Government of Gouvernement des
Northwest Territories Territoires du Nord-Ouest

MAY 31 2017

Mackenzie Valley Environmental Impact Review Board
c/o Ms. JoAnne Deneron
@ jdeneron@reviewboard.ca

Dear Ms. Deneron: JoAnne

**Environmental Assessment of DDEC's Jay Project (EA1314-01) – Measure 6-3, Approval of the Air Quality Emissions Monitoring and Management Plan**

The Department of Environment and Natural Resources (ENR) of the Government of the Northwest Territories (GNWT) was assigned a role in Measure 6-3 by the Mackenzie Valley Environmental Impact Review Board in the *Report of Environmental Assessment and Reasons for Decision* for Dominion Diamond Ekati Corporation's (Dominion's) Jay Project (EA1314-01). Measure 6-3 requires Dominion to finalize and implement the Air Quality Emissions Monitoring and Management Plan (AQEMMP) prior to construction of the Jay Project and to submit an updated AQEMMP for public review and approval process as required by the GNWT.

ENR has reviewed the Jay AQEMMP, January 2017, against the requirements of the Ekati Environmental Agreement, Measure 6-3, and the concerns of participating reviewers. ENR is of the view that Dominion's final proposed AQEMMP is adequate and complete. ENR therefore approves the AQEMMP. ENR has additionally made some comments and recommendations for matters that ENR is of the view need not be addressed in this AQEMMP, but should be incorporated into the overall site wide AQEMMP, slated for development in spring of 2017. Please see the attached Reasons for Decision for details on ENR's response to Measure 6-3.

.../2

ENR trusts that the information in the attached Reasons for Decision meets what is required of the GNWT in Measure 6-3. If Parties have questions relating to the Jay AQEMMP assessment or associated rationale, please contact Ms. Kate Witherly, Manager of Environmental Impact Assessment, at (867) 767-9233, ext. 53095 or kate_witherly@gov.nt.ca.

Sincerely,

Dr. Joe Dragon
Deputy Minister
Environment and Natural Resources

Attachments

c. Ms. Jaida Ohokannoak, Chairperson
Independent Environmental Monitoring Agency

Ms. Claudine Lee, Head of Environment and Communities
Dominion Diamond Ekati Corporation

Ms. April Hayward, Superintendent – Environment
Dominion Diamond Ekati Corporation

Mr. Mark Cliffe-Phillips, Executive Director
Mackenzie Valley Environmental Impact Review Board

Ms. Lisa Dyer, Director, Environment Division
Environment and Natural Resources

Mr. Joel Holder, Director, Conservation, Assessment and Monitoring Division,
Environment and Natural Resources

Ms. Lorraine Seale, Director, Securities and Project Assessment
Lands

**Reasons for Decision**

**Environment and Natural Resources' Response and Rationale for Measure 6-3, Approval of the Air Quality and Emissions Monitoring and Management Plan from the Environmental Assessment of Dominion Diamond Ekati Corporation's Jay Project (EA1314-01)**

## Background and Interpretation

The *Report of Environmental Assessment and Reasons for Decision* (Report of EA) for Dominion Diamond Ekati Corporation's (Dominion's) Jay Project, adopted on May 19, 2016, includes Measure 6-3. Measure 6-3 directs Dominion, in general, to finalize and implement the AQEMMP prior to construction of the Jay Project and provides direction on the content of the AQEMMP. The Measure reads specifically as follows:

> *In order to reduce adverse impacts from dustfall within the Jay Project area to caribou, so they are no longer significant, Dominion will finalize and implement the Air Quality Emissions Monitoring and Management Plan prior to construction. This plan will be applied throughout the construction, operation and closure phases of the Project.*
> *Dominion will:*
> - *Describe how it will implement commitments made in this plan (PR#424 p1-5 to 1-6) along with management response linkages to the Caribou Road Mitigation Plan and the Caribou Offset and Mitigation Plan.*
> - *Reduce dustfall by continuing and improving the following management and monitoring practices, including:*
>   - *Applying dust suppressant to control dust emission on haul roads during summer or non-frozen snow-free season*
>   - *Managing vehicle speed to limit road dust from vehicle wheel entrainment*
>   - *Implementing a dustfall monitoring program, methods, locations, monitoring parameters*
>   - *Sampling lichen tissues (heavy metal parameters) snow chemistry sampling*
>   - *Planning responses with triggers and action levels*
>   - *Allowing opportunity for public comment on updates or changes to the Air Quality Emissions Monitoring and Management Plan*
> - *Annually report monitoring results, success or failure of dust mitigations and adaptive management to communities in person in a culturally appropriate manner*

Measure 6-3 also involves the Government of the Northwest Territories (GNWT) in requiring Dominion to do the following:

- *submit an updated Air Quality Emissions Monitoring and Management Plan for public review and approval process as required by the GNWT*

*In addition, the GNWT will review and approve the Air Quality Emissions Monitoring and Management Plan as required by the Environmental Agreement and regulate in accordance with the Environmental Protection Act.*

It is important to note that there are limitations of Environment and Natural Resources (ENR's) authority with respect to this Measure. The Measure states that an AQEMMP will be submitted by Dominion for "public review and approval process as required by GNWT". GNWT does not have any environmental regulations that require a public review or approval process on the subject matter included in an AQEMMP, and as such, ENR will rely on Dominion's inclusion of public process in the review of the AQEMMP.

The Measure further states that the GNWT "will review and approve the AQEMMP as required by the Ekati Environmental Agreement". For clarity, section 6.4(a) of the Ekati Environmental Agreement (Environmental Agreement) allows ENR to review Environmental Management Plans and determine that an Environmental Management Plan is inadequate or incomplete. If ENR makes such a determination, Dominion must be provided with ENR's Report that sets out the aspects in which the Environmental Management Plan is inadequate or incomplete and Dominion must then address the deficiencies in a manner satisfactory to ENR. ENR has, in part, used the substantive requirements within this Measure against which to evaluate the adequacy and completeness of the AQEMMP. ENR has not evaluated whether Dominion has complied with the "allowing opportunity for public comment on updates or changes to the AQEMMP" and annual reporting to communities bullets that are set out under the "Dominion will" part of the Measure, as there is no indication that the GNWT is required to do so.

Furthermore, the Measure requires that the GNWT "regulate in accordance with the *Environmental Protection Act*" (EPA). ENR interprets this to mean that GNWT will regulate to the extent it can in accordance with the EPA. Currently, the ability to do so is limited but ENR is working on the development of Air Regulations in order to change this, by occupying a long-standing gap in environmental protection regulation in the territory. Until such Regulations are in place, ENR will continue to review and provide technical input and advice on matters related to air quality and emissions. ENR will not be regulating, and therefore will not be enforcing, any items associated with the AQEMMP at this time.

History/Timelines and Public Review

Dominion released a Draft Conceptual AQEMMP for the Jay Project in June of 2015 during the environmental assessment (EA) of the Jay Project. Dominion hosted a technical workshop to discuss this document on July 20, 2015, at which ENR was in attendance. ENR subsequently provided formal comments on the document on July 31, 2015 as part of the GNWT's Technical Report for the Dominion Jay Project (EA1314-01).

The next version was the Conceptual AQEMMP for the Jay Project, released by Dominion on May 31, 2016. ENR reviewed the document and provided comments on July 29, 2016. A workshop was then held by Dominion for parties to discuss this version of the plan on Sept 14, 2016. ENR was in attendance at the workshop.

The next version was the Draft AQEMMP submitted by Dominion in December 2016. ENR provided written comments on this document on Jan 10, 2017.

ENR was not the only organization provided with opportunity to comment on the May 31, 2016 and December 2016 draft versions of the AQEMMP. Dominion circulated the 2016 draft versions to Aboriginal Governments and organizations that were Parties in the Jay Project's EA, the Hamlet of Kugluktuk, the Independent Environmental Monitoring Agency (IEMA), the Wek'èezhìi Land and Water Board, and Environment and Climate Change Canada. Those parties were also invited to attend the September 14, 2016 workshop.

The current and final version of the AQEMMP for the Jay Project was submitted to ENR by Dominion on January 25, 2017. This is the version that ENR is using to satisfy the requirements of Measure 6-3.

ENR understands that the AQEMMP for the Jay Project will be amalgamated with the current Ekati AQEMMP in the spring of 2017, as committed to at the September 2016 workshop. Furthermore, ENR understands the amalgamated version of the document will be made available for review and comment.

As stated earlier, the Measure states that an "updated AQEMMP" will be submitted by Dominion for "public review… as required by the GNWT". ENR does not have a legislated requirement for a public review process for this subject matter; however, ENR has established that parties to the EA have been involved throughout the various stages of review of the AQEMMP. ENR has determined that Dominion's public review process for the updated AQEMMP has been adequate.

**ENR's Review**

Commitments

The Table of Commitments in the Preface to the AQEMMP for the Jay Project outlines the Commitment and Status of each commitment made throughout the Jay EA process. ENR has the following comments:

- Commitment to greenhouse gas (GHG) emissions, page ix, indicates that Dominion will continue to set targets for GHG emissions annually for the life of the Ekati Mine.
    - ENR Recommendation: this is an ongoing commitment, and should be listed as "Ongoing" rather than "Complete". ENR recommends this change be made when the AQEMMP's are amalgamated in the spring of 2017.

ENR does not find any issue with the remaining list or stated status of each of the commitments.

Incorporation of Other Parties' Comments

The majority of the comments from reviewers have been addressed by Dominion and incorporated into the main text of the AQEMMP. Appendix A of the Jay AQEMMP documents the comments Dominion received on the Jay AQEMMP during reviews, and Dominion's response to those comments. Of the reviewers' comments in Appendix A that were not incorporated, ENR provides the following discussion on the reviewer's issue and Dominion's responses and rationale:

- **IEMA-5**: IEMA is requesting a dustfall transect associated with the Long Lake Containment Facility (LLCF) given the chemical nature of the particulate that may be dispersing as fugitive dust. Dominion did commit to investigating further monitoring around the LLCF at the September 2016 workshop. However, Dominion then responded in January 2017 (to IEMA-1) that they will not be adding a transect along the LLCF as the current monitoring in the area is adequate.

  ENR agrees that it would be beneficial to have a transect established originating at the LLCF. Although the dust size fraction may lend itself to early fallout, as Dominion has indicated, the chemical nature of this particulate relative to road dust, for example, is worth investigating. ENR suggests that the pending interim dustfall objective associated with Measure 6-4 may provide additional justification for dustfall monitoring further from the source.

  Recommendation: ENR recommends that Dominion reconsider their determination on particulate monitoring in proximity to the LLCF, and recommends that a dustfall canister transect in alignment with the predominant

surface wind patterns be undertaken to understand the effectiveness of LLCF dust mitigation efforts and the role/efficiency of revegetation efforts.

- **IEMA-6**: IEMA has indicated that no monitoring sites are currently proposed for the area located north east of the Jay pit, and recommends that dustfall, lichen and snow chemistry sampling sites should be established on the northern and eastern shores of Lac du Sauvage. Dominion responded that additional dustfall stations to the north would be unlikely to provide any helpful supplemental information based on the results of the air quality dispersion modeling from the Developer's Assessment Report (DAR), but have committed to lichen, dustfall and snow chemistry sampling on the east shore of Lac du Sauvage.

  ENR agrees that additional sampling sites to the north of the Jay pit would likely not yield useful data – the predominant wind patterns demonstrate the area north of Lac du Sauvage is generally upwind from site throughout the year. ENR is supportive of the sampling sites on the east shore of Lac du Sauvage.

- **IEMA-10:** IEMA is seeking shorter-term response triggers for $PM_{2.5}$ and TSP rather than being based on an annual average, given that more particulate is generated on-site during the summer than the winter months. Dominion responded, in summary, that exceedances of TSP and $PM_{2.5}$ are often short-lived, transient, episodic events, and that road dust management is a seasonal undertaking which is not easily responded to based on a 24-hr average. Dominion did suggest that it may be reasonable to provide a trucker reporting mechanism in the overall road management activities, so that maintenance and water trucks could be deployed in short order to particularly dusty areas.

  ENR recognizes that the adaptive management response triggers in the AQEMMP are based on annual trend analyses, yet seasonal variations in TSP and $PM_{2.5}$ generation do exist. Specifically, TSP generation is naturally mitigated to a greater extent in winter than summer, and $PM_{2.5}$ emissions have additional sources in the winter from heating and idling motive equipment. To focus on the summer particulate sources, as expressed by IEMA-10, ENR notes that the turnaround time associated with obtaining partisol results and the very nature of a 24-hr standard means it is likely that any TSP event will have passed by the time results are understood, and mitigative measures would no longer be beneficial by that time. However, it's also important to note that exceedances of the 24-hr standards for TSP do not occur frequently (i.e., 3 exceedances out of 364 filter samples between 2012 and 2014, and 6 exceedances from the real-time TSP monitors, outside of forest fire days, between 2012 and 2014). Real-time $PM_{2.5}$ monitoring at the continuous air monitoring building also results in minimal exceedances of the standard (i.e., no exceedances after forest fire smoke

effects were considered). Focusing on managing TSP emission sources (i.e., fugitive dust from roads, earthworks, stockpiles, etc.) are an appropriate approach to avoiding exceedances of the standard, with a major initiative being Dominion's new site-wide dust suppressant application of Envirokleen, which will reportedly occur as a singular seasonal application, annually. ENR supports Dominion's suggestion to use visual observations from truckers to trigger real-time, localized, mitigative actions such as road watering.

Dominion has committed to developing triggers for managing dustfall within six months of the interim dustfall objective being adopted by the GNWT (i.e., the summer of 2017). The interim dustfall objective will be a seasonal objective. Therefore, ENR recognizes that seasonal assessment of TSP results, rather than only an annual assessment, would be a complementary approach to analyzing the effectiveness of mitigative dust control measures, and would assist in informing future dust management measures.

