



Independent Environmental Monitoring Agency

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February 23, 2018

Joseph Mackenzie
Chair, Wek'eezhii Land and Water Board
#1-4905 48th St, Yellowknife, NT
X1A 3S3

Re: Dominion Diamond Waste Rock Storage Area Co-Placement Study Design for the Jay Project

Dear Mr. Mackenzie,

The Independent Environmental Monitoring Agency (Agency) has reviewed the Jay Co-Placement Study Design (Study Design) submitted by Dominion Diamond. In addition to our assessment of the Study Design contained in this letter, the Agency also retained the services of Dr. Kevin Morin of the Minesite Drainage Assessment Group (MDAG) to review the Study Design. His full report has been included to provide greater technical detail regarding some of our comments.

Study Design Report Requirements

As stated in Schedule 6 Condition 3 of Water Licence W2012L2-0001 and explained in the Wek'eezhii Land and Water Board (Board) Reasons for Decision dated May 29, 2017, Dominion Diamond were required to submit the Study Design to address at a minimum the following:

- a) the sensitivity of effective neutralizing potential/acid potential (NP/AP) to imperfect mixing for the proposed co-placement management plan;*
- b) whether the effective neutralizing potential/acid potential (NP/AP) characteristics of the fine rock fractions for metasediments, granite, and diabase are different in samples of rock blasted during mining than in samples of rock prepared for humidity cell testing, and if so, a means of accounting for the differences when managing the proposed co-placement of rock in the WRSA;*
- c) how to optimize co-placement methods of blending and layering for the proposed coplacement of the potentially acid generating (PAG) and non-PAG rock to prevent acid rock drainage and metal leaching; and*
- d) any other testing or analysis that will inform the most appropriate NP/AP ratio and the coplacement method, limits, and controls for blending and/or layering.*

Overall, the Agency does not believe the current Study Design fully addresses the requirements outlined in Schedule 6 Condition 3. The following sections outline our rationale for this conclusion.

a) the sensitivity of effective neutralizing potential/acid potential (NP/AP) to imperfect mixing for the proposed co-placement management plan

Other than an annual expected NP/AP ratio there is little information presented on the level of imperfect mixing that will actually be produced while Jay is being mined. The Study Design does not describe in any detail the expected volumes of PAG and non PAG that will be mined on a daily or weekly scale. It also fails to include any work that will address this. Without a detailed level of geochemical mapping it is not possible to determine the sensitivity of effective NP/AP.

In the Study Design, Dominion Diamond continues to assume 100% efficiency of the Neutralizing Potential (NP) of rock. No substantive reasoning for this assumption has been provided. In the recent Jay WL Amendment Application Reasons for Decision, the Board indicated concerns with the effective NP:

The Board considers the effective NP/AP ratio and PAG layer thicknesses to be fundamental design aspects that must be well-supported and documented in the final Design Report. Similarly, rock placement methods, limits, and controls must also be carefully considered and described in the WROMP. (Jay WL Amendment Reasons for Decision May 29, 2017 p-48)

Figure 3-1 of the Study Design shows the NP/AP ratio for the Ekati Geochemistry data set. The Agency is concerned that assuming 100% efficiency of all NP in a sample, combined with the low NP/AP ratio of 2, underestimates the potential for the development of acidic drainage to occur. Without a much better understanding of the effective NP it is not possible to determine a reliable NP/AP ratio. It is clear from this graph and other results from the Acid Based Accounting (ABA) tests that a portion of the non PAG granite will likely result in acidic drainage. In addition, the geochemical analysis in the Study Design states that 95% of the granite has a ratio greater than 2 and is therefore non PAG (Study Design p-3-2). Unfortunately, that means that there is 5% of the 'clean granite' that will develop acidic drainage. Considering that these results assume 100% efficacy of NP, it seems that the actual amount of rock classified as PAG will only increase once the effective NP has been determined. The Board indicated similar concerns with the geochemical analysis stating in the Jay Project Reasons for Decision that:

The Board does not agree that DDEC's Geochemistry Baseline Report results conclusively support an NP/AP ratio of 2 or more. First, it is not clear that DDEC used the "effective" NP to determine its target NP/AP ratio of 2. The MEND Prediction Manual classifies mine materials as non-PAG if the NP/AP ratio is greater than or equal to 2 and all measured NP is "effective". "Effective" means that all measured NP is available and will maintain the drainage or contact water at a neutral pH, greater than 6. Several results in the Baseline Geochemistry Report suggest that not all the laboratory measured NP in the waste rock will be "effective". (Jay WL Amendment Reasons for Decision May 29, 2017 p-48)

The Agency is concerned that the amount of PAG may be underrepresented in the characterization section of the Study Design.

Recommendation: Dominion Diamond determine the effective NP/AP ratio specific to Jay waste rock and use that value to recharacterize the ARD potential for the Jay waste rock. Specifically, the

amount of PAG rock to be expected based on effective NP/AP ratio for each rock type should be quantified and described.

