

An aerial photograph showing a large reservoir with a dam in the foreground. The water is dark blue with ripples. The surrounding landscape is a mix of green and yellow trees, indicating autumn. In the background, there are rolling hills and mountains under a clear sky. The text is overlaid on the upper left portion of the image.

MOUNT POLLEY MINE DISASTER CHECK UP:

INACTION, UNCERTAINTY AND ONGOING RISKS FOR BC

REGULATORY RESPONSE TO THE MT. POLLEY EXPERT PANEL RECOMMENDATIONS

Summary of Public Risk Implications

INTRODUCTION

Shortly after midnight on August 4, 2014, a major breach occurred at Mount Polley tailings storage facility. The failure of the dam was sudden, with no warning. It sent up to 25 million cubic metres of wastewater and mine waste solids into downstream waters, destroying or affecting over nine kilometres of aquatic and riparian habitats.ⁱ

Following the breach, the Government of British Columbia, together with the Williams Lake Indian Band and the Soda Creek Indian Band, established an independent expert investigation and review panel (the Expert Panel) to investigate and report on that breach.ⁱⁱ The Expert Panel submitted a final report on January 30, 2015.

As part of its investigations and report, the Expert Panel commented on what actions could have been taken to prevent this failure and to identify practices or successes in other jurisdictions that could be considered for implementation in B.C. Shortly after the report's release, BC's Minister of Mines Bill Bennett committed to implementing all the report recommendations "to ensure our mining industry is safe."ⁱⁱⁱ

This document highlights the implementation status of seven of the recommendations that address significant implications for public and ecosystem risk, from existing and future tailings storage facilities. The technical review of the regulatory responses was completed by Dr. David Chambers, Executive Director of the Centre for Science in Public Participation.^{iv}

WHY "BUSINESS AS USUAL" CAN NOT CONTINUE

The Expert Panel recognized that the Mount Polley disaster was not an isolated incident. On the contrary, the accident was an indicator of a systemic failure with serious widespread public risk implications.

The Panel stated that it: *".. does not accept the concept of a tolerable failure rate for tailings dams. To do so, no matter how small, would institutionalize failure. First Nations will not accept this, the public will not permit it, government will not allow it, and the mining industry will not survive it."*^v

To put this risk in context, the panel noted that there are some 123 active tailings dams across the Province, and they warned that: *".. if the inventory of active tailings dams in the province re-mains unchanged, and performance in the future reflects that in the past, then on average there will be two failures every 10 years and six every 30. In the face of these prospects, the Panel firmly rejects any notion that business as usual can continue."*^{vi}

A related First Nations Energy and Mining Council report "Uncertainty Upstream" released the same year showed that the potential tailings related risks to Indigenous communities and salmon runs associated with 35 tailings dams at 26 mine sites.

Within the selected area of this study (a subset of the overall tailings storage facility risk expo-sure), there are 33 First Nations communities in watersheds that could be impacted by failures in the 35 tailings facilities, including 17 (52%) that would be within watersheds impacted by immediate flow paths of contaminants. Additional First Nations communities further upstream of potential contaminant flow paths may also be affected because of impacts to migrating fish that pass downstream of a tailings facility failure.^{vii}

British Columbians should not have to ask: which watershed is at risk next?

BC'S REGULATORY REGIME

While there are many complex reasons why the Mount Polley mine disaster occurred, the government's regulatory and enforcement capacity are central to the avoidance of future accidents.

The government's failure to provide adequate guidance and oversight in terms of the initial dam design and subsequent modifications as it was increased in height were fundamental to the collapse, and the Panel noted that: *"A lack of foresight in planning for dam raising contributed to the failure."* ^{viii}

The Auditor General of B.C. did an additional review of the compliance and enforcement regime of BC's mining sector in 2016. As part of that, they reviewed the Mount Polley accident and wrote: *"We found almost every one of our expectations for a robust compliance and enforcement program within the [Ministry of Energy and Mines] MEM and the [Ministry of Environment] MOE were not met. We found major gaps in resources, planning and tools. As a result, monitoring and inspections of mines were inadequate to ensure mine operators complied with requirements."* ^{ix}

Additionally the Auditor General stated that: *"MEM's inspection procedures require at least one geotechnical inspection per year; however, no such inspections were carried out for 2009, 2010 and 2011.. As the regulator, it was MEM's responsibility to ensure that the dam was being built as designed, including with the intended embankment slope. This, MEM did not do."* ^x

Clearly, major changes in regulation and enforcement practices are required to address the current and future risk. The state of these changes will be examined below.

