Rio Tinto

Environmental Report BC Works 2025

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Canada

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1. About the annual environmental report

The annual environmental report is a summary of the environmental performance for the year. This report is written for stakeholders and is a requirement under authorization 100138 for the P2-00001 permit. This report is submitted to the Ministry of Environment and Parks and made available to the public through the BC Works website.

Authorization 100138 context

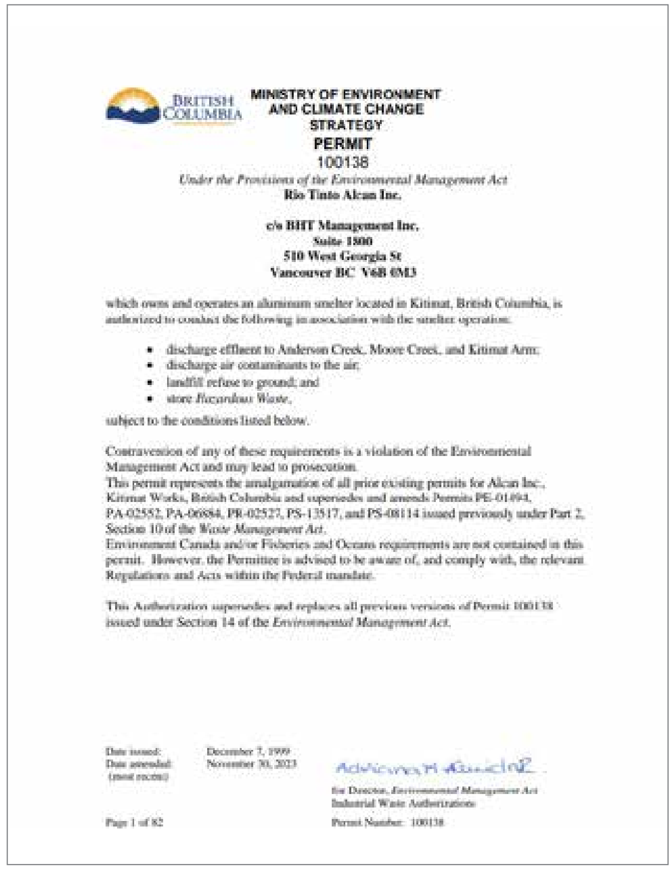
In 1999, Rio Tinto's BC Works became the first industrial facility in British Columbia to obtain a multi-media environmental permit from the provincial government under authorization 100138. The P2-00001 Multi-Media Waste Discharge Permit (P2 Permit) comprehensively addresses multiple air, water and solid waste discharges, sets limits and establishes monitoring and reporting requirements. This permit is the key environmental regulatory compliance benchmark for smelter operations. This process was transparent with Rio Tinto and the Kitimat Public Advisory Committee (KPAC) collaborating with the Ministry of Environment and Parks (BC ENV) to rationalize concerns and to mutually agree on priorities that will influence Rio Tinto's goal of continuous improvement.

In this report

This report includes summary results of permit compliance monitoring for effluents, air emissions, ambient air quality, SO_2 EEM, waste management, and groundwater monitoring. A summary of the Kemano permit monitoring results are included. Also presented in the report is a summary of the permit non-compliances and spills. A summary of the annual non-compliances and reportable spills is included in this report in Chapter 11.

Access & comments on the report

The 2025 Annual Environmental Report is available online at **https://www.riotinto.com/en/operations/canada/bc-works**. The website also provides information on key environmental performance indicators. Questions or comments are welcome and can be sent via email: **BCWorksInfo@riotinto.com** and via phone: **1 250 639 8383.**



MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

PERMIT

100138

Under the Provisions of the Environmental Management Act

Rio Tinto Alcan Inc.

c/o BHT Management Inc.
Suite 1800
510 West Georgia St
Vancouver BC V6B 0M3

which owns and operates an aluminum smelter located in Kitimat, British Columbia, is authorized to conduct the following in association with the smelter operation:

- discharge effluent to Anderson Creek, Moore Creek, and Kitimat Arm;
- discharge air contaminants to the air;
- landfill refuse to ground; and
- store *Hazardous Waste*,

subject to the conditions listed below.

Contravention of any of these requirements is a violation of the Environmental Management Act and may lead to prosecution.
This permit represents the amalgamation of all prior existing permits for Alcan Inc., Kitimat Works, British Columbia and supersedes and amends Permits PE-01494, PA-02552, PA-06884, PR-02527, PS-13517, and PS-08114 issued previously under Part 2, Section 10 of the *Waste Management Act*.
Environment Canada and/or Fisheries and Oceans requirements are not contained in this permit. However, the Permittee is advised to be aware of, and comply with, the relevant Regulations and Acts within the Federal mandate.

This Authorization supersedes and replaces all previous versions of Permit 100138 issued under Section 14 of the *Environmental Management Act*.

Date issued: December 7, 1999
Date amended: November 30, 2023
(most recent)

for Director, *Environmental Management Act*
Industrial Waste Authorizations

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Permit Number: 100138

Authorization 100138. The multimedia permit was issued in 1999 and is a living document, it under goes review's and updates as needed to reflect changes in operating conditions.

2. Operational overview

Rio Tinto operates a multi-faceted industrial complex in northern British Columbia, which is one of the largest industrial sites in the province. The operational footprint extends into 21 different First Nations Traditional Territories in Kitimat, Kemano, and the Nechako Reservoir, which encompasses Southside (Ootsa Nadina and Wisteria), Nechako River and its tributaries, Fraser Lake, Vanderhoof and Prince George.

2025 Operational year

In 2025, BC Works continued to focus on maintaining stable operations despite a year marked by ongoing external and internal challenges. Throughout the year, teams worked to manage the impacts of constrained reservoir conditions, tariffs, supply chain pressures, and various operational disruptions while keeping production steady and maintaining the integrity of the system.

A series of significant events required strong coordination across site, including unplanned interruptions that tested the resilience of our people and processes. Through collaboration and disciplined execution, the operation remained reliable and adaptable, ensuring continuity of production and supporting key customers when needed.

Investing in the long term sustainability of the site remained a priority. Several important upgrades and reliability projects advanced during the year, including major renewals to core infrastructure and improvements aimed at strengthening safety, asset performance, and environmental management. These efforts support safer, more efficient, and more modernized operations for the years ahead.

2025 also saw continued progress in building stronger partnerships and community relationships, including meaningful engagement with First Nations and contributions toward regional research and development. These initiatives reinforced our commitment to working collaboratively and investing in the future of the region.

Despite the year's challenges, BC Works closed 2025 with solid operational performance, demonstrating the resilience, adaptability, and dedication of our workforce. The progress made positions the operation well for continued safe, stable, and sustainable operations moving forward.

Operational process

The various components of the plant are described below, a schematic of the aluminium smelting process is shown in Figure 2.1, while a visual plant overview is shown in Figure 2.2.

Wharf & logistics

The main raw materials used in the aluminium smelting process are received at the wharf. The wharf is also used to ship the final aluminium product to customers overseas. These materials are alumina, green coke, petroleum pitch and calcined coke. Alumina is stored in 10 storage silos at BC Works and is used in Reduction in the smelting process. Green coke is stored at carbon south and is used in the coke calcination process. Petroleum pitch is stored in 3 storage tanks and is used in combination with calcined coke and other ingredients to form carbon anodes.

Carbon South

Carbon South is located at the southern end of the site near the wharf and contains the anode paste plant and the coke calcination plant. Carbon South is responsible for making the green anodes, the first step of the aluminium production process. Carbon South receives raw materials (coal tar pitch, green petroleum coke and calcined coke) from the wharf as well as recycled anodes from Carbon North, which are used to make the green anodes.

Carbon North

Carbon North is located at the north end of the site and contains the anode bake furnace, anode rodding shop, pallet storage building, carbon crushing plant and bath treatment centre. Carbon North is responsible for baking the green anodes and then rodding the baked anodes into anode assemblies (two anode blocks plus a stem) so that they can be used in the reduction process for anode change. Carbon North also receives spent anodes (baked anodes that come out of the reduction process) as well as bath collected from the anode change process, both of which are stored in the pallet storage building until the material is cooled. The spent anodes are then cleaned, de-rodded and crushed so that the carbon can be recycled at the anode paste plant and the bath can be treated at the bath treatment centre before being sent back to reduction to be used in the anode change process.

Reduction

The basis of AP-4X smelting technology uses electrolytic cells or pots contains molten bath (composed primarily of sodium fluoride and aluminium fluoride) which dissolves the alumina ore (composed of bonded atoms of aluminium and oxygen Al_2O_3) by an electrolytic reduction process (using electricity to break the aluminium-oxygen bond). The heavier aluminium molecules sink to the bottom of the pot in the form of molten aluminium. Oxygen is combined with carbon from the anode to form carbon dioxide. The molten aluminium that is extracted from the pots is transported to the two casting centres.

Casting

After it is siphoned from the pots in reduction, the molten aluminium is transported to the casting departments in cruces. Depending on customer needs, the metal will either go to B Casting or C Casting and be stored temporarily in holding furnaces. Various alloying materials (such as magnesium, copper, silicon and iron) are added to produce specific characteristics such as improved strength and corrosion resistance.

The aluminium is then poured into moulds and chilled, forming solid ingots of specified shapes and sizes. BC Works produces four types of aluminium ingots: value-added sheets and value-added remelt ingots, which both uses a combination of pure aluminium mixed with alloying materials to enhance the properties of the product; pure aluminium remelt ingots; and pure aluminium sows, which are sold to customers in North America, Asia and Europe for a variety of end-use applications.

Kemano

The electrolyte reduction process requires the use of large amounts of electricity. Electricity for BC Works is generated at the Kemano Operations' powerhouse, a 1,000 megawatt hydroelectric generating station located 75 kilometres southeast of Kitimat. This generating station uses water impounded in the 91,000 ha Nechako Reservoir in north-central British Columbia.

Figure 2.1 Typical Aluminium smelting process

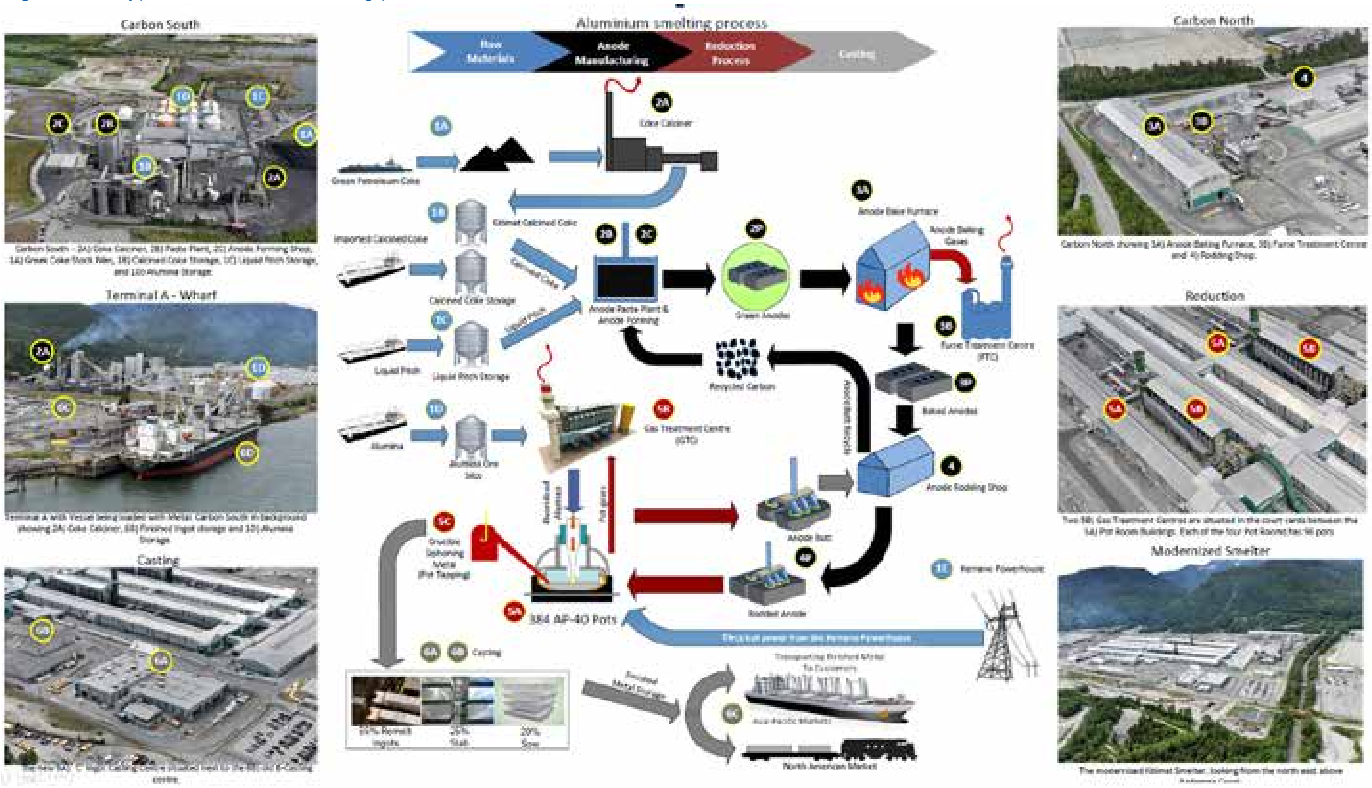


Figure 2.2 Kitimat Environmental operations

Effluent Collection and Treatment

- 1 D-Lagoon emergency outfall
- 2 D-Lagoon
- 3a 3b Stormwater discharges
- 4 J-Stream discharge
- 5 B-Lagoon
- 6 B-Lagoon outfall discharge
- 7 Saltwater addition
- 8 A-Lagoon
- 9 Inverted siphon
- 10 F-Lagoon
- 11 F-Lagoon emergency overflow and sampling station
- 12 Anderson Creek parking lot stormwater discharges
- 13 Moore Creek
- 14 Anderson Creek

Waste Storage, Disposal and Managed Sites

- 1 Yacht basin
- 2 Scow grid
- 3 Transfer station
- 4 Dredgeate disposal site
- 5 SPL landfill
- 6 Waste oil storage (building 104)
- 7 South landfill
- 8 North landfill
- 9 Hazardous waste storage
- 10 SPL overburden soil cell

Plant Components

- 1 Terminal A wharf
- 2 Green coke storage
- 3 Coke calciner
- 4 Anode paste plant and green anode forming shop
- 5 VSS potline 1-5
- 6 AP-4X potline
- 7 Anode bake furnace
- 8 Anode rodding shop
- 9 Casting centres (B & C)
- 10 Delining and relining facility

3. Environmental management and certifications

The Health, Safety, and Environment (HSE) Policy is the foundation for environmental management throughout Rio Tinto's global operations. HSE directives establish corporate-wide standards on major and minor environmental, health, and safety topics.

The HSE Policy and the more specific requirements of the Rio Tinto Health, Safety, Environment, and Quality (HSEQ) standards are put into practice at BC Works through a comprehensive, operation-specific Risk Management System. The system is maintained through adherence to the Rio Tinto Management System's 17 elements, which encompass the continuous improvement cycle of Plan, Do, Check, and Review (PDCR).

Independent certification

Since 2001, BC Works has been certified under the requirements of the ISO 14001 (1996) environmental program, with certification updated more recently to the ISO 14001 (2015) standard. ISO 14001 (2015) provides independent verification that BC Works assesses its environmental impacts, maintains procedures to manage its practices, and works continuously to reduce or eliminate its environmental footprint. In line with a company-wide commitment to sustainable management, BC Works holds certifications for both ISO 14001 (Environment) and ISO 9001 (Product Quality) standards. For the environment, this certification encompasses all Rio Tinto BC Works activities and locations where business risks are managed. For quality, it applies to the processes of manufacturing aluminium ingots and shipping.

In 2018, Rio Tinto BC Works was certified against the Aluminium Stewardship Initiative (ASI) Performance Standard as part of our commitment to responsible production of aluminium **[https://aluminium-stewardship.org/about-asi/members/Rio-Tinto-Aluminium-Division]**. ASI is a global non-profit standards setting and certification organisation, bringing together producers, users and stakeholders in the aluminium value chain with a commitment to maximise the contribution of aluminium to a sustainable society. Working together, ASI membership aims to collaboratively foster responsible production, sourcing and stewardship of aluminium.

Audit program

Independent ISO compliance and conformance audits are a requirement for certification. In 2025, the ISO 14001 recertification audit was completed, extending Kitimat's certification under the RTA Canada umbrella program. BC Works' integrated certification remains in line with the ISO 14001 (2015) standard and continues to be maintained.

On the ASI front, BC Works is part of the RTA Canada ASI certificate and first earned it's certification in 2018 after a thorough audit. A follow-up recertification audit was completed successfully in 2022. Most recently, between September 2023 and March 2024, another ASI recertification audit was completed on version 3 of the Performance Standard and full certification was granted. For those interested in the details, the complete audit report and certification confirmation are available on ASI's public website.

4. Effluents

Surface runoff from the smelter site, originating as snowmelt and rain, accounts for most of the water discharge. Seasonal precipitation varies significantly, and total discharges can be over 100,000 m^3 per day during fall and winter storms.

Sources and infrastructure

Whether water is in use at the smelter or accumulating through surface runoff, it collects contaminants from various sources. It is directed through underground drains and surface channels to one of six inflows into B-Lagoon that discharges into the Douglas Channel.

B-Lagoon consists of a primary and a secondary pond: Upper and Lower B-Lagoons. It is designed to remove contaminants by sedimentation, phytoremediation, along with saltwater addition to smooth fluctuations of inflows and contaminant levels. B-Lagoon discharges effluent continuously into the Douglas Channel. In 2025, the average discharge rate was 33,772 m^3 per day. The retention time for water in the lagoon is usually more than ten hours (confirmed by measurements conducted in 2018) but is reduced to about five hours during runoff events and heavy rainfall.

In 2024, Rio Tinto made a significant investment to the B-Lagoon outfall, thereby improving the structure to reduce emergency overflows to the Douglas channel and reduce the likelihood of fish passage into the lagoons. Outfall was designed to retain a 1 in 100 storm event. The outfall also has integrated technology to adjust water levels flowing out of the lagoons based on tide elevation. In 2025 there were no overflow events.

Discharge measurements related to permit requirements and additional monitoring are described below in the following 2025 performance section.

2025 Performance

Effluent water quality monitoring

Effluent water quality is monitored annually for the following parameters: flow variability, dissolved fluoride, dissolved aluminium, total suspended solids (TSS), cyanide, temperature, conductivity, hardness, toxicity, acidity, and polycyclic aromatic hydrocarbons (PAHs). Of these parameters, dissolved fluoride, dissolved aluminium, and TSS are monitored for long term trends.

Flow variability

Variability in the flow from B-Lagoon into the Douglas Channel is mainly a function of precipitation. As shown in Figure 4.1, peak rain events and flows occurred between January and March, and from September to December. The total amount of rainfall in 2025 (2955 mm) was slightly higher than the previous year. Most of the rain came in the fall months of 2025.

Long-term trends

Dissolved fluoride, dissolved aluminium, and total suspended solids are the most meaningful performance indicators of plant effluent water quality. Average annual performance for these have been consistently maintained below permit levels (10 mg/L, 3 mg/L and 50 mg/L respectively) in recent years. Figure 4.2 illustrates the long-term trend performance.

In 2025 dissolved aluminium loading slightly decreased from the previous year. Whereas TSS and dissolved fluoride were slighlty higher than previous years, TSS levels have been the most stable. In fact they often are undetected in the lab. TSS is one of the key performance indicators as it allows operations to monitor the efficiency of the lagoon.

Dissolved Fluoride

Dissolved fluoride originates mainly from the leaching of a landfill formerly used to dispose of spent pot lining. Information on the spent pot lining landfill is reported in Chapter 9, Groundwater monitoring. Other sources of fluoride are raw material losses around the smelter.

Dissolved fluoride is monitored continuously through daily composite sampling and monthly grab sampling. Daily composite and grab samples are sent to an outside laboratory for analysis (refer to Chapter 12 Glossary for sample method definitions).

The permit specifies a maximum concentration of 10 mg/L of dissolved fluoride in effluent; this level was exceeded by 0.6 mg/L on Dec 30th during a transition weather event from snow to rain. Average dissolved fluoride concentration for the year derived from composite sampling was 3.96 mg/L. The long-term trend is illustrated in Figure 4.2. The 2025 composite and grab sampling results (Figure 4.3) profile the higher concentrations that occurred during the higher precipitation and surface run-off events during the year.

Dissolved Aluminium

Aluminium metal at BC Works, such as finished products stored outside at the wharf, have a very low solubility and contribute little to the discharge of dissolved aluminium.

In addition to its use as a raw material, alumina is also used in the scrubbing process to remove fluoride from smelter emissions. Some scrubbed alumina is released through the potroom gases collection centres. In this form, scrubbed alumina has a higher solubility and is a contributor to both dissolved aluminium and dissolved fluoride.

In 2025, concentrations of dissolved aluminium did not exceed the maximum permit limit of 3.0 mg/L. The annual average of dissolved aluminium concentration was 0.22 mg/L (Figure 4.4).

Total Suspended Solids (TSS)

Solids that remain suspended in discharge from B-Lagoon include small amounts of materials used in industrial processes at the smelter and other naturally occurring substances like dust, pollen and silt. There is a proportional relationship between TSS levels and concentrations of both dissolved aluminium and polycyclic aromatic hydrocarbons (PAHs) because these contaminants are usually bound to suspended solids in water when entering the B-Lagoon system.

B-Lagoon is a large and well-vegetated area that is highly efficient in absorbing and processing effluent compounds. The permit specifies a concentration maximum of 50 mg/L of TSS in effluent.

Concentrations in 2025 were much lower than the permit level. The annual average concentration for the composite samples was 3.13 mg/L (Figure 4.5) which is consistent with previous years.

Cyanide

Cyanide is formed during the electrolytic reduction process and retained in the cathode lining material known as spent pot lining (SPL). In the past, material in the cathode was deposited on-site at the SPL landfill. Today, all generated SPL is shipped off-site to a Rio Tinto SPL treatment facility where the material is decontaminated and repurposed for various use. Groundwater and the bottom of the SPL landfill interact, generating a leachate containing cyanide. The source of the cyanide in B-Lagoon is from the J-Stream outlet.

The permit specifies a maximum concentration of 0.5 mg/L of strong acid dissociable cyanide (the more abundant, although less toxic form) in B-Lagoon. Concentrations are determined from the monthly grab samples. The permit level was not exceeded in 2025. Weak acid dissociable cyanide is also monitored, although there is no permit requirement (Figure 4.6).

Temperature

Water used for cooling is the major source of effluent at BC Works. B-Lagoon is designed to retain effluent long enough to ensure water temperatures are not elevated when discharged. The permit requires that the temperature of the lagoon discharge does not exceed 30°C. Temperatures were within permit requirements during 2025 (Figure 4.7).

Conductivity, hardness, saltwater addition and toxicity

Since 1997, salt water has been pumped into B-Lagoon at the connection between the primary and secondary ponds. As per permit requirements, the addition of salt water is monitored and managed to maintain non-toxic discharges.

In 2008, an independent consulting firm conducted a review to examine the correlation between seawater addition rates, conductivity, hardness, and toxicity. The review was in fulfilment of section 8.2.5 of the multi-media permit requirements. Results confirmed that the addition of sea water was successful at reducing the toxicity of the B-Lagoon effluent.

The data also confirmed the best way to predict toxicity is via aluminium concentration, conductivity and pH. Conductivity and hardness are monitored on a continuous and daily composite basis respectively, even though there are no permit limits for either parameter (Figure 4.8). These measures provide information that ensures the saltwater addition system is contributing to the reduction of toxicity at the at the B Lagoon outfall.

Water toxicity is determined through the application of a bioassay test. The toxicity of water discharged from B-Lagoon is tested by exposing juvenile rainbow trout to the effluent in a certified laboratory under controlled conditions (96LC50 bioassay test). The permit requires quarterly monitoring with a survival rate of at least 50 per cent for trout tested. All effluent discharge bioassay tests at B-Lagoon passed during 2025.

Acidity

A variety of contaminants can influence the acidity of effluent, by either increasing or decreasing the pH levels. A pH level of 7.0 is neutral, and water sources found adjacent to BC Works (Anderson Creek and the Kitimat River) usually have a pH level slightly below neutral (i.e. acidic, rather than alkaline).

Acidity is monitored using a variety of methods (continuous, daily composite and monthly grab samples). Daily composite samples are provided to an external laboratory for analysis. The permit requires that the pH of the effluent is maintained between 6.0 and 8.5. The 2025 annual pH composite sample average was 7.07. All sample measurements were within the permit limits. (Figure 4.9).

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs area a large family of chemical compounds (more than 4,000 have been identified) generated by the incomplete combustion of organic material.

Various operations at the smelter generate PAHs in both particulate and gaseous forms.

Other sources include raw materials (green coke and pitch) handling. PAHs are monitored through monthly grab samples. PAHs are also analysed from grab samples taken during special events. B-Lagoon discharges are monitored and analysed for 15 of the most common PAH compounds (Figure 4.10). In 2025 the overall trend PAHs appear to be less than previous years which may highlight some of the benefits of the new smelter technology.

All PAH results from 2025 were within permit limits set at 0.01 mg/L.

