

# Environmental Report BC Works 2024

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# 1. About the annual environmental report

The annual environmental report is a summary of our 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

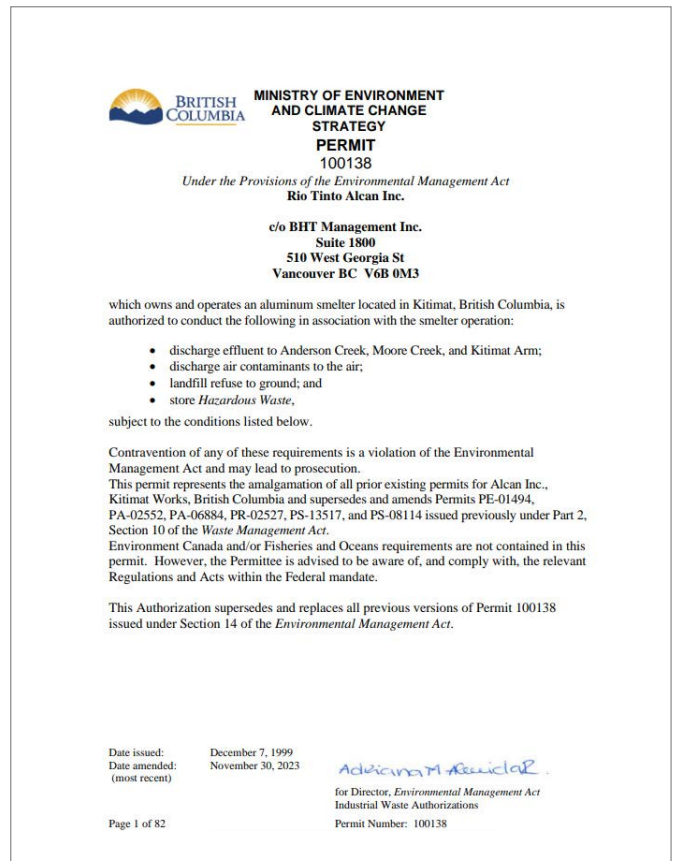
In 1999, Rio Tinto's BC Works became the first industrial facility in British Columbia to obtain a multi-media environmental permit from the provincial government under authorization 100138. The P2-00001 Multi-Media Waste Discharge Permit (P2 Permit) comprehensively addresses multiple air, water and 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 results of an annual review of air emissions monitoring, ambient air quality monitoring, surface water, effluent monitoring, groundwater monitoring, vegetation monitoring, and waste management monitoring where applicable for both the Kitimat and Kemano Operations. A summary of the annual non-compliances and reportable spills is included in this report in Chapter 11.

## Access & comments on the report

The 2024 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 made via email: [BCWorksInfo@riotinto.com](mailto:BCWorksInfo@riotinto.com) and via phone: 1 250 639 8383.



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.

### 2024 Operational year

In January of 2024 the smelter was still operating at capacity, having achieved full operations in September 2023. In January 2024, the anode paste plant, the coke calcination plant in carbon south, and the anode bake furnace in carbon north were all operational (Figure 2.1).

The focus of 2024 was continued operational stability. In July 2024, the decision was made to modulate 6% of pots due to ongoing drought conditions in the Nechako reservoir. Operating at a nominal 94% pots throughout the remainder of 2024, as well as purchasing power from the market, allowed us to mitigate the load on Kemano and protect the health of the reservoir and Nechako River.

Investing money back into our operational facilities is an important part of managing our business strategy, now and for the future. In September and October 2024, we undertook a significant upgrading project to replace our bath mill. The mill is an integral part of our operational process, where it handles “bath” – a cryolite cover mix used in our operations, which is recycled by crushing and screening at the bath plant. The complexity and magnitude of replacing this mill made it the largest project executed on site since 2018. The new mill was partially assembled off-site and then moved into position in early October, with the project completed and the new mill in operation by the end of the month. Replacing and upgrading this vital infrastructure allows us to continue with safe, sustainable and reliable operations.

In late 2024 we also broke ground on a project to replace our alumina conveyor. The new system is an enclosed pipe conveyor, which will significantly reduce dust emissions and spill risks while improving asset reliability. We look forward to completing this project in 2025.

### Operational process

The various components of the plant are described below and shown in Figure 2.2

#### Wharf & logistics

The main raw materials used in the aluminium smelting process are received at the wharf. These materials are alumina, green coke, liquid pitch, calcined coke, and external anodes. 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. Liquid pitch is stored in 3 storage tanks and is used in combination with calcined coke and other ingredients to form carbon anodes. Additionally, aluminium fluoride, another key material used in the smelting process, is received by rail or truck and stored onsite for use in the electrolytic reduction process.

#### 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 (liquid 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 reacts with the alumina ore (composed of bonded atoms of aluminium and oxygen,  $Al_{2}O_{3}$ ) 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. The aluminium smelting process takes place in the 4 reduction buildings, each building houses 96 pots totalling 384 pots.

## Casting

After it is siphoned from the pots in reduction, the molten aluminium is transported to the casting departments in crucs. 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, iron, chromium, and manganese) 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 three types of aluminium ingots: value-added sheets, which use 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. Additionally, BC Works has the capacity to produce value-added remelt ingots, which would also combine pure aluminium with alloying materials to improve product properties.

## Kemano

The electrolytic 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

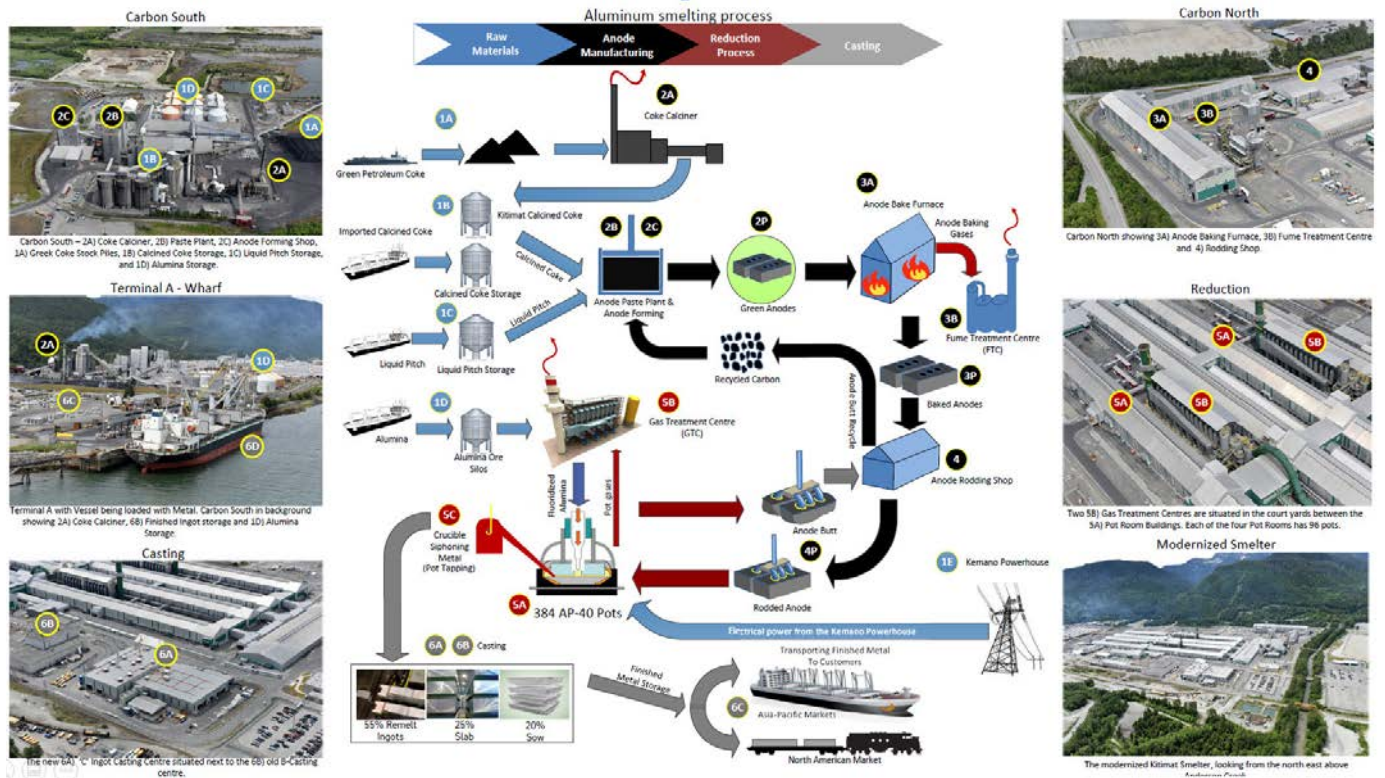


Figure 2.2 Kitimat Environmental operations



**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 Scrap and salvage recycling
- 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 HSEQ Management System’s 17 elements, which encompass the continuous improvement cycle of Plan, Do, Check, and Review (PDCR).

## Independent certification

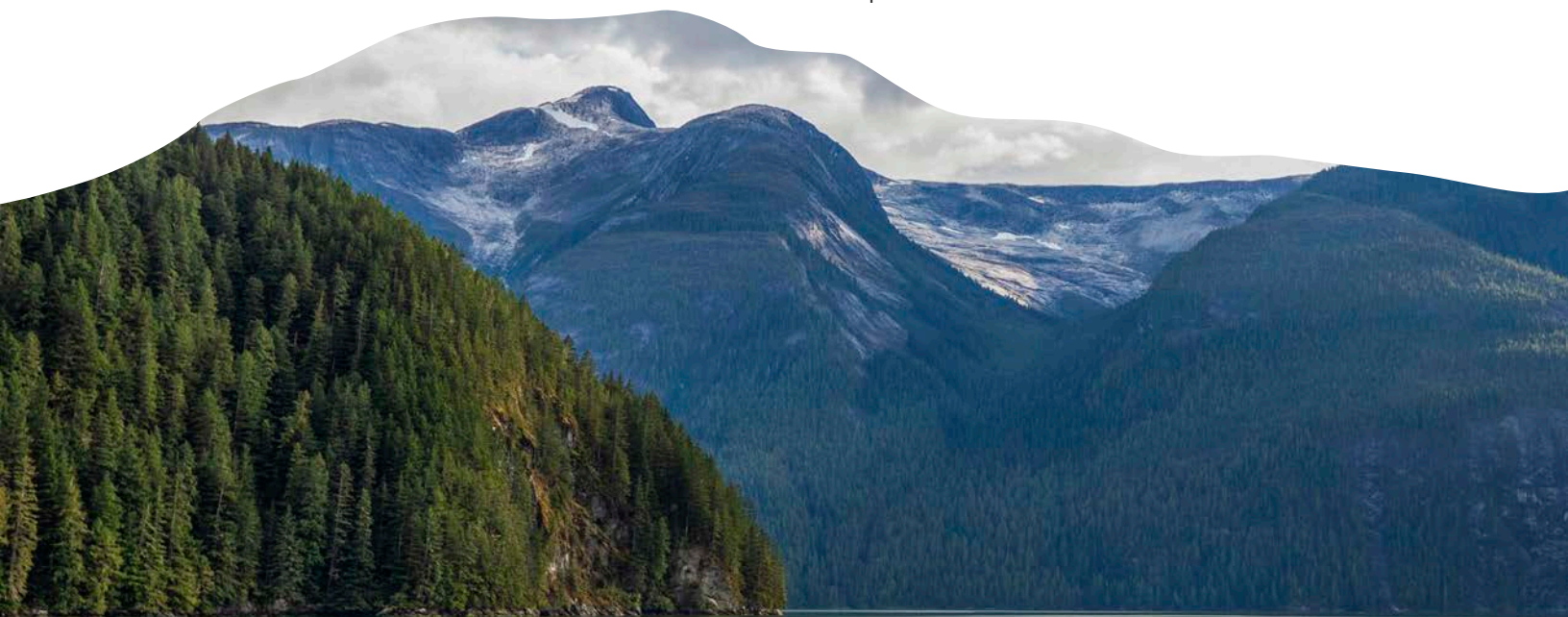
Since 2001, BC Works has been certified under the requirements of the ISO 14001 (1996) environmental program, with certification updated more recently to the ISO 14001 (2015) standard. ISO 14001 (2015) provides independent verification that BC Works assesses its environmental impacts, maintains procedures 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, BC Works also achieved certification under the Aluminium Stewardship Initiative (ASI) Performance Standard. This certification confirms compliance with rigorous environmental, social, and governance standards. The ASI certification aligns with Rio Tinto’s values of sustainable development and provides customers with independent assurance that the metal used in products such as coffee pods, cars, and smartphones is produced responsibly—with low carbon emissions, high standards for biodiversity, respect for Indigenous peoples’ rights, and responsible water management.

## Audit program

Independent ISO compliance and conformance audits are a requirement for certification. In 2023, the ISO 14001 surveillance audit was completed, extending Kitimat’s certification under the 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 first earned 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, BC Works underwent another ASI recertification audit and received full certification. 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<sup>3</sup> 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 and phytoremediation, along with saltwater addition to smooth fluctuations of inflows and contaminant levels. B-Lagoon discharges effluent continuously into the Douglas Channel. In 2024, the average discharge rate was 22,025 m<sup>3</sup> 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 2023 Rio Tinto made a significant investment to the B-Lagoon outfall improving the structure to reduce emergency overflows to the Douglas channel along with reduce the likely hood 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 2024 there were no overflow events.

Discharge measurements related to permit requirements and additional monitoring are described below in the following 2024 performance section.

### 2024 Performance

#### Effluent water quality monitoring

Effluent water quality is monitored annually for the following parameters: flow variability, dissolved fluoride, dissolved aluminium, TSS, cyanide, temperature, conductivity, hardness, toxicity, acidity and Total PAH. 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 in January to March and in September through December. The total amount of rainfall in 2024 (1873 mm) was very similar comparing to previous years. Most of the rain came in the fall months of 2024.

#### 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 2024 dissolved fluoride, dissolved aluminium and total suspended solids loads slightly decreased from the previous year. TSS has been the most stable of the parameters often coming back as non-detect from 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 not exceeded in 2024. Average dissolved fluoride concentration for the year derived from composite sampling was 3.8 mg/L. The long-term trend is illustrated in Figure 4.2. The 2024 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 2024, concentrations of dissolved aluminium did not exceed the maximum permit limit of 3.0 mg/L. The annual average of dissolved aluminium concentration was 0.30 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 2024 were much lower than the permit level. The annual average concentration for the composite samples was 2.4 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 lining 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 2024. 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 2024 (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 2024.

## 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 2024 annual pH composite sample average was 6.9. All sample measurements were within the permit limits. (Figure 4.9).

## Polycyclic Aromatic Hydrocarbons (PAHs)

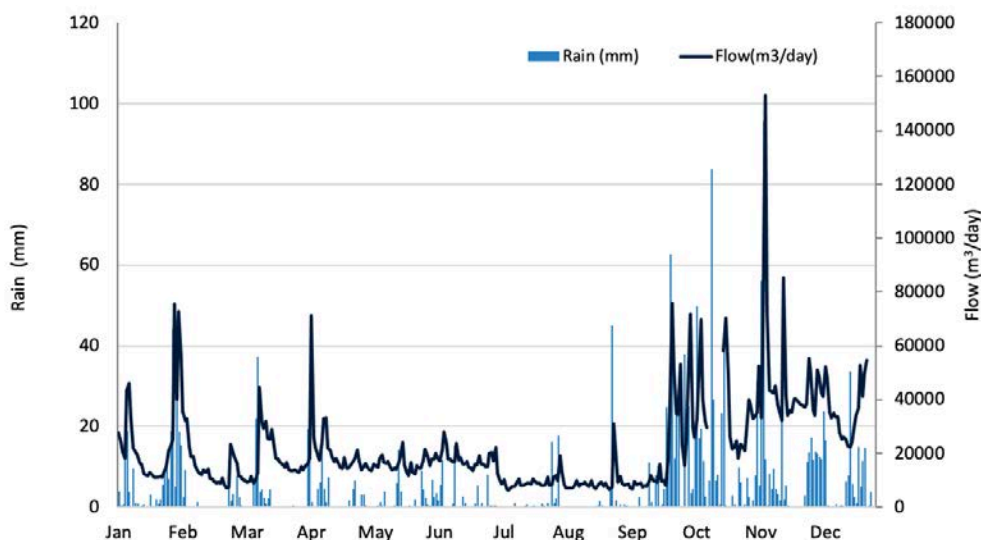
Polycyclic Aromatic Hydrocarbons (PAHs) are a large family of chemical compounds (more than 4,000 have been identified) generated by the incomplete combustion of organic material.

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

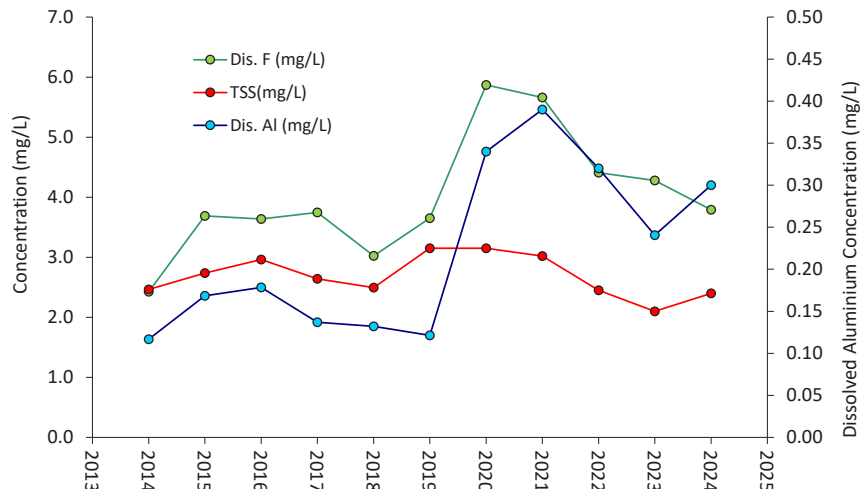
Other sources include raw materials (green coke and pitch) handling. PAHs are monitored using two methods: weekly analysis of composite and monthly grab samples. PAHs are also analysed from grab samples taken during special events. B-Lagoon discharges are monitored and analysed for 15 of the most common PAH compounds (Figure 4.10). In 2024 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 2024 were within permit limits set at 0.01 mg/L.

**Figure 4.1**  
Flow variability,  
B-Lagoon 2024



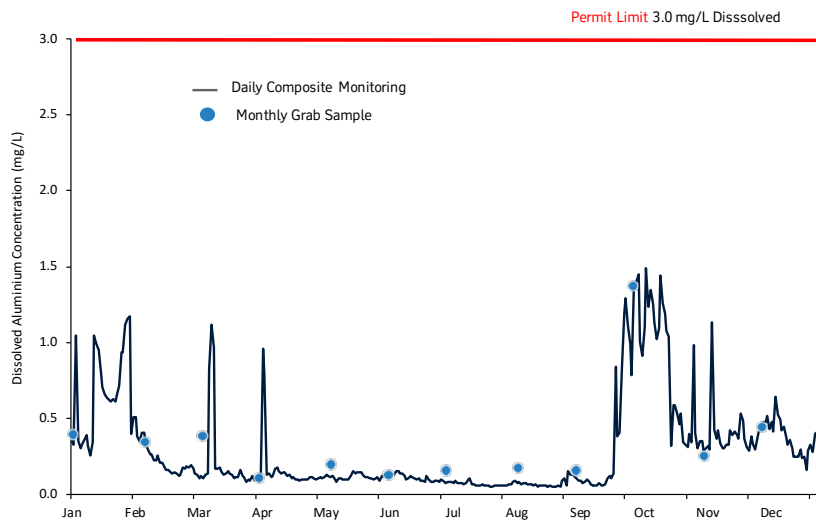
**Figure 4.2**  
Dissolved Fluoride,  
Dissolved Aluminium and  
Total Suspended Solids,  
B-Lagoon 2024



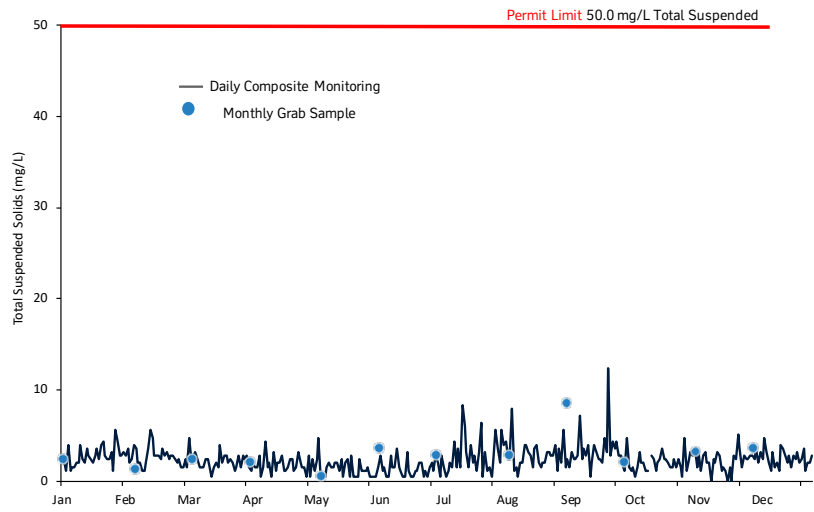
**Figure 4.3**  
Dissolved Fluoride,  
B-Lagoon 2024



