B.C. Works' Sulphur Dioxide Environmental Effects Monitoring

Detailed Terms of Reference for the 2026 Comprehensive Review

November 2025

Prepared for:

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The Terms of Reference (TOR) consists of three items:

1. **Overview of the Comprehensive Review in 2026 (as per EEM Phase III Plan, 2019-2025)**
2. **Draft outline for the Comprehensive Review Report**
3. **Draft schedule for Comprehensive Review tasks**

TOR Item 1: Overview of the Comprehensive Review in 2026 (as per EEM Phase III Plan, 2019-2025)

The excerpts below show Section 10.5 from the EEM Phase III Plan for 2019-2025, which describe the intent and scope of the Comprehensive Review in 2026.

10.5 Comprehensive Review in 2026

A compressive review of the monitoring conducted during the Phase III SO_2 EEM program will be undertaken in 2026. A draft report synthesizing the results of this review will be prepared by December 31, 2026, which will:

- Build on the knowledge gained in the 2019 SO_2 EEM Comprehensive Review,
- Summarize what has been learned, and what question have been answered,
- Describe which if any of the KPI thresholds have been exceeded, and if so, what actions were taken,
- Describe any modifications to KPIs, methods or thresholds that have been made based on annual results to date, and why,
- Summarize the effects of climate change based on an assessment of the climate change indicators,
- Look across the data for of the three lines of evidence to develop a holistic understanding of B.C. Works aluminium smelter's SO_2 effects on the environment and human health, and
- Recommend changes if/as needed to: the suite of KPIs to be continued post-2025, their measurement methods, and/or their thresholds – along with the rationale for these recommended changes.

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Terms of reference for the 2026 Comprehensive Review (including an approved dispersion model protocol) will be prepared by December 31st, 2025. The terms of reference will be developed according to Table 24. The schedule will target completion of the terms of reference by October 31st, 2025 but will allow 2 months of contingency time. The finalized terms of reference will be the scope of work for the 2026 Comprehensive Review.

Table 24. 2026 Comprehensive Review Terms of Reference development.

Deliverable	Due Date
Terms of Reference	
Scoping Workshop (one to two days)[1]	January - February 2025
Tracking table[2]	Two weeks following the scoping workshop
B.C. ENV Scoping comments stemming from Scoping workshop via tracking table[3]	30 days following the receipt of the tracking table from Rio Tinto
Rio Tinto response to B.C. ENV Scoping Comments via tracking table[4]	45 days following the receipt of scoping comments from B.C. ENV
Draft terms of reference[5]	June 15th, 2025
B.C. ENV review of draft terms of reference via tracking table	July 30th, 2025
Rio Tinto response to B.C. ENV comments on draft terms of reference via tracking table	September 30th, 2025
Final terms of reference[6]	December 31st, 2025
Dispersion Model Protocol	
Draft Dispersion Model Protocol[7]	May 30th, 2025
B.C. ENV review (and comments) of draft dispersion model protocol	June 30th, 2025
Rio Tinto Response to B.C. ENV comments on draft dispersion model protocol via tracking table	July 31st, 2025
Final Dispersion Model Protocol	July 31st, 2025
B.C. ENV approval of dispersion model protocol	August 31st, 2025

[1] Rio Tinto will host a scoping workshop with QPs (who are available to attend) and B.C. ENV. The scoping workshop will be held over 1 to 2 days and may be either an in-person or virtual (remote) attended workshop.

[2] Rio Tinto will prepare a tracking table based on the scope of the 2026 Comprehensive Review developed in the workshop. The tracking table will be provided in a spreadsheet format that is editable.

[3] B.C. ENV will be invited to provide follow-up comments to the scope agreed to at the scoping workshop. Comments will be entered in the tracking table provided by Rio Tinto.

[4] Rio Tinto with the input from the QPs will provide responses to the received comments from B.C. ENV. The responses will be used to prepare the draft terms of reference.

[5] The draft terms of reference will contain at a minimum: table of contents, section and sub-section headings, and summary bullets of the scope for each section and sub-section.

[6] Rio Tinto will submit the finalized draft terms of reference to B.C. ENV for review and approval. Two months of contingency time (Nov and Dec) is provided to allow for further iterations of the terms of reference (if required).

[7] Dispersion modelling is a long lead process that is relied on for the analysis the lines of evidence in the Comprehensive Review. The dispersion model protocol will be developed from B.C. ENV's template for dispersion model protocols. Approval of the dispersion model protocol will be required before September 1st in order for the development of the dispersion model to begin in 2025 and completion of the model runs to be done in the first quarter of 2026.

TOR Item 2: Outline for the Comprehensive Review Report

Executive Summary and KPI Report Cards

Table of Contents

List of Figures

- To be populated during development of Comprehensive Review document

List of Tables

- To be populated during development of Comprehensive Review document

Glossary

- To be developed during development of Comprehensive Review document

Abbreviations

- To be further populated during development of Comprehensive Review document (below is starting point based on previous reporting)

ANC	Acid neutralizing capacity
BACI	Before-after-control-impact
BCS	Base cation surplus
CAAQS	Canadian Ambient Air Quality Standards
CBANC	Charge balance ANC
CCME	Canadian Council of the Ministers of the Environment
CL	Critical load
CR	SO_2 EEM 2019 Comprehensive Review
DFO	Canadian Department of Fisheries and Oceans
DOC	Dissolved organic carbon
ECCC	Environment and Climate Change Canada
ENV	BC Ministry of Environment and Parks

EU	European Union
KAEEA	Kitimat Airshed Emissions Effects Assessment
KMP	Kitimat Modernization Project
KPI	Key performance indicator
MDD	Minimum detectable difference
NADP	National Atmospheric Deposition Program
PCA	Principle components analysis
PCMP	Plant and Cyanolichen Monitoring Program
QA/QC	Quality assurance / quality control
QPs	Qualified professionals (for the SO_2 EEM Program)
$RCOO^-_s$	Strongly acidic organic anions
SO_2 EEM	Rio Tinto BC Works' SO_2 Environmental Effects Monitoring Program
SSMB	Steady State Mass Balance (model)
STAR	SO_2 Technical Assessment Report
TOR	Terms of reference for the SO_2 EEM Comprehensive Review
VMP	Vegetation Monitoring Program
WHO	World Health Organization

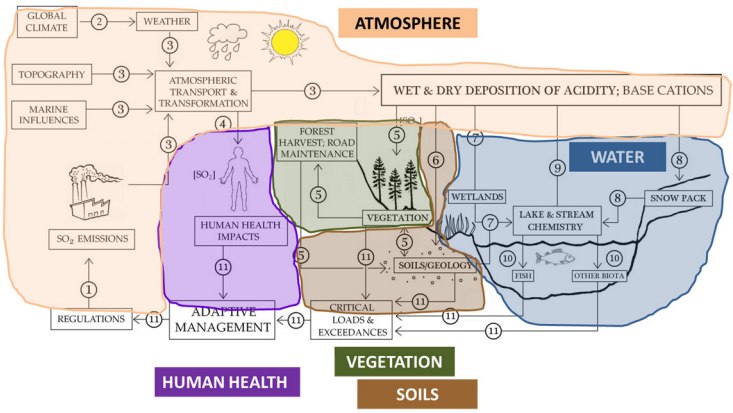
List of Measurement Units

- To be populated during development of Comprehensive Review document

1 Introduction

1.1 Background

- Short overview of the history of the EEM program, referencing figures below



Objectives of the report (expanded from Phase III Plan):

