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Ottawa, Canada
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January 18, 2012

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Gahcho Kué Diamond Project
De Beers Canada Inc.
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File#: NWT-080
File#: EIR 0607-001

Sent via e-mail: veronica.chisholm@debeerscanada.com

Subject: Natural Resources Canada's Information Requests Regarding Environmental Impact Statement and Conformity Responses for De Beers Gahcho Kué Project, EIR 0607-001

Further to the Mackenzie Valley Environmental Impact Review Board's (MVRB) letter of December 6, 2011, Natural Resources Canada (NRCan) is providing the attached Information Requests (IR) to De Beers Canada for the Gahcho Kué Diamond Project Environmental Impact Review.

NRCan reviewed the Environmental Impact Statement (EIS) including Conformity Responses with respect to: Mine Waste Management - Metal Leaching and Acid Rock Drainage (includes tailings, waste rock and mine effluents, and involves expertise in tailings and waste rock characterization, prediction, prevention and control, and effluent treatment processes); Permafrost and Terrain Conditions; Geotechnics; and Surficial Geology. Our information requests are directed to the proponent, to request clarification or additional information to understand the project's potential effects.

Should you have any questions regarding NRCan's information requests, please do not hesitate to contact the undersigned at 613-995-7686 or john.king@nrcan.gc.ca.

Sincerely,

Original signed by

John King
Senior Policy Analyst
Environmental Assessment Division
Natural Resources Canada

Attach: (1)

c.c.:
NRCan: J. Clarke, C. Hogan, R. Johnstone, F. Schellekens
MVRB: C. Hubert

Canada

NRCan's Information Requests for Environmental Impact Statement, De Beers Gahcho Kué Project, EIR 0607-001

Natural Resources Canada – Mining and Mineral Sciences Laboratories (MMSL)

Reviewer 1:

Area of Expertise:
Mine Waste Management, Acid Rock/Mine Drainage and Metal Leaching, Environmental Hydro-geochemistry and Mine Reclamation, Decommissioning and Closure.

IR Number: NRCan 1-1

Source: Natural Resources Canada – MMSL, Reviewer 1

To: De Beers Canada Inc.

Subject: Dewatering of Kennady Lake

References: Section 3.9.4 – Dewatering of Kennady Lake (Documents Reviewed: Section 3.9 – Water Management / Project Development).

Preamble:
Water management is a key component of the Project as the diamond bearing kimberlite pipes are mainly located under Kennady Lake. The key water-related activity at the site that will take place during the project will be the dewatering of areas 2 to 7 of Kennady Lake and Lake 1 to gain access to the three kimberlite ore bodies.

Request:
The Kennady Lake dewatering and water management scheme at the project site is not very clearly described in the water management section of the project description. Is this more clearly described in another document?

IR Number: NRCan 1-2

Source: Natural Resources Canada – MMSL, Reviewer 1

To: De Beers Canada Inc.

Subject: Groundwater from Open Pit Developments

References: Section 3.9.6.3 – Managing Groundwater from Open Pits (Documents Reviewed: Section 3.9 – Water Management /Project Development).

Preamble:
During pit dewatering operations, groundwater flowing into open pits is expected to range from a minimum of ~ 770,000 m^3/y at the end of construction (Year -1), to about 1,500,000 m^3/y in year 6 when total inflow to the open pits reaches maximum. While a majority of the incoming groundwater would be managed through the Water Management Pond (WMP) and recycled, a portion of it would be discharged to Lake N11.

Requests:

(i) As the total dissolved solids (TDS), salinity and some trace metal concentrations of the inflowing pit water are expected to increase with depth, how the discharge of this incoming pit water at depths would be handled and its impact on the receiving water quality managed? [We understand that Aboriginal Affairs and Northern Development Canada is submitting IRs that relate to this subject, focusing on water quality and quantity (see AANDC IRs 19-21).]

