June 2019 Environmental Update for SLEMA Board

July 04, 2019

Outline

1. Mine Update
2. SNP Report
3. Inspection Report
4. MVLWB Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update
5. Aboriginal Update
6. SLEMA's Activities

Acronyms

- AEMP – Aquatic Effects Monitoring Program
- ARD – Acid Rock Drainage
- DFO – Fisheries and Oceans Canada
- ECCC – Environment and Climate Change Canada
- ECM – Extended Care and Maintenance
- ENR – Department of Environment and Natural Resources, GNWT
- EQC – Effluent Quality Criterion
- GNWT – Government of the Northwest Territories
- INAC – Indigenous and Northern Affairs Canada (formerly Aboriginal Affairs and Northern Development Canada [AANDC])
- MVEIRB – Mackenzie Valley Environmental Impact Review Board
- MVLWB – Mackenzie Valley Land and Water Board
- PK – Processed Kimberlite
- SLEMA – Snap Lake Environmental Monitoring Agency
- SNP – Surveillance Network Program
- SSWQO – Site-Specific Water Quality Objective
- TDS – Total Dissolved Solids
- WEMP – Wildlife Effects Monitoring Program
- WTP – Water Treatment Plant
- WMP – Water Management Pond

1. Mine Update

- The Snap Lake Mine is currently under Extended Care and Maintenance (suspended operations);
- Snap Lake Mine resumed Care and Maintenance activities at site on March 4, 2019.

2. May SNP Report

- Water Monitoring Analysis Results reported for:
  - **SNP 02-02,** North Pile Drainage Collection Ditch;
  - **SNP 02-03.1,** Core Facilities Area Collection Ditch near Water Management Pond;
  - **SNP 02-04.1 & 02-04.2 & 02-04.3,** Uncontrolled Surface Runoff at Culvert by Air Strip;

2. May SNP Report

- Water Monitoring Analysis Results reported for:
  - **SNP 02-05,** Uncontrolled Surface Runoff at Bulk Sample Mine Rock Pad;
  - **SNP 02-06,** Uncontrolled Surface Runoff at Quarry Site;
  - **SNP 02-07.3,** Uncontrolled Surface Runoff at Road to Bulk Emulsion Plant;
  - **SNP 02-09.4 & 02-09.5,** Uncontrolled Surface Runoff at Emulsion Plant Area;

2. May SNP Report

- Water Monitoring analysis results reported for:

  - **SNP 02-14,** Water Management Pond**;**
  - **SNP 2-15,** Water Intake from Snap Lake;
  - **SNP 02-16i**, Sewage Discharge from Sewage Treatment Plant.

2. May SNP Report

Regulatory monitoring of Snap Lake Mine included the following:

- Air quality monitoring;
- SNP monitoring;
- Visual fuel tank inspections;
- North Pile, ditch and perimeter sump visual inspection;
- Building visual inspection;

2. May SNP Report

Regulatory monitoring of Snap Lake Mine included the following:

- North Pile thermistor and piezometer monitoring;
- Meteorological data downloads;
- Dam and Water Management Pond visual monitoring;
- North Pile ditch and sump visual monitoring;
- Wildlife surveillance.

3. Inspection Report

- An inspection of the Snap Lake Mine was conducted by Inspector Joe Heron on June 7,2019;

The following areas were inspected

- Water Management Pond
- North Pile Perimeter Sumps
- Water Treatment Plant
- Sewage Treatment Plant
- Waste Transfer Area
- Fuel Storage and Transfer Area
- Spill #17-044

3. Inspection Report

- No major concerns were noted during the inspection
- Water Management Pond – WMP

The WMP is the holding area for the mine wastewater;

Water from the WMP is treated prior discharge through a diffuser into Snap Lake

The water quality of the discharged effluent must be in compliance with the Effluent Quality Criteria as per Water Licence

3. Inspection Report

- Fuel storage and management

The Inspector noted that no all the pumps for fuel transfer have secondary containment placed underneath;