- Provide an overview of the evolution of the EEM program for each receptor
- Build on the knowledge gained in the 2019 SO2 EEM Comprehensive Review,
- Summarize what has been learned, and what questions have been answered,
- Describe which if any of the KPI thresholds have been exceeded, and if so, what actions were taken,
- Describe any modifications to KPIs, methods or thresholds that have been made based on annual results to date, and why,
- Summarize the effects of climate change based on an assessment of the climate change indicators,
- Look across the data for of the four lines of evidence to develop a holistic understanding of B.C. Works aluminium smelter's SO2 effects on the environment and human health, and
- Recommend changes if/as needed to: the suite of KPIs to be continued post-2025, their measurement methods, and/or their thresholds – along with the rationale for these recommended changes.
- Recommend a date for the next comprehensive review.

Out of scope of the 2026 Comprehensive Review are:

- Cumulative effects assessment of combined Rio Tinto and LNG Project emissions,
- Development of a cumulative effects approach
- Assessment of data and monitoring scopes that were not part of the Phase III plan

1.2 Facility Production and Emissions from 2019 to 2025

- Describe the permitted emissions of SO_2
- Present production and emissions data from 2019-2025.
- Discuss SO_2 emission rate variability and what information is available.

1.3 Organization of this Report

- Structure and organization of report

2 Evaluation of KPIs against Thresholds, Informative Indicators, & Synthesis of Results

- Summarize results and learning across pathways and receptors:
  - Results and recommendations (example template shown in Table 1 below)

- What has been learned and what questions have been answered (example template shown in Table 2 below)

Table 1. Summary of results pertaining to KPIs or informative indicators.

	Atmospheric Pathways	Human Health	Terrestrial Ecosystems (Vegetation)	Terrestrial Ecosystems (Soils)	Aquatic Ecosystems
Were any KPI thresholds reached? If so, what was the response? Were any KPIs modified? Are any modifications recommended to either KPIs or informative indicators that support KPIs? Were there any modifications to methods used for KPIs and informative indicators? Are any modifications recommended to methods of monitoring or modelling KPIs or informative indicators?					

Table 2. Summary of what questions have been answered thus far under the EEM Program, and whether any questions remain to be answered or new material questions have emerged. Details of the answers to various questions are provided within each of the indicated sections of this report.

	Atmospheric Pathways (section 3)	Human Health (section 4)	Terrestrial Ecosystems (Vegetation; section 5)	Terrestrial Ecosystems (Soils; section 6)	Aquatic Ecosystems (section 7)
EEM Questions that have been answered Questions still to be answered New questions that emerged					

- This will be a summary table showing which questions from Table 19 of the EEM Plan have been answered, and which are still in process. The questions will be stated here, but not the hypotheses. Other questions will be added that have emerged since the 2013 EEM (e.g., in the Plant & Cyanolichen Biodiversity Monitoring Program (PCMP), in the Phase III EEM Plan and in various EEM reports since 2019)
- A table of questions and hypotheses will be in an Appendix to this report. The wording of those from the original STAR/EEM Program questions/hypotheses may appear slightly modified in this report, as needed based on how things evolved during the EEM Program development,

and subsequently during the first 12 years. If the wording of the questions and hypothesis in this report is not an exact match to those in the STAR we will explain why.

3 Review Results for Atmospheric Pathways

3.1 Atmospheric Concentrations

- Why this is an important component of the EEM (refer back to source-pathway-receptor conceptual model in section 1.1)
- Short description of how the atmospheric concentration component has evolved over the three phases of the EEM program

3.1.1 What did we set out to learn?

- Explain what we set out to learn and explain why there are no KPI thresholds for atmospheric pathways.
- Briefly explain the questions and hypotheses from the Phase III EEM (and any STAR questions that still apply).
    - A1. Does CALPUFF accurately represent recent SO_2 air concentrations?
    - D1. Does the CALPUFF model accurately predict recent total sulphur deposition?

3.1.1.1 EEM Informative Indicators

- Informative Indicator: Atmospheric SO_2 concentrations
- Informative Indicator: Atmospheric S deposition
- Contribution of dry deposition to total deposition

3.1.2 What methods did we use?

- Describe all of the inputs and methods used in the analyses for this review.
- Provide an overview and put details in an appendix.

3.1.2.1 Data we collected: modeling

- Describe the collection of data inputs for CALPUFF.

3.1.2.2 Planned analyses: modeling

- For the following reasons, it isn't necessary to redo the atmospheric modelling completed for the 2019 Comprehensive Review:
    - Two of the three emission scenarios covered in the 2019 Comprehensive Review (35 tpd and 42 tpd) far exceed the actual smelter emissions that occurred between 2020 and 2024 (24, 17, 7.4, 25 and 30 tpd, respectively).
    - Therefore, the ecological effects modelled in the 2019 Comprehensive Review (which showed no exceedance of model-based KPIs under any emission scenario) exceed any effects which would have occurred between 2020 and 2024.
    - Redoing atmospheric modelling will have no effect on evaluations of the Health KPI, which depends on measured rather than modelled [SO_2]. The empirical KPIs for terrestrial and aquatic ecosystems also do not depend on atmospheric modelling.
    - Annual precipitation and wet deposition during the last three years with complete records (2022-2024) have been within the range observed from 2016-2018, the meteorological years used in the 2019 Comprehensive Review.

  - Levels of [SO2] and S deposition at the edges of the model domain used in the 2019 Comprehensive Review were far below critical loads for both terrestrial and aquatic ecosystems, so it isn't necessary to expand the CALPUFF modelling domain
- Use the 2019 CALPUFF model developed for the 2019 Comprehensive Review using corrected CALMET wind data. Summarize comparisons of 2019 CALPUFF model predictions with monitored SO_2 data for 2020-2024. Refine CALPUFF methods if there is insufficient alignment between modeled and monitored SO_2 concentrations (method described in EEM Program Plan, page 7). This subtask includes evaluating hourly SO_2 concentrations at the Haul Road, Riverlodge, Whitesail, Service Centre and Kitamaat Village continuous monitoring station locations, for the same years. [This subtask must be done early in the Review process as the results are required inputs for some of the receptor analyses.]
- Compare monitoring with modelling (quantitative and qualitative):
  a) Compare continuous analyzer monitoring results to CALPUFF model output from the 2019 CALPUFF.
  b) Compare the spatial gradient of SO_2 concentrations from the passive monitoring program to output from the 2019 CALPUFF model for this same period, making appropriate adjustments to CALMET and/or CALPUFF parameters.
  c) Compare wet deposition monitoring results to CALPUFF model output from 2019 CALPUFF, making appropriate adjustments to CALMET and/or CALPUFF parameters.

