CONCEPTUAL AIR QUALITY AND EMISSION MONITORING AND MANAGEMENT PLAN FOR THE JAY PROJECT

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Prepared for: Dominion Diamond Ekati Corporation

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June 2015

DOMINION DIAMOND

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Plain Language Summary

This document comprises the Dominion Diamond Air Quality and Emissions Monitoring and Management Plan (AQEMMP) for the Jay Project (Project). Note that this is a conceptual plan intended for discussion through the permitting process for the Project and is not intended to replace the existing Ekati Air Quality Management Plan which is in the process of being updated to include the Lynx Project. The implementation of this plan would be expected at the commencement of the Project taking into account feedback and input from regulatory agencies, communities, and other stakeholders. This AQEMMP includes the monitoring provisions for the Project and to address air quality monitoring and management using an adaptive approach. This means that if the early warning levels are reached, adaptive management response plans will be implemented.

The air quality monitoring component will be used to coordinate monitoring of ambient air quality at the Project during the construction, operation, and closure phases. This ambient air quality monitoring data will be compared to applicable air quality criteria to provide an indication of the Project's performance with respect to air quality and it will be analyzed for trends in the three-year report. The air quality data will be drawn upon specifically to support other monitoring plans.

The emissions management component presents the approach that will be used in the three-year report to provide a summary of emissions from the Project. The emission calculation methodology for each of the main Project sources is discussed in detail in this document. The calculated emissions will be compared to relevant regulatory guidelines, and to the Jay Project Developer's Assessment Report (DAR) (Dominion Diamond 2014) predictions and associated follow-up work, such as, updates provided in adequacy review responses and Information Requests (IRs) to evaluate emissions performance.

An important outcome of evaluating emissions performance is to identify trends or results that trigger an early warning level. Emissions and concentrations will be evaluated against the early warning levels regularly. Where an early warning level has been triggered, a response plan will be formulated and implemented. The trigger levels for each compound are based on the DAR predictions and associated follow-up work such as updates provided in adequacy review responses and IRs, the applicable ambient air quality standards and objectives, and a percent increased change (year to year) in measured concentrations. When these factors are considered collectively, potential issues can be identified and resolved before an adverse effect occurs, which is the primary benefit of this type of proactive and adaptive management system.

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Revision History

Version	Date	Notes/Revisions
Version 1	2009	EKATI Diamond Mine Air Quality Management and Monitoring Plan (BHP Billiton 2009)
Version 2	June 2015	Development of the conceptual AQEMMP for the Jay Project for submission to the Mackenzie Valley Environmental Impact Review Board.

Abbreviations

Abbreviation	Definition
AQEMMP	Air Quality and Emissions Monitoring and Management Plan
CAPM	Continuous Ambient Particulate Monitors
CCME	Canadian Council of Ministers of the Environment
CH_4	methane
CO_2	carbon dioxide
CO_2E	carbon dioxide equivalent
Dominion Diamond	Dominion Diamond Ekati Corporation
EC	Environment Canada
EMS	Environmental Management System
GHG	greenhouse gas
GNWT	Government of the Northwest Territories
IR	Information Request
Project	Jay Project
MVEIRB	Mackenzie Valley Environmental Impact Review Board
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
NPRI	National Pollutant Release Inventory
NWT	Northwest Territories
PK	processed kimberlite
$PM_{2.5}$	particulate matter with mean aerodynamic diameter 2.5 micrometres or smaller
PM_{10}	particulate matter with mean aerodynamic diameter 10 micrometres or smaller
QA	quality assurance
QC	quality control
SO_2	sulphur dioxide
TSP	total suspended particulate
USEPA	United States Environmental Protection Agency

Units of Measure

Unit	Definition
%	percent
°C	degrees Celsius
g/GJ	grams per gigajoule
g/year	grams per year
GJ/kg	gigajoules per kilogram
kg	kilogram
kg/kmol	kilograms per kilomol
kg/m^2/day	kilograms per squared metre per day
kg/m^3	kilograms per cubic metre
kg/year	kilograms per year
km	kilometre(s)
kph	kilometres per hour
lb	pounds
m	metres
m^3	cubic metres
m^3/year	cubic metres per year
pg/m^3	pictograms per cubic metre
ppmw	parts per million weight
VKT	vehicle kilometres travelled
VMT	vehicle miles travelled
µg/m^3	micrograms per cubic metres
µm	micrometres

1 INTRODUCTION

Dominion Diamond Ekati Corporation (Dominion Diamond) is a Canadian-owned and Northwest Territories (NWT) based mining company that mines, processes, and markets Canadian diamonds from the Ekati Diamond Mine (Ekati Mine). Dominion Diamond also markets Canadian diamonds from its 40% ownership of the Diavik Diamond Mine.

Dominion Diamond proposes to develop the Jay Pit with associated mining and transportation infrastructure to add 10 or more years of mine life to the existing Ekati Mine. The proposed Jay Project (Project) will be an extension of the Ekati Mine, which is a large, stable, and successful mining operation that has been operating for 16 years and is expected to continue to operate until 2019. It and its surrounding claim block are located approximately 300 kilometres (km) northeast of Yellowknife in the Northwest Territories (Map 1-1).

The Jay kimberlite pipe (Jay pipe) is located beneath Lac du Sauvage in the southeastern portion of the Ekati Mine property approximately 25 km from the main facilities and approximately 7 km to the northeast of the Misery Pit. A horseshoe-shaped dike will be constructed to isolate the portion of Lac du Sauvage overlying the Jay kimberlite pipe. The isolated portion will be dewatered to allow for open-pit mining of the kimberlite pipe. The Project will also require an access road, pipelines, and power lines to the Jay Pit from the Misery Pit.

The majority of the facilities required to support the Jay Pit and process the kimberlite already exist at the Ekati Mine, including:

- Misery Pit mining infrastructure (e.g., fuel facility, explosives magazines);
- primary roads and transportation infrastructure (e.g., Ekati airstrip, Misery Road);
- Ekati main camp and supporting infrastructure;
- Ekati processing plant; and,
- fine processed kimberlite management facilities.

Dominion Diamond will conduct open pit mining, processing, and associated activities at the Jay Project. The three phases of the life of the Project include construction, operations, and closure. Activities at the Project will include:

- dikes to facilitate the partial dewatering of Lac du Sauvage;
- open pit mining of the Jay kimberlite pipe;
- existing processing facilities and infrastructure;
- ore stockpiles;
- waste rock piles;
- quarrying;

- the existing Ekati winter access road and accommodations facilities;
- fuel, lubricant, and glycol storage facilities and laydown areas;
- explosives storage facilities and use of explosives;
- a landfarm;
- a landfill;
- a composting facility;
- site facilities and infrastructure including but not limited to the water supply facility, sewage treatment plant, pipelines, incinerator, site roads, all-season airstrip and apron, power plant, electrical distribution, and material storage, and sorting facilities; and,
- use of equipment, vehicles and machines.

Dominion Diamond has used an Air Quality Management and Monitoring Plan (AQMMP) for the existing Ekati project since 1995, but the proposed Jay Project extension provides an opportunity to review and revise the existing AQMMP (last formally revised in 2009) to tailor it to the changing needs of the Project. Dominion Diamond is committed to regional and cumulative effects monitoring and will make the data collected through the AQMMP available to Environment Canada and the GNWT for regional cumulative effects monitoring initiatives.

Section 1.3 of the 2009 AQMMP states that it is a living document that may change over the life of the mine (BHP Billiton 2009). This document comprises the Dominion Diamond Air Quality and Emissions Monitoring and Management Plan (AQEMMP) for the Project. Note that this is a conceptual document intended for discussion through the permitting process for the Project and is not intended to replace the existing Ekati Air Quality Management Plan which is in the process of being updated to include the Lynx Project. The implementation of this plan would be expected at the commencement of the Jay Project taking into account feedback and input from regulatory agencies, communities, and other stakeholders.

This AQEMMP includes the monitoring provisions for the Project and to address air quality monitoring and management using an adaptive response approach. Adaptive response refers to establishing a series of measurement thresholds beyond which actions to investigate and, if necessary, address the underlying reasons for reaching those thresholds are undertaken.

Section 1 provides information on the commitments, scope, objectives, methods and approach used in this plan. Section 2 describes the air quality monitoring program, while Section 3 provides details on the emissions monitoring program. Response planning is described in Section 4, while Section 5 provides information on reporting. The content of Section 6 relates to regional and cumulative effects monitoring programs and Section 7 describes engagement .

LEGEND

- JAY PROJECT
- EXISTING MINE OR PROJECT
- TERRITORIAL CAPITAL
- POPULATED PLACE
- HIGHWAY
- ALL-SEASON ROAD
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- TERRITORIAL/PROVINCIAL BOUNDARY
- TREELINE
- WATERCOURSE
- WATERBODY

150 0 150

SCALE 1:6,000,000 KILOMETRES

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REFERENCE

WATER OBTAINED FROM ATLAS OF CANADA
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
PROJECTION: CANADA LAMBERT CONFORMAL CONIC

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

LOCATION OF THE JAY PROJECT

Golder Associates

PROJECT	1419751.4100.50		FILE No.	
DESIGN	MJ	27/05/15	SCALE AS SHOWN	REV. 0
GIS	ANK	27/05/15	MAP 1-1	
CHECK				
REVIEW				

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1.1 Commitments

The AQEMMP serves to help Dominion Diamond meet their permit obligations conditions. All relevant requirements are provided in the commitment table below (Table 1.1-1). The commitment table, developed as an outcome of the regulatory process, also indicates where these requirements are met. Dominion Diamond has also been meeting the existing commitments and reporting requirements in the AQMMP throughout the operating life of the Mine.

