
INDEPENDENT
ENVIRONMENTAL
MONITORING AGENCY
CLOSING ARGUMENTS:

Potassium EQC Amendment
(W2012L2-0001) Public Hearing
February 8, 2018

Submitted to the Wek'eezhii Land and Water Board



INDEPENDENT ENVIRONMENTAL MONITORING AGENCY—

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INTRODUCTION

1.1 Background and Mandate - Independent Environmental Monitoring Agency

The Independent Environmental Monitoring Agency (Agency) has participated in environmental management and regulation of the Ekati Diamond Mine for over 19 years. The Agency was established in 1997 through a legally-binding Environmental Agreement to act as a public oversight body for the Mine.

The Agency is a non-profit society under territorial legislation with funding provided by Dominion Diamond Ekati ULC (Dominion Diamond) as set out by the Environmental Agreement. We report to our society members (the Tłı̨chǫ Government, Akaitcho Treaty 8 (Yellowknives Dene First Nation and Lutsel K'e Dene First Nation), North Slave Métis Alliance, Kitikmeot Inuit Association, Government of the Northwest Territories (GNWT), Government of Canada and Dominion Diamond) and, although our Directors are appointed by these members, once appointed they operate independently. Directors are knowledgeable and experienced in fields such as wildlife, fisheries, lands, water and environmental assessment and have extensive experience with, and knowledge of, environmental management at the Ekati Diamond Mine.

Our mandate as set out in the Environmental Agreement is to:

- Review, report and make recommendations on the environmental programs, reports and activities of Dominion Diamond and government regulators and the integration of the experience and Traditional Knowledge of Aboriginal peoples.
- Participate as an intervenor in regulatory and other legal processes concerning the environment.
- Maintain a resource library of environmental information relevant to Ekati.
- Distribute information about Ekati to Aboriginal peoples and the general public.
- Provide an effective means to bring to Dominion Diamond and governments the concerns of Aboriginal peoples and the general public.

1.2 Organization of the Closing Arguments

The Agency is pleased to present our Closing Arguments on Dominion Diamond's application to amend the Potassium effluent quality criteria (EQC) in Conditions H.20 (a), (b) and (c) of the Ekati Mine Water Licence W2012L2-001. We have carefully considered the information provided by Dominion Diamond and other parties as part of the application process, including the November 2017 Technical Session, Information Requests, Public Hearing, and responses to undertakings.

The first part of this intervention focuses on the Site-Specific Water Quality Objective (SSWQO) and Dominion Diamond's application to amend the maximum average and maximum grab potassium EQC for discharges at Surveillance Network Program (SNP) stations 1616-30, 1616-43 and 1616-47. The second part focuses on the support of additional toxicity studies proposed by the Government of the Northwest Territories (GNWT).

2.0 Site-Specific Water Quality Objectives

2.1 General

The Canadian Council of Ministers of the Environment (CCME) *Canadian Water Quality Guidelines* provide the basic scientific and methodological approaches needed to evaluate the effects of water quality variables on water resources in Canada.

Water Quality Objectives (WQOs) are numerical concentrations or narrative statements that establish the conditions necessary to support and protect the most sensitive designated use of water at a site, including the aquatic organisms living in those waters. The philosophical basis for developing WQOs for water bodies of national or regional significance is to avoid degradation of existing water quality (CCME 2003). For other water bodies, such as those in the Koala watershed downstream of the Long Lake Containment Facility (LLCF), WQOs are established to protect the designated uses of the aquatic ecosystem.

Site Specific Water Quality Objectives (SSWQO) are WQOs that have been modified to account for local environmental conditions or other factors such as locally occurring aquatic life. The development of SSWQOs can be a complicated process and requires extensive knowledge of the physical and chemical characteristics of the water body under consideration and the aquatic species and environmental conditions that are relevant to the site. Once such information is acquired, SSWQOs for the protection of aquatic life are derived using the approach described in the Protocol for the Derivation of Water Quality Guidelines for the Protection of Aquatic Life (CCME 1991) and are presumed to be considered by Dominion Diamond to be protective of the local receiving aquatic environment.

2.2 Site-Specific Water Quality Objectives: Potassium – Ekati Mine

Short-term and long-term SSWQOs for potassium were first developed for the Ekati mine by Dominion Diamond in 2012 to assess possible environmental risks associated with increasing potassium concentrations observed downstream of the LLCF.

