AMBIENT AIR QUALITY FOLLOW-UP MONITORING PLAN

EQUINOXGOLD
VALENTINE GOLD MINE

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PREPARED BY:	Stantec Consulting Ltd. / VGM Environment
APPROVER:	Jamie Russell
APPROVAL SIGNATURE:	

Ambient Air Quality Follow-up Monitoring Plan

REVISION HISTORY

REV NO.	DESCRIPTION OF CHANGE	COLLATOR	APPROVER
0.0	See revision log	Stantec	Tara Oak
1.0	See revision log	Trudy Wells	Trudy Wells
2.0	See revision log	Stantec	Jamie Russell

Revision Log

Version	Date Issued	Revision Notes*	Page(s)
0.0	January 2023	Initial document	
1.0	September 2024	Company name change to Calibre Mining Corporation Valentine Gold	Throughout the document
		Company logo change to Calibre Valentine Gold Mine	All Pages
		Included details of Berry Pit Expansion Registration/ Environmental Assessment (Section 1.0)	1
		Project overview updated to reflect Berry Pit Expansion (Section 1.1)	2 - 3
		Update of project emissions to provide additional details for the air quality assessment (Section 2.2)	17
		Update of proposed mitigation and management measures to reflect Berry Pit Expansion (Section 3.0)	22
		Update of meteorology content to include the installation of the meteorological station and the measurement parameters (Sections 4.1.2.1, 4.2.1).	29 - 30
		Update of the air quality methods to include regulatory consultation and monitoring equipment requirements (Section 4.2.2)	31
		Update of the Guide for Reporting to the National Pollutant Release Inventory to reference 2022 -2024 (Sections 5.0 and 7.0)	32, 34
2.0	May 2026	Company name change to Equinox Gold Corp. (Equinox)	Throughout the document
		Company logo change to Equinox Gold Corp.	All Pages
		Update Introduction section to align with other FMPs	Pages 1-2
		Expansion of the AAQFMP to include light and dustfall monitoring components, and stack testing and dispersion modelling (purpose, background, regulatory setting, monitoring approach, and reporting).	Throughout the document
		Update the CCME CAAQS to the most recent standards	Table 1.1, Page 6
		Addition of VGM Certificate of Approval (AA25-055710) requirements	Section 1.3.2.3, pages 9-10
		Update to Berry Pit EIS Emissions and Modelling results	Section 2.2.1.2 and 2.2.2, pages 33-37, Appendix B and C
		Update methods of monitoring programs to reflect on-going and planned activities now that the project has advanced	Section 4.2, pages 38-41
		Update reporting requirements to include those from the COA, and expand to include the additional light and dustfall programs.	Section 5.0, pages 44-49
		Added Stack Testing Plan to list of related management plants and monitoring programs	Table 6.1, page 49
		Provide copy of CoA in Appendix A, revise modelling results and contour plots in Appendix B and C to those from the Berry Pit EIS	Appendices

Table of Contents

ABBREVIATIONS V

1.0 INTRODUCTION 1
1.1 PROJECT OVERVIEW 2
1.2 PURPOSE AND OBJECTIVES 3
1.2.1 Purpose 3
1.2.2 Objectives 4
1.3 REGULATORY SETTING 5
1.3.1 Federal Regulatory Requirements 5
1.3.2 Provincial Regulatory Requirements 7
1.3.3 International Guidelines (Lighting) 10
1.3.4 Alternative Jurisdictions (Dustfall) 12

2.0 ENVIRONMENTAL SETTING 13
2.1 BASELINE CONDITIONS 13
2.1.1 Meteorology 13
2.1.2 Ambient Air Quality 17
2.1.3 Lighting 21
2.1.4 Dustfall 23
2.2 PROJECT EMISSIONS 23
2.2.1 Air Contaminant Releases 24
2.2.2 Dispersion Modelling 27

3.0 PROPOSED MITIGATION AND MANAGEMENT MEASURES 28

4.0 MONITORING PROGRAM 30
4.1 MEASUREABLE PARAMETERS AND THRESHOLDS 31
4.1.1 Thresholds 31
4.1.2 Measurable Parameters 37
4.2 METHODS 39
4.2.1 Meteorology 39
4.2.2 Ambient Air Quality 40
4.2.3 Lighting 43
4.2.4 Dustfall 43
4.2.5 Stack Testing 44

5.0 REPORTING 46
5.1 ANNUAL SUMMARY REPORT 49
5.2 MONTHLY REPORT 49
5.3 CONTINUOUS MONITOR INTERNAL RECORDS 50
5.4 STACK TESTING & DISPERSION MODELLING REPORTS 50
5.5 LIGHT REPORT 50
5.6 DUSTFALL REPORT 51
5.7 NPRI REPORTING 51

6.0 RELATED DOCUMENTS 52

7.0 REFERENCES 53

LIST OF TABLES

Table 1.1 Canadian Ambient Air Quality Standards Air Quality Management Levels 6
Table 1.2 Summary of NL Ambient Air Quality Standards (NLAAQS) 7
Table 1.3 VGM Certificate of Approval – Air Quality Related Conditions 9
Table 1.4 Environmental Lighting Zones 11
Table 1.5 Recommended Maximum Values of Light Trespass (Illumination) per Environmental Zones 11
Table 1.6 Reference Levels of Sky Glow 11
Table 2.1 Climate Normals, Buchans, Newfoundland and Labrador (1981 – 2010) 14
Table 2.2 Ambient Air Quality Data as Measured at the Grand-Falls Windsor NAPS Monitoring Location (2016 – 2017) 18
Table 2.3 Ambient Air Quality Monitoring Survey Results for TSP, PM_{10} and Metals within the Project Area, June 2020 19
Table 2.4 Ambient Air Quality Monitoring Survey Results for SO_2 and NO_2 within the Project Area, June 2020 20
Table 2.5 Air Contaminant Releases – Construction 24
Table 2.6 Annual Air Contaminant Release Estimates – Operation 26
Table 4.1 Monitoring Thresholds for TSP, PM_{10} and $PM_{2.5}$ and Trace Metals 31
Table 4.2 AAQFMP Trigger Action Response Plan 34
Table 4.3 Air Quality – Moderate and High Impact - Action Pre-Defined Responses 35
Table 4.4 Sources and Parameters for Stack Testing 39
Table 4.5 List of Meteorological Equipment 40
Table 4.6 Artificial Light Monitoring Locations 43
Table 4.7 Stack Sampling Methodology 45
Table 5.1 Reporting Requirements Summary 47
Table 6.1 Related Management Plans and Monitoring Programs 52

Table B-1 Maximum Predicted Ground-level Concentrations – Operation B.2
Table B-2 Maximum Predicted Concentrations – Camp / Cabin Locations – Operation B.4

LIST OF FIGURES

Figure 2-1 Winds at Deer Lake, Newfoundland and Labrador (2015 – 2019) 15
Figure 2-2 Seasonal Winds at Deer Lake, Newfoundland and Labrador (2015 – 2019) 16
Figure 2-3 Distribution of Artificial Light Within and Surrounding the VGM Prior to Activities (2020) 22
Figure 4-1 Ambient Air Quality Monitoring Locations 41

Figure C-1 Maximum Predicted 24-Hour TSP Concentrations (Including Background C.2
Figure C-2 Maximum Predicted 24-Hour PM_{10} Concentrations (Including Background) C.3
Figure C-3 Maximum Predicted 24-Hour $PM_{2.5}$ Concentrations (Including Background) C.4
Figure C-4 Maximum Predicted Annual $PM_{2.5}$ Concentrations (Including Background) C.5
Figure C-5 Maximum Predicted 1-Hour NO_2 Concentrations (Including Background) C.6
Figure C-6 Maximum Predicted 24-Hour HCN Concentrations C.7

LIST OF APPENDICES

Appendix A Certificate of Approval
Appendix B Dispersion Modelling Results
Appendix C DIspersion Modelling Contour Plots

ABBREVIATIONS

AAQFMP	Ambient Air Quality Follow-up Monitoring Program
AAQS	Ambient Air Quality Standards
AMPRP	Accidents and Malfunctions Prevention and Response Plan
As	Arsenic
Ba	Barium
Be	Beryllium
Bi	Bismuth
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
Cd	Cadmium
CEPA	*Canadian Environmental Protection Act, 1999*
CIE	Commission Internationale de L'Éclairage
CO	Carbon monoxide
Co	Cobalt
Cr	Chromium
Cu	Copper
EIS	Environmental Impact Statement
ECCC	Environment and Climate Change Canada
EPP	Environmental Protection Plan
FMP	Follow-up Monitoring Program
GHGEFMP	Greenhouse Gas Emissions Follow-up Monitoring Program
HCN	Hydrogen Cyanide
Hg	Mercury
IAAC	Impact Assessment Agency of Canada
IR	Information Requirements
Li	Lithium
LAA	Local Assessment Area
NAPS	National Air Pollution Surveillance Program
NCDC	National Climatic Data Center in the USA
NH_3	Ammonia

Ni	Nickel
NL	Newfoundland and Labrador
NLAAQS	NL Ambient Air Quality Standards
NLDECCC	NL Department of Environment, Conservation and Climate Change
NLDFAL	NL Department of Forestry Agriculture and Lands
NLDMPA	NL Department of Municipal and Provincial Affairs
NL EPA	*Newfoundland and Labrador Environmental Protection Act*
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides
NPRI	National Pollutant Release Inventory
O_3	Ozone
Pb	Lead
PM	Particulate matter
$PM_{2.5}$	Fine particulate matter with an aerodynamic diameter less than 2.5 µm
PM_{10}	Respirable particulate matter with an aerodynamic diameter less than 10 µm
RAA	Regional Assessment Area
Sb	Antimony
Se	Selenium
Sn	Tin
SO_2	Sulphur dioxide
TMF	Tailings Management Facility
TSP	Total Suspended Particulate Matter
US EPA	United States Environmental Protection Agency
VGM	Valentine Gold Mine
VOC	Volatile organic compounds
Zn	Zinc

1.0 INTRODUCTION

Equinox Gold Corporation (Equinox)[1] submitted the Environmental Impact Statement (EIS) for the Valentine Gold Project and the Berry Pit Expansion Environmental Registration / Environmental Assessment (Valentine Gold Project) Update. The combined approved projects are now referred to as the Equinox Valentine Gold Mine (VGM). The VGM is located in central Newfoundland, approximately 57 km south of Buchans, and is comprised of open pits, disposal piles, crushing and stockpiling areas, site infrastructure, a tailings management facility, and mine site haul and access roads. Production capacity is estimated at 10,960 tonnes per day, with an operation life of approximately 14 years. The mine site is accessed by an existing gravel road, approximately 82 km in length, which extends south from Millertown to the VGM.

The purpose of the Ambient Air Quality Follow-up Monitoring Program (AAQFMP) is to verify predictions and address commitments made in the original EIS (Marathon 2020), the Project Expansion Environmental Registration / Environmental Assessment (Marathon 2023) as well as those developed through Information Requirements (IR) received as part of the regulatory review process. Additionally, the AAQFMP outlines the air quality requirements specified in the VGM Certificate of Approval (COA, Approval No. AA25-055710) issued by NLDECCC and details the planned monitoring actions to meet these requirements.

This document describes follow-up and monitoring activities for the construction, operation, and decommissioning/closure phases of the VGM based on regulatory compliance requirements and Project approvals and authorizations. This is a living document that will be reviewed, updated and improved upon based on policy and technology changes as the Project progresses through the phases (i.e., construction to operation). Additionally, refinements may occur in response to the findings of the monitoring program (adaptive management), consultation with regulators, engagement with Indigenous groups, and conditions of authorization. As the VGM transitions between Project phases, this AAQFMP will retain information from earlier stages for completeness. For example, monitoring requirements associated with the construction phase will be maintained even once the VGM has moved into operations.

[1] In January 2024, Marathon Gold Corporation and the Valentine Gold Project was acquired by Calibre and was referenced as Calibre Valentine Gold Mine (VGM). In June 2025, Calibre merged with Equinox Gold Corporation and is now referenced as the Equinox VGM.

The construction and operation of the Project are governed by the VGM Management System, which includes tools such as corporate environmental and social policies, an environmental protection plan (EPP), environmental management plans, and follow-up monitoring programs (FMPs), which will be updated as applicable throughout the life of the VGM to reflect the latest project, regulatory and environmental information. The EPP outlines protection and response measures associated with potential environmental effects related to VGM construction and operational activities, providing general environmental protection procedures related to VGM activities and infrastructure including air contaminant and greenhouse gas emissions management, erosion and sedimentation control, rock and soils management, and traffic management, as well as specific protection procedures for caribou (*Rangifer tarandus*), avifauna, and other wildlife (including bats and American marten [*Martes americana atrata*]); fish and fish habitat; historic resources; and the Victoria Dam.

The EPP is closely linked to the follow-up monitoring programs as it describes practical procedures to reduce or eliminate potential adverse environmental effects, as well as instructions for addressing planned and unplanned activities/events associated with VGM activities. A process for the communication to Indigenous groups of potential adverse effects of planned VGM activities upon the use of land and resources by Indigenous persons (including hunting, trapping, fishing and gathering, and access to lands and resources) is provided in the Current Use of Lands and Resources for Traditional Purposes Indigenous Communications Plan. Response measures in the event of an accidental event are described in Section 4 of the Accidents and Malfunctions Prevention and Response Plan (AMPRP). Additionally, communications and reporting requirements are provided in the Section 5 of the AMPRP and in the Accidents and Malfunctions Indigenous Communication Plan.

The VGM has developed a grievance mechanism to afford a process for addressing grievances on the part of non-Indigenous and Indigenous groups or Indigenous persons resulting from the effects of the VGM to these users, such as effects to land and resource use, health, socio-economic conditions and heritage resources. In the event that grievances are received, these will be logged and investigated.

1.1 PROJECT OVERVIEW

Equinox's Valentine Gold Mine (VGM) is an open pit gold mine located in the west-central region of the Island of Newfoundland (NL), near Valentine Lake. The VGM uses standard surface mining techniques to mine gold ore from the Leprechaun, Marathon and Berry open pits. Ore material will initially be mined and processed at a nominal rate of 6,850 tonnes per day (Tpd), increasing to 10,960 Tpd in Year 4.

Ore is processed through the process plant, where it is crushed, milled and put through flotation and cyanidation processes to recover the gold. Separate stockpiles are established for high-grade and high-medium-grade ore for priority processing and low-grade ore for processing later in the mine life. Tailings are treated in the process plant area to remove the cyanide and subsequently deposited in an engineered tailings management facility (TMF). Gold is formed into doré bars, which are shipped from site to refiners in secured trucks.

Construction activities for the VGM began in October 2022 and continued through 2025. The VGM became operational in November 2025. The estimated mine operation life is 14.4 years (including the Berry Pit Expansion). The VGM is planned to operate 24 hours a day, seven days a week on a 12-hour shift basis. Upon cessation of mining, the operation will be closed, and the site components will be rehabilitated and monitored in accordance with applicable regulations at the time of closure.

1.2 PURPOSE AND OBJECTIVES

This document has been developed and prepared using currently available information and will require updates based on further details regarding Project design, sequencing, and methods change over the life of the Project.