Figure 4.1

Flow variability, B-Lagoon 2025

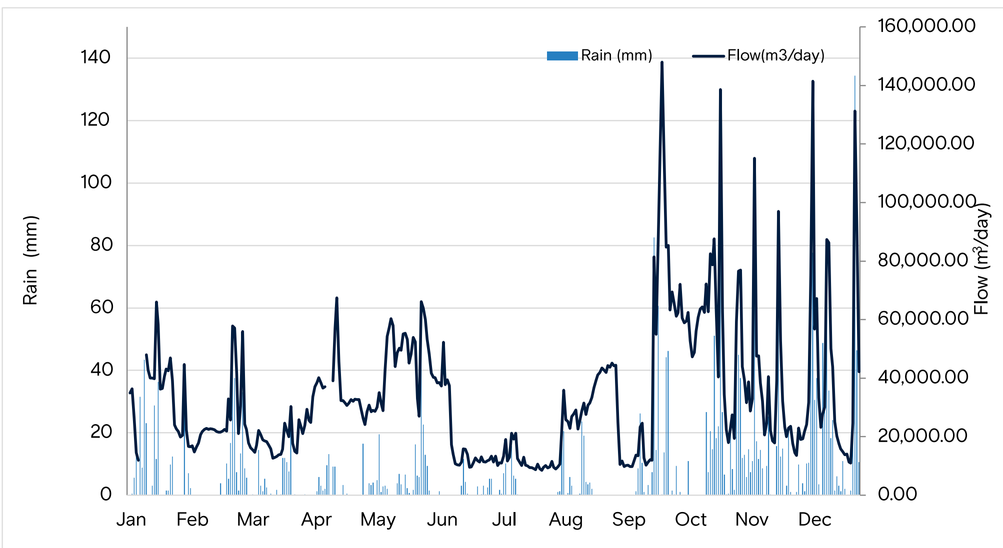


Figure 4.2

Dissolved fluoride, dissolved aluminium and total suspended solids, B-Lagoon 2025

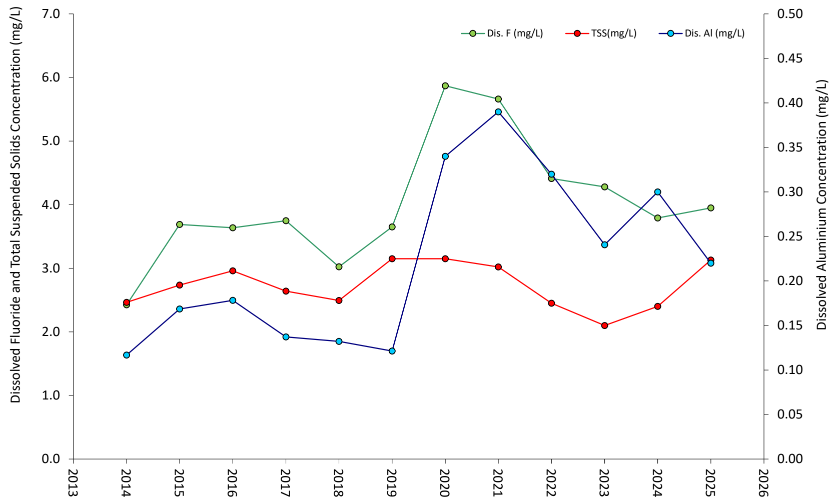


Figure 4.3

Dissolved fluoride, B-Lagoon 2025

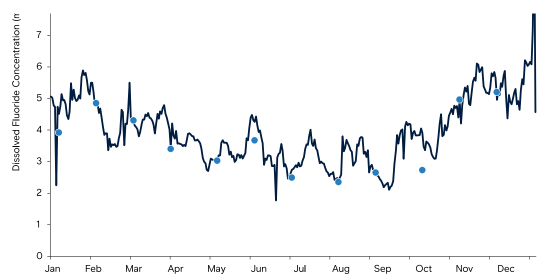


Figure 4.4

Dissolved Aluminium, B-Lagoon 2025

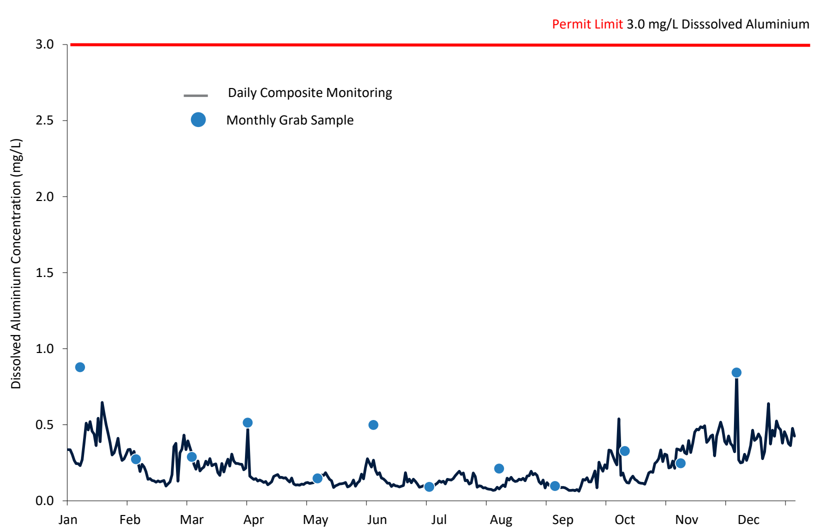


Figure 4.5

Total Suspended Solids, B-lagoon 2025

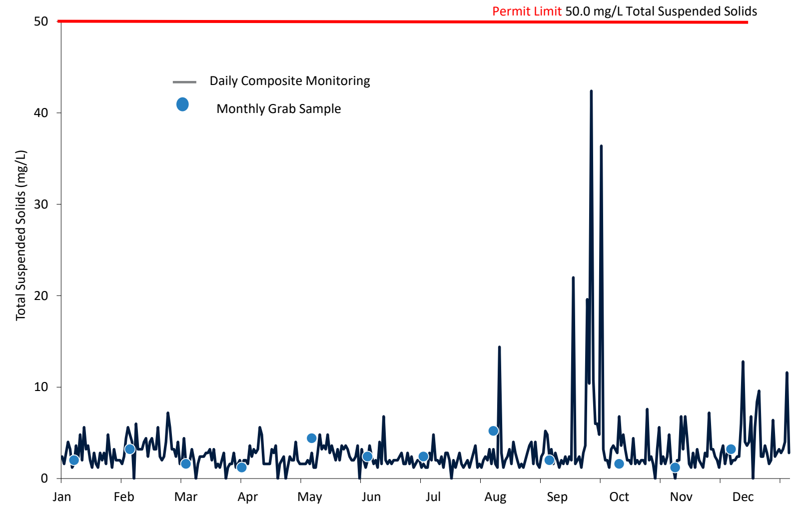


Figure 4.6

Cyanide, B-lagoon 2025

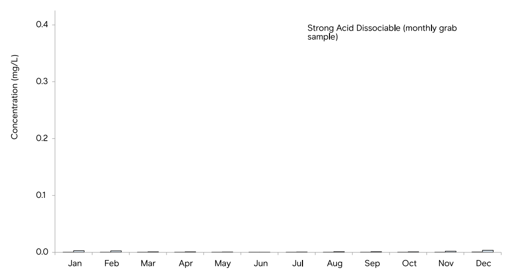


Figure 4.7

Temperature, B-lagoon 2025

Figure 4.8
Conductivity and hardness, B-Lagoon 2025

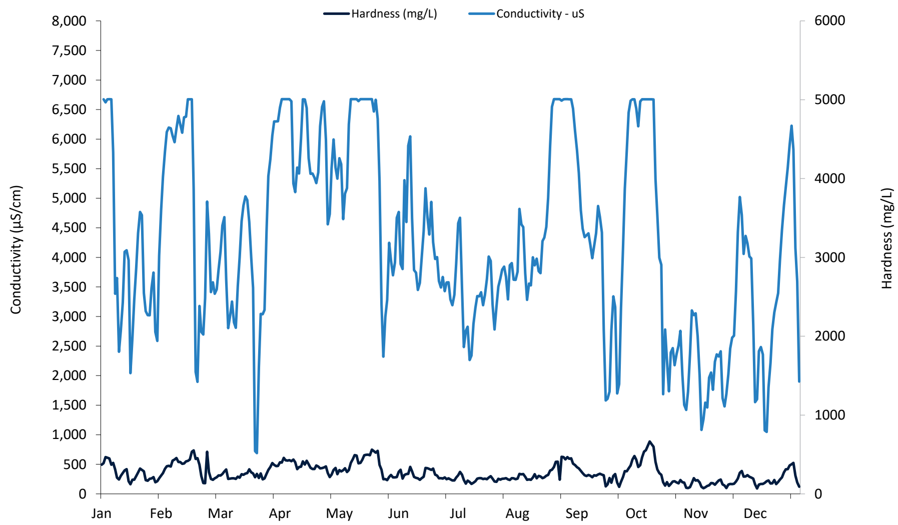


Figure 4.9
Acidity, B-Lagoon 2025

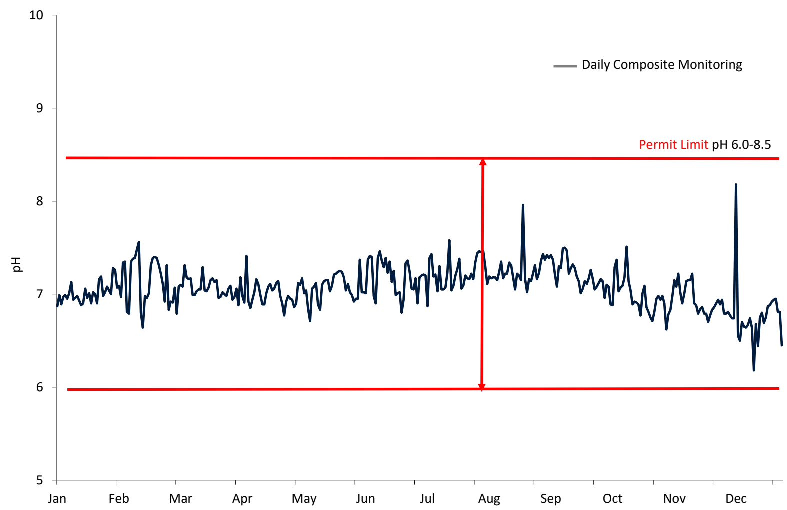
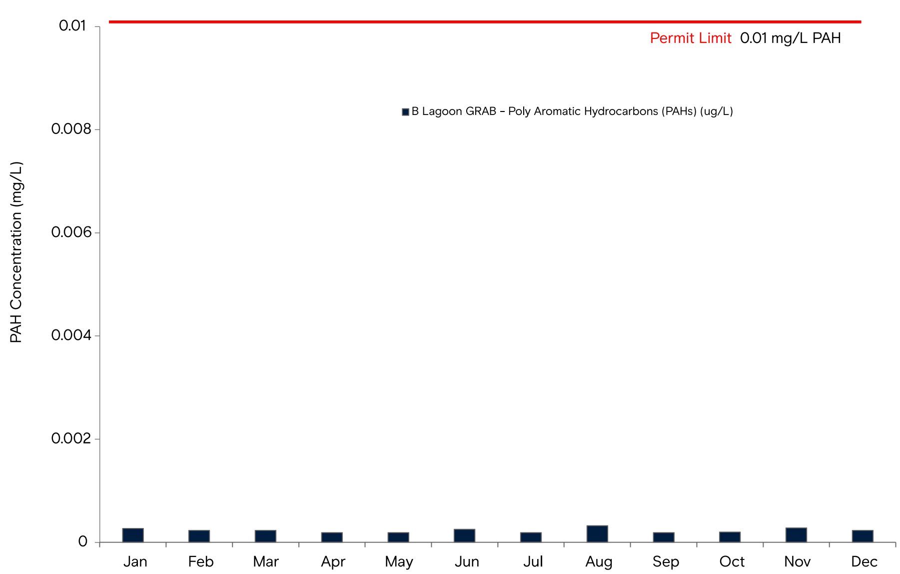


Figure 4.10
Polycyclic aromatic hydrocarbons, B-Lagoon 2025



5. Emissions

This chapter describes the results from air emissions as per the P2-00001 Permit for the various air discharge points from BC Works.

2025 Overview

Operational sources & emission types

At BC Works the process of making aluminium releases emissions at various steps in the process. The first step of the process is using raw materials to form green anodes in Carbon South. These anodes are then transferred to Carbon North for baking. The baked anodes are then rodded and transferred to Reduction (AP-4X prebake technology) to be used in the electrolytic process to generate molten aluminium, which is tapped and transferred to the Casting departments. As the baked anodes are consumed in the electrolytic process, they are replaced with new anodes in the anodes change process. The used (spent) anodes and bath collected from this change process are sent back to Carbon North to be recycled back into the process of making aluminium.

Emissions control equipment is situated in each operational area as required, some of which are monitored annually or biennially by a qualified third-party consulting company to sample emissions such as: fluoride gas (Fg), fluoride particulate (Fp), sulphur dioxide (SO_2), polycyclic aromatic hydrocarbons (PAHs), nitrogen oxides (NOx), and particulates (PM) as they exit from the stacks. Operational data from various areas within the plant is also used to calculate plant wide emissions for total fluoride (Ft), sulphur dioxide, greenhouse gas (GHG) and nitrogen oxide emissions.

In addition to monitoring emissions, regular air quality and vegetation monitoring is conducted in the Kitimat Valley. Information on these monitoring programs is detailed in Chapters 6 and 7, respectively.

Reported values are in standard conditions according to section 1.3.4 of the Permit.

Operational performance

In 2025, BC Works continued to focus on maintaining stable operations despite a year marked by ongoing external and internal challenges. Throughout the year, teams worked to manage the impacts of constrained hydro conditions, tariffs, supply chain pressures, and various operational disruptions while keeping production steady and maintaining the integrity of the system.

Operational sources

Wharf

The wharf, situated at the southern end of the site, serves as the receiving point for raw materials—including coal tar pitch, green petroleum coke, calcined coke, and alumina—which are offloaded from ships and barges into silos and storage areas. During transfer via conveyors or trucks, fugitive dust can be generated. To mitigate this, dust collectors are installed along the conveyor transfer points for alumina and calcined coke, designed to capture fugitive dust effectively. If a dust collector fails to treat emissions at the expected level during material handling, an upset notification must be submitted to the BC ENV.

Table 5.1 provides a summary of dust collector upsets.

Carbon South

Carbon South is located at the southern end of the site near the wharf and contains the anode paste plant and the coke calcination plant. Carbon South is responsible for making the green anodes, the first step of the aluminium production process. Carbon South receives raw materials (coal tar pitch, green petroleum coke and calcined coke) from the wharf as well as recycled anodes from Carbon North, which are used to make the green anodes.

The emission control devices located in the coke calcination plant and in the anode paste plant (APP) must be operational when the plants are operational; however, upsets and or bypasses may occur during operations due to maintenance or unplanned events. A bypass of an emissions control device is defined as an engineered pathway for emissions to pass through the equipment without treatment, whereas an upset is defined as any condition of an emissions control device that is not treating the emissions at the expected treatment level. Each time an emission control device is bypassed or has an upset, a notification must be sent to the BC ENV. Table 5.2 shows each bypass that occurred for each pollution control device in 2025 in Carbon South.

Coke calcination plant

Green coke is fed through the kiln to produce calcined coke. During this process, moisture and volatiles are removed from the green coke, and the volatiles are incinerated in both the kiln and the pyroscrubber. The freshly calcined coke is cooled with water, and the resultant steam is processed through the venturi scrubber before being discharged through the cooler stack. Emissions from both the cooler and the pyroscrubber stacks are typically monitored twice a year through stack tests. In 2025, the Pyroscrubber and the cooler were stack sampled in March and September. The results were within permit limits.

Anode paste plant

The anode paste plant uses calcined petroleum coke (from the coke calcination plant and from the wharf), Liquid pitch, and a portion of recycled carbon (from spent anodes crushed in Carbon North as well as reject paste and green anodes from APP) to produce green anodes. There are five dust collectors, two pitch incinerators and one pitch fume treatment device used to mitigate the emissions being released into the atmosphere from the green anode production process. Each of the devices is stack sampled once a year and has permit limits related to particulate emissions, and certain devices used to scrub fumes that come from the liquid pitch are stack sampled for polycyclic aromatic hydrocarbons (PAHs).

Liquid Pitch Incinerator (LPI)

The liquid pitch incinerator (LPI) is located on top of three storage tanks which are used to store liquid pitch after it has been transferred off boats at the wharf. The three tanks are connected to the liquid pitch incinerator, and when the pressure in the tank increases, the fumes travel to the pollution control device, which incinerates the fumes prior to releasing them into the atmosphere. This pollution control device is analysed for PAHs and has a permit limit for particulate emissions. The stack test results were within permit limits for particulates (Table 5.5).

FC-3

The liquid pitch is pumped from the three storage tanks as needed into a day tank, where it is stored until it is used in the green anode forming process. The day tank has a liquid pitch incinerator and is called the FC-3 day tank incinerator, it is analysed for PAHs and has a permit limit associated with particulate emissions (Table 5.6). The stack test results were within permit limits for particulate.

Dust collectors

Dry raw materials (calcined coke and baked recycle carbon) go through a screening and grinding process and are separated based on granulometries (sizes). The material is then stored in bins depending on the granulometries (fraction's 1 -3). Dust Collector 10 (DC10) collects dust during the screening process, and the dust collected in DC10 is sent to the ball mill feed bins. There are two ball mills (1 and 2) which crush the dust collected from DC10 as well as larger calcined coke particles into ultrafine material. The dust collected from the two ball mills is done by dust collector 11 (DC11) and dust collector 12 (DC12). The dust collected by DC11 and 12 is transferred into a storage bin (fraction 4). All four fractions of material (Fraction 1, 2, 3 and 4) are then mixed together in building 558 and dust collector 13 (DC13) and dust collector 14 (DC14) collect the dust from the mixture as it is transferred to building 5130 for the anode making process (liquid pitch fumes and dust are treated from this process by the pitch vapour treatment device). The dust collected from DC13 and DC14 is then recycled back into the dry material mixture that is used in the anode mixing and forming process.

All dust collectors were stack sampled and were within permit limits for particulate emissions (Table 5.7).

Pitch Vapour Treatment (PVT)

The Pitch Vapour Treatment (PVT) system, also known as the Pitch Fume Treatment Centre (PFTC), controls emissions generated during the anode mixing and forming process. This process occurs in Building 5130, where pitch (sourced from the FC-3 day tank) is combined with dry materials (from Building 558) and compacted to form green anodes. Emissions from this system were analysed for particulates and polycyclic aromatic hydrocarbons (PAHs) in accordance with permit requirements (see Table 5.8).

Carbon North

Carbon North is located at the north end of the site and contains the anode bake furnace, anode rodding shop, pallet storage building, carbon crushing plant and bath treatment centre. Carbon North is responsible for baking the green anodes and then rodding the baked anodes into anode assemblies (two anode blocks plus a stem) so that they can be used in the reduction process for anode change. Carbon

North also receives spent anodes (baked anodes that come out of the reduction process) as well as bath collected from the anode change process, both of which are stored in the pallet storage building until the material is cooled. The spent anodes are then cleaned, de-rodded and crushed so that the carbon can be recycled at the anode paste plant and the bath can be treated at the bath treatment centre before being sent back to reduction to be used in the anode change process.

Anode baking furnace

The anode bake furnace receives green anodes from the anode paste plant in Carbon South and bakes them at the anode bake furnace. The baking process releases emissions which are collected and treated by the fume treatment centre which is attached to the anode bake furnace. Once the anodes are baked, they are transported to the anode rodding shop.

Fume Treatment Centre (FTC)

The fume treatment centre pulls air from the anode bake furnace, the air is cooled, then injected with alumina which scrubs fluoride and PAHs from the air, the air then passes through filter bags to remove any particulates before the air exits through the stack.

The FTC is to be operational when the anode bake furnace is running; however, due to emergencies and planned maintenance, the device may be bypassed. Each bypass is communicated to external stakeholders at that time and a monthly summary is publicised on the BC Works website. Moreover, the date, bypass duration as well as the cause are documented and reported to the BC ENV within required reporting timeline which is different for type of bypasses (e.g., planned, approved, and unplanned bypasses). Table 5.9 shows each upset that occurred in 2025.

The FTC is monitored on an annual basis as per permit requirements for fluoride, particulates, PAHs, nitrogen oxide and sulphur dioxide. There are permit limits in place for PAHs and particulate emissions, while the results for fluoride are used in the monthly compliance reporting against the plant wide Total Fluoride permit limit (see section on Plant Wide – Total Fluoride Emissions).

The FTC is required to have the stack tested once a year. In 2025, the parameters were compliant during September 2025 testing (Table 5.10).

Pallet storage building

The pallet storage building is utilized to store spent anodes and bath materials from the reduction anode change process, allowing them to cool before being recycled (see sections on the anode rodding shop and bath treatment centre). A dynamic emission estimation method based on the number of anode butts transferred from the pot line is used to estimate the pallet storage building's monthly emission intensity. The annual average emission intensity for the pallet storage building in 2025 was 0.06 kg of gaseous fluoride per Mg of aluminium.

Anode rodding shop

The anode rodding shop receives baked anodes from the anode baking furnace as well as spent anodes from the pallet storage building. Baked anode blocks are received from the anode bake furnace and rodded to create rodded assemblies (two anode blocks per assembly) which are transported to reduction to be used in the electrolytic process.

Spent anodes are received from the pallet storage building and go through a series of processes to remove any bath that may be attached to the anode (see bath treatment and storage section below), the carbon is then removed from the stem and transfered to the carbon recycle plant.

Carbon recycle plant

De-rodded anodes are conveyed from the ARS to the carbon recycle plant where they are crushed, the dust collected from this process is captured by dust collector 5810-DCB-001. This dust from the dust collector and the crushed anodes are stored in a silo before it is shipped down to carbon south to be recycled into the recipe for making green anodes.

Dust collectors

Some of the dust collectors used at the anode rodding shop, carbon recycle plant, and the bath treatment and storage plant are monitored and reported for leak detection as per permit requirements. Leak detection is reported monthly to the BC ENV. Table 5.11 is a list of dust collectors that are reported for leak detection.

Bath treatment and storage

The bath treatment centre receives bath from the pallet storage building and from the anode rodding shop. The bath is crushed under suction and is stored in silos where it is recycled back into reduction in the anode change process.

5710-DCB-001 & 5710-DCB-003

There are two major dust collectors at the bath treatment and storage facility that are monitored relative to permit levels for total particulate. There were no exceedances of the permit limits in 2025 (Table 5.12). These two dust collectors are also monitored for leak detection (Table 5.11).

Reduction

The aluminium smelting process takes place in the 4 reduction buildings, each building houses 96 pots totalling 384 using AP-4X technology. The basis of AP-4X smelting technology is similar to that of the old Söderberg Vertical Stud smelting technology where each operational pot contains molten bath (composed primarily of sodium fluoride and aluminium fluoride) which dissolves the alumina ore by an electrolytic reduction process, the output of the process is molten aluminium. The difference between the two technologies is that the AP-4X smelter has the pots covered with hoods which are used to prevent emissions from being released from the pots as the emissions are continuously pulled from each pot and to a gas treatment centre (GTC). Fugitive emissions that escape through the pot hoods during operational activities such as anode change, tapping, etc. are released and monitored through the reduction buildings' roof ventilators. Since September 2023, the permit limits were reduced to their original values (0.9 kg/Mg Al of total fluoride and 1.3 kg/Mg Al particulates) after completing the successful re-start campaign.

Gas Treatment Centres (GTCs)

Two Gas Treatment Centres (GTCs) manage emissions extracted from the pots across four reduction buildings. The East GTC treats emissions from Buildings 1000 and 2000, while the West GTC handles emissions from Buildings 3000 and 4000. Each GTC processes air from 192 pots: the air is injected with alumina to scrub fluoride, then filtered through bags to remove particulates before being released through the stack. The alumina used in this process is subsequently recycled into the reduction process, feeding the pots for aluminium production.

The GTCs are designed to operate continuously, 24/7. However, performance may occasionally fall below expected levels due to planned or unplanned maintenance, resulting in an "upset." In such cases—whether planned or unplanned—notification must be sent to the BC ENV and external stakeholders, as required by permit conditions. Planned upsets for routine maintenance may be pre-approved under the P2 permit, while those for non-routine maintenance require approval prior to the scheduled date. In 2025, two planned upsets occurred at the GTCs for critical repairs. For unplanned upsets, notification must be submitted to the Ministry within one business day, detailing the cause, date, and duration. Additionally, a summary of all planned and unplanned upsets is reported monthly. Table 5.13 provides details of each upset recorded in 2025.

The GTC is monitored on an annual basis as per permit requirements for fluoride, particulates and sulphur dioxide (Table 5.14). In 2025, GTC stacks were sampled once in March and once in September. The results for fluoride and particulates are used in the monthly compliance reporting against the plant wide Total Fluoride permit limit (see section on Plant Wide – Total Fluoride Emissions & Plant Wide – Particulate Emissions).

Roof vents

The design of each of the 4 potroom buildings allows for fresh air to be pulled in from the basement panels through to the main floor and out through the roof vent. This design minimizes the exposure to employees working in reduction. This design also allows for any fugitive emissions (emissions that do not get pulled through to the GTCs) to escape through the top of the reduction buildings. The fugitive emissions leaving through the reduction roof vents in each operational building are monitored for fluoride gas, fluoride particulates and particulate matter on a bi-monthly basis (14 +/- 3 days). In each half building there are 4 continuous samplers (shuttles) and treated air filters (cassettes) are used to conduct the monitoring. Each shuttle also records temperature, air speed, pump flow and sampling time, all of which are used to calculate the emissions for each sampling period.

The reduction roof vent fluoride emissions (Figure 5.3) and particulate emissions (Figure 5.4) are reported on a monthly basis to the BC ENV and are used for compliance reporting against the P2-0001 plant wide permit limits for Total Fluoride (see Plant Wide Emission Section - Figure 5.6) and particulates (see Plant Wide Emission Section - Figure 5.9).

Lining de-lining

When a pot is nearing the end of its operational life it is cut off from the power supply, the remaining aluminium siphoned out and the anodes are raised out of the molten bath. The pot is cooled under the suction of the GTC for about 2 days before the process of delining, followed by the lining begins.

The beginning of the delining process starts with the anodes being removed and transferred to the pallet storage building for recycling, the superstructure (which houses the anodes) removed from the pot, and then the pot shell is moved out of the reduction lines and into the lining delining building. Once in the lining delining operation, the remaining bath, cathode, and refractory are removed from the pot shell under the suction of the 4421-DCB-001 dust collector. This dust collector was stack sampled in 2025 as per permit requirements (Table 5.15) and monitored for leak detection (Table 5.16).

The pot shell is then lined with new refractory and cathodes and moved back into the reduction lines, where the superstructure is replaced and the pot is prepped, energized (power re-connected) and started up (aluminium making).

Casting

The molten aluminium that is siphoned from the pots in reduction is transported to the casting departments in cruces and depending on the customer needs the metal will either go to B or C casting. Over the years, the use of chlorine was reduced and finally removed from casting operations in April 2014, the permit limit for chlorine consumption remains at 300 kg per day. There was no SF6 consumption in 2025 during the process of casting aluminium.

Dust collectors

Dust collectors are used during the casting operation to control dust emissions. When an emission control device without an engineered bypass pathway is not able to treat the emissions at the expected treatment level, this is reported as an upset. Each time a device had or planned to have an unplanned upset, a notification must be sent to the BC ENV as either a request for an approved bypass (for planned works) or as an emergency notification (due to an unplanned event). Table 5.17 showed one reported upset of casting dust collectors in 2025.

B- Casting

In B-casting, aluminium is transferred from cruces into either Furnace 41 or Furnace 42. Both furnaces feed into the DC4 pit, which is used to produce slab or sheet metal tailored to customer specifications. Each furnace has a stack that releases emissions into the atmosphere, and these stacks are sampled twice a year for nitrogen oxide, chloride, chlorine, and particulate emissions, as required by the permit. However, no specific permit limits are tied to these sampling results.

Additionally, B-casting includes the sow caster, which pours metal directly from cruces —without involving a furnace or stacks—into moulds. These moulds are cooled until the metal solidifies into a solid form known as a "sow." This process has no direct emissions monitoring, and the resulting metal is shipped to customers for re-melting.