It also noted the adequacy regarding quantity and location of the spill response materials at site

3. Inspection Report

- Waste Management

Waste that reports to the Waste Management Area was properly segregated, staged and labeled;

It appeared to the Inspector that the Waste Management Plan was in compliance;

Incinerable waste is incinerated. Ashes are tested prior final disposal into the landfill. Ashes no suitable to go to the landfill are shipped offsite to an approved facility;

Inert waste is deposited into the mine landfill , waste is covered over with processed kimberlite

3. Inspection Report

- Waste Management

Sewage is pretreated at the mine STP, sewage effluent is discharged into the WMP and treated again;

Sludge is deposited into the mine landfill;

- Spill #17-044

This spill occurred on December 7, 2017 at the auxiliary genset day tank #2;

The tank overtopped and ~5 m^3 of diesel fuel spilled onto the soil impacting ~ 8m^2

3. Inspection Report

- Spill #17-044

Cleanup efforts include the pumping out and recovery of fuels within the containment berm, the removal and disposal of the impacted soil and the installation of two monitoring wells

The reminder clean up will be addressed during mine reclamation activities

- Inspector's Conclusion

The Licensee appeared to be in compliance with the conditions of the WL ;

Overall, the site was very orderly, and no major issues were noted by the Inspector.

3. Inspection Report

Photo #1 Water Management Pond. No capacity issues were noted

3. Inspection Report

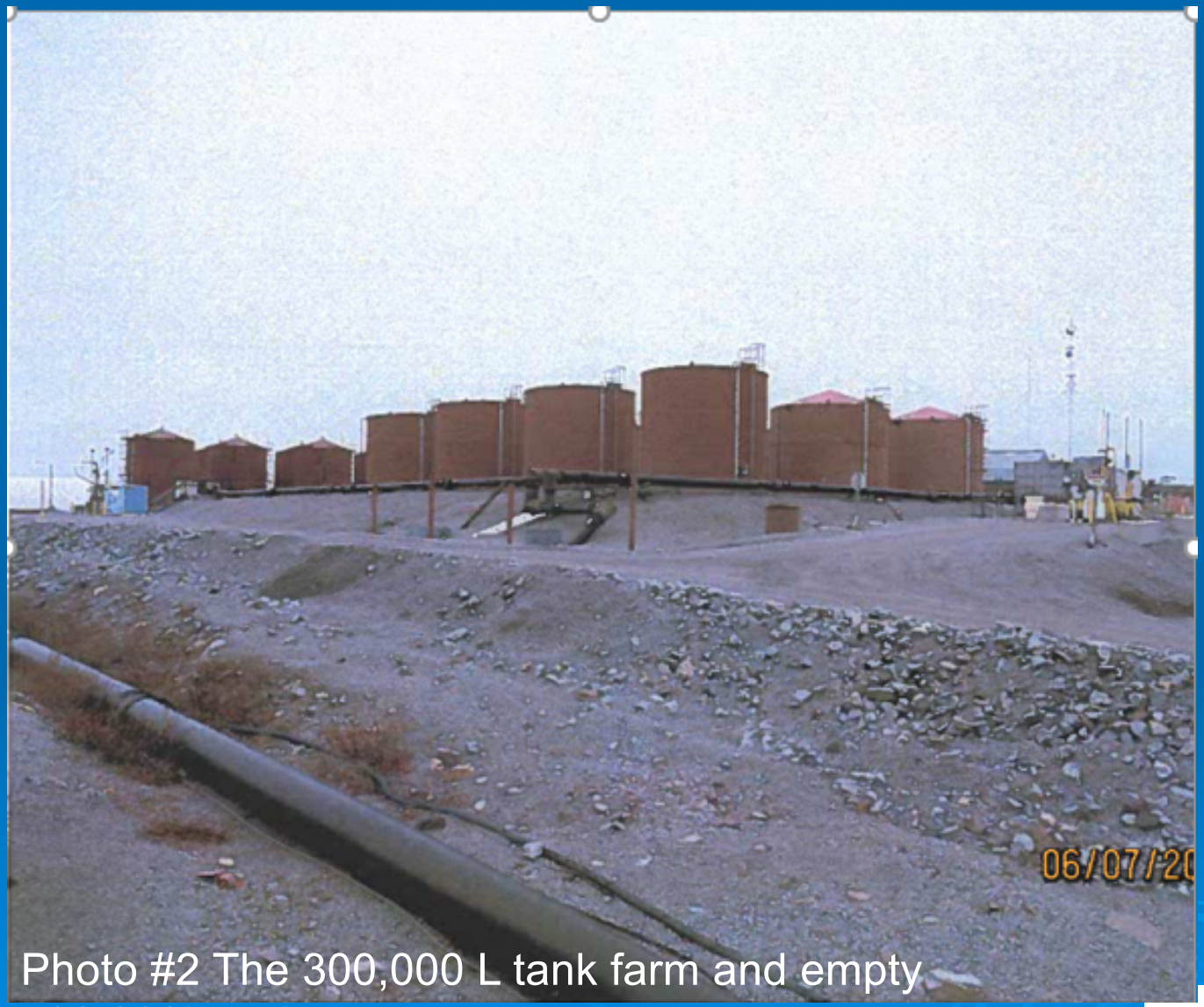

Photo #2 The 300,000 L tank farm and empty 500,000L tanks

3. Inspection Report

Photo #3 Waste Management Area with Sump #1

3. Inspection Report

Photo #4 Containment with burned ashes

3. Inspection Report

Photo #5 Other view of the Waste Management Area - WMA

3. Inspection Report

Photo #6 Tank that overtopped in December 2017, Spill #17-044

3. Inspection Report

Photo #7 View of the monitoring wells installed at spill site in order to monitor if there was any impact on groundwater quality due to the spill

4. Mackenzie Valley Land and Water Board's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- UPDATE #1 – June 6 Correspondence on LUP

