TECHNICAL MEMORANDUM

TO:

Impact Assessment Agency of Canada
Ontario Ministry of Environment, Conservation and Parks

FROM	EMAIL	REF
AtkinsRéalis	Craig.Wallace@atkinsrealis.com	661910

DATE

06 April 2026

SUBJECT

Webequie Supply Road Project – Addendum to the Final Environmental Assessment Report / Impact Statement (EAR/IS)
Responses to Comments on Human Health Risk Assessment

The attached report is Addendum #4 to the Final Environmental Assessment Report / Impact Statement (EAR/IS) for the Webequie Supply Road Project (the Project, WSR). The purpose of this addendum is to provide the revised Human Health Risk Assessment (HHRA) Report (Appendix P of the Draft EAR/IS) with updated results from the air dispersion re-modelling using data provided by MECP Environmental Monitoring and Reporting Branch and to address comments on the Draft EAR/IS from the Technical Assessment and Standards Development Branch (TASDB) of the Ministry of the Environment, Conservation and Parks (MECP). Details of these comments are presented in the attached Comment Response Table and in Appendix P2.M of the Record of Engagement and Consultation.

Attachments: Revised HHRA Report
Comment Response Table

AtkinsRéalis

Webequie Supply Road

Webequie First Nation

April 6, 2026

AtkinsRéalis Ref: 661910

ADDENDUM 4: HUMAN HEALTH RISK ASSESSMENT

Signature Page

Prepared By:

Mandeep Purewal, MET, RPBio, P.Ag., CSAP
Senior Risk Assessor and Toxicologist / Technical Lead for Risk Assessment

Environment Practice
Engineering Services Canada

Reviewed By:

Tara Siemens-Kennedy, MET, PChem, CSAP
Senior Risk Assessment and Toxicologist / Technical Director for Risk Assessment

Environment Practice
Engineering Services Canada

Notice to Reader

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Any soil and rock descriptions in this report and associated logs have been made with the intent of providing general information on the subsurface conditions of the site. This information should not be used as geotechnical data for any purpose unless specifically addressed in the text of this report. Groundwater conditions described in this report refer only to those observed at the location and time of observation noted in the report.

This report must be read as a whole, as sections taken out of context may be misleading. If discrepancies occur between the preliminary (draft) and final versions of this report, it is the final version that takes precedence. Nothing in this report is intended to constitute or provide a legal opinion.

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Contents

Contents (Cont'd)

In Text Figures

In-Text Tables

Contents (Cont'd)

In-Text Tables (Cont'd)

Appendices

Executive Summary

Webequie First Nation is completing an Environmental Assessment (EA) under Ontario's Environmental Assessment Act (EAA) and Impact Assessment (IA) under Canada's Impact Assessment Act (IAA) for the proposed Webequie Supply Road ("the Project", WSR). The proposed Project is a new all-season road approximately 107 kilometres (km) in length, connecting Webequie First Nation and its airport to existing mineral exploration activities and proposed future mining development in the McFaulds Lake area. As part of both the provincial and federal assessments, the proponent (Webequie First Nation) must outline and discuss how the Project will impact human health during each phase of the Project.

This human health risk assessment (HHRA) was prepared pursuant to the Human Health Study Plan prepared by AtkinsRéalis Canada Inc.[1] (AtkinsRéalis) in 2021 and will support the Health Impact Assessment (HIA), which will be summarized in the Environmental Assessment Report/Impact Statement (EAR/IS) for the Project. In 2024 a HHRA (Appendix P of the EAR/IS) was prepared to support the EAR/IS. The HHRA, in part, was based on the Air Quality Impact Assessment (AQIA) completed for the Project. Provincial regulators reviewed the AQIA and provided comments, with the AQIA updated based on their comments. This HHRA addendum has been prepared based on the revised AQIA (AtkinsRéalis, 2024a) and incorporates comments on the 2024 HHRA from the Human Toxicology and Air Standards Section, Technical Assessment and Standards Development Branch, of the Ministry of the Environment, Conservation and Parks (MECP) provided in November 2025.

Human health was identified as a valued component (VC) to be included in the EAR/IS if significant Project-related changes in contaminant concentrations in any media type, including water, soil, sediment, or air, are predicted to result from Project construction and operation, the HHRA evaluates potential exposure of humans to these contaminants. Noise is also a potential Project-related non-chemical stressors that can affect human health and is also evaluated in the HHRA.

Based on a review of the findings presented for indicator VCs including air quality; geology, terrain and soils; surface water resources; groundwater resources; and vegetation, fish and wildlife, no significant Project related increases in contaminant concentrations were predicted for any VC, except for air. Additionally, a review of the noise results indicated that net adverse effects of noise during the construction and operation phases of the Project are predicted to be not significant.

The results of the revised AQIA were reviewed to identify contaminants of potential concern (COPCs) for quantitative evaluation of human receptor exposure and risk in the HHRA. Contaminants with the potential to increase in concentration during the Project's construction or operation phases to concentrations exceeding the applicable air quality guidelines areas of interest (i.e., existing or future residences, nearby institutional buildings or culturally sensitive areas) were retained as COPCs.

As the AQIA did not assess concentrations of metals, and as they are naturally occurring in soils and gravels that will be disturbed during the Project construction and operations, baseline soil data from the region (from Eagle's Nest Multi-Metal Mine Environmental Assessment ["Eagle's Nest EA"]), along with total suspended particulate (TSP) concentrations predicted by the AQIA were used to predict concentrations of metals in TSP. The predicted metals concentrations were compared to the Ontario Ambient Air Quality Guidelines (AAQC) for metals. This comparison indicated that there is the potential for hexavalent chromium, iron and nickel to exceed the AAQC in TSP generated by the Project at areas of interest. On this basis these metals were also retained as COPCs for evaluation in the HHRA. It is

[1] Formerly known as SNC-Lavalin Inc.

acknowledged that metals (and PAH) data was not available for gravel that will be used in future phases of the Project, and further testing is recommended to address potential contributions from this source.

Members of the Webequie First Nation community were identified as the critical receptor group for assessment in the HHRA, with exposures and risks estimated for residents considered protective of summer residents, community members hunting, fishing, trapping and foraging in the local study area (LSA), as well as other people who may live in or visit the LSA. As COPCs were only identified in air, the primary exposure pathway by which Webequie First Nation community members and other populations in the LSA have the potential to be exposed to Project related COPCs is via inhalation. The HHRA assessed exposures and associated risks to Webequie First Nation community members exposed to the air COPCs identified during the construction and operation phases of the Project. The results of the HHRA indicated the potential for health risks exceeding regulatory negligible risk levels for the following:

- **Construction phase:** PM_{10} (24-hour), $PM_{2.5}$ (24-hour), TSP (24-hour), SO_2 (1-hour), NO_2 (1-hour), DPM (2-hour), acrolein (24-hour), benzene (24-hour) and benzo(a)pyrene (24-hour) based on predicted/estimated exceedances of the applicable air quality benchmarks, in addition to chromium (VI), iron and nickel which were modelled from TSP concentrations.
- **Operation phase:** TSP (24-hour), PM_{10} (24-hour) and $PM_{2.5}$ (24-hour) based on predicted/estimated exceedances of the applicable air quality benchmarks, in addition to chromium (VI) and iron which was modelled from TSP concentrations.

As the results of the air quality modelling presented in the AQIA are conservative and have likely overpredicted Project related emissions, the HHRA has also likely overpredicted associated exposures and health risks. An Air Quality and Dust Control Management Plan that will be developed and implemented for the Project will integrate a monitoring procedure for dustfall and measures to control or limit particulate emissions. Additional mitigation measures beyond those accounted for in the AQIA will be implemented, as warranted.

Overall, the HHRA has likely overpredicted exposures and associated health risks associated with the Project. When the conservatism and uncertainty in the estimates are considered, in addition to the proposed air monitoring and mitigation measures recommended, it is unlikely that unacceptable health risks will result from the Project. The results of the HHRA are contingent upon the application of mitigation measures described in each of the linked VC assessments. Additionally, the following recommendations are provided based on the results of the HHRA.

1. **Soil and Gravel Sampling:**
   - To further characterize metals in soil and associated particulates during the Project, it is recommended that soil samples be collected from the LSA and submitted for analysis of total metals, as well as for speciation of chromium. This data should be used to confirm that the soil metals concentrations obtained from the Eagle's Nest EA are representative of the WSR ROW, and to determine concentrations of hexavalent chromium, if any, in soils in the region. This data should be used to update the results of the HHRA.
   - To characterize metals and PAHs in gravel and associated particulates from gravel during the Project, it is recommended that gravel samples be collected and submitted for analysis of metals and PAHs. This data should be used to confirm potential contributions of gravel particulate to human exposures.
2. **Air Quality Monitoring:**
   - Install real-time air quality monitoring stations at key locations, specifically near points of impingement of interest where exceedances of the air quality guidelines were predicted by the AQIA.

- **Construction phase:** Focus on monitoring PM_{10} (24-hour), $PM_{2.5}$ (24-hour), TSP (24-hour), SO_2 (1-hour), NO_2 (1-hour), DPM (2-hour), acrolein (24-hour), benzene (24-hour) and benzo(a) pyrene (24-hour) in addition to chromium (VI), iron and nickel to ensure concentrations remain within acceptable limits.
- **Operation phase:** Focus on monitoring TSP (24-hour), PM_{10}(24-hour) and $PM_{2.5}$ (24-hour) in addition to chromium (VI) to ensure concentrations remain within acceptable limits.

3. **Dust Control Measures**:
   - Implement dust suppression measures if exceedances of the air quality guidelines are identified.
4. **Regular Reporting and Review**:
   - Provide regular updates on air quality data to stakeholders and rightsholders, including the Webequie First Nation, and other First Nation communities.
   - Review monitoring data periodically to identify trends and implement corrective actions if necessary.

By following these recommendations, the Project can effectively manage and mitigate the exposure and risks associated with emissions during both the construction and operation phases. Further, the soil and gravel data will allow for a more accurate prediction of metals (and PAHs in gravel) concentrations in particulate generated from these materials, as well as associated exposures and risks.

1. Introduction

Webequie First Nation is completing an Environmental Assessment (EA) under Ontario's *Environmental Assessment Act* (EA Act) and Impact Assessment (IA) under Canada's *Impact Assessment Act* (IA Act) for the proposed Webequie Supply Road ("the Project", WSR). The proposed Project is a new, all-season road approximately 107 kilometres (km) in length, connecting Webequie First Nation and its airport to existing mineral exploration activities and proposed future mining development in the McFaulds Lake area. As part of both the provincial and federal assessments, the proponent (Webequie First Nation) must outline and discuss how the Project will impact human health during each phase of the Project.

The proposed WSR is a new two-lane all-season road within a cleared right-of-way (ROW) approximately 35 metres (m) in width and approximately 107 km in length. The preliminary recommended preferred route for the road consists of a northwest-southeast segment running 51 km from the Webequie First Nation Reserve to a 56 km segment running east-west before terminating near McFaulds Lake, within the Ring of Fire region. A total of 17 km of the WSR is within the Webequie First Nation Reserve lands, with the remainder of the road located on un-surveyed Ontario Crown lands.

This report was prepared pursuant to the Human Health Study Plan prepared by AtkinsRéalis Canada Inc.[2] (AtkinsRéalis) in 2021 and submitted to the Impact Assessment Agency of Canada (IAAC) and the Ontario Ministry of the Environment, Conservation and Parks (MECP) for review and validation that it meets the federal requirements in the Tailored Impact Statement Guidelines (TISG) and approved Terms of Reference (ToR) for the provincial EA. The results of this human health risk assessment (HHRA) will support the Health Impact Assessment (HIA), which will be summarized in the Environmental Assessment Report/Impact Statement (EAR/IS) for the Project and are intended to meet the requirements of both the federal TISG and the provincially approved ToR.

Human health was identified as a valued component (VC) to be included in the EAR/IS: if significant Project-related changes in chemical concentrations in any media type, including water, soil, sediment, or air, are predicted to result from Project construction or operation, the HHRA evaluates potential exposure of humans to these chemicals. Noise is also a potential Project-related non-chemical stressor that can affect human health, which was also included in the scope of the HHRA.

The objective of the HHRA is to evaluate potential health risks to local communities, including residents, Indigenous communities and sensitive sub-populations, from predicted exposure to Project-related contaminants. The HHRA identifies potential Project-related contaminants, the people that have the potential to be exposed to them, as well as the pathways by which they may be exposed (e.g., ingestion, dermal contact, inhalation). This HHRA is technical in nature, as it has been completed in accordance with specific and prescriptive risk assessment methodology and terminology as outlined in relevant federal (i.e., Health Canada) and provincial (i.e., MECP) guidance documents. Results of this HHRA have been summarized and interpreted in Section 17 (Human Health) of the EAR/IS.

As background, a HHRA dated October 2024 (Appendix P of the EAR/IS) was prepared to support the EAR/IS. Following review of the Air Quality Impact Assessment (AQIA), provincial regulators issued comments which justified a revision of the AQIA. This HHRA has been prepared based on the revised AQIA and incorporates comments on the October 2024 HHRA from the Human Toxicology and Air Standards Section, Technical Assessment and Standards Development Branch, of the Ministry of the Environment, Conservation and Parks (MECP) provided in November 2025.

[2] Formerly known as SNC-Lavalin Inc.

2. HHRA Approach

2.1 Regulatory Framework and Guidance

Based on the scale and complexity of the Project, and the potential for significant environmental effects, a Comprehensive Environmental Assessment must be completed for approval under the Environmental Assessment (EA) Act. On May 3, 2018, the Ontario Minister of Environment, Conservation and Parks (then Minister of Environment and Climate Change) signed a voluntary agreement with Webequie First Nation to make the WSR Project subject to Ontario's Environmental Assessment Act. The purpose of this HHRA is to fulfil the assessment scope outlined in the provincial ToR and in the TISG published by the Impact Assessment Agency of Canada (IAAC) (February 2020).

The HHRA is completed as a deterministic detailed quantitative risk assessment (DQRA) principally following federal guidance available from Health Canada. Applicable federal and provincial risk assessment guidance used to complete the HHRA includes the following:

- Health Canada / Federal Risk Assessment Guidance:
  - Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 4.0 (HC, 2024; for guidance not specifically available in HC, 2010a).
  - Part V: Guidance on Human Health Detailed Quantitative Risk Assessment for Chemicals ($HHRA_{Chem}$) (HC, 2010a).
  - Toxicological Reference Values (TRVs), Version 3.0 (HC, 2021).
  - Supplemental Guidance on Human Health Risk Assessment for Country Foods (HHRA Foods) (HC, 2010b).
  - Supplemental Guidance on Human Health Risk Assessment of Air Quality, Version 2.0 (HC, 2017a).
  - Guidance for Evaluating Human Health Impacts in Environmental Assessments: Human Health Risk Assessment. 2019.
  - Guidance for Evaluating Human Health Impacts in Environmental Assessments: Air Quality. Health Canada. 2023a.
  - Guidance for Evaluating Human Health Impacts in Environmental Assessments: Country Foods. Health Canada. 2023b.
  - Evaluating Human Health Impacts in Environmental Assessments: Noise. Health Canada. 2017.
  - Guidance for Evaluating Human Health Impacts in Environmental Assessments: Drinking and Recreational Water Quality. Health Canada. 2023c.
- Ontario / Provincial Risk Assessment Guidance:
  - Rationale for the Development of Generic Soil and Groundwater Standards for Use at Contaminated Sites in Ontario. 2011.
  - Ontario's Ambient Air Quality Criteria. 2019.
  - Standards and Guidelines to Support Ontario Regulation 419/05 – Air Pollution – Local Air Quality. 2019.
  - Ontario – Air Contaminants Benchmarks List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants.

2.2 HHRA Components and Approach

The HHRA was largely completed according to the above Health Canada guidance and is consistent with methods commonly used by regulatory agencies across Canada and the United States (US), including the Ontario MECP and the US Environmental Protection Agency (US EPA). The HHRA consists of five main components, including the following:

- *Problem Formulation:* The Problem Formulation presents the location and description of the Project, the identification of chemicals of potential concern (COPCs) for the Project, the populations (also referred to as receptors of concern) that have the potential to be exposed to COPCs, and the relevant exposure pathways for the receptors of concern.
- *Exposure Assessment:* The Exposure Assessment involves the estimation of the dose of each COPC that the receptors of concern have the potential to be exposed to.
- *Toxicity Assessment:* The Toxicity Assessment is the compilation of toxicity data on the potential adverse health effects for each of the COPCs, as well as TRVs for each of the COPCs. For non-carcinogenic chemicals, TRVs represent an exposure dose or air concentration below which no adverse effects are expected to occur. For carcinogenic chemicals, the TRV is presented as an upper bound of the increased cancer risk from a lifetime exposure to the chemical.
- *Risk Characterization:* In the Risk Characterization, the doses estimated in the Exposure Assessment are compared to/combined with the TRVs identified in the Toxicity Assessment to estimate potential health risks associated with receptor exposure to the COPCs under the assumptions of the HHRA.
- *Uncertainty Analysis:* The Uncertainty Analysis is conducted to evaluate the sources of uncertainty inherent in the HHRA, as well as how the uncertainty affects the results of the HHRA.

This assessment has been conducted using a series of worst-case assumptions to ensure that human health risks associated with the Project are not under-predicted. This type of approach limits the likelihood of under-predicting health risks and is likely to result in a considerable over-prediction of risks. This is further discussed in the Uncertainty Analysis.

3. Problem Formulation

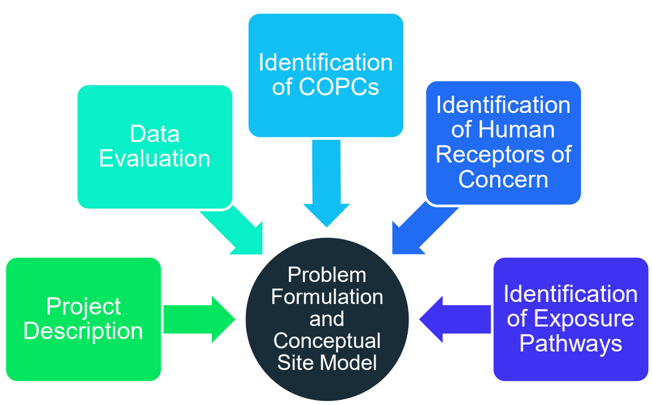
The first stage of the HHRA is the Problem Formulation and involves "screening" of the main aspects of human health risk comprised of the contaminant concentrations in various exposure media that human receptors may be exposed to, the identification of the human receptors who may be exposed to contaminants identified in the study area, and the potentially operable exposure pathways by which humans have the potential to be exposed to the contaminants.

The Problem Formulation herein also includes a description of the Project and human use in the relevant study areas. Furthermore, a review of anticipated Project-related effects to linked VCs is also included, to allow for qualitative evaluation of relevant environmental media and to determine the scope of the quantitative HHRA. Where Project-related effects to contaminant concentrations in environmental media were not identified, or were concluded to not be significant, the potential exposures and effects to human health were also concluded to be not significant in the associated VC assessment and further evaluation of human exposure to these media and potential risk was not conducted. If potential Project-related effects to contaminant concentrations were identified, predicted concentrations were carried forward for further evaluation in the HHRA.

The main elements of Problem Formulation include the following:

1. **Project Description:** Details on the Project and surrounding lands are described to provide context for the HHRA and to provide a basis for the identification of receptors of concern and potential operable exposure pathways. The study area will also be defined, which will include both the Local Study Area (LSA) and Regional Study Area (RSA), as defined in **Section 3.5**.
2. **COPC Screening:** The data representative of the Project emissions and potential effects is reviewed, and the results of the data evaluation are used to screen data and identify COPCs.
3. **Human Receptors of Concern:** Using the information from the Project description and for the surrounding area, the locations with highest Project emissions and regulatory guidance are used to identify potential human receptors of concern.
4. **Identification of Exposure Pathways:** Using the findings of the previous sections (including the human receptor identification and COPC screening), potentially operable exposure pathways are identified.
5. **Conceptual Site Model:** The conceptual model provides a summary of the receptors of concern and the potentially operable exposure pathways carried forward for quantitative evaluation in the HHRA.

Figure 3-1: Main Elements of the Problem Formulation



Once relevant media have been identified, COPC screening conducted and relevant receptors defined, the outcome of the Problem Formulation is a conceptual site model (CSM), which is the foundation of the HHRA. The CSM outlines the receptor/COPC/exposure pathway combinations of highest potential risk and focuses the HHRA on those combinations. For a potentially unacceptable risk to be present, all three of: a) route of exposure to a COPC, b) a COPC in a high enough concentration to result in a health risk, and c) a receptor must be present. If any one of these three components is not present, then an unacceptable risk will also not be present.

3.1 Project Description

The proposed WSR is located in north-western Ontario on un-surveyed Ontario Crown lands and Webequie First Nation Reserve lands approximately 525 km northeast of the City of Thunder Bay, as shown in **Figure 3-2**. The WSR is intended to facilitate the movement of materials, supplies and people from Webequie First Nation Reserve to the mineral exploration areas near McFaulds Lake area and will connect the community to the provincial road network to the south should the other two road projects (Northern Road Link – NRL; and Marten Falls Community Access Road – MFCAR) be constructed. It is expected to accommodate an annual average daily traffic of less than 500 vehicles consisting of light to medium personal vehicles, commercial vehicles and heavier trucks hauling industrial supplies and equipment.

The proposed WSR will accommodate a two-lane, all-season road with waterbody crossings. The cleared right-of-way (ROW) will be approximately 35 m in width and approximately 107 km in length, crossing through an area of extensive wetlands, organic soils and several watercourses, and will include bridge construction over major waterbodies such as Winisk Lake, Winiskisis Channel, and the Muketei River. Minor waterbody crossings will be accomplished using a variety of culvert types and sizes.

The Project will also include aggregate pits/quarries located as close as possible to the WSR ROW, and associated access roads to connect these gravel sources to the ROW. Some of these will be retained to supply aggregates for road maintenance during the operations phase; those deemed unnecessary for this purpose with be decommissioned and restored. Currently, the proposed ROW for the road is undeveloped, except for approximately 5 km of existing roadway from Webequie First Nation to the south. Currently, there are no residents are located along the proposed ROW. Other project components will include rest and maintenance areas along the WSR, and a permanent Maintenance and Storage Facility (MSF) for operation and maintenance of the WSR once operational.

The terrain and topography along the preliminary recommended preferred route for the WSR are relatively flat with two distinct sections, namely the north-south trending section and the east-west trending section (refer to **Figure 3-3**). In general, the north-south section of the road passes typically through an area of high relief and better ground conditions, while the east-west section passes typically through an area of low relief and poor ground conditions (wetland, peat and bog). Typical elevations in the north-south section are >200 m, while in the east-west section they are <200 m.

The north-south trending segment of the road (51 km) resting mostly over mineral soil will be cleared of all vegetation within the 35 m wide ROW to accommodate the two-lane, all-season road. Shoulders, ditches, and berms of stripped organic materials on the outside will also be shaped along this segment.

The east-west trending segment of the WSR is located within the Hudson Bay Lowlands Ecozone that includes the James Bay ecoregion and is composed mostly of peatland (muskeg) having a depth of 2 m - 4 m of waterlogged organic soil, which represents poor to very poor conditions for building a road. A floating road design is therefore considered by adding an underlying layer of aggregates (along with geotextile fabrics or geogrids) that will compress the peat resulting in settlement and consolidation. A surface layer of crushed stone will be added to complete the road that is expected to lay 1.2 m above the surrounding lowland areas. Changes to surface water quality in the Surface Water Resources assessment were not predicted to be significant based on the results of the Surface Water Resources Assessment (SWRA) which considered baseline water quality conditions and the potential for the Project to result in changes in water quality. The SWRA predicted that local water quality within the surface water LSA may experience increased concentrations of potential contaminants above applicable screening criteria; however, these changes are expected to be of low magnitude and contained within the boundaries of the LSA. With mitigation and environmental protection measures applied, the net effects on the surface water quality are of low magnitude and predicted to be not significant.

- Construction of the all-season road is anticipated to take 5-6 years to complete and will include, but is not limited to, the following activities:
- Physical surveying of road right-way width and alignment, as well as supportive temporary infrastructure (e.g., access road, aggregate source areas and camps);
- Vegetation clearing, earth grading and road construction granular placement within an approximately 35 m ROW width over a distance of 107 km;
- Construction of multi-span watercourse-crossing structures ranging in length from 20 m to 250 m;
- Construction of single-span watercourse-crossing structures ranging in length from 5 m to 20 m;
- Construction of watercourse crossing culverts and culverts for localized road drainage;
- Vegetation clearing, earth grading and construction of temporary and permanent supportive infrastructure (i.e., access roads, camps, storage/laydown yards, aggregate pits);
- Aggregate extraction and production (e.g., crushing/screening) at source areas;
- Earth and aggregate hauling operations;
- Operation, maintenance and storage of machinery and equipment;
- Construction camps (average workforce accommodation – 100);
- Management and stockpiling of topsoil and unsuitable earth material along the right-of-way;
- Post-construction clean-up and restoration;
- Equipment and crew mobilization/de-mobilization; and
- Construction monitoring to ensure avoidance of direct impacts on traditional activities of First Nations.

During the operation phase of the Project, expected to last 75 years, activities such as the assessment of the condition and operating performance of the road surface, drainage system and structures at waterbody crossings will be conducted regularly along the road ROW.

Figure 3-2: Project Location

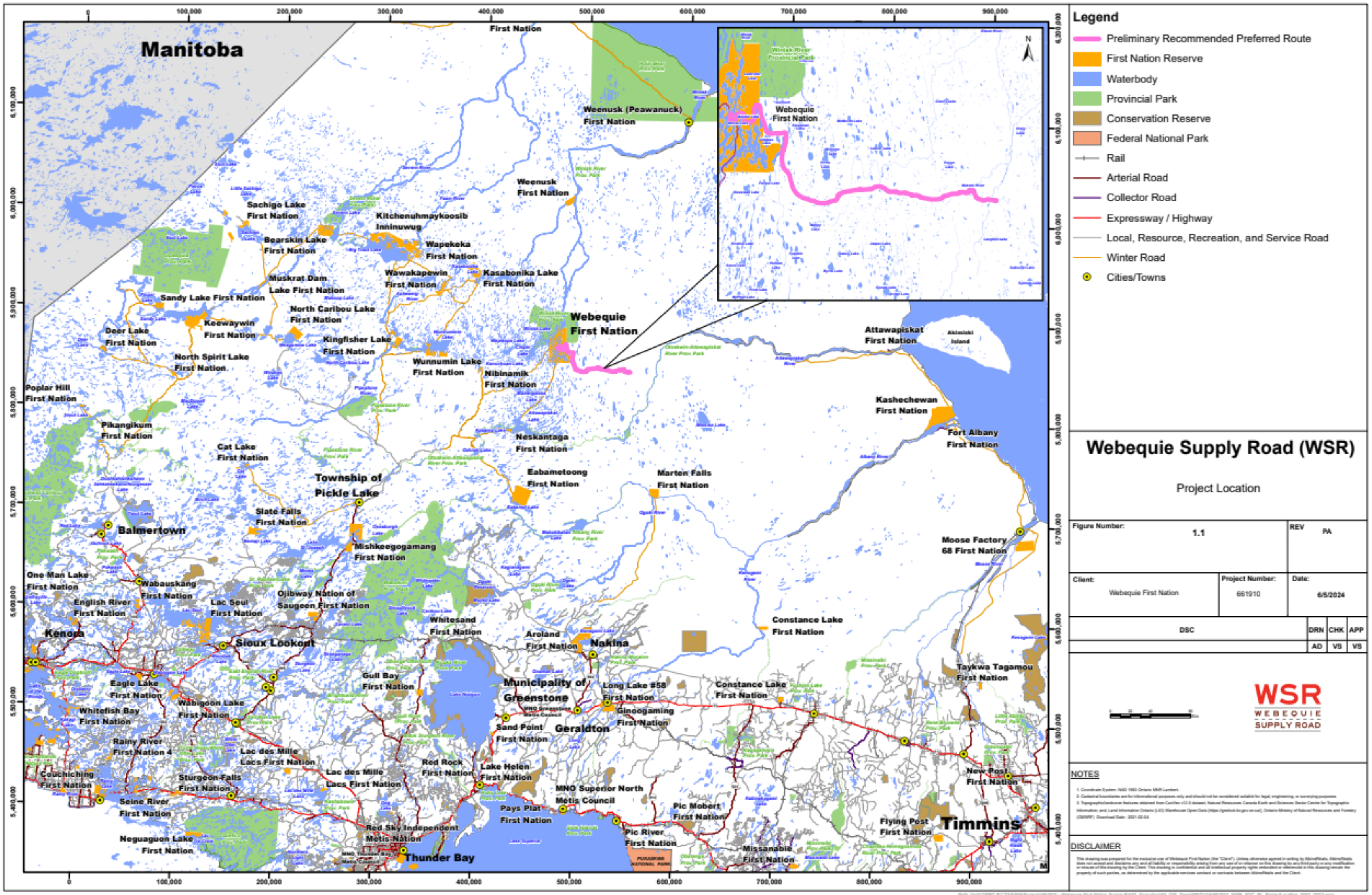
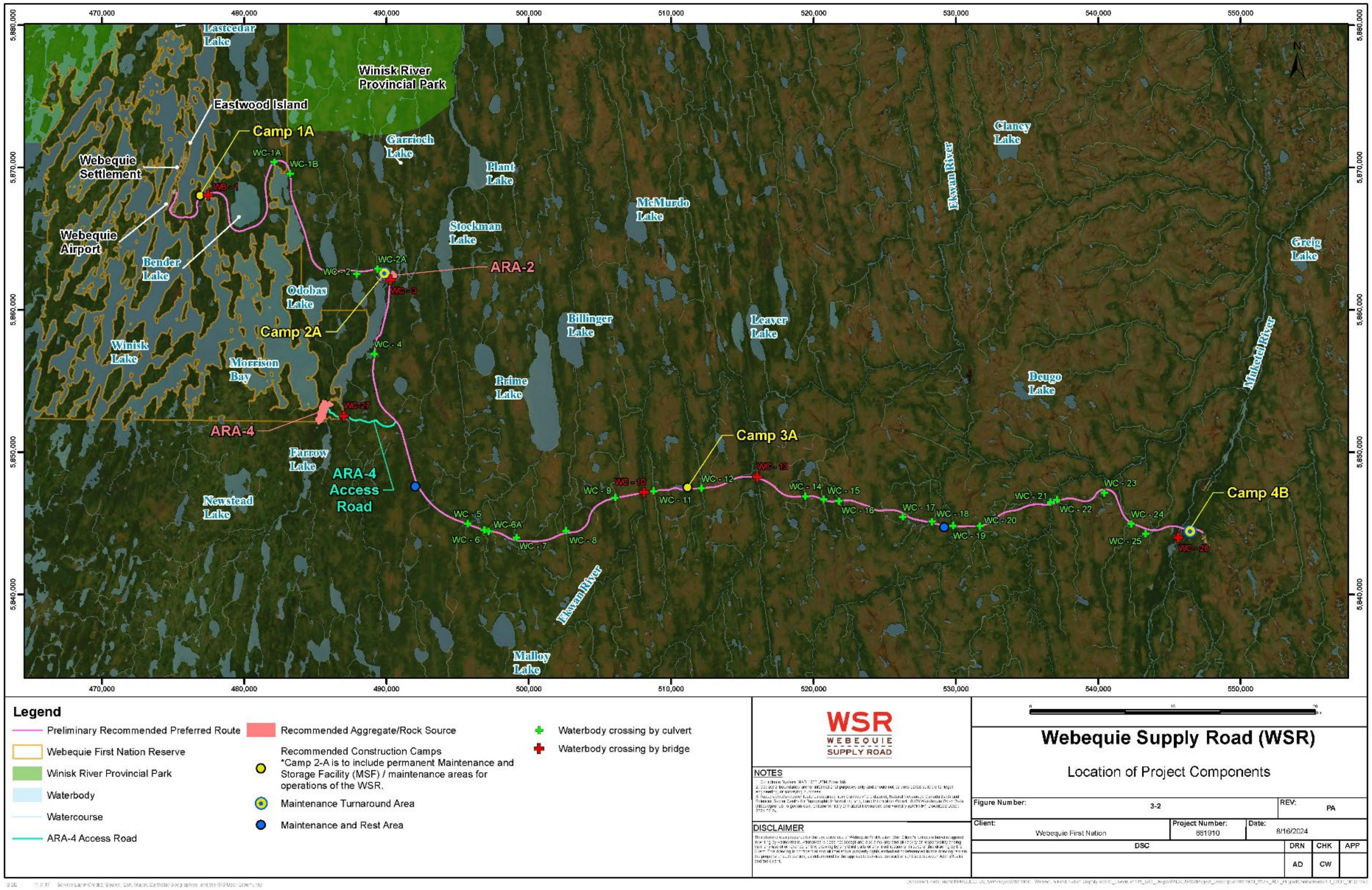


Figure 3-3: Location of Project Components



3.2 Human Use of the Study Area

The Project is located on largely undeveloped Crown lands, including the traditional lands of both Webequie First Nation and Marten Falls First Nation. Traditional activities of Indigenous community members include hunting, fishing and gathering, as well as cultural and spiritual activities, described further below. Other uses of the lands consist of recreational activities, typically fly-in camps and tourist lodges. Otoskwin/Attawapiskat River Provincial Park and the Winisk River Provincial Park also provide opportunities for recreational use. The Study Area as it pertains to the HHRA is further defined in **Section 3.5**.

In accordance with the Study Plan, the HIA and the current HHRA will focus on the potential for health impacts to the Webequie First Nation. Although other Indigenous communities are located within the broader area of the WSR, due to the proximity of their community to the Project, most Project-impacts will be experienced by the Webequie First Nation, and the evaluation of Project-related impacts to the health of Webequie First Nation community members is considered protective of members of other communities and individuals who may be exposed to Project-related impacts to a lesser extent. As such, information on human use of the Project LSA and RSA is focussed on Webequie First Nation. The subsequent information on Webequie First Nation use of the project study areas was obtained from the HIA.

The Webequie First Nation community is located on the northern peninsula of Eastwood Island on Winisk Lake. It is a remote community accessible only by air and winter road; it is currently serviced by a Visual Flight Rules (VFR) Webequie Airport, and a winter road, which branches off the Northern Ontario Resource Trail (NORT), 250 km northeast of the Township of Pickle Lake, providing road access for only a brief period in the winter months. First Nation fly-in communities have observed that winter road seasons are getting shorter, and this is a major concern for shipping in supplies (CBC, 2023b). Due to the isolation and difficulty in obtaining fresh produce, Webequie First Nation households are increasing their reliance on traditional country foods. The HIA indicates that over 75% of Webequie First Nation households include country foods in their meals at least two days per week.

Webequie First Nation has culturally significant and sensitive sites throughout their traditional land. Many culturally significant sites have been identified within the LSA and the RSA; however, no culturally significant sites are present within the WSR ROW. Water is seen as the most precious element of their livelihood; as a result, areas with waterbodies are seen as highly spiritual and there is a responsibility to protect them. Additionally, the area that extends 40-50 km in radius around the Webequie community is for traditional and recreational activities such has trapping, fishing, ceremonial activities, gathering/harvesting and hunting of local wildlife species. Wildlife species (e.g., moose, caribou, waterfowl) are a critical part of the diet of the community and hunting is a significant cultural activity that associates Webequie people to the land. As discussed in **Section 3.3.5**, in acknowledgement of the importance of traditional country foods to the Webequie First Nation, a Country Foods Assessment was conducted and is provided in Appendix 13 of the EAR/IS.

3.3 Review of Anticipated Project-Effects on Contaminant Levels

The HHRA supports the requirements of the evaluation of human health provided in the HIA, which is based on the information requirements outlined in the approved TISG and ToR for the Project. The scope of the HIA was determined in consultation with multiple stakeholders, including regulatory agencies, Indigenous communities and members of the public, as described in Section 17 (Human Health) of the EAR/IS.

The HHRA includes site setting information, as well as the methods and results for the assessment. The potential for risks to human health were only assessed where measurable changes in concentrations in relevant media, including soil, sediment, water, air, vegetation, wildlife and/or fish, were identified to be significant as a result of Project construction or operations phases. The HHRA relies on the findings presented in the EAR/IS for indicator VCs, including:

- Section 6 – Geology, Terrain and Soils (**Section 3.3.1**);
- Section 7 – Surface Water Resources (Section **3.3.2**);
- Section 8 – Groundwater Resources (Section **3.3.3**); and
- Section 9 – Atmospheric Environment (Air Quality; **Section 3.3.4**).

Consideration of Country Foods was included in the Study Plan for the HHRA/HIA. The potential for Project-related increases of concentrations of contaminants in country foods is linked to the potential for changes in contaminant concentrations in environmental media that country foods biota could be exposed to (including soil, water and air), and thus are linked to the VC assessments listed above. Additionally, assessments of vegetation, fish and wildlife are linked to the HHRA as exposures of these biota to contaminants are addressed in each of these linked VC assessments. As a result, the review of anticipated Project-effects to country foods, presented in **Section 3.3.5**, below, discusses results of all linked VC assessments to determine the path forward for assessment of country foods in the HHRA.

Finally, as noise is included in the scope of the HHRA, the results of the noise assessment provided in the EAR/IS Section 9 Atmospheric Environment assessment are evaluated in **Section 3.3.6**.

Results of each of these indicator VCs with respect to their relevance to the HHRA are summarized and discussed in the following sub-sections. Following these discussions and qualitative evaluations, the final scoping for the HHRA is presented in **Section 3.4**.

3.3.1 Geology, Terrain and Soils

The assessment of potential effects to Geology, Terrain and Soils presented in Section 6 of the EAR/IS includes a subcomponent on soil quality, which supports the quality of resources and land available for use by human receptors.

Changes to soil quality resulting from Project-related activities in the construction and operation phases, are anticipated due to:

- Surveying, vegetation clearing, and grubbing;
- Construction grading, backfilling, excavation and blasting activities;
- Use of supportive infrastructure, the constructed road, and structure at waterbodies;
- Decommissioning and closure of temporary aggregate extraction and processing areas;
- Construction camps, access roads, and laydown/storage area emissions, discharges and wastes;
- Maintenance and repair of the road; and
- Operation of pits, quarries and maintenance yard/facility.

The effect is considered negative as changes to soil quality can have an impact on the environment and ecosystem function. The magnitude of the effect is considered moderate as activities may result in changes to soil quality beyond what could naturally occur on the landscape. The effect is limited to the disturbed areas within the Project footprint. The impact on soil resources is anticipated to be moderate due to the abundance of soil resources on the landscape. Effect timing is negligible as disruption will occur during non-sensitive and sensitive periods. The duration of most effects from changes to soil quality is considered short-term as they are anticipated to only be impacted during the construction phase of the Project, with only a few effects that would extend into the operations phase being characterized as medium-term. The effect frequency is expected to be continuous during construction and infrequently during operations. The effect is reversible, changes to soil quality are expected to be recovered or restored after site reclamation. The effect is certain to occur as activities resulting in changes to soil quantity, distribution, and quality are integral to the construction of project-related infrastructure.

The net effect of anticipated changes to soil quality is considered not significant, and the assessment indicates that soil quality changes will be limited to the immediate Project Footprint (i.e., the WSR ROW), when human receptors are not expected to spend much time. While dust generation and deposition are expected to occur during both the construction and operations phases, they are not expected to change soil quality within the LSA or RSA, as the disrupted soils would have the same quality as the soils in adjacent locations. As a result, quantitative evaluation of potential exposures and risks for human receptors exposed to soils impacted as a result of the Project construction and operations is not warranted.

The gravel that is to be used in the construction of the road is proposed to be analysed in the future, as the design and construction details are finalized. Analysis of gravel on a per mass basis is recommended. Further consideration of the potential for gravels to impact the LSA, including surrounding soils and air quality (i.e., from dust generation), will be conducted once the data is available. Leachate testing results available to date have indicated that the leachability of metals from gravel is low and thus, impacts to surface water and groundwater are not anticipated.

3.3.2 Surface Water Resources

The assessment of potential effects to Surface Water Resources, presented in Section 7 of the EAR/IS, included surface water quality. Surface water quality, evaluated through consideration of indicators such as the concentration of suspended solids and concentration of potential contaminants (individual chemicals substances), is an important consideration for human use, including drinking water consumption and recreational or cultural use. The assessment of Surface Water Resources identified the potential for effects to surface water quality during the construction and operations phases of the Project.

Changes in surface water quality are anticipated, due to:

- Short-term discharges of construction water, wastewater, or wash water that have different quantities of potential contaminants or suspended solids from the receiving waterbody;
- Blasting activities releasing potential contaminants into nearby waterbodies; and
- Road maintenance activities leading to the deposition of sediment into waterbodies.

However, changes to surface water quality were not predicted to be significant based on the results of the Surface Water Resources Assessment (SWRA) which considered baseline water quality conditions and the potential for the Project to result in changes in water quality. The SWRA predicted that local water quality within the surface water LSA may experience increased concentrations of potential contaminants above applicable screening criteria; however, these changes are expected to be of low magnitude and contained within the boundaries of the LSA. With mitigation and environmental protection measures applied, the net effects on the surface water quality are of low magnitude and predicted to be not significant.

Effects on water quality resulting from short-term discharges, blasting activities, and erosion and sedimentation are predicted to be of low magnitude. Water quality sample data were collected from major crossings and will be used in conjunction with an environmental monitoring plan to compare water quality conditions post-construction and during operations. The moderate confidence level is attributed to the complexity inherent in predicting the magnitude of effects, considering the dynamic nature of surface runoff patterns and potential influences on water quality. The Project does not include the release or diversion of any substantial water sources and mitigation measures are planned for accidental release of chemicals. Furthermore, leachate testing of gravel has indicated that there is a low potential for leachability.

As significant effects to water quality were not predicted for the construction or operations phases of the Project, quantitative evaluation of potential exposures and risks of humans to contaminants in surface water is not warranted as exposures and risks would also not be expected to be significant. Surface water quality will continue to be monitored throughout the construction and operation phases of the Project.

3.3.3 Groundwater Resources

The assessment of potential effects to Groundwater Resources includes a subcomponent on groundwater quality which supports the access and use of cleaning drinking water by human receptors. The potential for blasting of rocks to introduce deleterious substance and reduce groundwater quality was identified as a potential cause to change groundwater quality during the construction stage of the Project.

The effect of blasting of rocks on alteration of groundwater quality is considered to be negative as the introduction of substances with the use of explosives may result in reduction of groundwater quality in the vicinity of the blasting locations. The magnitude of the effect is low to moderate as the change in groundwater quality is anticipated to be less than or within the range of seasonal variations.

The effect's geographic extent will be limited to the quarry areas within the Project footprint, where rocks will be blasted for the extraction of road construction materials. The effect occurs during blasting activities in construction and operations phases. This could happen either in dry or non-dry seasons. The effect is medium-term in duration. The effect is predicted to be intermittent in frequency as it only happens when rock blasting occurs. Leachate testing of gravel has indicated that there is a low potential for leachability.