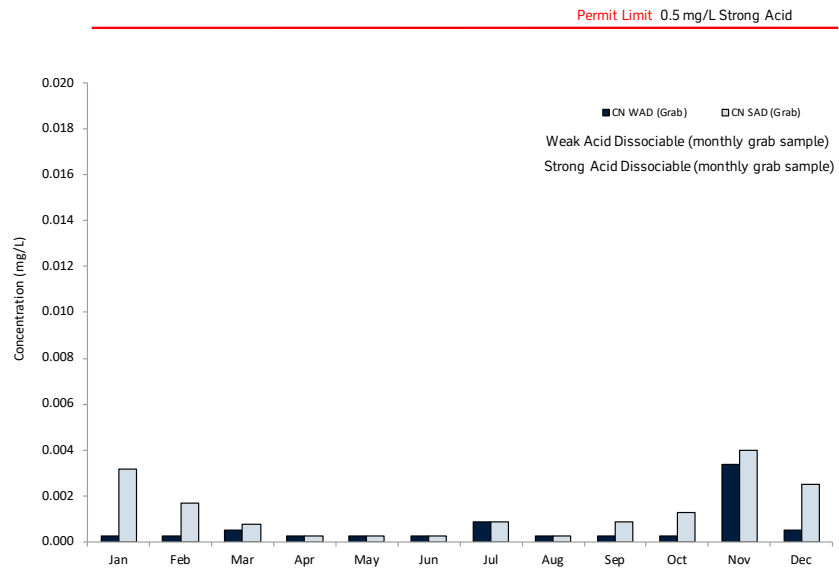
**Figure 4.4**  
Dissolved Aluminium,  
B-lagoon 2024



**Figure 4.5**  
Total Suspended Solids,  
B-lagoon 2024



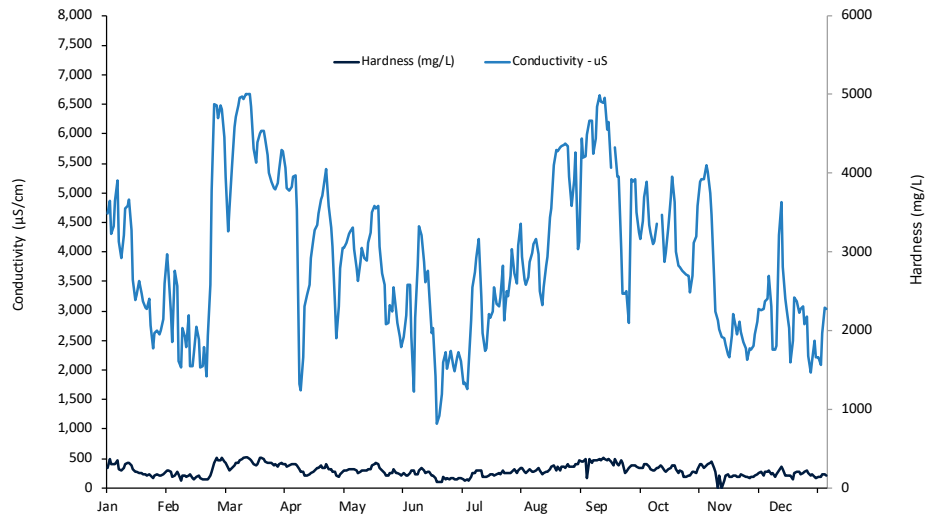
**Figure 4.6**  
Cyanide,  
B-lagoon 2024



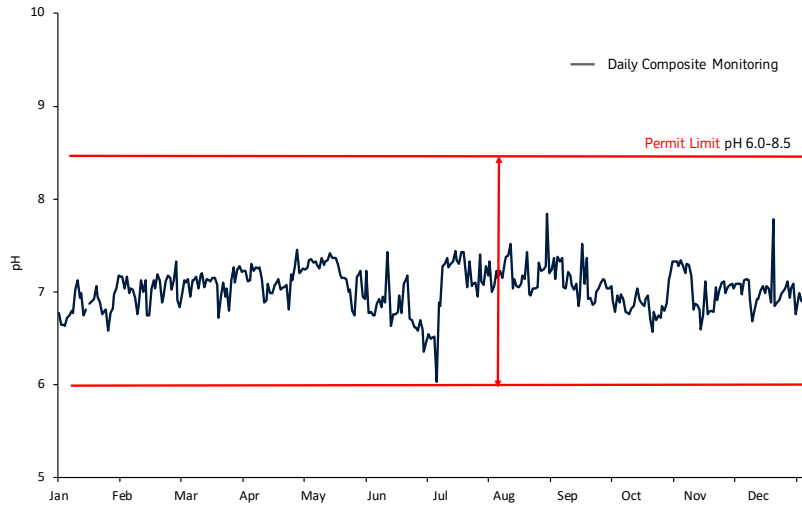
**Figure 4.7**  
Temperature,  
B-lagoon 2024



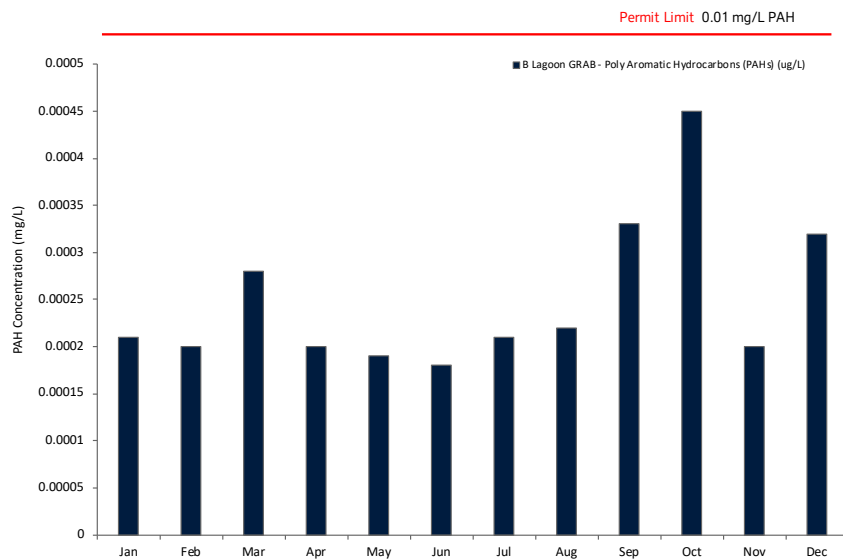
**Figure 4.8**  
Conductivity and hardness, B-lagoon 2024



**Figure 4.9**  
Acidity, B-lagoon 2024



**Figure 4.10**  
Polycyclic Aromatic Hydrocarbons, B-lagoon 2024



# 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.

## 2024 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 areas 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<sub>2</sub>), 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

The year 2024 marked a significant year for BC Works, with operations sustaining full production from the outset and building on the milestone of reaching full capacity in 2023. However, at the end of Q2, smelter load was reduced in order to take proactive steps to mitigate the drought conditions of the Nechako Reservoir.

Throughout the year, BC Works documented eight self-reported non-compliances: seven stemming from emission control device upsets and bypasses, and one tied to a permit limit exceedance for total particulate matter at the Pyroscrubber stack. Each incident prompted thorough investigations and completed closure reports (refer to Chapter 11 for details on permit non-compliances). All other air monitoring compliance points (stacks) at BC Works adhered to permit limit in 2024, except for the Pyroscrubber stack, which recorded elevated total particulate matter levels in December.

## 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 Ministry of Environment and Parks.

Table 5.1 provides a summary of dust collector upsets. A notable entry from 2024 involves upsets with unknown duration, identified during an investigation of a reporting permit non-compliance. (See Chapter 11 for additional information).

## 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 Ministry of Environment and Parks. Table 5.2 shows each bypass that occurred for each pollution control device in 2024 in Carbon South. In 2024, there were two self-reported permit non-compliances due to late reporting of upsets related to the incinerators in APP (See Chapter 11 for additional information).

### 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 2024, the Pyroscrubber and the cooler were stack sampled in May, September, and December. The results were within permit limits except total particulate matter level of the Pyroscrubber in December.

### 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 and PAH.

### 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 bypasses are communicated to external stakeholders at that time and 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 Ministry of Environment and Parks within required reporting timeline which is different for type of bypasses (e.g., planned, approved, and unplanned bypasses). Table 5.6 shows each upset that occurred in 2024.

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 2024, the parameters were compliant (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). Two methods were employed to calculate the amount of fugitive fluoride released during cooling in 2024. From January to March, an emission factor of 0.07 kg of fluoride gas per Mg of aluminium was applied. From April to December, an adjusted Pallet Storage Building (PSB) methodology was used to determine emissions. These factors contribute to the plant-wide Total Fluoride permit limit (refer to the section on Plant-Wide Total Fluoride Emissions).

### 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 re-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) to de-rod the anode by removing the carbon. The carbon is then transferred 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 on a monthly basis to the Ministry of Environment and Parks. 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 2024 (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 derived from 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 Ministry of Environment and Parks 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 2024, no planned upsets occurred at the GTCs, thanks to improvements made in 2023, including the installation of a second airlift, which enabled maintenance without triggering an upset. 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 2024.

The GTC is monitored on an annual basis as per permit requirements for fluoride, particulates and sulphur dioxide (Table 5.14). In 2024, GTC stacks were sampled once in October. 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 Ministry of Environment and Parks 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). In 2024, the continuous monitors in 8 half buildings were utilized to monitor the emissions from the 8 operational half buildings.

## 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 2024 as per permit requirements for (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 gas 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 2024 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 Ministry of Environment and Parks as either a request for an approved bypass (for planned works) or as an emergency notification (due to an unplanned event). In 2024, one of the permitted dust collectors, B221 Cruce Cleaner, went offline to be replaced with the new dust collector. While using a mobile dust collector at the emission source, B221 Cruce Cleaner dust collector was on a pre-approved bypass. Table 5.17 is a list of reported upsets for dust collectors in 2024.

## 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. The casts from DC4 are considered the final product, meaning customers do not re-melt them. 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, while Furnace 62 is now also utilized for casting foundry alloy ingots. 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 used for dross cooling and is monitored for leaks. No leaks were detected in 2024.

### Furnace 62

Furnace 62 was historically used for ingot chain, but in 2019, this process was modified so that furnace 62 can also be used to produce Foundry, a type of value-added product (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 2024, there were no permit exceedances of the total fluoride emissions 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 2022 and 2023, there is 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), the slight increase in 2022 and 2023 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 53%, and the Gas Treatment Centres, which accounted for 17% of total particulate emissions for BC Works (Figure 5.11).

### Sulphur Dioxide emissions

Plant-wide sulphur dioxide (SO<sub>2</sub>) emissions are calculated using a mass balance calculation, incorporating sources from three areas: Carbon South, Carbon North, and Reduction. In Carbon South, during the coke calcination process, green petroleum coke is processed into calcined coke, releasing sulphur dioxide emissions through the Pyroscrubber and cooler. In Carbon North, during the anode baking process, green anodes made from calcined coke, recycled anodes, and pitch are baked, releasing sulphur dioxide through the Fume Treatment Centre. In Reduction, during the electrolytic process, anodes are consumed, and sulphur dioxide is emitted via the reduction roof vents and Gas Treatment Centres. In 2022, the Pyroscrubber and cooler were non-operational.

Average SO<sub>2</sub> 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 2024, the monthly average SO<sub>2</sub> emission levels remained well below the permit limit (see Figure 5.12).

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).

In addition to monitoring emissions, BC Works carries out every year extensive monitoring activities under the SO<sub>2</sub> Environmental Effects Monitoring program (SO<sub>2</sub> EEM), where four different lines of evidence are studied; water, human health, soil and vegetation. Results and information about the SO<sub>2</sub> EEM can be found online at [www.riotinto.com/bcworks](http://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 (81%), and most smelting-related emissions are attributable to anode consumption, while 5% 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 CO<sub>2</sub> equivalent produced in aluminium smelting, which impacts the amount of PFC emissions. During the restart, an increase in anode effect frequency and duration is expected and observed to peak in 2022 while steadily decreasing throughout 2023 (Figure 5.16).

BC Works' GHG emissions have been steadily decreasing since 2015 (Figure 5.17). However, due to operational instability starting in 2019 with the early pot failure and 2020 pot replacement campaign, followed by the 2021 labour dispute and subsequent 75% shutdown of the smelter and the 2022 restart, there has been an increasing trend in tonnes of CO<sub>2</sub> equivalent per Mg Al. In 2023, as operations stabilized, GHG emissions began to decrease. In 2024, the operation significantly improved the anode effect rate compared to previous years, reducing PFC emissions and their corresponding CO<sub>2</sub> equivalent.

BC Works aims to continue increasing the stability of the operations and decrease the greenhouse gas emissions with a reduction target of 5% for 2025.

### 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 2024, the NO<sub>x</sub> emissions showed relatively similar levels throughout the year except for the coke calcination maintenance shut-down period in April and November in Carbon South.

When the new plant reached full production in 2016, so did the NO<sub>x</sub> 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)

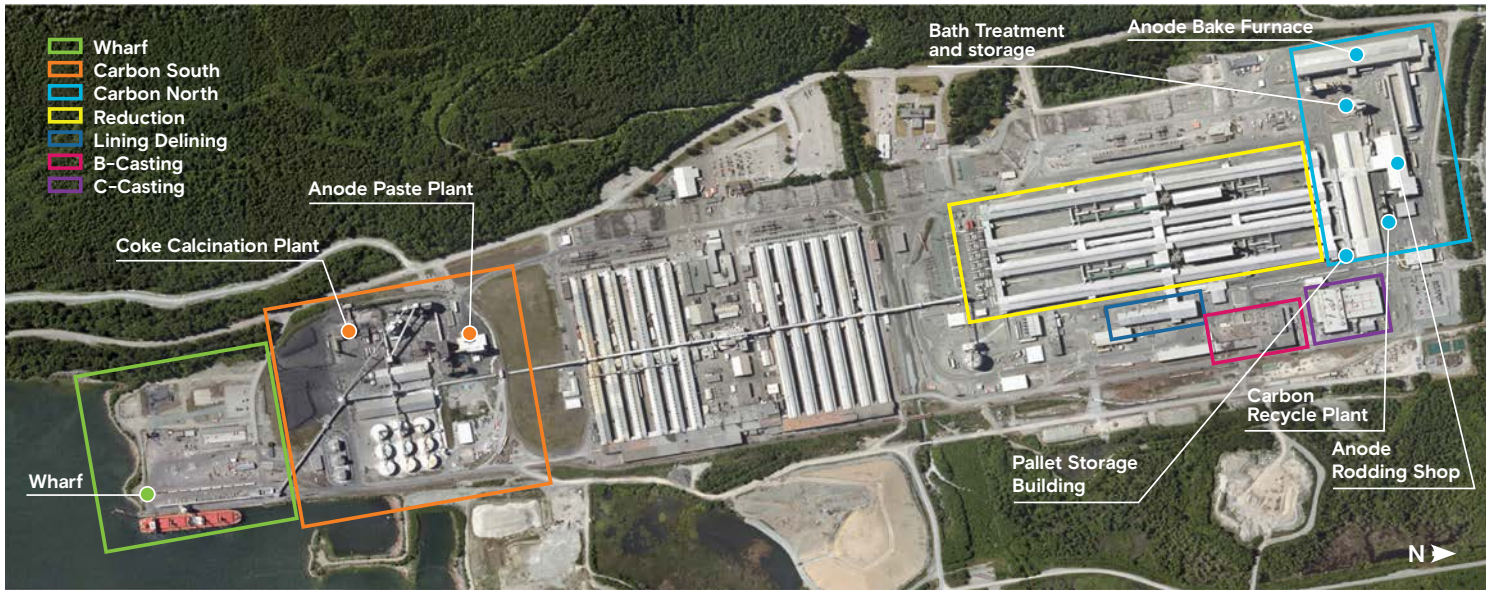
The fugitive dust management plan (FDMP) provides guidance for managing and controlling fugitive dust. The FDMP does not address requirements under WorkSafe BC or other regulatory requirements beyond EMA. The FDMP is intended to cover the handling of raw materials and by-products that are normal to both 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.

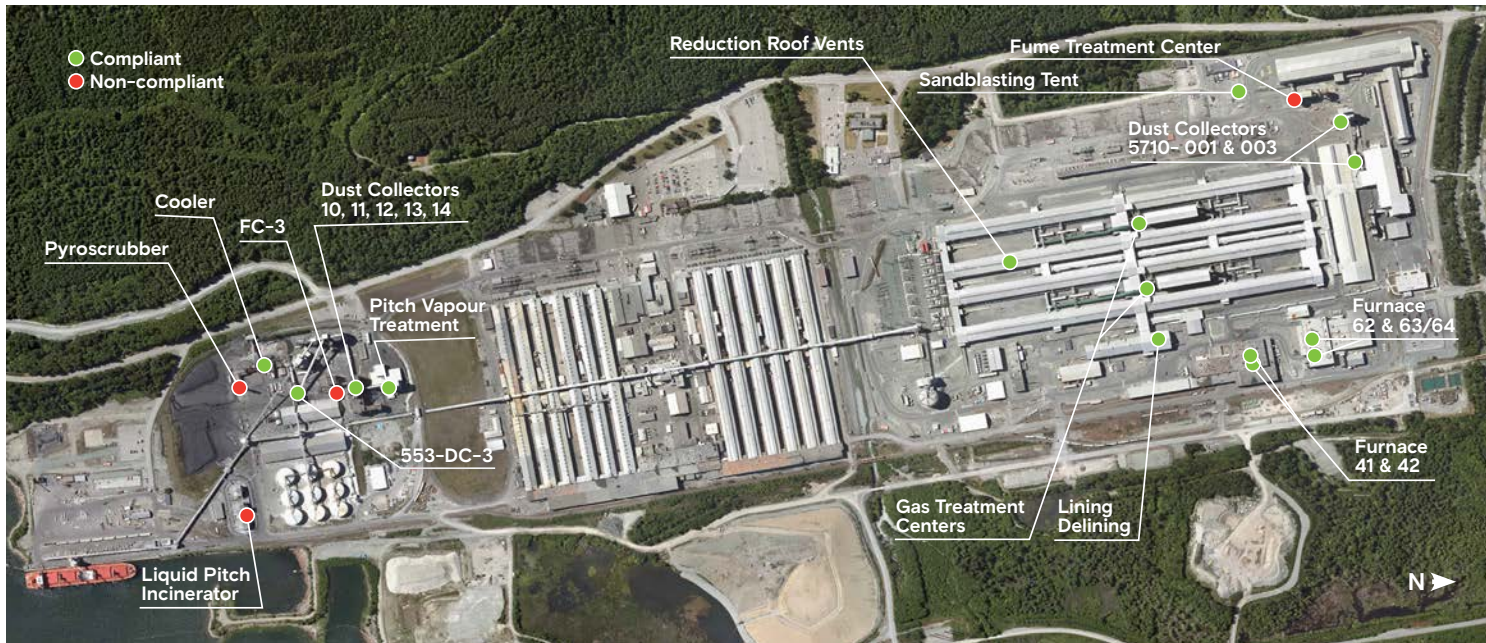
**Figure 5.1 Operational Areas**

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).



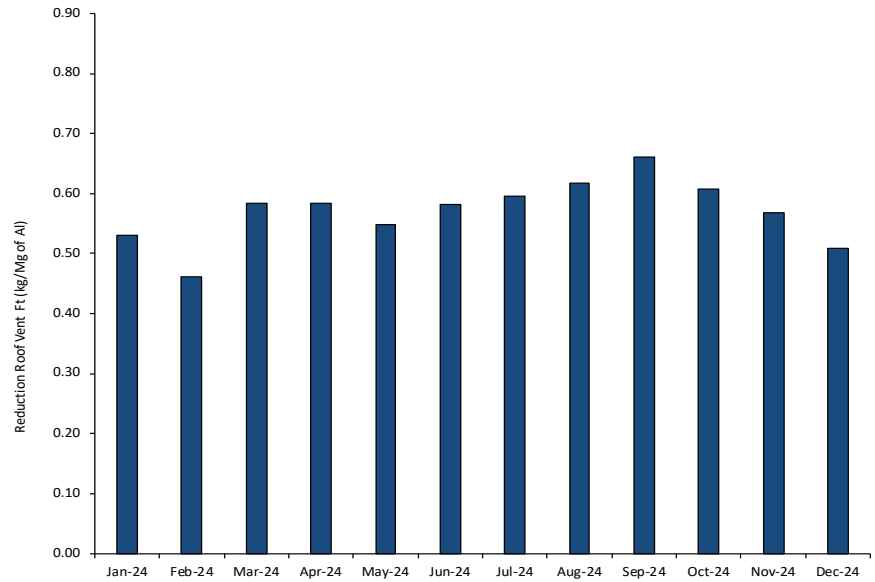
**Figure 5.2 Operational Performance.**

There were 4 locations that resulted in 8 permit non-compliances (red) related to air emissions discharges in 2024; the remaining discharge points were compliant (green).



