2023 Environment Management System & Community Engagement Report

31 March 2024

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Cover: Photo by Jeff Fountain

1 Summary

Over the last decade, Vale's Copper Cliff Smelter Operations have operated under both a site-specific standard (SSS) for nickel and sulphur dioxide (SO_2). These SSS approvals included a requirement to implement communication and community engagement plans and to form an Environmental Monitoring Team (EMT). This annual report documents 2023 community activities and environmental accomplishments.

Vale's website, www.vale.com/canada is a resource for information about the company's environmental performance and community involvement. Current and recent environmental monitoring results as well as real-time and historical monitoring results are posted on the website. Details about monitoring programs, emission reductions, dust emissions controls and other environmental initiatives can also be found here.

For the first time since the COVID-19 pandemic, Vale hosted an Open House at the NAOC facility in June, 2023.

Compliance with Ontario air quality standards is evaluated using dispersion modelling to determine maximum contaminant concentrations in the community, and also by measuring concentrations of SO_2, total suspended particulate (TSP) and metals at several monitoring stations throughout the community. In 2023, there were:

- no measured exceedances of the SO_2 standard (O.Reg 490) or the Upper Risk Threshold (O. Reg 652) attributable to Vale operations.
- two (2) exceedances of the 24-hour TSP standard of 120 µg/m^3, both attributed to Vale operations, at the monitoring stations located at Dynamic Earth (7 March 2023) and Power Street (12 April 2023).
- three (3) exceedances of the 24-hour TSP standard of 120 µg/m^3; but after investigations, none of these were attributed to Vale operations.
- One (1) exceedance of the manganese standard of 0.4 µg/m^3 but after investigation, it was determined to be a laboratory error.

Vale's Clean Atmospheric Emission Reduction (AER) Project and Surface Facilities Upgrade Project (SFU) were completed in 2020 and resulted in a 90% reduction in SO_2 emissions from Vale's Smelter Operations, comparing operating years 2013-2016 (average of 143 200 tonnes SO_2) with emissions post Clean AER (average of 14009 tonnes SO_2 for operating years 2019-2023).

The Superstack liner demolition was completed in 2023. The Copper Stack demolition is scheduled to begin in September 2024.

Even though the Superstack is no longer a source of SO_2 emissions, Vale continues to operate an Emission Reduction Program (ERP) as required by our Smelter and Nickel Refinery ECAs, to monitor conditions.

The Nickel SSS of 1µg/m³ (annual) issued to Vale's Copper Cliff Smelter in 2011 expired at the end of 2021, and a new SSS of 0.4µg/m³ (annual) was issued December 23, 2021. The new SSS has a lower 24-hour reporting trigger and a new Nickel Action Plan. Reporting requirements for December 31, 2023 included an updated baghouse protocol, workroom initiatives update and housekeeping protocols for the Smelter.

In 2023, Vale received 19 complaints from community members, compared to 11 and 29 in 2021 and 2022, respectively.

2 Background

At the end of 2023, the following air quality related approvals from the Ministry of the Environment, Conservation and Parks (MECP) were in effect at the Vale Copper Cliff Smelter:

- Amended Environmental Compliance Approval # 6785-9BXPTC (January 2014)[1]
- Nickel Site Specific Standard Approval (annual) # 502-11-rv0 (December 2021)

The Nickel SSS contains a requirement to continue the operation of the Environmental Monitoring Team (EMT) which was created as a requirement of the Nickel SSS issued in 2011. The EMT has representation from the community, the MECP and Vale. The purpose of the EMT is to serve as a forum for dissemination, consultation, review and exchange of information regarding the operation of the Smelter, environmental issues such as air monitoring, analysis of monitoring data, and to review any new or amended Ministry approvals, as required. Per the 2011 Nickel SSS, Vale typically provided bi-annual updates of monitoring results, Action Plan progress, and communications initiatives to the EMT.

Two meetings were held in 2023 on the 28th of March and on the 28th of November.

This report documents the work of the EMT and the communications activities undertaken by Vale in 2023.

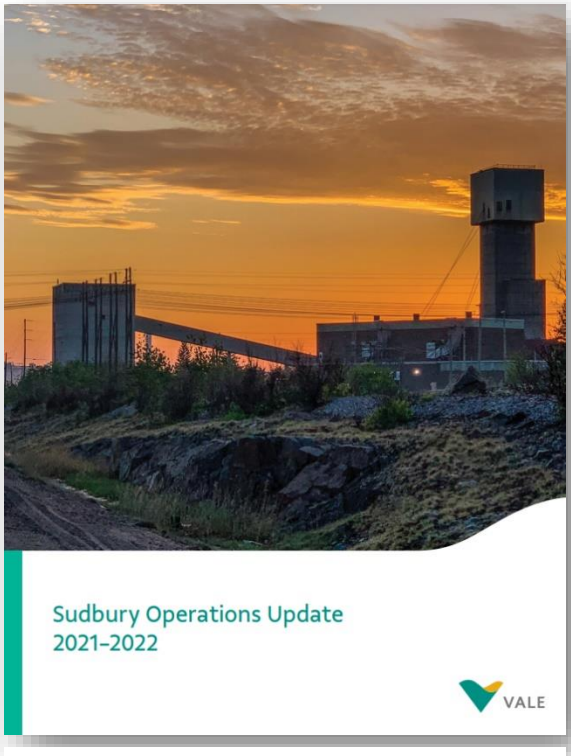
[1] Vale submitted an application to amend the Smelter's existing ECA (Air and Noise) in September 2020. The application requested an update to the terms and conditions to reflect the new operating reality of the Smelter (two new 450' Stacks, no more Superstack, Copper Stack or FBD Stack). Development of these terms and conditions were impacted by the development of the terms and conditions within the Smelter's new Nickel Site Specific Standard and Nickel Smelting and Refining SO_2 Regulation. Vale received the draft ECA on January 7, 2024 and is compiling a response to the MECP.

