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Review of ML/ARD Geochemistry & Water Quality Predictions

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Terminology

- ML/ARD – metal leaching and acid rock drainage
- AG – already acid generating
- PAG – potentially acid generating (i.e. after a time lag)
- Non-PAG – non-potentially acid generating
- KN – Kemess North (expansion)
- KS – Kemess South (existing operations)
- DI – Duncan Impoundment
- WQ – water quality
- LGO – low grade ore

Presentation Outline

- Regulatory and Policy Context
- Mine Aspects and Components (14)
  - Key Elements/Issues
  - Conclusions
  - Recommended *Mines Act* Permitting Conditions
- Summary Conclusions

Regulatory & Policy Context

- *Mines Act*
- Health, Safety and Reclamation Code for British Columbia
- Policy for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia
    - » Joint Policy with the Ministry of Environment

Mine Aspects & Components

1. Mine Plan
2. Geology
3. ML/ARD Prediction Work
4. Waste Disposal Alternatives Assessment
5. Water Management
6. Road Construction and Infrastructure
7. Conveyor Tunnel
8. Low Grade Ore Stockpile
9. Non-PAG Waste Rock Dump
10. Kemess North Pit
11. Kemess South Pit
12. Duncan Impoundment
13. Environmental Liabilities
14. Adaptive Management

1. Mine Plan

- The mine plan provides sufficient context for the results of the ML/ARD prediction work, the water quality predictions, the mitigation strategies proposed and the adaptive management plan.
- ***<u>Conclusion:</u>***
  - From a ML/ARD perspective, MEMPR is satisfied with the mine plan and sequencing information.
- ***<u>Recommended Permitting Condition:</u>***
  - Detailed mine plans consistent with Part 10 of the Health, Safety and Reclamation Code.

2. Geology

- Deposit contains high contents of sulphide minerals and low contents of neutralizing minerals (= ARD potential).
- Very large oxidized cap (i.e. gossan) which contains soluble minerals and produces natural acidic drainage.
- Significant anhydrite exists in the deposit which is a source of soluble sulphate.
- ***Conclusion:***
  - MEMPR is satisfied that the geological information provides a good basis for the ML/ARD prediction program.

3. ML/ARD Prediction Work

- MEMPR agrees with Proponent’s assessment, very significant risk for generation of ML/ARD.
- Waste rock classified as AG (Type I), PAG (Type II) and non-PAG (Type III).
- Tailings are PAG.
- Bulk of pit walls left at the end of mining also predicted to be AG/PAG.

3. ML/ARD Prediction Work

- Testing shows that there will be a lag time to ARD in PAG materials.
- Site-specific geochemical criteria developed for waste rock; management strategies based on this.
  - Type I (AG) – immediate submerge
  - Type II (PAG) – flood in 2 years (because of lag time)
  - Type III (non-PAG) – on-land disposal

3. ML/ARD Prediction Work

- ***<u>Conclusions:</u>***
  - MEMPR generally satisfied with ML/ARD prediction work.
  - Tailings, Type I and II waste rock and pit walls need to be managed to prevent environmental impacts related to ML/ARD.
- ***<u>Recommended Permitting Condition:</u>***
  - Detailed ML/ARD monitoring programs are required to guide tailings and waste rock handling, construction activities, and to update water quality predictions.

4. Waste Disposal Alternatives

- Best technology available to prevent ML/ARD in tailings and Type I and II waste rock and minimize environmental risk is storage in permanently saturated conditions.
- Two waste disposal options were examined to store the necessary volumes of AG/PAG waste rock and PAG tailings.
  - Option 1 – Duncan (Amazay) Lake
  - Option 2 – Multi-Facility

4. Waste Disposal Alternatives

- From a ML/ARD perspective, the Failure Modes Effects Assessment was adequate for examining relative risk of the two options.
- Provincial policy states:

  "Underwater disposal in natural water bodies will only be considered if it can be demonstrated that the disposal site is environmentally preferable and there will be no significant impact on the environment or downstream water uses, both during and following disposal."

4. Waste Disposal Alternatives

- ***Conclusions:***
  - MEMPR agrees that the long-term environmental risk of ML/ARD with Option 1 is much less than Option 2.
  - MEMPR believes Duncan (Amazay) Lake impoundment is environmentally preferable storage location for protecting downstream water quality, and is consistent with Policy.

