

Staff Report to Council

Planning and Development

FILE: 11-5280-02/21

REPORT DATE: October 19, 2021 **MEETING DATE:** November 23, 2021
TO: Mayor and Council
FROM: Anne Berry, Director of Planning and Development
SUBJECT: Air Quality Human Health Risk Assessment of Railway Diesel Emissions – Interim Report

CHIEF ADMINISTRATIVE OFFICER REVIEW/APPROVAL:



RECOMMENDATION(S):

THAT Council:

- A. Receive for information the report, “Air Quality Human Health Risk Assessment of Railway Diesel Emissions – Interim Report,” dated October 19, 2021; AND
- B. Direct staff to work with rights-holders, stakeholders, and partner agencies to advocate for enforceable and appropriate health-based air quality standards for railway emissions; OR
- C. Other.

PURPOSE

Representatives of the project team led by Envirochem Services Inc. will share their analysis to date of the current and projected diesel emissions from Canadian Pacific’s (CP) railway operations in Pitt Meadows.

Information Report Decision Report Direction Report

DISCUSSION

Background:

At the April 13, 2021 Regular Meeting of Council, staff presented background research and the project scope for an air quality human health risk assessment (HHRA) of locomotive diesel emissions from CP's current and projected operations in Pitt Meadows. The objectives of the study are to provide the City with:

- a review of local air quality data and comparison to relevant health standards and thresholds;
- estimates of current and projected locomotive diesel emission levels;
- a preliminary air quality HHRA of locomotive diesel emissions;
- baseline air quality data collection for current areas of specific concern; and
- recommendations for future monitoring or risk assessments.

With regard to the Road and Rail Improvement project and the proposed CP Logistics Park Vancouver (LPV) project, the study addresses analysis of the rail components based on each project's regulatory and operational context.

Road and Rail Project

Staff understand that CP is intending to build the new siding and lead track extension regardless of the execution of the Project Partnering Agreement. Under Section 98 (3) of the *Canada Transportation Act* CP does not need permission or permits from the City or other levels of government to construct these tracks within their current right-of-way. These rail additions, therefore, were included in the study as future conditions but do not contribute to changes in train volumes or emission production because, as discussed below, they will serve the same role for the Vancouver Intermodal Facility (VIF) as is currently served by the north mainline.

Harris Road vehicle traffic emissions were not included in the scope of the consultant's study; however, staff and the Vancouver Fraser Port Authority (Port) separately examined the impacts an underpass would have on greenhouse gas emissions at the rail crossing. The findings are reported below

Proposed Industrial CP Logistics Park Vancouver

CP must apply to the Canadian Transportation Agency and other federal agencies for relevant authorizations to construct and operate the LPV. The City will submit its opposition to this project to the regulatory bodies responsible for deciding on CP's various applications. To inform the City's submissions, the study analyzes the human health risks associated with future scenarios of locomotive operations with and without the LPV.

Relevant Policy, Bylaw or Legislation:

The Pitt Meadows Strategic Plan 2018-2022 includes policies advocating for issues of importance to our community and supporting healthy, inclusive and accessible living.

Analysis:

The study was structured to deliver findings in two phases. The attached interim report (Attachment A) addresses the first three study objectives listed above, and the findings include:

- A review of existing air quality data and comparison with relevant health and air quality thresholds and objectives.
- Emissions forecasting of fine particulate matter (PM_{2.5}) from locomotive diesel emissions and modelling of how it disperses across the community for the following three scenarios:
 1. CP's current train operations in Pitt Meadows (i.e., VIF and mainlines);
 2. Forecasted 2030 operations (i.e., increased mainline train activity and moving existing train building from the mainline to the new north lead extension); and,
 3. Forecasted 2030 operations as outlined above, plus the proposed Logistics Park and accompanying rail changes.
- Preliminary human health risk analysis (HHRA) of the modelled locomotive PM_{2.5} concentrations and dispersal.

Fine Particulate Matter (PM_{2.5})

The emissions estimates, modelling, and preliminary human health risk analysis explained in the attached interim report are focused on fine particulate matter (PM_{2.5}), one of several contaminants included in diesel engine emissions, primarily because of its relatively high toxicity. Health Canada has associated exposure to PM_{2.5} with increased risk of cancer, respiratory illness, cardiovascular conditions, and other health conditions. While the final report will also explore other diesel emissions components, a better understanding of PM_{2.5} was prioritized for the interim report.

Existing Air Quality Data

Four years of available Metro Vancouver air quality data from the regional monitoring station located on Old Dewdney Trunk Road was reviewed and compared to regional and federal air quality objectives. The findings indicate the air quality at that location has generally only exceeded Metro Vancouver's current air quality objectives when wildfire smoke has impacted the region. Aside from wildfire smoke impacts, PM_{2.5} levels were found to be proportionately higher when the wind is coming from the south, where contributing sources include the railway, Lougheed Highway traffic, and various land uses. The Metro Vancouver air quality data does not identify the relative levels of pollutants from train emissions or other specific sources; however, comparing this information with air quality data that will be collected from sites closer to the railway corridor will provide context to emissions modelling of train operations in Pitt Meadows.