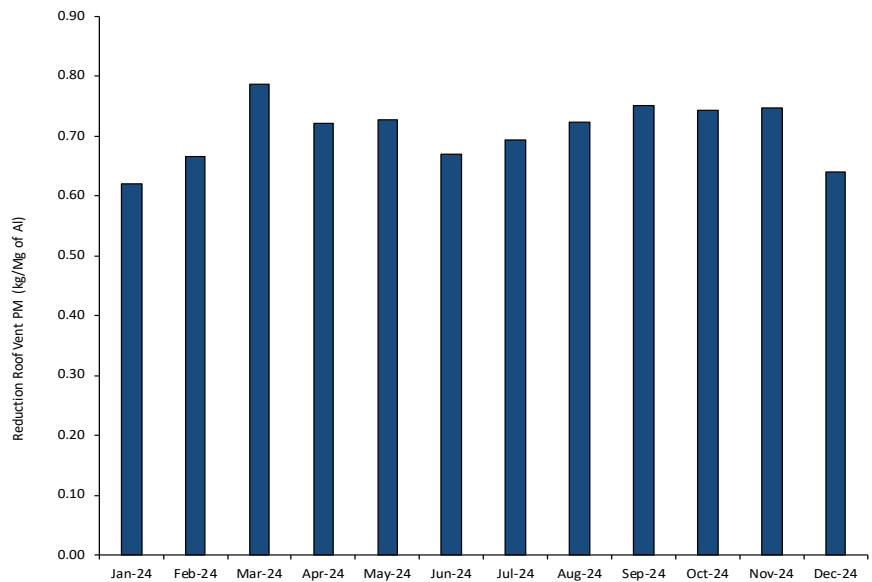
**Figure 5.3  
Reduction Roof Vent Total Fluoride**

The roof vent emissions are reported monthly from January – December. Roof vent fluoride emission is used to calculate plant wide total fluoride emission (permit limit 0.9 kg/Mg Al). See Plant wide emission for details.



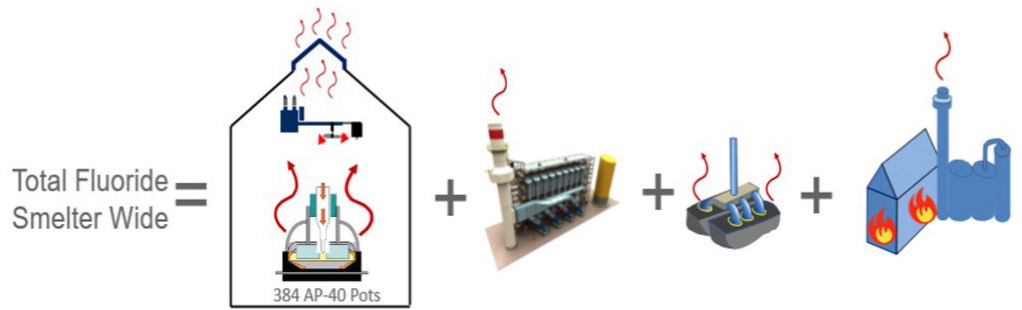
**Figure 5.4  
Reduction Roof Vent Particulate Emissions**

The roof vent emissions are reported monthly from January – December. Roof vent particulate emission is used to calculate plant wide total particulate emission (permit limit 1.3 kg/Mg Al). See Plant wide emission for details.



**Figure 5.5 Plant-Wide total Fluoride Emissions Calculation**

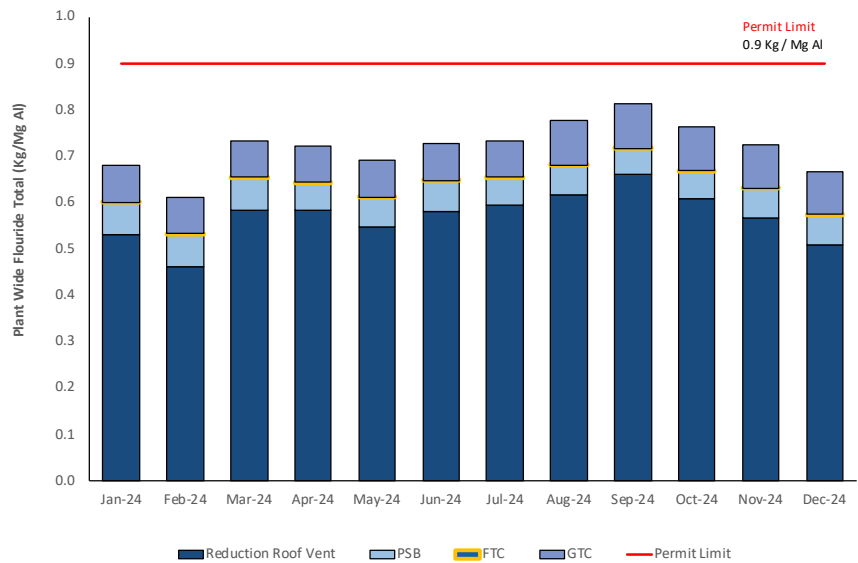
The plant wide total fluoride is calculated in kilograms per Mg Al each month by adding the emissions from the reduction roof vents plus the gas treatment centre stack test results plus the emissions factor from the pallet storage building plus the stack test results from the fume treatment centre.



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

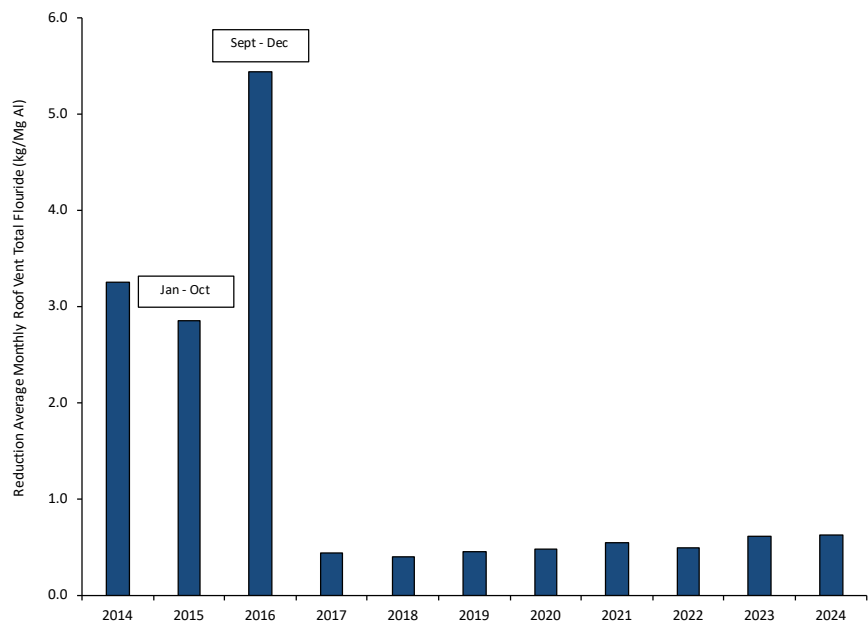
**Figure 5.6**  
**Plant Wide total Fluoride Emissions**

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.



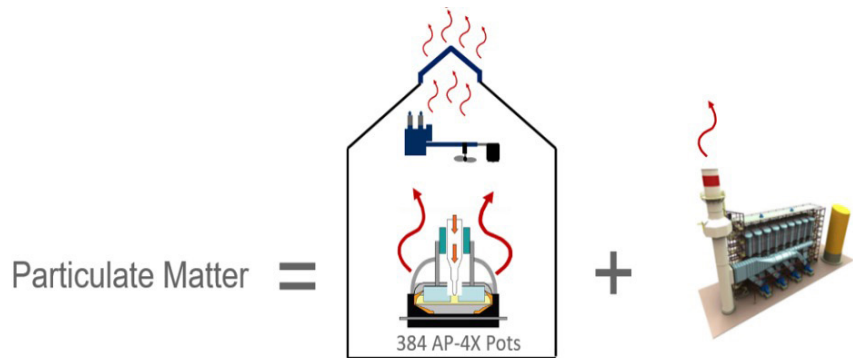
**Figure 5.7**  
**Historical Total Fluoride Emissions**

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 take into account the entire year's monthly data into the average due to data availability.



**Figure 5.8**  
**Plant Wide Particulate Emissions Calculation**

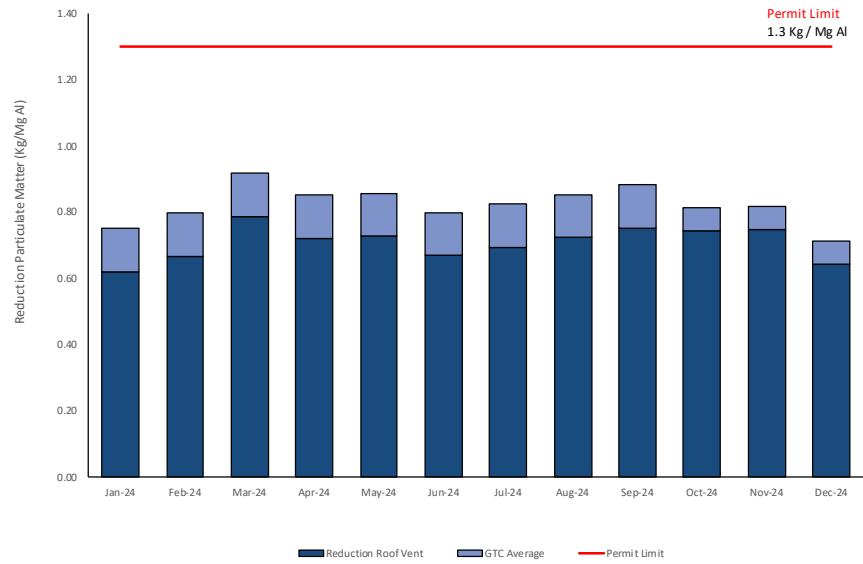
The plant wide particulate emissions is calculated in kilograms per Mg Al for each month by adding the emissions from the reduction roof vents plus the gas treatment centre stack test results.



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

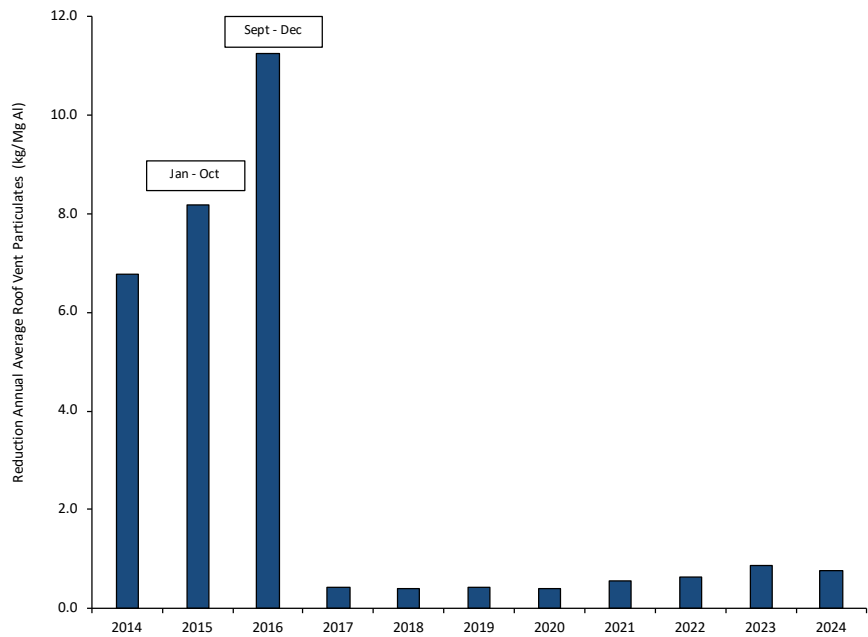
**Figure 5.9  
Plant Wide Particulate Emissions Calculation**

The plant wide particulate emissions 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.



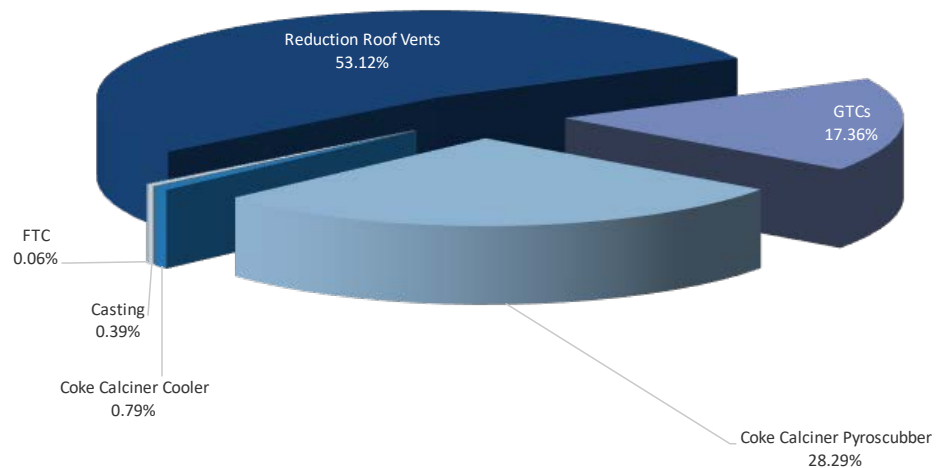
**Figure 5.10  
Historical Particulate Emissions**

The average monthly roof vent emissions for particulates have decreased since 2015 when the VSS smelter was shut down in October. Note that years 2015 and 2016 did not take into account the entire year's monthly data in the average due to data availability.



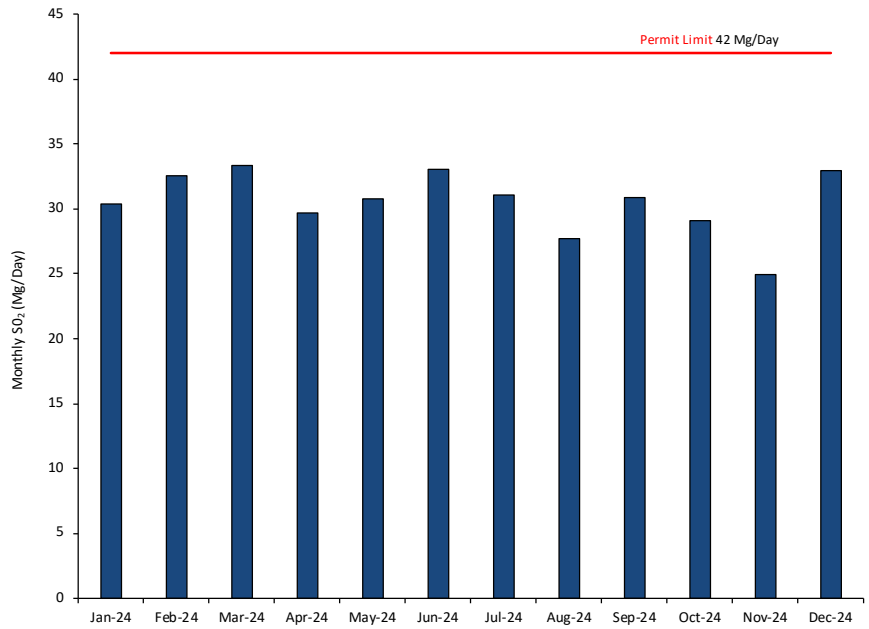
**Figure 5.11  
Particulate Emissions by Operational Area**

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



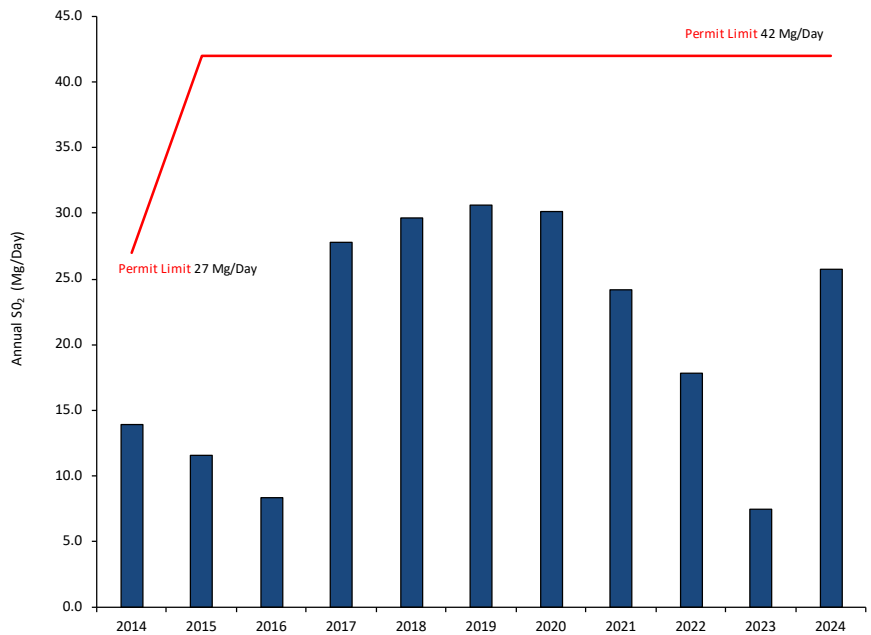
**Figure 5.12**  
**Sulphur Dioxide Emissions**

Sulphur Dioxide emissions in 2024 show a similar level throughout the year except the maintenance shutdown period in April and October–November.



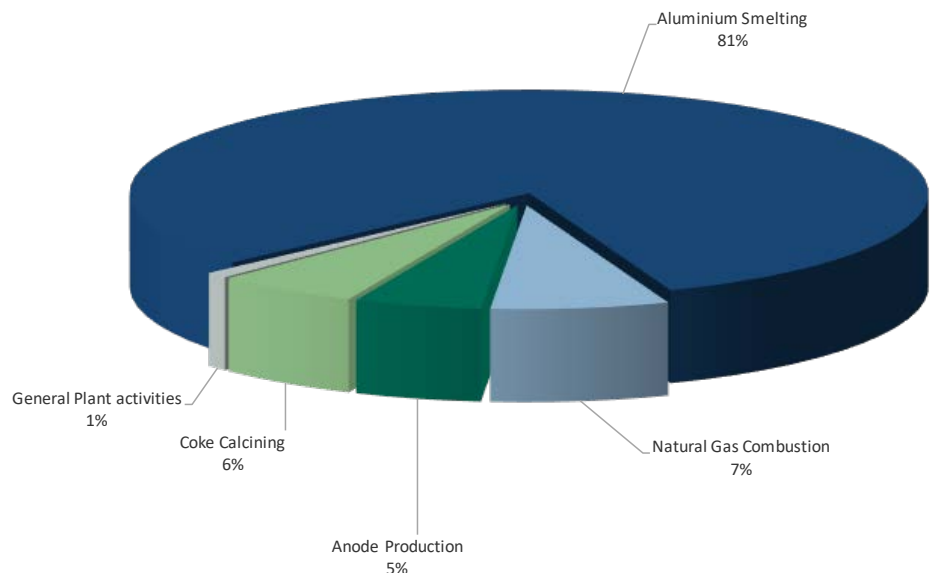
**Figure 5.13**  
**Historical Sulphur Dioxide Emissions**

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, 2024 shows higher levels of SO<sub>2</sub> emissions.



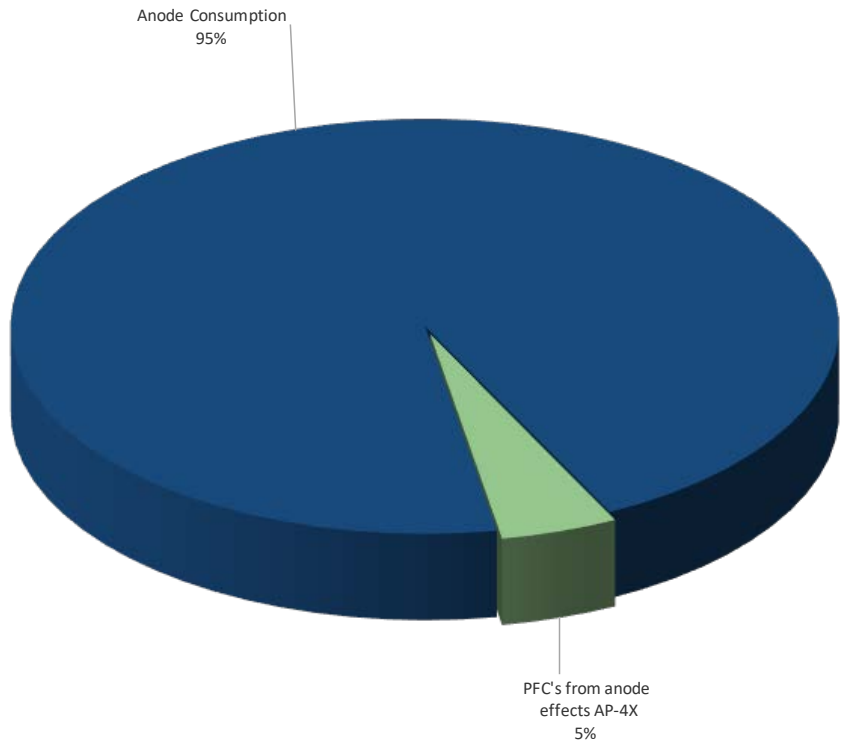
**Figure 5.14**  
**Operational sources of GHG Emissions**

Aluminium smelting produces the majority of greenhouse gas emissions during the electrolytic process.



