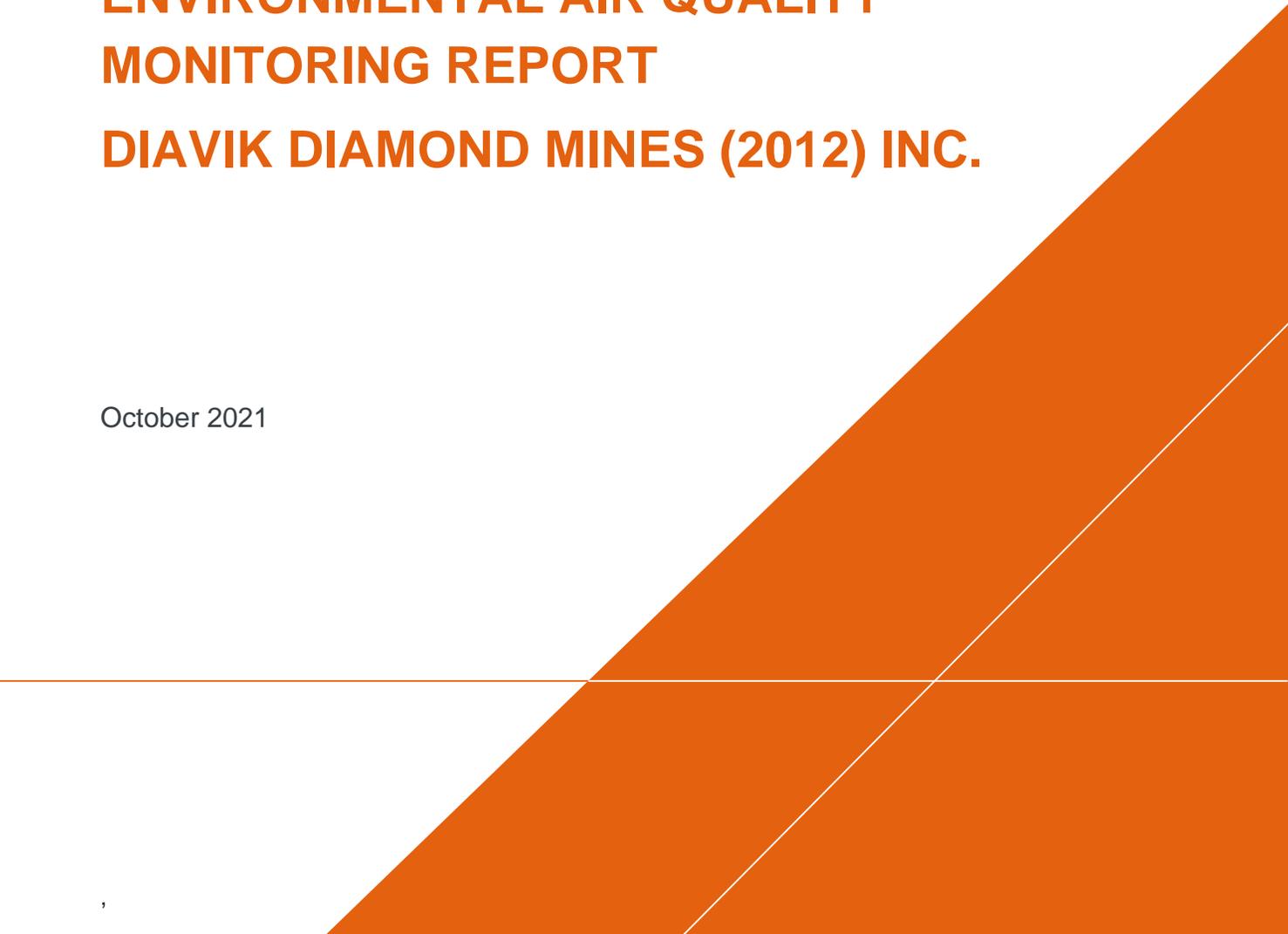# ENVIRONMENTAL MONITORING ADVISORY BOARD

PEER REVIEW OF THE 2020 ENVIRONMENTAL AIR QUALITY MONITORING REPORT

DIAVIK DIAMOND MINES (2012) INC.

October 2021

PEER REVIEW OF THE 2020 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 *2020 Environmental Air Quality Monitoring Report* (AQMR) [ERM 2021] prepared by ERM Consultants Canada Ltd. (ERM) for Diavik Diamond Mines (2012) Inc. (DDMI), dated July 2021 and a follow-on addendum dated October 22, 2021. The report summarizes the air quality monitoring activities conducted at the DDMI diamond mine during 2020. The components of DDMI's AQMR include the following:

- dustfall monitoring;
- snow core sampling program; 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;
- assessment of Quality Assurance/Quality Control (QA/QC) practices and Standard Operating Procedures (SOPs);
- integration of meteorological data and operational information;
- modelled data versus monitored dustfall; and
- how well DDMI addressed comments and recommendations on the 2019 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 2020 AQMR. The following sections outline the findings of the review. This current review concludes with a summary of key findings and recommendations.