5. Water Management

- Construction:
  - impoundment dewatering
- Operations:
  - facility used to collect inflows from mining disturbed areas.
  - clean water diversion, mill recycle, zero-discharge and seepage management for DI.
- Closure:
  - plug for conveyor tunnel, 2 spillways on DI, possible pumping of DI water to KN pit lake, HDS lime treatment plant.

5. Water Management

- ***<u>Conclusions:</u>***
  - Dam raises can be scheduled to avoid surface discharges during operations.
- ***<u>Recommended Permitting Conditions:</u>***
  - Detailed water management and sediment control plans.
  - During operations, track and update hydrology and water balance and assess requirements for water management and dam construction.

6. Road Construction & Infrastructure

- Only non-PAG materials will be used and sufficient materials are available for all construction needs.
- Where PAG materials are encountered in road cuts these will be avoided or the waste will be flooded in DI and mitigation/monitoring programs developed.
- ***Conclusion:***
  - Conceptual management plans for construction materials are adequate for this stage of review.
- ***Recommended Permitting Conditions:***
  - ML/ARD characterization of fill and any cut materials, and development of mitigation plans where needed.
  - Operational monitoring and management plans.

7. Conveyor Tunnel

- 2.8 km conveyor tunnel in expected AG/PAG materials.
- Proposed flooding at closure with bulkhead to prevent ML/ARD appears feasible.
- Seepage expected with high flows during operations and less after bulkhead is installed. South portal and North portal seepage will be directed to DI after closure.
- <u>WQ predictions:</u>
  - seepage non-acid during operations
  - small potential for mildly acidic seepage post-closure (upper bound).

7. Conveyor Tunnel

- uncertainties with groundwater inputs and loadings from spilled ore.
- predicted amount of contaminants from tunnel would not adversely affect DI water quality.
- If North portal seepage is acidic it will be pumped to KN pit.

- ***Conclusions:***
  - Satisfied with conceptual plans for flooding at closure and seepage management proposals.
  - Generally satisfied with seepage water quality predictions and inputs to DI modelling.

7. Conveyor Tunnel

- ***<u>Recommended Permitting Conditions:</u>***
  - Detailed plans for characterization, materials management and seepage monitoring/management during operations and post-closure.
  - Preliminary design for tunnel closure; detailed design prior to closure.
  - Detailed closure costs for establishing closure liability and financial security.
  - During operations, updated seepage assessments and water quality modelling to determine final closure requirements.

8. Low Grade Ore Stockpile

- Up to 44 million tonnes low grade ore near crusher for up to 16 yrs, made up of AG and PAG.
- Management plan is to separate and prevent formation of new ML/ARD by milling within 5 years.
- Manage drainage from AG low grade ore through lime addition and mill reclaim during operations.
- Loadings to DI from low grade ore are very small compared to other sources.

8. Low Grade Ore Stockpile

- Operational seepage WQ could be worse than predictions for a given stockpile.
- Significant liability in temporary or early shut down.
- Commitment to mill or move to flooded location.
- MEMPR supports flooded storage to KN pit and not DI.
- ***Conclusions:***
  - Generally satisfied with the assessment of LGO for panel review stage.

8. Low Grade Ore Stockpile

- ***Recommended Permitting Conditions:***
- Detailed plans for the following:
  - Characterizing and segregating types of LGO.
  - Scheduling plans to show LGO can be milled within 5 yrs.
  - Drainage management plan that includes measures to prevent contamination of non-PAG dump.
  - Monitoring programs to track acid weathering and WQ.
  - Establishing triggers for immediate milling.
  - Detailed costs for relocating all LGO to KN pit to be used for establishing the financial security.

9. Non-PAG Waste Rock Dump

- ~ 57 million tonnes of non-PAG (Type III) waste rock disposed in on-land dump near pit.
- ML/ARD prediction work supports non-PAG designation and storage in unflooded, on-land location.
- Enough non-PAG waste rock for proposed additional uses:
  - North dam construction
  - wave barrier over tailings
  - cover over exposed beaches
  - retainment structure for sludge from lime treatment plant

9. Non-PAG Waste Rock Dump

- ***Conclusions:***
  - Predictions may underestimate seepage WQ from non-PAG rock, but increases in contaminants would not significantly affect DI water quality.
  - On-land disposal preferable to minimize dam heights.
- ***Recommended Permitting Conditions:***
  - Testing and waste handling protocols for clean segregation of non-PAG waste rock.