On June 6, 2019, the MVLWB informed regarding the LUP that it requires more studies. Some of the topics requiring further investigation are:

1. Additional information regarding the proposed activities for the closure and post-closure phases of Snap Lake Mine, related to the Final Closure and Reclamation Plan and the associated Financial Security Analysis Report;

4. MVLWB's Water Licence and Land Use Permit Review Process for Snap Lake Mine Closure Update

- <u>UPDATE #1- June 6 Correspondence on LUP</u>

2. Changes to additional overlapping management plans (Engagement Plan, Spill Contingency Plan, Waste Management Plan, and North Pile Management Plan) that apply to both the Permit MV2017D0032 and Water Licence MV2019L2-0004.

4. MVLWB WL & LUP Review Process Update

- <u>UPDATE #2 Preliminary Screening Determination</u>

On June 6, 2019, the MVLWB issued the Preliminary Screening Determination for the 2019 Renewal Application for Water Licence MV2019L2-0004 and Amendment Application for Land Use Permit MV2017D0032 and concluded that:

1. The proposed development will not have a significant adverse impact on the environment

4. MVLWB WL & LUP Review Process Update

- <u>UPDATE #2 Preliminary Screening Determination</u>

2. The proposed development impact on the environment can be mitigated through the various management plans, and

3. The proposed development is not a cause of public concern;

Thus, *the Applications can proceed through the regulatory process and any impacts of the development on the environment can be mitigated through the imposition of the terms and conditions in the LUP or WL*

4. MVLWB WL & LUP Review Process Update

- UPDATE #3 Regarding the Work Plan and timelines

On June 11, 2019, the MVLWB issued a correspondence regarding the Work Plan and the timelines;

Mackenzie Valley Land Use Regulations requires the MVLWB to make a decision on the LUP application within a period of 42 days after receipt of the complete application;

On June 6, 2019, the Board invoked the Regulations to allow for additional time to gather Information;

4.2 MVLWB WL & LUP Review Process Update

- UPDATE #3 Regarding the Work Plan and timelines

The Waters Act requires the MVLWB to make a decision on a water licence application within a period of nine months after the day on which an application is deemed complete and the review process begins;