3 Communications and Community Engagement

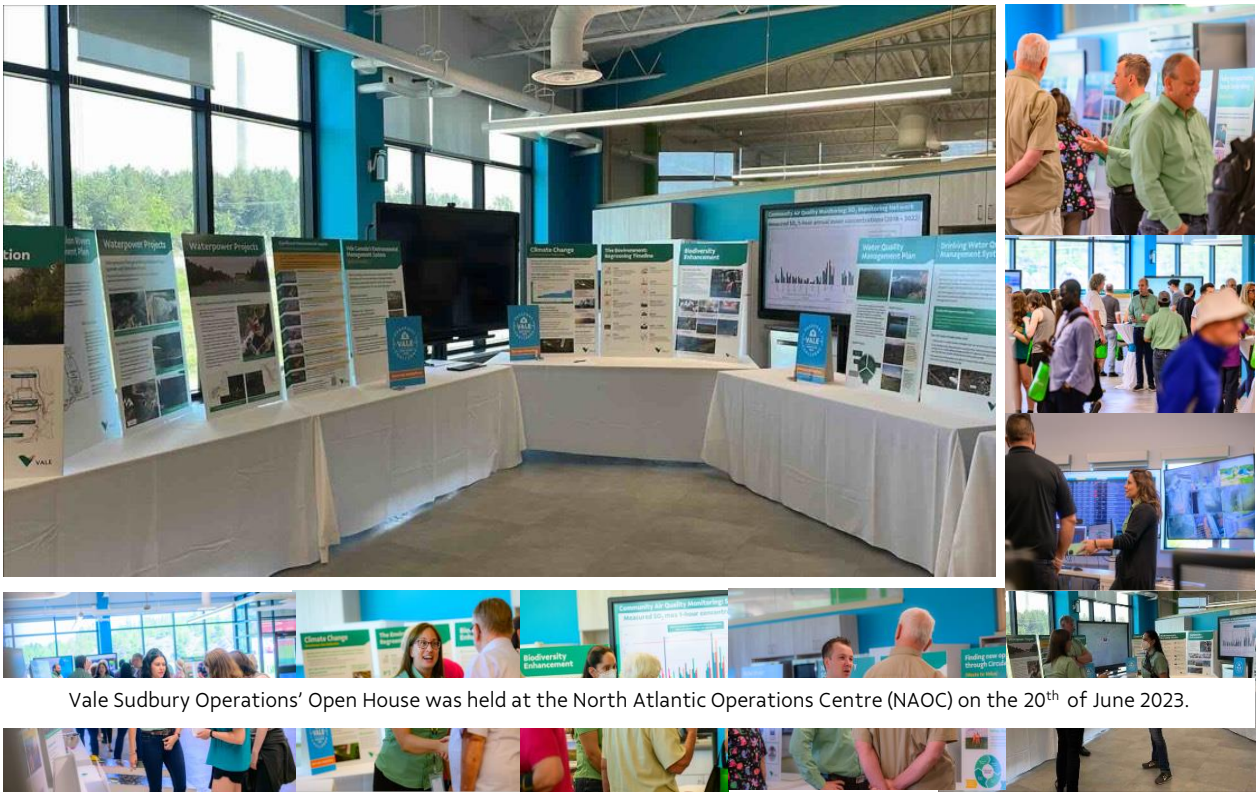
The EMT provides proactive, transparent and timely communications that update current performance and the progress of Vale's Action Plan to meet the requirements of its Site-Specific Standard (SSS) Approval.

Information was shared through the course of the year via:

- 2022 EMT Community Report: Distributed to EMT and MECP31 March 2023.
- Integrated Community Report :. The annual Integrated Community Report was posted to Vale's website in February 2023 along with the reports from its other Canadian operating sites.
- Open House was held on June 20th, 2023.



2022 Integrated Community Report – Issued Feb. 2023



Vale Sudbury Operations' Open House was held at the North Atlantic Operations Centre (NAOC) on the 20th of June 2023.

3.1 Vale Website

In addition to the Clean AER Project web page, Vale's website, www.vale.com/canada, also includes air quality information that further fulfill its site-specific standard approval requirements.

The air quality documents posted on this site include:

- Most recent and historical metals and SO_2 monitoring results (reported quarterly)
- Glossary of terms
- Details about the monitoring and emission reduction programs, and
- Information about dust emission controls

The website also includes information about Vale in the community as well as information about the company's water, reclamation and decommissioning management activities.

4 Community Air Quality Monitoring

4.1 Sulphur Dioxide

There are 18 fixed continuous SO_2 monitoring stations located in the community, owned by Vale and Sudbury Integrated Nickel Operations, a Glencore Company and operated and maintained by FROSKR (a division of BESTECH Canada Limited). In addition, the network includes the operation of three meteorological towers and Vale's mobile SO_2 monitoring unit. A map indicating the location of the stations is provided (see Figure 1).

In addition to the real-time monitoring data, quarterly and annual reports of SO_2 concentrations measured at the fixed stations were compiled and reported by an independent consultant and submitted to the MECP. The reports are posted on the Vale website on a quarterly basis.