Furnace 41 & Furnace 42

Furnace 41 and 42 and their emissions can be seen in Table 5.18.

C-Casting

In C-casting, aluminium is transferred from cruces into one of three furnaces: Furnace 62, Furnace 63, or Furnace 64. Furnaces 63 and 64 feed into the ingot chain, casting pure aluminium ingots weighing 23 kg each. C-casting has only two stacks: one for Furnace 62 and another shared by Furnaces 63 and 64. Both stacks are sampled twice annually for nitrogen oxide and particulate emissions, as mandated by permit requirements, though no specific permit limits are tied to these results. The metal produced in C-casting is sold to customers for re-melting purposes.

Additionally, a dust collector (6900-DCB-001) is permitted for dross cooling and is monitored for leaks. No leaks were detected in 2025.

Furnace 62

Furnace 62 was historically used for ingot chain (Table 5.20).

Furnace 63/64

Furnace 63/64 was stack sampled twice as per permit requirements, and the results are shown in Table 5.20.

Plant wide

Total Fluoride emissions

The plant-wide Total Fluoride emissions are calculated using Reduction's roof vents and gas treatment centres as well as Carbon North's fume treatment centre and pallet storage building (Figure 5.5). The plant-wide total fluoride permit limit is 0.9 kg / Mg Al.

In 2025, the total fluoride emissions were all well below the permit limit except for in September when the total fluoride emissions met, but did not exceed, the permit limit. (Figure 5.6).

A review of the historical data from 2014 to 2024 shows a significant decrease in fluoride emissions which is largely attributed to the change in technology (pots with hoods, GTC and FTC) (Figure 5.7). In recent years there has been a slight increase in emissions which is largely attributed to the restart activities.

Total Particulate emissions

The plant wide particulate emissions are calculated using reductions roof vents and the gas treatment centre (Figure 5.8). The plant wide Total Fluoride permit limit is 1.3 kg/tonne of Al.

In 2024, there were no permit exceedances of particulate emissions permit limit (Figure 5.9).

The decrease in measured particulate emissions after 2015 is a result of the modernised smelter coming on-line and the full shutdown of the old VSS operation and the change in technology (pots with hoods, GTC and FTC) (Figure 5.10). In recent years there has been a slight increase in emissions which is largely attributed to the restart activities.

Across the site, the main contributors of particulate emissions were linked to the reduction of roof vents, which contributed 57%, the coke calciner pyroscrubber, accounting for 28%, and the Gas Treatment Centres, which accounted for 14% of total particulate emissions for BC Works (Figure 5.11).

Sulphur Dioxide emissions

The plant wide sulphur dioxide permit limit was at 27 Mg per day from 2000 – 2013. In April 2013, the operation permit limit was increased to 42.0 Mg per day for the modernised smelter aluminium production increase and anticipated future decline in global anode grade coke quality (Figure 5.13) (Figure 5.13). Average SO_2 emissions have risen since 2015, a trend attributed to the smelter achieving full metal production in 2016 and sustaining an approximately 50% higher aluminium output. In 2025, the monthly average SO_2 emission levels remained well below the permit limit, with a decrease in emissions in May during the coke calcination maintenance shut-down period in May and in Carbon South as well as a downward trend towards the end of the year. (see Figure 5.12).

In addition to monitoring emissions, BC Works carries out every year extensive monitoring activities under the SO_2 Environmental Effects Monitoring program (SO_2 EEM), where four different lines of evidence are studied; water, human heath, soil and vegetation. Results and information about the SO_2 EEM can be found online at **www.riotinto.com\bcworks**

Natural Gas consumption

Natural gas is widely used at BC Works in various applications where heat is required. Variables affecting usage levels include production levels and the availability of energy generated by the hydroelectric facility at Kemano Operations.

BC Works consumption rates and associated emissions are calculated using standards developed by the US Environmental Protection Agency (US- EPA). Plant-wide natural gas consumption and preliminary data of associated emissions can be seen in Table 5.21.

Greenhouse Gas emissions

Several sources contribute to greenhouse gas (GHG) emissions at BC Works (see Figure 5.14). Operational data from these sources is used to calculate monthly and annual GHG emissions, which are reported to federal and provincial governments following verification through a third-party audit. This audit takes place after the submission of this report. The GHG emission data presented here is preliminary and subject to potential updates in the future.

Most GHG emissions are generated through the smelting process (80%), and most smelting-related emissions are attributable to anode consumption (92%), while 8% are attributable to PFC emissions (Figure 5.15).

The frequency and duration of anode effects in aluminium smelting can either increase or decrease the amount of PFC emissions which correlates to the amount of CO_2 equivalent produced in aluminium smelting. (Figure 5.16)

BC Works' GHG emissions are largely linked to operational stability within the reduction potrooms (Figure 5.17). Periods of instability can be observed in the emissions in 2019 due to early pot failure and in 2020 during the pot replacement campaign. In 2021 a labour dispute resulted in a 75% shutdown of the smelter which was followed by an increase in emissions in 2022 due to the pot restart campaign. In 2023, as operations stabilized, GHG emissions began to decrease and have continued to remain within operational expectations.

BC Works aims to continue increasing the stability of the operations and decrease the greenhouse gas emissions with a reduction target of 4% for 2026 by focusing on improvements on anode effect performance.

Nitrogen Oxide emissions

Nitrogen oxide emissions are generated plant-wide from four main sources: natural gas consumption, coke calcination, metal production, and open wood burning. In 2025, the NOx emissions showed relatively similar levels throughout the year except for the coke calcination maintenance shut-down period in May and in Carbon South.

When the new plant reached full production in 2016, so did the NOx emissions. The emissions started to decrease in 2020 as pots were removed from operation due to early pot failure. This trend continued in 2021 as additional pots were removed from production due to the labour dispute, which also included the shutdown of the coke calcination plant in 2021 and 2022. Emissions began to increase in 2023 as the plant reached full production.

Fugitive Dust Management Plan (FDMP)

The fugitive dust management plan (FDMP) provides guidance for managing and controlling fugitive dust. The FDMP does not address requirements under WorkSafe BC or other regulatory requirements beyond EMA. The FDMP is intended to cover the handling of raw materials and by-products that are normal to both the current AP4-X Pre-Bake Smelter and legacy raw materials and by-products left over from the VSS Smelter. The FDMP may be used to support construction projects within the smelter's fence line, but it is not intended to support major construction works or demolition works, which may require project-specific fugitive dust management and an action plan.

Mobile dust collectors

The fugitive dust management plan allows for the use of mobile dust collectors that meet the minimum specification of 20,000 CFM and filter efficiency of 99.99% at 0.067 microns to control fugitive emissions at the source.

Figure 5.1 Operational Areas

There are seven operational areas where emissions are vigilantly monitored. Starting at the south end of the site, there is the Wharf (green), followed by Carbon South (orange) which contains the coke calcination plant and the anode paste plant, then Reduction (yellow), Lining Delining (dark blue), Carbon North (light blue) which contains the anode bake furnace, bath treatment and storage centre, anode rodding shop, carbon recycle plant, and the pallet storage building, as well as C-Casting (purple) and B-Casting (pink).

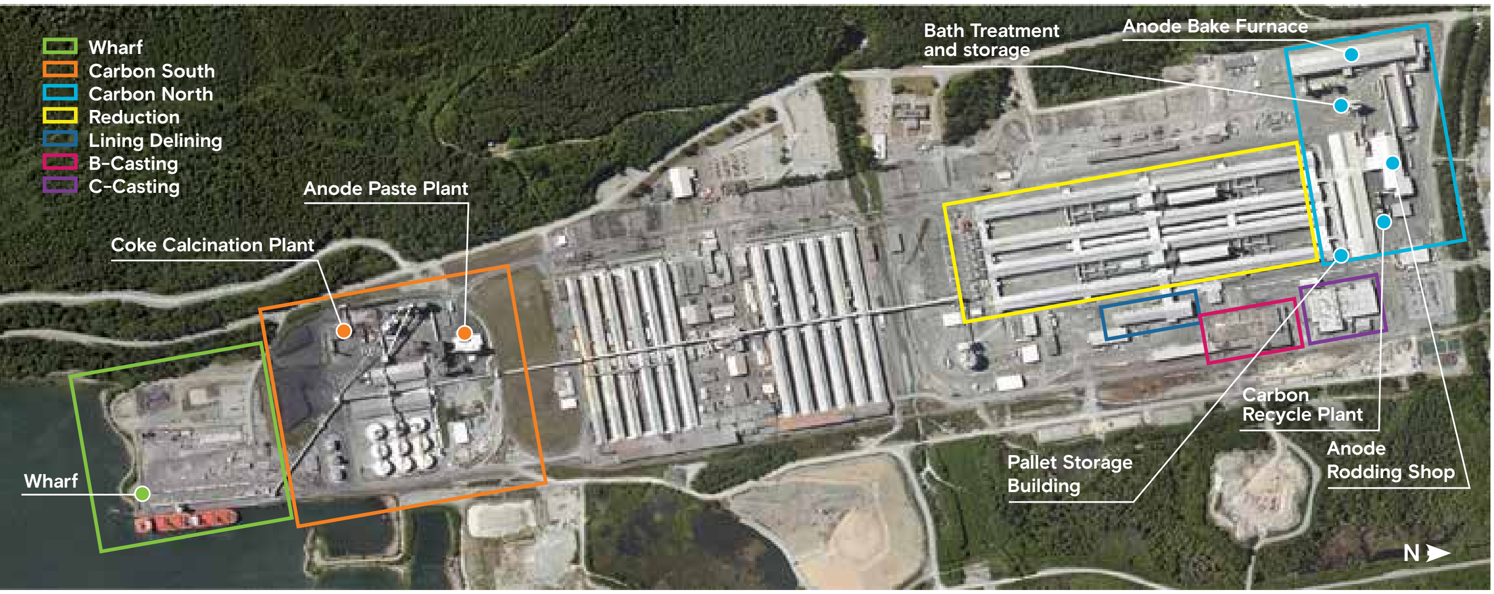


Figure 5.2 Operational Performance.

All air discharge points were compliant (green) in 2025.

Figure 5.3
Reduction Roof Vent Total Fluoride

The roof vent emissions are reported monthly from January – December.

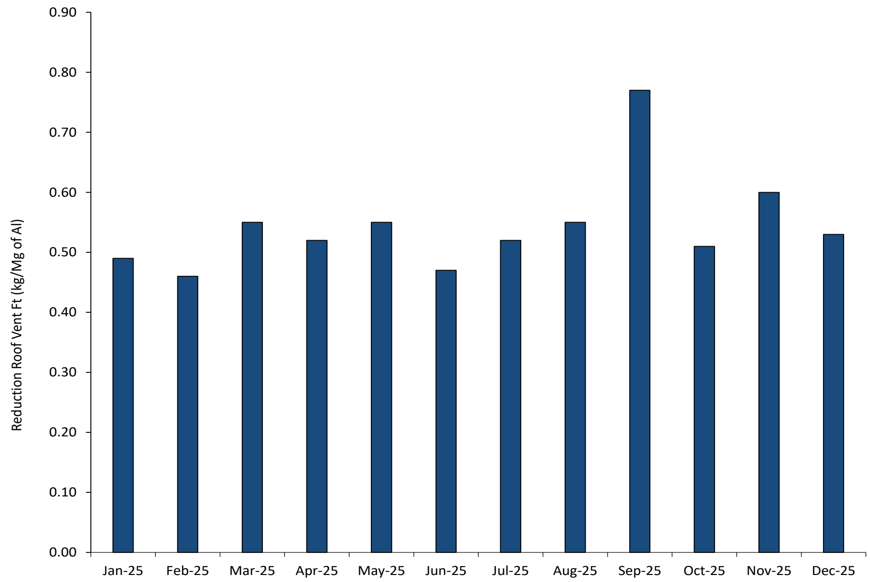


Figure 5.4
Reduction Roof Vent Particulate Emissions

The roof vent emissions are reported monthly from January – December.

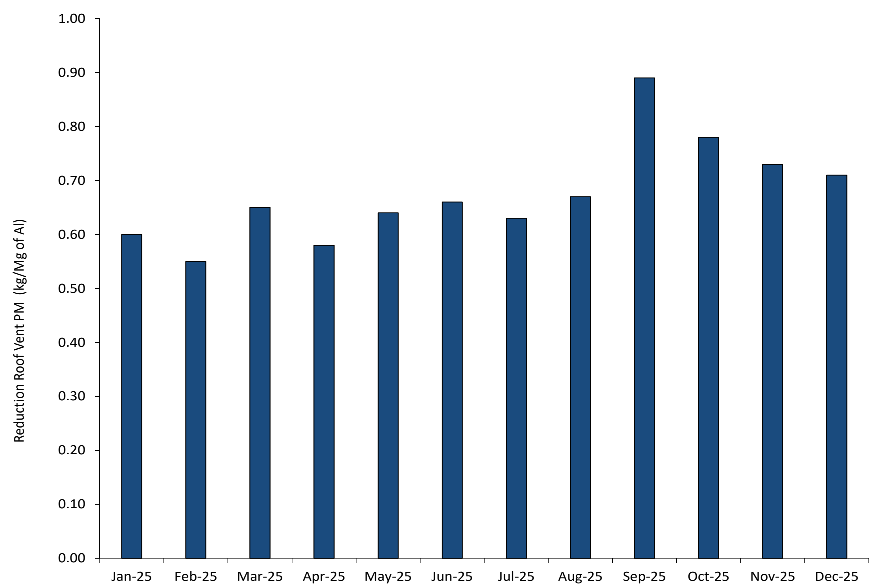
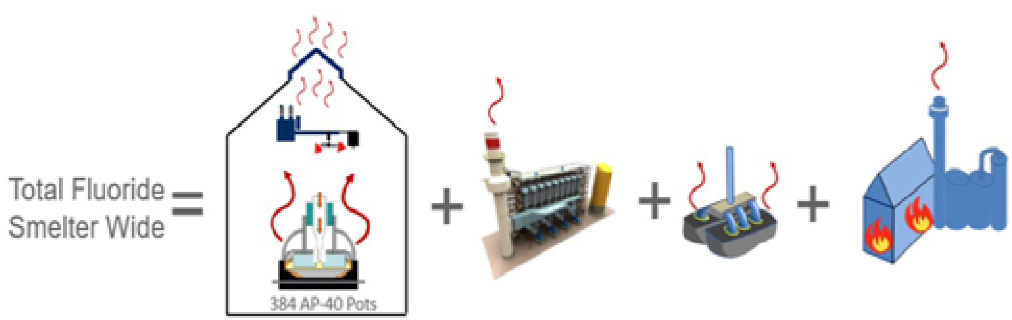


Figure 5.5 Plant-Wide Total Fluoride Emissions Calculation

The plant wide total fluoride is calculated in kilograms per Mg Al each month by adding the emissions from the reduction roof vents plus the gas treatment centre stack test results plus the emissions factor from the pallet storage building plus the stack test results from the fume treatment centre.



Source	Pot room roof vents	Gas Treatment Centers	Anode Butts	Fume Treatment Centre
Emission Type	Fugitive	Direct	Fugitive	Direct
Method	Roof cassette	Stack sample	Emission factor	Stack sample

Figure 5.6
Plant Wide Total Fluoride Emissions

The plant wide total fluoride is calculated in kilograms per Mg Al each month by adding the emissions from the reduction roof vents plus the GTC, FTC and PSB.

Note: September met but did not exceed the plant wide permit limit.

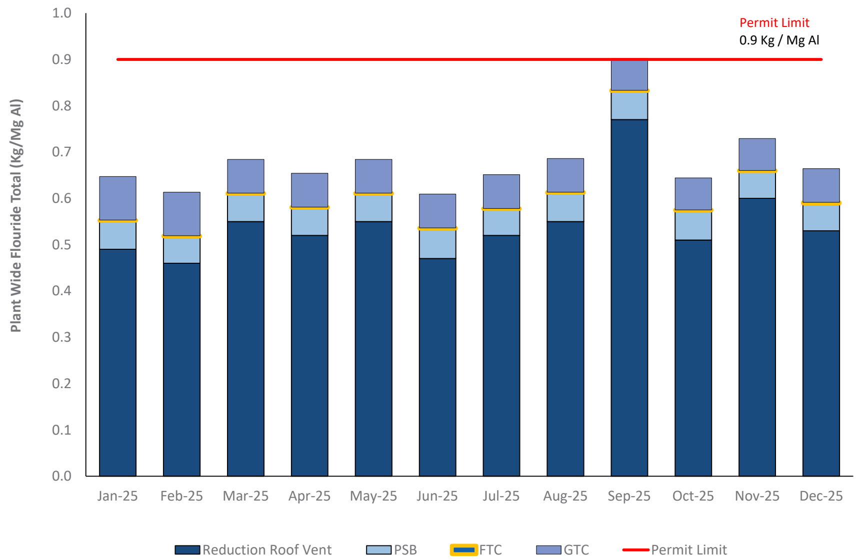


Figure 5.7
Historical Total Fluoride Emissions

The average monthly roof vent emissions for total fluoride have decreased since 2015 when the VSS smelter was shut down in October. Note years 2015 and 2016 did not consider the entire year's monthly data into the average due to data availability related to the shutdown of the VSS smelter and the start-up of the AP-4X smelter.

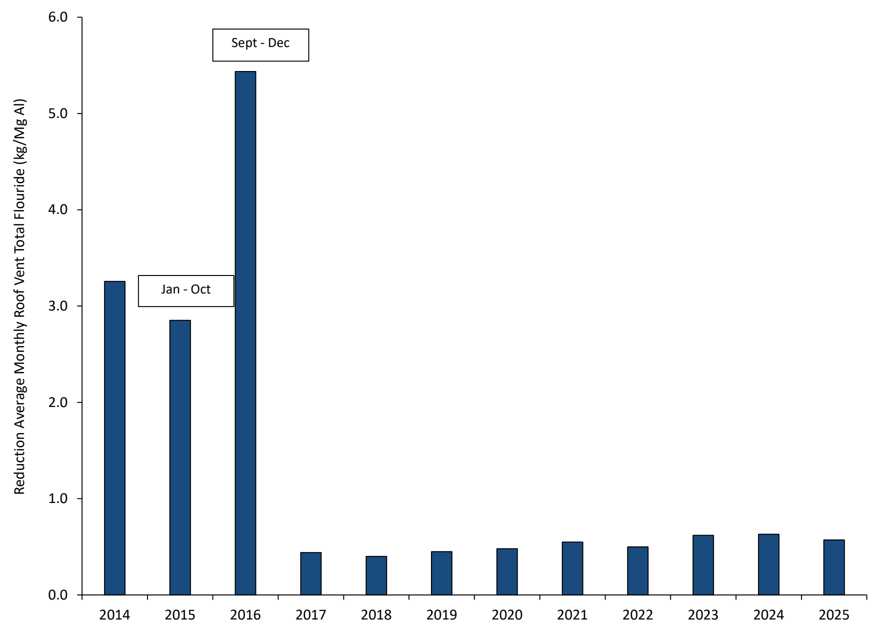
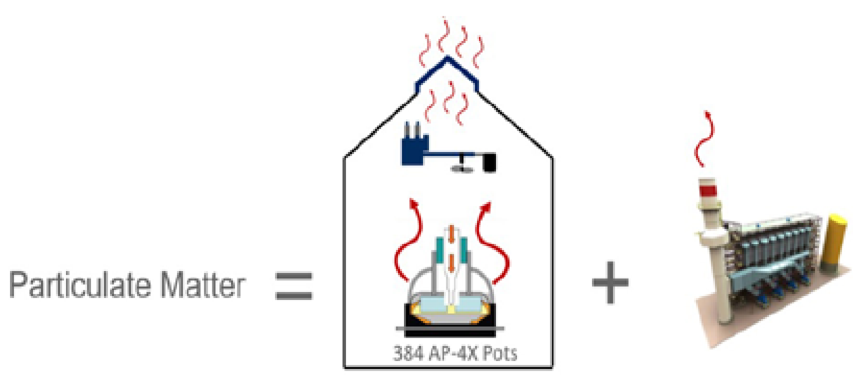


Figure 5.8
Plant Wide Particulate Emissions Calculation

The plant wide particulate emissions value is calculated in kilograms per Mg Al for each month by adding the emissions from the reduction roof vents plus the gas treatment centre stack test results.



Source	Pot room roof vents	Gas Treatment Centers
Emission Type	Fugitive	Direct
Monitoring Method	Roof Vent Cassette	Stack sample

Figure 5.9
Plant Wide Particulate Emissions Calculation

The plant wide particulate emissions value is calculated in kilograms per megagram of aluminium for each month by adding the emissions from the reduction roof vents plus the gas treatment centre stack test results. In September a new stack test was performed, and the results of that test are used for the remainder of the 2025 reporting year.

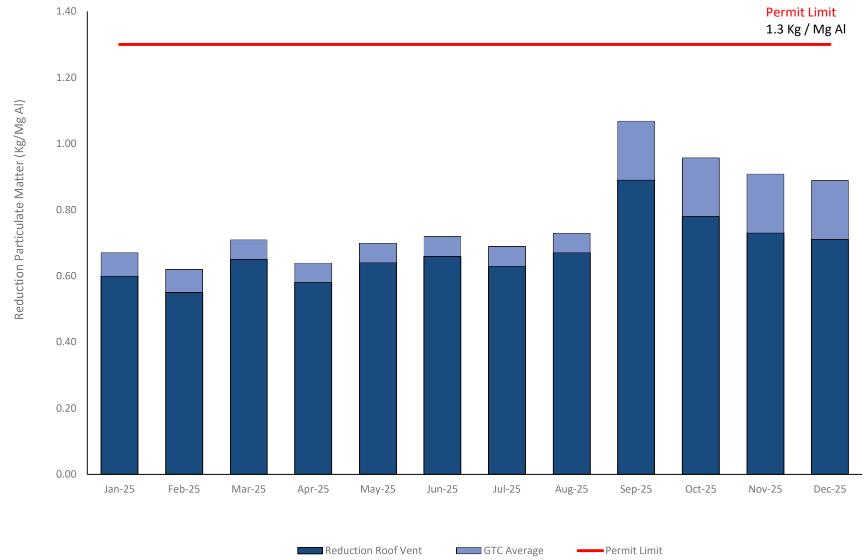


Figure 5.10
Historical Particulate Emissions

The average monthly roof vent emissions for particulates have decreased since 2015 when the VSS smelter was shut down in October. Note years 2015 and 2016 did not consider the entire year's monthly data into the average due to data availability related to the shutdown of the VSS smelter and the start-up of the AP-4X smelter.

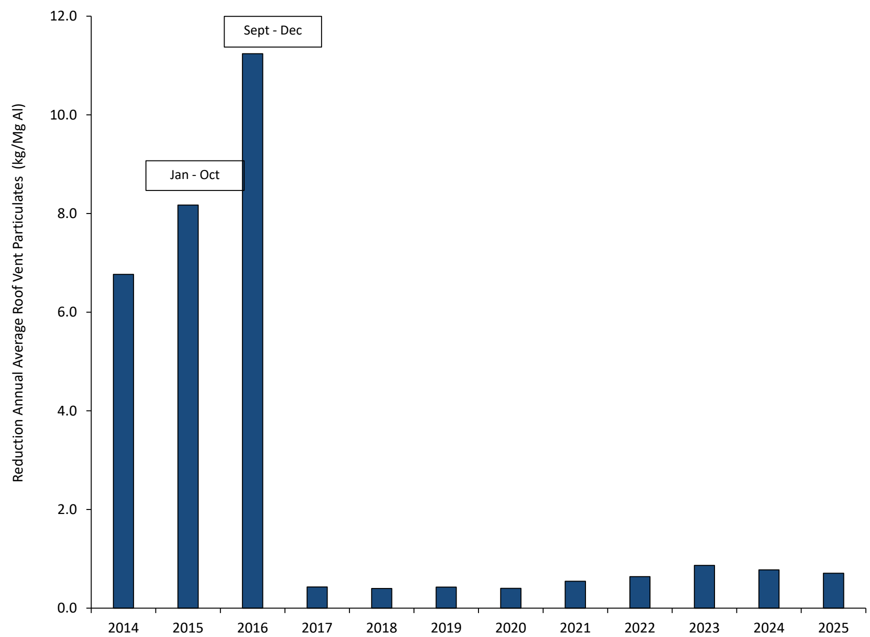


Figure 5.11
Particulate Emissions by Operational Area

The particulate emissions from the stack tests and or roof vents for each operational area were used to determine the percent of particulate emissions from each operational area.

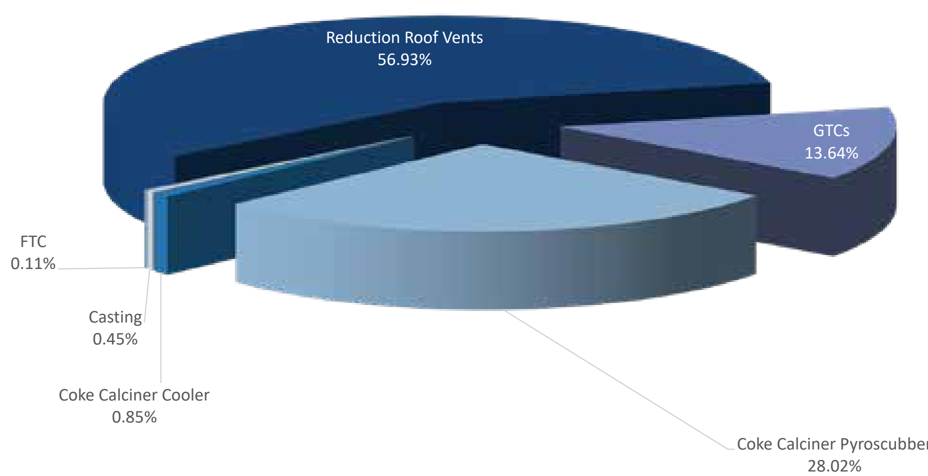


Figure 5.12
Sulphur Dioxide Emissions

Sulphur Dioxide emissions in 2025.