For ecological context, the effect is categorized as sensitive as measurable changes in groundwater levels in shallow aquifers are expected. The effect is reversible. The groundwater quality can be restored to pre-development conditions by natural attenuation. The effect may occur (possible) when rock blasting occurs.

Overall, the alteration of groundwater quality due to the blasting of rocks is considered to be not significant to groundwater contaminant concentrations, and by extension to human receptor exposures and potential health risks. As a result, quantitative evaluation of potential exposures and risks of humans to contaminants in groundwater is not warranted.

3.3.4 Air Quality

The Air Quality Impact Assessment (AQIA) (AtkinsRéalis, 2024a) is provided as an Appendix of the EAR/IS, in support of the Section 9 Atmospheric Environment assessment. The AQIA evaluated the potential for the Project to impact the ambient air quality around the road and near supportive infrastructure. Potential air contaminants included the criteria air contaminants (CACs) (NO_2, CO, SO_2,), particulates (TSP, PM_{10}, $PM_{2.5}$), ten (10) toxic contaminants from the VOC category (including carbonylic and aromatic compounds), benzo[a]pyrene (also referred to as B[a]P) as a surrogate for PAHs, diesel particulate matter (DPM) and dustfall. Metals were not modelled because information on their concentrations in site soils and aggregate materials to be handled during construction was not available. The HHRA relied on the findings of the AQIA, with substances projected to exceed applicable criteria being carried forward for assessment in the COPC screening of the HHRA.

Atmospheric dispersion modelling was carried out using expected but conservative emission scenarios during road construction and the operation phase. The emission sources were from the combustion of diesel fuel or gasoline from land mobile equipment, heavy-duty trucks and light-duty vehicles during the construction and operation phase of the WSR. The modelling exercise also considered fugitive dust emissions mostly from vehicular traffic on the road and the handling of aggregates and other earth materials during construction.

The assumptions and modelling approach used to estimate exposure concentrations are described in detail in the AQIA and are summarized here. The atmospheric dispersion modelling followed the requirements of the MECP's Atmospheric Dispersion Modelling Guide for Ontario (ADMGO, 2017) and incorporated recommendations from the US EPA (2017, 2023) for the selected dispersion model. The AERMOD model considered key meteorological parameters that influence dispersion, including wind speed and direction, atmospheric stability indices (friction velocity, Monin–Obukhov length, and surface roughness length), mixing height and ambient temperature. These data were applied on an hourly basis over a five-year period. Hourly precipitation data were also incorporated to support the estimation of wet deposition of particulate matter.

Ambient concentrations of emitted contaminants were calculated at points of impingement of interest including existing residences or group of residences within the community of Webequie, institutional buildings, culturally sensitive areas, and locations for future residences along the road. Consistent with the AQIA, the results of the AQIA were compared to Ontario Ambient Air Quality Criteria (AAQC), Ontario Air Contaminant Benchmarks (ACB) and the Canadian Ambient Air Quality Standards (CAAQS) (collectively referred to as the air quality guidelines).

Changes in air quality, estimated based on Project emissions compared with baseline concentrations and for cumulative (baseline + Project emissions) greater than the air quality guidelines, were predicted for both the construction and operation phases of the Project, both with and without planned mitigative measures in place. For this HHRA, only the AQIA results which were predicted assuming that mitigation has been implemented have been further considered. The predicted changes in air quality include the following:

- During the construction phase, concentrations of TSP (24 hour), PM_{10} (24 hour), $PM_{2.5}$ (24 hour and annual), NO_2 (1 hour and 24 hour), SO_2 (10 minute and 1 hour), CO (1 hour), acrolein (1 hour and 24 hour), propanal/propionaldehyde (10 minute), benzo(a)pyrene (24 hour) and diesel particulate matter (DPM) (2 hour) exceeded the air quality guidelines at one or more area of interest. Areas/points of interest (POI) are areas/points within the vicinity of the road for which air concentrations were modelled by the AQIA including those that were identified as culturally significant to members of the Webequie community and areas where members have the potential to spend significant portions of their time, locations and distances to these areas are presented below. In addition, dustfall exceeded the 30-day and annual AAQC. As not all parameters exceeded their respective benchmarks at all points/areas of interest or in areas where Webequie community members are anticipated to spend significant portions of their time, the detailed list of exceedances by point/area of interest for community members are presented in **Table 3-8**.
- During the operation phase, concentrations of PM_{10} (24-hour), $PM_{2.5}$ (24-hour and annual) and TSP (24-hour and annual) exceeded air quality guidelines at one or more areas of interest. In addition, dustfall exceeded the 30-day and annual AAQC Concentrations of all other potential air contaminants evaluated, included gaseous CACs and the air toxics, were less than the air quality guidelines at all areas of interest. As with the construction phase, as not all parameters exceeded their respective benchmarks at all points/areas of interest, the detailed list of exceedances by point/area of interest are presented in **Table 3-14**.
- The HHRA focused on sensitive receptors including members of the Webequie community. The HHRA relied on the predicted concentrations from the AQIA for the following POI or areas of interest:

- Existing residences (RP01), the closest receptor for this category is located 1,350 m from the road centerline (RCL);
- Institutional buildings (I01), the closest receptor for this category is located 1,800 m from the RCL;
- Culturally sensitive areas, the closest receptor for this category is CHL25, located 60 m from RCL; and
- Future residences (RPF42 [site D]), the closest receptor for this category is located approximately 55 m from RCL.

The AQIA was conducted using a conservative approach and assumptions, and thus, has likely overpredicted the potential for effects on air quality. Despite this, based on the potential for changes to air quality, quantitative evaluation of potential exposures and risks of humans to contaminants in air will be conducted in the HHRA (**Section 6**).

3.3.5 Country Foods

As the WSR and Webequie First Nation area is used by the community for hunting, fishing and harvesting activities, a baseline country foods (or "traditional foods", as per HC, 2023) study was conducted to assess baseline concentrations of potential contaminants in berries, game birds, small and large mammals and fish. A Country Foods Consumption and Use Survey was conducted from December 2022 and January 2023 in the Webequie community, the results of which are supplemented with information available from the First Nations Food, Nutrition and Environment Study (FNFNES) community data, as detailed in the Country Foods Assessment report (Chan et al., 2019). Additionally, AtkinsRéalis collected vegetation samples (where available) and fish samples in 2020, while the Webequie First Nation provided mammal and bird samples to AtkinsRéalis in 2020 and 2021. Results of the above-listed studies were provided in the Country Foods Assessment report (AtkinsRéalis, 2024b; Appendix 13 of the EAR/IS).

The potential for Project-related increases of concentrations of contaminants in country foods is linked to the potential for changes in contaminant concentrations in the environmental media that country foods biota are exposed to, including soil, water and air. To evaluate the potential for the Project to adversely affect the concentrations of contaminants in country foods, linked assessments for the environmental media, as well as groups of biota that would include country foods, were reviewed for indicator VCs in the following EAR/IS sections:

- Section 6 - Geology, Terrain and Soils;
- Section 7 - Surface Water Resources;
- Section 8 - Groundwater Resources;
- Section 9 - Air Quality;
- Section 10 - Fish and Fish Habitat;
- Section 11 - Vegetation and Wetlands; and
- Section 12 - Terrestrial Habitat and Wildlife.

Consideration of potential contaminant-related effects to groups of country food items, including plants, fish and wildlife, are discussed below. Note that other effects to country foods (e.g., habitat availability, access for harvest, migration, etc.) are not included in the current discussion, as the HHRA is focused on contaminant levels in biota tissues, and the subsequent human exposures to contaminants following consumption of country food items.

Changes to concentrations of contaminants in environmental media are not anticipated to be significant for surface water, groundwater or soil (see **Sections 3.3.1** to **3.3.3**). As a result, consistent with the results of linked VC assessments (i.e., for Vegetation and Wetlands, Fish and Fish Habitat, and

Terrestrial Habitat and Wildlife), exposures of plants, fish or wildlife to changes (if any) in concentrations of contaminants in surface water, groundwater or soil are also not expected to be significant.

As described in **Section 3.3.4**, increased levels of contaminants and dust in air during construction and operation phases of the Project was identified as a predicted Project-related effect with and without mitigation. The potential for air exposures to affect exposures and contaminant concentrations in each group of country food items is discussed in further detail in **Sections 3.3.5.1** to **3.3.5.3**, below.

3.3.5.1 Plants

Contaminant uptake by plants is not anticipated to increase as a result of Project-related activities, as no significant effects to surface water, groundwater or soil quality are anticipated and leachate testing on gravels has indicated a low leachate potential for metals. However, results of the AQIA indicate that dust will be generated through construction and operation phases of the Project; this dust could deposit on edible vegetation, which could then be consumed by human receptors.

The Vegetation and Wetland assessment indicated that effects to plants from air quality / dust deposition decreases with distance from the roadway, with significant and moderate effects to community / species diversity and composition occurring within 20 m and 60 m of the roadway. Within these distances from the roadway, it is unlikely that significant foraging for edible vegetation would occur, and no culturally sensitive areas have been identified within these boundaries. While the deposition model considers local topography, it does not consider the presence of vegetation and trees that can act as physical barriers, especially against the dispersion of particulate down-wind. Even with the conservatism of the model, a dust control mitigation plan is recommended so that in the event of dustfall exceedances of the AAQC, if any are observed, mitigation measures will be taken at culturally sensitive areas/residences including areas that are traditionally used for foraging edible vegetation. Deposition would also be limited temporally during construction given the short period of dust emissions in an area, and thus any dust deposited on vegetation would most likely be washed away by precipitation and other natural phenomena (e.g., wind).

As a result, based on the lines of evidence summarized above and discussed in further detail in the AQIA and the Vegetation and Wetland assessment, while dust may accumulate on vegetation near the roadway, no significant foraging in these areas is anticipated. Given the conservatism in the modelling and that mitigation measures will be in place so that dustfall levels remain below the AAQC at culturally sensitive areas and sensitive receptors, the deposition of dust on edible vegetation that may be foraged is not anticipated to be significant and thus would not be expected to result in appreciable increases in human receptor exposure to contaminants through the ingestion pathway. It is further noted that, during the operation phase, dust generated by the Project from soil disturbances (i.e., soil dust) is anticipated to be limited in frequency and area (as detailed in AtkinsRéalis, 2024a and **Section 3.7.1** of this HHRA). It is recognized that gravel analysis was not available at the time of report preparation, and this remains an uncertainty. Analysis of gravel used in the Project road construction has been recommended, and the results of the linked VC reports (as listed in **Section 3.3.5**), as well as potential impacts to the conclusions of the HHRA, will be revisited once the gravel analysis results are available.

3.3.5.2 Fish

Contaminant uptake by fish is not anticipated to increase as a result of Project-related activities, as no significant effects to surface water, groundwater or sediment quality are anticipated. The AQIA indicates that dust will be generated through construction and operations phases of the Project; while dust could deposit in nearby aquatic receiving environments, the Fish and Fish Habitat assessment did not identify the potential for significant increases of contaminants in these aquatic habitats to result in increased exposures or effects to fish species. As a result, deposition of dust in aquatic receiving environments is not expected to result in appreciable changes to concentrations of contaminants in fish tissue.

3.3.5.3 Wildlife

Wildlife encompasses a variety of species, including mammals and birds. Contaminant uptake by wildlife is not anticipated to increase as a result of Project-related activities, as no significant effects to surface water, groundwater, soil or sediment quality are anticipated. While dust may deposit on vegetation consumed by wildlife, the Terrestrial Habitat and Wildlife Assessment indicated that effects to wildlife resulting from dust deposition were of low significance. Mammals typically have large home ranges, which means they are less likely to be affected by localized changes in contaminant levels, particularly as the primary impact anticipated is dust generation in the vicinity of the roadway. However, it is likely that mammals will be deterred from being present when construction and vehicle traffic is active. Birds also tend to have large flight ranges and can avoid areas with active construction and vehicle traffic. These factors combined indicate that the project activities will not significantly impact the contaminant concentrations in wildlife.

3.3.5.4 Country Foods Assessment Summary

Country foods baseline tissue data is available and has been summarized in the Country Foods Assessment report (AtkinsRéalis, 2024b; Appendix 13 of the EAR/IS). As described in the preceding sections and based on the results of the linked VC assessments, Project-related contaminant increases in country foods items are not expected to be appreciable; therefore, increases in exposures and resulting risks for human receptors consuming country foods items from the Project area are not anticipated. As a result, a quantitative evaluation of human exposures and risks to contaminants in country food items for the baseline and Project scenarios has not been included herein.

The results and recommendations of the various linked VC assessments indicate that monitoring will be implemented to assess predicted significant changes in the concentrations of contaminants in environmental media (as presented in **Section 6.1**) through Project construction and operation phases. It is recommended that, if appreciable changes in concentrations of parameters, particularly those that are bioaccumulative, are identified in surface water, groundwater, soil or sediment during the Project construction or operation phases, additional sampling of relevant country food biota (i.e., biota with the potential to be exposed to noted contaminant increases in the environment) be conducted. Measured concentrations in country food items could then be compared to recorded baseline concentrations summarized in the Country Foods Assessment Report (AtkinsRéalis, 2024b; Appendix 13 of the EAR/IS). If warranted, quantitative evaluations of exposure and risk to human receptors could also be conducted at that time.

3.3.6 Noise

An assessment of noise has been conducted and described in a Noise and Vibration Technical Report (SLR, 2024) and the Assessment of Effects on Atmospheric Environment in the Section 9 of the EAR/IS. Noise levels have the potential to increase in both the construction and operation phases of the Project, through activities that include blasting, and use of vehicles, machinery and equipment. The predicted net effects for changes in noise levels are provided as follows:

Change in Noise Levels due to Aggregate Extraction Operations During Construction Phase

- The Noise Impact Modelling conducted for aggregate extraction activities indicated that predicted sound levels are expected to minorly exceed NPC-300 guideline limits at Construction Camp 2A located near ARA-2. Given workers will be in the field during the daytime, the exceedances are minor (by a maximum of 4 dBA). Therefore, the magnitude of the effect is considered to be low.
- The effect's geographic extent will be limited to the noise LSA. The effect is short-term in duration and predicted to be infrequent in the aggregate resource areas. For ecological and social context, the effect is categorized as moderate resilience as the noise LSA is considered a rural area. The effect is likely to occur but is reversible as the acoustic environment is expected to return to the background noise levels when noise generating activities cease.

Change in Noise Levels due to General Construction Activities During Construction Phase

- The Noise Impact Modelling conducted for the construction of the proposed roadway and bridges indicated that the highest predicted noise levels at the culturally sensitive areas CHL-5, CHL-7, CHL-17, CHL-25, and Construction Camp 1A site C05 are between 48 and 57 dBA, exceeding the MNL threshold of 47 dBA (L_{DN}). Therefore, the magnitude of the effect is considered to be low to moderate.
- The effect's geographic extent will be limited to the noise LSA. The most affected NSAs are found within 150 m of the roadway, or 300 m of a waterbody crossing (involving pile driving/bridge construction). There are no exceedances predicted for the existing permanent residences within the Webequie community. The effect is short-term in duration and predicted to be infrequent. Noise impacts from roadway construction are only expected to affect NSAs for approximately one week based on an approximate 100 m/day rate of construction.
- For ecological and social context, the effect is categorized as moderate resilience as the noise LSA is considered a rural area. The effect is likely to occur but is reversible as the acoustic environment is expected to return to the background noise levels when noise generating activities cease.

Change in Noise Levels due to Vehicle Use of the Proposed Road During Operation Phase

- The noise modelling conducted to predict noise generated from the operations of the WSR indicated that changes in sound levels resulting from the proposed Project are expected to be negligible for the existing residences within the Webequie community and less than the 5 dB change threshold outlined in the Joint Protocol and MTO Noise Guide. Overall "Build" sound levels are predicted to be less than or equal to 45 dBA which is considered appropriate for a quiet rural environment. For the culturally sensitive areas, the maximum sound level is predicted to be 46 dBA. The maximum change is predicted to be 14 dB which is above the MTO Joint Protocol/Noise Guide threshold. Overall "Build" sound levels are highly dependent on the exact location of the NSAs. Sound levels are predicted to be less than 46 dBA which is considered appropriate for a quiet rural area. With respect to Health Canada Guidelines, changes in sound levels resulting from the proposed Project are expected to be negligible for all NSAs and less than the 6.5% threshold. Therefore, the magnitude of the effect is considered to be low.
- The effect's geographic extent will be limited to the noise LSA. The effect is medium-term in duration and predicted to be frequent as it is expected that there will be intermittent presence of vehicles on the road during the operation phase.
- For ecological and social context, the effect is categorized as moderate resilience as the noise LSA is considered a rural area. The effect is likely to occur but is reversible as the acoustic environment is expected to return to the background noise levels as noise from vehicle use of the road will attenuate following a vehicle pass-by.

Summary of Project-related Noise Effects

With the implementation of mitigation measures, the Project will result in construction and operation noise effects that are not expected to exceed guidance levels and do not require noise mitigation beyond best management practices outlined in the Atmospheric Environment assessment (Section 9 of the EAR/IS).

The predicted overall sound levels during construction are not excessive and meet the guidelines limits for a suburban or semi-rural area. Additionally, the predicted sound pressure levels during operations are expected to well below the Health Canada threshold for annoyance. As a result, further assessment of noise in the HHRA is not warranted.

As indicated in the Section 9 Atmospheric Environment assessment, implementation of a noise monitoring program throughout construction and operations phases has not been recommended for the Project. However, if noise complaints arise, they will be investigated and addressed.

3.4 HHRA Scope Definition

Through the evaluation of information provided in associated VC sections of the EAR/IS for indicator VCs, the potential for significant Project-related exceedances of relevant guidelines were identified and/or predicted for air only, associated with emissions released during Project construction and operation. The HHRA relied on the findings of the assessments for the other (i.e., other than air) linked VCs, which consistently indicated that Project is not expected to result in significant changes in soil, surface water, groundwater, sediment, vegetation, fish, wildlife or country foods.

Given that only air contaminants were identified as exceeding applicable guidelines, inhalation is the primary operable exposure pathway between people living, working and visiting the region, and contaminants of potential concern (COPCs) associated with the Project. As a result, direct exposures (e.g., through inhalation of outdoor air) of humans to contaminants of potential concern (COPCs) in emissions will be the subject of the next stage of the quantitative HHRA.

The HHRA comprises an assessment of the possible human health effects associated with emissions from the Project released into outdoor air. As a result, the HHRA is comprised of the following:

- An acute (i.e., ≤ 24 hours) and chronic (i.e., > 90 days) air quality HHRA for the construction and operations phase of the Project. The HHRA assesses Project incremental exposure to airborne COPCs, including particulate matter.
- The air quality modelling results used in the HHRA accounted for the full range of receptor locations evaluated in the AQIA, including existing and future residences, institutional buildings and culturally sensitive areas identified by Webequie First Nation, as well as standardized receptor distances from the road centreline (RCL) (for example, 50 metres), consistent with the AQIA modelling domain.

3.5 Study Area

The proposed WSR is in northwestern Ontario, near Webequie First Nation, which is located approximately 525 km northeast of Thunder Bay as shown in **Figure 3-2**. Main components of the Project are shown on **Figure 3.4**. As noted, the preliminary recommended preferred route for the WSR consists of a northwest-southeast segment running 51 km from Webequie First Nation to a 56 km segment running east before terminating near McFaulds Lake. A total of 17 km of the proposed WSR is within Webequie First Nation Reserve lands.

The WSR will be constructed and operated as a facility that only provides a connection between Webequie First Nation and the McFaulds Lake area to serve mineral exploration and future mining development activities, with no connection to the provincial highway system, although it is anticipated that the WSR will ultimately be an all-season road connection between the McFaulds Lake area and the provincial highway system to ensure/maximize the viability of mine developments. The study area for the HHRA represents the WSR between the Webequie First Nation to the McFaulds Lake area.

The HHRA relies on the results of the AQIA (AtkinsRéalis, 2024a) to characterize air quality. As presented in **Section 3**, no significant Project related effects have been predicted for other media, including soil, sediment, groundwater, surface water, fish and wildlife and vegetation. The study areas included in AQIA considered the following (refer to **Figure 3-4**):

- **The Local Study Area (LSA)**, or the area where largely direct, and indirect effects of the Project are likely to occur. The LSA extends 1 km from each side of the centreline of the WSR, and 500 m from temporary and permanent supportive infrastructure (construction camps, aggregate/rock source areas, access roads, MSF). This includes the road ROW or Project Footprint of the supportive infrastructure where most sources that will impact air quality are likely to occur.
- **The Regional Study Area (RSA)** is the area where potential, largely indirect and cumulative effects of the Project in the broader, regional context may occur. The RSA extends 5 km from boundaries of the LSA.
- In selecting the LSA and RSA boundaries, consideration was given to potential effects and effect pathways because of the Project. For air quality, the effects of the Project activities are considered to be constrained to the LSA spatial boundaries. Sensitive receptors and future land use were considered in the AQIA. The modelling approach for the assessment focused on the western portion of the WSR from the community of Webequie to the point where the road intersects with the proposed permanent access road to the ARA-4 aggregate source area (41.5 km). The approach of focusing on the impacts to sensitive receptors located in and near the community of Webequie was adopted because the construction and operation of the road is expected to be similar along the full length (i.e., the impacts assessed for the western part will be of similar nature for the eastern part). It was determined that modelling the full road (>100 km) would be computationally time consuming and would not provide different results. The spatial assessment boundaries for the air dispersion modelling for the Project are presented in **Figure 3-4**, **Figure 3-5** and **Figure 3-6**.
- The LSA and RSA for each environmental discipline may vary from the above-described general study areas based on the potential for the Project to directly or indirectly affect each environmental discipline (valued component); therefore, in some cases discipline-specific LSAs and RSAs have been defined for the Project. The LSA and RSA associated with the AQIA were the primary study areas for the HHRA.

The following temporal boundaries were used:

- **Construction Phase**: All activities associated with the initial development and construction of the road and supportive infrastructure from the start of the construction to the start of the operation and maintenance of the Project and is anticipated to be approximately 5 to 6 years in duration.
- **Operation Phase**: All activities associated with operation and maintenance of the road and permanent supportive infrastructure (e.g., operation and maintenance yard, aggregate extraction and processing areas) that will start after the construction activities are complete, including site restoration and decommissioning of temporary infrastructure (e.g., access roads, construction camps, etc.). The Operations Phase of the Project is anticipated to be 75 years based on the expected timeline when major refurbishment of road components (e.g., bridges) is deemed necessary.

The proposed WSR is expected to operate for an indeterminate period; therefore, future suspension, decommissioning and eventual abandonment is not evaluated in the AQIA or this HHRA.

Figure 3-4: Air Quality and Climate Change Study Areas

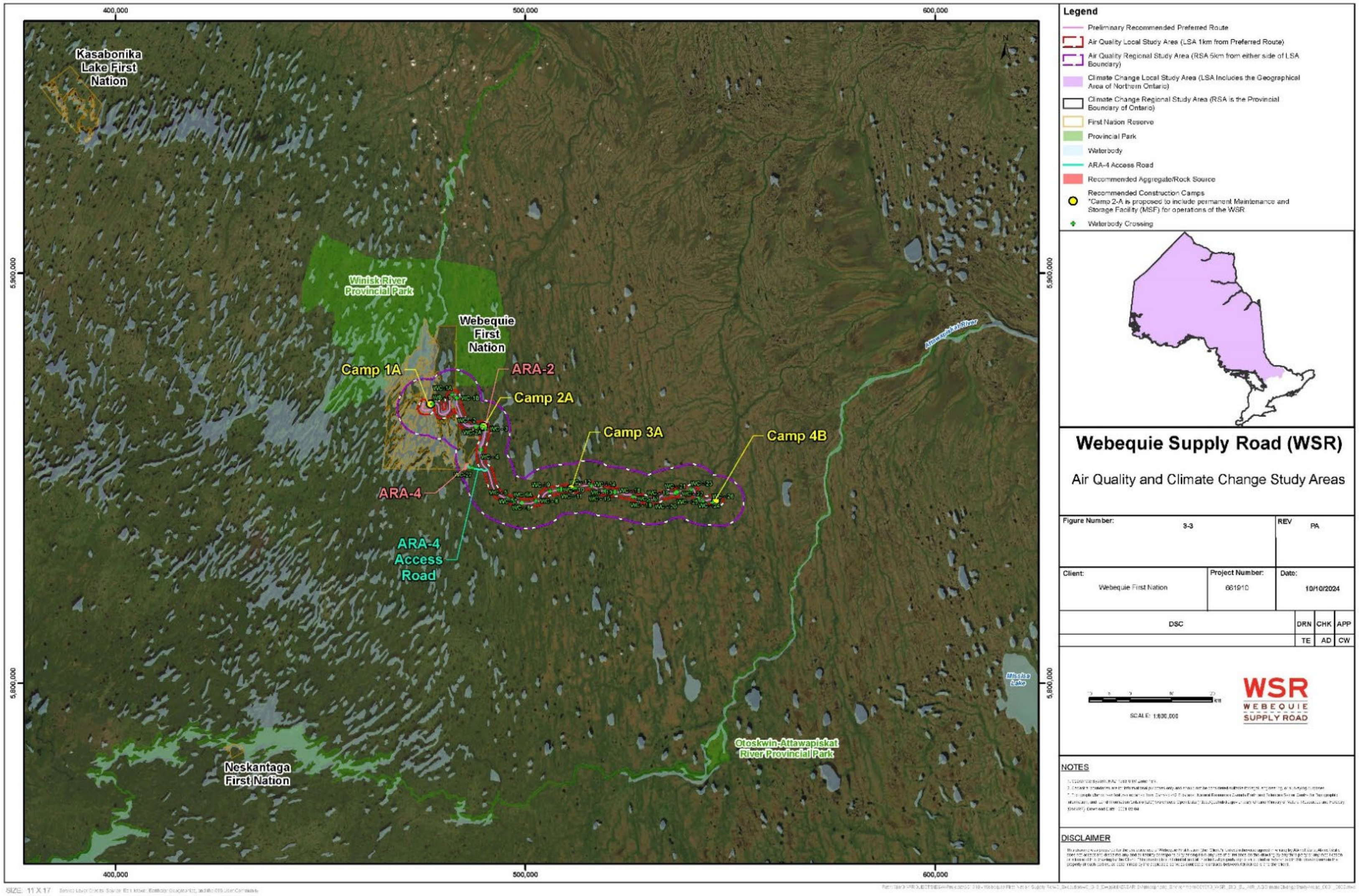


Figure 3-5: Air Dispersion Modelling Domain

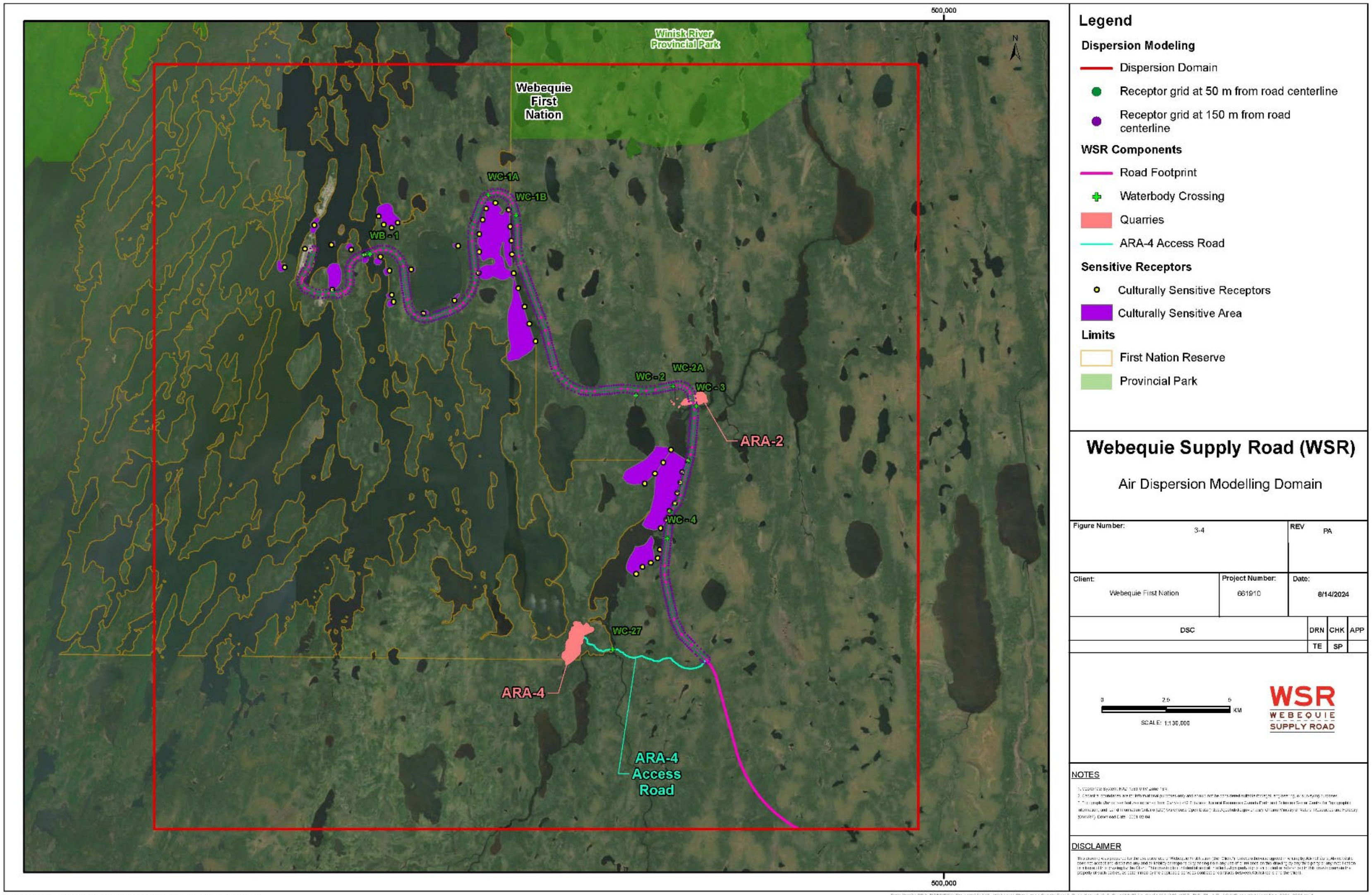
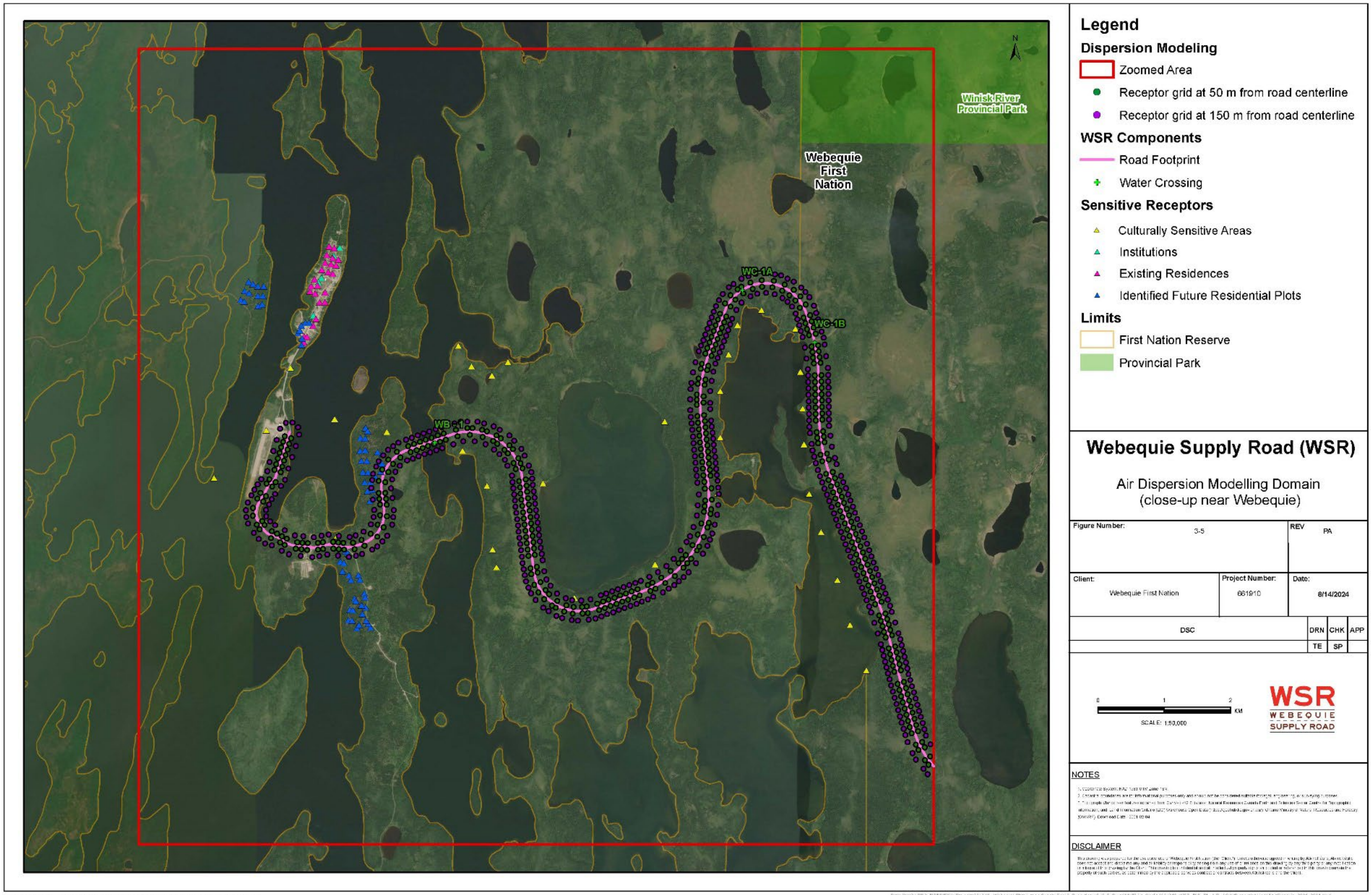


Figure 3-6: Air Dispersion Modelling Domain (close-up near Webequie)



3.6 Assessment Scenarios

The objective of the HHRA was to evaluate the potential human health risks for the following scenarios:

- Baseline Scenario – includes potential health risks associated with the existing environmental conditions; and
- Project Scenario – includes potential health risks associated with the Project, including the baseline condition, to assess both incremental and cumulative health risks associated with the Project.

The above-described scenarios are assessed in the HHRA and are discussed throughout the report.

3.7 COPC Screening

Project activities were evaluated (in each of the related VC sections) for their potential to introduce or significantly redistribute contaminants into the local environment. Where identified, contaminants were then evaluated for their potential to adversely affect the health of populations with the potential to be exposed to the chemicals. As described in **Section 3.3**, no significant effects, including increasing concentrations of Project-related contaminants, were predicted for soil, groundwater, surface water, sediment, terrestrial wildlife, fish and/or vegetation.

Air quality is the only VC with links to human health where contaminant concentrations were predicted to have the potential to increase during construction and operations of the Project and exceed the applicable guidelines. All air contaminants with the potential to exceed the applicable guidelines at areas of interest have been retained as preliminary contaminants of potential concern (COPCs) in the HHRA.

Consistent with the AQIA, the Ontario Ambient Air Quality Criteria (AAQC) and the Canadian Ambient Air Quality Standards (CAAQS) for contaminants relevant to the Project are presented in **Table 3-1A** and **Table 3-1B** It is acknowledged that the 24-hour AAQCs are not short-term benchmarks, as they represent a concentration that is equivalent to the annual average with short-term exposure duration (24-hour). As such, to ensure that air quality guidelines protective of short-term health effects are applied, the US Environmental Protection Agency's (USEPA) National Air Quality Standards (NAAQS) have also been applied. The NAAQS are health-based and are generally updated more frequently than the CAAQS. As shown, the NAAQS are higher than, or equivalent to, the lowest of the corresponding provincial and/or federal criteria/standards presented in **Table 3-1A**, demonstrating that the Ontario AAQC and the CAAQS are health protective. As such, they have been carried forward in the HHRA for the assessment of health effects associated with the air contaminants.

Table 3-1A: Ambient Air Quality Criteria and Standards for CACs

Pollutant	Averaging Period	Ontario AAQC (1)		CAAQS (1)		USEPA NAAQS	
		[ppb]	[µg/m³]	[ppb]	[µg/m³]	[ppb]	[µg/m³]
Total suspended matter (TSP)	24-hour	—	120	—	—	—	120
	Annual	—	60 (2)	—	—	—	60
Fine inhalable fraction of particulate (PM_{10})	24-hour	—	50	—	—	—	—
Fine particulate matter ($PM_{2.5}$)	24-hour	—	27 (3)	—	23 (4)	—	30
	Annual	—	8.8 (5)	—	8 (6)	—	—

Pollutant	Averaging Period	Ontario AAQC (1)		CAAQS (1)		USEPA NAAQS	
		[ppb]	[µg/m³]	[ppb]	[µg/m³]	[ppb]	[µg/m³]
Sulphur dioxide (SO_2)	10-minute	67	180	—	—	—	—
	1-hour	40	100	65 (7)	173	172	450
	Annual	4	10	4 (8)	10	11	30
Nitrogen dioxide (NO_2)	1-hour	200	400	42 (9)	79	200	400
	24-hour	100	200	—	—	100	200
	Annual	—	—	12 (8)	22	30	60
Carbon monoxide (CO)	1-hour	30,000	36,200	—	—	—	—
	8-hour	13,000	15,700	—	—	—	—

Notes:
(1) **Sources:** Ontario AAQC – MECP (2020); CAAQS – CCME (2025); USEPA NAAQS (available at NAAQS Table | US EPA).
(2) As the geometric mean of daily measurements over a year.
(3) The 3-year average of the annual 98th percentile of the daily 24-hr average concentrations.
(4) Applicable starting in 2030. Represent also a 3-year average of the annual 98th percentile of the daily 24-hr average concentrations.
(5) The 3-year average of the annual average concentrations.
(6) Applicable starting in 2030. Represent also a 3-year average of the annual average concentrations.
(7) The 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations.
(8) The average over a single year of all 1-hour average concentrations. The maximum result from the 5 years of meteorological data is applied.
(9) The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations.

In addition to the CACs, the AQIA included other potentially Project-sourced contaminants like aldehydes, specific VOCs, and PAHs in exhaust gases from vehicles and mobile equipment, as well as dustfall. It is noted that the AAQC dustfall limits are considered as a guideline in the AQIA to inform the reader of the extent of dust deposition on the surrounding environment that is associated with the Project. As requested by the TISG, DPM was modelled as $PM_{2.5}$ generated by engines. Air quality guidelines for DPM are limited: Health Canada (2016) provides guidance values for short-term and chronic exposures to DPM that have been used for comparative purposes. The AQIA results for these other potential air contaminants (i.e., other than the CACs) are presented in **Table 3-1B**.

Metals were not modelled as part of the AQIA because information on their concentrations in site soils and aggregate materials to be handled during construction was not available; metals are further evaluated in **Section 3.7.1** of the HHRA.

Table 3-2B: Ambient Air Quality Criteria and Standards for Other AQIA Studied Contaminants

Pollutant	Averaging Period	Ontario AAQC (1)		CAAQS (1)		Health Canada (1)	
		[ppb]	[µg/m³]	[ppb]	[µg/m³]	[ppb]	[µg/m³]
1,3-butadiene	24-hour	4.5	10	—	—	—	—
	Annual	0.91	2	—	—	—	—
Acetaldehyde	30-minute	278	500	—	—	—	—
	24-hour	278	500	—	—	—	—
Acrolein	1-hour	2.0	4.5	—	—	—	—
	24-hour	0.17	0.4	—	—	—	—

Pollutant	Averaging Period	Ontario AAQC [1]		CAAQS [1]		Health Canada [1]	
		[ppb]	[μg/m³]	[ppb]	[μg/m³]	[ppb]	[μg/m³]
Benzene	24-hour	0.72	2.3	—	—	—	—
	Annual	0.14	0.45	—	—	—	—
Ethylbenzene	10-minute	438	1,900	—	—	—	—
	24-hour	231	1,000	—	—	—	—
Formaldehyde	24-hour	53	65	—	—	—	—
Hexanes	24-hour	711	2,500	—	—	—	—
Propanal / Propionaldehyde	10-minute	4.2	10	—	—	—	—
Toluene	24-hour	532	2,000	—	—	—	—
Xylenes	10-minute	692	3,000	—	—	—	—
	24-hour	168	730	—	—	—	—
Benzo(a)pyrene as a surrogate to PAHs	24-hour	—	0.00005	—	—	—	—
	Annual	—	0.00001	—	—	—	—
Diesel particulate matter (DPM)	2-hour	—	—	—	—	—	10 [2]
	Annual	—	—	—	—	—	5 [2]
Dustfall	30-day	—	7 g/m²	—	—	—	—
	Annual	—	4.6 g/m² [3]	—	—	—	—

Notes:

(1) **Sources:** Ontario AAQC – MECP (2020); CAAQS – CCME (2025); Health Canada (2016).

(2) Health Canada does not provide any information regarding the statistical representation to consider for comparison with the guidance values. Hence, the maximum concentration calculated for the 2-hour exposure period and the annual period is considered in this study for information purpose.

(3) Represents the arithmetic mean of 30-day periods over an annual averaging time.

As noted, all air contaminants predicted at concentrations exceeding their respective air quality guidelines were retained as preliminary COPCs in the HHRA. Further evaluation of these preliminary COPCs is detailed in **Section 3.7.1**, below.

The AQIA (AtkinsRéalis, 2024a) used the indicators presented in **Table 3-2** to assess potential effects to air quality. These indicators have also been carried forward into the HHRA to assess potential effects to air quality. Rationale for the selection of the indicators is also presented in **Table 3-2**.

Table 3-3: Air Quality VC – Indicators Used to Assess Potential Effects to Air Quality in the HHRA and Rationale

Indicators	Rationale
Quantitative changes to ambient air contaminants in the study area, including: ▪ **Particulates** (total suspended matter [TSP], fine inhalable fraction of particulate matter [PM_{10}], and fine particulate matter [$PM_{2.5}$]). ▪ **Criteria air contaminants** (sulphur dioxide [SO_2], nitrogen dioxide [NO_2], carbon monoxide [CO], and ground-level ozone [O_3]).	▪ Indigenous Knowledge and feedback from Indigenous communities regarding the importance of air quality. ▪ Commitment to meet CCME's Air Quality Management System requirements. ▪ Commitment to avoid or minimize adverse effects to nearby receptors (residential homes) and culturally sensitive areas of value and interest to Indigenous

Indicators	Rationale
▪ **Relevant volatile organic compounds (VOC)** (1,3-butadiene, acetaldehyde, acrolein, benzene, ethylbenzene, formaldehyde, hexanes, propionaldehyde, toluene, xylenes). ▪ **Benzo(a)pyrene (B[a]P)** as a surrogate to Polycyclic Aromatic Hydrocarbons (PAH). ▪ **Diesel particulate matter (DPM).** ▪ **Dustfall.**	peoples (e.g., spiritual sites, fishing and hunting areas). ▪ Sensitivity of human health and the environment to air quality changes. ▪ Predicted air contaminant concentrations compared to air quality guidelines protective of potential health effects and/or the reduction of population level-based health risks (for non-threshold contaminants).

