Based on Table 9.1-C-2 in Appendix 9.1-C, it appears residential land use criteria were used. If the intention is to evaluate food ingestion, the more appropriate screening criteria would be the CCME soil quality guidelines for agricultural land use.	If changes in soil concentrations are used to evaluate changes in foods, CCME soil quality guidelines for agricultural land use should be used instead of residential criteria where they are more conservative.
HC-03	EIS Section 16.2.2.9	This section identifies noise mitigation measures that will be implemented to reduce noise levels. Additional mitigation measures that could be implemented to reduce noise levels can be found in the New South Wales Construction Noise Guidelines (attached).	Consider implementing all technically and economically feasible noise mitigation measures, such as those found in the New South Wales Construction Noise document, in addition to the specific measures presented in EIS Section 16.2.2.9.

[9] Health Canada. 2013. Interim Guidance on Human Health Risk Assessment for Short-Term Exposure to Carcinogens at Contaminated Sites. Prepared by the Contaminated Sites Division, Safe Environments Directorate. http://www.hc-sc.gc.ca/ewh-semt/contamsite/index-eng.php

[10] Canadian Council of Ministers of the Environment (CCME). 2015. Scientific Criteria Document for Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health: Nickel. CCME

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HC-04	EIS Section 9.2-Table 9.2-27 And Table 9.2-35	At several receptor locations during Construction Phase 5, change in %HA is approaching the acceptable level of 6.5% (e.g. R9 and R14 are predicted to be 6.1% and several others are above 5.5%). In addition, at several receptor locations speech intelligibility levels are approaching the acceptable value of 55 dBA (e.g. R9 and R14 are predicted to be 53.9 dBA). Given the stated computer noise model accuracy is +/- 5 dB, these values could exceed the acceptable standards at certain receptor locations. It is advisable, particularly during Construction Phase 5, to ensure that people have the opportunity to express any concerns about noise and that additional mitigation measures be implemented in the event of noise complaints.	Consider implementing a formalized complaint-response-resolution process.
HC-05	EIS Section 17.1	Proposed monitoring for impacts to groundwater is described in this section. There is no discussion about monitoring local drinking water supplies for potential impacts.	If there is the potential for groundwater to be consumed in nearby cabins/residences, it would be useful to establish baseline concentrations of contaminants in drinking water sources prior to project construction and in the event of potential changes to the quality of drinking water as a result of project activities and/or in the event of public complaints about changes in taste or quality of drinking water supplies.
HC-06	EIS Section 17.6	The EIS states that surface water monitoring will be conducted in accordance with procedures described in the BC Field Sampling Manual 2013. If the surface water is used for potable drinking water, water quality should be compared to the *Guidelines for Canadian Drinking Water Quality* or the provincial equivalent.	In the event that surface water is expected to be consumed by local people, compare future contaminant concentrations from the surface water monitoring program to aquatic life guidelines and drinking water guidelines.
HC-07	EIS Section 9.1.3.3	Section 9.1.3.3 states "*the framework of risk assessment, described in more detail in Section 9.1.3.3…..*" references the same section as the statement.	Reference the correct section/subsection where this information can be found.
HC-08	EIS Section 9.1.5.1.2 page 9.1-19	In the section titled "*Comparison of Predicted Maximum Concentrations to **Chronic** Screening Criteria*", the following statement appears: "*if the predicted maximum concentrations were …… considered for further [evaluation] in the **acute** inhalation risk assessment*". Given that this section relates to how substances were screened in for chronic exposure, this statement appears to be incorrect.	Ensure the correct terminology is used when assessing risks.

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.

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).

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
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.

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.