A Case for Consistency in Tailings Dam Breach Assessments

WD Clohan¹, P Chapman² and N Moon³

¹. Water Resources Engineer & CFD Specialist, Golder Associates Ltd., Vancouver, BC, Canada V5M 0C4. Email: dclohan@golder.com
². Principal, Mine Waste Division Leader, Golder Associates Pty Ltd., West Perth, Western Australia, Australia, 6005. Email: pchapman@golder.com.au
³. Associate, Water Resources Engineer, Golder Associates Pty Ltd., Brisbane, Queensland, Australia, 4064. Email: nmoon@golder.com.au

ABSTRACT

There is, arguably, no other mining process that can have such a sudden negative impact to micro- and macro-socioeconomics, environmental receptors, and human life as the failure of a tailings storage facility (TSF) embankment. Whilst many designs are robust, it is industry practice to perform a tailings dam breach assessment (DBA) so that the consequences of failure are known and mitigation measures and emergency response can be developed in the unlikely event of a failure.

A generalized conceptualization of a typical tailings dam breach is as follows: stored tailings are consolidated and spatially heterogenous; a supernatant pond is present; a failure of the containing embankment occurs; the leading edge of material leaving the TSF is water; hydraulic erosional forces combined with liquefaction processes entrain tailings to create a slurry-like flow; once all supernatant is released, hydraulic erosional forces subside and geomechanics dominate; the slurry-like tailings may continue to flow and trend to a material specific residual strength ratio value; the backscarp slopes tend to a pre-failure in situ state; the temporally varying mixture of water and tailings leaving the TSF will travel downstream/downslope; tailings spatial/temporally deposit downstream while at the same time in situ material is spatially and temporally entrained into the breach slurry; finally, the slurry travels until either driving forces are overcome by resisting forces, or until the slurry reaches a barrier.

The state-of-practice to account for the above-mentioned conceptualization is a dynamic environment that continuously evolves as new research, technology, and societal perceptions/values change. However, due to the complexity of the overall process, simplifications and engineering judgement are required. As such, bias and subjectivity become an important consideration when comparing multiple tailing DBA's.

The intent of the paper is to present the implication of bias and subjectivity associated with tailings DBA, and suggests a means of standardization.