The MVLWB Day Count stops whenever the Board requires the Proponent to provide information for the regulatory process to continue. Once that information has been provided, the MVLWB Day Count resumes;

Item #	Task	Responsible Party	MVLWB Day Count (275 Max)	Due Date (Date Completed)
1.	Renewal Application Submitted	Proponent		(April 1, 2019)
2.	Renewal Application deemed complete	MVLWB staff	11	(April 12, 2019)
3.	Renewal Application and Draft Work Plan sent out for review	MVLWB staff	11	(April 12, 2019)
4.	Comments due on the Draft Work Plan	Reviewers and Proponent	22	(April 23, 2019)
5.	Amendment Application Submitted	Proponent	35	(May 6, 2019)
6.	Reviewer comments due on Applications	Reviewers	46	(May 17, 2019)
7.	Proponent responses to Reviewer comments on Applications	Proponent	46	(June 3, 2019)
8.	Preliminary Screening	MVLWB	49	(June 6, 2019)
9.	**Technical session**	**All Parties**	**89-91**	**July 16-18, 2019**
10.	Circulate Information Requests from Technical Session	MVLWB staff	95	July 22, 2019
11.	Deadline to respond to Information Requests	All Parties	95	August 6, 2019
12.	**Deadline for Interventions**	**Interveners**	**130**	**September 10, 2019**
13.	**Pre-Hearing Conference**	**All Parties**	**-**	**September 16, 2019**
14.	Proponent response to Interventions	Proponent	130	September 24, 2019
15.	Deadline for Intervener Public Hearing presentations	Interveners	137	October 1, 2019
16.	Proponent Public Hearing presentation due	Proponent	144	October 8, 2019
17.	**Public Hearing**	**All Parties**	**158-159**	**October 22-23, 2019**
18.	Circulate Public Hearing Undertakings	MVLWB staff	166	October 30, 2019
19.	Public Hearing Undertakings due	All Parties	166	November 13, 2019
20.	Circulate Draft Licence/Permit	MVLWB staff	180	November 27, 2019
21.	Reviewer comments due on Draft Licence/Permit	Reviewers	194	December 11, 2019
22.	Proponent response to reviewer comments on Draft Licence/Permit	Proponent	194	December 18, 2019
23.	Deadline for Closing Arguments from Interveners	Interveners	213	January 6, 2020
24.	Deadline for Closing Arguments from Proponent	Proponent	220	January 13, 2020
25.	**Board decision on Applications**	**MVLWB**	**-**	**Late January 2020**

Table1: Regulatory Process Timeline

4. MVLWB WL & LUP Review Process Update

- UPDATE #4 Ten day pause period for Preliminary Screening Decisions

On June 27, with the enactment of Bill C-88, the Mackenzie Valley Environmental Impact Review Board indicated the commencement of a ten day pause period for preliminary screening decisions;

A ten-day pause period is established following preliminary screening decisions that do not result in a referral to EA;

During this period, no authorizations can be issued;

4.2 MVLWB WL & LUP Review Process Update

- UPDATE #4 Ten day pause period for Preliminary Screening Decisions

The ten-day pause provides a short, formal period for the Review Board or other referral bodies to order an EA after a preliminary screening decision but before regulatory authorizations are issued and work begins;

If no referral to EA is made by the end of the ten-day pause period, regulatory authorizations can be issued on the following day;

4. MVLWB WL & LUP Review Process Update

- UPDATE #4 Ten day pause period for Preliminary Screening Decisions

If an EA is ordered, the referral body should notify the regulatory authority as soon as possible and must do so before the end of the ten-day pause period.