Table 1.1-1 Summary of Commitments to Air Quality and Emissions

Commitment	Reference Document	Corresponding Section
Dominion Diamond currently has existing monitoring programs in place to track effects on wildlife, aquatics, and air quality. Dominion Diamond will discuss with potentially affected Aboriginal groups collaborative ways for community members to be involved in these programs.	Jay Project DAR	5.3.6
Continuous improvement and emission reduction are key management approaches that support the principle of keeping clean areas clean and encompass the Dominion Diamond goal of using best available technology economically achievable.	Jay Project DAR	7.3.2.2
Dominion Diamond will follow general management approaches for air emissions from the Project: • Project mine equipment and haul vehicles will be regularly maintained to reduce emissions and maximize fuel efficiency. • Low sulphur (15 parts per million by weight [ppmw]) diesel will be used in fleet vehicles. • Site road topping surfaces will be regularly maintained for operational efficiencies and to minimize fuel consumption. • Energy conservation initiatives such as maintaining site road topping surfaces for energy efficiency will be undertaken.	Jay Project DAR	7.3.2.2
Dominion Diamond will manage dust and particulate emissions by continuing and evolving the following management practices: • water spray and chemical suppressant application to control dust emissions on haul roads during summer or non-frozen season; and, • managing vehicle speed to limit road dust from vehicle wheel entrainment.	Jay Project DAR	7.3.2.2
Dominion Diamond plans to incorporate the results of its ambient air quality monitoring program into its environmental management plans as part of its response to the principle of continuous improvement.	Jay Project DAR	7.3.2.2
Dominion Diamond plans to develop an ambient air quality monitoring program that will be used to guide adaptive management strategies and the implementation of mitigation, if and as required, to maintain exposure to TSP levels below those that would be of concern.	Jay Project DAR	7.4.2.2.5
The Ekati Mine utilizes modern incineration equipment to achieve dioxin and furan concentrations below the federal emission guideline and will continue this practice for the Project.	Jay Project DAR	7.4.2.2.9
Dominion Diamond will incorporate mitigation as required to prevent negative effects to human health.	Jay Project DAR	7.4.2.2.11
Compliance inspection, environmental monitoring, and follow-up monitoring programs form part of the environmental management system for the Project. If monitoring or follow-up detects effects that are different from predicted effects, or the need for improved or modified design features and mitigation, then adaptive management will be implemented. This may include increased monitoring, changes in monitoring plans, or additional mitigation.	Jay Project DAR	7.7

Table 1.1-1 Summary of Commitments to Air Quality and Emissions

Commitment	Reference Document	Corresponding Section
Dominion Diamond will develop and execute ambient air quality monitoring programs as appropriate to validate that the predicted concentrations from the Project are conservative and to assist in managing that the Project emissions are kept to a reasonable level.	Jay Project DAR	8.6.3.3
Vehicle speed will be managed to limit dust production. Mitigation measures to reduce dust migration into offices and accommodation can also be considered.	Jay Project Wildlife and Human Health Risk Assessment	7.2.1.4
Dominion Diamond will manage dust and particulate emissions by continuing and evolving the following management practices: • water spray and dust suppressant application to control dust emissions on haul roads during summer or non-frozen season; and, • managing vehicle speed to limit road dust from vehicle wheel entrainment.	DAR Community Engagement Meetings Follow-up Reponses – February 2, 2015	1.3
Dominion Diamond is committed to Environmental Protection as is stated in our Sustainable Development Policy posted across Ekati, Yellowknife, and Sorting and Valuation Facility offices.	Round 1 IR Responses	DAR-GNWT-IR-69
The DAR provides Dominion Diamond's intention to amend the AQMMP to address monitoring and mitigation of air quality for the Jay Project. This will build on the current Ekati Mine AQMMP. Detailed changes to the AQMMP will be developed as part of the regulatory permitting based on the outcome of the Environmental Assessment. The Government of the Northwest Territories, Environment Canada, aboriginal communities, and other organizations will be engaged during the amendment of the AQMMP.	Round 1 IR Responses	DAR-GNWT-IR-4
The potential effects of the emissions associated with the airstrip will continue to be monitored throughout the life of the Project.	Round 1 IR Responses	DAR-IEMA-IR-40
The Government of the Northwest Territories, Environment Canada, aboriginal communities, and other organizations will be engaged during the amendment of the AQMMP.	Round 1 IR Responses	DAR-IEMA-IR-41
To reduce road dust, which is the largest source of fugitive dust or particulate matter emissions at the Jay Project, water and approved chemical suppressants will be used on the haul roads during seasons when the ground is free of snow and ice, which provide a high level of natural dust mitigation.	Round 1 IR Responses	DAR-MVEIRB-IR-7
Dominion Diamond is to hold a meeting with EC to clarify emissions model and will prepare a summary report of the results of this meeting to be submitted to the Review Board	DAR Technical Sessions – April 24, 2015	April 24 Transcript

DAR = Developer's Assessment Report; AQMMP = Air Quality Monitoring and Management Plan; EC = Environment Canada; GNWT = Government of the Northwest Territories; TSP = total suspended particulate.

1.2 Scope

The air quality monitoring and emissions management activities and planning are harmonized into one document, this AQEMMP. Information related to each component will be presented together in three-year summary reports.

The data generated from air quality monitoring serves a distinct purpose as does the data generated from the emissions management component of this plan. The ambient monitoring data collected through the execution of the monitoring plan will be used to validate the predicted concentrations derived through dispersion modelling assessment and will be compared to applicable Federal and Territorial ambient air quality standards. It will also be used to determine the effectiveness of mitigation strategies (e.g., the application of chemical suppressants to reduce dust). These data may from time to time be provided to other disciplines tasked with monitoring additional terrestrial and aquatic ecological receptors (e.g., wildlife, water quality). The emissions data generated will validate the inputs to the dispersion modelling and will be evaluated against pre-defined early-warning levels to identify where adaptive management responses may be necessary.

The overall purpose of the AQEMMP is to describe the activities involved in the monitoring and management of emissions and air quality and to provide a template for the monitoring reports. This report is a “living” document that may need to be adaptively managed over the life of the Project and the Ekati Mine.

1.3 Objectives

The AQEMMP has been prepared not only to address ambient air quality matters specifically, but also to provide data that will support the study of the linkages between air quality and areas of study. This document and the monitoring program provide a framework for air quality monitoring that can be used to support cross-disciplinary study. This document has been developed to address the following objectives:

- enable evaluation against applicable Federal and Territorial ambient air quality standards;
- track trends in ambient air quality and emissions;
- validate air quality predictions made in the DAR and associated follow-up work such as updates provided in adequacy review responses and IRs;
- identify the need for adaptive management response plans by evaluation of results against pre-defined early warning levels; and,
- provide data including dust deposition to evaluate effects to aquatic and terrestrial ecological receptors.

To achieve these objectives, Section 2 of the AQEMMP concentrates on the following four main components:

- on-site meteorological monitoring;

- ambient monitoring of total suspended particulate (TSP), fine particulate matter with mean aerodynamic diameter 2.5 micrometres (μm) or smaller ($PM_{2.5}$), sulphur dioxide (SO_2), and nitrogen oxides (NO_X);
- passive monitoring of nitrogen dioxide (NO_2); and,

Snow, Lichen, and Vegetation Studies.

Section 3 focuses on the following three main components:

- emissions estimates and measurement;
  - Criteria Air Contaminants (CACs) – emission factor approach;
  - Greenhouse Gases (GHGs) – emission factor approach; and,
  - dioxins, furans, and mercury – stack testing approach
- fuel use summary; and,
- emissions mitigation strategies.

1.4 Methods and Approach

Dominion Diamond understands the need for adaptive management of the monitoring programs and acknowledges that the monitoring sites may change as the Project evolves. However, effort will be made to maintain consistency in the reference monitoring locations, as this is an important consideration in conducting trend analysis. In addition, Dominion Diamond will engage with communities for their input on the ongoing development of the AQEMMP.

Monitoring activities will consist of “off-site”, i.e., ambient monitoring. Ambient monitoring is not intended to provide information related to worker exposure in the workplace, as this is dealt with in other Dominion Diamond Health Safety and Environment (HSE) programs. Off-site monitoring is expected to occur a short distance outside of the active, developed area of the Ekati Mine and it now specifically includes monitoring near the Jay Pit which would provide increased coverage of Project activities which are not located near current monitoring stations. The locations have been chosen based on areas of maximum off-site predictions presented in the DAR and associated follow-up work such as updates provided in adequacy review responses and IRs, and with consideration to areas of interest from other disciplines. A map of the Project site indicating the proposed active Project area and the proposed air monitoring locations is provided in Section 2 (Map 2.1-1).

The monitoring data will enable comparison between applicable ambient air quality standards and concentrations measured at or beyond the Project boundary. The Project boundary for the purposes of air quality is defined in Section 7 of the DAR as the extent of the disturbed area of Project operations. This off-site monitoring is important because it provides an indication of the ambient concentrations of air emissions to which the public engaged in local and traditional land use activities in the area, or other components of the receiving environment including caribou, other wildlife, or vegetation, may be exposed. The effectiveness of the AQEMMP is dependent, in part, on selecting appropriate criteria against which Project emissions and the resulting ambient air concentrations should be compared. The Project will evaluate results against the applicable Northwest Territories (NWT) Ambient Air Quality Standards, Canadian Ambient Air Quality Standards and National Air Quality Objectives for TSP (24-hour and annual), $PM_{2.5}$ (24-hour), and NO_2 and SO_2 (1-hour, 24-hour and annual) (GNWT 2014; CCME 2000a,b; CCME 2001; Environment Canada 1981). Table 1.4-1 provides the relevant air quality standards.

Table 1.4-1 Relevant Ambient Air Quality Standards and Objectives

Parameter	NWT Standards[(a)]	Canadian-Ambient Air Quality Standards[(b)]
SO_2 [μg/m³]		
1-Hour	450	—[(d)]
24-Hour	150	—
Annual	30	—
NO_2 [μg/m³]		
1-Hour	400	—
24-Hour	200	—
Annual	60	—
TSP [μg/m³]		
24-Hour	120	—
Annual[(e)]	60	—
$PM_{2.5}$ [μg/m³]		
24-Hour	28	28, (27) [(f)]
Annual	10	10, (8) [(f)]

a) Source: GNWT 2014.
b) Source: Environment Canada 2013.
c) Source: Environment Canada 1981.
d) "—" = not applicable.
e) As a geometric mean.
f) 28 = 2015 Standard, (27) = 2020 Standard), 10 = 2015 Standard, (8) = 2020 Standard

In addition to evaluating Project emissions and ground-level concentrations against applicable regulatory standards, it is Dominion Diamond's intent to manage emissions and ground-level concentrations in keeping with the principles of "Continuous Improvement" and "Keeping Clean Areas Clean", as described in the Canada-Wide Standards for Particulate Matter and Ozone (CCME 2000a). Therefore, the monitoring of trends in emissions and ambient air quality is an important component of the AQEMMP, as discussed in Sections 2 and 3.