1.2.1 Purpose

The purpose of the AAQFMP is to:

- Identify the regulatory requirements, air quality standards, and conditions relevant to releases to air from the Project.
- Identify and describe the sources of air contaminant releases during Project construction, operation and decommissioning/closure.
- Describe the mitigation measures for reducing gaseous contaminants and fugitive dust emissions associated with mine activities during Project construction, operation and decommissioning/closure.
- Describe the ambient air quality monitoring and modelling to be conducted during Project construction, operation and decommissioning/closure, to meet federal and provincial ambient air quality standards and criteria.
- Apply the principles of adaptive management to dust emissions based on the results of the ambient particulate matter (PM) monitoring program to continually assess the effectiveness of dust mitigation measures and the corrective actions to further reduce dust emissions (e.g., implementation of additional mitigation measures).
- Describe the provincial and federal requirements for emissions reporting and air quality monitoring reporting.
- Identify the regulatory guidelines relevant to dustfall resulting from deposition of dust generated from the Project.
- Describe the dustfall monitoring to be conducted during Project construction, operation and decommissioning/closure.
- Identify the regulatory requirements, lighting standards, and conditions relevant to light releases from the Project.
- Identify and describe the sources of light releases during Project construction, operation and decommissioning/closure.
- Describe the environmental light monitoring to be conducted during Project construction, operation and decommissioning/closure.

The AAQFMP applies to VGM activities and specifically addresses ambient air quality management and mitigation. Workplace (e.g., occupational) air quality and worker exposure assessments/monitoring, controls, and mitigation measures have been developed and are addressed separately from the ambient requirements.

The management and mitigation measures for reducing GHG emissions are addressed in the Greenhouse Gas Emissions Follow-up Monitoring Program (GHGEFMP).

1.2.2 Objectives

Objectives and targets are established to drive continuous improvement in environmental performance through the adaptive management process and are consistent with the overall strategic goals of the VGM. Objectives are measurable (where possible), monitored, communicated, and updated as appropriate.

The objectives of the AAQFMP are to:

- Implement ambient air quality monitoring program during VGM construction and operation to monitor ambient PM and trace metals concentrations relative to regulatory ambient air quality criteria.
- Implement mitigation measures to reduce air contaminant emissions from the Project activities to the extent feasible.
- Use the ambient air quality monitoring results for PM and trace metals to implement adaptive management for fugitive dust emissions.
- Implement an environmental light monitoring program during VGM construction and operation to monitor obtrusive artificial lighting at night.
- Implement a dustfall monitoring program during VGM operations to monitor for deposition over time on nearby lands.

1.3 REGULATORY SETTING

1.3.1 Federal Regulatory Requirements

The *Canadian Environmental Protection Act, 1999* (CEPA) sets ambient air quality standards as environmental quality objectives specifying goals or purposes for pollution prevention or environmental control that have the ultimate goals of improving air quality, protecting the environment and producing healthier communities.

The Canadian Ambient Air Quality Standards (CAAQS; CCME 2025) were established under CEPA through a collaborative process involving the federal, provincial and territorial governments and stakeholders under the direction of the Canadian Council of Ministers of the Environment (CCME). The CAAQS were developed as part of the Air Quality Management System (CCME 2012a) with the objective of driving continuous improvement of air quality in Canada. The CCME describes the process for selecting monitoring stations, measuring pollutant concentrations, and determining achievement of the CAAQS (CCME 2019a; CCME 2012b). The achievement of the CAAQS is based upon the measured air quality concentrations at community monitoring stations with comparison to the CAAQS and assigning air quality status to one of four management levels (CCME 2025; CCME 2012b). The four air quality management levels (Table 1.1) require progressively more rigorous actions by jurisdictions as air quality approaches or exceeds the CAAQS, thereby allowing proactive management actions to be undertaken to reduce emissions and avoid exceedances of the CAAQS (CCME 2019a).

Table 1.1 Canadian Ambient Air Quality Standards Air Quality Management Levels

Air Quality Management Levels	8-hour Ozone (µg/m^3)		24-hour $PM_{2.5}$ [a] (µg/m^3)		Annual $PM_{2.5}$ [b] (µg/m^3)		1-hour Sulphur Dioxide [c] (µg/m^3)		Annual Sulphur Dioxide [d] (µg/m^3)		1-hour Nitrogen Dioxide [e] (µg/m^3)		Annual Nitrogen Dioxide [f] (µg/m^3)	
	2020	2025	2020	2030	2020	2030	2020	2025	2020	2025	2020	2025	2020	2025
Red	>122	>118	>27	>23	>8.8	>8.0	>183	>170	>13	>10	>113	>79	>32	>23
Orange	>110 and ≤122	>110 and ≤118	>19 and ≤27	>16 and ≤23	>6.4 and ≤8.8	>6.0 and ≤8.0	>131 and ≤183	>131 and ≤170	>8 and ≤13	>8 and ≤10	>58 and ≤113	>58 and ≤79	>13 and ≤32	>13 and ≤23
Yellow	>98 and ≤110		>10 and ≤19	>10 and ≤16	>4.0 and ≤6.4	>4.0 and ≤6.0	>79 and ≤131		>5 and ≤8		>38 and ≤58		>4 and ≤13	
Green	≤98		≤10		≤4.0		≤79		≤5		≤38		≤4	

Notes:
[a] Achievement based on the 3-year average of the annual 98th percentile of $PM_{2.5}$ daily 24-hour average concentrations
[b] Achievement based on the 3-year average of the annual average of the $PM_{2.5}$ daily 24-hour average concentrations
[c] Achievement based on the 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations
[d] Achievement based on the average over a single calendar year of all 1-hour average SO_2 concentrations
[e] Achievement based on the 3-year average of the annual 98th percentile of the NO_2 daily maximum 1-hour average concentrations
[f] Achievement based on the average over a single calendar year of all 1-hour average NO_2 concentrations
Source: Canadian Council of Ministers of the Environment (CCME) website: https://ccme.ca/en/air-quality-report

The CAAQS are based on three interrelated elements: an averaging time, a numerical value for each averaging time and a statistical note on the metric. This statistical note sets the method of calculation to determine how the ambient air contaminant concentrations are to be compared to the numerical value of the CAAQS, to determine whether the measured values have achieved or met the standard. The CAAQS and the year when each ambient standard comes into effect are presented in Table 1.1.

The CEPA also stipulates those owners or operators of facilities that meet published reporting requirements must report to the Environment and Climate Change Canada (ECCC) National Pollutant Release Inventory (NPRI) system. The NPRI reporting requirements apply to more than 300 substances. The need to report depends on the amount that was released (to air, water and land), disposed or recycled at the facility during each calendar year. The values must be reported if the release is greater than a specified threshold described in the NPRI documents. Reports are required to be submitted to the NPRI system for each calendar year by June 1 of the following year.

1.3.2 Provincial Regulatory Requirements

1.3.2.1 Regulations

Air quality in NL is regulated by the *Air Pollution Control Regulation (2022)* under the NL *Environmental Protection Act (*NL EPA). This Regulation and Act provide measures to regulate the release of air contaminants to the atmosphere from “sources”, provide testing and monitoring provisions, and establish maximum permissible ground-level concentrations of specified air contaminants in ambient air, among other requirements. The NL Ambient Air Quality Standards (NLAAQS) apply to ambient air and were initially established under the NL EPA in 2004 and updated in 2022. The NLAAQS (Government of NL 2022) applicable to the Project are presented in Table 1.2.

Table 1.2 Summary of NL Ambient Air Quality Standards (NLAAQS)

Air Contaminant	Average Period	Newfoundland and Labrador Ambient Air Quality Standard ($\mu g/m^3$)
Total Suspended Particulate Matter (TSP)	24-hour	120
	Annual	60
Respirable Particulate Matter (PM_{10})	24-hour	50
Fine Particulate Matter ($PM_{2.5}$)	24-hour	25
	Annual	8.8
Nitrogen Dioxide (NO_2)	1-hour	400
	24-hour	200
	Annual	100

Table 1.2 Summary of NL Ambient Air Quality Standards (NLAAQS)

Air Contaminant	Average Period	Newfoundland and Labrador Ambient Air Quality Standard ($\mu g/m^3$)
Sulphur Dioxide (SO_2)	1-hour	900
	3-hour	600
	24-hour	300
	Annual	60
Carbon Monoxide (CO)	1-hour	35,000
	8-hour	15,000
Ammonia (NH_3)	24-hour	100
Arsenic (As)	24-hour	0.3
Cadmium (Cd)	24-hour	2
Copper (Cu)	24-hour	50
Lead (Pb)	24-hour	2
	30-day	0.7
Mercury (Hg)	24-hour	2
Nickel (Ni)	24-hour	2
Zinc (Zn)	24-hour	120

1.3.2.2 Guidelines

The NLDECCC has published a number of guidance documents and policies to support proponents operating in NL to meet the regulatory requirements with respect to monitoring ambient air quality. In particular, Guidance Document GD-PPD-009.4, “Determination of Compliance with Ambient Air Quality Standards” (Government of NL 2012a) (the Compliance Guideline) defines the procedures that NLDECCC will follow when determining whether a facility is in compliance with the NL *Air Pollution Control Regulations*. This Guideline outlines conditions under which a facility shall complete air dispersion modelling, ambient air quality monitoring and/or stack emissions testing. The following documents provide the details under which dispersion modelling, ambient air quality and stack emissions testing should be conducted:

- Guidance Document, GD-PPD-019.2, “Guidance for Plume Dispersion Modelling” (Government of NL 2012b)
- Guidance Document, GD-PPD-065, “Ambient Air Monitoring Guidelines” (Government of NL 2010)
- Guidance Document, GD-PPD-016.2, “Procedure Guide for Source Emission Testing” (Government of NL 2023)

The Compliance Guideline defines five different emission source types and associated requirements with respect to demonstrating compliance with the NL *Air Pollution Control Regulation.* Based on the emissions estimated during Project operation (as presented in Chapter 6 of the Berry-Pit Expansion Project EIS (Marathon 2023) and Section 4 below), the Project would be considered a Type 1 Emissions Source, and would be subject to the following requirements:

- For a new facility:
  - Register a stack emission test and a dispersion model within the first 6 months of operation and register a second stack emission test and dispersion model within the last 6 months of the first 2 years of operation. After the first 2 years of operation, a new facility becomes an existing facility
- For an existing facility (i.e., following the first two years of operation):
  - Register a stack emission test and dispersion model once every 4 years if it has been shown, through a registered dispersion model, that the facility is compliant with the AAQS for all pollutants.
  - If a registered dispersion model indicates non-compliance with the AAQS for any pollutant, then the facility will normally complete and register a stack emission test and dispersion model, once every 2 years.
  - Under special circumstances, the Department reserves the right to require an existing facility to register a stack emission test, and a dispersion model at more frequent intervals.

The results of the air dispersion modelling (i.e., predicted ground level concentrations) are to be compared to the NLAAQS to determine compliance with the *Air Pollution Control Regulation*. If a facility is determined to be non-compliant (i.e., the dispersion model predicts exceedances of the NLAAQS), it would enter into a compliance agreement with NLDECCC, which may consist of establishing a compliance ambient air quality monitoring network. In addition to a compliance ambient air quality monitoring network, a facility may be required to establish a community ambient air quality monitoring network as part of a Certificate of Approval to operate.

1.3.2.3 Certificate of Approval

Equinox's Valentine Gold Mine was issued a Certificate of Approval (COA) (Approval No. AA25-055710) by the NLDECCC on May 20, 2025, pursuant to the *Environmental Protection Act*. The COA includes specific requirements related to the management of ambient air quality, as summarized in **Error! R eference source not found.**.

Table 1.3 VGM Certificate of Approval – Air Quality Related Conditions

Section	Condition(s)	Summary of Requirement(s)
General	6	All reasonable efforts shall be taken to minimize the impact of the operation on the environment, including minimizing air pollution.
Burning Prohibition	23 and 24	Limitations on materials that can be burned in a fire, and requirements to notify the Department prior to burning.
Dust Suppression	26	Control of dusting during construction and operations. Departmental approval required for suppressants other than water or calcium chloride.

Table 1.3 VGM Certificate of Approval – Air Quality Related Conditions

Section	Condition(s)	Summary of Requirement(s)
Ambient Air	63, 64, 65, 66, 68	An ambient air monitoring program should be operated at an approved location on-site. The ambient air monitoring should include continuous monitoring of TPM and $PM_{2.5}$ and be conducted in accordance with the Guidance Document, GD-PPD-065, "Ambient Air Monitoring Guidelines" (Government of NL 2010). Calibrations, site visits, and maintenance information shall be recorded in the DR DAS logbook.
Ambient Air	67	A meteorological station must be operated, calibrated and maintained on-site in accordance with US EPA guidelines. Parameters to monitor include wind speed, wind direction, air temperature, relative humidity, barometric pressure, and precipitation.
Pollution Control Equipment	69	Pollution control equipment shall be maintained and operated as per manufacturer specifications.
Reporting	76 and 77	Monthly reporting of compliance monitoring required in the Approval, which includes the continuous air quality monitor, must be submitted to the Department within 30-days of the reporting month.

A copy of the VGM COA has been provided in Appendix A.

1.3.3 International Guidelines (Lighting)

Artificial light is not a traditional air contaminant; however, it contributes to the atmospheric environment and is considered in this monitoring plan to provide context for potential effects associated with VGM lighting.

Most lighting guidelines and regulations have been directed toward the provision of suitable lighting for the safe and efficient activities of humans. For example, street lighting, indoor lighting and lighting around industrial plants are subjects of various guidelines to facilitate a safe work environment. Currently there are no legally binding requirements (e.g., regulations, orders) in the Province of Newfoundland and Labrador (NL) to regulate obtrusive light from industrial facilities for humans or wildlife.

Various international organizations, including DarkSky and the Commission Internationale de L'Éclairage (CIE), also known as the International Commission on Illumination, have developed guidelines and recommendations to limit light pollution and associated effects to humans. The Illuminating Engineering Society of North America (IESNA) has adopted these guidelines and provides recommendations for use in designing new outdoor lighting systems.

The CIE has established guidelines for light trespass and glare for various levels of urbanization. The guideline light levels are based on environmental zones and time of day (CIE 2017). The five zones are listed in Table 1.4. The maximum values recommended by the CIE for light trespass by environmental lighting zones and time of day are presented in Table 1.5. Based on the baseline light surveys conducted as part of the VGM Project Environmental Impact Statement, the existing environmental lighting zone is classified as E1 –Dark.

