Staff Report to Council

Planning and Development

FILE: 11-5280-02/22

REPORT DATE:	July 20, 2022	**MEETING DATE:**	July 26, 2022
TO:	Mayor and Council		
FROM:	Angie Lucas, Director of Planning and Development		
SUBJECT:	Air Quality Human Health Risk Assessment of Railway Diesel Emissions – Final Report		

CHIEF ADMINISTRATIVE OFFICER REVIEW/APPROVAL:

RECOMMENDATION(S):

THAT Council:

A. Receive for information the staff report titled "Air Quality Human Health Risk Assessment of Railway Diesel Emissions – Final Report," presented at the July 26, 2022 Public Council Meeting; OR

B. Other.

PURPOSE

Representatives of the project team led by Envirochem Services Inc. will share their analysis of the projected human health risks 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:

An interim air quality human health risk analysis (HHRA) was presented on November 23, 2021 and included:

- A review of existing Pitt Meadows air quality data (including conducting air quality monitoring at a residence adjacent to the mainline track) 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 rail 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 CP Logistics Park Vancouver (LPV) and accompanying rail changes.
- Preliminary human health risk analysis (HHRA) of the modelled locomotive $PM_{2.5}$ concentrations and dispersal.

The attached study expands on this prior work to include projections and risk analysis of additional railway diesel-source air contaminants (e.g., diesel particulate matter (DPM), nitrogen dioxide (NO_2), and acrolein – see descriptions in appendix B of the attached report) and inclusion of projections of air contaminants from heavy truck traffic associated with operation of the proposed LPV. This final report also provides a comprehensive risk analysis of the potential current and future health impacts of diesel emissions from major railway operations in Pitt Meadows.

With regard to the Road and Rail Improvement Project and the proposed LPV project, the study addressed analysis of the rail components based on each project's regulatory and operational context.

<u>Road and Rail Improvements Project</u>

Staff understand that CP has the ability to construct the new siding and lead track extension regardless of the status of the Pitt Meadows Road and Rail Improvements Project. Under Section 98(3) of the *Canada Transportation Act,* CP does not need permission or permits from the City, Canadian Transportation Agency, 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.

Analysis of railway operation impacts to on-road vehicle emissions at train crossings were not included in the consultant's scope of work, which focused on human health impacts of locomotive emissions. Further information on on-road vehicle emissions, including staff's review of vehicle greenhouse gas emissions at the Harris Road rail crossing, can be found in the November 23, 2021 staff report.

<u>Proposed Industrial CP Logistics Park Vancouver</u>

CP must apply to the Canadian Transportation Agency for approval to construct and operate the LPV, and other federal agencies for task specific permits and authorizations. The City will proactively

engage throughout the Canadian Transportation Agency's review of the LPV, including detailing the overwhelming drawbacks associated with the LPV, and continue to submit its opposition to this project to other federal regulatory bodies. To inform the City's submissions, the study analyzed the potential human health risks associated with current and future scenarios of railway 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:

Background Air Quality

As reported in the November 2021 interim report, 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, air pollution levels were found to be proportionately higher when the wind is coming from the south, where contributing sources include CP's operations, Lougheed Highway traffic, and various land uses. The Metro Vancouver air quality data does not, however, identify the relative levels of pollutants from train emissions or other specific sources.

Twenty-six (26) days of near-rail $PM_{2.5}$ air quality data was also collected at an urban residential property adjacent to the rail corridor. Comparison to the Metro Vancouver monitoring station over the same period (figure 3-4 in Attachment A) shows near-rail $PM_{2.5}$ concentrations were generally higher than at the regional monitoring station; however, they remained below the relevant Metro Vancouver Ambient Air Quality Objective.

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 objectives and standards are also not entirely health-based, meaning health impacts can still occur if air contaminant measurements remain under the threshold values defined in the objectives and standards. Instead, these metrics are primarily used to inform air quality monitoring of large areas (e.g., Metro Vancouver) and support related permitting and policy development.

Emissions Forecasting and Modelling

The study forecasted locomotive diesel emission production volumes (and heavy truck activity associated with the LPV) and modelled how the resulting air contaminants spread into the surrounding areas for the three scenarios described below. All three scenarios were developed as plausible worst-case scenarios based on information available from CP and reviews of similarly sized railyards and rail corridors. VIF activity levels were constant in the modelling of all three scenarios

because they were defined using the upper levels of activity for railyards of that size (i.e., operational capacity) identified through review of similarly sized railyards elsewhere in North America.

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, therefore, a buffer that allows for 'what-if' scenarios where individual study variables may be underestimated (e.g., some locomotives produce more emissions than others, or future train activity exceeds what was anticipated by the 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 able to construct under federal legislation.