2   DISCUSSION

2.1   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 2020 AEMP results is provided in the AQMR, while details are provided in *Diavik Diamond Mine: 2020 Dust Deposition Report* (DDMDDR) prepared by ERM, dated March 2021. 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/dm^2 per 30 days) and a guideline for commercial and industrial areas where higher dustfall rates are expected (158 mg/dm^2 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.	**AQMR, Page 2-10:** *"The three highest estimated dustfall rates in 2020 measured using gauges occurred at the following monitoring locations: Dust 10 (757 mg/dm^2/y; 46 m from the Mine), followed by Dust 3 (599 mg/dm^2/y; 22m from the Mine) and Dust 11 (446 mg/dm^2/y; 747 m from the Mine). This is similar to 2019, when Dust 3 recorded the highest rate followed by Dust 10 and Dust 11. The elevated rates at the Dust 10 site are explained by its location adjacent to the A21 open pit, while Dust 11 is located west of the South Country Rock Pile – Waste Rock Storage Area (SCRP-WRSA; Figure 2.1-1).*
	In comparison to the dustfall estimated data from 2019's, the dustfall estimated in 2020's is only consistent for Dust 3 and Dust not Dust 11. The Dust 11 is reportedly located relatively far from the mine at 747 metres, west of the South Country Rock Pile – Waste Rock Storage Area. The AQMR indicated that the primary sources of fugitive dust were associated with unpaved road and airstrip usage and construction and mining activities at the A21 open pit. The AQMR also indicated that the major material transfers in 2020 included the use of haul roads to move waste rock and till and the transfer of kimberlite ore to the processing plant including source of fugitive dust from truck traffic along the ice road to the Mine.
	Furthermore, the report noted that the predominant winds blew from the northwest, southeast and east as depicted in the wind rose in Figure 2.1-1and the results show that the proximity to the mine activity is a stronger indicator of dust deposition than wind direction. This is supported by the fact that the three highest dust deposition rates in 2020 (Dust 10, 3, and 11) are located south or southwest of the mine footprint where wind speeds were relatively weak compared to other directions. Given the distance from the Mine, the reported estimated dustfall at elevated levels at Dust 11 remains unexplained.
	Arcadis recommends inclusion of two (2) temporary stations to the north and east of the current Dust 11 location respectively, where the source of the dust can likely be verified and confirmed. Furthermore, as to previous years, Arcadis also strongly 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. This evaluation is essentially important for the sake of comparison between modelled results and actual monitoring reflecting the existing operations and meteorological conditions.
	2.	**AQMR, Page 2-11: "***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 mine footprint such as near A21 between May and September, although in 2020 the variations in dustfall rates from summer to winter were generally minor. The difference between the summer and winter dustfall rate was generally minor with the summer rate being higher at most sites (e.g., the Dust 1 rate was 596 mg/dm^2/y in the summer and 164 mg/dm^2/y in the winter), while some sites recorded a higher winter dustfall rate (e.g., the Dust 2A rate was 298 mg/dm^2/y in the summer and 322 mg/dm^2/y in the winter.***"* Given these observations, the interpretations of the findings in the 2020 AQMR are unclear, similar to what was noted in the 2019's AQMR. The dustfall is expected to be relatively higher during the summer months when compared to the winter months. This expected observation was demonstrated in the results noted at Dust 1. However, the observed dustfall rate was recorded higher in winter than in the summer for the 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 to evaluate using actual dust observation and mitigation application logs, which would allow for the correlation of observed visual dust and the application of mitigation measures whether having a positive impact on the overall dustfall results. Furthermore, as noted above in the previous comment, Arcadis recommends 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.). This modelling assessment would generally provide correlation 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 being effective.

2.2 NPRI and GHG Emission Inventories

Given the extension of the reporting deadline for 2020 reportable year submission to Environment and Climate Change Canada (ECCC) under the National Pollutant Release Inventory (NPRI) reporting program to September 30, the final evaluation for 2020 NPRI reporting has been included as an addendum in the AQMR on October 22, 2021..

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
3.	**AQMR, Section 3** The results of the GHG emissions inventories are discussed in Section 3 of the AQMR. As indicated in Arcadis' previous reviews, the AQMR does not include any detailed information about the emission factors or calculation methodologies used for the GHG inventories. On the basis of the limited information presented within the AQMR regarding operating conditions at the mine for the reportable year 2020, Arcadis considers the values reported by DDMI to be reasonable by comparison to previous years' submissions. However, it should be noted that the ECCC's 2020 Greenhouse Gas Quantification Requirements apply to mining operations and a detailed review of the methodologies used/calculations specifically conducted to derive these estimates would be required to confirm their appropriateness and completeness. Similarly, the results of the NPRI reportable emissions inventories are discussed in an addendum cover letter of the AQMR. The results compared 2020 NPRI Criteria Air Contaminant emission submission results against the 2019's NPRI submission. However, as indicated in Arcadis' previous reviews, the addendum did not include any detailed information about the emission factors or calculation methodologies used for the inventories. Without the review of the detailed methodologies employed for the NPRI reported emission calculations, the comprehensiveness and accuracy cannot be confirmed.