(ii) Has the deep formation groundwater been or would be tested for dissolved radionuclides components such as radon gas (Rn-222) and its parent and progeny radionuclides for developing the groundwater management plan accordingly?

IR Number: NRCan 1-3

Source: Natural Resources Canada – MMSL, Reviewer 1

To: De Beers Canada Inc.

Subject: Radionuclide Content and Radon Gas Emanation Potential of Mine Rock and Kimberlite Deposits

References: Section 8 – Geochemical Characterization - Metal Leaching and Acid/Alkaline Drainage (Documents Reviewed: Section 8, Appendix 8.II – Metal Leaching and Acid/Alkaline Drainage).

Preamble:
Approximately 30 million tonnes of diamondiferous kimberlite and 226.4 million tonnes of host mine/country rock would be mined by open pit mining of the three kimberlite pipes. Because of their volcanic origin, the kimberlite pipes and their contact rock may contain uranium and thorium decay series radionulides, specifically Ra-226, its gaseous decay product Rn-222 (radon) and other components.

Request:
Both the kimberlite and mine rock should be tested for uranium and thorium decay series radionuclides and radon gas emanation potentials.

IR Number: NRCan 1-4

Source: Natural Resources Canada – MMSL, Reviewer 1

To: De Beers Canada Inc.

Subject: Mine Rock - Metal Leaching and Acid/Alkaline Drainage

References: Section 8 – Geochemical Characterization of Mine Rock- Metal Leaching and Acid/Alkaline Drainage (Documents Reviewed: Section 8, Appendix 8.II – Metal Leaching and Acid/Alkaline Drainage).

Preamble:
Approximately 6% or 13.6 million tonnes of the mine rock is classified as PAG and will be placed within the two waste rock piles and some in the mined out open pits. In the waste rock piles, the PAG materials would be incorporated and encapsulated within permafrost and covered with a layer of till on top to reduce precipitation infiltration. In the back-filled pits, the rock would be submerged under water upon reflooding of Kennady Lake at closure. This would also lead to some submergence of the PAG rock in the two waste rock piles.

Requests:

(i) Approximately what tonnage of the total PAG rock would be placed in each of the two waste rock piles and the mined out 5034 pit?

(ii) Upon reflooding of Kennady Lake, how much PAG rock would be above water in the two waste rock piles and if the desired till cover on top would be sufficient to prevent acid generation/metal leaching impacts? Could this excess rock be placed in the other two mined out pits?

(iii) Some mine rock has a paste pH of 5.5 that should have been classified as weakly acidic rather than neutral to alkaline pH.

(iv) Section 8.II.4.3.1: Static Testing
What is the upper value of NPR used for classification of PAG rock? In Figure 8.11-13, a significant number of mine rock samples have NPR of <3, are these included in the PAG classification?

(v) Section 8.II.4.3.2: Whole Rock Chemistry
Should the elevated concentrations of metals: Cr, Cu, Zn, and some Co, Mo, Mn, Pb, Sb and U in the mine rock be of concern in the sub-aerial management

scenario of such materials in the long-term with the anticipated climate change impacts?

(vi) Section 8.II.4.3.2: Humidity Cell Testing
For many PAG rock samples, the sulphide depletion time is significantly longer than the carbonate NP depletion and longer than the total NP depletion. Should sub-aerial management of such materials within the waste rock piles be problematic in the long-term given the short time frame of humidity cell testing?

(vii) Figure 8.II-17 – The x-axis label for total sulphur should read 10 instead of 100.

(viii) Tables 8.II.29a and 29b - SO_4 conc. expressed as µg/L should have been mg/L.

(ix) Table 8-II-35 – For grandiorite and altered grandiorite samples, how the percentage of samples having total sulphur concentrations of 0.1% and 0.3%, respectively, was calculated for sample sizes of n = 1 and 2? For n =1, the number should have been either 0% or 100% and for n = 2, it should have been 0%, 50% or100%.

IR Number: NRCan 1-5

Source: Natural Resources Canada – MMSL, Reviewer 1

To: De Beers Canada Inc.