3.1.2.3 Data we collected: monitoring

- Describe the continuous monitoring network; site locations and nature of continuous analyzer.
- Describe deposition monitoring network (may take until summer of 2026 to get all of the NADP data; could add later as CR is finalized)
- Describe the SO_2 passive sampling network; site locations and sampling frequency.

3.1.2.4 Planned analyses: monitoring

- Report on the optimization of the air quality monitoring network and summarize optimization effort and associated conclusions to-date (network optimization to be concluded by start of 2026 CR). Include discussion of compliance with siting criteria and QA/QC issues
- Examine trends in SO2 at continuous monitoring sites
- Evaluate sulphur dioxide (SO_2) passive sampler results for 2019-2025.
  a) Calibrate passive samplers against active (continuous) stations (compare average monthly SO_2 concentrations estimated from passive monitors with observations from 4 continuous monitors during the period from 2019 to 2025; The calibration / evaluation will be carried out station-by-station.
  b) Evaluate temporal variation in SO_2 passive samplers in the Kitimat Valley and agreement with SO_2 emission levels (2019 to 2025).
  c) Evaluate spatial variation in SO_2 passive samplers in the Kitimat Valley (spatio-temporal plots).
  d) Develop framework for synthesizing SO_2 results from 2019-2025.

3.1.3 What did we learn, and did we make any adjustments to the EEM Program?

- Provide an overview of the results, referencing past Tech Memos, and put details in an appendix.

- Summarize what has been learned overall from these results thus far under the second 6 years of the EEM Program.
- Describe adjustments that have been made to modelling and monitoring methods based on what was learned.
- Explain whether question A1 from the EEM Plan has been answered, and whether new material questions have emerged.
- Are the spatial SO_2 dispersion patterns predicted in STAR within residential areas and the Service Centre of Kitimat in agreement with recent measurements (from continuous analyzers and possibly passive samplers)?
- Are changes needed to the SO_2 monitoring network (answered through network optimization efforts, status reported in Section 3.12.4)?
- Identify incomplete actions from sections 2.2.1, 2.2.2, 2.2.3 and 2.3.3 of the EEM Plan, as well as the atmospheric pathways portions of the Phase III Plan.
- Explain what changes if any have been already made to this informative indicator.

3.1.4 What do we recommend for the EEM Program going forward?

- Recommended changes to monitoring methods, frequency or extent
  - Evaluate whether passive sampling program provides value in next phase after 2025.
- Recommended changes to modelling methods
- Recommended changes to the informative indicators

3.2 Atmospheric Deposition

- Why this is an important component of the EEM (refer back to source-pathway-receptor conceptual model in section 1.1)
- Short description of how atmospheric deposition component has evolved over the three phases of the EEM program

3.2.1 What did we set out to learn?

- Briefly explain the questions and hypotheses from the STAR and questions posed in the Phase III Plan.

3.2.2 What methods did we use?

- Describe all of the inputs and methods used in the analyses for this review.
- Provide an overview and put details in an appendix.

3.2.2.1 Data we collected: Wet deposition

- Describe the collection of rainfall chemistry by the NADP stations.

3.2.2.2 Planed Analyses: Wet deposition

- Evaluate wet deposition results for Haul Road (2012–2025) and Lakelse Lake (2013–2025).
  a) Examine ion balance (quality control) of precipitation chemistry; other QA/QC procedures will be applied to evaluate the quality of the data (in general the methods will follow accepted approaches used under the Convention on Long-Range Transboundary Air Pollution).
  b) Evaluate rainfall amount (compared with ECCC meteorological stations).
  c) Evaluate seasonality in precipitation chemistry and deposition.
  d) Evaluate temporal change in precipitation chemistry and deposition.

e) Produce temporal charts of sulphate deposition (month by week plots) for Haul Road and Lakelse Lake.
f) Assess base cation precipitation chemistry (inputs to revision of regional critical loads).
g) Examine trends in wet deposition at Haul Road and Lakelse Lake

3.2.2.3 Data we collected: Dry deposition

- Describe the collection of data for modelling of dry deposition.

3.2.2.4 Planed Analyses: Dry deposition

- Evaluate the Big Leaf dry deposition model
  a) Describe data requirements for the Big Leaf model.
  b) Describe data sources (2019-2025) for application of the model.
  c) Explore simplified methods to predict dry deposition compared to running the Big Leaf model.

3.2.2.5 Planned Analyses: Total deposition

a) Evaluate total S deposition at Haul Road and Lakelse Lake.

3.2.3 What did we learn, and did we make any adjustments to the EEM Program?

- Provide an overview of the results, referencing past EEM reports and Technical Memos, and put details in an appendix.
- Summarize what has been learned overall from these results under the Phase III of the EEM Program.
- Identify incomplete actions from sections 2.2.1, 2.2.2 and 2.2.3 of the EEM as well as the atmospheric pathways portions of the Phase III Plan.
- Explain whether questions D1 and D2 from the EEM Plan (as well as other questions raised in the Phase III Plan) have been answered, and whether new questions have emerged.
- Explain what changes if any have been already made to the informative indicators.

3.2.3.1 Knowledge gained

- Reliability of passive samplers
- Spatial and temporal variation of SO_2
- Spatial and temporal variation of total sulphur deposition
- Contribution of dry to total deposition, and variability with precipitation
- Evaluation of modelled and observed atmospheric sulphur data

3.2.4 What do we recommend for the EEM Program going forward?

- Recommended changes to monitoring methods, frequency or extent
  - Whether to continue wet deposition monitoring at Haul Road and Lakelse lake
- Recommended changes to modelling methods
- Recommended changes to the informative indicators

4 Review Results for Human Health

- Why this is an important component of the EEM (refer back to source-pathway-receptor conceptual model in section 1.1)

- Short description of how the human health component has evolved over the three phases of the EEM program

4.1 What Did We Set Out to Learn?

- Explain that we set out to learn if any KPI thresholds were reached or exceeded.
- Briefly explain the questions and hypotheses from the Phase III EEM (and any STAR questions that still apply).
    - HH1. How conservative is the CALPUFF model in predictions of SO_2 levels?
    - Note that question HH1 is very similar to question D1. Explain that analyses show that Riverlodge is representative of the highest concentrations, so that if Riverlodge passes CAAQS criteria, other areas will also.

4.2 What Methods Did We Use?

- Describe all the inputs and methods used in the analyses for this review.
- Provide an overview and put details in an appendix.

