

ENVIRONMENTAL MONITORING ADVISORY BOARD

PEER REVIEW OF THE 2019 ENVIRONMENTAL AIR QUALITY MONITORING REPORT DIAVIK DIAMOND MINES (2012) INC.

October 2020



**PEER REVIEW OF THE
2018 ENVIRONMENTAL
AIR QUALITY
MONITORING REPORT
DIAVIK DIAMOND
MINES (2012) INC.**

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1 INTRODUCTION

As requested by the Environmental Monitoring Advisory Board (EMAB), Arcadis Canada Inc. (Arcadis) undertook a review of the *2019 Environmental Air Quality Monitoring Report* (AQMR) [ERM 2020] prepared by ERM Consultants Canada Ltd. (ERM) for Diavik Diamond Mines (2012) Inc. (DDMI). The report summarizes the air quality monitoring activities conducted at the DDMI diamond mine during 2019. The components of DDMI's AQMR include the following:

- dustfall monitoring;
- snow core sampling program;
- National Pollutant Release Inventory (NPRI) reporting; and
- Greenhouse Gas (GHG) reporting.

The aspects of the AQMR contained within Arcadis' scope of review specifically included:

- implications resulting from A21 Kimberlite Pipe and associated construction and operational activities;
- adequacy of monitoring locations;
- effectiveness of dust suppression techniques;
- quality Assurance/Quality Control (QA/QC) practices and Standard Operating Procedures (SOPs);
- integration of meteorological data and operational information;
- modelled versus monitored TSP and dustfall;
- adequacy and effectiveness of TSP samplers used; and
- how well DDMI addressed comments and recommendations on the 2018 AQMR.

Arcadis completed a review of each of the above components of the air quality monitoring program in place at the DDMI diamond mine, as described in the 2019 AQMR. The following sections outline the findings of the review. The report concludes with a summary of key findings and recommendations.

2 DISCUSSION

2.1 Continuous TSP Monitoring

Continuous air monitoring (CAM) was commissioned in April 2013 at two sampling locations: 1) the communications building adjacent to the accommodations complex; and 2) the A154 dike along the southeast corner of the A154 pit. The locations were selected based on the results of an updated air dispersion modelling analysis (completed in 2012), the proximity to the Project footprint, and power requirements. In previous reports, there were discussions of continuous TSP Monitoring for the two locations. However, in AQMR 2019 Report, there is neither discussion of a completed continuous TSP monitoring nor a rationale was provided as such for the discontinuation. It is in Arcadis' opinion that the AQMR must provide at a minimum provide rationale for its deviation from its continuous TSP monitoring.

2.2 Dustfall and Snow Core Sampling

The dustfall monitoring and snow core sampling programs were implemented in 2001 under the Aquatic Effects Monitoring Program (AEMP) as a means of collecting information on dust deposition with distance from mining activities. A summary of the 2019 AEMP results is provided in the AQMR, while details are provided in *Diavik Diamond Mine: 2019 Dust Deposition Report* (DDMDDR) prepared by ERM [2020]. With no local guidance for dustfall, the AQMR compares DDMI dustfall levels to former objectives used by the the Alberta Ambient Air Quality Guidelines for dustfall (Table 2.1-2; Alberta Environment and Parks 2019) The Alberta Ambient Air Quality Guidelines for dustfall include a guideline for residential and recreation areas (53 mg/dm² per 30 days) and a guideline for commercial and industrial areas where higher dustfall rates are expected (158 mg/dm² per 30 days). To compare against the Alberta Ambient Air Quality Guidelines, the daily and annual thresholds are calculated based on the 30-day objectives.

Our comments with respect to dustfall and snow core sampling are presented in Table 1.

Table 1. Review of Dustfall and Snow Core Sampling

No.	Comment
1.	<p>AQMR, Page 2-6: <i>“The Northwest Territories has no guidelines or objectives for dustfall deposition. The estimated dustfall rates are compared to the Alberta Ambient Air Quality Guidelines for dustfall (Table 2.1-2; Alberta Environment and Parks 2019), which are used only as general performance indicators and are not a regulatory requirement in compliance evaluation. The Alberta Ambient Air Quality Guidelines for dustfall include a guideline for residential and recreation areas (53 mg/dm² per 30 days) and a guideline for commercial and industrial areas where higher dustfall rates are expected (158 mg/dm² per 30 days). To compare against the Alberta Ambient Air Quality Guidelines, the daily and annual thresholds are calculated based on the 30-day objectives. The daily threshold ranged from 1.77 mg/dm²/d to 5.27 mg/dm²/d, while the annual threshold ranged from 646 to 1924 mg/dm²/y.”</i></p> <p>The previous AQMRs compared DDMI dustfall levels to the former British Columbia Ministry of Environment (BC MOE) dustfall objectives for the mining, smelting and related industries (Table 3.1-2; BC MOE 2016) with values ranging from 1.7 to 2.9 mg/dm²/day, based on a 30-day average. It is understood that the 1.7 mg/dm²/d objective is often considered to be applicable at sensitive locations, whereas the 2.9 mg/dm²/d objective is applicable to areas where it can be</p>