Recommendation: ENR recommends that Dominion add a seasonal timeframe to the Response Planning section of the AQEMMP for TSP, in addition to the annual trend analysis, when the site-wide AQEMMP is merged in the spring of 2017. This will account for the seasonal variations of TSP generation and ideally avoid any potential minimization of annual results, and will also complement the dustfall analysis which is to be conducted on a seasonal basis. ENR recommends that the annual TSP standard be applied for seasonal comparison.

- **DKFN-1**: The Deninu K'ue First Nation (DKFN) have requested that additional snow and lichen samples be collected on the lakes. Dominion has responded that they believe there are sufficient sampling stations, and that shore locations would actually reveal higher concentrations of measured parameters than those expected on the lakes (due to proximity to source).

  ENR notes that it is beneficial to have snow and lichen sampling locations co-located, as has generally been conducted for the remainder of the site's snow and lichen sampling. Collecting strictly snow samples from the lake will provide additional winter data, but would not benefit the lichen data set and trend analysis. Dominion has added two sites to the site-wide snow and lichen sampling network to address Jay pipe emissions; one directly to the east of Jay on the far shore of Lac du Sauvage, and one approximately 1km SW from Jay. (DKFN did not specifically state at which lakes they were interested in seeing additional sampling sites, but ENR would like to clarify that the proposed new site is on the far side of Lac du Sauvage, and therefore not likely to have higher concentrations of measured parameters than a sampling site on the lake itself.) Although additional data is always helpful, ENR does not specifically recommend

that additional snow sampling locations on the lakes in proximity to the Jay Project are required at this time.

- **DKFN-2**: The DKFN have requested that dust monitoring stations be added to both the east and west of the Jay Project. Dominion responded that a continuous air quality monitoring station is being added to the west of the Jay Project, and a dustfall canister is being added on the closest outcropping of land to the east of the project. ENR notes that dustfall canisters will also be installed to the south west of the Jay Project, associated with a transect off the Jay road, and that the predominant wind patterns don't generally support monitoring stations in the northern direction. ENR anticipates the dustfall stations to be installed to the east and west of the Jay Project will satisfy DKFN's request.

Compliance with the Ekati Environmental Agreement (Environmental Agreement)
ENR has compared the AQEMMP against the requirements of the Environmental Agreement and finds that the AQEMMP is adequate and complete. Specifically, the following sections of the Environmental Agreement are addressed in the AQEMMP: s.6.1(a), and s.7.1(a) through (d).

Compliance with Measure 6-3
ENR's analysis of how Dominion has fulfilled each of the substantive components of Measure 6-3 is presented below.

Recall that Measure 6-3 states the following, (in italics):

*Dominion will*:

1. *describe how it will implement commitments made in this plan (PR#424 p1-5 to 1-6) along with management response linkages to the Caribou Road Mitigation Plan and the Caribou Offset and Mitigation Plan.*

The implementation of commitments made in document PR#424, on pages 1-5 and 1-6, are addressed in the AQEMMP.

The management response linkages to the Caribou Road Mitigation Plan (CRMP) in the AQEMMP are limited to the pilot test of an alternative chemical dust suppressant, which is Dominion's primary initiative to control fugitive dust from roads.

The Caribou Offset and Mitigation Plan (COMP) is not linked in the current AQEMMP; however GNWT has recommended and Dominion has agreed[1] that the site-wide AQEMMP to be developed in spring 2017 will include linkages to the COMP, which is also set for release in spring 2017.

2. *reduce dustfall by continuing and improving the following management and monitoring practices, including:*
    - *applying dust suppressant to control dust emissions on haul roads during summer or non-frozen snow-free season*
    - *managing vehicle speed to limit road dust from vehicle wheel entrainment*
    - *implementing a dustfall monitoring program, methods, locations, monitoring parameters*
    - *sampling lichen tissues (heavy metal parameters) snow chemistry sampling*
    - *planning responses with triggers and action levels*

The technical items presented above are addressed in the AQEMMP.

General Comments

ENR has identified some minor editorial issues with the AQEMMP and recommends that the following be addressed when the AQEMMP for the Jay Project is merged with the Ekati AQEMMP in the spring of 2017:

- P.2-1 – QA/QC is incorrectly referenced to Section 2.6. It should be referencing section 2.9.
- P.3-12 – the document refers to a "pending NWT dustfall standard". It's important to note that the GNWT is developing an interim dustfall objective for the Ekati site as a result of Measure 6-4, and not a dustfall standard for the NWT. This reference should be corrected.

**Conclusion**

Measure 6-3 requires ENR to determine whether Dominion's public review process for the updated AQEMMP has been adequate, and to review and determine whether Dominion's proposed AQEMMP is adequate and complete. ENR has determined that Dominion's public review process has been adequate. ENR has furthermore reviewed the AQEMMP, January 2017, against the requirements of the Environmental Agreement, substantive components of Measure 6-3, and the concerns of participating reviewers, and hereby approves the AQEMMP.

[1] As per comment and response to 'AQEMMP-GNWT-1' on page A-6 of the AQEMMP, January 2017.

ENR has made some comments and recommendations as a result of the review, and recommends that Dominion should incorporate them into the overall site wide AQEMMP, slated for development in spring of 2017.

ENR is of the opinion that we have satisfied our obligations to Measure 6-3.


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

Prepared for: Dominion Diamond Ekati Corporation

Prepared by: Golder Associates Ltd.

January 2017

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# Preface

This document comprises the Dominion Diamond Ekati Corporation (DDEC)'s Air Quality and Emissions Monitoring and Management Plan (AQEMMP) for the Jay Project (Project) submitted to the Government of Northwest Territories (GNWT). This AQEMMP is not intended to replace the existing Ekati Diamond Mine Air Quality Management Plan at this time, but will evolve over the next several months to do so.

Changes to this document since the last version include small revisions to the content of the document based on comments received on the May 2016 version and the technical workshop held in September 2016. The May 2016 version reflected updates based on the review of the environmental assessment and commitments made in the review and engagement process since the draft of the AQEMMP which was submitted to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) in June 2015. This version includes monitoring methodologies and updated maps showing the monitoring locations. This AQEMMP includes the monitoring provisions for the Project and addresses air quality monitoring and management using an adaptive approach such that action is required to improve air quality before the measured air quality reaches the Territorial and Federal air quality standards. The dispersion and control of fugitive dust especially from haul roads is important to communities in the North and DDEC intends to continue to work with the regulatory agencies to plan and implement an appropriate response to increasing deposition rates of dustfall, should they become evident in the monitoring data.

On February 1, 2016, the MVEIRB released their Report of Environmental Assessment and Reasons for Decision (REA). On May 19, 2016, the Government of the Northwest Territories Minister of Lands accepted the measures and commitments in the REA. The REA included Measures 6-3,6-4, 9-1, and 9-2 related to the Jay AQEMMP which are listed in the table below.

## Report of Environmental Assessment Measures Related to the Air Quality and Emissions Monitoring and Management Plan for the Jay Project

| Measure No. | Subject | Description |
|---|---|---|
| 6-3 | Air Quality Emissions Monitoring and Management Plan | In order to reduce adverse impacts from dustfall within the Jay Project area to caribou, so they are no longer significant, **Dominion** will finalize and implement the Air Quality Emissions Monitoring and Management Plan prior to construction. This plan will be applied throughout the construction, operation and closure phases of the Project.<br>Dominion will:<br>• describe how it will implement commitments made in this plan (PR#424 p1-5 to 1-6) along with management response linkages to the Caribou Road Mitigation Plan and the Caribou Offset and Mitigation Plan.<br>• reduce dustfall by continuing and improving the following management and monitoring practices, including:<br>– applying dust suppressant to control dust emissions on haul roads during summer or non-frozen snow-free season<br>– managing vehicle speed to limit road dust from vehicle wheel entrainment<br>– implementing a dustfall monitoring program, methods, locations, monitoring parameters<br>– sampling lichen tissues (heavy metal parameters) snow chemistry sampling<br>– planning responses with triggers and action levels<br>– allowing opportunity for public comment on updates or changes to the Air Quality Emissions Monitoring and Management Plan<br>• annually report monitoring results, success or failure of dust mitigations and adaptive management to communities in person in a culturally appropriate manner<br>• submit an updated Air Quality Emissions Monitoring and Management Plan for public review and approval process as required by the GNWT<br>In addition, the GNWT will review and approve the Air Quality Emissions Monitoring and Management Plan as required by the Environmental Agreement and regulate in accordance with the Environmental Protection Act. |
| 6-4 | Dustfall standards | Prior to construction, the **GNWT** will develop an interim dustfall objective for all types of dustfall that impact caribou and caribou habitat, including impacts on lichen and other caribou forage within the Jay Project zone of influence. The objective will reduce dust-related sensory disturbances to caribou to the greatest extent practicable.<br>Dominion will use the interim dustfall objective to inform its actions to reduce impacts to caribou and caribou habitat from dustfall. |

## Report of Environmental Assessment Measures Related to the Air Quality and Emissions Monitoring and Management Plan for the Jay Project

| Measure No. | Subject | Description |
|---|---|---|
| 9-1 | Incineration - Stack Testing and reporting | To reduce the likelihood of impacts resulting from the release of dioxins and furans, **Dominion** will conduct incinerator stack testing at least every three years and submit any stack test results to the GNWT Department of Environment and Natural Resources and Environment Canada no more than 90 days after the completion of stack testing. No more than 120 days after any failed stack test, (with failure determined according to the Canada Wide Standards for Dioxins and Furans or applicable regulation or guidance developed by the GNWT), Dominion will:<br>1. Develop an Adaptive Management Response Plan, containing:<br>a) An assessment of the incinerator operations and management that contributed to the failed stack test, and methods to rectify them.<br>b) A consideration of the need for increased monitoring of incinerator operational indicators associated with the formation of dioxins and furans. This may include inline continuous emission monitoring for, but not limited to: flow of flue gas, oxygen content, and carbon monoxide.<br>2. Submit the Adaptive Management Response Plan to the GNWT Department of Environment and Natural Resources and Environment Canada.<br>3. Implement the methods identified by Dominion (under 1a above) no later than the submission of the Response Plan, and earlier if feasible.<br><br>Dominion will re-stack test the incinerators within six months of the initial failed stack test. This second stack test will verify the effectiveness of the methods proposed and implemented in the Adaptive Management Response Plan and demonstrate compliance with the Canada-wide Standards for Dioxins and Furans. All stack tests must be conducted in accordance with national standards, and include detailed documentation to demonstrate that representative composition and batch size of waste were used during the testing process.<br>Exemptions for the second stack test may occur based on a review of the factors that contributed to the failed stack text and approval of the Adaptive Management Response plan by GNWT Department of Environment and Natural Resources, in consultation with Environment Canada.<br>Suggestion: Inline continuous emission monitoring<br>The Review Board suggests that the developer, in consultation with the GNWT and EC, assess the feasibility and utility of additional inline continuous emission monitoring and provide a report of the findings within one year of Ministerial approval of this Report of EA. |

**Report of Environmental Assessment Measures Related to the Air Quality and Emissions Monitoring and Management Plan for the Jay Project**

| Measure No. | Subject | Description |
|---|---|---|
| 9-2 | Reporting on GHG emissions and management | **Dominion** will provide, in its Air Quality Emissions Monitoring and Management Plan annual report, information on its greenhouse gas management for all Project phases including, but not limited to:<br>• A calculation of greenhouse gas emissions by combustion source;<br>• greenhouse gas emissions reduction targets for the upcoming year and how they were determined;<br>• reporting of whether past reduction targets were achieved and how, or if they were not, why;<br>• a description of monitoring including the parameters, methods, frequency, and data analysis;<br>• a description of adaptive policies, strategies and mitigative actions undertaken, or proposed, to reduce greenhouse gas emissions, including but not limited to:<br>– the results of Dominion's proposed ore hauling pilot study, including a description of greenhouse gas emissions for each alternative hauling method studied compared to existing and/or proposed strategies;<br>– the results of Dominion's proposed concept study on the use of alternative energies to offset a portion of the Jay Project's energy needs, including the methods and analysis; and,<br>– if the concept study leads to a feasibility study on the use of alternative energy to offset a portion of the Jay Project's energy needs, report on the results, including the methods and analysis.<br>During its community visits, Dominion will engage on its greenhouse gas emissions management, and report on how results of past engagement have been incorporated into Dominion's management of greenhouse gas emissions. |

The table below lists the commitments from the Environmental Assessment and the status of each commitment.