Dominion Diamond has incorporated a number of design features that demonstrate the concepts of "Continuous Improvement" and "Keeping Clean Areas Clean." These include, but are not limited to, the following:

- selection of highly-efficient combustion equipment including the use of low emission engines available for most new construction and mining equipment;
- use of ultra low-sulphur diesel (15 ppm or lower);

- Biodiesel pilot project;
- efficient haul routes to tailings facilities;
  - the Project plan design minimizes haul distances, and therefore, reduces fuel consumption; and,
  - Ekati Mine operating practices that minimize idling of equipment during cold weather (i.e., large equipment will be shut down rather than allowed to idle during breaks and shift changes, and small equipment will have plug-in block heaters to avoid idling).
- modern incineration facilities and waste segregation policies;
- worker education;
- on-site recycling programs including a composting facility;
- development of an air quality management plan to guide actions and documentation needs around air quality;
- design waste heat recovery systems to capture heat that can be used for building heating coupled with modern heating and ventilation equipment for all enclosed workplaces and living environments; and,
- the design of highly insulated buildings including camp to minimize heat loss.

Implementation of these policies and practices demonstrates Dominion Diamond's ongoing efforts to reduce emissions through the application of continuous improvement.

The AQEMMP covers the three main phases of the Project: construction, operations, and closure. As the construction, operations, and closure phases of monitoring will occur over many years, the three year report will evolve as management and monitoring needs change.

2 AIR QUALITY MONITORING PROGRAM

2.1 Introduction

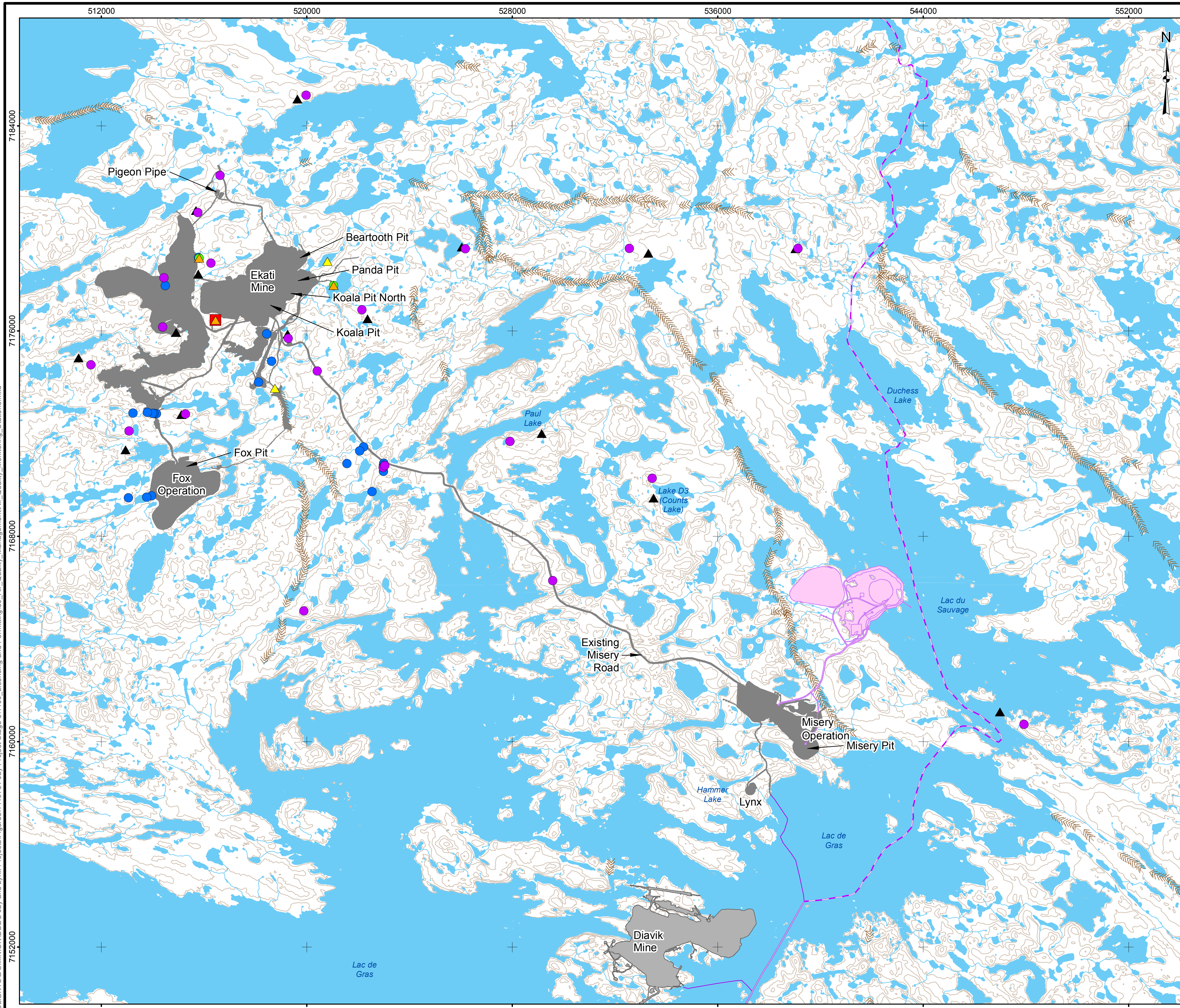
The AQEMMP will be used to coordinate monitoring of ambient air quality at the existing Ekati facilities and the Jay Project when it comes on-line during the construction, operations, and closure phases. Air quality monitoring will be used to validate the effect of emissions on water quality, and deposition on plants and soil in the study area. Air quality monitoring will also be compared to applicable air quality criteria and the DAR (Dominion Diamond 2014) and analyzed for trends in the three-year report. In this way, the implementation of the AQEMMP will be able to provide an indication of the Project's performance with respect to air quality.

The main components of the air quality monitoring program, AQEMMP, and the sub-sections in which they are discussed, are as follows:

- meteorological monitoring (Section 2.2);
- TSP and $PM_{2.5}$ monitoring (Section 2.3);
- Dustfall and Sulphate and Nitrate Deposition (Section 2.4);
- SO_2 and NO_2 monitoring (Section 2.5); and,
- quality assurance/quality control (QA/QC) (Section 2.6).

Map 2.1-1 shows the proposed monitoring station locations at the Project during the construction phase. As the Project evolves, the proposed monitoring station locations, excluding background, existing or reference stations, may change.

For each of the AQEMMP components, the details of the monitoring station locations, methods, parameters, frequency, and data analysis are presented in the following sections.



LEGEND

- EKATI MINE FOOTPRINT
- DIAVIK MINE FOOTPRINT
- PROPOSED JAY FOOTPRINT
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- ELEVATION CONTOUR (10 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY

EXISTING STATIONS

- CONTINUOUS AIR MONITORING BUILDING (CAMB)
- DUSTFALL STATION
- HIGH VOLUME AIR SAMPLING (HVAS) STATION
- LICHEN SAMPLING LOCATIONS
- METEOROLOGICAL STATION
- PARTISOL STATION
- SNOW CHEMISTRY SAMPLING LOCATION

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NOTES

JAY PROJECT AIR MONITORING LOCATIONS WILL BE FINALIZED AS ENGAGEMENT ACTIVITIES ARE COMPLETED

REFERENCE

EXISTING STATION LOCATIONS PROVIDED BY ERM RESCAN
CANVEC © NATURAL RESOURCES CANADA, 2012
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

3 0 3
SCALE 1:150,000 KILOMETRES

PROJECT
DOMINION DIAMOND
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
EXISTING AND PROPOSED AIR QUALITY MONITORING STATION LOCATIONS

Golder Associates

PROJECT	1419751.4100.50		FILE No.	
DESIGN	MJ	27/05/15	SCALE AS SHOWN	REV 0
GIS	ANK	01/06/15		
CHECK			MAP 2.1-1	
REVIEW				

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2.2 Meteorological Monitoring

Meteorological data are collected on an hourly basis at the Ekati Mine airstrip by Dominion Diamond airport staff. Measurements of temperature, pressure, wind speed, wind direction, visibility, humidity, wind chill calculations, and general site conditions (e.g., blowing snow, fog) are recorded to support aircraft travel.

The parameters monitored by the Koala weather station include wind speed, wind direction, relative humidity, temperature, and rainfall/precipitation. The data are also used by other disciplines to aid in the analysis of other monitoring data. Meteorological monitoring is an important input for any subsequent emissions dispersion modelling assessments that may be required during the life of the Project. The data play a crucial role in the characterization of general air quality trends and specific meteorological conditions at the Project site.

Additionally, a micrometeorological station operates on Polar Lake during the open-water season to provide data for Penman evaporation calculations. The location of this station is also shown on Map 2.1-1.

During winter months, a Nipher Snow Gauge at the Koala meteorological station is monitored following large snowfalls to generate monthly totals for snow-water equivalent precipitation. Snow is collected in a copper cylinder which is situated in the middle of the shield. The shield for the gauge, which is shaped like the terminus of a trumpet, has been designed to minimize the turbulent effects of wind over the gauge mouth.

Meteorological data (air temperature and precipitation) obtained from Lupin and Yellowknife airport are used for comparison with the data collected at the Ekati Mine.

The automated meteorological stations include a datalogger that collects a reading from each of the sensors every five seconds. Averages are automatically generated and saved to final storage on an hourly and daily basis. The array containing the daily averages for the sensors is saved to final storage at midnight. Data are saved to a storage module which is taken back to the Environment Department office and downloaded monthly. The station continues to operate after the storage module has been removed. As soon as data are collected from the storage module using a laptop computer, they are checked for gaps and to confirm that all of the sensors are working. The data are then added to the existing database for each climate station. If there are no problems with the station or the data, the memory of the storage module is cleared. The storage module is then returned to the weather station.

A preventive maintenance program continues to reduce the amount of missing data for each of the automated stations. A fresh (calibrated) set of sensors is installed at one of the stations at a pre-determined interval and the used sensors are returned to the supplier for maintenance. This rotating maintenance routine reduces the risk of missing data and enhances the overall accuracy of the data. A record of the scheduled maintenance is maintained.

2.2.1 Monitoring Station Location

The Koala automated meteorological station (Map 2.1-1) was installed in August 1993 at the 'Old Camp' site and continues to operate at that location.

2.2.2 Monitoring Methods

Meteorological data will be collected continuously using industry-standard sensors and data collection equipment. No changes to the current Ekati meteorological monitoring program are proposed for the Project. The monitored parameters are listed in Section 2.2.4.

