Independent review of June 20, 2016 Technical Advisory Report.

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Background:

On August 4, 2014 a catastrophic failure of the Tailings storage Facility (Tailing Pond) at Mount Polley mine released millions of cubic meters of mine related effluent into Hazeltine Creek and subsequently, Quesnel Lake and the Quesnel River. Key factors contributing to this event appears to have been, inadequate design of the Tailings Storage facility, mine operation that exceeded the capacity of the Tailings Storage Facility and inconsistent monitoring and inspections, both by the mine operations and regulating authorities.

An interim Water Management Plan, which allowed conditional re-opening of the mine, will expire in November 2017, to be replaced by a Long Term Water Management Plan. The Long Term Management Plan must be adaptable to mine development and consider operations, closure and post closure condition of the mine and in the receiving environment.

Downstream users likely to be impacted by the Long Term Water Management Plan have a number of questions and concerns discussed below:

1. **Environmental Concerns**- Mount Polley mine has a surplus water balance. Thus, whether operating or not, there will be effluent discharge from the site. Effluent volume and quality are expected to fluctuate based on conditions of mining operations, weather and other natural factors.

i. **Volume of Effluent**- The projected volume of effluent discharged to the receiving waters was derived from computers modelling exercises which used the best data available. However, these models and input date carry inherent uncertainty when proposing acceptable discharge levels and dilution rates. The projections and recommendations suggested by these models need to be “truth tested” as operations proceed and changes made if necessary, as indicated in the following:

“Some effluent targets were further refined…to allow a margin of safety between an expected (discharge water, receiving water) quality and enforceable limits…this prevents the administrative burden of non-compliance” Never the less with this caveat, the modelling results will be used to “propose discharge limits for permit 11678 for the operations phase, using best applicable practices, assessing the best available technology, establishing a discharge location and assessing receiving environmental conditions.”

What we do know for certain is that at the proposed effluent discharge rate of .33 cubic meter per second approximately 9 million cubic meters of waste water will be released to the receiving environment every year.

Section 2.3.4 of the TAR recommends that the “No discharge, scenario should be imposed as often as possible”, but later in the report recommends that “No discharge should only be considered a contingency plan, effectively taking serious consideration of this option off the table.

ii. **Location of Discharge**- Two extreme considerations regarding how to manage the tailings generated by the mining operation are:

* Dryland tailings storage, which is done in other mines in BC and around the world. This option was dismissed outright being considered too expensive.
* Dump the tailing directly into Quesnel Lake. This, of course, would create an environmental concern.

These possibilities being considered unrealistic, several other options were considered and ranked, using a number of criteria.

1. The options recommended in the TAR is a pipeline to convey treated excess water from Tailings storage facility to sub surface diffusers in Quesnel Lake. Reasons given:

* Costs less than a pipeline to the Quesnel River, less “Linear disturbance”
* Modelling suggested that environmental impacts, although largely unknown will be within “Acceptable” limits.

2. The options of a pipeline to the Quesnel River was not recommended

* There would be more cost and more “linear disturbance” during pipeline and diffuser construction
* A large initial dispersal zone would be required which could adversely impact fish spawning and rearing habitat in the Quesnel River.

Both options would allow complete rehabilitation of Hazeltine Creek.

iii. **Quality of discharged effluent, potential impacts on receiving environment**

The TAR suggests that, at the predicted discharge rates and dilution rates the effluent would not be “acutely toxic” within the immediate Quesnel Lake discharge zone. In order to achieve this the “proposed effluent discharge” targets were reduced to projected concentrations not considered to have the potential for acute toxicity at the end of the pipe. The TAR recommends that “uncertainties related to the feed (incoming) water quality flows and target quantities for the receiving environment…need to be addressed”

The potential for long term accumulation of toxic and/or harmful components of the effluent is not adequately addressed in the TAR. These concerns are discussed in the Comprehensive Environmental Monitoring Plan but remedies to deal with “worst case scenarios” can only be designed in response to as yet uncollected date provided by the Environmental Monitoring Plan.

