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Vaughn Palmer: 'Observing' a slow-motion disaster

Mount Polley tailings dam had grown from a few metres high in late 1990s to 40 metres

By Vaughn Palmer, Vancouver Sun February 5, 2015

Imperial Metals used the 'observational method' to monitor its Mount Polley tailings dam, but many of the instruments used to measure movement and water pressure did not work, according to the report prepared by an independent panel of engineering experts.
Photograph by: JONATHAN HAYWARD , THE CANADIAN PRESS

VICTORIA — As the waters kept on rising behind the doomed Mount Polley tailings dam last year, the mine operator was relying on a method of monitoring the structure that was both "misapplied" and "useless."

So said an independent panel of engineering experts, reporting last week on the application at Mount Polley of what is known as the “observational method” for managing the design and stability of structures like the tailings dam.

The method relies on observations, gathered mainly from instruments on site, to identify problems and implement changes, including increases in the height of the structure — as happens multiple times with tailings dams.

The observational method was adopted way back in the year 2000 at Mount Polley and is, as the panel conceded, a commonly accepted approach. But in this case, it was the wrong one.

“The first (problem) was simple geometry,” reported the panel. “The observational method relies on measuring the right things in the right places. While this was comparatively easy over the 1,000-metre length of the first stage dam, it became increasingly difficult as the length grew to five kilometres.”

Likewise, there were difficulties with the regular increases in the height of the dam, as the operator added layer upon layer to keep ahead of the rising tide of water in the tailings pond.

The perimeter embankment, where the dam would eventually fail, started out just a few metres high when mine operations began in the late 1990s. By the time of the breach last August, it had grown to a height of almost 40 metres.

Moreover, owing to a shortage of construction material, the slope was overly steep.

“Too steep to be accessible,” according to the panel, “and few instruments installed on the crest could survive the near-constant construction there for very long.”

Those instruments were inclinometers, which measure any horizontal movement in the structure, and piezometers, which measure any buildup of water pressure inside the mass.

As far back as 2006, a dam safety review recommended “replacement of non-functioning instrumentation” because monitoring the state of the embankments “is an essential component of sound tailings management.”

Five years later, an update found that only 40 per cent of the piezometers installed at the dam were actually functional. The panel found roughly the same proportion, 9 of 22 instruments, were operational on the perimeter embankment at the time of the breach. Only two inclinometers were determined to be reliably operational as well.

Moreover, “the few piezometers and inclinometers at the perimeter embankment were too far beyond the dam toe to produce critical data, and too far (apart) to cover the area where the breach occurred.”

The problem went deeper than that. Even if the instruments had been fully operational and better positioned, they were not up to detecting what happened early on the morning of Aug. 4.

For that is when a layer of glacial till, lurking undetected under the perimeter embankment, suddenly slumped under the weight of the dam and triggered the breach in a matter of moments.

“Were the instruments to warn somehow of a rapidly developing failure, there would be no way to respond in time to avert it,” wrote the panel. “The observational method is useless without a way to respond to the observations.”

Hence the panel’s view that the method was “misapplied” at Mount Polley. “It relies on recognition of the potential failure modes, an acceptable design to deal with them, and practical contingency plans to execute in the event observations lead to conditions that require mitigation. The lack of recognition of the critical failure mode that prevailed reduced the method to mere trial and error.”

In short, the design for the ever-rising tailings dam needed to incorporate more precautions against the possibility of catastrophic failure of the structure, and minimize the risk of a massive spill of tainted water and tailings.

Instead, the panel found “dam raising bordering on ad hoc and only responding to events as they occurred,” reliance on guidelines that were “never intended for tailings dams,” and safety standards that “made it harder to gauge just how closely dam raising was approaching the edge of the cliff.”

Far from excusing what happened by focusing on the single undetected flaw that triggered the breach, the panel highlighted the might-have-beens and should-have-beens. Those included construction of a more gentle slope with a wider crest on the perimeter of the dam: “The embankment would not have failed.”

Or more attention to concerns about water levels and the lack of a protective beach of tailings to keep waves and water off the earthen embankment: “Had the water level been even a metre lower and the tailings beach commensurately wider, this last link might have held until dawn the next morning, allowing timely intervention and potentially turning a fatal condition into something survivable.”

Or earlier recognition of the need to construct a supporting buttress, eight metres high, in the centre of the perimeter embankment: “Had it been in place on Aug. 3, 2014, the dam would have survived.”

Not what the Liberals, with their preferred focus on the single and unavoidable explanation of the dam failure, want to hear. But it is all there in the report on a disaster that, with the right precautions, might have been minimized or avoided altogether.

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