In addition to the above indicators, metals that are naturally occurring in soils that will be disturbed during the construction of the WSR, as well as by vehicle traffic during the operation phase, have also been retained for evaluation in the HHRA. As air quality data was not available for metals, baseline soil data from the region (i.e., from the Eagle's Nest Multi-Metal Mine Environmental Assessment ["Eagle's Nest EA"] provided as Appendix A) and the TSP concentrations predicted for the construction and operation phases of the Project were used to predict soil dust concentrations of metals for consideration in the HHRA.

3.7.1 Air COPCs

To assess the Project, atmospheric dispersion modelling was carried out using expected but conservative emission scenarios during road construction and the operation phase. The HHRA has relied on the results of the AQIA. As Air Quality and Dust Control Management Plan will be employed during the construction phase of the Project, the HHRA considered scenarios with and without mitigations in place. As the WSR will not be fully surfaced with asphalt or chip seal from the start, the maintenance crew will operate a truck that will spray water over the gravel-surface road from May to November, or when needed, during the operation phase until the asphalt or chip seal is in place.

Details and the timeline of the construction phase, as presented in the AQIA, are provided as follows but final details will be determined in the Detail Design phase through discussions between Indigenous communities and the construction contractor:

- The construction of the WSR will be conducted all-year round over an approximately 60-month period by team of workers that will set camp at one of four locations planned along the 107 km WSR. The detailed construction staging and sequencing of the Project will be determined in the Detail Design phase through discussions between Indigenous communities and the construction contractor. It is anticipated that road construction will be linear starting from the first construction camp (expected to be located at 15 km south-east from Webequie) running west towards Webequie and then running east towards McFaulds Lake. The workers will commute daily from the construction camp to their work location.
- The WSR will consist of two distinct segments, one of 51 km from Webequie running south-easterly and then of 56 km running east until it terminates near the McFaulds Lake area. The first segment (western half of the WSR) resting mostly over mineral soil will be cleared of all vegetation within the 35 m ROW to accommodate the two-lane all-season road. Shoulders, ditches (as enhanced grass swales) and berms of stripped organic materials on the outside will also be shaped along this segment. Cut and fill earthworks will be needed to adjust the vertical alignment by either lowering or raising the existing grades. An underlying layer of aggregates and a surface layer of crushed stone will then be conveyed by trucks from a nearby quarry and compacted on site by heavy machinery. A layer of chip seal or asphalt pavement will be also added onto the road surface.

- The eastern segment of the WSR being located within the Hudson Bay Lowlands Ecozone is composed mostly of peatland (muskeg) having a depth of 2-4 m of waterlogged organic soil, which represents poor to very poor conditions for building a road. A floating road design is being recommended by adding an underlying layer of aggregates (along with geogrids) that will compress the peat resulting in settlement and consolidation. A surface layer of crushed stone will be added to complete the road that is expected to lay 1.2 m above the surrounding lowland areas. Cross-culverts will be integrated within the road structure at regular intervals to ensure that the hydraulic conductivity of the peatlands is maintained.
- Some watercourse crossings will require steel-concrete bridges that will include a substructure composed of a foundation, abutments and piers supporting the superstructure consisting of steel plate girders, the deck and side barriers with railings. Natural revegetation, seeding and/or planting will be done on and around the embankments once the bridge is completed. Several culverts will also be fitted to cross minor watercourses.
- Aggregates and crushed stones will come from two source locations, one of which will be used exclusively during the construction phase (ARA-2) and another (ARA-4) which lifespan will extend during the operation phase to provide aggregates for operations and maintenance of the road. Production activities will include hole drilling, blasting, and rock conveyance to a nearby crushing plant that should include a primary crusher, a secondary crusher, a screening plant, diesel generators, conveyors, a control tower and supporting mobile loaders. The ARA-4 quarry, being in an area far from the WSR, will necessitate the clearing and construction of an access road of 5 km, which will include the crossing of a waterbody.
- Progressive rehabilitation work will be carried out along the WSR as well as at the ARA-2 quarry and the worker camps when construction work is completed or almost completed. The closure of temporary construction camps and laydown areas will involve its clean-up (material, waste, and contaminated soil removal) followed by the levelling and trimming of areas to encourage natural revegetation.

The emission sources considered in the air dispersion modelling in the AQIA included the combustion of diesel fuel or gasoline from land mobile equipment, heavy-duty trucks and light-duty vehicles during the construction and operation phase of the WSR. The modelling also considered fugitive dust emissions mostly from vehicular traffic on the road and the handling of aggregates and other earth materials during construction. The AQIA predicted that vehicular traffic will not create conditions that would increase the ground-level O_3 concentration in ambient air (AtkinsRéalis, 2024a).

This AQIA modelling domain was selected to focus on the impacts within a corridor along the road but also in proximity to sensitive receptors (i.e., current and future residences, institutional buildings, and culturally sensitive areas) as the majority of sensitive receptors are located in the modelling domain and the impacts along the road are expected to be similar for the remaining length (i.e., ~66 km not included in the model). The modelling considered receptors, or areas of interest for potential contaminant concentrations in ambient air, at 50 m and 150 m distance from the road centreline (RCL) and at every 100 m on either side along the road. As discussed in the AQIA, modelling the full length of the road at the proposed receptor resolution would have been computationally prohibitive; focusing on a representative portion of the alignment prioritizes higher-resolution modelling in areas where local-scale air quality effects and interactions with sensitive receptors are most relevant to the objectives of the study.

Discrete receptors were also placed at the air sensitive locations in the area including:

- **Twenty-four (24) existing residences** or group of residences including mostly homes within the community of Webequie.
- **Six (6) institutional buildings** including two schools, a nursing station, a church, a community building, and business center.

- **Twenty-one locations in culturally sensitive areas** including spiritual or sacred spaces for members of the Webequie First Nation and other Indigenous communities and/or stakeholders and locations important for harvesting country foods or hunting.
- **Sixty-seven (67) locations for future residences (RPF)** per the Webequie First Nation On-Reserve Land Use Plan of 2019 distributed amongst four areas (Site A; Site West; Site C and Site D).

The AQIA presented the maximum concentrations expected at these locations for contaminants emitted during each phase with and without mitigation measures in place (AtkinsRéalis, 2024a); however, the HHRA relied on the results with mitigation measures for the conclusions and recommendations of the HHRA, but have included all scenarios assessed in the AQIA to ensure transparency and consideration of risks without mitigation controls. Consistent with the AQIA, the following scenarios have been included in the HHRA:

- Background or baseline concentrations including use of data from MECP's monitoring network, considered in the context of each construction scenario including:
  - Concentrations of contaminants from engines having Tier 3 certification only;
  - Concentrations of contaminants from engines based on the Tier 4 (80%) / Tier 3 (20%) scenario; and
  - Concentrations of particulates and dustfall from fugitive dust emissions based on the scenario without water dust control on the road and the scenario with water dust control.

The results of the AQIA for both the construction and operation phases of the Project are presented in the following sections, with the results used to identify final COPCs to carry forward for evaluation in the HHRA. The HHRA will focus on the results for maximum concentrations calculated at sensitive receptors for contaminants which are meaningfully impacted by the Project as reported by the AQIA.

3.7.1.1 Construction Phase COPCs

The results of the AQIA for the construction phase includes Project-related emissions during the construction phase, as well as baseline (or background) concentrations, and a cumulative scenario (background + Project). The results of the AQIA with and without mitigation measures assumed to be in place are presented in **Table 3-3** through **Table 3-7**. Apart from the contaminants presented in the following tables, no other exceedances were identified at the areas of interest modelled in the AQIA for the construction phase of the Project.

Table 3-4: Maximum Concentrations for Non-Particulate Contaminants Calculated in the Modelling Domain for the Construction Phase (Tier 3 only scenario)

Contaminant	Applicable Standard	Averaging Period	Maximum Project Contribution (A)[1]		Background Concentration (B)[2]		Total (A+B)		Limit Value (μg/m³)
			μg/m³	% limit	μg/m³	% limit	μg/m³	% limit	
Sulphur dioxide (SO_2)	AAQC	10-minute	**14,023**	7,791	149	83	**14,172**	7,873	180
	AAQC	1-hour	**8,499**	8,499	90	90	**8,589**	8,589	100
	CAAQS	1-hour	**8,499**	4,913	18	10	**8,517**	4,923	173
	AAQC	Annual	0.11	1.1	0.50	5.0	**0.61**	6.1	10

Contaminant	Applicable Standard	Averaging Period	Maximum Project Contribution (A)[(1)]		Background Concentration (B)[(2)]		Total (A+B)		Limit Value (µg/m³)
			µg/m³	% limit	µg/m³	% limit	µg/m³	% limit	
Nitrogen dioxide (NO_2)	AAQC	1-hour	**7,519**	1,880	51	13	**7,570**	1,892	400
	CAAQS	1-hour	**2,902**	3,673	28	35	**2,930**	3,709	79
	AAQC	24-hour	**448**	224	23	12	**471**	235	200
	AAQC	Annual	9.9	45	2.6	12	13	57	22
Carbon monoxide (CO)	AAQC	1-hour	**62,703**	173	5061	14	**67,764**	187	36,200
	AAQC	8-hour	7,924	50	3253	21	11,177	71	15,700
1,3-butadiene	AAQC	24-hour	0.52	5.2	0.12	1.2	0.64	6.4	10
	AAQC	Annual	0.0031	0.15	0.010	0.50	0.013	0.65	2.0
Acetaldehyde	AAQC	30-minute	146	29	14	2.8	160	32	500
	AAQC	24-hour	29	5.8	12	2.4	41	8.2	500
Acrolein	AAQC	1-hour	**22**	485	0.040	0.89	**22**	486	4.5
	AAQC	24-hour	**5.3**	1,314	0.040	10	**5.3**	1,324	0.40
Benzene	AAQC	24-hour	**15**	661	0.90	39	**16**	700	2.3
	AAQC	Annual	0.090	20	0.30	67	0.39	87	0.45
Ethylbenzene	AAQC	10-minute	20	1.0	0.28	0.015	20	1.0	1,900
	AAQC	24-hour	2.9	0.29	0.17	0.017	3.0	0.30	1,000
Formaldehyde	AAQC	24-hour	24	37	2.9	4.5	27	41	65
Hexanes	AAQC	24-hour	0.72	0.029	0.45	0.018	1.2	0.047	2,500
Propanal / Propionaldehyde	AAQC	10-minute	**42**	424	1.6	16	**44**	440	10
Toluene	AAQC	24-hour	11	0.53	1.4	0.070	12	0.60	2,000
Xylenes	AAQC	10-minute	142	4.7	0.86	0.029	143	4.8	3,000
	AAQC	24-hour	21	2.8	0.52	0.071	21	2.9	730
B(a)P	AAQC	24-hour	**2.3×10^{-3}**	4,574	**1.2×10^{-4}**	240	**2.4×10^{-3}**	4,814	5×10^{-5}
	AAQC	Annual	**1.2×10^{-5}**	117	**2.0×10^{-5}**	200	**3.2×10^{-5}**	317	1×10^{-5}
Diesel particulate matter (DPM)	HC	2-hour	**1,354**	13,544	0	0	**1,354**	13,544	10
	HC	Annual	1.8	35	0	0	1.8	35	5

Notes:

Concentrations that are greater than the corresponding AAQC, CAAQS or Health Canada (HC) guiding value for DPM are denoted in bold.

(1) Maximum concentration calculated in the modelling domain (at 50 m from the road centerline or at the perimeter of the ARA-2 quarry).

(2) Background concentrations as established in AQIA (AtkinsRéalis, 2024a).

Table 3-5: Maximum Concentrations for Non-Particulate Contaminants Calculated in the Modelling Domain for the Construction Phase (80% Tier 4F and 20% Tier 3 scenario)

Contaminant	Applicable Standard	Averaging Period	Maximum Project Contribution (A) (1)		Background Concentration (B) (2)		Total (A+B)		Limit Value ($\mu g/m^3$)
			$\mu g/m^3$	% limit	$\mu g/m^3$	% limit	$\mu g/m^3$	% limit	
Sulphur dioxide (SO_2)	AAQC	10-minute	**3,043**	1,691	149	83	**3,192**	1,773	180
	AAQC	1-hour	**1,844**	1,844	90	90	**1,934**	1,934	100
	CAAQS	1-hour	**1,844**	1,066	18	10	**1,862**	1,076	173
Nitrogen dioxide (NO_2)	AAQC	1-hour	**4,664**	1,166	51	13	**4,715**	1,179	400
	CAAQS	1-hour	**2,897**	3,667	28	35	**2,925**	3,703	79
	AAQC	24-hour	**321**	161	23	12	**344**	172	200
Carbon monoxide (CO)	AAQC	1-hour	**62,681**	173	5,061	14	**67,742**	187	36,200
	AAQC	8-hour	7,840	50	3,253	21	11,093	71	15,700
Acrolein	AAQC	1-hour	**4.6**	102	0.040	0.89	**4.6**	103	4.5
	AAQC	24-hour	**1.5**	384	0.040	10	**1.6**	394	0.40
Benzene	AAQC	24-hour	**4.4**	193	0.90	39	**5.3**	232	2.3
Formaldehyde	AAQC	24-hour	24	37	2.9	4.5	27	41	65
Propanal / Propionaldehyde	AAQC	10-minute	8.9	89	1.6	16	10	100	10
B(a)P	AAQC	24-hour	**6.3×10^{-4}**	1,260	**1.2×10^{-4}**	240	**7.5×10^{-4}**	1,500	5×10^{-5}
	AAQC	Annual	5.6×10^{-6}	56	**2.0×10^{-5}**	200	**2.6×10^{-5}**	256	1×10^{-5}
Diesel particulate matter (DPM)	HC	2-hour	**275**	2,748	0	0	**275**	2,748	10

Notes:

Concentrations that are greater than the corresponding AAQC, CAAQS or Health Canada (HC) guiding value for DPM are denoted in bold.

(1) Maximum concentration calculated in the modelling domain (at 50 m from the road centerline or at the perimeter of the ARA-2 quarry).

(2) Background concentrations as established in AQIA (AtkinsRéalis, 2024a).

Table 3-6: Maximum Concentrations for Particulates and Dustfall Calculated in the Modelling Domain for the Construction Phase

Contaminant	Applicable Standard	Averaging Period	Maximum Project Contribution (A) (1)		Background Concentration (B) (2)		Total (A+B)		Limit Value ($\mu g/m^3$)
			$\mu g/m^3$	% limit	$\mu g/m^3$	% limit	$\mu g/m^3$	% limit	
Scenario – Unpaved Surface (No Control)									
Total suspended matter (TSP)	AAQC	24-hour	**16,423**	13,686	45	38	**16,468**	13,723	120
	AAQC	Annual	55	92	4.0	6.7	59	98	60
Fine inhalable fraction (PM_{10})	AAQC	24-hour	5,878	11,756	28	56	**5,906**	11,812	50
Fine particulate matter ($PM_{2.5}$) (4)	CAAQS	24-hour	**1,151**	5,006	13	55	**1,164**	5,061	23
	AAQC	24-hour	**1,151**	4,264	13	47	**1,164**	4,311	27
	CAAQS	Annual	3.7	46	4.7	59	**8.4**	104	8.0
	AAQC	Annual	3.7	42	4.7	53	8.4	95	8.8
Dustfall	AAQC	30-days	**10**	143	0.40	5.7	**10**	148	7.0
	AAQC	Annual	**5.2**	114	0.40	8.7	**5.6**	123	4.6
Scenario – Unpaved Surface with Road Water Control									
Total suspended matter (TSP)	AAQC	24-hour	**16,211**	13,510	45	38	**16,256**	13,547	120
	AAQC	Annual	53	89	4.0	6.7	57	96	60
Fine inhalable fraction (PM_{10})	AAQC	24-hour	**5,752**	11,505	28	56	**5,780**	11,561	50
Fine particulate matter ($PM_{2.5}$) (4)	CAAQS	24-hour	**1,141**	4,961	13	55	**1,154**	5,016	23
	AAQC	24-hour	**1,141**	4,226	13	47	**1,154**	4,273	27
	CAAQS	Annual	3.4	43	4.7	59	**8.1**	102	8.0
	AAQC	Annual	3.4	39	4.7	53	8.1	93	8.8
Dustfall	AAQC	30-days	**10**	143	0.40	5.7	**10**	148	7.0
	AAQC	Annual	**4.7**	102	0.40	8.7	**5.1**	110	4.6

Notes:
Concentrations that are greater than the corresponding AAQC or CAAQS are denoted in bold.
(1) Maximum concentration calculated in the modelling domain (at 50 m from the road centerline or at the perimeter of the ARA-2 quarry).
(2) Background concentrations as established in AQIA (AtkinsRéalis, 2024a).

Table 3-7: Maximum Concentrations in Areas of Interest for the Scenario with Tier 4 (80%) / Tier 3 (20%) Engines During the Construction Phase

Sector or Receptor	NO_2			SO_2		CO
	AAQC	CAAQS	AAQC	AAQC	AAQC	AAQC
	1-h	1-h	24-h	10-min	1-h	1-h
Limit value (μg/m³)	**400**	**79**	**200**	**180**	**100**	**36,200**
Project contribution (μg/m³)						
50 m from road centerline (1)	**416**	**392**	194	31	19	1,342
150 m from road centerline (1)	221	**207**	109	30	18	622
300 m from road centerline (1)	154	**148**	95	27	16	554
Quarry perimeter	**4,664**	**2,897**	**321**	**3,043**	**1,844**	**62,681**
Existing residences (RP01) (2)	98	**95**	36	2.8	1.7	83
Institutional buildings (I01) (3)	93	**92**	34	2.1	1.3	66
Culturally sensitive areas (4)						
CHL25 (60 m from RCL)	265	**250**	134	36	22	757
CHL05 (150 m from RCL)	179	**171**	89	10	5.8	410
CHL14 (200 m from RCL)	138	**132**	77	6.9	4.2	241
CHL28 (240 m from RCL)	135	**132**	86	20	12	409
CHL02 (350 m from RCL)	139	**127**	68	4.6	2.8	252
Project contribution + background (μg/m³)						
50 m from road centerline (1)	**467**	**420**	**217**	**180**	**109**	6,403
150 m from road centerline (1)	272	**235**	132	179	**108**	5,683
300 m from road centerline (1)	205	**176**	118	176	**106**	5,615
Quarry perimeter	**4,715**	**2,925**	**344**	**3,192**	**1,934**	**67,742**
Existing residences (RP01) (2)	149	**123**	59	152	92	5,144
Institutional buildings (I01) (3)	144	**120**	57	151	91	5,127
Culturally sensitive area (4)						
CHL25 (60 m from RCL)	316	**278**	157	**185**	**112**	5,818
CHL05 (150 m from RCL)	230	**199**	112	159	96	5,471
CHL14 (200 m from RCL)	189	**160**	100	156	94	5,302
CHL28 (240 m from RCL)	186	**160**	109	169	**102**	5,470
CHL02 (350 m from RCL)	190	**155**	91	154	93	5,313
Exceedance setback from RCL (m) (5)	**50–150**	**n/a**	**50–100**	**50–100**	**100–200**	**< 50**
Exceedance setback from QCP (m) (5)	**500–700**	**n/a**	**100–200**	**500–2,000**	**500–2,000**	**100–200**

Notes:
Concentrations that are greater than the corresponding AAQC or CAAQS are denoted in bold.
(1) To demonstrate the impact of emission sources other than blasts at different setbacks along the WSR, receptors located in the area of influence of the ARA-2 quarry was not considered in determining the maximums at 50, 150 and 300 m.
(2) Closest receptor of this category from the RCL at 1,350 m. Results for other receptors located further away are in AQIA.
(3) Closest receptor of this category from the RCL at 1,800 m.
(4) Only the results for culturally sensitive receptors located within 400 m of the RCL are presented.
(5) Qualifies the distance from the RCL and the quarry center point (QCP) where the standard including the background concentration is exceeded according to calculations.

Table 3-6 (Cont'd): Maximum Concentrations in Areas of Interest for the Scenario with Tier 4 (80%) / Tier 3 (20%) Engines During the Construction Phase

Sector or Receptor	Acrolein		Benzene	Propanal / Propion-aldehyde	B(a)P	DPM
	AAQC	AAQC	AAQC	AAQC	AAQC	HC
	1-h	24-h	24-h	10-min	24-h	2-h
Limit value (μg/m³)	**4.5**	**0.40**	**2.3**	**10**	**0.000050**	**10**
Project contribution (μg/m³)						
50 m from road centerline (1)	4.4	**1.5**	**4.4**	8.6	**0.00063**	**271**
150 m from road centerline (1)	1.9	**0.49**	1.4	3.6	**0.00020**	**116**
300 m from road centerline (1)	1.0	0.27	0.79	2.0	**0.00011**	**60**
Quarry perimeter	1.7	**0.58**	1.7	3.3	**0.00021**	**90**
Existing residences (RP01) (2)	0.27	0.063	0.18	0.52	0.000026	**15**
Institutional buildings (I01) (3)	0.22	0.060	0.17	0.42	0.000025	**12**
Culturally sensitive areas (4)						
CHL25 (60 m from RCL)	2.5	**0.74**	2.1	4.8	**0.00030**	**147**
CHL05 (150 m from RCL)	1.4	0.36	1.0	2.6	**0.00015**	**83**
CHL14 (200 m from RCL)	0.80	0.20	0.58	1.5	**0.000082**	**44**
CHL28 (240 m from RCL)	0.78	0.23	0.67	1.5	**0.000095**	**45**
CHL02 (350 m from RCL)	0.83	0.16	0.47	1.6	**0.000067**	**50**
Project contribution + background (μg/m³)						
50 m from road centerline (1)	**4.5**	**1.6**	**5.3**	**10.2**	**0.00075**	**271**
150 m from road centerline (1)	1.9	**0.53**	**2.31**	5.2	**0.00032**	**116**
300 m from road centerline (1)	1.1	0.31	1.7	3.6	**0.00023**	**60**
Quarry perimeter	1.8	**0.62**	**2.6**	4.9	**0.00033**	**90**
Existing residences (RP01) (2)	0.31	0.10	1.1	2.1	**0.00015**	**15**
Institutional buildings (I01) (3)	0.26	0.10	1.1	2.0	**0.00015**	**12**
Culturally sensitive area (4)						
CHL25 (60 m from RCL)	2.5	**0.78**	**3.0**	6.4	**0.00042**	**147**
CHL05 (150 m from RCL)	1.4	0.399	1.9	4.2	**0.00027**	**83**
CHL14 (200 m from RCL)	0.84	0.24	1.5	3.1	**0.00020**	**44**
CHL28 (240 m from RCL)	0.82	0.27	1.6	3.1	**0.00022**	**45**
CHL02 (350 m from RCL)	0.87	0.20	1.4	3.2	**0.00019**	**50**
Exceedance setback from RCL (m) (5)	**50–100**	**100–200**	**100–200**	**50–150**	**n/a**	**> 2,000**
Exceedance setback from QCP (m) (5)	**< 100**	**150–250**	**100–200**	**< 100**	**n/a**	**> 2,000**

Notes:
Concentrations that are greater than the corresponding AAQC or CAAQS are denoted in bold.
(1) In order to demonstrate the impact of emission sources other than blasts at different setbacks along the WSR, receptors located in the area of influence of the ARA-2 quarry was not considered in determining the maximums at 50, 150 and 300 m.
(2) Closest receptor of this category from the RCL at 1,350 m. Results for other receptors located further away are in Appendix B of the AQIA.

(3) Closest receptor of this category from the RCL at 1,800 m.
(4) Only the results for culturally sensitive receptors located within 400 m of the RCL are presented.
(5) Qualifies the distance from the RCL and the quarry center point (QCP) where the standard including the background concentration is exceeded according to calculations.

Table 3-8: Maximum Particulate Concentrations and Dust Depositions in Areas of Interest for the Scenario with Water Dust Control on Road Surfaces During the Construction Phase

Sector or Receptor	TSP	PM_{10}	$PM_{2.5}$		Dustfall	
	AAQC	AAQC	CAAQS	CAAQS	AAQC	AAQC
	24-h	24-h	24-h	Annual	30-days	Annual
Limit value (µg/m³)	**120**	**50**	**23**	**8.0**	**7.0**	**4.6**
Project contribution (µg/m³)						
50 m from road centerline (1)	**16,211**	**5,752**	**1,141**	1.5	**10**	3.8
150 m from road centerline (1)	**2,610**	**1,283**	**189**	0.49	5.0	1.1
300 m from road centerline (1)	**1,102**	**672**	**96**	0.35	2.5	0.64
Quarry perimeter	**1,595**	**815**	**105**	3.4	**9.7**	**4.7**
Existing residences (RP01) (2)	**140**	**141**	**24**	0.061	0.24	0.048
Institutional buildings (I01) (3)	**135**	**130**	20	0.052	0.20	0.040
Culturally sensitive areas (4)						
CHL25 (60 m from RCL)	**5,701**	**2,448**	**381**	0.59	**7.8**	1.3
CHL05 (150 m from RCL)	**1,828**	**934**	**146**	0.45	3.3	0.82
CHL14 (200 m from RCL)	**1,179**	**549**	**103**	0.38	2.8	0.71
CHL28 (240 m from RCL)	**1,068**	**587**	**88**	0.20	1.7	0.24
CHL02 (350 m from RCL)	**629**	**383**	**68**	0.15	1.2	0.20
CHL06 (400 m from RCL)	**601**	**406**	**75**	0.20	1.3	0.25
Project contribution + background (µg/m³)						
50 m from road centerline (1)	**16,256**	**5,780**	**1,154**	6.2	**10**	4.2
150 m from road centerline (1)	**2,655**	**1,311**	**201**	5.2	5.4	1.5
300 m from road centerline (1)	**1,147**	**700**	**108**	5.0	2.9	1.0
Quarry perimeter	**1,640**	**843**	**117**	**8.1**	**10**	**5.1**
Existing residences (RP01) (2)	**185**	**169**	**37**	4.8	0.64	0.45
Institutional buildings (I01) (3)	**180**	**158**	**33**	4.8	0.60	0.44
Culturally sensitive area (4)						
CHL25 (60 m from RCL)	**5,746**	**2,476**	**394**	5.3	**8.2**	1.7
CHL05 (150 m from RCL)	**1,873**	**962**	**159**	5.1	3.7	1.2
CHL14 (200 m from RCL)	**1,224**	**577**	**116**	5.1	3.2	1.1
CHL28 (240 m from RCL)	**1,113**	**615**	**101**	4.9	2.1	0.64
CHL02 (350 m from RCL)	**674**	**411**	**80**	4.8	1.6	0.60
CHL06 (400 m from RCL)	**646**	**434**	**87**	4.9	1.7	0.65

Notes:
Concentrations that are greater than the corresponding AAQC or CAAQS are denoted in bold.
(1) In order to demonstrate the impact of emission sources other than blasts at different setbacks along the WSR, receptors located in the area of influence of the ARA-2 quarry was not considered in determining the maximums at 50, 150 and 300 m.

(2) Closest receptor of this category from the RCL at 1,350 m. Results for other receptors located further away are in Appendix B of the AQIA.
(3) Closest receptor of this category from the RCL at 1,800 m.
(4) Only the results for culturally sensitive receptors located within 400 m of the RCL are presented.

As shown in **Table 3-6** and **Table 3-7**, the following contaminants had maximum predicted concentrations identified in one or more areas of interest with sensitive receptors (e.g., culturally significant areas, current/future residences, institutional buildings) and have been carried forward for further evaluation in the HHRA:

- Maximum concentrations of PM_{10} (24-hour), $PM_{2.5}$ (24-hour), TSP (24-hour), SO_2 (10 minute and 1-hour), NO_2 (1-hour), DPM (2-hour), acrolein (24-hour), benzene (24-hour), B(a)P (24-hour), and dustfall (30 days) based on predicted/estimated exceedances of the applicable air quality benchmarks.

The following factors should be considered when assessing the impact of the construction phase on air quality:

- The potential exceedances at areas of interest only concern short-term AAQC (24-hours and less, except for dustfall, which is further discussed below) and could only occur over a short period (i.e., 1-2 days) at each receptor given that the emission sources will be moving as road construction progresses.
- As it is not possible to define the exact combination and distribution of equipment, or the activities that will occur at individual sections of the road during construction, all potential emissions (dozers, excavators, loaders, etc.) were combined as a single source and assumed to be operating concurrently as a simplified but conservative approach. For example, all three dozers and graders available on site were assumed to be in operation at the same time and near one another, which results in higher localized concentrations than is unlikely to reflect reality (at a minimum, there would be some distance between the pieces of machinery).
- The Air Quality and Dust Control Management Plan will not be limited to the mitigation measures assumed in the AQIA, with many other options available to mitigate dust generation and exhaust emissions. This is further discussed in **Section 6.1**.

As the HHRA does not consider short-term occupational exposures (e.g., those associated with concentrations predicted near the road centreline), the exceedances predicted at areas of interest (i.e., current and future residences, institutional buildings and culturally sensitive areas) will be relied upon for decision making purposes in the HHRA. Quantitative evaluation for concentrations near the road centre line, along with those for sensitive receptors (e.g., community members in residences, institutional buildings and those at culturally sensitive areas), is presented in Appendix B.

Based on the rationale, **Table 3-8**, below, presents the COPCs carried forward in air for the construction phase of the Project.

Table 3-9: COPCs in Air – Construction Phase

COPC	Concentration (Project µg/m³)	Concentration (Cumulative, Project + Background µg/m³)	Limit Value (µg/m³)
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Tier 4(80%) /Tier 3(20%) Engines			
NO_2	**95**	**123**	79 (1-hour CAAQS)
B(a)P	0.000026	**0.00015**	0.000050 (24-hour AAQC)
DPM	**15**	**15**	10 (2-hour Health Canada)

COPC	Concentration (Project µg/m³)	Concentration (Cumulative, Project + Background µg/m³)	Limit Value (µg/m³)
Scenario: Nearest Sensitive Receptor (Culturally Sensitive Area CHL25 (60 m from RCL) with Tier 4(80%) /Tier 3(20%) Engines			
NO_2	**250**	**278**	79 (1-hour CAAQS)
SO_2	36	**185**	180 (10-minute AAQC)
SO_2	22	**112**	100 (1-hour AAQC)
Acrolein	**0.74**	**0.78**	0.40 (24-hour AAQC)
Benzene	2.1	**3.0**	2.3 (24-hour AAQC)
B(a)P	**0.00030**	**0.00042**	0.000050 (24-hour AAQC)
DPM	**147**	**147**	10 (2-hour Health Canada)
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Water Dust Control on Road Surfaces			
TSP	**140**	**185**	120 (24-hour AAQC)
PM_{10}	**141**	**169**	50 (24-hour AAQC)
$PM_{2.5}$	**24**	**37**	23 (24-hour CAAQS)
Scenario: Nearest Sensitive Receptor (Culturally Sensitive Areas CHL25 60 m from RCL) with Water Dust Control on Road Surfaces			
TSP	**5701**	**5746**	120 (24-hour AAQC)
PM_{10}	**2448**	**2476**	50 (24-hour AAQC)
$PM_{2.5}$	**381**	**394**	23 (24-hour CAAQS)
Dustfall (1)	**7.8**	**8.2**	7.0 (30 days AAQC)

Notes:
Concentrations that are greater than the corresponding AAQC or CAAQS are denoted in **bold**.
(1) Limited to CHL25, not identified at other areas/points of interest for sensitive receptors, no annualized exceedances identified at CHL25 or other areas/points of interest for sensitive receptors.

In the case of 30-day dustfall, as outlined in the AQIA (AtkinsRéalis, 2024a), the maximum calculated dustfall does not exceed the AAQC of 7.0 µg/m^2 per 30-days at sensitive receptors, except for a single culturally sensitive location nearby the WSR footprint. A similar trend is observed regarding the annualized dustfall calculations with no exceedances at 50 m from RCL nor at sensitive receptors. While direct control on emissions from vehicle engines is not possible, dust emissions from the road surface can be effectively managed (AtkinsRéalis, 2024a). Considering that part of the road will not be fully surfaced with asphalt or chip seal from the start, the maintenance crew will have a water truck available that will spray water over the gravel-surface road from April to November, when needed (AtkinsRéalis, 2024a). Similarly, the HHRA recommends dust control measures to supress dust if exceedances of the air quality guidelines are identified. Therefore, while identified as a COPC that requires monitoring and mitigation, dustfall was not retained as a COPC for quantitative evaluation of exposures and associated risks.

In addition, to estimate Project scenario concentrations of metals in dust (i.e., TSP) generated from soils in the LSA, soil data collected as part of the Eagle's Nest EA (see Appendix A), located in the Ring of Fire, has been used. It is noted that baseline soil data from the Project study area was collected as part of the country foods baseline assessment; however, the data collected is representative of peat which, based on moisture content, is less likely to generate dust when disturbed. A review of the Eagle's Nest soil data indicates that concentrations of all metals were higher in the Eagle's Nest soils than in the peat samples collected during the country foods assessment. As such, use of the Eagle's Nest data is considered conservative and health protective. Except for leachate testing, gravel has not been characterized at this time. Given the lack of data for gravel, the HHRA will be revisited based on the results of the analysis once it is available (see **Section 8.3**).

A total of eight soil samples (+ one duplicate) were collected to characterize baseline soil conditions as part of the Eagle's Nest EA. As dusts would be generated from soils from various areas across the LSA and based on the assumption that the soil data is representative of the LSA, dust concentrations from soil were estimated using 95% upper confidence limit of the mean (UCLM) concentrations of the metals in soil. The 95% UCLMs were calculated using US EPA ProUCL Version 5.2, which explicitly considers non-detect observations.

Health Canada (2024) recommends a default dust (PM_{10}) concentration for unpaved roads of 250 µg/m³. However, as the Ontario AAQC for metals are based on metals in TSP, the maximum predicted TSP concentration at a sensitive receptor has been used along with the above discussed baseline soil data to predict metals concentrations in TSP. As presented in **Tables 3-3** to **Table 3-7**, only short-term (24-hour) exceedances of TSP were predicted, with all predicted concentrations less than the annual AAQC. On this basis, and as exceedances at each location will only be on a short-term basis given that the emission sources will be moving as road construction progresses, metals concentrations in TSP were only predicted for this scenario (i.e., 24-hours).

Table 4a through Table 4c of Appendix B presents the estimated construction phase concentrations of metals in soil particulate. It is noted that baseline concentrations of metals in soil particulate have been estimated using the baseline Eagle's Nest soil data and the baseline TSP concentration of 45 µg/m³ with TSP concentrations for the project being based on those identified for each scenario in the AQIA (presented in Table 4a through Table 4c of Appendix B). The predicted 24-hour TSP metals concentrations have been compared to the Ontario AAQC for metals. **Table 3-9**, below, summarizes the metals and scenarios for which predicted concentrations exceeded the Ontario AAQC, these metals were retained as COPCs in the HHRA. All remaining metals were below their respective guidelines.

Table 3-10: Metals COPCs in Air (24-hour TSP) – Construction Phase

Metal	95% UCLM Soil Concentration (µg/g)	Construction Phase Soil Particulate Concentration (µg/m³)**	Baseline Soil Particulate Concentration (µg/m³)	Baseline + Construction Phase Soil Particulate Concentration (µg/m³)	Ontario's Ambient Air Quality Criteria* (µg/m³)
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Tier 4(80%) /Tier 3(20%) Engines					
Chromium (VI)	8.6	**0.00120**	0.000386	**0.001588**	0.0007(24-hour) (VI)
Iron (Fe)	33717	**4.72038**	1.517265	**6.237645**	4 (24-hour)
Scenario: Nearest Sensitive Receptor Culturally Sensitive Area CHL25 (60 m from RCL) with Tier 4(80%) /Tier 3(20%) Engines					
Chromium (VI)	8.6	**0.04895**	0.000386	**0.049334**	0.0007(24-hour) (VI)
Iron (Fe)	33717	**192.22062**	1.517265	**193.737882**	4 (24-hour)
Nickel (Ni)	37.8	**0.21550**	0.001701	**0.217199**	0.2 (24-hour)

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

* Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

** Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at the sensitive receptor.

*** No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

BOLD Exceeds AAQC.

Despite the conservative approach used to estimate the metals concentrations in TSP, only hexavalent chromium, nickel and iron were identified as having the potential to exceed their respective AAQC. On this basis, in addition to PM_{10} (24-hour), $PM_{2.5}$ (24-hour), TSP (24-hour), SO_2 (10 minute and 1-hour), NO_2 (1-hour), DPM (2-hour), acrolein (24-hour), benzene (24-hour) and B(a)P (24-hour); hexavalent chromium, nickel and iron have been retained as COPCs in air for the construction phase of the Project based on estimated concentrations at points of interest (e.g., locations of sensitive receptors such as current/future residences, institutional buildings and areas identified by WSR community members as being of cultural importance).

As noted, the exceedances predicted by the AQIA for the air COPCs (except metals) were only for the short-term (24-hour or less) guidelines, and thus, only acute exposures will be evaluated in the HHRA for these CACs.

3.7.1.2 Operation Phase

The results of the AQIA for the operation phase, which includes Project-related emissions during the operation phase considered cumulatively with baseline conditions, both with and without mitigation measures assumed to be in place, are presented in **Table 3-10** through **Table 3-13**.

Table 3-11: Maximum Concentrations for Non-Particulate Contaminants Calculated for the Operation Phase

Pollutant	Applicable Standard	Averaging Period	Maximum Project Contribution (A)		Background Concentration (B)		Total (A+B)		Limit Value (µg/m³)
			µg/m³	% limit	µg/m³	% limit	µg/m³	% limit	
Sulphur dioxide (SO_2)	AAQC	10-minute	0.31	0.17	149	83	149	83	180
	AAQC	1-hour	0.19	0.19	90	90	90	90	100
	CAAQS	1-hour	0.19	0.11	18	10	18	11	173
	AAQC & CAAQS	Annual	0.0020	0.020	0.50	5.0	0.50	5.0	10
Nitrogen dioxide (NO_2)	AAQC	1-hour	18	4.5	51	13	69	17	400
	CAAQS	1-hour	18	23	28	35	46	59	79
	AAQC	24-hour	2.9	1.5	23	12	26	13	200
	AAQC & CAAQS	Annual	0.32	1.4	2.6	12	2.9	13	22
Carbon monoxide (CO)	AAQC	1-hour	55	0.15	5,061	14	5 116	14	36,200
	AAQC	8-hour	13	0.082	3,253	21	3 266	21	15,700
1,3-butadiene	AAQC	24-hour	0.00087	0.0087	0.12	1.2	0.12	1.2	10
	AAQC	Annual	0.000056	0.0028	0.010	0.50	0.010	0.50	2.0
Acetaldehyde	AAQC	30-minute	0.55	0.11	14	2.8	15	2.9	500
	AAQC	24-hour	0.076	0.015	12	2.4	12	2.4	500

Pollutant	Applicable Standard	Averaging Period	Maximum Project Contribution (A)		Background Concentration (B)		Total (A+B)		Limit Value (µg/m³)
			µg/m³	% limit	µg/m³	% limit	µg/m³	% limit	
Acrolein	AAQC	1-hour	0.066	1.5	0.040	0.89	0.11	2.4	4.5
	AAQC	24-hour	0.011	2.7	0.040	10	0.051	13	0.40
Benzene	AAQC	24-hour	0.014	0.61	0.90	39	0.91	40	2.3
	AAQC	Annual	0.00089	0.20	0.30	67	0.30	67	0.45
Ethylbenzene	AAQC	10-minute	0.13	0.0066	0.28	0.015	0.41	0.021	1,900
	AAQC	24-hour	0.012	0.0012	0.17	0.017	0.18	0.018	1,000
Formaldehyde	AAQC	24-hour	0.24	0.36	2.9	4.5	3.1	4.8	65
Hexanes	AAQC	24-hour	0.0059	<0.001	0.45	0.018	0.46	0.018	2,500
Propanal / Propionaldehyde	AAQC	10-minute	0.034	0.34	1.6	16	1.6	16	10
Toluene	AAQC	24-hour	0.033	0.0016	1.4	0.070	1.4	0.072	2,000
Xylenes	AAQC	10-minute	0.92	0.031	1.6	0.053	2.5	0.084	3,000
	AAQC	24-hour	0.092	0.013	0.52	0.071	0.61	0.084	730
B(a)P	AAQC	24-hour	4.6×10^{-7}	0.93	**1.2×10^{-4}**	240	**1.2×10^{-4}**	241	5×10^{-5}
	AAQC	Annual	2.6×10^{-8}	0.26	**2.0×10^{-5}**	200	**2.0×10^{-5}**	200	1×10^{-5}
Diesel particulate matter (DPM)	HC	2-hour	0.80	8.0	0	0	0.80	8.0	10
	HC	Annual	0.0079	0.16	0	0	0.0079	0.16	5

Notes:
Concentrations that are greater than the corresponding AAQC, CAAQS or Health Canada (HC) guiding value for DPM are denoted in bold.

