SLEMA
October 2011
Environmental Update

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Outline

1. Mine Update
2. Inspection Update
3. Regulator Update
4. Stakeholders' Update
5. Reviews
6. SLEMA Position on Water Lincence Renewal

Acronyms

- AANDC – Aboriginal Affairs and Northern Development Canada (previous INAC – India and Northern Affairs Canada)
- AEMP – Aquatic Effects Monitoring Program
- ARD – Acid Rock Drainage
- DFO – Fisheries and Oceans Canada
- EC – Environment Canada
- ENR – Department of Environment and Natural Resources, GNWT
- GNWT – Government of the Northwest Territories
- MVLWB – Mackenzie Valley Land and Water Board
- PK – Processed Kimberlite
- SLEMA – Snap Lake Environmental Monitoring Agency
- SNP – Surveillance Network Program
- TDS – Total Dissolved Solids
- WEMP – Wildlife Effects Monitoring Program
- WTP – Water Treatment Plant
- WMP – Water Management Pond

1.1 Mine Update – September 2011

- Production rate: 66.6 % of its capacity (62,926 tonnes of kimberlite processed)
- 2,623 m^3 of water withdrawn from Snap Lake
- 745,023 m^3 of treated water discharged into Snap Lake
- 56,185 tonnes of coarse reject and 48,444 m^3 of slimes deposited in the North Pile
- 1 spills (0 reportable)
- Water sampled in 12 SNP monitoring stations
  - The monthly average for all parameters met compliance except
    - Fecal Coliform in SNP 02-16i
    - Total Suspended Solids (TSS) in SNP 02-17
- Reclaimed material from the AN pad used for internal cross-dykes in the North Pile

1.2 Authorization for Divergence of Water

- Surface water containment structures and facilities at Snap Lake are currently at capacity
- De Beers requested on September 28, 2011
  - Diversion of water on-site at Snap Lake Mine for temporary containment within the South Quarry
  - The water level in the South Quarry will not be allowed to increase above the bedrock surface
- Authorized by AANDC on September 28
- Diversion of excess water to the underground as an emergency contingency measure is likewise authorized

1.3 Discharge from SNP 02-17

- 48 hours notice for the commencement of water treatment and discharge at SNP 02-17 (temporary Water Treatment Plant)
  - Dated September 28, 2011
  - This station will be compliant with all commitments set out in Water License
- Reissuance of SNP 02-17 dated June 23
  - The compliance point for SNP 02-17 has been moved from the historic sea can station to being located within the temporary Water Treatment Plant

1.4 Incident Investigation Report – SNP 02-17

- Dated October 3, 2011
- Nitrate concentrations at SNP 02-17 was above Water Licence criteria in July 2011
  - It was a legal non-compliance
  - 6 direct causes identified
  - Root cause identified as “past affecting the future”
    - Poor methods of dealing with excessive/waste emulsions underground as well as the storage of the bulk bags of ammonia nitrate within the Starter Cell is believed to be the cause

1.4 Incident Investigation Report – SNP 02-17

- Mitigation controls
  - Possibility of adding in-line nitrate analyzers to the sampling procedures
  - Planned to research and evaluate solutions and causes related to water quality
- "De Beers Canada remains committed to a high standard of excellence with regards to environmental stewardship at Snap Lake. Lessons learned from this regrettable incident are being used to improve and refine on-site operations and processes to prevent any future similar occurrences"

Comments from the Environmental Analyst

- The incident indicated a systematic failure of site water management
- The investigation is thorough, and the report is satisfactory
- It is recommended that De Beers re-examine its certified Environmental Management System, and conduct risk assessment for any site operation/activity directly and indirectly related to water issue

1.5 Spills in the East Cell

- One spill occurred on October 2, 2011
  - North Pile runoff water spilled into a boulder field on the tundra near Perimeter Sump #3
    - Unknown origin
    - Emergence measures taken
- Another spill on October 11
  - Visible pooling in the north of Perimeter Sump #4
- Water is elevated in Perimeter Sumps and ditches due to surface containment structures and facilities being at capacity as well as increased flow of minewater from the underground
  - Water is being diverted from Perimeter Sump 3 & 4 to reduce head pressure and flow to the boulder field

Location of Spill 11-391 and 11-398

1.6 Notifications of Emergency Measures

- Dated October 6 and 17, 2011 for 2 spills
- Mitigation activities approved by the Inspector
  - The excavation of a temporary sump and installation of a pump
- All seepage collected by this temporary sump will be transferred to Permanent Sump 3 from where it will be pumped to the South Quarry situated within the Starter Cell of the North Pile for temporary containment until it is directed to the Water Treatment Plant