Dominion Diamond applied to the Wek'èezhìi Land and Water Board (WLWB) in 2015 to revise the SSWQOs for potassium to incorporate new water quality data and toxicity test results. The new data and test results were used in place of values reported in the literature because these were believed to reflect a more accurate measure of sensitivity to potassium under the water quality conditions present at the Ekati mine.

In the documentation submitted to support establishment of a SSWQO for potassium (page 6-1, DD 2015), Dominion Diamond states:

The revised short-term SSWQO of 105 mg/L (compared to the previous short-term SSWQO of 112 mg/L) is appropriate for application in instances where a short-term perturbation of the environment occurs (e.g., a spill). The revised long-term SSWQO of 70 mg/L (compared to the previous long-term SSWQO of 41 mg/L) is appropriate for monitoring of receiving environment quality, and is expected to be protective of aquatic life for long-term exposures. (emphasis added).

The Agency believes this statement is important as it provides insight into the meaning and intent of SSWQOs, as understood by Dominion Diamond at the time.

In its decision of January 21, 2016 the WLWB determined that a short-term SSWQO for potassium of 103 mg/L and a revised long-term SSWQO of 64 mg/L were appropriate for protection of the aquatic receiving environment downstream of Ekati mine^{1,2}.

2.3 Application to Amend Effluent Quality Criteria for Potassium

Issue statement:

SSWQOs are established using site-specific physical, chemical and biological characteristics in order to avoid degradation of existing water quality and to protect the designated uses of the aquatic ecosystem. The Agency believes the EQCs in Conditions H.20 (a), (b) and (c) of the Ekati Mine Water Licence in conjunction with mitigative actions should be set at levels that are protective of the current SSWQOs.

Dominion Diamond Conclusion:

There is sufficient understanding of the receiving environment in the vicinity of Ekati mine to amend the EQC for potassium at SNP stations 1616-30, 1616-43 and 1616-47 to directly reflect the short-term and long-term SSWQOs for potassium of 103 mg/L and 64 mg/L, respectively. Dominion Diamond believes that the predicted exceedances during the under-ice period will not result in adverse downstream effects due to the conservatism inherent to the calculated SSWQO.

Agency Conclusion:

The document entitled *Ekati Diamond Mine Revised Site Specific Water Quality Objectives for Potassium* (DD 2015) formed the basis for Dominion Diamond's application to revise the existing SSWQOs in 2015 and provides insight into the meaning and intent of SSWQOs. The document states (page 6-1) the proposed short-term SSWQO of 105 mg/L (subsequently revised to 103 mg/L) is appropriate for application in instances where a short-term perturbation of the environment occurs (e.g., a spill) while the revised long-term SSWQO of 70 mg/L (subsequently revised to 64 mg/L) is expected to be protective of aquatic life for long-term exposures (emphasis added).

According to modeling results provided by Dominion Diamond in response to Technical Session Information Request No. 5, potassium concentrations in Leslie and Moose lakes may exceed the long-term SSWQO for potassium in the near (2019-2022) and distant (2038-2043) future.

In reviewing Dominion Diamond's response to Undertaking #3 from the Public Hearing an EQC of 44mg/l does not appear to be achievable. Dominion Diamond noted that there are many variables and

¹ Dominion Diamond originally proposed an SSWQO of 70 mg/L (July 31, 2015 submission). A discrepancy identified in the data resulted in a request that DDEC investigate and identify any implications of this discrepancy to the proposed SSWQO. DDEC re-calculated the proposed SSWQO to be 64 mg/L for potassium.

² Dominion Diamond proposed a revised short-term SSWQO of 103 mg/L in the Potassium Response Plan Version 1.2 after Species Sensitivity calculations yielded a value of 103.2 mg/L.

mitigative options available based on the situation. In response to Undertaking #3 Dominion Diamond states that ‘From an environmental protection standpoint, aligning the EQC with the SSWQO allows Dominion Diamond greater flexibility to manage Discharge to reduce concentrations in the Receiving Environment. There is more dilution in the LLCF and downstream lakes during the freshet period, therefore, flexibility in the EQC would allow Discharge of higher loadings from the LLCF during this period, when natural inflows to the downstream lakes provide dilution and Discharge can be optimized to remain protective of the environment’ (Undertaking #3 p. 4). This paragraph hints at possible operational flexibility that could allow for the SSWQO to not be exceeded in Leslie and Moose Lakes.