2.2.3 Monitoring Frequency

Meteorological monitoring will be conducted year-round throughout the construction, operations, and closure phases of the Project. Meteorological data will be measured continuously and recorded hourly. The data will be downloaded bi-weekly by Dominion Diamond site staff.

2.2.4 Monitoring Parameters

The tower system will continuously measure the following meteorological parameters:

- wind speed at 10 m above the ground;
- wind direction at 10 m above the ground;
- temperature at 2 m above the ground;
- relative humidity at 2 m above the ground;
- solar radiation at 2 m above the ground; and,
- precipitation.

2.2.5 Data Analysis

A summary of the meteorological monitoring will be presented in the three-year report. Extreme meteorological events and trends will be identified, where necessary, and discussed in the report.

2.3 Total Suspended Particulate and $PM_{2.5}$ Monitoring

Suspended particulate matter (fine dust) emissions will be generated by wind erosion of local landscapes, removal and displacement of rock and overburden from the pit, movement of vehicles/equipment, airstrip activities, construction activities, the combustion of diesel fuel, and solid waste incineration.

Suspended particulate matter emissions are generally grouped into a number of different size fractions. The particulate matter size fractions considered in this plan are as follows:

- TSP – which includes particulate matter nominally less than 100 μm; and
- $PM_{2.5}$ – which includes particulate matter nominally less than 2.5 μm.

2.3.1 Monitoring Station Locations

This version of the AQEMMP includes the ongoing operation of the existing Ekati Mine particulate monitoring stations and incorporates the addition of monitoring for particulate in the vicinity of the Jay Pit. The proposed monitoring location during the construction, operations, and closure phases of the Project at the Jay Pit has been selected to provide a conservative management approach to ambient particulate concentrations. The location has been selected based on the areas of maximum off-site particulate predictions in the DAR and the follow-up work in the IR process and where line power is available or can be made available.

Accessibility to the site has also been considered. Dominion Diamond recognizes that establishing permanent locations is an important part of producing consistent data suitable for ongoing comparison purposes and trend analysis. The station is located at the Project boundary on the east side of the Jay Pit to account for the dominant, seasonal wind direction and for the areas of predicted higher concentrations of particulates and combustion-based emissions.

2.3.2 Monitoring Methods

The Dominion Diamond Ekati Mine particulate monitoring program has evolved over the life of the existing operation and now includes a combination of partisol samplers designed to measure TSP and $PM_{2.5}$ and continuous samplers. Partisol samples are drawn nominally every sixth day, consistent with the National Air Pollution Surveillance (NAPS) schedule. The Partisols operate on the principle of a measured stream of air being passed through a pre-weighed filter and size-selected particles are deposited and retained on the filter. The filter-based samples are then sent to an accredited laboratory for analysis and determination of ambient concentrations. Continuous particulate monitoring is also conducted using beta-attenuation (Met-One BAM 1020) monitors. This monitoring is conducted continuously and records hourly data at the Mine.

Continuous Ambient Particulate Monitors operate on the principle that a stream of ambient air at a controlled flow rate is drawn through a size-selective inlet and deposited onto an auto-advancing filter tape. Detection of beta particles passed through the filter tape allows for a measurement of the accumulation of particulate deposited onto the filter tape. The measurement of the accumulated particles and air volume are used to derive the measured ambient concentrations for a given time period.

2.3.3 Monitoring Frequency

Particulate sampling using the Partisols will be conducted every sixth day, year-round.

Continuous monitoring using the BAM 1020s allows for the detection of intermittent or short-term outlier events and supplies data for a robust data set. Near real-time analysis of the continuous data can also be performed to assist the analyst to conditions of interest or equipment faults. This type of analysis is not possible using the filter-based methodology.

Monitoring of TSP and fine particulate matter will continue beyond construction, into the operations and closure phases of the Project.

2.3.4 Data Analysis

The TSP and $PM_{2.5}$ data from each of the monitoring locations (existing stations and the new station near the Jay Pit) will be analyzed for indications of air quality concerns on an annual basis (e.g., increasing trends, measured concentrations above the DAR predictions, or applicable ambient air standards). The results of this analysis will be presented every third year in a summary report and will be used to update and modify the dust management procedures. The analysis of spatial particulate trends will compare measured particulate concentrations from the monitoring stations.

The possibility exists that unusual events in the region (e.g., forest fire transporting airborne particulate) could result in higher than normal measured particulate concentrations. Any such unusual event will be analyzed in conjunction with the on-site meteorological data to investigate the cause of the event.

The analysis of temporal trends will look for consistent trends in the measured particulate concentrations on an annual basis. The response planning and action levels to deal with increasing trends are described in Section 4. Managing trends in ambient particulate concentrations on an annual basis is appropriate given the scale of the Project and the long-term nature of the monitoring program.

2.4 Dustfall Monitoring and Sulphate and Nitrate Deposition

The main dust generation processes at the Project will be wind erosion of fugitive sources, removal and displacement of rock and overburden from the pit, rock crushing, and movement of vehicles/equipment on site. When the particles are large enough they can settle from the air onto vegetation or waterbodies. The dustfall monitoring program measures the quantities of dust deposited near the Project.

The monitoring equipment at each site is static, with each site consisting of two sets of canisters mounted to a dedicated pole. Data are collected passively over consecutive, one-month periods. One monitor collects data for laboratory analysis of metals, and the other collects sample to be analyzed for sulphate, nitrate, and soluble and insoluble particulate.

The canisters are retrieved and submitted for laboratory analysis every 30 days, at which time, replacement canisters are installed. The first sampling of the year occurs in June, and the last canisters are retrieved in September. Monitoring is thus conducted for the months of June, July, and August.

Data from the haul roads are compared to data collected from two background monitoring sites, which coincide with the snow and lichen collection sites AQ-49 and AQ-54. These sites are located approximately 20 and 35 km west of the main Ekati site respectively.

2.4.1 Monitoring Station Locations

In 2007, dustfall stations were erected along the Misery, Sable, and Fox haul roads to measure the dust deposition from these sources (see Map 2.1-1). Each road had groups of four stations, one station approximately 30 m from the road centreline on the predominantly upwind (northeast) side of the road, and the other three stations on the predominantly downwind side (southwest) at 30 m, 90 m, and 300 m from the road centreline. In 2008, the monitoring array was increased to measure deposition values 1,000 m from the road centreline. As a result, the exact location of the monitors was altered for the Fox haul road, as 1,000 m from the centreline of the road at the initial location was in a lake. In 2008, the Sable road stations were discontinued, due to inactivity at this location, and were relocated to east and northwest of the airstrip, and to the Long Lake Containment Facility (LLCF) at Dike B and adjacent to TSP-3.

An additional dustfall station is proposed on the east side of the Jay Pit in an area predicted to receive relatively larger amounts of deposited particles as described in the DAR. The proposed location for the new Jay station(s) is shown on Map 2.1-1. Additionally, Dominion Diamond expects to establish a dustfall station transect along the Jay Road to monitor dust deposition levels associated with the Jay Project specifically. Specific locations for the monitors will be determined through engagement with communities and regulators during the permitting process.

Dustfall sample locations may continue to be refined on an annual basis based on sample results or areas of special interest.

2.5 Passive Monitoring of Nitrogen Dioxide

The main sources of NO_2 emissions from the Project will be the Ekati Mine power plant, mining activities including the fleet of haul trucks, and the incinerators. Dominion Diamond intends to incorporate passive monitoring of NO_2 into the AQEMMP to evaluate against the NWT Ambient Air Quality Standard for NO_2 (GNWT 2014).

2.5.1 Monitoring Station Locations

The proposed passive NO_2 monitoring stations is to be co-located with the “90 metre” dustfall monitoring station proposed for the Jay Project area and with the continuous air monitoring building. Co-locating these stations will allow for the efficient collection of samples and the passive data can be validated using the continuous data. Additional passive monitoring stations will be evaluated if they are warranted.

2.5.2 Monitoring Methods

Passive NO_2 samplers are proposed for the Jay Project. The monitors are suitable for this type of program as they require no electricity, and can be left unattended for extended periods. The sample media are taken to the field and exposed in protective shelters that are mounted to a support pole or small tripod. The passive samplers will be exposed for a nominal period of 30 days before they are retrieved, replaced, and sent to the laboratory for analysis.

2.5.3 Monitoring Frequency

Passive samplers are exposed in the field for a nominal period of 30 days. Sampling will be carried out year-round. As passive sampling is done over a longer period to allow for a sufficient sample size for analysis, it provides an indication of longer-term air quality trends. Comparison to the annual NO_2 standard is appropriate.

Passive NO_2 monitoring is proposed for the operations phase of the Project. Should it be discovered that NO_2 concentrations are consistently less than predicted in the DAR, or are static for the first few years of operation, the frequency of monitoring may be adjusted depending on the acceptability of this to the regulatory agencies.

2.5.4 Monitoring Parameters

The passive samples will be analyzed for the potential presence of NO_2.

2.5.5 Data Analysis

The ambient NO_2 concentrations measured at the passive stations will be analyzed for spatial and temporal trends.

The analysis of the NO_2 sampling results will include the comparison of results with the NWT Ambient Air Quality Standard (GNWT 2014). However, since the passive sampling data are collected on a monthly basis and the NWT standards do not have monthly criteria, the annual average of the monthly data will be compared to the annual NWT standards for NO_2. The passive monitoring will be used to supplement the data generated through emissions calculations and the continuous monitoring that are presented in the three-year report.

Analysis of spatial trends will include comparisons between the passive stations.

The analysis of temporal trends will look for consistent, increasing trends in the measured NO_2 concentrations on an annual basis. The response planning and action levels for increasing trends are described in Section 4.

2.6 Lichen Tissue Sampling

Lichen studies were conducted at the Ekati Mine approximately third year since 1998, with the most recent survey conducted in 2014.

Lichens are well known for being good indicators of air quality and are commonly used as monitors for heavy metal accumulation. They are suitable biomonitors due to their wide geographical distribution, their availability for collection throughout the year, and their stable morphology (little seasonal variability). Unlike snow monitoring, which accumulates only one season's worth of deposition, lichens can demonstrate cumulative effects over time.