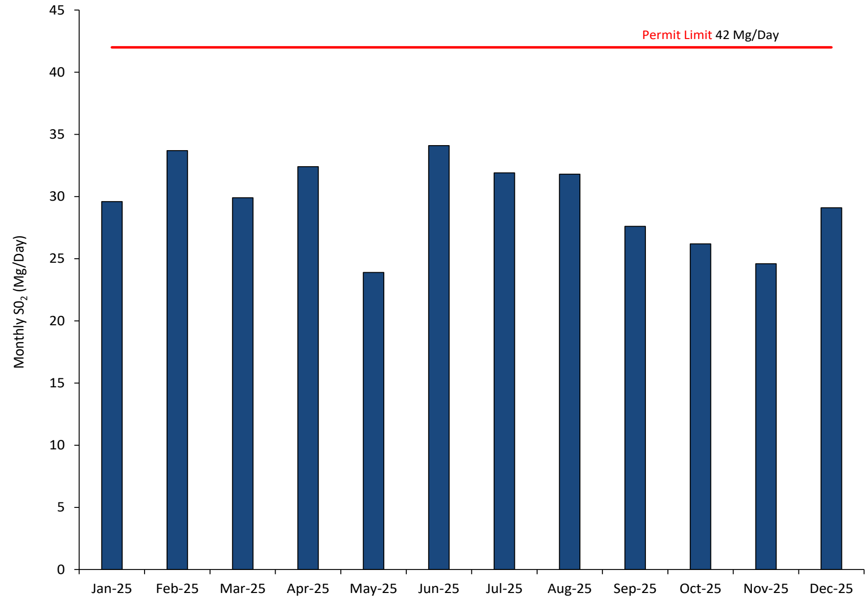


Figure 5.13
Historical Sulphur Dioxide Emissions

Increased in Sulphur Dioxide emissions started to occur in 2017 as the new AP-4X smelter became fully operational. In 2020 and 2021 a decrease in emissions is attributed to the low number of operational pots, this trend continued until the plant reached full production at the end of 2023. With full production, higher levels of SO_2 emissions are expected. Note in 2022, the coke calcination plant and subsequent stacks (pyroscrubber and cooler) were not operational.

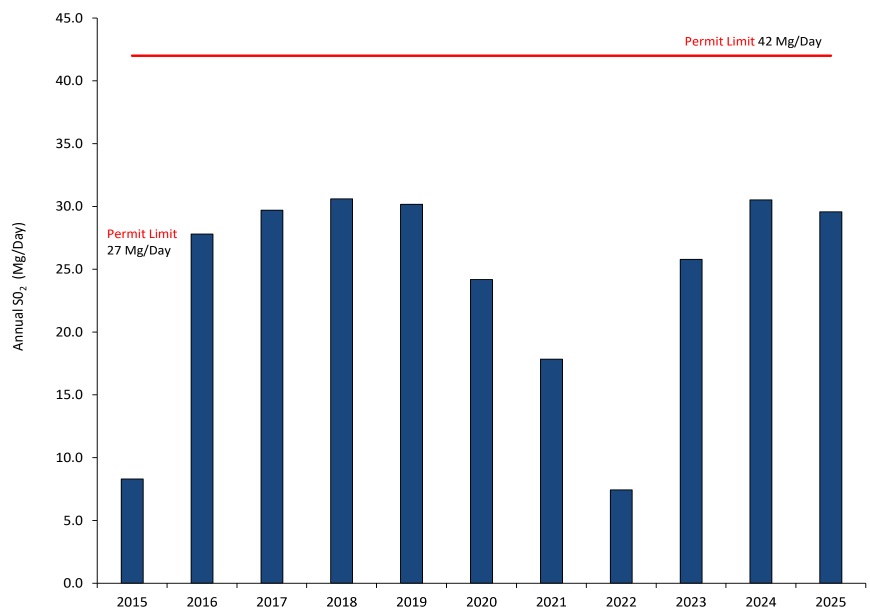


Figure 5.14
Operational sources of GHG Emissions

Aluminium smelting produces most greenhouse gas emissions during the electrolytic process.

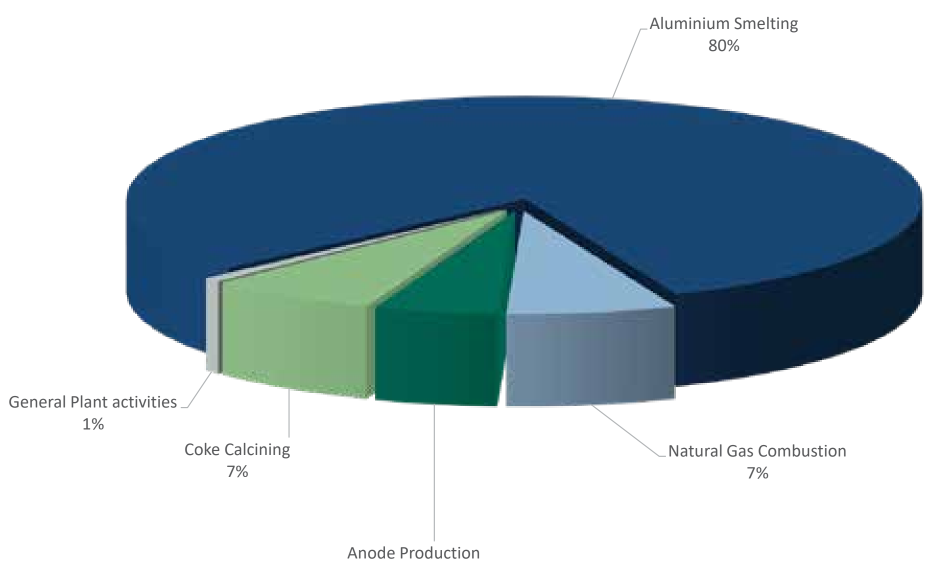


Figure 5.15
GHG Emissions from Aluminium Smelting

The consumption of anodes in the electrolytic process is typically the main contributor of greenhouse gas emissions from the aluminium smelting process.

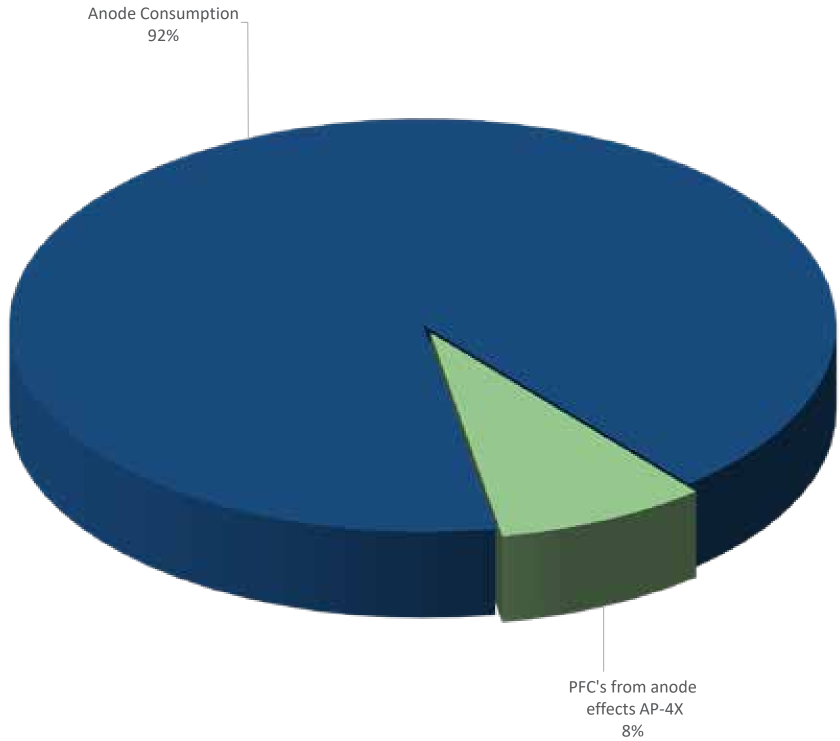


Figure 5.16
Monthly GHG Emissions & Anode Effect Duration

A few process challenges resulted in elevated anode effect duration in June, August and December.

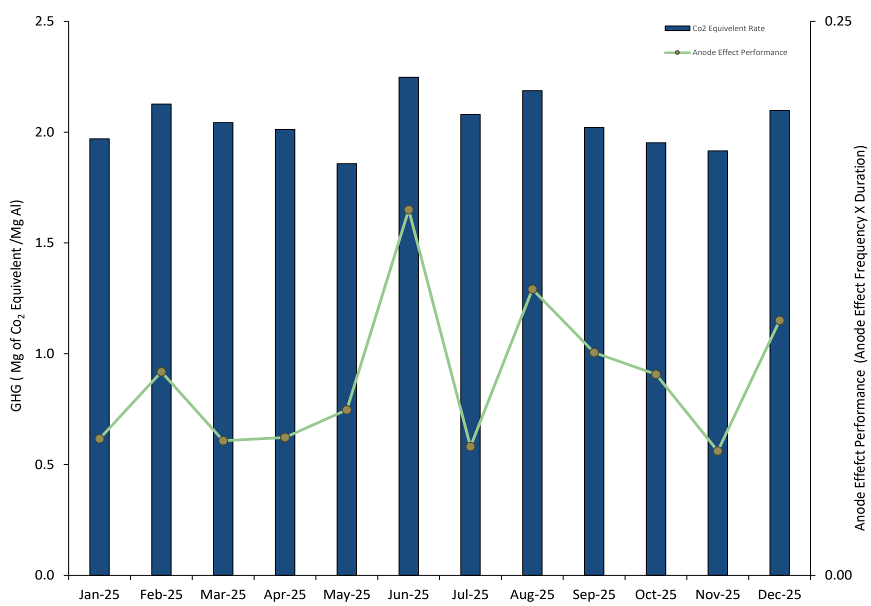


Figure 5.17
Historical GHG Emissions & Anode Effect Duration

The annual average GHG emissions (Mg of CO_2 equivalent per Mg Al) have decreased since 2015 when the VSS smelter was shut down. The variability in tonnes of CO_2 equivalent per megagram of aluminium correlates with the stability of the operation.

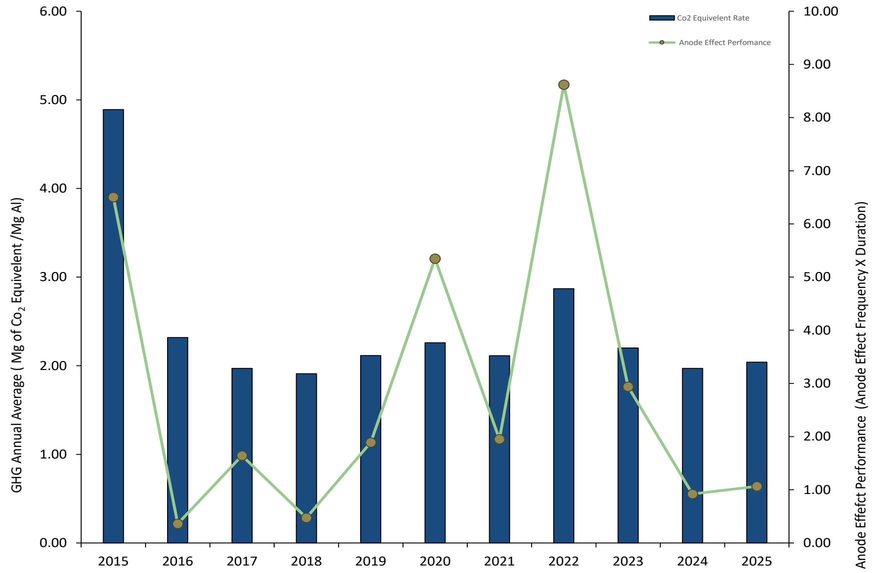


Figure 5.18
Monthly Nitrogen Oxide Emissions.

Throughout 2025, NOx emissions were below the permit limit of 1.12 Mg per day.

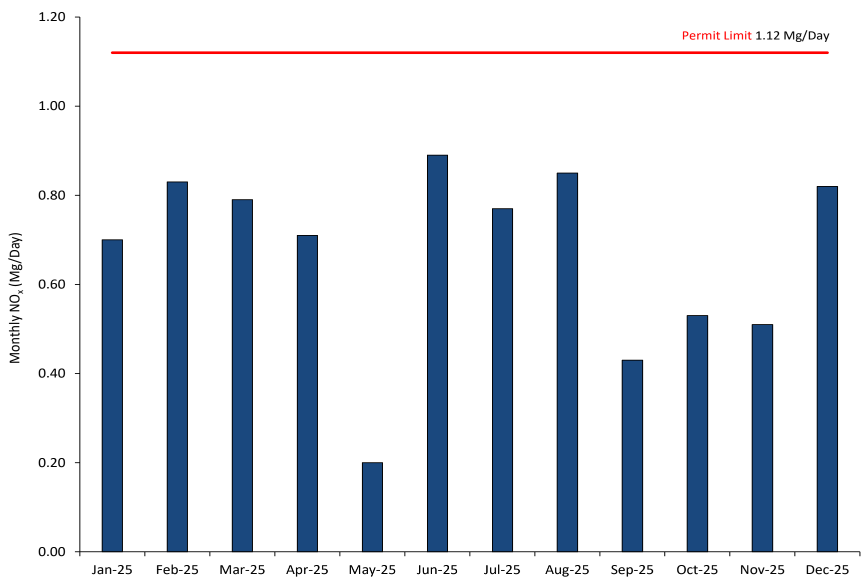


Figure 5.19
Historical Nitrogen Oxide Emissions.

Summation of annual NOx emissions from 2015 to 2025.

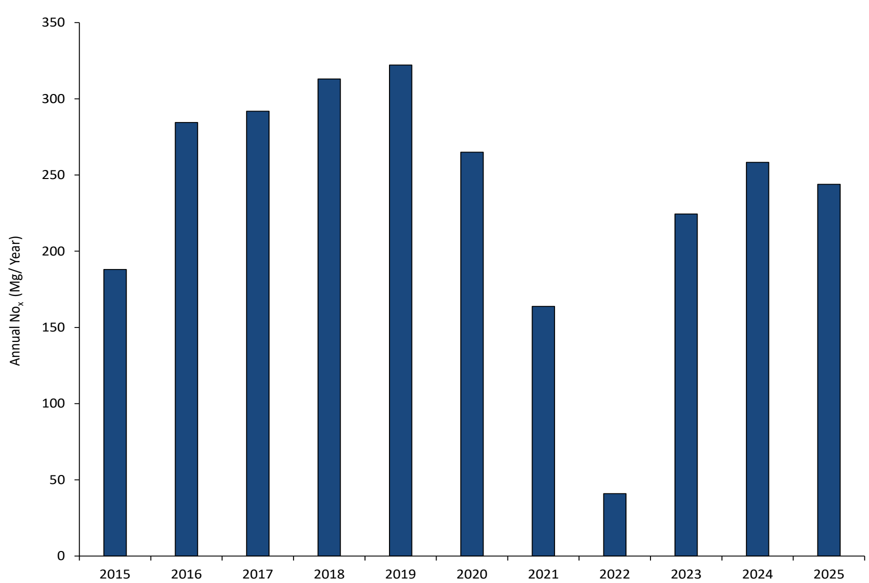


Table 5.1 Wharf Emission Control Upsets Hours

Wharf dust collectors that had upset conditions during unplanned maintenance challenges.

Date	Equipment	Upset Type	Duration	Cause
2-Jan-25	Stn3-DC-11	Unplanned	5days 2hrs 50mins	Missing blower part
10-Jan-25	Stn3-DC-11	Unplanned	13days 7hrs 30mins	Both conveyance routes undergoing maintenance
19-Feb-25	Air slide into E silo	Unplanned	3hrs 45mins	Air damper open too wide and missing filters
22-Feb-25	Bin 21-DC-19	Unplanned	3days 0hrs 30mins	Part repair
12-May-25	Stn4-DC-13	Unplanned	6mins	Filter change
12-May-25	Bin 21-DC-19	Unplanned	6mins	Filter change
22-Jul-25	B134-DC-17	Unplanned	2hrs 24mins	Clogged dust collector bags
30-Jul-25	Stn4-DC-13	Unplanned	8mins	Clogged dust collector bags
19-Aug-25	T5-DC2A	Unplanned	7mins	Loose DC filters
25-Aug-25	K3 Alumina Unloader	Unplanned	15mins	Filter failures
4-Sep-25	K3 Alumina Unloader	Unplanned	1hr 55mins	Filter failures
10-Nov-25	Tower 10 - DC 21	Unplanned	24 mins	Filter failures

Table 5.2 Carbon South Emission Control Bypass/Upset Hours

Carbon South emission control devices that were not treating the emissions as expected during unplanned scenarios (such as a power outage) or for planned and unplanned maintenance activities.

Date	Equipment	Upset Type	Duration	Cause
20-Feb-25	552 Incinerator (FC3)	Unplanned	2hrs 54mins	No plant air caused incinerator to stop
12-Mar-25	552 Incinerator (FC3)	Unplanned	6hrs 16mins	552 Incinerator Tripped
21-Apr-25	B565-DC-9	Unplanned	4days 8hrs 45mins	Damaged parts
7-May-25	552 Incinerator (FC3)	Unplanned	4hrs 54mins	No plant air caused incinerator to stop
26-May-25	B565-DC-9	Approved	17days 15hrs 0mins	Critical part damaged
23-Jun-25	B565-DC-9	Unplanned	1 day 2 hours 54mins	Rotary valve bridged
27-Jul-25	Dedusting Over Coke Dust Bin	Unplanned	60 mins	Plugged filter
20-Aug-25	552 Incinerator (FC3)	Planned	10hrs 0mins	Instrumentation preventative maintenance
25-Aug-25	552 Incinerator (FC3)	Unplanned	1hr 6mins	Power Loss caused incinerator to trip
11-Sep-25	552 Incinerator (FC3)	Unplanned	20 mins	Communication Failure
21-Nov-25	575 Incinerator (LPI)	Planned	5days 0hrs 52mins	Planned maintenance on the electrical power transformer supplying power to the incinerator
22-Nov-25	B558-Vacuum	Unplanned	15mins	Improper connection to vacuum bags
25-Nov-25	B558-Vacuum	Unplanned	10mins	Improper connection to vacuum bags

Table 5.3 Calcined Coke Stack Test – Pyroscrubber

The Pyroscrubber stack was sampled twice in 2025. Both sampling results were within permit limits.

Performance Measure	Pyroscrubber	
Date	March 2025	Sept 2025
Particulate (kg/hr) Permit Limit: 21.1 kg/Hr	10.3	3.1
SO_2 (kg/hr)	109	171
NOx (kg/hr)	16.4	11.8

Table 5.4 Calcined Coke Stack Test – Cooler

The Venturi scrubber stack was sampled twice in 2025 and were within permit limits.

Performance Measure	Venturi	
Date	March 2025	Sept 2025
Particulate (kg/hr) Permit Limit: 3.9 kg/Hr	0.17	1.9
PAH (mg/m^3)	0.008	<0.002

Table 5.5 Liquid Pitch Incinerator (LPI) Stack Test

The LPI was stack sampled once in 2025, and the stack test result was compliant.

Performance Measure	LPI
Date	September 2025
Particulate (mg/m^3) Permit Limit: 500 mg/m^3	3
PAH (mg/m^3)	0.0005

Table 5.6 FC-3 Stack Tests

The FC-3 incinerator stack was sampled once in 2025, and the results were within permit requirements for particulates.

Performance Measure	FC-3
Date	September 2025
Particulate (mg/m^3) Permit Limit: 120 mg/m^3	2.5
PAH (mg/m^3)	0.13

Table 5.7 Anode Paste Plant Dust Collector Stack Tests

The dust collectors at the anode paste plant were stack sampled once in 2025 and were compliant with permit limits.

Performance Measure	Dust Collectors				
	DC10	DC11	DC12	DC13	DC14
Dates	Sept 2025	Sept 2025	Sept 2025	Sept 2025	Sept 2025
Particulate (mg/m^3) Permit Limit: 120 mg/m^3	0.6	4.4	9.6	2.2	3.5

Table 5.8 Pitch Vapor Treatment (PVT) Stack Test

The PVT stack was sampled, and results were within permit requirements for particulates and PAHs.

Performance Measure	PVT
Date	March 2025
Particulate (mg/m^3) Permit Limit: 30 mg/m^3	1.1
PAH (Kg/Mg of Paste) Permit Limit: 0.03 Kg/Mg of Paste	0.005

Table 5.9 Fume Treatment Center Bypass Hours

This emission control device may be bypassed during unplanned scenarios (such as a power outage) or for preventative maintenance purposes.

Date	Equipment	Upset Type	Duration	Cause
27-Feb-25	Mode 2	Unplanned	1hr 14mins	Air fluidization fans motor was not available – motor belt damage
11-Mar-25	Mode 2	Planned	7hrs 55mins	Inlet Plenum Cleaning
24-Jun-25	Mode 2	Planned	8hrs 5mins	Inlet Plenum Cleaning
7-Jul-25	Modes 2-3-4	Unplanned	2hrs 23mins	No flow for the cooling tower water pump – valve was closed
16-Jul-25	Modes 2-3-4	Unplanned	41mins	Human error – wrong bypassed while doing the PM
13-Aug-25	Mode 2	Unplanned	2hrs 30mins	While doing the PM for the exhaust ramp lid replacement, system was not placed in fire move mode which cause the FTC bypass (mode 2)
9-Sep-25	Mode 2	Planned	7hrs 13mins	Inlet Plenum Cleaning
9-Dec-25	Mode 2	Planned	9hrs 56mins	Inlet Plenum Cleaning

Table 5.10 Fume Treatment Center Stack Test

The FTC stack was sampled in 2025 and was within permit expectations.

Performance Measure	FTC
Dates	Sept 2025
Particulate (Kg/Mg of baked Anode) Permit Limit: 0.3 Kg/Mg of baked Anode	0.04
PAH (Kg/Mg of baked Anode) Permit Limit: 0.05 Kg/ Mg of baked Anode	0.00007
Fluoride Total (Kg/Mg Al)	0.002
Fluoride Total (Kg/Mg Al) Permit Limit: Included in Plant Wide limit	0.0009
SO_2 (Mg/day) Permit Limit: Included in Plant Wide limit	2.9
NOx (Mg/day) Permit Limit: Included in Plant Wide limit	0.5

Table 5.11 Leak Detection

Leaks are monitored on a number of dust collectors in Carbon North that play a role in the anode rodding, carbon recycling and bath treatment.

	Number of Leaks Detected											
Emissions control device	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Anode Rodding Shop 5610-DCB-001	0	0	0	0	1	0	0	0	0	0	0	0
Anode Rodding Shop 5610-DCB-003	0	0	0	0	1	0	1	1	0	0	0	1
Carbon Recycling 5810-DCB-001	1	5	0	2	1	1	0	2	0	0	0	0
Bath treatment and storage 5710-DCB-001	0	0	2	6	6	4	2	1	4	6	1	1
Bath treatment and storage 5710-DCB-003	0	1	0	3	2	6	4	4	3	2	4	1

Table 5.12 Bath Treatment and Storage Stack Test

The bath treatment stacks are monitored annually for particulates, and both stacks were compliant.

Performance Measure	DCB-001	DCB-003
Dates	March 2025	March 2025
Particulate Emissions (mg/m^3) Permit Limit: 30 mg/m^3	1.4	0.6

Table 5.13 Gas Treatment Center (GTC) Upset Hours

The East and West GTC are emission control devices that can cause an upset during unplanned scenarios (such as a power outage) or for preventative maintenance purposes (such as airlift cleaning).

Date	GTC	Category	Upset Type	Duration	Cause
17-Jun-25	East	Planned	No Feed	4hrs 25mins	Critical repair (change the knife gate on the 300 ton fresh alumina silo)
16-Jun-25	West	Unplanned	No Exhaust	26mins	Power Ops tripped the West GTC
31-Jul-25	West	Planned	No Feed	8hrs 0mins	Non-routine maintenance (change the fluidizing fabric on the fresh alumina distribution box)
31-Jul-25	West	Unplanned	No Feed	2hrs 0mins	Unexpected maintenance delay due to challenged target location
03-Sep-25	West	Unplanned	No Suction	13mins	GTC shutdown that resulted in GTC's key components to not operate
30-Nov-25	East	Unplanned	Reduced Feed	10hrs 45mins	EPS Pit plugged/ No alumina to the GTC's had to reduce feed to keep fresh flowing
01-Dec-25	West	Unplanned	Reduced Feed	10hrs 45mins	EPS Pit plugged/ No alumina to the GTC's had to reduce feed to keep fresh flowing
11-Dec-25	West	Unplanned	Other	11hrs 15mins	Transformer Failed

Table 5.14 Gas treatment center Stack Test

The GTC stacks were sampled twice during 2025. Both tests were compliant with permit limits.

Performance Measure	GTC East	GTC West
Date	March 2025	Sept 2025
Total Particulates (mg/m^3)	0.39	3.5
Particulate (Kg/Mg of Aluminium) Permit Limit: Included in Plant Wide limit	0.04	0.32
Particulate (Kg/Mg of Aluminium) Permit Limit: Included in Plant Wide limit	0.18	
Total Fluoride (mg/m^3)	0.4	1.05
Fluoride Total (Kg/Mg of Aluminium) Permit Limit: Included in Plant Wide limit	0.04	0.098
Fluoride Total (Kg/Mg of Aluminium) Permit Limit: Included in Plant Wide limit	0.069	

Table 5.15 Delining Stack Test

The 4421-DCB-001 dust collector was stack sampled and was within permit limits.

Performance Measure	4421-DCB-0011
Date	September 2025
Particulate (mg/m^3) Permit Limit: 10 mg/m^3	4

Table 5.16 Delining leak detection

Leaks are monitored at the lining delining dust collector.

Emissions control device	Number of Leaks Detected											
	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Lining Delining 4421-DCB-001	1	0	3	5	1	2	2	0	1	1	2	1

Table 5.17 Casting Emission Control Upsets Hours

Casting dust collectors that had upset conditions in 2025, including bypass of permitted dust collector for project to install a new dust collector. .

Date	Equipment	Upset Type	Duration	Cause
07-May-2025	6260-DCB-001	Unplanned	3 hrs	Clogged hopper

**A mobile dust collector was deployed to control the dust.*

Table 5.18 B Casting - Bi-Annual Stack Test

The stack tests were completed as per permit requirements for both furnace 41 and furnace 42.

Performance Measure	B Casting			
	Furnace 41		Furnace 42	
Dates	March 2025	Sept 2025	March 2025	Sept 2025
NOx (mg/m^3)	0.08	0.03	0.05	0.11
Chloride (mg/m^3)	164.8	186.1	249	243.6
Chlorine (mg/m^3)	4.5	3.5	3.2	3.3
Particulate (mg/m^3)	39.9	53	59.5	45.7

Table 5.19 Dross treatment leak detection

Leaks are monitored at the dross treatment dust collector.

Emissions control device	Number of Leaks Detected											
	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Dross Treatment 6900-DCB-001	0	0	0	0	0	0	0	0	0	0	0	0

Table 5.20 C Casting – Bi-Annual Stack Test

The stack tests were completed as per permit requirements for both furnaces 62 and 63/64.

Performance Measure	C Casting			
	Furnace 62		Furnace 63-64	
Dates	March 2025	Sept 2025	March 2025	Sept 2025
NOx (mg/m^3)	0.9	0.7	3.5	1.5
Particulate (mg/m^3)	1.3	1.9	1.3	1.7

Table 5.21 Plant Wide – Natural Gas Consumption and Associated Emissions

The amount of natural gas consumption varies depending on operational dynamics.