1.7 Response to Inspectors Direction for cleanup of AN Storage Pad

- Dated October 13, 2011
- “As per the Inspectors direction, clean-up of the AN Pad has been completed. In summary, the entire AN Pad has been removed down to tundra (photos attached). All materials have been removed to the North Pile as per Inspector direction. The sump and road to the (former) pad remain intact. A full report of activities, including sample results, is being compiled and will be forwarded to the Inspector for review”

1.8 Responses to AANDC Comments on 2010 Mine Reclamation Status Report on July 25, 2011

- Dated October 25, 2011
- Map for landfill location and the soil stockpile
  - Provided. A similar map will accompany future reports
- Vegetation and soil research
  - Background review of other mines will be a task to complete in the initial phases of the research
  - Permanent Sample Plots are standard size for this kind of research. They are scheduled to be surveyed in 2013
- The North Pile thermistor data
  - Provided a series of maps

2. Inspection Update

- INAC Inspector – Tracy Covey
- No inspection reports received

3. Regulator Update

- MVLWB
  - Updated list of Information Requests and Responses on September 28 and October 12, 2011
  - EcoMetrix submitted Memo for the Suggested Effluent Criteria for the Snap Lake Diamond Mine on October 19
  - Responded to DFO's Information Request (IR#19) regarding the Board's water licensing process on October 28
    - "The IR process is established by the Board to assist parties in the exploration and understanding of the evidence filed in a proceeding. The Board is not subject to questioning through the IR process. Furthermore, the Board is unable to forecast its future response or decisions to information which it has yet to receive"

3.1 Technical Meeting of Water Licence on October 24, 2011

- Participants
  - Staff from MVLWB, DFO, EC, AANDC
  - Staff from De Beers and Golder
  - Staff from SLEMA
- Topics
  - The incorporation of relevant portions of the existing Fisheries Act Authorization, and
  - How to update licence conditions to best incorporate Adaptive Management requirement

4. Stakeholders' Update

- YKDFN Response to the Work Plan
- ENR Decline the Technical Meeting

4.1 YKDFN Response to the Work Plan

- Dated October 13, 2011
  - "the YKDFN simply do not have the capacity to prepare an intervention prior to Nov. 7th - between GIANT Tech sessions next week and the De Beers Gaucho Kue workshop the week after", but
  - "will present during the public presentation opportunity, and will take advantage of the opportunity to ask questions of the proponent as members of the public"

4.2 ENR Decline the Technical Meeting

- Dated October 6, 2011
- “The Department of Environment and Natural Resources has reviewed the Board’s request to verify attendance at the Technical Meeting be held on October 24th, 2011, and would like to verify that ENR not be attending the meeting”

5. Reviews

- Air Quality, Meteorological Monitoring and Emission Reporting 2010 Annual Report
- De Beers Reponses to Information Requests
- De Beers Response to Inspector's Report on September 16, 2011
- Suggested Effluent Criteria for the Snap Lake Diamond Mine

5.1 Air Quality, Meteorological Monitoring and Emission Reporting 2010 Annual Report

- Submitted on June 23, 2011
- Particulate Monitoring
  - 24-hour TSP standard (120 µg/m^3) was exceeded four times during 2010
  - No guidelines for PM_{10} and $PM_{2.5}$ were exceeded
- Passive Monitoring
  - The peak concentrations of both NO_2 and SO_2 fall well below related air quality objectives
- Emissions
  - Emissions were well below the 2007 Air Modeling Update
  - The 2010 SO_2 emission rates are higher than in 2009 due to the inclusion of furnaces that burn waste oil with higher sulphur content

Comments from the Environmental Analyst

- No concerns are raised
- Follow-up
  - Stack testing for incinerator was scheduled in 2012, based on De Beers comments during the Technical Session for Water Licence Renewal (September 14-16, 2011)

5.2 De Beers Reponses to Information Requests

- Responses to Information Request #3-#15
  - Submitted on September 27, 2011
- Responses to Information Request #16-#50
  - Submitted on October 11
- Comments from the Environmental Analyst
  - The responses are reasonably detailed

Information Request

- Information Request (IR) is a process whose purpose is to collect written information about the specific issues during the Water Licence application
- The following slides describe some important IRs from different stakeholders and related responses from De Beers

Response to IR #4

- Investigation to determine if runoff from the historic ammonia nitrate (AN) storage pad has resulted in changes to water quality in Snap Lake
  - Technical memorandum prepared by Golder Associates
  - Key findings
    - There could be connectivity from the historic AN storage pad to Snap Lake via overland flow; however, large amounts of water over a continuous period of time would be required to fill all three catchment areas between the pad and Snap Lake
    - If AN was migrating from the storage pad to the northwest arm near SNAP02A, the changes in water quality have been negligible relative to the changes from the plume