Subject: Process Kimberlite - Metal Leaching and Acid/Alkaline Drainage

References: Section 8 – Geochemical Characterization of Kimberlite - Metal Leaching and Acid/Alkaline Drainage (Documents Reviewed: Section 8, Appendix 8.II – Metal Leaching and Acid/Alkaline Drainage).

Preamble:
Up to 25% of the fine process kimberlite (PK) would be placed in a land-based, fine process PK management facility with a designed capacity of ~ 5.5 million tonnes and the rest in the mined out Hearne pit. The coarse PK would be placed in a coarse PK pile with a designed capacity of ~ 5.2 Mm^3 and in the mined out 5034 pit. Both facilities would be progressively reclaimed during operations as well upon closure.

Requests:
(i) Section 8.II.4.1.1.2: ABA Testing Figure 8.II.2 requires redrawing of 1:1 and 1:10 Ca NP vs. total NP fit lines as they are incorrectly plotted.

(ii) Section 8.II.4.1.2: Whole Rock and Trace Element Chemistry The bulk kimberlite has elevated concentrations of Cr, Mn, Ni and some Co, Cu and Zn. The shake flask tests showed some leaching of Al, Cr, Ni and Fe. Both coarse and fine PK have elevated concentrations of B, Co, Cr, Mn, Mo, Ni, and some Cu and

Zn. Would the leaching and mobility of some of these metals be problematic in the long-term for land-based, sub-aerial waste management facilities?

(iii) Section 8.II.4.1.4.1: Humidity Cell Testing and Column Leaching

a) The humidity cell testing showed some decreasing pH and As leaching trends during the short 35 week monitoring period. The column leaching tests also showed As leaching with time for columns # 7 and # 9. Is this trend expected to continue in the long-term? Perhaps long-term monitoring of these columns is required.

b) All kimberlite samples tested showed depletion of Ca NP well in advance of total sulphide AP depletion. Should this be of concern as the remaining NP would only be realized upon acid generation, perhaps, contributing to metal mobility issues.

(iv) Section 8.II.4.2.6: Submerged Column Testing (Reviewer 1&2) The monitoring time frame of 7-weeks for the submerged kimberlite column testing was too short to draw any conclusions. Long-term monitoring of these columns is required to establish water quality impacts of coarse and fine PK management under submerged conditions. Leaching of Mn, Fe, As and Se may be of concern under reducing conditions in the submerged state. The EIS indicates that the tests were ongoing at the time of its preparation; please provide the latest update.

IR Number: NRCan 1-6

Source: Natural Resources Canada – MMSL, Reviewer 1

To: De Beers Canada Inc.

Subject: Long-Term Effects, Reclamation and Closure

References: Section 10 – Long-term Biophysical Effects, Reclamation and Closure (Documents Reviewed: Section 10, Long-term Biophysical Effects, Reclamation and Closure).

Preamble:
During operation and post closure, water quality in Kennady Lake is modelled to have elevated TDS and concentrations of P and metals: Co, Cr, Fe, Hg, Mn, Pb, Se, Tl, U and Zn. In addition, concentrations of Ag, Al, As, B, Ba, Be, Cd, Cu, Mo, Ni Sr and V are also projected to increase in Kennady Lake. Some of these are projected further to remain above the post closure water quality guidelines.

Requests:

(i) Section 10.1.3.1 Site Location The project location longitudinal and latitude coordinates are reversed in the text.

(ii) Section 10.2 Long-term Effects on Water Quality What would be the long-term impacts of these elevated water quality parameters on Kennady Lake habitat and its downstream environment?

Reviewer 2

Area of Expertise:
Mine waste management related to acidic drainage and metal leaching, including tailings, waste rock and sludge, and mine effluents and involves expertise in tailings and waste rock characterization, prediction, prevention and control, and effluent treatment processes.

IR Number: NRCan 1-7

Source: Natural Resources Canada – MMSL, Reviewer 2

To: De Beers Canada Inc.

