

REPORT - MEETING No. 6

INDEPENDENT GEOTECHNICAL REVIEW BOARD (IGRB)

September 16, 2020

Review of Water Dam, Water Management and Tailings Storage Systems, KSM Project

British Columbia, Canada



REPORT – MEETING NO. 6, INDEPENDENT GEOTECHNICAL REVIEW BOARD

REVIEW OF WATER DAM, WATER MANAGEMENT AND TAILINGS STORAGE SYSTEMS, KSM PROJECT

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1. Introduction

The sixth meeting of the Independent Geotechnical Review Board (IGRB or Board) for the Kerr Sulphurets-Mitchell (KSM) Project (Project) was convened by KSM Mining ULC (KSM) on September 16, 2020. Because of coronavirus (COVID-19) restrictions the meeting was held via a video conference. The Board is comprised of Dr. Andrew Robertson (Chairman), Mr. Anthony Rattue (Vice Chairman), Mr. Terry Eldridge, Dr. Gabriel Fernandez, Dr. Ian Hutchison, Mr. Jim Obermeyer, Dr. Leslie Smith, and Dr. Jean-Pierre Tournier.

Messrs. Fernandez and Smith were not in attendance at this specific meeting. Dr. Smith held a separate videoconference meeting with Mr. Brent Murphy, Mr. Peter Williams, and Mr. Mike Skurski of KSM on September 15 to discuss the PowerPoint presentation that was presented to the Board members on September 16. Dr. Gabriel Fernandez also held a videoconference discussion with KSM management following the Board meeting.

The Agenda of the September 16 meeting is attached as Appendix A and the list of attendees is presented in Appendix B. The topics discussed are listed below, together with the section numbers of this report which contain the resulting comments and recommendations of the Board:

- COVID-19 impact on activities and schedule (see Section 3 of this report);
- 2020 Prefeasibility Study/Preliminary Economic Analysis (PFS/PEA) update (Section 4);
- Studies – Mitchell Treaty Tunnel (MTT) drilling (Section 5) and geochemical block modelling (Section 6); and
- Other items (Section 10).

The following specific topics within the purview of the IGRB were also presented:

- Status of the Klohn/ERM 2017 Hydrometeorological Report (Section 7);
- The Golder/AWA Associates 2020 Hydrometeorological Review (Section 7);
- The Golder Hydrogeological Data Review (Section 8); and
- The Golder Water Quality/Quantity Model Framework (Section 9).

The Board's review scope includes the Water Storage Dam (WSD) and the associated Seepage Collection Dam (SCD), the Waste Rock Storage Facilities (RSFs), surface water management, and the Tailings Management Facility (TMF) including its seepage control facilities. As for prior meetings, the Board's review is carried out at "Discussion Level", in which the Board relies principally on information provided during meeting presentations with support from KSM study reports where these have been provided.

In this report, the Board provides: observations made during the meeting, presents the outcomes of the discussions and gives recommendations for future work. *The recommendations are given in the body of the report in italics. The more significant recommendations are underlined.* The Board considers comments and recommendations provided in this report to be applicable to the proposed future Feasibility Study (FS) and permitting activities.

2. Documentation Provided

Information provided to the Board prior to the meetings were:

- May 25, 2020 Memorandum from Scott Bailey, Acting Chief Executive Assessment Officer and Associate Deputy Minister, Ministry of Energy, Mines and Petroleum Resources, BC, regarding KSM's March and April 2020 communications expressing concerns about the coronavirus (COVID-19) restrictions impeding KSM's progress towards meeting the "substantially started" deadline (July 29, 2024) in the Environmental Assessment (EA) Certificate M14-01;
- July 3, 2020 Memorandum from Jay Layman, President and Chief Operating Officer, KSM Mining ULC, providing the additional information requested in the above referenced Scott Bailey Memorandum and requesting a two-year extension to the EA Certification "substantially started" deadline; and
- PDF presentation "KSM-6th IGRB Meeting" dated September 16, 2020.

3. Impacts of COVID-19 on KSM

It was reported by KSM that COVID-19 has seriously disrupted the capital markets and it is anticipated that the markets will not stabilize for 18 to 24 months after the end of COVID emergency conditions. Companies that were considering investing in the Project will be focusing on maintaining their current operations rather than seeking new opportunities, so securing a JV partner will be delayed. In addition, new safety requirements imposed by COVID 19 have severely limited KSM's ability to execute the work programs that were scheduled for 2020 as well as permitting efforts which must precede the work to achieve the "substantially started" deadline of July 29, 2024 in the Environmental Assessment (EA) Certificate M14-01.