	<p>shown that unacceptably deleterious changes will not follow. This 2019 AQMP evaluated against the Alberta Ambient Air Quality Guidelines, the daily and annual thresholds were calculated based on the 30-day objectives. This evaluation in 2019 is inconsistent with the previous AQMRs. Furthermore, a rationale for this change was not provided either in the 2019 AQMR. In comparing the two guideline values, the BC MOE had more stringent values than Alberta's. On this basis, Arcadis recommends that a rationale must be included in the AQMR report for the change prior to implementation as part of assessment in this 2019 report.</p>
<p>2.</p>	<p>AQMR, Page 2-9: <i>“The higher deposition rate near the ice road (at Dust 7 station) during the winter is explained by dustfall associated with the ice road, and by Dust 7’s location close to the road and downwind of it. Some dustfall stations that are located close to the ice road (SS2-4 and SS3-8) did not show elevated readings, possibly because they are upwind of the road”.</i></p> <p><i>The greatest estimated dustfall rate measured using gauges occurred at Dust 3 (25 m from the Mine). The Dust 3 measured dustfall rate in 2018 was 796 mg/dm²/y. Dust 7 (667 mg/dm²/y) and Dust 10 (645 mg/dm²/y) recorded the second and third highest dustfall rates measured using gauges, respectively. Both sites are located on the south side of the Mine. Dust 7 is located 1,147 m from the Mine but very close to the winter road (figure 3.1-1), and Dust 10 is located 46 m from the Mine adjacent to the A21 open pit.”</i></p> <p>The 2019 AQMR indicated that one of the primary sources of fugitive dust was associated with truck traffic along the ice road to the Mine. In comparison to the reported dustfall values provided in Table 3-1 of 2019 Dust Deposition Report in Appendix A of the AQMR, dust fall station SS3-8 recorded 296 mg/dm²/y while Dust 7 station recorded 298 mg/dm²/y. Even though the AQMR report claims that SS3-8 did not show “elevated” levels, the value is in essence very similar in comparison, a minor difference of only 2 mg/dm²/y. Furthermore, the report noted that the SS3-8 being upwind of the ice road which is correlated to the predominant wind direction blowing from the northwest as depicted in the wind rose in Figure 2.1-1. In comparison, dustfall data of 248 mg/dm²/y as recorded in SS3-4, is located to the north of the SS3-8 further away from the ice road. Considering these correlation between the three stations’ data sets, it does not appear to indicate the source of the dustfall at Dust 7, SS3-8 and SS3-4 are associated with the ice road, rather the high concentrations appear to indicate that dustfall is likely due to the operations from the Mine.</p> <p>Since there are increased dust observations for the series of these stations, Arcadis recommends relocating the SS3-4 and SS3-8 stations to the west and east of the current locations respectively, where the source of the dust can likely be verified and confirmed.</p> <p>Arcadis also recommends that the 2012 modelling assessment be updated during the review of the EAQMP to reflect current operations and assess the observed dustfall observations with predicted concentrations within the updated assessment.</p>
<p>3.</p>	<p>AQMR, Page 2-11: <i>“Fugitive dust generation is expected to be greatest during snow-free periods where and when there is site activity. It was expected that the highest fugitive dust generation and resulting dustfall occurred in areas closest to the roads, the airstrip, and the mine footprint such as near A21 between May and September. The difference between the summer and winter dustfall rate was generally minor with the summer rate being slightly higher at some stations (e.g., the rate at Dust 3 was 1,024 mg/dm²/y in the summer and 940 mg/dm²/y in the</i></p>