4.2.1 Planned analyses:

- Evaluate KPI results for 2019-2025. Describe evolution of this KPI over time (past and future, BC IAAQO and CCME values).
    - Convey that the threshold will become 65 ppb in 2025, and so 3-year average of KPI over 2023-2025 will be compared to 65 ppb for each site.
    - Conduct assessment of acceptable or unacceptable impacts to the receptor (was the threshold for facility-based mitigation exceeded?).
    - Discuss network optimization results which showed that monitoring sites adequately represent spatial distribution of [SO_2]

4.3 What Did We Learn, and Did We Make Any Adjustments to the EEM Program?

- Provide an overview of the results, referencing past EEM reports and Technical Memos, and put details in an appendix.
- Summarize what has been learned overall from these results for human health thus far under the second 6 years of the EEM Program.
- Explain whether questions D1 and HH1 (as well as any other questions from the Phase III Plan) have been answered, and whether new questions have emerged.
- Explain whether a KPI threshold been reached, and if so, what actions were taken, or need to be taken.
- Explain what changes if any have been already made to the health KPI (the KPI itself, methods, or thresholds).
    - Include description of exceptional events analysis

4.4 What Do We Recommend for the EEM Program Going Forward?

- Recommended changes to monitoring methods, frequency or extent
- Recommended responses to exceedances of thresholds

5 Review Results for the Vegetation Component of Terrestrial Ecosystems

Need to explain how vegetation and soils are now combined into terrestrial ecosystems, and how reporting is provided for each of these two components.

- Why this is an important component of the EEM (refer back to source-pathway-receptor conceptual model in section 1.1)
- Short description of how the vegetation component has evolved over the three phases of the EEM program
- Explain focus of PCMP on differential trends in plants, and how this relates to biodiversity.
- Explain relationship between soils and vegetation components of EEM.

5.1 What Did We Set Out to Learn?

- Explain that we set out to learn if any vegetation Informative Indicator thresholds for increased monitoring or mitigation were met, referring to Table 8 of the SO2 EEM Phase III plan.
- Explain that we set out to learn the answers to the vegetation questions in the Plant and Cyanolichen Monitoring Program (PCMP), as well as to continue to examine the potential direct effects of sulphur on vegetation through the existing Vegetation Monitoring Program (VMP) during the transitional period (2019-2020) prior to implementation of the PCMP in 2021.
- Explain the relationship of the VMP and the PCMP during the period since 2019, including sampling and analysis of western hemlock foliage that occurred in 2019 and 2020 during the transition to the PCMP.
- Explain focus of PCMP on trends in specific plants, and the extent to which the PCMP does / doesn't consider biodiversity [potentially better fit in 5.3.2]
- Explain relationship between soils and vegetation components of EEM
- Briefly explain the questions related to the PCMP, and those still relevant related to the VMP

- Focal question: Is the species richness and relative abundance of cyanolichens and/or the community structure (including species richness and cover in the low shrub and herb layers) and health of vascular plants changing in a manner that is different from reference areas due to SO_2 emissions and subsequent S deposition from Rio Tinto's B.C. Works?
- Component question 1: Are differential changes (different trends) in select layers of vascular plant community structures and health, and cyanolichen species presence and relative abundance (compared to initial measurements and reference areas) occurring over time related to SO2 emissions and S deposition from the Rio Tinto B.C. Works at sites with modelled medium and high S deposition levels?
- Component question 2: Are there differential changes (different trends) in the occurrence or abundance of species, including those thought to be acid-sensitive, acid-tolerant, or culturally important plants and cyanolichens (compared to initial measurements and reference areas) occurring over time related to SO2 emissions and S deposition from the Rio Tinto B.C. Works at sites with modelled medium and high S deposition levels?
- V2. How healthy is vegetation in sites with predicted exceedance of critical loads of soil and/or lakes and streams south of Lakelse Lake? What are the major stressors of vegetation health (e.g. pests, pathogens, drought, deposition)?
- V3. Are plants (particularly those of cultural importance) showing symptoms in areas with highest exceedances of soil critical loads?

- Refer to Table 10 and related subsections of the EEM Program Plan, which outline how each of vegetation health (including potential SO2 injury), plant and cyanolichen diversity informative indicators are measured and evaluated.
- Discuss evidentiary framework from Figure 3 in the document, *A Plan to Monitor Components of Cyanolichen and Vascular Plant Communities in the Vicinity of Rio Tinto B.C. Works as a Component of the SO_2 Environmental Effects Monitoring Program* (Laurence *et al*. 2020) – evaluate whether it is still useful to establish causality, or does it need to be modified?
- Describe other questions that have emerged since the development of the PCMP.

5.1.1 EEM Key Performance Indicator

- Explain why there is no KPI, with reference to the PCMP, Phase III EEM plan, and external scientific resources.

5.1.2 EEM Informative Indicators

- Indicators from SO2 EEM Phase III plan:
  - Vegetation Health (including potential SO2 injury);
  - Plant Biodiversity;
  - Cyanolichen Biodiversity.

5.2 What Methods Did We Use?

- Outline the methods for both field data collection and analyses for both VMP (during the transition to the PCMP in 2019 and 2020), and the PCMP (implemented in 2021) including timing and spatial location.
- Explain the transition from the VMP to the PCMP.
- Use appendices for detailed information, potentially including PCMP Plan, and PCMP & VMP reporting.

5.2.1 Data we collected: VMP (2019-2020)

- Provide all the methods used for vegetation health and S-levels in western hemlock needles, noting timing and locations.
- Reference VMP reports (or include in appendix).

5.2.2 Data we collected: PCMP (2021-2025)

- Provide all the methods used for the PCMP, including aspects related to vegetation health, plant biodiversity and cyanolichen biodiversity, noting timing and locations.
- Reference PCMP Plan, and PCMP annual and end-of-cycle reports (or include in appendix).

5.2.3 Analyses we conducted with these data

- Hemlock sampling: S levels analysed (VMP 2019 & 2021). Present results in appendix and refer to annual reports.
- Vegetation inspections (VMP 2019 & 2021): Provide an overview of results and refer to annual reports.
- Evaluate visual vegetation inspection results from PCMP, in context with those from VMP (2019 and 2020), for the 2019-2025 period.
    - Analyze the extent of any insect infestations or disease epidemics to observation results.
    - Integrate the results of vegetation monitoring—inspection and sampling—with results of soils monitoring to assure coverage of sensitive soils or critical load exceedances.
- Evaluated effectiveness of the PCMP methods for the first end-of-cycle reporting period: reference Year 3 report (2024).
- All analyses undertaken as described in PCMP for each year (annual reports), including the two years in which trend lines are to be presented (Years 4 and 5), for those sites which will have had two measurements (note that the second end-of-cycle report will be available in early 2027).
- Evaluate the 2025 CALPUFF results (for actual emissions and additional scenarios) IF AVAILABLE to assess the extent of potential S deposition that might affect PCMP and sensitive vegetative receptors, including vegetation health, plant and cyanolichen biodiversity.
    - Conduct a spatial analysis to relate results to updated CALPUFF modeling (actual and scenarios); include a map overlaying CALPUFF model results for Vegetation.
    - Also check that predicted [SO2] hasn't changed significantly since the 2019 CR, and remains low relative to thresholds.