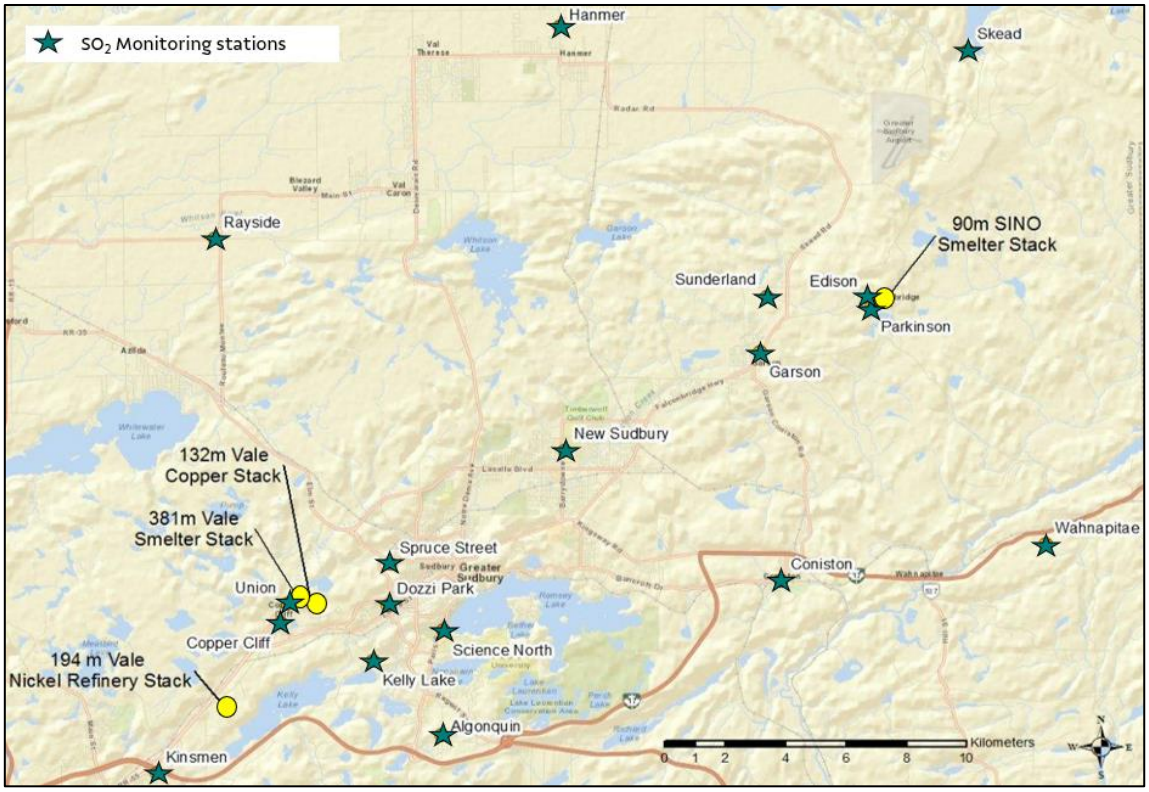


Figure 1: Sudbury SO_2 Monitoring Network

With the completion of the Clean AER and SFU Projects in 2020, Vale has significantly reduced SO_2 emissions from its Sudbury area operations, both in terms of tonnes emitted and impact in the community:

- Improved milling techniques have removed more sulphides from the ore before it reaches the Smelter.
- The Smelter transitioned to a single furnace operation (from two furnaces) and discontinued all pyrometallurgical (molten metal operations which generate SO_2) copper processing operations.
- Two new converters with advanced offgas collection systems and a new Wet Gas Cleaning Plant effectively diverted +95% of the offgas reporting to the Superstack to the Acid Plant
- SO_2 is captured from all primary pyrometallurgical activities at the Smelter, wet-gas-cleaned and processed at the Acid Plant to produce marketable sulphur products.

Since the Summer 2020 PMP, the Superstack and Copper Stack are permanently disconnected from all processes. The removal of the Superstack line was commissioned in 2023. Demolition of the Copper Stack is scheduled to begin in September, 2024.
INSERT CONTEXT PARAGRAPH EXPLAINING THE TRANSITION FROM THE O.REG 419 STANDARD FOR SO2 TO O.REG 652-21.

Results from the monitoring network indicate that annual mean SO_2 concentrations were well below the annual AAQC of 4 ppb SO_2 in 2023 at all stations (see Figure 2). All Vale

stations were calculated to have annual arithmetic mean concentrations that were less than 2 ppb SO_2. The highest annual average for 2023, at any of the Vale stations, was 1.1 ppb SO_2 measured at the Spruce Street station.

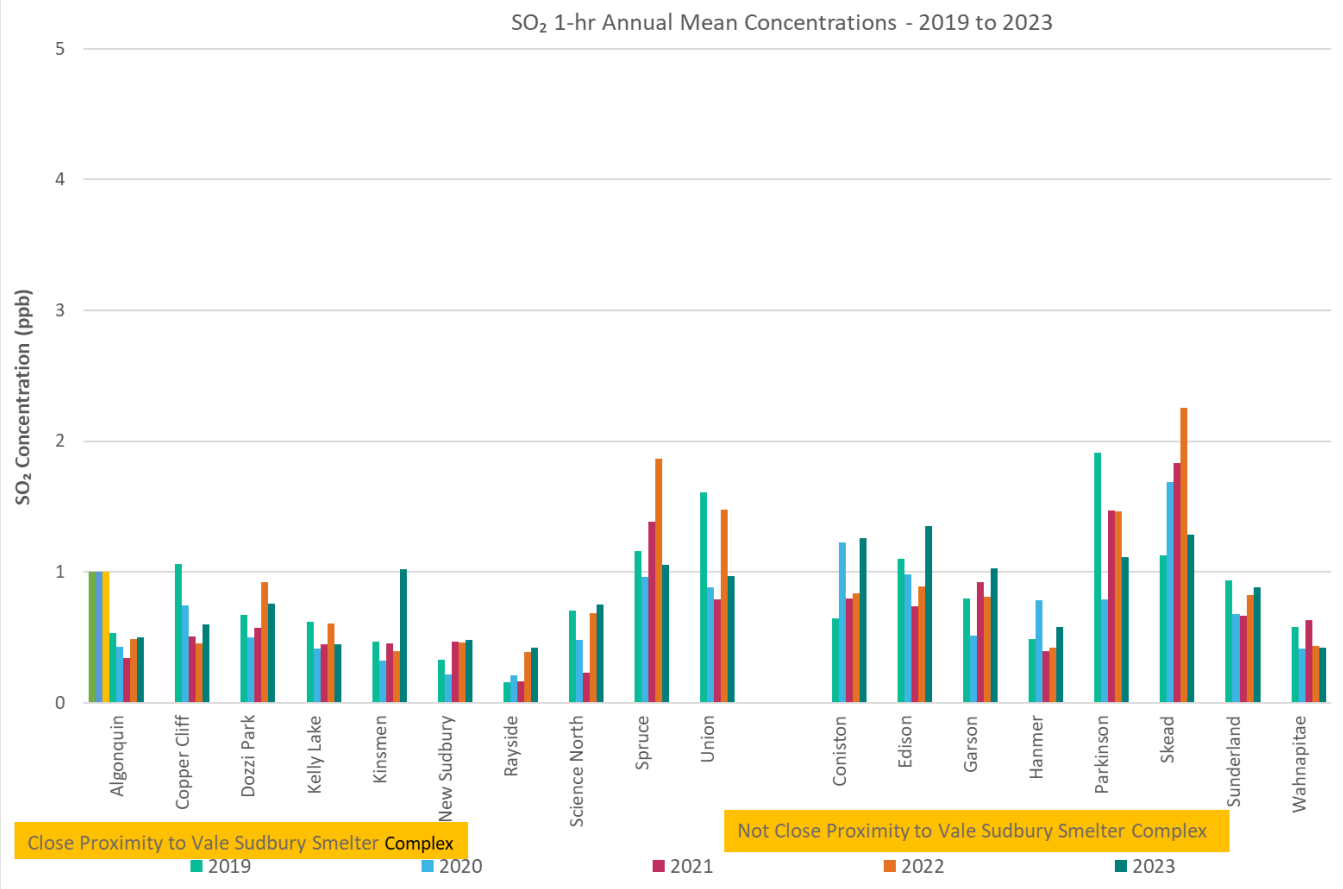


Figure 2: SO_2 Annual Mean Concentrations: All Stations 2019 to 2023

In 2018, the MECP introduced a new 1-hr SO_2 standard under Ontario Regulation 419/05, reducing the standard from 690 µg/m^3 to 100 µg/m^3 effective July 1st, 2023, both modelled and measured. The 690 µg/m3 (250 ppb) SO_2 1-hr air quality standard automatically became the Upper Risk Threshold. The Smelter and Nickel Refinery complied with the 1-hr SO_2 standard of 690µg/m^3 (250ppb), both modelled and measured.