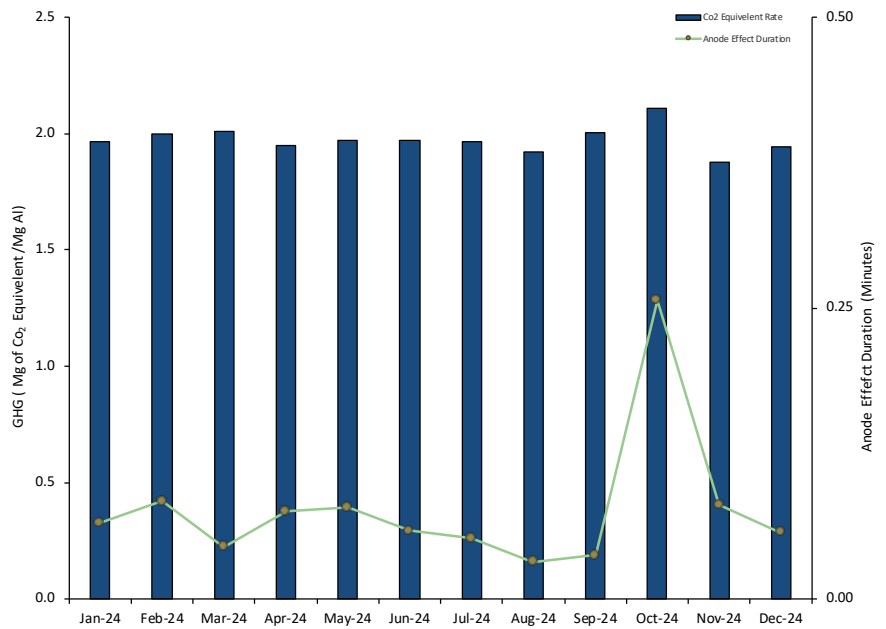
**Figure 5.15**  
**GHG Emissions from Aluminium Smelting**

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



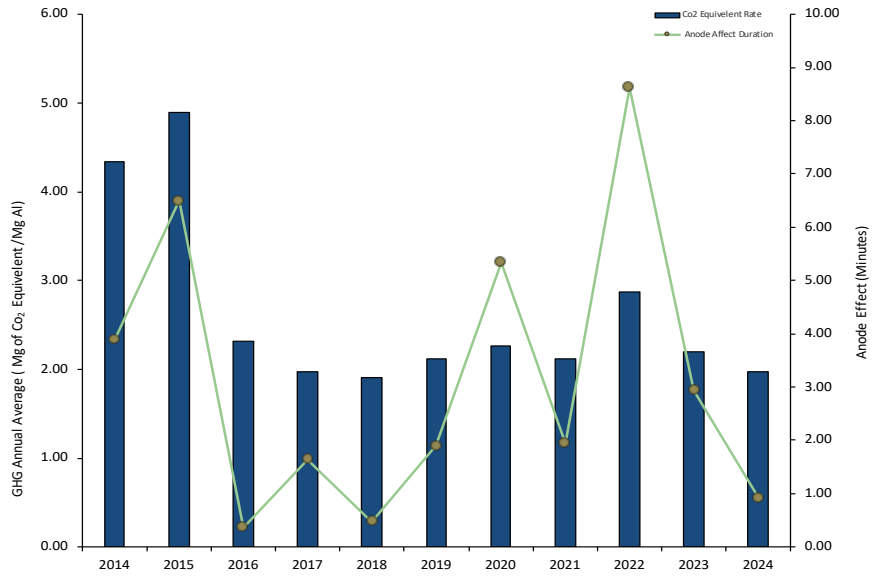
**Figure 5.16**  
**Monthly GHG Emissions & Anode Effect Duration**

A few process challenges resulted in elevated anode effect duration in October.



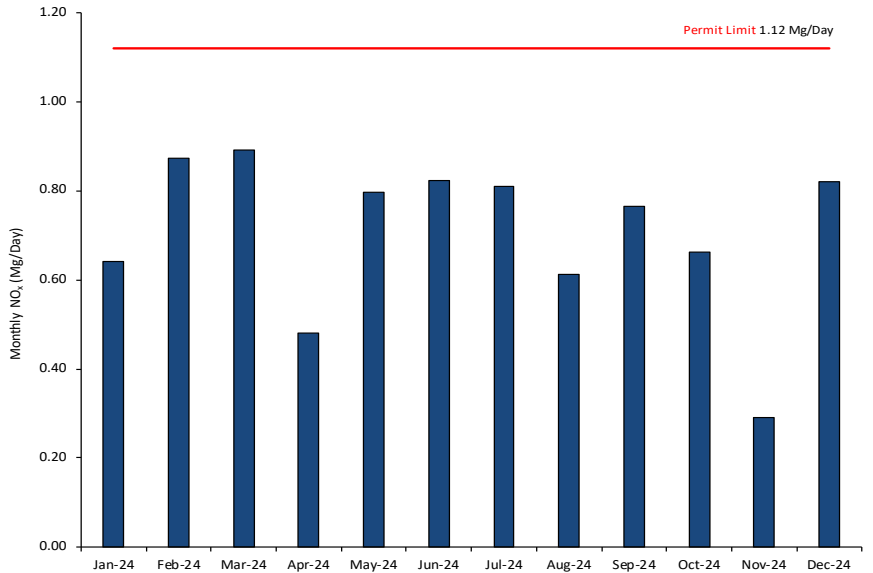
**Figure 5.17**  
**Historical GHG Emissions & Anode Effect Duration**

The annual average GHG emissions (Mg of CO<sub>2</sub> equivalent per Mg Al) have decreased since 2015 when the VSS smelter was shut down. During stable operational years, the emissions were below 2.0 Mg of CO<sub>2</sub> equivalent per Mg Al and in unstable years (since 2019), the emissions were above 2.0 tonnes of CO<sub>2</sub> equivalent per Mg Al.



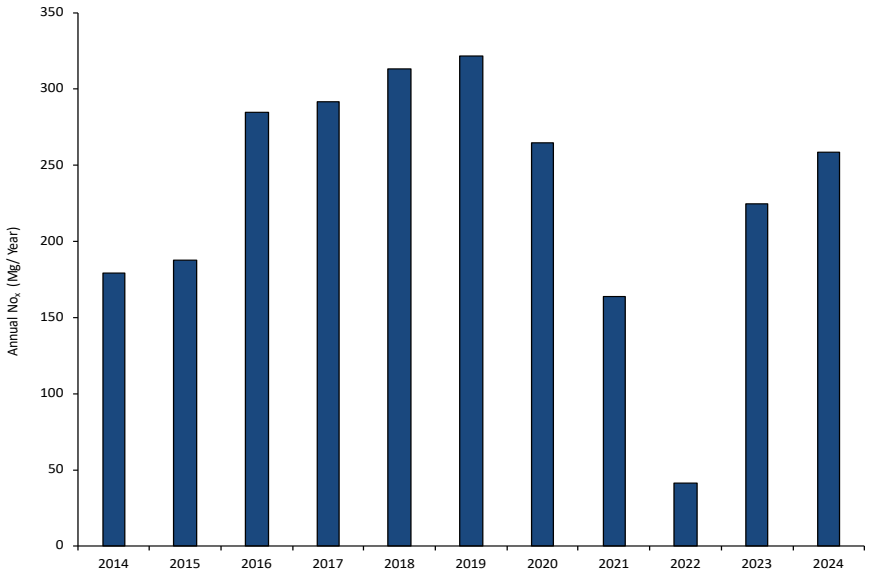
**Figure 5.18**  
**Monthly Nitrogen Oxide Emissions.**

Throughout 2024, NO<sub>x</sub> emissions were below the permit limit of 1.12 Mg per day. A subsequent shutdown of the coke calcination plant in April and October 2024 is seen in the decrease in emissions.



**Figure 5.19**  
**Historical Nitrogen Oxide Emissions.**

Summation of annual NO<sub>x</sub> emissions from 2014 to 2024.



**Table 5.1 Wharf Emission Control Upsets Hours**

Wharf dust collectors that had upset conditions during unplanned maintenance challenges. Entries with unknown duration were identified dust collector upset via permit non-compliance investigation (NCR 20240420).

Date	Equipment	Type	Duration	Cause
1-Jan-24	B134-DC-17	Unplanned	Unknown	Reduced suction
3-Jan-24	T2-DC1A	Unplanned	6h	Inoperative air pulse and clogged bags
9-Jan-24	Stn3-DC-10	Unplanned	Unknown	Rotary valve trips reducing collection efficiency
12-Jan-24	B514-DC-15	Unplanned	Unknown	Rotary valve trips reducing collection efficiency
15-Jan-24	B134-DC-17	Unplanned	Unknown	Reduced suction
15-Jan-24	T9-DC-20	Unplanned	Unknown	Belts loose leading to reduced collection efficiency
18-Jan-24	B134-DC-17	Unplanned	Unknown	Rotary valve trips reducing collection efficiency
22-Jan-24	B134-DC-17	Unplanned	Unknown	Reduced suction efficiency due to holes in ducting
22-Jan-24	B134-DC-17	Unplanned	Unknown	Reduced suction efficiency due to impeller housing wear
23-Jan-24	B134-DC-17	Unplanned	Unknown	Reduced suction due to rotary valve motor failure
23-Jan-24	B504C-DC-37	Unplanned	Unknown	Reduced suction due to rotary valve motor failure
25-Jan-24	B514-DC-15	Unplanned	Unknown	Belts loose leading to reduced collection efficiency
25-Jan-24	Bin 21-DC-19	Unplanned	Unknown	Belts loose leading to reduced collection efficiency
29-Jan-24	B514-DC-15	Unplanned	Unknown	Reduced suction at headbox
2-Feb-24	Stn3-DC-10	Unplanned	Unknown	Rotary valve trips reducing collection efficiency
3-Feb-24	B134-DC-17	Unplanned	Unknown	Rotary valve trips reducing collection efficiency
3-Feb-24	Stn3-DC-10	Unplanned	Unknown	Reduced suction due to holes in ducting
4-Feb-24	B134-DC-17	Unplanned	Unknown	Belts loose leading to reduced collection efficiency
10-Feb-24	T9-DC-20	Unplanned	Unknown	Reduced suction at drop
12-Feb-24	B506-DC-5	Unplanned	Unknown	Reduced suction due to holes in ducting
13-Feb-24	T10-DC-21	Unplanned	Unknown	Reduced suction due to air gap
13-Feb-24	Stn3-DC-10	Unplanned	Unknown	Rotary valve trips reducing collection efficiency
14-Feb-24	T9-DC-20	Unplanned	Unknown	Reduced efficiency of dust collector filters
14-Feb-24	T9-DC-20	Unplanned	Unknown	Reduced filter efficiency
19-Feb-24	B506-DC-5	Unplanned	Unknown	Reduced suction due to holes in ducting
19-Feb-24	B506-DC-5	Unplanned	Unknown	Belts loose leading to reduced collection efficiency
22-Feb-24	B506-DC-5	Unplanned	Unknown	Rotary valve trips reducing collection efficiency
24-Feb-24	Stn3-DC-10	Unplanned	Unknown	Rotary valve trips reducing collection efficiency
26-Feb-24	B504B-DC-35	Unplanned	Unknown	Reduced filter efficiency
28-Feb-24	DC-1	Unplanned	Unknown	Reduced efficiency of dust collector filters
29-Feb-24	B506-DC-5	Unplanned	Unknown	Reduced filter efficiency
29-Feb-24	T11-DC-22	Unplanned	Unknown	Belts loose leading to reduced collection efficiency
29-Feb-24	T11-DC-23	Unplanned	Unknown	Belts loose leading to reduced collection efficiency
2-Mar-24	B506-DC-5	Unplanned	Unknown	Reduced suction efficiency due to seized impeller
2-Mar-24	B504J-DC-38	Unplanned	Unknown	Reduced filter efficiency
4-Mar-24	B514-DC-15	Unplanned	Unknown	Reduced filter efficiency
5-Mar-24	B506-DC-5	Unplanned	16h 45min	Equipment failure

Date	Equipment	Type	Duration	Cause
7-Mar-24	Stn3-DC-10	Unplanned	Unknown	Rotary valve trips reducing collection efficiency
7-Mar-24	Stn3-DC-10	Unplanned	Unknown	Reduced efficiency of dust collection due to bearing failure
9-Mar-24	B506-DC-5	Unplanned	Unknown	Reduced filter efficiency
17-Mar-24	Tower 10 - DC21	Unplanned	6h 24min	Insufficient dust collector bags
21-Mar-24	B504C-DC-37	Unplanned	Unknown	Motor Alarm - E3 fault: Overload
24-Mar-24	Stn3-DC-10	Unplanned	Unknown	Reduced filter efficiency
25-Mar-24	B504J-DC-38	Unplanned	Unknown	Reduced filter efficiency
30-Mar-24	B504G-DC-40	Unplanned	Unknown	Constant OverRange Warning Alarms
4-Apr-24	B506-DC-5	Unplanned	Unknown	Reduced suction from holes in filterbox
6-Apr-24	T9-DC-20	Unplanned	Unknown	Reduced filter efficiency
9-Apr-24	B504B-DC-35	Unplanned	Unknown	Reduced collection efficiency due to leak of rotary valve seal
11-Apr-24	T10-DC-21	Unplanned	Unknown	Reduced filter efficiency
13-Apr-24	Stn3-DC-10	Unplanned	Unknown	Reduced efficiency due to holes in ducting
13-Apr-24	FDC16 - AIRSLIDE F1	Unplanned	Unknown	Reduced efficiency of dust collector filter bags
13-Apr-24	FDC14A - AIRSLIDE F14A	Unplanned	Unknown	Reduced efficiency of dust collector filter bags
18-Apr-24	DC20	Unplanned	1day	Insufficient dust collector bags
23-Apr-24	dc19	Unplanned	21h	Insufficient dust collector bags
23-Apr-24	DC21	Unplanned	14h	Insufficient dust collector bags
26-Apr-24	DC17	Unplanned	1h 45min	Insufficient dust collector bags
28-Apr-24	DC15	Unplanned	14h 46min	Insufficient dust collector bags
11-May-24	T2-DC1A	Unplanned	2d 1h 21min	Equipment challenges
11-May-24	T6-DC3A	Unplanned	2d 1h 21min	Insufficient dust collector bags
16-May-24	DC15	Unplanned	21h 40min	Equipment challenges
17-May-24	T2-DC1A	Unplanned	8h 30min	Structure gap
26-May-24	T2-DC1A	Unplanned	15min	Damaged parts
28-May-24	K3 transfer conveyor	Unplanned	40min	Insufficient dust collector bags
31-May-24	T6-DC3A	Unplanned	1h 52min	Damaged parts
31-May-24	T6-DC3A	Unplanned	4d 3h 30min	Equipment challenges
10-Jun-24	DC20	Unplanned	15min	Insufficient dust collector bags
14-Jun-24	T11-DC22	Unplanned	30min	Insufficient dust collector bags
15-Jun-24	T2-DC1A	Unplanned	18min	Hole in Suction side pipe in DC1
24-Jun-24	B514-DC-15	Unplanned	15min	Damaged parts
5-Jul-24	DC17	Unplanned	15h 30min	Insufficient dust collector bags
7-Jul-24	DC20	Unplanned	13h 20min	Insufficient dust collector bags
16-Jul-24	DC17	Unplanned	30min	Incorrect valve position
19-Jul-24	DC17	Unplanned	1h 20min	Incorrect valve position
6-Aug-24	T6-DC3A	Unplanned	2h 10min	Equipment failure
1-Sep-24	T9-DC-20	Unplanned	34min	Insufficient dust collector bags
16-Oct-24	B504-DC-DE	Unplanned	25min	Air slide pressure too high
22-Nov-24	Stm3-DC-10	Unplanned	5min	Equipment failure
26-Nov-24	Bin 21-DC-19	Unplanned	18h	Equipment failure

**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	Type	Duration	Cause
15-Jan-24	FC-3	Unplanned	4h 13min	System condition fault
18-Mar-24	C38-DC-2	Unplanned	1d 5h 30min	Insufficient dust collector bags
2-Apr-24	LPI	Unplanned	0h 55min	System condition fault
20-Apr-24	FC-3	Unplanned	1h 43min	Lost communication
18-May-24	LPI	Unplanned	30min	Power outage
18-May-24	FC-3	Unplanned	30min	Power outage
12-Jun-24	FC-3	Planned	4h 5min	Transformer maintenance
8-Jul-24	LPI	Unplanned	12min	System condition fault
17-Aug-24	LPI	Unplanned	27min	System condition fault
28-Aug-24	Venturi & cooler	Unplanned	1d	Failure of a fan on the venturi system & calciner's cooler system
3-Sep-24	LPI	Unplanned	1h 40min	System condition fault
11-Sep-24	B565-DC-9	Unplanned	2d 9h 0min	Insufficient dust collector bags
21-Oct-24	LPI	Planned	3d 9h 44min	Replace Catalyst, routine Maintenance
1-Nov-24	5130-DCB-001	Unplanned	10min	Insufficient dust collector bags
17-Nov-24	FC-3	Unplanned	38min	Lost communication
14-Dec-24	FC-3	Unplanned	3h 20min	Lost communication

**Table 5.3 Calcined Coke Stack Test – Pyroscrubber**

The Pyroscrubber was stack sampled twice in 2024. April results was within permit limits, while December particulate level was above permit limit.

Performance Measure	Pyroscrubber	
	Apr-24	Dec-24
Date	Apr-24	Dec-24
Particulate (kg/hr) Permit Limit: 21.1 kg/Hr	13.6	<b>28.9</b>
SO <sub>2</sub> (kg/hr)	167.9	132.7
NOx (kg/hr)	13.8	9.2

**Table 5.4 Calcined Coke Stack Test – Cooler**

The Venturi scrubber was stack sampled twice in 2024 and was within permit limits.

Performance Measure	Venturi	
	Apr-24	Dec-24
Date	Apr-24	Dec-24
Particulate (kg/hr) Permit Limit: 3.9 kg/Hr	0.7	0.5
PAH (mg/m <sup>3</sup> )	0.07	0.05

**Table 5.5 Liquid Pitch Incinerator (LPI) Stack Test**

The LPI was stack sampled once in 2024 and the stack test result was compliant.

Performance Measure	LPI
Date	Sep-24
Particulate (mg/m <sup>3</sup> ) Permit Limit: 500 mg/m <sup>3</sup>	5.3
PAH (mg/m <sup>3</sup> )	0.003

**Table 5.6 FC-3 Stack Tests**

The FC-3 incinerator stack was sampled once in 2024 and the results were within permit requirements for particulates.

Performance Measure	FC3
Date	Apr-24
Particulate (mg/m <sup>3</sup> ) Permit Limit: 120 mg/m <sup>3</sup>	4.1
PAH (mg/m <sup>3</sup> )	0.32

**Table 5.7 Anode Paste Plant Dust Collector Stack Tests**

The dust collectors at the anode paste plant were stack sampled once in 2024 and were compliant with permit limits.

Performance Measure	Dust Collectors				
Dates	Apr-24	Apr-24	Apr-24	Apr-24	Apr-24
Particulate (mg/m <sup>3</sup> ) Permit Limit: 120 mg/m <sup>3</sup>	1.6	3.1	4.9	1.6	1.3

**Table 5.8 Pitch Vapor Treatment (PVT) Stack Test**

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

Performance Measure	PVT
Date	Apr-24
Particulate (mg/m <sup>3</sup> ) Permit Limit: 30 mg/m <sup>3</sup>	1.9
PAH (Kg/Mg of Paste) Permit Limit: 0.03 Kg/Mg of Paste	0.008

**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	Bypass Mode	Type	Duration	Cause
27-Feb-24	Mode 2	Planned	6h 36 min	Routine Maintenance
12-Mar-24	Mode 3	Planned	3h 2 min	Non routine maintenance
14-Mar-24	Mode 3	Unplanned	13 min	Power outage
18-May-24	Mode 2	Unplanned	19 min	Power outage
22-May-24	Mode 2	Planned	7h	Routine Maintenance
22-Aug-24	Mode 2	Planned	6h 47 min	Routine Maintenance
25-Oct-24	Mode 3	Unplanned	1h 27 min	Plant-wide power outage
31-Oct-24	Mode 3	Planned	21 min	Equipment repairs leading FTC outage
4-Nov-24	Mode 3	Unplanned	23 min	Equipment failure
12-Nov-24	Mode 3	Planned	26 min	Routine Maintenance
12-Nov-24	Mode 2	Planned	7h 14 min	Routine Maintenance
26-Nov-24	Mode 2	Unplanned	1h 18 min	Equipment failure
30-Dec-24	Mode 2	Planned	8h	Routine Maintenance

**Table 5.10 Fume Treatment Center Stack Test**

The FTC was stack sampled in 2024 and was within permit expectations.

Performance Measure	FTC
Date	Sep-24
Particulate (Kg/Mg of baked Anode) Permit Limit: 0.3 Kg/Mg of baked Anode	0.03
PAH (Kg/Mg of baked Anode) Permit Limit: 0.05 Kg/Mg of baked Anode	0.00007
Particulate Fluoride (mg/m <sup>3</sup> )	0.02
Gaseous Fluoride (mg/m <sup>3</sup> )	0.283
Fluoride Total (Kg/Mg Al) Permit Limit: Included in Plant Wide limit	0.0009
SO <sub>2</sub> (Mg/day) Permit Limit: Included in Plant Wide limit	4.1
NOx (Mg/day) Permit Limit: Included in Plant Wide limit	0.44

**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.

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

**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	Apr-24	Apr-24
Particulate Emissions (mg/m <sup>3</sup> ) Permit Limit: 30 mg/m <sup>3</sup>	0.7	0.5

**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	Upset Condition	Type	Duration	Cause
14-03-2024	East	No feed	Unplanned	1h 59min	Power outage
14-03-2024	West	No feed	Unplanned	1h 52min	Power outage
20-05-2024	West	No feed	Unplanned	6h 30 min	Equipment failure
25-10-2024	East	No Exhaust	Unplanned	1h 44 min	Power outage
26-10-2024	West	No Exhaust	Unplanned	1h 44 min	Power outage
20-11-2024	East	No feed	Unplanned	2h 53 min	Equipment failure

**Table 5.14 Gas treatment center Stack Test**

During the re-start the expectation was to stack sample both GTCs during peak emissions and a second time during the ramp down of the re-start. The stack sample in January and October represent these periods. An additional test was completed in November for particulates due to the higher than anticipated values for the West measured in September.