Table 1.4 Environmental Lighting Zones

Zone	Lighting Environment	Examples
E0	Intrinsically Dark	Dark Sky Parks and Astronomical Observatories
E1	Dark	Relatively Uninhabited rural areas
E2	Low district brightness	Sparsely inhabited rural areas
E3	Medium district brightness	Well inhabited rural and urban settlements
E4	High district brightness	Town and city centers and other commercial areas
Source: CIE 2017		

Table 1.5 Recommended Maximum Values of Light Trespass (Illumination) per Environmental Zones

Time of Day	Environmental Zones				
	E0	E1	E2	E3	E4
19:00 – 23:00	n/a	2 lux	5 lux	10 lux	25 lux
23:00 – 6:00	n/a	< 0.1 lux	1 lux	2 lux	5 lux
Source: CIE 2017					

Reference levels for sky glow are shown in Table 1.6 below (Berry 1976). The units for sky glow are arranged such that higher values correspond to a darker sky and an ability to observe more astronomical objects, while lower values refer to a sky with more sky glow that obscures astronomical objects. The unit of measure for sky glow is often made in magnitudes per square arcsecond (mag/arcsec^2). A sky glow measurement representative of a clear sky in a rural environment where stars are abundant would be approximately 21 to 22 mag/arcsec^2 and within a city or urban area where stars are minimally visible would be approximately 18 to 19 mag/arcsec^2 (Berry 1976).

Table 1.6 Reference Levels of Sky Glow

Sky Glow (mag/arcsec^2)	Corresponding Appearance of the Sky
21.7 (Rural)	The sky is covered with stars that appear large and close. In the absence of haze, the Milky Way can be seen to the horizon. The clouds appear as black silhouettes against the sky.
21.6	Sky appearance similar to that defined for rural (above) but with a glow in the direction of one or more cities is seen on the horizon. Clouds are bright near the city glow.
21.1	The Milky Way is brilliant overhead but cannot be seen near the horizon. Clouds have a greyish glow at the zenith and appear bright in the direction of one or more prominent city glows.
20.4	The contrast to the Milky Way is reduced and detail is lost. Clouds are bright against the zenith sky. Stars no longer appear large and near.
19.5	Milky Way is marginally visible, only near the zenith. Sky is bright and discoloured near the horizon in the direction of cities. The sky looks dull grey.
18.5 (Urban)	Stars are weak and washed out and reduced to a few hundred. The sky is bright and discoloured everywhere.
Source: Berry 1976	

1.3.4 Alternative Jurisdictions (Dustfall)

Newfoundland and Labrador does not have provincial criteria for dustfall. In absence of Newfoundland and Labrador specific criteria, the Ontario guideline value of 7 g/m² per 30 days will be used for comparison to dustfall sampling results. This benchmark is widely used in Canadian jurisdictions where site-specific limits are not defined and is considered appropriate for evaluating potential nuisance and deposition-related effects.

There are also no existing provincial criteria in Newfoundland and Labrador, or other Canadian jurisdictions for deposition of metals (monitored via metals in dustfall). Monitoring for metal deposition can be trended over time to track environmental loading trends, and potential impacts to country foods.

While there are no existing regulatory requirements for monitoring of dustfall, the Wildlife Division of the Department of Forestry Agriculture and Lands (NLDFAL) has requested that it be monitored as a parameter that may influence the health of caribou in the Project area. In addition, the results from the dustfall monitoring will be incorporated into the Country Foods Report.

2.0 ENVIRONMENTAL SETTING

2.1 BASELINE CONDITIONS

2.1.1 Meteorology

Existing meteorology and climate in the Project Area are characterized using climate normals and wind data from representative meteorological stations located nearest to the VGM, and with sufficient data availability. Climate normals for the 30-year period from 1981 to 2010 and wind data from 2015 to 2019 were obtained and used in this assessment. The climate normals information was obtained from ECCC (ECCC 2019a) and the wind information was obtained from the United States based National Climatic Data Center (NCDC) (NCDC 2020).

Climate normals and hourly wind data for the 30-year period of 1981-2010 were obtained from the nearest meteorological stations to the mine site. These included: Buchans and Deer Lake (ECCC, 2019a, NCDC 2020). The thirty-year climate normals (1981-2010) were obtained from the Buchans station, which is located approximately 55 km north-northeast of the mine site. Hourly wind data covering the 2015 to 2019 period were obtained from the Deer Lake station, which is located approximately 95 km north of the site. Wind data were obtained from the Deer Lake station, as wind data are not available from the Buchans station, and Deer Lake is the nearest station to the mine site with wind data available.

The 1981 to 2010 climate normals for the Buchans station are shown in Table 2.1.

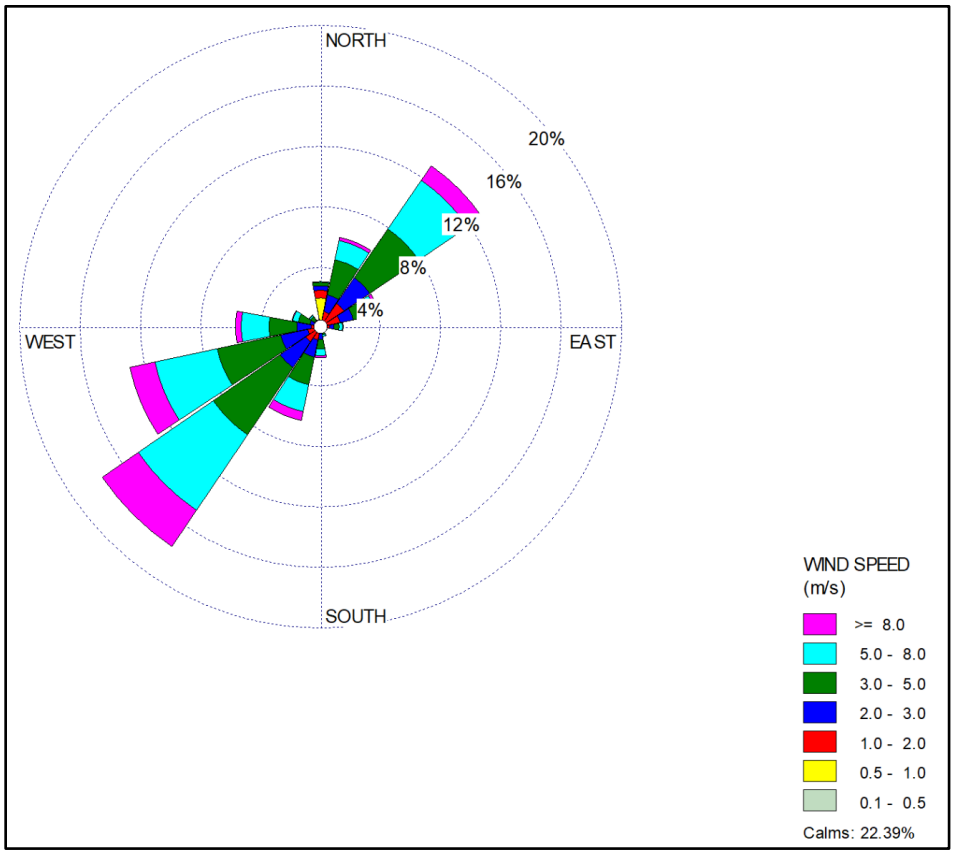
Table 2.1 Climate Normals, Buchans, Newfoundland and Labrador (1981 – 2010)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature													
Daily Mean (°C)	-8.2	-8.4	-4.8	1	7	12.1	16.3	16.2	11.9	6	0.5	-4.5	3.8
Daily Maximum (°C)	-4.6	-4.4	-0.9	4.6	11.5	17	21.1	20.9	15.8	9.1	3.1	-1.5	7.6
Daily Minimum (°C)	-11.8	-12.3	-8.7	-2.5	2.5	7.1	11.4	11.6	7.9	2.8	-2.1	-7.5	-0.1
Extreme Daily Maximum (°C)	13.5	10	17	20.6	27.5	32	33	32	30	22.5	15.6	12.8	--
Date of Occurrence (yyyy/dd)	2006/15	1976/02	1999/29	1979/29	1999/08	1999/14	1983/05	1995/11	2001/10	1994/09	1977/10	1969/04	--
Extreme Daily Minimum (°C)	-30	-33.5	-30.5	-22.5	-10	-3.3	1	1.1	-2.2	-8.3	-19	-26	--
Date of Occurrence (yyyy/dd)	2004/25	1993/07	1990/08	1995/06	1972/02	1974/01	1995/02	1976/19	1972/29	1972/22	1992/24	1993/29	--
Precipitation													
Rainfall (mm)	33.7	25.6	39.5	59.5	82.2	87.7	95.3	123	110.3	92.5	81.5	46.3	877
Snowfall (cm)	88.3	72.5	55.5	26.2	4.4	0.1	0	0	0.1	5	30.4	76.9	359.3
Precipitation (mm)	122	98.1	95	85.7	86.6	87.8	95.3	123	110.4	97.5	111.8	123.1	1,236.2
Extreme Daily Rainfall (mm)	58.4	47	52.4	54	63.6	72.8	74.6	139	69	66.8	68.6	66.3	--
Date of occurrence (yyyy/dd)	1983/13	1971/14	1983/22	1994/07	1993/15	1985/06	1996/14	1983/07	1998/05	1966/05	1995/26	1975/22	--
Extreme Daily Snowfall (cm)	40	38.1	70	20	17.8	10.2	0	0	3.8	28.4	25	30	--
Date of occurrence (yyyy/dd)	1984/11	1973/11	2005/30	1992/06	1972/11	1976/12	1965/01	1965/01	1971/28	1969/22	1994/28	2000/27	--
Extreme Daily Precipitation (mm)	58.4	47	70	54	63.6	72.8	74.6	139	69	66.8	68.6	73.4	--
Date of occurrence (yyyy/dd)	1983/13	1971/14	2005/30	1994/07	1993/15	1985/06	1996/14	1983/07	1998/05	1966/05	1995/26	1975/22	--
Source: ECCC 2019a													

Daily average temperatures at Buchans range between -8.4°C to 16.3°C, with the lowest average temperatures occurring in February and the highest occurring in July. Extreme daily maximum and minimum temperatures range between -33.5°C (February) to 33°C (July).

Total annual average precipitation at Buchans is 1,236 mm, with 359 cm of snow and 877 mm of rain. Monthly average precipitation ranges between 86 to 123 mm, with the least occurring in April and the most occurring in December.

A wind rose plot of the annual winds at Deer Lake from 2015 to 2019 is shown in Figure 2-1. Seasonal wind rose plots are also shown in Figure 2-2. Winds prevail from the southwest and northeasterly directions. The highest wind speeds occur most frequently from the southwest direction and the lowest wind speeds occur most frequently from the north and northeast directions. Calm periods are also common, with wind speeds less than 0.5 metres per second (m/s), accounting for more than 22% of the observed winds at Deer Lake over the 2015 to 2019 period. Generally, the seasonal winds are consistent, with winds prevailing from the southwest and northeast (i.e., there is limited seasonal variation in the winds at Deer Lake).



Data source: NCDC 2020

Figure 2-1 Winds at Deer Lake, Newfoundland and Labrador (2015 – 2019)

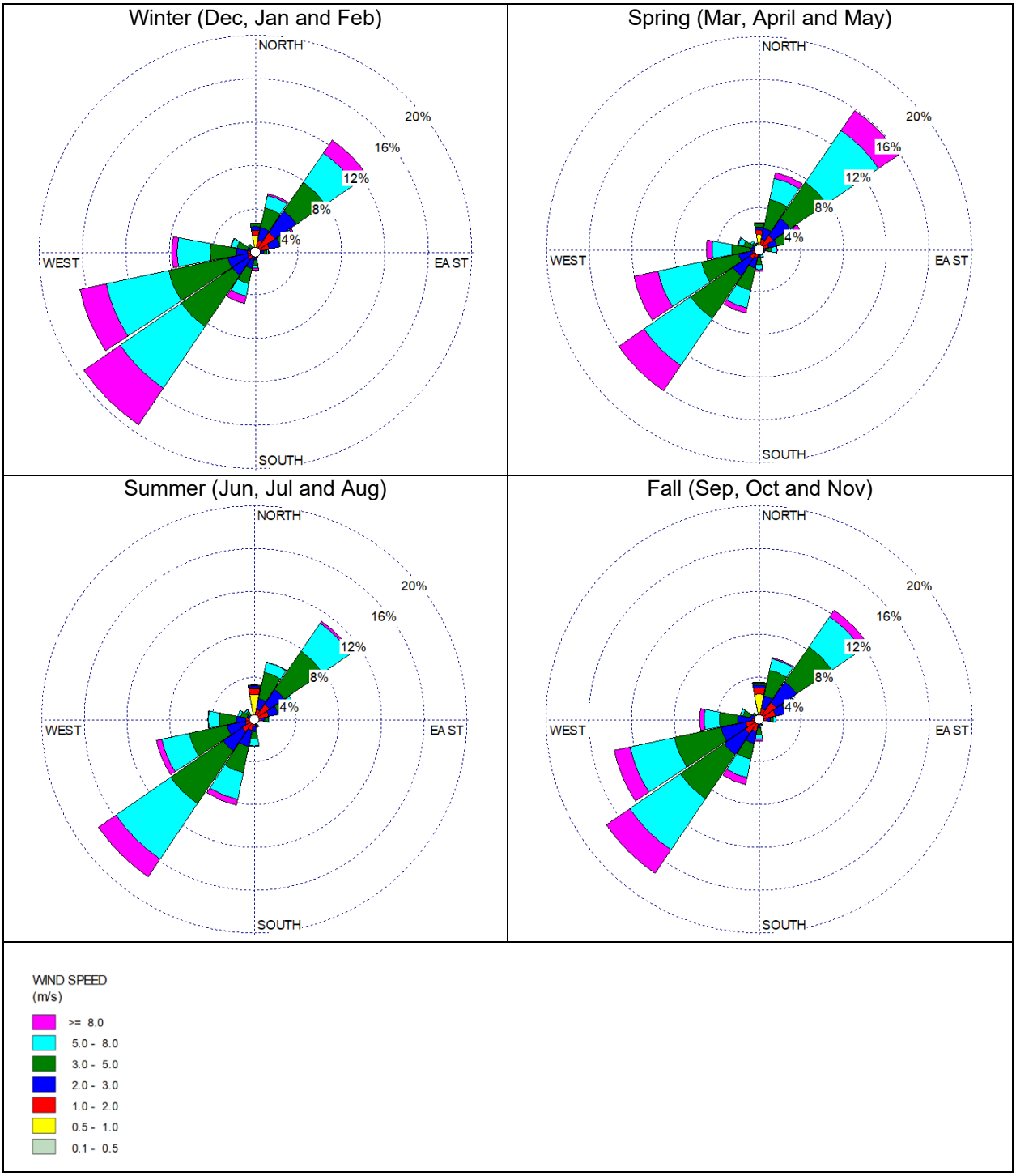


Figure 2-2 Seasonal Winds at Deer Lake, Newfoundland and Labrador (2015 – 2019)

2.1.2 Ambient Air Quality

Given the largely undeveloped nature of the Project Area, there are few sources of air contaminants from human activities in the area, and further, there are no large industrial emissions sources within the Project Area. Based on a review of NPRI data (ECCC 2026) for the Island of Newfoundland, the nearest sources of air contaminants to the mine site (but outside of the Project Area) consist of two mine sites which are no longer operational, and the Corner Brook Pulp and Paper Mill. The two mine sites are the Teck Resources Duck Pond Mine and Barite Mud Services which are located approximately 57 km and 41 km northeast of the mine site, respectively. The Duck Pond Mine is no longer operational and is in the closure and rehabilitation phase, while Barite Mud Services is operational on a seasonal basis. Although neither mine site remains fully operational, potential exists for fugitive dust to be generated at each site. In addition, decommissioning activities are on-going at the Duck Pond Mine, which could result in further fugitive dust emissions. The Corner Brook Pulp and Paper Mill is located approximately 90 km to the northwest of the mine site. Based on NPRI reporting data, substantive air contaminant emissions from the pulp and paper mill consist of combustion gases (nitrogen oxides [NO_X], carbon monoxide [CO], and SO_2), particulate matter (PM), volatile organic compounds (VOCs) and selected trace metals.