## DDEC Commitments from the Environmental Assessment Process

| Subject | Source | Commitment | Status |
|---|---|---|---|
| Air quality emissions modelling | Technical session April 24 – commitment #7 | DDEC 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. | Complete. Meeting held May 7, 2015 and submitted summary to MVEIRB on May 28, 2015 |
| Technical workshop | DAR-GNWT-IR2-19 | DDEC provided a draft conceptual Air Quality Emissions Monitoring and Management Plan (AQEMMP) for the Jay Project to the Mackenzie Valley Environmental Impact Review Board for discussion on June 1, 2015, and followed up with a workshop on June 26, 2015 to engage with regulatory and community groups. The development of the Jay Project AQEMMP is ongoing and the schedule for testing and reporting is to be discussed and finalized during the Jay regulatory process. DDEC will host a technical workshop to discuss the proposed triggers and technical components of the AQEMMP in July 2015 and will also provide an engagement schedule for the AQEMMP. | Complete. Workshop held on July 20, 2015 |
| Adaptive management AQ triggers | Regulatory Engagement Follow-Up Responses from May 7, 2015 Air Quality Regulatory Meeting | DDEC will include adaptive management trigger levels and associated actions in the draft Air Quality Monitoring and Management Plan, which will be provided to the Mackenzie Valley Review Board public registry by June 1, 2015. | Complete. AQEMMP submitted to MVEIRB June 1, 2015. |
| Emissions for Project mine fleet and equipment | DAR-GNWT-IR2-02 | DDEC is committed to minimizing emissions from mine equipment according to the established principles of Best Available Technology Economically Available (BATEA). All equipment operating at the Ekati Mine has a set preventative maintenance plan that ensures equipment is operating at optimal conditions and performance. | Ongoing |
| NWT Ambient Air Quality Guidelines | DAR-LKDFN-IR2-01<br>DAR-MVEIRB-IR2-28 | Furthermore, the GNWT has adopted regulations specifically for the protection of the health and safety of workers at mines. The Government of the Northwest Territories Mine Health and Safety Regulations (Section 9.02) states that employees shall not be exposed to airborne chemical or physical substances in excess of those specified in the 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices published by the American Conference of Governmental Industrial Hygienists (GNWT 2015). These thresholds are higher than the NWT ambient air quality guidelines and would be applicable inside the development area. | Ongoing |
| NWT Ambient Air Quality Guidelines | DAR-LKDFN- IR2-01 | It is DDEC's intent to apply the NWT ambient air quality guidelines (GNWT-ENR 2014) as standards or targets for purposes of air quality monitoring and management at the Project. Therefore, the fact that the NWT ambient air quality guidelines are non-legally binding, as clarified by the GNWT Department of Environment and Natural Resources (ENR) in a letter (GNWT-ENR 2015) responding to Undertaking 17 from the Mackenzie Valley Environmental Impact Review Board (MVEIRB) Technical Sessions for the Project on April 24, 2015, will have no effect on how DDEC plans to manage the air quality at the Project. | Ongoing |

## DDEC Commitments from the Environmental Assessment Process

| Subject | Source | Commitment | Status |
|---|---|---|---|
| NWT Ambient Air Quality Guidelines | DAR-LKDFN-IR2-01<br>DAR-MVEIRB-IR2-28 | DDEC, in its proposed Conceptual Air Quality and Emission Monitoring and Management Plan for the Jay Project (AQEMMP; DDEC 2015) submitted to the MVEIRB on June 1, 2015, and discussed with parties during a workshop on June 26, plans to include an adaptive management approach to the management of air quality at the Project site. | Completed and included in AQEMMP. |
| NWT Ambient Air Quality Guidelines | DAR-LKDFN-IR2-01<br>DAR-MVEIRB-IR2-28 | The NWT ambient air quality guidelines, regardless of their current non-legally binding status, will be used as the bases for the criteria that will trigger appropriate management actions as proposed in the AQEMMP. If new ambient air quality guideline or standard values are adopted by the GNWT in the future, the AQEMMP for the Project will be updated to reflect the changes in the guidelines or standards. | Ongoing |
| Greenhouse gas emissions | DAR-LKDFN-IR2-05<br>DAR-NSMA-IR2-04 | DDEC is committed to reducing overall greenhouse gas emissions from the Ekati Mine. As noted in the response to DAR-NSMA-IR2-04, DDEC has set the following targets for reducing greenhouse gas emissions for fiscal year 2016 (February 1, 2015 to January 31, 2016):<br>• Reduce energy baseload by 5%<br>• Reduce Greenhouse Gas Emissions by 5%<br>• Realize energy savings of $2 million<br>• Reduce fuel consumption by 5% | Ongoing |
| Greenhouse gas emissions | DAR-LKDFN- IR2-05<br>DAR-NSMA-IR2-04 | DDEC will continue to set targets for greenhouse gas emissions annually for the life of the Ekati Mine and this will be reported as part of the Air Quality Monitoring Program report, Mining Association of Canada Towards Sustainable Mining Program, and the Environment Canada Greenhouse Gas Inventory. | Complete and included in AQEMMP. |
| Greenhouse gas emissions | DAR-MVEIRB- IR2-29 | DDEC will continue to set targets for GHG annually for the life of the Ekati Mine and the Jay Project, and this will be reported as part of the Air Quality Monitoring Program report, Mining Association of Canada Towards Sustainable Mining Program, and the Environment Canada Greenhouse Gas Inventory. Targets for GHG reductions have not been set for the Jay Project. DDEC will continue to set targets for GHG emissions on an annual basis. Targets will be selected with consideration of the stage of the Project (e.g., construction, operation). Examples of the targets set for Ekati Mine's 2016 fiscal year (February 1, 2015 to January 31, 2016) are:<br>• Reduce energy baseload by 5%<br>• Reduce fuel consumption by 5%<br>• Realize energy savings of $2 million<br>• Reduce GHG Emissions by 5% | Ongoing |
| Monitoring transects | DKFN Technical Report Response #2 | The monitoring transect proposed along the Jay Road in the Conceptual Air Quality and Emissions Monitoring and Management Plan (AQEMMP) will be designed and sited to optimize the potential to monitor elevated concentrations and deposition rates, and to capture the potential effects from the Jay Road and the Jay Pit. | Complete and included in AQEMMP. |

## DDEC Commitments from the Environmental Assessment Process

| Subject | Source | Commitment | Status |
|---|---|---|---|
| Adaptive management AQ triggers | GNWT technical report response #1<br>NSMA technical report response #12 | DDEC agrees with the recommendations of the GNWT with the following minor revisions noted in Table 2.1-1 (underlined text to identify the change). DDEC recommends these final revisions to ensure that the development of action plans are prepared for a change based on an increase in year to year concentrations. | Complete |
| Fugitive dust abatement program | IEMA technical report response #10 | As part of construction and operations for the Project, dust generation and deposition will be monitored under the AQEMMP, as well as water quality (including TSS measurements) at stations in close proximity to Project activities (e.g., dike construction) in the AEMP. Mitigation strategies to minimize dust generation, such as limiting vehicle speeds, applying dust suppressants, or road watering, and monitoring and evaluation (which includes adaptive management trigger thresholds for particulate matter), will be implemented as per the Fugitive Dust Abatement Program detailed in the AQEMMP for the Project. | Ongoing |
| NWT Ambient Air Quality Guidelines | LKDFN technical report response #9 | During construction and operations of the Jay Project, DDEC intends to apply the NWT ambient air quality guidelines (GNWT-ENR 2014) as standards for purposes of air quality monitoring and management at the Project. | Included in Section 1.3 of this report. |
| Dust suppression | YKDFN technical report response #4 | DDEC is committed to ongoing evaluation and improvement of dust suppression at the Ekati Mine. | Ongoing. Circulation of the 2015 EnviroKleen Pilot Study Report and the 2016 Dust Suppression Program May 24, 2016 |
| Dust suppression | YKDFN technical report response #4 | DDEC is committed to ongoing investigation of appropriate and effective dust suppressants. DDEC has implemented a pilot project looking at alternatives to the use of DL-10 on haul roads at the Ekati Mine. | Ongoing. Circulation of the 2015 EnviroKleen Pilot Study Report and the 2016 Dust Suppression Program May 24, 2016 |
| AQEMMP engagement | DKFN Technical Report Response #2<br>LKDFN technical report response #9<br>Tlicho technical report response #6 | As described in the DDEC's July 24, 2015 letter posted to the MVEIRB public registry regarding the Draft Engagement Program for Amendments to the Ekati Mine Wildlife and Air Monitoring and Management Plans to Incorporate the Jay Project, additional engagement with parties on the AQEMMP (including station locations) will occur following the Environmental Assessment approval and prior to construction of the Project. | Ongoing. As per the letter submitted to MVEIRB on July 24, 2015, DDEC is circulated an updated Jay Project AQEMMP on May 31, 2016 and held a technical workshop on September 14, 2016. |

## DDEC Commitments from the Environmental Assessment Process

| Subject | Source | Commitment | Status |
|---|---|---|---|
| AQEMMP engagement | Tlicho technical report response #6 | DDEC will continue to engage with Tłı̨chǫ government and Tłı̨chǫ Elders along with all of the IBA groups on the design and implementation of the air quality programs. As described above, additional engagement on the AQEMMP will occur following the Environmental Assessment approval and prior to construction of the Project. | Ongoing. As per the letter submitted to MVEIRB on July 24, 2015, DDEC is circulated an updated Jay Project AQEMMP on May 31, 2016 and held a technical workshop on September 14, 2016. |
| AQEMMP engagement | YKDFN technical report response #4 | DDEC will continue to work with the regulators and other parties in future revisions of the AQEMMP prior to the construction of the Project. | Ongoing. As per the letter submitted to MVEIRB on July 24, 2015, DDEC is circulated an updated Jay Project AQEMMP on May 31, 2016 and held a technical workshop on September 14, 2016. |

# Abbreviations

| Abbreviation | Definition |
|---|---|
| AQEMMP | Air Quality and Emissions Monitoring and Management Plan |
| AQMMP | Air Quality Management and Monitoring 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 |
| DAR | Developer's Assessment Report |
| DDEC | Dominion Diamond Ekati Corporation |
| EA | Environmental Assessment |
| e.g. | for example |
| Ekati mine | Ekati Diamond Mine |
| ENR | Environment and Natural Resources, Government of the Northwest Territories |
| GHG | greenhouse gas |
| GNWT | Government of the Northwest Territories |
| i.e. | that is |
| 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 |
| NTU | nephelometric turbidity units |
| NWT | Northwest Territories |
| $PM_{2.5}$ | particulate matter with mean aerodynamic diameter 2.5 micrometres or smaller |
| QA | quality assurance |
| QC | quality control |
| $SO_2$ | sulphur dioxide |
| TDS | total dissolved particulate |
| TSP | total suspended particulate |
| USEPA | United States Environmental Protection Agency |
| WLWB | Wek'èezhìı Land and Water Board |
| WRSA | waste rock storage area |

# Units of Measure

| Unit | Definition |
|---|---|
| % | percent |
| µS/cm | microsiemens per centimetre |
| cm | centimetre |
| 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 square metre per day |
| kg/m$^3$ | kilograms per cubic metre |
| kg/year | kilograms per year |
| km | kilometre |
| L | litre |
| lb | pounds |
| m | metres |
| m$^3$ | cubic metres |
| m$^3$/year | cubic metres per year |
| mg/L | milligrams per litre |
| 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 (DDEC) 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). DDEC also markets Canadian diamonds from its 40 percent (%) ownership of the Diavik Diamond Mine.

DDEC proposes to develop the Jay Pit with associated mining and transportation infrastructure to add 13 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 18 years. It and its surrounding claim block are located approximately 300 kilometres (km) northeast of Yellowknife in the NWT (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.

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

- dikes to facilitate the dewatering of a portion of Lac du Sauvage;
- open pit mining of the Jay kimberlite pipe;
- existing processing facilities and infrastructure;
- ore stockpiles;
- a waste rock storage area (WRSA);
- 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, composter, site roads, all-season airstrip and apron, power plant, electrical distribution, and material storage, and sorting facilities; and,
- use of equipment, vehicles, and machines.

DDEC 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. DDEC is committed to regional and cumulative effects monitoring and will make the data collected through the AQMMP available to Environment Canada and the Government of the Northwest Territories (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 DDEC Air Quality and Emissions Monitoring and Management Plan (AQEMMP) for the Project. Development of the AQEMMP was initiated during the Environmental Assessment (EA) review process with a conceptual AQEMMP submitted to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) on June 1, 2015, as an initial draft for discussion. A workshop was subsequently held with regulators and Aboriginal communities on June 26, 2015 to allow for discussion and feedback. On July 24, 2015, DDEC submitted a letter to MVEIRB outlining future engagement on the Jay AQEMMP which included the completion and distribution of a draft version of the Jay AQEMMP to the parties of the EA within one month of the receipt of the Environmental Assessment approval. This also included the commitment for DDEC to host a technical workshop prior to the commencement of Jay Project construction activities. A version of the AQEMMP was submitted to the Wek'èezhìı Land and Water Board (WLWB) in May 2016 and stakeholders for feedback and comment and the technical workshop was held in Yellowknife on September 14, 2016. Feedback on the May 2016 version and from the workshop has been incorporated into this document.

This version of the AQEMMP which has been submitted to support the Water Licence amendment and Land Use Permit applications to the WLWB is not intended to replace the existing Ekati Air Quality Management Plan which is being updated to include the Lynx and Sable projects at this time. DDEC does intend to harmonize a site-wide air quality management plan in the coming months. A tentative date for a site-wide draft plan is April 2017.

This AQEMMP includes the monitoring provisions for the Project and addresses 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 would be 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, and 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 summarizes linkages to other plans, 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

## 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 | 30/05/16 | | |
| CHECK | AP | 30/05/16 | | |
| REVIEW | CM | 30/05/16 | | |

**MAP 1-1**

G:\CLIENTS\DOMINION\DDEC Jay and Lynx Projects\Figures\1419751 Jay Project Stage 3\4100_Licencing and Permitting\50_Air_Quality_Management\Location_of_Jay_Project.mxd

## 1.1 Scope

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

The data generated from air quality monitoring program serves a distinct purpose, as do 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 verify the predicted concentrations derived through dispersion modelling assessment and will be compared to applicable Federal and Territorial ambient air quality standards. They 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 itself need to be adaptively managed over the life of the Project and the Ekati mine.

## 1.2 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 other 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 of the monitored conditions against applicable Federal and Territorial ambient air quality standards;
- track trends in ambient air quality and emissions;
- verify air quality predictions made in the Developer’s Assessment Report (DAR) and associated follow-up work such as updates provided in adequacy review responses and Information Requests;
- identify the need for adaptive management response plans by evaluation of results against pre-defined early warning levels; and,
- enable the provision of 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 – emission factor approach;
  - Greenhouse Gases (GHGs) – emission factor approach; and,
  - dioxins, furans, and mercury – stack testing approach
- fuel use summary; and,
- emissions mitigation strategies.