5.3 What Did We Learn, and Did We Make Any Adjustments to the EEM Program?

5.3.1 Knowledge gained

- A synthesis of results of vegetation inspections (including any biotic stressors) since 2019.
- A preliminary understanding of the baseline and variability in the plant and cyanolichen biodiversity data set, including an anticipated two years (22 sites) with a second cycle of measurement completed.
- An analysis and review of the PCMP methods and how they can be refined to better meet objectives.
- A review of deposition category appropriateness, based on any changes to modelled deposition and review of Program objectives and learnings.

5.3.2 Modifications to the EEM Program

- Explain whether the focus of PCMP has shifted from original design (re: biodiversity) [only briefly if already addressed in 5.1]
- Assess safety risks of the monitoring program
- Identify potential changes to the Informative Indicator depending on the results of the analyses.
- Confirm categories of PCMP monitoring sites given modelled smelter emissions

5.3.3 Comprehensive synthesis ('pulling the pieces together')

- Relate vegetation results to soils, aquatics, and deposition.
    - Show S results from VMP chemical analyses during the transition to the PCMP. Discuss observations of any vegetation injury observed during the 2019-2025 period in spatial relation to sensitive soils and SO_2 isopleths.
    - Note that it is too early in the PCMP to determine potential changes in plant and cyanolichen biodiversity or relate such to soils, aquatic or deposition components.
- Review and relate deposition modeling with vegetation deposition zone categories: Review the biological reasoning behind the low, medium and high deposition categories, and relate to the modeling scenarios; provide reasoning for model selection.
- Briefly explore correlations between soil characteristics (determined from initial soil sampling/analysis) and plant species distributions, with caveat that soils are collected from limited locations in plots whose structural complexity (e.g. microtopography) may strongly influence plant species distribution.

5.3.4 Conclusions

- Discuss whether the current Informative Indicator is sensitive and useful for assessment of the risk to health of vegetation and ecosystems from smelter emissions. If not, discuss whether changes are necessary, or if there are more appropriate indicators.
- Discuss what changes have occurred since the last CR with regard to risk to vegetation and ecosystem health.
- Discuss how the PCMP integrates with and supports other components of the EEM.
- Address questions posed in PCMP and Phase III Plan
- Describe any new questions which have emerged

5.4 What Do We Recommend for the EEM Program Going Forward?

- Recommendations regarding the potential for a Key Performance Indicator (why it isn't yet possible [need at least two rotations of sampling scheme (6 years) to detect plant responses], or what KPI threshold might be [e.g., multiple lines of evidence pointing to an ecologically significant smelter effect on vegetation via soil acidification)
- Recommend whether the PCMP should continue as is, or whether any changes are required.
- Assess site locations with respect to modelled deposition.
- Recommendations regarding Informative Indicators.
- Discuss any potential analyses of interest that may arise from emerging or new questions with respect to terrestrial vegetation.
- Discuss some of the practical limitations in ability to track plant biodiversity, challenges in detecting effects of climate change

6 Review Results for the Soils Component of Terrestrial Ecosystems

- Why this is an important component of the EEM (refer back to source-pathway-receptor conceptual model in section 1.1)
- Short description of how the soils component has evolved over the three phases of the EEM program

6.1 What Did We Set Out to Learn?

- Explain what we set out to learn if any KPI thresholds were reached.
- Briefly explain the questions and hypotheses from the STAR and Phase III Plan
- Planned to evaluate Al solubility in upland mineral soils varying in organic matter content
- Planned to evaluate wetland sensitivity to acidic deposition

6.1.1 EEM Key Performance Indicators

- KPI: Atmospheric S deposition and critical load (CL) exceedance risk
- KPI: Long-term soil acidification (rate of change of base cation pool) attributable to S deposition
- Review rationale for thresholds and effects domain used in KPI, referencing literature.

6.1.2 EEM Informative Indicators

- Informative Indicator: Soil base cation weathering rates
- Informative Indicator: Magnitude of exchangeable cation pools (Ca, Mg, K, Na)
- Informative Indicator: Time to depletion of exchangeable cation pools (Ca, Mg, K, Na)

6.2 What Methods Did We Use?

- Describe all of the inputs and methods used in the analyses for this review.
- Provide an overview and put details in an appendix.

6.2.1 Data we collected

- Wetland and soil samples (sampling and analysis) across the study area
- Sampling and analysis of long-term soil plots (2023)
    - Explain the protocol/rationale for not sampling the Kemano plot (and secondary plots).
    - Explore the idea of sampling plots more frequently at first and less frequently later and convey the conclusion/recommendation.

6.2.2 Analyses we conducted: critical loads

- Re-calculate critical loads across the study domain using the SSMB model:
    a) Re-calculate CL for S using SSMB (S and N for holistic section)
    b) Estimate exceedance of the study area using CALPUFF results from Atmospheric Pathways
    c) Uncertainty analysis: determination of critical load and exceedance under revised base cation deposition, Al solubility, and wetland geochemistry.
    d) Exceedance will be evaluated for the entire study area and effects domain (the area under the 7.5 kg $SO_4^{2-}ha^{-1}yr^{-1}$ deposition plume from 42 tonnes per day using predictions from the 2019 CALPUFF model, from the 2019 Comprehensive Review).

6.2.3 Analyses we conducted: long-term soil plots

- Evaluate results of the long-term plots during from 2015, and 2018 and 2023.
    a) Evaluate soil chemistry, soil moisture, tree biomass at long-term plots, and the schedule of future sampling (e.g., assessment of resample period).
    b) Evaluate statistical power for detecting change in exchangeable base cation pools (using minimum detectable difference or power analysis).

6.2.4 Assessment of acceptable or unacceptable impacts to terrestrial receptor

- The assessment of the impacts to the terrestrial ecosystems as "acceptable" or "unacceptable" is directly linked to the KPI (exceedance of critical loads and change in exchangeable base cation pools). The weight of evidence approach for assessing whether the critical load exceedance is casually related to the BC Works smelter will be summarised.
    - If the KPI thresholds associated with facility-based mitigation in the EEM is exceeded, this will be identified as an "unacceptable" impact to the terrestrial receptor.
    - Impacts to terrestrial ecosystems that do not exceed the KPI threshold associated with facility-mitigation in the EEM will be identified as "acceptable"
    - NOTE: all impacts, regardless of classification will be explored, analyzed, interpreted and documented in detail.
- If needed, apply the weight-of-evidence approach for assessing causality (described in Section 7 of the EEM Program Plan).
- Summary of in-situ mitigation pilot project scope, should in-situ mitigation be triggered.

6.3 What Did We Learn, and Did We Make Any Adjustments to the EEM Program?

- Provide regional specific estimates of Al solubility and wetland geochemistry.
- Determine the level of exceedance based on updated critical loads.
- Document whether soil base cation pools have changed between 2015 and 2023
- Discuss what has been learned overall regarding the smelter's effects on soils thus far under the first second 6 years of the EEM Program.
- Address questions posed in Phase III Plan
- Explain whether a KPI threshold been reached, and if so, what actions were taken, or need to be taken.
- Explain what changes if any have been already made to the soils KPIs (the KPI itself, methods, or thresholds) or the informative indicators.