Recommendation: In order to reliably address the effective neutralizing potential/acid potential (NP/AP) to imperfect mixing, the Agency believes the following additional work is required:

- The drilling and sampling of sufficient additional exploratory drillholes to accurately map the waste rock characteristics around the Jay Pipe;
- Additional ABA analyses should be conducted of samples taken along the length of the drill cores in order to provide a better understanding of the geochemical characteristics of the waste rock surrounding Jay Pipe; and
- Analysis of the mining sequence for Jay to accurately estimate how effective the proposed co-placement will be.

For further detail regarding these recommendations please see Chapters 1 and 2 of the MDAG report.

b) whether the effective neutralizing potential/acid potential (NP/AP) characteristics of the fine rock fractions for metasediments, granite, and diabase are different in samples of rock blasted during mining than in samples of rock prepared for humidity cell testing, and if so, a means of accounting for the differences when managing the proposed co-placement of rock in the WRSA;

There can be differences between scales for fine grained samples used in the humidity cell tests and those from full scale blasting. In order to accurately assess those differences the waste rock would need to be tested at varying scales ranging from kilograms to tonnes to thousands of tonnes. The current Study Design proposes to undertake kinetic testing on the kilogram scale.

In addition, the proposed geochemical testing program will be conducted on samples of run-of-mine blasted rock collected from the Misery Pit. While Dominion Diamond suggests waste rock collected from the Misery Pit is geologically analogous to the nearby Jay Pit, no supporting evidence is provided for this statement.

Greater detail regarding these comments can be found in the following section of the MDAG review: 2.1.3, 2.1.4, 3.1.

Recommendation: To accurately test the characteristics of the fine fraction through various scales, a range of test piles should be conducted at a variety of scales.

c) how to optimize co-placement methods of blending and layering for the proposed coplacement of the potentially acid generating (PAG) and non-PAG rock to prevent acid rock drainage and metal leaching;

The Study Design does not provide any new information regarding how the co-placement method will be optimized. In order to effectively manage any potential ARD issues with the blending method, a detailed understanding of the pre-mined spatial locations of the PAG zones is required. In the

absence of a detailed understanding of the type and volume of the run-of-mine rock to be encountered at any given time during operations there can be no optimization or blending of waste rock. It is simply end dumping.

Section 5.2.2 of the Study Design states that *“Effective reporting of the NP/AP ratios during Jay WRSA construction will be an important component in ensuring that the geochemical design criteria are being achieved.”* This does not explain how it will be managed nor what mitigative measures will be undertaken should a large volume of PAG rock be encountered.

Based on Section 4 and Figure 4.2 of the Study Design a relatively high amount of PAG rock will be encountered early in the Jay Project with NP/AP annual ratios expected to be slightly over 2 for the first 3 years. This is a concern since it is understood that to properly mitigate PAG rock in the WRSA the rock needs to have adequate effective NP below and surrounding it. If relatively high amounts of PAG or uncertain PAG rock are placed in the Jay WRSA early in mine life the Agency is concerned that there may not be sufficient effective NP surrounding the PAG to ensure adequate neutralization, resulting in acid drainage.

Recommendation: Dominion Diamond describe in detail what steps will be taken to ensure that the expected PAG or uncertain PAG rock, which is to be placed in the Jay WRSA, particularly early in Jay project life, will be sufficiently surrounded by neutralizing rock.

Recommendation: Dominion Diamond describe what triggers and mitigation measures will be initiated if a large volume of PAG is encountered. In addition, Dominion Diamond should explain what is the maximum allowable threshold for PAG rock to be placed before mitigative measures are initiated.

Recommendation: To reliably be able to optimize co-placement methods of blending and layering the following work would need to be initiated:

- The drilling and sampling of sufficient additional exploratory drillholes to accurately map the waste rock characteristics around the Jay Pipe;
- Additional ABA analyses should be conducted of samples taken along the length of the drill cores in order to provide a better understanding of the geochemical characteristics of the waste rock surrounding Jay Pipe; and
- Analysis of the mining sequence for Jay to accurately estimate how effective the proposed co-placement will be.

Greater detail can be found in MDAG Sections 2.1 and 2.2.

d) any other testing or analysis that will inform the most appropriate NP/AP ratio and the co-placement method, limits, and controls for blending and/or layering.

While Dominion Diamond is proposing some test work to estimate effective NP, NP/AP ratios, etc., the Agency believes there will not be the level of information required to reliably predict the effectiveness of the co-placement method for the Jay waste rock pile. This is likely to remain the case until the waste rock surrounding the Jay Pipe is better understood and tested. As described above, in

order to reliably answer these questions a considerable additional amount of work needs to be conducted to reliably characterize the waste rock surrounding the Jay pipe.

Should you have any questions concerning these comments, the Agency is pleased to discuss these at your convenience.

Sincerely,

A handwritten signature in blue ink, appearing to read "Jaida Ohokannoak", with a long horizontal flourish extending to the right.

Jaida Ohokannoak
Chairperson

Cc: Dominion Diamond – April Hayward
Tlcho Government – Jessica Hum
Yellowknives Dene First Nation – Alex Power
Lutsel K'e Dene First Nation – Ron Griffith
North Slave Metis Alliance – Nicole Goodman
Kitikmeot Inuit Association – Geoff Clark
Government of the Northwest Territories – Laurie McGregor
Indigenous and Northern Affairs Canada – Michael Roesch