## 1.3 Methods and Approach

DDEC 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, DDEC 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 DDEC Health Safety and Environment 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 that 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 Information Requests (IRs), engagement with regulators and communities, and with consideration to areas of interest from other disciplines. A map of the Project site showing the 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 analysis 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 (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 and Emissions Standards**

| Parameter | NWT Standards[a] | Canadian-Ambient Air Quality Standards[b] | Canada Wide Standards [c,d] |
|---|---|---|---|
| **$SO_2$ [µg/m³]** | | | |
| 1-Hour | 450 | —[e] | — |
| 24-Hour | 150 | — | — |
| Annual | 30 | — | — |
| **$NO_2$ [µg/m³]** | | | |
| 1-Hour | 400 | — | — |
| 24-Hour | 200 | — | — |
| Annual | 60 | — | — |
| **TSP [µg/m³]** | | | |
| 24-Hour | 120 | — | — |
| Annual[f] | 60 | — | — |
| **$PM_{2.5}$ [µg/m³]** | | | |
| 24-Hour | 28 | 28, (27) [g] | — |
| Annual | 10 | 10, (8) [g] | — |
| **Dioxins and Furans [pg I-TEQ/m³]** | — | — | 80 |
| **Mercury [µg/m³]** | — | — | 20 |

a) Source: GNWT 2014.

b) Source: Environment Canada 2013.

c) Source: CCME 2001.

d) Source: CCME 2000.

e) "—" = not applicable.

f) As a geometric mean.

g) 28 = 2015 Standard, (27) = 2020 Standard), 10 = 2015 Standard, (8) = 2020 Standard.

NWT = Northwest Territories; $SO_2$ = sulphur dioxide; $NO_2$ = nitrogen dioxide; TSP = total suspended particulate; $PM_{2.5}$ = particulate matter with mean aerodynamic diameter 2.5 micrometres or smaller; pg I-TEQ/m³ = picograms of International Toxicity Equivalents per cubic metre of exhaust; µg/m³ = micrograms per cubic metres.

Table 1.4-1 does not list either a Territorial or Federal standard for dustfall deposition against which dustfall measured at the Project could be evaluated. This is because a Territorial standard does not currently exist. As per Measures 6-3 and 6-4 from MVEIRB's Report of Environmental Assessment and Reasons for Decision (REA; MVEIRB 2016), it is also DDEC's intent to work with GNWT Environment and Natural Resources (ENR) to develop Project-specific triggers and action level responses to measured deposition rates of dustfall should they increase significantly year over year. ENR is developing an interim, project-specific dustfall guideline to be in place before the start of construction as per the above Measure 6-4. DDEC will develop an appropriate management strategy consistent with the interim guidance from ENR.

In addition to evaluating Project emissions and ground-level concentrations against applicable regulatory standards, it is DDEC'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.

DDEC 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 parts per million 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 DDEC'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

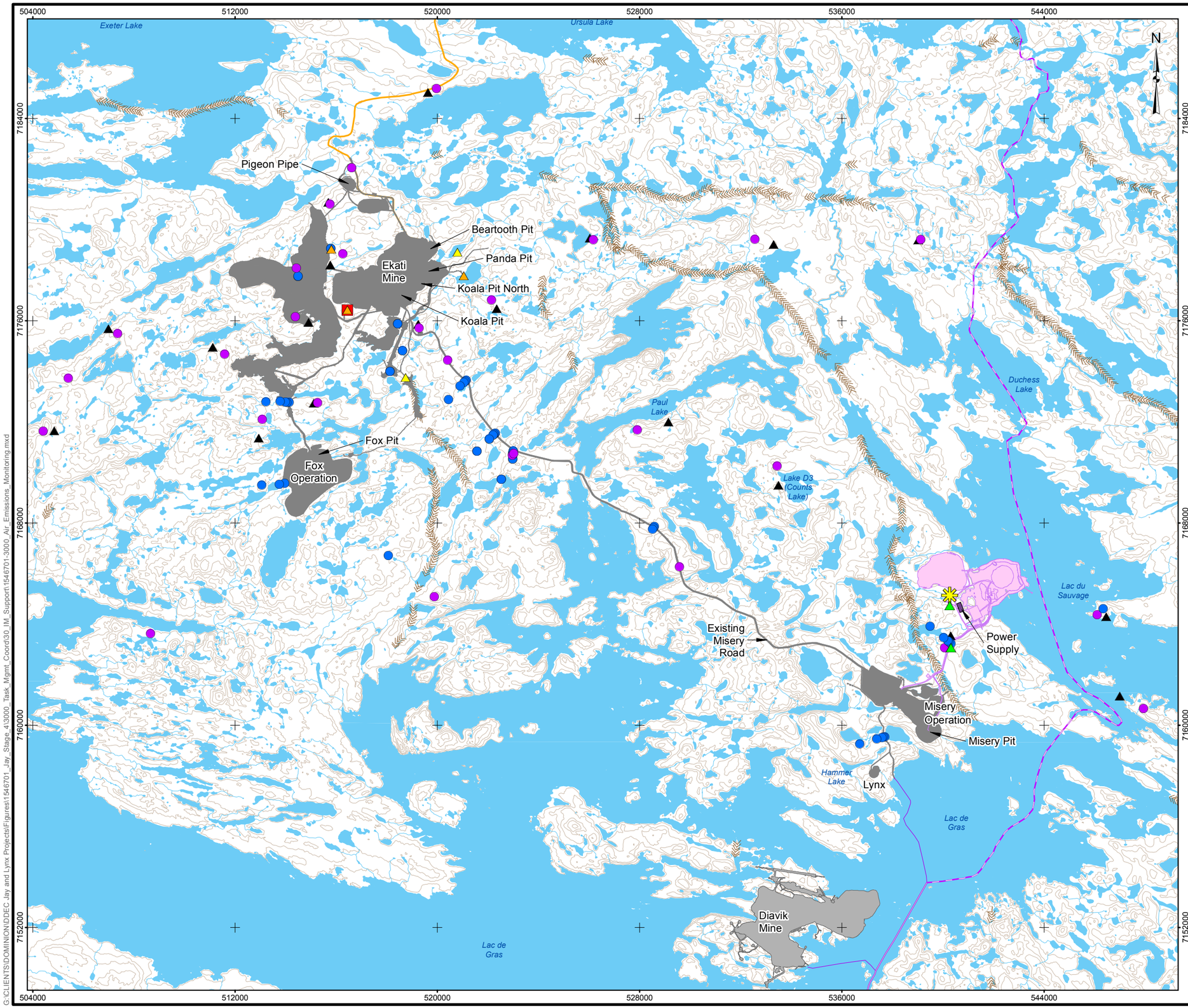
The AQEMMP will be used to coordinate monitoring of ambient air quality at the existing Ekati mine facilities and the Jay Project when it comes on-line during the construction, operations, and closure phases. Air quality monitoring will be used to provide data to validate the predicted effects of emissions 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 (DDEC 2014) and analyzed for trends in the three-year report. The implementation of the AQEMMP will provide an indication of the Project's performance with respect to air quality.

The main components of the AQEMMP, and the sub-sections in which each component is 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);
- passive monitoring of $NO_2$ (Section 2.5);
- lichen tissue sampling (Section 2.6);
- snow chemistry (Section 2.7); and,
- quality assurance/quality control (QA/QC) (Section 2.6).

Map 2.1-1 shows the monitoring station locations at the Project.

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
- SABLE ALL-SEASON ROAD
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- ELEVATION CONTOUR (10 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY
- JAY CONTINUOUS AIR QUALITY MONITORING STATION
- CONTINUOUS AIR MONITORING BUILDING (CAMB)
- DUSTFALL STATION
- LICHEN SAMPLING LOCATION
- METEOROLOGICAL STATION
- PARTISOL STATION
- PASSIVE $NO_2$ MONITORING STATION
- SNOW CHEMISTRY SAMPLING LOCATION

## REFERENCE

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
# AIR QUALITY AND METEOROLOGICAL MONITORING STATION LOCATIONS

Golder Associates

| | | | | | |
|---|---|---|---|---|---|
| PROJECT | | 1546701 | FILE No. | | |
| DESIGN | CM | 17/10/16 | SCALE AS SHOWN | REV | 0 |
| GIS | ANK | 24/01/17 | MAP 2.1-1 | | |
| CHECK | CM | 24/01/17 | | | |
| REVIEW | KM | 24/01/17 | | | |

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## 2.2 Meteorological Monitoring

Meteorological data are collected on an hourly basis at the Ekati mine airstrip by DDEC 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 when staff are present at the airport.

The parameters monitored by the Koala meteorological 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 (consistent with the vendor's specifications) 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 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 DDEC site staff.

### 2.2.4 Monitoring Parameters

The tower system will continuously measure the following meteorological parameters:

- wind speed at 10 metres (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. DDEC recognizes that establishing permanent locations is an important part of producing consistent data suitable for ongoing comparison purposes and trend analysis. The station (Jay Air Quality Monitoring Station) will be located approximately 200 m south of the WRSA and approximately 200 m west of the Jay North Road, near 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 DDEC 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 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 or equivalent 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 alert 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 downloaded weekly and analyzed for indications of air quality concerns and reported in a data report 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 as required. 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 consistency 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 Nitrogen Dioxide and Sulphur Dioxide Monitoring

Nitrogen dioxide ($NO_2$) and sulphur dioxide ($SO_2$) are by-products of combustion generated by burning fossil fuels associated with the movement of vehicles/equipment, airstrip activities, construction activities, and solid waste incineration. These compounds will be measured continuously at the Jay Air Quality Monitoring Station.

### 2.4.1 Monitoring Station Locations

$NO_2$ and $SO_2$ will be measured continuously at the Jay Air Quality Monitoring Station when a power supply is available.

### 2.4.2 Monitoring Methods

$NO_2$ and $SO_2$ monitoring will be conducted at the Jay Air Quality Monitoring station using Thermo Fisher Scientific model 42i and 43i or equivalent ambient gas monitors. These samplers use chemiluminescence technology and pulsed fluorescence technology to monitor ambient concentrations of $NO_2$ and $SO_2$ respectively.

### 2.4.3 Monitoring Frequency

Continuous monitoring using the 42i and 43i instruments allows for the detection of intermittent or short-term outlier events and supplies data for a robust dataset. Near real-time analysis of the continuous data can also be performed to alert the analyst to conditions of interest or equipment faults. This type of analysis is not possible using the filter-based methodology.

Monitoring of $NO_2$ and $SO_2$ matter is expected to continue beyond construction, into the operations and closure phases of the Project, although it should be noted that ambient concentrations of $SO_2$ are expected to be very low, commensurate with the near total removal of elemental sulphur from diesel fuel

in recent years. Ongoing monitoring of $SO_2$ may be re-evaluated based on data trends and discussions with ENR.

### 2.4.4 Data Analysis

The $NO_2$ and $SO_2$ data from each of the monitoring locations (existing stations and the new station near the Jay Pit) will be downloaded weekly and analyzed for indications of air quality concerns and reported in a data report 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. The analysis of spatial trends will compare measured concentrations from the monitoring stations.

The possibility exists that unusual events in the region (e.g., forest fire) could result in higher than normal measured 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 consistency in the measured 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 $NO_2$ and $SO_2$ concentrations on an annual basis is appropriate given the scale of the Project and the long-term nature of the monitoring program.

## 2.5 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.

### 2.5.1 Monitoring Station Locations

Dustfall stations are currently installed at two locations along the Misery haul road, the Fox haul road, east and northwest of the airstrip, and at the Long Lake Containment Facility at Dike B and adjacent to TSP-3 to measure the dust deposition from these sources (see Map 2.1-1). Each location has groups of five stations, one station approximately 30 m from the road centreline or emission source on the predominantly upwind (northeast) side of the road, and the other four stations on the predominantly downwind side (southwest) at 30 m, 90 m, 300 m, and 1,000 m from the road centreline or potential emission source.

Additional dustfall stations are proposed near the Jay Pit in an area predicted to receive relatively larger amounts of deposited particles as described in the DAR and a single dustfall station will be installed on the east side of Lac du Sauvage. The location for the new Jay station(s) is shown on Map 2.1-1. Additionally, DDEC will establish a dustfall station transect along the Jay Road as shown in Map 2.1-1 to monitor dust deposition levels associated with the Jay Project road construction and operations, as well as the construction of the dike.

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

### 2.5.2 Methods

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. Samples are sent to an accredited laboratory for analysis once per month during the summer sampling season.

### 2.5.3 Frequency

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.

### 2.5.4 Data Analysis

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. Dustfall, sulphate, and nitrate deposition levels will also be evaluated against the NWT guidelines or standards when they are developed.

## 2.6 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. DDEC 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).

### 2.6.1 Monitoring Station Locations

The proposed passive $NO_2$ monitoring stations are to be co-located with the “90 metre” dustfall monitoring station proposed for the Jay Project area and with the continuous $NO_2$ data from the Jay Air Quality Monitoring Station. 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.

### 2.6.2 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.

### 2.6.3 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.

### 2.6.4 Monitoring Parameters

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

### 2.6.5 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.

## 2.7 Lichen Tissue Sampling

Lichen studies were conducted at the Ekati mine approximately every 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.

### 2.7.1 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 Project.

### 2.7.2 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 inductively coupled plasma mass spectrometry), mercury, total sulphur, and total Kjeldahl nitrogen.

### 2.7.3 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.

### 2.7.4 Monitoring Parameters

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

### 2.7.5 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.

## 2.8 Snow Chemistry

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

### 2.8.1 Monitoring Station Locations

The snow sampling program was revised in 2008 in discussion with Environment Canada, GNWT, and the Independent Environmental Monitoring Agency, 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.

## 2.8.2 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 centimetres [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 4 litre (L) 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 4 L 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.

## 2.8.3 Monitoring Frequency

Snow core and snow scoop samples are collected every third year 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.

