ARCADIS Design & Consultancy for natural and built assets

Environmental Monitoring Advisory Board

PEER REVIEW OF THE 2017 ENVIRONMENTAL AIR QUALITY MONITORING REPORT DIAVIK DIAMOND MINES (2012) INC.

SUMMARY REPORT

October 2018

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1 INTRODUCTION

A monitoring program to assess air quality on a regular basis is a requirement at the Diavik Diamond Mine. Each year the company, Diavik Diamond Mine (2012) Inc. (DDMI), has to report on the air quality monitoring results. DDMI completed their annual reporting requirements in 2017 in the report titled "2017 Environmental Air Quality Monitoring Report".

The Environmental Monitoring Advisory Board (EMAB) asked Arcadis Canada Inc. (Arcadis) to complete a technical review the 2017 air quality report. This summary provides an overview of Arcadis' findings.

2 BACKGROUND OF THE AIR QUALITY MONITORING

Air quality monitoring activities at the DDMI mine include three main components:

- Continuous monitoring of total suspended particulates:
  - Total suspended particulates are tiny particles that stay in the air. The concentration of them can be measured by weighing how many get captured on a filter.
  - These particles can come from human-made sources such as: motor vehicle use, combustion products from space heating, industrial processes, power generation. Natural sources can be: soil, pollen, bacteria.
- Dustfall monitoring and snow core sampling:
  - Dustfall is created when fine particles in the air are deposited onto the ground.
- Reporting results to the National Pollutant Release Inventory (NPRI) and greenhouse gas (GHG) emissions inventories of Environment and Climate Change Canada (ECCC):
  - The NPRI is Canada's legislated, publicly accessible inventory of pollutant releases.

3 FOCUS OF ARCADIS REVIEW

Arcadis was asked to review the 2017 air quality reporting with a focus on the following:

- How well the monitoring program is designed and carried out;
- Quality of data and analyses;
- Defensibility of conclusions;
- Issues raised by the report; and,
- Recommendations for improvement.

The Arcadis review also provides comments on the implications of construction and operation of the A21 Kimberlite Pipe, representation of data in relation to station locations, effectiveness of monitoring dust control activities at the mine site, comparison of measured data to modelling results, integration of

operational information, and how well Diavik addressed previous comments and recommendations. A summary of the review findings is presented below, divided into the three main components:

- Continuous Total Suspended Particulate Monitoring;
- Dustfall and Snow Core Sampling;
- NPRI and GHG Emission Inventories.

4 SUMMARY OF REVIEW FINDINGS

4.1 Continuous Total Suspended Particulate Monitoring

Continuous air monitoring started in April 2013 at two sampling locations: 1) the communications building (CB) adjacent to the accommodations complex; and 2) the A154 dike (A154) along the southeast corner of the A154 pit. The locations were selected based on the results of an updated air dispersion modelling analysis, the proximity to the Project footprint and power requirements. The device that is used to make continuous measurements is called a beta attenuation monitor (BAM).

The main concerns about the continuous monitoring program are presented below:

- Quality Assurance and Quality Control (QA/QC):
  - In reviewing the reports, a significant, overarching problem with the monitoring relates to how the BAMs were looked after. That is, in order for there to be confidence about the results presented in the DDMI reports, it needs to be clear that the measurement device is taking accurate readings. This is done by regular calibration and preventative maintenance of the machine.
  - The report identifies that the monitors are still unable to operate efficiently to obtain a complete data set.
  - The major concern with this QA/QC issue is that it makes it very difficult to trust the monitoring results. The validity of the total suspended particulate dataset is questionable.
- Location of Monitoring Stations:
  - To be effective, the monitoring stations need to be in places where they are expected to capture the maximum total suspended particulate concentrations. This is done by knowing the most common wind directions for the site, by having a record of actual wind measurements and using modelling predictions.
  - Based on information provided in the reports, it is not clear that this is the case since no modelling information is provided in the report.
- Poor Description of Results:
  - The air quality reporting highlights one instance at A154 Dike where total suspended particulate concentrations are much higher than expected but the reason for exceedance isn't definitively discussed.

- The report also does not provide any discussion for other elevated results and whether dust suppression methods are reducing dust as expected.

