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Via E-mail: twaterho@sfu.ca & lba21@sfu.ca

Simon Fraser University
8888 University Drive
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Attention: Terry Waterhouse & Laura Barnette

RE: TRANS MOUNTAIN EXPANSION PROJECT – REVIEW OF HUMAN HEALTH RISK ASSESSMENTS, EVIDENCE REPORT

Pottinger Gaherty Environmental Consultants Ltd. (PGL) is pleased to provide this evidence report of our opinion of the human health risk assessment work completed for the proposed Trans Mountain Expansion Project (TMEP) by Trans Mountain Pipeline ULC (Trans Mountain).

We reviewed the responses to Simon Fraser University's (SFU) Information Requests No. 2 related to emergency response and preparedness, portions of Volume 5 and 8 of the TMEP Application, human health risk assessments (Intrinsik, 2013a, 2013b, 2014a, 2014b, 2014c), and the facility risk assessment (Doug McCutcheon and Associates, Consulting, 2013) to identify possible gaps or deficiencies. The following is a fact-based evidence report for consideration by the National Energy Board (NEB) that focuses on the adequacy of the Human Health Risk Assessment (HHRA) in relation to the community at SFU.

This evidence report is presented with the following sections:

- Background – a brief background to the proposed Trans Mountain project with a focus on the components on Burnaby Mountain;
- HHRA Methodology – description of typical HHRA framework;
- HHRA in Context of Environmental Assessments – discusses the role of HHRAs in the context of environmental assessments;
- How Trans Mountain Assessed Human Health Impacts – summary of the work completed by Trans Mountain to assess human health impacts; and
- Gaps and Conclusions.

Based on our review, the HHRAs completed for the TMEP have not addressed:

- Risks from exposure to fire-related emissions (e.g., smoke and SO₂), from an accident and/or malfunction, to human receptors at SFU;
- The risks from exposure from the potential release of products that might be transported or stored other than the Cold Lake Winter Blend; and
- The risks to human receptors under high intensity exposure scenarios.

This means that the risk characterization and conclusions in the HHRA's completed for the TMEP may not capture the potential exposure scenarios needed to appropriately inform an NEB decision. The NEB risks approving a project that has not fully considered the health risks associated with a realistic emergency situation, thereby possibly lacking in appropriate response plans and exposure of the SFU community to unknown health risks.

1.0 BACKGROUND

Trans Mountain is proposing to expand its pipeline system, between Edmonton to Burnaby. The system transports crude oil and refined products between the two locations. The proposed expansion involves the following:

- Completion of the twinning of the pipeline in Alberta and BC with 987km of new buried pipeline;
- New and modified facilities, including pump stations and tanks; and
- Additional tanker loading facilities at the Westridge Marine Terminal, Burnaby, BC.

For Burnaby Mountain, this means an additional 14 storage tanks and new pipelines to the Burnaby Terminal, and new pipelines between the Burnaby and Westridge Marine Terminals. The additional storage tanks, which will increase storage capacity by 620,000m³ (230% of existing capacity), are proposed on the north and east sides of the site (near SFU).

The area between SFU and the Burnaby Terminal is predominately forest, with the only two access routes to the campus. SFU is concerned about the potential effects of an accident or malfunction, such as a fire or spill, leading to hazardous exposure, isolation, and/or evacuation of the SFU population.

2.0 HHRA METHODOLOGY

Risk assessment is a tool used to evaluate and estimate the severity of existing and potential future impacts from exposure to substances to an individual. It involves the collection, analysis and interpretation of environmental data and the comparison to toxicological values based on specific target organs. The outcome is a calculated level of risk which is deemed as acceptable or unacceptable, based on regulatory or societal values.

There are three prerequisites for a risk to exist:

- A substance must be present at hazardous levels;
- A receptor must be present; and
- An exposure pathway must exist between a receptor and a substance.