Twenty-six (26) days of preliminary near-rail PM_{2.5} air quality data were also collected at an urban residential property adjacent to the rail corridor. Comparison to the Metro Vancouver monitoring station over the same period (figure 4 in Attachment A) shows near-rail PM_{2.5} concentrations were generally higher than at the regional monitoring station; however, it remained below the relevant Metro Vancouver air quality objective.

Applicability of Air Quality Objectives and Standards

The Metro Vancouver Ambient Air Quality Objectives and the Canadian Ambient Air Quality Standards discussed in the attached report are both non-statutory objectives, meaning they are not enforceable. These metrics, instead, are primarily used to inform air quality monitoring of large areas (e.g., Metro Vancouver) and support related permitting and policy development.

The federal *Locomotive Emissions Regulation* (LER) mandates emission standards and testing regimes for locomotives operated by federally regulated railways (including CP). These emission criteria are tied to United States (US) emission standards and apply increasingly restrictive standards based on locomotive manufacturing dates or the certification of locomotives by the US Environmental Protection Agency.

Locomotives brought into service following the coming-into-force date of the LER (June 9, 2017) must meet emission standards that correspond with their original manufacturing date the entire time they are in operation. Locomotives already in service before June 9, 2017, are exempt from the emission standards and testing requirements until they are withdrawn from service to be upgraded or remanufactured. Once a locomotive cannot properly function without being upgraded (for locomotives manufactured before 1973) or remanufactured, it must be updated to meet the emission standards for new locomotives. The LER, however, only applies to locomotive 'tail-pipe' emissions and does not apply to the cumulative impacts of locomotive use or related air quality and health impacts affecting communities.

Based on a review of relevant air quality and emissions standards and regulations, there are no enforceable standards directly governing impacts on local air quality by train emissions. Metro Vancouver does regulate regional production of harmful emissions; however, they do not have jurisdiction over federally regulated railways.

Emissions Forecasting and Modelling

The study forecasted locomotive emission production and modelled how the contaminants spread into the surrounding areas for the three scenarios described below to understand the potential volumes and impacts of train emissions. All three scenarios were developed as plausible worst-case scenarios based on information available from CP and reviews of similarly sized railyards and train corridors. Also, VIF activity levels were constant across all three scenarios since upper levels of activity for railyards of that size were identified based on reviews of similarly sized railyards. Worst-case scenarios are used in this and similar studies to avoid under-estimating the emission levels and potential human health risks. The resultant findings provide upper values of what might occur and will serve as a point of comparison for targeted air quality monitoring in this study.

Scenario 1: estimated train emissions from current locomotive operations on the two CP mainline tracks, at the Vancouver Intermodal Facility (VIF), and West Coast Express station.

The mainline train emission calculations included two VIF departing east-bound trains per day idling on the north mainline, east of Harris Road at the Bonson Road pedestrian bridge (i.e., close to Edith McDermott and Davie Jones Elementary schools as a worst-case), plus two westbound trains idling on the north mainline waiting for the Pitt River rail bridge to close.

Scenario 2: estimated emissions from forecasted 2030 locomotive operations on the two CP mainline tracks, at the VIF, and West Coast Express station.

As with scenario 1, the freight calculations included two east-bound trains per day idling at the Bonson Road pedestrian bridge, plus two trains per day waiting for the Pitt River rail bridge to close. Emission estimates included these idling trains located 14 feet north from the scenario 1 mainline locations, on the new siding along the VIF and on the lead track extension towards Golden Ears Way that CP is intending and able to construct under federal legislation.

Scenario 3: emission estimates added the forecasted train operations from the proposed CP Logistics Park: Vancouver (LPV) to the scenario 2 emission estimates.

Projected LPV train operations included two departing trains per day idling on the LPV siding track just north of Highland Park Elementary as a plausible worst-case scenario.

Emissions Modelling Analysis

Emissions modelling is commonly used in similar studies of emission production and dispersion from specific sources. It is instrumental here since the contaminants from trains are chemically similar to other mobile sources (e.g., emissions from diesel passenger, freight, and farm vehicles), plus several natural sources (e.g., dust and wildfire smoke). Modelling is also the only way to estimate the impact of future operations, such as emissions due to projected increases in rail traffic or railyard activities.