2.6.1 Monitoring Station Locations

In 2014, lichen samples were collected at 39 sampling locations, many of which coincided with the snow sampling locations to facilitate comparability of the data. A total of five microsites samples were taken from mid elevation of the slopes and were combined to form a composite sample. Depending on local abundance, either *Flavocetraria cucullata* or *Peltigera aphthosa* species were collected. If both species were present at a site, both were collected. An additional lichen sampling plot is proposed to be co-located with the 90 metre dustfall station associated with the new Jay pit.

2.6.2 Monitoring Methods

Samples are obtained using latex gloves and are collected by either breaking the lichen off by hand, or cutting with stainless steel scissors if wet. Samples are then placed into clean, properly labelled, paper bags. Tools are cleaned and dried between sites.

Post collection, lichen is air dried overnight at room temperature, repackaged, and then sent to the laboratory for analysis of Total Metals (by ICP-MS), Mercury, Total Sulphur, and Total Kjeldahl Nitrogen.

2.6.3 Monitoring Frequency

The lichen sampling program is carried out every third year. The most recent program was in 2014, and the next anticipated round of sampling will be in 2017.

2.6.4 Monitoring Parameters

Parameters currently assessed in the Ekati lichen monitoring program will be carried forward and used after the Jay Project commences.

2.6.5 Data Analysis

The data will be reviewed and analyzed to determine, where possible, the following: relationship between distance from the mine site and the concentration of elements in *Flavocetraria cucullata*; difference in element concentration in co-located *Flavocetraria cucullata* between the historic sampling; and relationship between dustfall and snow melt water with the lichen and soil sample collection areas.

2.7 Snow Chemistry

Snow core and snow scoop samples are collected on an every three year basis to determine the snow quality; sampling is completed just prior to spring melt.

2.7.1 Monitoring Station Locations

The snow sampling program was revised in 2008 in discussion with Environment Canada, GNWT, and IEMA and based on a review of the 2005 sampling program. The 2008 program involved 33 sites, some within the mine footprint and others in a generally radial pattern away from the minesite, to measure background effects and/or effects over distance. Map 2.1-1 identifies the sampling locations from the 2014 program. A supplemental snow chemistry monitoring site will be included and co-located with the 90 metre dustfall and NO_2 passive sampling station on the east side of the Jay Pit.

2.7.2 Monitoring Methods

Snow samples are collected at each sample location using a snow corer. Samples are collected by inserting the snow corer vertically into the base of the snow column. If required, the area about the perimeter of the corer is shovelled to facilitate removal, and the shovel is inserted at the base of the snow corer to retain the sample. If vegetation or dirt is present at the base, the bottom section of the snow core (approximately 5 cm) is discarded to prevent contamination of the sample.

At each of the 33 sample sites, a snow sample is taken at the top, middle, and toe of representative slopes according to the following methods.

Dependent on the depth of snow encountered, one of the following sampling methods is employed:

- Snow core samples collected from deep snow are homogenized in a clean plastic Ziploc bag. A four-litre sub-sample is collected; or,
- Where snow depth is insufficient to permit a core sample, for example on a windblown lake, scoop samples are taken and then homogenized in a clean plastic Ziploc bag. A four litre sub-sample is collected.

Snow is melted in the plastic bags, transferred into water sampling bottles, and then sent to the laboratory for analysis. Analyzed snow chemistry parameters are listed in Table 2.7-1.

2.7.3 Monitoring Frequency

Snow core and snow scoop samples are collected on an every three year basis to determine the snow quality; sampling is completed just prior to spring melt. This sampling was completed in 1998, 2001, 2005, 2008, 2011, and 2014. The next sampling program is planned for 2017.

2.7.4 Monitoring Parameters

Monitoring parameters for snow chemistry monitoring are listed in Table 2.7-1.

Table 2.7-1 Parameters for Snow Chemistry Monitoring

Variables	Units	Variables	Units
Physical/Ion		**Total Metals**	
Alkalinity, Total	mg/L	Aluminum (Al)	mg/L
Bicarbonate (HCO_3)	mg/L	Antimony (Sb)	mg/L
Carbonate (CO_3)	mg/L	Arsenic (As)	mg/L
Conductivity (EC)	µS/cm	Barium (Ba)	mg/L
Hydroxide	mg/L	Beryllium (Be)	mg/L
pH	pH	Boron (B)	mg/L
Chloride (Cl)	mg/L	Cadmium (Cd)	mg/L
Potassium (K)	mg/L	Calcium (Ca)	mg/L
Silicon (Si) – Total	mg/L	Chromium (Cr)	mg/L
Sulphate (SO_4)	mg/L	Cobalt (Co)	mg/L
Total Suspended Solids	mg/L	Copper (Cu)	mg/L
Turbidity	NTU	Iron (Fe)	mg/L
Hardness	mg/L	Lead (Pb)	mg/L
Ion Balance	%	Magnesium (Mg)	mg/L
TDS (Calculated)	mg/L	Manganese (Mn)	mg/L
		Mercury (Hg)	mg/L
Nutrients/Organics		Molybdenum (Mo)	mg/L
Total Ammonia-N	mg/L	Nickel (Ni)	mg/L
Nitrate-N	mg/L	Selenium (Se)	mg/L
Nitrite-N	mg/L	Silver (Ag)	mg/L
Orthophosphate (PO_4-P)	mg/L	Sodium (Na)	mg/L
Total Phosphorus	mg/L	Strontium (Sr)	mg/L
Total Organic Carbon	mg/L	Uranium (U)	mg/L
Total Kjeldahl Nitrogen	mg/L	Vanadium (V)	mg/L
		Zinc (Zn)	mg/L

mg/L = milligrams per litre; NTU = nephelometric turbidity unit; µS/cm = microsiemens per centimetre; % = percent.

2.7.5 Data Analysis

Parameters currently assessed in the Ekati snow chemistry monitoring program will be carried forward and used after the Jay Project commences.

2.8 Quality Assurance/Quality Control Procedures

Quality Assurance (QA) refers to plans or programs that encompass a wide range of internal and external management and technical practices designed to ensure the collection of data of known quality that matches the intended use of the data. Quality Control (QC) is a specific aspect of QA that refers to the internal techniques used to measure and assess data quality (American Public Health Association et al. 2012). As QC procedures implemented as part of the AQEMMP are variable and program-specific, the procedures have been summarized in this section on a program component basis.

2.8.1 Meteorological Monitoring

The QA/QC procedures for the meteorological monitoring program include the following:

- Data are to be downloaded from the station(s) bi-weekly and manually checked by qualified personnel for anomalous data that may indicate problems with the system.
- Sensors will be calibrated on a schedule consistent with each sensor's requirements (generally every 12 to 24 months) based on manufacturer specifications and professional experience.
- The station will be attended weekly (as weather conditions permit) to ensure that sensors within reach are free of debris, frost or damage that may prevent accurate measurement of meteorological data. A checklist has been developed that allows an organized approach to determining the fitness of the station.
- Data will be downloaded consistent with detailed written operating instructions..

2.8.2 Continuous Particulate, SO_2, and NO_2 Monitoring

QA/QC procedures for the continuous monitoring program include the following:

- Continuous samplers will be calibrated and maintained quarterly or on the recommended schedule as prescribed by the analyzer's manufacturer.
- Data will be downloaded consistent with detailed written operating instructions from qualified personnel.

2.8.3 Passive Monitoring

The QA/QC procedures for the passive monitoring program include the following:

- Travel blanks (laboratory prepared samples that travel with the samples but are not exposed to the atmosphere) will be used.
- Duplicate samples will be exposed and analysed.
- Laboratory blanks will be analyzed.
- An accredited laboratory will be used for pre-sample preparation and analysis.
- Samples will be collected consistent with detailed written operating instructions from qualified personnel. Qualified personnel (i.e., a certified laboratory technician, professional air quality scientist or engineer) will calculate ambient NO_2 concentrations based on laboratory results.

3 EMISSIONS MONITORING PROGRAM

3.1 Introduction

The AQEMMP will be used to coordinate the monitoring of emissions during the construction, operations, and closure phases of the Project. Emissions calculated for these phases will be compared to the DAR emission estimates and the updates presented in the IR process to evaluate the emissions performance. This process will occur on an annual basis and will be summarized in the three-year report along with a description of adaptive management response plans, if necessary.

The three main components of the emissions monitoring program of the AQEMMP, and the sub-sections in which they are discussed, are as follows:

- emissions estimates (Section 3.2);
- fuel use summary (Section 3.3); and,
- emissions mitigation strategies, which include the dust abatement program (Section 3.4).

3.2 Emission Estimates

This section presents the approaches that will be used in the report to provide a summary of emissions at the Project. This section identifies the various types of emissions from the Project and provides examples of approaches for calculating these emissions. The calculated emissions will be compared to those in the air quality assessment presented in the DAR to evaluate emissions performance.

The emissions estimate component of the AQEMMP has the following objectives:

- to demonstrate commitment to ongoing monitoring of emissions at the Project site;
- to provide an overview of the appropriate methods for calculating emissions from the Project;
- to enable an evaluation of Project emissions against those modelled in the DAR; and,
- to demonstrate Dominion Diamond’s approach to continuous improvement.

3.2.1 Types of Emissions

3.2.1.1 Combustion Emissions

Combustion is the process of burning fuels of various types, and using the energy released to produce electricity, space or process heating, or to facilitate on-site transportation and incineration. There are three primary combustion sources at the Project:

- power generators;
- Project fleet; and,
- incinerators.

Compounds such as oxides of nitrogen (NO_X), particulates and greenhouse gases (GHGs) are common combustion by-products from the Project sources. These by-products are the subject of regulatory guidance which limits the release amounts of the compounds to protect the receiving environment. Dominion Diamond has committed to meet the relevant NWT Ambient Air Quality Standards (Table 1.4-1) that apply to these compounds (GNWT 2014).

In addition to the ambient air quality criteria for common combustion compounds (i.e., NO_2, and suspended particulates), there also exist Canada-Wide Standards for other combustion by-products, such as dioxins, furans, and mercury that may be released during on-site waste incineration (CCME 2001). A summary of the Canada-Wide Standards for dioxins, furans, and mercury is presented in Table 3.2-1 and these apply to municipal waste incineration at new facilities such as the Project. The achievement of these Canada-Wide Standards requires that the best available control techniques, such as a waste diversion program, be used.

By calculating and reporting emissions in a summary report and further to Environment Canada's National Pollutant Release Inventory (NPRI), Dominion Diamond can determine whether operational emissions are at or below the accepted standards and the emission estimates provided in the DAR.

