



NRCan Presentation on Gahcho Kué Project

**Mackenzie Valley Environmental Impact Review Board
Panel Public Hearing**

Yellowknife, NWT, December 6, 2012



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NRCan Expertise

- **Minerals and metals sciences - mine waste management:**
 - acid rock/mine drainage and metal leaching,
 - environmental hydro-geochemistry, and
 - mine reclamation, decommissioning and closure.
- **Earth sciences - physical environment:**
 - permafrost and terrain sensitivity,
 - geotechnical science, and
 - bedrock geology.



NRCan's Technical Participation

NRCan has participated in:

- Review of Terms of Reference, July – Oct. 2007
- De Beers' EIS Workshop, Yellowknife, Oct. 26-27, 2011
- Review of EIS and Supplemental Information, Jan. - Dec. 2011
- Submission of Information Requests (IRs), Dec. 2011 and July 2012
- Review of Proponent's IR Responses (April and Aug., 2012)
- Technical Meeting, Yellowknife, May 22-24, 2012
- Submission of Technical Report, Oct. 2012



NRCan's Recommendations

- Provide guidance on factors that should be considered in detailed/final project design and in subsequent monitoring plans.
- Two Issues:
 - Groundwater management from open pit developments – monitoring for dissolved radionuclides; and
 - Permafrost and terrain conditions, and stability of project components (mine waste and water management facilities).



Groundwater from Open Pit Developments – monitoring for dissolved radionuclides

Why is this Important?

- Relevant to Key Line of Inquiry Long-Term Biophysical Effects - Closure and Reclamation; and Subject of Note Groundwater Monitoring.
- During pit dewatering operations, groundwater flowing into open pits is expected to range from ~ 770,000 to 1,500,000 m³/y.
- The majority of the incoming groundwater would be managed through the Water Management Pond and recycled, a portion of it would be discharged to Lake N11.
- Kimberlite pipes and their contact rock may contain Uranium and Thorium decay series radionuclides.



Groundwater from Open Pit Developments – monitoring for dissolved radionuclides

NRCan Views:

- Testing of deep formation groundwater is required to determine if there are dissolved radionuclides components.
- Proponent's geochemical testing (response to NRCan Information Request 1-2) indicates that:
 - Solid phase uranium and thorium concentrations were close to their typical crustal abundance, and
 - these parameters do not tend to be mobilized (2012 EIS Supplement - Appendix 8.III).
- Proponent will confirm radionuclides are not leachable by incorporating these parameters into their groundwater quality monitoring programs.
- NRCan agrees with the Proponent's commitment to confirm that radionuclides are not leachable in the groundwater.



Groundwater from Open Pit Developments – monitoring for dissolved radionuclides

NRCan Recommendations:

- NRCan recommends that the Proponent include Uranium, Thorium and possibly Radium-226 as screening parameters as part of their ongoing groundwater quality monitoring program.
- The Proponent has indicated (Nov. 7, 2012) that they will include these parameters in their groundwater quality monitoring program.



Permafrost and Terrain Conditions and Stability of Project Components - mine waste management facilities, dams and dykes

Why is this Important?:

- Relevant to Key Line of Inquiry Water Quality; and Subject of Note Permafrost, Groundwater and Hydrogeology.
- Stability of engineered structures, including processed kimberlite facilities, waste rock pile, dams and dykes will be dependent on the properties of underlying foundation and construction materials.
- In the permafrost zone, the thermal condition of subsurface materials and ground ice conditions, must also be considered in the design.
- Maintenance of facility integrity is important to ensure minimal impacts on the aquatic and terrestrial environments including impacts on water quality.



Permafrost and Terrain Conditions and Stability of Project Components - mine waste management facilities, dams and dykes

NRCan Views:

- Information collected during initial geotechnical investigations is sufficient for the conceptual/preliminary design of processed kimberlite and water management facilities:
 - *support Proponent's plans for further geotechnical investigations to support detailed design.*
- Although design does not rely solely on frozen conditions to ensure integrity and prevent seepage, frozen conditions and potential for changing thermal conditions must be considered.
- NRCan supports Proponent's proposed approach for detailed design of dykes including evaluation of thermal performance of permafrost foundations.
- Potential for frost heave or thaw settlement instability in processed kimberlite facility:
 - *monitoring required to ensure no excessive deformation of cover.*

Permafrost and Terrain Conditions and Stability of Project Components - mine waste management facilities, dams and dykes

NRCan Recommendations:

Dykes, particularly those remaining at closure (e.g., A1 and D) -- NRCan recommends that the Proponent:

- Conduct further geotechnical investigations along dyke alignments to better characterize foundation materials including thermal conditions,
- Conduct analysis to evaluate the long-term thermal behaviour of permafrost foundations, and
- Develop plans to monitor thermal performance and stability of dyke foundations to determine if mitigation is required.

Processed Kimberlite Facility -- NRCan recommends that the Proponent:

- Develop a monitoring plan to assess pile condition and stability and to determine the need for mitigation should there be instability or deformation of the cover affecting the performance.

The Proponent has committed (Nov. 7, 2012) to undertake further geotechnical investigations, thermal analysis, and monitoring plans.



Closing

- Natural Resources Canada appreciates the opportunity to participate in this review.



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