Scenario 3: emission estimates from Scenario 2 plus the forecasted train and heavy truck operations from the proposed CP Logistics Park: Vancouver (LPV).

Projected LPV train operations included two departing trains per day idling on the LPV loop track just north of Highland Park Elementary as a plausible worst-case scenario. In addition to the heavy truck diesel emissions, the modelling included air contaminant contributions from brake wear, tire wear, and road-dust kicked up from truck activities related to the proposed LPV operations.

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 and heavy trucks 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 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 Pitt River 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 at the LPV in scenario 3 (along with heavy truck traffic), 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 and air contaminants due to the proposed LPV rail and heavy truck activities.

The modelling indicates that most of the air contaminant concentrations under all three scenarios remain below Metro Vancouver's ambient air quality objectives (AAQO), with the exception of nitrogen dioxide (NO_2). The modelled NO_2 levels exceed Metro Vancouver's AAQO in all three scenarios, and do not include existing background levels from other sources.

The estimated 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 short-term and annual average concentrations 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 acute (i.e., short-term 1-hour) and chronic (i.e., annual) exposure were sometimes different, according to the concentration levels and rate of dispersion modelled for each emission contaminant.

The maps shown in attachment A, tables 5-2, 5-3, and 5-4 spatially illustrate the predicted maximum short-term 1-hour and annual average ground-level concentrations of diesel particulate matter (DPM), $PM_{2.5}$ and NO_2 calculated for each point in the area over the modelled year. Because dispersion of the emission components (and, therefore, their concentration) would vary depending on prevailing wind speed and direction, the maps at the top of each table showing maximum short-term values do not show concentration values that necessarily would occur simultaneously. Instead, the locations included in each colour band are estimated to have a maximum concentration value that falls within the range represented by that colour at some point over the course of the year.

Preliminary Human Health Risk Analysis

The preliminary human health risk analysis (HHRA) summarized in the attached report calculated the health risks of chronic (long-term) and acute (short-term) exposures to locomotive and heavy truck diesel emission air contaminants 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 for most air contaminants (with maximum 24 hour rolling average for $PM_{2.5}$), while annual average concentrations were used to calculate chronic exposure health risks. The duration and frequency used to calculate the chronic health risks are summarized in Attachment A (see table 6-2).

Toxicity values used to calculate the health risks (i.e., concentration thresholds where health effects are more likely to occur) were based on health standards used by Canadian health agencies, or international health agencies where Canadian standards do not exist. In the case of $PM_{2.5}$, NO_2, and chronic impacts of SO_2, health-based toxicity thresholds were not available from Canadian or international health agencies; therefore, Canadian Ambient Air Quality Standards (AAQS) values were used. Notably, Health Canada indicates there is no safe threshold for exposure to $PM_{2.5}$ and NO_2; therefore, health effects are likely to occur where concentrations are below the Canadian AAQS.

The method used to estimate health risk did not include background concentration levels (i.e., quantity of existing contaminants currently present in the atmosphere) in the risk calculations, but does account for this absence. This allows for direct comparison between the three scenarios to estimate the change in emission production and health risks associated with current and projected increases in railway operations.

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. For example, the assumed exposure frequency and duration values used to estimate the chronic health risks for residents include 24 hours per day of exposure, 7 days a week for 80 years. There are many residents who work at home, home-school children, provide home-based childcare, or are retired, so lower frequency and duration values would underestimate the upper range of potential health risks.

The heath risk analysis for scenario 1 indicates:

- All worst-case locations (i.e., those with the highest modelled contaminant concentrations) for each land use type identified above have increased non-cancer health risks for acute (short-term) exposure to DPM and NO_2. Several worst-case locations also have increased health risk for acute exposure to $PM_{2.5}$ (childcare, health care, and residence) and nickel (residence). Non-cancer health risks for chronic (long-term) exposure is within the acceptable risk range for all worst-case locations, except for NO_2 (residence and senior care locations) and acrolein (residence).
- The worst-case locations for all land use types have increased lifetime cancer risks from diesel particulate material (DPM). 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 each land use type have increased non-cancer health risks for acute exposure for $PM_{2.5}$, DPM, and NO_2. Several also have increased health risks for acute exposure to nickel (childcare, health care, and residence) and acrolein (childcare and residence). Non-cancer health risks for chronic exposure is within the acceptable risk range for all worst-case location, except for NO_2 (residence, childcare, and senior care locations) and acrolein (residence, childcare, and senior care locations).

- The worst-case locations for all land use types have lifetime cancer risks from diesel particulate material (DPM) that are higher than scenario 1. Additionally, the lifetime cancer risk values from diesel particulate material (DPM) for all modelled locations (not just the worst-case locations) were between 55% and 89% higher than scenario 1.