No authorizations can be issued until after the EA is completed

5. Aboriginal Update

- On June 18, 2019 members of the SLEMA's Board visited Snap Lake Mine;

- The SLEMA's Board members were received by De Beers personnel at site and Ms. Michele Peter, Superintendent, Environment & Asset and Ms. Colleen Prather, Regulatory Specialist;

5. Aboriginal Update: June 18 Visit to Site

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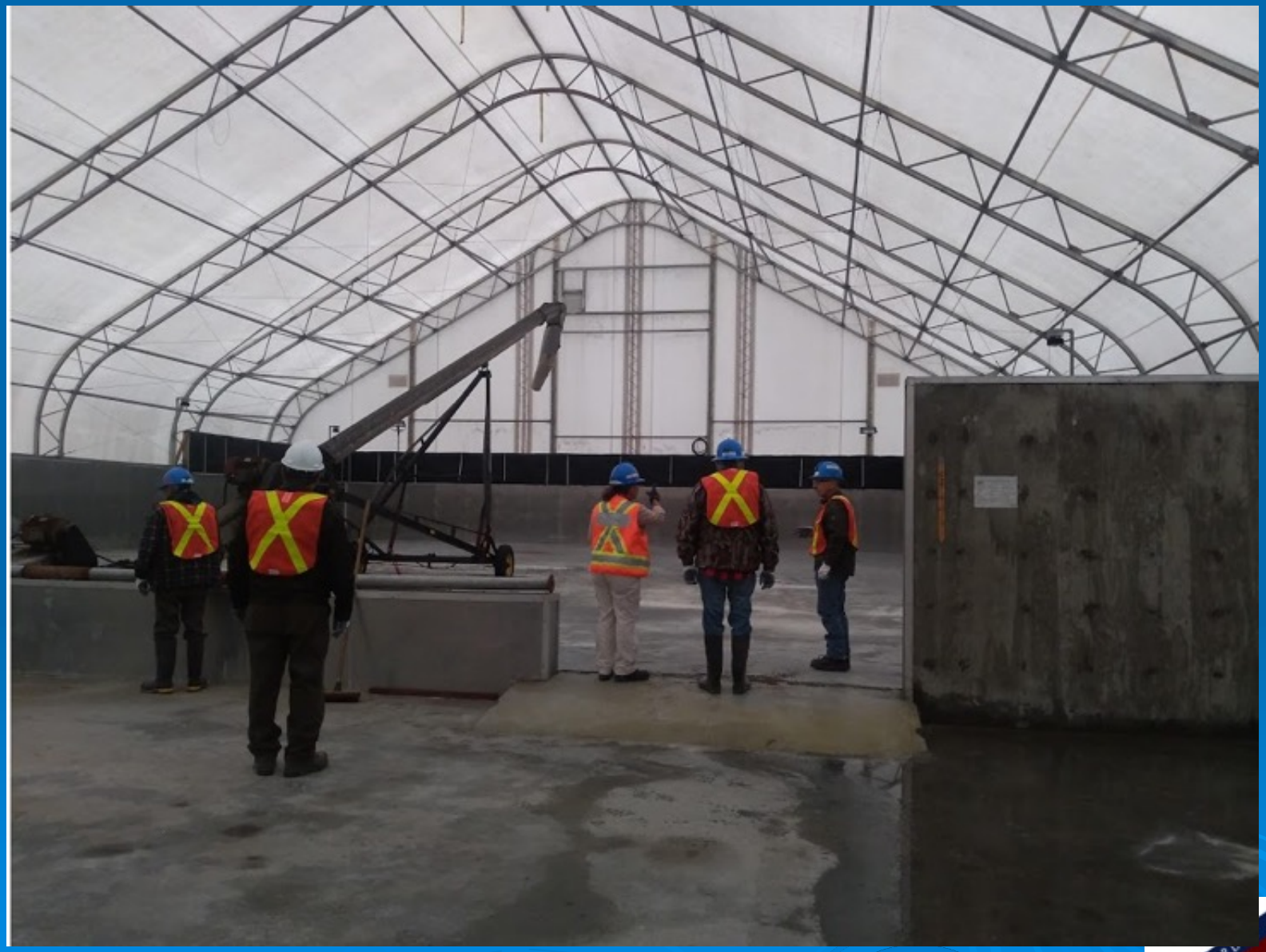