Table 3-12: Maximum Concentrations for Particulates and Dustfall Calculated for the Operation Phase

Pollutant	Applicable Standard	Averaging Period	Maximum Project Contribution (A)		Background Concentration (B)		Total (A+B)		Limit Value (µg/m³)
			µg/m³	% limit	µg/m³	% limit	µg/m³	% limit	
Scenario – Unpaved Surface (No Control)									
Total suspended matter (TSP)	AAQC	24-hour	**1,392**	1,160	45	38	**1,437**	1,197	120
	AAQC	Annual (3)	**100**	167	4.0	6.7	**104**	173	60
Fine inhalable fraction (PM_{10})	AAQC	24-hour	**506**	1,013	28	56	**534**	1,069	50
Fine particulate matter ($PM_{2.5}$) (4)	CAAQS	24-hour	**31**	135	13	57	**44**	191	23
	AAQC	24-hour	**31**	115	13	48	**44**	163	27
	CAAQS	Annual	4.7	59	4.7	59	**9.4**	118	8.0
	AAQC	Annual	4.7	54	4.7	53	**9.4**	107	8.8
Dustfall	AAQC	30-days	**26**	377	0.40	5.7	**27**	383	7.0
	AAQC	Annual	**14**	308	0.40	8.7	**15**	317	4.6

Pollutant	Applicable Standard	Averaging Period	Maximum Project Contribution (A)		Background Concentration (B)		Total (A+B)		Limit Value (µg/m³)
			µg/m³	% limit	µg/m³	% limit	µg/m³	% limit	
Scenario – Unpaved Surface (Water Control)									
Total suspended matter (TSP)	AAQC	24-hour	**1,031**	859	45	38	**1,076**	897	120
	AAQC	Annual (3)	**97**	161	4.0	6.7	**101**	168	60
Fine inhalable fraction (PM_{10})	AAQC	24-hour	**355**	709	28	56	**383**	765	50
Fine particulate matter ($PM_{2.5}$)	CAAQS	24-hour	22	97	13	57	**35**	153	23
	AAQC	24-hour	22	82	13	48	**35**	131	27
	CAAQS	Annual	3.7	46	4.7	59	**8.4**	105	8.0
	AAQC	Annual	3.7	42	4.7	53	**8.4**	95	8.8
Dustfall	AAQC	30-days	**19**	264	0.40	5.7	**19**	270	7.0
	AAQC	Annual	**11**	234	0.40	8.7	**11**	243	4.6
Scenario – Paved Surface									
Total suspended matter (TSP)	AAQC	24-hour	97	81	45	38	**142**	118	120
	AAQC	Annual	16	26	4.0	6.7	20	33	60
Fine inhalable fraction (PM_{10})	AAQC	24-hour	45	89	28	56	**73**	145	50
Fine particulate matter ($PM_{2.5}$)	CAAQS	24-hour	4.6	20	13	57	18	76	23
	AAQC	24-hour	4.6	17	13	48	18	65	27
	CAAQS	Annual	1.0	13	4.7	59	5.7	71	8.0
	AAQC	Annual	1.0	12	4.7	53	5.7	65	8.8
Dustfall	AAQC	30-days	2.5	36	0.40	5.7	2.9	42	7.0
	AAQC	Annual	1.8	39	0.40	8.7	2.2	48	4.6

Notes:
Concentrations that are greater than the corresponding AAQC or CAAQS are denoted in bold.

Table 3-13: Maximum Concentrations in Areas of Interest for the Scenario with Unpaved Surface and Water Control During the Operation Phase

Sector or Receptor	TSP		PM_{10}	$PM_{2.5}$		Dustfall		NO_2
	24-hour	Annual	24-hour	24-hour	Annual	30-day	Annual	1-hour
Limit value (µg/m³)	**120**	**60**	**50**	**23**	**8.0**	**7.0**	**4.6**	**79**
Project contribution (µg/m³)								
50 m from road centerline	**1,031**	**97**	**355**	22	3.7	**19**	**11**	18
150 m from road centerline	**463**	26	**167**	9.4	1.2	5.0	2.7	11
300 m from road centerline	**329**	16	**114**	5.8	0.77	2.6	1.5	7.3
Existing residences (RP01) (1)	43	1.6	28	1.5	0.11	0.23	0.11	1.9
Institutional buildings (I01) (2)	35	1.4	24	1.5	0.10	0.21	0.10	1.7
Culturally sensitive areas (3)								
CHL25 (60 m from RCL)	**673**	40	**225**	14	1.6	**7.8**	3.8	11

Sector or Receptor	TSP		PM_{10}	$PM_{2.5}$		Dustfall		NO_2
	24-hour	**Annual**	**24-hour**	**24-hour**	**Annual**	**30-day**	**Annual**	**1-hour**
CHL05 (150 m from RCL)	**231**	19	**114**	6.9	0.93	2.6	1.7	5.0
CHL14 (200 m from RCL)	**192**	17	**98**	6.4	0.86	2.8	1.6	4.0
CHL28 (240 m from RCL)	**190**	8.6	**92**	5.0	0.48	1.3	0.69	5.8
Future residences (4)								
RPF01 (site A) (1 km RCL)	43	1.6	29	1.5	0.11	0.23	0.12	1.9
RPF10 (site West) (2 km RCL)	38	1.2	25	1.3	0.085	0.17	0.082	1.5
RPF39 (site C) (100 m from RCL)	**537**	24	**200**	11	1.1	4.2	2.0	11
RPF42 (site D) (55 m from RCL)	**675**	54	**243**	15	2.1	**11**	**5.8**	11
Project contribution + background (μg/m³)								
50 m from road centerline	**1,076**	**101**	**383**	**35**	**8.4**	**19**	**11**	46
150 m from road centerline	**508**	30	**195**	22	5.9	5.4	3.1	39
300 m from road centerline	**374**	20	**142**	19	5.5	3.0	1.9	35
Existing residences (RP01) (1)	88	5.6	**56**	15	4.8	0.63	0.51	30
Institutional buildings (I01) (2)	80	5.4	**52**	14	4.8	0.61	0.50	30
Culturally sensitive area (3)								
CHL25 (60 m from RCL)	**718**	44	**253**	**27**	6.3	**8.2**	4.2	39
CHL05 (150 m from RCL)	**276**	23	**142**	20	5.6	3.0	2.1	33
CHL14 (200 m from RCL)	**237**	21	**126**	19	5.6	3.2	2.0	32
CHL28 (240 m from RCL)	**235**	13	**120**	18	5.2	1.7	1.1	34
Future residences (4)								
RPF01 (site A) (1 km RCL)	88	5.6	**57**	15	4.8	0.63	0.52	30
RPF10 (site West) (2 km RCL)	83	5.2	**53**	14	4.8	0.57	0.48	30
RPF39 (site C) (100 m from RCL)	**582**	28	**228**	**24**	5.8	4.6	2.4	39
RPF42 (site D) (55 m from RCL)	**720**	58	**271**	**28**	6.8	**11**	**6.2**	39

Notes:
Concentrations that are greater than the corresponding AAQC or CAAQS are denoted in bold.
(1) Closest receptor of this category from the RCL at 1,350 m. Results for other receptors located further away are in Appendix B of the AQIA.
(2) Closest receptor of this category from the RCL at 1,800 m.
(3) Only the results for culturally sensitive receptors located within 250 m of the RCL are presented.
(4) Only the results for the receptors closest to the RCL for each future residence areas are provided.

Table 3-14: Maximum Concentrations in Areas of Interest for the Scenario with Paved Surface During the Operation Phase

Sector or Receptor	TSP		PM_{10}	$PM_{2.5}$		Dustfall	
	24-hour	Annual	24-hour	24-hour	Annual	30-day	Annual
Limit value (µg/m³)	**120**	**60**	**50**	**23**	**8.0**	**7.0**	**4.6**
Project contribution (µg/m³)							
50 m from road centerline	97	16	45	4.6	1.0	2.5	1.8
150 m from road centerline	36	4.2	23	2.0	0.34	0.73	0.45
300 m from road centerline	25	2.5	17	1.3	0.22	0.42	0.26
Existing residences (RP01) (1)	3.1	0.25	3.0	0.35	0.033	0.028	0.019
Institutional buildings (I01) (2)	3.0	0.22	2.9	0.30	0.029	0.023	0.016
Culturally sensitive areas (3)							
CHL25 (60 m from RCL)	56	6.3	25	2.7	0.45	0.98	0.65
CHL05 (150 m from RCL)	20	3.1	12	1.5	0.27	0.46	0.30
CHL14 (200 m from RCL)	13	1.8	10	1.0	0.17	0.22	0.16
CHL28 (240 m from RCL)	15	1.4	10	1.2	0.14	0.18	0.12
Future residences (4)							
RPF01 (site A) (1 km RCL)	3.4	0.26	3.0	0.35	0.033	0.028	0.019
RPF10 (site West) (2 km RCL)	2.7	0.18	2.5	0.29	0.024	0.020	0.013
RPF39 (site C) (100 m from RCL)	44	3.7	22	2.3	0.30	0.56	0.35
RPF42 (site D) (55 m from RCL)	60	8.5	23	3.1	0.58	1.4	0.97
Project contribution + background (µg/m³)							
50 m from road centerline	**142**	20	**73**	18	5.7	2.9	2.2
150 m from road centerline	81	8.2	**51**	15	5.0	1.1	0.85
300 m from road centerline	70	6.5	45	14	4.9	0.82	0.66
Existing residences (RP01) (1)	48	4.3	31	13	4.7	0.43	0.42
Institutional buildings (I01) (2)	48	4.2	31	13	4.7	0.42	0.42
Culturally sensitive area (3)							
CHL25 (60 m from RCL)	101	10	**53**	16	5.2	1.4	1.0
CHL05 (150 m from RCL)	65	7.1	40	14	5.0	0.86	0.70
CHL14 (200 m from RCL)	58	5.8	38	14	4.9	0.62	0.56
CHL28 (240 m from RCL)	60	5.4	38	14	4.8	0.58	0.52
Future residences (4)							
RPF01 (site A) (1 km RCL)	48	4.3	31	13	4.7	0.43	0.42
RPF10 (site West) (2 km RCL)	48	4.2	31	13	4.7	0.42	0.41
RPF39 (site C) (100 m from RCL)	89	7.7	**50**	15	5.0	0.96	0.75
RPF42 (site D) (55 m from RCL)	105	13	**51**	16	5.3	1.8	1.4
Exceedance setback from RCL (m)	**50–100**	**< 50**	**50–100**	**< 50**	**< 50**	**< 50**	**< 50**

Notes:

Concentrations that are greater than the corresponding AAQC or CAAQS are denoted in bold.

(1) Closest receptor of this category from the RCL at 1,350 m. Results for other receptors located further away are in Appendix B of the AQIA.

(2) Closest receptor of this category from the RCL at 1,800 m.
(3) Only the results for culturally sensitive receptors located within 250 m of the RCL are presented.
(4) Only the results for the receptors closest to the RCL for each future residence areas are provided.

Despite the conservative approach used for the air dispersion modelling included in the AQIA (AtkinsRéalis, 2024a), the predicted concentrations of all potential air contaminants during the operations phase, except for PM_{10} (24-hour), $PM_{2.5}$ (24-hour), TSP (24-hour) and dustfall (30 days), were below all applicable AAQC and CAAQS without mitigation, and thus, the data for those parameters for the operation phase have not been re-presented here.

Table 3-10 through **Table 3-13** presents the operation phase air dispersion modelling results for parameters predicted to exceed the applicable air quality guidelines, with and without paved surfaces and dust control. The COPCs for the operations phase for the HHRA are presented in **Table 3-14**. As discussed for the construction phase, only the exceedances at areas of interest for sensitive receptors were carried forward for evaluation in the HHRA although risk estimates for other scenarios are provided for transparency in Appendix B.

Table 3-15: COPCs in Air – Operations Phase

COPC	Concentration (Project µg/m³)	Concentration (Cumulative, Project + Background µg/m³)	Limit Value (µg/m³)
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Unpaved Surface and Water Control			
PM_{10}	28	**56**	50 (24-hour AAQC)
Scenario: Nearest Sensitive Receptor (Future Residences) with Unpaved Surface and Water Control			
TSP	**675**	**720**	120 (24-hour AAQC)
PM_{10}	**243**	**271**	50 (24-hour AAQC)
$PM_{2.5}$	15	**28**	23 (24-hour CAAQS)
Dustfall	**11**	**11**	7.0 (30 days AAQC)
Scenario: Nearest Sensitive Receptor (Culturally Sensitive Area CHL25 (60 m from RCL) with Unpaved Surface and Water Control			
TSP	**673**	**718**	120 (24-hour AAQC)
PM_{10}	**225**	**253**	50 (24-hour AAQC)
$PM_{2.5}$	14	**27**	23 (24-hour CAAQS)
Dustfall	**7.8**	**8.2**	7.0 (30 days AAQC)
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Paved Surface			
None			
Scenario: Nearest Sensitive Receptor (Future Residences) with Paved Surface			
PM_{10}	23	**51**	50 (24-hour AAQC)
Scenario: Nearest Sensitive Receptor (Culturally Sensitive Area CHL25 (60 m from RCL) with Paved Surface			
PM_{10}	25	**53**	50 (24-hour AAQC)

Notes:
Concentrations that are greater than the corresponding AAQC or CAAQS are denoted in **bold**.

As detailed in AtkinsRéalis (2024a), maximum calculated dustfall concentrations at existing residences, institutional buildings, culturally sensitive areas, and future residences are 0.23, 0.21, 7.8 and 11 µg/m^2 over 30-days of deposition, respectively. Hence, for some sensitive receptors, the criteria of 7.0 µg/m^2

representing the accepted threshold in Ontario for soil and vegetation is exceeded for the unpaved road surface with water control scenario (AtkinsRéalis, 2024a). When analysing the scenario using a paved surface, the maximum dust depositions at 50 m from RCL, including all sensitive receptors, comply with the applicable AAQC (AtkinsRéalis, 2024a). The frequency of the exceedance for the unpaved road surface with water control scenario was 1 or 1.7% of the time based on the 5-year meteorological dataset and given the short period of dust emissions in an area, which deposited dust likely be washed away with precipitation and other natural phenomenon (AtkinsRéalis, 2024a). Nonetheless, a dust control management plan was recommended in the AQIA with the HHRA similarly recommending dust control measures. Therefore, while identified as a COPC that requires monitoring and mitigation, dustfall was not retained forward as a COPC for quantitative evaluation of exposures and associated risks.

As with the construction phase, the Eagle's Nest EA soil data was used to predict concentrations of metals in soil particulate during the operations phase of the Project. As noted, the road will eventually be fully surfaced with asphalt or chipseal, however; as it won't be initially, the AQIA assumed the surfacing was not in place. Further, the AQIA indicates that during the operations phase, the predicted TSP and PM_{10} concentrations are primarily associated with road dust. On this basis, the maximum predicted TSP concentration for the operations phase at the location(s) of the sensitive receptors (areas of interest) have conservatively been used to predict the concentrations of metals in soil particulate during the operations phase.

As with the construction phase, the metals concentrations were predicted using the maximum 24-hour TSP and have been compared to the Ontario AAQCs for metals.

Table 4d through Table 4k of Appendix B presents the estimated operations metals concentrations in TSP for each scenario compared to the Ontario AAQCs for metals. **Table 3-15**, below, presents the estimated operations phase concentrations of metals in TSP which exceeded the Ontario AAQCs for metals, with all remaining parameters were below their respective AAQCs.

Table 3-16: Metals COPCs in Air (24-hour TSP) – Operations Phase

Metal	95% UCLM Soil Concentration (µg/g)	Operations Phase Soil Particulate Concentration (µg/m³)**	Baseline Soil Particulate Concentration (µg/m³)	Operations Phase + Baseline Soil Particulate Concentration (µg/m³)	Ontario's Ambient Air Quality Criteria* (µg/m³)
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Unpaved Surface and Water Control					
Chromium (VI)	8.6	0.00037	0.000386	**0.000756**	**0.0007(24-hour) (VI)**
Scenario: Nearest Sensitive Receptor CHL25 (60 m from RCL) with Unpaved Surface and Water Control					
Chromium (VI)	8.6	**0.00578**	0.000386	**0.006165**	**0.0007(24-hour) (VI)**
Iron (Fe)	33717	**22.69154**	1.517265	**24.208806**	**4 (24-hour)**
Scenario: Nearest Sensitive Receptor (Future Residences) with Unpaved Surface and Water Control					
Chromium (VI)	8.6	**0.00580**	0.000386	**0.006182**	**0.0007(24-hour) (VI)**
Iron (Fe)	33717	**22.75898**	1.517265	**24.276240**	**4 (24-hour)**
Scenario: Nearest Sensitive Receptor CHL25 (60 m from RCL) with Paved Surface					
Chromium (VI)	8.6	0.00048	0.000386	**0.000867**	**0.0007(24-hour) (VI)**

Metal	95% UCLM Soil Concentration (µg/g)	Operations Phase Soil Particulate Concentration (µg/m³)**	Baseline Soil Particulate Concentration (µg/m³)	Operations Phase + Baseline Soil Particulate Concentration (µg/m³)	Ontario's Ambient Air Quality Criteria* (µg/m³)
Scenario: Nearest Sensitive Receptor (Future Residences) with Paved Surface					
Chromium (VI)	8.6	0.00052	0.000386	**0.000902**	**0.0007(24-hour) (VI)**

Notes:
95% UCLM 95% upper confidence limit of the mean soil concentration.
* Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.
** Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor.
*** No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).
BOLD Exceeds AAQC.

The concentrations of hexavalent chromium and iron in TSP were predicted to have the potential to exceed the AAQC. On this basis, in addition to PM_{10} (24-hour), $PM_{2.5}$ (24-hour), and TSP (24-hour), hexavalent chromium and iron have been retained as COPCs for the operations phase and will be further evaluated in the HHRA based on estimated concentrations at points of interest (e.g., locations of sensitive receptors such as current/future residences, institutional buildings and areas identified by WSR community members as being of cultural importance.

3.8 Receptor and Exposure Pathway Identification

The LSA for the WSR includes the following communities:

- Webequie First Nation;
- Attawapiskat First Nation;
- Eabametoong First Nation;
- Kasabonika Lake First Nation;
- Marten Falls First Nation; and
- Neskantaga First Nation.

As described in **Section 3.4**, the HIA and this HHRA will specifically focus on the potential health impacts to the Webequie First Nation. In accordance with the Study Plan, due to the community's proximity to the Project, the Webequie First Nation community members have the potential to experience exposure to Project related COPCs more than other members of Indigenous communities in the LSA, as well as the general public. The Webequie First Nation community has therefore been selected as the critical receptor group for evaluation in the HHRA. The Webequie First Nation community, as with the other First Nations communities, includes local residents, Indigenous land users, sensitive sub-populations and members of all ages. The assessment of exposures and risks to members of the Webequie First Nation is considered protective of other potential receptor groups that live in or have the potential to visit the LSA.

Webequie First Nation community members reside in the LSA on a full-time basis. In addition, there are cabins present along the WSR ROW near Webequie First Nation that are likely used on a seasonal basis and as the Project may open up access to new areas east of Webequie First Nation, additional cabins may be established in the future. As such, Webequie First Nation community members may also reside at locations within the LSA on a seasonal basis.

Members of the Webequie First Nation have reported that they hunt, fish, forage and trap in the LSA. During these activities, community members may spend extended periods of time in areas near or along the WSR ROW or may travel back to their community daily.

As described in **Sections 3.2** and **3.3**, air quality is the only VC with links to human health where contaminant concentrations were predicted to have the potential to increase during the Project. On this basis, COPCs in air were identified and have been carried forward in the HHRA. Subsequent sections of the HHRA will assess exposures and risks of identified receptors of concern to the COPCs identified in air. To estimate exposures, receptors will be assumed to be exposed to the maximum concentrations of the air COPCs predicted by the AQIA (and in **Section 3.3** for metals), regardless of location. On this basis, the duration of exposure will be the key determinant of risks, with the receptor group exposed for the longest duration receiving the highest potential exposures and associated risks.

Based on the above, Webequie First Nation community members residing in the community on a full-time basis have been identified as the critical receptor group for assessment in the HHRA. In accordance with Health Canada (2024), residents are assumed to be present and exposed to the identified COPCs for 24 hours a day, seven days a week, 52 weeks a year for 80 years. The subsequent sections of the HHRA will therefore focus on this receptor group, with exposures and risks estimated for residents considered protective of summer residents, community members hunting, fishing, trapping and foraging in the LSA, as well as other people that may live in or visit the LSA.

As COPCs were only identified in air, the primary exposure pathway by which Webequie First Nation community members and other populations in the LSA have the potential to be exposed to Project related COPCs is via inhalation. As discussed in **Section 3.2**, the emissions and dust generated by the Project are not predicted to have a significant adverse effect on other human health related VCs, including increasing concentrations of Project-related contaminants in other media, including in soil and country foods. Thus, no COPCs were identified in these other media, and no other significant, operable exposure pathways were identified for Webequie First Nation community members or other populations spending time in the LSA.

It is noted that the potential for dusts generated from gravel used in the Project to impact linked VCs has not yet been assessed and will be revisited once the analysis of gravel is conducted.

3.9 Conceptual Site Model

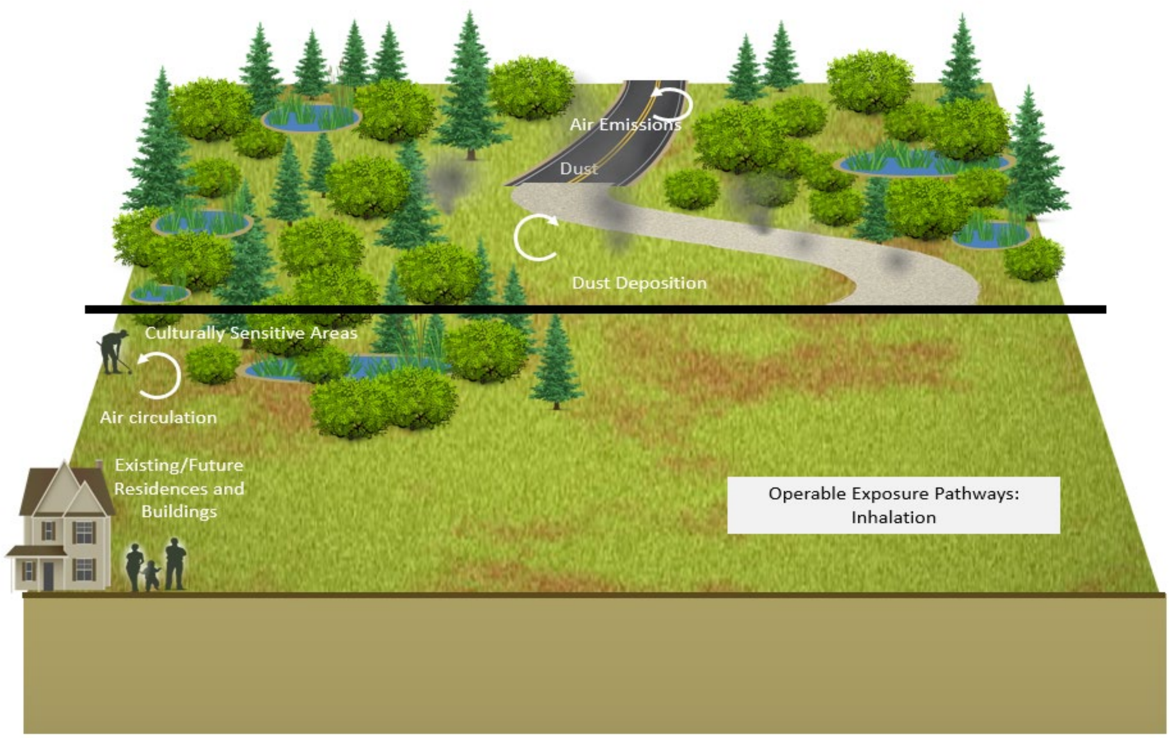
The final stage of the Problem Formulation is the development of a Conceptual Site Model (CSM): a CSM presents a summary of the Problem Formulation for the HHRA, including the identified receptors of concern, the age group(s) to be evaluated in the HHRA, and the identified operable exposure pathways. Based on a review of the findings presented for indicator VCs including air quality; geology, terrain and soils; surface water resources; groundwater resources; and vegetation, fish and wildlife, no significant Project related increases in contaminant concentrations were predicted for any VC, except for air. Consequently, air was the only media carried forward into the HHRA. A CSM has been developed for the Project emissions and is presented below in tabular form. A graphical CSM summarizing the operable exposure pathways follows.

Table 3-17: Conceptual Site Model, Human Health

Land Use	Receptor of Concern	Age Groups Considered	Operable Exposure Pathways
Residential	**Webequie First Nation Community Members**	**Infant** **Toddler** **Child** **Teen** **Adult**	**Inhalation of Project emissions in air**
Residential	Seasonal Residents	Infant Toddler Child Teen Adult	*Evaluation of the Residential Receptor is protective of seasonal residents*
Undeveloped Lands	People Involved in Hunting, Fishing, Foraging, Trapping	Infant Toddler Child Teen Adult	*Evaluation of the Residential Receptor is protective of people involved in hunting, fishing, foraging and trapping*

Notes:
BOLD – Retained for Quantitative Evaluation in the HHRA.

Figure 3-7: Conceptual Site Model, Graphical Summary of Operable Exposure Pathways



Exposures and risks to the Webequie First Nation community members will be quantified in **Sections 4** and **6,** respectively.

4. Exposure Assessment

The exposure assessment stage of the HHRA involves the estimation of the quantity of each COPC received by each receptor, typically on a per unit time basis such as a daily intake or dose.

- The principal stages of the exposure assessment consist of the following:
  - Characterization/estimation of exposure point concentrations (EPCs);
  - Receptor characterization including compilation of physical and behavioural characteristics of human receptors that influence intake rates (e.g. body weight, time-activity patterns, media intake rates, dermal contact rates, etc.); and
  - Exposure estimation for each receptor, COPC and exposure pathway.

4.1 Exposure Point Concentrations

The EPCs selected for the air COPCs were the maximum concentrations of the air contaminants predicted by the AQIA at a point of impingement of interest (i.e., culturally sensitive area, residence, etc.) in **Table 3-8** and **Table 3-14**, as well as the conservatively estimated concentrations of metals in TSP presented in **Table 3-9** and **Table 3-15**.

EPCs for each scenario evaluated, are presented in the Appendix B tables, including background concentrations. The EPCs presented in the attached Appendix B tables were used to quantify inhalation exposures to Webequie First Nation community members, with the scenarios evaluated for the Project construction phase and operations phase, along with corresponding Appendix B table references, summarized as follows:

Construction Phase:

- Table 1a: Modelled Air Contaminants Inhalation Risk Estimates for the Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase.
- Table 1b: Modelled Air Contaminants Inhalation Risk Estimates for CHL25 (60 m from RCL) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase.
- Table 1c: Modelled Air Contaminants Inhalation Risk Estimates for 50 m from Road Centerline with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase.
- Table 2a: Modelled Air Contaminants Inhalation Risk Estimates for the Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Unpaved Surface and Water Control - Operation Phase.
- Table 2b: Modelled Air Contaminants Inhalation Risk Estimates for CHL25 (60 m from RCL) with Unpaved Surface and Water Control - Operation Phase.
- Table 2c: Modelled Air Contaminants Inhalation Risk Estimates for 50 m from Road Centerline with Unpaved Surface and Water Control - Operation Phase.
- Table 2d: Modelled Air Contaminants Inhalation Risk Estimates for the Nearest Sensitive Receptor (Future Residences) with Unpaved Surface and Water Control - Operation Phase.
- Table 4a: Metals COPCs in Air (24-hour TSP) – (Existing Residences + Institutional Buildings) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase.
- Table 4b: Metals COPCs in Air (24-hour TSP) – CHL25 (60 m from RCL) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase.

- Table 4c: Metals COPCs in Air (24-hour TSP) – 50 m from Road Centerline with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase.

Operations Phase:

- Table 3a: Modelled Air Contaminants Inhalation Risk Estimates for the Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Paved Surface - Operation Phase.
- Table 3b: Modelled Air Contaminants Inhalation Risk Estimates for CHL25 (60 m from RCL) with Paved Surface - Operation Phase.
- Table 3c: Modelled Air Contaminants Inhalation Risk Estimates for 50 m from Road Centerline with Paved Surface - Operation Phase.
- Table 3d: Modelled Air Contaminants Inhalation Risk Estimates for the Nearest Sensitive Receptor (Future Residences) with Paved Surface - Operation Phase.
- Table 4d: Metals COPCs in Air (24-hour TSP) – Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Unpaved Surface and Water Control - Operation Phase.
- Table 4e: Metals COPCs in Air (24-hour TSP) – CHL25 (60 m from RCL) with Unpaved Surface and Water Control - Operation Phase.
- Table 4f: Metals COPCs in Air (24-hour TSP) – 50 m from Road Centerline with Unpaved Surface and Water Control - Operation Phase.
- Table 4g: Metals COPCs in Air (24-hour TSP) – Nearest Sensitive Receptor (Future Residences) with Unpaved Surface and Water Control - Operation Phase.
- Table 4h: Metals COPCs in Air (24-hour TSP) – Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Paved Surface - Operation Phase.
- Table 4i: Metals COPCs in Air (24-hour TSP) – CHL25 (60 m from RCL) with Paved Surface - Operation Phase.
- Table 4j: Metals COPCs in Air (24-hour TSP) – 50 m from Road Centerline with Paved Surface - Operation Phase.
- Table 4k: Metals COPCs in Air (24-hour TSP) – Nearest Sensitive Receptor (Future Residences) with Paved Surface - Operation Phase.

4.2 Receptor Characteristics

Age-dependent receptor characteristics were obtained from Health Canada (2024) and are summarized in **Table 4-1**, below, with the exposure frequency and durations also recommended by Health Canada (2024) for residential scenarios, and assumed for Webequie First Nation community members, presented in **Table 4-2**. Webequie First Nation community members with the potential to be exposed to COPCs in outdoor air in the LSA could include members from any of the age groups listed below. Most COPCs have corresponding inhalation TRVs, and thus exposures were determined as amortized air concentrations (see **Section 4.3** below), in which no age-specific receptor- characteristics are incorporated into the inhalation exposure calculations. However, when inhalation TRVs were not available (e.g., for iron), exposure doses via the inhalation pathway were calculated. In accordance with Health Canada (2024) guidance, toddlers and adults were selected as the critical receptors for non-carcinogens and carcinogens, respectively.

Table 4-1: Summary of Receptor Characteristics

Receptor Characteristic	Infant	Toddler	Child	Teen	Adult	Reference
Age	0 to <6 months	6 months to <5 years	5 to <12 months	12 months to <20 years	≥ 20 years	Health Canada, 2024
Age Group Duration	0.5 years	4.5 years	7 years	8 years	60 years	Health Canada, 2024
Bodyweight	8.2 kg	16.5 kg	32.9 kg	59.7 kg	70.7 kg	Health Canada, 2024
Inhalation Rate	2.2 m^3/day	8.3 m^3/day	14.5 m^3/day	15.6 m^3/day	16.6 m^3/day	Health Canada, 2024

Notes:
kg kilograms
m^3/day cubic meters per day

Table 4-2: Receptor Exposure Durations

Receptor Characteristic	Webequie First Nation Community Member	Reference
Hours per Day of Exposure	24	Health Canada, 2024
Days per Week of Exposure	7	Health Canada, 2024
Weeks per Year of Exposure	52	Health Canada, 2024
Life Expectancy	80	Health Canada, 2024

The receptor characteristics and exposure durations presented in the preceding tables have been used along with the following exposure intake equations to estimate inhalation exposures to Webequie First Nation community members.

4.3 Exposure Equations

Exposures via the inhalation of Project emissions were estimated using the following Health Canada (2024) equation:

$$EIA = \frac{C_A \times D_1 \times D_2 \times D_3 \times D_4}{LE}$$

Where:

EIA = exposure from the inhalation (µg/m^3; as an “amortized air concentration”)

C_A = air concentration (µg/m^3)

D_1	=	hours per day exposed/24 hours (unitless)
D_2	=	days per week exposed/7 days (unitless)
D_3	=	weeks per year exposed/52 weeks (unitless)
D_4	=	total years exposed to site (only used for carcinogens)
LE	=	life expectancy (years) (only used for carcinogens)

Where inhalation TRVs (e.g. Tolerable Concentrations, Inhalation Unit Risks) were not available for a COPC, the following equation (Health Canada, 2024) was used to estimate an exposure dose:

$$EIA = \frac{C_A \times IR_A \times RAF_{Inh} \times D_1 \times D_2 \times D_3 \times D_4}{BW \times LE}$$

Where:

EIA	=	exposure from the dust inhalation pathway for soil (µg/kg bw/d)
C_A	=	air concentration (µg/m^3)
IR_A	=	receptor air intake (inhalation) rate (m^3/day)
RAF_{Inh}	=	relative absorption factor by inhalation (unitless, chemical-specific)
D_1	=	hours per day exposed/24 hours (unitless)
D_2	=	days per week exposed/7 days (unitless)
D_3	=	weeks per year exposed/52 weeks (unitless)
D_4	=	total years exposed to site (only used for carcinogens)
BW	=	body weight (kg)
LE	=	life expectancy (years) (only used for carcinogens)

The exposure estimates for the Webequie First Nation community members are provided in Appendix B.

5. Toxicity Assessment

The toxicity assessment is completed for all COPCs retained for quantitative evaluation in the HHRA. This stage of the HHRA involves identification of TRVs for each COPC. For threshold substances, which are typically non-carcinogenic, the TRVs are presented as an acceptable air concentration (for air and soil particulate inhalation exposures) or dose level (for COPCs with no acceptable air concentration) that was derived such that it is unlikely to be associated with appreciable risks, based on the assumption that these substances act in a threshold manner with an air concentration/exposure dose below which no adverse effects are expected to occur. For carcinogenic chemicals, the TRV was presented as a unit risk estimate or cancer potency factor (i.e., slope factor) based on the assumption that carcinogens act in a non-threshold manner with any exposure capable of producing carcinogenic effects.

TRVs are developed by regulatory authorities such as Health Canada, the US EPA, and the World Health Organization. Given that the Project falls under both federal and provincial jurisdiction, both federal and provincial sources of TRVs were reviewed, with the most scientifically defensible value selected for use. In cases where Ontario MECP or Health Canada TRVs were not available, or were determined not to be suitable (i.e., another agency recommended a TRV based on toxicological data that would not have been available by the agencies at the time they derived their TRV), other international agency TRVs have been considered. The US EPA was given general preference when Ontario MECP or Health Canada TRVs were not available. Various agencies/sources considered in the review and compilation of the available TRVs for the COPCs include:

- US EPA sources including, but not limited to:
  - Integrated Risk Information System (http://www.epa.gov/IRIS/); and
  - Provisional Peer-Reviewed Toxicity Values (PPRTV) for Superfund from the US EPA Superfund Health Risk Technical Support Center within the Office of Research and Development's National Center for Environmental Assessment (http://hhpprtv.ornl.gov/index.html).
- World Health Organization (WHO) sources including, but not limited to:
  - http://www.inchem.org/;
  - http://www.euro.who.int/data/assets/pdf_file/0009/128169/e94535.pdf; and
  - Institute of Medicine (IOM). National Library of Medicine (NIH) US available at: https://www.nlm.nih.gov/.

The HHRA has considered both acute and chronic inhalation exposures, and as such, TRVs for both exposure durations have been identified, where available. Acute and chronic inhalation TRVs are defined as follows:

- Acute TRV: the air concentration of a chemical that can be tolerated without appreciable health effects on a short-term (e.g. 1-hour, 24-hour) basis and in the case of the 24-hour AAQCs, a short-term representation of a chronic benchmark. As noted in **Section 3.7**, the health-based USEPA NAAQS were referenced for comparison to ensure that the 24-hour AAQCs were health-protective. As the USEPA NAAQS were higher and/or equivalent to the 24-hour AAQCs, they were determined to be health-protective and thus have been applied as TRVs.
- Non-Cancer Chronic TRV: the air concentration of a chemical that can be tolerated without appreciable health effects for exposures that occur continuously for exposures over an entire lifetime.
- Cancer Chronic TRV: the air concentration associated with a specified increase in the incremental lifetime cancer risk for exposures that occur for exposures over an entire lifetime.

In addition, where no inhalation TRVs were available (e.g., iron), chronic oral TRVs have been identified.

The TRVs provided by the above listed agencies are developed to be protective of critical sub-groups, or sensitive subpopulations (i.e., those with physical characteristics or conditions that may result in an increased likelihood of adverse effect to a given level of exposure, for example, the elderly or persons suffering from existing medical conditions). These sensitive subpopulations are considered by the agencies in the derivation of TRVs: when deriving TRVs, health agencies apply safety or uncertainty factors (i.e., an intraspecies/human variability uncertainty factor) to protect for sensitive subpopulations. It is noted that while regulatory health agencies derive TRVs to be protective of vulnerable sub-populations, these limits are not inherently designed to cover all potentially vulnerable individuals (e.g., those with existing medical conditions).

For the CACs, a range of the available acute and chronic air quality guidelines available from Ontario MECP, the CCME and the WHO were used. The respective benchmark for each CAC was adopted as the TRV. It is noted that, for the CACs, the exceedances predicted were only for the short-term exposures (i.e., 1-hour, 24-hour) and thus, only acute TRVs have been presented for these COPCs. Further, while the concentrations of metals were estimated based on exceedances of 24-hour TSP using the maximum 24-hour concentrations of TSP predicted at a point of impingement of interest, based on a lack of acute TRVs for the metal COPCs (i.e., chromium (VI), nickel and iron), only chronic exposures and associated risks could be estimated.

For all COPCs, use of a TRV derived specifically for the route of exposure (i.e., inhalation, oral) was preferred over route-to-route extrapolation (e.g., to estimate risks from the inhalation route, it was generally preferential to use an inhalation TRV rather than an oral TRV). Nevertheless, for COPCs where no appropriate inhalation TRVs were available, but oral TRVs were recommended by a recognized health agency, the oral TRVs were used to assess risks associated with inhalation exposures.

The acute and chronic duration inhalation TRVs selected for comparison to receptor exposures are summarized in **Table 5-1**. As no inhalation TRV was identified for iron, an oral TRV has been used and is presented in **Table 5-2**. A brief description of the endpoint/target organ (i.e., potential effects) representing the toxicological basis of the TRV is also provided in **Table 5-1** and **Table 5-2**.

Table 5-1: Summary of Inhalation TRVs

Chemical	Inhalation TRV	Endpoint/Target Organ	Reference
Metals			
Chromium VI	UR: 7.6×10^{-2} $(\mu g/m^3)^{-1}$	Lung cancer	Health Canada (2025)
	RfC: 1.0×10^{-1} $\mu g/m^3$	Respiratory effects: increased albumin and lactate dehydrogenase in bronchioalveolar lavage fluid	Health Canada (2025)
Nickel	RfC: 1.8×10^{-2} $\mu g/m^3$	Respiratory tract toxicity morphological and biological effects on alveolar cells	Health Canada (2025)
Criteria Air Contaminants			
PM_{10}	24-hour: 50 $\mu g/m^3$	Reduction in life expectancy: increased cardio-pulmonary and lung cancer mortality	AAQC based on WHO (2006)
$PM_{2.5}$	24-hour: 23 $\mu g/m^3$	Reduced lung function and chronic obstructive pulmonary disease	AAQC & CAAQS based on WHO (2006)
NO_2	1-hour: 79 $\mu g/m^3$	Possible lung metabolism, structure, function, inflammation and host defence against pulmonary infection	CAAQS based on WHO (2006)

Chemical	Inhalation TRV	Endpoint/Target Organ	Reference
SO_2	1-hour: 100 µg/m^3	Respiratory morbidity	AAQS
TSP	24-hour: 120 µg/m^3	Not documented. Further discussed in the Uncertainty Section.	AAQC

Notes:
UR unit risk
RfC reference concentration
µg/m^3 micrograms per cubic meter

As summarized in **Table 5-1**, acute TRVs were identified for the CACs; however, no acute TRVs were identified the metals COPCs. Further, no inhalation TRVs were identified for iron. **Table 5-2** below presents oral TRVs for iron, which have been used to estimate exposures to via inhalation as a dose.

Table 5-2: Summary of Oral TRVs

Chemical	Oral TRV	Endpoint/Target Organ	Reference
Metals & Metalloids			
Iron	RDA: 3000 µg/day/16.5 kg = 424 µg/kg/day (toddler) 5000 µg/day/70.7 kg = 70 µg/kg/day (adult)	Recommended Daily Allowance	IOM (2001) Oral TRV is considered as a basis for calculating inhalation risk based on route of exposure extrapolation.

Notes:
RDA recommended daily allowance
µg/kg bw/d micrograms per kilogram body weight per day
* Also discussed in **Section 7**.

The TRVs identified above have been used along with the exposure estimates from **Section 4** to estimate non-cancer and cancer health risks associated with exposure to the Project COPCs in air.

5.1 Bioavailability Assessment

Absorption (or bioavailability) factors allow for the comparison of exposures to the same chemical via multiple routes (e.g., dermal and oral). Health Canada (2024) recommends a relative absorption factor (RAF) of 1 (100%) for inhalation exposures. The assumption that the COPCs have an RAF of 100% for all inhalation exposures is conservative and will result in the over-prediction of exposures and therefore associated risks.

5.2 Evaluation of Potential Additive Effects

Where evidence was available to suggest that the critical effects of two or more COPCs occur at the same target site (i.e., tissue or organ system), an assessment of the potential for additive effects at the target site was conducted. If the available data suggested two or more COPCs exert (or could potentially exert) their critical effects by similar mechanisms of action, then the risks associated with exposure to those COPCs were conservatively assumed to be additive. Based on the COPCs identified for the sensitive receptors in the HHRA, there is a potential for COPCs to be considered additive (e.g., respiratory function). This is further discussed in **Section 7**.

6. Risk Characterization

Potential risks to each receptor are quantified in the risk characterization stage of the HHRA. Risk characterization is completed for all operable receptor/COPC/exposure pathway combinations identified in the Problem Formulation stage. Non-cancer and cancer risks for Webequie First Nation community members were estimated by integrating the results of the Exposure Assessment (**Section 4**) and the Toxicity Assessment (**Section 5**) to define the magnitude of the health risk.

Non-cancer risks associated with the inhalation of Project emissions were estimated as hazard quotient (HQ) values according to the following formula:

$$HQ = \frac{\text{Amortized Air/Dust Concentration } (\mu g/m^3)}{\text{Reference Concentration } (\mu g/m^3)}$$

Non-cancer risks from inhalation exposures where inhalation TRVs were not available were estimated as HQ values according to the following formula:

$$HQ = \frac{\text{Estimated Exposure } (\mu g/kg \text{ body weight/day})}{\text{Reference Dose } (\mu g/kg \text{ body weight/day})}$$

Cancer risks from the inhalation of Project emissions were estimated as Incremental Lifetime Cancer Risks (ILCRs) as follows:

$$ILCR = \text{Amortized Air/Dust Concentration } (\mu g/m^3) \times \text{Inhalation Unit Risk } (\mu g/m^3)^{-1}$$

For inhalation exposures where unit risk estimates were not available, ILCRs were evaluated using estimated lifetime daily exposures. Cancer risks were estimated as ILCR values according to the following formulas:

$$ILCR = \text{Estimated Lifetime Daily Exposure } (\mu g/kg/day) \times \text{Cancer Potency Factor } (\mu g/kg/day)^{-1}$$

The resulting chronic HQs and ILCRs were compared to the Health Canada negligible risk levels. Health Canada (2024) guidance indicates that total HQs can be interpreted according to the following general guidelines:

- ≤ 0.2 = negligible (i.e., acceptable) human health risks; and
- 0.2 = potential unacceptable risks which may require mitigation or more detailed assessment.

Health Canada's negligible risk level of 0.2 (or 20% of the TRV) for non-carcinogens allows for 80% of the acceptable exposure level (i.e., as defined by the TRV) to come from other sources. This approach is based on the potential for exposures to a chemical in air, soil, water, food and consumer products (i.e., 20% of the acceptable exposure is typically allocated to each of these 5 media/sources). The non-cancer risk estimates associated with chronic exposures to Project emissions were compared to the Health Canada negligible risk level of 0.2. The interpretation of HQs > 0.2 requires consideration of the overall risk assessment process, including the assumptions used and the uncertainties in those assumptions.