Subject: Waste rock geochemical testing

References: Section 3.7.3.2 Geochemical Characterization of Mine Rock (Documents Reviewed: Section 3, Project description. Geochemical Characterization of Mine Rock).

Preamble:
Geochemical testing was conducted on waste rock. It is indicated that granite is the dominate rock type. Testing of mine rock type revealed "neutral to alkaline paste pH values (pH of all samples was 5.5 or greater)".

Requests:

(i) Please indicate the methodology referring to the pH value and reference of the results.

(ii) Please provide the definition of a neutral pH or reconsider wording in the document.

IR Number: NRCan 1-8

Source: Natural Resources Canada – MMSL, Reviewer 2

To: De Beers Canada Inc.

Subject: Overburden: Lake Sediment

References: Section 3.7.2 Overburden, Section 8.II.1.2, 8.II.1.3, Appendix 8.II Metal leaching and acid/alkaline rock drainage (Documents Reviewed: Appendix 8.II Metal leaching and acid/alkaline rock drainage).

Preamble:
Overburden will be used in the construction of dykes within the Kennedy Lake sub-watershed areas. Lakebed sediments will be used to cover any areas in the core of the mine rock piles where potentially reactive mine rock is sequestered.

Requests:

(i) Lake sediments can act as a major sink for pollutant due to anoxic condition prevailing at the bottom of the lake. Please indicate the lake sediment composition and mineralogy.

(ii) Please comment on the potential release of metals from the sediment used as a construction material for reclamation purpose.

(iii) Please comment if sulphide compound are present in the lake sediment. If present, sulphide compound may be oxidized when used as a construction material and further release heavy metals.

Natural Resources Canada – Earth Sciences Sector (ESS)

Documents Reviewed:
Terms of Reference for the Gahcho Kué Environmental Impact Statement, Oct. 2007
De Beers Canada Inc. Environmental Impact Statement, Dec. 2010
Review focussed on:

- Sections 3, 8, 10, 11, 13, including updated sections in response to MVEIRB Deficiency Statement (July 2011)
- Annex A, D, H
- De Beers Conformity Response to MVEIRB Deficiency Statement - Response to items 1 and 3 (July 2011)

IR Number: NRCan 1-9

Source: Natural Resources Canada – ESS

To: De Beers Canada Inc.

Subject: Baseline terrain and geotechnical conditions in the mine site area
Relevant to Key Line of Inquiries, Water Quality, Long-term Biophysical Effects; Subject of Note, Permafrost, Groundwater and Hydrogeology

References:
TOR 3.13, 4.1.2, 4.1.4, 5.2.5, 5.2.6
EIS sections 3 (3.7, 3.9), 8, 11 (11.5, 11.6), Annex D

Preamble:
Stability of engineered structures including dams, dykes and mine waste management facilities, will be dependent among other factors on the properties of the underlying foundation materials. Some descriptions of subsurface materials are provided as are temperature profiles from boreholes (Annex D). Although the Proponent indicates that geotechnical boreholes were drilled in 2004 to obtain information on materials at mine waste management sites and dam alignments, the detailed logs are not provided. The detailed geotechnical logs in combination with the ground temperature information would provide NRCan with a more complete understanding of variability of sediment properties with depth and the geotechnical properties of the site subsurface materials.

Request:
Please provide additional detailed information on characteristics of sub surface materials obtained from geotechnical investigations such as borehole logs and results of laboratory testing (including index and strength tests).

IR Number: NRCan 1-10

Source: Natural Resources Canada – ESS

To: De Beers Canada Inc.