Response to IR #6

- Chronic toxicity tests
  - Sporadic chronic toxicity events, such as are observed with the effluent and in the receiving environment, are not uncommon for a wide variety of industrial discharges and are not expected to translate to adverse effects in the receiving environment
  - Based on comparison of the chemistry data for treated mine water samples with and without adverse effects in the toxicity tests, it appears that most of the observed toxicity was not related to the chemistry composition of the samples
  - Data are being interpreted in a conservative manner

Response to IR #8

- Calculation of whole lake average TDS values
  - Currently using data collected from 15 current monitoring stations in the main basin of Snap Lake, excluding the northwest arm
  - The average concentration at each station is used in the calculation, which is the mid-depth result for stations with no vertical gradient, or a depth-averaged value calculated from the results from three depths for stations with a vertical gradient
  - The approach for calculating the whole-lake average TDS will be updated once the maximum depth-averaged concentration approaches 350 mg/L. At that time, the need to complete a power analysis and/or statistical comparison will be assessed

Response to IR #10

- Major storm event
  - A more common event (i.e. a 1 in 5 year storm) could be more appropriate as a trigger for additional onsite monitoring. This is likely to occur several times over the life of the mine, has a 20% chance of occurring in any given year, and would not be overly onerous as a monitoring trigger

Response to IR #11

- Management of hydrocarbon (oil) contaminated soil
  - All contaminated soil presently shipped off-site for disposal at certified and regulated hazardous waste disposal facilities
    - 20,800 Kg to the Yellowknife Solid Waste Facility in 2011
    - 261,240 Kg to the Yellowknife Solid Waste Facility in 2010
  - Recently drafted a standard operating procedure for landfarm operations, but no immediate plans to operate the landfarm

Response to IR #13

- Submission of reports and plans
  - To combine regulatory submissions into a single package due to be submitted to the Board on June 30th of each year

Response to IR #20

- Rationale for a 15 year term of Water Licence
  - Regulatory efficiency
  - Optimization of collective resources
  - “a water licence renewal hearing would not necessarily provide stakeholders with an opportunity to comment on the terms, conditions, and thresholds contained in the water licence over and above what they would be accorded under a similar process, such as on an application to amend the water licence”
  - MVLWB recently issued a licence with a 15-year term (MV2011L3-0001) on September 29, 2011

    The Town of Fort Smith
    - November 1, 2011- October 31, 2036

Response to IR #26

- Whether the 2011 “near field” (the lake area close to the location of the discharge diffuser) prediction are comparable to the Environmental Assessment Report (EAR) “Max. 1% of lake” predictions?
  - The “near field” predictions in the 2011 report are comparable to, but not exactly the same as, the “Max in 1% of lake” predictions from the EAR. Due to differences in model grid dimensions, it was not possible to output a prediction that included 1% of the lake volume, so the term “1% of lake” was not applied. The “near field” prediction incorporates about 0.4% of the lake volume, which means that it includes less dilution from the lake than the “1% of lake” prediction would have

Response to IR #28

- How close to full is the starter cell?
  - As of October 1, 2011, approximately 800,000 m3 of capacity remained in the Starter Cell, which equates to approximately 8-10 months, assuming that no paste deposition occurs
    - Up to May – July 2012
- IR #40: when is the anticipated date of placing paste into the North Pile?
  - This is dependent on the results of the trials. If the trials are successful, the anticipated date of placing paste into the North Pile is Q1 2012

Response to IR #37

- Is there anticipated change in the final footprint of the North Pile?
  - The final footprint of the North Pile is not currently anticipated to change; however, the footprint of the entire North Pile will be evaluated as part of the detailed design of the West Cell

Response to IR #41 & 50

- What are the anticipated material/physical properties of the paste for the North Pile, including: (a) Strength of the paste for the North Pile? (b) Moisture content of the paste for the North Pile?
  - Paste will be made up of coarse, grits and fine processed kimberlite (PK). The PK consists of kimberlite and granitic host rock. The final "recipe" is dependent on the results of the paste trials. Testing of the paste will be performed to determine these parameters. Testing results will be compared to values used in the design and evaluated. The strength of the paste will be determined following the trials. It is anticipated that the solids content of the paste will be 60% (m/m); therefore, the balance is water (40%)
- What is the range of moisture content of the tailings currently in the Starter Cell?
  - The range of moisture content of the discharge slurry currently being deposited in the Starter Cell is approximately 48-52%

Response to IR #44

- Is there a time when the kimberlite composition does not allow for paste production and DBCI will need to use slurry tailings?
  - Potentially, yes. For example, during any breakdown of the paste system, De Beers may need to revert to the “emergency” slurry pumping system as per original design. Locations within the North Pile are designed for slurry deposition

Response to IR #45

- Has the change in the Starter Cell due to slurry tailings been integrated into the closure plan?
  - The Starter Cell design allows for storage/deposition of dry, slurry, or paste forms of processed kimberlite. The closure conditions of the North Pile consider, without limitation, capping, monitoring, and water management. The closure plan includes a research and development (ICRP, Appendix B, Sections 1.4 to 1.7) to address uncertainties associated with cover design and North Pile characteristics (i.e., seepage waters, thermal regime, etc.)