Reporting on dioxins, furans, and mercury emissions will be completed under the direction of the Ekati Mine Incinerator Management Plan.

Table 3.2-1 Canada-Wide Standards for Municipal Waste Incineration Emissions

Municipal Waste Incineration Compound	Emission Limit
Dioxins and Furans[a]	80 picograms of International Toxic Equivalents (I-TEQ) per cubic metre (pg/m^3)
Mercury[b]	20 micrograms per cubic metre ($\mu g/m^3$)

a) CCME 2001.
b) CCME 2000b.

3.2.1.2 *Fugitive Emissions*

Fugitive emissions are expected as a result of the Project construction and operation activities and are expected to consist primarily of fugitive dust.

Fugitive dust emissions can result from Project sources through either mechanical or natural processes. Examples of mechanical processes that can generate fugitive dust include crushing, materials handling, vehicle fleet operation, heavy equipment operation, and vegetation removal. The main natural process that generates fugitive dust is wind erosion. There are three main potential fugitive emission sources at the Project:

- the roads;
- the Jay Pit; and,
- the waste rock storage area.

3.2.1.3 Methods

This section describes three methods that can be used to estimate Project emissions (depending on the compounds). The methods are:

- using a mass balance approach;
- using an emission factor approach (published or calculated); or,
- using available intermittent source stack testing data.

The mass balance approach is based on the law of conservation of mass in a system. Essentially, if there is no accumulation within the system, then all the materials that go into the system must come out. Fuel analysis data is a good example of the mass balance approach in predicting emissions.
For example, if the sulphur content of a fuel is known, then the emissions of sulphur (in the form of SO_2) can be calculated by assuming that all of the sulphur in the fuel is emitted from the system.

The second approach proposed for estimating emissions is the use of emission factors. Emission factors are available for many emission source categories and are based on the results of source tests performed at one or more facilities within an industry. An emission factor is the contaminant emission rate relative to the level of source activity. Generic emission factors are commonly used when site-specific source monitoring data are unavailable.

The use of source-specific stack testing data is appropriate for emission sources or compounds that may be difficult to characterize using either mass balance or emission factors. A stack test measures the amount of a specific compound(s) present in the stack exhaust gas.

The appropriate/recommended methods that can be used for estimating emissions of specific compounds are as follows based on professional experience:

- SO_2 – mass balance approach;
- NO_X – emission factor approach;
- particulates – emission factor approach;
- GHGs – emission factor approach; and,
- dioxins, furans, and mercury – stack testing approach.

The following sections provide examples of how emissions will be calculated using each of aforementioned approaches at the Project. The recommended methods are consistent with those used in DAR and with other northern Canadian Mines.

3.2.1.4 Sulphur Dioxide Emission Calculation Methods

3.2.1.4.1 Sulphur Dioxide Combustion Emissions

The diesel fuel used at the Project contains trace amounts of sulphur. When the fuel is burned, the sulphur oxidizes to form SO_2. To estimate SO_2 emissions from the Project, the mass balance approach is recommended.

An example calculation of using this approach for a power plant is provided below. In the example calculation, a fuel sulphur content of 0.05 percent (%) by weight (500 parts per million by weight [ppmw]) is assumed. Supplier documentation will be used to confirm the fuel sulphur content for each reporting period.

Example: Assume the engines in a power plant consume 24,000 cubic metres (m^3) of fuel per year, and that the fuel has a density of 881 kilograms per cubic metre (kg/m^3) and a sulphur content of 0.05% by weight.

$$M = \rho \times V_f \times f_S \times \frac{MW_{SO2}}{MW_S}$$

where:

M	=	total emissions, (tonnes per year)
ρ	=	fuel density, (kg/m^3)
Vf	=	volume of fuel used, (m^3 per year)
fS	=	fraction of sulphur in fuel, (unit-less)
$MWSO_2$	=	molecular weight of SO_2, (64.06 kilograms per kilomole [kg/kmol])
MWS	=	molecular weight of sulphur, (32.07 kg/kmol)

Note: The above is a general equation designed to estimate SO_2 emissions from the combustion of fuel based on known fuel sulphur content.

Calculate the total weight of the compound released in kilograms per year (kg/year).

$$M = \frac{881 kg}{m^3} \times \frac{24{,}000 m^3}{year} \times 0.0005 \times \frac{64.06 kg / kgmol SO_2}{32.07 kg / kgmol S} = 21{,}117.63 \frac{kg SO_2}{year}$$

Convert the annual release to a daily value in tonnes.

$$21{,}117.63 \frac{kg SO_2}{year} \times \frac{1 year}{365 days} \times \frac{1 tonnes}{1000 kg} = 0.058 \frac{tonnes SO_2}{day}$$

3.2.1.4.2 Sulphur Dioxide Fugitive Emissions

In addition to Project combustion emissions, fugitive emissions should also be considered. In the case of SO_2, no fugitive emissions are expected from the Project.

3.2.1.5 Oxides of Nitrogen Emission Calculation Methods

3.2.1.5.1 Oxides of Nitrogen Combustion Emissions

Fuel burned in combustion equipment produces NO_X emissions at the Project. An example calculation of power plant NO_X emissions using the emission factor approach is provided below.

Example: Assume the engines in a power plant consume 24,000 m³ of fuel per year and the diesel specifications indicate that the heating value of diesel is 0.0449 gigajoules per kilogram (GJ/kg) of fuel consumed. Furthermore, the diesel has a density of 881 kg/m³ and the emission factor for NO_X is 1,376 grams per gigajoule (g/GJ).

$$M = \rho \times V_f \times HV \times E$$

where:

M	=	total emissions, (tonnes per year)
ρ	=	fuel density, (kg/m³)
Vf	=	volume of fuel used, (cubic metres per year [m³/year])
HV	=	fuel heating value, (GJ/kg)
E	=	emission factor, (g/GJ)

Note: The above is a general equation for emissions estimation using emission factors.

Calculate the total weight of the compound released in grams per year (g/year).

$$M = \frac{881 kg}{m^3} \times \frac{24{,}000 m^3}{year} \times \frac{0.0449 GJ}{kg} \times \frac{1{,}376 g}{GJ} = 1.306 x 10^9 \frac{g}{year}$$

Convert the annual release to a daily value in tonnes.

$$1.306 x 10^9 \frac{g}{year} \times \frac{1 tonne}{10^6 g} \times \frac{1 year}{365 day} = 3.578 \frac{tonnes}{day}$$

3.2.1.5.2 Oxides of Nitrogen Fugitive Emissions

In addition to Project combustion emissions, fugitive emissions should also be considered. In the case of NO_X, no fugitive emissions are expected from the Project.

3.2.1.6 Particulate Emission Calculation Methods

3.2.1.6.1 Particulate Combustion Emissions

Fuel burned in combustion equipment produces particulate emissions at the Project. An example calculation of power plant particulate emissions using the emission factor approach is provided in the following paragraphs.

Example: Assume the engines in a power plant consume 24,000 m³ of fuel per year and the diesel specifications indicate that the heating value of diesel is 0.0449 GJ/kg of fuel consumed. Furthermore the diesel has a density of 881 kg/m³ and the emission factor for TSP is 42.99 g/GJ.

$$M = \rho \times V_f \times HV \times E$$

where:

M	=	total emissions, (tonnes per year)
ρ	=	fuel density, (kg/m³)
Vf	=	volume of fuel used, (m³ per year)
HV	=	fuel heating value, (GJ/kg)
E	=	emission factor, (g/GJ)

Note: The above is a general equation for emissions estimation using emission factors.

Calculate the total weight of the compound released in g/year.

$$M = \frac{881kg}{m^3} \times \frac{24{,}000m^3}{year} \times \frac{0.0449GJ}{kg} \times \frac{42.99g}{GJ} = 4.081x10^7 \frac{g}{year}$$

Convert the annual release to a daily value in tonnes.

$$4.081x10^7 \frac{g}{year} \times \frac{1tonne}{10^6 g} \times \frac{1year}{365day} = 0.112 \frac{tonnes}{day}$$

The same type of calculation would be used to determine $PM_{2.5}$ emissions with a modified emission factor based on published data (e.g., the United States Environmental Protection Agency's AP-42 compendium of emission factors for TSP and $PM_{2.5}$). For example; to complete the calculation for $PM_{2.5}$, an emission factor of 35.34 g/GJ would be used instead of 42.99 g/GJ.

$$M = \frac{881kg}{m^3} \times \frac{24{,}000m^3}{year} \times \frac{0.0449GJ}{kg} \times \frac{35.34g}{GJ} = 3.35x10^7 \frac{g}{year}$$

Convert the annual release to a daily value in tonnes.

$$3.35x10^{7}\frac{g}{year}\times\frac{1tonne}{10^{6}g}\times\frac{1year}{365day}=0.0.092\frac{tonnes}{day}$$

3.2.1.6.2 Particulate Fugitive Emissions

In addition to Project combustion emissions, fugitive emissions should also be considered. Fugitive particulate emissions are expected from the Project, particularly from vehicle traffic, the pit, and WRSA.

3.2.1.6.3 Vehicle Traffic Particulate Emissions

An example calculation of TSP emissions from vehicle traffic using the emission factor approach is provided below. The road dust emission calculation takes into consideration the following factors:

- the particle size;
- the silt content of the road surface;
- the mean vehicle weight;
- the surface material moisture content; and,
- the number of days of precipitation per year.

The calculation is used to generate a site-specific emission factor, in this case kilograms (kg) of TSP released per vehicle kilometre travelled (VKT). The site-specific emission factor is then multiplied by the number of VKT on-site over the reporting period to obtain a mass emission rate.

$$E=FVKT\times k\times\left(\frac{s}{12}\right)^{a}\times\left(\frac{W}{3}\right)^{b}\times\left(\frac{M}{1}\right)^{c}\times\left[\frac{365-(p+snow)}{365}\right]$$

where:

E	=	emission factor, (kg per VKT)
k	=	particle size multiplier, (pound [lb] per vehicle miles travelled [VMT])
s	=	silt content of road surface material, (%)
W	=	mean vehicle weight, (tonnes)
M	=	surface material moisture content, (%)
p	=	number of days with at least 0.01 inches of precipitation per year, (dimensionless)
snow	=	number of days of snow cover per year, (dimensionless)
FVKT	=	conversion from (lb per VMT) to (kg per VKT)
a, b, c	=	constants

The above equation can be found in the Environment Canada Road Dust Guidance Document (Environment Canada 1998).