Given that the nearest sources of air contaminant emissions are outside of the Project Area and distant from the mine site, it is unlikely that these air contaminant releases would contribute in a substantive way to a negative change in air quality within the Project Area of the VGM.

Existing air quality in the Project Area was characterized by obtaining and assessing measured ambient air quality data, as well as data for releases of air contaminants from existing sources within the Local Assessment Area (LAA). A baseline ambient air quality monitoring survey was conducted near the proposed mine site in June 2020. The survey consisted of measuring ambient concentrations of total suspended particulate matter (TSP), particulate matter less than 10 microns in diameter (PM_{10}), trace metals, sulphur dioxide (SO_2) and nitrogen dioxide (NO_2). The monitoring event was conducted from June 15-19, 2020.

In addition to the data collected within the Project Area, the most recently available ambient air quality data (2016 to 2017) from the National Air Pollutant Surveillance (NAPS) Program (ECCC 2019b) and the provincial air quality report for 2020 were obtained (Newfoundland and Labrador Department of Municipalities and Environment (NLDMAE) 2021).

The nearest and most representative NAPS ambient air quality monitoring (AAQM) station to the mine site is at Grand Falls-Windsor, approximately 120 km northeast of the mine site. There is also a NAPS station located at Corner Brook, which is closer to the mine site; however, this station is immediately adjacent to the Corner Brook Pulp and Paper Mill. Therefore, air contaminant concentrations measured at the Corner Brook station are likely to be less representative of existing ambient concentrations in the area of the VGM than those measured at the Grand Falls-Windsor station, as there are no large emissions sources in close proximity the Grand Falls-Windsor station.

Concentrations of the following air contaminants are measured at the Grand Falls-Windsor station:

- Particulate matter ≤ 2.5 microns ($PM_{2.5}$)
- Ozone (O_3)
- Nitric oxide (NO)
- NO_2
- NO_X
- CO
- SO_2

An overview of the 2016-2017 NAPS monitoring results for the Grand Falls-Windsor station, for those air contaminants relevant to the VGM, are presented in Table 2.2.

Table 2.2 Ambient Air Quality Data as Measured at the Grand-Falls Windsor NAPS Monitoring Location (2016 – 2017)

Value	Measured Concentrations (ug/m^3)			
	SO_2	NO_2	$PM_{2.5}$	CO
Max Hourly	15.7	73.4	76.0	916
98th Percentile	2.62	11.3	16.0	286
90th Percentile	2.62	3.76	9.00	206
3-hour 90th percentile	2.62	-	-	-
8-hour 90th percentile	-	-	-	200
Max Daily	2.95	12.7	16.1	373
Max Daily (excl hourly values >90th percentile)	0	1.88	8.00	195
Daily 98th Percentile*	-	-	10.3	-
Daily Average	-	-	-	-
Max Annual Average	0.78	2.56	4.66	155
Annual Average (excl hourly values >90th percentile)	0.78	1.40	3.84	144

Notes:
* Average of 2016 and 2017 annual 24-hour 98th percentiles, for comparison with CAAQS for $PM_{2.5}$
NL AAQS for 24-hour time averaging period: SO_2 - 300 ug/m^3, NO_2 - 200 ug/m^3, $PM_{2.5}$ - 25 ug/m^3
NL AAQS for 8-hour time averaging period: CO – 15,000 ug/m^3
NL AAQS for the annual time averaging period: SO_2 - 60 ug/m^3, NO_2 - 100 ug/m^3, $PM_{2.5}$ – 8.8 ug/m^3
Source: ECCC 2019b

As presented in Table 2.2, the ambient air quality monitoring data collected at the NAPS monitoring location in Grand Falls-Windsor in 2016-2017, for those air contaminants of interest to the VGM, were below the applicable AAQS in NL.

In addition to the NAPS data presented above, according to the NL 2020 Ambient Air Quality Report (NLDMAE 2021), there were no measured concentrations that exceeded the provincial NL AAQS (for SO_2, NO_2 or CO) or the federal CAAQS (for $PM_{2.5}$ – 27 ug/m^3) in 2020 at the Grand Falls-Windsor NAPS station (NLDMAE 2021).

The results of the ambient air quality monitoring conducted within the Project Area in June 2020 for TSP, PM_{10} and speciated metals are presented in Table 2.3.

Table 2.3 Ambient Air Quality Monitoring Survey Results for TSP, PM_{10} and Metals within the Project Area, June 2020

Parameter	NL AAQS (µg/m^3)	Monitoring Results (24-hour Concentrations (µg/m^3)		
		June 15-16, 2020	June 16-17, 2020	June 17-18, 2020
Total Suspended Particulate Matter (TSP)	120	5.1	8.6	13.8
Particulate Matter less than 10 Microns (PM_{10})	50	5.1	7.5	13
Trace Metals				
Total Aluminum (Al)	-	<0.084	0.087	0.17
Total Antimony (Sb)	-	<0.0021	<0.0021	<0.0021
Total Arsenic (As)	0.3	<0.0021	<0.0021	<0.0021
Total Barium (Ba)	-	<0.0021	<0.0021	<0.0021
Total Beryllium (Be)	-	<0.0013	<0.0012	<0.0012
Total Bismuth (Bi)	-	<0.0021	<0.0021	<0.0021
Total Boron (B)	-	<0.042	<0.042	<0.042
Total Cadmium (Cd)	-	<0.00042	<0.00042	<0.00042
Total Calcium (Ca)	2.0	<0.21	0.21	0.24
Total Chromium (Cr)	-	<0.0021	<0.0021	<0.0021
Total Cobalt (Co)	-	<0.0013	<0.0012	<0.0012
Total Copper (Cu)	50	<0.0013	<0.0012	<0.0012
Total Iron (Fe)	-	<0.21	<0.21	<0.21
Total Lead (Pb)	2.0	<0.0013	<0.0012	<0.0012
Total Magnesium (Mg)	-	<0.042	0.050	0.11
Total Manganese (Mn)	-	0.0031	0.0032	0.0070
Total Molybdenum (Mo)	-	<0.0013	<0.0012	<0.0012
Total Nickel (Ni)	2.0	<0.0021	<0.0021	<0.0021
Total Potassium (K)	-	<0.21	<0.21	<0.21
Total Selenium (Se)	-	<0.0042	<0.0042	<0.0042
Total Silver (Ag)	-	<0.00042	<0.00042	<0.00042
Total Sodium (Na)	-	<0.21	<0.21	0.44
Total Strontium (Sr)	-	<0.0021	<0.0021	<0.0021

Table 2.3 Ambient Air Quality Monitoring Survey Results for TSP, PM_{10} and Metals within the Project Area, June 2020

Parameter	NL AAQS ($\mu g/m^3$)	Monitoring Results (24-hour Concentrations ($\mu g/m^3$)		
		June 15-16, 2020	June 16-17, 2020	June 17-18, 2020
Total Thallium (Tl)	-	<0.00042	<0.00042	<0.00042
Total Tin (Sn)	-	<0.0013	<0.0012	<0.0012
Total Titanium (Ti)	-	<0.0042	<0.0042	0.0043
Total Uranium (U)	-	<0.00042	<0.00042	<0.00042
Total Vanadium (V)	2.0	<0.0013	<0.0012	<0.0012
Total Zinc (Zn)	120	<0.021	<0.021	<0.021

Notes:
"<" indicates analysis below the reportable detection limit
"-"indicates no applicable criteria in the province of NL

The 24-hour measured concentrations of TSP, PM_{10} and trace metals were well below applicable ambient air quality criteria in NL. Measured concentrations of particulate matter (TSP and PM_{10}) ranged from 5.1 $\mu g/m^3$ to 13.8 $\mu g/m^3$ and the concentrations of TSP and PM_{10} were consistent, suggesting that the existing particulate matter within the Project Area is made up mostly of PM_{10}. Metals detected in the samples include aluminum, calcium, magnesium, manganese, sodium and titanium; the measured concentrations were below the regulatory standards where they exist. The remaining metals that were sampled were not detected above the analytical method reportable detection limits.

The results of the ambient air quality monitoring conducted within the Project Area in June 2020 for NO_2 and SO_2 are presented in Table 2.4.

Table 2.4 Ambient Air Quality Monitoring Survey Results for SO_2 and NO_2 within the Project Area, June 2020

Parameter	Monitoring Results, Concentration over Monitoring Period, June 15 – 19, 2020 ($\mu g/m^3$)	Monitoring Results, Converted to an estimated 24-hour Concentration* ($\mu g/m^3$)	NL AAQS ($\mu g/m^3$)
Sulphur Dioxide (SO_2)	2.62	3.84	300
Nitrogen Dioxide (NO_2)	<0.188	0.276	200

Note:
*Measured concentrations were converted to an estimated 24-hour concentration using guidance published in the "Air Dispersion Modelling Guideline for Ontario" (OMECC 2017)

The measured concentrations of SO_2 and NO_2 were below applicable ambient air quality criteria in NL and were consistent with data measured through NAPS at the Grand Falls-Windsor monitoring station.

2.1.3 Lighting

Figure 2-3 shows the distribution of artificial light surrounding the Project Area (Interactive world light pollution map based on the NOAA / EOG overlay 2015, World Atlas 2015), prior to activities on-site. As can be seen in Figure 2-3 there were essentially no existing sources of artificial light contributing to the existing ambient light environment within the Project Area. The sky glow levels within these areas were 22.0 mag/arc sec^2. Sky glow levels in this range are representative of an unpolluted starry sky, where, on clear nights with no haze, many thousands of stars would be visible and the Milky Way would be clearly visible (Berry 1976; United States Department of Energy (U.S. DOE) 2017).

A baseline ambient light monitoring survey was conducted at one location near the center of the mine site on June 16, 2020. Ambient light monitoring included measurements of illuminance (lux) and sky glow (mag/arc sec^2). The results of the ambient light monitoring field survey for sky glow were similar to the values presented on the 2020 satellite imaginary and ranged from 21.84 to 22.81 mag/arc sec^2. Field measurements of incident light were less than 0.01 lux.

Based on the ambient light levels (both sky glow and light trespass), the Project Area and surrounding environment prior to the mine could be considered a dark, rural area (environmental zone, Category E1) according to the International Commission on Illumination (CIE 2017).

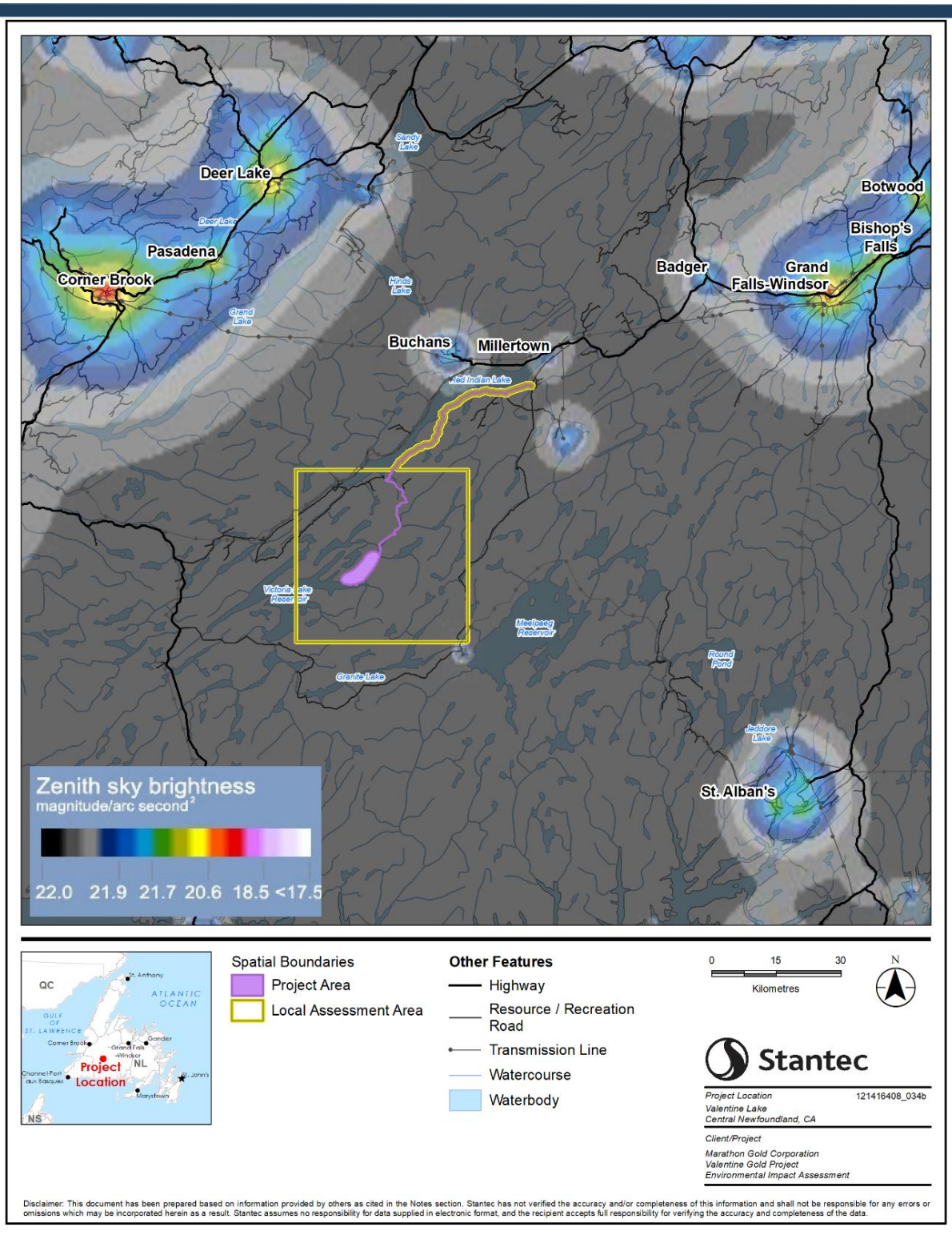


Figure 2-3 Distribution of Artificial Light Within and Surrounding the VGM Prior to Activities (2020)

2.1.4 Dustfall

Baseline dustfall data are not available for the VGM and surrounding area, as there are no existing local or regional dustfall monitoring stations and dustfall is not routinely monitored by provincial or federal ambient air quality networks in the region. Baseline dustfall monitoring was not conducted prior to VGM construction.

The mine is located in a rural area, with limited existing development and industrial activity prior to VGM development. As such, baseline dustfall conditions would have been expected to be low. The landscape was predominantly natural, with vegetation cover limiting the extent of exposed soils under undisturbed conditions. Accordingly, potential dust generation under baseline conditions is anticipated to have been low.