## 2.8.4 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 |

**Table 2.7-1 Parameters for Snow Chemistry Monitoring**

| Variables | Units | Variables | Units |
|---|---|---|---|
| **Physical/Ion** | | **Total Metals** | |
| 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 |

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

### 2.8.5 Data Analysis

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

## 2.9 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.

As a general commitment, where the data capture rate falls below 85% in a given year, the cause will be investigated and reported in the following year's data summary. DDEC will continue to strive for 100% data capture in all of its air quality monitoring programs.

### 2.9.1 Meteorological Monitoring

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

- Data are to be downloaded from the stations 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.

### 2.9.2 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.

### 2.9.3 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 analyzed.
- 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 DDEC'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 $NO_X$, particulates, and GHGs are common combustion by-products from the Project sources. Some of these by-products are the subject of regulatory guidance which limits the release amounts or ambient concentrations of the compounds to protect the receiving environment. DDEC 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), DDEC 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. DDEC has also committed to a rigorous stack testing regime every third year that will enable assessment of ongoing compliance with the Canada-Wide Standards. As per the hearing undertaking DAR-MVEIRB-UT2-05 (DDEC 2015a), DDEC made the following commitments in regards to stack testing. DDEC will submit any waste incinerator stack test results to ENR and Environment Canada no more than 90 days after completing a stack test. In the event of a failed stack test, DDEC will develop and submit to ENR and Environment Canada, an Adaptive Management Response Plan no more than 120 days after the failed stack test. DDEC will also re-stack test the incinerators within 6 months of the initial failed stack test; however, exemptions for the second stack test may occur based on a review conducted by ENR, in consultation with Environment Canada. This is also consistent with Measure 9-1 of the REA (MVEIRB 2016).

**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 WRSA.

### *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% 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).

$$M = \frac{881kg}{m^3} \times \frac{24{,}000m^3}{year} \times 0.0005 \times \frac{64.06kg/kgmolSO_2}{32.07kg/kgmolS} = 21{,}117.63\frac{kgSO_2}{year}$$

Convert the annual release to a daily value in tonnes.

$$21{,}117.63\frac{kgSO_2}{year}\times\frac{1year}{365days}\times\frac{1tonnes}{1000kg}=0.058\frac{tonnesSO_2}{day}$$

#### 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).

$$M=\frac{881kg}{m^3}\times\frac{24{,}000\,m^3}{year}\times\frac{0.0449\,GJ}{kg}\times\frac{1{,}376\,g}{GJ}=1.306\,x10^9\,\frac{g}{year}$$

Convert the annual release to a daily value in tonnes.

$$1.306\,x10^9\,\frac{g}{year}\times\frac{1tonne}{10^6\,g}\times\frac{1year}{365\,day}=3.578\,\frac{tonnes}{day}$$

### 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.

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

Convert the annual release to a daily value in tonnes.

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

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.

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

Convert the annual release to a daily value in tonnes.

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

### *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 WRSAs 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 ($N_2O$). This section of the AQEMMP directs the methodology for calculating GHG emissions (as per Measure 9-2 of the REA; MVEIRB 2016), but does not include a write-up of DDEC's strategy on managing GHG emissions and climate change. DDEC sets targets for GHG emissions annually for the Ekati mine. Projects to reduce GHG and to further optimize the use of energy at Ekati are tracked by the Greenhouse Gas and Energy Management Steering Committee which report performance in the annual report.

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-$CO_2$ GHGs 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 2,725, 0.18, and 0.031 $kg/m^3$ respectively (Environment and Climate Change Canada 2016).

$$M = Vf \times E$$

where:

M = total emissions, (tonnes per year)

Vf = volume of fuel used, (m³ per year)

E = emission factor, (kg/m³)

Calculate the total $CO_2$ emissions in tonnes/year.

$$M_{CO_2} = \frac{24{,}000 m^3}{year} \times \frac{2{,}725 kg}{m^3} \times \frac{1 tonne}{1{,}000 kg} = 65{,}400 \frac{tonnes CO_2}{year}$$

Calculate the total $CH_4$ emissions in tonnes/year.

$$M_{CH4} = \frac{24{,}000 m^3}{year} \times \frac{0.18 kg}{m^3} \times \frac{1 tonne}{1{,}000 kg} = 4.32 \frac{tonnes CH_4}{year}$$

Calculate the total $N_2O$ emissions in tonnes/year.

$$M_{N2O} = \frac{24{,}000 m^3}{year} \times \frac{0.031 kg}{m^3} \times \frac{1 tonne}{1{,}000 kg} = 0.744 \frac{tonnes N_2O}{year}$$

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

$$65{,}400\ tonnes CO_2 + (4.32\ tonnes CH_4 \times 25) + (0.744\ tonnes N_2O \times 298) = 65{,}730\ \frac{tonnes CO_2 E}{year}$$

### 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 annual data report. In addition to fuel usage at the site, the amount of waste burned in the incinerator will be provided in the annual data 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

This section provides information on the kinds of mining-related activities that can generate fugitive dust and the primary mitigation activities that will be used to manage the fugitive dust to minimize the effects of dust deposition on ambient air quality.

#### *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.

The methods primarily include the following:

- application of chemical suppressants and water to site roadways in season;
- use of speed limits to limit wheel entrainment and air turbulence, appropriate to the location, to maintain a safe work environment where visibility is not unduly impaired and as an integral part of the management of fugitive dust;
- deposition of dust outside the Jay Pit from drilling and blasting and ore handling are expected to be minimal but the following practices and mitigation activities will be used;
  - employment of dust skirts over the drill bore on rock drills to prevent cutting dust (if it is present) from migrating beyond the close proximity to the drill;
  - blast planning and sequencing will contribute to safe and effective blasting. Blasts are planned to minimize dust and waste;
  - handling coarse, often wet material between the Jay Pit and the primary crusher at the Ekati main camp; and,
- completion of Jay Project construction crushing during summer months wherein the integrated dust suppressing water-spray system can be used to control dust emissions.

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

DDEC 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%.

As described in the Caribou Mitigation Plan (DDEC 2015b), DDEC completed a pilot test application of an alternative dust suppressant prior to site-wide use to determine its effectiveness. DDEC is expanding the pilot study into a more comprehensive trial on the Misery Road with the objective to determine whether this product reduces fugitive dust from roads better than current dust suppression practices. The proposed dustfall sampling program will be conducted from early June to early September over two years (2016 and 2017), with results of the program after Year 1 being reported in an Interim report and include learnings and proposed improvements. DDEC circulated the 2015 EnviroKleen Pilot Project Report and the 2016 Dust Suppression Plan to the Parties of the Environmental Assessment on May 25, 2016. This dustfall study is also referenced in Measure 6-2(a)ii of the REA (MVEIRB 2016).

Furthermore, as per Measure 6-1 of the REA (MVEIRB 2016), DDEC will prepare a best management practices document which will include adaptive management triggers for additional dust suppression based on the pending NWT dustfall standard. The document is anticipated to be prepared for review in spring 2017, and will take into account the learnings from the first year of the dust pilot study referenced above.

# 4 RESPONSE PLANNING

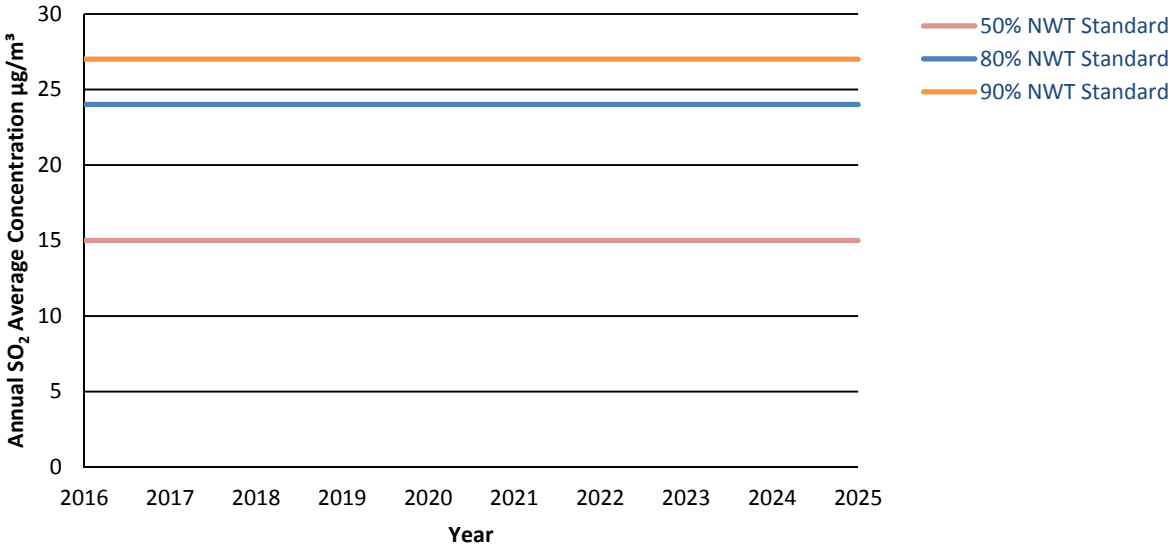
One of the purposes of the AQEMMP is to identify trends in ambient (beyond the disturbed area defining the Project boundary) air quality and to use this information to inform management decisions around emissions mitigation. This type of proactive management requires that a clear and well-documented 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.

The annual average concentrations for each year and 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 and/or percent increase (year to year) in concentrations at which additional response should be considered.

**Figure 4-1 Trigger Levels for Annual Ambient $SO_2$ Concentrations**




$SO_2$ = sulphur dioxide; µg/m$^3$ = micrograms per cubic metre; % = percent; NWT = Northwest Territories.

- Action Level I – Concentrations between 80% and 90% of the annual ambient air quality standard.

  –OR–

  Concentrations less than between 10% and 20% increase year to year and above 50% of the annual ambient air quality standard.

- Action Level II – Concentrations above 90% of the annual ambient air quality standard.

  –OR–

  Concentrations 20% or more year to year increase and above 50% of the annual ambient air quality standard.

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

- **Action Level I** – internal review and development and implementation of a response plan.
- **Action Level II** – external review and development and implementation of a response plan.

Table 4-1 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 4-1 Criteria Used to Determine Compliance**

| Parameter | Criteria (µg/m³) | 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; µg/m³ = 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, DDEC 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.

Although there is currently no Territorial standard for dustfall, the dispersion and control of fugitive dust especially from haul roads is important to communities in the North and DDEC intends to continue to work with the regulatory agencies to plan and implement an appropriate response to increasing deposition rates of dustfall, should they become evident in the monitoring data. When an interim project-specific dustfall standard is developed by ENR as per Measure 6-4, DDEC will work with them to develop a series of appropriate thresholds and action levels consistent with the new standard.

# 5 AQEMMP REPORTING

DDEC will prepare and annual data report and a three-year trend report. The annual report will include a summary of outcomes from the air quality monitoring program and air emissions data collected during each year.

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;
- results of the most recent stack testing completed on site for dioxins and furans or reference to the year stack testing was completed, if not in the reporting year;
- 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 GNWT.

The three-year report will include the above information and look at trends in the data over the three-year period.

A summary of greenhouse gas emissions and comparison to the GHG targets will also be provided in an appendix to the AQEMMP Report including the following information;

- the target for GHG emission reduction for the reporting year;
- annual greenhouse gas emissions in $CO_2$ equivalent units;
- in-vessel composter methane emissions, until it can be demonstrated that it does not produce methane emissions;

- percent change year to year; and,
- DDEC will report annual emission estimates to the NPRI and GHG emissions to the appropriate federal program.

DDEC sets targets for the business and those targets are tracked by the Greenhouse Gas and Energy Management Steering Committee which will report annual performance in the annual report. DDEC will include the information required under Measure 9-2 from the Report of EA as part of the GHG Management Report. A copy will be reproduced as an appendix in the AQEMMP annual report.

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

# 6 LINKAGES TO OTHER PLANS

The monitoring and management of air quality, including dustfall, is specifically planned and managed under the direction of this AQEMMP. DDEC will make the results of the air quality monitoring programs available to the teams working on other monitoring programs, such as, the Aquatic Effects Monitoring Program and the Wildlife Effects Monitoring Plan, where air quality data may be a relevant input to the interpretation of their results.

# 7 ENGAGEMENT ON THE AQEMMP

A draft plan was submitted to the MVEIRB in June 2015 and a workshop with regulators and communities was held on June 26, 2015 to provide an opportunity for feedback on the draft. Further engagement on specific aspects of the AQEMMP occurred through the EA process.

A version was submitted on May 2016 to support the Water Licence and Land Use Permit applications for the Project. This version was updated based on feedback received following that submission. As per the July 24, 2015 letter submitted to the MVEIRB public registry, DDEC hosted a technical workshop on September 14, 2016 to discuss and receive input on the plan prior to the initiation of construction activities. Recommendations received during engagement and responses from DDEC are summarized in Appendix A.

DDEC has committed to further engagement on the AQEMMP through the permitting phase of the Project. Comments and feedback are expected from government agencies, communities, and other interested stakeholders.