10. Kemess North Pit

- Water Quality Modelling
- Lime Treatment and Sludge Management

10. KN Pit – WQ Modelling

- Characterization data indicated exposed pit walls will contain AG/PAG materials.
- Modelling identified that KN pit water will be acid with high metals from oxidation/leaching of pit walls.
- Pit water must be treated to prevent adverse affect to DI WQ and to keep flooded tailings and waste rock stable.
- The pit will start to overflow ~ 80 years post-closure.
- MEMPR had some issues with the modelling, but agree with the conclusion that treatment of KN pit water is needed.

10. KN Pit – WQ Modelling

- ***Conclusions:***
  - MEMPR is satisfied with WQ modelling conclusion which demonstrates the need for mitigation.
  - MEMPR considers lime treatment to be the only mitigation able to provide long-term protection of DI water quality.
  - Satisfied with Proponent commitment to build and operate HDS lime treatment plant in the future.
  - Conceptual design adequate for this stage of review.

10. KN Pit – WQ Modelling

- ***Recommended Permitting Conditions:***
  - Updated WQ predictions required for closure planning and detailed collection and treatment plant design.
  - Detailed monitoring programs required to support revised predictions.

10. KN Pit –Treatment / Sludge

- MEMPR considers HDS lime treatment to be proven technology capable of providing effective and reliable means of protecting the environment.
- There are significant long-term environmental risks/liabilities with active ARD treatment.
- Successful management requires long-term operator vigilance, adaptive management, effective monitoring, maintenance and contingencies to minimize risk.
- Requires adequate financial security to cover cost liabilities.

10. KN Pit – Treatment / Sludge

- Discharges from treatment plant will go to DI.
- MEMPR feels that WQ modelling may underestimate arsenic and sulphate contents to DI.
- Significant sludge produced as by-product of lime treatment; 2 storage options – DI + on-land near non-PAG dump.
- MEMPR only supports on-land facility for sludge storage due to uncertainties with DI WQ if sludge placed there.
- Conceptual on-land facility adequate to store 1000 years sludge.

10. KN Pit – Treatment / Sludge

- ***Conclusions:***
  - MEMPR satisfied with conceptual design for on-land sludge storage.
- ***Recommended Permitting Conditions:***
  - Provincial policy states active ARD treatment liabilities should be secured at 100%.
  - Detailed costing information for construction and operation of HDS lime plant to establish financial security. Required at start of operations.
  - In the future, plans for monitoring sludge volume, characteristics, stability, and effluent and seepage WQ.

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11. Kemess South Pit

- Modelling identified potential uncertainty with Kemess South pit WQ.
- Potential WQ issues related to the existing pit wall at the Kemess South operations.
- The storage of Kemess North tailings will not adversely affect Kemess South pit WQ.
- ***Conclusions:***
  - MEMPR is satisfied with level of assessment for the panel review stage.
  - Operational and closure issues at Kemess South will continue to be covered under existing *Mines Act* permit.

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12. Duncan Impoundment

- Impoundment Design
- Zero Discharge
- Maintenance of Saturated Conditions
- Chemical Stability of Submerged Tailings
- Tailings Re-suspension
- Water Quality Modelling
    - Approach and Inputs
    - Modelling Results
    - Duncan Impoundment Management Implications
- Future Use of Duncan Impoundment

12. Duncan Impoundment - Design

- Design capable of storing all AG/PAG waste rock and tailings underwater; flexibility for storing more if required.
- Immediate flooding of Type I (AG) in deepest part of DI and flooding of Type II (PAG) within 2 years.
- DI water will be maintained above pH 7.5 during operations to minimize solubility of metals.
- Tailings beaches will be developed to prevent wave erosion of the dam.

12. Duncan Impoundment - Design

- ***Conclusion:***
  - General design and waste placement strategies acceptable to MEMPR.
- ***Recommended Permitting Conditions:***
  - Detailed waste management and operator protocols for tailings and waste rock placement in DI.
  - Updated estimate of lime requirements and additional methods to keep impoundment and pore water pH above 7.5.