All of the above terms, except mean vehicle weight (W), which will be specific to the vehicle type, can be found in regulatory guidance documents (i.e., Environment Canada Road Dust Guidance Document [Environment Canada 1998] and United States Environmental Protection Agency [USEPA] AP-42 [USEPA 1995]).

$$E = 0.2819 \times 5.3 \times \left(\frac{8.3}{12}\right)^{0.8} \times \left(\frac{20}{3}\right)^{0.5} \times \left(\frac{0.7}{1}\right)^{-0.4} \times \left[\frac{365-(118+181)}{365}\right] = 0.599 kg/VKT$$

Wind Erosion Particulate Emissions

Fugitive particulate emissions generated by wind erosion of open aggregate storage piles, drained lake beds, and waste rock storage areas are also expected from the Project. The wind-generated particulate emission calculation takes into consideration various factors, such as the particle size, the number of disturbances over the reporting period, amount of precipitation and the surface erosion potential. Site-specific emission factors are calculated for the stored aggregate, or waste rock in kilograms per square metre per day (kg/m^2/day), which are then multiplied by the exposed pile surface area over the reporting period to obtain a mass emission rate.

3.2.1.7 Greenhouse Gas Emission Calculation Methods

Greenhouse gas emissions are emitted from the combustion sources at the Ekati Mine. Diesel combustion at the Project is the largest contributor to GHG emissions. The GHGs that are expected to be released as a result of the Project include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

Though the emissions of CH_4 and N_2O are expected in much smaller volumes than CO_2, their global warming potentials are much greater than that of CO_2. To maintain a valid comparison of the relative contribution of each compound to the overall total GHG emissions from the Project, CH_4, and N_2O emissions are converted to CO_2 equivalent (CO_2E) units. Global warming potential factors are used to convert non-CO_2 greenhouse gases to CO_2E. The global warming potential factor for CH_4 and N_2O are 25 and 298 respectively (IPCC 2007). An example calculation is provided in the following paragraphs.

Example: Assume the engines in a power plant consume 24,000 m^3 of fuel per year. The GHG emission factors for CO_2, CH_4, and N_2O are 2,730, 0.133, and 0.4 kg/m^3 respectively (Environment Canada 2006).

$$M = Vf \times E$$

where:

M = total emissions, (tonnes per year)

Vf = volume of fuel used, (m^3 per year)

E = emission factor, (kg/m^3)

Calculate the total CO_2 emissions in tonnes/year.

$$M_{CO_2} = \frac{24{,}000 m^3}{year} \times \frac{2{,}730 kg}{m^3} \times \frac{1 tonne}{1{,}000 kg} = 65{,}520 \frac{tonnes CO_2}{year}$$

Calculate the total CH_4 emissions in tonnes/year.

$$M_{CH4} = \frac{24{,}000 m^3}{year} \times \frac{0.133 kg}{m^3} \times \frac{1 tonne}{1{,}000 kg} = 3.192 \frac{tonnes CH_4}{year}$$

Calculate the total N_2O emissions in tonnes/year.

$$M_{N2O} = \frac{24{,}000 m^3}{year} \times \frac{0.4 kg}{m^3} \times \frac{1 tonne}{1{,}000 kg} = 9.600 \frac{tonnes N_2O}{year}$$

Calculate the total CO_2E emissions in tonnes/year using the global warming potential factors for CH_4 and N_2O.

$$65{,}520 tonnes CO_2 + (3.192 tonnes CH_4 \times 21) + (9.600 tonnes N_2O \times 310) = 68{,}563 \frac{tonnes CO_2 E}{year}$$

3.2.1.8 Dioxins, Furans, and Mercury Calculation Methods

Combustion of waste in the Ekati Mine incinerator has the potential to release dioxins, furans, and mercury to the atmosphere. The emissions of these compounds are evaluated against the Canada-Wide Standards.

The emissions of dioxins, furans, and mercury from the incinerator will be highly dependent on the quantities and types of waste that will be burned. For this reason, emission estimates based on mass balance or emission factors are difficult to calculate. The proposed approach for estimating emissions from the incinerator is to use intermittent stack sampling data for the incinerator and compare this data to the Canada-Wide Standards.

3.3 Fuel Use and Waste Summary

Fuel usage for the Project combustion sources, identified in Section 3.2.1, will be documented monthly and presented in the three-year summary report. In addition to fuel usage at the site, the amount of waste burned in the incinerator will be provided in the three-year summary report.

3.4 Emissions Mitigation Strategies

There are a number of mitigation strategies that will be integrated into the operations phase of the Project to minimize air emissions. These mitigations primarily focus on minimizing fugitive dust emissions. This is because fugitive dust can be effectively managed through operational strategies to a greater degree than the other air emission compounds released from the Project. A fugitive dust abatement program has been incorporated as Section 3.4.1 of this document. As for the other compounds released from the Project, particularly combustion compounds (i.e., SO_2, NO_X, particulate, dioxins, furans, and mercury), the following mitigation will be used:

- design features that minimize equipment hours and fuel burn;
- fuel conservation measures to reduce SO_2, NO_X, and particulate emissions;
- Canadian Council of Ministers of the Environment (CCME), USEPA (2016 standard compliance), and internationally compliant equipment to reduce NO_X emissions;
- CCME compliant equipment to reduce dioxins and furans emissions;
- waste diversion methods to minimize dioxins, furans, and mercury emissions from the incinerator;
- operation of combustion equipment, particularly Project equipment, power plant and incinerator, at manufacturer recommended temperature and conditions;
- regular maintenance of the vehicle fleet; and,
- operational practices to limit equipment idling.

3.4.1 Fugitive Dust Abatement Program

3.4.1.1 Objectives

The objective of the fugitive dust abatement program is to effectively manage dust generation from surface dust sources. The dominant fugitive dust sources are expected to be from blasting in the pit, and haul road traffic. Other fugitive dust generating sources are expected to be road traffic, mining activities at the Jay Pit, drilling, loading, hauling and dumping activities at the WRSA, aircraft landing and takeoff activities, and wind erosion from exposed surfaces. Studies have shown that winter dust emissions (when road conditions and the landscape in the Project area are dominated by snow and ice) are mitigated naturally by approximately 95% and summer dust emission from road traffic are mitigated by approximately 80% through the application of chemical dust suppressant (Environment Canada 2008; De Beers 2010).

3.4.1.2 Methods

A discussion of fugitive dust abatement measures is provided in this section, as relating to mitigation to minimize dust from the drilling, blasting, ore handling, and primary crushing activities associated with the Project. These measures may be revisited pending results of the analysis..

3.4.1.3 Application of Chemical Dust Suppressants and Water on Haul Road Surfaces

Dominion Diamond will control dust through the application of chemical dust suppressants on haul road surfaces beyond 30 metres from watercourse crossings. Suppressants control dust on roads by increasing the cohesiveness of the surface material making it less susceptible to becoming suspended in the air and by their hydrophilic properties, that they attract atmospheric water vapour. Water will be applied to control dust emissions where necessary within 30 metres of watercourse crossings.

During the summer months (typically late May through late September) the application of suppressants to dust-prone surfaces will be an effective approach to managing fugitive dust for road surfaces. Winter dust emissions (when road conditions are dominated by snow and ice) are mitigated naturally by approximately 95%.

4 RESPONSE PLANNING

One of the purposes of the AQEMMP should be to identify trends in ambient (beyond the disturbed area defining the Project boundary) air quality and to use this information to inform management decisions around emissions mitigation. This type of proactive management requires that a clear and well-documented system be established. This section provides details on how such a system would operate.

For the system to operate effectively the following parameters must be clearly defined:

- the methods for determining trends and identifying when emissions mitigation is necessary;
- the monitoring timeframe over which emissions mitigation decisions will be made; and,
- the action levels at which emissions mitigation will be employed.

Each year the annual average concentrations for each of the monitored compounds will be analyzed and summarized as part of the three-year summary report. Where applicable, the trend analysis that guides response planning will incorporate shorter monitoring periods (e.g., TSP and $PM_{2.5}$), where the monitoring that is conducted at the Project permits direct comparison. These concentrations will be plotted on a graph, similar to the example plot shown for SO_2 in Figure 4-1, so that the magnitude and trends in concentration over time can be easily observed. To evaluate the need for further investigation or adaptive management responses, pre-determined early-warning action levels will also be presented on the figure. These action levels indicate a range or percent change (year to year) in concentrations at which additional response should be considered. A description of how the action levels should be applied to each of the compounds emitted by the Project is provided below.

A systematic approach was taken to develop trigger levels for each compound based on the DAR predictions and the Air Quality Assessment Update predictions (Golder 2015), the applicable ambient air quality criteria and a percent change (year to year) in measured concentrations. For example, the trigger levels for SO_2 are as follows:

- **Trigger Level I** – annual concentrations below the maximum DAR prediction and less than 20% of the applicable ambient air quality criteria.
- **Trigger Level II** – concentrations above the maximum annual concentrations predicted in the DAR and between 20% and 50% of the applicable ambient air quality criteria, and greater than +40% year to year change.
- **Trigger Level III** – annual concentrations above 50% of the applicable ambient air quality criteria and more than +20% year to year change.