THE MORE THINGS STAY THE SAME

Not only did regulators fail to prevent the disaster, they have subsequently permitted activities that have not reflected a precautionary, accountable or transparent approach to addressing the ongoing problems and risks at the site.

In December 2015, a short-term permit was granted to Mount Polley Mining Corporation (MPMC) to discharge treated mine effluent down Hazeltine Creek into Quesnel Lake and, in June 2016, to return to full operations using the repaired and reinforced tailings dam that had breached.

These decisions were made despite First Nations and community concerns. The province acknowledged in its "Reasons for Decision" statement that the company's water discharge permit was granted even though Xat'sull First Nation and Williams Lake negotiators asked that effluent discharge meet BC's Water Quality Guidelines. ^{xi}

Local citizens are still seeking independent, accessible weekly monitoring of Quesnel Lake and surrounding waters and are calling for remediation of Hazeltine Creek, Polley Lake and Quesnel Lake, which remains incomplete. ^{xii} In addition, an appeal has been launched by a member of Concerned Citizens of Quesnel Lake for the mine waste discharge permit issued by MOE in April 2017 ^{xiii}. The hearing is set for the end of January 2019. ^{xiv}

In essence, many of the Independent Panel Report recommendations that came out of the mining disaster appear not to be implemented at the source: Imperial Metals' Mount Polley mine.

In an effort to get BC on the "path to zero failures", a number of recommendations were made to decrease the current inventory of tailings storage facilities by half (from 123 to 60), and use Best Available Technology and Practices to existing and new tailings facilities. Without fully implementing the recommendations, and ensuring diligent enforcement and compliance, we can assume that the risk level of two failures every decade has not been eliminated. The public and the watersheds we rely on remain at risk.

TECHNICAL REVIEW OF KEY EXPERT PANEL RECOMMENDATIONS AND BC GOVERNMENT RESPONSES

The government of British Columbia committed to fully implementing the recommendations of the Expert Panel report. Below is an analysis of what it has done (or not done) on seven of the top recommendations to reduce the risks of another catastrophic tailings breach like Mount Polley.

1. Employment of Best Available Technology (BAT)

Expert Panel Recommendation: Implement Best Available Technologies (BAT) using a phased approach.

“BAT should be actively encouraged for new tailings facilities at existing and proposed mines. Safety attributes should be evaluated separately from economic considerations, and cost should not be the determining factor.

- a. For existing tailings impoundments. Rely on best practices for the remaining active life.
- b. For new tailings facilities (TSF). BAT should be actively encouraged for new tailings facilities at existing and proposed mines.
- c. For closure. BAT principles should be applied to closure of active impoundments so that they are progressively removed from the inventory by attrition.^{xv}

BC Government Action: *BC Reclamation Code Part 10 Amendment*

The issue of BAT is addressed only once in the revised Mining Code, with no definition. There is no clear requirement that BAT be compulsory, only that BAT must be “assessed”. Therefore, the use of Best Available Technology is only partially addressed in the BC Code.

CSP2 Implementation Assessment: The Expert Panel was very specific in its description of how BAT should be used: *“The overarching goal of BAT is to reduce the number of tailings dams subject to failure. This can be achieved most directly by storing the majority of the tailings below ground-in mined-out pits for surface mining operations or as backfill for underground mines.”*^{xvi}

The Expert Panel was very focused in its recommendations for technologies that it envisioned being applied at new mines: *“Filtered tailings technology embodies all three BAT components described in section 9.3.1 (BAT Principles). .. Variations on this technology are easily envisioned, for example separation, dewatering, and gravity drainage of sand tailings by cycloning to reduce quantities requiring filtration dewatering.”*^{xvii} However, both regulators and industry, in their responses to the Expert Panel, have avoided directly addressing dry closures.