Year	Natural Gas Consumption (m^3/y)	Associated Emissions (tonnes/year)			
		Nitrogen Oxides	Total Particulate	Sulphur Dioxide	Carbon Monoxide
Emission Factor kg/10^6 m^3		**1600**	**30.7**	**9.6**	**1344**
2021	25,955,000	41.53	0.8	0.25	34.88
2022	22,750,900	36.4	0.7	0.22	30.58
2023	29,700,000	47.52	0.91	0.29	39.92
2024	30,644,200	49.03	0.94	0.29	41.19
2025	30,065,300	48.1	0.92	0.29	40.41

Table 5.22 Mobile Dust Collector Usages in 2025

Three different areas deployed mobile dust collectors to control fugitive dust for their process.

Operational Area	Process Description	Exhaust Type	Bypass	Duration
Casting (B130)	Additional dust management during Cruce cleaning plan B at B130, managing cryolite	Outside	No	12 months on/off as required
Casting (B4440)	Additional dust management during Cruce cleaner while B221 Cruce cleaner dust collector is being replaced, managing cryolite	Outside	Yes	Feb, Mar on/off as required
Wharf (9 Silos)	Additional dust management during truck loading of alumina	Outside	No	May, Sept, Oct, Dec on/off as required

6. Air quality monitoring

This chapter presents the 2025 air quality and meteorological monitoring reporting requirements according to section 8.5 of the Permit.

Network overview

Seven air quality parameters are monitored: hydrogen fluoride (HF), sulphur dioxide (SO_2), polycyclic aromatic hydrocarbons (PAHs), Ozone (O_3), Nitrous Oxide (NOx), and two levels of fine particulate matter. Particulate matter is referred to as PM_{10} and $PM_{2.5}$ and is measured against size thresholds of 10 and 2.5 microns, respectively. Rio Tinto voluntarily upgraded the Whitesail monitoring station in 2018 with the Nitrous Oxide (NOx) and Ozone (O_3) monitors so that an Air Quality Health Index (AQHI) for Kitimat can be reported.

The collected air quality data are reported out according to the Permit. Specifically, Section 8.5 of the Permit requires the following reporting:

- SO_2 and HF: Mean monthly concentration and daily hourly maximums.
- $PM_{2.5}$ and $PM_{10:}$ Daily average and daily hourly maximum concentrations.
- PAH (15 congeners): all PAH data as 24-hour average on the NAPS schedule.
- Rain chemistry for the Haul Road and Lakelse Lake stations (SO_2 EEM deposition stations).

The scope of this chapter is to provide an interpretive summary of the above permit required monitoring and reporting. Table 6.1 and figure 6.1 present the scope and location of the ambient air quality monitoring.

Weather monitoring

Meteorological (weather) monitoring data, including wind speed and direction, and temperature are collected at five air quality monitoring stations (Haul Road, Service Center (Industrial Ave.), Riverlodge, Kitamaat Village, and Whitesail) plus the Yacht Club station. Precipitation monitoring and chemistry analysis are undertaken using samples collected at the Haul Road and Lakelse Lake stations. Relative humidity is additionally collected at the Industrial and Whitesail monitoring stations. The weather data provides additional insight into air quality data interpretation.

Quality assurance and control

The validation of air quality data is conducted using a quality control/quality assurance process. The quality control component is to ensure that all instrument maintenance and operational guidelines for the instruments are being followed correctly and documented. Moreover, when summarizing air quality data, a data completeness criterion of 75% is applied, as recommended in Ministry of Environment and Parks (BC ENV) guidance documents.

Air quality monitoring stations in the Kitimat valley are operated by an independent consultant. A technician performs weekly inspections, calibrations, and routine maintenance on the equipment. Air quality data are reviewed each business day, validated monthly, and submitted to the Ministry. In the event where remedial actions are required to ensure the validity of the data, this information is reported to the Ministry.

The quality assurance audit procedure is conducted by Ministry staff. This involves visits twice per year to the sites. A review of station and instrument documentation, condition and a reference audit calibration check on each instrument being operated under permit is completed. The results of the quality control/quality assurance process are then used to validate the data collected by the Provincial Air Quality Monitoring network **(www.env.gov.bc.ca/epd/bcairquality).**

The Ministry audited the ambient air quality monitoring network from February 26-27, 2025, and again from July 29-30, 2025. Village (SO_2, $PM_{2.5}$), Haul Road (SO_2, $PM_{2.5}$), Industrial (SO_2), Riverlodge (SO_2, $PM_{2.5}$, PM_{10}), and Whitesail (NOx, O_3, SO_2, $PM_{2.5}$) were included in each audit. Every audit result passed.

Amendment to Section 8.5 ambient air monitoring and reporting

The BC ENV amended section 8.5 of the permit for ambient air monitoring and reporting requirements on November 30, 2023. This chapter has been updated to include the new reporting requirements for ambient air quality (s. 8.5.5.2) and meteorological monitoring (s. 8.5.7.2). The new reporting requirements require an annual review of the air quality data and meteorological data quality review by a QP. This chapter is intended to meet these reporting requirements. The presentation of monitoring results, data capture, data validation and instrument validation has been prepared by Trinity Consulting.

2025 Monitoring results

Ambient air quality monitoring for all results stations and parameters is presented in Table 6.2. Air quality data used in this report was extracted from BC ENV's ENVISTA database each month throughout 2025. In 2025, another industrial emitter started operations in Kitimat and air quality monitoring results are cumulative of source emissions for the respective monitoring parameters.

Hydrogen Fluoride (HF)

HF concentrations are measured with Picarro analyzers (cavity ring down spectroscopy). HF monitoring results are presented in both Table 6.2 and Figure 6.2. Since the smelter has been modernized, ambient HF concentrations are typically very low (less than 1 ppb).

Sulphur Dioxide (SO_2)

SO_2 is monitored at three residential stations (Whitesail, Riverlodge, and Kitamaat Village) in addition to the Industrial Haul Road station, Service Centre (Industrial Ave.), and Lakelse Lake. The Permit requires the reporting of hourly daily maximums and monthly averages. A summary of the 2025 monitoring results is provided in Table 6.2 and monthly means are shown in Figures 6.3a to 6.3c. Daily hourly averages for 2025 for all five stations are presented in Figures 6.4a to 6.4f.

Additionally, the summary statistics in Table 6.2 include the percentile results for comparison to the Provincial SO_2 Air Quality Objective. In comparison to the SO_2 air quality objective's threshold of 65 ppb, the Haul Road station measured the highest hourly concentration, which was 150% of the threshold. The maximum hourly average SO_2 concentrations at the community stations shown in Table 6.2 ranged from 26.2 ppb to 84.1 ppb. There were 2 days in 2025 in which the Service Centre air monitoring station's SO_2 hourly concentration was above 65 ppb. The maximum annual average SO_2 concentration at a community station was 1.7 ppb.

Particulate ($PM_{2.5}$ and PM_{10})

Fine particulates have a wide variety of sources, both natural and human caused. In northern BC, forest fires (prescribed and wild), and emissions from fireplaces and wood burning stoves, are among the major contributors to fine particulates.

In addition to these primary particulate emissions, further contribution occurs due to gas emissions undergoing physical and chemical reactions. Emissions from BC Works, including sulphur dioxide and nitrogen oxides, are among the precursors to these secondary particulates.

Provincial ambient air quality objective's threshold for PM_{10} is 50 micrograms per cubic meter ($\mu g/m^3$) averaged over 24 hours while the air quality objective threshold for $PM_{2.5}$ is 25 ug/m^3 and is evaluated at the 98th percentile of the daily average for 1 year.

The Permit requires the reporting for particulate matter to include both daily average and daily hourly maximum concentrations for both $PM_{2.5}$ and PM_{10}. Beyond the required permit reporting, additional statistics for fine particulates are presented in Table 6.2. Charts of the daily average fine particulates for all the reporting stations are provided in Figures 6.5a to 6.5d and 6.6. Average residential $PM_{2.5}$ levels for Kitimat are low, ranging between 3.7 ug/m^3 to 5.0 ug/m^3. Residential stations showed elevated $PM_{2.5}$ levels at times, with 2 to 7 days over the 25 ug/m^3 air quality objective in 2025.

Nitrogen Oxides (NOx) and Ozone (O_3)

NOx and O_3 monitoring results from the Whitesail station are presented in figures 6.7 and 6.8. NOx and O_3 are provided for the purposes of supporting the Kitimat AQHI reporting.

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are primarily generated from the anode manufacturing processes (liquid pitch storage, Anode Paste Plant and Anode Baking Furnace); in both particulate and gaseous forms. Other sources of ambient PAHs include vehicle exhaust, petroleum fuel fumes and smoke from wood burning and forest fires. Ambient air monitoring is conducted to monitor for 15 different PAHs listed in the Permit. Sampling is done on a schedule that is coordinated with the National Air Pollution Surveillance (NAPS) to enable comparison of findings from different monitoring sites. PAH monitoring is done at 3 stations, the Haul Road, Whitesail and Kitamaat Village stations.

The 2025 ambient PAH monitoring results are summarized in Table 6.4. The annual average PAH concentration was 17.3 ng/m^3 at the Haul Road station, 4.2 ng/m^3 at the Whitesail station, and 13.3 ng/m^3 at the Kitimat Village station. In 2025, total PAH concentrations were approximately consistent in comparison to 2024. Figures 6.9a to 6.9c present the 2025 sampling results for the three stations.

The PAH congeners are sorted according to molecular weight in Figure 6.10; over 80% of the PAHs at Haul Road and Kitimaat Village are light molecular weight PAHs. Approximately 70% of the PAHs at Whitesail are light weight PAHs. Changes in distribution of PAH congeners between the stations are not only due to distance from the smelter source, but also due to photochemical degradation and seasonal contributions of non-smelter PAH sources.

Rain chemistry

Precipitation samples are collected on a weekly basis from the Haul Road and Lakelse Lake Deposition stations. Rain chemistry monitoring has been conducted since 2000 and was expanded to include Lakelse Lake in 2013. Total precipitation depths are presented in Figure 6.11a. Samples are assessed for rain acidity and concentrations of 11 specific substances. Weekly measurements falling within the 2025 water year (October 1st, 2024, to September 30th, 2025) are presented in Figures 6.11b to 6.11e. Precipitation chemistry is used in the SO_2 EEM program to estimate the amount of sulfate deposition in the Kitimat Valley.

Percent data capture

All parameters (air quality and meteorological) met the data capture goal of 90% for the year (table 6.3).

Data validation

The data validation process involves actions and decisions which result in the transition of the as-collected data to a final dataset with an established level of data validity. Level 0 data are obtained directly from the instrument with no modifications.

Level 1 data features the primary removal of data values. Data are removed when a malfunction is present, and it is clear the instrument is not functioning within procedural tolerances. This may include, but is not limited to, power outages, wildlife damage, instrument failure, communication issues, and severe weather. Data are removed when maintenance or automated checks occur. Cross-references are made between station log entries and manually flagged data. When retrievable, missing data is backfilled anytime the primary collection system failed. Data are removed if automated checks, field calibration checks, or audits indicated the instrument was operating outside of acceptable tolerance levels. Valid data must withstand the criteria outlined in the BC Field Sampling Manual Part B and CSA R101:22 documents.

Level 2 data is the product of the final review process. Data are viewed on time-series plots and compared against independent datasets, such as collocated parameters and parameters from nearby stations. Data is returned to the level 1 process if anomalies are detected. Data are accepted as valid after a final reviewer has examined all justifications for removing data and performed their independent comparison of datasets.

Instrument performance evaluation

Proper siting of ambient air quality monitoring stations is essential to accurately measure gases in the area without bias induced by highly localized environmental factors. Each air quality monitoring station in the Kitimat ambient air network consists of a climate-controlled shelter, which protects equipment from precipitation, rodents, fluctuations in temperature and humidity, vandalism, and excessive dust or dirt. The shelter temperature is maintained between 20 and 30 degrees Celsius (°C) and needs to be stable within ± 2°C across each 1-hour period. Sample inlets are installed at a minimum height of 2 meters (m) above ground level, and are not installed near building ventilation, HVAC systems, frequently disturbed dust sources, or any other exhaust sources that may interfere with accurate ambient readings.

Routine inspections are performed to ensure monitoring equipment is operating properly as intended. Preventative maintenance is performed, as necessary, which includes shelter integrity checks, routine filter replacements, manifold checks, equipment checks, supply stock checks, and station temperature checks. A non-conformance occurs when manufacturer specifications, or specifications within the B.C. Field Sampling Manual, cannot be met. All non-conformances are investigated to identify the root cause of the failure, documented, a corrective action is implemented, and a corrective action report is sent to the BC ENV.

Daily zero and span verification checks are conducted on the air quality analyzers. Multi-point verification checks on gas analyzers occur after installation, bi-annually, before and after analyzer maintenance, prior to calibration, prior to shut-down, when zero or span checks indicate a need for calibration, and when instrument behavior indicates a potential problem. A calibration occurs anytime a multi-point verification falls outside of acceptable criteria. Ozone analyzers are calibrated using a calibrator with a UV photometer. Zero-air supply systems that utilize scrubbing media and filters are regularly maintained. Gas cylinders at ambient air monitoring sites are stored to prevent contamination with water. If contamination occurs, the gas cylinder is removed and replaced.

Monthly flow and leak checks are conducted on the PM_{10} and $PM_{2.5}$ monitors using a flow meter which has been calibrated or certified annually against a National Institute of Standards and Technology (NIST) traceable standard. In addition, each PM_{10} or $PM_{2.5}$ sampler's temperature and barometric pressure are also verified during the monthly flow and leak check using certified temperature and pressure standards.

Meteorological field calibration verification checks occur semi-annually to ensure that measurement accuracy is within the manufacturer's specifications. Field verification refers to the process of comparing the measurements by instruments installed with measurements taken by independent devices. Field verifications are conducted using certified instruments brought to the site for the sole purpose of verification.

Independent instrument performance audits are performed by the BC ENV to provide confidence that the data gathered are accurate and of adequate quality for use in environmental decisions.