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6. SLEMA's Activities

- SLEMA commented on the 2018 Aquatic Effects Monitoring Program (AEMP) Annual Report (Report):

Comparisons between Measured and Predicted Treated Effluent Discharge Concentrations are presented in various part of the Report;

SLEMA found no use in comparing measured vs predicted treated effluent discharge concentration because these values are compared in different conditions;

6. SLEMA's Activities

- SLEMA comments on the 2018 Aquatic Effects Monitoring Program (AEMP) Annual Report:

This comparison as it is presented it does not help to assess the accuracy of the model predictions;

It will be more useful in order to assess the accuracy of the model prediction to compare the model predicted values vs. effluent water quality prior Reverse Osmosis (RO) Treatment;

6. SLEMA's Activities

- SLEMA comments on the 2018 Aquatic Effects Monitoring Program (AEMP) Annual Report:

SLEMA observes that at SNP 2-14 (Water Management Pond) model predicted a maximum concentration of sulfate of 78 mg/L;

According to the 2018 AR, the lower concentration of sulfate reported at SNP 2-14 is 138 mg/L and the higher is 598 mg/L. Why is that difference between predicted and reported sulfate concentration?

6. SLEMA's Activities

- SLEMA comments on the 2018 Aquatic Effects Monitoring Program (AEMP) Annual Report:

Recommendation: 1) Predicted model concentrations to be compared with concentration values in similar conditions.

2) Discuss the difference between predicted and reported sulfate concentration

6. SLEMA's Activities

- SLEMA comments on the 2018 Aquatic Effects Monitoring Program (AEMP) Annual Report:

Why is important to validate the accuracy of the model predictions?

Because model's results are used to propose Effluent Quality Guidelines and to forecast effluent concentrations during closure and post closure

6. SLEMA's Activities

- TK Panel met June 19 in Yellowknife. Elders in attendance were:
- Adrian Dhont & Wayne Langenham (NSMA)
- Philip Liske & Mike François (YKDFN)
- Celine Marlowe & Albert Boucher (LKDFN)
- Noel Drybones & Joseph Moosenose (Tlicho)

6.0 SLEMA's Activities

- SLEMA Board met on June 19, 2019.
- Attendees:
- Johnny Weyallon (Tlicho)
- Arnold Enge (NSMA)
- Beth Keats (YKDFN)
- James Marlowe (LKDFN)
- TK Panel Members (Tlicho, NSMA, YKDFN, LKDFN)
- Michelle Peters & Colleen Prathers (De Beers)
- Jamies Steele & Joe Heron (GNWT-Lands)
- Sonia Aredes & Philippe di Pizzo (SLEMA Staff)

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

1) The Issue:

- De Beers studies at Snap Lake Mine concluded that nitrate (NO_3^-) is the most likely chemical parameter requiring treatment at post closure;

- Three screening steps were performed, where predicted concentrations in the overflow sumps discharging to Snap Lake were compared to normal range concentrations in Snap Lake

Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

- Nitrate was identified as a Parameter of Potential Concern (POPC)
- POPC are parameters with predicted 95th percentile concentrations at the edge of the mixing zones in the main basin and northwest arm of Snap Lake that were greater than AEMP benchmarks minus 25%;
- Therefore it is proposed that Post Closure water quality based Effluent Quality Guideline be developed only for nitrate

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

2) Origin of Nitrate, Nitrite and Ammonium in Snap Lake Effluent

- Nitrogen salts contribution from explosives

Nitrogen losses to water during explosives use occur through contact between water and the nitrogen compounds produced during detonation;

The nitrogen compounds used in explosives are extremely soluble in water and any contact between water and these compounds either before detonation or after detonation will result in nitrogen losses to water

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

Nitrogen losses occur because of spills of explosives during unloading, blending and loading operations, subsequent water contact with the spill area via washdown, precipitation or snowmelt will dissolve any residual nitrogen compounds;