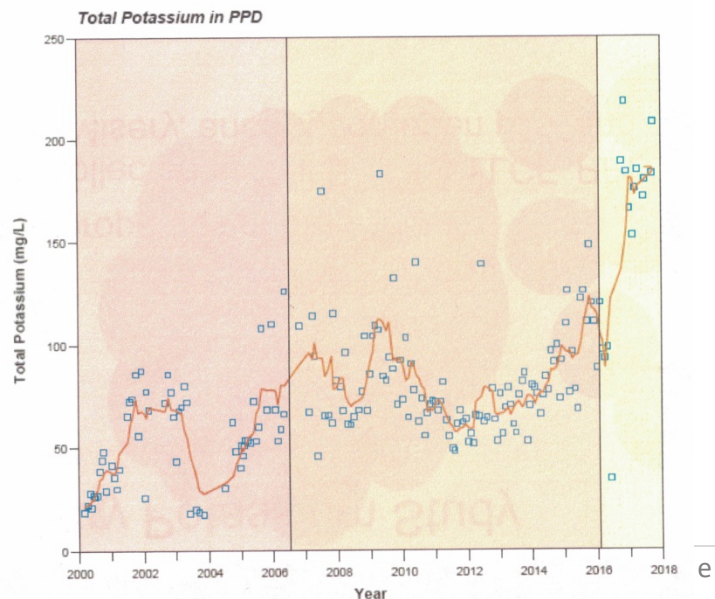
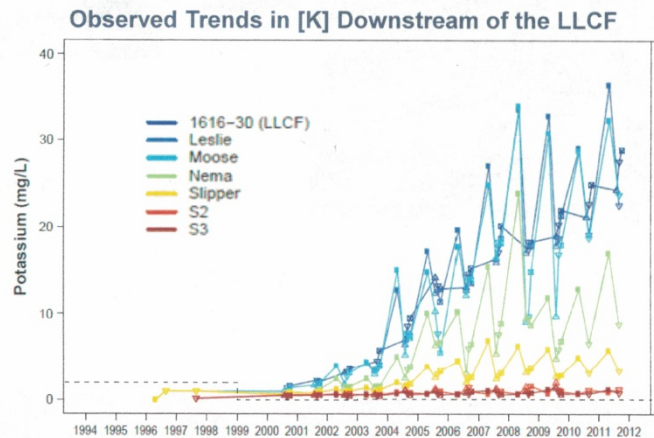
Given the SSWQOs for potassium reflect an accurate measure of ecosystem sensitivity under conditions present at the Ekati mine and the intent and meaning of SSWQOs is to protect these aquatic ecosystems, it is the Agency’s opinion that the SSWQO should not be exceeded. This may be achievable by some combination of EQC increase and mitigative action, however every effort should be made to ensure that the SSWQO is not exceeded in the downstream environment under all but the most extreme scenarios (represented by the 95% of the Stochastic Model from IR#5 Figure 1 a.).

Evidence and Rationale:

There has been an observed increasing trend of potassium concentrations in lakes downstream of the LLCF. Refer to figure entitled *Observed Trends in [K] Downstream of the LLCF* (DD2017).

It is important to note that the initial lake downstream of the LLCF, Leslie Lake, provides no effective mixing and, as a result, no mixing zone for the discharge has been established. The maximum average (long-term) EQC for potassium established at SNP station 1616-30 is currently the same as the previous long-term SSWQO (41 mg/L) and the maximum grab sample (short-term) EQC for potassium is twice the average (82 mg/L).

The largest source of potassium to the aquatic environment at Ekati has been the process plant, and this is likely to continue. Since 2016, potassium concentrations in waste water from the plant and in Cell D of the LLCF have been elevated compared to concentrations observed historically. Refer to figure entitled *Total Potassium in PPD* (DD 2017). In the short term, levels of potassium in process plant discharges are predicted to remain high until 2021, when mining of the Misery pit is expected to cease.



A recent geochemical investigation by Dominion Diamond identified the likely cause of these elevated concentrations as being an exchange of potassium ions (primarily in Misery pit ore) and calcium ions in solution during the milling process.