12. DI – Zero Discharge

- Definition is no surface discharge during operations. Seepage below dams will be pumped back to DI.
- No mining operation is truly zero discharge as seepage losses will always occur.
- Unrecovered seepage is predicted to be 1.5 L/s for DI.
- Impacts to downstream from seepage losses has not quantified. Seepage could form up to 50% of flow in Duncan Creek during low flow.
- Commitment to further assess need for seepage reduction measures during detailed design.

12. DI – Zero Discharge

- Potential measures during operations are to place tailings higher along edges of impoundment where waste rock occurs, grouting seepage zones, and installing wells and pumping groundwater back to DI.
- ***Conclusions:***
  - Plans for further assessment at permitting and the commitment to monitor and implement contingency seepage reduction or groundwater collection measures should be adequate to manage operational seepage issues.

12. DI – Zero Discharge

- ***<u>Recommended Permitting Conditions:</u>***
  - Re-evaluate seepage reduction and contingency measures during detailed design.
  - Monitoring programs for operations; review seepage issues annually.
  - Update seepage water quality predictions during operations and seepage management requirements for closure.

12. DI - Maintenance of Saturation

- Low permeability dam.
- High hydraulic conductivity contrast between the tailings and dam vs. the dam drain materials.
- Water table is kept high to have all AG/PAG in fully saturated conditions.

12. DI - Maintenance of Saturation

- ***Conclusion:***
  - DI design should be capable of keeping all AG/PAG wastes in fully saturated conditions and is acceptable to MEMPR.
- ***Recommended Permitting Conditions:***
  - During operations, determine final closure design to meet objectives of fully saturated conditions in AG/PAG wastes.
  - Monitoring program for confirming saturated conditions.

12. DI - Chemical Stability of Waste

- Reasonable description of how DI water cover will function.
- Water column will be well oxygenated.
- MEMPR expects the rate of oxidation of underlying wastes should be very low.
- MEMPR agrees that the contaminant loadings from the tailings and waste rock would be insignificant compared to other contaminant sources to DI.
- Slow oxidation of wastes should not adversely affect DI WQ as long as wave re-suspension is managed and neutral pH are assured.

12. DI - Chemical Stability of Waste

- Keeping DI pH >7.5 during operations and lime treatment of KN pit drainage should ensure DI has neutral pH post-closure.
- Commitment to place at least 1 metre fresh tailings over all waste rock will limit pore water flux.
- Conservative assumption of no removal of metals by organic sediments over time, but MEMPR recognizes these mechanisms likely to occur to some extent.

12. DI - Chemical Stability of Waste

- ***Conclusions:***
  - MEMPR satisfied with assessment of how DI water cover will function to minimize oxidation of waste rock and tailings.
  - Water cover is the best mitigation strategy to minimize oxidation and the generation of ML/ARD in KN tailings and waste rock.
  - Impoundment design should be capable of keeping wastes geochemically stable by storing in permanent, fully saturated conditions.

12. DI - Tailings Re-suspension

- Re-suspension of tailings by wave action can occur where water is 3 meters deep or less.
- This could lead to increased oxidation of tailings.
- Proposed mitigation of placing a non-PAG rock cover over shallow beach areas.

12. DI – Tailings Re-suspension

- ***<u>Conclusion:</u>***
  - MEMPR is satisfied with assessment and mitigation proposed.
- ***<u>Recommended Permitting Conditions:</u>***
  - Detailed design for thickness of rock cover and depth of placement with factor of safety for seasonal fluctuation.
  - Detailed information on placement methods.
  - Detailed costs of placing non-PAG rock cover over shallow tailings areas for calculation of financial security requirements.

12. DI WQ - Approach & Inputs

- Dilution and water balance model – base case and upper bound scenarios modelled.
- MEMPR agrees that all major sources of contaminant loadings incorporated in modelling.
- During operations, water is recycled to the mill, and any contaminants are removed by the mill (DI WQ not sensitive to tunnel, KN pit dewatering, waste rock, LGO).
- Inputs from surface water tributaries, groundwater and tailings slurry water are direct measurements.

12. DI WQ - Approach & Inputs

- Inputs from tailings beaches, reclaimed seepage, tailings pore water displacement, and diffusion of tailings pore water were based on reasonable assumptions. But in general, there is considerable uncertainty with these kinds of estimates.
- Solubility limits were assessed using a geochemical model (PHREEQC); was used to cap predicted concentrations. MEMPR requested further details to confirm approach and results. This information has since been provided and is satisfactory.