2.2 PROJECT EMISSIONS

During construction, activities result in releases of air contaminants from fuel combustion in heavy equipment and fugitive dust due to earth moving and site preparation activities. During operation, air contaminants are released from mining activities, from fuel combustion in heavy equipment, fugitives from ore handling, and from processing plant sources. The release estimates were prepared and summarized in an emissions inventory for both construction and operation. The inventories were prepared using operational and design information provided by Equinox and published emission factors. Additional details on air contaminant release estimates for construction and operation are provided below. They were initially provided in Chapter 5 of the EIS (Marathon 2020), were refined in response to Information Requirements (IRs) and updated to include the project Berry Pit Expansion, in Chapter 6 of the Berry Pit Expansion EIS (Marathon 2023). During the decommissioning, rehabilitation and closure phase of the Project, air contaminant releases will be similar to, or less than, those during construction and operation.

An air quality transport and dispersion model provides the link between the air contaminant releases and changes to ambient concentrations. For the air quality assessment, the CALMET, a diagnostic meteorological model which reconstructs the 3 dimensional wind and temperature fields starting from existing data (meteorological, orography and land use) was used. The air dispersion quality model, California Puff (CALPUFF) (Scire et al. 2000) was used to determine the potential effects of the air contaminant releases during operation of the VGM on ambient air quality. The potential air contaminant releases during construction were estimated for the EA, and were not modelled, since these releases are expected to be short-term and lower in magnitude than during operation.

An overview of the air contaminant release estimates and results of the dispersion modelling are presented in the following subsections and include the Berry Pit Expansion. Specific details can be found in Chapter 6 of the Berry Pit Expansion EIS (Marathon 2023).

2.2.1 Air Contaminant Releases

2.2.1.1 Construction

During construction, air contaminant releases are expected from the following activities:

- Air contaminants generated from the combustion of fossil fuels (e.g., diesel and gasoline) in equipment and vehicles
- Particulate matter (dust) generated by land clearing, earth moving activities, material handling, and blasting
- Particulate matter (dust) generated by equipment movements, and vehicles on unpaved roads

The quantities of air contaminants that may be released during construction were estimated. Releases were estimated for blasting activities, fugitives from wind erosion of stockpile surfaces, material transfer (loading and unloading) at stockpiles, fugitives from travel on haul roads, and from fuel combustion in mobile heavy equipment. The air contaminant release estimates from construction activities are provided in Table 2.5.

Table 2.5 Air Contaminant Releases – Construction

Air Contaminant	CAS #	Emission Rate (tonnes/year)					
		Blasting	Stockpile Fugitives	Transfer Points at Stockpiles	Haul Route Fugitives	Mobile Combustion Sources - Heavy Equipment	Total
TSP	N/A-1	0.98	30.0	21.9	434	1.32	
PM_{10}	N/A-2	0.51	15.0	10.4	136	1.32	163
$PM_{2.5}$	N/A-3	0.15	6.00	1.57	17.2	1.32	26.2
NO_X	10102-44-0	17.4	-	-	-	112	129
SO_2	7446-09-5	2.17	-	-	-	37.9	40.1
CO	630-08-0	73.8	-	-	-	123	196
As	7440-38-2	9.81E-06	3.00E-04	6.08E-05	-	-	3.71E-04
Cd	7440-43-9	8.83E-07	2.70E-05	5.47E-06	-	-	3.34E-05
Cu	7440-50-8	9.81E-05	3.00E-03	6.08E-04	-	-	3.71E-03
Pb	7439-92-1	2.94E-05	8.07E-04	1.56E-04	-	-	9.92E-04
Hg	7439-97-6	2.94E-07	9.00E-06	1.82E-06	-	-	1.11E-05
Ni	7440-02-0	8.34E-06	2.41E-04	4.77E-05	-	-	2.97E-04
Zn	7440-66-6	2.39E-05	6.33E-04	1.20E-04	-	-	7.77E-04
Ba	7440-39-3	2.54E-05	6.44E-04	1.19E-04	-	-	7.89E-04
Sr	7440-24-6	3.50E-05	8.39E-04	1.51E-04	-	-	1.02E-03
Be	7440-41-7	1.08E-07	3.11E-06	6.16E-07	-	-	3.84E-06
Cobalt	7440-48-4	7.36E-06	2.02E-04	3.89E-05	-	-	2.48E-04

Table 2.5 Air Contaminant Releases – Construction

Air Contaminant	CAS #	Emission Rate (tonnes/year)					
		Blasting	Stockpile Fugitives	Transfer Points at Stockpiles	Haul Route Fugitives	Mobile Combustion Sources - Heavy Equipment	Total
Li	7439-93-2	1.96E-05	6.00E-04	1.22E-04	-	-	7.41E-04
Sb	7440-36-0	1.96E-05	6.93E-04	1.48E-04	-	-	8.61E-04
Sn	7440-31-5	3.43E-05	1.10E-03	2.26E-04	-	-	1.36E-03
Se	7782-49-2	2.94E-05	9.00E-04	1.82E-04	-	-	1.11E-03
Cr	7440-47-3	4.78E-05	1.57E-03	3.27E-04	-	-	1.94E-03
Bi	7440-69-9	9.81E-06	3.00E-04	6.08E-05	-	-	3.71E-04

2.2.1.2 Operation

During operation of the VGM, air contaminants may be released to the atmosphere as follows:

- Particulate matter (TSP, PM_{10} and $PM_{2.5}$) and trace metals (within the dust) during ore handling and crushing (material loading / unloading and transfer, ore and material hauling, crushing and screening)
- Fugitive releases of particulate matter (TSP, PM_{10} and $PM_{2.5}$) and trace metals (within the dust) due to wind erosion of ore stockpiles and waste rock pile surfaces; note: fugitive releases are characterized as those not originating from a stack or vent, and are released over an area or from an initial volume
- Fugitive releases of particulate matter (TSP, PM_{10} and $PM_{2.5}$) and trace metals (within the dust) from the TMF due to wind erosion of dry, exposed tailings beach surfaces
- Fugitive releases of NO_X, SO_2, CO, particulate matter (TSP, PM_{10} and $PM_{2.5}$), and trace metals (within the dust) from blasting at the Marathon and Leprechaun pits
- Releases of NO_X, SO_2, CO, and particulate matter (TSP, PM_{10} and $PM_{2.5}$) from internal combustion engines associated with mobile heavy equipment for material loading, unloading and hauling
- Releases of particulate matter (TSP, PM_{10} and $PM_{2.5}$), trace metals (within the dust), NH_3, and HCN from the processing plant sources

A summary of the estimated annual air contaminant releases during operation is provided in Table 2.6.

Table 2.6 Annual Air Contaminant Release Estimates – Operation

Source/Activity	Emissions (tonnes/year)											
	TSP	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	HCN	NH_3	As	Cd	Cu	Pb
Pit Blasting	3.98	3.98	3.98	-	141	17.6	598	-	2.90E-05	2.43E-06	3.00E-04	8.45E-05
Stockpiles	80.5	40.2	16.1	-	-	-	-	-	8.05E-04	7.24E-05	8.05E-03	2.25E-03
TMF	348	174	26.1	-	-	-	-	-	4.39E-03	2.97E-04	6.16E-02	6.32E-03
Conveyors / transfer points	18.2	8.6	1.30	-	-	-	-	-	1.33E-04	1.11E-05	1.37E-03	3.86E-04
Loading / unloading at stockpiles	61.8	29.2	4.43	-	-	-	-	-	4.70E-04	3.98E-05	4.83E-03	1.45E-03
Ore Processing Equipment	99.1	36.8	5.58	-	-	-	-	-	7.23E-04	6.06E-05	7.46E-03	2.11E-03
Haul Route Fugitives	1,689	714	79	-	-	-	-	-	-	-	-	-
Processing Plant Sources	129	111	58.1	-	-	-	-	47.1	9.40E-04	7.88E-05	9.70E-03	2.74E-03
Mobile Combustion Sources - Heavy Equipment	5.47	5.47	5.47	5.47	469	0.944	492	-	-	-	-	-
Total	*2,434*	*1,123*	*200*	*5.47*	*609*	*19*	*1,090*	*47.1*	*7.49E-03*	*5.62E-04*	*9.33E-02*	*1.53E-02*

Source/Activity	Hg	Ni	Zn	Ba	Sr	Be	Cobalt	Li	Sb	Sn	Se	Cr
Pit Blasting	8.29E-07	2.61E-05	9.85E-05	8.53E-05	1.12E-04	4.18E-07	3.70E-05	5.62E-05	6.10E-05	9.41E-05	8.00E-05	1.37E-04
Stockpiles	2.41E-05	6.60E-04	1.79E-03	1.85E-03	2.47E-03	8.53E-06	5.63E-04	1.61E-03	1.77E-03	2.90E-03	2.41E-03	4.11E-03
TMF	7.53E-05	7.94E-03	1.55E-02	2.44E-02	1.74E-02	5.51E-05	1.91E-03	4.53E-03	4.75E-03	7.61E-03	8.73E-03	3.91E-02
Conveyors / transfer points	3.78E-06	1.19E-04	4.50E-04	3.89E-04	5.10E-04	1.91E-06	1.69E-04	2.56E-04	2.78E-04	4.30E-04	3.65E-04	6.25E-04
Loading / unloading at stockpiles	1.35E-05	4.30E-04	1.60E-03	1.46E-03	1.97E-03	6.67E-06	5.80E-04	9.14E-04	9.10E-04	1.51E-03	1.31E-03	2.14E-03
Ore Processing Equipment	2.06E-05	6.51E-04	2.45E-03	2.12E-03	2.78E-03	1.04E-05	9.22E-04	1.40E-03	1.52E-03	2.35E-03	1.99E-03	3.41E-03
Haul Route Fugitives	-	-	-	-	-	-	-	-	-	-	-	-
Processing Plant Sources	5.52E-04	8.46E-04	3.19E-03	2.76E-03	3.62E-03	1.35E-05	1.20E-03	1.82E-03	1.98E-03	3.05E-03	2.59E-03	4.43E-03
Mobile Combustion Sources - Heavy Equipment	-	-	-	-	-	-	-	-	-	-	-	-
Total	*6.91E-04*	*1.07E-02*	*2.51E-02*	*3.30E-02*	*2.89E-02*	*9.66E-05*	*5.37E-03*	*1.06E-02*	*1.13E-02*	*1.79E-02*	*1.75E-02*	*5.40E-02*

2.2.2 Dispersion Modelling

The maximum predicted concentrations (outside the Project Area) of the air contaminants of concern released during normal operation of the VGM combined with measured background concentrations (to account for existing conditions) are provided in Table B-1 in Appendix B.

The maximum predicted concentrations, combined with measured background, at the camps (exploration camp, accommodations camp, outfitters camp) and cabin locations in the LAA and Regional Assessment Area (RAA) are provided in Table B-2 in Appendix B; these are the highest predicted concentrations that occur at camp / cabin locations within the LAA/RAA.

The predicted concentrations are also presented graphically in the form of isopleth plots (concentration contour plots) (refer to Appendix C). The highest predicted concentrations generally occur within 1-2 km of the Project Area boundary.

The maximum predicted concentrations of most air contaminants considered in this study when combined with background are below the provincial AAQS and the adopted AAQS outside the Project Area, with the noted exception of the 24-hour PM_{10} concentrations.

Maximum predicted 24-hour concentrations of PM_{10} due to VGM-related releases combined with the measured ambient background concentration are above the ambient air quality standard (adopted for the assessment) as presented in Table B-1. The exceedances of the 24-hour PM_{10} standard are predicted to occur along the Project Area boundary to the southwest (near the Leprechaun pit) at six receptor locations (out of nearly 15,000 modelled). Exceedances are expected to be infrequent and of short duration. In total there were four days (out of 1,095 modelled) when exceedances of the 24-hour standard were predicted to occur (or less than 0.5% of the time). The predicted exceedances of the PM_{10} standard are likely a result of releases from the sources in and around the Leprechaun pit (haul trucks, blasting and waste rock storage), based on the location of occurrence of the maximum predicted concentrations (~1 km to the west of the Leprechaun pit along the fence line).

Generally, the maximum predicted concentrations reach background levels within 10 to 15 km of the Project Area boundary. Maximum predicted air contaminant concentrations (including background) are also below the adopted standards at the camps (existing exploration camp, accommodations camp, outfitters camp) and cabin locations (at camp / cabin locations within the LAA/RAA).

The maximum predicted concentrations (including background) of $PM_{2.5}$, are also below the 24-hour CAAQS.

3.0 PROPOSED MITIGATION AND MANAGEMENT MEASURES

The air contaminant emissions mitigation measures were presented in Chapter 5, Atmospheric Environment, of the Valentine Gold EIS under Section 5.4. A full listing of the mitigation and management commitments for the VGM can be found in Appendix 2E of the EIS (Marathon 2020). These measures will also be applied to the Project Expansion, as applicable. No new mitigation measures specifically pertaining to the Project Expansion were identified. The following mitigation measures, related to air quality, are to be applied throughout Project construction, operation and decommissioning, rehabilitation and closure.

Mitigation measures related to air quality include the following.

- During dry periods, water will be applied to the access road, site roads and haul roads as needed to mitigate dust emissions. The application of water will be limited to non-freezing temperatures to avoid icing that can present a safety hazard. Watering is most effective immediately after application, and repeated watering several times a day might be required, depending on surface and meteorological conditions. Water used for dust suppression will be sourced from site contact water (instead of natural waterbodies) whenever possible.
- The application of dust suppressants other than water to roads as an alternative option to watering will be considered in consultation with NLDECCC. Dust suppression would be applied on an as-needed basis during high wind conditions or if measured ambient particulate matter (PM) or trace metal concentrations are in exceedance of the NLAAQS, and if an increase of watering is determined ineffective or unfeasible at the time. The chosen dust suppressant will be approved by the NLDECCC prior to application. These suppressants, if required, will be applied, as per the manufacturer's recommendations.
- An ambient air quality monitoring program will be implemented throughout the life of the VGM, as required and in accordance with Project permitting and conditions of approval.
- When loading stockpiles, drop heights will be reduced to be as close to the pile as possible.
- Surfaces of topsoil and overburden stockpiles will be stabilized during extended periods between usage by means of vegetating or covering the exposed surfaces.
- Conveyors will be covered to reduce fugitive dust emissions.

- Specific sources of air contaminant emissions will be equipped with emission control technologies to reduce emissions. These include
  - Lime silo: baghouse
  - Sodium cyanide mix tank: cyclone dust collector
  - Copper sulphate storage tank: cyclone dust collector
  - Sodium metabisulphite mix tank: cyclone dust collector
  - PAX storage tank: baghouse
  - Lime mix / storage: cyclone dust collector
  - Elution electrowinning: mist eliminator
  - ICU Electrowinning: mist eliminator
  - Barring furnace: baghouse
  - Carbon regeneration kiln: scrubber
- Engines and exhaust systems of construction and mining equipment will be subject to a comprehensive equipment preventative maintenance program to maintain fuel efficiency and performance. To reduce emissions, equipment and vehicle idling times, and cold starts will be reduced to the extent possible. VGM has implemented an idling policy to this effect.
- Vehicles and heavy equipment will be maintained in good working order and will be equipped with appropriate mufflers to reduce noise.
- Haul roads and infrastructure will be designed to reduce transportation and haul distances where possible.
- Project vehicles will be required to comply with posted speed limits on the access road, site roads and haul roads to limit fugitive dust from vehicle travel on unpaved roads. Speed limits will be set in accordance with provincial regulations and industry standards (e.g., for haul roads). Additional speed restrictions will be implemented during caribou migration periods.