Subject: Borrow source requirements
Relevant to Subject of Note, Permafrost, Groundwater and Hydrogeology

References:
TOR 3.1.3, 3.2.1, 5.2.5
EIS section 3

Preamble:
The EIS (section 3) indicates that granular fill will be required for construction of mine infrastructure such as roads, airstrip and foundations. Although the Proponent indicates that crushed mine rock would be used for construction reducing the need for additional quarries, it is not mentioned whether unconsolidated sediments (in addition to till overburden mentioned for processed kimberlite piles) are required for construction. Clarification is therefore required on whether additional sand and gravel resources are required and if required, details on location of potential borrow sites as well as properties

of the unconsolidated sediments at these sites. This information is required for NRCan to better understand the footprint of project activities and potential environmental effects that may be associated with granular resource extraction.

Request:
Please clarify whether additional borrow sites (unconsolidated sediments) will be required to meet granular resource needs for project construction. If additional borrow sites are required, please provide information on locations and material properties including ground ice conditions.

IR Number: NRCan 1-11

Source: Natural Resources Canada – ESS

To: De Beers Canada Inc.

Subject: Dam design and wave height
Relevant to: Key Line of Inquiry, Water Quality; Subject of Note, Permafrost, Groundwater and Hydrogeology

References:
TOR 3.1, 4.1.2
EIS section 3, 8

Preamble:
A number of dams and dykes will be constructed for water management or diversion. These structures must be sufficiently high to ensure that overtopping does not occur. It is therefore important to understand the variability in water levels that may occur as well as the potential wave height. The proponent also indicates in the EIS (section 3.9.4.2), a dyke is to be constructed at the north eastern edge of the west waste rock pile to decrease wind effects in the settling zone. De Beers indicates that if the wind direction aligns with the long fetch of area 3 and causes increased wave heights the dyke would be constructed to reduce the effect of wind and limit waves. It is not clear whether the proponent has done any analysis to determine the wind and wave climate at the site to ensure that dams and dykes are designed to perform as intended, i.e. to prevent overtopping or to ensure that the effects of wind in the settling zone are minimized. It also not clear what the design freeboard is.

Requests:
i. Please provide any additional information how climate and water flow trends, variability and extremes are used to determine dam and dyke design elevations, including design water levels and freeboard.

ii. Please provide any additional information on analysis conducted related to the wind and wave environment to facilitate dam and dyke design and provide clarification of the design freeboard that will be used.

IR Number: NRCan 1-12

Source: Natural Resources Canada – ESS

To: De Beers Canada Inc.

Subject: Foundation stability at dam, dyke and berm alignments
Relevant to: Key Line of Inquiry, Water Quality, Long-term Biophysical Effects; Subject of Note, Permafrost, Groundwater and Hydrogeology

References:
TOR 3.1, 4.1.2, 4.1.4, 5.2.5, 5.2.6
EIS section 3, 8, 10, 11 (11.6), Annex D; Conformity Response to Item 1 and 3

Preamble:
Information collected by the Proponent indicates that permafrost at the mine site is generally warmer than -2.5°C (EIS sec 11.6.2.1, Annex D) and the available information indicates that permafrost may be present beneath some of the dyke and berm alignments. In its Conformity Response (section 4.4), the Proponent has indicated that dykes and berms will not be designed to rely on permafrost conditions over the long-term to ensure integrity and prevent seepage. NRCan would agree with the Proponent that frozen conditions should not solely be relied on given the relatively warm permafrost conditions and the potential for thawing under a changing climate. In section 4.4 of the Conformity Response, the Proponent indicates that the design will include an evaluation of foundation conditions to determine if permafrost thaw is an issue. The Proponent also mentions that additional till fill will be placed on the downstream side of dykes to reduce potential for seepage should the thermal evaluation indicate that permafrost below the key trench will thaw. It is not clear what investigations have been conducted to determine the foundation conditions at the dyke alignments. It is also not clear why the dyke design proposed for the case of permafrost thawing is not utilized for all dykes regardless of whether the thermal evaluation indicates permafrost thaw may occur (especially since dykes will be designed not to rely on frozen conditions over the long-term). If the thermal evaluation does indicate that permafrost thaw below the key trench is unlikely in the long-term, mitigation options and contingency plans will be required should actual conditions deviate from those predicted, in order to ensure maintenance of the integrity of the dykes and minimize potential environmental impacts.