Neither the Smelter nor the Nickel Refinery could meet the new standard of 100 µg/m^3 (38 ppb). As an alternative compliance mechanism, the MECP published Ontario Regulation 652/21 (O. Reg. 652/21)- Air Pollution – Discharge of SO_2 from Nickel Smelting and Refining Facilities in the Sudbury Area in September 2021 (other industries in Ontario have also received industry specific SO_2 regulations).

Effective July 1st, 2023, Vale has operated under O. Reg. 652/21 as an amendment to Ontario Regulation 419/05, under Section 5. The new regulation, O. Reg. 652/21, triggers a new annual reporting requirement for 1-hour measured events over 120 ppb. In addition, for any 1-hour measured event over 250ppb (Upper Risk Threshold (URT)), immediate reporting is required.

There was no exceedance of the 1-hour SO_2 Ontario Regulation 419 standard of 250 ppb in 2023 up to July 1st, 2023. Starting July 1st, 2023 with the new O. Reg.652/21 reporting requirements, there was no exceedance of the 1-hr event over 120 ppb and there was no exceedance of 1-hour event over 250 ppb (URT).

The highest maximum 1-hour SO_2 measured in 2023 at any of the **Vale SO_2 Monitoring Stations** was measured at the Kinsmen station, at 108 ppb. The graph below shows the 2019 to 2023 maximum 1-hour SO_2 concentrations for all the stations (see Figure 3).

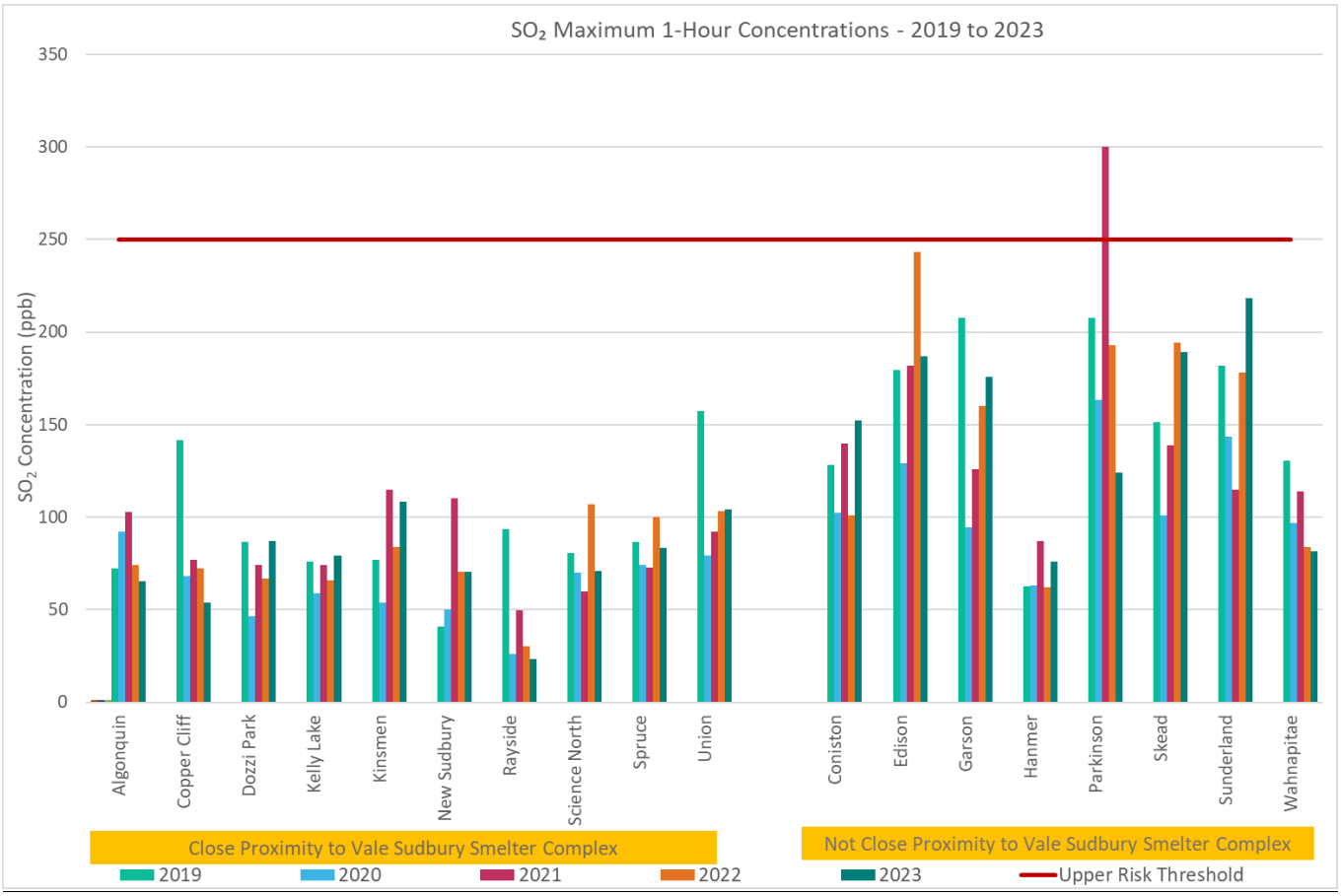


Figure 3: SO_2 Maximum 1-hour Concentrations (2019 to 2023)

4.2 SO_2 Compliance to new regulations

As previously stated, effective mid-2023, the MECP reduced the 1hr SO_2 standard to 100µg/m³. When this was announced in 2018, the MECP recognized that various industries in Ontario would not be able to meet this standard and began working on Technical Standards or industry specific regulations to allow those industries to continue operating while progressively improving their SO_2 emissions scenarios. Specifically for the nickel smelting and refining industry, the MECP issued Regulation 652 in September 2021, which will be effective for Vale as of July 2023. The new regulation contains terms and conditions that require:

- Primary and secondary emissions capture on pyrometallurgical equipment (molten metal operations that generate SO_2) – All primary emissions are captured for Smelter's pyrometallurgical vessels. Secondary capture on Smelter's converters was completed during Clean AER. The Nickel refinery is currently

installing an SO_2 scrubber to capture its top blown converter emissions. The scrubber project is scheduled to be completed by Q1, 2026.