The Bottom-line:

According to the Panel:

“BAT should be actively encouraged for new tailings facilities at existing and proposed mines. Safety attributes should be evaluated separately from economic considerations, and cost should not be the determining factor.”

The Panel was clear in its recommendation that “cost should not be the determining factor” when choosing what type of tailings storage facility should be used at a mine. BC still has no working definition of BAT, and no explicit criteria against which to measure the degree to which BAT is being employed. To date, the recommended approach of separately addressing costs and risks has not been followed. BC communities are still not guaranteed the use of BAT in existing or future TSFs.

2. Elimination of Wet Closure Systems

Expert Panel Recommendation: Eliminating water from impoundments was not one of the top recommendations pulled out but was clearly delineated in the report discussion of Best Available Technologies.

“It can be quickly recognized that water covers run counter to the BAT principles ... No method for achieving chemical stability can succeed without first ensuring physical stability: chemical stability requires above all else that the tailings stay in one place.”^{xviii}

“The goal of BAT for tailings management is to assure physical stability of the tailings deposit. This is achieved by preventing release of impoundment contents, independent of the integrity of any containment structures. In accomplishing this objective, BAT has three components that derive from first principles of soil mechanics:

- 1. Eliminate surface water from the impoundment.*
- 2. Promote unsaturated conditions in the tailings with drainage provisions.*
- 3. Achieve dilatant conditions throughout the tailings deposit by compaction.”^{xix}*

BC Government Action: BC Reclamation Code Part 10 Amendment The Code Guidelines state that an: “Effort to reduce and remove water from containment within tailings facilities should be made”, and that: “Alternatives to water covers should be considered in planning stages.”^{xx}

CSP2 Implementation Assessment: Without establishing eliminating water as a priority, the result post-Mount Polley has been that wet closure remains the most common approach for potentially acid-generating tailings. Why eliminating water covers was not carried forward as an independent recommendation is not clear. It is controversial in that it departs from accepted practice and would be more expensive than wet covers to implement, but the Expert Panel clearly considered it as a BAT objective.

The Expert Panel clearly thought dry tailings, and dry closure at a minimum, should be a priority because: “The overarching goal of BAT is to reduce the number of tailings dams subject to failure.”^{xxi}

If there is no tailings dam to hold back conveyable tailings, then there is no dam to fail. By failing to address this issue head-on, it is business-as-usual for TSF closure design, and the risk of continued dam failures is being perpetuated.

The Bottom-line:

The Panels’ recommendation of eliminating surface water from TSFs in order to remove the threat of breach was clear, if controversial. It is controversial for a variety of reasons.

Dry closure is currently not considered the engineering norm in most mining operations due to a variety of factors including the fact that dry tailings and closure systems tend to be more expensive. It is also important to note that while dry stack systems remove the tailings dam failure problem, they are not a silver bullet, as they do not prevent a key environmental issue of acid mine drainage (AMD).^{xxii} Where sulphide bearing ores are present, and sub-aqueous tailings systems are not employed, other measures, including collecting and treating all water that comes in contact with the tailings, will probably be necessary.

Notwithstanding these challenges, the BC government has not followed the Expert Panel’s recommendation to at least assess the viability of dry closure (non-water cover tailings). Which indicates that we have a business as usual model for tailings facility design and closure in BC.

3: Maintenance of a Tailings Management System that includes regular system audits.

Expert Panel Recommendation: Improve corporate governance. Corporations proposing to operate a tailings storage facility (TSF) should be required to be a member of the Mining Association of Canada Guide (MAC) or be obliged to commit to an equivalent program for tailings management, including the audit function.