4.0 MONITORING PROGRAM

This AAQFMP is based on the results of the air quality assessment conducted to support the EIS, applicable provincial and federal regulations and guidelines, commitments made to Miawpukek First Nation (MFN), and the Project's provincial and federal conditions of approval.

The results of the dispersion modelling conducted in support of the VGM EIS (Marathon 2023), based on the current design of the VGM, demonstrated compliance of the proposed facility with the NLAAQS with the exception of particulate matter less than 10 microns in diameter, which was predicted to exceed provincial criteria along the VGM boundary to the southwest (near the Leprechaun pit) at six receptor locations (out of nearly 15,000 modelled).

As per the provincial Compliance Guidance Document (GD-PPD-009.4) (2012a), compliance ambient air quality monitoring is required during the operation of the VGM to provide an understanding of the offsite contaminant concentrations and evaluate the need for more rigorous mitigation. Continuous, real-time, monitoring will include meteorological monitoring (wind speed and wind direction) and monitoring of ambient TSP, PM_{10} and $PM_{2.5}$ concentrations during the operation of the VGM. In addition to the continuous particulate monitoring, periodic integrated sampling is proposed for TSP and trace metals during construction and the first three years of operation.

The observed ambient air quality values would be compared with provincial air quality standards and objectives and used to verify predicted (modelled) residual effects on air quality associated with fugitive dust. The air quality assessment conducted to support the development of the EIS has identified fugitive dust from mining activities as the major contributor to predicted high ambient PM concentrations outside the Project boundary. More specifically, the elevated PM concentrations predicted during operation are due to fugitive releases from heavy equipment movements (along haul routes and around the pits and waste rock storage piles) as well as fugitive dust generated from wind erosion of dry areas within the tailing management facility.

Ambient TSP and trace metal concentrations will be monitored in areas with predicted high concentrations and in proximity to sensitive receptors, including the accommodations camp.

Reports from the ambient air monitoring program will be submitted annually to the regulatory authorities and shared with interested Indigenous groups and local stakeholders. Further, notification will be provided in the event that elevated ambient concentrations are observed (where exceedances of air quality criteria occur). Monitoring data will be reviewed internally by the Environmental Superintendent or designate on a regular basis and used to implement adaptive management for fugitive dust emissions.

The results of the ambient air quality monitoring program will be used to assess the effectiveness of the dust mitigation and to evaluate the potential need for more rigorous dust mitigation. If the monitoring program indicates that ground-level TSP, PM_{10}, $PM_{2.5}$ or trace metals concentrations exceed the NLAAQS, additional mitigation measures to reduce PM emissions will be implemented and this monitoring program may be updated if relevant. If new mitigation measures are implemented, IAAC will be notified within 24 hours, and VGM will follow-up with a detailed description of the measures within 7 days following implementation.

Details of the ambient air quality monitoring program are presented in the following sections and are based on the Project design and operation, the dispersion modelling conducted to support the development of the EIS, the provincial and federal EA conditions of approval, and the VGM COA.

4.1 MEASUREABLE PARAMETERS AND THRESHOLDS

4.1.1 Thresholds

4.1.1.1 Meteorology

There are no applicable regulatory thresholds for meteorological monitoring. The objective of meteorological monitoring at the site is to provide representative data for precipitation and winds for use in evaluation of the effects of meteorology on dust levels and to support investigation of sources of dust in the event of ambient air quality threshold exceedances.

4.1.1.2 Ambient Air Quality

The measured concentrations of TSP, PM_{10} and $PM_{2.5}$ will be compared to the NLAAQS to determine compliance during the operation of the Project. The applicable NLAAQS are presented in Table 4.1.

Table 4.1 Monitoring Thresholds for TSP, PM_{10} and $PM_{2.5}$ and Trace Metals

Air Contaminant	Average Period	Newfoundland and Labrador Ambient Air Quality Standard ($\mu g/m^3$)
Total Suspended Particulate Matter (TSP)	24-hour	120
	Annual	60
Respirable Particulate Matter (PM_{10})	24-hour	50
Fine Particulate Matter ($PM_{2.5}$)	24-hour	25
	Annual	8.8
Arsenic (As)	24-hour	0.3
Cadmium (Cd)	24-hour	2
Copper (Cu)	24-hour	50
Lead (Pb)	24-hour	2
Lead (Pb)	30-day	0.7
Mercury (Hg)	24-hour	2
Nickel (Ni)	24-hour	2
Zinc (Zn)	24-hour	120

Data Assessment and Response Framework

Monitoring data collected through the AAQFMP requires a systematic data evaluation process, as well as management responses that would be taken, in response to certain data evaluation outcomes. A common assessment (data evaluation) and management response framework will be implemented. This multi-step process includes the following:

Step 1 - Data Management and Evaluation

This step includes quality assurance and quality control (QA/QC); comparisons to the thresholds and to reference and/or baseline; and review of the data using various tools such as Exploratory Data Analysis (EDA) and Statistical Data Analysis (SDA), to determine if substantive change in air quality is occurring. A change may be detected statistically or qualitatively, relative to benchmarks, baseline values and/or spatial or temporal trends. A change may be statistically significant, but professional judgement may also be applied using the various evaluation tools to detect a change qualitatively.

If Step 1 does not detect change, then no action is required. If a change is observed, then further evaluation of the data for that/those indicator(s) will be carried out under Step 2.

Step 2 - Determining Whether the Observed Change is Project-Related

Step 2 involves determining if the changes in the indicator(s) of concern are due to the VGM or due to natural variability or other causes. This will include, as needed, an evaluation of both Project-related and non-Project related activities to assess potential influences of these factors in the observed change. This question can be addressed using EDA and subsequently using SDA. EDA will be completed to visualize overall data trends, and could include evaluating spatial patterns, to examine the spatial extent and pattern of observed changes.

Exploratory data analyses could include comparisons of data from reference and potential impact areas and from baseline and operational monitoring programs. This can further assist with determining whether the observed changes were due to natural variability, other anthropogenic activities in the vicinity of the Project, or the Project.

If the Step 2 analysis concludes that the changes in monitoring parameters of concern are, or are likely, due to the Project, the assessment will proceed to Step 3. If it is concluded the observed differences relative to baseline conditions are not due to the VGM, no management response will be required.

Step 3 - Determine Action Level

If the evaluation conducted in Step 2 has indicated with some certainty that the measured change is Project-related, Step 3 involves determination of the action level associated with the observed monitoring results through comparisons to the benchmark. Three (3) levels of action have been identified: low, moderate, and high; and the response actions range from increased monitoring and data analysis (e.g., trend analysis); identification of possible sources; to risk assessment and/or mitigation. The Trigger Action Response Plan (TARP) presented in Table 4.2 outlines the thresholds and responses for each action level. Where actions cannot be specified based on factors such as the number of potential sources, evaluation of project contribution, and severity of the action, the moderate and high level of action refer to the Mitigation Toolkit that follows.

Trigger Action Response Plan

The thresholds (low, moderate, high) and responses for each action level are included in Table 4.2.

Table 4.2 AAQFMP Trigger Action Response Plan

Project Activity	Objectives	Performance Indicators	Monitoring Program / Plan	Condition Status / Threshold			Pre-defined Response(s)		
				Low Risk	Moderate Risk	High Risk	Low Risk	Moderate Risk	High Risk
Life of Project	Meeting particulate matter (PM_{10}, $PM_{2.5}$ and TSP) and metals air quality standards	Particulate matter (TSP, PM_{10} and $PM_{2.5}$) and trace metals monitoring data Project Standard(s); • 120 µg/m^3 averaged daily for TSP, • 50 µg/m^3 averaged daily for PM_{10} • 25 µg/m^3 averaged daily for $PM_{2.5}$ • Metals standards presented in Table 4.1	Continuous ambient air quality monitoring for TSP, PM_{10} and $PM_{2.5}$ near the site. Integrated sampling for trace metals.	Measured TSP, PM_{10}, $PM_{2.5}$, and/or metals concentrations are greater than 90% of the ambient air quality standards	Measured TSP, PM_{10}, $PM_{2.5}$, and/or metals concentrations are above the ambient air quality standards on occasion	Measured TSP, PM_{10}, $PM_{2.5}$, and/or metals concentrations are above the ambient air quality standards frequently	Env't Dept: Review whether increase is attributed to the Project. Continue monitoring to determine if elevated levels are sustained or continuing to increase. Review the level of compliance for mitigation measures that are associated with managing the amount of fuel burned (e.g., idling policy, speed limits, etc.). Operations: Review schedule and procedures for ongoing maintenance for stationary and mobile diesel-powered equipment. Review the effectiveness of the dust mitigation at potential source locations. Review schedule, procedures, and make improvements to the dust suppression program.	Env't Dept: Verify increase can be attributed to the Project. Identify the root cause for the measured concentrations. Continue monitoring to determine if elevated concentrations are sustained or continuing to increase. Operations: Implement responses from the Mitigation Toolkit (or new mitigation developed through investigation). Identify high risk mitigation measures for future implementation if needed	Env't Dept: Verify increase can be attributed to the Project. Identify the root cause for the measured concentrations. Identify impacts to the receiving environment and/or human health. Conduct a risk evaluation to determine if levels pose an immediate health risk. Operations: Implement responses from the Mitigation Toolkit (or new mitigation developed through investigation).

Mitigation Toolkit

The Moderate and High Action Pre-Defined Responses to be implemented in the event of an exceedance of a moderate risk or high risk threshold are outlined in Table 4.3 for Air Quality. These responses should not be considered exhaustive and may be supplemented pending the results of adaptive management investigations and subsequent approval.

Note: These Moderate and High Action Pre-Defined Responses are subject to further review, if necessary. Even when finalized these responses should not be considered exhaustive and may be supplemented pending the results of adaptive management investigations and subsequent QIA approval.

Table 4.3 Air Quality – Moderate and High Impact - Action Pre-Defined Responses

Air Quality
Dust and Particulate Emission Controls: • Spray (or respray) with approved dust suppressant • Research and implement alternate dust suppression methods and products • Surface watering and sprinkler system options via mister trucks or trailers • Increase surface watering and dust suppressant application frequency • Where applicable, install or redesign conveyor shrouding for fugitive dust • Review of new technology and engineering solutions available on the market for dust control • Enclosure of facilities or operations Reduction or cessation of activity: • Adapt production rate to environmental conditions • Modify timing or frequency of operational activities (e.g., blasting frequency)
Assessment and/or Monitoring (General) • Increase frequency of inspection and audits • Increase frequency of source emissions testing • Revisit number and locations of monitoring locations • Update country food risk assessment if the metals levels determined by the environmental monitoring program are trending upwards • Development of site-specific risk-based guidelines
Negotiation of compensation

4.1.1.3 Lighting

There are no applicable provincial or federal regulatory thresholds for environmental lighting in Newfoundland and Labrador. Accordingly, lighting monitoring is not conducted for compliance purposes. The objective of the lighting monitoring program is to collect representative data to characterize changes in artificial lighting from baseline conditions within and surrounding the mine resulting from VGM operations. Guidelines developed by the International Commission on Illumination (CIE), along with sky glow reference levels previously presented in Section 1.3.3, will be used to contextualize and categorize observed lighting conditions.

4.1.1.4 Dustfall

There are no applicable provincial regulatory criteria for dustfall (settleable particulate matter) in Newfoundland and Labrador.

In the absence of Newfoundland and Labrador–specific dustfall criteria, monitoring results will be evaluated and interpreted in the context of guidance applied in other Canadian jurisdictions, including the Ontario dustfall guideline value of 7 g/m² per 30 days, as described in Section 1.3.4. This benchmark is commonly used where site-specific or provincial criteria are not defined and provides a consistent reference for evaluating potential nuisance-related and deposition-related effects. There are no criteria for metal deposition levels.

Dustfall monitoring data will be used to support adaptive management by identifying changes relative to baseline or reference conditions, evaluating the effectiveness of dust mitigation measures, and informing the need for additional controls should sustained increases in deposition be observed.

4.1.1.5 Stack Testing

There are no provincial or federal regulatory thresholds applicable for source emission testing results for the sources at VGM (i.e., non-combustion sources), nor are there in-stack limits defined in the VGM COA. Guidance on the methods and requirements for stack testing are outlined in the Guidance Document, GD-PPD-016.21, “Procedure Guide for Source Emission Testing” (Government of NL 202304). Results from stack testing will be used as inputs to the air dispersion model to assess potential impacts on off-site air quality, and will also be used to support the redevelopment of releases reported to NPRI.

4.1.1.6 Dispersion Modelling

Predicted concentrations from air dispersion modelling, which will utilize the stack testing results as input, will be compared against NLAAQS to determine compliance during the operation of the VGM. The NLAAQS were previously presented in Section 4.1.1.2.

4.1.1.7 National Pollutant Release Inventory (NPRI)

Reporting to the National Pollutant Release Inventory (NPRI) is governed by substance-specific thresholds established under the Canadian Environmental Protection Act, 1999 and detailed in Environment and Climate Change Canada’s Guide for Reporting to the NPRI. There are over 300 substances listed in the NPRI, with varying reporting thresholds ranging from 1 kg to 10 tonne.

Substance releases will be evaluated against the applicable NPRI reporting thresholds in effect for the reporting year, and reporting will be completed where the criteria are met. NPRI reporting obligations are assessed independently of ambient air quality compliance and monitoring requirements, as they are based on annual emission totals rather than measured or modelled ambient concentrations.

4.1.2 Measurable Parameters

4.1.2.1 Meteorology

The installation of an on-site meteorological (met) station has been completed, in discussion with NLDECCC and following guidance information on siting criteria from the equipment manufacturer, the United States Environmental Protection Agency (US EPA) *Quality Assurance Handbook for Air Pollution Measurement Systems - Volume IV: Meteorological Measurements Version 2.0 (Final) EPA-454/B-08-002,* and the World Meteorological Organization (WMO), as appropriate.

Weather data collected at the site can be used to confirm design parameters used in sizing infrastructure, update the site water balance through operation and to inform the implementation of the Water Management Plan. The implementation of the met station satisfies the provincial EIS guideline requirement to monitor precipitation at higher elevations (i.e., at the site) to assist and inform runoff assessments (p.52, Government of NL 2020).

Therefore, the following variables are measured for monitoring purposes:

- Precipitation intensity
- Soil moisture
- Solar radiation
- Wind speed and direction
- Snow depth/snow water equivalent
- Temperature and relative humidity
- Barometric pressure

4.1.2.2 Ambient Air Quality

The criteria pollutants that will be measured under the ambient air quality monitoring program include:

- Total suspended particulate matter (TSP)
- Particulate matter less than 10 microns in diameter (PM_{10})
- Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$)
- Trace metals

As the VGM will not include the operation of major stationary combustion sources, monitoring for oxides of nitrogen and sulphur dioxide (SO_2) is not needed. This is further supported through the results of the air dispersion modelling conducted in support of the preparation of the EIS. The maximum predicted ground level concentrations of nitrogen dioxide (NO_2) and SO_2 were well below regulatory criteria.