- Study on the effectiveness of SO_2 capture over converting equipment. The plan for effectiveness SO_2 capture is due to be submitted on July 1st, 2024.

- Control of SO_2 emissions from pyrometallurgical equipment either by an Acid Plant, lime-injected baghouse, scrubber or other technology proposed by the company (with consideration for technical feasibility and cost-effectiveness). Come Q1, 2026, both the Smelter and Nickel Refinery will meet this objective.

- Monitoring and reporting requirement- ongoing requirement. Reporting requirements as of March 31st, 2024 and ongoing.

5 Nickel

Vale's particulate sampling network operates on concurrent 3-day or 6-day sampling schedules, with 9 stations operating monitors that collect particulate matter on filters over a 24-hour period. The filters are sent to an independent lab/consultant for gravimetric and metals analyses and reporting.

Quarterly reports are posted on the Vale website as they become available (several weeks lag time required for filter and data analysis). A map showing the location of the 9 monitoring stations is provided below (Figure 4).

In 2023, the following nickel standards were in effect per the Nickel Site Specific Standard:

- 24-hr Upper Risk Threshold (URT) of 2 µg/m^3 nickel.
- Annual average standard of 0.04 µg/m^3 for Fielding Road monitoring station.
- Annual average standard of 1.0 µg/m^3 for the remaining monitoring stations as per the site-specific standard in effect until December 2031.

In addition, there is a 24-hour standard for Total Suspended Particulate of 120 µg/m^3.

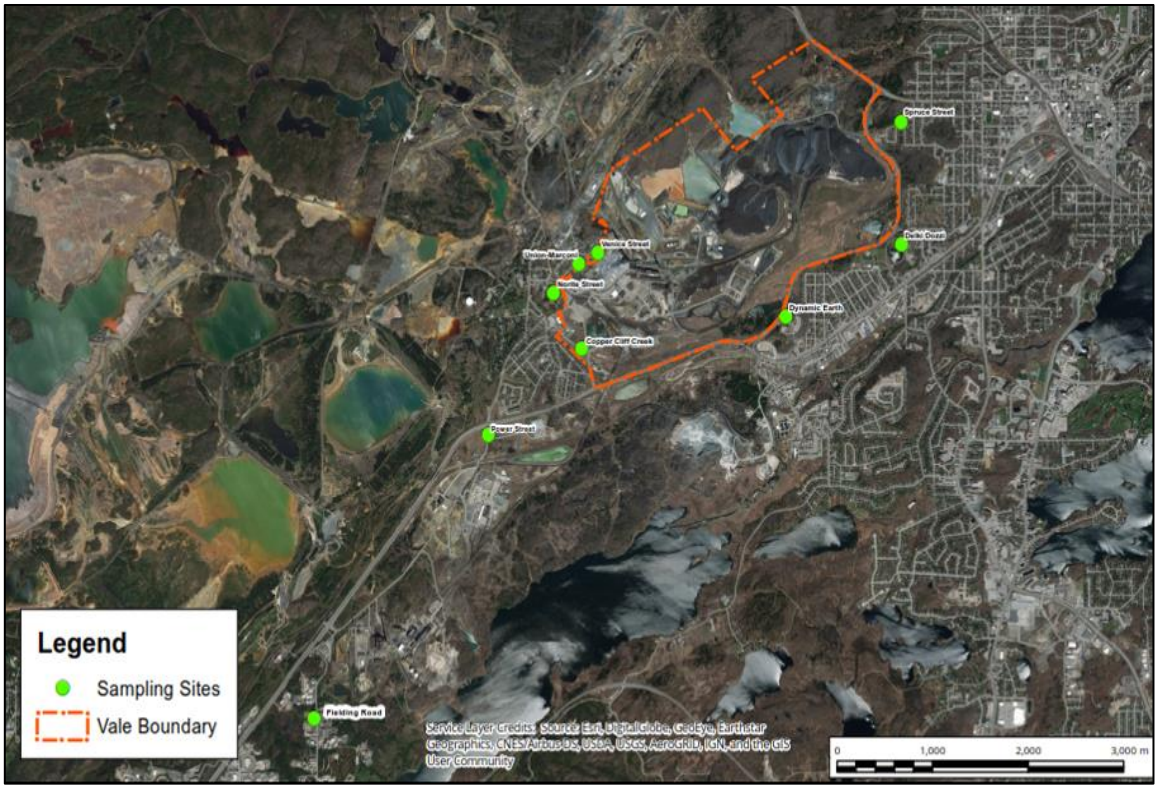


Figure 4: Vale's particulate sampling network

There were five TSP exceedances measured in 2023 and one manganese exceedance measured in 2023:

TSP – the following TSP (24 hour) measured exceedances were recorded but after investigation, none of these were attributed to Vale Operations (sources).

- One TSP (24 hour) exceedance (133 µg/m^3) at Fielding Road station on 29th June 2023. A review of the weather conditions on this day determined the wind direction did not correlate with the wind direction. Vale used cameras to visually confirm the dust was not from Vale property and caused by Fielding Road construction.
- One TSP (24 hour) exceedance (287 µg/m^3) at Fielding Road station on 5th July 2023. A review of the weather conditions on this day determined the wind direction did not correlate with the wind direction. Vale used cameras to visually confirm the dust was not from Vale property and caused by Fielding Road construction.
- One TSP (24 hour) exceedance (314 µg/m^3) at Fielding Road station on 14th July 2023. A review of the weather conditions on this day determined the wind direction did not correlate with the wind direction. Vale used cameras to visually confirm the dust was not from Vale property and caused by Fielding Road construction.

- One manganese (24hrs) exceedance (0.407 µg/m³) at Delki Dozzi station on 23rd July 2023. The filter was re-analyzed which determined there was a laboratory error which caused the exceedance and not Vale sources.

TSP – the following TSP (24 hour) measured exceedances were recorded and were attributed to Vale Operations (sources).