12. DI WQ - Approach & Inputs

- ***Conclusions:***
  - Generally satisfied with approach and most of the input sources to DI water quality modelling.
  - As with any modelling, there are uncertainties with flow and chemistry predictions.
  - Due to uncertainties and some non-conservative assumptions, there is potential that actual discharge WQ could be higher than predicted.
  - MEMPR's suggested approach to deal with WQ uncertainties discussed later.

12. DI WQ - Modelling Results

- Predictions for DI WQ made for 4 time periods:
  - Initial discharge
  - Year 2 of discharge
  - Steady state between year 5 and 80
  - Post year 80 when KN pit overflows to DI
- Results of DI and seepage WQ modelling are used as inputs to predict downstream WQ.
- Downstream WQ predictions previously only used base case DI discharge WQ predictions, but now the modelling has been conducted to incorporate upper bounds – MOE.

12. DI WQ - Modelling Results

- Results suggest DI will meet federal MMER requirements (max. monthly mean) at all times.
- Depending on time period of discharge, modelling shows DI will likely not meet BC receiving environment WQ guidelines for protection of aquatic life for:
  - Cd, SO_4, Cu and maybe Se and Co – base case
  - Plus maybe Sb, As, Cr and Ag – upper bound
- Seepage from SE and SW dams will be elevated in SO_4, Cd and maybe Co and Se.

12. DI WQ - Modelling Results

- Modelling shows that water quality is expected to change over time.
- WQ improves after initial discharge until year 80 because of dilution with clean water inflows to the DI.
- After year 80, WQ gets worse due to contaminant inputs from treated KN pit water.

12. DI WQ - Modelling Results

- ***Conclusions:***
  - Reasonable effort was made to generate detailed WQ predictions, but significant limitations and uncertainties exist with modelling (including downstream) that cannot be quantified further at this stage of assessment.
  - MEMPR feels there is some potential that actual DI WQ and seepage could be worse than predictions, but there is also the possibility that WQ could be better.
  - MEMPR agrees that residual uncertainties can be handled through adaptive management provided there is sufficient caution built into the approach.

12. DI WQ - Modelling Results

- ***Recommended Permitting Conditions:***
  - Additional study programs and comprehensive monitoring program to revise modelling and resolve uncertainties.
  - Every 5 years during operations, revised WQ predictions, update adaptive management strategies and provide updated detailed liability cost estimates.

12. DI - Management Implications

- Some risk that DI will not be suitable for discharge – requires effective and feasible contingency plans.
- Development of site specific receiving WQ objectives - MOE jurisdiction.
- Proposed adaptive management strategies to mitigate risk of unsuitable WQ for DI discharge at closure:
  - <u>Low sulphate exposed beach</u>
    - Placement of low sulphur and low sulphate beach is required but modelling suggest low sulphur tailings could still be significant load of SO_4 and Cd to DI.

12. DI - Management Implications

- <u>Low sulphate exposed beach (cont'd)</u>
  - MEMPR only supports an exposed beach cover of non-PAG waste rock– review during operations.
- <u>Option for total non-PAG rock cover over surface of DI</u>
  - The necessity of this should be evaluated during operations based on updated WQ predictions.
- <u>Non-PAG rock cover to prevent wave re-suspension</u>
  - Acceptable.

12. DI - Management Implications

- <u>Raising dams to store water</u>
  - Would only provide very short-term mitigation and would be subject to geotechnical review.
- <u>Water diversion to enhance downstream dilution</u>
  - Reasonable concept, but degree of improvement unknown.
- <u>Pumping DI water to KN pit</u>
  - Only contingency that could provide definitive (but temporary) protection of the receiving environment.

12. DI - Management Implications

- ***<u>Conclusions:</u>***
  – MEMPR considers pumping of DI water to KN pit to be only proposed strategy capable of definitive (but temporary) protection of downstream WQ. Pumping assessed as feasible.
  – Recommend that the financial security cover the costs for a minimum of 5 years of pumping. Allow time for improvements to WQ and development of alternate strategies if required.
  – MEMPR supports the placement of a non-PAG waste rock cover over all exposed tailings beaches.

12. DI - Management Implications

- No contingency measures proposed for post-closure seepage management. Proponent must commit to manage post-closure seepage if WQ objectives cannot be met.