The Expert Panel noted: *“Compliance with the TSM (Toward Sustainable Mining) initiative is an element of [Best Available Practices] BAP for the mining industry today. ... At the same time, many in the industry have reacted to the Mount Polley failure with incredulity, asking how it could have happened with programs such as MAC’s in place. This serves as a reminder that these programs should not instill a sense of overconfidence and cannot themselves be seen as a substitute for more fundamental changes in technology.”* ^{xxiii} *(Emphasis added)*

BC Government Action: *BC Reclamation Code Part 10 Amendment*
The code requires that mines develop and maintain a Tailings Management System that includes regular system audits. The MAC Guide is specifically referenced.

CSP2 Implementation Assessment: While having an appropriate management system in place is important, as the Expert Panel warns, *“.. these programs .. cannot themselves be seen as a substitute for more fundamental changes in technology.”* This is why the issue of dry closures (the fundamental change) is so important. There is a risk that the use of management systems will be “substituted” for the needed fundamental change.

The Bottom-line:

The Mining Association of Canada’s “Towards Sustainable Mining” system were the preferred standard as a means for ensuring that tailings facilities are meeting audited levels of quality. Note that a) not all mining companies are MAC members (e.g. Taseko), and b) TSM is a benchmarking system, not a performance standards accreditation system, so the ‘guarantees’ of best practice even under TSM are not robust.

Moreover, as the Expert Panel underscored, these programs should not instill a sense of overconfidence and cannot themselves be seen as a substitute for more fundamental changes in technology, and the requirement for government oversight and enforcement (the absence of which was one of the problems that led to the Mount Polley disaster).

4. Requirement for a bankable feasibility that considers all technical, environmental, social and economic aspects of the project

Expert Panel Recommendation: *“Future permit applications for a new TSF should be based on a bankable feasibility that would have considered all technical, environmental, social and economic aspects of the project in sufficient detail to support an investment decision, which might have an accuracy of +/- 10-15%. More explicitly it should contain the following:*

- a. *A detailed evaluation of all potential failure modes and a management scheme for all residual risk*
- b. *Detailed cost/benefit analyses of BAT tailings and closure options so that economic effects can be understood, recognizing that the results of the cost/benefit analyses should not supersede BAT safety considerations*
- c. *A detailed declaration of Quantitative Performance Objectives.”* ^{xxiv}

The Expert Panel further attempted to define how economics should be integrated into the alternative assessment/best available technology evaluation process:

“Full consideration of life cycle costs including closure, environmental liabilities, and other externalities will provide a more complete economic picture. While economic factors cannot be neglected, neither can they continue to pre-empt best technology.” ^{xxv}

BC Government Action: *BC Reclamation Code Part 10 Amendment*

- There are no requirements for a bankable feasibility study ^{xxvi}
- In terms of “Failure Modes Effects Assessment or equivalent,” there are new permit application requirements for alternatives assessment of Best Available Technologies, declaration of Quantitative Performance Objectives, and proposed program for prediction, identification and management of physical, chemical, and other risks associated with tailings storage facilities and dams. The alternatives assessment for TSFs will consider BAT and will provide a comparative analysis of options considering the following sustainability factors: Environment, Society, and Economics.
- There are no requirements for a detailed cost/benefit analyses of BAT tailings and closure options
- Part 10 now requires quantitative performance objectives, and an annual review.

CSP2 Implementation Assessment: Today economics drives alternatives assessment, risk assessment, and multiple-accounts analysis. Using economic factors as a primary driver for risk considerations is understandable, but it is not compatible with a goal/priority of safety/physical stability.

The Expert Panel clearly recommended that financial feasibility include existing externalities and full life-cycle costs. Without explicitly stating that existing externalities and full life-cycle cost must be considered in “economics and financial feasibility” considerations, the result of these analyses will remain business as usual.

There are no requirements for a bankable feasibility study, although most (but not all) mines routinely do these now. Lacking the cost/benefit tool, and the data provided by a bankable feasibility study, a major factor in the choice of tailings facility design, location, operation, and closure is being ignored.

The Bottom-line:

A key Panel recommendation was for a: “Detailed cost/benefit analyses of BAT tailings and closure options so that economic effects can be understood, recognizing that the results of the cost/benefit analyses should not supersede BAT safety considerations.” ^{xxvii} Furthermore, the Expert Panel clearly recommends that financial feasibility include externalities and full life-cycle costs. Unfortunately, BC does not yet recognize the need for cost/benefit analysis and there are no requirements for a bankable feasibility study that addresses the Panel’s stated concerns.