Performance Measure	GTC East	GTC West
Date	Oct-24	Oct-24
Total Particulates (mg/m <sup>3</sup> )	0.6	0.8
Particulate (Kg/Mg of Aluminium) Permit Limit: Included in Plant Wide limit	0.6	0.8
Particulate (Kg/Mg of Aluminium) Permit Limit: Included in Plant Wide limit	0.07	
Particulate Fluoride (mg/m <sup>3</sup> )	0.045	0.048
Gaseous Fluoride (mg/m <sup>3</sup> )	0.775	1.052
Total Fluoride (mg/m <sup>3</sup> )	0.8	1.1
Fluoride Total (Kg/Mg of Aluminium) Permit Limit: Included in Plant Wide limit	0.08	0.11
Fluoride Total (Kg/Mg of Aluminium) Permit Limit: Included in Plant Wide limit	0.095	

**Table 5.15 Delining Stack Test**

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

Performance Measure	4421-DCB-001
Date	Oct-24
Particulate (mg/m <sup>3</sup> ) Permit Limit: 10 mg/m <sup>3</sup>	1.3

**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-0011	3	5	3	1	2	2	0	0	1	0	2	0

**Table 5.17 Casting Emission Control Upsets Hours**

Casting dust collectors that had upset conditions in 2024, including bypass of permitted dust collector for project to install a new dust collector.

Date	Equipment	Upset Type	Duration	Cause
12-03-2024	6260-DCB-001	Unplanned	7d 21h	Insufficient DC inlet flow
20-03-2024	6260-DCB-001	Planned	1h	Non routine maintenance
10-05-2024	B221-Cruce Cleaner	Unplanned	1d 4h	Insufficient dust collector bags
26-06-2024	B221-Cruce Cleaner	Unplanned	5h	Insufficient dust collector bags
15-07-2024	B221-Cruce Cleaner	Planned	48 d*	Dust collector replacement project
02-09-2024	B221-Cruce Cleaner	Unplanned	3 d	Dust collector replacement project
05-09-2024	B221-Cruce Cleaner	Planned	117 d*	Dust collector replacement project
11-09-2024	6260-DCB-001	Unplanned	6h	Insufficient dust collector bags

\*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	Apr-24	Oct-24	Apr-24	Oct-24
NOx (mg/m <sup>3</sup> )	4.8	2.0	1.0	3.7
Chloride (mg/m <sup>3</sup> )	118.8	198.2	157.3	283.5
Chlorine (mg/m <sup>3</sup> )	2.6	2.0	3.9	2.9
Particulate (mg/m <sup>3</sup> )	36.2	65.4	44.3	39.1

**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	Apr-24	Sep-24	Apr-24	Sep-24
NOx (mg/m <sup>3</sup> )	2.3	1.4	3.0	1.6
Particulate (mg/m <sup>3</sup> )	7.9	1.8	4.0	1.9

**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 <sup>3</sup> /y)	Associated Emissions (Tonnes/year)			
		Nitrogen Oxides	Total Particulate	Sulphur Dioxide	Carbon Monoxide
2012	19,695,700	31.51	2.39	0.19	26.47
2013	19,492,700	31.19	2.37	0.19	26.20
2014	18,048,900	28.88	2.19	0.17	24.26
2015	22,801,400	36.48	2.77	0.22	30.65
2016	32,066,200	51.31	3.90	0.31	43.10
2017	31,360,000	50.18	3.81	0.30	42.15
2018	31,240,900	49.99	3.80	0.30	41.99
2019	30,746,100	49.19	3.74	0.30	41.32
2020	30,966,900	49.55	3.77	0.30	41.62
2021	25,955,000	41.53	3.16	0.25	34.88
2022	22,750,900	36.40	2.77	0.22	30.58
2023	29,700,000	47.52	3.61	0.29	39.92
2024	30,644,200	49.03	3.73	0.29	41.19

**Table 5.22 Mobile Dust Collector Usages in 2024**

Three different area deployed mobile dust collector 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	Apr& Jun – Dec on / off as required
Project (Line 2A)	Dust management inside line 2A while crushing concrete. The project performed the crushing for 21 days in December 2024.	Inside	No	8 hrs/day during project



# 6. Air quality monitoring

This chapter presents the 2024 air quality and meteorological monitoring reporting requirements according to section 8.5 of the Permit.

## Network overview

Seven air quality parameters are monitored by Rio Tinto: hydrogen fluoride (HF), sulphur dioxide (SO<sub>2</sub>), polycyclic aromatic hydrocarbons (PAHs), Ozone (O<sub>3</sub>), Nitrous Oxide (NOx), and two levels of fine particulate matter. Particulate matter is referred to as PM<sub>10</sub> and PM<sub>2.5</sub> 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<sub>3</sub>) monitors so that an Air Quality Health Index Plus (AQHI-Plus) for Kitimat can be reported.

The collected air quality data are reported out according to the Permit 100138 Multimedia Waste Discharge permit. Specifically, Section 8.5 of Permit 100138 requires the following reporting:

- SO<sub>2</sub> and HF: Mean monthly concentration and daily hourly maximums.
- PM<sub>2.5</sub> and PM<sub>10</sub>: 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<sub>2</sub> EEM deposition stations).

The scope of this chapter is to provide an interpretive summary of the above permit required monitoring and reporting.

## 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 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](http://www.env.gov.bc.ca/epd/bcairquality)).

The Ministry audited the ambient air quality monitoring network from January 30–31, 2024, and again from October 30–31, 2024. Village (SO<sub>2</sub>, PM<sub>2.5</sub>), Haul Road (SO<sub>2</sub>, PM<sub>2.5</sub>), Industrial (SO<sub>2</sub>), Riverlodge (SO<sub>2</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>), and Whitesail (NOx, O<sub>3</sub>, SO<sub>2</sub>, PM<sub>2.5</sub>) were included in each audit. All monitoring instruments passed both audits.

## Amendment to Section 8.5 ambient air monitoring and reporting

The BC Ministry of Environment and Parks 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.

## 2024 Monitoring results

Ambient air quality monitoring for all results stations and parameters are presented in Table 6.2. Air quality data used in this report was extracted from the Ministry's ENVISTA database each month throughout 2024.

### Hydrogen Fluoride (HF)

HF monitoring is done with Picarro analyzers (cavity ring down spectroscopy) and 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<sub>2</sub>)

SO<sub>2</sub> is monitored at four community stations (Whitesail, Riverlodge, Kitamaat Village and the Service Centre) in addition to the Industrial Haul Road station (fence line), and Lakelse Lake (deposition monitoring). Permit 100138 requires the reporting of hourly daily maximums and monthly averages. A summary of the 2024 monitoring results is provided in Table 6.2 and monthly means are shown in Figures 6.3a and 6.3b. Beyond the required Permit 100138 reporting, the daily hourly averages for 2024 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<sub>2</sub> Air Quality Objective (AQO). The Provincial SO<sub>2</sub> AQO is 70 ppb and achievement is based on the annual 99th percentile of the daily one hour maximum (1HDM) averaged over three consecutive years. In comparison to the SO<sub>2</sub> air quality objective, the annual 99th percentile of the 1HDM for all community stations were below 70 ppb. Kitamaat Village measured the highest hourly concentration which 95.8 ppb. The residential maximum hourly average SO<sub>2</sub> concentrations shown in Table 6.2 ranged from 24.7 ppb to 95.8 ppb. There was 1 day in 2024 in which a residential SO<sub>2</sub> hourly concentration was above 70 ppb (Kitamaat Village). The maximum residential annual average SO<sub>2</sub> concentration was 0.6 ppb.

### SO<sub>2</sub> environmental effects monitoring

In 2021, a Comprehensive Review of BC Works' SO<sub>2</sub> EEM program was completed. No exceedances of the KPIs for human health, vegetation, soils and lakes were found and recommendations were provided for consideration in the Phase III monitoring cycle. Links to download SO<sub>2</sub> EEM documents and the Comprehensive Review report can be found on the Rio Tinto BC Works' web site.

### Particulate (PM<sub>2.5</sub> and PM<sub>10</sub>)

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 for PM<sub>10</sub> is 50 micrograms per cubic metre (µg/m<sup>3</sup>) averaged over 24 hours while the air quality objective for PM<sub>2.5</sub> is 25 µg/m<sup>3</sup> evaluated at the 98th percentile of the daily average for 1 year.

Permit 100138 requires the reporting for particulate matter to include both daily average and daily hourly maximum concentrations for both PM<sub>2.5</sub> and PM<sub>10</sub>. 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<sub>2.5</sub> levels for Kitimat are low, ranging between 2.7 µg/m<sup>3</sup> to 3.4 µg/m<sup>3</sup>. Residential stations showed elevated PM<sub>2.5</sub> levels at times, with 3 to 6 days over the 25 µg/m<sup>3</sup> air quality objective in 2024.

### Polycyclic Aromatic Hydrocarbons (PAHs)

#### NO<sub>x</sub> and O<sub>3</sub>

NO<sub>x</sub> and O<sub>3</sub> are measured and reported for Rio Tinto from the Whitesail station. Results for NO<sub>x</sub> and O<sub>3</sub> are shown in Figures 6.7 and 6.8.

PAHs are generated by the incomplete combustion of organic material. Various procedures at Kitimat Operations generate PAHs, in both dissolved and gaseous forms. They occur in emissions primarily as a by-product of the anode manufacturing process; other sources include vehicle exhaust and smoke from forest fires and wood-burning stoves.

Ambient air monitoring is conducted to test for the presence of some of the most common PAHs, although no permit limits exist. 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. Permit 100138 requires the monitoring of 15 PAH congeners.

The 2024 ambient PAH monitoring results are summarized in Table 6.3. Annual average PAH concentrations observed at Haul Road station was 16.3 ng/m<sup>3</sup>, Whitesail station was 5.0 ng/m<sup>3</sup> and Kitimat Village was 14.0 ng/m<sup>3</sup>. In 2024, total PAH concentrations declined or stayed the same in comparison to 2023. Figures 6.9a to 6.9c present the 2024 sampling results for the three stations.

The PAH congeners are sorted according to molecular weight. As can be seen 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 is not only due to distance from the smelter source, but also photochemical degradation and seasonal contributions of different PAH sources such as vehicle exhaust, petroleum fumes and wood stoves.

## 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 base cations and anions. Weekly measurements falling within the 2024 water year (October 1st, 2023, to September 30th, 2024) are presented in Figures 6.11b to 6.11e. Precipitation chemistry is used in the SO<sub>2</sub> 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 6.4) except for the wind speed and direction sensor at Riverlodge. The direction component had been damaged by wildlife in 2023, and a technician was not able to reach the sensor until February 2nd, 2024, due to winter conditions that inhibited man-lift operations.

## 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 is 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 B.C. 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 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.

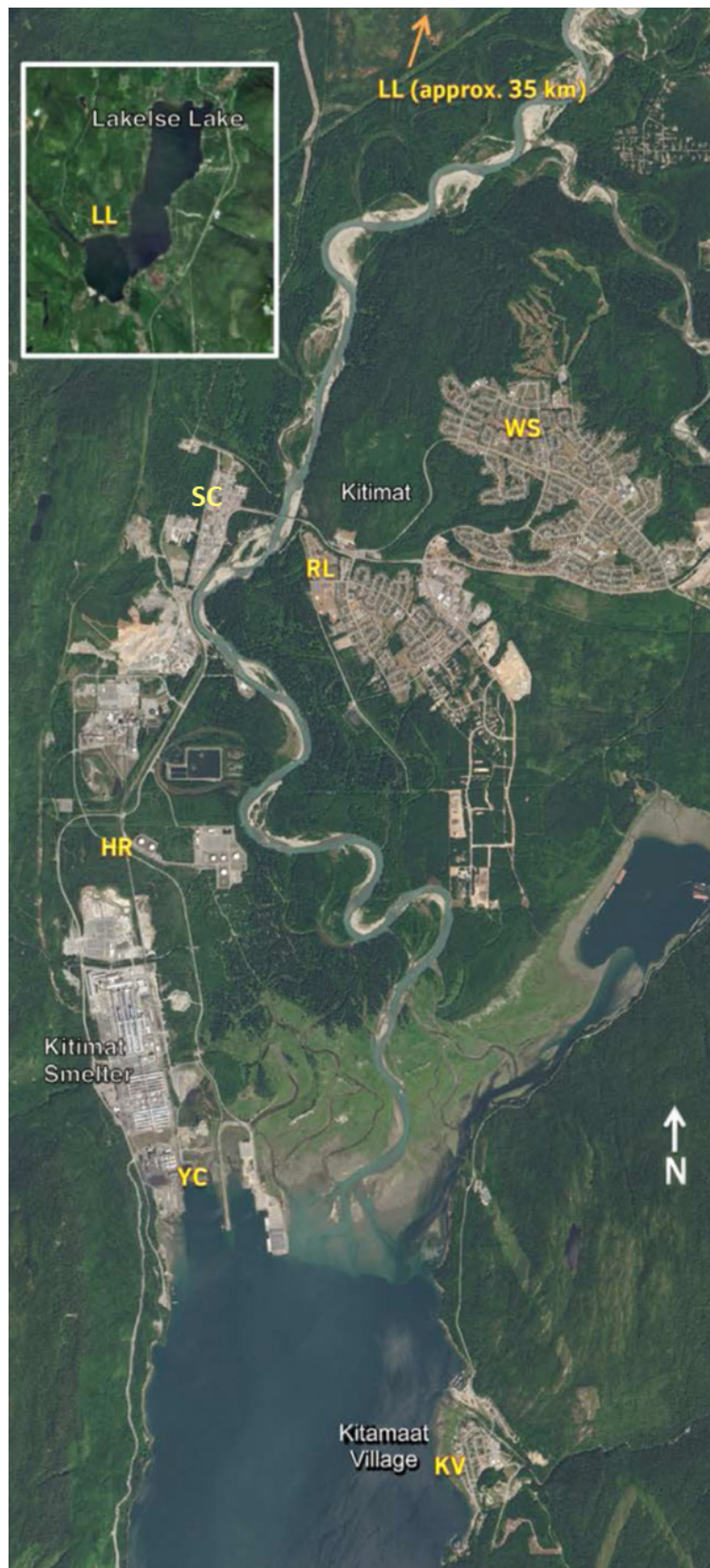
Monthly flow and leak checks are conducted on the PM<sub>10</sub> and PM<sub>2.5</sub> monitors using a flow meter which has been calibrated or certified annually against a National Institute of Standards and Technology (NIST) traceable standard. In addition, each PM<sub>10</sub> or PM<sub>2.5</sub> 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.

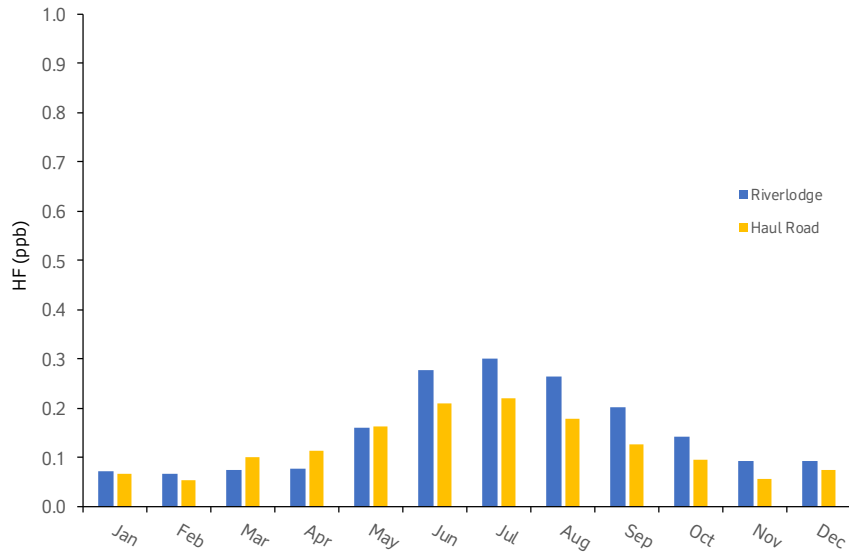
Independent instrument performance audits are performed by the British Columbia Ministry of Environment and Parks to provide confidence that the data gathered are accurate and of adequate quality for use in environmental decisions.

Figure 6.1

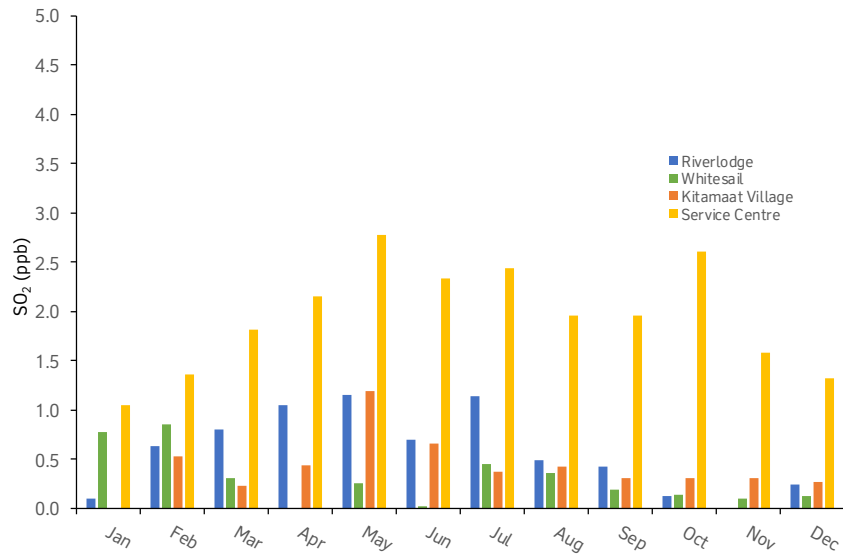
Location of Ambient Air Monitoring Stations in Kitimat Valley



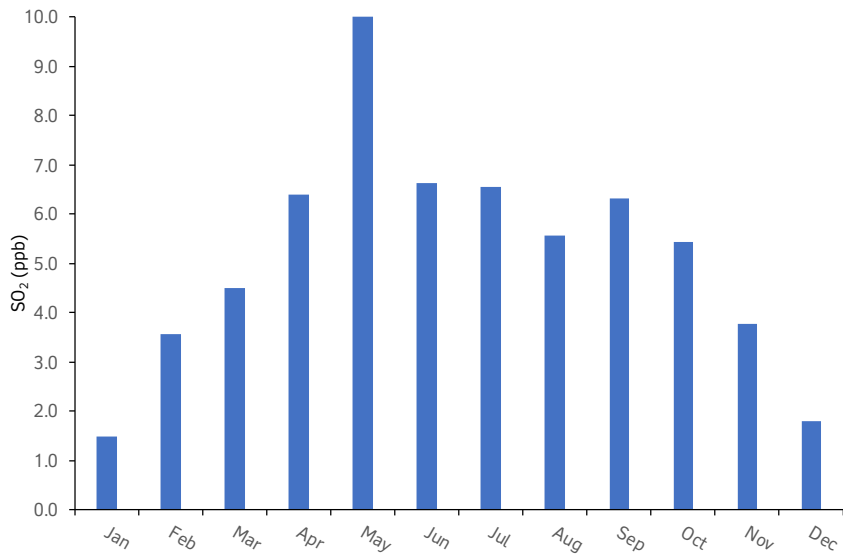
**Figure 6.2**  
Hydrogen Fluoride  
Monthly Averages



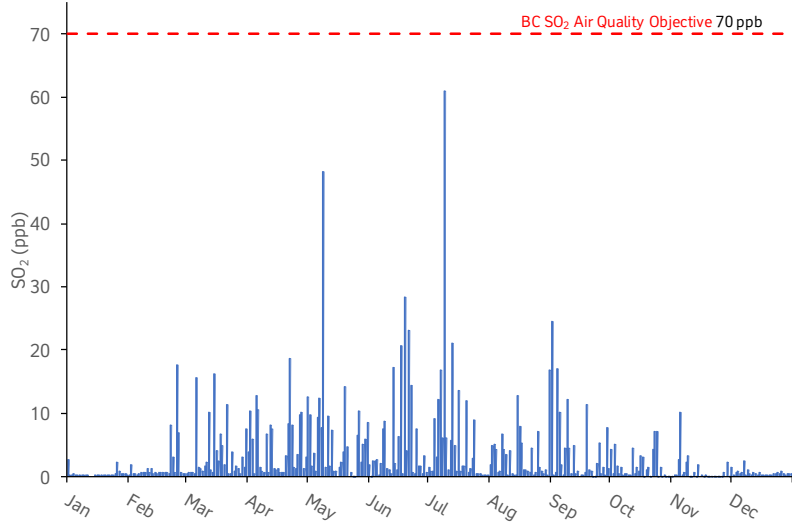
**Figure 6.3a**  
Community Station  
Monthly SO<sub>2</sub>  
Averages



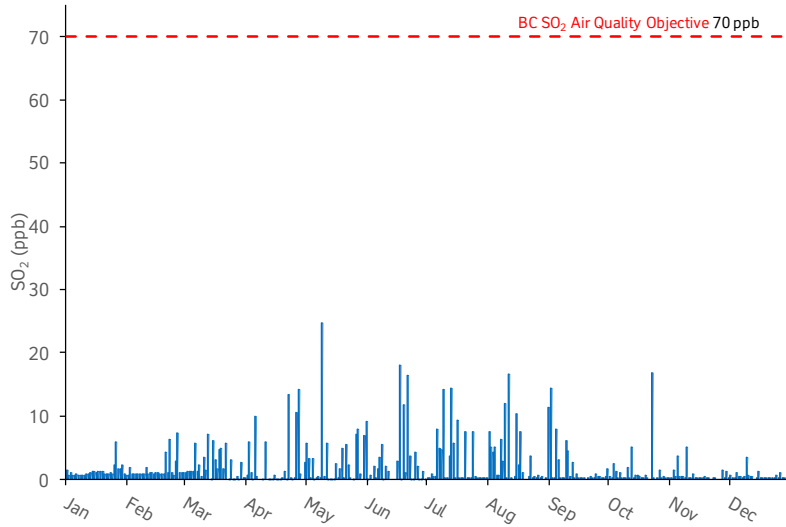
**Figure 6.3b**  
Haul Road (Fence Line)  
Monthly SO<sub>2</sub> Averages