6.3.1 Knowledge gained

- Critical loads and exceedances for terrestrial ecosystems
- Ability to detect changes in soil chemistry (power analysis)
- Geochemistry of wetland soils and sensitivity to deposition
- Soil solubility of aluminum and implications for CL assessment
- Identification of major knowledge gaps that add uncertainty to results

6.3.2 Modifications to the EEM program

- Assess safety risks of the monitoring program

6.3.3 Comprehensive synthesis ('pulling all the pieces together')

- Exceedances of critical loads
- Summary of observed changes in soil chemistry
- Link soils and vegetation
- Possible inclusion of N in future critical load assessments (cumulative effects)

6.3.4 Conclusions

- Has the smelter contributed to the Acidification of terrestrial ecosystems?
- Assessment of acceptable or unacceptable impacts on Terrestrial receptor

6.4 What Do We Recommend for the EEM Program Going Forward?

- Recommended changes to monitoring methods, frequency or extent
- Recommended changes to the KPIs or informative indicators
- Recommended changes to thresholds
- Recommended responses to exceedances of thresholds
- Draft scope for receptor-based mitigation (referencing past literature);
    - Report on need for receptor-based mitigation (or lack thereof)
        - Expect to find no evidence of need for receptor-based mitigation given small % of area with CL exceedance; well below 5% of effects domain; CL analysis provides ability to see trends early
    - Describe in an Appendix how we would do receptor-based mitigation if it were required

7 Review Results for Aquatic Ecosystems

- Why this is an important component of the EEM (refer back to source-pathway-receptor conceptual model in section 1.1)
- Short description of how the aquatic ecosystem component has evolved over the three phases of the EEM program

7.1 What Did We Set Out to Learn?

- Briefly explain the questions and hypotheses from the STAR, noting that the questions and hypotheses are further refined later in this outline
    - Phase II thoroughly answered some of the questions from the STAR. Remaining questions from the STAR were a continuing focus of activities in Phase III
- Review the rightmost column of Table 10.3-1 in Volume 2 of the STAR.
- Relevant, remaining questions from the STAR & EEM:
    - W2. How many of the 7 to 10 potentially vulnerable lakes actually acidify due to smelter operations, and to what extent?
        - [W2a.] Have any of the sensitive lakes exceeded their KPI thresholds?
        - [W2b.] Does the weight of evidence suggest that any of the lakes have actually acidified and that such acidification is due to the smelter (examining changes in all relevant water chemistry parameters)?
        - [W2c.] What is the water chemistry of less sensitive lakes? Do any of them show any evidence of acidification and/or impact from the smelter?
        - [W2d.] How many lakes have actually acidified due to the smelter and exceeded their KPI thresholds?
- OTHER questions elsewhere within the STAR / Phase II EEM Plan
    - Do we see any evidence of regional acidification when we analyze the lakes as a group?
    - Examine changes in ANC, SO4 and pH relative to steady-state predictions

7.1.1 EEM Key Performance Indicators

- As described in Section 6.2.4 (Key Performance Indicator), including Table 15, in the Phase III Plan

7.1.2 EEM Informative Indicators

- Phase III informative indicators:
    - As described in Table 16 from the Phase III Plan - i.e., Section 6.2.5: Informative Indicators
    - Add reference to Lake Ratings in EEM Plan
- Additional informative indicators applied in CR:
    - Informative Indicator: Atmospheric S deposition (updated in 2026 CR) and CL exceedance risk
    - Informative Indicator: Predicted steady state pH (from 2020 CR) versus recent measurements of lake pH

7.1.3 Other questions that have emerged since the development of the Phase III EEM

- New questions that have emerged:
    - Do changes in emissions result in immediate (i.e., same year) changes to lake chemistry or is there a lag? Address this for both decreases and increases in emissions (noting confounding from year to year changes in precipitation)
    - How sensitive are KPI analyses to alternative assumptions about the baseline?
    - Can novel methods of trend detection provide additional insights beyond the comparisons of last 3 years of data to the pre-KMP baseline? [summarize recent work done by Graham Mushet and Carl Schwarz, plus other environmental effects monitoring programs using trend-based KPIs (e.g., NAPAP)] – include in an Appendix to the CR
    - What would be the effect of reducing fall sampling from four events to three events? How would this change the estimate of the mean annual value for a given analyte, and tests of exceedance of KPI thresholds?
    - Bowbyes Lake – rationale for sampling

7.1.4 Critically reviewing the continued inclusion of existing lakes in the EEM program

- Explain the inclusion and deferral of this exercise in Phase III program
- Outline the critical question(s) to be addressed

7.1.5 Complexity and causality of changes in lake chemistry

- Short, contextual discussion on complexity of lake chemistry dynamics within these lakes (more detailed discussion was in 2020 CR).
    - Various changes occurring simultaneously (e.g., changes in ANC, pH, organic acids, Cl, SO4, precipitation), which add complexity to analyses and interpretations of changes in lake chemistry.
    - Importance of understanding both natural and anthropogenic changes

7.2 What Methods Did We Use?

- Describe all of the inputs and methods used in the analyses for this review.
- Provide an overview and put details in an appendix.

7.2.1 Data we collected

7.2.1.1 Water chemistry data

- High-level overview of data

7.2.1.2 Sampling locations and frequency

- Frequency and types of sampling done at each of the EEM lakes

7.2.2 Quality of water chemistry data

- Brief reference to QA/QC procedures and conclusions

7.2.3 Analyses we conducted with these data

7.2.3.1 Temporal patterns in water chemistry

- **Empirical changes in water chemistry**
  - Description of methods for examining empirical changes in water chemistry (as applied in Annual Reports)
  - Examining changes in base cations over time in each of the EEM lakes
- **Statistical Analyses of Trends and Temporal Patterns, and comparison to EEM thresholds**
  - Statistical methods applied in annual reports.
  - Additional novel methods not previously applied in annual reports (i.e., analyses of non-linear trends in mean values or variance)

7.2.3.2 Assessing changes in water chemistry with respect to STAR and EEM

- Empirical Changes in Water Chemistry Relative to Steady-state Predictions in 2020 CR
  - Examine actual change in ANC and pH vs. predicted ANC and pH change at steady state from the ESSA/DFO model (from 2019 CR),
  - Examine expected lake [SO4] from [(CALPUFF predictions of recent SO4 deposition) / (average estimated runoff)] vs. [observed [SO4]].