- ***<u>Recommended Permitting Conditions:</u>***
  - Costs of pumping DI to KN pit should be included in financial security for a minimum of 5 years. This would mean treatment plant needed in year ~30 (vs. ~80).
  - Preliminary design information, reclamation closure plans and detailed costing for placing non-PAG rock cover over exposed tailings beaches. Costs should be included in the financial security.

12. DI - Management Implications

- During operations, evaluate need for total rock cover over tailings.
- Develop detailed monitoring and research programs to refine WQ predictions.
- Every 5 years during operations and based on monitoring and research, provide revised WQ predictions, updated closure plans and adaptive management strategies, detailed cost estimates.
- If WQ uncertainties not resolved with new information during operations, the financial security should be adjusted to cover increased risks.

12. DI – Future Use

- Primary goal is downstream environmental protection.
- Secondary goal is to re-establish DI as functioning water body with fish habitat.
- Proposal that North Dam spillway will allow fish passage.
- Proposal for fertilization to enhance development of organic substrate, which could benefit metal removal processes.

12. DI – Future Use

- ***Conclusions:***
  - Potential impacts to DI WQ may persist over the long term.
  - MEMPR recommends that Duncan Creek and Duncan Impoundment not be considered fish habitat.
  - MEMPR recommends that fish access be prevented in these areas until it is clearly known that WQ is safe for fish during all phases of mine site discharge.
  - Risks and benefits with lake fertilization should be evaluated as part of detailed closure planning near the end of mine life.

13. Environmental Liabilities

- Major ML/ARD liabilities include costs of building and operating HDS lime treatment plant, management of treatment sludge, installing portal plug, placing non-PAG cover for wave re-suspension and exposed beaches, measures to manage post-closure WQ, monitoring and maintenance.
- Additional ML/ARD liabilities with LGO in early shut-down. The costs associated with managing LGO should be included in the financial security.
- ***Recommended Permitting Conditions:***
  - Details on closure plan (including early closure) and detailed costing of all liabilities (including ML/ARD) for inclusion in financial security.

14. Adaptive Management Plan

- ***Missing plans for:***
  - ML/ARD management of construction materials.
  - Maintain DI pH >7.5 through lime addition.
  - Placement of minimum of 1m of fresh tailings over all flooded waste rock.
  - Install bulkhead in conveyor tunnel at closure.
  - Pump North portal seepage to KN pit if acid.
  - Construct and operate HDS lime treatment plant for KN pit for as long as necessary to protect environment.
  - Store lime treatment sludge only in on-land facility.
  - Contingency measures for seepage WQ post closure.

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14. Adaptive Management Plan

- ***Conclusions:***
  – Identified items should be added to the AMP
- ***Recommended Permitting Conditions:***
  – Additional details on AMP required, including clear triggers for implementing management measures.

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Summary Conclusions

- Bulk of MEMPR issues have been resolved satisfactorily, to the extent possible at this time.
- From a ML/ARD perspective, the remaining issues can be dealt with at the *Mines Act* permitting stage.
- MEMPR believes that storing mine wastes in Duncan (Amazay) Lake is the environmentally preferable solution for minimizing risks of ML/ARD and protecting downstream water quality and is consistent with provincial policy.
- Residual uncertainty with WQ predictions can be handled through adaptive management provided there is sufficient caution in approach.

Summary Conclusions

- To manage this potential risk, MEMPR recommends:
  - placement of non-PAG rock cover over exposed beaches.
  - placement of additional financial security to cover costs of pumping DI discharge and seepage to KN pit for a minimum of 5 years.
  - development and implementation of a significant site monitoring and research program aimed at refining predictions.
  - every 5 years during operations, and based on results of detailed monitoring and research, the Proponent provide revised WQ predictions, updated closure plans, updated adaptive management strategies and updated detailed liability costing.

Summary Conclusions

- If WQ uncertainties not resolved early in mine operations, MEMPR should increase the security to cover the increased risks.

- This approach would provide a higher degree of certainty that downstream affects from DI would not occur during operations and post-closure, and would be consistent with provincial ML/ARD policy.

Summary Conclusions

- There will be significant long-term management and monitoring requirements of the Proponent relating to impoundment dams and the treatment of ARD from the pit and potentially neutral metal leaching from DI.

- It is recommended that the financial security fully cover these liabilities.