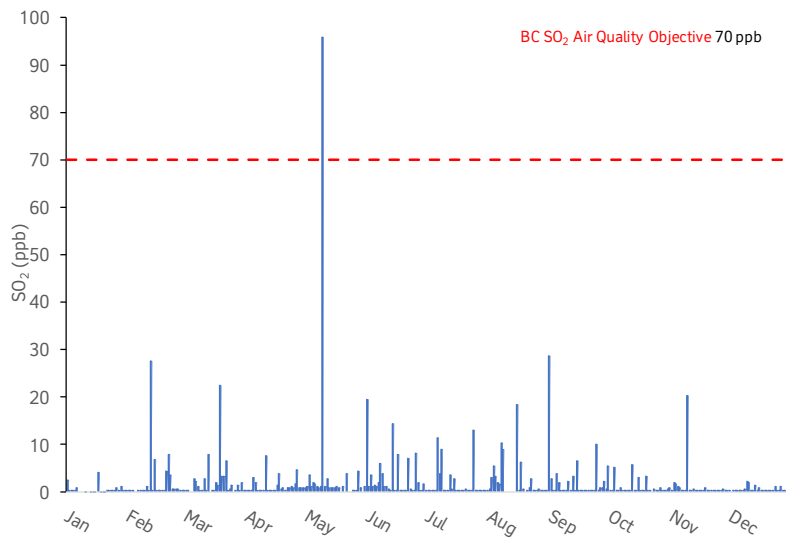
**Figure 6.4a**  
Riverlodge SO<sub>2</sub>  
1-Hour Daily Maximum



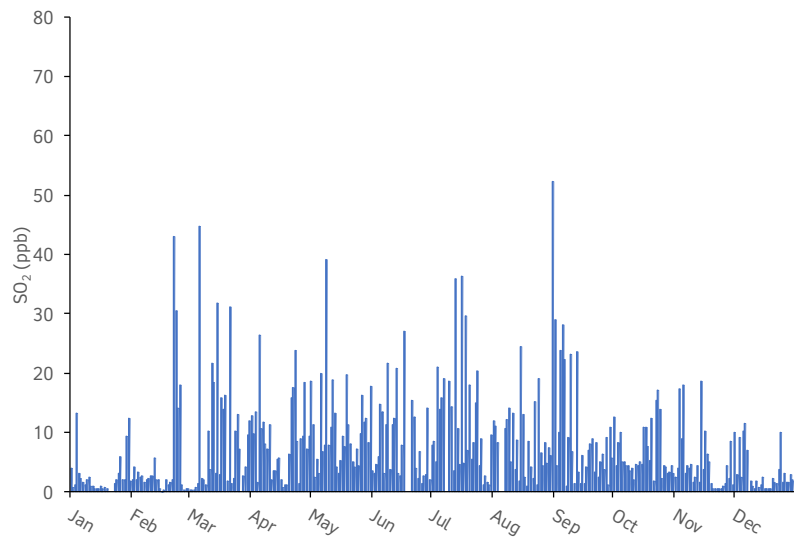
**Figure 6.4b**  
Whitesail SO<sub>2</sub>  
1-Hour Daily Maximum



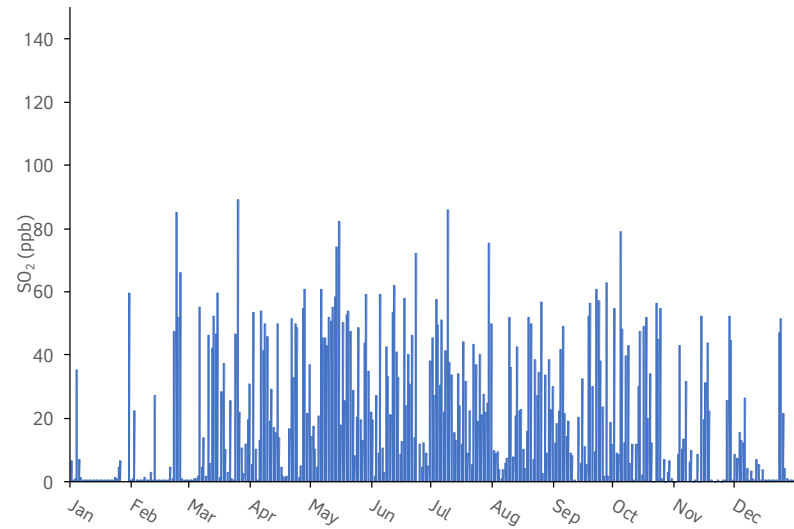
**Figure 6.4c**  
Kitamaat Village SO<sub>2</sub>  
1-Hour Daily Maximum



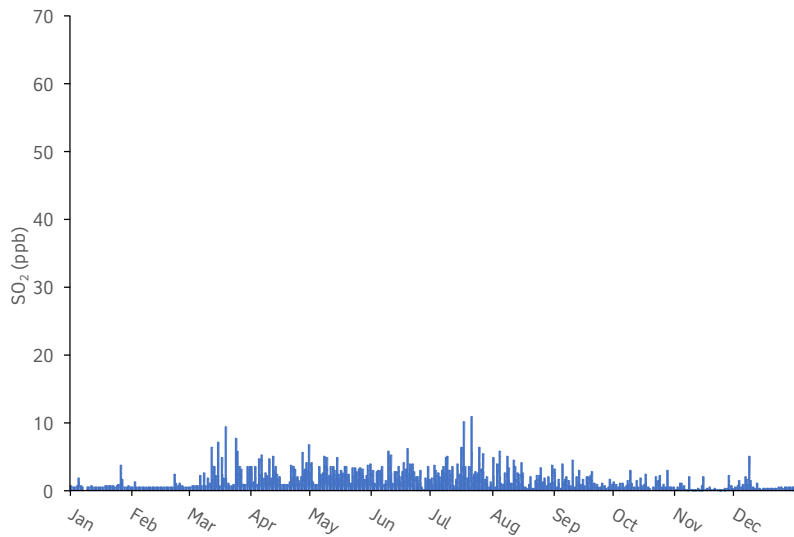
**Figure 6.4d**  
 Service Centre SO<sub>2</sub>  
 1-Hour Daily Maximum



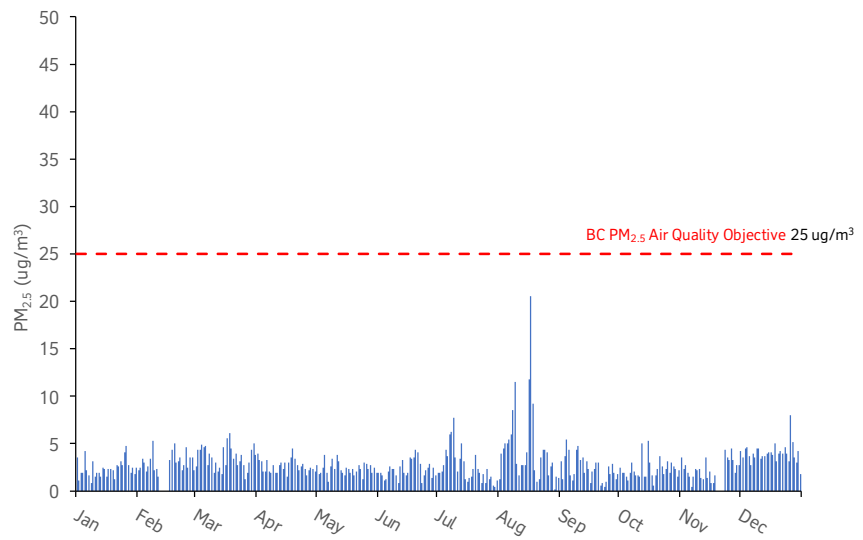
**Figure 6.4e**  
 Haul Road SO<sub>2</sub>  
 1-Hour Daily Maximum



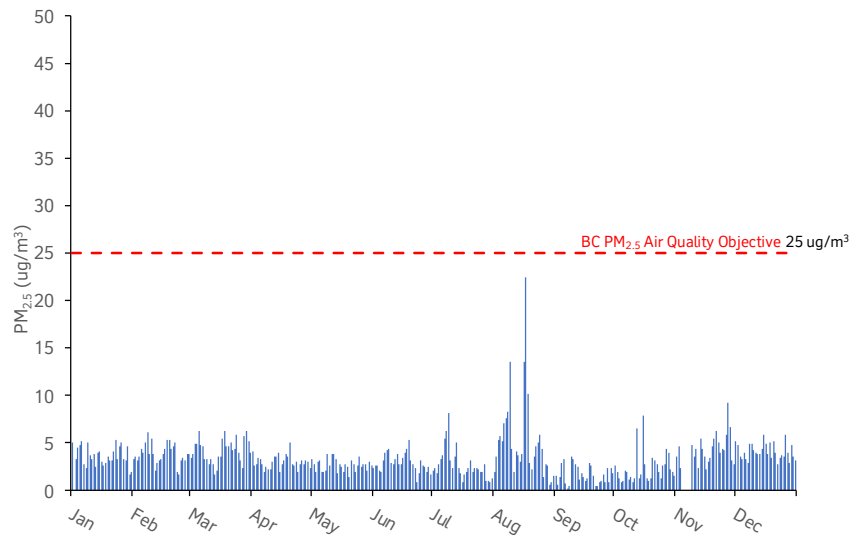
**Figure 6.4f**  
 Lakelse Lake  
 Deposition Station SO<sub>2</sub>  
 1-Hour Daily Maximum



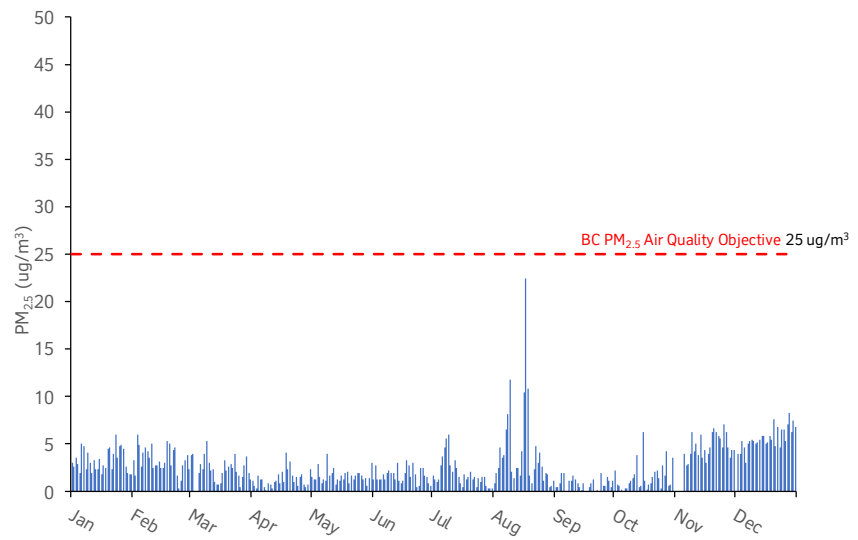
**Figure 6.5a**  
Riverlodge PM<sub>2.5</sub>  
24-Hour Average



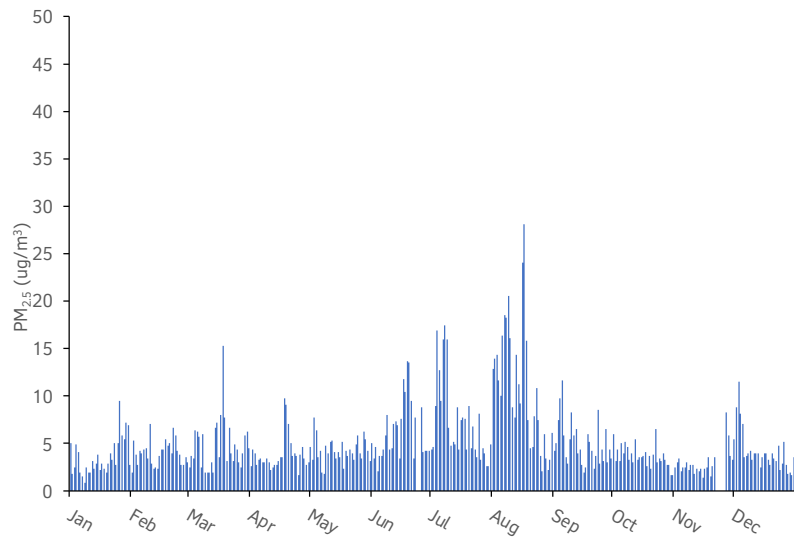
**Figure 6.5b**  
Whitesail PM<sub>2.5</sub>  
24-Hour Average



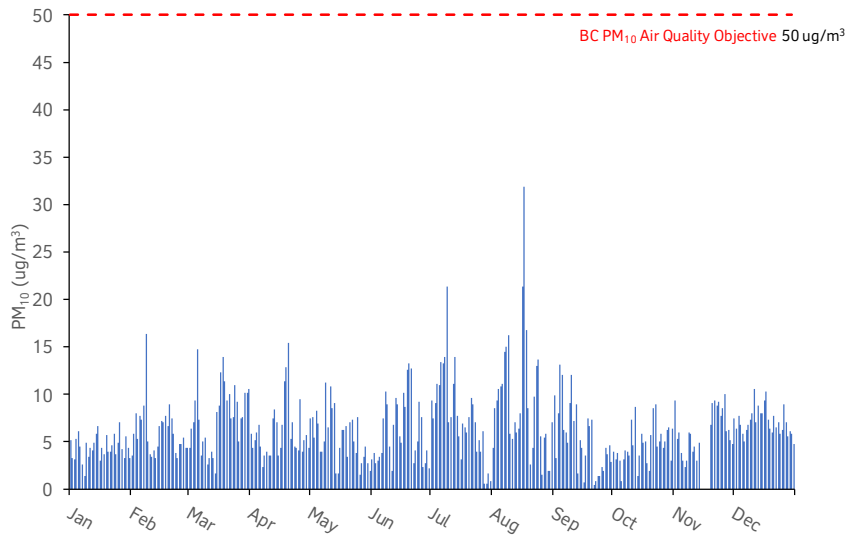
**Figure 6.5c**  
Kitamaat Village PM<sub>2.5</sub>  
24-Hour Average



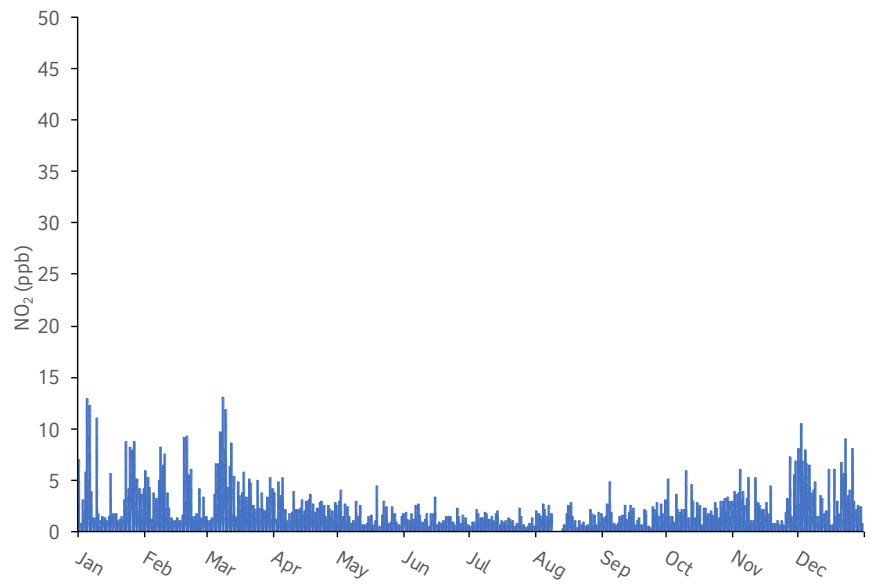
**Figure 6.5d**  
Haul Road PM<sub>2.5</sub>  
24-Hour Average



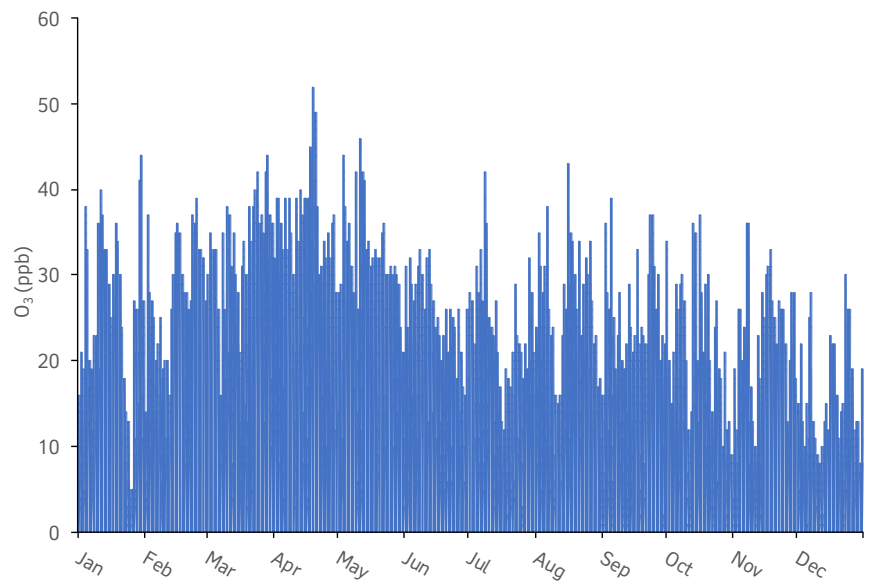
**Figure 6.6**  
Riverlodge PM<sub>10</sub>  
24-Hour Average



**Figure 6.7**  
Whitesail  
Total NO<sub>2</sub> 1-Hour 2024

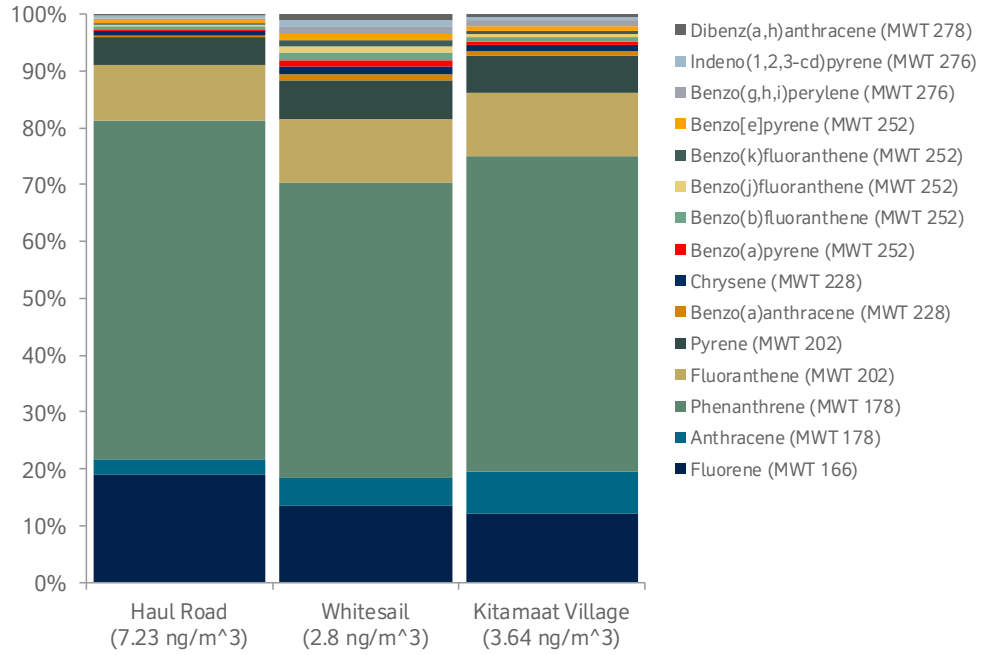


**Figure 6.8**  
Whitesail  
Total O<sub>3</sub> 1-Hour 2024

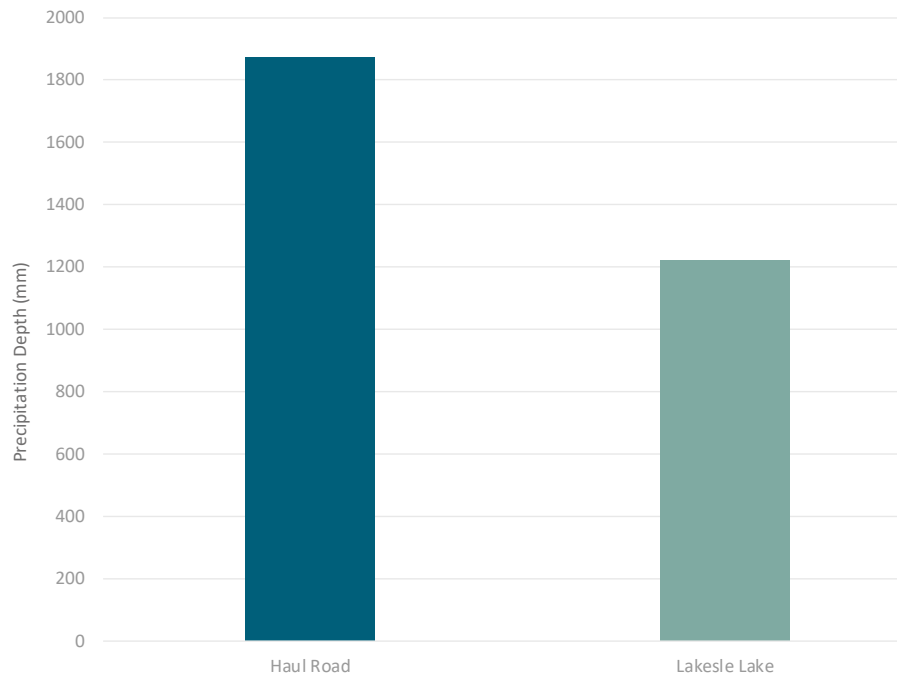




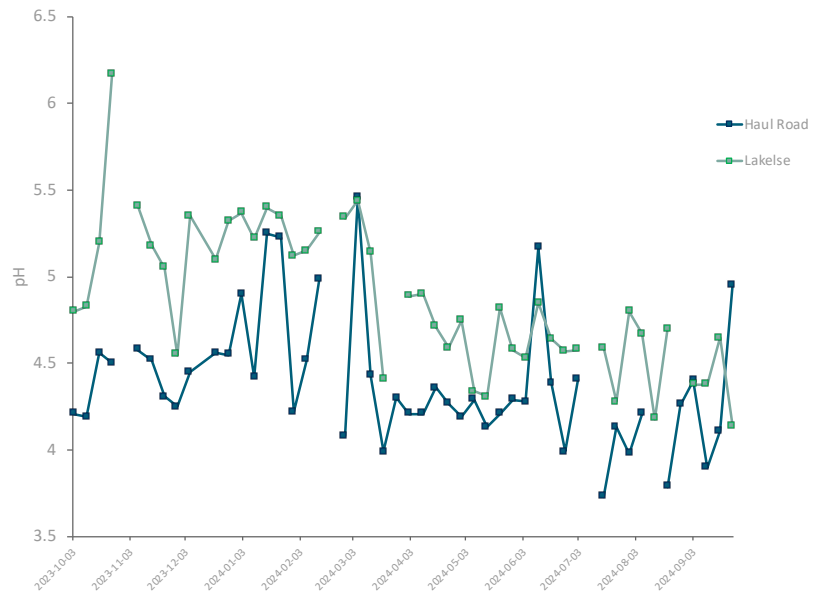
**Figure 6.10**  
PAH Congener  
Distribution 2024