Dry ANFO explosives will be dissolved by any water in the blasthole;

If the moisture content exceeds 5% the explosive will not detonate, and the material will remain in the site and will be susceptible to leaching;

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

Detonation of explosives that use ammonium nitrate/ sodium nitrate / calcium nitrate as oxidizers produces several nitrogenous compounds gases;

These include mainly nitrogen (N_2), some ammonia (NH_3) and oxides of nitrogen;

N_2 (gas) is slightly water soluble, thus it does not dissolve in water;

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

Ammonia gas (NH_3) is extremely water soluble and thus any ammonia gas produced that comes in contact with water would contribute to nitrogen salts in water;

The nitrogen oxides produced are moderately soluble in water and thus would dissolve in water and contribute to nitrogen salts in water;

Finally, most of the nitrogen oxides and ammonia gases produced during detonation and released to the atmosphere will ultimately return to the earth via precipitation or dry deposition at some distance from the mine, depending of the atmospheric conditions.

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

- Domestic sewage also contributes to nitrogen salts in the final effluent

Main compound of nitrogen found in domestic sewage are ammonium (NH_4^+), nitrite (NO_2^-) and nitrate (NO_3^-)

During closure and post closure given the low amount of people the contribution to nitrate salts in the final effluent from the domestic sewage is considered not a significant contribution;

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

3) Some Issues for Predicting Nitrogen Species in Minesite-Drainage Chemistry

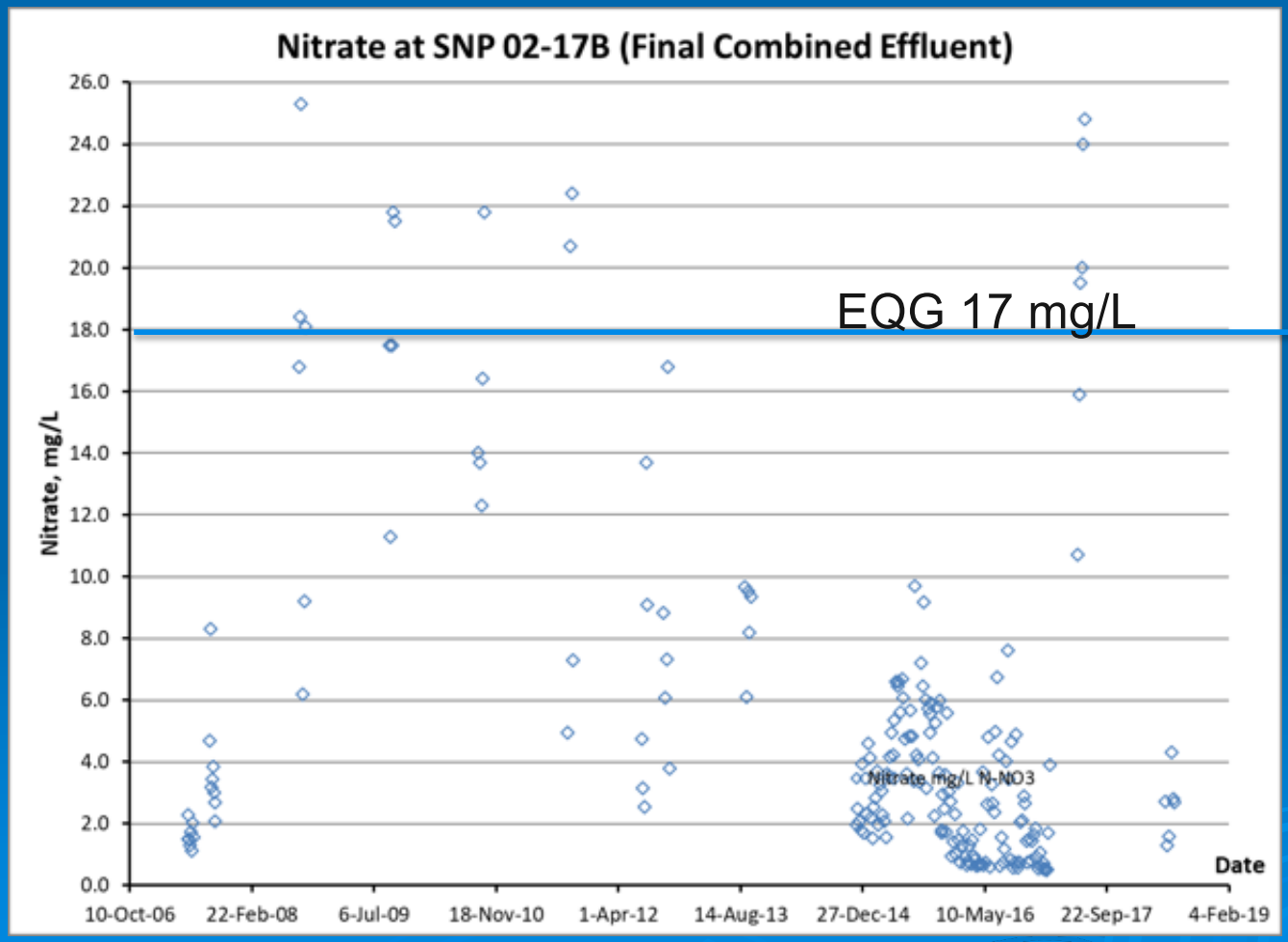
- Nitrogen species are redox reactive, so that nitrate, nitrite and ammonia can convert among themselves, raising concentrations of one while lowering the other;
- Nitrogen species can interact with nitrogen gas in the atmosphere;
- The chemical compositions of explosives can be highly variable