7.2.4 Weight-of-Evidence approach for assessing causality

- Evidentiary framework for identifying patterns consistent with smelter-driven acidification
- Summarize how we have applied Bayesian approach and simple EEM evidentiary framework to assess evidence that observed changes in chemistry are causally related to smelter operations
- What are the most likely causes of the observed chemical changes in each of the seven sensitive lakes? (e.g., STAR table 9.4-4)

7.2.5 Episodic acidification studies

- To the extent that's feasible, analyze continuous pH data (LAK006 and LAK028) with respect to episodic acidification.
  - Examine Lakelse wet deposition data, lake level data and chemical analyses of other ions to assess correlates with episodic declines in lake pH

7.2.6 Critical loads, exceedances and predicted changes in pH

- As noted in Recommendations 15 and 16 in 2019 CR, it isn't necessary to update or redo critical loads modelling for aquatic ecosystems [Insert recommendations 15 and 16 from 2019 CR]
- It also isn't necessary to do any further work on predicting future changes in ANC and pH due to RT emissions alone since that analysis was completed in the 2019 CR for (section 3.5 of Aquatic Appendix G). Section 3.5.4 of Aquatic Appendix G also estimated the change in predicted steady state pH (pH_∞) across a wide range of deposition levels (from 50% to 200% of CALPUFF deposition). Of the seven sensitive lakes, five showed a 0.1 unit decline in pH_∞ with a doubling of deposition from 100% to 200% of the CALPUFF estimates, and two lakes showed no change in pH_∞.
- Estimate F-factor in those lakes where there has been sufficient chemical change to do so, and compare to the assumed F-factor. [Quite close for LAK028, see 2016 EEM tech report].

7.2.7 Lake inclusion in EEM Program

- Methods / information to be considered:
  - STAR criteria for defining study area
  - STAR criteria for including lakes in EEM program:
    - Predicted critical load exceedances and future steady state pH under permitted deposition levels
  - Observed changes in CBANC and pH relative to predicted changes
  - Consideration of conclusions from power analyses (# years required to detect changes of interest in ANC and pH)

7.2.8 Other data and analyses

- BRIEFLY mention other pieces and cite past reports for details:
  - Investigations of chemistry of LAK028
  - Lake level monitoring
  - Investigations of factors affecting measured pH in waters of low ionic strength

7.2.9 Assessment of acceptable or unacceptable impacts to aquatic receptor

- The assessment of the impacts to the aquatic receptor as "acceptable" or "unacceptable"[1] is directly linked to the KPI
  - If the KPI threshold associated with facility-based mitigation in the EEM is exceeded, this will be identified as an "unacceptable" impact for the aquatic receptor.
  - Impacts to the aquatic receptor that do not exceed the KPI threshold associated with facility-mitigation in the EEM will be identified as "acceptable".
  - NOTE: all impacts, regardless of classification will be explored, analyzed, interpreted and documented in detail.
- The ability and/or limitations on assessing the trend toward an exceedance will be discussed
- Summary of in-situ mitigation pilot project scope, should in-situ mitigation be triggered.
- KPI thresholds and mitigation structure – consider whether the learning and information from the EEM Program since the development of the KPI threshold and mitigation framework suggest any need for change.

7.3 What did we learn, and did we make any adjustments to the EEM Program?

- Provide an overview of the results, referencing past EEM reports and Tech Memos, and put details in an appendix.
- Discuss what has been learned overall regarding smelter effects on aquatic ecosystems thus far under the second 6 years of the EEM Program.
- Explain whether STAR questions W1, and W2 have been answered, and what new questions have emerged. STAR question W3 (baseline status of fish populations) has been answered. STAR question W4 (changes in fish populations in lakes which have acidified) isn't relevant because no lakes have acidified (as of 2023 EEM report, expected to be similar by 2025).
- Explain whether a KPI threshold been reached, and if so, what actions were taken, or need to be taken.

[1] Section 4.2.6 of the P2-00001 permit, dated March 15, 2016, states "If any unacceptable impacts are determined through the use of the impact threshold criteria pertaining to emission reduction, then the maximum SO2 daily discharge limit shall revert back to 27 Mg/d, unless the Director amends the discharge limit."

7.3.1 Empirical Data from Lake Chemistry Monitoring Program

7.3.1.1 Quality of Water Chemistry Data

- Summary of QA/QC processes & outcomes

7.3.1.2 Water Chemistry Sampling Results

- Reference to detailed appendices
  - Sampling results
  - Detailed time series figures for each parameter, including nitrogen ([NO_3^-], [NH_4^+], [TKN])
- Tables/figures summarizing changes in primary water chemistry results
- Changes in base cations over time in each of the EEM lakes

7.3.1.3 Discussion of dominant patterns (if appropriate)

- Natural and anthropogenic factors that collectively contributed to observed patterns in water chemistry

7.3.2 Knowledge gained

7.3.2.1 Spatial and temporal patterns in water chemistry

7.3.2.2 Observed changes in water chemistry relative to predictions from STAR and 2019 CR

7.3.2.3 Application of the Evidentiary Framework

7.3.2.4 Episodic acidification

- Results from analyses of continuous pH monitoring data

7.3.2.5 Results from other data and analyses

- BRIEFLY mention other pieces and cite past reports for details:
  - Lake level monitoring
  - Non-EEM sites

7.3.3 Modifications to the EEM Program

7.3.3.1 Assessment of safety risks

7.3.3.2 Evaluation of new technologies

7.3.3.3 Modifications to sampling program and methods of data analysis

7.3.4 Comprehensive synthesis ('pulling all the pieces together')

7.3.4.1 Synthesis across four lines of evidence

- Brief intro/synopsis of key results

7.3.4.2 Summary of observed changes in lake chemistry, 2012-2025

7.3.4.3 Changes to and/or confirmation of the STAR results and assumptions

- Predicted vs. observed changes in water chemistry for each lake in EEM program

7.3.4.4 Exceedances of EEM Indicators

- Application of simple evidentiary framework to assess KPI and informative indicators
- For each lake, does the evidence suggest that acidification has occurred and is causally related to smelter operations?
- To what extent can we conclude whether any EEM lakes are trending towards exceedance of the KPI

7.3.4.5 KPI Thresholds

- Does our current knowledge gained from the EEM Program support the existing KPI thresholds or suggest any need to consider changes?

7.3.4.6 Evaluating inclusion of existing lakes in EEM program

7.3.5 Conclusions

7.3.5.1 Does the Weight of Evidence indicate that smelter emissions have contributed to the acidification of aquatic ecosystems?

7.3.5.2 Summary of answers to questions in the STAR and EEM Phase III Plan

7.3.5.3 Assessment of acceptable or unacceptable impacts on aquatic receptor

7.3.5.4 What outstanding questions still require further or ongoing investigation?

7.3.5.5 What new questions have emerged?

- e.g., cumulative effects of multiple emission sources, plus influence of climate change
- e.g., effects of year to year variation in Aug-Oct precipitation

7.4 What Do We Recommend for the EEM Program Going Forward?

NOTE: The following outlines the categories under which recommendations could potentially be made. Additional notes describe some of the topics that we currently anticipate will warrant discussion. However, the actual recommendations will be an outcome of the comprehensive review process and design work in 2026 – the notes in this section are not intended to suggest or reject any particular recommendation.