As per Section 46 of the BC Environmental Assessment Act, KSM has requested at least a two-year extension of the required "substantially started" deadline because of the issues and restrictions posed by COVID-19. A decision on this request is anticipated in February-March 2021. In the meantime, KSM is still working internally to achieve the 2024 substantially started date.

The Board was informed that the approach being adopted by KSM is to wait for a JV partner to fund much of the FS and associated field activities and designs. The Board has not been provided with any details regarding the Project schedule. While the approach to waiting for JV funding is technically feasible, it does increase the risk of not meeting the "substantially started" deadline. In addition, this approach will likely require a commitment to implementing the Project before completing the FS. This means there may also be increased cost risks that are not identified at the time a commitment is made to installing the works necessary to meet the "substantially started" deadline.

Recommendations

The Board observes that investigations have been delayed for Project components such as the Water Storage Dam (WSD), the Seepage Collection Dam (SCD) and Tailings Management Facility (TMF). *Seabridge needs to provide for enough time to properly design the facilities, so they satisfy the objectives for environmental protection and safe operation while not adversely impacting the design or construction schedules and costs. Key aspects of the Project that need to be further developed include identification and characterization of borrow sources for the TMF and certain detailed geotechnical and hydro-geologic data needed for the FS designs (see also Sections 5 and 8).*

4. 2020 PFS/PEA Update

4.1 WATER MANAGEMENT FRAMEWORK

The Board was informed that KSM had completed an alternative production plan and PEA (2020) to assess how the PFS production plans in the 2016 PFS could be optimized and to update the total resource estimate. The 2020 PEA reflects updated resource models for the Iron Cap, Kerr and Sulphurets deposits, but no change to the Mitchell resource model. The measured and indicated resources have increased to 3,038 Mt, and the inferred resource to 4,599 Mt.

The PFS continues to be based on processing 2.2 Mt of ore. However, the following changes in the mine production and project development plans are contemplated for future revisions to the PFS and FS:

- Increased extent of underground block caving mining;
- Reduced size of the open pits;
- Reduced size of the rock storage facilities (RSF);
- The McTagg RSF is eliminated;
- The McTagg RSF upper surface water diversion channel is eliminated;
- Mitchell Diversion Tunnel is realigned and changed to a single concrete lined bore;
- McTagg Diversion Tunnel (MTDT) is shortened and modified to single concrete lined bore;
- The North Pit Wall Diversion Adit (NPWDA) is realigned to enhance Mitchell pit dewatering;
- Mitchell Valley Drainage Tunnel (MVDT) is realigned and changed to single concrete lined bore;
- Sulphurets and Kerr ore and waste are to be hauled to the Mitchell area; and
- Increased concentrator processing rate from 130,000 tpd to 170,000 tpd for a specified period.

The reduction in surface disturbance within the mining area, that results from the planned increase in production from underground block caving and hauling the mined materials from the Sulphurets and Kerr mines to the Mitchell area, is viewed positively by the Board.

The Board notes that increasing the concentrator processing rate from 130,000 tpd to 170,000 tpd would stress an already aggressive raise rate for the TMF and would likely require increasing the starter dam sizes. *These issues would require evaluation in the FS.*

KSM performed a “materiality check” and confirmed that the PFS with the above changes remains valid. The Board concurs that the 2016 PFS is still relevant and supports further evaluation of the above refinements in the FS level design.

Recommendations

The Board recommends that any increase in the rate of production beyond that used in the current PFS design of the TMF requires evaluation of the size of the starter dams, the availability of borrow materials for the starter dams and the ability to raise the sand dams efficiently at the required rate.

The Board recommends that design of the inter-ramp slopes of the Mitchell Pit consider the need for safe access into the pit during the post-mining period.