3 CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

There are a few improvements that could be made as noted in the review of the DDMI *2020 Environmental Air Quality Monitoring Report* and some generalizations and comments made that are not supported by the data. Overall, Arcadis' comments on the aspects of the 2020 AQMR are provided below:

- Implications resulting from A21 Kimberlite Pipe and associated construction and operational activities: As to the components of this overall AQMR, DDMI demonstrated an effective monitoring program in 2020 that included dust deposition (dustfall) monitoring, a snow core program and finally, reporting to the ECCC's national greenhouse gas reporting program. This report presented an update which is relatively similar to the historical years with some expected variations. This AQMR could have been improved further if the report demonstrated listed specific changes in the associated construction and operational activities in comparison to the previous year's and commented how those changes correlated with the overall objective for 2020.

- Adequacy of monitoring locations: Overall the monitoring locations are generally considered adequate as an effective means to correlate the contribution of the mining activities and the impacts considering the distances and the meteorological conditions. However, some improvements could be made with the addition of temporary stations as noted in this Peer Review and relocations of SS3-4 and SS3-8 dust stations in 2019 Peer Review.

- Effectiveness of dust suppression techniques: The AQMR recognized the effectiveness of dust suppression as it was indicated that during the summer months from June and September 2020, approximately 3,472 m^3 of water was applied to the site and 26,820 m^3 of water was applied to haul roads; however, the exact impact of dust suppression was not determined from the data collected in 2020. The future AQMRs should make an effort to verify the effectiveness of the dust suppression by correlating the collected data with and without the suppression measures.

- Assessment of Quality Assurance/Quality Control (QA/QC) practices and Standard Operating Procedures (SOPs) – The AQMR demonstrated good QA practices through providing the detailed field notes generated from each of the collected dataset at the stations.

- Integration of meteorological data and operational information: The AQMR provided predominant wind directions based on the wind rose generated from the meteorological dataset collected at the mine. The AQMR did not include the precipitation data in correlating the overall dust fall impacts from the operations.

- Modelled data versus monitored dustfall: The AQMR did not provide any discussion with regards to an evaluation of the 2012 (or any recent) modelled dataset against the 2020 monitored dataset.

- How well DDMI addressed comments and recommendations on the 2019 AQMR: This 2020 AQMR included general comments about the applicability of the Province of Alberta's Ambient Air Guideline instead of the previously used guideline from the Province of British Columbia's. However, other recommendations such as the relocation of the Dust stations, inclusion of a comprehensive NPRI and GHG report and finally, an update of the 2012 modelled dataset were not addressed as per the 2019's Peer Review.

The main points of concern are summarized below:

Dustfall and Snow Survey Programs

- The results of the Dustfall and Snow core sampling program strongly indicate that that proximity to mining activity is a stronger indicator of dust deposition than the omnidirectional wind directional pattern as noted in the AQMR. This is supported by the fact that the stations with the elevated dust deposition rates occurred in areas closest to the roads, the airstrip, and mine footprint such as near A21 during the summer months.
- At station Dust2A, higher dustfall values were recorded in the winter when compared to the summer. It was expected that higher dustfall would occur in the summer rather than the winter. This was not borne out by observation and should have been further evaluated and an adequate explanation provided for this variance.
- Similar to 2019, the 2020 AQMR also failed to make reasonable attempt for the evaluation of the effectiveness of the dust suppression/mitigative efforts, other than to make general statement that *"however, it is likely that road watering reduced the amount of dust generated at the mine"* and that the higher overall dust rates were likely a result of surface activity, particularly at A21 open pit.
- The 2020 AQMR indicated that the dust fall estimated at Dust 11 station is 446 mg/dm^2/y while being located at 747 metres from the Mine. Given the location of the station not relatively closer to the Mine and significant haul routes, the source of the elevated dustfall remains unexplained.

NPRI and GHG

- The evaluation of the reported amounts submitted to the ECCC's NPRI program was provided as an addendum on October 22, 2021; however, there was not enough information to validate the accuracy and comprehensiveness of the stated emissions in the NPRI submission for 2020.
- There was not enough information provided within the AQMR to validate the reported values to the ECCC's GHG reporting program.

3.2 Recommendations

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

- With the unknown source for the elevated dustfall estimated at Dust 11, Arcadis recommends introduction of two (2) temporary stations to the north and east of the current Dust 11 station location, where the source of the dust can likely be verified.
- 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.
- 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.