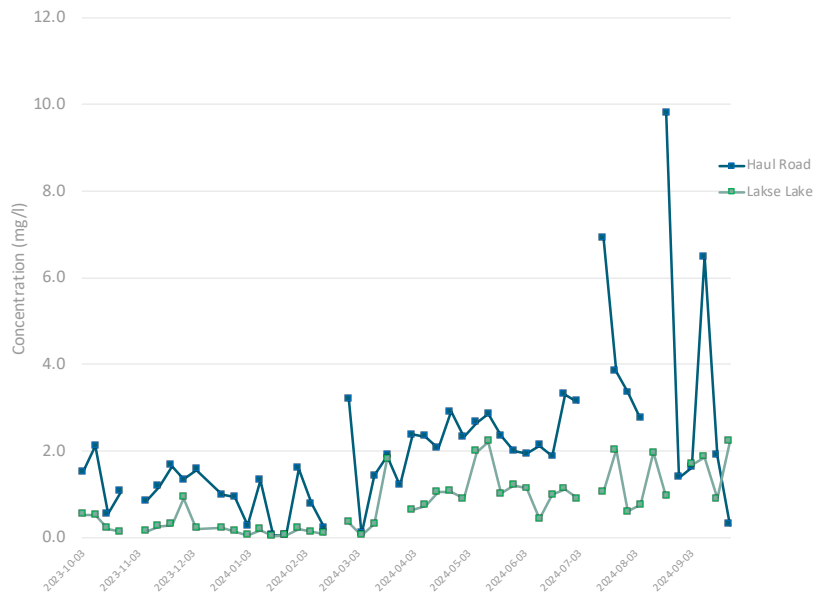
**Figure 6.11a**  
Haul Road and  
Lakesle Lake  
Precipitation Depths  
2024



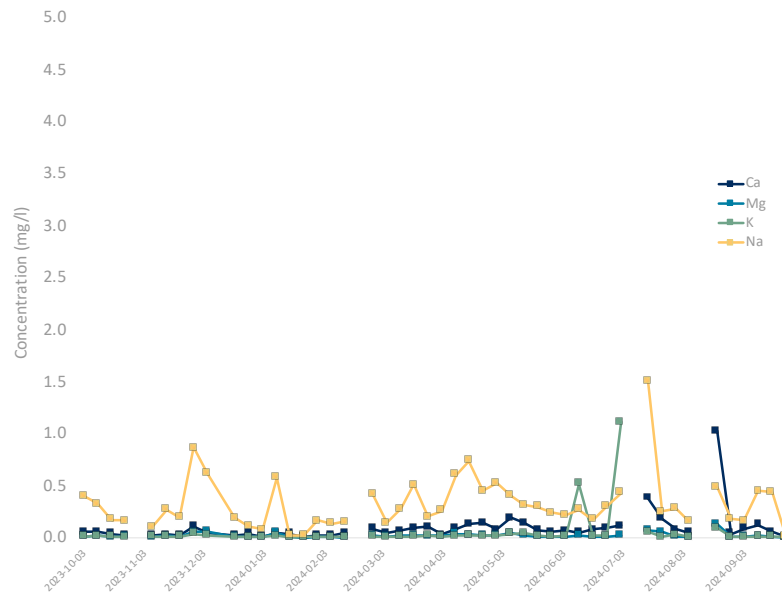
**Figure 6.11b**  
Haul Road and  
Lakesle Lake  
Precipitation pH  
2024



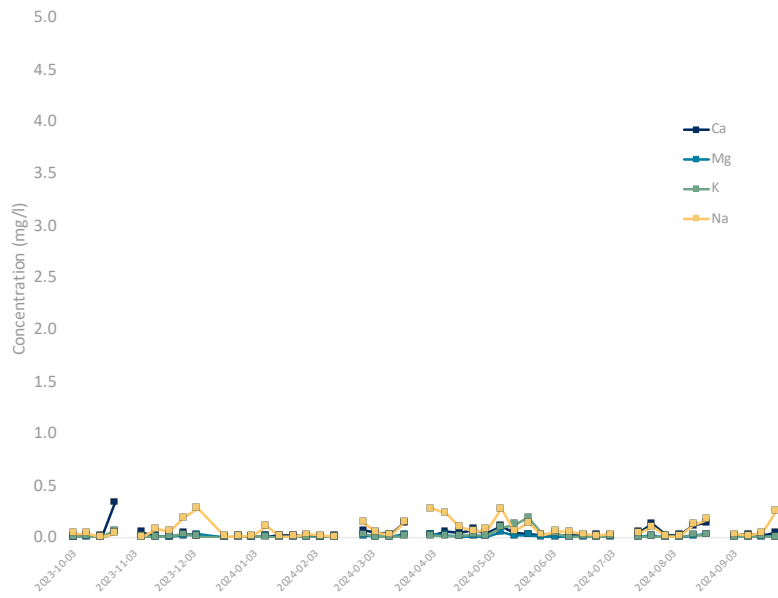
**Figure 6.11c**  
Haul Road and  
Lakesle Lake  
SO<sub>4</sub> Concentration in  
Precipitation 2024



**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)	Riverlodge Residential (RL)	Whitesail Residential (WS)	Kitamaat Village Residential (KV)	Service Centre (SC)	Yacht Club (YC)	Lakelse Lake Desposition (LL)
Sulphur Dioxide (SO <sub>2</sub> )	✓	✓	✓	✓	✓		✓
Particulates (PM <sub>2.5</sub> )	✓	✓	✓	✓			
Particulates (PM <sub>10</sub> )		✓					
Hydrogen Fluoride (HF)	✓	✓					
Nitrous Oxides (NO <sub>x</sub> )			✓				
Ozone (O <sub>3</sub> )			✓				
AQHI Plus			✓				
Rain Chemistry	✓						✓
Meteorological Monitoring	✓	✓	✓	✓	✓	✓	
Polycyclic Aromatic Hydrocarbons (PAH)	✓		✓	✓			
Wind Speed and Direction	✓	✓	✓	✓	✓	✓	
Temperature	✓	✓	✓	✓	✓	✓	
Relative Humidity			✓		✓		
Pressure			✓				

**Table 6.2** 2023 Ambient Air Quality Monitoring Results<sup>1</sup>

STATISTIC	Fence Line Haul Road	Industrial Avenue	Lakelse Lake Deposition Station	Riverlodge	Whitesail	Kitimaat Village
<b>SO<sub>2</sub></b>						
Annual Average (ppb)	5.5	2.0	0.8	0.6	0.3	0.4
99th Percentile, D1HM <sup>2</sup>	82.1	39.2	7.8	24.6	16.6	22.4
Days above 70 ppb (Hourly)	8	0	0	0	0	1
Minimum (Hourly, ppb)	-1.0	-0.4	-0.2	-0.7	-1.3	-0.7
Maximum (hourly, ppb)	89.2	52.4	10.9	60.9	24.7	95.8
Standard Deviation (ppb)	10.4	3.1	0.7	1.8	1.1	1.7
<b>PM<sub>2.5</sub></b>						
Annual Average (ug/m <sup>3</sup> )	5.1			2.9	3.4	2.7
98th Percentile, 24 hour	16.9			6.3	8.1	7.6
Days above 25 ug/m <sup>3</sup> (24 hour)	53			3	6	4
Minimum (Hourly, ug/m <sup>3</sup> )	0.0			0.0	0.0	0.0
Maximum (hourly, ug/m <sup>3</sup> )	99.0			35.0	54.0	38.0
Maximum daily average (ug/m <sup>3</sup> )	28.1			20.5	22.5	22.5
Standard Deviation (ug/m <sup>3</sup> )	6.2			2.8	3.0	3.2
<b>PM<sub>10</sub><sup>3</sup></b>						
Annual Average (ug/m <sup>3</sup> )				6.4		
Minimum (Hourly, ug/m <sup>3</sup> )				0.0		
Maximum (hourly, ug/m <sup>3</sup> )				95.0		
Maximum daily average (ug/m <sup>3</sup> )				16.7		
Days above 50 ug/m <sup>3</sup> (24 hour)				0		
Standard Deviation (ug/m <sup>3</sup> )				5.8		
<b>HF</b>						
Annual Average (ppb)	0.10			0.20		
Minimum (Hourly, ppb)	-0.02			0.03		
Maximum (hourly, ppb)	0.46			0.51		
Days above 65 ug/m <sup>3</sup> (hourly) <sup>4</sup>	0			0		
Standard Deviation (ppb)	0.1			0.1		
<b>NO<sub>2</sub></b>						
Annual Average (ppb)					1.0	
Minimum (Hourly, ppb)					0.0	
Maximum (hourly, ppb)					13.0	
Standard Deviation (ppb)					1.2	
<b>O<sub>3</sub></b>						
Annual Average (ppb)					19.6	
Minimum (Hourly, ppb)					0.0	
Maximum (hourly, ppb)					52.0	
Standard Deviation (ppb)					9.4	

Notes: <sup>1</sup> Data extracted from BC ENV's Envista database.

<sup>2</sup> D1HM is the daily 1 hour maximum

<sup>3</sup> PM10 monitoring at the Haul Road station was done under a temporary requirement of the May 5, 2020 Event Response Plan approval

<sup>4</sup> Hydrogen fluoride (HF) is reported against the Quebec hourly HF air quality standard of 65 ug/m3 as a temporary requirement of the approval of the May 5, 2020 Event Response Plan.

**Table 6.3**

Geometric mean Total 15 PAH Concentrations (2022, 2023 and 2024)

Station	15 PAH Geomean (ng/m <sup>3</sup> )			2024 15 PAH Statistics (ng/m <sup>3</sup> )		
	2022	2023	2024	Min	Max	Standard Deviation
Haul Road	17.3	29.2	16.3	2.5	128.9	19.2
Whitesail	3.7	5.0	5.0	1.7	39.2	6.5
Kitimat Village	5.1	18.1	14.0	5.2	35.6	7.0

**Table 6.4** 2024 Percent Data Capture

PARAMETER (% Data Capture)	INDUSTRIAL				RESIDENTIAL	
	Haul Road	Industrial Avenue	Lakelse Lake Deposition Station	Riverlodge	Whitesail	Kitimaat Village
SO <sub>2</sub>	94.1	92.9	94.9	94.5	94.5	93.1
PM <sub>2.5</sub>	97.5			97.1	97.7	95.7
PM <sub>10</sub>		98.2				
HF	94.2			94.2		
NOx			93.4			
O <sub>3</sub>			94.5			
Wind Speed and Direction	97.5	95.3		89.0	98.4	98.9
Temperature	99.8	97.4		99.7	99.7	99.6
Relative Humidity		97.4			99.8	
Pressure					100	
Precipitation	100		100			

# 7. Vascular plant & cyanolichen monitoring

The vascular plant and cyanolichen monitoring program was developed in 2020 and implemented in 2021 following the recommendations of the 2019 comprehensive review of the SO<sub>2</sub> EEM program.

## Background

BC Works emits fluoride and sulphur dioxide as byproducts of the aluminium smelting operations (See Chapter 5 – Emissions). The fluoride gas and sulphur dioxide can be absorbed by vegetation and, depending on the concentration, they may affect plant growth and overall plant health. BC Works has been monitoring vegetation since 1970's for fluoride, as this was one of the main air emissions of the old VSS smelter; in 1984, sulphur monitoring in vegetation was added to the program. As a result, BC Works has one of the largest historical databases of this type in British Columbia. Based on the findings of the 2019 SO<sub>2</sub> EEM Comprehensive Review, the Vegetation Monitoring program was re-structured to develop a terrestrial line of evidence integrating the vegetation and soils (the “BC Works SO<sub>2</sub> Environmental Effects Monitoring Comprehensive Review – Synopsis” can be downloaded from [www.riotinto.com/en/operations/canada/bc-works](http://www.riotinto.com/en/operations/canada/bc-works)). The vegetation monitoring program adopted many pre-established locations from the Ministry of Environment and Parks' monitoring program for use in the vascular plant and cyanolichen biodiversity monitoring program.

This program seeks to provide an indication of whether future SO<sub>2</sub> emissions from BC Works can cause changes to the species composition and abundance of cyanolichens, and/or the species composition and percent cover of vascular plants in the low shrub and herb layers, including plants identified as culturally important. The overall health of vascular plants and cyanolichens is also documented at each location. The locations of sites are distributed fairly evenly across three sulphur deposition zones:

- High: >7.5 kg SO<sub>4</sub><sup>2-</sup>/ha/year,
- Moderate: ~ 7.5 kg SO<sub>4</sub><sup>2-</sup>/ha/year,
- Low: <2.5 kg SO<sub>4</sub><sup>2-</sup>/ha/year).

Each year, approximately one third of the total number of sites is assessed; the same sites will be re-monitored on a rotating 3-year basis (Figure 7.1).

## Program overview

Sites are assessed for general ecological site information, vascular plant biodiversity in the low shrub and herb layers, cyanolichen biodiversity, and plant health, and each has a baseline soil sampling undertaken (where possible) during the first round of assessments. In 2021, the first year of the monitoring program, ten sites were assessed; in 2022 the monitoring program was conducted at 14 sites; and, in 2023, the final 11 plots of the monitoring program were visited, for a total of 35 sites. In 2024, the ten sites initially assessed in 2021 were assessed for the second time, and an additional site was added to the program and assessed for the first time, increasing the total of active sites in the program to 36. (Table 7.1).

## Third year assessment (First end-of-cycle)

In 2023, the first end-of-cycle was completed for the program, with the final twelve of the total of 35 sites each assessed once. In March 2024, we produced the first End-of-Cycle reporting for this program. In future ends-of-cycle (every third year of the program), when sites will have been assessed at least twice, end-of-cycle reporting will largely examine and analyse any potential trends that emerge from the vascular plant and cyanolichen data, including any changes in species composition, species abundance, or health, in relation to where they lie spatially and with respect to deposition zone. As this was not possible for the first end-of-cycle (as no site had been assessed more than once), the opportunity was used to “step back” and look the program as a whole, examining potential risks and exploring recommendations that could improve sample design and subsequent analyses.

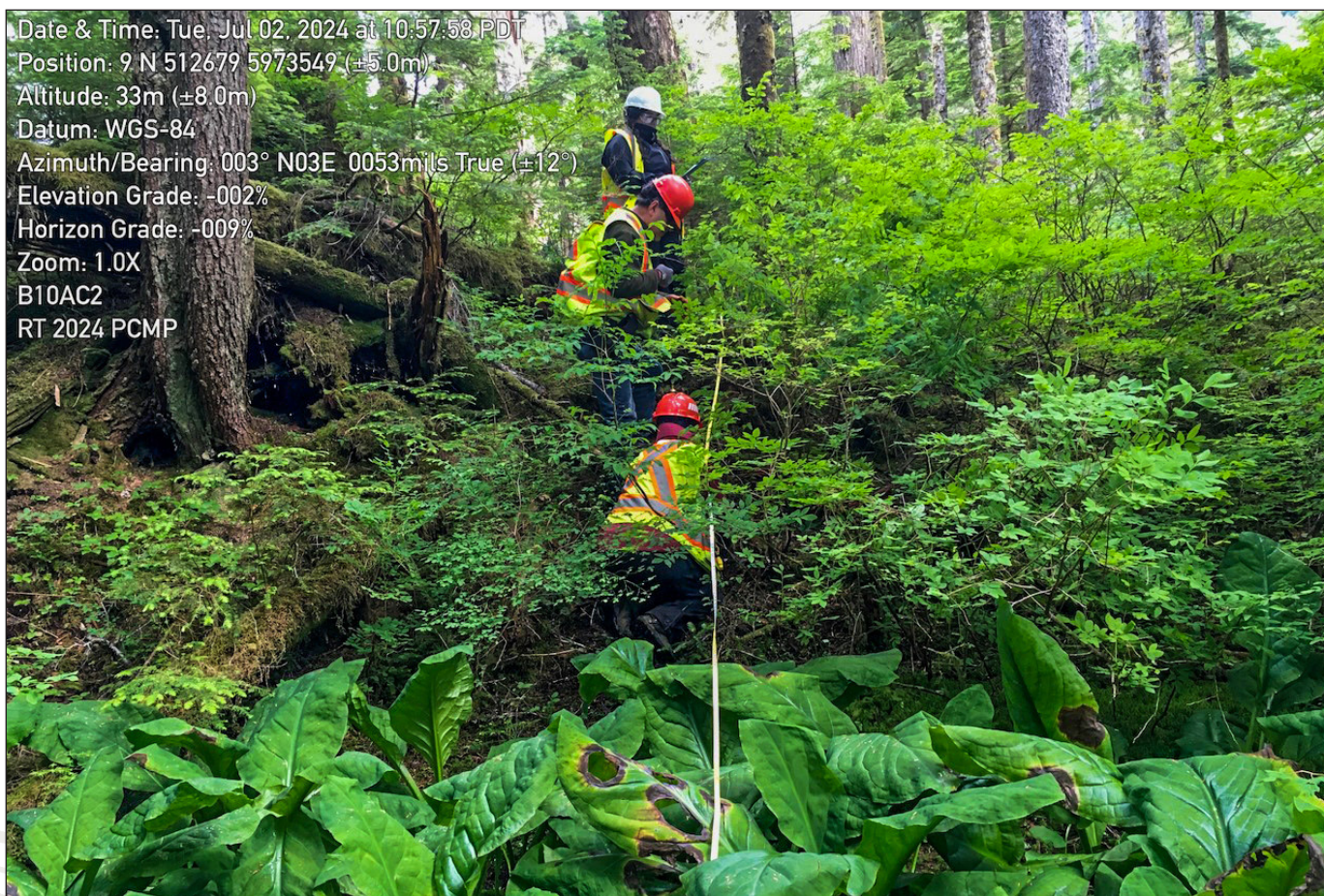
To get a good understanding of the baseline, we examined initial differences in both vascular plant and cyanolichen biodiversity between sites: Our underlying assumption is that any differences are unrelated to the new emissions environment related to the modernized smelter (commissioned in 2016), and this program is designed to detect medium- and long- term changes or trends in biodiversity within sites. What we found, for example when comparing biodiversity profiles, was that baselines for vascular plants were relatively similar; for cyanolichens, the artefact of historical fluoride emissions resulted in decreasing cyanolichen presence with increased proximity to the smelter. In both cases, we found that we have developed a baseline that we can build on to achieve the objectives of the program. Our end-of-cycle assessment of the program examined other questions related to the effectiveness of the program, such as the appropriateness of annual field timing, and made recommendations for improvements to measures of abundance for both vascular plants and cyanolichens that have been incorporated into the 2024 field assessments. Overall, the deeper dive gave assurance that the program is on a good footing going forward and the results support the goals and objectives of the monitoring program.

## 2024 Field monitoring

In early summer of 2024, ten of the program's sites originally assessed in 2021 were re-assessed: This marks the first time that a comparison of data from two assessments in the program was possible, and the first "trend lines" could be created for the vascular plant species that were monitored. When these are linked to Deposition Zone, we are able to examine whether there are significant trends in biodiversity related to deposition. In addition, Rio Tinto added a site to the program this year (site B36) and assessed it for the first time, such that there are now 36 total sites that have been assessed at least once.