Based on the findings presented in the attached report, locomotive PM_{2.5} emissions are projected to be more concentrated in the vicinity of the VIF for all three scenarios. The lower train speed limit (40 km/h) for the rail bridge crossing results in locomotives slowing and spending relatively more time and, therefore, polluting more in this area. Switching activities at the VIF facility, and the LPV in scenario 3, also contribute to the higher overall emission production in this area. For the mainline east of the VIF, rail speed limits are higher, resulting in trains in the emissions modelling spending less time in these areas per length of track. The modelled emissions and contaminant concentrations, therefore, are comparatively lower through this area. The most significant increase in emission concentrations occurs between scenario 1 and scenario 2 due to an approximate doubling of freight train traffic. Comparison between scenarios 2 and 3 shows a lower, but still noticeable, increase in emissions due to the proposed LPV train activities.

The modelling indicates that the locomotive PM_{2.5} emission concentrations under all three scenarios remain well below Metro Vancouver's ambient air quality objectives (AAQO).

However, the report notes that the AAQO is not based solely on human health considerations, nor are there measurement objectives for 1-hour average or maximum PM_{2.5} concentrations.

The estimated 1-hour average and annual average ground level concentration values for all areas were used to separately identify the locations of maximum predicted ground-level concentrations for the following land-use types where people will be exposed:

- Residences
- Schools
- Child care facilities
- Senior care facilities
- Health care facilities
- Businesses
- Publicly accessible locations

The worst-case locations with the highest projected 1-hour and annual average concentrations for locomotive PM_{2.5} in each of these categories were then analyzed to determine the potential for increased health risks. For each land use category, the worst-case locations for short-term (i.e., 1-hour) and chronic (i.e., annual) exposure were sometimes different, depending on the modelling.

Preliminary Human Health Risk Analysis

The preliminary human health risk analysis (HHRA) summarized in the attached report calculated the health risks of chronic and short-term exposures to locomotive PM_{2.5} emissions at the location with the highest estimated concentration for each land use category identified above. The calculations took into account exposure concentrations, duration, frequency, and life expectancy (for cancer risk). Maximum predicted 1-hour average concentrations were used to calculate short-term exposure health risks, while annual average concentrations were used to calculate chronic exposure health risks using health thresholds published by Health Canada. The duration and frequency of PM_{2.5} exposure used to calculate the health risks for each land use location are summarized in Attachment A (see table 13). The method used to estimate health risk did not include background PM_{2.5} levels (i.e., from other sources) in the risk calculations, but does account for this absence. As with the emissions forecasting, the values used to calculate human health risk also apply a plausible worst-case scenario approach intended to identify the likely upper range of the potential health risks.

The health risk analysis for scenario 1 indicates:

- The worst-case residential, child care, and senior care locations have increased non-cancer health risks for short-term exposure, but chronic exposure is within an acceptable risk range for all land uses.
- The worst-case locations for all land uses, except health care, have increased lifetime cancer risks. Notably, the worst-case residential location's estimated risk is substantially higher (an estimated 23 additional cancer cases per 100,000 people exposed) than Health Canada's guideline of an acceptable incremental lifetime cancer risk of 1 per 100,000.

Scenario 2 analysis indicates:

- All worst-case locations for all land uses have increased short-term exposure to non-cancer health risks, while chronic exposures for all locations remain under the risk threshold.
- The worst-case locations in all land use categories have increased lifetime cancer risks with risk values between 1.7 and 37 estimated additional cases per 100,00 for health care and residential locations respectively.

Scenario 3 analysis indicates:

- The worst-case locations for all land uses have increased short-term exposure non-cancer health risks, while chronic exposures remain under the risk threshold.
- The lifetime cancer risk is similar to scenario 2 for the worst-case locations in all land uses, with higher values for the worst-case business and publicly accessible locations.

Health Canada indicates the health impacts of short-term exposure to PM_{2.5} can include: respiratory inflammation or irritation, and triggering of pre-existing respiratory illnesses such as asthma. Chronic exposure can lead to asthma development, chronic obstructive pulmonary disease, decreased lung function, various heart problems, and more frequent medical care and hospital admissions. In addition, the lifetime cancer risk estimates the number of cancer cases per 100,000 people exposed to PM_{2.5} at the estimated concentration level that would occur above the average cancer rate in the same population.

Using the findings from the emissions dispersion modelling and health risk analysis of PM_{2.5}, plus a similar analysis of other diesel emission contaminants, the consultant will identify the areas projected to be most heavily impacted by current and future locomotive operations. Temporary air quality monitoring stations will target key locations to collect baseline air quality data. The collected data will be compared to the Metro Vancouver air quality data and the modelling estimates to better understand the current health risks.

Air Quality Sampling

In addition to the already collected near-rail PM_{2.5} air quality data, locations for the targeted baseline air quality sampling will be established based on the modelling work. The data collection will run for three months. The baseline air quality sampling data is not expected to change the findings of the HHRA since risk analysis identifies the upper range of the potential health risks. Instead, all collected air quality data will be compared with the Metro Vancouver air quality data, the emissions modelling findings, health standards and thresholds, and future air quality data collection. The collected air quality data, its comparison with modelling findings, a more comprehensive HHRA, plus recommendations for future monitoring will be included in the final report.