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

- Thus, the prediction of nitrogen species in minesite drainages from explosive residue is not as simple as for some other elements;
- A study in BC mines conducted by EC in 1988, showed that nitrogen leaching from each minesite, through surface water and groundwater, was the sum from various sources; These sources included pits, waste rock, and tailings, which showed that explosive derived nitrogen was carried by ore and waste rock into other minesite components for later leaching

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

4) How much is nitrate concentration in the final effluent discharge at Snap Lake?



7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

5) Nitrogen compounds toxicity

- Ammonia toxicity in freshwater

There are several factors that are known to affect the toxicity of ammonia in freshwater, they include pH, temperature, dissolved oxygen concentration, salinity;

Of these, pH is thought to be the most important factor influencing ammonia toxicity;

There is a substantial body of data available on the toxicity of ammonia to aquatic organisms, in particular acute, chronic, and sub-lethal effects of ammonia in fish.

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

- Nitrate toxicity in fresh water

Nitrate is the most oxidized form of nitrogen in the environment and also the most stable form;

Along with phosphorus, nitrogen plays a major role in eutrophication in waters;

Common ecological changes to aquatic systems undergoing nutrient enrichment may include an increase in algal and macrophyte production resulting undesirable blooms, a decrease in water clarity, a loss of cold water fisheries and changes in species composition.

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

Nitrate is considerably less toxic than ammonia or nitrite, with acute median lethal concentrations of NO_3-N being up to two orders of magnitude higher than for NH_3-N and NO_2-N

Nonetheless, nitrate can produce toxic effects.

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

6) Conclusion:

Because of many factors, the prediction of the nitrogen species of nitrate, nitrite, and ammonia in minesite-drainage chemistry is difficult;

Some studies performed by EC in BC mine sites suggest that a significant amount of nitrogen may be stored at the blast site and/or in the blasted rock at the drier site;

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

- If so, this stored nitrogen could become mobile later upon contact with water such as during a spring freshet, or could convert to nitrogen gas during long residence times;
- Nitrogen species are redox reactive, so that nitrate, nitrite and ammonia can convert among themselves, raising concentrations of one while lowering the other

7. Case Study: Nitrate, Nitrite and Ammonium in SL Effluent

- Therefore, Post Closure EQG should include all the forms of nitrogen and not only nitrate (NO_3^-)