4.1.2.3 Lighting

The lighting parameters that will be monitored under the ambient air quality monitoring program include:

- Light trespass
- Sky glow

Glare was not identified as a pathway for obtrusive light for VGM based on their approach to manage glare emissions as identified in the EIS (Marathon Gold, 2023). Therefore, glare is not included in this monitoring plan.

4.1.2.4 Dustfall

The dustfall parameters that will be monitored under the ambient air quality monitoring program include:

- Total dustfall (deposition) per m^2, over a 30-day period
- Metal deposition per m^2, over a 30-day period

The metals that will be analyzed for in the dustfall will be consistent with those measured under the country foods program, which includes the following:

- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Bismuth
- Boron
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Molybdenum
- Nickel
- Phosphorus
- Potassium
- Selenium
- Silver
- Sodium
- Strontium
- Thallium
- Tin
- Titanium
- Uranium
- Vanadium
- Zinc

4.1.2.5 Stack Testing

In 2025, Stantec completed a review of potential emission sources at VGM and identified recommended sources and parameters for testing, based on estimated emissions and the feasibility of conducting testing on the various sources, as summarized in the Stack Testing Plan (Stantec, 2025). The findings of this review, in conjunction with consultation with NLDECCC, led to proposed stack testing on the sources and parameters presented in Table 4.4.

Table 4.4 Sources and Parameters for Stack Testing

Source	Parameters to Measure
Barring Furnace Exhaust Stack	Metals and Mercury
	Total Particulate Matter (TPM)
Carbon Regeneration Kiln Exhaust Stack	Metals and Mercury
	TPM
Stockpile Dust Collection Fan Outlet	Metals and Mercury
	TPM
	PM_{10} / $PM_{2.5}$
Electrowinning Stack	Metals and Mercury
	TPM
	Ammonia

4.1.2.6 Dispersion Modelling

The parameters that will be included in the air dispersion modelling will be consistent with those that were modelled as part of the Berry Pit Expansion EIS (Marathon 2023), which included the air contaminants with NLAAQS. The emission rates measured during stack emissions testing will be included and for sources where stack emissions testing is not conducted, updated emissions estimates will be used based on operational data and available emission factors.

4.2 METHODS

4.2.1 Meteorology

An automated met station is installed within the Project area to measure relevant meteorological parameters (e.g., precipitation, wind speed and direction) to meet applicable operational requirements of the mine and the regulatory guidelines.

The meteorological station includes a 10-metre tower for mounting the instrumentation for measurement of the required meteorological variables. The station is controlled with a data logger capable of logging the required meteorological variables. The list of monitoring equipment for the proposed measurement parameters is provided in Table 4.5.

Table 4.5 List of Meteorological Equipment

Parameter	Monitoring Equipment	Serial Number
Datalogging	CR1000x	43543
Snow Depth	SnowVUE10	10293
Precipitation	ARG314	223812
Temperature/Relative Humidity	HygroVUE10	E3851
Wind Speed & Direction	Anemometer 05108-45-L40	195560
Barometric Pressure	BaroVUE10	1771
Solar Radiation	SP Lite2 Pyranometer	222279
Soil Moisture	Stevens Hydra-Probe II	281213
Snow Water Equivalent	Fluidless Snow Pillow 5	-

4.2.2 Ambient Air Quality

Ambient air quality monitoring will be conducted in accordance with the provincial Guidance Document, GD-PPD-065 (Government of NL 2010).

4.2.2.1 Continuous Monitoring – PM_{10} and $PM_{2.5}$

Real-time, continuous ambient air quality monitoring is conducted to measure relevant criteria pollutants using methods that are designated as US EPA “reference methods” or “equivalent methods”, in accordance with Title 40, Part 53 of the United States Environmental Protection Agency Code of Federal Regulations (40 CFR Part 53). The designated reference and equivalent methods are listed in the US EPA, Center for Environmental Measurements and Modeling, “List of Designated Reference and Equivalent Methods” document, which was last updated in June 2021 (List of Designated Reference and Equivalent Methods (epa.gov)).

In consultation with NLDECCC, it was determined that one permanent continuous monitoring station was required. Accordingly, a Teledyne Model T640 ambient particulate monitor (and applicable accessories) was procured for continuous emissions monitoring, and measures TSP, $PM_{10,}$ and $PM_{2.5}$. The continuous T640 monitor is deployed on-site near the communications tower, at the approximate coordinates 48.359539°, -57.130611°, as displayed in Figure 4.1 as the “AQ Station”.

Figure 4-1 Ambient Air Quality Monitoring Locations

The continuous T640 monitor was initially installed in December 2024, during construction of the VGM. The T640 station was originally located near the security trailer; however, this area was unpaved and subject to heavy traffic, resulting in direct particulate influence and making it unsuitable for representative monitoring. In May 2025, the station was relocated to it's current location, shown in Figure 4-1 as the "AQ Station." The station was setup following guidance published by the Canadian Council of Ministers of the Environment (CCME) "Ambient Air Monitoring and Quality Assurance/Quality Control Guidelines" (2019).

4.2.2.2 Annual Event Monitoring – TSP and Metals

In addition to the continuous ambient air monitoring station, an annual ambient air quality monitoring event will be conducted to measure TSP and associated trace metals. This monitoring will be scheduled during periods of peak expected dust generation (e.g., July or August). The first TSP and metal ambient monitoring event occurred during the construction phase of the VGM and will be conducted annually for the first three years of operations.

During each of the monitoring years, three consecutive 24-hour ambient air samples will be collected simultaneously at three on-site monitoring locations (nine samples per year). The monitoring locations have been selected to represent conditions near sensitive receptors and key operational areas and include:

- A location near the northeast edge of the Property (nearest off-site receptors, including cabin owners) ("Victory")
- A location near the on-site accommodations ("Accommodations")
- A location near the permanent ambient air quality monitoring station. ("AQ Station")

These monitoring locations are presented in Figure 4.1.

Each monitoring location will be equipped with a high-volume air sampler (if power is available) operating over a 24-hour sampling period. Sampling will be conducted in accordance with the Newfoundland and Labrador *Guidelines for Ambient Air Monitoring* (GD-PPD-065; Government of NL 2010) and United States Environmental Protection Agency (US EPA) Federal Reference Method (FRM) requirements for high-volume sampling under 40 CFR Part 50. If continuous power supply is not available, which may be the case at the Victory Pit location, a low-volume sampler will be used in lieu.

Collected quartz filter samples will be submitted to an ISO/IEC 17025-accredited laboratory for analysis. Samples will be analyzed for TSP mass and trace metals, including arsenic (As), cadmium (Cd), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), and zinc (Zn).

Metals analysis will be conducted in accordance with the U.S. EPA *Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air*, Compendium Method IO-3.2, using appropriate analytical methods (e.g., NIOSH 6009/7303 and Standard Method 3125). The AAQFMP will also follow the US EPA "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 11, Ambient Air Quality Monitoring Program" (EPA-454/B-08-003 January 2017).

4.2.3 Lighting

Ambient light monitoring will be conducted to characterize artificial lighting conditions associated with Project operations. Monitoring will include measurements of illuminance (lux) and sky glow (magnitudes per square arcsecond; mag/arcsec²). Light monitoring was completed once during the construction phase of VGM and will be repeated once during the operations phase, planned to occur in 2027.

Monitoring will be conducted over one night per event, following astronomical twilight, under clear-sky conditions and during periods of minimal lunar illumination where practicable. Illuminance and sky glow measurements will be collected concurrently at each location to ensure representative characterization of ambient lighting conditions.

Illuminance will be measured using a handheld integrating hemispherical light meter (Extech A33) with a resolution of 0.01 lux. Sky glow will be measured using a Unihedron Sky Quality Meter (SQM-L). At each monitoring location, three sky glow readings will be collected, and the maximum illuminance value will be recorded.

There are six locations in which light measurements are to be taken, which are summarized below in Table 4.6.

Table 4.6 Artificial Light Monitoring Locations

Monitoring Location	UTM 21 Coordinates	
	Easting	Northing
Main Access Road	493564.21	5360561.69
Accommodations	490362.77	5355843.10
Process Plant	490383.94	5356839.33
Marathon Pit	492046.96	5359774.20
Leprechaun Pit	486327.20	5355794.80
Berry Pit	489707.21	5358331.86

4.2.4 Dustfall

Dustfall samples will be collected twice per year over the first three years of the operational phase of the VGM. Following the first three years of operation, the results of the program will be reviewed and discussed with NLDECCC, and it will be reevaluated whether dustfall sampling should continue annually or at a reduced frequency. Dustfall sampling will include:

- Four to eight (4-8) dustfall samples collected within wildlife foraging areas near the VGM and along the predicted caribou migratory pathways (e.g., near the Marathon Pit and access road) during the fall migratory period (approximately November 1 to December 15)
- Four to eight (4–8) dustfall samples collected in areas where country food harvesting occurs (e.g., berries and Labrador tea), during a period distinct from the fall migratory period and selected to target conditions when dustfall is expected to be elevated.

The final sampling locations are under development and will consider the Caribou and Country Foods Follow-up Monitoring Programs to ensure alignment with other environmental monitoring programs. Results from the dustfall monitoring program will be reported as part of the Country Foods monitoring report.

In absence of Newfoundland and Labrador specific dustfall guidance, dustfall sampling will follow British Columbia's (2018), *Standard Operating Procedure for the Sample Collection of Dustfall (Settleable Particulate Matter) and Metals (SOP-05c)*. The analysis will follow ASTM Method D1739-98. This passive monitoring method involves deploying dustfall collection containers of specified dimensions containing a laboratory-prepared liquid sampling matrix during dry conditions. Samplers will be installed at a minimum height of 2 metres above ground level and will remain deployed for a 30-day sampling period. Samplers may be mounted to existing structures (e.g., decks or utility poles) or installed on concrete blocks in remote locations, as required.

At the conclusion of each 30-day deployment period, dustfall samples will be retrieved and submitted to an accredited laboratory for analysis Meteorological conditions during each sampling period, including ambient temperature, precipitation, and wind speed and direction, will be obtained from the on-site meteorological station, with data provided by VGM, and will be used to support interpretation of dustfall results.

4.2.5 Stack Testing

The stack testing will be conducted following guidance from NLDECCC's "Procedural Guide for Source Emissions Testing" (2023). As previously identified in Section 1.3.2, as a new facility, VGM is required to conduct a stack emission test within the first 6 months of operation and again within the last 6 months of the first 2 years of operation. After which VGM will be classified as an existing facility, and only require stack testing every 4 years, unless dispersion modelling predicts non-compliance with NLAAQS.

As required under the NL guidance, in advance of each stack testing program, a pre-test plan will be developed and submitted to the Department at least 30-days prior to conducting the testing program. The pre-test plan will provide details about the sources and testing methods. The NL guidance provides a list of approved source emission testing methods, which includes the US EPA methods. The sources, air contaminants for testing, and applicable methods are presented in Table 4.7.

Table 4.7 Stack Sampling Methodology

Source	Variable to be Measured	Reference Method(s)
Barring Furnace Exhaust Stack	Metals and Mercury	US EPA Method 29
	TPM	US EPA Method 29 (combined with metals)
Carbon Regeneration Kiln Exhaust Stack	Metals and Mercury	US EPA Method 29
	TPM	US EPA Method 29 (combined with metals)
Stockpile Dust Collection Fan Outlet	Metals and Mercury	US EPA Method 29
	TPM	US EPA Method 29 (combined)
	PM_{10} / $PM_{2.5}$	US EPA Method 201a [1]
Electrowinning Stack	Metals and Mercury	US EPA Method 29
	TPM	US EPA Method 29 (combined)
	Ammonia	US EPA Method CTM 27

Notes:

US EPA United States Environmental Protection Agency.

[1] The stockpile dust collection fan outlet is the only source at the facility to meet the minimum stack diameter requirements for US EPA Method 201a.

5.0 REPORTING

A summary of the reporting requirements of the monitoring programs described in this air quality monitoring plan is provided in Table 5.1.

Table 5.1 Reporting Requirements Summary

Report	Applicable Regulatory Requirement	Regulatory Authority / Recipient	Frequency	Submission Deadline	Required Content
Annual Report	Condition 2.10 of the Berry Pit Expansion EIS Decision Statement issued under Section 54 of the *Canadian Environmental Assessment Act, 2012.*	Impact Assessment Agency of Canada (IAAC) and NLDECCC	Annually	March 31 following year	Summary of monitoring methods and results, including monitoring locations and site features; operational details (parameters, equipment, frequency); summary statistics for meteorological conditions and ambient particulate matter/trace metals; comparison of results against NLAAQS.
Monthly Report	VGM COA issued by NLDECCC under the *Environmental Protection Act*	NLDECCC	Monthly	30-days after the reporting month	Summary of monitoring activities; data availability; exceedances; complaints (if any); mitigation actions implemented; notable observations
Stack Emissions Testing: Pre-Test Plan	NL Guidance Document, GD-PPD-016.1, “Procedure Guide for Source Emission Testing” (Government of NL 2023) under the *Air Pollution Regulations, 2022*	NLDECCC	Per stack testing event	30-days prior to stack testing event	Test objectives; stack and source description; operating conditions; test methods; QA/QC procedures; schedule; laboratory accreditation
Stack Emissions Testing: Report	NL Guidance Document, GD-PPD-016.2, “Procedure Guide for Source Emission Testing” (Government of NL 2023) under the *Air Pollution Regulations, 2022*	NLDECCC	Per stack testing event	120-days post stack testing event	Summary of testing program; methods; operating conditions; analytical results; QA/QC; comparison to approval limits; discussion of results (specifics outlined in GD-PPD-016.2)

Table 5.1 Reporting Requirements Summary

Report	Applicable Regulatory Requirement	Regulatory Authority / Recipient	Frequency	Submission Deadline	Required Content
Dispersion Modelling Report	Guidance Document, GD-PPD-019.2, "Guidance for Plume Dispersion Modelling" (Government of NL 2012b) under the *Air Pollution Regulations, 2022*	NLDECCC	Per stack testing event	120-days post acceptance of the stack testing report by NLDECCC	Emissions inventory; modelling methodology and inputs and output files; assumptions; results; comparison to applicable ambient air quality criteria; figures and tables (isopleths for pollutants predicted to exceed half the associated standard); a top-50 summary table for pollutants and averaging periods; discussion of results
NPRI	*Canadian Environmental Protection Act (CEPA)*	ECCC	Annually	June 1 following the reporting year	Facility and substance information; quantities released, disposed, or recycled; estimation methods; analytical lab data.
Ambient Air – TSP and Metals Report	Commitment to MFN through EIS IR Process	Equinox, MFN	Annually	February 10 following year	Not specified. To follow content of Annual Report (above).
Light Monitoring Report	Not applicable	Equinox	Once during operations (2027)	Six weeks post monitoring event	Sampling methods, sky glow and illuminance results.
Dustfall Report	Requested by Wildlife Division. To support the Country Foods monitoring requirement made in the EIS.	NLDFAL; Results will feed into Country Foods Report submitted IAAC	Annually	6 weeks of receipt of laboratory data	Sampling methods; dustfall results; meteorological summary

Additional details about the monitoring program reporting are provided in the following subsections.