What we found from the data was that there were no apparent trends in vascular plant biodiversity, with no significant differences between Low, Medium or High Deposition Zones for all measured vascular species—including those considered acid-sensitive or culturally important. Furthermore, there were no notable, unexplained differences in the biodiversity profiles of 2021 and 2024. Similarly, for cyanolichens, no clear species-specific trends or changes in cyanolichen biodiversity were observed.

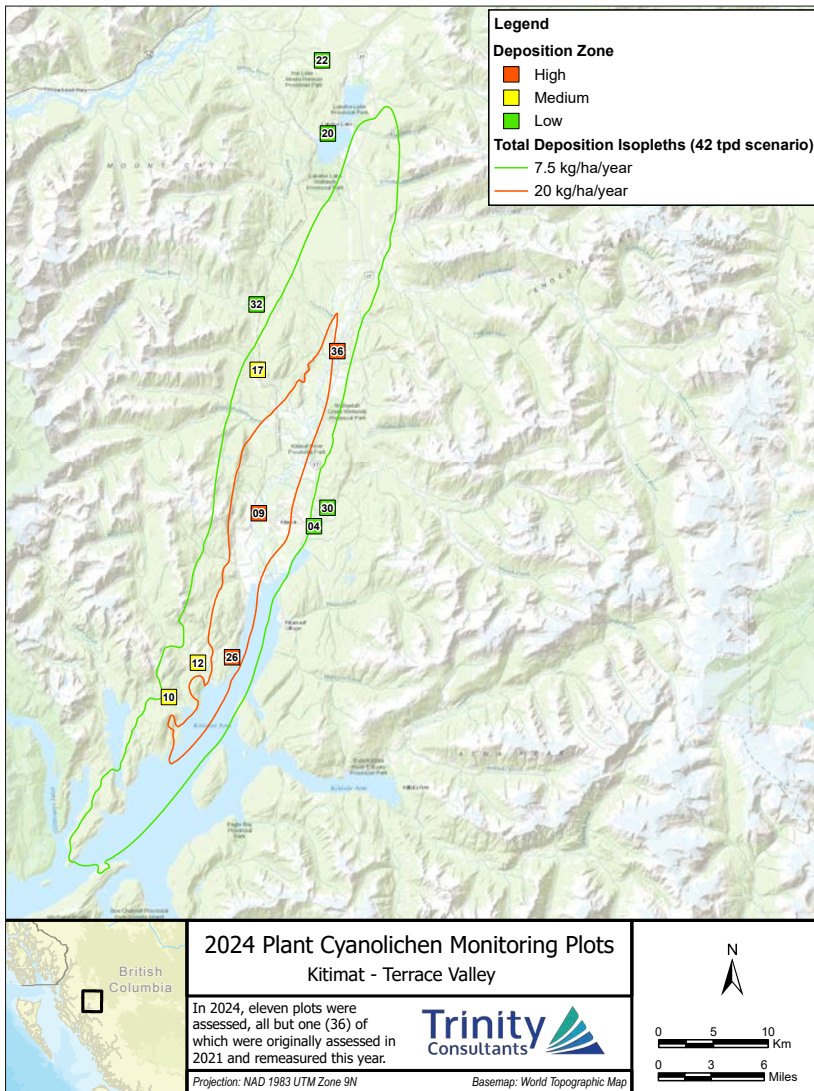
Overall, the health of plants and cyanolichens examined in 2024 was good, and no relationship between Deposition Zone and plant or cyanolichen health was detected.



Field crew taking measurements along a transect at a monitoring plot.

**Figure 7.1**

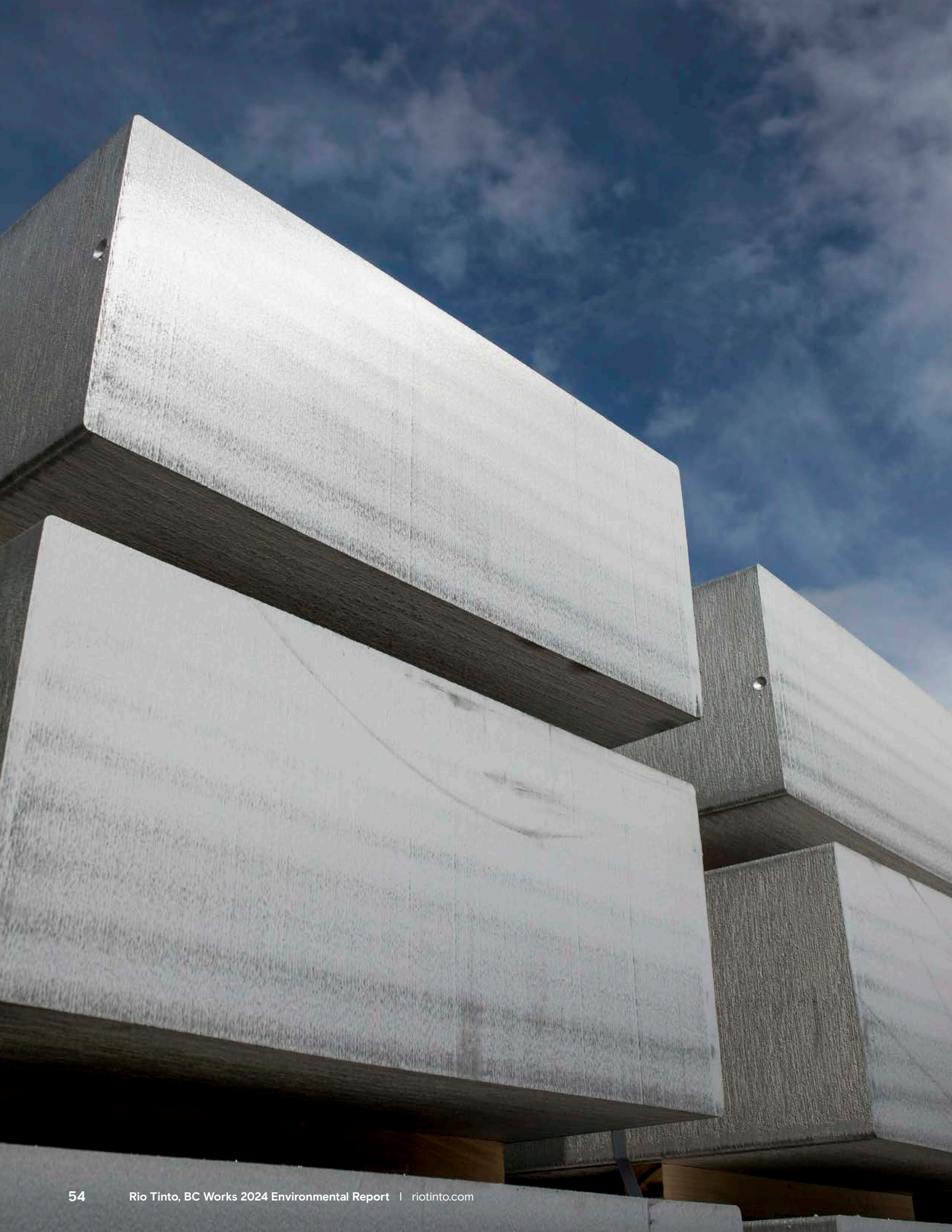
Monitoring Plot Locations. The 35 monitoring plots are distributed across high, moderate and low deposition zones across the Kitimat – Terrace Valley



**Table 7.1**

Monitoring plots per year. Monitoring plots per year. The same monitoring plots will be revisited every three years to understand potential changes to community structure.

Monitoring Year	Biodiversity Monitoring Plots
2021	B4, B9, B10, B12, B17, B20, B22, B26, B30, B32
2022	B1, B2, B3, B5, B7, B8, B15, B21, B24, B25, B27, B29 BK33, BK34 (Kemano control plots)
2023	B6, B18, B19, B23, B31, B35, B37, B38, B39, B41, B42
2024	B4, B9, B10, B12, B17, B20, B22, B26, B30, B32, B36



## 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. In particular, 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 those disposed at the South Landfill (i.e. inert industrial waste, asbestos materials, contaminated soil, and putrescibles), monthly wood waste and hazardous waste externally disposed or sent for recycling are reported in compliance with the permit requirements.

### 2024 Performance

#### Spent potlining

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

During 2024 approximately 9486 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 2024, 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 2024, 459.5 metric tonnes of wood was burned via air curtain incinerators.

#### South Landfill management

In 2023 the landfill closure team completed the final stage of capping of the South landfill. There was no material landfilled in the South landfill 2024.

As part of the requirement of the P2-00001 Multi-Media Permit related to the South Landfill, Rio Tinto completes and Environmental Effects Monitoring program (South Landfill EEM) annually. The overall objective of the ongoing South Landfill EEM program is to evaluate the health of the receiving environment which is potentially impacted by the landfill.

The overall conclusion of the 2024 South Landfill EEM program was that there was a low risk to ecological receptors due to impacts from the South Landfill. These results were based on consideration of chemistry, toxicity tests, and benthic community.

# 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.

## 2024 Monitoring results

### Spent Potlining Landfill

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<sup>3</sup> 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.

- Estimated groundwater flux for 2024 was 255,637 m<sup>3</sup>/yr.
- The 2024 mass loading estimate for fluoride was 15,481 kg/yr. This represents a 27% decrease from 2004 to 2024.
- The 2024 mass loading estimate for SAD-cyanide was 88 kg/yr. This represents a 57% decrease from 2004 to 2024.
- The 2024 mass loading estimate for dissolved aluminium was 477 kg/yr. This represents a 24% decrease from 2004 to 2024.

### SPL overburden cell

The SPL overburden cell is located North of Anderson creek. The SPL material is composed of approximately 10,500 m<sup>3</sup> 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 2024 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<sup>3</sup> 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 as of the current reporting period.

# 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.

## 2024 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 Total Suspended Solids (TSS). BOD is an indirect measure of the concentration of biodegradable matter, while TSS is a direct measure of suspended solids.

In 2024, all effluent discharge permit measurements were in compliance (Figure 10.1).

### Kemano emission discharge

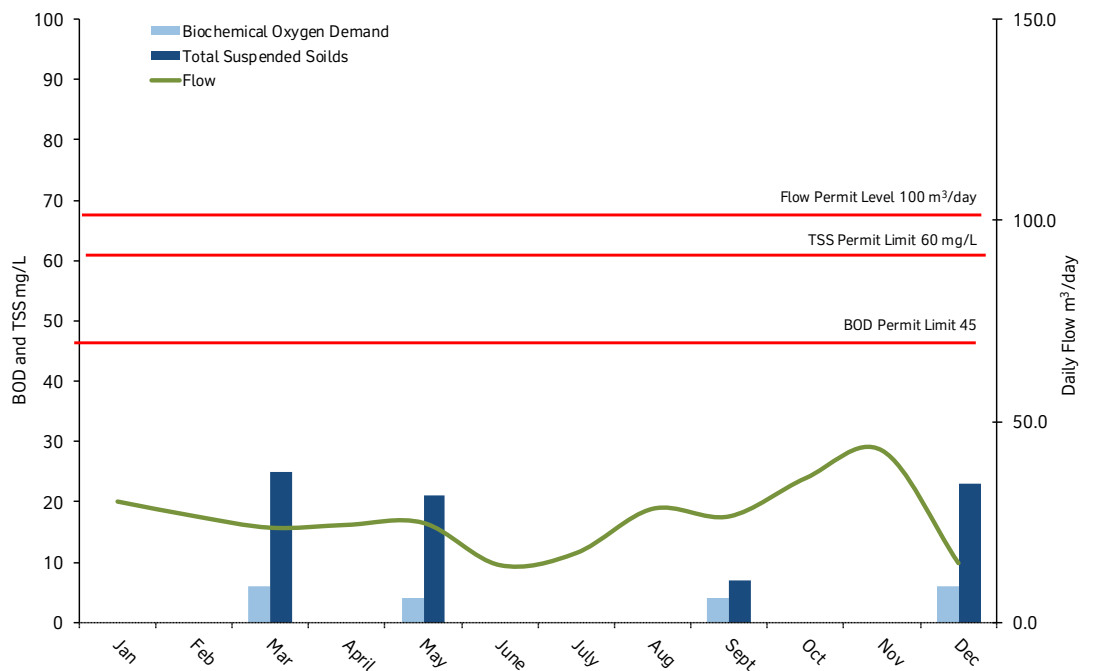
An incinerator is used to burn municipal-type waste generated by operations and maintenance crews while residing at Kemano Operations. The incinerator is a double-chambered, fuel-fired, forced air unit. The permit requires that the exhaust temperature of the Incinerator remain above 980°C and in 2024 permit requirements were in compliance. The Incinerator permit allows up to 1000 m<sup>3</sup> of domestic waste to be processed and in 2024 the total volume was 387.0 m<sup>3</sup> 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 a maximum annual maximum of 300 m<sup>3</sup>. In 2024, 16.9 m<sup>3</sup> of ash and refuse were buried.

Treated sludge from the sewage treatment plants is deposited in filtration ponds that dewater it before disposal. The dewatered sludge is then deposited in the landfill. The permitted allowance is for disposal of up to 900 m<sup>3</sup> of treated sludge per year. In 2024, 8.0 m<sup>3</sup> of sludge was disposed of.

**Figure 10.1**  
Effluent discharge,  
Kemano 2024



# 11. Summary of non-compliance and spills

In 2024, BC Works reported eight non-compliant conditions to the BC Ministry of Environment and Parks for the Kitimat Smelter operations.

## 2024 Performance

### Non-compliance summary

In 2024, eight non-compliances were reported to the BC Ministry of Environment Parks. 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).

**Table 11.1** Summary of non-compliances, 2024

Occurrence date	Non-Compliance	Permit Requirement	Cause	Corrective Actions
April 4, 2024	Missed upset reporting of FC-3.	Notify BC ENV of upset within 1 business day.	The reporting procedure hasn't been completed.	1) Development of visual tracker to indicate upset/bypass status 2) Implementation of secondary checker to oversee upset notification.
4/24/2024	Late upset reporting of dust collectors along the overhead material conveyor	Notify within 5 business days	Lack of awareness of the reporting requirements	1) Re-evaluation of the frequency of replacement for Dust Collector filters. 2) Reporting process for Dust Collector upset with the department and environmental team was established
6/26/2024	Missed reporting of B221 cruce cleaner Dust collector	Notify within one business day	B221 cruce cleaner Dust collector upset was not reported to environment team resulting in missing reporting deadline (1 business day)	1) Notify of NCR, complete investigation, submit closure report 2) Trained supervisors on Dust Collector upset reporting
July 7, 2024	Missed upset reporting of LPI.	Notify BC ENV of upset within 1 business day.	Upset of Liquid Pitch Incinerator but not reported to the environment team in a timely manner, resulting in late reporting to ministry within 1 business day	1) Environmental team member added to the notification process
September 2, 2024	Unauthorized bypass of B221 DC.	Request bypass approval before planned maintenance on permitted emission control device.	The project delegate went on vacation and unexpectedly extended his/her leave due to personal reasons. The operational team was unaware of the bypass approval requirement for using a mobile dust collector at B4440 for the B221 DC replacement project. As a result, the environment team could not submit the extension request before September 1, the end date of the previous bypass approval	1) Reviewed area's permit requirement with casting leads and operation representative.
November 4, 2024	Missed upset reporting of FTC.	Notify within one business day.	The operational area reported the FTC Mode 3 bypass to the environmental team who provided positive confirmation that the upset notification had been received. However, the environment team did not notify BC ENV of the upset within 1 business day.	1) The ENV team reviewed the reporting process & worked through the visual tracker.
11/26/2024	Missing reporting parameter – TSS	Ensure that proper care is taken in sampling, storing, and transporting the samples	The October 13 sample was collected and sent to the shipping department. Purolator picked up the package and delivered it to the lab. The lab found the sample bottles to be damaged. The most probable cause of this non-compliance is inadequate packaging and improper sample handling during transportation	1) Review of procedures for collecting and shipping b lagoon samples 2) Update packaging materials for effluent samples.
12/18/2024	Pyroscrubber particulate matter level above permit limit	Permit limit TPM 21.1 kg/hr	Under Investigation	1) Resample within 14 days from preliminary data was submitted to Rio Tinto 2) Investigation to identify corrective actions

## 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 Ministry of Environment and Parks (referred to as “reportable” spills), depending on the nature and volume of the substance spilled. In 2024, eleven 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, 2024

Occurrence date	Substance	Amount	Environmental Media	Cause	Corrective Actions
2/2/2024	Hydraulic Oil	~ 150 L	Concrete	Cruce tilting repeatedly resulted in hydraulic oil spill	1) The spill was cleaned up 2) Repaired equipment
3/18/2024	Alumina	~ 227 kg	Gravel	Leak at SPS line	1) The spill was cleaned up using a vacuum truck 2) Communicated to utilize operators' knowledge when they were unfamiliar with the equipment.
4/20/2024	Leachable Fluorides	Unknown	Air	Unknown	1) Rail car to sit to re-inspect the bin 2) Communicate to leaders that call when there is a leak.
4/28/2024	Hydraulic Oil	~110 L	Concrete	Hose leak on MTV#5	1) Reviewed SOP with MTV driver involved in incident
6/4/2024	Alumina	~250 kg	Paved ground	Excess material built up in the conveyor system due to a scraper misalignment, causing Alumina to escape the system and spill out of containment.	The spill was cleaned
6/5/2024	Alumina	~220 kg	Paved ground	Connection part on the conveyor left open	1) Stopped unloading and cleaned up materials with a vacuum truck. 2) Sealed area and repaired defects found from inspection.
7/9/2024	Hydraulic Oil	~150 L	Concrete	Failure of hydraulic line	1) Cleaned up the surface with absorbent pads
7/18/2024	Alumina	~250 kg	Concrete	Unknown	The spill was cleaned up
10/25/2024	Liquid Pitch	~ 100 GHG.gal	Paved ground	Pipe containing liquid pitch flowing out of the building	1) Perform Process Hazard Analysis on Pitch storage and Circulation System 2) Install deflector shields around pitch pump bellows.
11/22/2024	Sewage Leak	~20 t	Soil	Unknown	1) Complete excavation and repairs to line
12/8/2024	Alumina	~2 t	Concrete	Blockage due to coke contamination	1) Stopped alumina conveyance 2) Spill cleaned up using vacuum truck

# 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.

### 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<sub>2</sub>e)

This is a quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO<sub>2</sub> 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**

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

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

## Notations

Notation	Parameter
<b>96LC<sub>50</sub></b>	Rainbow Trout 96hr Static Acute 100% concentration screen (pass/fail)
<b>Al</b>	Aluminium
<b>Al<sub>2</sub>O<sub>3</sub></b>	Aluminium Oxide
<b>BOD</b>	Indirect measure of the concentration of biodegradable matter
<b>CN-SAD</b>	Cyanide Strong Acid Dissociable
<b>CN-WAD</b>	Cyanide Weak Acid Dissociable
<b>CO<sub>2</sub></b>	Carbon Dioxide
<b>D1HM</b>	Daily 1 hour maximum
<b>Dis. Al</b>	Dissolved Aluminium
<b>Dis. F</b>	Dissolved Fluoride
<b>Fg</b>	Gaseous Fluoride
<b>Fp</b>	Fluoride particulate
<b>Ft</b>	Total Fluoride
<b>GHG</b>	Greenhouse Gases
<b>H<sub>2</sub>SO<sub>4</sub></b>	Sulfuric Acid
<b>ha</b>	Hectare
<b>HF</b>	Hydrogen Fluoride
<b>hr</b>	hour
<b>kg</b>	Kilogram
<b>kg/Mg Al</b>	kg of substance per metric tonne of Al
<b>m<sub>3</sub></b>	Cubic meter
<b>Mg</b>	Megagram (1 metric tonne)
<b>mg/L</b>	Milligrams per liter
<b>mm</b>	Millimeter

Notation	Parameter
<b>MWT</b>	Molecular weight
<b>ng/m<sup>3</sup></b>	nanogram per cubic meter
<b>NO</b>	Nitrogen monoxide
<b>NO<sub>2</sub></b>	Nitrogen dioxide
<b>NOx</b>	Nitrogen Oxides
<b>O<sub>3</sub></b>	Ozone
<b>PAH</b>	Polycyclic Aromatic Hydrocarbons
<b>PFC</b>	Perfluorocarbons (CF <sub>4</sub> and C <sub>2</sub> F <sub>6</sub> )
<b>pH</b>	Potential hydrogen
<b>PM</b>	Particulate Matter
<b>PM<sub>10</sub></b>	Particulate Matter 10 µm or less
<b>PM<sub>2.5</sub></b>	Particulate Matter 2.5µm or less
<b>ppb</b>	Parts per Billion (vol/vol)
<b>PVC</b>	Polyvinyl chloride
<b>Q1</b>	1st Quarter of the Year
<b>Q2</b>	2nd Quarter of the Year
<b>Q3</b>	3rd Quarter of the Year
<b>Q4</b>	4th Quarter of the Year
<b>SF<sub>6</sub></b>	Sulphur Hexafluoride
<b>SO<sub>2</sub></b>	Sulphur Dioxide
<b>SO<sub>4</sub><sup>2-</sup></b>	Sulfate ion
<b>TSS</b>	Total Suspended Solids
<b>ug/m<sup>3</sup></b>	microgram per cubic meter
<b>yr</b>	year
<b>µS/cm</b>	micro siemens per centimeter

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