Merely saying that environmental, societal, and economic factors must be ‘considered’ does not provide the guidance required to prioritize the considerations necessary to drive a safety-first design approach. Therefore, the public cannot be anymore assured that a full costing of potential impacts and benefits will be completed than they were before Mount Polley.

5. Increasing the use of Independent Tailings Dam Review Boards (ITRB)

Expert Panel Recommendation: Enhance validation of safety and regulation of all phases of a TSF:
Increase utilization of Independent Tailings Review Boards (ITRBs).

The Expert Panel, in recommending that ITRBs be implemented, noted: *“Experience has shown that the effectiveness of an ITRB in specific circumstances depends on the following:*

- *That it not be used exclusively as a means for obtaining regulatory approval.*
- *That it not be used for transfer of corporate liability by requesting indemnification from Board members.*
- *That it be free from external influence or conflict of interest.*
- **That there be means to assure that its recommendations are acted upon.”** ^{xxviii}
(Emphasis added)

BC Government Action: *BC Reclamation Code Part 10 Amendment*

- All existing mines in British Columbia with tailings storage facilities must establish an ITRB by Dec. 31, 2016.
- The Terms of Reference and the proposed membership of the ITRBs must be approved by the Chief Inspector of Mines.
- Mines must submit an annual report to the Chief Inspector of Mines that include details on the activities of the mine’s ITRB.

CSP2 Implementation Assessment: It is the last bullet from the Expert Panel that is of some concern. The ITRB’s recommendations could be altered or ignored. In addition, the Expert Panel noted: *“No ITRB can function successfully without unqualified support and commitment at the highest corporate levels. While it is essential that the Board be organized by Mine Operations, it is equally essential that its reports go to senior corporate management and Regulators.”* ^{xxix}

In order to avoid undermining the effectiveness of the ITRB, any ITRB recommendation that is altered, or not implemented, by either the mine operator or regulators should be publicly disclosed.

The Bottom-line:

BC now requires that all future mines do establish an ITRB. However, the mere existence of an ITRB does not in any way guarantee dam safety or the use of BAT. There is no requirement for a company to follow the recommendations of the ITRB, nor to make public those recommendations and the company’s response to them.

The absence of real mechanisms for transparency and accountability to/for the expert recommendation mean that the existing provisions fail to provide any further guarantee of safety.

6. Use of Quantitative Performance Objectives (QPOs) to improve Regulator evaluation of ongoing TSFs

Panel Recommendation: Strengthen current regulatory operations In explaining the significance of the need for QPOs, the Panel noted that: *“the Regulator is not the designer, and this limits the degree of inquiry that is manageable. If Regulators were provided with more information in an ongoing manner, they would be better versed to engage the Engineer of Record.. To this end, MEM should evaluate how to determine the QPOs associated with ongoing facilities and begin to apply them in practice.”* ^{xxx} They recommended that MEM:

- a. Utilize the recent inspections of TSFs in the province to ascertain whether they may be at risk due to the following potential failure modes and take appropriate actions
 - i. Filter adequacy
 - ii. Water balance adequacy
 - iii. Undrained shear failure of silt and clay foundations
- b. Utilize the concept of Quantitative Performance Objectives (QPOs) to improve Regulator evaluation of ongoing facilities. ^{xxxi}

BC Government Action: BC Reclamation Code Part 10 Amendment

- Quantifiable performance objectives (QPOs) are now required.
- The Code now calls for inspections for filter, water balance, and foundation adequacy. There are specific requirements for an analysis of water balance and dam foundation. It does not specifically address dam filter, but some dams do not require filters.

CSP2 Implementation Assessment: It is an important step forward that a number of QPOs are now required by BC, including seismic and flood design criteria, design slopes, and minimum static factor of safety.