In general, HHRA methodology is based on methods developed for human exposure to environmental contaminants. The framework for HHRA is based on the following:

- Scoping/problem formulation – Scoping and problem formulation is the first and the most critical step when conducting an HHRA. This step establishes the spatial and temporal boundaries, and identifies substances that may have adverse effects to potential human receptors via credible exposure pathways (contaminants of concern);
- Exposure assessment – The exposure assessment is a quantitative process to estimate the dose or level of exposure experienced by human receptors. This often includes exposure, fate and transport modelling;
- Toxicity/Hazard assessment – This involves describing the acute and chronic effects of substances, mode of action, and selection of acceptable exposure limits for each substance. These limits are typically available from regulatory agencies (e.g., Health Canada, US

Environmental Protection Agency, World Health Organization), and when not available, they can be developed from published toxicological studies;

- Risk characterization – Risk characterization involves comparing the exposure estimated to the acceptable exposure limit to yield a risk estimate. The risk estimate is compared to risk levels typically set by regulatory agencies; and
- Uncertainty – Describes the uncertainties that could contribute to variability in the risk characterization, the potential changes, and the level of confidence in the current outcome.

This approach is described in detail in AB HPB (2011), BC MOE (2012), HC (2012), and US EPA (1989).

3.0 HHRA IN CONTEXT OF ENVIRONMENTAL ASSESSMENTS

Environmental assessment (EA) involves the assessment of potential (and cumulative) effects for all phases of a proposed project (i.e., construction, operation, decommissioning/abandonment), including accidents and malfunctions (i.e., unplanned events). Although accidents and malfunctions may have a low likelihood of occurrence, there is a potential for significant risks if there are severe consequences and because of their unplanned nature. To examine the human health component in the environmental assessment, HHRAs can be used to assess the potential risks to people from exposure during all project phases.

In the context of EA, HHRAs are a tool to help decision-makers make effective and prioritized decisions that have the greatest potential to protect human health. They are intended to be a transparent tool, to guide risk management decisions. They can be used to understand the potential risks to human health and to design mitigation measures to address unacceptably high risks, such as emergency response plans.

This information is required to be considered by the NEB as per the NEB Filing Requirements under Human Health (NEB, 2014):

“Where it is reasonable to assume there could be a potentially high or significant risk to human health from the project, provide a human health risk assessment.”

Additionally, the guidance in the NEB Filing Manual for this requirement includes (NEB, 2014):

“As the definition of human health includes consideration of mental and social well-being, applicants must also consider any adverse emotional or social stressors potentially resulting from the project, including:

- *concern for public safety from construction or operations-related accidents or malfunctions; or*
- *disruption of normal, daily living activities.”*

The decision makers for this project are tasked with answering a multitude of questions, including:

Do we understand the risks posed by accidents to the health of local communities, and is the project appropriately planned and prepared to prevent significant consequences?

4.0 HOW TRANS MOUNTAIN ASSESSED HUMAN HEALTH IMPACTS

For the proposed project, Trans Mountain assessed the potential for adverse environmental effects as part of their application to the NEB. Environmental effects, including those caused by accidents and malfunctions were considered. For human health, these effects were considered in several risk assessments.

4.1 HHRAs

HHRAs were completed for the pipeline and related facilities (Intrinsik, 2013a, 2014a), the Westridge Terminal facilities (Intrinsik, 2014c), and the marine transportation (Intrinsik, 2013b, 2014b). In general, these reports followed typical HHRA methods from Health Canada (HC, 2010) and risk characterization was completed using toxicological data. These reports helped to identify the need for planning and preparedness around emergency and spill response.