Impact Assessment

The main constituents of interest of untreated discharge were identified as metals, PH, total suspended solids, nitrate and sulfate. More research is needed on the effects of elevated concentration of the various forms of Nitrogen (Nitrate/Nitrate Ammonia) particularly with respect to the immediate Discharge Zone in Quesnel Lake. Constituents identified in Table 6-2 of the TAR as exceeding either the BC Water Quality Guidelines or the 30 day BC Water Quality Guidelines are: fluoride, sulphate, nitrate and total metals, including antimony, arsenic, beryllium, chromium, copper, selenium and dissolved aluminum.

Effluent Management/Treatment Options

The TAR indicated that after consultation “decentralized passive water treatments” were preferred “subject to performance limits”. Treatment options are discussed in Appendices E, F and K. The effectiveness of centralized passive /hybrid systems is unproven. In the passive mode a coagulant/polymer is not added and mechanical mixing is not active, allowing the discharge rate to be increased. Predication of post treatment is based on a number of inputs, all of which have inherent variability and uncertainty.

* Copper: It is recommended that the current treatment technology be optimized to improve copper removal to attain the operations treatment target for copper (p.138) Although, it is acknowledged that “copper could be acutely lethal at the predicated site water concentrations”. The water treatment plan recommends that “modifications to improve copper removal” be considered. These are discussed in appendix E. “Copper removal in particular has not consistently met design criteria” (in treated water) “Additional copper removal may be required” It is assumed that an improvement in equipment/or operational procedures could achieve this.
* Total Suspended Solids: As with copper, the removal of total suspended solids has “not consistently met design criteria”. The same remedies suggested fir copper are recommended for total suspended solids.
* Total dissolved Solids: “Identified as a contaminant of potential concern because predicated concentration are higher than baseline” (6.3.4.4)
* Selenium (6.3.2): The post treatment “percentage modelled” selenium concentration (0.087mg/l) is higher than the proposed effluent limit of 0.075mg/l. Although, the “model predications” are based on several conservative assumptions, concentration of selenium released into the receiving environment remains a concern. A Selenium Management Plan is presented in Appendix M. during operation of the mine and post closure, “if passive treatment systems are implemented, even if the Best Available Technologies for passive treatment are applied selenium concentrations in the treated water source may still exceed the BC Water Quality Guideline of 2 micrograms/l” Therefore, reducing selenium concentrations prior to discharging will be imperative”
* Arsenic: there are “no provincial or federal short term guidelines”, however “predicated arsenic concentrations for the Quesnel Lake discharge would not be acutely lethal” The lack of short term guidelines and the failure to consider the effects of long term exposure to sub lethal levels of aluminum is not well researched. The possibility that the above researched contaminants could interact synergistically, symbiotically or antagonistically is not adequately dealt with in the TAR. If such interactions occur, they are “not expected to cause toxicity”. It is hoped that “testing conducted as part of the discharge monitoring will verify this”.

iv. **Groundwater**: “Hydrogeological/hydrological investigations and ground water modelling are dynamic sciences” Details of the models used, model assumptions and associated uncertainty with respect to groundwater seepage are provided in Appendices B and D. 6.1.2 “Actual seepage from the storage facilities may be lower than the estimates provided” through modelling. On the other hand due to the inherent uncertainty surrounding computer models, seepage could be greater than predicated. Post closure the “most significant seepage would occur during the first 10 -20 years. Should this be the case, potential environmental impacts are unknown.

**Discussion and Conclusions**

The disclaimer at the end of the Tar and supporting documents acknowledges the risk associated with basing recommendations and decisions on computer models. Simply assimilating reams of data, statistically analyzing the data and then running it through a series of computer models does not necessarily allow us to describe what is happening nor predict what will happen in the natural environment.

Best Available Technology is just that. Advances in technology will occur, but, for the most part cannot be predicted. We can only hope that advances in technology will develop quickly enough to address any short comings in the modeling predications provided in the TAR.

The timelines for operations, closure and post closure are extremely amorphous. Depending on world copper prices, operation costs and other factors, the mine could run for 4 years (or more) suspend operations and sporadically reopen oven an unpredictable cycle and time frame, or close after 4 years as suggested in the TAR. Who would be responsible and accountable for monitoring operations and post closure recovery, compliance and non-compliance with permit requirements and overall moral accountability to receiving environment water users?

In terms of benefit to risk receiving environment water users are being asked to absorb the risk while Mount Polley Mining Company and the Province of BC will reap the benefits.