In the case of acute exposures to CACs, risk estimates were compared to an acceptable HQ of 1.0 as background concentrations of the CACs have been considered in the estimation of exposures and risks to the Project (cumulative scenario), and as receptors are only exposed to the CACs in air (i.e., exposures to other media are not relevant).

In addition, Health Canada (2024) indicates that an ILCR less than or equal to 1×10^{-5} or a one in 100,000 increase above background in the potential for developing cancer, is generally considered to represent a negligible risk, while an ILCR greater than 1×10^{-5} may indicate that some form of mitigation or more detailed site-specific analysis is required. Like non-cancer risks, interpretation of ILCR estimates greater than 1 x 10^{-5} requires consideration of the overall risk assessment process and assumptions. It is noted that the Ontario MECP recommends the use of a target ILCR of 1 x 10^{-6} (or a one in 1,000,000 increase above background in the potential of developing cancer). While the Health Canada negligible risk level has been used in the HHRA, the Ontario target is discussed in the context of the results of the HHRA for hexavalent chromium, a carcinogenic COPC evaluated in the HHRA.

In contrast to the estimation of HQs, the estimation of ILCRs is exclusive of background exposures; the HHRA predicted the incremental cancer risk, above background, from exposures associated with the Project emissions.

6.1 Risk Characterization Results

As described throughout the report, the HHRA has used a series of conservative assumptions, including that receptors are exposed to the maximum predicted concentrations of Project emissions at areas of interest, to estimate exposures and associated risks to receptors of concern. The HHRA includes scenarios presented in the AQIA both with and without risk management measures. The conservative modelling in the AQIA, compounded with the conservative approach undertaken in the HHRA, will tend to overestimate potential exposures and associated risks to receptors of concern.

The non-cancer and cancer risk estimates that exceeded their respective risk-based target thresholds for Webequie First Nation community members are discussed below. **Table 6-1** presents COPCs with acute (≤24-hour) risk estimates exceeding the risk-based target of a HQ of ≤ 1, with **Table 6-2** presenting COPCs with chronic (>90-day scenario) risk estimates exceeding a HQ ≤ 0.2 or a ILCR of 1 x 10^{-5}. Risk estimates for all COPCs, including those substances and scenarios for which risk estimates are below target risk levels, are presented in Appendix B.

As discussed, the COPCs were identified based on exceedances of short-term air quality guidelines at areas of interest, and thus, for the CACs, only acute risks have been estimated.

In addition, concentrations of metals in dust (TSP) were conservatively estimated using the maximum 24-hour predicted TSP and soils metals concentrations from the Eagle's Nest Mine. Using this conservative approach, only chromium (VI), iron and nickel were predicted to exceed air quality guidelines. As there is a lack of acute TRVs for chromium (VI), nickel, and iron, chronic exposures and associated risks have been estimated for these COPCs. All exceedances of the air quality guidelines were carried further for evaluation, with using TRVs recommended by regulatory health agencies (e.g., Health Canada, US EPA).

Table 6-1: Summary of Risk Estimate Exceedances – Webequie First Nation Community Member: Construction and Operation Phase, Acute (≤ 24 hr) Scenario

COPC	HQ (Baseline)	HQ (Project)	HQ (Cumulative)
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase [a]			
B(a)P	**2.4E+00**	5.2E-01	**3.0E+00**
DPM	0.0E+00	**1.5E+00**	**1.5E+00**
$PM_{2.5}$	5.7E-01	1.0E+00	**1.6E+00**
PM_{10}	5.6E-01	**2.8E+00**	**3.4E+00**
TSP	3.8E-01	**1.2E+00**	**1.5E+00**
NO_2	3.5E-01	**1.2E+00**	**1.6E+00**

COPC	HQ (Baseline)	HQ (Project)	HQ (Cumulative)
Scenario: Nearest Sensitive Receptor (Culturally Sensitive Area) CHL25 (60 m from RCL) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase [a]			
Acrolein	1.0E-01	**1.9E+00**	**2.0E+00**
Benzene	3.9E-01	9.1E-01	**1.3E+00**
B(a)P	**2.4E+00**	**6.0E+00**	**8.4E+00**
DPM	0.0E+00	**1.5E+01**	**1.5E+01**
$PM_{2.5}$*	5.7E-01	**1.7E+01**	**1.7E+01**
PM_{10}*	5.6E-01	**4.9E+01**	**5.0E+01**
TSP*	3.8E-01	**4.8E+01**	**4.8E+01**
SO_2	9.0E-01	2.2E-01	**1.1E+00**
NO_2	3.5E-01	**3.2E+00**	**3.5E+00**
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Unpaved Surface and Water Control - Operation Phase [a]			
PM_{10}	5.6E-01	5.6E-01	**1.1E+00**
Scenario: Nearest Sensitive Receptor (CHL25 (60 m from RCL) with Unpaved Surface and Water Control - Operation Phase [a]			
$PM_{2.5}$	5.7E-01	**6.1E-01**	**1.2E+00**
PM_{10}	5.6E-01	**4.5E+00**	**5.1E+00**
TSP	3.8E-01	**5.6E+00**	**6.0E+00**
Scenario: Nearest Sensitive Receptor (Future Residences) with Unpaved Surface and Water Control - Operation Phase [a]			
$PM_{2.5}$	5.7E-01	6.5E-01	**1.2E+00**
PM_{10}	5.6E-01	**4.9E+00**	**5.4E+00**
TSP	3.8E-01	**5.6E+00**	**6.0E+00**
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Paved Surface - Operation Phase [a]			
No exceedances			
Scenario: Nearest Sensitive Receptor CHL25 (60 m from RCL) with Paved Surface - Operation Phase [a]			
PM_{10}	5.6E-01	5.0E-01	**1.1E+00**
Scenario: Nearest Sensitive Receptor (Future Residences) with Paved Surface - Operation Phase [a]			
PM_{10}	5.6E-01	4.6E-01	**1.0E+00**

Notes:

[a] Acute risk estimates have been compared to a target risk level of HQ ≤ 1.0
HQ Hazard quotient
ILCR Incremental lifetime cancer risk, not applicable for the acute scenario
\- Not applicable
BOLD HQ >1.0

Table 6-2: Summary of Risk Estimate Exceedances – Webequie First Nation Community Member: Construction and Operation Phase, Chronic (>90 day) Scenario

COPC	HQ (Baseline)	HQ (Project)	HQ (Cumulative)	ILCR (Baseline)	ILCR (Project)	ILCR (Cumulative)
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase [a]						
Chromium (VI)	3.9E-03	1.2E-02	1.6E-02	**2.2E-05**	**6.9E-05**	**9.1E-05**
Scenario: Nearest Sensitive Receptor CHL25 (60 m from RCL) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase [a]						
Chromium (VI)	3.9E-03	**4.9E-01**	**4.9E-01**	**2.2E-05**	**2.8E-03**	**2.8E-03**
Iron	1.8E-03	**2.3E-01**	**2.3E-01**	-	-	-
Nickel	4.8E-02	**6.0E+00**	**6.1E+00**	-	-	-
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Unpaved Surface and Water Control - Operation Phase [a]						
Chromium (VI)	3.9E-03	3.7E-03	7.6E-03	**2.2E-05**	**2.1E-05**	**4.3E-05**
Scenario: Nearest Sensitive Receptor CHL25 (60 m from RCL) with Unpaved Surface and Water Control - Operation Phase [a]						
Chromium (VI)	3.9E-03	5.8E-02	6.2E-02	**2.2E-05**	**3.3E-04**	**3.5E-04**
Scenario: Nearest Sensitive Receptor (Future Residences) with Unpaved Surface and Water Control - Operation Phase [a]						
Chromium (VI)	3.9E-03	5.8E-02	6.2E-02	**2.2E-05**	**3.3E-04**	**3.5E-04**
Scenario: Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Paved Surface - Operation Phase [a]						
No exceedances						
Scenario: Nearest Sensitive Receptor CHL25 (60 m from RCL) with Paved Surface - Operation Phase [a]						
Chromium (VI)	3.9E-03	4.8E-03	8.7E-03	**2.2E-05**	**2.7E-05**	**4.9E-05**
Scenario: Nearest Sensitive Receptor (Future Residences) with Paved Surface - Operation Phase [a]						
Chromium (VI)	3.9E-03	5.2E-03	9.0E-03	**2.2E-05**	**2.9E-05**	**5.1E-05**

Notes:

[a] Chronic risk estimates have been compared to a target risk level of HQ ≤ 0.2 / ILCR <1.0E-05
HQ Hazard quotient
ILCR Incremental lifetime cancer risk
\- Not applicable
BOLD Quotient >0.2 (1.0 for CAC) / ILCR >1E-05

Construction Phase

As presented in **Table 6-1**, acute exposure risks exceeding the negligible risk level were predicted for the Project construction phase (cumulative exposures) for acrolein, benzene, B(a)P, DPM, $PM_{2.5}$, PM_{10}, TSP, NO_2, and SO_2. As discussed in the AQIA, the predicted concentrations of these parameters during the construction phase are conservative, and the following should be considered when interpreting the results, as well as the potential for risks to exceed the negligible risk level:

- Short-term (24-hours and less) exceedances were identified, and thus only acute exposures and associated risks were predicted. If the concentrations are reached during construction, they could only occur over a short period (i.e., 1-2 days) at each receptor given that the emission sources will be moving as road construction progresses.

- While the deposition model considered local topography, it did not consider the presence of vegetation and trees that can act as physical barriers, especially against the dispersion of particulate down-wind. This has the potential to have resulted in exceedances of the AAQC at distances that may not be realized.
- As detailed in AtkinsRéalis (2024a), when the road surface will be fully surfaced with asphalt or chipseal, it will result in much lower TSP, PM_{10} and $PM_{2.5}$ concentrations in air and dustfall on the ground in the immediate area of the road. The impact of flexible pavements on particulate emissions was also modeled accordingly (AtkinsRéalis, 2024a).
- While exceedances of the air quality guidelines were predicted without and with mitigations, the predictions are highly conservative, and air monitoring will be conducted throughout the Project to ground truth the results of the AQIA. If exceedances of the air quality guidelines are measured, mitigation measures beyond those recommended in The Air Quality and Dust Control Management Plan and assumed in the AQIA, will be implemented. Additional measures that could be used to mitigate dust and exhaust emissions include idling minimization, limitation of unnecessary vehicle and heavy equipment movement, and the wetting of soil and aggregate during dry days. Moreover, mitigation measures for dozers and graders, which are the main source of particulates, could include watering, although this would only be used as essential as it would be challenging to implement. The management plan could therefore integrate a monitoring procedure with the intent of mitigating the impact of these emissions by controlling (limiting) their usage during unfavorable weather conditions for example. These additional measures could not be properly translated into the air dispersion model and so their potential impact was not accounted for in the predicted construction phase air concentrations.

In addition to the exceedances of the above, both non-cancer and cancer risks in excess of the Health Canada (and Ontario MECP) negligible risk levels were estimated for hexavalent chromium, iron and nickel in dust (estimated based on the maximum 24-hour TSP). It is noted that as no baseline soil data was available for speciated chromium (i.e., trivalent chromium and hexavalent chromium), and thus the baseline total chromium concentration in soil was conservatively used to predict the baseline soil concentrations of the chromium species. Based on previous estimates provided by Health Canada, it was conservatively assumed that 1/7 of the total chromium was hexavalent chromium, and that the remaining 6/7 is trivalent chromium. This is likely an overestimate of the hexavalent chromium concentration in soil, and thus, also in particulate generated from soil. To address uncertainty associated with the relevance of available soil quality data from Eagle's Nest Mine, it is recommended that soil samples be collected from the LSA and be submitted for chromium speciation, and that the results of the HHRA be revisited based on the measured hexavalent chromium concentrations in soil.

It is noted that gravel analytical results were not available on a per-mass basis for inclusion in the HHRA. As the project design phase progresses, these data will be provided to stakeholders and the data will be reviewed in the context of the findings of the HHRA, with the HHRA revisited as required.

There is additional conservatism in the risk estimates for metals in TSP as while only acute exposures are anticipated (based on the AQIA), based on a lack of acute TRVs, only chronic exposures and associated risks could be estimated for the metals. This approach assumes that Webequie First Nation community members would be exposed to metals in TSP 24 hours a day, seven days a week, 52 weeks a year, for 80 years, while actual exposures to metal COPCs in dust generated during the construction phase would be for a maximum of one to two days at a single receptor location.

Operations Phase

Based on the maximum 24-hour TSP concentration and the assumptions discussed above for chromium (in the lack of speciation data), the potential for cancer risks exceeding the Health Canada (and Ontario MECP) negligible risk level was predicted for hexavalent chromium for the operation phase. No other COPCs were identified to have risks in excess of the target risk levels.

As with the construction phase, a conservative approach was used to estimate exposures and risks associated with chromium (VI). As noted for the construction phase, while only acute exposures are anticipated (based on the AQIA), based on a lack of acute TRVs, only chronic exposures and associated risks could be estimated for the chromium (VI). This approach assumes that Webequie First Nation community members would be exposed to chromium (VI) in TSP 24 hours a day, seven days a week, 52 weeks a year, for 80 years, while actual exposures would be for a maximum of one to two days at a single receptor location. As the carcinogenic risks associated with chromium (VI) are based on exposure over a lifetime, this approach is ultra conservative and has overpredicted exposure and associated risks.

As with the construction phase, there is additional conservatism in the estimates, including the assumption that 1/7 of the total chromium measured in baseline soils is hexavalent chromium. Further, background concentrations contributed to a significant proportion of the ILCR. These conservative assumptions have likely overestimated exposures and associated risks, and thus confirmation of hexavalent chromium concentrations in background soils is recommended (with the results of the HHRA revisited). Further, as noted, air monitoring is recommended, with additional dust mitigation measures implemented as required.

Overall, the conservative approach used in the AQIA and in the HHRA exposure assessment has likely resulted in an overestimation of potential air concentrations of COPCs, and of exposures and associated risks to Webequie First Nation community members. Despite this, it is recommended that air monitoring be conducted during both the construction and operation phases, with additional mitigation measures, beyond those assumed in the AQIA, introduced as necessary.

7. Uncertainty Analysis

Some degree of uncertainty is inherent to the prediction of any health risk, regardless of the source of the COPCs or the methods used in the assessment. To be health protective and not under predict potential risks associated with exposures to the Project emissions, the HHRA has been conducted using a series of conservative assumptions intended to reflect reasonable worst-case conditions. As such, the results of the HHRA will tend to over predict exposures, and therefore associated risks, to Project emissions. Some of the main sources of uncertainty in the HHRA, and their impact on the results of the HHRA, are presented in the following table.

Table 7-1: Main Sources and Impacts of Uncertainty in the HHRA

HHRA Section	Source of Uncertainty	Impact on Results of the HHRA
Problem Formulation	The air dispersion model used in the AQIA (AtkinsRéalis, 2024a) uses both conservative assumptions meteorological conditions to predict emissions, resulting in conservative air quality estimates. The conservatism in the air quality model is described in the AQIA report. The maximum concentrations predicted by the AQIA at a point of impingement of interest were used as exposure point concentrations in the HHRA. The HHRA assumed exposure to maximum predicted concentrations on a continuous basis for both the characterization of acute and chronic exposures and associated health risks.	Use of the AQIA maximum predicted concentrations has the potential to result in an over-prediction of potential exposures. It is noted that the AQIA is based on air dispersion modelling, and as with all models, there is inherent uncertainty. The assumptions and associated uncertainty in the model are detailed in the AQIA report. It is understood that an Air Quality Management Plan will be developed for the Project and will include dustfall monitoring.
	It was assumed that the characterization of exposures and risks to Webequie First Nation community members is protective of other Indigenous communities in the RSA, as well as other people that may visit the LSA and RSA.	Given the proximity of the Webequie First Nation to the Project, of all potential receptors in the region, they are expected to be the most highly exposed. Characterization of exposures and risks to community members therefore is health protective and has the potential to overestimate exposures and risks to other receptors.
	To estimate Project scenario concentrations of metals in dust (i.e., TSP) generated from soils in the Study area, soil data collected as part of the Eagle’s Nest Multi-metal Mine Environmental Assessment, located in the Ring of Fire, has been used. Baseline soil data from the project study areas was collected as part of the country foods baseline assessment; however, the data collected is representative of peat, which based on moisture content is less likely to generate dust when disturbed. A review of the Eagle’s Nest soil data indicates that concentrations of all metals were higher in the Eagle’s Nest soils than in the peat samples collected during the country foods assessment. As such, use of the Eagle’s Nest data is considered conservative and health protective. A total of eight soil samples (+ one duplicate) were collected to characterize baseline soil conditions as part of the Eagle’s Nest EA. As dusts would be generated from soils from various areas across the LSA and based on the assumption that the soil data is representative of the LSA, dust concentrations from soil were estimated using 95% upper confidence limit of the mean (UCLM) concentrations of the metals in soil. The 95% UCLMs were calculated using US EPA ProUCL Version 5.2, which explicitly considers non-detect observations.	Given that the measured soil concentrations of total metals were higher in the Eagle’s Nest dataset than in the peat samples collected from the WSR study area, it is unlikely that particulate concentrations of metals have been underestimated. Further, as the region has received minimal disturbance by anthropogenic activities, it is considered likely that the Eagle’s Nest soil data is representative of soils in the general region.
	No baseline soil data was available for speciated chromium (i.e., trivalent chromium and hexavalent chromium); therefore, the baseline total chromium concentration in soil was conservatively used to predict the baseline soil concentrations of the chromium species. Based on previous estimates provided by Health Canada, it was conservatively assumed that 1/7 of the total chromium was hexavalent chromium, and that the remaining 6/7 is trivalent chromium.	As there are no anthropogenic sources of hexavalent chromium in the region, this is likely an overestimate of the hexavalent chromium concentrations in soil, and thus, also in particulate generated from soil. This will have resulted in an overprediction of exposures and risks associated with hexavalent chromium.
	No per mass basis gravel analysis was available for inclusion in the HHRA. Gravel analysis has been limited to leachate testing which was used to support the lack of leachability of gravel materials into waterways. However, per mass basis gravel analysis is recommended to determine if metals and PAHs resulting from gravel material used during road construction will significantly impact the findings of the HHRA.	The source of construction materials are typically expected to be free of anthropogenic sources of contamination, but there is a potential for naturally occurring metals or PAHs to be present. It remains unknown if concentrations are present in a significant quantity so the uncertainty remains. However, in the event that elevated concentrations are present, dust generation is expected to be minimal and the HHRA has recommended monitoring to measure actual exposure conditions with mitigation if needed based on the monitoring results. Leachate analysis has indicated low leachability of gravels, the impact on dust from the project remains unknown with analysis of gravel recommended on a per mass basis to confirm that the material is not expected to impact the findings of the HHRA.
	There is the potential for PAHs to be present in future road surfacing (chip seal or asphalt). PAHs in asphalt were not evaluated as COPCs based on the following: ▪ PAHs are strongly bound to the asphalt matrix; ▪ PAHs in asphalt are present largely as high-ring (4–6 ring) PAHs, which are far less mobile and bioavailable than lighter PAHs (e.g., naphthalene); and ▪ Not readily released into air, water, or skin-contact media once asphalt has cooled and cured. Overall, PAHs present in asphalt do not pose a meaningful risk to human health under normal conditions of use.	Given the rationale presented, the potential for PAHs to be present in future road surfacing does not pose a significant exposure risk for human receptors.

HHRA Section	Source of Uncertainty	Impact on Results of the HHRA
Exposure Assessment	The HHRA used maximum predicted concentrations of air COPCs predicted in the AQIA (AtkinsRéalis. 2024a) at the points of impingement of interest to determine exposures to receptors in the Study Area. In addition, the 95%UCLM soil concentrations in the area were used to estimate resulting soil dust concentrations used as exposure point concentrations (EPCs) in the HHRA.	The use of maximum predicted concentrations of air contaminants, as well as 95%UCLM soil concentrations to estimate dust concentrations of metals, has likely resulted in the over-prediction of exposures and associated risks.
	While only acute exposures are anticipated (based on the AQIA and exceedances of TSP and PM_{10}) for hexavalent chromium, based on a lack of acute TRVs, only chronic exposures and associated risks could be estimated. This approach assumes that Webequie First Nation community members would be exposed to hexavalent chromium 24 hours a day, seven days a week, 52 weeks a year, for 80 years, while actual exposures to hexavalent chromium in dust generated during the construction phase would be for a maximum of one to two days at a single receptor location. Further, as only 24-hour exceedances of PM_{10} were predicted for the operations phase, with all other particulate and dustfall predictions less than the AAQC, only acute exposures are anticipated for the operations phase as well.	The receptor exposure duration assumptions used in the HHRA are highly conservative when determining chronic risks due to the Project. It is considered unlikely that a single receptor would be exposed to maximum predicted concentrations to the extent of that assumed in the HHRA. The use of the conservative assumptions will result in the overprediction of exposures and risks for receptors in the Study Area.
	The HHRA assumed continuous exposure to outdoor dust and air concentrations for residents in the project study areas.	Project related soil dust concentrations in the outdoor environment are anticipated to be higher than that of Project sourced COPCs in the indoor environment. Therefore, the assumption that receptors are exposed to outdoor soil dust 24 hours a day will tend to over predict exposures and associated risks.

Table 7-1 (Cont'd): Main Sources and Impacts of Uncertainty in the HHRA

HHRA Section	Source of Uncertainty	Impact on Results of the HHRA
Toxicity Assessment	No acute TRVs were available for hexavalent chromium (VI), nickel, or iron. As only chronic TRVs were available, only chronic exposures and associated risks could be estimated. Further, as no inhalation TRVs were available for iron, or nickel , a chronic oral TRV was used to characterize risks.	The assessment of chronic exposures in the absence of acute TRVs will overestimate exposures and associated risks. The use of an oral TRV to characterize risks associated with inhalation exposures, in the absence of an inhalation TRV, is recommended by Health Canada and other regulatory agencies. On this basis, it is considered unlikely that risks have been underestimated.
	Based on the COPCs identified for the sensitive receptors in the HHRA, there is a potential for COPCs to be considered additive (e.g., respiratory function). The carcinogenic COPCs (e.g. Cr (VI)) were reviewed to determine if they act via a mutagenic mode of action.	The HHRA evaluated risks for each COPC and for scenarios involving sensitive receptors. It is recognized that COPCs may have additive effects. The results of the risk characterization showed that these COPCs exceeded target levels individually, and recommended risk management measures include monitoring these parameters relative to their respective AAQC or CAAQS. The recommendation for monitoring reduces the uncertainty associated with additivity as mitigation measures are recommended to meet the existing limits set out by regulatory agencies (e.g., AAQC and CAAQS targets developed for populations are expected to be met). Chromium (VI) has the potential to act via a mutagenic mode of action. However, as indicated earlier, speciation data is not available for soils and it was conservatively assumed that 1/7 of the total chromium was hexavalent chromium, and that the remaining 6/7 is trivalent chromium, likely overestimating the potential chromium (VI) assessed in the HHRA. Risk estimates for chromium (VI) were in excess of target levels for both the construction and operations phase of the project and risk mitigation has been recommended. It is noted that once speciation data becomes available, age-dependent adjustment factors should be applied in the estimation of risks (in accordance with Health Canada, 2024) in the event that risk targets are met without application of these factors. However, given the conservatism applied in the HHRA in the estimation of chromium (VI) concentrations, and that risk mitigation measures were considered warranted without further adjustment, it is unlikely that this has added uncertainty to the conclusions of the HHRA.
	The TRVs provided by regulatory health agencies (e.g., Health Canada, US EPA, WHO) are protective of critical sub-groups, or sensitive subpopulations (i.e., those with physical characteristics or conditions that may result in an increased likelihood of adverse effect to a given level of exposure, for example, the elderly or persons suffering from existing medical conditions). These sensitive subpopulations are considered by the agencies in the derivation of TRVs. When deriving TRVs, health agencies apply safety or uncertainty factors (i.e., an intraspecies/human variability uncertainty factor) to protect for sensitive subpopulations. TRVs are determined from responses to exposures observed in toxicity (animal) studies and epidemiology (human) studies. For noncarcinogens, these responses were typically reported as an oral dose (i.e., mg chemical/kg body weight/day), or air concentration (i.e., mg/m^3), associated with a No Observed Adverse Effect Level (NOAEL) or Lowest Observed Adverse Effect Level (LOAEL), which was then adjusted (i.e., reduced) by the application of uncertainty factors. Uncertainty factors are assigned to account for uncertainty of the response between species (e.g., 10-fold), the response within a species population (e.g., 10-fold), the difference in response to sub-chronic versus chronic exposures (e.g., 10-fold), the difference between a LOAEL and the NOAEL (e.g., 10-fold), and the quality of the database for observed effects (e.g., 3-fold). The overall uncertainty associated with an observed response is the product of the individual uncertainty factors and generally ranges from 10 to 1000.	The HHRA used TRVs recommended by regulatory health agencies to determine potential risks resulting from exposure to COPCs. TRVs selected for use in the HHRA have incorporated an uncertainty factor to account for potential inter-individual differences in sensitivity. Uncertainty factors generally result in a 10-to-1000-fold adjustment/reduction to account for sensitivity. Therefore, the TRVs are health protective, and protective of sensitive sub-populations. It is considered unlikely that risks have been under-predicted based on the TRVs used in the HHRA.
Risk Characterization	Health Canada (2024) guidance indicates that total Hazard Quotients are interpreted according to the following general guidelines: ▪ ≤ 0.2 = negligible human health risks; and ▪ > 0.2 = potential unacceptable risks which may require mitigation or more detailed assessment. Health Canada's negligible risk level of 0.2 (or 20% of the TRV) for non-carcinogens allows for 80% of the acceptable exposure level (i.e., as defined by the TRV) to come from other sources; this approach is based on the potential for exposures to a chemical in air, soil, water, food and consumer products (i.e., 20% of the acceptable exposure is allocated to each of these 5 media/sources). However, Health Canada considered a HQ of 1.0 acceptable when background/multimedia exposures are considered. Where available, the HHRA used background exposure data for determining cumulative risks.	The risk estimates in the HHRA assumed air, soil and food exposures and considered background concentrations where available. The Health Canada (2024) essentially negligible human health risks HQ of 0.2 is derived to consider additional background and multimedia sources of COPCs. Therefore, use of a HQ of 0.2 as a target risk level in the HHRA where background and multiple exposure media have been considered is highly conservative.

HHRA Section	Source of Uncertainty	Impact on Results of the HHRA
	For the operation phase of the Project, over the duration when the surface is not paved, the predicted HQs for PM_{10} , $PM_{2.5}$ and/or TSP exceeded the negligible risk level for acute risks of an HQ ≤ 1.0 at two points of impingement of interest (at culturally sensitive area CHL25 at 60 m from the road centre line and at existing/future residences). However, for the paved scenarios, the only exceedance of the negligible risk level was a marginal exceedance predicted for PM_{10} (HQ of 1.1) for the nearest culturally sensitive area.	Based on the low magnitude of the PM_{10} exceedance for the paved scenario, and given the conservatism in the model, with the majority of the PM_{10} concentration being attributed to background, the actual potential for unacceptable risks is considered to be low to negligible. Despite this, air monitoring is recommended to ground truth the results of the AQIA, and additional dust mitigative measures will be employed as required based on the results of the air monitoring.
	The report evaluated potential health risks resulting from the Project using a risk assessment framework. The HHRA was completed using Health Canada risk assessment guidance and is generally consistent with risk assessment methodology used by the US EPA and WHO.	The use of Health Canada guidance and supporting regulatory guidance indicates that the HHRA results are consistent with HHRA's conducted under similar assumptions and scenarios for Projects those seeking regulatory compliance. It is considered unlikely that risks have been under predicted in the context of the regulatory framework.
	Risk characterization uses the results of the previous assessments and assumptions considered in the HHRA (e.g., exposure assessment, toxicity assessment). Therefore, the uncertainties of the previous sections are compounded in the risk characterization stage of the HHRA.	Due to the conservatism in the previous sections, it is considered likely that potential risks due to the Project have been over-estimated.

As summarized in the above table, the conservative approach used to estimate exposures and associated risks to the receptors of concern will, overall, tend to overestimate exposures and risks.

8. Conclusions and Risk-Based Recommendations

A HHRA dated October 2024 (Appendix P of the EAR/IS) was prepared to support the EAR/IS. Following review of the AQIA, provincial regulators issued comments which justified a revision of the AQIA. This HHRA Addenda has been prepared based on the revised AQIA (AtkinsRéalis, 2024a) and incorporates comments on the October 2024 HHRA from the Human Toxicology and Air Standards Section, Technical Assessment and Standards Development Branch, of the Ontario MECP provided in November 2025.

The HHRA has been conducted using methods and guidance recommended by Health Canada, Ontario MECP and other regulatory health agencies, and using a series of conservative assumptions that will tend to overpredict exposures, and therefore risks, to the identified receptors of concern. As noted, the potential for risks exceeding Health Canada and the Ontario MECP negligible risk levels has been predicted for both the construction and operation phases of the Project when cumulative (i.e., baseline + Project) exposures are considered.

The following sections further discuss the results for the construction phase and operation phase of the Project, including a comparison of estimated risks for the baseline scenario, Project scenario and cumulative scenario. Overall, the HHRA has likely overpredicted exposures and associated health risks associated with the construction and operation phases of the Project. When the conservatism and uncertainty in the estimates are considered, as long as mitigation measures are implemented, and air monitoring is implemented to ground truth the results of the AQIA and HHRA, it is unlikely that unacceptable health risks will result from the Project.

8.1 Construction Phase

The HHRA estimated exposures to baseline concentrations of the identified air COPCs, as well as associated risks with the project construction itself along with cumulative (baseline + project construction) risks.

The results of the revised AQIA indicated that estimated acute risks for the baseline scenario were greater than the Health Canada and Ontario MECP negligible risk level for B(a)P (24-hour). Additionally, baseline carcinogenic risks for chromium (VI) exceeded the negligible risk level of 1×10^{-5}.

For the construction phase of the Project, non-cancer risks associated with the Project only were in excess of the Health Canada and Ontario MECP negligible risk level for one or more of the scenarios evaluated for acrolein (24-hour), B(a)P (24-hour), DPM (2-hour), $PM_{2.5}$ (24-hour), PM_{10} (24-hour), TSP (24-hour), NO_2 (1-hour), chromium (VI), iron and nickel. Cumulative non-carcinogenic risks (baseline + Project) in excess of the negligible risk levels were predicted for each of these COPCs, as well as benzene (24-hour) and SO_2 (1-hour). Baseline concentrations of SO_2 contributed significantly, and more so, than the Project to the HQ of 1.1 (baseline of 9×10^{-1} compared to Project contribution of 2.2×10^{-1}). Cumulative (baseline + Project) carcinogenic risk for chromium (VI) exceeded the negligible risk level of 1×10^{-5}.

In the absence of soil data from the area, which contains peat and is thus less likely to produce particulate, metals concentrations were estimated using soil data from the Eagle's Nest Mine and maximum predicted TSP concentrations likely resulting in an overprediction of concentrations and associated risks. In the absence of speciated chromium concentrations in soil, the baseline TSP hexavalent chromium concentration was predicted using highly conservative assumptions. Overall, all estimated exposures and risks associated with exposures to hexavalent chromium are considered to be highly conservative and unlikely to represent actual exposures. As noted below, it is therefore recommended that soil samples be collected from the LSA and submitted for analysis of chromium speciation, with the results used to revisit the conclusions of the HHRA for metals COPCs (iron, nickel and chromium [VI]).

As discussed in **Section 6.1**, the results of the AQIA for the construction phase are conservative and have likely overpredicted Project-related emissions. Further, the predicted ≤ 24-hour exceedances are unlikely to occur over the same area with repeated frequency as construction activities would move along the corridor and the only annual exceedance is based on existing baseline conditions with negligible contributions from the project itself. An Air Quality and Dust Control Management Plan that will be developed and implemented for the Project will integrate a monitoring procedure for dustfall effects and measures to control or limit particulate emissions. Additional mitigation measures beyond those accounted for in the AQIA will be implemented, as warranted.

8.2 Operation Phase

The HHRA estimated exposures to baseline concentrations of the identified air COPCs, as well as associated risks with the Project during the operations itself along with cumulative (baseline + Project operations) risks. During the operations phase, the results of the revised AQIA resulted in estimated risks for the baseline scenario greater than the Health Canada and Ontario MECP negligible risk levels for chromium (VI). Baseline concentrations of $PM_{2.5}$ (24-hour) contributed significantly (approximately 50%) to risk estimates in excess of negligible risk levels.

For the operations phase of the Project, non-cancer risks associated with the Project only were in excess of the Health Canada and Ontario MECP negligible risk level for one or more of the scenarios evaluated for $PM_{2.5}$ (24-hour), PM_{10} (24-hour) and TSP (24-hour). Cumulative non-carcinogenic risks (baseline + Project) in excess of the negligible risk level were predicted for each of these COPCs. Project and cumulative (baseline + Project) carcinogenic risk for chromium (VI) exceeded the negligible risk level of 1×10^{-5}.

In the absence of soil data from the area, which contains peat and is thus less likely to produce particulate, metals concentrations were estimated using soil data from the Eagle's Nest Mine and maximum predicted TSP concentrations likely resulting in an overprediction of concentrations and associated risks. In the absence of speciated chromium concentrations in soil, the baseline TSP hexavalent chromium concentration was predicted using highly conservative assumptions. Overall, all estimated exposures and risks associated with exposures to hexavalent chromium are considered to be highly conservative and unlikely to represent actual exposures. As noted below, it is therefore recommended that soil samples be collected from the LSA and submitted for analysis of chromium speciation, with the results used to revisit the conclusions of the HHRA for chromium (VI).

As discussed in **Section 6.1**, the results of the AQIA for the operations phase are conservative and have likely overpredicted Project related emissions. An Air Quality and Dust Control Management Plan that will be developed and implemented for the Project will integrate a monitoring procedure for dustfall effects and measures to control or limit particulate emissions. Additional mitigation measures beyond those accounted for in the AQIA will be implemented, as warranted.

8.3 Risk-Based Recommendations

As discussed in earlier sections, at the time of completion of the HHRA, data representative of metals in dust generated from the Project was not available and thus, additional analyses are required to confirm the results of the HHRA. Further, the results of the HHRA are contingent upon the application of mitigation measures described in each of the linked VC assessments. As such, the following recommendations are provided based on the results of the HHRA:

1. **Soil and Gravel Sampling:**
   - To further characterize metals in soil and associated particulates from soil during the Project, it is recommended that soil samples be collected from the LSA and submitted for analysis of total metals, as well as for speciation of chromium. This data should be used to confirm that the soil metals concentrations obtained from the Eagle's Nest EA are representative of the WSR ROW, and to determine concentrations of hexavalent chromium, if any, in soils in the region. This data should be used to update the results of the HHRA.
   - To characterize metals and PAHs in gravel and associated particulates from gravel during the Project, it is recommended that gravel samples be collected and be submitted for analysis of metals and PAHs. This data should be used to confirm potential contributions of gravel particulate to human exposures.
2. **Air Quality Monitoring**:
   - Install real-time air quality monitoring stations at key locations, specifically near points of impingement of interest where exceedances of the air quality guidelines were predicted by the AQIA.
   - **Construction phase:** Focus on monitoring PM_{10} (24-hour) $PM_{2.5}$ (24-hour) TSP (24-hour), SO_2 (1-hour), NO_2 (1-hour), DPM (2-hour), acrolein (24-hour), benzene (24-hour) and benzo(a) pyrene (24-hour) in addition to chromium (VI), iron and nickel to ensure concentrations remain within acceptable limits.
   - **Operation phase:** Focus on monitoring TSP (24-hour), PM_{10} (24-hour) and $PM_{2.5}$ (24-hour) in addition to chromium (VI) to ensure concentrations remain within acceptable limits.
3. **Dust Control Measures**:
   - Implement dust suppression techniques if exceedances of the air quality guidelines are measured.
4. **Regular Reporting and Review**:
   - Provide regular updates on air quality data to stakeholders and rightsholders, including the Webequie First Nation, and other First Nation communities.
   - Review monitoring data periodically to identify trends and implement corrective actions if necessary.

By following these recommendations, the Project can effectively manage and mitigate the exposure and risks associated with emissions during both the construction and operation phases. Further, the soil and gravel data will allow for a more accurate prediction of metals concentrations in particulate generated from soils, as well as risks associated with exposures to metals in particulate.

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APPENDIX A

Eagle's Nest Multi-Metal Mine Environmental Assessment Baseline Metals Soil Data

TABLE 1: Soil Chemistry from Eagle's Nest Environmental Assessment: Baseline Total Metals

Metals	Units	Detection Limit	Sample ID									Statistic	
			12-SOIL-04-1	12-SOIL-05-1	12-SOIL-05-2 (duplicate)	12-SOIL-07-1	12-SOIL-07-2	12-SOIL-08-1	12-SOIL-08-2	12-SOIL-09-1	12-SOIL-09-2	Maximum Concentration	ProUCL 95%UCLM
Antimony (Sb)	ug/g	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-
Arsenic (As)	ug/g	0.20	2.91	5.15	4.87	3.25	0.87	5.36	4.58	2.90	5.07	5	5
Barium (Ba)	ug/g	1.0	61.3	116	104	16.2	40.2	127	117	35.0	109	127	107
Beryllium (Be)	ug/g	0.50	0.62	1.08	0.99	<0.50	<0.50	0.85	0.81	<0.50	0.76	1	1
Boron (B)	ug/g	5.0	10.8	15.3	14.6	<5.0	7.2	14.3	14.9	6.4	19.5	20	15
Cadmium (Cd)	ug/g	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.54	<0.50	0.54	-
Calcium (Ca)	ug/g	100	26500	7160	7070	6640	53000	6130	61700	2490	96600	96600	50374
Chromium (Cr)	ug/g	1.0	33.8	68.8	63.1	2.9	5.5	79.5	59.5	15.3	52.1	80	60
Cobalt (Co)	ug/g	1.0	eight soil	15.9	14	<1.0	1	17.6	12.9	3.1	12.4	18	14
Copper (Cu)	ug/g	1.0	12	18.5	17.5	1.8	11.8	19.3	28.2	5.9	25.5	28	21
Iron (Fe)	ug/g	50	21000	39700	36000	566	3820	44500	30300	10100	28600	44500	33717
Lead (Pb)	ug/g	1.0	9.8	14.8	12.8	9.3	2.6	14.8	10.3	27.4	10.1	27	17
Lithium (Li)	ug/g	1.0	18.5	42.2	37.1	<1.0	<1.0	43.8	33.1	6.6	32.3	44	35
Mercury (Hg)	ug/g	0.010	0.025	0.023	0.024	0.104	0.084	0.017	0.028	0.121	0.02	0.121	-
Molybdenum (Mo)	ug/g	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-
Nickel (Ni)	ug/g	1.0	23.2	43.7	40	2.3	5.7	48.9	36	8.5	33.8	49	38
Selenium (Se)	ug/g	1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	1.3	-
Uranium (U)	ug/g	1.0	<1.0	<1.0	<1.0	<1.0	2.5	<1.0	<1.0	<1.0	<1.0	3	-
Vanadium (V)	ug/g	1.0	37.5	71.3	65.5	<1.0	5.1	79.3	57.8	20.8	55.1	79	62
Zinc (Zn)	ug/g	5.0	58.3	75.1	71.5	20.1	13.2	98.5	66.5	40.2	62.4	99	73

Notes:

Data obtained from Noront Resources Ltd. (Noront). 2013. Eagle's Nest Project Environmental Impact Statement/ Environmental Assessment Report – Draft Copy.

ProUCL 95% UCLM - 95% upper confidence limit of the mean concentration; calculated using USEPA's ProUCL, Version 5.2.

APPENDIX B

HHRA Worked Calculations and Detailed Results

Example Risk Calculations and Detailed Results

1 Introduction

This appendix provides technical information to support the Human Health Risk Assessment (HHRA) results presented in the main report. Worked example of the risk estimation procedure are provided in the following section. Detailed risk estimates for the human receptors of concern quantitatively evaluated in the HHRA are attached to this appendix as Tables 1a to 5k.

2 Worked Examples of Risk Calculations

The following worked examples provide the risk estimation procedure for exposure of the nearest sensitive receptors[1] to chromium (VI) and iron in soil dust during the construction phase in a Tier 4 (80%)/Tier 2 (20%) engine usage scenario. The inhalation pathway was assessed for all parameters except for those parameters (e.g., iron) without a suitable inhalation toxicity reference value (TRV). For these parameters, exposure doses were instead estimated via the ingestion pathway. The worked examples show risk calculations for non-carcinogenic exposures in toddlers for both chromium (VI) and iron as well as carcinogenic exposures in adults (using an amortized air concentration) for chromium (VI) alone.

The following were used as exposure point concentrations for human receptors:

- Cumulative[2] chromium (VI) concentration = 0.0016 µg/m^3
- Cumulative iron concentration = 6.2 µg/m^3

2.1 Estimation of Risks from Inhalation of Soil Particulate

For chromium (VI), an inhalation TRVs (unit risk estimate) were available for characterization of both non-carcinogenic and carcinogenic inhalation risks. As previously noted, no inhalation TRV was available for iron and, therefore, an oral TRV was used for comparison against the estimated exposure dose for iron. Chromium (VI) and iron exposures via inhalation of airborne soil particulate was estimated according to the following equation:

$$EIA = \frac{C_A \times IR_A\,(for\ dose\ calculations\ only) \times RAF_{Inh} \times D_1 \times D_2 \times D_3 \times D_4}{BW\,(for\ dose\ calculations\ only) \times LE}$$

Where:

EIA	=	exposure from the dust inhalation pathway for soil (µg/m^3 [concentration] or µg/kg BW/day [dose])
C_A	=	particulate concentration in air (0.0016 µg/m^3 for chromium [VI]; 6.2 µg/m^3 for iron)
IR_A	=	inhalation rate (8.3 m^3/day toddler) (only used to estimate exposure dose for iron)
RAF_{Inh}	=	relative absorption factor via inhalation (1.0)
D_1	=	hours per day exposed (24 hours/24 hours)
D_2	=	days per week exposed (7 days/7 days)

[1] Nearest sensitive receptors include the existing residences and institutional buildings within the Webequie First Nation community.
[2] The cumulative concentration which includes contributions from the project as well as the pre-existing conditions.

D_3	=	weeks per year exposed (52 weeks/52 weeks)
D_4	=	total years exposed (60 years, only used to amortize exposure concentration for chromium [VI])
BW	=	body weight (16.5 kg toddler) (only used to estimate exposure dose for iron)
LE	=	life expectancy (80 years, only used to amortize exposure concentration for chromium [VI])

Non-carcinogenic inhalation risks for parameters with available inhalation TRVs were estimated as a hazard quotient (HQ) according to the following equation:

$$HQ = \frac{EIA\ (\mu g/m^3)}{Reference\ Concentration\ (\mu g/m^3)}$$

Non-carcinogenic inhalation risks for parameters without inhalation TRVs were estimated as a HQ according to the following equation:

$$HQ = \frac{EIA\ (\mu g/kg\ BW/day)}{Reference\ Dose\ (\mu g/kg\ BW/day)}$$

Carcinogenic inhalation risks were estimated as an Incremental Lifetime Cancer Risk (ILCR) according to the following equation:

$$ILCR = Amortized\ EIA\ (\mu g/m^3) \times Inhalation\ Unit\ Risk\ (\mu g/m^3)^{-1}$$

Selected TRVs (i.e., reference concentration, reference dose, inhalation unit risk) for the relevant parameters and exposure pathway combinations are provided in the main report.