The Board suggests KSM maintain contact with the university consortiums, and potentially other cooperative ventures, that are conducting research on improved methods of tailings disposal. Examples include:

- *Tailings and Industrial Waste Engineering (TAILENG) Research Center (Universities: Georgia Tech - lead, Colorado State, UC California Berkley, Illinois) – <http://taileng.ce.gatech.edu/>*
- *Tailings Center of Excellence (Universities: U of Arizona, Colorado State, Colorado School of mines) – <https://www.minesnewsroom.com/news/colorado-school-mines-develop-mine-tailings-center-excellence-csu-university-arizona>*
- *Carleton University Tailings Research Group, Ottawa – <https://paulsimms0.wixsite.com/tailings-carleton>*

5. Site Investigations

5.1 MITCHELL TREATY TUNNEL

While this tunnel is not within the purview of the Board, it provides an example for how future investigation and tunnel construction would proceed at the water diversion tunnels at the mine sites. Progress with the investigations is therefore discussed in this report. While not discussed during the September 16 call, there was an exchange about tunnelling methods in a separate call with Dr. Gabriel Fernandez. In this section, the Board includes our comments and provides some suggestions for consideration, but no formal recommendations.

KSM outlined the drilling program conducted along the 23 km long MTT alignment. As with other Project activities, the pandemic-based restrictions have severely affected the program. Only one drill was operated during the current year, and the number of holes to be drilled has therefore been reduced. Drilling is expected to continue in future years.

With the progressive retreat of the glaciers, additional rock exposures are available for geological mapping. The information derived from drilling increases the knowledge of the conditions that may be anticipated along the tunnel alignment. The enhanced geological data that was gained from the horizontal hole KC-17-64 drilled from the SW Mitchell Portal is worthy of note.

Originally, the 2020 program included 10 boreholes located strategically along the alignment. This will likely be reduced to 5 holes. KSM has attempted to benchmark the scope of the program against other similar projects. The appropriate total length of geotechnical drilling can be deemed to be somewhat proportional to the length of tunnel. However, depth of cover above the tunnel crown (up to 900 m in this case) and the variability of geological conditions, obviously increases the number of required boreholes for a given length of tunnel. Indeed, the benchmark graph presented by KSM and which is based on an international database relating total geotechnical drilling length to tunnel length, shows considerable scatter and no clear trend.

One of the boreholes already drilled extended down to a depth of ~ 900 m and showed no significant signs of squeezing which indicates the presence of relatively competent rock mass. Results from permeability testing carried out in the borehole were not available for this review.

Discussions were held about the balance between increased field drilling to identify, plan and design for expected conditions versus less initial investigation and reliance on problem solving and design changes during the construction process. Greater knowledge of the tunnelling conditions would reduce the unknowns for bidders for construction, thus potentially lowering the need for contingency allowances and decreasing the potential risk of schedule delays. Overall Project planning in the current situation will determine whether the schedule will allow additional investigation in the next year or so.

On more specific topics, the Board made the following observations. The lithology of the Iron Cap ore body begs the question as to whether it should be projected onto the tunnel alignment, and also whether mining this ore body could adversely affect the tunnel's stability. In addition, the trace of the Sulphurets Thrust Fault (STF), particularly as revised with more recent field data, suggests that the tunnel alignment could be further optimized to minimize potential impacts from this fault. KSM pointed out that there are limitations to the corridor available for tunnelling due to the proximity of claim boundaries. Overall, the Board sees merit in extending the drilling program as soon as conditions allow to further consider the above issues and optimize the tunnel alignment.

The current design for the tunnel contemplates excavation by drill and blast. An additional adit is to be excavated in an area of nominal cover about 6.5 km from the Treaty Portal (located at the Northeast end of the tunnel) to open additional excavation fronts in order to meet the schedule.

The tunnel excavation in the first 15 km from the Treaty Portal will be in relatively competent rock with shallower cover, and it is anticipated that a reasonable rate of advance will be achieved. Because of the downward inclination of the tunnel profile, additional effort, i.e., borings with packer testing, is warranted to assess potential water inflows into the tunnel as excavation advances. It might be advantageous to advance the excavation of one tunnel a few hundred feet ahead of the second to reduce water pressures and explore the ground conditions. Excavation of the 10 km of tunnel from the Mitchell Portal may be more challenging due to the potential presence of segments of squeezing ground in the fault areas as well as larger water inflows.

Suggestions have been made about excavating the tunnels using Tunnel Boring Machines (TBM), to expedite construction. In the view of the Board, this alternative may be viable except in the 10 km segment of high cover in a faulted, folded rock mass.