Figure 6.1

Location of Ambient Air Monitoring Stations in Kitimat Valley

Figure 6.2

Hydrogen Fluoride Monthly Averages

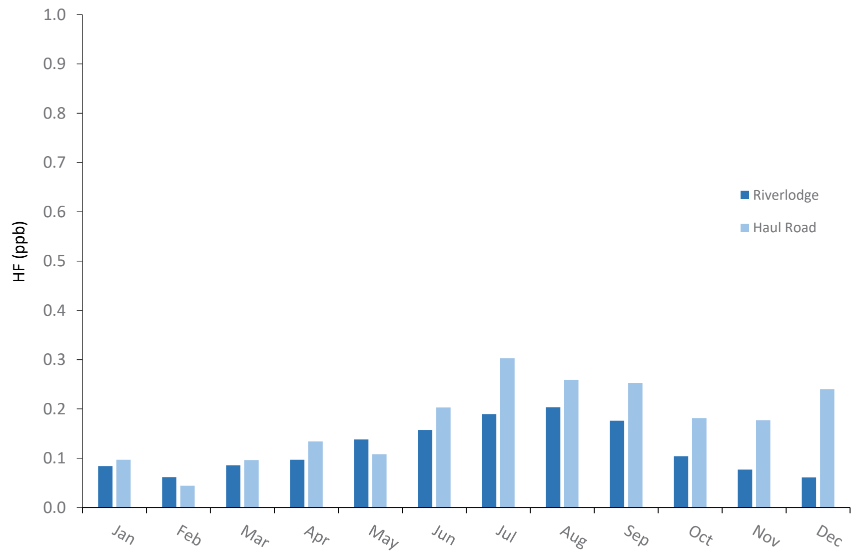


Figure 6.3a

Monthly SO_2 Averages

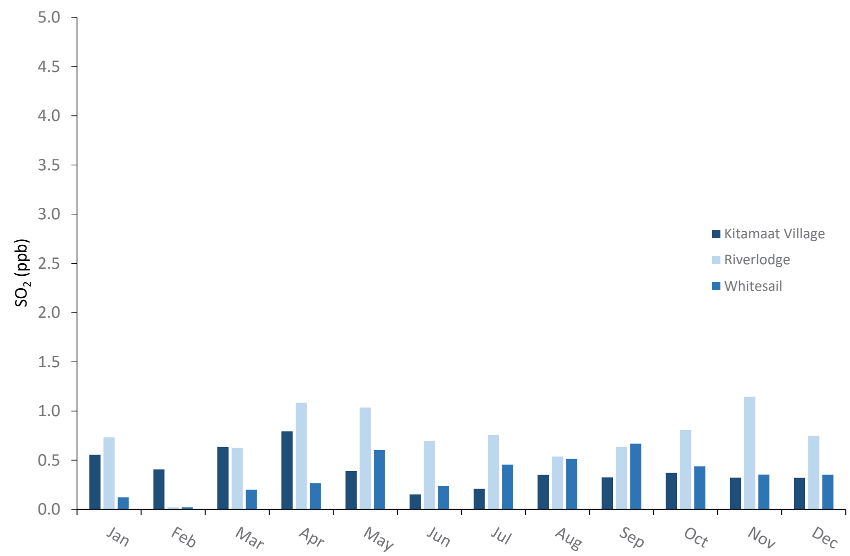


Figure 6.3b

Service Centre Monthly SO_2 Averages

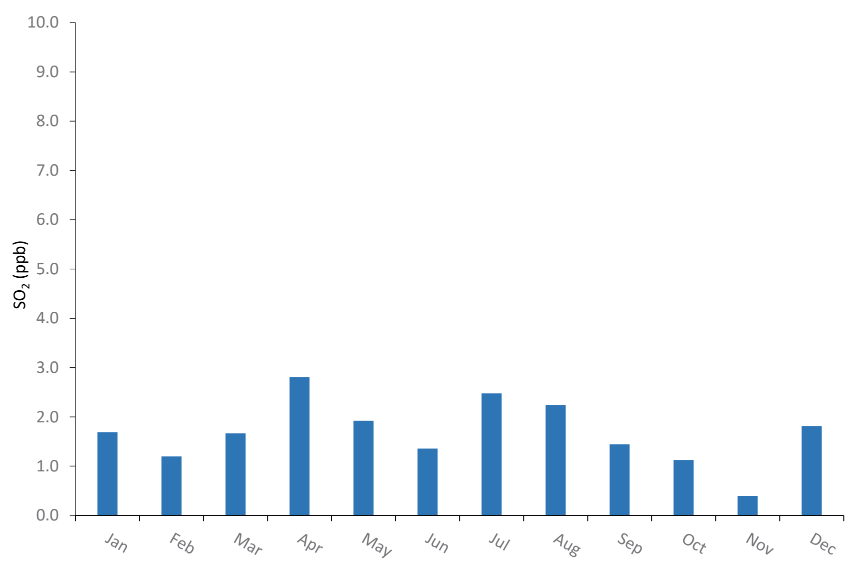


Figure 6.3c

Haul Road
Monthly SO_2 Averages

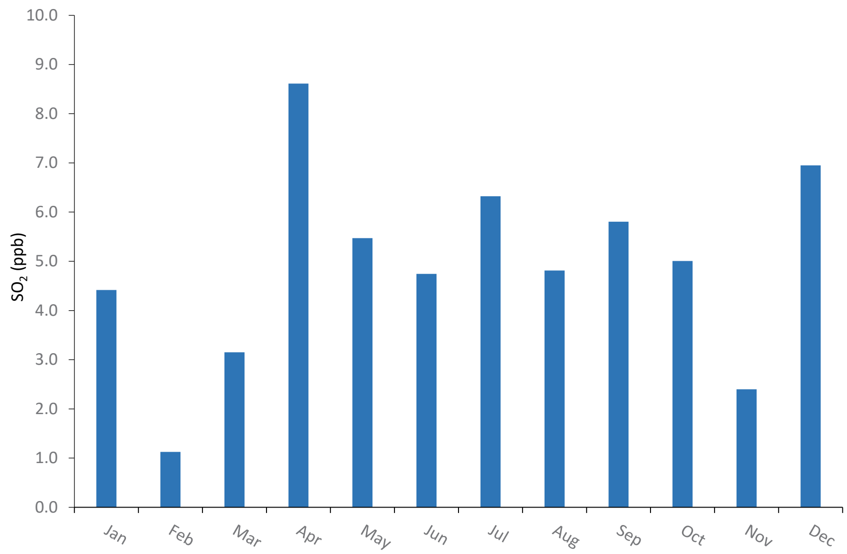


Figure 6.4a

Riverlodge SO_2
1-Hour Daily Maximum

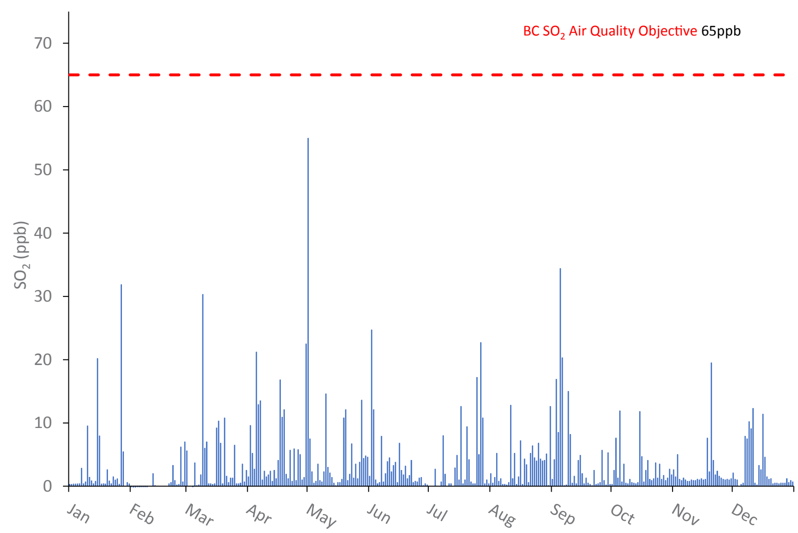


Figure 6.4b

Whitesail SO_2
1-Hour Daily Maximum

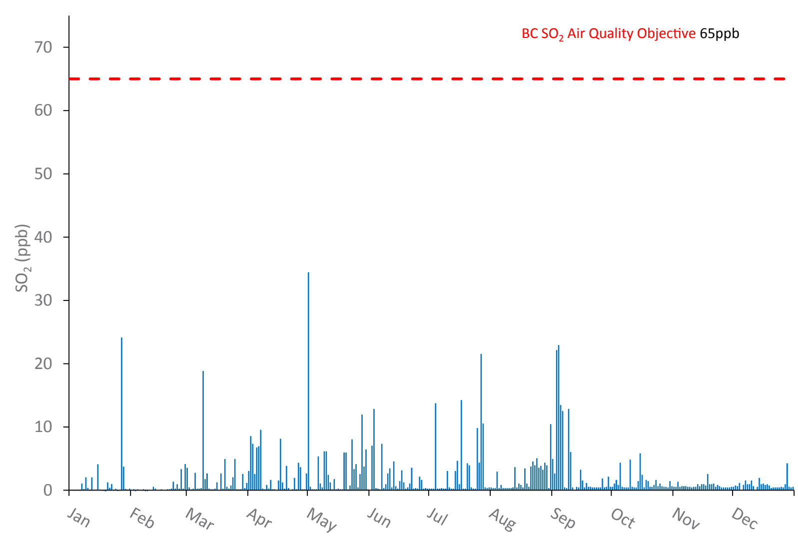


Figure 6.4c

Kitamaat Village SO_2
1-Hour Daily Maximum

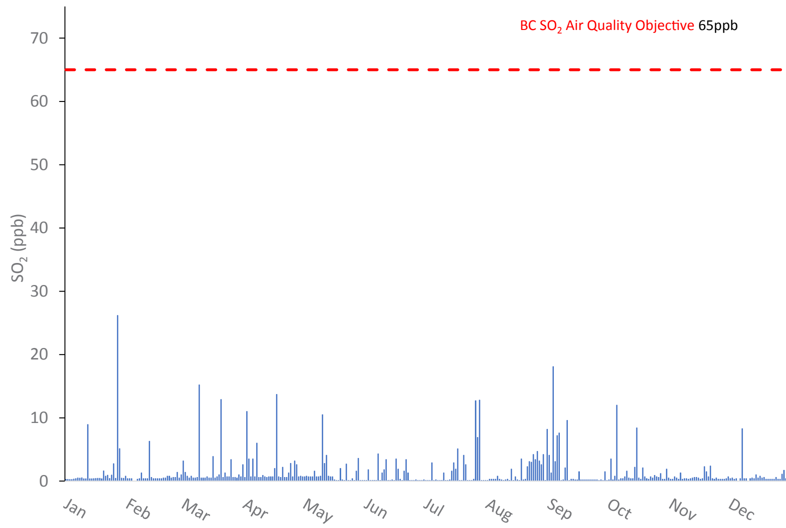


Figure 6.4d

Service Centre SO_2
1-Hour Daily Maximum

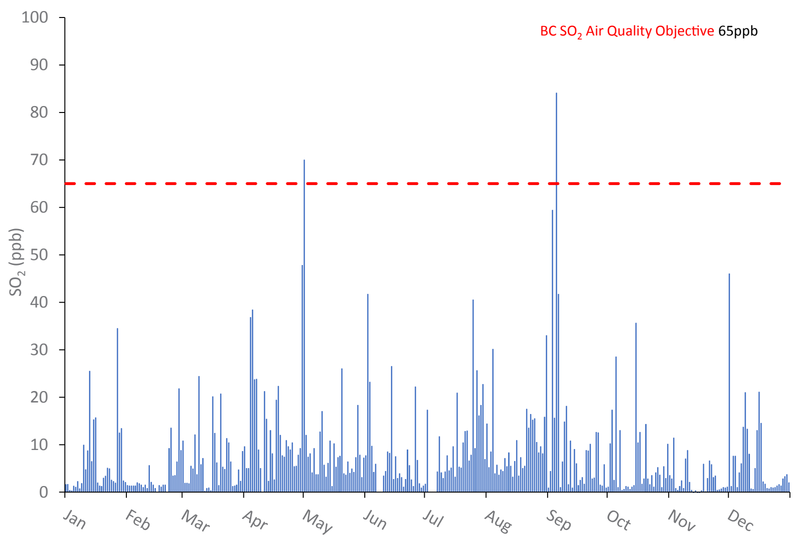


Figure 6.4e

Haul Road SO_2
1-Hour Daily Maximum

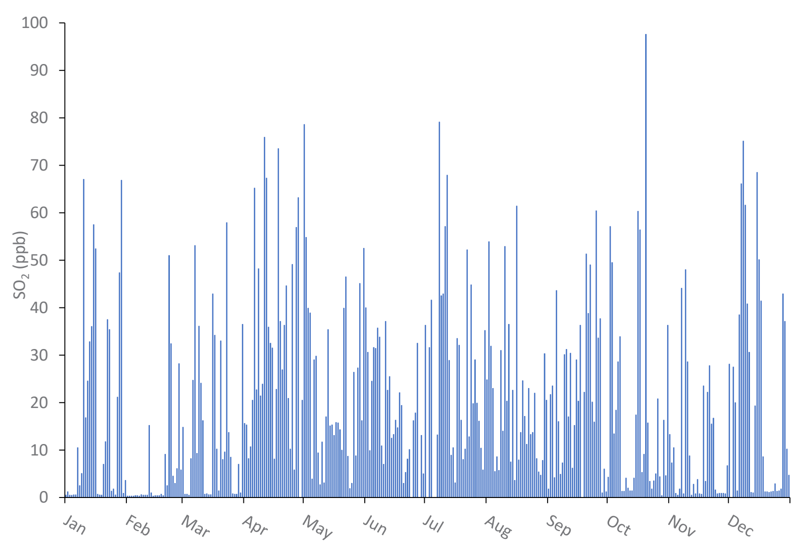


Figure 6.4f

Lakelse Lake
Deposition Station SO_2
1-Hour Daily Maximum

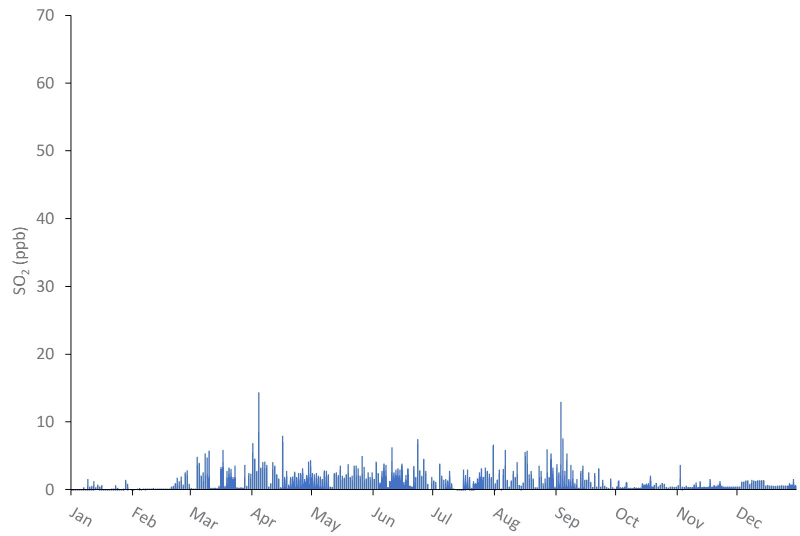


Figure 6.5a

Riverlodge $PM_{2.5}$
24-Hour Average

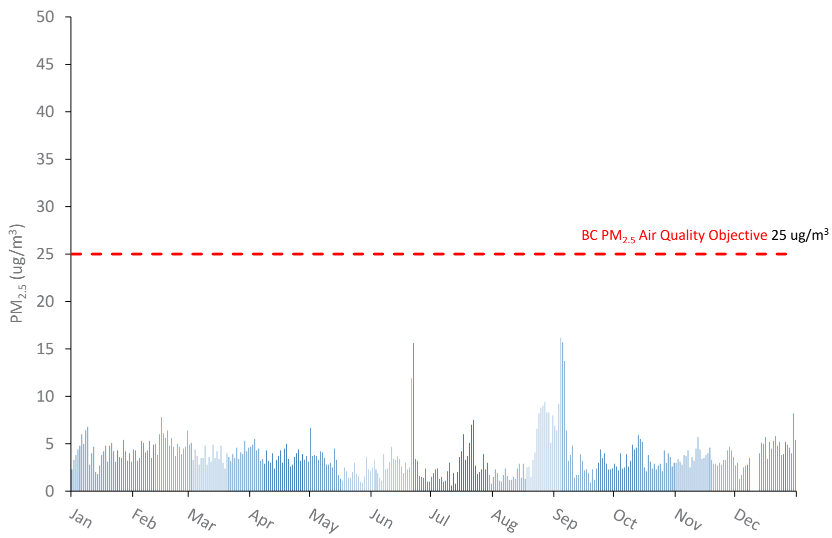


Figure 6.5b

Whitesail $PM_{2.5}$
24-Hour Average

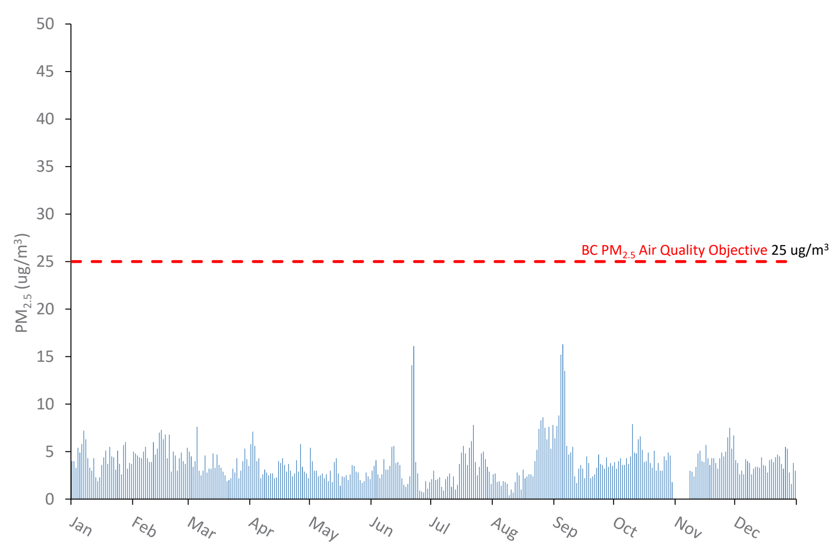


Figure 6.5c
Kitamaat Village $PM_{2.5}$
24-Hour Average

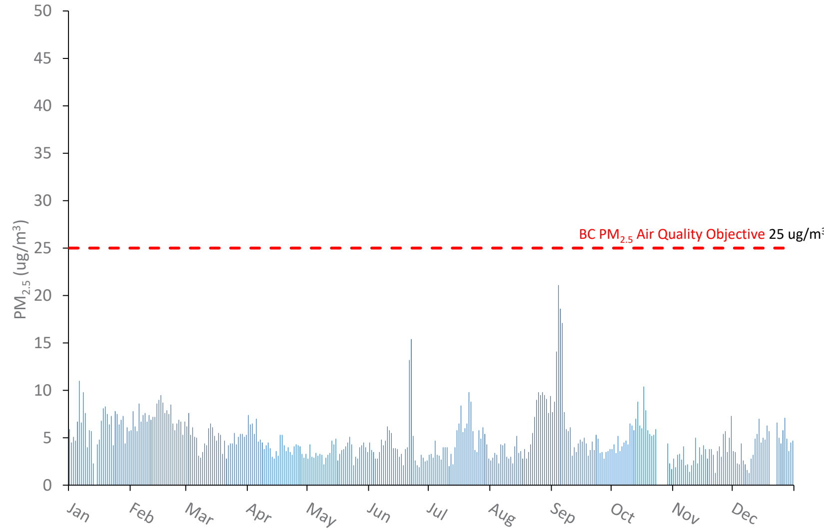


Figure 6.5d
Haul Road $PM_{2.5}$
24-Hour Average

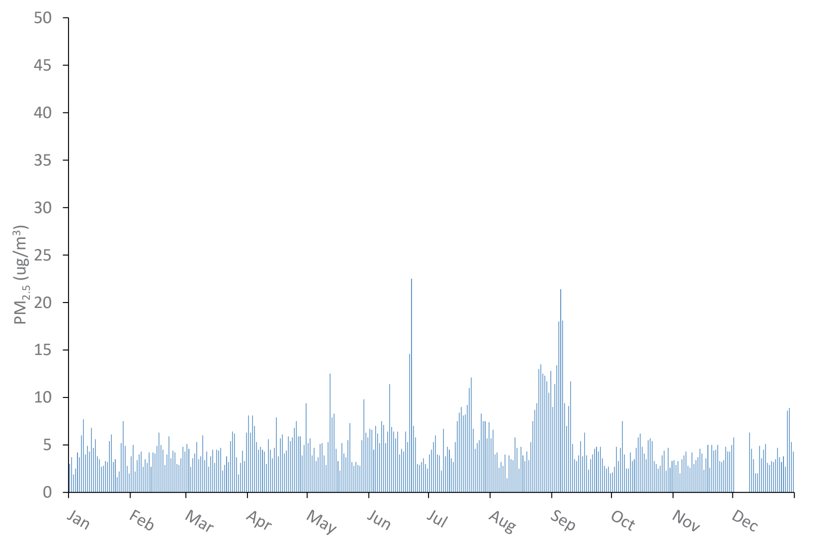


Figure 6.6
Riverlodge PM_{10}
24-Hour Average

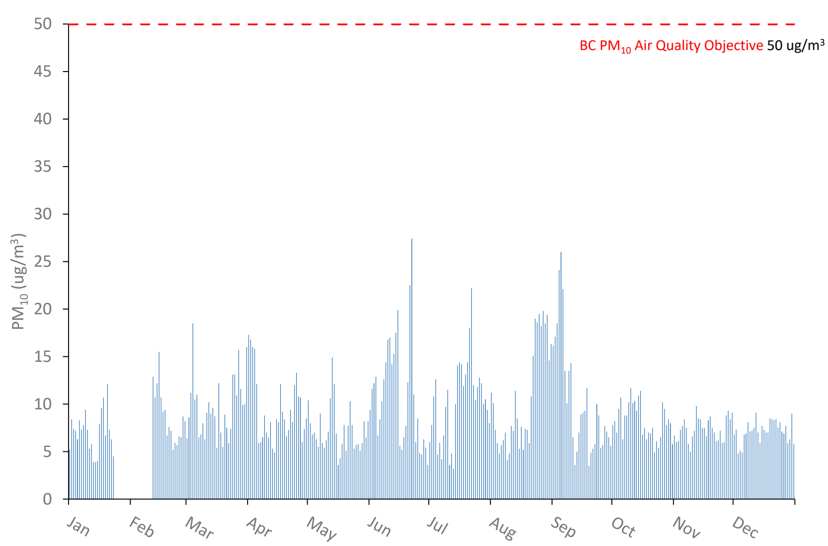


Figure 6.7

Whitesail
Total NO_2 1-Hour

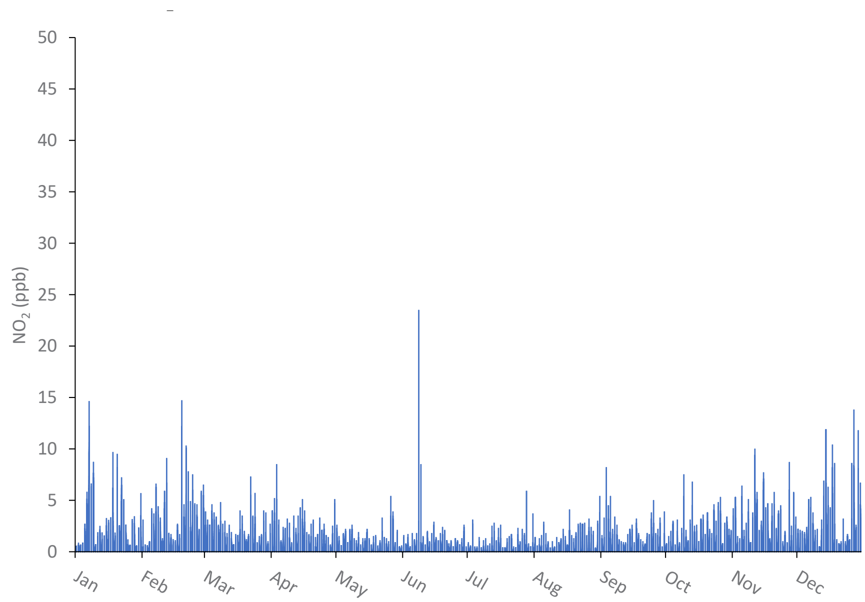


Figure 6.8

Whitesail
Total O_3 1-Hour

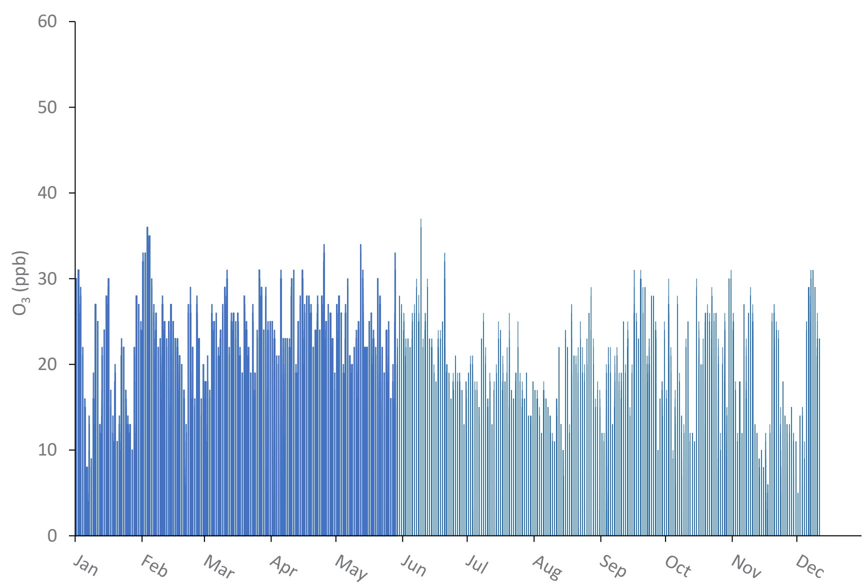


Figure 6.9a

Kitamaat Village
Total 15 PAH 2025

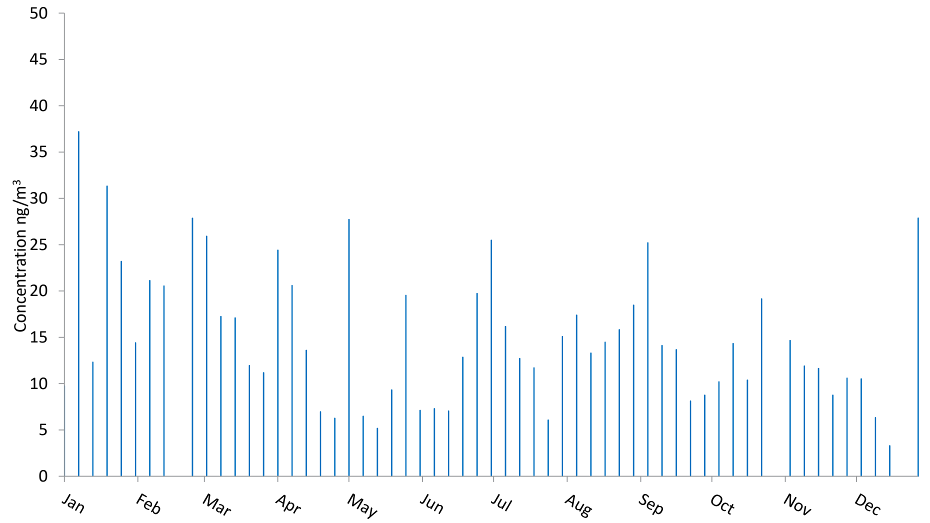


Figure 6.9b

Whitesail
Total 15 PAH 2025

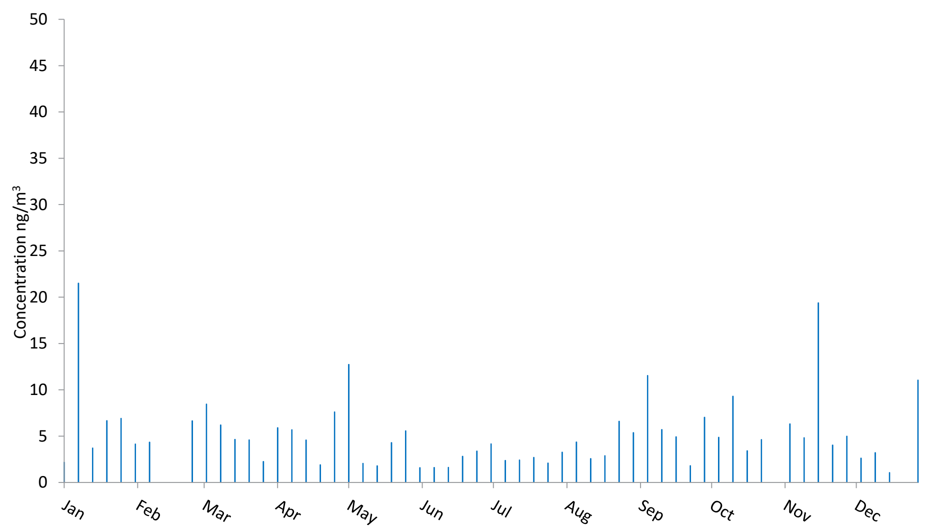


Figure 6.9c

Haul Road
Total 15 PAH 2025

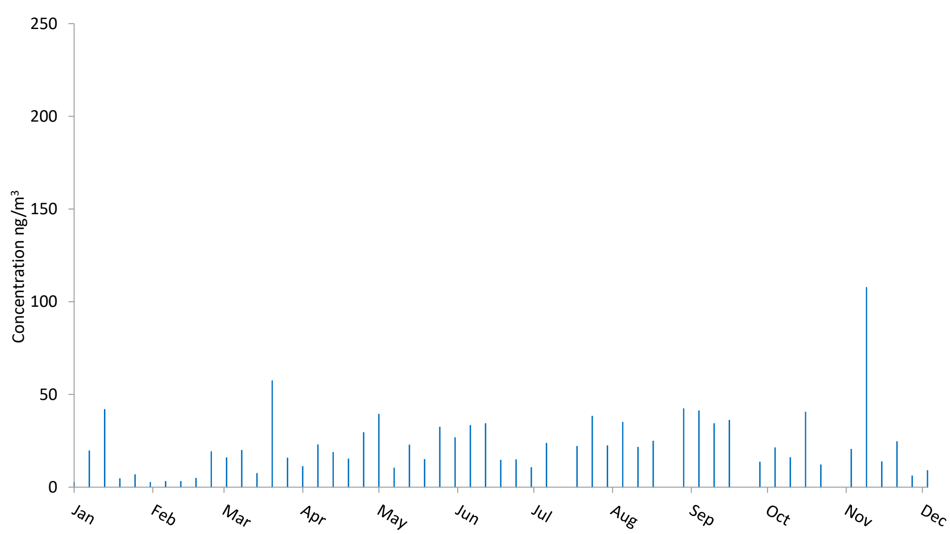


Figure 6.10

PAH Congener Distribution 2025

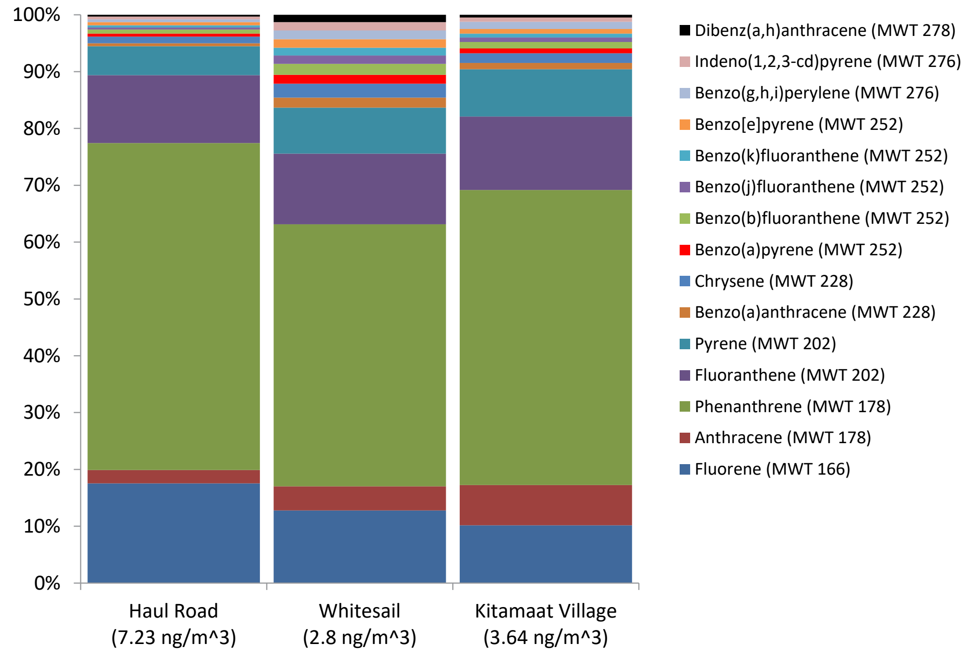


Figure 6.11a

Haul Road and Lakesle Lake Precipitation Depths 2025

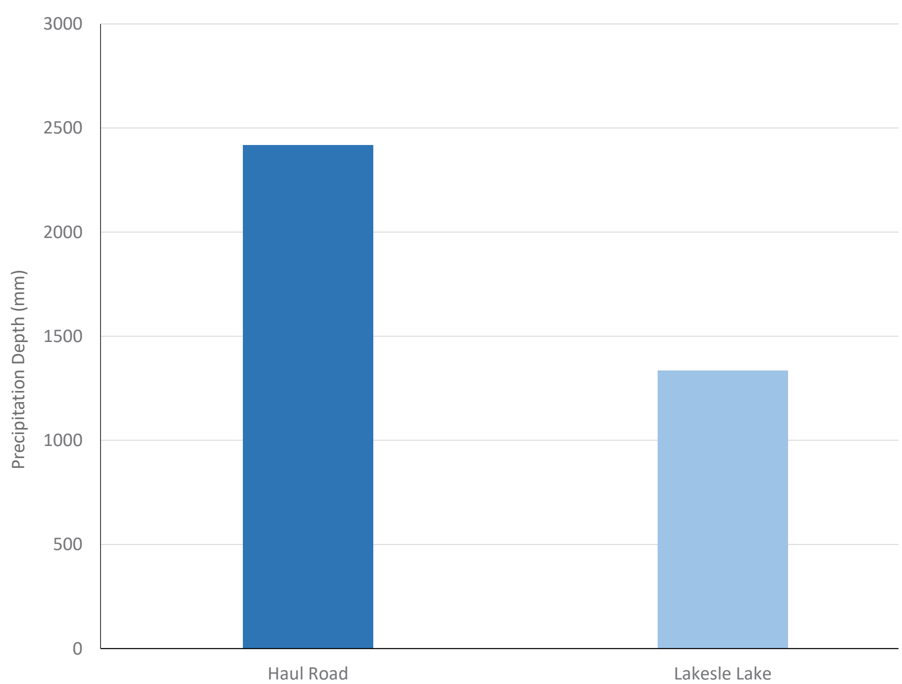


Figure 6.11b

Haul Road and Lakesle Lake Precipitation pH 2025

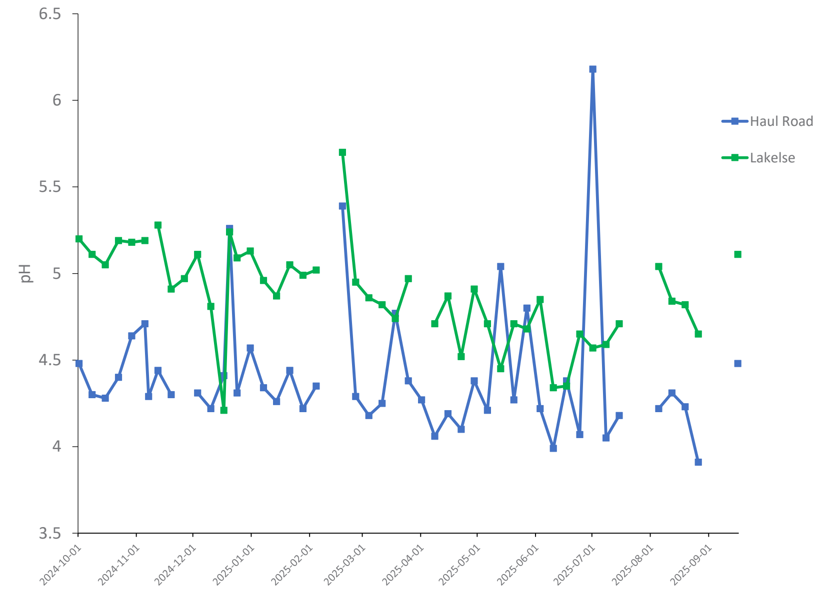


Figure 6.11c

Haul Road and Lakesle Lake SO_4 Concentration in Precipitation 2025

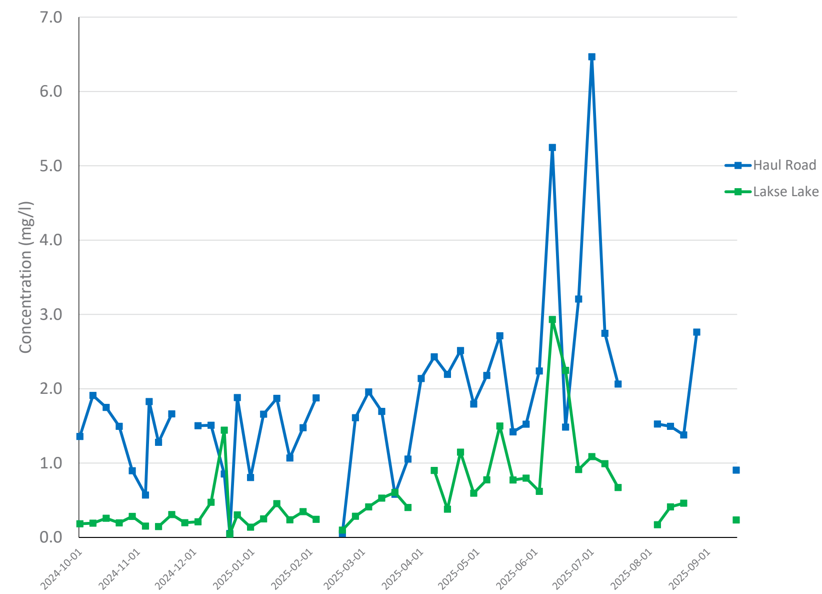


Figure 6.11d

Haul Road Precipitation Chemistry Base Cations

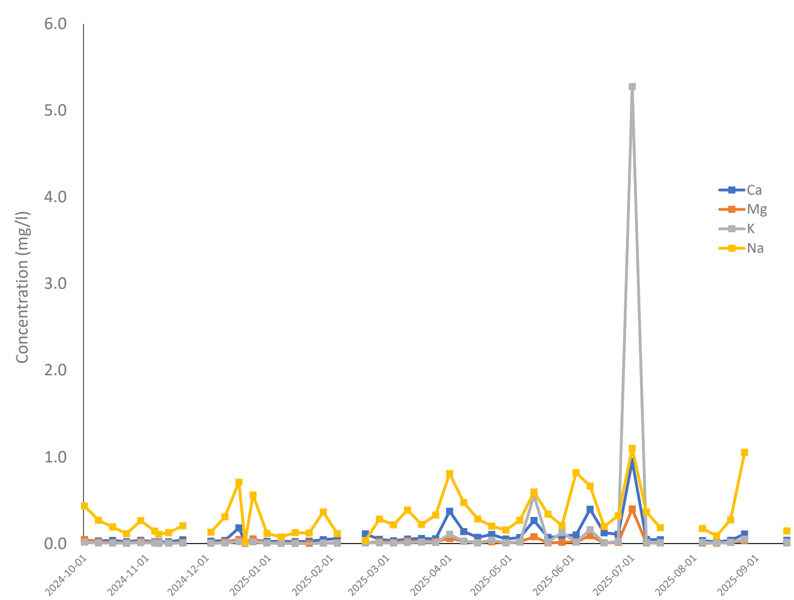


Figure 6.11e

Lakesle Lake
Precipitation Chemistry
Base Cations

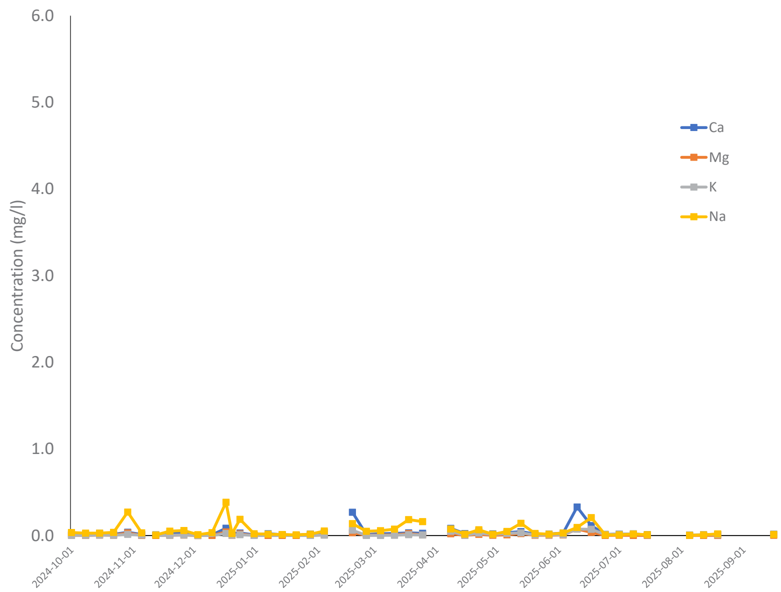


Table 6.1 Ambient Air Monitoring Network

Ambient Air Network	Haul Road Fence Line (HR)	Service Centre (SC)	Lakelse Lake Desposition (LL)	Riverlodge (RL)	Whitesail (WS)	Kitamaat Village (KV)	Yacht Club (YC)
Sulphur Dioxide (SO_2)	✔	✔	✔	✔	✔	✔	
Particulates ($PM_{2.5}$)	✔			✔	✔	✔	
Particulates (PM_{10})				✔			
Hydrogen Fluoride (HF)	✔			✔			
Nitrous Oxides (NO_x)					✔		
Ozone (O_3)					✔		
AQHI Plus					✔		
Rain Chemistry	✔		✔				
Meteorological Monitoring	✔	✔		✔	✔	✔	✔
Polycyclic Aromatic Hydrocarbons (PAH)	✔				✔	✔	
Wind Speed and Direction	✔	✔		✔	✔	✔	✔
Temperature	✔	✔		✔	✔	✔	✔
Relative Humidity		✔			✔		
Pressure					✔		