	<p><i>winter), while some sites recorded a higher dustfall rate in winter than in summer (e.g., the rate at Dust 2A was 309 mg/dm²/y in the summer and 399 mg/dm²/y in the winter)”</i></p> <p>Given these observations, the interpretations of the findings in the AQMR are unclear. Arcadis concurs that the dustfall is expected to be relatively higher during the summer months for majority of the stations, if not all. Given the observed impacts that the dustfall rate is recorded higher in winter than in the summer for station in Dust 2A, Arcadis deduces that the observation is likely due to shifting or changes in mining activities and that the fact that the station location is downwind based on the predominant wind direction from the northwest. Notwithstanding the above, it is recommended that the 2012 modelling assessment be updated to identify the changes to general mining activities (i.e. increase use of certain roadways, new mining areas, suspended activities, etc.). Furthermore, evaluate visual dust observation and mitigation application logs, or similar, which would allow for the correlation of observed visual dust and changes in operations to the dustfall results as well as the demonstration of the mitigation measures are having a positive impact on the dustfall results. This reassessment would provide confidence that the observed concentrations are within or below those of the conservatively model predicted concentrations and therefore confirm that the implemented mitigation measures employed at the Mine are effective.</p>
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2.3 NPRI and GHG Emission Inventories

Emissions for CO, SO₂, NO_x, VOC, Ammonia (NH₃), TSP, PM, PM₁₀ and PM_{2.5} were estimated for 2019 reportable year submission to Environment and Climate Change Canada (ECCC) under the National Pollutant Release Inventory (NPRI) reporting program. In addition, Greenhouse Gas (GHG) emissions were calculated and reported to the federal system through ECCC.

Our comments with respect to NPRI and GHG emission inventories are presented in Table 2.

Table 2. Review of NPRI and GHG Inventories

No.	Comment
4.	<p>AQMR, Section 3 and Section 4</p> <p>The results of the NPRI and GHG emissions inventories are discussed in Sections 3 and 4 of the AQMR, respectively. As indicated in Arcadis' previous reviews, the AQMR does not include any detailed information about the emission factors or calculation methodologies used for either of the inventories. On the basis of the limited information presented within the AQMR regarding operating conditions at the Mine for the reportable year 2019, Arcadis considers the values reported by DDMI to be reasonable by comparison to previous years' submissions. However, it should be note that a detailed review of the methodologies used/calculations specifically conducted to derive these estimates would be required to confirm their appropriateness and completeness.</p>

3 CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

There are few improvements that could be made as noted in the review of the DDMI *2019 Environmental Air Quality Monitoring Report* and some generalizations and comments made that are not supported by the data. The main points of concern are summarized below:

General Comments

- There was no mention of rationale for the deviation or discontinuation of TSP monitoring program in the 2019 AQMR. This is of particular concern, given the fact that several issues were identified in the previous reviews pertaining to the TSPs.
- There was not enough information provided in the AQMR to validate the reasoning for adopting a change in the comparison of dustfall evaluation values. The previous AQMRs compared DDMI dustfall levels to the former British Columbia Ministry of Environment dustfall objectives for the mining, smelting and related industries (Table 3.1-2; BC MOE 2016) whereas in 2019 the Alberta Ambient Air Quality Guidelines for dustfall were used for comparison.

Dustfall Monitoring Program

- The results of the Dustfall and Snow core sampling program strongly indicate that the A21 Open Pit operations have impacted the dust seen off-site from the Mine, specifically Dust 10 station. It was expected that the highest fugitive dust generation and resulting dustfall occurred in areas closest to the roads, the airstrip, and mine footprint such as near A21 between May and September.
- There were minor differences in dustfall values noted between the summer and winter seasons, more specifically at Dust2A station which recorded higher dustfall values in the winter when compared to the summer. These general observations were not provided with an interpretation and should have been further evaluated with comments noting the rationale.
- Similar to 2018, in the 2019 AQMR there was no attempt to evaluate or use the dustfall results to evaluate the effectiveness of the dust suppression efforts or correlate to mining activities, other than to state that it is expected that road watering reduced the amount of dust generated and that the higher overall dust rates were likely a result of surface activity, particularly at A21.

NPRI and GHG

- There was not enough information provided within the AQMR to validate the reported values to NPRI or GHG.

3.2 Recommendations

Based on the above conclusions of the review, Arcadis has the following recommendations for future EAQMP activities and reporting:

- Data pertaining to meteorological observations and records of on-site activities, including any visual dust observation and mitigation logs, be used to document the cause/rationale for events of high dustfall values measured at the various stations.
- A detailed comparison of monitored and modelled dustfall be included within the AQMR.
- Details of the NPRI and GHG calculations be included, or a reference to an external document containing such details, to allow for validation of methods and quantities reported.

Arcadis recommends that the following items be considered during the re-evaluation of the EAQMP for the site:

- The 2012 dispersion modelling assessment be updated to reflect current operations and be used to evaluate the appropriate locations for assessment of dustfall observations with predicted concentrations within the updated assessment.

