Tailings Basin Stability and Environmental Protections

PolyMet has a big advantage over other new or developing mines because we will reuse a tailings basin that already exists at the site as a result of earlier iron ore processing. The basin has proven to be stable over its 40-year existence; even so, before we put the existing basin back into use, we will incorporate additional engineering controls to ensure it remains stable and will protect nearby natural resources over the long term.

What are tailings?

- Tailings are what are left after ore has been mined, crushed, processed and stripped of its economic metals. The silt and sand-like material is mixed with water and pumped to large basins or impoundments for permanent storage. The coarser tailings solids are used to build walls or dams that form large basins. Water collects and pools in the basins during operations, and is recycled back to the plant for reuse.
- Tailings structures from iron and taconite mining have been in existence for decades along the Iron Range in northeastern Minnesota. Thousands more are found throughout the world. Tailings impoundments have similarities, but their differences often far outweigh their similarities because mining operations vary widely in geography, geology, hydrology, mineralogy and other characteristics.
- Tailings basins are highly engineered structures that are continuously maintained, monitored and inspected for stability.

Steps PolyMet is taking to enhance stability and safety of its tailings structure

Dam stability and water management are two key considerations when siting, designing, building and operating tailings impoundments. The design of the existing structure has stood the test of time for 40 years; PolyMet will apply a similar engineering design to the structure, with additional engineering controls, when we begin copper-nickel mining operations.

- Geotechnical experts independently performed numerous geotechnical evaluations and concluded it is feasible to add our tailings to the existing facility. These experts will assist in the specification of future engineering requirements once production starts.
- Foundation conditions at the PolyMet site have been explored repeatedly beginning more than 50 years ago and more recently with sophisticated methods of exploration. Minnesota-based Barr Engineering, PolyMet's engineering firm, has been designing tailings basins for mines in northern Minnesota since the 1960s and now works on tailings basin projects around the world.
- We'll incorporate two major design enhancements to ensure the structure achieves accepted factors of safety for slope stability into the future:
    - Buttresses will be added to the exterior face of the dam during the first few years of operations to supplement the existing structure.

- A series of internal concrete-like walls will be built prior to the commencement of mining using a method called Cement Deep Soil Mixing. CDSM consists of drilling into the layer of the tailings basin where the smallest particles of tailings material – often referred to as slimes and fines – from the LTV Steel mining days have settled. Cement is injected and mixed with the tailings to form overlapping, interlocking columns. This serves only as a contingency to increase the basin's overall resistance to slope movement from a major earthquake, even though the probability of one occurring is extremely low. The area is historically void of any significant seismic activity.

Other considerations for safety and stability

- Dam safety inspections are currently conducted at the existing facility by the Minnesota Department of Natural Resources, and these inspections will continue on a regular basis throughout operations and after closure under the provisions of our future permit. DNR inspections will be supplemented by frequent inspections by PolyMet staff and independent geotechnical experts retained by PolyMet. Any issues identified during these inspections will be addressed accordingly.
- Slope angles are gradual and not steep, thereby decreasing stability risk by spreading the load over a broader area. PolyMet's embankment slopes are 3.0 horizontal to 1 vertical for the rock buttress but typically 4.5H:1V at the steepest points and 8.6H:1V average.

Contingency and emergency planning

- As we plan the project, we do our best to anticipate the events that could cause a failure, including those that could happen in series (the domino effect). Taking this information into account, we design the structure to reduce the risk of those events occurring. We also have a Contingency Action Plan that will be in place – one that will assist us with identification of early warning signs, potential consequences, and required actions. In the unlikely event something does go wrong – our Contingency Action Plan is an initial guide to help us respond quickly and appropriately. A draft of this plan is included as an attachment to the April 2013 NorthMet Project Flotation Tailings Management Plan, the latter of which is a reference to the SDEIS.
- We are continually monitoring, testing and improving the NorthMet design to ensure it's appropriate given the characteristics of the tailings and site.

Steps PolyMet is taking to ensure water quality standards are met and resources used wisely

- Before we put the existing tailings basin back into use we will upgrade it with a collection system to control leakage and pump it back into the tailings basin. This will consist of a nearly five-mile-long cutoff wall – an underground barrier made of bentonite – that will extend from surface to bedrock around a portion of the tailings basin. (A similar structure also will be built around the permanent waste rock stockpile.) This is to keep untreated water from migrating off-site.
- At closure, a permanent pond will be formed at the tailings basin. The pond bottom and exposed beach areas will be amended with bentonite to limit oxygen infiltration and water percolation into the tailings. This is to minimize future leakage and the potential for water quality impacts.
- Monitoring devices will be installed in the basin, data from which will be used to systematically and continually evaluate water movement and slope stability.

Tailings basin water not acidic

Water in the existing basin, and water in the PolyMet tailings basin in the future, is in the pH neutral range and therefore is not acidic.