Table 6.2 2025 Ambient Air Quality Monitoring Results[1]

STATISTIC	Haul Road Fence Line	Industrial Avenue	Lakelse Lake Deposition Station	Riverlodge	Whitesail	Kitimaat Village
SO_2						
Annual Average (ppb)	4.9	1.7	0.5	0.7	0.4	0.4
99th Percentile, D1HM[2]	75.9	47.8	7.5	30.3	22.1	13.7
Days above 65 ppb (hourly)	6	2	0	0	0	0
Minimum (hourly, ppb)	-0.3	-1.2	-0.2	-0.4	-0.5	-0.1
Maximum (hourly, ppb)	97.6	84.1	14.3	55.0	34.4	26.2
Standard Deviation (ppb)	9.2	3.5	0.7	1.8	1.3	0.8
$PM_{2.5}$						
Annual Average (ug/m^3)	5.1			3.7	3.9	5.0
98th Percentile, 24 hour	10.4			8.3	13.0	9.0
Days above 25 ug/m3 (24 hour)	18			0	0	0
Minimum (hourly, ug/m^3)	0.0			0.0	0.0	0.0
Maximum (hourly, ug/m^3)	88.0			27.0	32.0	56.0
Maximum daily average (ug/m^3)	22.5			16.2	16.3	21.1
Standard Deviation (ug/m^3)	4.4			3.0	2.9	3.5
PM_{10}[3]						
Annual Average (ug/m^3)				9.0		
Minimum (hourly, ug/m^3)				0.0		
Maximum (hourly, ug/m^3)				84.0		
Maximum daily average (ug/m^3)				18.7		
Days above 50 ug/m^3 (24 hour)				0		
Standard Deviation (ug/m^3)				5.9		
HF						
Annual Average (ppb)	0.20			0.10		
Minimum (hourly, ppb)	-0.02			0.01		
Maximum (hourly, ppb)	1.36			0.40		
Days above 65 ug/m3 (hourly)[4]	0			0		
Standard Deviation (ppb)	0.1			0.1		
NO_2						
Annual Average (ppb)					1.0	
Minimum (hourly, ppb)					0.0	
Maximum (hourly, ppb)					23.5	
Standard Deviation (ppb)					1.2	
O_3						
Annual Average (ppb)					15.9	
Minimum (hourly, ppb)					0.0	
Maximum (hourly, ppb)					37.0	
Standard Deviation (ppb)					7.8	

Notes: [1] Data extracted from BC ENV's Envista database.
[2] D1HM is the daily 1 hour maximum
[3] PM10 monitoring at the Haul Road station was done under a temporary requirement of the May 5, 2020 Event Response Plan approval.
[4] Hydrogen fluoride (HF) is reported against the Quebec hourly HF air quality standard of 65 ug/m^3 as a temporary requirement of the approval of the May 5, 2020 Event Response Plan.

Table 6.3 2025 Percent Data Capture

PARAMETER (% Data Capture)	Haul Road Fence Line	Industrial Avenue	Lakelse Lake Deposition Station	Riverlodge	Whitesail	Kitimaat Village
SO_2	94.2	93.2	92.4	93.7	94.9	94.7
$PM_{2.5}$	97.7			98.2	97.1	97.5
PM_{10}				94.2		
HF	95.0			94.7		
NOx					95.0	
O_3					94.7	
Wind Speed and Direction	95.5	95.9		98.0	96.2	99.0
Temperature	99.9	99.9		100	99.9	100
Relative Humidity		99.9			99.9	
Pressure					100	
Precipitation	100		100			

Table 6.4 Geometric mean Total 15 PAH Concentrations (2023, 2024 and 2025)

	15 PAH Geomean (ng/m^3)			2025 15 PAH Statistics (ng/m^3)		
Station	2023	2024	2025	Min	Max	Standard Deviation
Haul Road	29.2	16.3	17.3	2.6	107.7	17.2
Whitesail	5.0	5.0	4.2	1.1	21.5	3.9
Kitimat Village	18.1	14.0	13.3	3.3	37.2	7.3

7. SO_2 EEM program

This chapter presents a summary of the 2025 activities undertaken by the SO_2 Environmental Effects Monitoring (SO_2 EEM) Program. Details of the activities, monitoring results and assessment of KPIs are presented in the annual SO_2 EEM report.

About the SO_2 EEM

The SO_2 EEM program is a requirement of section 4.2.6 of the Permit and was amended into the Permit in 2013 as part of the SO_2 permit amendment for the modernization of the Kitimat smelter.

The SO_2 EEM monitors the SO_2 emissions from the smelter and the potential effects on human health (air quality), terrestrial ecosystems (soils, cyanolichens and plants), and aquatic ecosystems (lakes). The SO_2 EEM has annual monitoring activities to assess if a threshold of a receptor based KPI has been exceeded. The annual results are presented in a separate annual report that can be found on the Rio Tinto BC Works website.

Three main field programs were undertaken in 2025:

- SO_2 Air Quality (refer to chapter 6 for monitoring results)
- Annual SO_2 Passive Sampling
- Plant and Cyanolichen Monitoring Program
- Annual Lake Sampling Program

SO_2 passive sampling

SO_2 Passive sampling is conducted annually in the Kitimat valley between May to October. In 2025, there were 23 sampling stations as shown in Figure 7.1. The locations of the sampling sites include valley monitoring network, colocations with continuous monitoring stations, and a background station in Kemano. In 2025, Rio Tinto supported the Gitga'at First Nation with SO_2 passive sampling. Results of the passive sampling program are reported out in the Annual SO_2 EEM report.

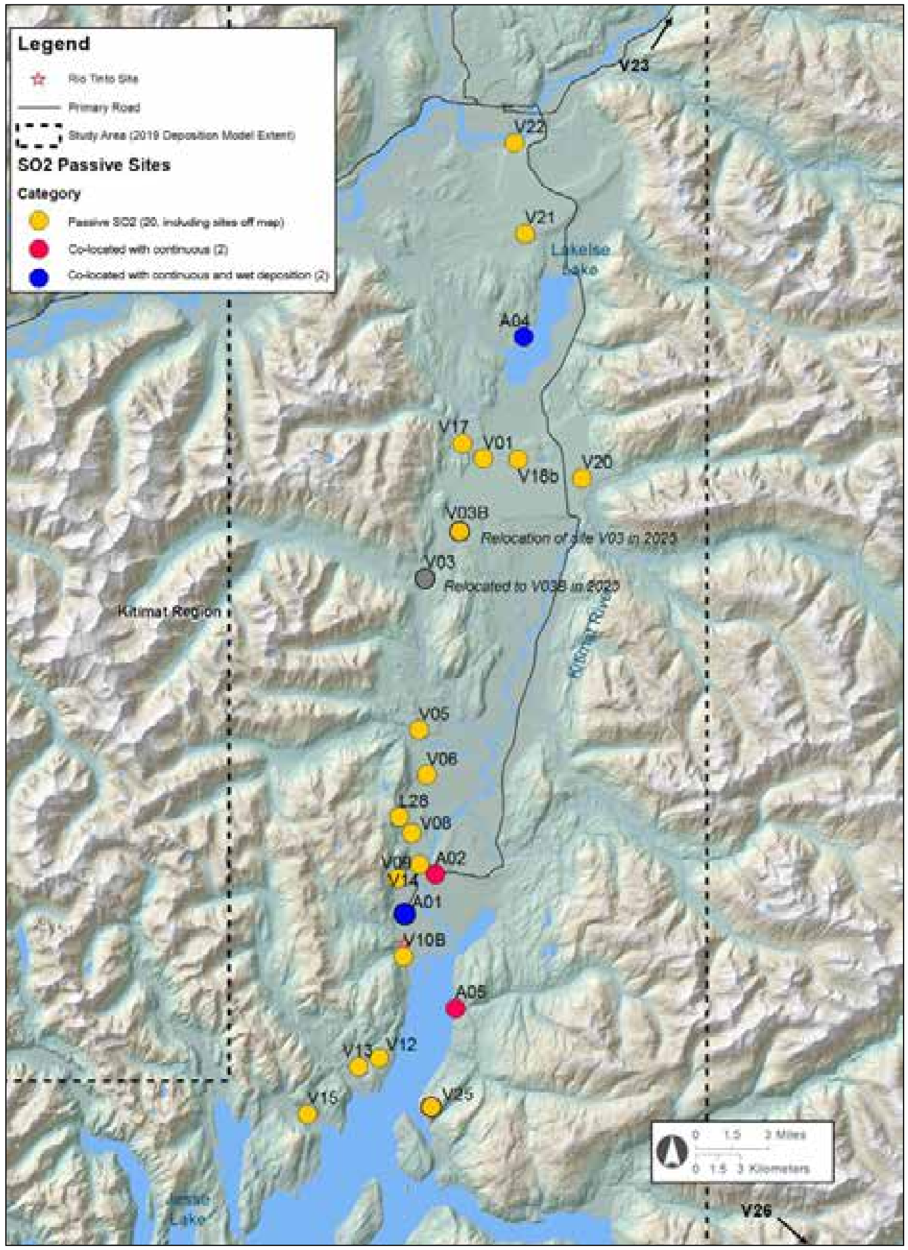


Figure 7.1 SO_2 Passive sampling locations

Plant and Cyanolichen Monitoring Program (PCMP)

The Vascular Plant and Cyanolichen Biodiversity Monitoring Program ("the Program," or "PCMP") monitors 33 plots that are set in set in mature forest ecosystems of the Kitimat Valley and Lakelse Watershed. The program is designed to is designed to detect trends that may emerge in the biodiversity (species richness and abundance) of vascular plants in the low shrub and forb layers, in species of cultural importance and those thought to be acid-sensitive, and in arboreal cyanolichens. The Program focuses on detecting potential mid- to long- term effects that may be associated with cumulative acidification (SO_2 & NOx) effects from industrial emissions (primarily SO_2 from effects from the Rio Tinto BC Works smelter site).

The PCMP is designed as a rotating panel study and 11 to 12 plots in regions of low, medium and high deposition zones are assessed each year. After 3 years, an end of cycle monitoring report is completed to assess the trends and variability in the monitoring data. The 2025 field data represent the first remeasurement of twelve sites first assessed in 2022 as part of the PCMP. 2025 plot measurements are part of the "Year 2" site cohort in the three-year plot cycle: As such, this is the second of three years during which PCMP sites have had (or will have) their first remeasurement. Figure 7.2 shows the location of the 2025 PCMP sampling plots.

The PCMP is led by Balanced Ecological Management Company and is supported by Wai Wah Environmental (field technicians and field safety). For the 2025 monitoring program, prior to the assessments, two days were spent in training and calibrating the field crew and demonstrating site and data collection to representatives from the BC ENV and Rio Tinto. Assessments include percent cover and line transects to document plant species composition and abundance, a cyanolichen biodiversity and health assessment, and an overall plant health assessment. Photo 7.1 shows the data collection along a transect at one of the PCMP monitoring plots.

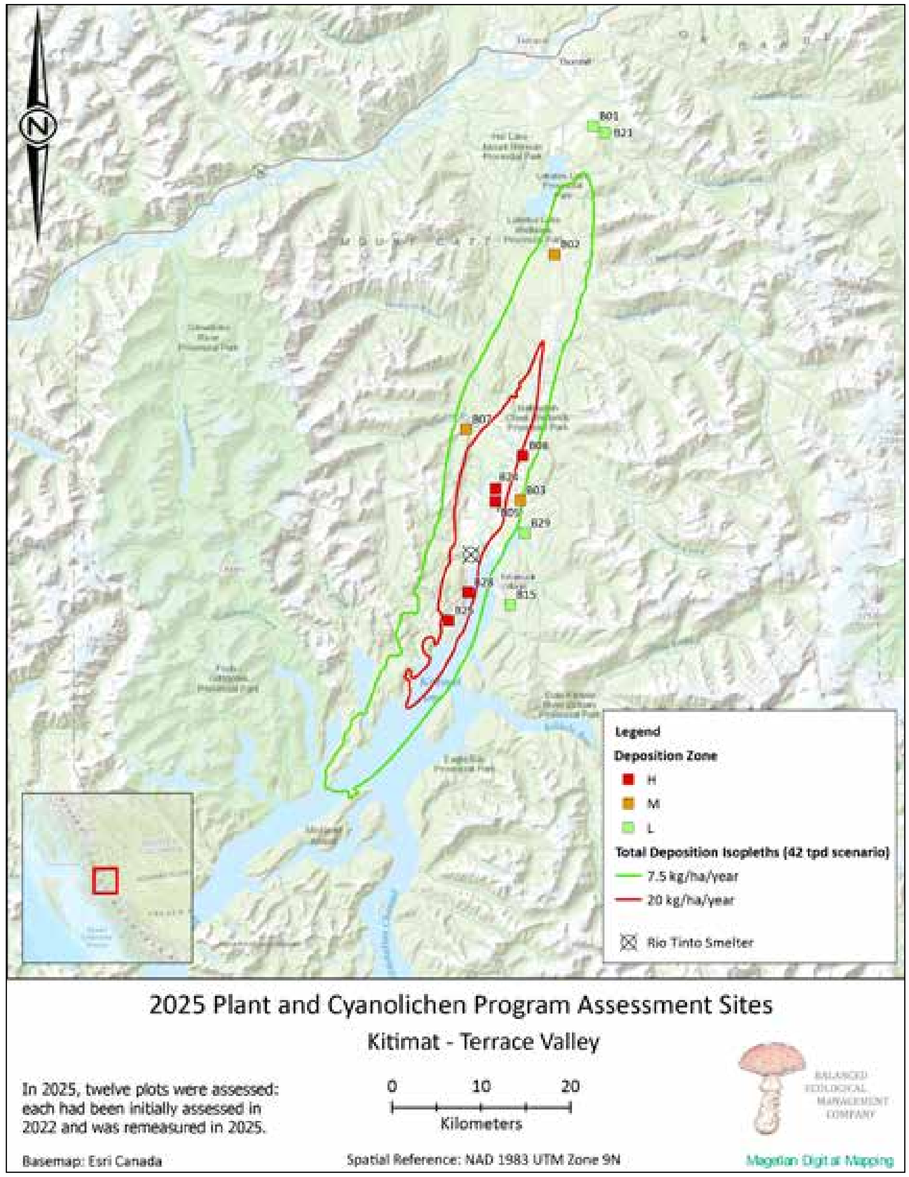


Figure 7.2 Plant and Cyanolichen Monitoring Program assessment sites in 2025

Photo 7.1 Balanced Ecological Management and Wai Wah completing field measurements at a PCMP monitoring plot.

2025 data showed no apparent trends in vascular plant biodiversity, with no significant differences between Low, Medium or High Deposition Zones for individual species or combined species groups, and no notable, unexplained differences in the biodiversity profiles of these sites when comparing 2022 with 2025. For cyanolichens, the results do not suggest any differential trend in cyanolichen biodiversity between Deposition Zones, outside of continuing to demonstrate the legacy effect of historical fluoride deposition that severely impacted cyanolichen distribution. While the cyanolichen results are inherently variable, there were no clear species-specific trends or changes in cyanolichen biodiversity observed in the 2025 reassessment of the sites.

One of the planned plots for monitoring in 2025 was removed from the program for future re-assessments due to recent disturbances around the plot. While disturbance was recent enough that most of the 2025 assessment could be completed without impact, providing a second set of data for the site, the long-term site integrity has been affected by nearby clearing and associated windthrow leaving an insufficient lichen search area.

Annual Lake Sampling Program

Eleven lakes are monitored annually by the SO_2 EEM program. These lakes include 7 acid sensitive lakes, 1 less sensitive lake and 3 control lakes (Figure 7.3). The monitoring work is broken down into two scopes, first, the continuous monitoring of two lakes (Lak006 and Lak028) and a fall lake sampling campaign. Limnotek, who specializes in limnology, has been sampling and monitoring the lakes since 2012.

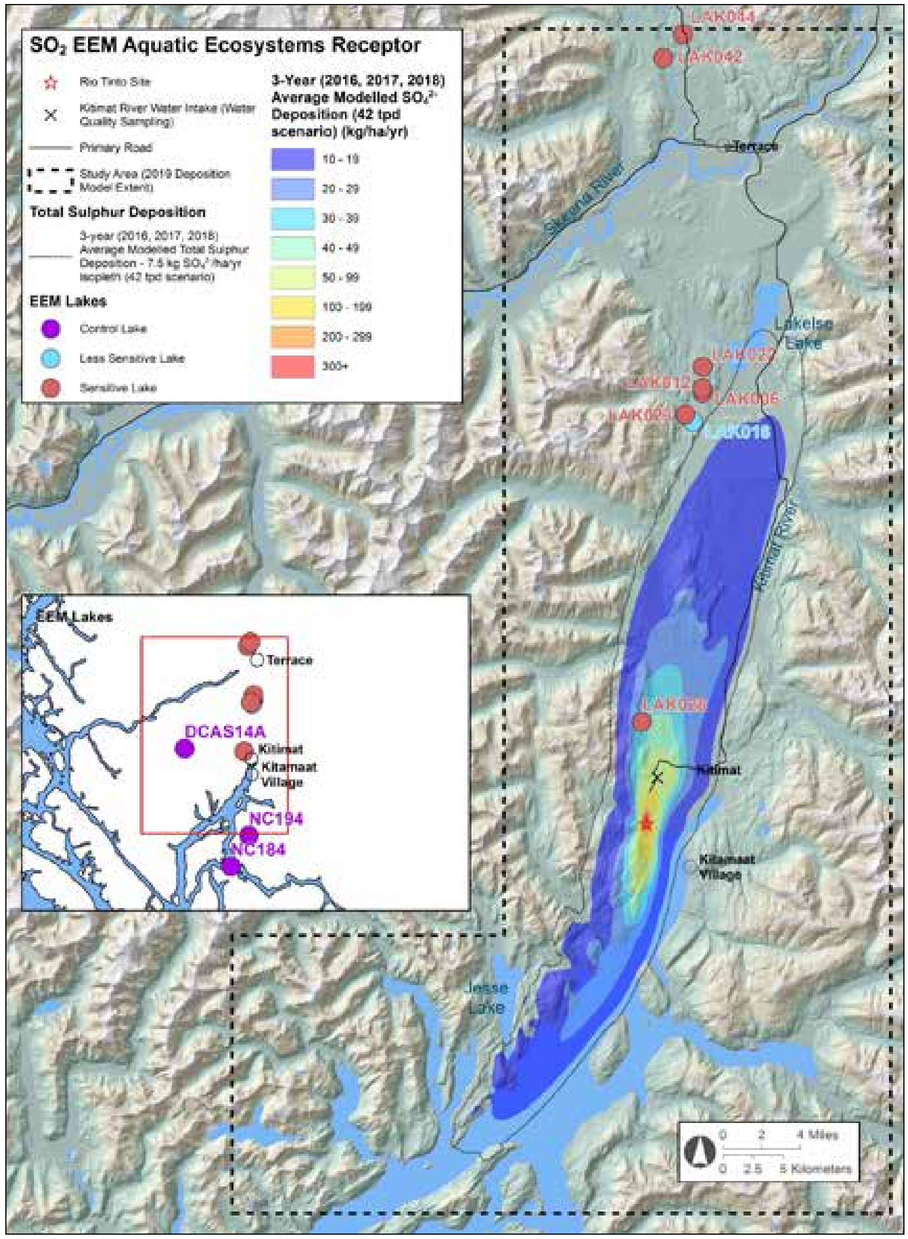


Figure 7.3 SO_2 EEM Lakes monitored in 2025

2025 field work included the continuous monitoring of Lak006 and Lak028, where continuous monitors for pH, conductivity, and depth were installed from June to late October. Monthly water samples were collected at both lakes during visits to maintain and calibrate the continuous monitoring equipment. The intensive fall lake sampling program included three weekly sampling of 7 acid sensitive lakes that are ground based accessible and a sampling inventory of all 11 SO_2 EEM lakes by helicopter. Results of the lake sampling program are presented in the SO_2 EEM annual report and are used to assess if there are changes in the lake specific acid neutralizing capacities that exceed the KPI thresholds.

8. Waste management

The operation of the smelter results in the generation of various solid and liquid wastes. Appropriate management of these wastes is a central part of BC Work's operating strategy with the objective of limiting the smelter's environmental footprint.

In August 2010, the multimedia permit was amended to allow for the disposal of KMP non-hazardous related wastes into the South Landfill.

The amendment is inclusive of the design, operation and closure phases. The appropriate procedures for handling, storage and disposal of these wastes are in place and are reviewed as changes in operations occur.

Waste management procedures ensure full compliance with requirements related to regulated hazardous wastes and additional materials deemed to be hazardous by BC Works.

Opportunities for waste reduction and for improvements in waste handling are assessed and implemented on a continuous basis. Opportunities to recover, reuse, and recycle waste materials are pursued whenever feasible. On-going practices include reducing raw material usage, thus reducing demand on the landfill and contributing to reducing the overall impact on the environment.

Waste management activities are tracked and reported. All waste types including industrial waste, asbestos materials, contaminated soil, putrescibles, wood waste and hazardous wastes externally disposed or sent for recycling are reported in compliance with the permit requirements.

2025 Performance

Spent Potlining

Spent potlining (SPL) is a hazardous waste material produced at BC Works resulting from the disposal of the carbon cathode after years of smelting.

During 2025 approximately 9043 metric tonnes of SPL was generated and shipped off-site. The material was sent to the Spent Potlining Recycling Plant located in Saguenay, Quebec where the material was treated and recycled.

Asbestos and Refractory Ceramic Fibres (RCF)

Asbestos and refractory ceramic fibres (a less hazardous substitute to asbestos) are used for insulation. These materials are considered by BC Works to be sufficiently hazardous to require special disposal methods.

In 2025, no asbestos or ceramic fibers materials were sent to the North and South Landfill.

Wood waste

Wood waste is collected from around the smelter site on a regular basis and sent to a wood containment area. Wood is burned once sufficient volumes have accumulated at the containment area. In 2025, 197 metric tonnes of wood was burned via air curtain incinerators.

South Landfill management

The landfill capping activities were completed in 2023 and there has been no material landfilled in the South Landfill since 2023. As a result of the closure of the landfill, the annual environmental effects monitoring (EEM) program transitioned into a Closure Receiving Environment Monitoring (CREM) program in 2024. The CREM is conducted annually to meet the requirement of the P2-100138 Multi-Media Permit. The objectives of the CREM Program are to monitor the health of Moore Creek from impacts associated with the South Landfill following landfill closure and to monitor the cap effectiveness in reducing contaminant loadings to the receiving environment. The CREM has a five-year cycle and 2025 is the second year of the CREM program during closure. The results of previous EEM programs and results to date have shown that there is a low risk to aquatic receptors due to impacts from the South Landfill. The estimated mass loading of fluoride to the receiving environment in 2025 was 68 kg/year, which is a decrease from 2023 and 2024

9. Groundwater monitoring

Ongoing efforts are in progress aimed at minimizing groundwater contamination and exploring effective disposal and treatment strategies for stored materials.

Introduction

A variety of monitoring programs are conducted relating to groundwater quality and flow in the vicinity of BC Work's Kitimat landfill sites that are, or have the potential to be, a source of contamination. In 2022, these efforts focused on the spent potlining landfill and the dredgate disposal site. Long-term initiatives are underway with objectives to further reduce groundwater contamination and identify disposal and treatment options for stored materials.

2025 Monitoring results

Spent Potlining Landfill (SPL)

The spent potlining landfill is comprised of three separate subsections formerly used to dispose of spent potlining (SPL). The landfill is located south of Potroom 1A and north of the Anode Paste Plant (refer to Kitimat Operations map Figure 2.1).