# 8 REFERENCES

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# 9 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):<br>1) learning in order to reduce management uncertainties;<br>2) using what is learned to change policy and practice;<br>3) focusing on improving management; and,<br>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. |
| $PM_{2.5}$ | Airborne particulate matter with a mean aerodynamic diameter less than 2.5 µm (microns).<br>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. |

DOMINION DIAMOND

# APPENDIX A

# REVIEWER RECOMMENDATIONS AND PROPONENT RESPONSES

January 2017

# Tables

Table A-1 Air Quality and Emissions Monitoring and Management Plan Reviewer Recommendations and Proponent Responses, July 2016. ..... 1
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**Table A-1 Air Quality and Emissions Monitoring and Management Plan Reviewer Recommendations and Proponent Responses, July 2016.**

| ID | Subject | AQEMMP Workshop Recommendation | Venue | Date | Participant and Organization that Suggested Recommendation | Revision to AQEMMP or Rationale if Revision Not Made |
|---|---|---|---|---|---|---|
| AQEMMP-ECCC-1 | General comments | ECCC acknowledges that the AQEMMP is not a final document, as it is lacking details regarding several aspects of the proposed monitoring, including the number and location of sampling/monitoring sites, and specific sampling instruments to be employed. ECCC requests the opportunity to review the AQEMMP again once these details have been provided. Some of the specific comments below reflect the need for more details. | E-mail | July 27, 2016 | Bradley Summerfield (ECCC) | DDEC has updated the AQEMMP and circulated this version for comment on December 13, 2016. |
| AQEMMP-ECCC-2 | TSP and $PM_{2.5}$ monitoring | Section 2.3.1 indicates that monitoring locations for new locations around the Jay Pit have been selected, however the specific locations are not described nor shown on Map 2.1-1. Please provide this information. | E-mail | July 27, 2016 | Bradley Summerfield (ECCC) | Monitoring locations as discussed in the September 14, 2016 technical meeting are included in the updated version of the AQEMMP circulated on December 13, 2016 in Map 2.1-1. |
| AQEMMP-ECCC-3 | Other sampling locations | Sampling locations around the Jay Pit for snow chemistry, passive $NO_2$, dustfall, and lichen sampling were not described in their respective sections, nor shown on Map 2.1-1. Please provide this information. | E-mail | July 27, 2016 | Bradley Summerfield (ECCC) | DDEC has included a map (Map 2.1-1) with sampling locations in the updated version of the AQEMMP circulated on December 13, 2016. |
| AQEMMP-ECCC-4 | Fugitive dust abatement | ECCC acknowledges that a “best management practices” document which includes adaptive management triggers will be forthcoming from Dominion Diamond, and looks forward to the opportunity to provide comments on it. | E-mail | July 27, 2016 | Bradley Summerfield (ECCC) | N/A |
| AQEMMP-ECCC-5 | Passive $NO_2$ sampling | During cold temperatures (below -10 °C), passive $NO_2$ samplers have been shown to underestimate actual ambient concentrations. Please provide more details regarding the sampling method used, including the model of samplers employed, their specifications, and recommended temperature range. ECCC also recommends collocating one passive $NO_2$ sampler with the continuous NOx analyzer to validate the concentrations estimated using the passive sampling method. | E-mail | July 27, 2016 | Bradley Summerfield (ECCC) | The Maxxam Analytics passive samplers that are planned for use at the Project are rated to perform from in temperatures from -40°C to +35°C. These samplers are regularly and successfully used across Canada. The reference method for $NO_2$ is as follows:<br>Monitoring $NO_2$ in the Atm. by using All-Season Passive Samplers H. Tang, T. Lau, B. Brassard and Walter Cool, “A new all-season passive sampling system for monitoring $NO_2$ in air.” The passive system is well described in:<br>Introduction to Maxxam All-Season Passive Sampling System and Principles of Proper Use of Passive Samplers in the Field Study, H. Tang, Centre for Passive Sampling Technology, Maxxam Analytics Inc., Edmonton, Alberta. Excerpted from the above method is the following statement regarding ambient meteorological conditions:<br><br>“Field Validation - The PASS for $SO_2$, $NO_2$, $O_3$, and $H_2S$ has been validated in many air monitoring stations in Alberta Canada for a long period of time (all seasons). The rain shelters were fastened using an outside bracket in the stations so that the passive samplers were at the same elevation as the inlet for the continuous analyzers. During validation, the temperature ranged from –40°C to 35°C, the average wind speed from 20 to over 130 cm/s, and the relative humidity from 30 to 100%. The exposure times ranged from 2 days to 3 months. The correlation between the PASS and an $SO_2$, $NO_2$, $O_3$, or $H_2S$ continuous analyzer is very good.”<br><br>A passive sampling station will be co-located with the Jay continuous monitoring station to validate the passive data as described in Section 2.6.1 of the AQEMMP. |
| AQEMMP-ECCC-6 | $SO_2$ monitoring | $SO_2$ is listed as a target for monitoring in Section 1 of the AQEMMP, as well as in the QA/QC portion of Section 2 and in Section 4 (Response Planning), however no details regarding monitoring methods, locations, frequency, and data analyses were provided. Please provide these details. | E-mail | July 27, 2016 | Bradley Summerfield (ECCC) | DDEC committed to sampling $SO_2$ in the September 14, 2016 workshop. Section 2.4 of the AQEMMP now includes the requested details of the planned $SO_2$ monitoring. The detailed information is provided in the AQEMMP, Section 2.4.1. |
| AQEMMP-ECCC-7 | Quality Assurance | Frequency of data downloading and analysis: No information regarding the frequency with which the continuous particulate, $SO_2$, and $NO_2$ monitoring data will be downloaded and analyzed. ECCC recommends that data be downloaded and verified at least weekly to ensure that problems with the system and air quality issues are noticed corrected quickly. | E-mail | July 27, 2016 | Bradley Summerfield (ECCC) | Data are downloaded and checked weekly during the inspection of the Continuous Air Monitoring Building. |
| AQEMMP-GNWT-1 | Section 1.3 Methods and Approach- page 1-6 | Comment: The Government of the Northwest Territories (GNWT) is required under Measure 6-4 of the Report of EA to develop an interim dustfall objective for all types of dustfall that impact caribou and caribou habitat. This objective will be specific to the Jay Project and will not be applied across the NWT.<br><br>Recommendation: The reference on page 1-6 to ENR developing a dustfall standard for the NWT should be removed. It would be more appropriate for Section 1.3 to refer to the interim dustfall objective required under Measure 6-4 than to refer to a NWT-wide dustfall standard. | Letter | July 29, 2016 | Kate Witherly (GNWT) | The AQEMMP has been updated to accurately reflect the NWT commitment to develop a project-specific dustfall objective; the revised text can be found at the bottom of page 1-3 in Section 1.3. |

**Table A-1 Air Quality and Emissions Monitoring and Management Plan Reviewer Recommendations and Proponent Responses, July 2016.**

| ID | Subject | AQEMMP Workshop Recommendation | Venue | Date | Participant and Organization that Suggested Recommendation | Revision to AQEMMP or Rationale if Revision Not Made |
|---|---|---|---|---|---|---|
| AQEMMP-GNWT-2 | Section 2.5 Passive Monitoring of Nitrogen Dioxide | Comment: The GNWT recognizes that passive $NO_2$ monitoring will be conducted in proximity to the Jay operations, in addition to co-locating a sampler with the continuous $NO_x$ monitor at the main Ekati site, and will be carried out year-round. The specifications for the passive samplers are not provided and therefore do not verify the approved operational temperatures of these instruments.<br><br>Recommendation: The $NO_2$ passive monitoring specifications should be provided to verify that they will function in the winter temperatu.res. | Letter | July 29, 2016 | Kate Witherly (GNWT) | The Maxxam Analytics passive samplers that are planned for use at the Project are rated to perform from in temperatures from -40ºC to +35ºC. These samplers are regularly and successfully used across Canada. The reference method for $NO_2$ is as follows:<br>Monitoring $NO_2$ in the Atm. by using All-Season Passive Samplers H. Tang, T. Lau, B. Brassard and Walter Cool, "A new all-season passive sampling system for monitoring $NO_2$ in air." The passive system is well described in:<br>Introduction to Maxxam All-Season Passive Sampling System and Principles of Proper Use of Passive Samplers in the Field Study, H. Tang, Centre for Passive Sampling Technology, Maxxam Analytics Inc., Edmonton, Alberta. Excerpted from the above method is the following statement regarding ambient meteorological conditions:<br><br>"Field Validation - The PASS for $SO_2$, $NO_2$, $O_3$, and $H_2S$ has been validated in many air monitoring stations in Alberta Canada for a long period of time (all seasons). The rain shelters were fastened using an outside bracket in the stations so that the passive samplers were at the same elevation as the inlet for the continuous analyzers. During validation, the temperature ranged from –40°C to 35°C, the average wind speed from 20 to over 130 cm/s, and the relative humidity from 30 to 100%. The exposure times ranged from 2 days to 3 months. The correlation between the PASS and an $SO_2$, $NO_2$, $O_3$, or $H_2S$ continuous analyzer is very good." |
| AQEMMP-GNWT-3 | Section 3.2.1.1 Combustion Emissions | Comment: The GNWT acknowledges that DDEC has incorporated the stack testing and reporting requirements outlined in Measure 9-1 into Section 3.2..1.1of the conceptual AQEMMP.<br><br>Recommendation: N/A | Letter | July 29, 2016 | Kate Witherly (GNWT) | NA |
| AQEMMP-GNWT-4 | Section 3.4.1.3 Application of Chemical Dust Suppressants and Water on Haul Road Surfaces- page 3-11 | Comment: It is unclear whether the 2016 Dust Suppression Plan is the dustfall study that is referenced in Measure 6-2(a)ii of the Report of EA..<br><br>Recommendation: Clarify whether the enhanced dust mitigation study referenced in Measure 6- 2(a)ii of the Report of EA is the same as the 2016 Dust Suppression Plan. | Letter | July 29, 2016 | Kate Witherly (GNWT) | Yes, the 2016 Dust Suppression Plan is the first year of the dustfall study that is referenced in Measure 6-2(a)ii. |
| AQEMMP-GNWT-5 | Section 3.4.1.3 Application of Chemical Dust Suppressants and Water on Haul Road Surfaces- page 3-11 | Comment: The GNWT is required under Measure 6-4 of the Report of EA to develop an interim dustfall objective for all types of dustfall that impact caribou and caribou habitat. This objective will be specific to the Jay Project and will not be applied across the NWT.<br><br>Recommendation: The reference on page 3-11to a pending NWT dustfall standard should be removed. ENR will be developing an interim dustfall objective, as required under Measure 6-4 of the Report of EA, which is specific to the Jay Project. | Letter | July 29, 2016 | Kate Witherly (GNWT) | The reference to the GNWT interim dustfall objective specific to caribou and caribou habitat related to the Jay Project has been corrected in the updated version circulated on December 13, 2016. |
| AQEMMP-GNWT-6 | "Section 4 Response Planning- | Comment: This section references a three-year summary report.<br><br>Recommendation: Clarify if air quality reporting will occur annually or every three years. | Letter | July 29, 2016 | Kate Witherly (GNWT) | Reporting is discussed in Section 5 of the AQEMMP. Reporting will include an annual data report and a 3-year trend report. |
| AQEMMP-GNWT-7 | page 4-1" | Comment: N/A<br><br>Recommendation: The formatting of Figure 4-1 needs to be corrected. | Letter | July 29, 2016 | Kate Witherly (GNWT) | The formatting for Figure 4-1 was corrected between the first (June 2015) and second (May 2016) drafts of the AQEMMP. |
| AQEMMP-GNWT-8 | Section 4 Response Planning- page 4-2 | Comment: The GNWT is required under Measure 6-4 of the Report of EA to develop an interim dustfall objective for all types of dustfall that impact caribou and caribou habitat. This objective will be specific to the Jay Project and will not be applied across the NWT.<br><br>Recommendation: ENR recommends that the term 'dustfall standard' be replaced with 'interim dustfall objective' so that the last sentence on page 4-4 reads<br>"When an interim dustfall objective is developed by the GNWT as per Measure 6-4, Dominion Diamond will work with them to develop a series of appropriate thresholds and action levels consistent with the new standard." | Letter | July 29, 2016 | Kate Witherly (GNWT) | The text in question in the AQEMMP has been adjusted to incorporate the correct terminology. The revised text now sits in Section 4, page 4-3 of the AQEMMP. |