2.1.1 Non-Carcinogenic Exposure – Chromium (VI)

The exposure concentration for chromium (VI) in soil particulate was estimated as follows:

$$EIA = 0.0016\ \mu g/m^3 \times 1.0 \times 24\ hr/24\ hr \times 7\ days/7\ days \times 52\ weeks/52\ weeks$$
$$= 1.6 \times 10^{-3}\ \mu g/m^3$$

The non-carcinogenic soil particulate inhalation risk for chromium (VI) was then estimated as a HQ as follows:

$$HQ = \frac{1.6 \times 10^{-3}\ \mu g/m^3}{1.0 \times 10^{-1}\ \mu g/m^3}$$

An HQ of 1.6 x 10^{-2} was estimated for the Webequie First Nation community member exposed to chromium (VI) via inhalation of soil particulate.

2.1.2 Carcinogenic Exposure (Adult) – Chromium (VI)

The amortized exposure concentration for chromium (VI) in soil particulate for an adult receptor was estimated as follows:

$$EIA = \frac{0.0016\ \mu g/m^3 \times 1.0 \times 24\ hr/24\ hr \times 7\ days/7\ days \times 52\ weeks/52\ weeks \times 60\ years}{80\ years}$$

$$= 1.2 \times 10^{-3}\ \mu g/m^3$$

The carcinogenic soil inhalation particulate risk for chromium (VI) was then estimated as an ILCR as follows:

$$ILCR = 1.2 \times 10^{-3}\ \mu g/m^3 \times (7.6 \times 10^{-2}\ \mu g/m^3)^{-1}$$

An ILCR of 9.1 x 10^{-5} was estimated for an adult Webequie First Nation community member exposed to chromium (VI) via soil particulate inhalation.

2.1.1 Non-Carcinogenic Exposure (Toddler) – Iron

The exposure dose for iron in soil particulate for a toddler receptor was estimated as follows:

$$EIA = \frac{6.2\ \mu g/m^3 \times 8.3\ m^3/day \times 1.0 \times 24\ hr/24\ hr \times 7\ days/7\ days \times 52\ weeks/52\ weeks}{16.5\ kg}$$

$$= 3.1\ \mu g/kg\ BW/day$$

The non-carcinogenic soil particulate inhalation risk for iron was then estimated as an HQ as follows:

$$HQ = \frac{3.1\ \mu g/kg\ BW/day}{4.2 \times 10^2\ \mu g/kg\ BW/day}$$

An HQ of 7.4×10^{-3} was estimated for the toddler resident receptor exposed to the maximum concentration of iron in soil via inhalation of soil particulate.

3 Detailed Risk Estimates

Detailed risk estimates for the human receptors of concern quantitatively evaluated in the HHRA are attached to this appendix as Tables 1a to 5k.

Table 1a: Modelled Air Contaminants Inhalation Risk Estimates for the Nearest Sensitive Receptor (Existing Residences+Institutional Buildings) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase

Scenario: Baseline

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	(μg/m^3)		(μg/m^3)		
Criteria Air Contaminants					
Acrolein	1 hour AAQC:	4.5	0.04	1 hour	8.9E-03
Acrolein	24 hour AAQC:	0.40	0.04	24 hour	1.0E-01
Benzene	24 hour AAQC:	2.3	0.90	24 hour	3.9E-01
Propanal	10 minute AAQC:	10	1.6	24 hour	1.6E-01
BaP	24 hour AAQC:	0.000050	0.00012	24 hour	**2.4E+00**
DPM	2 hour HC:	10	0	2 hour	0.0E+00
$PM_{2.5}$*	24 hour CAAQS:	23	13	24 hour	5.7E-01
$PM_{2.5}$*	Annual CAAQS:	8.0	4.7	Annual	5.9E-01
PM_{10}*	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP*	24 hour AAQC:	120	45	24 hour	3.8E-01
CO	1 hour AAQC:	36,200	5,061	1 hour	1.4E-01
SO_2	10 minute AAQC:	180	149	10 minute	8.3E-01
SO_2	1 hour AAQC:	100	90	1 hour	9.0E-01
NO_2	1 hour AAQC:	400	51	1 hour	1.3E-01
NO_2	1 hour CAAQS:	79	28	1 hour	3.5E-01
NO_2	24 hour AAQC:	200	23	24 hour	1.2E-01

Scenario: Project (Construction)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	(μg/m^3)		(μg/m^3)		
Criteria Air Contaminants					
Acrolein	1 hour AAQC:	4.5	0.27	1 hour	6.0E-02
Acrolein	24 hour AAQC:	0.40	0.063	24 hour	1.6E-01
Benzene	24 hour AAQC:	2.3	0.18	24 hour	7.8E-02
Propanal	10 minute AAQC:	10	0.52	24 hour	5.2E-02
BaP	24 hour AAQC:	0.000050	0.000026	24 hour	5.2E-01
DPM	2 hour HC:	10	15	2 hour	**1.5E+00**
$PM_{2.5}$*	24 hour CAAQS:	23	24	24 hour	1.0E+00
$PM_{2.5}$*	Annual CAAQS:	8.0	0.061	Annual	7.6E-03
PM_{10}*	24 hour AAQC:	50	141	24 hour	**2.8E+00**
TSP*	24 hour AAQC:	120	140	24 hour	**1.2E+00**
CO	1 hour AAQC:	36,200	83	1 hour	2.3E-03
SO_2	10 minute AAQC:	180	2.8	10 minute	1.6E-02
SO_2	1 hour AAQC:	100	1.7	1 hour	1.7E-02
NO_2	1 hour AAQC:	400	98	1 hour	2.5E-01
NO_2	1 hour CAAQS:	79	95	1 hour	**1.2E+00**
NO_2	24 hour AAQC:	200	36	24 hour	1.8E-01

Scenario: Baseline+Project (Construction)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Construction (%)
	(μg/m^3)		(μg/m^3)				
Criteria Air Contaminants							
Acrolein	1 hour AAQC:	4.5	0.31	1 hour	6.9E-02	13%	87%
Acrolein	24 hour AAQC:	0.40	0.10	24 hour	2.5E-01	40%	63%
Benzene	24 hour AAQC:	2.3	1.1	24 hour	4.8E-01	82%	16%
Propanal	10 minute AAQC:	10	2.1	24 hour	2.1E-01	76%	25%
BaP	24 hour AAQC:	0.000050	0.00015	24 hour	**3.0E+00**	80%	17%
DPM	2 hour HC:	10	15	2 hour	**1.5E+00**	0%	100%
$PM_{2.5}$*	24 hour CAAQS:	23	37	24 hour	**1.6E+00**	35%	65%
$PM_{2.5}$*	Annual CAAQS:	8.0	4.8	Annual	6.0E-01	98%	1%
PM_{10}*	24 hour AAQC:	50	169	24 hour	**3.4E+00**	17%	83%
TSP*	24 hour AAQC:	120	185	24 hour	**1.5E+00**	24%	76%
CO	1 hour AAQC:	36,200	5,144	1 hour	1.4E-01	98%	2%
SO_2	10 minute AAQC:	180	152	10 minute	8.4E-01	98%	2%
SO_2	1 hour AAQC:	100	92	1 hour	9.2E-01	98%	2%
NO_2	1 hour AAQC:	400	149	1 hour	3.7E-01	34%	66%
NO_2	1 hour CAAQS:	79	123	1 hour	**1.6E+00**	23%	77%
NO_2	24 hour AAQC:	200	59	24 hour	3.0E-01	39%	61%

Notes:

BOLD Hazard Quotient >1.0

* Maximum Particulate Concentrations and Dust Depositions in Areas of Interest For the Scenario with Water Dust Control on Road Surfaces During the Construction Phase

Table 1b: Modelled Air Contaminants Inhalation Risk Estimates for CHL25 (60 m from RCL) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase

Scenario: Baseline

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	(μg/m^3)		(μg/m^3)		
Criteria Air Contaminants					
Acrolein	1 hour AAQC:	4.5	0.04	1 hour	8.9E-03
Acrolein	24 hour AAQC:	0.40	0.04	24 hour	1.0E-01
Benzene	24 hour AAQC:	2.3	0.90	24 hour	3.9E-01
Propanal	10 minute AAQC:	10	1.6	24 hour	1.6E-01
BaP	24 hour AAQC:	0.000050	0.00012	24 hour	**2.4E+00**
DPM	2 hour HC:	10	0	2 hour	0.0E+00
$PM_{2.5}$*	24 hour CAAQS:	23	13	24 hour	5.7E-01
$PM_{2.5}$*	Annual CAAQS:	8.0	4.7	Annual	5.9E-01
PM_{10}*	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP*	24 hour AAQC:	120	45	24 hour	3.8E-01
CO	1 hour AAQC:	36,200	5,061	1 hour	1.4E-01
SO_2	10 minute AAQC:	180	149	10 minute	8.3E-01
SO_2	1 hour AAQC:	100	90	1 hour	9.0E-01
NO_2	1 hour AAQC:	400	51	1 hour	1.3E-01
NO_2	1 hour CAAQS:	79	28	1 hour	3.5E-01
NO_2	24 hour AAQC:	200	23	24 hour	1.2E-01

Scenario: Project (Construction)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	(μg/m^3)		(μg/m^3)		
Criteria Air Contaminants					
Acrolein	1 hour AAQC:	4.5	2.5	1 hour	5.6E-01
Acrolein	24 hour AAQC:	0.40	0.74	24 hour	**1.9E+00**
Benzene	24 hour AAQC:	2.3	2.1	24 hour	9.1E-01
Propanal	10 minute AAQC:	10	4.8	24 hour	4.8E-01
BaP	24 hour AAQC:	0.000050	0.00030	24 hour	**6.0E+00**
DPM	2 hour HC:	10	147	2 hour	**1.5E+01**
$PM_{2.5}$*	24 hour CAAQS:	23	381	24 hour	**1.7E+01**
$PM_{2.5}$*	Annual CAAQS:	8.0	0.59	Annual	7.4E-02
PM_{10}*	24 hour AAQC:	50	2448	24 hour	**4.9E+01**
TSP*	24 hour AAQC:	120	5701	24 hour	**4.8E+01**
CO	1 hour AAQC:	36,200	757	1 hour	2.1E-02
SO_2	10 minute AAQC:	180	36	10 minute	2.0E-01
SO_2	1 hour AAQC:	100	22	1 hour	2.2E-01
NO_2	1 hour AAQC:	400	265	1 hour	6.6E-01
NO_2	1 hour CAAQS:	79	250	1 hour	**3.2E+00**
NO_2	24 hour AAQC:	200	134	24 hour	6.7E-01

Scenario: Baseline+Project (Construction)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Construction (%)
	(μg/m^3)		(μg/m^3)				
Criteria Air Contaminants							
Acrolein	1 hour AAQC:	4.5	2.5	1 hour	5.6E-01	2%	100%
Acrolein	24 hour AAQC:	0.40	0.78	24 hour	**2.0E+00**	5%	95%
Benzene	24 hour AAQC:	2.3	3.0	24 hour	**1.3E+00**	30%	70%
Propanal	10 minute AAQC:	10	6.4	24 hour	6.4E-01	25%	75%
BaP	24 hour AAQC:	0.000050	0.00042	24 hour	**8.4E+00**	29%	71%
DPM	2 hour HC:	10	147	2 hour	**1.5E+01**	0%	100%
$PM_{2.5}$*	24 hour CAAQS:	23	394	24 hour	**1.7E+01**	3%	97%
$PM_{2.5}$*	Annual CAAQS:	8.0	5.3	Annual	6.6E-01	89%	11%
PM_{10}*	24 hour AAQC:	50	2476	24 hour	**5.0E+01**	1%	99%
TSP*	24 hour AAQC:	120	5746	24 hour	**4.8E+01**	1%	99%
CO	1 hour AAQC:	36,200	5,818	1 hour	1.6E-01	87%	13%
SO_2	10 minute AAQC:	180	185	10 minute	**1.0E+00**	81%	19%
SO_2	1 hour AAQC:	100	112	1 hour	**1.1E+00**	81%	20%
NO_2	1 hour AAQC:	400	316	1 hour	7.9E-01	16%	84%
NO_2	1 hour CAAQS:	79	278	1 hour	**3.5E+00**	10%	90%
NO_2	24 hour AAQC:	200	157	24 hour	7.9E-01	15%	85%

Notes:

BOLD Hazard Quotient >1.0

* Maximum Particulate Concentrations and Dust Depositions in Areas of Interest For the Scenario with Water Dust Control on Road Surfaces During the Construction Phase

Table 1c: Modelled Air Contaminants Inhalation Risk Estimates for 50 m from Road Centerline with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase

Scenario: Baseline

Chemical	TRV ($\mu g/m^3$)		Exposure Concentration ($\mu g/m^3$)	Averaging Time	Hazard Quotient
Criteria Air Contaminants					
Acrolein	1 hour AAQC:	4.5	0.04	1 hour	8.9E-03
Acrolein	24 hour AAQC:	0.40	0.04	24 hour	1.0E-01
Benzene	24 hour AAQC:	2.3	0.90	24 hour	3.9E-01
Propanal	10 minute AAQC:	10	1.6	24 hour	1.6E-01
BaP	24 hour AAQC:	0.000050	0.00012	24 hour	**2.4E+00**
DPM	2 hour HC:	10	0	2 hour	0.0E+00
$PM_{2.5}$*	24 hour CAAQS:	23	13	24 hour	5.7E-01
$PM_{2.5}$*	Annual CAAQS:	8.0	4.7	Annual	5.9E-01
PM_{10}*	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP*	24 hour AAQC:	120	45	24 hour	3.8E-01
CO	1 hour AAQC:	36,200	5,061	1 hour	1.4E-01
SO_2	10 minute AAQC:	180	149	10 minute	8.3E-01
SO_2	1 hour AAQC:	100	90	1 hour	9.0E-01
NO_2	1 hour AAQC:	400	51	1 hour	1.3E-01
NO_2	1 hour CAAQS:	79	28	1 hour	3.5E-01
NO_2	24 hour AAQC:	200	23	24 hour	1.2E-01

Scenario: Project (Construction)

Chemical	TRV ($\mu g/m^3$)		Exposure Concentration ($\mu g/m^3$)	Averaging Time	Hazard Quotient
Criteria Air Contaminants					
Acrolein	1 hour AAQC:	4.5	4.4	1 hour	9.8E-01
Acrolein	24 hour AAQC:	0.40	1.5	24 hour	**3.8E+00**
Benzene	24 hour AAQC:	2.3	4.4	24 hour	**1.9E+00**
Propanal	10 minute AAQC:	10	8.6	24 hour	8.6E-01
BaP	24 hour AAQC:	0.000050	0.00063	24 hour	**1.3E+01**
DPM	2 hour HC:	10	271	2 hour	**2.7E+01**
$PM_{2.5}$*	24 hour CAAQS:	23	1141	24 hour	**5.0E+01**
$PM_{2.5}$*	Annual CAAQS:	8.0	1.5	Annual	1.9E-01
PM_{10}*	24 hour AAQC:	50	5752	24 hour	**1.2E+02**
TSP*	24 hour AAQC:	120	16211	24 hour	**1.4E+02**
CO	1 hour AAQC:	36,200	1324	1 hour	3.7E-02
SO_2	10 minute AAQC:	180	31	10 minute	1.7E-01
SO_2	1 hour AAQC:	100	19	1 hour	1.9E-01
NO_2	1 hour AAQC:	400	416	1 hour	1.0E+00
NO_2	1 hour CAAQS:	79	392	1 hour	**5.0E+00**
NO_2	24 hour AAQC:	200	194	24 hour	9.7E-01

Scenario: Baseline+Project (Construction)

Chemical	TRV ($\mu g/m^3$)		Exposure Concentration ($\mu g/m^3$)	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Construction (%)
Criteria Air Contaminants							
Acrolein	1 hour AAQC:	4.5	4.5	1 hour	1.0E+00	1%	98%
Acrolein	24 hour AAQC:	0.40	1.6	24 hour	**4.0E+00**	3%	94%
Benzene	24 hour AAQC:	2.3	5.3	24 hour	**2.3E+00**	17%	83%
Propanal	10 minute AAQC:	10	10.2	24 hour	1.0E+00	16%	84%
BaP	24 hour AAQC:	0.000050	0.00075	24 hour	**1.5E+01**	16%	84%
DPM	2 hour HC:	10	271	2 hour	**2.7E+01**	0%	100%
$PM_{2.5}$*	24 hour CAAQS:	23	1154	24 hour	**5.0E+01**	1%	99%
$PM_{2.5}$*	Annual CAAQS:	8.0	6.2	Annual	7.8E-01	76%	24%
PM_{10}*	24 hour AAQC:	50	5780	24 hour	**1.2E+02**	0%	100%
TSP*	24 hour AAQC:	120	16256	24 hour	**1.4E+02**	0%	100%
CO	1 hour AAQC:	36,200	6,403	1 hour	1.8E-01	79%	21%
SO_2	10 minute AAQC:	180	180	10 minute	1.0E+00	83%	17%
SO_2	1 hour AAQC:	100	109	1 hour	**1.1E+00**	83%	17%
NO_2	1 hour AAQC:	400	467	1 hour	**1.2E+00**	11%	89%
NO_2	1 hour CAAQS:	79	420	1 hour	**5.3E+00**	7%	93%
NO_2	24 hour AAQC:	200	217	24 hour	**1.1E+00**	11%	89%

Notes:

BOLD Hazard Quotient >1.0

* Maximum Particulate Concentrations and Dust Depositions in Areas of Interest For the Scenario with Water Dust Control on Road Surfaces During the Construction Phase

As the HHRA does not consider short-term occupational exposures (e.g., those associated with concentrations predicted near the road centreline), the exceedances predicted at areas of interest (i.e., current and future residences, institutional buildings and culturally sensitive areas) will be relied upon for decision making purposes in the HHRA

Table 2a: Modelled Air Contaminants Inhalation Risk Estimates for the Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Unpaved Surface and Water Control - Operation Phase

Scenario: Baseline

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	(μg/m^3)		(μg/m^3)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	13	24 hour	5.7E-01
$PM_{2.5}$	Annual CAAQS:	8.0	4.7	Annual	5.9E-01
PM_{10}	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP	24 hour AAQC:	120	45	24 hour	3.8E-01
TSP	Annual AAQC:	60	4.0	Annual	6.7E-02
NO_2	1 hour CAAQS:	79	28	1 hour	3.6E-01

Scenario: Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	(μg/m^3)		(μg/m^3)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	1.5	24 hour	6.5E-02
$PM_{2.5}$	Annual CAAQS:	8.0	0.11	Annual	1.4E-02
PM_{10}	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP	24 hour AAQC:	120	43	24 hour	3.6E-01
TSP	Annual AAQC:	60	1.6	Annual	2.7E-02
NO_2	1 hour CAAQS:	79	1.9	1 hour	2.4E-02

Scenario: Baseline+Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Operation (%)
	(μg/m^3)		(μg/m^3)				
Criteria Air Contaminants							
$PM_{2.5}$	24 hour CAAQS:	23	15	24 hour	6.5E-01	87%	10%
$PM_{2.5}$	Annual CAAQS:	8.0	4.8	Annual	6.0E-01	98%	2%
PM_{10}	24 hour AAQC:	50	56	24 hour	**1.1E+00**	50%	50%
TSP	24 hour AAQC:	120	88	24 hour	7.3E-01	51%	49%
TSP	Annual AAQC:	60	5.6	Annual	9.3E-02	71%	29%
NO_2	1 hour CAAQS:	79	30	1 hour	3.8E-01	94%	6%

Notes:
BOLD Hazard Quotient >1.0

Table 2b: Modelled Air Contaminants Inhalation Risk Estimates for CHL25 (60 m from RCL) with Unpaved Surface and Water Control - Operation Phase

Scenario: Baseline

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	13	24 hour	5.7E-01
$PM_{2.5}$	Annual CAAQS:	8.0	4.7	Annual	5.9E-01
PM_{10}	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP	24 hour AAQC:	120	45	24 hour	3.8E-01
TSP	Annual AAQC:	60	4.0	Annual	6.7E-02
NO_2	1 hour CAAQS:	79	28	1 hour	3.6E-01

Scenario: Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	14	24 hour	6.1E-01
$PM_{2.5}$	Annual CAAQS:	8.0	1.6	Annual	2.0E-01
PM_{10}	24 hour AAQC:	50	225	24 hour	**4.5E+00**
TSP	24 hour AAQC:	120	673	24 hour	**5.6E+00**
TSP	Annual AAQC:	60	40	Annual	6.7E-01
NO_2	1 hour CAAQS:	79	11	1 hour	1.4E-01

Scenario: Baseline+Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Operation (%)
	($\mu g/m^3$)		($\mu g/m^3$)				
Criteria Air Contaminants							
$PM_{2.5}$	24 hour CAAQS:	23	27	24 hour	**1.2E+00**	48%	52%
$PM_{2.5}$	Annual CAAQS:	8.0	6.3	Annual	7.9E-01	74%	25%
PM_{10}	24 hour AAQC:	50	253	24 hour	**5.1E+00**	11%	89%
TSP	24 hour AAQC:	120	718	24 hour	**6.0E+00**	6%	94%
TSP	Annual AAQC:	60	44	Annual	7.3E-01	9%	91%
NO_2	1 hour CAAQS:	79	39	1 hour	4.9E-01	72%	28%

Notes:
BOLD Hazard Quotient >1.0

Table 2c: Modelled Air Contaminants Inhalation Risk Estimates for 50 m from Road Centerline with Unpaved Surface and Water Control - Operation Phase

Scenario: Baseline

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	13	24 hour	5.7E-01
$PM_{2.5}$	Annual CAAQS:	8.0	4.7	Annual	5.9E-01
PM_{10}	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP	24 hour AAQC:	120	45	24 hour	3.8E-01
TSP	Annual AAQC:	60	4.0	Annual	6.7E-02
NO_2	1 hour CAAQS:	79	28	1 hour	3.6E-01

Scenario: Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	22	24 hour	9.6E-01
$PM_{2.5}$	Annual CAAQS:	8.0	3.7	Annual	4.6E-01
PM_{10}	24 hour AAQC:	50	355	24 hour	**7.1E+00**
TSP	24 hour AAQC:	120	1031	24 hour	**8.6E+00**
TSP	Annual AAQC:	60	97	Annual	**1.6E+00**
NO_2	1 hour CAAQS:	79	18	1 hour	2.3E-01

Scenario: Baseline+Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Operation (%)
	($\mu g/m^3$)		($\mu g/m^3$)				
Criteria Air Contaminants							
$PM_{2.5}$	24 hour CAAQS:	23	35	24 hour	**1.5E+00**	37%	63%
$PM_{2.5}$	Annual CAAQS:	8.0	8.4	Annual	**1.1E+00**	56%	44%
PM_{10}	24 hour AAQC:	50	383	24 hour	**7.7E+00**	7%	93%
TSP	24 hour AAQC:	120	1076	24 hour	**9.0E+00**	4%	96%
TSP	Annual AAQC:	60	101	Annual	**1.7E+00**	4%	96%
NO_2	1 hour CAAQS:	79	46	1 hour	5.8E-01	61%	39%

Notes:

BOLD Hazard Quotient >1.0

As the HHRA does not consider short-term occupational exposures (e.g., those associated with concentrations predicted near the road centreline), the exceedances predicted at areas of interest (i.e., current and future residences, institutional buildings and culturally sensitive areas) will be relied upon for decision making purposes in the HHRA

Table 2d: Modelled Air Contaminants Inhalation Risk Estimates for the Nearest Sensitive Receptor (Future Residences) with Unpaved Surface and Water Control - Operation Phase

Scenario: Baseline

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	13	24 hour	5.7E-01
$PM_{2.5}$	Annual CAAQS:	8.0	4.7	Annual	5.9E-01
PM_{10}	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP	24 hour AAQC:	120	45	24 hour	3.8E-01
TSP	Annual AAQC:	60	4.0	Annual	6.7E-02
NO_2	1 hour CAAQS:	79	28	1 hour	3.6E-01

Scenario: Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	15	24 hour	6.5E-01
$PM_{2.5}$	Annual CAAQS:	8.0	2.1	Annual	2.6E-01
PM_{10}	24 hour AAQC:	50	243	24 hour	**4.9E+00**
TSP	24 hour AAQC:	120	675	24 hour	**5.6E+00**
TSP	Annual AAQC:	60	54	Annual	9.0E-01
NO_2	1 hour CAAQS:	79	11	1 hour	1.4E-01

Scenario: Baseline+Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Operation (%)
	($\mu g/m^3$)		($\mu g/m^3$)				
Criteria Air Contaminants							
$PM_{2.5}$	24 hour CAAQS:	23	28	24 hour	**1.2E+00**	46%	54%
$PM_{2.5}$	Annual CAAQS:	8.0	6.8	Annual	8.5E-01	69%	31%
PM_{10}	24 hour AAQC:	50	271	24 hour	**5.4E+00**	10%	90%
TSP	24 hour AAQC:	120	720	24 hour	**6.0E+00**	6%	94%
TSP	Annual AAQC:	60	58	Annual	9.7E-01	7%	93%
NO_2	1 hour CAAQS:	79	39	1 hour	4.9E-01	72%	28%

Notes:
BOLD Hazard Quotient >1.0

Table 3a: Modelled Air Contaminants Inhalation Risk Estimates for the Nearest Sensitive Receptor (Existing Residences + Institutional Buildings) with Paved Surface - Operation Phase

Scenario: Baseline

Chemical	TRV ($\mu g/m^3$)		Exposure Concentration ($\mu g/m^3$)	Averaging Time	Hazard Quotient
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	13	24 hour	5.7E-01
$PM_{2.5}$	Annual CAAQS:	8.0	4.7	Annual	5.9E-01
PM_{10}	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP	24 hour AAQC:	120	45	24 hour	3.8E-01
TSP	Annual AAQC:	60	4.0	Annual	6.7E-02

Scenario: Project (Operation)

Chemical	TRV ($\mu g/m^3$)		Exposure Concentration ($\mu g/m^3$)	Averaging Time	Hazard Quotient
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	0.35	24 hour	1.5E-02
$PM_{2.5}$	Annual CAAQS:	8.0	0.033	Annual	4.1E-03
PM_{10}	24 hour AAQC:	50	3.0	24 hour	6.0E-02
TSP	24 hour AAQC:	120	3.1	24 hour	2.6E-02
TSP	Annual AAQC:	60	0.25	Annual	4.2E-03

Scenario: Baseline+Project (Operation)

Chemical	TRV ($\mu g/m^3$)		Exposure Concentration ($\mu g/m^3$)	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Operation (%)
Criteria Air Contaminants							
$PM_{2.5}$	24 hour CAAQS:	23	13	24 hour	5.7E-01	100%	3%
$PM_{2.5}$	Annual CAAQS:	8.0	4.7	Annual	5.9E-01	100%	1%
PM_{10}	24 hour AAQC:	50	31	24 hour	6.2E-01	90%	10%
TSP	24 hour AAQC:	120	48	24 hour	4.0E-01	94%	6%
TSP	Annual AAQC:	60	4.3	Annual	7.2E-02	93%	6%

Notes:
BOLD Hazard Quotient >1.0

Table 3b: Modelled Air Contaminants Inhalation Risk Estimates for CHL25 (60 m from RCL) with Paved Surface - Operation Phase

Scenario: Baseline

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	13	24 hour	5.7E-01
$PM_{2.5}$	Annual CAAQS:	8.0	4.7	Annual	5.9E-01
PM_{10}	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP	24 hour AAQC:	120	45	24 hour	3.8E-01
TSP	Annual AAQC:	60	4.0	Annual	6.7E-02

Scenario: Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	2.7	24 hour	1.2E-01
$PM_{2.5}$	Annual CAAQS:	8.0	0.45	Annual	5.6E-02
PM_{10}	24 hour AAQC:	50	25	24 hour	5.0E-01
TSP	24 hour AAQC:	120	56	24 hour	4.7E-01
TSP	Annual AAQC:	60	6.3	Annual	1.1E-01

Scenario: Baseline+Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Operation (%)
	($\mu g/m^3$)		($\mu g/m^3$)				
Criteria Air Contaminants							
$PM_{2.5}$	24 hour CAAQS:	23	16	24 hour	7.0E-01	81%	17%
$PM_{2.5}$	Annual CAAQS:	8.0	5.2	Annual	6.5E-01	90%	9%
PM_{10}	24 hour AAQC:	50	53	24 hour	**1.1E+00**	53%	47%
TSP	24 hour AAQC:	120	101	24 hour	8.4E-01	45%	55%
TSP	Annual AAQC:	60	10	Annual	1.7E-01	40%	63%

Notes:

BOLD Hazard Quotient >1.0

Table 3c: Modelled Air Contaminants Inhalation Risk Estimates for 50 m from Road Centerline with Paved Surface - Operation Phase

Scenario: Baseline

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	13	24 hour	5.7E-01
$PM_{2.5}$	Annual CAAQS:	8.0	4.7	Annual	5.9E-01
PM_{10}	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP	24 hour AAQC:	120	45	24 hour	3.8E-01
TSP	Annual AAQC:	60	4.0	Annual	6.7E-02

Scenario: Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	4.6	24 hour	2.0E-01
$PM_{2.5}$	Annual CAAQS:	8.0	1.0	Annual	1.3E-01
PM_{10}	24 hour AAQC:	50	45	24 hour	9.0E-01
TSP	24 hour AAQC:	120	97	24 hour	8.1E-01
TSP	Annual AAQC:	60	16	Annual	2.7E-01

Scenario: Baseline+Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Operation (%)
	($\mu g/m^3$)		($\mu g/m^3$)				
Criteria Air Contaminants							
$PM_{2.5}$	24 hour CAAQS:	23	18	24 hour	7.8E-01	72%	26%
$PM_{2.5}$	Annual CAAQS:	8.0	5.7	Annual	7.1E-01	82%	18%
PM_{10}	24 hour AAQC:	50	73	24 hour	**1.5E+00**	38%	62%
TSP	24 hour AAQC:	120	142	24 hour	**1.2E+00**	32%	68%
TSP	Annual AAQC:	60	20	Annual	3.3E-01	20%	80%

Notes:

BOLD Hazard Quotient >1.0

As the HHRA does not consider short-term occupational exposures (e.g., those associated with concentrations predicted near the road centreline), the exceedances predicted at areas of interest (i.e., current and future residences, institutional buildings and culturally sensitive areas) will be relied upon for decision making purposes in the HHRA

Table 3d: Modelled Air Contaminants Inhalation Risk Estimates for the Nearest Sensitive Receptor (Future Residences) with Paved Surface - Operation Phase

Scenario: Baseline

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	13	24 hour	5.7E-01
$PM_{2.5}$	Annual CAAQS:	8.0	4.7	Annual	5.9E-01
PM_{10}	24 hour AAQC:	50	28	24 hour	5.6E-01
TSP	24 hour AAQC:	120	45	24 hour	3.8E-01
TSP	Annual AAQC:	60	4.0	Annual	6.7E-02

Scenario: Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	($\mu g/m^3$)		($\mu g/m^3$)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour CAAQS:	23	3.1	24 hour	1.3E-01
$PM_{2.5}$	Annual CAAQS:	8.0	0.58	Annual	7.3E-02
PM_{10}	24 hour AAQC:	50	23	24 hour	4.6E-01
TSP	24 hour AAQC:	120	60	24 hour	5.0E-01
TSP	Annual AAQC:	60	8.5	Annual	1.4E-01

Scenario: Baseline+Project (Operation)

Chemical	TRV		Exposure Concentration	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Operation (%)
	($\mu g/m^3$)		($\mu g/m^3$)				
Criteria Air Contaminants							
$PM_{2.5}$	24 hour CAAQS:	23	16	24 hour	7.0E-01	81%	19%
$PM_{2.5}$	Annual CAAQS:	8.0	5.3	Annual	6.6E-01	89%	11%
PM_{10}	24 hour AAQC:	50	51	24 hour	**1.0E+00**	55%	45%
TSP	24 hour AAQC:	120	105	24 hour	8.8E-01	43%	57%
TSP	Annual AAQC:	60	13	Annual	2.2E-01	31%	65%

Notes:

BOLD Hazard Quotient >1.0

Table 4a: Metals COPCs in Air (24-hour TSP) – (Existing Residences + Institutional Buildings) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase

Metal	95% UCLM Soil Concentration (µg/g)	Construction Phase Soil Particulate Concentration (µg/m^3)**	Baseline Soil Particulate Concentration (µg/m^3)	Baseline + Construction Phase Soil Particulate Concentration (µg/m^3)	Ontario's Ambient Air Quality Criteria* (µg/m^3)
Antimony (Sb)	1	0.00014	0.000045	0.000185	25 (24-hour)
Arsenic (As)	5	0.00070	0.000225	0.000925	0.3 (24-hour)
Barium (Ba)	106.9	0.01497	0.004811	0.019777	10 (24-hour) total water soluble
Beryllium (Be)	0.9	0.00013	0.000041	0.000167	0.01 (24-hour)
Boron (B)	15.1	0.00211	0.000680	0.002794	120 (24-hour)
Cadmium (Cd)	0.5	0.00007	0.000023	0.000093	0.025 (24-hour)
Chromium (Cr, total)***	60.1	0.00841	0.002705	0.011119	0.5 (24-hour) (III)
Chromium (VI)	8.6	0.00120	0.000386	0.001588	**0.0007(24-hour) (VI)**
Chromium (III)	51.5	0.00721	0.002318	0.009530	0.5 (24-hour) (III)
Cobalt (Co)	13.7	0.00192	0.000617	0.002535	0.1 (24-hour)
Copper (Cu)	21	0.00294	0.000945	0.003885	50 (24-hour)
Iron (Fe)	33,717	4.72038	1.517265	6.237645	**4 (24-hour)**
Lead (Pb)	16.6	0.00232	0.000747	0.003071	0.5 (24-hour)
Lithium (Li)	35	0.00490	0.001575	0.006475	20 (24-hour)
Mercury (Hg)	0.1	0.00001	0.000005	0.000019	2 (24-hour)
Molybdenum (Mo)	1	0.00014	0.000045	0.000185	120 (24-hour)
Nickel (Ni)	37.8	0.00529	0.001701	0.006993	0.2 (24-hour)
Selenium (Se)	1.3	0.00018	0.000059	0.000241	10 (24-hour)
Uranium (U)	2.5	0.00035	0.000113	0.000463	0.3 (24-hour)
Vanadium (V)	61.8	0.00865	0.002781	0.011433	2 (24-hour)
Zinc (Zn)	73.1	0.01023	0.003290	0.013524	120 (24-hour)

Scenario	Chemical	Exposure Concentration (µg/m^3)	Exposure Concentration (g/m^3)	Averaging Time
Baseline	TSP	45	4.5E-05	24 hour
Project	TSP	140	1.4E-04	24 hour
Baseline + Project Phase	TSP	185	1.9E-04	24 hour

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor of 140 µg/m^3 (or 1.4E-04 g/m^3).

No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

Exceeds AAQC.

The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration.

Table 4b: Metals COPCs in Air (24-hour TSP) – CHL25 (60 m from RCL) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase

Metal	95% UCLM Soil Concentration (µg/g)	Construction Phase Soil Particulate Concentration ($\mu g/m^3$)**	Baseline Soil Particulate Concentration ($\mu g/m^3$)	Baseline + Construction Phase Soil Particulate Concentration ($\mu g/m^3$)	Ontario's Ambient Air Quality Criteria* ($\mu g/m^3$)
Antimony (Sb)	1	0.00570	0.000045	0.005746	25 (24-hour)
Arsenic (As)	5	0.02851	0.000225	0.028730	0.3 (24-hour)
Barium (Ba)	106.9	0.60944	0.004811	0.614247	10 (24-hour) total water soluble
Beryllium (Be)	0.9	0.00513	0.000041	0.005171	0.01 (24-hour)
Boron (B)	15.1	0.08609	0.000680	0.086765	120 (24-hour)
Cadmium (Cd)	0.5	0.00285	0.000023	0.002873	0.025 (24-hour)
Chromium (Cr)***					
Chromium (total)	60.1	0.34263	0.002705	0.345335	0.5 (24-hour) (III)
Chromium (VI)	8.6	0.04895	0.000386	0.049334	**0.0007(24-hour) (VI)**
Chromium (III)	51.5	0.29368	0.002318	0.296001	0.5 (24-hour) (III)
Cobalt (Co)	13.7	0.07810	0.000617	0.078720	0.1 (24-hour)
Copper (Cu)	21	0.11972	0.000945	0.120666	50 (24-hour)
Iron (Fe)	33,717	192.22062	1.517265	193.737882	**4 (24-hour)**
Lead (Pb)	16.6	0.09464	0.000747	0.095384	0.5 (24-hour)
Lithium (Li)	35	0.19954	0.001575	0.201110	20 (24-hour)
Mercury (Hg)	0.1	0.00057	0.000005	0.000575	2 (24-hour)
Molybdenum (Mo)	1	0.00570	0.000045	0.005746	120 (24-hour)
Nickel (Ni)	37.8	0.21550	0.001701	0.217199	**0.2 (24-hour)**
Selenium (Se)	1.3	0.00741	0.000059	0.007470	10 (24-hour)
Uranium (U)	2.5	0.01425	0.000113	0.014365	0.3 (24-hour)
Vanadium (V)	61.8	0.35232	0.002781	0.355103	2 (24-hour)
Zinc (Zn)	73.1	0.41674	0.003290	0.420033	120 (24-hour)

Scenario	Chemical	Exposure Concentration ($\mu g/m^3$)	Exposure Concentration (g/m^3)	Averaging Time
Baseline	TSP	45	4.5E-05	24 hour
Project	TSP	5,701	5.7E-03	24 hour
Baseline + Project Phase	TSP	5,746	5.7E-03	24 hour

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor of 5,701 $\mu g/m^3$ (or 5.7E-03 g/m^3).

No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

Exceeds AAQC.

The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration.

Table 4c: Metals COPCs in Air (24-hour TSP) – 50 m from Road Centerline with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase

Metal	95% UCLM Soil Concentration (µg/g)	Construction Phase Soil Particulate Concentration (µg/m^3)**	Baseline Soil Particulate Concentration (µg/m^3)	Baseline + Construction Phase Soil Particulate Concentration (µg/m^3)	Ontario's Ambient Air Quality Criteria* (µg/m^3)
Antimony (Sb)	1	0.01621	0.000045	0.016256	25 (24-hour)
Arsenic (As)	5	0.08106	0.000225	0.081280	0.3 (24-hour)
Barium (Ba)	106.9	1.73296	0.004811	1.737766	10 (24-hour) total water soluble
Beryllium (Be)	0.9	0.01459	0.000041	0.014630	**0.01 (24-hour)**
Boron (B)	15.1	0.24479	0.000680	0.245466	120 (24-hour)
Cadmium (Cd)	0.5	0.00811	0.000023	0.008128	0.025 (24-hour)
Chromium (Cr)***					
Chromium (total)	60.1	0.97428	0.002705	0.976986	**0.5 (24-hour) (III)**
Chromium (VI)	8.6	0.13918	0.000386	0.139569	**0.0007(24-hour) (VI)**
Chromium (III)	51.5	0.83510	0.002318	0.837416	**0.5 (24-hour) (III)**
Cobalt (Co)	13.7	0.22209	0.000617	0.222707	**0.1 (24-hour)**
Copper (Cu)	21	0.34043	0.000945	0.341376	50 (24-hour)
Iron (Fe)	33,717	546.58629	1.517265	548.103552	**4 (24-hour)**
Lead (Pb)	16.6	0.26910	0.000747	0.269850	0.5 (24-hour)
Lithium (Li)	35	0.56739	0.001575	0.568960	20 (24-hour)
Mercury (Hg)	0.1	0.00162	0.000005	0.001626	2 (24-hour)
Molybdenum (Mo)	1	0.01621	0.000045	0.016256	120 (24-hour)
Nickel (Ni)	37.8	0.61278	0.001701	0.614477	**0.2 (24-hour)**
Selenium (Se)	1.3	0.02107	0.000059	0.021133	10 (24-hour)
Uranium (U)	2.5	0.04053	0.000113	0.040640	0.3 (24-hour)
Vanadium (V)	61.8	1.00184	0.002781	1.004621	2 (24-hour)
Zinc (Zn)	73.1	1.18502	0.003290	1.188314	120 (24-hour)

Scenario	Chemical	Exposure Concentration (µg/m^3)	Exposure Concentration (g/m^3)	Averaging Time
Baseline	TSP	45	4.5E-05	24 hour
Project	TSP	16,211	1.6E-02	24 hour
Baseline + Project Phase	TSP	16,256	1.6E-02	24 hour

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor of 16,211 µg/m^3 (or 1.6E-02 g/m^3).

No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

Exceeds AAQC.

The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration.

As the HHRA does not consider short-term occupational exposures (e.g., those associated with concentrations predicted near the road centreline), the exceedances predicted at areas of interest (i.e., current and future residences, institutional buildings and culturally sensitive areas) will be relied upon for decision making purposes in the HHRA

Table 4d: Metals COPCs in Air (24-hour TSP) – Nearest Sensitive Receptor (Existing Residences+Institutional Buildings) with Unpaved Surface and Water Control - Operation Phase

Metal	95% UCLM Soil Concentration (µg/g)	Operation Phase Soil Particulate Concentration (µg/m³)**	Baseline Soil Particulate Concentration (µg/m³)	Baseline + Operation Phase Soil Particulate Concentration (µg/m³)	Ontario's Ambient Air Quality Criteria* (µg/m³)
Antimony (Sb)	1	0.00004	0.000045	0.000088	25 (24-hour)
Arsenic (As)	5	0.00022	0.000225	0.000440	0.3 (24-hour)
Barium (Ba)	106.9	0.00460	0.004811	0.009407	10 (24-hour) total water soluble
Beryllium (Be)	0.9	0.00004	0.000041	0.000079	0.01 (24-hour)
Boron (B)	15.1	0.00065	0.000680	0.001329	120 (24-hour)
Cadmium (Cd)	0.5	0.00002	0.000023	0.000044	0.025 (24-hour)
Chromium (Cr)***					
Chromium (total)	60.1	0.00258	0.002705	0.005289	0.5 (24-hour) (III)
Chromium (VI)	8.6	0.00037	0.000386	0.000756	**0.0007(24-hour) (VI)**
Chromium (III)	51.5	0.00222	0.002318	0.004533	0.5 (24-hour) (III)
Cobalt (Co)	13.7	0.00059	0.000617	0.001206	0.1 (24-hour)
Copper (Cu)	21	0.00090	0.000945	0.001848	50 (24-hour)
Iron (Fe)	33,717	1.44983	1.517265	2.967096	4 (24-hour)
Lead (Pb)	16.6	0.00071	0.000747	0.001461	0.5 (24-hour)
Lithium (Li)	35	0.00151	0.001575	0.003080	20 (24-hour)
Mercury (Hg)	0.1	0.00000	0.000005	0.000009	2 (24-hour)
Molybdenum (Mo)	1	0.00004	0.000045	0.000088	120 (24-hour)
Nickel (Ni)	37.8	0.00163	0.001701	0.003326	0.2 (24-hour)
Selenium (Se)	1.3	0.00006	0.000059	0.000114	10 (24-hour)
Uranium (U)	2.5	0.00011	0.000113	0.000220	0.3 (24-hour)
Vanadium (V)	61.8	0.00266	0.002781	0.005438	2 (24-hour)
Zinc (Zn)	73.1	0.00314	0.003290	0.006433	120 (24-hour)

Scenario	Chemical	Exposure Concentration (µg/m³)	Exposure Concentration (g/m³)	Averaging Time
Baseline	TSP	45	4.5E-05	24 hour
Project	TSP	43	4.3E-05	24 hour
Baseline + Project Phase	TSP	88	8.8E-05	24 hour

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor of 43 µg/m³ (or 4.3E-05 g/m³).