The rationale for the proposed fully lined tunnel includes:

- Sealing off zones of potentially acid generating (PAG) rock in the excavated walls;
- Providing for erosion protection of non-PAG loose materials due to the presence of shear zones and induced by inward groundwater flows, and
- Reducing the risk of permanently lowering the current ground water levels in the vicinity of the tunnel.

The Board suggest the following be considered when more detailed analyses and designs are undertaken:

- Concrete lining the tunnel for the reasons stated above. While it may be possible to reduce the extent of the concrete liner as the field investigations and designs evolve in future, the Board suggests it would be prudent, at this stage, to conservatively assume a fully lined tunnel;
- Thorough grouting along the tunnel crown to achieve an intimate contact between the liner and the surrounding ground and minimize ground water flows along the alignment. The grout mix should be sulphate resistant, and consideration could be given to installing a sulphate resistant concrete liner in the PAG zones of the tunnel;
- Drilling within a wider corridor, to the extent claim boundaries permit, rather than along an assumed specific linear alignment based on limited information. While more holes may be required with this approach, when combined with cross-hole seismic surveys discussed below, it will provide for a better 3-D characterization of ground conditions and information to realign the tunnel as necessary;
- A cross-hole seismic survey would enhance the data gathering from the boreholes. Shorter holes, to serve as the seismic source, could be drilled in proximity to the deep holes in which the geophones and/or other sensors are installed;
- Further evaluation of the potential implications of the limited investigation campaign prior to the preparation of bid documents and before contract award for the tunnelling work. The commercial terms should take the amount of information available into account and the resultant uncertainties associated with actual field conditions, in order to structure a contract that is equitable for both the contractor and KSM; and
- TBM excavation in the lower 10 km segment of high cover may not be feasible due to the presence of faults and shear zones. The probability of entrapment of the TBM in the shear zones could be very high.

5.2 WATER STORAGE AND SEEPAGE COLLECTION DAMS

An adequate understanding of the geology, hydrogeology and the groutability of the rock in the area of the WSD and the SCD is paramount and will likely only be attained by further drilling and the installation of multi-level piezometers, thermistors and automated data recording over an annual cycle. Numerical modelling on its own is unlikely to be a satisfactory alternative.

In prior reports, the Board recommended changes and additions to the proposed investigation program including relocating the dam axis upstream to avoid the calcareous siltstone and sandstone. This relocation requires a review of the location of the upstream portal of the diversion tunnel coupled with additional investigations. These recommendations have not been addressed to date.

The Board recommends that for the WSD and the SCD, a thorough evaluation of the potential impact of less-than-optimal information on the Project design and costs should be undertaken to:

- Assess the need for collection of essential comprehensive site data; and
- Identify possible conservative design elements or mitigation measures that need to be incorporated in the design to address data gaps.

5.3 TAILINGS MANAGEMENT FACILITY

Complimentary investigations of the TMF footprint and the borrow sources will also be required in a timely manner prior to construction.

The Board recommends a thorough evaluation of the potential impact of less-than-optimal information on the Project design and costs should be undertaken to assess the risks and identify possible mitigation measures.

5.4 GENERAL RECOMMENDATIONS

The Board reiterates the recommendation made in our Report No. 4, that information be provided to better appreciate where and what types of investigations are possible. This would include tabulation of the various Project phases, the associated information needs, anticipated means of access, and possible investigative methods. Plan views of the proposed investigation areas and data collection points would also be helpful.

The proposed site investigation and information gathering could be categorized as:

- Required for demonstration of feasibility in the FS;
- Required for detail design; and
- Desirable for establishing the scope of work and site conditions for various construction contract packages.

This recommendation applies to all Project components. The Board understands the current limitations on field work but recommends that enough field investigations be carried out to better characterize geologic, geotechnical and groundwater conditions, and that less reliance be placed on problem solving during construction.

6. Geochemical Block Modelling

Golder is adding a geochemical model component to the existing waste rock block model to provide predictions over time of the types of rock and mineral composition, long-term acid rock drainage (ARD) and metal leaching (ML) potential for the open pit and block cave mines. This “geochemical block modeling” is intended to be used to predict the leachate quality in the underground and open pit mines and in the Waste Rock Storage Facility (RSF) for use in the Water Quantity/Quality Modeling Framework discussed in Section 9 below.