Scenario 3 analysis indicates:

- All worst-case locations for each land use type have increased non-cancer health risks for acute exposure for $PM_{2.5}$, DPM, and NO_2. Several also have increased health risks for acute exposure to nickel (business, childcare, health care, and residence) and acrolein (childcare and residence). Non-cancer health risks for chronic exposure is within the acceptable risk range for all worst-case locations, except for NO_2 (residence, childcare, and senior care locations) and acrolein (residence, childcare, and senior care locations).
- The worst-case locations for all land use types have lifetime cancer risks from diesel particulate material (DPM) that are the same as or are higher than scenario 2. For all modelled locations, the lifetime cancer risk was up to 95% higher than the same location calculated for scenario 2.

Similar to the emissions mapping, the maps shown in table 6-10 spatially illustrates the predicted maximum acute non-cancer health risk values of acrolein, DPM, formaldehyde, nickel, $PM_{2.5}$, and NO_2 calculated for each point in the area over the modelled year and for each scenario. Because dispersion of the emission components (and, therefore, their concentration) would vary depending on prevailing wind speed and direction, the maps do not show acute health risk values that necessarily would occur simultaneously. Instead, the locations included in each colour band are estimated to have an acute health risk value that falls within the range represented by that colour at some point over the course of the year. The areas identified in light green and red are areas that are identified as exceeding the acute non-cancer health risk thresholds used in this study.

Table 6-11 spatially illustrates the predicted chronic non-cancer health risks for NO_2 and acrolein, at all modelled locations for all three scenarios, based on annual average concentrations calculated for each modelled location. Areas shown in light green and red have projected chronic non-cancer health risks that exceed the health thresholds used in this study.

Table 6-12 spatially illustrates the predicted lifetime cancer risks for exposure to DPM, at all modelled location for all three scenarios, based on calculated annual average concentrations. All areas within all coloured bands exceed Health Canada's threshold of acceptable risk of 1 additional cancer case per 100,000 people exposed.

As noted previously, the results represent the upper values of estimated potential human health risk due to current and future railway locomotive and heavy truck (for scenario 3) diesel emissions. The HHRA results do not necessarily predict that a community member living or working in a particular part of the city may or may not experience health impacts directly due to rail activities since there are many variables involved (e.g., genetic susceptibility, age, exposure duration and frequency, weather patterns, train activity, background sources, etc.). However, the findings are based on industry standard methods, guidelines, and best practices for estimating human health risks for the community as a whole. As such, the results suggest there are substantial concerns with the impacts to the community attributed to current and projected rail-source diesel emissions in Pitt Meadows.

Air Quality Sampling

In addition to the already collected near-rail $PM_{2.5}$ air quality data, the project proposed to identify locations for targeted baseline air quality sampling based on the modelling work. The original intent was for air quality data collection to run for three months and for this to serve as a comparison for future collected data.

Through discussion with the consultant, and review of recent air quality monitoring projects underway by health authorities and proposed by Metro Vancouver, a revised approach is being reviewed that will enable longer-term (e.g., two to three years) of continuous data gathering. This longer-term sampling will provide a more robust data set for future comparison.

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 and is based on a modelling approach. Instead, the collected air quality data will be compared with the Metro Vancouver air quality data and air quality thresholds to assist with advocacy for improved emissions policies and regulations.

Advocacy

As noted in the November 23, 2021 staff report, 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. In response to the presented information, Council passed the following motion at the November meeting:

"That Council:

> 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."

Given the concerning health risk estimates identified in the attached report and Council's previous direction, staff will continue to engage others (including Metro Vancouver, Fraser Health, Provincial and Federal agencies) to identify collaboration opportunities to address air quality concerns. Following these discussions, staff will report back to Council in November 2022 with information on collaboration opportunities and a recommended advocacy strategy to pursue pollutant avoidance and mitigation measures.

COUNCIL STRATEGIC PLAN ALIGNMENT

☒ Principled Governance ☐ Balanced Economic Prosperity ☐ Corporate Excellence

☒ Community Spirit & Wellbeing ☐ Transportation & Infrastructure Initiatives

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): This report will be publicly available on the City's website.

KATZIE FIRST NATION CONSIDERATIONS

Referral ☒ Yes ☐ No

Refer to Katzie First Nation for their information.

SIGN-OFFS

Written by:	**Reviewed by:**
Colin O'Byrne, Manager of Planning	Angie Lucas, Director of Planning and Development
	Justin Hart, Manager of Major Projects

ATTACHMENT(S):

A. Pitt Meadows Preliminary Air Quality and Human Health Risk Assessment of Railway-source Diesel Emissions, Envirochem Services Inc., July 2022.