No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

Exceeds AAQC.

The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration.

Table 4e: Metals COPCs in Air (24-hour TSP) – CHL25 (60 m from RCL) with Unpaved Surface and Water Control - Operation Phase

Metal	95% UCLM Soil Concentration (µg/g)	Operation Phase Soil Particulate Concentration (µg/m³)**	Baseline Soil Particulate Concentration (µg/m³)	Baseline + Operation Phase Soil Particulate Concentration (µg/m³)	Ontario's Ambient Air Quality Criteria* (µg/m³)
Antimony (Sb)	1	0.00067	0.000045	0.000718	25 (24-hour)
Arsenic (As)	5	0.00337	0.000225	0.003590	0.3 (24-hour)
Barium (Ba)	106.9	0.07194	0.004811	0.076754	10 (24-hour) total water soluble
Beryllium (Be)	0.9	0.00061	0.000041	0.000646	0.01 (24-hour)
Boron (B)	15.1	0.01016	0.000680	0.010842	120 (24-hour)
Cadmium (Cd)	0.5	0.00034	0.000023	0.000359	0.025 (24-hour)
Chromium (Cr)***					
Chromium (total)	60.1	0.04045	0.002705	0.043152	0.5 (24-hour) (III)
Chromium (VI)	8.6	0.00578	0.000386	0.006165	**0.0007(24-hour) (VI)**
Chromium (III)	51.5	0.03467	0.002318	0.036987	0.5 (24-hour) (III)
Cobalt (Co)	13.7	0.00922	0.000617	0.009837	0.1 (24-hour)
Copper (Cu)	21	0.01413	0.000945	0.015078	50 (24-hour)
Iron (Fe)	33,717	22.69154	1.517265	24.208806	**4 (24-hour)**
Lead (Pb)	16.6	0.01117	0.000747	0.011919	0.5 (24-hour)
Lithium (Li)	35	0.02356	0.001575	0.025130	20 (24-hour)
Mercury (Hg)	0.1	0.00007	0.000005	0.000072	2 (24-hour)
Molybdenum (Mo)	1	0.00067	0.000045	0.000718	120 (24-hour)
Nickel (Ni)	37.8	0.02544	0.001701	0.027140	0.2 (24-hour)
Selenium (Se)	1.3	0.00087	0.000059	0.000933	10 (24-hour)
Uranium (U)	2.5	0.00168	0.000113	0.001795	0.3 (24-hour)
Vanadium (V)	61.8	0.04159	0.002781	0.044372	2 (24-hour)
Zinc (Zn)	73.1	0.04920	0.003290	0.052486	120 (24-hour)

Scenario	Chemical	Exposure Concentration (µg/m³)	Exposure Concentration (g/m³)	Averaging Time
Baseline	TSP	45	4.5E-05	24 hour
Project	TSP	673	6.7E-04	24 hour
Baseline + Project Phase	TSP	718	7.2E-04	24 hour

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor of 673 µg/m³ (or 6.7E-04 g/m³).

No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

Exceeds AAQC.

The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration.

Table 4f: Metals COPCs in Air (24-hour TSP) – 50 m from Road Centerline with Unpaved Surface and Water Control - Operation Phase

Metal	95% UCLM Soil Concentration (µg/g)	Operation Phase Soil Particulate Concentration ($\mu g/m^3$)**	Baseline Soil Particulate Concentration ($\mu g/m^3$)	Baseline + Operation Phase Soil Particulate Concentration ($\mu g/m^3$)	Ontario's Ambient Air Quality Criteria* ($\mu g/m^3$)
Antimony (Sb)	1	0.00103	0.000045	0.001076	25 (24-hour)
Arsenic (As)	5	0.00516	0.000225	0.005380	0.3 (24-hour)
Barium (Ba)	106.9	0.11021	0.004811	0.115024	10 (24-hour) total water soluble
Beryllium (Be)	0.9	0.00093	0.000041	0.000968	0.01 (24-hour)
Boron (B)	15.1	0.01557	0.000680	0.016248	120 (24-hour)
Cadmium (Cd)	0.5	0.00052	0.000023	0.000538	0.025 (24-hour)
Chromium (Cr)***					
Chromium (total)	60.1	0.06196	0.002705	0.064668	0.5 (24-hour) (III)
Chromium (VI)	8.6	0.00885	0.000386	0.009238	**0.0007(24-hour) (VI)**
Chromium (III)	51.5	0.05311	0.002318	0.055429	0.5 (24-hour) (III)
Cobalt (Co)	13.7	0.01412	0.000617	0.014741	0.1 (24-hour)
Copper (Cu)	21	0.02165	0.000945	0.022596	50 (24-hour)
Iron (Fe)	33,717	34.76223	1.517265	36.279492	**4 (24-hour)**
Lead (Pb)	16.6	0.01711	0.000747	0.017862	0.5 (24-hour)
Lithium (Li)	35	0.03609	0.001575	0.037660	20 (24-hour)
Mercury (Hg)	0.1	0.00010	0.000005	0.000108	2 (24-hour)
Molybdenum (Mo)	1	0.00103	0.000045	0.001076	120 (24-hour)
Nickel (Ni)	37.8	0.03897	0.001701	0.040673	0.2 (24-hour)
Selenium (Se)	1.3	0.00134	0.000059	0.001399	10 (24-hour)
Uranium (U)	2.5	0.00258	0.000113	0.002690	0.3 (24-hour)
Vanadium (V)	61.8	0.06372	0.002781	0.066497	2 (24-hour)
Zinc (Zn)	73.1	0.07537	0.003290	0.078656	120 (24-hour)

Scenario	Chemical	Exposure Concentration ($\mu g/m^3$)	Exposure Concentration (g/m^3)	Averaging Time
Baseline	TSP	45	4.5E-05	24 hour
Project	TSP	1,031	1.0E-03	24 hour
Baseline + Project Phase	TSP	1,076	1.1E-03	24 hour

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor of 1,031 $\mu g/m^3$ (or 1.0E-03 g/m^3).

No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

Exceeds AAQC.

The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration.

As the HHRA does not consider short-term occupational exposures (e.g., those associated with concentrations predicted near the road centreline), the exceedances predicted at areas of interest (i.e., current and future residences, institutional buildings and culturally sensitive areas) will be relied upon for decision making purposes in the HHRA

Table 4g: Metals COPCs in Air (24-hour TSP) – Nearest Sensitive Receptor (Future Residences) with Unpaved Surface and Water Control - Operation Phase

Metal	95% UCLM Soil Concentration (µg/g)	Operation Phase Soil Particulate Concentration (µg/m^3)**	Baseline Soil Particulate Concentration (µg/m^3)	Baseline + Operation Phase Soil Particulate Concentration (µg/m^3)	Ontario's Ambient Air Quality Criteria* (µg/m^3)
Antimony (Sb)	1	0.00068	0.000045	0.000720	25 (24-hour)
Arsenic (As)	5	0.00338	0.000225	0.003600	0.3 (24-hour)
Barium (Ba)	106.9	0.07216	0.004811	0.076968	10 (24-hour) total water soluble
Beryllium (Be)	0.9	0.00061	0.000041	0.000648	0.01 (24-hour)
Boron (B)	15.1	0.01019	0.000680	0.010872	120 (24-hour)
Cadmium (Cd)	0.5	0.00034	0.000023	0.000360	0.025 (24-hour)
Chromium (Cr)***					
Chromium (total)	60.1	0.04057	0.002705	0.043272	0.5 (24-hour) (III)
Chromium (VI)	8.6	0.00580	0.000386	0.006182	**0.0007(24-hour) (VI)**
Chromium (III)	51.5	0.03477	0.002318	0.037090	0.5 (24-hour) (III)
Cobalt (Co)	13.7	0.00925	0.000617	0.009864	0.1 (24-hour)
Copper (Cu)	21	0.01418	0.000945	0.015120	50 (24-hour)
Iron (Fe)	33,717	22.75898	1.517265	24.276240	**4 (24-hour)**
Lead (Pb)	16.6	0.01121	0.000747	0.011952	0.5 (24-hour)
Lithium (Li)	35	0.02363	0.001575	0.025200	20 (24-hour)
Mercury (Hg)	0.1	0.00007	0.000005	0.000072	2 (24-hour)
Molybdenum (Mo)	1	0.00068	0.000045	0.000720	120 (24-hour)
Nickel (Ni)	37.8	0.02552	0.001701	0.027216	0.2 (24-hour)
Selenium (Se)	1.3	0.00088	0.000059	0.000936	10 (24-hour)
Uranium (U)	2.5	0.00169	0.000113	0.001800	0.3 (24-hour)
Vanadium (V)	61.8	0.04172	0.002781	0.044496	2 (24-hour)
Zinc (Zn)	73.1	0.04934	0.003290	0.052632	120 (24-hour)

Scenario	Chemical	Exposure Concentration (µg/m^3)	Exposure Concentration (g/m^3)	Averaging Time
Baseline	TSP	45	4.5E-05	24 hour
Project	TSP	675	6.8E-04	24 hour
Baseline + Project Phase	TSP	720	7.2E-04	24 hour

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor of 675 µg/m^3 (or 2.8E-04 g/m^3).

No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

Exceeds AAQC.

The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration.

Table 4h: Metals COPCs in Air (24-hour TSP) – Nearest Sensitive Receptor (Existing Residences+Institutional Buildings) with Paved Surface - Operation Phase

Metal	95% UCLM Soil Concentration (µg/g)	Operation Phase Soil Particulate Concentration (µg/m³)**	Baseline Soil Particulate Concentration (µg/m³)	Baseline + Operation Phase Soil Particulate Concentration (µg/m³)	Ontario's Ambient Air Quality Criteria* (µg/m³)
Antimony (Sb)	1	0.00000	0.000045	0.000048	25 (24-hour)
Arsenic (As)	5	0.00002	0.000225	0.000240	0.3 (24-hour)
Barium (Ba)	106.9	0.00033	0.004811	0.005131	10 (24-hour) total water soluble
Beryllium (Be)	0.9	0.00000	0.000041	0.000043	0.01 (24-hour)
Boron (B)	15.1	0.00005	0.000680	0.000725	120 (24-hour)
Cadmium (Cd)	0.5	0.00000	0.000023	0.000024	0.025 (24-hour)
Chromium (Cr)***					
Chromium (total)	60.1	0.00019	0.002705	0.002885	0.5 (24-hour) (III)
Chromium (VI)	8.6	0.00003	0.000386	0.000412	0.0007(24-hour) (VI)
Chromium (III)	51.5	0.00016	0.002318	0.002473	0.5 (24-hour) (III)
Cobalt (Co)	13.7	0.00004	0.000617	0.000658	0.1 (24-hour)
Copper (Cu)	21	0.00007	0.000945	0.001008	50 (24-hour)
Iron (Fe)	33,717	0.10452	1.517265	1.618416	4 (24-hour)
Lead (Pb)	16.6	0.00005	0.000747	0.000797	0.5 (24-hour)
Lithium (Li)	35	0.00011	0.001575	0.001680	20 (24-hour)
Mercury (Hg)	0.1	0.00000	0.000005	0.000005	2 (24-hour)
Molybdenum (Mo)	1	0.00000	0.000045	0.000048	120 (24-hour)
Nickel (Ni)	37.8	0.00012	0.001701	0.001814	0.2 (24-hour)
Selenium (Se)	1.3	0.00000	0.000059	0.000062	10 (24-hour)
Uranium (U)	2.5	0.00001	0.000113	0.000120	0.3 (24-hour)
Vanadium (V)	61.8	0.00019	0.002781	0.002966	2 (24-hour)
Zinc (Zn)	73.1	0.00023	0.003290	0.003509	120 (24-hour)

Scenario	Chemical	Exposure Concentration (µg/m³)	Exposure Concentration (g/m³)	Averaging Time
Baseline	TSP	45	4.5E-05	24 hour
Project	TSP	3.1	3.1E-06	24 hour
Baseline + Project Phase	TSP	48	4.8E-05	24 hour

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor of 3.1 µg/m³ (or 3.1E-06 g/m³).

No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

Exceeds AAQC.

The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration.

Table 4i: Metals COPCs in Air (24-hour TSP) – CHL25 (60 m from RCL) with Paved Surface - Operation Phase

Metal	95% UCLM Soil Concentration (µg/g)	Operation Phase Soil Particulate Concentration (µg/m^3)**	Baseline Soil Particulate Concentration (µg/m^3)	Baseline + Operation Phase Soil Particulate Concentration (µg/m^3)	Ontario's Ambient Air Quality Criteria* (µg/m^3)
Antimony (Sb)	1	0.00006	0.000045	0.000101	25 (24-hour)
Arsenic (As)	5	0.00028	0.000225	0.000505	0.3 (24-hour)
Barium (Ba)	106.9	0.00599	0.004811	0.010797	10 (24-hour) total water soluble
Beryllium (Be)	0.9	0.00005	0.000041	0.000091	0.01 (24-hour)
Boron (B)	15.1	0.00085	0.000680	0.001525	120 (24-hour)
Cadmium (Cd)	0.5	0.00003	0.000023	0.000051	0.025 (24-hour)
Chromium (Cr)***					
Chromium (total)	60.1	0.00337	0.002705	0.006070	0.5 (24-hour) (III)
Chromium (VI)	8.6	0.00048	0.000386	0.000867	**0.0007(24-hour) (VI)**
Chromium (III)	51.5	0.00288	0.002318	0.005203	0.5 (24-hour) (III)
Cobalt (Co)	13.7	0.00077	0.000617	0.001384	0.1 (24-hour)
Copper (Cu)	21	0.00118	0.000945	0.002121	50 (24-hour)
Iron (Fe)	33,717	1.88815	1.517265	3.405417	4 (24-hour)
Lead (Pb)	16.6	0.00093	0.000747	0.001677	0.5 (24-hour)
Lithium (Li)	35	0.00196	0.001575	0.003535	20 (24-hour)
Mercury (Hg)	0.1	0.00001	0.000005	0.000010	2 (24-hour)
Molybdenum (Mo)	1	0.00006	0.000045	0.000101	120 (24-hour)
Nickel (Ni)	37.8	0.00212	0.001701	0.003818	0.2 (24-hour)
Selenium (Se)	1.3	0.00007	0.000059	0.000131	10 (24-hour)
Uranium (U)	2.5	0.00014	0.000113	0.000253	0.3 (24-hour)
Vanadium (V)	61.8	0.00346	0.002781	0.006242	2 (24-hour)
Zinc (Zn)	73.1	0.00409	0.003290	0.007383	120 (24-hour)

Scenario	Chemical	Exposure Concentration (µg/m^3)	Exposure Concentration (g/m^3)	Averaging Time
Baseline	TSP	45	4.5E-05	24 hour
Project	TSP	56	5.6E-05	24 hour
Baseline + Project Phase	TSP	101	1.0E-04	24 hour

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor of 56 µg/m^3 (or 5.6E-05 g/m^3).

No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

Exceeds AAQC.

The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration.

Table 4j: Metals COPCs in Air (24-hour TSP) – 50 m from Road Centerline with Paved Surface - Operation Phase

Metal	95% UCLM Soil Concentration (μg/g)	Operation Phase Soil Particulate Concentration ($\mu g/m^3$)**	Baseline Soil Particulate Concentration ($\mu g/m^3$)	Baseline + Operation Phase Soil Particulate Concentration ($\mu g/m^3$)	Ontario's Ambient Air Quality Criteria* ($\mu g/m^3$)
Antimony (Sb)	1	0.00010	0.000045	0.000142	25 (24-hour)
Arsenic (As)	5	0.00049	0.000225	0.000710	0.3 (24-hour)
Barium (Ba)	106.9	0.01037	0.004811	0.015180	10 (24-hour) total water soluble
Beryllium (Be)	0.9	0.00009	0.000041	0.000128	0.01 (24-hour)
Boron (B)	15.1	0.00146	0.000680	0.002144	120 (24-hour)
Cadmium (Cd)	0.5	0.00005	0.000023	0.000071	0.025 (24-hour)
Chromium (Cr)***					
Chromium (total)	60.1	0.00583	0.002705	0.008534	0.5 (24-hour) (III)
Chromium (VI)	8.6	0.00083	0.000386	0.001219	**0.0007(24-hour) (VI)**
Chromium (III)	51.5	0.00500	0.002318	0.007315	0.5 (24-hour) (III)
Cobalt (Co)	13.7	0.00133	0.000617	0.001945	0.1 (24-hour)
Copper (Cu)	21	0.00204	0.000945	0.002982	50 (24-hour)
Iron (Fe)	33,717	3.27055	1.517265	4.787814	**4 (24-hour)**
Lead (Pb)	16.6	0.00161	0.000747	0.002357	0.5 (24-hour)
Lithium (Li)	35	0.00340	0.001575	0.004970	20 (24-hour)
Mercury (Hg)	0.1	0.00001	0.000005	0.000014	2 (24-hour)
Molybdenum (Mo)	1	0.00010	0.000045	0.000142	120 (24-hour)
Nickel (Ni)	37.8	0.00367	0.001701	0.005368	0.2 (24-hour)
Selenium (Se)	1.3	0.00013	0.000059	0.000185	10 (24-hour)
Uranium (U)	2.5	0.00024	0.000113	0.000355	0.3 (24-hour)
Vanadium (V)	61.8	0.00599	0.002781	0.008776	2 (24-hour)
Zinc (Zn)	73.1	0.00709	0.003290	0.010380	120 (24-hour)

Scenario	Chemical	Exposure Concentration ($\mu g/m^3$)	Exposure Concentration (g/m^3)	Averaging Time
Baseline	TSP	45	4.5E-05	24 hour
Project	TSP	97	9.7E-05	24 hour
Baseline + Project Phase	TSP	142	1.4E-04	24 hour

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor of 97 $\mu g/m^3$ (or 9.7E-05 g/m^3).

No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

Exceeds AAQC.

The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration.

As the HHRA does not consider short-term occupational exposures (e.g., those associated with concentrations predicted near the road centreline), the exceedances predicted at areas of interest (i.e., current and future residences, institutional buildings and culturally sensitive areas) will be relied upon for decision making purposes in the HHRA

Table 4k: Metals COPCs in Air (24-hour TSP) – Nearest Sensitive Receptor (Future Residences) with Paved Surface - Operation Phase

Metal	95% UCLM Soil Concentration (µg/g)	Operation Phase Soil Particulate Concentration (µg/m³)**	Baseline Soil Particulate Concentration (µg/m³)	Baseline + Operation Phase Soil Particulate Concentration (µg/m³)	Ontario's Ambient Air Quality Criteria* (µg/m³)
Antimony (Sb)	1	0.00006	0.000045	0.000105	25 (24-hour)
Arsenic (As)	5	0.00030	0.000225	0.000525	0.3 (24-hour)
Barium (Ba)	106.9	0.00641	0.004811	0.011225	10 (24-hour) total water soluble
Beryllium (Be)	0.9	0.00005	0.000041	0.000095	0.01 (24-hour)
Boron (B)	15.1	0.00091	0.000680	0.001586	120 (24-hour)
Cadmium (Cd)	0.5	0.00003	0.000023	0.000053	0.025 (24-hour)
Chromium (Cr)***					
Chromium (total)	60.1	0.00361	0.002705	0.006311	0.5 (24-hour) (III)
Chromium (VI)	8.6	0.00052	0.000386	0.000902	**0.0007(24-hour) (VI)**
Chromium (III)	51.5	0.00309	0.002318	0.005409	0.5 (24-hour) (III)
Cobalt (Co)	13.7	0.00082	0.000617	0.001439	0.1 (24-hour)
Copper (Cu)	21	0.00126	0.000945	0.002205	50 (24-hour)
Iron (Fe)	33,717	2.02302	1.517265	3.540285	4 (24-hour)
Lead (Pb)	16.6	0.00100	0.000747	0.001743	0.5 (24-hour)
Lithium (Li)	35	0.00210	0.001575	0.003675	20 (24-hour)
Mercury (Hg)	0.1	0.00001	0.000005	0.000011	2 (24-hour)
Molybdenum (Mo)	1	0.00006	0.000045	0.000105	120 (24-hour)
Nickel (Ni)	37.8	0.00227	0.001701	0.003969	0.2 (24-hour)
Selenium (Se)	1.3	0.00008	0.000059	0.000137	10 (24-hour)
Uranium (U)	2.5	0.00015	0.000113	0.000263	0.3 (24-hour)
Vanadium (V)	61.8	0.00371	0.002781	0.006489	2 (24-hour)
Zinc (Zn)	73.1	0.00439	0.003290	0.007676	120 (24-hour)

Scenario	Chemical	Exposure Concentration (µg/m³)	Exposure Concentration (g/m³)	Averaging Time
Baseline	TSP	45	4.5E-05	24 hour
Project	TSP	60	6.0E-05	24 hour
Baseline + Project Phase	TSP	105	1.1E-04	24 hour

Notes:

95% UCLM 95% upper confidence limit of the mean soil concentration.

Ontario's Ambient Air Quality Criteria, Standards Development Branch, Ontario Ministry of the Environment May 2020.

Estimated as the 95%UCLM soil concentration multiplied by the maximum predicted TSP concentration at a sensitive receptor of 60 µg/m³ (or 6.0E-05 g/m³).

No speciation data was available, conservatively assumed that 1/7 of total chromium is present as chromium (VI), with the remaining 6/7 present as chromium (III).

Exceeds AAQC.

The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration.

Table 5a: Metals Dust Risk Estimates for the Existing Residences + Institutional Buildings with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	3.9E-04	2.9E-04	-	3.9E-03	**2.2E-05**
Iron	-	-	4.2E+02	-	-	7.6E-01	1.8E-03	-

Scenario: Project (Construction)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	1.2E-03	9.0E-04	-	1.2E-02	**6.9E-05**
Iron	-	-	4.2E+02	-	-	2.4E+00	5.6E-03	-

Scenario: Baseline+Project (Construction)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Construction (%)
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)				
Metals										
Chromium (VI)	1.0E-01	7.6E-02	-	1.6E-03	1.2E-03	-	1.6E-02	**9.1E-05**	24%	76%
Iron	-	-	4.2E+02	-	-	3.1E+00	7.4E-03	-	24%	76%

Notes:

BOLD Hazard Quotient >0.2 / ILCR >1E-05

- Not applicable

Table 5b: Metals Dust Risk Estimates for the CHL25 (60 m from RCL) with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	3.9E-04	2.9E-04	-	3.9E-03	**2.2E-05**
Iron	-	-	4.2E+02	-	-	7.6E-01	1.8E-03	-
Nickel	-	-	1.8E-02	-	-	8.6E-04	4.8E-02	-

Scenario: Project (Construction)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	4.9E-02	3.7E-02	-	**4.9E-01**	**2.8E-03**
Iron	-	-	4.2E+02	-	-	9.7E+01	**2.3E-01**	-
Nickel	-	-	1.8E-02	-	-	1.1E-01	**6.0E+00**	-

Scenario: Baseline+Project (Construction)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Construction (%)
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)				
Metals										
Chromium (VI)	1.0E-01	7.6E-02	-	4.9E-02	3.7E-02	-	**4.9E-01**	**2.8E-03**	1%	99%
Iron	-	-	4.2E+02	-	-	9.7E+01	**2.3E-01**	-	1%	99%
Nickel	-	-	1.8E-02	-	-	1.1E-01	**6.1E+00**	-	1%	99%

Notes:

BOLD Hazard Quotient >0.2 / ILCR >1E-05

- Not applicable

Table 5c: Metals Dust Risk Estimates for 50 m from Road Centerline with Tier 4(80%) /Tier 3(20%) Engines - Construction Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	3.9E-04	2.9E-04	-	3.9E-03	**2.2E-05**
Iron	-	-	4.2E+02	-	-	7.6E-01	1.8E-03	-
Nickel	-	-	1.8E-02	-	-	8.6E-04	4.8E-02	-
Beryllium	-	-	2.0E+00	-	-	2.0E-05	1.0E-05	-
Chromium (III)	-	-	3.0E+02	-	-	1.2E-03	3.9E-06	-
Cobalt	-	-	2.0E+00			3.1E-04	1.6E-04	-

Scenario: Project (Construction)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	4.9E-02	3.7E-02	-	**4.9E-01**	**2.8E-03**
Iron	-	-	4.2E+02	-	-	2.7E+02	**6.5E-01**	-
Nickel	-	-	1.8E-02	-	-	3.1E-01	**1.7E+01**	-
Beryllium	-	-	2.0E+00	-	-	7.3E-03	3.7E-03	-
Chromium (III)	-	-	3.0E+02	-	-	4.2E-01	1.4E-03	-
Cobalt	-	-	2.0E+00			1.1E-01	5.6E-02	-

Scenario: Baseline+Project (Construction)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Construction (%)
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)				
Metals										
Chromium (VI)	1.0E-01	7.6E-02	-	1.4E-01	1.0E-01	-	**1.4E+00**	**8.0E-03**	0%	35%
Iron	-	-	4.2E+02	-	-	2.8E+02	**6.5E-01**	-	0%	100%
Nickel	-	-	1.8E-02	-	-	3.1E-01	**1.7E+01**	-	0%	100%
Beryllium	-	-	2.0E+00	-	-	7.4E-03	3.7E-03	-	0%	100%
Chromium (III)	-	-	3.0E+02	-	-	4.2E-01	1.4E-03	-	0%	100%
Cobalt	-	-	2.0E+00			1.1E-01	5.6E-02	-	0%	100%

BOLD Hazard Quotient >0.2 / ILCR >1E-05

- Not applicable

Berlyllium is not a COPC for sensitive receptors, the Health Canada (2025) Oral TDI of 2.0E-03 mg/kgbw/day based on a BMDL for gastrointestinal toxicity was applied.

Cobalt is not a COPC for sensitive receptors, the Oral TDI used was based off of ATSDR (2024) value for elevated blood count: 2 µg/kg/day = subchronic TRV for cobalt of 20 µg/kg bw/day with an uncertainty factor of 10 applied for extrapolation from sub-chronic to chronic.

Chromium (III) is not a COPC for sensitive receptors, the Oral TDI of 300 µg/kg/day for No effects observed at any dose level from Health Canada (2025). Oral TRV is considered as a basis for calculating inhalation risk based on route of exposure extrapolation.

Cobalt is not a COPC for sensitive receptors, the oral TDI of 20 ug/kg/day for elevated red blood cell counts in male rates from ATSDR (2024) was used. The TRV is lower than the provisional TRV from US EPA (2008).

*As the HHRA does not consider short-term occupational exposures (e.g., those associated with concentrations predicted near the road centreline), the exceedances predicted at areas of interest (i.e., current and future residences, institutional buildings and culturally sensitive areas) will be relied upon for decision making purposes in the HHRA

Table 5d: Metals Dust Risk Estimates for the Nearest Sensitive Receptor (Existing Residences+Institutional Buildings) with Unpaved Surface and Water Control - Operation Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC ($\mu g/m^3$)	UR $(\mu g/m^3)^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration ($\mu g/m^3$)	Cancer (Ammortized) Air Concentration ($\mu g/m^3$)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	3.9E-04	2.9E-04	-	3.9E-03	**2.2E-05**

Scenario: Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC ($\mu g/m^3$)	UR $(\mu g/m^3)^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration ($\mu g/m^3$)	Cancer (Ammortized) Air Concentration ($\mu g/m^3$)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	3.7E-04	2.8E-04	-	3.7E-03	**2.1E-05**

Scenario: Baseline+Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Operation (%)
	RfC ($\mu g/m^3$)	UR $(\mu g/m^3)^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration ($\mu g/m^3$)	Cancer (Ammortized) Air Concentration ($\mu g/m^3$)	Dose (µg/kg/day)				
Metals										
Chromium (VI)	1.0E-01	7.6E-02	-	7.6E-04	5.7E-04	-	7.6E-03	**4.3E-05**	51%	49%

BOLD Hazard Quotient >0.2 / ILCR >1E-05
- Not applicable

Table 5e: Metals Dust Risk Estimates for CHL25 (60 m from RCL) with Unpaved Surface and Water Control - Operation Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC ($\mu g/m^3$)	UR $(\mu g/m^3)^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration ($\mu g/m^3$)	Cancer (Ammortized) Air Concentration ($\mu g/m^3$)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	3.9E-04	2.9E-04	-	3.9E-03	**2.2E-05**
Iron	-	-	4.2E+02	-	-	7.6E-01	1.8E-03	-

Scenario: Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC ($\mu g/m^3$)	UR $(\mu g/m^3)^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration ($\mu g/m^3$)	Cancer (Ammortized) Air Concentration ($\mu g/m^3$)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	5.8E-03	4.3E-03	-	5.8E-02	**3.3E-04**
Iron	-	-	4.2E+02	-	-	1.1E+01	2.7E-02	-

Scenario: Baseline+Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Operation (%)
	RfC ($\mu g/m^3$)	UR $(\mu g/m^3)^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration ($\mu g/m^3$)	Cancer (Ammortized) Air Concentration ($\mu g/m^3$)	Dose (µg/kg/day)				
Metals										
Chromium (VI)	1.0E-01	7.6E-02	-	6.2E-03	4.6E-03	-	6.2E-02	**3.5E-04**	6%	94%
Iron	-	-	4.2E+02	-	-	1.2E+01	2.9E-02	-	6%	94%

BOLD Hazard Quotient >0.2 / ILCR >1E-05
- Not applicable

Table 5f: Metals Dust Risk Estimates for 50 m from Road Centerline with Unpaved Surface and Water Control - Operation Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	3.9E-04	2.9E-04	-	3.9E-03	**2.2E-05**
Iron	-	-	4.2E+02	-	-	7.6E-01	1.8E-03	-

Scenario: Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	8.9E-03	6.6E-03	-	8.9E-02	**5.0E-04**
Iron	-	-	4.2E+02	-	-	1.7E+01	4.1E-02	-

Scenario: Baseline+Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Operation (%)
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)				
Metals										
Chromium (VI)	1.0E-01	7.6E-02	-	9.2E-03	6.9E-03	-	9.2E-02	**5.3E-04**	4%	96%
Iron	-	-	4.2E+02	-	-	1.8E+01	4.3E-02	-	4%	96%

BOLD Hazard Quotient >0.2 / ILCR >1E-05

- Not applicable

As the HHRA does not consider short-term occupational exposures (e.g., those associated with concentrations predicted near the road centreline), the exceedances predicted at areas of interest (i.e., current and future residences, institutional buildings and culturally sensitive areas) will be relied upon for decision making purposes in the HHRA

Table 5g: Metals Dust Risk Estimates for Nearest Sensitive Receptor (Future Residences) with Unpaved Surface and Water Control - Operation Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	3.9E-04	2.9E-04	-	3.9E-03	**2.2E-05**
Iron	-	-	4.2E+02	-	-	7.6E-01	1.8E-03	-

Scenario: Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	5.8E-03	4.3E-03	-	5.8E-02	**3.3E-04**
Iron	-	-	4.2E+02	-	-	1.1E+01	2.7E-02	-

Scenario: Baseline+Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Operation (%)
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)				
Metals										
Chromium (VI)	1.0E-01	7.6E-02	-	6.2E-03	4.6E-03	-	6.2E-02	**3.5E-04**	6%	94%
Iron	-	-	4.2E+02	-	-	1.2E+01	2.9E-02	-	6%	94%

BOLD Hazard Quotient >0.2 / ILCR >1E-05
- Not applicable

Table 5h: Metals Dust Risk Estimates for Nearest Sensitive Receptor (Existing Residences+Institutional Buildings) with Paved Surface - Operation Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
No COPCs	-	-	-	-	-	-	-	-

Scenario: Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
No COPCs	-	-	-	-	-	-	-	-

Scenario: Baseline+Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Operation (%)
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)				
Metals										
No COPCs	-	-	-	-	-	-	-	-	-	-

BOLD Hazard Quotient >0.2 / ILCR >1E-05
- Not applicable

Table 5i: Metals Dust Risk Estimates for CHL25 (60 m from RCL) with Paved Surface - Operation Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	3.9E-04	2.9E-04	-	3.9E-03	**2.2E-05**

Scenario: Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	4.8E-04	3.6E-04	-	4.8E-03	**2.7E-05**

Scenario: Baseline+Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Operation (%)
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)				
Metals										
Chromium (VI)	1.0E-01	7.6E-02	-	8.7E-04	6.5E-04	-	8.7E-03	**4.9E-05**	45%	55%

BOLD Hazard Quotient >0.2 / ILCR >1E-05
- Not applicable

Table 5j: Metals Dust Risk Estimates for 50 m from Road Centerline with Paved Surface - Operation Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	3.9E-04	2.9E-04	-	3.9E-03	**2.2E-05**
Iron	-	-	4.2E+02	-	-	7.6E-01	1.8E-03	-

Scenario: Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	8.3E-04	6.2E-04	-	8.3E-03	**4.7E-05**
Iron	-	-	4.2E+02	-	-	1.6E+00	3.9E-03	-

Scenario: Baseline+Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Operation (%)
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)				
Metals										
Chromium (VI)	1.0E-01	7.6E-02	-	1.2E-03	9.1E-04	-	1.2E-02	**6.9E-05**	32%	68%
Iron	-	-	4.2E+02	-	-	2.4E+00	5.7E-03	-	32%	68%

BOLD Hazard Quotient >0.2 / ILCR >1E-05

- Not applicable

As the HHRA does not consider short-term occupational exposures (e.g., those associated with concentrations predicted near the road centreline), the exceedances predicted at areas of interest (i.e., current and future residences, institutional buildings and culturally sensitive areas) will be relied upon for decision making purposes in the HHRA

Table 5k: Metals Dust Risk Estimates for the Nearest Sensitive Receptor (Future Residences) with Paved Surface - Operation Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	3.9E-04	2.9E-04	-	3.9E-03	**2.2E-05**

Scenario: Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	1.0E-01	7.6E-02	-	5.2E-04	3.9E-04	-	5.2E-03	**2.9E-05**

Scenario: Baseline+Project (Operation)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Operation (%)
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)				
Metals										
Chromium (VI)	1.0E-01	7.6E-02	-	9.0E-04	6.8E-04	-	9.0E-03	**5.1E-05**	43%	57%

BOLD Hazard Quotient >0.2 / ILCR >1E-05
- Not applicable

Table 3: Metals Dust Risk Estimates for the Maximum Sensitive Receptor - Construction Phase

Scenario: Baseline

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	3.0E-02	7.6E-02	-	3.0E-03	2.3E-03	-	1.0E-01	**1.7E-04**
Iron	-	-	4.2E+02	-	-	7.5E-01	1.8E-03	-

Scenario: Project (Construction)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)		
Metals								
Chromium (VI)	3.0E-02	7.6E-02	-	3.0E-02	2.3E-02	-	**1.0E+00**	**1.7E-03**
Iron	-	-	4.2E+02	-	-	8.3E+00	2.0E-02	-

Scenario: Baseline+Project (Construction)

Chemical	TRV			Exposure Concentration/Dose			Hazard Quotient	ILCR	Risk Estimate Contribution from Baseline (%)	Risk Estimate Contribution from Construction (%)
	RfC (µg/m^3)	UR (µg/m^3)$^{-1}$	RfD (µg/kg/day)	Non-cancer Air Concentration (µg/m^3)	Cancer (Ammortized) Air Concentration (µg/m^3)	Dose (µg/kg/day)				
Metals										
Chromium (VI)	3.0E-02	7.6E-02	-	3.3E-02	2.5E-02	-	**1.1E+00**	**1.9E-03**	9%	91%
Iron	-	-	4.2E+02	-	-	9.1E+00	2.1E-02	-	8%	92%

Notes:

BOLD Hazard Quotient >0.2 / ILCR >1E-05

- Not applicable

Table 2: Criteria Air Contaminants Inhalation Risk Estimates for the Maximum Sensitive Receptor - Operation Phase

Scenario: Baseline

Chemical	Acute TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	(µg/m^3)		(µg/m^3)		
Criteria Air Contaminants					
PM_{10}	24 hour AQO:	50	20	24 hour	4.0E-01

Scenario: Project (Operation)

$PM_{2.5}$	Acute TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	(µg/m^3)		(µg/m^3)		
PM_{10}					
TSP	Annual AQO:	60		Annual	
PM_{10}	24 hour AQO:	50	36	24 hour	7.2E-01

Scenario: Baseline+Project (Operation)

Chemical	Acute TRV		Exposure Concentration	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Operation (%)
	(µg/m^3)		(µg/m^3)				
Criteria Air Contaminants							
PM_{10}	24 hour AQO:	50	56	24 hour	**1.1E+00**	36%	64%

Notes:

BOLD Hazard Quotient >1.0

Propanal

Table 5: Summary of Risk Estimates for the Maximum Sensitive Receptor

Chemical	Hazard Quotient (Baseline)	Hazard Quotient (Project)	Hazard Quotient (Cumulative)	ILCR (Baseline)	ILCR (Project)	ILCR (Cumulative)
Construction Phase						
$PM_{2.5}$	4.7E-01	**1.5E+00**	**1.9E+00**	-	-	-
PM_{10}	4.0E-01	**5.0E+00**	**5.4E+00**	-	-	-
TSP	3.8E-01	**3.7E+00**	**4.1E+00**	-	-	-
NO_2	7.0E-02	1.6E-01	2.3E-01	-	-	-
Chromium (VI)	1.0E-01	**1.0E+00**	**1.1E+00**	**1.7E-04**	**1.7E-03**	**1.9E-03**
Iron	1.8E-03	2.0E-02	2.1E-02	-	-	-
Operations Phase						
PM_{10}	4.0E-01	6.8E-01	**1.1E+00**	-	-	**-**
Chromium (VI)	1.0E-01	2.0E-01	**3.0E-01**	**1.7E-04**	**3.4E-04**	**5.1E-04**
Iron	1.8E-03	3.9E-03	5.7E-03	-	-	-

Notes:

BOLD Hazard Quotient >0.2 (1.0 for CAC) / ILCR >1E-05

- Not applicable

Table 1: Criteria Air Contaminants Inhalation Risk Estimates for the Maximum Sensitive Receptor - Construction Phase

Scenario: Baseline

Chemical	Acute TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	(μg/m^3)		(μg/m^3)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour AQO:	27	12.6	24 hour	4.7E-01
PM_{10}	24 hour AQO:	50	20	24 hour	4.0E-01
TSP	24 hour AQO:	120	45	24 hour	3.8E-01
NO_2	1 hour AQO:	79	28	24 hour	3.5E-01

Scenario: Project (Construction)

Chemical	Acute TRV		Exposure Concentration	Averaging Time	Hazard Quotient
	(μg/m^3)		(μg/m^3)		
Criteria Air Contaminants					
$PM_{2.5}$	24 hour AQO:	27	36.4	24 hour	**1.3E+00**
PM_{10}	24 hour AQO:	50	250	24 hour	**5.0E+00**
TSP	24 hour AQO:	120	444	24 hour	**3.7E+00**
NO_2	1 hour AQO:	79	65	24 hour	8.2E-01

Scenario: Baseline+Project (Construction)

Chemical	Acute TRV		Exposure Concentration	Averaging Time	Hazard Quotient	Hazard Quotient Contribution from Baseline (%)	Hazard Quotient Contribution from Construction (%)
	(μg/m^3)		(μg/m^3)				
Criteria Air Contaminants							
$PM_{2.5}$	24 hour AQO:	27	52	24 hour	**1.9E+00**	24%	70%
PM_{10}	24 hour AQO:	50	270	24 hour	**5.4E+00**	7%	93%
TSP	24 hour AQO:	120	489	24 hour	**4.1E+00**	9%	91%
NO_2	1 hour AQO:	79	93	24 hour	**1.2E+00**	30%	70%

Notes:

BOLD Hazard Quotient >1.0

Comment Response Table

Comment Response Table

Proposal: Webequie Supply Road – Draft Environmental Assessment
Proponent: Webequie First Nation

Commenter Name and Job Title: Ganesharam Balagopal, Senior Regulatory Toxicologist, and Deep Patel, Human Toxicologist
Ministry and Branch: Human Toxicology and Air Standards Section,
Technical Assessment and Standards Development Branch
Ministry of the Environment, Conservation and Parks

Comments Summary: Following is a summary of the general comments on the HHRA report, intended to highlight key areas requiring clarification and additional justification. The individual section-specific comments from the HHRA report are provided in the table below.

1. **Problem Formulation & Conceptual Site Model (CSM):**

   To strengthen the HHRA, we recommend considering revising the CSM to address several critical gaps. The report should clearly state the objectives of the assessment and define acute, subchronic, and chronic exposure durations with appropriate averaging times. The CSM should also identify all receptors (including sensitive subpopulations such as children, elders, and individuals with pre-existing conditions), address seasonal variation, and provide additional rationale for any pathway exclusions.

   Additionally, the CSM should incorporate potential sources of contaminants such as gravel materials, or activities that may result in exposure such as the peat road design and blasting activities, as these may influence soil, water, and air quality. These enhancements will improve transparency, ensure completeness, and support a scientifically robust risk characterization.

   Comments in the table below related to this subject are: 1-3, 5, 7, 8, 26-29

2. **COPC Selection & TRV Justification**:

   The proponent should provide a clear and transparent screening process and rationale for selecting chemicals of potential concern (COPCs) and toxicity reference values (TRVs). For example, where ingestion pathways cannot be ruled out, oral TRVs should also be included. The current document does not explain why certain COPCs were included or excluded, nor does it justify the choice of TRVs or benchmarks, which may lead to uncertainty in risk estimates.

   Further, ensure that benchmarks reflect appropriate exposure durations (acute, subchronic, chronic) and that any assumptions about additivity for common toxicological endpoints are clearly explained, to improve transparency and consistency of the HHRA.