- One TSP (24 hour) exceedance (160 µg/m³) at Dynamic Earth station on 7th March 2023. A review of the weather conditions on this day indicates that the source of TSP was from Vale sources due to material handling at the Smelter Complex with wind direction correlating with the station during the 24hrs sampling period.
- One TSP (24 hour) exceedance (144 µg/m³) at Power Street station on 12th April 2023. A review of the weather conditions on this day indicates that the source of TSP was from Vale sources due to dry and cold conditions with wind direction correlating with the station for a duration of time in during the 24hrs sampling period.

No nickel exceedances were reported in 2023. Nickel monitoring data for 2022 and 2023 for the 9 air quality monitoring stations are presented in the two graphs that follow. The most recent and historical detailed monitoring results for these and other metals measured at these stations are posted on the Vale website.

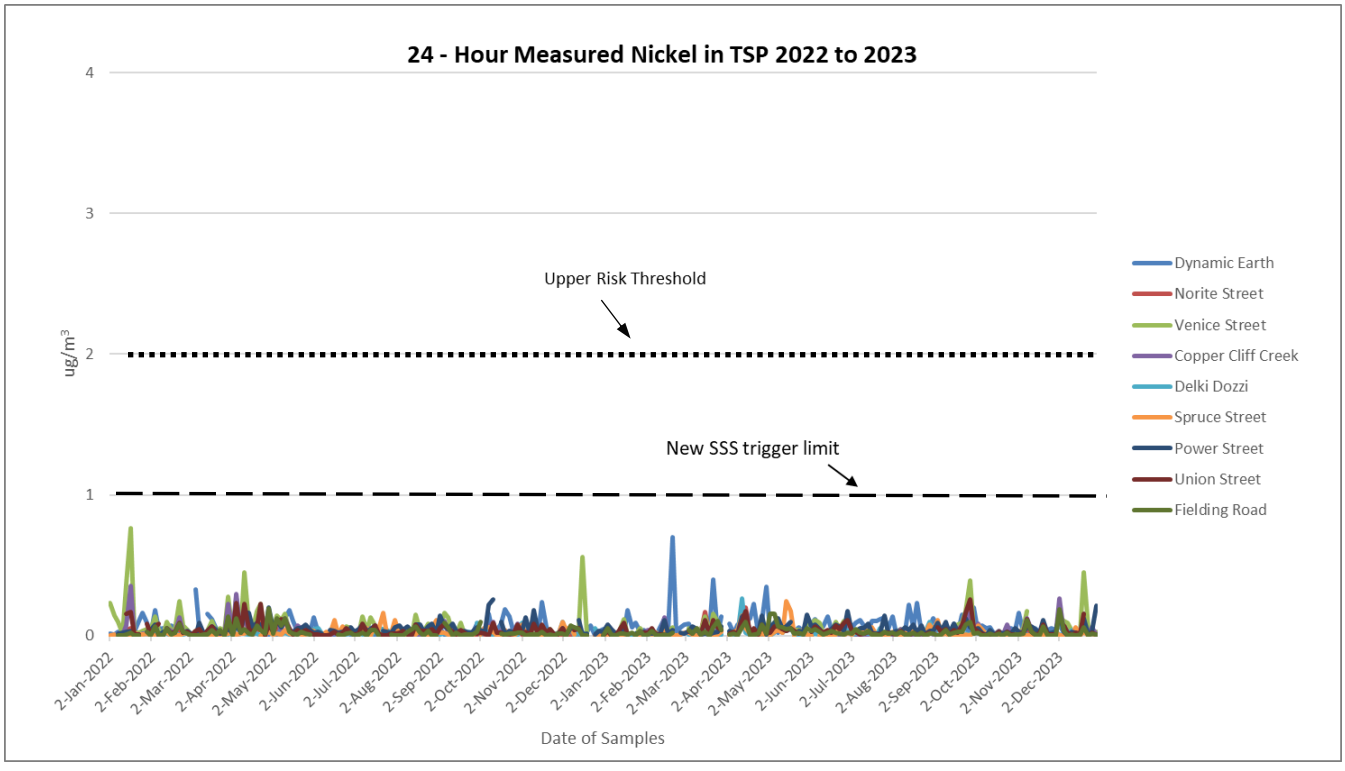
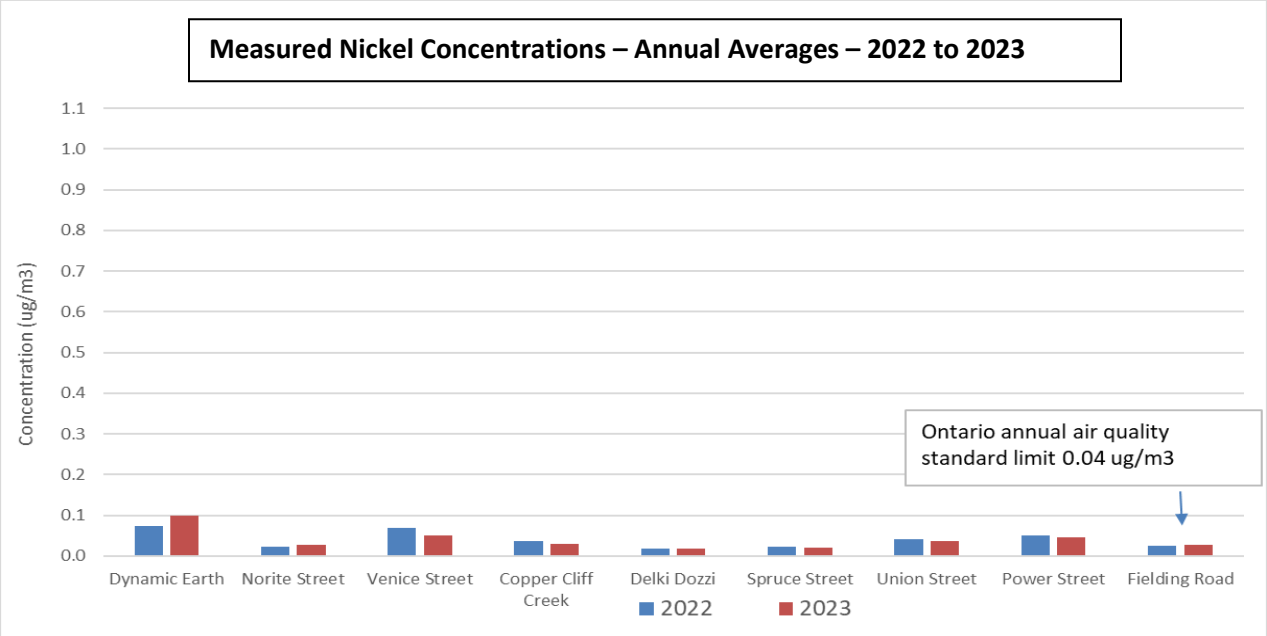


Figure 5: 24-hour Measured Nickel in TSP – all stations 2022 to 2023



Note: The Fielding Road station is not included in the nickel Site-specific Standard (SSS) for the Copper Cliff Smelter and as such fall under the Ontario annual standard limit of 0.04µg/m³.