During the Technical Session conducted on November 29, 2017 the Agency submitted the following Information Request:

IR No. 5 - Dominion to provide back-calculated concentration, with rationale, for potassium at SNP station 1616-30 which would ensure the SSWQO in the downstream receiving environment would not be exceeded.

In its response, Dominion Diamond did not provide the requested back-calculated concentration for potassium because, according to Dominion Diamond, such a calculation would not adequately represent the range of potential conditions. However, in response to Undertaking #3 Dominion Diamond did provide the back-calculated concentration of 44 mg/l as the concentration required under base case scenario to ensure the SSWQO of 64 mg/l not be exceeded in Leslie and Moose Lakes.

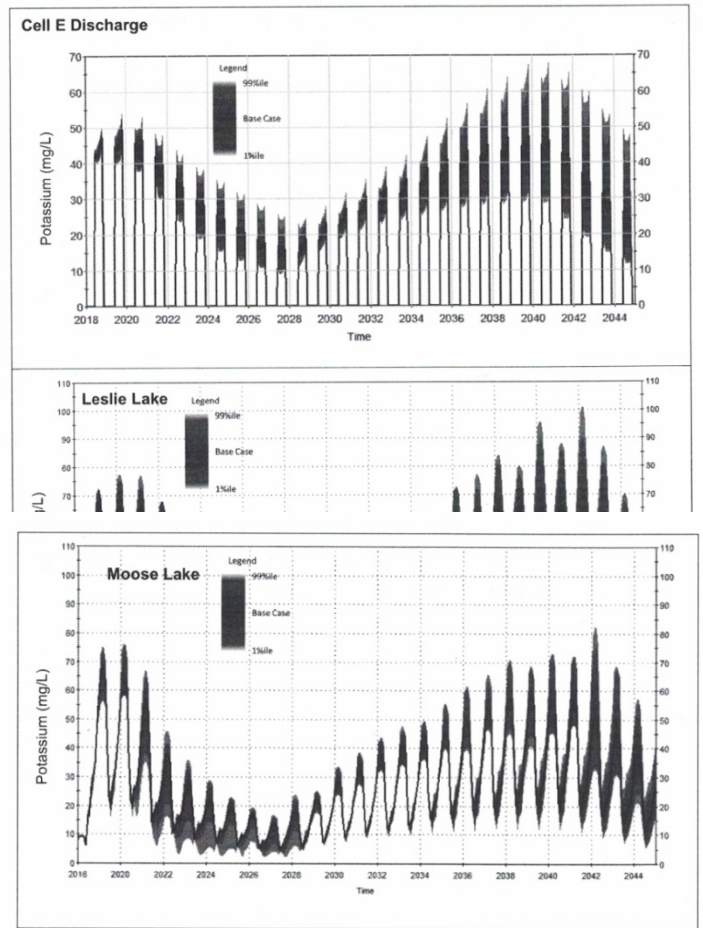
In an effort to incorporate this range of conditions in its response to IRs, Dominion Diamond provided stochastic modelling results that suggest, with inter-annual variability, open-water season discharge from Cell E of the LLCF may range from 40 mg/L to 52 mg/L of potassium over the next four years, significantly less than the proposed maximum average and grab EQCs. During the same period, model results suggest under-ice conditions over several months in Leslie Lake may range from 55 mg/L to 78 mg/L and between 55 mg/L and 75 mg/L in Moose Lake, which exceed the current long-term SSWQO of 64 mg/L in some cases. Refer to figures 1a.

In the longer-term, model results suggest open-water season discharge from Cell E of the LLCF will decrease starting in 2020 and then begin to increase in 2029 from 25 mg/l to as high as 68 mg/L in 2040 before declining. Results also suggest under-ice concentrations of potassium may again begin to exceed the current long-term SSWQO of 64 mg/L in Leslie and Moose Lake starting in 2036, before declining.

Agency Recommendation:

The Wek’eezhii Land and Water Board in consideration of both EQCs and mitigative options establish EQCs for potassium in

Figure 1a. Results of Stochastic Model Runs Evaluating Variability and Uncertainty in the Model Predictions



Conditions H.20 (a), (b) and (c) of the Ekati Mine Water Licence W2012L2-001 at levels that ensure short-term and long-term SSWQOs are not exceeded in the downstream receiving environment under all but the most extreme scenarios (represented by the 95% of the Stochastic Model from IR#5 Figure 1 a.), including the annual under-ice period.