7.4.1 Monitoring program for aquatic ecosystems

- Spatial coverage and temporal intensity of monitoring; parameters analyzed and methods

7.4.2 Changes to the KPIs or informative indicators

- Continuation of KPI; possible additional informative indicators to capture cumulative effects

7.4.3 Modelling aquatic effects

- Summary of modelling included in 2019 CR and its sufficiency

7.4.4 Analyses and annual reporting

- Refinements

7.4.5 Additional topics

- As necessary

8 Climate Change

- Introduce why it is important to be aware of climate change effects and influences on the SO2 EEM source-pathway-receptor conceptual model in section 1.1.
- Rio Tinto's voluntary commitment to include climate change in the SO2 EEM program.

8.1 What Did We Set Out to Learn?

- Clarify purpose and intent of this section on climate change.
- Explain that we set out to learn if we are seeing evidence so far of effects of climate change on EEM KPIs and informative indicators.
- Explain that we set to to develop an understanding of the potential future climate change effects for the Kitimat Valley.
- Explain that we developed a set of reference meteorological and effects monitoring indicators that may help identify signals of climate change in the Kitimat Valley and also help inform the interpretations of the data collected for the EEM.
- Understand the future climatic change projections for the Kitimat Valley and understand the appropriate scenarios (rage of projections) that would be helpful to consider in the EEM.
- Understand what additional data sets (such as from Climatedata.ca) and scenarios that may be helpful to include for understanding climatic change effects in the Kitimat Valley.

8.2 What Methods Did We Use?

- Assess the quality of the meteorological data as records permit.
- Statistically assess the meteorological data quality for developing a meteorological indicator for still air days.
- Assessment of the solar irradiance data collected at the Whitesail and Lakelse stations to determine if a solar irradiance indicator can be developed.
- Check across the SPR model with the QP team to identify other climate change indicators that would be helpful to include for understanding the interpretations of the EEM data.
- Obtain input from outside the QP team to on other feasible indicators that may be helpful to inform the understanding of climate change in the valley and interpretations of the EEM data.
- Evaluate other potential indicators such as soil moisture, total degree days > 5°C, relative humidity, temperature, snowpack, and frequency of extreme events.
- Update the meteorological and EEM climate change indicators.

- Evaluate the meteorological and EEM climate change indicators to assess if we can detect a signals of climate change effects in the data.
- Examine common trends across treatment and control sites to make at least qualitative inferences of how climate change may be affecting water, vegetation and soils

8.3 \What Did We Learn?

- Summarize the key findings climate change forecasts for the Kitimat Valley
- Present updated meteorological and effects monitoring indicators
- Understanding on the potential climate change effects signals that may need to be disentangled (use of controls) to interpret smelter caused SO2 effects.
- Do we see signals of climate change in the indicators and do the signals align with the climate change forecasts for the Kitimat Valley?

8.4 What Do We Recommend for the EEM Going Forward?

- Recommendations for the set of climate change indicators (meteorological and effects) to be considered in the next monitoring cycle.
- If additional controls would be helpful to disentangle climate change effects from smelter effects.

9 Holistic Understanding of Smelter Effects on the Environment and Human Health across all Lines of Evidence

- Provide a map showing all sampling/monitoring locations across pathways and receptors (ideally both Rio Tinto EEM and LNGC monitoring sites on one map, to support collaboration; if not possible, put LNGC maps into an Appendix).
- Look across all lines of evidence and receptors, integrate information across disciplines, and provide a clear summary of what we've learned about the links between SO_2, human health and ecosystems.
    - Include a Looking Outward Matrix to organize this (example template shown in Table 3 below). Crosscheck to explore inconsistencies across analyses, and why these might have occurred.
    - Summary of KPI, thresholds and results over 2019-2025 (example template in Table 4 below)
    - Synthesis of deposition-driven S results across vegetation, terrestrial ecosystems and aquatic ecosystems
    - Synthesis of SO_2 concentration-driven results across human health and vegetation
- Summarize what we've learned in terms of the STAR source-pathway-receptor diagram, and identify gaps in data or knowledge.
- Are observed effects less than, similar to or greater than what was predicted in the STAR?
- Are we seeing any trends toward unacceptable impacts when looking across all lines of evidence?
- Use multiple lenses to synthesize results

Table 3. Looking Outward Matrix showing information links among pathways and receptors (example for illustration of the matrix format).

To → From ↓	Atmosphere	Human Health	Vegetation	Soils	Surface Waters
Atmos.	Emissions of SOx	$[SO_2]$ vs. KPI	$[SO_2]$ and S deposition vs. vegetation trends	Deposition vs. soil CL, and vs. soil base saturation	Deposition vs lake CL, (summarize from 2019)
Human Health					
Vegetation				Observations of vegetation effects vs. areas of soil CL exceedance	
Soils			Areas of soil CL exceedance vs. vegetation observations		Soil CL exceedance vs. Lake CL exceedance
Surface Waters	Compare Δ $[SO_4]$ to CALPUFF estimates of Δ S deposition by lake			BC weathering rate from [BC] and runoff vs. soil estimates of weathering rates	

Table 4. Summary of KPIs, thresholds and performance 2019-2025

	KPIs	Threshold for increased monitoring	Threshold for receptor-based mitigation	Threshold for facility-based mitigation	Results over 2019-2025
Human Health					
Vegetation					
Soils					
Surface Waters					

10 Synthesis of Recommendations

- Provide summary of recommendations in a tabular form for each receptor, referencing the sections with justifications for the recommendations (sections 3 to 7).

11 Cited References and Reports

- List of references cited in the Comprehensive Review

12 Cited EEM Technical Memos

- List of EEM Technical Memos cited in the Comprehensive Review

Appendices

- Appendices will be prepared for Comprehensive Review details not appropriate for the main CR Report

TOR Item 3: Draft Schedule of Comprehensive Review Tasks

	Draft EEM Schedule for 2026	PRELIMINARY - FOR REVIEW																							
	Timestep: half-month	January		February		March		April		May		June		July		August		September		October		November		December	
	2026 Comprehensive Review	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
1. Primary Technical Work & Developing Chapters																									
1.1	QP initiation & team coordination meeting																								
1.2	Analyses and Documentation																								
1.3	GIS & mapping support																								
1.4	QP meetings (x2)																								
1.5	QP work on cross-cutting chapters																								
1.6	Climate Change chapter																								
2. Consolidated Draft Report																									
2.1	Prepare Draft 1 EEM Comprehensive Review Report																								
3. Review and finalization of DRAFT Report																									
3.1	RT review (of Draft 1) - present & discuss																								
3.2	RT review (of Draft 1) - technical revisions																								
3.3	ENV review (of Draft 2) - present & discuss																								
3.4	ENV review (of Draft 2) - technical revisions																								
3.5	Prepare "Final Draft" (Draft 3) document																								
4. Engagement and Consultation																									
4.1	Engagement and consultation - develop materials																								
4.2	Engagement and consultation - plan & deliver																								
5. Final EEM Comprehensive Review Report																									
5.1	Revise and Finalize Report																								
6. Project Management																									
6.1	Project & team management; coordination and communication with client																								

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