Figure 6: Annual averaged Nickel concentrations – all stations 2022 to 2023

5.1 Dispersion Modelling

In addition to assessing compliance with air quality standards using community monitors, Vale also conducts dispersion modelling assessments, at least annually, to determine the maximum impact in the community from its emissions sources. The modelling predicts the maximum impact of various contaminants within a radius of at least 10km from Vale's operations using a 5-year meteorological data. The dispersion modelling conducted in 2023 demonstrated compliance with all regulatory instruments.

6 Emissions Reduction Program

Vale's Emissions Reduction Program (ERP) has always been a significant contributor to the company's positive SO_2 emissions performance. The program has been evolving and adapting to operational changes to ensure compliance with the Environmental Compliance Approval (ECA). Even though the Superstack is no longer a source of SO_2 emissions, the ERP continues to be implemented as it is a requirement under the ECAs. The ERP program was extensively restructured in 2023 to align with operational changes and are focused on monitoring ambient SO_2 ground level concentrations in the community attributed to Vale sources.

The ERP was traditionally responsible for controlling production in the Smelter converter and copper aisles (which were the major contributors to the Superstack plume) and providing guidance in the Nickel Refinery converter aisle during adverse weather conditions. Now that there is no converter or copper production to control, ERP's role comprises of:

- Guiding production in the converter aisle of the Nickel Refinery.
- Monitoring weather, production and emissions monitoring systems – then providing guidance when certain maintenance activities and slag pouring activities should occur or be delayed.
- Mobile monitoring for SO_2 in the community when deemed necessary. In 2023, the mobile unit was dispatched within the community, sparingly; actively monitoring for SO_2 only on three instances following complaints, where minimal readings were observed.

7 Environmental Community Concerns

The Smelter ECA and Nickel SSS require Vale to have a telephone number available to the public to register environmental complaints and concerns. All complaints/concerns must be documented and followed up. Vale has had a process in place to address community concerns for many years. For the Smelter, the telephone number is 705-682-8283. This number is answered by a Smelter employee 24 hours per day, 7 days per week. Vale also has a general community concerns line (705-222-VALE) that is also answered 24 hours per day, 7 days a week by an answering service. Vale employees respond to the concerns received on this line within 48 hours.

When community concern calls are received, they are routed to the appropriate department and the caller is contacted directly by a subject matter expert from Vale. A complaint log form is filled out that records the date, time, name, address and phone number of the person (if available), along with the wind direction at the time of the incident (available from Vale's meteorological records). Additional information (if applicable) is also captured in the log, including:

- Actions taken to investigate the cause of the complaint and result
- Recommendations for remedial measures
- Managerial/operational changes to avoid recurrence
- Feedback given to the caller

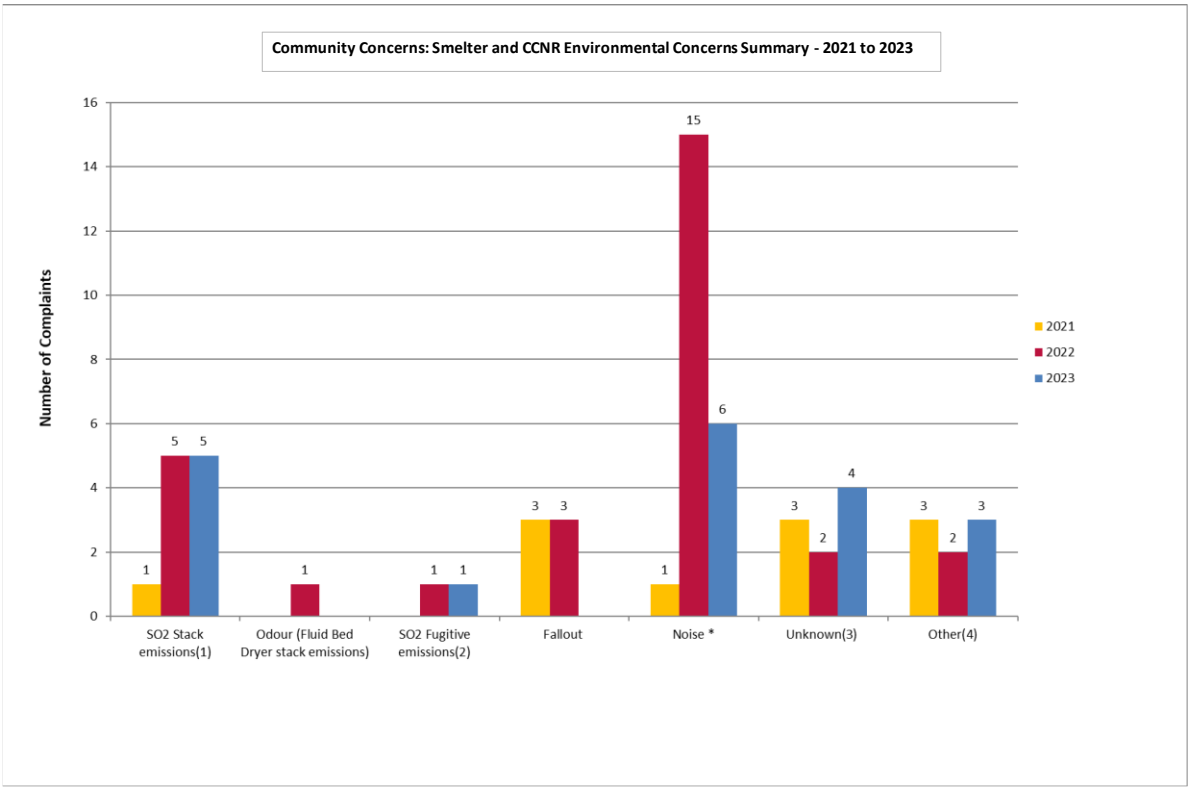
The Smelter ECA requires Vale to keep the complaint records on file for seven years, and to submit quarterly reports to the MECP summarizing the information about the complaints, including follow-up details. This information was submitted to the MECP for Q1, Q2, Q3 and Q4 of 2023.