   Comments in the table below related to this subject are: 17, 19, 30, 36, 46–50

3. **Air Quality Assessment & Modelling:**

   It is apparent that the current modelling of emissions from vehicle omits important COPCs such as SO_2, CO, and additional VOCs (including diesel exhaust components), which may cause the HHRA to underestimate potential risks. We recommend including all relevant COPCs in the dispersion modelling and clearly identifying the model used, meteorological data inputs, and key assumptions.

   It is recommended to properly define points of impingement (POIs) and justify receptor distances, ensuring that both temporary and permanent receptors are adequately represented. Further, the report should present modelling results both with and without mitigation measures, to demonstrate the effectiveness of risk management strategies.

   Comments in the table below related to this subject are: 18, 20, 21, 32, 33, 35, 41

4. **Exposure Pathways & Sensitive Populations:**

   To ensure the HHRA reflects all relevant exposure scenarios, consider expanding the assessment beyond inhalation-only pathways. Limiting the analysis to air exposure overlooks potential ingestion and dermal contact routes, which may occur through dust deposition impacting soil, water, and vegetation. These pathways can be particularly relevant for traditional land users and sensitive populations such as children, elders, and individuals with pre-existing health conditions.

   The details on the characterization of gravel and construction materials used for the project should be provided. These materials may introduce metals, polycyclic aromatic hydrocarbons (PAHs), and other contaminants that could affect soil, groundwater, surface water, and air quality. We recommend conducting chemical characterization and, where appropriate, leach testing of gravel to identify any COPCs in this material and incorporate appropriate COPCs and exposure pathways into the CSM while analyzing pathways of exposure in CSM.

   We recommend incorporating a multi-pathway exposure assessment or, at minimum, providing a clear quantitative discussion of these additional routes and their potential contribution to overall risk. Including this analysis will improve completeness and demonstrate that all plausible exposure scenarios have been considered.

Comments in the table below related to this subject are: 6, 9–16, 22–24, 26–29, 39, 40, 43, 44

5. **Risk Management Measures (RMM):**

   To provide a transparent analysis of potential risks, the report should present risk estimates both with and without applying risk management measures (RMMs). The current document includes risk calculations only with mitigation measures in place which limits the ability to evaluate the true effectiveness of controls.

   We recommend moving the discussion of RMM to the appropriate section after uncertainty analysis and clearly distinguishing between active and passive mitigation. This allows risk calculation to be done with and without active mitigation (RMM). This approach will improve clarity and support informed decision-making.

   Comments in the table below related to this subject are: 34, 38

6. **Risk Characterization & Uncertainty Analysis:**

   Risk characterization and uncertainty analysis should consider and discuss the points raised above with respect to exposure scenarios and duration of exposures, and pathways of exposure including multi-pathway, (Points # 1,2, 3 and 4 above); further review of risk characterization cannot be completed until exposure pathways and other elements are incorporated. We also recommend addressing the uncertainty about chromium speciation (proportion of hexavalent chromium) through sampling and analysis.

   Comments in the table below related to this subject are: 51–58

7. **References and Consistency Issues:**

   The current version cites the 2017 Health Canada guidance series for air quality, water quality, and country foods. These have since been superseded by the 2023 updates, which should be considered.

   In addition, please review terminology and consistency issues throughout the HHRA and verify that all cross-references and numerical values (e.g., table notes, exceedance statements) are accurate and consistent across the document.

   Comments in the table below related to this subject are: 4, 37, 42, 48

Comment #	GRT Comments				Proponent Response
	Page/ Section #	Comments & Rationale	Proposed Action/Solution	Type of Comment: A. Required for EA (per ministry mandate/policy/legislation) B. Recommended for EA C. Editorial D. Permitting Related, Not Required for EA	
Executive Summary and Introduction Pages 6-8					
1.	Page 7	Define acute and chronic exposure in the executive summary.	Please provide a brief definition and averaging time for acute and chronic exposure up front in the summary for better understanding to the reader.	B	Definitions added throughout report and first occurrence in report (Section 3.4, first bullet). In addition, the conclusions and the executive summary (Page 8) have been updated to include the specific time period associated with each AAQS/CAAQS to increase transparency.
2	Page 8	Further clarity is required in the introduction.	The introduction should clearly state the objectives of the HHRA (e.g., to evaluate potential health risks from predicted exposure to project-related contaminants). The introduction should also briefly mention who is being assessed (e.g., local residents, Indigenous land users, sensitive subpopulations) and how (e.g., inhalation, ingestion).	A	Added to Executive Summary (Page 8). Additional text for the receptors considered also added to Section 3.8 (Page 54 and 55).

Comment #	GRT Comments				Proponent Response
	Page/ Section #	**Comments & Rationale**	**Proposed Action/Solution**	**Type of Comment:** **A. Required for EA (per ministry mandate/policy/legislation)** **B. Recommended for EA** **C. Editorial** **D. Permitting Related, Not Required for EA**	
3	Page 8	It is stated that 17 km of the WSR is within the First Nations reserve land. However, it is not apparent if the study area includes the assessment of these residential exposures. Does the WSR stretch pass through any residential area or human dwelling?	Additional clarity is needed, please provide additional rationale of how the residential locations will be assessed.	A	There are no existing residences in the immediate vicinity of the proposed road (Page 14 Section 3.1); however, the HHRA included consideration of residential areas and areas of importance to the local residents (Page 7 Executive Summary). The specific distances to the nearest points of interest/areas of interest have been added to Section 3.3.4 (Pages 22 and 23) which includes existing residences, institutional buildings, culturally sensitive areas and future residences. Section 3.7.1 (Pages 36 and 37) discussed the evaluation of residential receptors. The AQIA, on which the HHRA relied Section 3.7.1 (Page 36 and 37), included 24 existing residences (mostly homes within the community of Webequie), 6 institutional buildings (including 2 schools, a nursing station, a church, a community building and a commercial building) and 21 culturally sensitive areas (spiritual or sacred places for the community and stakeholders including important locations for harvesting of country foods and hunting). In addition, the 67 future residences (based on Webequie Land Use Plan) were included as detailed in Section 3.7.1 (Page 37)
4	Page 9 Section 2.1	The HHRA cites old federal guidance documents from 2017 for air quality, water quality, and country foods. These references should be updated to the latest Health Canada guidance published in 2023 to ensure alignment with current best practices. Please review and replace the following references: 1. *Evaluating Human Health Impacts in Environmental Assessments: Air Quality* (2017) 2. *Evaluating Human Health Impacts in Environmental Assessments: Country Foods* (2017) 3. *Evaluating Human Health Impacts in Environmental Assessments: Water Quality* (2017)	The latest reference on this topic was published in 2023 and the link is provided below. 1. https://publications.gc.ca/collections/collection_2024/sc-hc/H129-54-1-2023-eng.pdf 2. https://publications.gc.ca/collections/collection_2024/sc-hc/H129-54-5-2023-eng.pdf 3. https://publications.gc.ca/collections/collection_2024/sc-hc/H129-54-2-2023-eng.pdf.	B	Noted and replaced Section 2.1 (Page 11).
Problem Formulation Pages 11 - 41					
5.	Page 12 & 13 Section 3.1	It is not apparent the project timelines for the different phases of the undertaking, (i.e. WSR construction and operation) as well as impact of seasonal considerations. Temporal boundaries (construction: 5–6 years; operation: 75 years) are mentioned later in Section 3.5 Study Area, but not in Section 3.1 where readers expect project context. Further, seasonal considerations (e.g., winter road, dust control during dry months) are scattered but not consolidated.	A clear understanding of the timelines of the phases of the undertaking is required, a schematic representation of timeline in the project could be beneficial.	B	The temporal boundaries have been added to the text on Section 3.1 (Page 15). Please also refer to Section 3.5 (Page 28).
6.	Page 12 Section 3.1	In paragraph 3, procuring the gravels from pits and quarries require further details. Additional detail and composition of the gravel being used are required to ensure that COPCs are captured and that these COPCs may require additional modelling for exposure considerations. It is also not apparent if operations involving gravel are being considered as part of this undertaking.	Additional consideration of both the processing and future source of COPCs from gravel are required. This includes an analysis of the composition of the gravel to ensure that no COPCs are missed. Depending on this information, additional direct and indirect exposure routes may need to be addressed. This information is critical for assessing indirect exposure pathways and should be linked to soil and groundwater quality discussions in Section 3.3. Additional consideration of the gravel operations may need to be incorporated.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).

Comment #	GRT Comments				Proponent Response
	Page/ Section #	Comments & Rationale	Proposed Action/Solution	Type of Comment: A. Required for EA (per ministry mandate/policy/legislation) B. Recommended for EA C. Editorial D. Permitting Related, Not Required for EA	
7.	Page 12 Section 3.1	It is not apparent how the floating road on top of peat is being considered for potential impacts on water quality and human exposure.	Additional consideration and rationale is required to assess this potential exposure pathway.	B	Leachate testing has indicated that the gravel material has a low leaching potential with impacts on water quality not anticipated. As stated in Section 3.3 (Page 18), the HHRA relies on the findings presented in the EAR/IS for indicator VCs, including: Section 6 - Geology, Terrain and Soils; Section 7 - Surface Water Resources; and Section 8 - Groundwater Resources. No changes to water quality are predicted based on the findings above as detailed in each summary of these indicator VCs presented in Section 3.3.1 (Page 19 and 20), Section 3.3.2 (Page 20 and 21), Section 3.3.3 (Page 21).
8.	Page 17 Section 3.3.1	The section does not specify what types of contaminants (e.g., hydrocarbons, metals, particulates) might be introduced to soil or how they could lead to potential exposures.	It is expected that contaminant within the LSA and the gravel procured for road construction use should also be considered.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.31 Page 20). Further consideration of the potential for gravels to impact the LSA, including surrounding soils and air quality (i.e., from dust generation), will be conducted once the data is available. Leachate testing results for gravel have indicated that the leachability of metals from gravel is low and thus, impacts to surface water and groundwater are not anticipated Section 3.3.1 (Page 19 and 20), Section 3.3.2 (Page 20 and 21), Section 3.3.3 (Page 21).
9.	Page 17 section 3.3.1	“The magnitude of effect on soil is considered moderate due to project activities”. However, the gravel for road construction as a potential source of contaminants has not been included in the discussion.	A discussion on gravel for road construction should be included in this section.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).
10.	Page 18 Section 3.3.1. First paragraph	“The duration of most effects from changes to soil quality is considered short-term…” The changes to the soil quality that is based on crushed gravels may also have a long-term impact on the LSA.	A discussion on the potential long-term effect from the contents of the crushed gravels on the ecosystem and soil, ground water that could impact human health requires additional elaboration.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).
11.	Page 18 Section 3.3.1, 2nd paragraph	It is stated that the dust generated and deposited would not affect the soil quality beyond the LSA. However, there is insufficient data to support this claim, if crushed gravels are used from another area for road construction. Dust will often be carried beyond the area it is generated.	Crushed gravels should be analyzed for its contents and the contaminants be included in formulation.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).

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	Page/ Section #	Comments & Rationale	Proposed Action/Solution	Type of Comment: A. Required for EA (per ministry mandate/policy/legislation) B. Recommended for EA C. Editorial D. Permitting Related, Not Required for EA	
12.	Page 18 Section 3.3.2, 4th paragraph	The text refers to "chemical constituents" and "potential contaminants" but does not specify which substances are of concern (e.g., nitrates, heavy metals, hydrocarbons).	Both the terms (chemical constituents and potential contaminants) should be defined, and chemicals categorized with sufficient justification.	B	Potential contaminants have been used throughout. The potential contaminants considered in the assessments for each of the linked VCs are presented in their respective Sections of the EAR/IS. Text added to Section 3.3.2, 4th paragraph (Page 21) to explicitly state that the findings were used in the HHRA.
13.	Page 18 Section 3.3.2, 5th paragraph	There's no mention of baseline conditions or whether existing water quality data were used to contextualize predicted changes and its impact on human health.	More details during problem formulation are required on the use of baseline data and future prediction due to road construction activity including construction materials exposure to the LSA.	A	Additional text has been added to Section 3.3.2 (Pages 20 and 21). The Surface Water Resources assessment concluded that changes to surface water quality were not predicted to be significant. This determination was based on findings presented in the EAR/IS, which included evaluations of geology, terrain, soils, surface water, and groundwater resources. To address transparency, the HHRA was updated to clarify that baseline water quality data from the EAR/IS was considered in evaluating potential impacts. The report provides text at the beginning of Section 3.3 (Pages 18 and 19) and was added specifically to reliance on Surface Water Resources conclusions. Text added to Section 3.3.2, 4th paragraph (Page 21) to explicitly state that the findings were used in the HHRA.
14.	Page 18 Section 3.3.2, 5th paragraph	Settling of particles from air emissions and re-entrainment of dust into water bodies and its potential impact to human health was not considered. Additional rationale is required to assess whether these pathways should be assessed.	Emissions from project activity including the gravels used for road construction should be considered and discussed as an exposure pathway for potential human impact.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).
15.	Page 18 Section 3.3.2, 5th paragraph	As a conclusion to Section 3.3.2, it is stated that "significant effects to water quality were not predicted…", however, it is not apparent how this was determined.	A detailed consideration of the construction material that would be released to air and enters the water bodies has to be given and discussed.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).
16.	Page 19 Section 3.3.3, 1st paragraph	This section discusses rock blasting as a potential source of groundwater contamination, but this consideration is not applied consistently throughout the HHRA. Additionally, the magnitude of effect due to blasting is considered low to moderate for groundwater quality and is stated to be within the range of seasonal variation. However, such an inference cannot be drawn unless the gravel procured from local quarries or pits is chemically characterized.	Rock blasting as a potential source of contamination should be consistently considered throughout the HHRA. Further, chemical characterization of the gravels is required to support the comments on the effects of blasting on groundwater quality.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).
17.	Page 19 Section 3.3.4, 1st paragraph	It is not apparent how air contaminants which are considered to have potential impact on human health were screened.	A brief rationale for the selection of these contaminants should be provided in this document.	A	The HHRA relied on the findings of the Air Quality Impact Assessment, with any substances that were predicted to exceed applicable criteria being assessed in the COPC screening of the HHRA. The HHRA has been updated to reflect the approach (Section 3.3.4 Page 21, 22 and 23).

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	Page/ Section #	**Comments & Rationale**	**Proposed Action/Solution**	**Type of Comment:** **A. Required for EA (per ministry mandate/policy/legislation)** **B. Recommended for EA** **C. Editorial** **D. Permitting Related, Not Required for EA**	
18.	Page 19 Section 3.3.4, 2nd paragraph	It is stated that "Atmospheric dispersion modelling was carried out for both construction and operation phase". Please provide a plain language summary of the assumptions and modelling used to assess exposure point concentrations.	This paragraph should also include brief details on model used, meteorological data & modelling assumptions.	B	Additional details have been added to Section 3.3.4. Further details of the assumptions and modeling used to assess exposure concentrations are presented in the AQIA. The HHRA was updated with a brief summary of assumptions after the revised modelling was conducted (Section 3.3.4 Page 21, 22 and 23).
19.	Page 19 Section 3.3.4, 3rd paragraph	Air benchmarks were referred from Ontario's AAQC list and CAAQS. Additionally, the Ontario Air Contaminant Benchmark (ACB) list should also be considered, as it provides health-based screening levels for contaminants not fully addressed by AAQC or CAAQS. Other relevant toxicity reference sources could also be reviewed to ensure comprehensive coverage.	Additionally, Ontario Air Contaminant Benchmark (ACB) list can also be considered.	B	The findings of the revised AQIA results were reviewed to ensure benchmarks are consistent with those used in the air quality assessment. Text has been updated to reflect consideration of ACBs (Section 3.3.4 Page 22 3rd paragraph).
20.	Page 20 Section 3.3.4.	The phrases "exceedance at one or more location" and "point of impingement" have been used inconsistently in this section. Further, the clarity in defining POI is missing.	The distinction between exceedances "at one or more location" and "at points of impingement of interest" needs clarification. Moreover, the POI should be defined including the distance of the receptor from the point of release of the COPC.	B	The HHRA has been updated based on the revised air modelling. Distances to the nearest points/areas of interest have been added to Section 3.3.4 with distances and details presented on Page 22 and 23.
21.	Page 20 Section 3.3.4.	It is stated that "based on the potential for changes to air quality, quantitative evaluation of potential exposures and risks of humans to contaminants in air will be conducted in the HHRA." It is not clear when will be the risk calculation of the HHRA conducted.	If it is done further down in the document or in the future, it should be referenced in this section.	A	Addressed. Reference to risk characterization added to the HHRA (Page 23, last paragraph of Section 3.3.4).
22.	Page 21 Section 3.3.5.1	It is stated that contaminant uptake by plants is not anticipated by project activity. However, sufficient rational has not been provided to support this assertion. For example, has leach testing been done on the crushed gravels which may contain potential metals as COPC (if otherwise proved not to have any COPC with chemical characterization) could be a source for plant uptake through fall outs in soil or water media.	A discussion and supporting data of gravel chemical characteristic is needed.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).
23.	Page 21 Section 3.3.5.1. 4th Paragraph	This paragraph claims operational dust "is not anticipated to differ in composition from baseline dust." This assumes the disturbed soil is uncontaminated and the procured gravel is also without any COPCs—but if baseline soils contain metals or other pollutants along with any COPC in the procured gravel (e.g., legacy contamination), this could underestimate exposure.	As above baseline chemical characterization data is required and included while discussion. As mentioned in comment #22.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).
24.	Page 22 Section 3.3.5.4. 1st Paragraph	It is stated that country food tissue data is available, and project related contaminant increase in country food is not expected. Additional justification is required.	A clear consideration of sources of COPCs including crushed gravels may require additional consideration.	B	As noted in Section 3.3.5 (Page 23), the potential for Project-related increases of concentrations of contaminants in country foods is linked to the potential for changes in contaminant concentrations in the environmental media that country foods biota are exposed to, including soil, water and air. As no significant changes were predicted for the linked VCs, except air, no associated changes in country foods were predicted. Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).

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	Page/ Section #	**Comments & Rationale**	**Proposed Action/Solution**	**Type of Comment:** **A. Required for EA (per ministry mandate/policy/legislation)** **B. Recommended for EA** **C. Editorial** **D. Permitting Related, Not Required for EA**	
25.	Page 22 Section 3.3.5.4. 2nd Paragraph	It is stated monitoring of contaminants will continue during the construction and operation phase. However, in is not apparent which contaminants will be measured in baseline samples and monitoring in the operation phase.	A list of contaminants measured in baseline samples and monitored in the operation phase should be provided in this section.	A	The analysis of the baseline monitoring will be dependent on each indicator VC as referenced in Section 3.3.5 (Page 23). The only media which had significant changes predicted was air. Please refer to Section 3.7 (COPC Screening – Air COPC Screening Page 35 through Page 54) which includes additional details on constituents measured in baseline and predicted samples. Text has been added to the HHRA to reflect this (Section 3.3.5 Page 23 which includes a reference to the Country Foods Assessment which provides all sampling details).
26.	Page 24 Section 3.4	The scope of the HHRA assumes that inhalation of air contaminants is the only exposure pathway considered; however, this assumption is not clearly explained or supported. Redistribution of particulate matter as COPCs to other media (e.g., soil, groundwater, plants) is not addressed, which could influence indirect exposure pathways and should be discussed in the CSM. Additionally, while the section states that acute and chronic air quality will be assessed, subchronic exposures are also relevant for the project phase. Proper benchmarks to protect against acute, subchronic, and chronic toxicities should be defined, with a clear rationale for TRV selection. Finally, the description of receptors within the LSA lacks clarity. Different receptor types, such as temporary receptors (construction camps, seasonal cabins) and permanent receptors (future residents along the road), should be explicitly identified and considered in the assessment.	1. Provide a clear justification for limiting the HHRA to inhalation exposure or include a discussion on the potential redistribution of particulate matter to other media and its implications for human health. 2. Expand the scope to include subchronic exposure benchmarks and provide a rationale for the selection of TRVs for all exposure durations (acute, subchronic, chronic). 3. Revise the study area description to clearly identify receptor locations and differentiate between temporary and permanent receptors, ensuring these are reflected in the CSM and subsequent risk characterization.	A	1) The HHRA relied on the results of the indicator VCs. Results indicate that no significant changes in contaminant distributions are anticipated for soil, groundwater and plants as a result of the project. Section 3.3 (Page 18 to Page 25) of the HHRA discusses the findings (Section 3.3.1 – Geology, Terrian and Soils, Section 3.3.2 – Surface Water Resources, Section 3.3.3 – Groundwater Resources and Section 3.3.5 – Country Foods). The HHRA relied on these findings. Therefore, although the HHRA considered each of these media, they were not retained for quantitative evaluation. As noted, further consideration of the potential for dust from gravel to impact the other VCs, as well as the HHRA, is planned once the gravel analysis is complete. Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20). 2) As discussed in the HHRA, only exceedances of the acute (< 24 hour) air quality guidelines were predicted, and further, given that sources will be moving during the construction phase, exceedances at a location will only be short term (Section 3.7.1.1 Page 44, Page 46, Section 6.1 Page 67) . Further, while maximum 24-hour TSP was used to predict metals concentrations in dust (along with the Eagle's Nest EA soil data), chronic exposures and associated risks were assessed given the lack of acute TRVs. In Section 5 (Page 61), Acute TRVs have been defined as the air concentration of a chemical that can be tolerated without appreciable health effects on a short-term (e.g. 1-hour, 24-hours) basis. With respect to the 24-hour AAQCs, which are acknowledged to be a short-term representation of a chronic benchmark, in Section 3.7 (Page 32), the health-based USEPA NAAQS were referenced for comparison to ensure that the 24-hour AAQCs were health-protective. As the USEPA NAAQS

Comment #	GRT Comments				Proponent Response
	Page/ Section #	**Comments & Rationale**	**Proposed Action/Solution**	**Type of Comment:** **A. Required for EA (per ministry mandate/policy/legislation)** **B. Recommended for EA** **C. Editorial** **D. Permitting Related, Not Required for EA**	
					were higher or equivalent to the 24-hour AAQCs, they were determined to be health protective and thus have been applied as TRVs. The HHRA focused on the acute and chronic exposures based on the results of the AQIA. The averaging periods of the air dispersion modelling exceedances were based on AAQC and CAAQS. The exceedances identified in the AQIA for sensitive receptors were those that were ≤ 24 hours. Sub-chronic exceedances were not identified. 3) Based on the response provided above, revisions are not required to the original tabular CSM, however, a graphical summary (Figure 3-7 Page 56) has been added to Section 3.9 to help increase transparency.
27.	Page 25 Section 3.4 2nd paragraph	It is stated that "As presented in Section 3.2, no significant project related effects have been predicted for other media". Requires further consideration.	Such discussions have not been done in Section 3.2 and therefore such statements should be clarified or discussed further. Or additional justification is required to support this statement.	A	The correct reference is Section 3.3 (Page 19) discussed project related effects (Section 3.3.1 – Geology, Terrian and Soils, Section 3.3.2 – Surface Water Resources, Section 3.3.3 – Groundwater Resources and Section 3.3.5 – Country Foods). The text has been updated (Section 3.4 Page 27, 2nd paragraph).
28.	Page 29 Section 3.7 1st paragraph	It is stated that "As described in Section 3.3, no significant effects, including increasing concentrations of Project-related contaminants, were predicted for soil, groundwater." Requires further consideration.	Such discussions have not been done in Section 3.3 and therefore such statements should be clarified or discussed further. Or additional justification is required to support this statement.	A	Additional text has been added to Section 3.7. The HHRA relied on the findings of the indicator VCs, which are summarized in Section 3.3 (Section 3.3.1 – Geology, Terrian and Soils, Section 3.3.2 – Surface Water Resources, Section 3.3.3 – Groundwater Resources and Section 3.3.5 – Country Foods). The findings indicate that no significant increases in concentrations are predicted for these VCs (Section 3.7 Page 32 1st and 2nd paragraph)
29.	Page 29 Section 3.7 2nd paragraph	It is stated that "Air quality is the only VC linked to human health effects". Such claims have to be backed with data and a fully rationalized CSM model.	Detailed explanation and rationale for this assumption is lacking anywhere in the document. A summary explaining why soil, groundwater, surface water, and country foods were excluded should be included. Include a Conceptual Site Model diagram showing: Sources (construction activities, vehicle emissions, dust), pathways (airborne transport), receptors (Webequie FN residents, seasonal users), exposure route(s). This will provide transparency and help understand the basis for HHRA scoping decisions.	A	An updated graphical CSM summarizing operable exposure pathways, including emissions, dust and air circulation with both a traditional land user and residents has been added to the HHRA in Section 3.9 as Figure 3-7 (Page 56). The rationale for the exclusion of the other pathways is presented in Section 3.3, the HHRA relied on the findings of the indicator VCs and no significant changes to contaminant distributions were predicted, other than the Air VC, therefore they were not retained past the Problem Formulation of the HHRA.
30.	Page 30 Table 3.1	Table 3.1 lists number of contaminants as indicators of air quality VC without justification for their selection.	Rationale for the selection of the contaminants should be provided.	A	The title of Table 3-1 has been updated to provide more clarity with text added to clarify in Section 3.7 (Page 32). The text (Section 3.7 Page 32) prior to Table 3.1 states that *All air contaminants with the potential to exceed the applicable guidelines have been retained as preliminary contaminants of potential concern (COPCs) in the HHRA.* Also noted on Page 34.

Comment #	GRT Comments				Proponent Response
	Page/ Section #	**Comments & Rationale**	**Proposed Action/Solution**	**Type of Comment:** **A. Required for EA (per ministry mandate/policy/legislation)** **B. Recommended for EA** **C. Editorial** **D. Permitting Related, Not Required for EA**	
31	Page 30 Section 3.7.1. 1st Paragraph	It is stated that "WSR will not be fully surfaced with asphalt or chip seal from the start." As per the approved terms of reference dated August 2020, the road is only a gravel road which indicates asphalt may not be used. Further clarification is required, and appropriate COPC (e.g. PAHs) should be considered.	If at all it is surfaced with asphalt, will it be done within the project period? A plan of timeline should be stated. A clear explanation should be provided.	A	The HHRA has been revised with additional details added based on the updated AQIA which includes different scenarios with details added in Section 3.7.1 (Page 35 through 37), it is recognized, however, that final details with be determined in the Details Design phase through discussions between Indigenous communities and the construction contractor.
32.	Page 30 Section 3.7.1. 3rd Paragraph	"The modelling considered receptors, or points of impingement, for potential contaminant concentrations in ambient air, at 50 m and 150 m distance from the road centreline (RCL)……". Additionally, it is also specified many receptors that may be potential near the project site or could get exposed to project activities.	Real ground distance of all the receptors should be cited in the document and a rationale for selecting the assumed distance i.e. 50 m, 150 m etc. should be provided.	B	Added. Please refer to Section 3.3.4 (Pages 22 and 23) for details with distances included.
33.	Page 31 Section 3.7.1.1. Table 3.2	The table provides the results of dispersion modelling during the construction phase. The table is missing in many COPCs.	COPCs like sulphur dioxide, carbon monoxide and other VOCs like ethylbenzene, xylene and contents of diesel exhausts are missing that has been mentioned in previous sections. These COPCs should be modelled and included in the table. If these COPCs were not modelled, provide a clear rationale.	A	Please refer to the revised Section 3.7 (Page 32 through 54) which has been updated based on the revised AQIA. While the AQIA contains details of the modelling parameters and assumptions, the HHRA has been revised to include more detail on exceedances modelled and assumptions made in the modelling.
34.	Section 3.7.1.1. Table 3.2. (page 31); Table 3.3 (page 34); Table 3.5 (page 37)	Dispersion modelling results were presented with mitigation in place assumed. It is not apparent that what kind of risk mitigations are in place. If it is an active risk management measure, please provide the calculation with and without mitigation as well.	The table should also present modelling results of the COPC emissions both with and without mitigation measure.	A	The HHRA has been updated to include scenarios COPC screening and risk estimates without mitigation measures based on the revised AQIA. Please refer to Section 3.7 (Page 32 through 54) and Section 6 (Table 6-1 and 6-2) as well as Appendix B detailed results tables.
35.	Page 32 Section 3.7.1.1. 1st paragraph	Benzeno(a)pyrene is modelled, and exceedance has been reported. If this is to represent whole PAHs, further consideration is required. BaP is a surrogate representing industrial emissions to air. However, if BaP is from any other operation especially involving soil or gravel, Toxic Equivalence Factor (TEF) should be considered.	It is recommended that TEF should be considered while measuring PAHs and a discuss is required if otherwise.	B	Please refer to the revised HHRA. As indicated in the HHRA, air quality is the only pathway that is considered to have a significant change in contaminant concentrations. No other sources of PAHs are anticipated, discussion has been added to Section 7 T(able 7-1 Page 71, Problem Formulation) Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).
36.	Page 33 Section 3.7.7.1 1st bullet point	It is stated "The potential exceedances only concern short-term AAQC (24-hours…)". Note: 24-hr AAQCs are not short-term benchmark, it only represents a concentration that is equivalent to the annual average with short-term exposure duration (24-hr).	If the exposure is only of short-term duration, appropriate benchmarks should be used (e.g. acute or subchronic benchmarks). Provide a rationale for benchmark selection in Section 5 and cross-reference it here.	A	In Section 3.7 (Page 32), the health-based USEPA NAAQS were referenced for comparison to ensure that the 24-hour AAQCs were health-protective. As the USEPA NAAQS were higher or equivalent to the 24-hour AAQCs, they were determined to be health protective and thus have been applied as TRVs.
37.	Page 33 Section 3.7.7.1 2nd bullet point	It is stated "Dust deposition on the ground and on vegetation above the threshold would be limited to the road….". Note: Thresholds are not benchmarks. This statement requires further clarification.	Provide rationale and justification to support either qualitative or quantitative assessment.	B	HHRA text has been revised to 'benchmark' for clarity. When the term threshold refers to the text/term used directly in the AQIA the reference added to the sentence (Section 3.7.1 Page 53).

Comment #	GRT Comments				Proponent Response
	Page/ Section #	**Comments & Rationale**	**Proposed Action/Solution**	**Type of Comment:** **A. Required for EA (per ministry mandate/policy/legislation)** **B. Recommended for EA** **C. Editorial** **D. Permitting Related, Not Required for EA**	
38.	Page 33 Section 3.7.1.1 5th bullet point	This bullet discusses in detail about the Risk Management Measures (RMM). However, the RMM should be discussed after the risk calculation and discussion on uncertainties.	The RMM should be included in the appropriate section at the end.	A	Acknowledged. The information was included to provide transparency in the air COPC concentrations, i.e., to say what was not considered in the AQIA. The details have been moved to Section 6.1 – Risk Characterization Results, (Page 67, bullet 3) with a reference added.
39.	Page 34 Section 3.7.7.1 1st paragraph	"estimate Project scenario concentrations of metals in dust (i.e., TSP) generated from soils in the study area, soil data collected as part of the Eagle's Nest Multi-metal Mine Environmental Assessment, located in the Ring of Fire, has been used" It is not apparent how gravel used in road construction would contribute to dust exposure	The HHRA should include the characterization of gravel and evaluation of the potential for gravel to contribute to dust exposure.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).
40.	Page 35. Table 3.4	The metals concentrations in airborne particulates are estimated using soil metal concentrations multiplied by TSP concentration. This assumes all particulate matter is soil-derived, which may not be entirely accurate (other sources could contribute metals i.e. project activity and gravels).	Additional explanation of this assumption's validity, or whether emissions inventories support it, would improve clarity.	B	Other contributions are anticipated to be insignificant, as discussed in Section 3.3 Review of Anticipated Project-Effects (Page 18 through 24) on Contaminant Levels. Regarding contributions from gravels, gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).
41.	Page 36. Section 3.7.1.2. 1st paragraph	Vehicle emissions including SO_2 concentrations or modeling results during the operation phase were not mentioned.	Given that operational emissions could include vehicle exhaust or other combustion sources, SO_2 should typically be considered and modeled alongside NO_2 and VOCs. If SO_2 was modeled, add results to Table 3-5 and discuss whether concentrations were below AAQC. If not modeled, provide a rationale as to why (e.g., emission estimates indicate negligible contribution). Ensure consistency between COPC screening (Section 3.3.4) and modeling results (Section 3.7.1.2).	A	The HHRA relied on the results of the AQIA. The HHRA was revised based on the updated AQIA results. SO_2 has been included in the COPC screening Section 3.7.1 (Page 35 through 54), Risk characterization Section 6.1 (Table 6-1 Page 66 and text on Page 67) as well as the Appendix B detailed risk estimate tables and Section 8 Conclusions (Section 8.1 Page 75 and Section 8.3 Page 77) and Executive Summary (Page 8 and 9).
42.	Page 37, 3rd paragraph and page 39, notes section.	The maximum predicted TSP concentration at a sensitive receptor is stated as 97 µg/m³ in the text but 489 µg/m³ in the notes under Table 3-6 (there seems to be a discrepancy).	Clarify whether the 97 or 489 µg/m³ is correct for the TSP concentration used to calculate metals concentrations.	A	The HHRA relied on the results of the AQIA. The HHRA was revised based on the updated AQIA results. Based on the multiple scenarios assessed in the revised HHRA, Appendix B Table 4 series includes the TSP details used to calculate metals concentrations for each scenario including those without mitigation.

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43.	Page 40. Section 3.8. 5th paragraph.	As COPCs were only identified in air, the primary exposure pathway by which Webequie First Nation community members and other populations in the LSA have the potential to be exposed to Project related COPCs is via inhalation. This assertion has not been fully justified. The potential for dust to contributed to other routes of exposure have not been well characterized. Some indirect exposure pathways (e.g., dermal contact with settled dust, ingestion of contaminated surface water or soil) do not appear as they have been assessed fully. See comments in above sections.	Given the potential redistribution of particles from air to different media, a detailed discussion (including quantitative assessment) is needed to assess other routes of exposure.	A	The HHRA relied on the results of the AQIA and the findings from the indicator VCs with only the AQIA predicting significant changes to contaminant concentrations. To address associated concerns, the HHRA recommended that the Air Quality and Dust Control Management Plan that will be developed and implemented for the Project integrate a monitoring procedure for dustfall effects and measures to control or limit particulate emissions. Additional mitigation measures beyond those accounted for in the AQIA will be implemented, as warranted. Section 8.1 (Conclusions and Risk-Based Recommendations – Construction Phase Page 75 and 76) and Section 8.2 (Conclusions and Risk-Based Recommendations – Operation Phase Page 76) and Section 8.3 (Risk-Based Recommendations Page 77) as well as the Executive Summary (Page 8 and 9).
44.	Page 41. Section 3.9 and table 3.8	Lack of consideration of sensitive subpopulations. Vulnerable subpopulations (e.g., elders, pregnant women, people with pre-existing respiratory conditions) may have greater sensitivity to air pollutants, especially PM_{10} and metals like Cr(VI).	A qualitative discussion would add to the transparency and completeness of the HHRA.	B	The discussion has been added to the Uncertainty Analysis Section 7, Table 7-1 (Page 73).
Exposure Assessment Pages 42 - 44					
45.	Page 42. Section 4.1, Table 4.1	Data on SO2 and CO2 are missing in the table. In the operations phase, PM2.5 and TSP are also missing.	Clarification is required.	A	Acknowledged. Please refer to the current HHRA document which has been updated based on the revised AQIA. With Section 3.7. COPC screening including parameters included as per the revised AQIA (concentrations and parameters) in Section 3.7.1.1 and Section 3.7.1.2 (Pages 37 through 54).
Toxicity Assessment Pages 45 - 47					
46.	Page 45. Section 5	"Acute TRV: the air concentration of a chemical that can be tolerated without appreciable health effects on a short-term basis (e.g. 1-hour, 24-hours)". 24-hour AAQCs are not acute TRVs. These benchmarks are short-term representation of a chronic benchmarks.	Clarification is required on the limits used to assess short-term risks.	A	In Section 3.7 (Page 32), the health-based USEPA NAAQS were referenced for comparison to ensure that the 24-hour AAQCs were health-protective. As the USEPA NAAQS were higher or equivalent to the 24-hour AAQCs, they were determined to be health protective and thus have been applied as TRVs, discussion added to Section 5 (Page 61).
47.	Pages 45-46 Section 5	"The TRVs provided by the above listed agencies are protective of critical sub-groups ….for example, the elderly or persons suffering from existing medical conditions)." While TRVs may consider vulnerable sub-population, it never covers people with existing medical conditions.	Additional context or clarification to this statement is needed.	B	Additional text added to the HHRA to clarify in both Section 5 (Page 62, first paragraph) along with the Uncertainty Analysis in Section 7, Table 7-1 Toxicity Assessment (Page 73).
48.	Page 46. Section 5	"a range of the available acute and chronic air quality guidelines available from Ontario MECP, the CCME and the WHO were used." This statement requires further clarification.	Further clarification is required when using acute or chronic benchmarks.	A	Additional text added to the HHRA to clarify. Please refer to Section 5 (Page 61 and 62) for updated text and additional details added.

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49.	Page 46. Table 5.1	PM_{10} 24-hr benchmark is noted as 50 ug/m^3. However, it is not an acute number. It is extrapolation from a chronic effect.	Clarification is required in use of this benchmark.	A	In Section 3.7 (Page 32), the health-based USEPA NAAQS were referenced for comparison to ensure that the 24-hour AAQCs were health-protective. As the USEPA NAAQS were higher or equivalent to the 24-hour AAQCs, they were determined to be health protective and thus have been applied as TRVs. Text has been added to clarify in Section 5 (Page 62).
50.	Page 47. Table 5.2	Oral TRV was provided only for iron and is considered as a basis for calculating inhalation risk based on route extrapolation. As discussed, earlier ingestion pathway cannot be ruled out and oral TRVs are needed for COPC.	Oral TRVs of COPCs should be provided with rationale. The TRVs can represent acute, subchronic and chronic as needed.	A	Ingestion pathways are considered to be insignificant. Inhalation is the only route of exposure based on the findings of the indicator VCs. Additional rationale added to Table 5-2 (Page 63) on the use of oral TRV and to Section 5 text for the use of acute and chronic TRVs (Page 61 and 62).
Risk Characterization Pages 48 - 51					
51.	Page 49. Table 6.1	This table presents acute risk estimates. However acute risk has not been properly characterized in this document.	A clear definition of short-term (acute) exposure and its benchmark should be included. Use of 24-hr averaging period as equivalent to short-term (acute) exposure may be reasonable but would require additional justification and clarification as an initial screening step.	A	Additional text added to the HHRA to clarify rationale and approach has been added to Section 5 (Page 61 and 62) on the use of acute benchmarks.
52.	Page 50 Section 6.1	An expanded Section 6.1 may be needed to address dust re-entrainment and deposition, including scenarios with and without risk management measures.	Additional rationale and considerations are required.	B	The HHRA relied on the results of the AQIA and based exposures on those realistically expected to occur. The HHRA has been revised to include scenarios without control measures as per the revised AQIA (Section 3.7 COPC Screening and Section 6.1 Risk Characterization Tables 6-1 and 6-2 (Pages 65 through 67). The HHRA has concluded that risk controls including air monitoring are recommended. Clarification has been added to Section 8 of the HHRA.
53.	Page 50. Last para	It is stated that there is no baseline chromium speciation data so only the total chromium baseline concentration was used and with the assumption 1/7th is the hexavalent chromium as recommended by Health Canada. The document concludes this approach is over estimation of risk. However, the gravels used in road construction should also be taken into account for potential Chromium and speciation content before any risk calculations or conclusions are drawn.	Potential chromium content with speciation from the gravels used in road construction should be considered and assessed if applicable.	A	Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Executive Summary (Page 8), Section 8.3 (Page 77), Risk-Based Recommendations and throughout the report (including Section 3.3.1 Page 20).
54.	Page 51, 2nd para	It is stated in the document, "The predicted PM10 concentration did not account for the eventual asphalt or chip-seal surfacing and the AQIA indicated that the PM10 concentration will decrease by approximately 50% once the surfacing is in place." However, addition of asphalt may result in potential PAHs to the environment and eventually could lead to human exposure.	A discussion potential asphalt exposure to human which may include PAHS among other contaminants should be considered and discussed.	A	The HHRA relied on the findings of the AQIA, which relied on B(a)P being a surrogate to PAHs. Generally, by assessing B(a)P and given the conservatism in the modeling and HHRA, it is unlikely that exposures to other PAHs would impact the findings of the HHRA as monitoring of B(a)P is recommended in Section 8. Additional details from the AQIA on the modeling of asphalt and flexible pavements has been added to Section 6.1 (Page 68 2nd bullet point).

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55.	Page 51, 3rd para	States that it is an over estimation of risk during construction phase, since the chromium speciated concentration for hexavalent is considered 1/7th. However, in the same page (page 51, 1st para), it is stated that it is recommended to collect soil sample for baseline speciation of chromium and there could be a potential from the crushed gravels to release any contaminant including chromium.	Clarification in the course of action is required, for sample collection to characterize chromium speciation and recalculation of risk using characterized chromium data.	A	The HHRA recommends the sampling of soil and gravel with speciation of chromium included to reduce the uncertainty associated with the assumed chromium (VI) composition of soil used in the HHRA. Gravel analysis (including metals and PAHs) will be conducted with the results provided to MECP and, if required, the findings will be used to update the HHRA as per Section 8.3 (Page 77), Risk-Based Recommendations and Executive Summary (Page 8).
Uncertainty Analysis Pages 52 - 54					
56.	Section 7. Page 52	In uncertainty analysis, it is stated that conservative approach was adopted due to potential over estimation of risk from air. However, the assessment included only the inhalation exposure in the exposure pathways, whereas redistribution of suspended particles to soil or water bodies and the associated exposure pathways should also be considered.	Additional, quantitative considerations on other pathways or routes of exposure need to be addressed.	B	The HHRA relied on the results of the indicator VCs which did not predict significant changes in contaminant concentrations, with changes limited to those predicted in air concentrations. The HHRA has included recommendations for real-time air quality monitoring stations at key locations, specifically near points of impingement/ areas of interest where exceedances of the air quality guidelines were predicted by the AQIA, Section 8.3 (Page 77) of the HHRA and Executive Summary (Page 9).
57.	Page 53 to 54 Table 7.1	Table summarizes different parts of the HHRA. However, based on this review this table will need to be revisited.	Table 7.1 should be reconsidered once the comments on the problem formulation step are addressed.	A	Acknowledged. No significant changes were identified for the Problem Formulation. Revisions based on the revised HHRA have been incorporated into Section 7, Table 7-1 (Page 71).
Conclusion and Risk based Recommendations Pages 55 - 57					
58.	Pages 55 - 57	Similar to the above comments Conclusion and Recommendations should follow updated modifications to the HHRA.	As above # 55.	B	Acknowledged. Please refer to revised HHRA report Section 8 (Page 75 through 77).

AtkinsRéalis

AtkinsRéalis Canada Inc.

1300 – 733 Seymour Street
Vancouver, BC V6B 0S6
Canada
604.662.3555

atkinsrealis.com