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|---|---|---|---|---|---|---|
| AQEMMP-GNWT-9 | Section 4 Response Planning- page 4-4 | Comment: Section 5 of the conceptual AQEMMP for the Jay Project outlines what information the AQEMMP annual report will contain. Section 5 does not mention reporting on adaptive policies, strategies and mitigative actions undertaken, or proposed, to reduce greenhouse gas emissions. Measure 9-2 of the Report of EA requires Dominion to include this information in the AQEMMP annual report.<br><br>Recommendation: Dominion should include all of the information required under Measure 9-2 of the Report of EA in the AQEMMP annual report. Adaptive policies, strategies and mitigative actions undertaken, or proposed, to reduce greenhouse gas emissions should be included in the list of items that will be reported in the AQEMMP annual report. | Letter | July 29, 2016 | Kate Witherly (GNWT) | DDEC will include the information required under Measure 9-2 from the Report of EA as part of the GHG Management Report. A copy will be reproduced as an appendix in the AQEMMP annual report. |
| AQEMMP-GNWT-10 | Section 5 AQEMMP Reporting- page 5-1 | Comment: Section 5 of the conceptual AQEMMP states that the Greenhouse Gas and Energy Management Steering Committee will report annual performance in the annual report. It is unclear if the term 'annual report' refers to the AQEMMP annual report or to a report produced by the Steering Committee.<br><br>Recommendation: Dominion should clarify if the AQEMMP annual report is the report referred to in Section 5 when discussing how the Greenhouse Gas and Energy Management Steering Committee will communicate annual performance.<br>Dominion should include reporting on what the greenhouse gas emissions reduction target is for the upcoming year and how that target was determined in the list of items that will be reported in the AQEMMP annual report. | Letter | July 29, 2016 | Kate Witherly (GNWT) | Please see the response to AQEMMP-GNWT-9. |
| AQEMMP-IEMA-1 | General Comments - Incorporating Jay AQEMMP into the Site-wide Air Quality Management Plan | The *Introduction* section (page 1-2) states '*This version of the AQEMMP ... remains a conceptual document for discussion through the permitting process of the Project; it is not intended to replace the existing Ekati Air Quality Management Plan which is being updated to include the Lynx and Sable Projects'.* The Monitoring Agency recognises the early nature of the Jay Project and conceptual nature of the proposed document. However, the Agency could not identify any commitment by Dominion Diamond Ekati Corporation (DDEC) in the document to incorporate the Jay AQEMMP into the current site-wide Air Quality Management Plan once a final decision is made by the company to proceed with the Project.<br><br>Recommendation: DDEC should commit to incorporating the Jay AQEMMP into the site-wide Air Quality Management Plan within 12 month of initiating Project construction. | Letter | July 29, 2016 | Jaida Ohokannoak (IEMA) | DDEC discussed this matter with IEMA in the September 14, 2016 technical workshop and committed to the incorporation of the Jay AQEMMP into the Ekati AQEMMP in the spring of 2017. |
| AQEMMP-IEMA-2 | General Comments - Update of Site-wide AQEMMP | The existing Ekati Air Quality Management Plan was last updated in 2009 and should now be updated to include the Lynx, Sable and Jay projects. A single amalgamated Plan would provide better clarity, consistency and certainty as well as support administrative and operational efficiency by DDEC and regulatory agencies.<br><br>Recommendation: The GNWT should require an updated Air Quality Emissions Monitoring and Management Plan for the entire site as envisioned by the Environmental Agreement. | Letter | July 29, 2016 | Jaida Ohokannoak (IEMA) | Please see the response to AQEMMP-IEMA-1. |
| AQEMMP-IEMA-3 | General Comments - GNWT Interim Dustfall Standard and Implementation | Measure 6-4 of the Report of Environmental Assessment directs the GNWT to develop an interim dustfall objective for all types of dust that impact caribou and caribou habitat; and directs DDEC to use the interim objective to inform its actions. Reference is made by DDEC to the proposed objective throughout the conceptual AQEMMP and, in section 1.3, DDEC commits to '*engage to develop an appropriate management strategy consistent with the Territorial (dustfall) Standard'.* The Monitoring Agency believes that the interim dustfall standard is a key air quality element moving forward. It will be a key benchmark against which DDEC's future dust abatement planning will be assessed and action levels and triggers will be measured.<br><br>Recommendation: Due to the key nature of the pending GNWT dustfall objective, DDEC should commit to:<br>1. Maintain the Jay AQEMMP as a *interim document* until the dustfall objective has been adopted by the GNWT; and<br>2. Update the Jay AQEMMP to incorporate the GNWT interim dustfall objective within six months of the objective being adopted. | Letter | July 29, 2016 | Jaida Ohokannoak (IEMA) | DDEC will treat the AQEMMP as a final document, but because it is a living document, commits to incorporating the provisions of the GNWT interim dustfall objective within six months of it being adopted. |

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|---|---|---|---|---|---|---|
| AQEMMP-IEMA-4 | Section 2 - General: Air Quality Monitoring Program - Location of Monitoring Stations | The conceptual AQEMMP is non-committal with respect to the specific location of Air Quality monitoring sites associated with the Jay Project. Map 2.2-1 Existing and Proposed Air Quality Monitoring Stations Locations does not identify any proposed Air Quality stations, only the existing ones under the Ekati AQMP. On page 2-1, DDEC states that *'engagement through the permitting process for the Project will inform the final locations of the monitoring stations'.* While qualitative statements have been included throughout the conceptual plan (i.e. sections 2.3.1 and 2.4.1), it remains difficult to assess the adequacy of the Air Quality monitoring program without information being provided on the specific proposed locations and numbers of monitoring stations.<br><br>Recommendation: The Jay AQEMMP should contain specific information on the location and type of all proposed Air Quality monitoring, including dustfall, snow and lichen sampling stations prior to commencement of construction. | Letter | July 29, 2016 | Jaida Ohokannoak (IEMA) | The updated version of the AQEMMP circulated on December 13, 2016 includes information on the location of all proposed air quality monitoring, including dustfall, snow and lichen sampling stations (Map 2.1-1). Information on the sampling programs for dustfall, snow, and lichen are found in Sections 2.5, 2.7, and 2.8. |
| AQEMMP-IEMA-5 | Section 2.4 - Dustfall Monitoring and Sulphate and Nitrate Deposition | Section 2.4.1 and Map 2.1-1 confirm that dustfall and Partisol monitors have been established near the Long Lake Containment Facility (LLCF). In its 2016 Environmental Impact Report (EIR), DDEC reports that total dustfall levels near the LLCF exceeded the BC Guideline upper threshold of 2.9 mg/dm$^2$/day during 2012 and 2014, while approaching, but not exceeding, this value in 2013. The data suggests that the LLCF may be a significant source of fugitive dust to the receiving environment during the dry summer months when fine processed kimberlite is susceptible to disturbance by wind.<br><br>Recommendation: A dustfall transect, similar to transects established near the Misery and Fox haul roads, should be operated during the dry summer months (i.e. June, July, August) to monitor fugitive dust originating from the LLCF. | Letter | July 29, 2016 | Jaida Ohokannoak (IEMA) | Current monitoring does occur adjacent to Cells A and B of the LLCF where exposed deposited FPK can be dispersed by wind (Station LLCF-PB is upwind and LLCF-PA is downwind). However, reclamation research has focused on Cell B of the LLCF to re-vegetate the area to limit the amount of erosion and wind dispersion [therefore expect dustfall to decline as vegetation cover increases]. In addition, heavier particles like FPK (FPK is < 0.5 mm) tend to fall out more quickly than fine particulate; therefore, given that the majority of the mass of airborne dust (generally >30 um) tends to fall out within 100 m of the road, we expect the majority of the FPK to fall adjacent to the LLCF. Therefore, it is not necessary to add additional arrays of dustfall collectors around the LLCF. |
| AQEMMP-IEMA-6 | Section 2.6 and 2.7 - Lichen Tissue and Snow Chemistry Sampling | An additional lichen and snow chemistry monitoring site is proposed to be co-located with the 90 meter station associated with the dustfall transect along the Jay Road. Currently, lichen and snow chemistry sites are located near the Narrows (southeast of the Jay Pit) and Counts Lake (northwest of the Jay Pit). No monitoring sites are currently proposed for the area located northeast of the Jay Pit. In our Closing Submission to the Mackenzie Valley Impact Review Board, the Monitoring Agency recommended that monitoring sites designed to capture dustfall, lichen and snow chemistry north and east of Lac du Sauvage should be included in the AQEMMP for the Jay Project.<br><br>Recommendation: Monitoring and sampling sites to capture dustfall, lichen and snow chemistry should be established on the northern and eastern shores to Lac du Sauvage. | Letter | July 29, 2016 | Jaida Ohokannoak (IEMA) | The air quality dispersion modelling that was conducted to support the Developer's Assessment Report (DAR) for the Project indicated that there would be a higher likelihood of observing slightly elevated concentrations of dust to the east, rather than the north. A figure showing the pattern of dispersion was provided and discussed during the September 14th, 2016 technical session. The same figure can be referenced in the air quality assessment portion of the DAR as Map 7.4-20. Additional dustfall stations to the north would be unlikely to provide any helpful supplemental information and are therefore not proposed. DDEC has committed to lichen and dustfall monitoring stations on east shore of Lac du Sauvage as shown in Map 2.1-1 of the AQEMMP. |
| AQEMMP-IEMA-7 | Section 2.8.2 - Continuous Particulate, SO2 and NO2 Monitoring | The 2016 EIR reports that the historic issue of low percentage data capture from continuous air monitoring equipment has largely been resolved. The Monitoring Agency acknowledges DDEC's successful efforts in this regard. Section 2.8.2 of the conceptual AQEMMP confirms that QA/QC procedures have been established for the calibration of continuous Particulate, $SO_2$ and $NO_2$ monitors and for downloading data consistent with written operating instructions. However, the section is silent on the subject of data capture standards and objectives.<br><br>Recommendation: DDEC's air quality QA/QC procedures should include benchmarks for acceptable data capture from all continuous air monitoring equipment operating at the Ekati site and describe what actions would be taken should the benchmarks not be achieved. | Letter | July 29, 2016 | Jaida Ohokannoak (IEMA) | DDEC strives to capture 100% of the data available through all of their air quality monitoring programs. Several years ago, there were some challenges with the rate of data capture through the Ekati air quality monitoring program, challenges which have since been resolved. The rate of data capture has been high in recent years. The reality of monitoring in an Arctic environment, however, necessarily means that even a small problem with a sophisticated air quality analyzer could take it out of service for several weeks owing simply to shipping logistics, the availability of trained technicians, and repair wait times. An unexpected instrument failure of this nature could conceivably take an instrument out of service for 15-20% of the year even with all the responsible parties doing their work diligently. With this in mind, DDEC has not committed to a specific data capture efficiency, but will strive for 100% data capture. Should the actual data capture rate fall below 85% in a given year, DDEC will investigate and report on the cause(s) and the steps taken (if any exist) to prevent a future occurrence in the following year's data report. |
| AQEMMP-IEMA-8 | Section 3.2.1.7 - Greenhouse Gas Emission Calculation Methods | This section provides methodology for calculating greenhouse gas emissions based on diesel fuel combustion. Other potential sources of GHG emissions, although admittedly smaller, exist at the Ekati Mine. One source is the composting of waste. Implemented in 2015, organic waste materials are currently fed into a Brome in-vessel composter where most of the available carbon is converted to $CO_2$ under aerobic conditions, and a small fraction converted to methane. A preliminary search through scientific literature identifies several methods for calculating GHG emissions from composting operations based on a carbon balance approach.<br><br>Recommendation: DDEC should include $CO_2$ and $CH_4$ emissions from the Brome in-vessel composter in the site-wide GHG emissions estimates | Letter | July 29, 2016 | Jaida Ohokannoak (IEMA) | Environment and Climate Change Canada's "Technical Guidance on Reporting Greenhouse Gas Emissions" (https://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=47B640C5-1&offset=5&toc=show), Section 3.3.2 states that $CO_2$ emissions from non-combustion of biomass does not need to be reported. This is reiterated in the National Inventory Report, where it states that the $CO_2$ from composting does not need to be reported.<br><br>DDEC will report methane ($CH_4$) through the Greenhouse Gas Reporting Program until it has demonstrated that the composter does not produce $CH_4$. Until that time, DDEC will use the emission factors provided through ECCC to calculate $CH_4$ emissions. |

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| AQEMMP-IEMA-9 | Section 3.4.1.2 - Fugitive Dust Abatement Program – Methods | Section 3.4.1.2 states '*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*'. The Monitoring Agency could not find a description of these measures in the provided text.<br><br>Recommendation: DDEC should provide a description of fugitive dust abatement measures relating to minimizing and mitigating fugitive dust from drilling, blasting, ore handling and primary crushing activities associated with the Jay Project. | Letter | July 29, 2016 | Jaida Ohokannoak (IEMA) | DDEC is satisfied that the industry-standard measures taken to limit dust generation during drilling, blasting, ore handling, and primary crushing are sufficient and that additional measures to control these sources are not required. The ambient air quality monitoring program for TSP will provide feedback regarding the effectiveness of the existing control measures site-wide, and should the annual values show elevated concentrations that can be attributed to these activities specifically, additional control measures may be considered. The focus of dust control at the Jay Project is on ore haulage on the Jay Road and on the Misery Haul road. Measures taken to reduce dust generation from hauling on these roads will yield results that considerably outweigh those that may be achieved by further mitigation of the drilling, blasting, ore handling, and primary crushing activities. |
| AQEMMP-IEMA-10 | Section 4 - Response Planning - Action Levels and Responses | Air quality Action Levels and responses are described in this section, including a hierarchical series of actions that will be implemented when triggers are exceeded. These actions (i.e. continue monitoring, internal review and development and implementation of a response plan, external review and development and implementation of a response plan) vary depending upon which Action Level (i.e. Action Level I, II or III) is reached. The basis for determining whether a response is required is a comparison of the monitoring data to the annual criteria used to determine compliance.<br>The Monitoring Agency has concerns with the proposed Action Levels for Total Suspended Particulate (TSP) and $PM_{2.5}$ and in particular use of the annual compliance criteria. On page 3-10 of the AQEMMP, DDEC confirms 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%. If the accepted Action Level is based upon annual TSP and $PM_{2.5}$ criteria, and levels are naturally mitigated by 95% during the approximate 9 months of winter conditions, then levels could exceed the Action Level during the remaining 3 month summer period without triggering a management response.<br>DDEC currently uses Partisol samplers to monitor 24-hour TSP levels and Met-One BAM 1020 samplers to continuously monitor $PM_{2.5}$ levels at several locations around the mine site<br><br>Recommendation: Exceedances of TSP and $PM_{2.5}$ levels are typically short-term and episodic in nature during the dry summer months. DDEC currently uses air quality monitoring equipment which is designed to monitor daily TSP and continuous $PM_{2.5}$ levels DDEC should develop triggers for these parameters which are based on the GNWT 24-hour air quality standards instead of the current annual criteria.<br><br>Recommendation: Timeframes should be provided in the AQEMMP during which response plans will be developed and implemented in the event that Action Level II or III criteria are exceeded.<br><br>Recommendation: DDEC should commit to develop and implement a dustfall Action Level trigger within six months of the GNWT interim dustfall objective being adopted. | Letter | July 29, 2016 | Jaida Ohokannoak (IEMA) | 1) IEMA indicates correctly that exceedances of TSP and $PM_{2.5}$ are often short-lived, transient events. These events can indeed occur occasionally. The current practice and future plans include a significant annual dust management program involving a combination of chemical suppressants and road watering and blading. The program is designed to control road dust emissions over the course of a season and involve considerable logistics, properly prepared equipment, materials, and trained personnel. It may be reasonable to provide a mechanism in the overall road management activities, whereby truck operators can report exceptionally dusty conditions to the maintenance team and that a water truck could be deployed to a particularly dusty area in response to visual observations of higher than usual dust generation. Responding specifically to 24-hour TSP and $PM_{2.5}$ values reported by the monitoring would be impractical and ineffective.<br>2) Evaluation of whether the triggered events require additional response or planning will be carried out on an annual basis and reported in the annual report. If necessary, action plans will be implemented in the following dust season.<br>3) DDEC will develop appropriate triggers for managing dustfall within six months of the interim dustfall objective being adopted by the GNWT. |
| AQEMMP-IEMA-11 | Section 5 - AQEMMP Reporting | Section 5 describes the type of information that will be included in the annual data report. The listing appears to be extensive, with the exception of reporting results from the 3-year incinerator stack emissions testing program.<br><br>Recommendation: Results from the 3-year incinerator emissions testing program should be reported in the annual data report for years during which incinerator testing is performed. | Letter | July 29, 2016 | Jaida Ohokannoak (IEMA) | DDEC will report the results from the three-year incinerator stack testing in the annual report for years which the testing is completed, and will make reference to the most recent test results in each of the annual data reports that cover a non-testing year. |

AQEMMP = Air Quality and Emission Monitoring and Management Plan; $CH_4$ = methane; $CO_2$= carbon dioxide; DDEC = Dominion Diamond Ekati Corporation; ECCC = Environment and Climate Change Canada; EA = environmental assessment; GHG = greenhouse gas; GNWT = Government of the Northwest Territories; IEMA = Independent Environmental Monitoring Agency. QA = quality assurance; QC = quality control; $SO_2$ = sulphur dioxide.