Feedback on community concerns is also actively sought during various formal and informal interactions with our communities. The company invites the public to express their concerns through a variety of methods (phone lines, email, feedback forms and in person).

The Smelter Environmental Concerns Summaries for 2021 to 2023 are presented in Figure 7. There were a total of 19 community concerns logged in 2023, compared to 29 in 2022 and 11 in 2021.

Six of the 19 complaints received in 2023 were attributed to noise from the Smelter Complex. Of these 6, five are attributed to the ore trains traveling through the Town of Copper Cliff.

Copper Cliff Mine South has resumed producing ore and haulage of the ore is via train to Clarabelle Mill, passing through the Copper Cliff area. This method was used historically to transport the ore however it has been well over a decade since ore trains have hauled ore through the town of Copper Cliff. In response to the complaints, administrative controls have been initiated by the Transportation Department to assist in reducing noise (and diesel) emissions. These controls include removing any engines that are not able to be properly maintained and having sufficient hauling capacity to reduce shunting near Copper Cliff. Vale continues to work with the noise consultant to review additional options for noise reduction.



(1) Stack emissions - include all emissions from stack sources.
(2) Fugitive emissions - include process fugitives and fugitives from slag operations.
(3) Unknown - After investigation, unable to identify source of concern and/or concern did not correspond with wind direction from Vale's Smelter's emissions.
(4) Other - Appearance of plume, odours not attributed to the Fluid Bed Dryer etc.
* Q4 2023 three of the noise complaints are noise/emissions complaints from the ore trains

Figure 7: Vale Smelter Environmental Concerns Summary for 2021 to 2023

8 Nickel SSS Action Plan Update

The Nickel SSS of 1µg/m³ (annual) issued to Vale's Copper Cliff Smelter in 2011 expired at the end of 2021, and a new SSS of 0.4µg/m³ (annual) was issued December 23, 2021. All the action items in the 2011 Nickel SSS Action Plan had been implemented by the end of 2021 except the Material Handling Relocation project. The 2021 Nickel SSS Action Plan contains the following items:

Action Plan Item	Updated Timeline (As of March 27, 2024)
Material Handling Relocation (This item was carried over from the previous Action Plan)	2026
Determine requirement for further track-out controls after MHR is complete	Delayed due to Material Handling Relocation – 2027 evaluation, 2029 implementation if required
Implement Dust Emission Management Plan	Ongoing
Study for options and cost Effectiveness to reduce traffic on main entrance road	2026, Budget planning for 2026.
Annual evaluation and implementation of workroom improvement initiatives	Submitted report in December 2023. Reporting required annually.
Annual workroom monitoring to confirm effectiveness of above	Workroom monitoring performed in 2023 to get baseline.
Formal Housekeeping Protocol	Submitted report in December 2023. Reporting required annually.
Formal Baghouse Protocol	Submitted report in December 2023. Reporting required annually.
Study for efficiency of dust collection systems	2026, Budget planning for 2025 delayed

Figure 8: 2023 Nickel SSS Action Plan

As with the previous Nickel SSS, Vale will continue preparing reports to update the status of its Action Plans annually. Updates are posted on Vale's website (link).

The new Material Handling building Is in the process of undergoing re-engineering which is scheduled to be completed in April. The new scope of work will be tendered out and it is anticipated that foundation work will begin in June. The bulk of building construction will take place in 2025 with completion scheduled in the early part of 2026.

9 Environmental Management System (ISO14001:2015)

ISO 14001 is the internationally recognized standard for environmental management systems (EMS). It provides companies with a framework for designing and implementing an EMS, and continually improving their environmental performance. After our Newfoundland and Labrador sites were certified in early 2023, our Ontario and Manitoba operations followed suit in August and November 2023, respectively.

One of the Environment Department's goals is to develop a culture of continual improvement with respect to the environment at our plants and mines, by increasing awareness and engaging employees at all levels at our Sudbury Operations.

An **Environmental Policy Statement** has been developed that applies to Vale operating sites within Canada, where mining, milling, smelting and/or refining activities take place to produce nickel, copper, cobalt and precious metal products.

Canada EMS - Environmental Policy Statement

PGS-005476, Rev: 01-10/03/2023

Issuer Area: Environmental Department – Canadian Operations
Technician Responsible: Name: Lisa Lanteigne, Registration: IO955268, Area: EMS.
Target Audience: All Vale Canada Limited employees and contractors.
Need of training: (X)YES ( )NO

Application:

This Environmental Policy Statement applies to Vale operating sites within Canada, where mining, milling, smelting and/or refining activities take place to produce nickel, copper, cobalt and precious metal products.

Commitments:

Vale Canadian Operations are committed to protection of the environment, through pollution prevention, sustainable use of water and energy, and effective management of our waste streams. We will act responsibly, respecting the local environment and communities where we operate.

Vale Canadian Operations will:

- Establish, maintain and continually improve an environmental management system for operating sites within Canada.
- Routinely assess the environmental aspects of our activities, products and services under normal, abnormal and emergency conditions, to ensure that the environmental risks and opportunities of our operations are managed effectively.
- Fulfill our environmental compliance obligations.
- Establish environmental objectives, identify actions and measure progress towards achieving identified targets, with the goal of continuous improvement of environmental performance.
- Promote awareness, involvement and competence in environmental management for all employees and contractors whose actions have the potential to impact the environment.
- Communicate our environmental performance to local communities and other stakeholders.

Accountability:

The leadership teams for the Newfoundland and Labrador, Ontario and Manitoba jurisdictions are accountable for environmental performance, through the implementation of an effective environmental management system. This will be achieved by integrating environmental risk management into Vale's business processes, providing resources, communicating the importance of environmental risk management within the workforce, and promoting continual improvement in environmental performance.

Employees and contractors are responsible for taking the actions necessary to protect the environment. within the scope of their work activities and in accordance with this policy.

Figure 9: Environmental Policy Statement

10 Contact Info

For more information or to discuss this report, contact Gary Remington, Superintendent – Environment, Ontario Operations, Vale Canada Limited at: gary.remington@vale.com .