Requests:
i. Please clarify why a similar design technique will not be utilized for all dykes, given the Proponent's intention not to rely on frozen conditions to control seepage.

ii. Please provide further details on the results of geotechnical investigations conducted for dyke alignments and plans for future investigations including thermal evaluation to facilitate the detailed dyke design.

iii. Please outline the contingency plans (including secondary containment systems) and mitigation options to be implemented should foundation conditions over the long-term deviate from those predicted in the thermal evaluation. This should also include a discussion of how information obtained through monitoring programs will be utilized in the decision process to determine when mitigation is required and to select from mitigation options.

IR Number: NRCan 1-13

Source: Natural Resources Canada – ESS

To: De Beers Canada Inc.

Subject: Shoreline erosion associated with rising water levels
Relevant to: Key Line of Inquiry, Water Quality; Subject of Note, Permafrost, Groundwater and Hydrogeology

References:
TOR 3.1.3, 4.1.2, 5.2.5
EIS section 8, 11.6

Preamble:
The water management plan requires diversion of runoff (through construction of diversion dykes) which will result in increased water levels and surface area in a number of diversion lakes (e.g. Lake N11, lakes in watershed A,D,E, EIS Section 8.4, 8.6). Increases in water levels can result in thawing of frozen terrain and shoreline erosion, leading to increased sediment input into lakes. The Proponent has identified this as a potential impact (Table 8.6.1). The Proponent has concluded these effects are likely to be minor and has suggested a number of mitigation options (Table 8.6.1). Surveys will be conducted to determine the sensitivity of shorelines but no detail has been provided on the investigations to be conducted or the criteria that will be utilized to select from the mitigation options.

Requests:
i. Please provide additional information on the surveys to be conducted to characterize shoreline sensitivity.

ii. Provide additional information regarding the decision process/criteria that will be utilized to determine if mitigation will be required to minimize erosion impacts and to also select the mitigation option.

IR Number: NRCan 1-14

Source: Natural Resources Canada – ESS

To: De Beers Canada Inc.

Subject: Seepage and stability from processed kimberlite and waste rock piles
Relevant to: Key Line of Inquiry, Water Quality; Subject of Note, Permafrost, Groundwater and Hydrogeology

References:
TOR 4.1.2, 4.1.4, 5.2.5, 5.2.6
EIS Section 3, 8, 10, 11.5, 11.6, Conformity Response to Items 1 and 3

Preamble:
The Proponent has indicated that processed kimberlite (PK) will be placed at the containment site in winter and summer which may lead to the existence of frozen and unfrozen layers within the pile (e.g. section 4.2., 4.3 of conformity response). It is not clear however, whether consolidation of the unfrozen layers or pore water expulsion during frost penetration will have a significant effect on seepage or pile stability during the operation phase. The Proponent has indicated that freezing or thawing (and associated heave and settlement) of PK is not expected to affect the stability of the pile. However, it is not clear if an assessment of the frost susceptibility and thaw sensitivity of the material has been conducted. The Proponent has outlined measures for controlling infiltration into PK piles and also for ensuring chemical stability of both PK piles and waste rock piles. Submergence of all or part of these piles is part of the design. Infiltration however may occur during operation and prior to completion of refilling of Kennady Lake and return to the original lake level of 420.7m. It is unclear what measures will be implemented to ensure infiltration is minimized prior to submergence.

Requests:

i. Please provide additional information related to the stability analysis for the PK piles, in particular provide (a) clarification regarding the effects that consolidation of unfrozen layers or pore water expulsion during freezing will have on seepage and pile stability; (b) information on assessment of frost susceptibility and thaw sensitivity of PK and its incorporation into the stability analysis.

ii. Please provide clarification on measures to be implemented to reduce infiltration into mine waste piles (PK and waste rock) to ensure chemical stability prior to submergence.