Prior to 1989, approximately 460,000 m^3 of SPL were disposed of at the landfill site as per permit limits. The landfill was decommissioned in the fall of 1989 and initially capped with a low permeability cover. Over the next decade the three subsections were capped with polyvinyl chloride (PVC) liners. The capping significantly reduced surface water infiltration, thus reducing contaminant loading into the environment.

Groundwater monitoring has been carried out in accordance with the requirements of the multi-media permit and the SPL management plan. Estimates of annual contaminant mass loading to Kitimat Arm were prepared for fluoride, SAD-cyanide, dissolved aluminium, and dissolved aluminium. These estimates are based on estimated groundwater flux through a rectangular cross-section across the SPL plume immediately up gradient of the Yacht Basin, coupled with measured contaminant concentrations in groundwater within this cross-section.

There is generally a declining trend in contaminant concentrations and mass loading into Yacht Basin for fluoride and SAD-cyanide over the last 20 years. Although some monitoring wells show marginal increases compared to last year, concentrations in 2025 are reasonably consistent with 2024 and 2023 concentrations.

- The groundwater discharge rate for 2025 is estimated at 281,486 m^3/yr.
- The 2025 mass loading estimate for fluoride is 16,051 kg/yr.
- The 2025 mass loading estimate for SAD-cyanide is 102 kg/yr.
- The 2025 mass loading estimate for dissolved aluminium is 585 kg/yr.

SPL overburden cell

The SPL overburden cell is located North of Anderson creek. The SPL material is composed of approximately 10,500 m^3 of overburden material that came from the eastern lobe of the SPL landfill in 1996. The overburden cell was originally lined with a Claymax liner that has since been replaced several times, with a synthetic liner most recently in 2010.

The SPL overburden cell have a double membrane lining system that collects water between the primary and the secondary liners. This water is tested and pumped out on a regular basis. In 2025 no water was pumped from the cells..

Dredgate Disposal Site (DDS) landfill

The Dredgate Disposal Site (DDS) was commissioned in 2018 and utilized by the project team leading the Terminal A expansion. Between 2018 and 2019, a total of 53,474 m^3 of IL+ sediment was dredged and placed into the designated cell, with this activity concluding by December 31, 2019. In 2020, the IL+ cell was capped and closed in accordance with the design drawings and closure plan, with the official closure period commencing on September 8, 2020. Groundwater monitoring for the cell was conducted, measuring various analytical parameters as required. Following closure, the final closure plan outlined specific monitoring requirements, which included quarterly sampling in the first year (November 2020 to August 2021) and annual sampling thereafter in September 2022 and September 2024 (two years later). With the completion of the September 2024 sampling, the filling of the DDS is complete, and all groundwater monitoring requirements specified in the final closure plan have been fulfilled.

10. Kemano permits

BC Works Kemano facility is the hydroelectric power station that supplies electricity to BC Works.

Introduction

Up until 2000, Kemano Operations included a town site with a resident population of 200 to 250 people. At that time the powerhouse was automated which reduced the operations and maintenance personnel to rotating crews of 20 to 30 people.

2025 Performance

Kemano effluent discharge

The Kemano sewage treatment plant and several holding tanks in the area surrounding Kemano have effluent discharge permits. The discharges consist of treated sewage and are subject to permit requirements with respect to Biological Oxygen Demand (BOD) levels and concentrations of Toal Suspended Solids (TSS). BOD is an indirect measure of the concentration of biodegradable matter, while TSS is a direct measure of suspended solids.

In 2025 the TSS & BOD sampling of effluent discharge measurements were compliant with permit requirements, however there were 6 excedance of the permitted daily maximum flow. At the time of writing this report, one flow excedance on September 23, 2025, was communicated to the BC ENV and investigated. However during a review of the data for this report 5 other excedances of daily maximum flow were found. We are currently investigating these events (Figure 10.1).

Kemano emission discharge

An incinerator is used to burn municipal-type waste generated by operations and maintenance crews while residing at Kemano Operations. The incinerator is a double-chambered, fuel-fired, forced air unit. The permit requires that the exhaust temperature of the Incinerator remain above 980°C and were compliant with the permit requirements in 2025. The Incinerator permit allows up to 1000 m^3 of domestic waste to be processed and in 2025 the total volume was 578.0 m^3 for the year.

Kemano landfill

Non-combustible refuse and ash from the incinerator are buried in a landfill near Kemano. The landfill permit limits the amount of material to an annual maximum of 300 m^3. In 2025 4.65 m^3 of ash and refuse were buried.

Treated sludge from the sewage treatment plants are deposited in filtration ponds that dewater the sludge before disposal. The dewatered sludge is then deposited in the landfill. Permitted allowance is for disposal of up to 900 m^3 of treated sludge per year. In 2025 13.0 m3 of sludge was disposed of in the filtration pond.

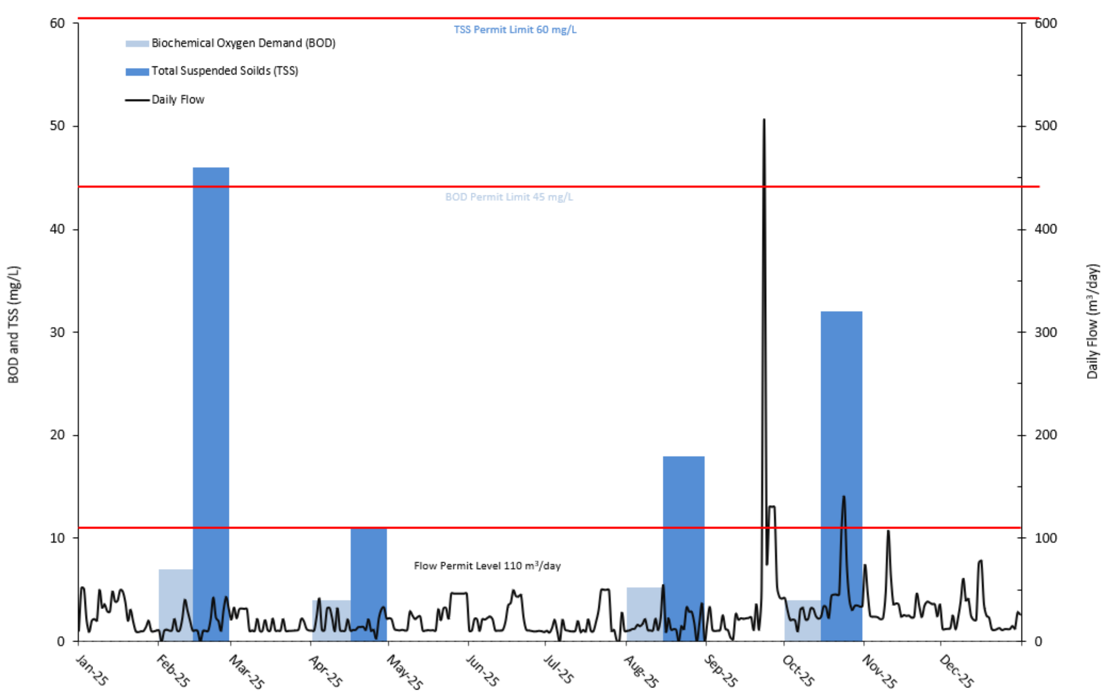


Figure 10.1

Effluent Discharge, Kemano 2025. There were 6 exceedences of the daily maximum flow. The TSS and BOD remained in compliance in 2025.

11. Summary of self reported non-compliance and spills

In 2025, BC Works reported nine non-compliant conditions to the BC ENV for the Kitimat Smelter operations.

2025 Self-reported non-compliance summary

In 2025, nine non-compliances were reported to the BC ENV. These non-compliances are summarized with a brief description of their causes and the corrective actions that are either being assessed or implemented at the time this report was prepared (Table 11.1). At the time of writing this report, five additional noncompliances related to the excedeence of the daily maximum flow at the Kemano sewage treatment plant were identified. Theses exceedences occurred in 2025 and were not identified in the reporting year. These events are currently under investigation. There was a compliance inspection conducted by BC ENV in 2025 that reviewed the landfills and lagoon systems at BC Works. We are currently working through the findings from this compliance inspection.

Table 11.1 Summary of non-compliances, 2025

Occurrence date	Non-Compliance	Permit Requirement	Cause	Corrective Actions
1/8/2025	Missing flow data	Continuous monitoring of flow data	On December 27, 2024, a wireless communication system at B Lagoon started to experience power supply issues, resulting in missing data from the continuous monitoring system. As per permit clause 7.1.6, Rio Tinto reported an unplanned upset at B Lagoon. On January 02, an investigation determined that the missing data could be salvaged from a backup recorder. However, upon analysis of the salvaged data, the connection from the B lagoon flow meter to the recording system was lost, resulting in missing flow data at the B lagoon from January 8, 2025, to January 10, 2025.	Immediate corrective measures have been taken to re-establish the connection from the flow meter to the backup recorder and stabilize the power supply to the wireless communication system.
1/31/2025	Missing effluent data	Daily effluent sampling	Upon investigation, evidence was found that the samples were taken, however they did not arrive at the laboratory for analysis prior to the reporting deadline. When the samples arrived at the laboratory they were analyzed and the results were below permit requirements.	A non-compliance closure report was submitted within 30 days to the BC Ministry of Environment and Parks Actions to improve the communication between the samplers and warehouse supervisor was implemented to ensure timely shipping of effluent samples. A non compliance closure report was submitted to the BC ENV outlining the cause and actions taken.
2/10/2025	Missing upset reporting	Notify within one business day	On February 10, 2025, an upset of the Liquid Pitch Incinerator occurred for a period of 50 minutes, this upset was not reported to the Ministry of Environment and Parks within 1 business day resulting in a non-compliance of permit clause 7.1.6.	Improvements to communication between area supervisors and environment team was implemented and learning sessions on the permit clause were held with area senior leaders. A non-compliance closure report was submitted to the BC ENV outlining the cause and actions taken.
4/2/2025	Missing Upset Reporting	Notify within five business days	On April 2 and 3, 2025, dusting was observed from the bath plant at Rio Tinto's Carbon North area and recorded in our internal incident management system. However, this was not reported to the Ministry of Environment and Parks within 5 business days as per permit clause 7.1.6 requirements.	Corrective actions to install a new pressure monitor on DCB004 and integrating an indicator into its HMI to enable operators to detect potential dust collector issues through real-time monitoring. was identified. A training session for senior leaders on emission control device management and compliance was held to improve area understanding of permit

Table 11.1 continued   Summary of non-compliances, 2025

Occurrence date	Non-Compliance	Permit Requirement	Cause	Corrective Actions
				requirements. A non compliance report was also sent to BC ENV outlining the actions taken was submitted.
8/1/2025	Missing continuous dissolved fluoride data from B Lagoon	Continuous monitoring of dissolved fluoride in B Lagoon	Since June 1, 2025, the dissolved fluoride monitoring equipment at B Lagoon has intermittently triggered faulty fluoride alarms. The automation team responded to the issue by verifying sampling conditions and replacing analyzer components, which temporarily restored normal function. However, persistent issues have led to an ongoing faulty high fluoride alarm since August 1, 2025, resulting in a lack of true continuous dissolved fluoride monitoring.	The 24-hour composite sampling system at B Lagoon has been and remains fully operational, and interim manual grab sampling is taking place to determine a daily snapshot of dissolved fluoride at B Lagoon. Further investigation determined the fluoride analyzer was deemed irreparable, and a replacement has been ordered and installed.
8/7/2025	Missing upset reporting	Notify within five business day	On July 30, 2025, during a routine shift inspection, the conveyor team observed dusting at the conveyor gallery and immediately stopped operations which stopped the dusting event. The source of the dusting was identified as a clogged dust collector bag in dust collector Stn4-DC-13 (Map ID: 59). The alumina conveyance remained stopped while the filter bag was replaced and operations resumed once the replacement was complete. However, the dust collector upset was not reported to BC Ministry of Environment and Parks by August 6, 2025, as required by permit Clause 7.1.6	Learning session on the permit requirements and subsequent procedure took place with area leaders. A non-compliance closure report was submitted to BC ENV within 30 days of the non-compliance highlighting the actions taken.
8/20/2025	Missing parameters in monthly reports	Monthly reporting of all required parameters	Missing reporting parameters from the following reports were identified in the 100138 2025 M04 Mx DATA monthly report and the 100138 2025 M04 AQ PAH monthly report. The specific parameters missing within each report were: • The effluent chemistry for April 1st, 2025 in the 100138 2025 M04 Mx DATA • The PAH analytical data from April 25, 2025 from all three stations: Haul Road, Whitesail, and Kitimat Village. The cause was due to human error in compiling the reports.	The missing parameters were added to the reports and the reports were resubmitted to BC ENV. A new process to review documents (e.g., laboratory results tracker, compliance reports checklist) were developed and implemented. A non-compliance closure report was submitted to BC ENV within 30 days outlining the corrective actions taken.
9/23/2025	Exceedance of maximum daily flow	Below 110 m3/day	On Monday September 22nd Kemano townsite was overwhelmed with creek water when the town site levee was breached and compromised. The creek had risen overnight rapidly from the intense rainfall that night. Partial flows from Horetsky creek flowed through the townsite until creek levels subsided. The creek water infiltrated a lift station that brings black water from accommodations of the 24plex to the sewage treatment plant. The creek water along with the black water was routed through the plant where it was treated and discharged to the Kemano river.	Corrective actions was to increase the elevation of the lift to prevent water infiltration from flooding events. This event was investigated and a closured report was submitted to the BC ENV within 30 days
12/30/2025	Dissolved fluoride exceedance in B Lagoon	Below 10.0mg/L	An exceedance of 0.6mg/L in the dissolved fluoride levels in B Lagoon on December 30, 2025 was discovered during the compilation of the monthly report. When reviewing the data from 2025, the fluoride profile averaged ~4 mg/L with a single spike above permit limits. During this period there was a long-prolonged period of cold weather and snow accumulation around site. At this time there was a transition in the weather to a more wintery mix with precipitation that would have increased flow in the lagoon and stormwater system. We are currently attributing the spike to a combination of legacy inputs to the lagoon along with contaminated snow accumulation near storm drains.	A focused effort has been at source control around the site; examples include actions targeted at process spills from the DPS and SPS lines. Efforts have also been directed at J stream to look for options to reduce fluoride loading linked to the legacy of the SPL landfill.

Spill summary

Spills at BC Works are first reported to the Plant Protection Department and subsequently to the Environmental Department. Regulatory requirements are in place to report certain types of spills to the BC ENV (referred to as "reportable" spills), depending on the nature and volume of the substance spilled. In 2025, ten spills were reported to the Ministry (Table 11.2).

Spill-related awareness and prevention is a major focal point throughout BC Works. Immediate containment and minimization of potential environmental damage is the priority. Specially equipped response teams are available when required. If appropriate, other agencies are informed, and their cooperation is enlisted.

Investigations and root cause analysis of reportable spills are conducted to prevent recurrence, and a system is maintained for recording and reviewing all spills and their frequency by type. This ensures that appropriate corrective actions are identified and tracked through to completion.

Table 11.2 Summary of Reportable Spills, 2025

Occurrence date	Substance	Amount	Environmental Media	Cause	Corrective Actions
1/16/2025	Hydraulic Oil	~ 150 L	Concrete	Equipment failure	The spill was cleaned up using absorball and peat moss
1/19/2025	Alumina	2000kg	Air, pavement	Leak in pipe	Vacuum truck used to clean up the spill
2/3/2025	Bath	146kg	Pavement	Leak in pipe	Clean up spill, follow up investigation and close report
3/14/2025	Alumina	100kg	Asphalt	Material spill during transportation	Clean up with sweeper
3/14/2025	Sewage	100L	Grass and gravel	Broken sewage pipe	Repair pipe
5/29/2025	Bath	1000kg	Asphalt, air	Leak in pipe	Area cleaned up with a sweeper and a vacuum truck. Booms placed around drains.
3/6/2025	Alumina	500kg	Asphalt	Leak in pipe	Area cleaned up with a sweeper and vacuum truck. Line repaired.
8/18/2025	Alumina	200kg	Air	Hole in pipe transporting alumina from 3310 silo to West GTC	Repair the pipe, clean up the area with sweepers, perform 5 Why investigation.
10/21/2025	Fire Water	Unknown	Gravel	Fire water protection used to suppress fire	Clean up of soils impacted by fire water suppression
10/27/2025	Oil	200L	Water	Failed oil cooler	Fix equipment

12. Glossary, abbreviations and notations

Glossary

Anode
One of two electrodes (the positive electrode) required to carry an electric current into the molten bath, a key component of the electrolytic reduction process that transforms alumina ore into aluminium. A green anode is an unbaked anode, whereas a baked anode is a green anode that has went through the anode baking process.

Anode Baking Furnace
Green anodes (un-baked) are brought to the Anode Baking Furnace (ABF) to bake the anodes. This process hardens the anodes and drives off volatile hydrocarbons (such as PAHs) from the liquid pitch used to bind the calcined coke and recycled carbon.

Anode Rodding Shop
The shop where baked anodes are rodded with electrodes and where spent anodes from the potrooms are disassembled.

Anode effects
A chemical reaction that occurs when the level of alumina in a pot falls below a critical level, resulting in reduced aluminium production and the generation of perfluorocarbons (PFCs) – a variety of gases with a high carbon dioxide equivalency.

Anode paste
One of the materials used to manufacture green anodes, composed of calcined coke and coal tar pitch.

Attrition index
An index used to express alumina strength; the higher the value, the weaker the alumina.

Bath
A process material consisting primarily of sodium aluminium fluoride, which is melted in the pots and used to dissolve the alumina for the electrolytic reduction process of making aluminium.

Bath Plant and Bath Tower
Bath generated from the pots is taken to the bath plant for processing and recycling. The bath tower is one component of the plant that conveys the reclaimed bath for processing.

CALPUFF
Advanced non-steady-state meteorological and air quality modeling system

Carbon dioxide equivalency (CO_{2eq})
This is a quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO_{2eq} that would have the same global warming potential as the emission when measured over a specified period.

Cassette sampling
A sampling procedure for air emissions where contaminants are collected using filters placed at regular intervals along the length of the potroom.

Cathode
One of two electrodes (the negative electrode) required to carry an electric current into the molten bath; a key component of the electrolytic reduction process that transforms alumina ore into aluminium.

Coke calcination/calcined coke
A process involving the use of high temperatures to drive off volatile matter found in green coke, thus producing calcined coke for use in anode manufacturing.

Composite sample
A composite sample is treated as a single sample, despite being made up of multiple temporally discrete samples. For example, all effluent composite samples are taken over 24 hours, during which a 50mL sample is collected every 10 minutes.

Dredgeate
Any material removed by dredging.

Dry scrubber
Pollution control equipment used to remove contaminants (in gaseous or particulate forms) from air emissions.

Effluent (B-lagoon)
Water discharge flowing out of the B-Lagoon outfall after treatment in the B-Lagoon system.

Electrolyte
A chemical compound that provides an electrically conductive medium when dissolved or molten.

Electrolytic reduction
This process uses electricity to remove oxygen molecules from aluminium oxide to form aluminium metal.

ENVISTA
British Columbia Air Resources Manager website

FC-3
Day Tank Incinerator localized on Carbon South

Fugitive dust
Solid airborne particulate matter that is emitted from any source other than a stack or a chimney.

Fume Treatment Centre
The primary pollution control system for the anode baking furnace. The Fume Treatment Centre (FTC) uses water to cool the hot fumes from the ABF. The FTC then filters the fumes to remove particulates, fluorides, and PAHs.

Geometric mean
A geometric mean is a type of mean or average which indicates the central tendency or typical value of a set of numbers by using the product of their values. The geometric mean is often used when comparing different items when

each item has multiple properties that have different numeric ranges.

Green coke
The raw form of coke received at Kitimat Operations, which is calcined for use in the manufacture of anodes; a by-product of oil refining.

Grab sample
A discrete sample used to collect information for a specific or short time. Variability of this data is much higher than a composite sample.

Gas Treatment Centre
The primary pollution control system for the potline. There are two Gas Treatment Centres (GTCs) for the modernized smelter, replacing the function of the 9 dry scrubbers used in the old VSS smelter. The GTCs filter the pot gases to remove particulates and fluorides.

IL-
For a given contaminant, a level of contamination which is at or below the threshold identified in the Contaminated Sites Regulation as being suitable for industrial lands (IL)

IL+
For a given contaminant, refers to a level of contamination which is below the threshold identified in the Hazardous Waste Regulation as that of being hazardous waste (HW) and is above the threshold identified in the Contaminated Sites Regulation as being suitable for industrial lands (IL)

Leachate
A liquid which results from water collecting contaminants as it passes through waste material.

Leftover metal
Metal which accumulates in a pot when the schedule to remove the metal is not followed.

Loading
Loading is the amount of a contaminant emitted in a given period.

Maximum allowable level
This level provides adequate protection against the effects of pollution on soil, water, vegetation, materials, animals, visibility, personal comfort, and well-being.

Maximum desirable level
This level is the long-term goal for air quality programs and provides a basis for the federal government's antidegradation policy for unpolluted parts of the country.

Maximum tolerable level
This level denotes time-based concentrations of air contaminants beyond which appropriate action is required to protect the health of the general population.

Ministry
Ministry of Environments and Parks (BC ENV), to which BC Operations reports on compliance with its permit requirements.

P2-00001 Permit
P2-00001 Multi-Media Waste Discharge Permit

Piezometer
A small diameter water well used to measure the hydraulic head of groundwater in aquifers.

Pitch
One of the materials from which anodes are made, and a by-product of metallurgical coke production.

Polycyclic aromatic hydrocarbons (PAHs)
A group of aromatic hydrocarbons containing three or more closed hydrocarbon rings. Certain PAH are animal and/or human carcinogens.

Pots/potline
Pots are large, specially designed steel structures within which electrolytic reduction takes place. The 396 pots at Kitimat Works are housed within a single potline.

Process correction
Accessing the condition of exception or sick pots and bringing them back to normal operating conditions.

Putrescible waste
Waste that rots which can be easily broken down by bacteria, for example food and vegetable waste.

Pyroscrubber
A combustion-based system that controls dust emissions from the coke calciner.

Retention time
The average time a drop of water takes to move through a lagoon from inlet to outlet.

Scow grid
A dry dock for flat bottomed vessels (scows) formed from a series of piles and sills.

Sick pot
A pot that has an elevated bath temperature and cannot be sealed properly or is uncovered.

Spent pot lining (SPL)
Lining from the inside of pots, composed of refractory bricks and carbon, has deteriorated to the point where it needs to be replaced.

Stud
Studs constructed of steel are inserted vertically into the anode to conduct the flow of electricity through the anode and into the electrolyte.

Total suspended solids (TSS)
A water quality measurement refers to the dry weight of particles trapped by a filter, typically of a specified pore size.

Abbreviations

Abbreviation	Definition
ABF	Anode Baking Furnace
AP-4X	Aluminium Pechiney-4XX KAmp prebake technology
APP	Anode Paste Plant
AQHI	Air Quality Health Index
AQHI +	Air Quality Health Index Plus
ARS	Anode Rodding Shop
ASI	Aluminium Stewardship Initiative
BC	British Columbia
BC ENV	Ministry of Environment and Parks
DC	Dust Collector
DDS	Dredgate Disposal Site
EEM	Environmental Effects Monitoring
ERP	Event Response Plan
FTC	Fume Treatment Center
GTC	Gas Treatment Center
HR	Haul Road
HSE	Health, Safety, Environment
HSEQ	Health, Safety, Environment and Quality
ISO	International Organization for Standardization
KMP	Kitimat Modernization Project
KPAC	Kitimat Public Advisory Committee
KPI	Key Performance Indicator

Abbreviation	Definition
KV	Kitimaat Village
LL	Lakelse Lake
LPI	Liquid Pitch Incinerator
NADP	National Atmospheric Deposition Program
NAPS	National Air Pollution Survey
PDCR	Plan, Do, Check and Review
PFTC	Pitch fume treatment centre
PSB	Pallet Storage Building
PVT	Pitch vapour treatment
RACI	Responsible, Accountable, Consulted, Informed
RCF	Refractory Ceramic Fibres
RL	Riverlodge
SPL	Spent Potlining
SR-M&WMP	Smelter Restart Materials and Waste Management Plan
SR-TAR	Smelter Restart Technical Assessment Report
TBD	To be determined
US- EPA	United States Environmental Protection Agency
VSS	Vertical Söderberg Stud
WS	Whitesail
YC	Yacht Club

Notations

Notation	Parameter
$96LC_{50}$	Rainbow Trout 96hr Static Acute 100% concentration screen (pass/fail)
Al	Aluminium
Al_2O_3	Aluminium Oxide
BOD	Indirect measure of the concentration of biodegradable matter
CN-SAD	Cyanide Strong Acid Dissociable
CN-WAD	Cyanide Weak Acid Dissociable
CO_2	Carbon Dioxide
D1HM	Daily 1 hour maximum
Dis. Al	Dissolved Aluminium
Dis. F	Dissolved Fluoride
Fg	Gaseous Fluoride
Fp	Fluoride particulate
Ft	Total Fluoride
GHG	Greenhouse Gases
H_2SO_4	Sulfuric Acid
ha	Hectare
HF	Hydrogen Fluoride
hr	hour
kg	Kilogram
kg/Mg Al	kg of substance per metric tonne of Al
m_3	Cubic meter
Mg	Megagram (1 metric tonne)
mg/L	Milligrams per liter
mm	Millimeter

Notation	Parameter
MWT	Molecular weight
ng/m^3	nanogram per cubic meter
NO	Nitrogen monoxide
NO_2	Nitrogen dioxide
NOx	Nitrogen Oxides
O_3	Ozone
PAH	Polycyclic Aromatic Hydrocarbons
PFC	Perfluorocarbons (CF4 and C2F6)
pH	Potential hydrogen
PM	Particulate Matter
PM_{10}	Particulate Matter 10 µm or less
$PM_{2.5}$	Particulate Matter 2.5µm or less
ppb	Parts per Billion (vol/vol)
PVC	Polyvinyl chloride
Q1	1st Quarter of the Year
Q2	2nd Quarter of the Year
Q3	3rd Quarter of the Year
Q4	4th Quarter of the Year
SF_6	Sulphur Hexafluoride
SO_2	Sulphur Dioxide
SO_4^{2-}	Sulfate ion
TSS	Total Suspended Solids
ug/m^3	microgram per cubic meter
yr	year
µS/cm	micro siemens per centimeter

Rio Tinto

Rio Tinto BC Works
1 Smeltersite Road

PO Box 1800
Kitimat BC V8C 2H2
Canada

T +1 250 639 8383

Rio Tinto Plc

St Jame's Square
London SW1Y 4AD
United Kingdom

T +44 20 7781 2000

riotinto.com

www.riotinto.com/operations/canada/bc-works