3.0 Additional Toxicity Testing

Issue statement:

Concerns were raised in the GNWT's intervention and during the Public Hearing regarding the potential toxicity to some species not covered in the initial Species Sensitivity Distribution (SSD) conducted by Dominion Diamond. To address these concerns the draft WL proposed adding conditions to Part H to include a Potassium Toxicity Study.

Dominion Diamond Conclusion:

Dominion Diamond does not agree that the test requested in the GNWT's intervention are necessary and point out that the proposed tests are not included in the Environment Canada Environmental Protection series whereas the tests included in the SSD were.

Agency Conclusion:

Based on the GNWT's Intervention, discussions at the Public Hearing and Undertaking #1 the Agency is concerned with potential toxic effects of Potassium to species present in the receiving environment (ie fathead minnow and Fingernail Clams) but not appropriately represented in the SSD.

In response to undertaking #1 which asked *'Dominion to provide a document that summarizes a study conducted on fingernail clams that was completed previously at the Ekati Mine (pg. 32 of transcript),* Dominion Diamond included a number of studies of the species in question. This would indicate that it is possible to conduct toxicity tests on these species. It is the Agency's opinion that these additional tests should be included in the SSD and as such would be of value in determining the potential effects of elevated potassium on the downstream environment based on site-specific conditions and species resident to the downstream environment at Ekati.

Evidence and Rationale:

The GNWT's intervention indicates that bivalves and Fathead Minnow (surrogate for Lake Chub) have high sensitivities to Potassium but are not currently represented in the SSD.

The response to Undertaking #1, Dominion Diamond showed that they had successfully conducted a toxicity study for Chloride using fingernail clams. This study indicates that it is possible to conduct a similar study with Potassium.

There was some discussion at the Public Hearing, resulting in Undertaking #1, regarding the ecological relevance of molluscs, including fingernail clams, to the Ekati mine site and lakes downstream and their value as a food source to large bodied fish such as whitefish. In response to undertaking #1 Dominion Diamond included results of relevant sections of the Aquatic Effects Monitoring Program (AEMP) the results concluded that:

The AEMP data establishes the following:

- *From benthic invertebrate community data, molluscs including fingernail clams can comprise a large proportion of the benthic community, depending on the monitored lake (Table 1).*
- *Fish stomach contents analysis for round whitefish (most recently collected in 2012), suggest the following: Round whitefish diet was predominately zooplankton (mainly Crustacea) and dipterans (Figure 1; Rescan 2013). The small proportion of molluscs observed in round whitefish stomachs were gastropods... and bivalves (family Sphaeriidae) (Table 2; Figure 1).*
- *Stomach contents analyzed by weight, indicate that the proportion of molluscs is higher (Figure 2; Rescan 2013); however examining the fish collected from Leslie and Moose lakes on an individual basis, the relative weight of molluscs in stomach contents is dominated by gastropods (Table 3)*

These conclusions confirmed that fingernail clams, comprise a large portion of the benthic community of some monitored lakes including Leslie Lake indicating that they are in fact ecologically relevant even though they do not appear to contribute significantly to the diet of fish.

Agency Recommendation:

Based on the concerns raised above, the Agency supports the inclusion of Part H Conditions 37 a) and b) of the draft WL regarding the Potassium Toxicity Study in the final WL.

References

CCME (Canadian Council of Ministers of the Environment). 1991. A protocol for the Derivation of Water Quality Guidelines for the Protection of Aquatic Life. In: Canadian Water Quality Guidelines: Appendix IX.

CCME (Canadian Council of Ministers of the Environment). 2003. Canadian Water Quality Site-Specific Guidelines for the Protection of Aquatic Life - Guidance on the Site-Specific Application of Water Quality Guidelines in Canada: Procedures for Deriving Numerical Water Quality Objectives.

DD (Dominion Diamond). 2015. Ekati Diamond Mine Revised Site-Specific Water Quality Objectives for Potassium.

DD (Dominion Diamond). 2017. Dominion Diamond Mines: Potassium Effluent Quality Criteria Amendment Presentation at WLWB Technical Session.