In brief, the HHRAs are summarized below:

- Pipeline and facilities – This HHRA considered the risks from a pipeline spill of Cold Lake Winter Blend (considered to be representative of the oil spilled) in an urban area. Two spill volumes were considered: 1,558m³ for a credible worst-case spill and 1,012m³ for a smaller spill. Spills were assumed to occur in a populated resulting in inhalation exposure to volatilized components of the released product. Receptors were considered to be the general public and emergency responders. Exposure was assumed to occur during the early stages of the spill, prior to implementation of emergency and spill response measures;
- Westridge Terminal – This HHRA considered the risks from the uncontrolled release of vapour and other emissions from the TMEP to residents (including aboriginal peoples, and urban dwellers) and area users (people who might use the area for recreation or other purposes). The main exposure pathway considered was inhalation; other pathways assessed included incidental ingestion, dermal contact, uptake through the food chain (i.e., consumption of impacted harvested foodstuffs). The local study area was assumed to be 5km, and included the entirety of SFU and Burnaby Mountain; and
- Marine Transportation – The marine HHRA evaluates the potential risks from exposure to chemical emissions due to Project-related marine traffic. Receptors considered were residents and/or area users within 5km of shipping lanes. Because the release mechanism was through emissions, the exposure pathways were the same as for the Westridge Terminal.

4.2 Risk Assessment – Burnaby Terminal Portion

Another risk assessment was completed for the Burnaby Terminal (Doug McCutcheon and Associates, Consulting, 2013). This risk assessment was based on the guidance provided by the Major Industrial Accidents Council of Canada (MIACC, 1994 and 1995). This type of risk assessment is conducted to demonstrate the level of risk to public safety associated with major projects and modifications to an existing facility.

The risk assessment evaluated the effects and consequences of a fire scenario from three accident scenarios. The three scenarios considered were:

- Tank fire caused by a major oil tank release;
- Toxic cloud release from a fire (includes smoke and SO₂); and
- Boil-over (specific type of fire scenario).

Two effects, radiant heat and smoke were considered most significant. The potential extent of impact was estimated for radiant heat, the smoke plume, and sulphur (SO₂). The immediate impact of radiant heat from fire at the facility is estimated to be up to 224m from the dike walls. The modelled concentrations for smoke and SO₂ were compared to Emergency Response Planning Guidelines and Immediately Dangerous to Life and Health levels. Smoke is estimated to drift down gradient up to 43km. SO₂ is modelled to extend as far as 5.2km. The SFU campus is less than 1km to the northeast from the Burnaby Terminal component of the TMEP.

5.0 GAPS AND CONSEQUENCES

When reviewed for completeness and consistency with typical guidance for conducting HHRAs, several gaps appear in the HHRAs provided for the TMEP. These gaps may limit the ability of the NEB to understand the magnitude of the risks, and suitability of the emergency management plans. The specific gaps identified are discussed below.