Performing this modeling will involve a significant effort incorporating detailed analyses of the site specific data collected at the KSM mine such as mineralogy, acid-base-accounting (ABA) and humidity cell (HCT) and barrel test results, and relevant data from analogous mine sites to improve the model’s predictive capability. The effort will include detailed analyses of the exploration data and spatial analyses of this information to establish geo-environmental domain types for the waste rock and mined surfaces.

Following the establishment of the block model, Golder intends to identify data gaps that would need to be filled to improve the predictive modeling capability suitable for the FS.

The Board commends KSM for undertaking this model development which will lead to a better understanding of the generation of acid and metal leachate throughout the Project operational time frame, better inform the designs and, as the model is refined during operations, improved operational decisions and mine expansion planning.

The Board recognizes building this model is a significant and complex project and have previously provided comments and recommendations in our November 2019 Review Report No. 5. In addition, and as discussed during these review meetings, further comments from the Board include:

- HCT testing involves using crushed materials which typically have a higher fines content than actual waste rock. As a result, HCT testing can release more neutralization potential early in the test leading to an initial underestimation of the ARD production rate;
- Barrell tests, which are conducted on the surface, are not representative of conditions in a backfilled block cave, where higher temperatures, increased humidity can generate more acidity at a faster rate. This has been the experience, for example, at the Britannia Mine in British Columbia. The Board understands Golder will address this concern by using a conceptual model of the acidification process to assess the applicability of available data and make any adjustments to this data that are needed. Data will also be collected from analogous mine sites including the Britannia Mine and others;
- It should be recognized that block cave waste rock has more fines than open pit waste due to the breakage and grinding of the rock that occurs during mining. This will need to be accommodated in the geochemical characteristics that are assigned to this material; and
- The Board notes that initially the model may not be sufficiently comprehensive and detailed because of inherent limitations in extrapolating laboratory and barrel test results to the full scale operations. The Board also recognizes that collecting additional samples and conducting laboratory and field barrel tests prior to the start of operations would have these same limitations, except where, as discussed in the recommendations below, the tests are conducted specifically to evaluate conditions in under different temperature and humidity conditions, such as in an underground mine.

Provided the above and possibly other detailed important ARD generating mechanisms are identified and addressed in the modeling, the Board is supportive of the overall effort and looks forward to reviewing the results during future meetings.

Recommendations

The Board has the following recommendations:

- *The use of empirical and analogue data where necessary is appropriate, and the model can, and should be, refined after start-up and as full-scale operational data is collected. With some exceptions as discussed in the last recommendation below, this represents a more practical and achievable approach to refining the model than initially collecting more laboratory and barrel test data;*
- *The Panel reminds the team that the data from the HCTs and barrel tests needs careful adjustment to account for the differing amounts of fines in the actual waste generated during mining versus in the lab and barrel samples; and*
- *The Panel also recommends specific large scale (barrel size) tests be conducted in a laboratory type enclosure under controlled temperature and humidity conditions, to simulate the geochemical behaviour in a typical block-cave operation.*

7. 2020 Hydrometeorological Review

Following review of the 2013 study in early 2020, KSM decided to update the precipitation and flood peak frequency analyses using longer hydrometeorological data records now available, and to also update the Probable Maximum Precipitation (PMP) estimates using storm transposition methods. The Board strongly supports this decision as the results directly affect the sizing and design of major facilities such as tunnels and spillways, establishing dam heights for sufficient freeboard and sizing of ditches and other diversion structures.

KSM has retained a Golder/Applied Weather Associates (AWA) team to complete an updated Hydrometeorological Study by late 2021. Following completion of this study, the Golder/AWA team will compare the results to the 2013 study so they can identify any differences, provide the rationale for these differences and justification for the updated (2021) results.

The scope of the 2020 Hydrometeorological Study is also intended to provide enough information for the water quality modeling discussed in Section 9 below, the FS design effort, and to support the regulatory interaction and permitting process. It generally includes the following tasks:

- Assemble available site and regional published information;
- Consider the effect of climate change to assess how this influences the hydrologic design parameters which are needed to design facilities that meet design standards under predicted future conditions;
- Apply storm transposition and maximization analyses to estimate PMP values;
- Update precipitation and flood frequency analyses based on longer data records;
- Generate a gridded representation of the data generated to account for local variability, the effect of altitude, slope attitude, and possibly other site-specific conditions that could affect the hydrologic design parameters;
- Develop hydrologic models including the following:
 - Models that predict runoff (streamflow) from precipitation and snowmelt and which are calibrated using field data; and
 - Glacial hydrologic models that predict future glacial melt rates and the resultant streamflow.
- Develop the necessary information and hydrologic design criteria for the mine site and tailings areas as well as the broader Unuk and Bell-Irving Rivers catchments;
- Use available benchmarks (analogs) to reasonably validate the results obtained; and
- Identify any data gaps that would need to be filled prior to completing the detailed design of the facilities.