4.2 Dustfall and Snow Core Sampling

The dustfall monitoring and snow core sampling programs started in 2001 under the Aquatic Effects Monitoring Program (AEMP). This sampling is done to collect information on dust deposition with distance from mining activities. A summary of the 2017 results is provided in the Air Quality Monitoring Report, while details are provided in Appendix E, *Diavik Diamond Mine 2017 Dust Deposition Report* (DDMDDR) prepared by ERM. Since there is no guidance in the NWT for acceptable dustfall concentrations, the Diavik report compares measured dustfall levels to former objectives used by the Province of British Columbia for the mining industry.

The main concerns about the dustfall and snow core sampling programs are presented below:

- Quality Assurance and Quality Control (QA/QC):
  - As with the total suspended particulate sampling, there is an overarching QA/QC problem with the dustfall monitoring. That is, the program does not follow standard (established) dustfall sampling procedures.
  - A Standard Operating Procedure (SOP) for dustfall is presented in the Appendix to the report, but the problem is that in the discussion section of the report there is no discussion of QA/QC rules followed in the field for dust gauges, at the time of sample collection. It is very important to follow proper procedure to ensure that results can be relied upon.
  - In addition to QA/QC problems with the field procedures, there is also a possible laboratory problem. That is, once samples are collected they are processed in a lab at the mine site to measure the concentrations of total suspended solids. The reporting provides no information on how this is done; therefore, it is not possible to know if proper procedure is being followed.
  - Dustfall collection happens four times per year (quarterly). This does not follow internationally established protocols which are based on monthly sampling. This can also result in findings that underestimate what is actually happening.
- Poor Data Analysis and Discussion:
  - There is no attempt in the reporting to evaluate or explain trends over time or distance for dustfall results and how those may show how well dust control at the site is working.
  - There is little attempt in the reporting to explain why elevated results are happening and what may be the cause.

4.3 NPRI and GHG Emissions Inventories

Emissions for various standard atmospheric components used to assess air quality (e.g., CO, SO_2, NOx, VOC, TSP, PM_{10} and $PM_{2.5}$) were estimated for 2017 and reported to ECCC under the NPRI reporting system. In addition, GHG emissions were calculated and reported to the federal system through ECCC.

As with the previously discussed concerns about reporting, the main issue with the NPRI and GHG emissions inventories is that the report does not include any detailed information about the emission factors or calculation methodologies used for either of the inventories. This means that Arcadis was unable to comment on whether or not the calculations used in the inventories were correct.

Arcadis considered the reported numbers compared to results from Ekati and Snap Lake mines, as well as considering the information provided within the report that describes how the mine operated in 2017. It was found that based on this information it is likely that the DDMI values reported are reasonable; however, there should be enough information provided in the DDMI reports to be able to tell without having to make inferences and comparisons to other sites.

5 RECOMMENDATIONS

Based on the Arcadis review, there are key concerns that make it difficult to have confidence in the results presented in the reporting for air quality monitoring at the DDMI mine site. The recommendations can be divided into three main areas:

- **Improvements to Quality Assurance and Quality Control in the Monitoring Program**
  - DDMI needs to include a detailed summary and adhere to QA/QC practices in the report for each aspect of the monitoring program, including all sampling and laboratory procedures.
  - DDMI needs to adhere to recommended calibration and preventative maintenance procedures to ensure all equipment are operating correctly.
  - Without this very important information, it is not possible to know if the results presented for the air quality monitoring are true.
  - When QA/QC practices and SOPs are not followed properly this can lead to mistakes in the field sampling and lab analysis, which also makes it difficult to know if the results presented for the air quality monitoring are true.
- **Locations of Sampling Sites**
  - DDMI should review the locations and frequency of the sampling sites for total suspended solids and snow core sampling because it is not clear in the reports that the results show what is really happening at the site. This should be done when the EAQMP is under review.
- **Assessment and Handling of Monitoring Data**
  - DDMI should provide more detail in the reporting about what calculations and statistical methods are used to come up with the results and conclusions.
  - DDMI should provide more discussion in the report about results that seem unusual, instead of ignoring them.

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