5.1 ANNUAL SUMMARY REPORT

Reports from the AAQFMP will be submitted annually, by March 31 of the following year, to regulatory authorities as required.

The meteorology and ambient air quality monitoring annual reports will include the results of the ambient air quality monitoring program following a standardized format, including:

- A map showing the location of emitting sources, property boundary and ambient air quality monitoring stations
- A summary of operations - parameters monitored, equipment model, frequency of site visits and calibrations, confirmation of data backups
- A summary of audits and audit outcomes
- Summary statistics for the meteorological monitoring data (e.g., ambient air temperature, precipitation, wind speed and direction (wind rose))
- Summary statistics for the measured ambient PM_{10} and $PM_{2.5}$ concentrations (e.g., annual arithmetic mean, maximum and daily average 24-hour, percent of valid data) from the continuous monitoring station
- Summary of TSP and trace metals concentrations obtained from the annual event monitoring
- A summary of exceedances of the NLAAQS if they occur, the number of times that exceedances occurred, the meteorology conditions that coincided with the exceedances, and additional mitigation measures used during exceedance periods.

Both a technical and a plain language summary will be provided as part of the annual reporting requirements.

5.2 MONTHLY REPORT

Monthly reports containing the results from the on-site continuous ambient air quality monitoring station and meteorological station will be submitted to the Department in digital format within 30 calendar days of the reporting month, as required under Condition 76 of VGM's COA, and will include the following information:

- Summary statistics for the meteorological monitoring data (e.g., ambient air temperature, precipitation, relative humidity, barometric pressure, wind speed and direction (wind rose))
- Summary statistics for the measured ambient PM_{10} and $PM_{2.5}$ concentrations (e.g., daily average 24-hour) from the continuous monitoring station
- Data availability and validity, with explanation for omissions of data, if applicable.

5.3 CONTINUOUS MONITOR INTERNAL RECORDS

As required in the COA Condition 68., information regarding the calibrations, site visits, and maintenance of the T640 continuous monitor must be recorded into the DR DAS electronic logbook. Records on calibration and maintenance of the meteorological station and its equipment must be made available upon request by the Department.

5.4 STACK TESTING & DISPERSION MODELLING REPORTS

At least thirty days prior to conducting a stack testing event, a pre-test plan must be submitted to the Department for review and approval. Within 120 days of completion of the stack testing event, a stack testing report must be submitted to the Department. Details of what the stack testing report must contain are outlined in the NL Guidance Document, GD-PPD-016.2, “Procedure Guide for Source Emission Testing” (Government of NL 2023). Within 120 days of Department acceptance of the stack testing report, a dispersion modelling report must be submitted to the Department. Details of what the dispersion modelling report must contained are outlined in the NL Guidance Document, GD-PPD-019.2, “Guidance for Plume Dispersion Modelling” (Government of NL 2012b).

5.5 LIGHT REPORT

Light monitoring reports are not a regulatory reporting requirement; however, reports will be prepared to support an improved understanding of potential environmental conditions and trends following development of the VGM. The results will be used to evaluate performance of mitigation measures, support adaptive management, and provide context for ongoing effects monitoring.

Light monitoring results will be summarized and assessed to identify temporal and spatial trends in illuminance levels and sky glow associated with VGM activities. These summaries will support understanding of changes to the nighttime environment over time and will be used to inform the effectiveness of lighting management practices implemented at the site. The lighting report will be completed approximately six weeks after conducting the lighting surveys.

The light reporting will focus on long-term trend evaluation rather than regulatory compliance thresholds and will be updated periodically as monitoring data become available.

5.6 DUSTFALL REPORT

Dustfall monitoring reports are not a regulatory requirement; however, monitoring has been included at the request of the NLDFAL Wildlife Division. As such, the report may be shared with the Wildlife Division. In addition, the dustfall monitoring results will be incorporated into the Country Foods annual report.

Dustfall monitoring results will be summarized to evaluate deposition rates and metal concentrations over time in relation to VGM activities. In addition to supporting interpretation of deposition trends, the results will be used to inform the Country Foods FMP by providing context on potential deposition-related exposure pathways. The results will also be used to support a broader understanding of potential effects on migratory caribou and their forage.

Where applicable, results will be compared qualitatively to guidance values from other Canadian jurisdictions to provide context for interpretation. The dustfall monitoring reports will be completed approximately six weeks after receipt of the laboratory data after the dustfall program.

5.7 NPRI REPORTING

In addition to the ambient air and meteorology monitoring, the CEPA, 1999 also stipulates those owners or operators of facilities that meet published reporting requirements must report to the ECCC NPRI reporting program. NPRI reporting applies to more than 300 substances and the amount that was released (to air, water and land), disposed or recycled at the facility during each calendar year must be reported if the release is greater than a specified threshold. Reports are required to be submitted to ECCC for each calendar year. Details pertaining to the reporting requirements are specified in “Guide for Reporting to the National Pollutant Release Inventory” that is updated routinely every 2 to 3 years by Environment Climate Change Canada (ECCC 2026).

6.0 RELATED DOCUMENTS

Other environmental management plans and monitoring programs related to this follow-up monitoring program are described in Table 6.1.

Table 6.1 Related Management Plans and Monitoring Programs

Plan/Program	Details
Environmental Protection Plan	The EPP provides general environmental protection procedures related to VGM activities and infrastructure such as air and greenhouse gas emissions management; erosion and sedimentation control; rock and soils management; and traffic management. Also included are protection procedures specific to caribou, avifauna, and other wildlife (including bats and American marten); fish and fish habitat; historic resources; and the Victoria Dam. The EPP also includes contingency plans for fuel and hazardous materials spills, failure of erosion and sediment control measures and/or dams, and forest fires.
Accidents and Malfunctions Prevention and Response Plan	The Accidents and Malfunctions Prevention and Response Plan outlines the mitigation measures and response measures for potential accidents and malfunctions. The Plan provides direction for communication and reporting requirements following an accident or malfunction. Potential accidents or malfunctions addressed include tailings management facility malfunction, stockpile slope failure, fuel and hazardous materials spill, unplanned release of contact water, fire/explosion, and vehicle accidents.
Greenhouse Gas Emissions Follow-up Monitoring Program	The Greenhouse Gas Emissions Follow-up Monitoring Program describes the management and mitigation measures to reduce GHG emissions associated with mine activities during VGM construction, operation and decommissioning/closure.
Stack Testing Plan	The Stack Testing Plan presents a proposed stack emissions testing plan for the VGM to support compliance with provincial air quality regulations. The plan reviews facility emission sources, relevant regulatory requirements and guidance, and applicable testing methodologies to identify which point sources emit non-negligible quantities of regulated air contaminants and are suitable for stack testing. Based on this review, the report recommends specific sources for testing, associated contaminants, and appropriate U.S. EPA reference methods, with the intent of supporting regulatory engagement and confirming stack testing requirements for the facility. It was submitted to and approved, with the exception of adding one additional source to test (Electrowinning) in 2025.

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Appendix A Certificate of Approval

Appendix B Dispersion Modelling Results

Table B-1 Maximum Predicted Ground-level Concentrations – Operation

Contaminant	Average Period	Background Concentrations ($\mu g/m^3$)	Predicted Concentrations ($\mu g/m^3$)	Predicted plus Background ($\mu g/m^3$)	NL AQ Standard ($\mu g/m^3$)	2020 CAAQS ($\mu g/m^3$)	2025 CAAQS ($\mu g/m^3$)	Ontario ACB ($\mu g/m^3$)	Percent of NL/Adopted Standard
TSP	24-hour	13.8	76.1	89.9	120	-	-	-	75%
	Annual	2.6	8.91	11.6	60	-	-	-	19%
PM_{10}	24-hour	13.0	38.2	51.2	50	-	-	-	102%
$PM_{2.5}$	24-hour	10.3	7.14	17.4	25	27.0	NA	-	70%
	Annual	3.8	0.895	4.74	8.8	8.8	NA	-	54%
NO_2	1-hour	3.8	79.4	83.2	400	112.9	79	-	2.10%
	24-hour	1.9	34.5	36.4	200	-	-	-	18%
	Annual	1.4	3.24	4.64	100	32.0	28.2	-	5%
SO_2	1-hour	2.6	18.8	21.4	900	183.4	170	-	0.20%
	3-hour	2.6	6.67	9.29	600	-	-	-	2%
	24-hour	neg.	4.12	4.12	300	-	-	-	1%
	Annual	neg.	0.0513	0.0513	60	13.1	10.5	-	1%
CO	1-hour	206	649	855	35,000	-	-	-	0.20%
	8-hour	200	545	745	15,000	-	-	-	5%
NH_3	24-hour	neg.	0.25	0.25	100	-	-	-	1%
HCN	24-hour	neg.	4.93	4.93	-	-	-	8	62%
As	24-hour	2.1E-03	4.19E-04	2.52E-03	0.3	-	-	-	1%
Cd	24-hour	4.2E-04	2.83E-05	4.48E-04	2	-	-	-	1%
Cu	24-hour	1.3E-03	5.83E-03	0.0071	50	-	-	-	1%
Pb	24-hour	1.3E-03	6.13E-04	1.91E-03	2	-	-	-	1%
	30-day	5.0E-04	2.37E-04	7.38E-04	0.7	-	-	-	<1%
Hg	24-hour	neg.	6.17E-05	6.17E-05	2	-	-	-	<1%

Table B-1 Maximum Predicted Ground-level Concentrations – Operation

Contaminant	Average Period	Background Concentrations ($\mu g/m^3$)	Predicted Concentrations ($\mu g/m^3$)	Predicted plus Background ($\mu g/m^3$)	NL AQ Standard ($\mu g/m^3$)	2020 CAAQS ($\mu g/m^3$)	2025 CAAQS ($\mu g/m^3$)	Ontario ACB ($\mu g/m^3$)	Percent of NL/Adopted Standard
Ni	24-hour	2.1E-03	7.54E-04	2.85E-03	2	-	-	-	<1%
Zn	24-hour	2.1E-02	1.48E-03	2.25E-02	120	-	-	-	<1%
Ba	24-hour	2.1E-03	2.34E-03	4.44E-03	-	-	-	10	<1%
Sr	24-hour	2.1E-03	1.67E-03	3.77E-03	-	-	-	120	<1%
Be	24-hour	1.3E-03	5.27E-06	1.31E-03	-	-	-	0.01	13%
Cobalt	24-hour	1.3E-03	2.19E-04	1.52E-03	-	-	-	0.1	2%
Li	24-hour	neg.	4.32E-04	4.32E-04	-	-	-	20	<1%
Sb	24-hour	2.1E-03	4.54E-04	2.55E-03	-	-	-	25	<1%
Sn	24-hour	1.3E-03	7.29E-04	2.03E-03	-	-	-	10	<1%
Se	24-hour	4.2E-03	8.31E-04	5.03E-03	-	-	-	10	<1%
Cr	24-hour	2.1E-03	3.72E-03	5.82E-03	-	-	-	0.5	1%
Bi	24-hour	2.1E-03	2.94E-04	2.39E-03	-	-	-	2.5	<1%

Table B-2 Maximum Predicted Concentrations – Camp / Cabin Locations – Operation

Contaminant	Average Period	Background Concentrations (µg/m³)	Predicted Concentrations (µg/m³)	Predicted plus Background (µg/m³)	NL Standard (µg/m³)	2020 CAAQS (µg/m³)	2025 CAAQS (µg/m³)	Ontario ACB (µg/m³)	Percent of NL/Adopted Standard
TSP	24-hour	13.8	13.8	46.5	120	-	-	-	50%
	Annual	2.6	2.6	7.9	60	-	-	-	18%
PM_{10}	24-hour	13.0	13	24	50	-	-	-	74%
$PM_{2.5}$	24-hour	10.3	10.3	7.05	25	27.0	NA	-	69%
	Annual	3.8	3.8	0.573	8.8	8.8	NA	-	50%
NO_2	1-hour	3.8	64.5	68.3	400	112.9	79	-	17%
	24-hour	1.9	20.4	22.3	200	-	-	-	11%
	Annual	1.4	2.67	4.07	100	32.0	28.2	-	4%
SO_2	1-hour	2.6	1.24	15	900	183.4	170	-	2.%
	3-hour	2.6	4.38	7	600	-	-	-	1%
	24-hour	neg.	1.34	1.34	300	-	-	-	<1%
	Annual	neg.	0.0353	0.0353	60	13.1	10.5	-	<1%
CO	1-hour	206	43.2	638	35,000	-	-	-	2%
	8-hour	200	0.215	415	15,000	-	-	-	3%
NH_3	24-hour	neg.	0.189	0.189	100	-	-	-	<1%
HCN	24-hour	neg.	4.32	4.32	-	-	-	8	54%
As	24-hour	2.1E-03	1.49E-04	2.25E-03	0.3	-	-	-	<1%
Cd	24-hour	4.2E-04	1.23E-05	4.32E-04	2	-	-	-	<1%
Cu	24-hour	1.3E-03	1.54E-03	2.84E-03	50	-	-	-	<1%
Pb	24-hour	1.3E-03	4.32E-04	1.73E-03	2	-	-	-	<1%
	30-day	5.0E-04	1.67E-04	6.68E-04	0.7	-	-	-	<1%
Hg	24-hour	neg.	4.70E-05	4.70E-05	2	-	-	-	<1%

Table B-2 Maximum Predicted Concentrations – Camp / Cabin Locations – Operation

Contaminant	Average Period	Background Concentrations (µg/m³)	Predicted Concentrations (µg/m³)	Predicted plus Background (µg/m³)	NL Standard (µg/m³)	2020 CAAQS (µg/m³)	2025 CAAQS (µg/m³)	Ontario ACB (µg/m³)	Percent of NL/Adopted Standard
Ni	24-hour	2.1E-03	1.73E-04	2.27E-03	2	-	-	-	<1%
Zn	24-hour	2.1E-02	5.27E-04	2.15E-02	120	-	-	-	<1%
Ba	24-hour	2.1E-03	5.25E-04	2.62E-03	-	-	-	10	<1%
Sr	24-hour	2.1E-03	5.83E-04	2.68E-03	-	-	-	120	<1%
Be	24-hour	1.3E-03	2.22E-06	1.30E-03	-	-	-	0.01	13%
Cobalt	24-hour	1.3E-03	2.01E-04	1.50E-03	-	-	-	0.1	2%
Li	24-hour	neg.	2.86E-04	2.86E-04	-	-	-	20	<1%
Sb	24-hour	2.1E-03	3.13E-04	2.41E-03	-	-	-	25	<1%
Sn	24-hour	1.3E-03	4.75E-04	1.78E-03	-	-	-	10	<1%
Se	24-hour	4.2E-03	4.04E-04	4.60E-03	-	-	-	10	<1%
Cr	24-hour	2.1E-03	8.55E-04	2.95E-03	-	-	-	0.5	<1%
Bi	24-hour	2.1E-03	1.41E-04	2.24E-03	-	-	-	2.5	<1%

Appendix C Dispersion Modelling Contour Plots