**Table A-2 Air Quality and Emissions Monitoring and Management Plan Reviewer Recommendations and Proponent Responses, January 2017.**

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| AQEMMP-GNWT-1 | Measure 6-3, Report of EA | Comment: Measure 6-3 requires Dominion to describe how it will implement management response linkages to the Caribou Road Mitigation Plan (CRMP) and the Caribou Offset and Mitigation Plan (COMP).<br>The GNWT recognizes that dust and the associated monitoring and mitigations are not addressed in the CRMP and the COMP is not required until May 2017.<br><br>Recommendation: The single, consolidated Ekati AQEMMP that incorporates the Jay Project is expected to be released in spring 2017, which is the same time that the COMP is scheduled for completion. The single, consolidated Ekati AQEMMP should include linkages to the COMP. | Letter | January 10, 2017 | Monica Wendt (GNWT) | DDEC is in agreement with this recommendation. |
| AQEMMP-GNWT-2 | Measure 6-3, Report of EA | Comment: Measure 6-3 requires Dominion to describe how it will implement commitments made in the AQEMMP. The table on pages vii to xi fulfills this requirement, for the most part. The following commitments require more information:<br>1. Greenhouse gas emissions (item three, page ix),<br>2. Fugitive dust abatement program (item two, page x).<br><br>Recommendation:<br>1. Please provide an update on the greenhouse gas emissions, specifically the targets mentioned in this commitment, for fiscal year 2016 or direct reviewers to where that information is provided. The status of this item should then be changed to complete.<br>2. The Fugitive Dust Abatement Program (section 3.4.1) should include a brief summary of how Dominion uses speed limits as a dust mitigation strategy, as required by this commitment. Dominion is also required by Measure 6-3 to manage vehicle speed to limit road dust. | Letter | January 10, 2017 | Monica Wendt (GNWT) | 1) As described in page ix of the AQEMMP, DDEC will continue to set targets for greenhouse gas emissions annually for the life of the Ekati mine and this will be reported as part of the Air Quality Monitoring Program report, Mining Association of Canada Towards Sustainable Mining Program, and the Environment Canada Greenhouse Gas Inventory.<br>2) A summary has been added to Section 3.4.1 of the AQEMMP. DDEC will prepare a best management practices document which will include adaptive management triggers for additional dust suppression based on the pending NWT dustfall standard. The document is anticipated to be prepared for review in spring 2017, and will take into account the learnings from the first year of the dust pilot study referenced above. Additional details about implementation of speed limits have been provided in Section 3.4.1.2. |
| AQEMMP-GNWT-3 | Section 3.4.1.2 Methods | Comment: Section 3.4.1.2 states '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'. The GNWT could not find a description of these measures in the provided text.<br>Dominion notes in Table A-1 of the AQEMMP that the industry-standard measures taken to limit dust generation during drilling, blasting, ore handling, and primary crushing are sufficient and that additional measures to control these sources are not required.<br><br>Recommendation: The wording of section 3.4.1.2 should reflect the actual content of the section. | Letter | January 10, 2017 | Monica Wendt (GNWT) | DDEC has provided updates to Section 3.4.1.2 of the AQEMMP. |
| AQEMMP-GNWT-4 | Section 5 AQEMMP Reporting - page 5-1 | Comment: Section 5 of the AQEMMP for the Jay Project outlines what information the AQEMMP annual report will contain. Section 5 does not mention reporting on adaptive policies, strategies and mitigative actions undertaken, or proposed, to reduce greenhouse gas emissions. It also does not mention reporting on greenhouse gas reduction targets for the upcoming year. Measure 9-2 of the Report of EA requires Dominion to include this information in the AQEMMP annual report.<br>Dominion notes in Table A-1 of the AQEMMP that it will include the information required under Measure 9-2 from the Report of EA as part of the GHG Management Report, which will be included as an appendix to the AQEMMP annual report.<br><br>Recommendation: Future versions of the AQEMMP should clearly state in the AQEMMP Reporting section (section 5) that Dominion will provide information required under Measure 9-2 in the AQEMMP annual report. | Letter | January 10, 2017 | Monica Wendt (GNWT) | Section 5 of the AQEMMP has been updated. DDEC will include the information required under Measure 9-2 from the Report of EA as part of the GHG Management Report. A copy will be reproduced as an appendix in the AQEMMP annual report. |
| AQEMMP-GNWT-5 | Table A-1 | Comment: Table A-1 documents a number of instances where Dominion is in agreement with reviewers and/ or has committed to a particular action.<br><br>Recommendation: Future versions of the AQEMMP should incorporate commitments from Table A-1 into the text of the AQEMMP. | Letter | January 10, 2017 | Monica Wendt (GNWT) | In several instances where a commitment has been made in Table A-1 of Appendix A, the commitment has been incorporated into the text of this version of the AQEMMP. Future versions (Spring 2017) will include the balance of the commitments made in Table A-1, as appropriate. |

**Table A-2 Air Quality and Emissions Monitoring and Management Plan Reviewer Recommendations and Proponent Responses, January 2017.**

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| AQEMMP-IEMA-1 | General Comments - Incorporating Jay AQEMMP into the Site-wide Air Quality Management Plan | The Agency notes the following commitments by DDEC that were not incorporated into the current document:<br>1. Incorporation of the provisions of the GNWT interim dustfall objective within six months of it being adopted, including development of an appropriate dustfall management strategy (AQEMMP-IEMA-3).<br>2. Strive for 100% air quality monitoring data capture efficiency and, should the actual data capture rate fall below 85% in any given year, investigate the causes and steps taken to prevent a future occurrence (AQEMMP-IEMA-7).<br>3. Report methane emissions from the in-vessel composter through the Greenhouse Gas Reporting Program using emission factors provided by Environment Canada and Climate Change until it has been demonstrated that the composter does not produce methane (AQEMMP-IEMA-8).<br>4. Prepare a best management practices document, which will include adaptive management triggers for additional dust suppression. (Measure 6-1 of the REA [MVEIRB 2016])<br>5. Provide a mechanism in the overall road management activities whereby truck operators can report exceptionally dusty conditions to the maintenance team and that a water truck be deployed to the dusty areas (AQEMMP-IEMA-10).<br>6. Report waste incinerator stack testing results in the annual report for years which the testing is completed and make reference to the most recent test results in each of the annual data reports that cover a non-testing year (AQEMMP-IEMA-11).<br><br>The Agency anticipates the incorporation of these commitments in the upcoming consolidated version of the AQEMMP expected in the spring of 2017. Also, although the Agency is satisfied with DDEC's commitment to provide a dust reporting mechanism in the overall road management activities (AQEMMP-IEMA-10), we will be seeking additional clarity around dustfall adaptive management and response planning with incorporation of the GNWT interim dustfall standard. | Letter | January 9, 2017 | Jaida Ohokannoak (IEMA) | Please see responses provided below, respectively:<br><br>1) Additional action on a dust reporting mechanism will be based on the pending interim guideline being developed by the GNWT.<br>2) Section 2.9 of the AQEMMP has been revised to include this provision.<br>3) Section 5, Reporting has been revised to include the reporting of any in-vessel composter methane emissions until it can be demonstrated that the composter does not produce methane. This information will be a component of the GHG Management Report which will be appended to the AQEMMP.<br>4) Per Measure 6-1 of the Report of EA, DDEC will prepare a best management practices document which will include adaptive management triggers for additional dust suppression based on the pending NWT dustfall standard. Please see AQEMMP Section 3.4.1.3.<br>5) Drivers already conduct this activity to maintain a safe operating environment of the site roads; an additional mechanism to report dusty conditions is not required.<br>6) The reporting of the most recent incinerator stack test results has now been explicitly included in Section 5 of the AQEMMP. |
| AQEMMP-IEMA-2 | General Comments - Update of Site-wide AQEMMP | Other matters that the Agency will be seeking clarity on include:<br>1. Absence of a dustfall transect adjacent to the Long Lake Containment Facility (LLCF).<br>2. Description of a 'predetermined interval' for installation of fresh (calibrated) meteorological monitoring station sensors (section 2.2).<br>3. Description of dustfall and sulphate and nitrate monitoring station locations. The AQEMMP states that monitoring transects of 5 stations are located adjacent to the airstrip and LLCF along with the Misery and Fox haul roads (section 2.5.1). This statement is inconsistent with Map 2.1-1 which shows dustfall transects located adjacent to haul roads only.<br>4. The Agency could not locate a description of fugitive dust abatement measures as they relate to drilling, blasting, waste rock and ore handling and primary crushing activities even though the text states a discussion is provided in section 3.4.1.2. The Agency accepts DDEC's explanation that the focus of dust control should remain on ore haulage and vehicle travel along the Jay and Misery roads. However, drilling, blasting, waste rock and ore handling and crushing activities remain a potential source of fugitive dust and a description of abatement measures being undertaken by DDEC should be provided (section 3.4.1.2). | Letter | January 9, 2017 | Jaida Ohokannoak (IEMA) | Please see responses provided below, respectively:<br><br>1) DDEC does not plan to install an additional transect adjacent to the LLCF. Other local dustfall monitoring activities will adequately capture dust deposition in the area.<br>2) Section 2.2 of the AQEMMP has been revised to explicitly describe the predetermined interval as per the vendor's specifications. Different sensors have different required intervals.<br>3) Map 2.1-1 does show dustfall monitoring stations adjacent to the LLCF and the airstrip as well as in transects adjacent to the haul road.<br>4) Section 3.4.1.2 has been revised to better describe the mitigation and procedures being employed to manage fugitive dust from drilling, blasting, and ore handling. |
| AQEMMP-DKFN-1 | Snow and Lichen Sampling | DKFN has recommended that snow and lichen samples be collected on the lakes. | Phone call | January 17, 2017 | Shawn McKay (DKFN) | The matter of snow (and lichen) sampling was discussed during the September 14, 2016 meeting in Yellowknife. DDEC explained that snow sampling on shore locations would provide the same information as if the sampling were done on the lakes. In fact, because the shore locations are typically nearer to the activities that could cause dust deposition, they are likely to show higher values than if the sampling were done on the lake(s). Additional air quality sampling on the lakes is not recommended as the existing monitoring stations provide adequate spatial coverage. |

**Table A-2 Air Quality and Emissions Monitoring and Management Plan Reviewer Recommendations and Proponent Responses, January 2017.**

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| AQEMMP-DKFN-2 | Dust and Meteorological Monitoring | DKFN has recommended that dust monitoring stations be both east and west of the Jay Project. | Phone call | January 17, 2017 | Shawn McKay (DKFN) | It was explained in the September 14, 2016 meeting in Yellowknife, that the best location for the continuous station was just west of the Jay Pit, as indicated on Map 2.1-1 in the AQEMMP. DDEC also agreed to include, snow and lichen sampling on the east side of Lac du Sauvage at two locations, one straight east of the Jay Project and the other to the southeast, essentially at the first available land in these respective directions and to co-locate a dustfall station at the “straight east” location. Each of these is indicated on Map 2.1-1. DDEC indicated in the September meeting that a station on the other side of Lac de Gras would be too far away to be meaningful, and further, a station in that area should be covered off under a Diavik mine monitoring program if it were to be required. The appropriate monitoring locations for the Ekati mine AQEMMP are identified on Map 2.1-1 in the AQEMMP. |
| AQEMMP-DKFN-3 | Dust and Meteorological Monitoring | DKFN recommends that maps are updated to include the early studies. | Phone call | January 17, 2017 | Shawn McKay (DKFN) | This question is likely referring to the idea that passive monitoring ($NO_2$ particularly) is planned at the Jay Road transect (the 90 m dustfall station) and at the location of the Jay Continuous Monitoring station prior to commissioning the actual continuous station. Map 2.1-1 in the AQEMMP has been modified to include this monitoring. |

AQEMMP = Air Quality and Emission Monitoring and Management Plan; DDEC = Dominion Diamond Ekati Corporation; DKFN = Deninu K’ue First Nation; EA = environmental assessment; GHG = greenhouse gas; GNWT = Government of the Northwest Territories; IEMA = Independent Environmental Monitoring Agency; LLCF = Long Lake Containment Facility; $NO_2$ = nitrogen dioxide.