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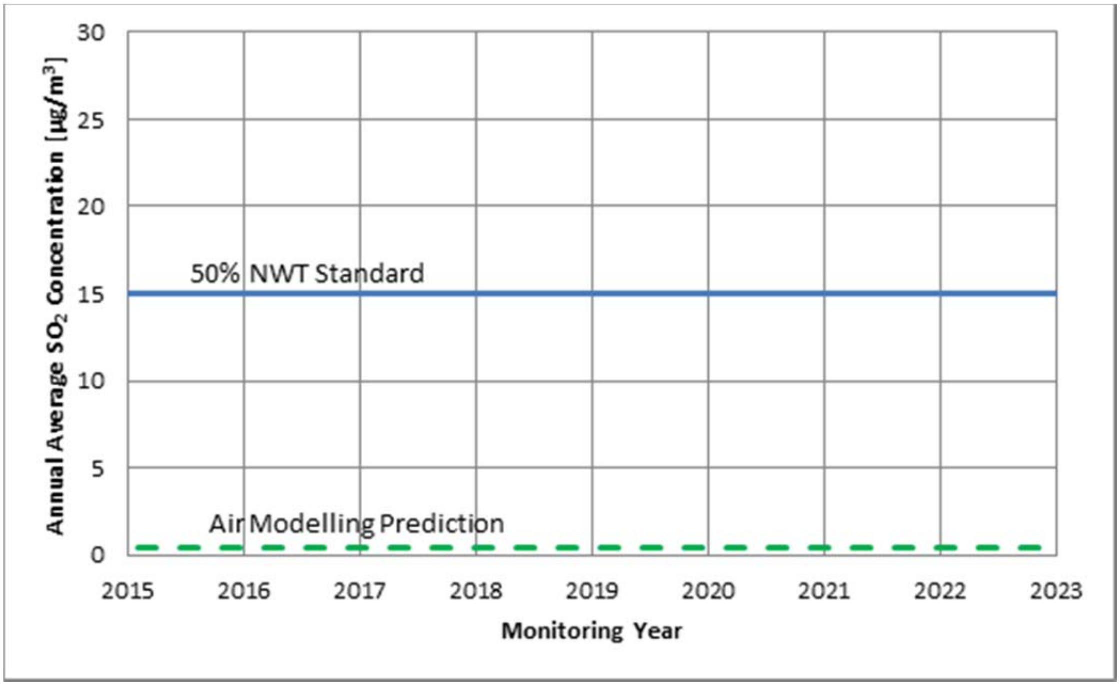
Figure 4-1 Trigger Levels for Annual Ambient SO_2 Concentrations



The above trigger levels are applicable to SO_2, but are not applicable to NO_2, TSP, and $PM_{2.5}$. This is because the SO_2 concentrations predicted in the DAR are very low in reference to the applicable standards (approximately 2% of the standard). As well, all annual average SO_2 concentrations measured at the Ekati Mine from 2009 to 2014 have been below 15% of the current GNWT annual standard (GNWT 2014). As the measured SO_2 concentrations have been historically low, small absolute changes relative to the applicable standards may not be relevant as actionable changes, though they may appear large as a percentage change. Given this context, year to year percentage change triggers have been given a nominally larger trigger value. For example, a change in annual SO_2 concentrations from 0.6 parts per billion (ppb) to 0.8 ppb is a 33% change year to year, but when compared to the annual standard of 11 ppb is only a 2% relative change.

NO_2 concentrations predicted in the DAR, and TSP and $PM_{2.5}$ concentrations predicted in the Air Quality Assessment Update are higher relative to the ambient air quality criteria than SO_2, and therefore, require different action levels that respond to smaller relative margins of the standards and a smaller percentage change in concentrations as follows:

- **Trigger Level I** – concentrations less than 80% of the applicable ambient air quality standard and less than +20% year to year change.
- **Trigger Level II** – concentrations less than 80% of the applicable ambient air quality standard and +20% year to year change.

- **Trigger Level III** – concentrations above 80% of the applicable ambient air quality standard and more than +10% year to year change.

Table 4-1 shows each of the Action Levels and the criteria required to trigger the appropriate management action.

The management action that will be implemented for each of the action levels is as follows:

- **Action Level I** – continue monitoring, no mitigation necessary.
- **Action Level II** – internal review and development and implementation of a response plan.
- **Action Level III** – external review and development and implementation of a response plan.

Table 4-1 Action Level Triggering Criteria

Criteria	Action Level I	Action Level II	Action Level III
SO_2			
Concentration below the maximum air modelling update prediction	✓		
Concentration below 20% of the applicable air quality standard	✓		
Concentration above the maximum air modelling update prediction		✓	
Concentration between 20% and 50% of the applicable air quality standard		✓	
Concentration greater than +40% change year to year		✓	
Concentration greater than 50% of the applicable air quality standard			✓
Concentration greater than +20% change year to year			✓
NO_2, TSP, and $PM_{2.5}$			
Concentration below 80% of the applicable air quality standard	✓	✓	
Concentration less than +20% change year to year	✓		
Concentration greater than +20% change year to year		✓	
Concentration greater than 80% of applicable air quality standard			✓
Concentration greater than +10% change year to year			✓

Note that multiple criteria need to be met to trigger the response, e.g., Action Level 3 for SO_2 is triggered when the monitored results exceed 50% of the applicable air quality standardand show a greater than 20% change year to year.

SO_2 = sulphur dioxide; NO_2 = nitrogen dioxide; TSP = total suspended particulate; $PM_{2.5}$ = fine particulate matter concentrations with mean aerodynamic diameter less than 2.5 micrometres;% = percent.

Table 4-2 indicates that criteria that will be used to determine "compliance" that will trigger actions as defined above. The 24-hour values are presented to provide context when reviewing data on an annual basis and can frame day-to-day decision making around emissions management. However, the basis for determining whether a response is required per the AQEMMP process is a comparison of the data to the annual criteria.

Table 4-2 Criteria Used to Determine Compliance

Parameter	Criteria ($\mu g/m^3$)	Source
Annual SO_2	30	NWT Ambient Air Quality Standard
Annual NO_2	60	NWT Ambient Air Quality Standard
24-Hour TSP	120	NWT Ambient Air Quality Standard
Annual TSP	60	NWT Ambient Air Quality Standard
24-Hour $PM_{2.5}$	28	NWT Ambient Air Quality Standard
Annual $PM_{2.5}$	10	NWT Ambient Air Quality Standard

Source: GNWT 2014.

SO_2 =sulphur dioxide; NO_2 = nitrogen dioxide; TSP = total suspended particulate; $PM_{2.5}$ = fine particulate matter concentrations with mean aerodynamic diameter less than 2.5 micrometres; NWT = Northwest Territories; $\mu g/m^3$ = micrograms per cubic metre.

This is a general approach that can be applied to any of the monitored compounds. If either an internal or external review is necessary, then this will likely include a review of ambient monitoring data and emissions to determine whether the elevated concentrations or trend is related to Mine equipment or operations. By responding to observed changes in air quality before the ambient air quality standards are reached, Dominion Diamond can identify equipment or practices that may be leading to higher concentrations or deposition rates and manage the issue by adapting the equipment or practice in question. This is the primary benefit of this type of proactive management system.

The regular review of the data and response should also include provision for changing either the location or the discontinuation of monitoring if the data show consistent results well below the respective criteria. For example, SO_2 monitoring has long-shown a declining trend and is now consistently measured below 15% of the applicable standards. If measured concentrations of a particular compound are shown to be consistently below 15% of the relevant annual criteria for two consecutive years, a review of the need for the monitoring in that location or for that parameter will be conducted. A decision will be made with engagement of regulators and communities to modify the monitoring program with consideration given to the review.

5 THREE-YEAR SUMMARY REPORT

Dominion Diamond will include in the three-year report a summary of outcomes from the air quality monitoring program and air emissions data collected during each year. In addition, Dominion Diamond will report annual emission estimates to the NPRI and GHG emissions to the appropriate federal program.

Meteorological data will be summarized and presented by parameter, including seasonal and annual wind roses. Comparisons to applicable climate normals (30-year average) for Yellowknife and past site monitoring will also be included.

Data summaries for each of the ambient monitoring stations and compounds (TSP, $PM_{2.5}$, dustfall, SO_2, and NO_2) will also be provided.

The report will include the following information:

- annual NO_X, SO_2, particulate and any exceedances of their respective action levels, and GHG emissions;
- an annual fuel use summary apportioned by the major sources using the same methods as the DAR;
- an assessment of the effectiveness of the emissions mitigation including the fugitive dust abatement program;
- comparisons of annual emission estimates to previous years and the estimates used in the DAR;
- comparisons of ambient air quality and deposition monitoring results to previous years, the predictions of the DAR and all applicable federal and territorial criteria, standards, objectives, and guidelines;
- analysis of ambient air quality trends to determine if emissions mitigation is necessary;
- responses (either initiated and/or planned) to air quality issues (e.g., equipment failure, data loss, increasing trends or exceedences of air quality critical/dispersion modelling predictions); and,
- monitoring results made available to the Government of Northwest Territories (GNWT).

Data will be managed in accordance with the Dominion Diamond Health Safety and Environment Management System.

6 ENGAGEMENT ON THE AQEMMP

This is a draft plan submitted to the Mackenzie Valley Environmental Impact Review Board, but will continue to be refined into the Water Licence and Land Use Permit stage of the Project. This document is presented for consideration and comment over the environmental assessment and permitting phase of the Jay Project. Comments and feedback are expected from government agencies, communities, and other interested stakeholders.

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8 GLOSSARY

Term	Definition
Adaptive management	The exact definition of adaptive management varies among monitoring components, but typically adheres to having four themes as follows (WLWB 2010): 1) learning in order to reduce management uncertainties; 2) using what is learned to change policy and practice; 3) focusing on improving management; and 4) doing the above in a formal, structured and systematic way.
Ambient	Existing or present in the surrounding air.
Dioxins	A variety of chemical compounds that can be described by the chemical formula: $C_4H_4O_2$.
Emission	Release of substances to atmosphere (can be fugitive emission, stack emission, diesel exhaust, mechanical ground disturbance, etc.).
Furans	One of a group of colorless, volatile, heterocyclic organic compounds containing a ring of four carbon atoms and one oxygen atom.
I-TEQ	International Toxic Equivalency Quotients (relative to 2,3,7,8 tetrachlorodibenzo-para-dioxin) are internationally established (through NATO) multiplication factors that are used to collectively express the toxicity of various dioxins, furans and co-planar PCBs (polychlorinated biphenyls) to humans, mammals, fish and birds relative to most toxic of these substances: 2,3,7,8-tetrachlorodibenzo-para-dioxin. The multiplication factors range from 0.000001 to 1.000000.
Mercury	A heavy, silvery potentially toxic transition metal.
PM10	Airborne particulate matter with a mean aerodynamic diameter less than 10 µm (microns). This represents the fraction of airborne particles that can be inhaled into the upper respiratory tract.
$PM_{2.5}$	Airborne particulate matter with a mean aerodynamic diameter less than 2.5 µm (microns). This represents the fraction of airborne particles that can be inhaled deeply into the pulmonary tissue.
Processed kimberlite	The material that remains after all economically and technically recoverable diamonds have been removed from the kimberlite during processing.
Relative humidity	The ration of the amount of water vapour actually present in the air to the greatest amount possible at the same temperature.
Total suspended particulate	The fraction of airborne particulates that will remain airborne after their release in the atmosphere; the average diameter is nominally of 100 µm (micrometres) and below.