The Board concurs with the proposed program as presented and looks forward to reviewing the 2021 Hydrometeorological Study after it is completed.

8. Hydrogeological Data Review

Golder have been retained to conduct a hydrogeology data review to identify data gaps that could affect:

- Requirements for, and scope of, hydrogeologic assessments to support permitting requirements;
- FS level mine design and planning for surface and underground excavations (open pits, block caves, tunnels, etc.); and
- Inputs to the site-wide water balance and water quality modeling (described in Section 9 below).

In the view of the Board, an experienced team has been retained to undertake the work. The project has been divided into three phases as follows:

- **Phase 1:** Identifying data gaps that affect interpretation of the regional groundwater flow system and that need to be addressed for permitting, which is now underway. In addition, Phase 1 will create a 3D visualization of the hydrogeology setting and database using the Leapfrog modeling package. The Board considers this an appropriate methodology. This Phase is also intended to establish the framework to move the remaining FS hydrogeologic studies forward.
- **Phase 2:** This phase will focus on identifying any data gaps that affect FS level planning and design.
- **Phase 3:** This involves development of a work plan and cost estimate to fill the identified data gaps.

The Board considers this phased approach provides a reasonable strategy for moving forward. No specific details have been provided for Board comment. It is expected the Phase 1 program will be completed in 2021.

The Board was informed that plans for proposed large scale, multi-well pump tests needed to understand the hydrogeologic conditions in the areas to be mined may be deferred until a JV partner is on board. The Board has concerns about the potential impact on the overall Project schedule if, as indicated, KSM plans to delay the start to fill data gaps identified in the Phase 2 study until a JV partner is on board.

Recommendations

Prior to initiation of any large-scale pumping tests, the IGRB recommends the work plans for conducting this work be presented to the Board for comment.

9. Water Quality/Quantity Model Framework

KSM is to be commended for taking on the development of a comprehensive water quality and quantity predictive tool that is intended to:

- Support regulatory compliance requirements and demonstrate compliance with the EA Certificate conditions;
- Facilitate understanding of the water quality by indigenous communities, government officials and the (general) public; and
- Provide input to ongoing engineering analyses and designs.

The model Framework (also referred to as the “Tool”) is similar to the one presented to the Board during its November 2019 review meeting. It includes different types of flow and water quality models used for different purposes. It will incorporate the Project area catchments as well as the Nass River to the boarder of Alaska. It is also designed to account for other anthropogenic activities, such as mining in adjacent catchments such as the Eskay, Goldwedge and Brucejack Creeks, to allow for identification of any potential incremental impacts caused by the KSM Project. The Framework would cover all mine phases from the current time through post-closure of the mine.

The Framework is being developed in stages and its development has advanced to the stage where it has demonstrated it can closely reproduce the water volume projections made earlier for the EA. The Board was not provided with any details of the individual models or their internal workings during the presentations.

The Board’s comments and recommendations outlined in our report on the November 2019 review meeting are still applicable. *In addition, the Board has the following recommendations:*

- *The integration of multiple models or model functions should not be overly complex, rather the use of independent sub-modules should be considered as necessary to perform different functions. Integration can then be provided using a common database for the model parameters and inputs;*
- *Apart from the regulatory and communications requirements, the models should be based on credible conceptual site models of the underlying water circulation systems to ensure these mechanisms are correctly simulated;*
- *Ensure the Framework and models are detailed enough to address the what-if questions that will arise; e.g.:*
 - *The analysis requirements for detailed design;*
 - *In modeling of ARD flows, allow for the accumulation of oxidation products over time and the prediction of the resulting higher concentration first flushes during Spring thaw and possibly extreme precipitation events; and*
 - *Simulate the consequences of a short- and long-term production shutdown to assist in the development of water management plans associated with potential temporary closure and permanent closure plans.*

The Board looks forward to reviewing the results of the Framework and model development.