The Expert Panel, however, specified a preference for: *“numerical values and limits associated with:*

- Beach widths
- Calibration of impoundment filling schedule
- Water balance audits and calibration
- Construction material availability and scheduling to ultimate height of structure
- Instrumentation adequacy and reliability
- Trigger levels for response to instrumentation
- Performance data gathering, interpretation, and reporting intervals” ^{xxxii}

The remaining QPOs are left to be specified with each mine plan/management system. This means that the values for most QPOs, while required, remain largely discretionary.

The Bottom-line:

The Expert Panel asks for specific QPOs, but not all are defined nor specified. This means that the values for most QPOs, while required, remain largely discretionary. The risk is that mine operators and inspectors are not being provided with adequate regulatory guidance for facility evaluation, as recommended by the Expert Panel. The self-regulation problem that was in large part responsible for the Mount Polley disaster has not been fully and properly replaced by effective government oversight and enforcement measures.

7: Improve dam safety guidelines

Expert Panel Recommendation: Improve dam safety guidelines: Recognizing the limitations of the current Canadian Dam Association (CDA) guidelines incorporated as a statutory requirement, develop improved guidelines that are tailored to the conditions encountered with Tailings Storage Facilities (TSFs) in British Columbia and that emphasize protecting public safety. The Expert Panel clearly said that *safety should be the paramount consideration* ^{xxxiii}, and that *financial feasibility include existing externalities and full life-cycle costs.* ^{xxxiv}

BC Government Action: BC Reclamation Code Part 10 Amendment: The mining code now includes design standards for TSFs that are tailored to the conditions encountered in British Columbia and that include provisions that address the protection of the public and environment including:

- TSF design requirements for the steepness of downstream slopes.
- A minimum static factor of safety.
- New seismic and flood design criteria.

CSP2 Implementation Assessment: While an improvement on previous versions, these guidelines do not “*emphasize protecting public safety*”. Despite the Panel’s clear recommendation that “*Safety attributes should be evaluated separately from economic considerations, and cost should not be the determining factor,*” ^{xxxv} according to the current Code, safety is only one of a number of considerations, and at best it is given only equal weight with financial concerns. ^{xxxvi}

Using economic factors as a primary driver for risk considerations is the norm today. Economic considerations serve as an obvious and important driver of alternatives assessment, risk assessment, and multiple-accounts analysis. However, the reality is that this economics-first approach is simply not compatible, and is often inconsistent, with the Panel’s strong recommendation to prioritize safety/physical stability.

The Bottom-line:

The primary concern with the implementation of the Mount Polley Expert Panel recommendations for safety is how safety is weighed in with environmental, societal, and economic considerations. Giving economics equal consideration with safety, as is currently the case in BC, is merely business as usual.



Conclusion:

After the Exxon Valdez oil spill and Lac Megantic's rail disaster, actions were immediately taken to remedy rules and regulations in those industries. The response since the Mount Polley mining disaster, the largest in B.C.'s history, has fallen short in many respects. Not only has the company faced no fines or penalties for the disaster, but the inventory of tailings facilities remains and new tailings storage facilities have been built using the same technology. While the BC government has partially responded to the recommendations of the Mount Polley Expert Panel, it has fallen short to significantly reduce the risks of another failure. A precautionary approach to public safety, not economics, should be the driving force behind new regulations for the mining industry. There is an urgent need for much greater transparency, consistency and accountability in the stated commitment to deliver best practices in tailings management for British Columbians. Our communities and watersheds depend on it.

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About First Nations Women Advocating Responsible Mining (FNWARM)

FNWARM seeks to promote environmentally sound practices that respect First Nations rights and acknowledge Full, Prior, Informed Consent (FPIC). In December 2010, FNWARM received the Canadian Boreal Award for its work in promoting responsible mining and was cited for its leading role in ensuring that the federal government rejected the proposed Prosperity Mine Project that would have destroyed Teztan Biny (Fish Lake) and its environs. For more information visit fnwarm.com



End Notes

ⁱ Mining Watch Canada Private Prosecution of Mount Polley. <http://www.mountpolleyontrial.ca/background/>

ⁱⁱ Mount Polley Independent Expert Investigation and Review Report. January 30, 2015. <https://www.mountpolleyreviewpanel.ca/final-report>

ⁱⁱⁱ Update on Independent Panel Recommendations. BC Government. February 11, 2015. <https://news.gov.bc.ca/stories/update-on-independent-panel-recommendations>

^{iv} See: www.csp2.org

^v Independent Expert Engineering Investigation and Review Panel Report on Mount Polley Tailings Storage Facility Breach. 2015, p. 119.