5.3 De Beers Response to Inspector's Report on September 16, 2011

- Dated September 29, 2011
- Expressed concerns and provide clarification about a number of the Inspector's remarks
- Disagreed with the Inspector's assertions that De Beers' mine staff has "obstructed" the Inspector's access to the mine and has been non-cooperative and "argumentative"
- Provided update on progress and status of technical challenges
- "De Beers is open to a dialogue with AANDC operations staff to address perceived or real barriers that may impede an effective working relationship with the Inspector assigned to the Snap Lake file"

Comments from the Environmental Analyst

- Ongoing open and honest dialogue between De Beers staff and the Inspector will facilitate effective working relationship

5.4 Suggested Effluent Criteria for the Snap Lake Diamond Mine

- Memo prepared by EcoMetrix for MVLWB on October 19
  - The CCME water quality guidelines for protection of aquatic life were generally considered to be appropriate as WQOs for Snap Lake, for parameters that have CCME guidelines
  - For nitrate and fluoride, an alternate value was selected.
  - For parameters without CCME guidelines, lowest chronic values from the toxicity literature or guidelines from other jurisdictions were selected

Suggested WQOs and Derived EQCs

Table 3: WQOs for Snap Lake and Derived EQCs for WTP Effluent

Chemical	WQO (mg/L)	EQC (mg/L)
TSS	5	7
TDS *	350	428
Ammonia-T-N *	1.47	1.75
Nitrite-N	0.06	0.06 [+]
Nitrate-N *	3.61	3.83
Aluminum	0.1	0.1
Arsenic	0.005	0.007
Boron	1.5	2.3
Barium	1	1.5
Cadmium	3.3E-05	4.2E-05
Chloride *	213	278
Chromium	0.0089	0.013
Copper	0.0024	0.0033
Fluoride	0.4	0.5
Manganese	1	1.5
Nickel	0.096	0.14
Lead	0.0032	0.0048
Strontium *	0.5	0.5
Zinc	0.03	0.04
pH (Minimum)	6.5	6.3
pH (Maximum)	9.0	10.4

* Parameters that are expected or likely to exceed WQOs in Snap Lake, and may therefore require more treatment

[+] Derived EQC for nitrite is lower than necessary because its rapid conversion to nitrate is not accounted for in the model. An EQC of 0.2 mg/L is suggested based on current WTP performance (see text for details).

Treatment Options to Meet EQCs

- The effluent parameters that are expected or likely in future to exceed WQOs for Snap Lake include ammonia nitrogen, nitrate nitrogen, chloride, TDS and strontium. These parameters may need ***enhanced treatment*** to ensure that WQOs are not exceeded in the lake, or if briefly exceeded, that lake water will meet the WQO before the end of operations
  - ***Reverse osmosis*** was identified as the most appropriate technology

Comments from the Environmental Analyst

- Welcome 20 proposed WQOs and EQCs. Among them
  - 19 WQOs are new
  - 7 EQCs are new, 13 EQCs are updated
- Further discussion required
  - Some proposed EQCs may trigger immediate compliance issues

Effluent Parameter	Nov 08-Oct 10 Effluent Quality mg/L		Proposed EQC mg/L
Ammonia-T-N	2.66		1.75
Nitrite-N	0.19	>	0.06
Nitrate-N	9.06		3.83
Strontium	1.6		0.5
TDS	566.3		428

6. SLEMA Position on Water Lincence Renewal

- Water Quality Objectives (WQOs)
  - Both Chloride and Fluoride added into the list of WQOs
  - SNP 02-20 added into the list of compliance points
- Surveillance Network Program (SNP)
  - SNP 02-03 to be resumed
  - Dissolved Oxygen (DO) added into the measurement list of SNP 02-17
  - Clear definition of SNP 02-18 and clarification of calculation of whole lake average of TDS

6. SLEMA Position on Water Lincence Renewal

- AEMP
  - De Beers to assess the changes to the aquatic community of Snap Lake based on MVEIRB criteria in the AEMP annual reports
- The North Pile
  - More stringent requirements on the North Pile operation
  - A special study or risk assessment on the deposition of slurry into the Starter Cell
- Site Remediation
  - Requested a term or condition on confirmatory soil sampling for remediation projects

6. SLEMA Position on Water Lincence Renewal

- Term of the WL
  - 5 year term recommended
- Other recommendations
  - A special study for the new diffuser recently replaced
  - Electronic data submission (water licence data)
  - TK incorporation into the environmental management