10. Other

The Board wishes to provide comments and recommendations on the following two additional aspects of the Project's development:

- Compliance with the new "Global Tailings Standard", and
- Closure planning.

These are discussed below.

10.1 GLOBAL INDUSTRY STANDARD ON TAILINGS MANAGEMENT

The new Global Industry Standard on Tailings Management (Global Standard) was issued on August 5, 2020 and is expected to become a key document outlining tailings governance expectations of governments, investors, communities, Non-governmental Organizations (NGOs) and insurance companies. The Board is aware that the International Council on Mining and Metals (ICMM) is developing guidance documents to facilitate member companies' compliance with the new standard. The ICMM guidance is expected to be released in late 2020 or early 2021.

The Global Standard sets out 15 basic principles organized in 6 main topics. The topics span:

- Interaction, consultation, and communication with the expectation that information will be publicly disclosed to support acceptance and accountability;
- Corporate management and governance systems;
- Design based on use of an integrated and multidisciplinary knowledge base; and
- Emergency planning and response.

The Global Standard is generally aligned with guidance from the Mining Association of Canada (MAC) and the Canadian Dam Association (CDA).

Based on the Board's review work to date, it is pleased to note that the Project likely complies with most, if not all, the Global Standard requirements. In particular, the Project appears to be aligned with the requirements for consultation and engagement of affected communities and public disclosure.

Recommendations

KSM should audit itself against the Global Standard and have this information available for review by future potential investors and other interested parties.

10.2 MINE CLOSURE PLANNING

The Board reminds the KSM team that current tailings standards, such as MAC and ICMM, require implementation of the "Design for Closure" approach, which means the closure designs should be advanced at least to a PFS level at the time of the FS and detailed designs for the mine are prepared.

The above requirements are important as they provide for:

- Designs that are amenable to feasible and robust closures;

- Design parameters and specifications, that are suitable for the anticipated post-mining land use, are applied in the event these are more stringent than those required for the operating phase;
- Minimizing the costs of closure works; and
- Closure construction add-on features such as, for example, hydro-power plant installations.

The infrastructure needs to be designed and built to satisfy the mining operations over a forecast mine life of around 50 years. However, mine closure may entail care and maintenance over a considerably longer period and parts of the infrastructure may become permanent legacy features. For example, operation of the planned hydro-electric facilities or even expansion thereof to supply electricity to future mining in the area or local communities after closure, should include considerations in the current designs for ease of maintenance and replacement of various components such as control gates. Experience from other post-mining upgrade projects shows many instances where considerable additional costs were incurred to carry out the upgrades that otherwise would have been relatively simple had certain features been included at the outset. Stoplog slots and secondary valves in hydraulic conduits are such features. The Board notes with interest the decisions to line some of the tunnels. This may well enhance the legacy value of some sections. Operation of the WSD over a different drawdown range may also be beneficial during post-closure.

Recommendations

The Board recommends that closure planning be advanced in accordance with the ICMM Integrated Mine Closure Guide, to at least a PFS level, in the near future. Furthermore, the Board considers it appropriate to review the updated closure plans during our next review meeting.

11. Closure

The IGRB appreciates the update on the KSM Project and the opportunity to review the information provided. The next review meeting has been tentatively scheduled for mid November 2021.

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Appendix A

Agenda

Agenda

IGRB Meeting – 6th Meeting

KSM Project

September 16, 2020

Video conference call

1. Discussion between IGRB and KSM (8:30 AM to 12:30 PM)

- COVID-19 Impact and Response
 - Partner discussions
 - EA Certificate – Extension request
 - Impact on planned field activities
- 2020 PFS/PEA Update
 - RSF
 - Block Caves
 - Pits
 - MDT realignment
- Studies
 - MTT Alignment Drilling
 - Waste Block Modelling
 - Other topics (if required)

2. Board Deliberations (2:00-4:00 PM)

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Appendix B

Attendees

Attendees

KSM:

- Peter Williams
- Brent Murphy
- Lionel Sequeira
- Elizabeth Miller
- Mike Skurski (Partial)

IGRB:

- Andy Robertson
- Jim Obermeyer
- Terry Eldridge
- Anthony Rattue
- Ian Hutchison
- Jean-Pierre Tournier
- Gabriel Fernandez (Separate call)
- Leslie Smith (Separate call)

Golder Associates:

- Dan Walker
- Kristen Salzsauler