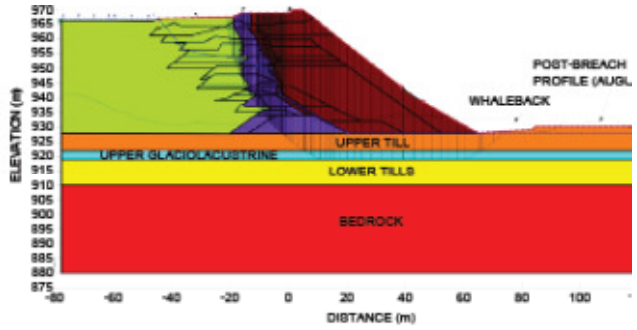
Mount Polley tailings dam disaster

On August 4, 2014, a tailings basin wall at the Imperial Metals Mount Polley copper mine in south central British Columbia failed, allowing 26 million cubic yards of silt- and sand-like

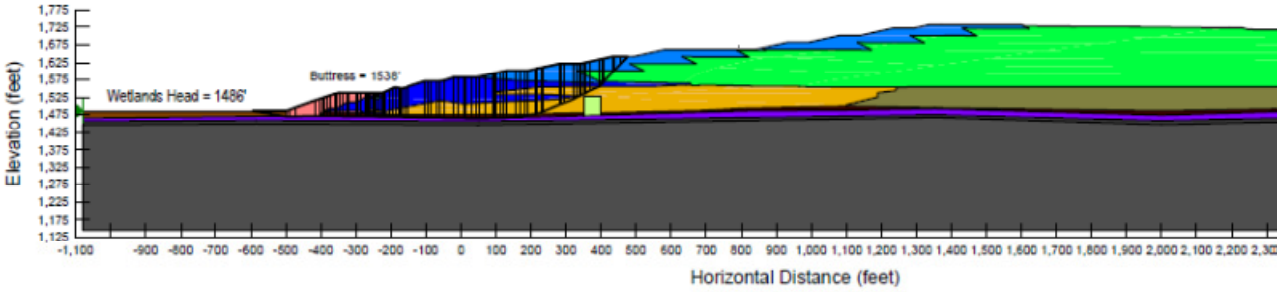
material and water to escape into the environment. A reasonable question generated by this failure is: could it happen here?

After a five-month investigation, a three-member panel of geotechnical experts assembled by the government concluded the failure was caused by a faulty design. The geotechnical modeling during design did not take into account the geologic complexities of the subsurface and therefore underestimated the amount of “loading” of tailings it could sustain. The foundation eventually failed under the weight of the dam walls. The panel concluded the steep slopes of the tailings embankment also contributed to the failure. (By comparison, the average dam slope for Mount Polley is roughly 6 times steeper than dam slopes for the PolyMet tailings basin.)

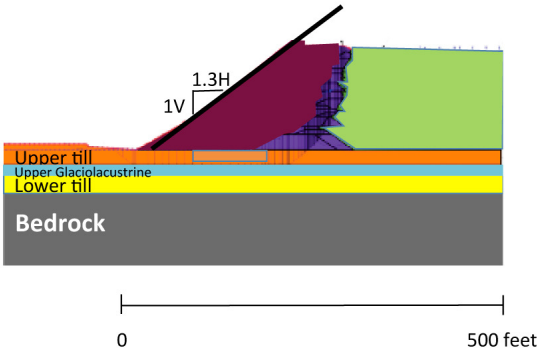
Mount Polley Cross Section



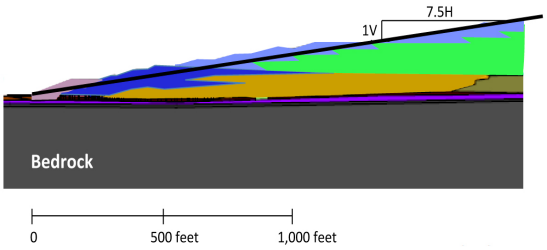
PolyMet Cross Section



Mount Polley Dam Slope 77 %



PolyMet Average Dam Slope 13 %



Major tailings basin failures like the one in B.C. are rare, and while there are never guarantees, the long-term history of the existing tailings structures and the steps we will take as outlined above will help ensure the PolyMet tailings structure remains stable throughout its lifetime.

PolyMet Mining's tailings basis is one of dozens of tailings basins found in northern Minnesota, some of which are as old as iron mining itself. None of these is known to have ever experienced a catastrophic dam failure.

Engineering link to PolyMet Mining?

Knight Piesold (KP), an engineering consulting company, designed the Mount Polley structure and was the Engineer of Record for that project; however, it was not serving in this capacity at the time of the failure. KP also is one of a number of subcontractors the Minnesota Department of Natural Resources hired to review the supplemental draft Environmental Impact Statement (SDEIS) for the PolyMet project. In such capacity, KP is a reviewer of the document and is not involved in any way with the design of the PolyMet tailings basin or project as a whole.