Greenhouse Gas (GHG) Vehicle Emissions

Related to the study of locomotive emissions is analysis of railway operation impacts to on-road vehicle emissions at train crossings. While this analysis is outside the scope of the consultant's focus on human health impacts of locomotive emissions, staff reviewed GHG emission impacts at the Harris Road rail crossing. This analysis used available traffic information and vehicle fuel and emission values from Government of Canada sources. The findings were then compared to a separate analysis undertaken by the Vancouver Fraser Port Authority (Port). The overall trend of the findings was the same, even though the two studies used slightly different assumptions on vehicle and engine types, traffic growth, and different reference sources for fuel use and emission values.

The results from staff's and the Port's work show GHG emissions from idling vehicles stopped for trains at the Harris Road rail crossing were approximately 268 to 324 tonnes of CO₂ per year in 2019. Projecting out to 2030 indicates GHG emissions will rise proportionately with traffic and train volume increases if the at-grade crossing is retained.

Neither study explored the net difference in emissions between free-flowing underpass traffic and traffic idling while waiting for trains that then accelerates up to speed. A brief look at methods for calculating this suggests it would not change the overall picture that unrestricted flow will comparatively reduce GHG emissions. Free-flowing traffic will still generate GHG emissions and this will increase with traffic growth; however, the volumes of emissions would be much higher if that same traffic was subject to periodic closing of an at-grade crossing.

Next Steps

The consultant will:

- Use the modelling data to identify locations to install temporary air quality monitoring stations to collect near-rail air contaminant levels for three months.
- Expand the risk analysis to consider other diesel emission components (e.g., CO, SO_x, NO₂) with known health risks.
- Compare the collected data from the temporary air quality monitoring stations with the regional air quality station data, regional air quality objectives, and the modelled data to:
 - discuss how measured air quality compares between sites close to the rail and the regional air quality monitoring station;
 - provide a contextual comparison between the worst-case modelled estimates and real-world data;
 - provide context for the worst-case health risk estimates; and,
 - provide recommendations on future or long-term monitoring.

The final report will not provide comments on, or analysis of, the proposed Harris Road underpass as that is not in this project's scope and would not materially change the outcome of the study. Further, review of the City's and the Port's calculations indicate that unrestricted flow associated with a grade separation will reduce GHG emissions compared to an at-grade crossing condition. Instead, the final report will provide analysis of the impacts on local air quality and human health of CP's current and forecasted train emissions in Pitt Meadows based on the scenario

descriptions described in the report and the collected air quality data. Note that as shown in scenarios 2 and 3, the implementation of the siding and lead track do not change train volumes and emissions, they simply facilitate the moving of activities currently occurring on the north mainline track to the new tracks. Therefore, similar to this report, the final report will not show a change in train volumes, emissions, or health risks directly associated with the lead and siding track. These emissions will occur regardless of the construction of the Harris Road underpass.

As noted above, the regulatory regime for locomotive emissions (i.e., the Locomotive Emissions Regulation) is limited to restricting maximum emission outputs for units being brought into service, based on the age of their manufacture, and increasingly stringent standards for new and remanufactured locomotives. There are no enforceable standards directly governing impacts on local air quality by train emissions. Given the concerning health risk estimates identified in the attached report, however, staff will continue to review federal legislation and work with Metro Vancouver and Fraser Health staff to identify a process to pursue pollutant avoidance and mitigation measures. As well, subject to Council direction, the City will assume an advocacy role to advocate for enforceable and appropriate health-based air quality standards for railway emissions that is currently lacking.

COUNCIL STRATEGIC PLAN ALIGNMENT

- Principled Governance Balanced Economic Prosperity Corporate Excellence
 Community Spirit & Wellbeing Transportation & Infrastructure Initiatives
 Not Applicable

Advocacy. Actively advocate for issues of importance to our community.

Wellness. Provide and encourage a community conducive to healthy, inclusive and accessible living.

FINANCIAL IMPLICATIONS

- None Budget Previously Approved Referral to Business Planning
 Other

There are no financial implications with this report.

PUBLIC PARTICIPATION

- Inform Consult Involve Collaborate Empower

Comment(s): The interim and final reports will be publicly available.

KATZIE FIRST NATION CONSIDERATIONS

Referral Yes No

Refer to Katize First Nation for their information.

SIGN-OFFS

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ATTACHMENT(S):

- A. Interim Report – Pitt Meadows Preliminary Air Quality and Human Health Risk Assessment of Railway-source Diesel Emissions, Envirochem Services Inc., November 10, 2021.