- Absence of fire scenario in the HHRA's – The HHRAs completed by Trans Mountain considered health effects to vapour from spills and leaks (along the pipeline or at the terminal), and emissions (from operational activities) related to the TMEP. Although there is a detailed discussion of a fire scenario for the risk assessment completed at the Burnaby Terminal (see Section 4.2 of this report), there is no linkage to the potential risks in any of the HHRAs.
 - There is a requirement, in the EA process, that proponents assess the potential impacts from accidents and malfunctions such as a fire. The risks from the potential effects of fire-related emissions have not been considered in the HHRA, following Health Canada methods. Emissions from fire events in general are well documented (Duran, 2014; Morandi et al., 2009; USDA, 1997). These emissions include soot and particulate matter, SO₂, carbon monoxide, sulphur and nitrogen oxides, volatile organic compounds such as benzene, and semi-volatile compounds such as polycyclic aromatic hydrocarbons (US EPA, 2002). Smoke and emissions from fires are known to adversely impact human health at SFU. This means that the probability (and magnitude) of an unacceptable risk was not determined for the various potential receptors at SFU.
 - The risk assessment for the Burnaby Terminal was completed using guidance from MIACC (1994, 1995). These types of risk assessments are used for risk reduction at industrial facilities and emergency response planning. The Burnaby Terminal risk assessment is not consistent with the framework, methods and rigour of typical HHRA's (AB HPB, 2011; BC MOE, 2012; HC, 2012; US EPA, 1989). It is not a surrogate for an HHRA and does not assess the risk (or significance of accidental effects) to the air quality and health of the SFU population. It is of note that this risk assessment did not evaluate the potential risk related to the spread of a fire to the surrounding forested area. This would lead to potentially greater exposure and risk to SFU from the smoke and emissions, and potential isolation of the campus by blockage of egress routes.
- Rationale for spill volume – The HHRAs provide a brief explanation for the use of the two different sized spills. There is no technical information or rationale provided to justify the use of either of these two volumes. There have been larger spills reported by Trans Mountain (1587m³ spilled in 1985) and others (Enbridge spilled 3,800m³ in 2001)¹.
- Limited contaminants of concern in HHRA - Cold Lake Winter Blend was assumed to be representative of the product released in an accident/malfunction. Kinder Morgan's website suggests crude oil, semi-refined and refined products will potentially be transported or stored along the TMEP. It is unknown if other products transported or stored are similar in chemistry, toxicology, and environmental behaviour if accidentally released. Emissions (i.e., vapour and fire-related) will depend on the grade and composition of the product and may vary significantly from Cold Lake Winter Blend. Because the emissions are potentially quite different depending on the product(s) released, the substances considered as potential health hazards (i.e., contaminants of concern) in the current risk assessments may be too limited (i.e., there may be other substances that should be considered contaminants of concern). As a result, the total risk may be underestimated and HHRA conclusions could change significantly depending on the products released.
- Incomplete receptor characterization – The general public, early responders, residents, and area users were considered to be receptors (in some combination) in the various HHRA's for

¹ The Trans Mountain spill is reported on their website (<http://www.transmountain.com/uploads/pages/1422040950-Dec-2014-Spill-Chart-for-posting-FINAL.pdf>) and the Enbridge spill in a CBC compilation of NEB incidents since 2000 (http://www.cbc.ca/news2/interactives/pipeline-incidents/data/pipeline_incidents_neb_2000_2012.csv).

the Project. Specific receptors in high intensity exposure scenarios (i.e., higher inhalation rates than general public), such as for construction workers, athletes, and people engaged in recreational activities (all frequently present at SFU), were not considered. Health Canada (2010) indicates it is advisable to include “a description of all potential exposure pathways and potential human receptors (including sensitive receptors)” and “exposure pathways and human receptors screened out be accompanied by a rationale as to why they would not be a potential concern.” In the absence of an assessment identifying all potential receptors and exposure pathways and why they may or may not be necessary, it is unknown if these or other receptors at SFU should be considered in the HHRA.

- As a result of the above gaps, the adequacy of proposed emergency planning to mitigate, or avoid, significant effects to human health at SFU is unknown (Etkin et al., 2015).

In conclusion, the TMEP Application does not sufficiently inform SFU of the potential risks to which they may be exposed or to comprehensively understand the human health risks to their populations. Without filling the information gaps identified herein, it is difficult to determine whether or not there are serious health risks that need specific attention in the emergency plans of SFU and TMEP.

6.0 STANDARD LIMITATIONS

PGL prepared this letter report for our client and its agents exclusively. PGL accepts no responsibility for any damages that may be suffered by third parties as a result of decisions or actions based on this letter report.

PGL relied on the listed documents for site information to prepare this opinion and as such, the limitations of our review are at least as great as those documents.

The findings and conclusions are site-specific and were developed in a manner consistent with that level of care and skill normally exercised by environmental professionals currently practising under similar conditions in the area. Changing assessment techniques, regulations, and site conditions means that environmental investigations and their conclusions can quickly become dated, so this report is for use now. The report should not be used after that without PGL review/approval.

The project has been conducted according to our instructions and work program. Additional conditions, and limitations on our liability are set forth in our work program/contract. No warranty, expressed or implied, is made.

7.0 REFERENCES

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8.0 CLOSING

We trust that this meets your needs. If you have any questions or require clarification, please contact Mike Shum or Matt Hammond at 604-895-7656 and 604-895-7644, respectively.

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