^{vi} Expert Panel Report, 2015. Appendix I: BC Tailings Dam Failure Frequency and Portfolio Risk. 8

^{vii} Uncertainty Upstream: Potential Threats from Tailings Facility Failures in Northern B.C. June 2015. First Nations Energy and Mining Council. <http://fnemc.ca/?portfolio=uncertainty-upstream>

^{viii} Expert Panel Report, 2015, p.136

^{ix} Auditor General of British Columbia, An Audit of Compliance and Enforcement of the Mining Sector (May 2016), pg.3

^x BC Auditor General, May 2016 (pp.71-72)

^{xi} Ministry of Environment, Environmental Protection, Mining Operations; FILE 11678 Permit Amendment, April 7, 2017 Reasons for Decision, pg. 6.

^{xii} Concerned Citizens of Quesnel Lake. <https://www.ccql.ca/>

^{xiii} Concerned Citizens of Quesnel Lake. <https://www.ccql.ca/about-us>

^{xiv} "Appeal challenges discharge of Mt. Polley mine effluent to Quesnel Lake", by Gordon Hoekstra. Vancouver Sun. August 15, 2018 <https://vancouversun.com/business/local-business/appeal-challenges-discharge-of-mt-polley-mine-effluent-to-quesnel-lake>

^{xv} Expert Panel Report, 2015, p. 125

^{xvi} Expert Panel Report, 2015, p. 122

^{xvii} Expert Panel Report, 2015, p. 122

^{xviii} Expert Panel Report, 2015, p. 124

^{xix} Expert Panel Report, 2015, p. 121

^{xx} BCMEM, Guidance Document, BC Health Safety and Reclamation Code, July 2016

^{xxi} Expert Panel Report, 2015, p. 122

^{xxii} AMD occurs when sulphides in rocks are exposed to air and water and sulphuric acid is produced. The acid will leach from the rock as long as its source rock is exposed to air and water and until the sulphides are leached out – a process that can last hundreds, even thousands of years. Water covered tailings impoundments are one strategy to attempt to avoid oxygen exposure. If tailings are uncovered, or a breach of the dam occurs, acid is carried off the minesite by rainwater or surface drainage and deposited into nearby streams, rivers, lakes and groundwater. AMD severely degrades water quality, and can kill aquatic life and make water virtually unusable. (see <https://www.protectfishlake.ca/media/amd.pdf>)

^{xxiii} Expert Panel Report, pp. 126-127

^{xxiv} Expert Panel Report, 2015, p. 139

^{xxv} Expert Panel Report, 2015, p. 123

^{xxvi} A "feasibility study" is a comprehensive technical and economic study of the selected development option for a mineral project, which includes detailed assessments of all applicable modifying factors together with any other relevant operational factors, and detailed financial analysis that are necessary to demonstrate, at the time of reporting, that extraction is economically viable. Terms such as "full, final, comprehensive, bankable, or definitive" feasibility study are equivalent to a feasibility study.

^{xxvii} Expert Panel Report, 2015, p. 128

^{xxviii} Expert Panel, 2015, p. 130

^{xxix} Expert Panel Report, 2015, p. 130

^{xxx} Expert Panel Report, 2015, p 131

^{xxxi} Expert Panel Report, 2015, p 140

^{xxxii} Expert Panel Report 2015, p. 128

^{xxxiii} Expert Panel, Report, 2015, p. 125

^{xxxiv} Expert Panel Report, 2015, p. 123

^{xxxv} Expert Panel Report, 2015, p. 125

^{xxxvi} BCMEM 2016, p. 14