

Tailings Dam Guidelines: Adopting international direction

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Recent tailings dam failures have led to worldwide alarm that we are still getting an average of two significant tailings dam incidents a year. This is despite the efforts of various industry organisations around the world to raise the standards of tailings dam management. Clearly, a significant number of mining dams are not resilient enough to ensure the required level of safety for sustainable mining operations in a modern world in which there is increasing concern for the environment. This paper updates ANCOLD with international developments in attempting to address shortcomings in the mining industry that is allowing these failures to continue to occur.

In Australia, ANCOLD have released an addendum to the 2012 ANCOLD Guidelines on Tailings Dams, Planning, Design, Construction, Operation and Closure, to coincide with the new ANCOLD Guidelines for Design of Dams and Appurtenant Structures for Earthquake. This addendum also addresses issues of governance of tailings dams and provides additional guidance on the serious issue of static-liquefaction, a critical factor in recent failures.

On the international scene, ICOLD is progressing a Tailings Dam Safety Bulletin that is hoped will set minimum standards for Tailings Dams for all member countries. In addition, the International Council of Mining and Metallurgy (ICMM) similarly wants to establish an international standard. It is likely that these international bodies will cooperate to ensure a consistent set of guidelines and that countries will accept and implement these.

This paper updates the ANCOLD position regarding guidelines and describes the state of various international guidelines following the June ICOLD meeting in Ottawa.

Background

The world has been shocked by recent dramatic failures of tailings dams in Brazil, with the Fundao failure releasing approximately 40 Mt with the loss of 17 lives and Brumadinho, in releasing an estimated 25 Mt, becoming possibly the world's worst tailings dam failure with the loss of nearly 300 lives. However, these recent losses should not have come as a surprise, as they are just the latest failures of these mine dams which have been taking place at a rate of up to 5 per year over the past 50 years. The cumulative total number of deaths from tailings dam failures has reached over 3000 (Davies, 2019).

The mining industry has not been sitting on its hands, with various bodies including ANCOLD, Canadian Dam Association (CDA), Mining Association of Canada (MAC), regulators in various countries and mining companies themselves (e.g. Rio Tinto D5 Standard) and International Council of Mining and Minerals (ICMM), actively working to develop guidelines and standards. These guidelines have been reasonably successful, with Australia, for example, avoiding any loss of life or significant environmental impact from dam failure, with the recent incident at Cadia Mine luckily having negligible impacts off site. The root cause of recent failures in both Canada and Australia has been the presence of an unrecognised foundation condition prompting both countries to review guidelines on site classification investigations. However, other failures have been caused by a range of reasons summarised in **Figure 1**.

Foundation failures, overtopping (water management) and structural failure have remained as important failure modes. Static liquefaction had not been recognised as an important failure mechanism at the time of compilation of this data by ICOLD but is becoming understood as a critical concern in the popular upstream construction method and being responsible directly or indirectly in recent failures.

Review of data on tailings dam failures reveals the range of issues leading up to failure cover all phases of the dam life including planning, design, construction, operation and closure. Accordingly, improvements in tailings dam safety must address all of these aspects. ICOLD has been focussed on addressing technical aspects since 1995, with various bulletins being issued covering a range of topics related specifically to mining dams. In 2018, ICOLD agreed to develop an international guideline that covered all aspects of tailings dam management and could be adopted by all member countries. This is currently in preparation.

In the meantime, major international investors, led by the Church of England, have initiated a survey of mining companies related to the safety of their dams and have partnered with ICMM and the United Nations Environment Program (UNE) to develop an internationally accepted Tailings Dam Standard. This will become a mandatory standard for management of all tailings dams owned or operated by ICMM company members, including 26 of the world's largest mining companies.

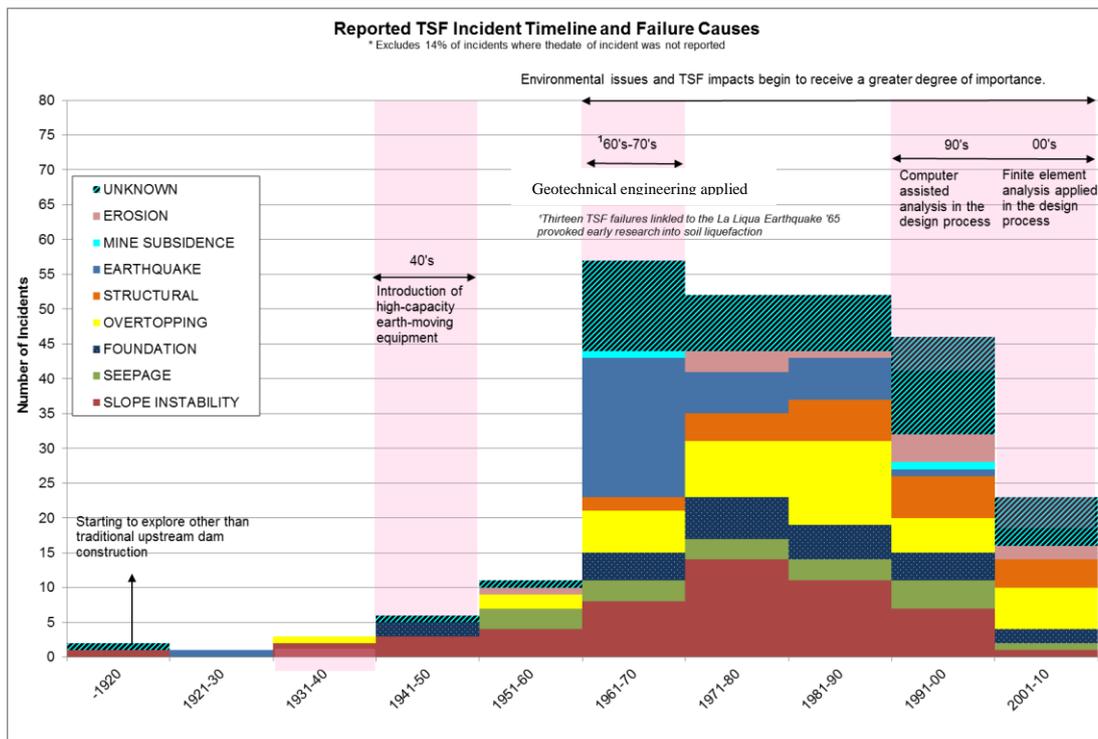


Figure 1 Causes of Tailings Dam Failures (courtesy GHD extension of ICOLD data from Bulletin 121)

Progress update

ICOLD

ICOLD commenced working on a Global Tailings Guideline Bulletin in 2018 and is attempting to develop a draft document by the end of 2019. The working group comprises members from Canada, Australia, South Africa, Sweden, UK and Brazil. Following a presentation at ICOLD 2019 by ICMM, the ICOLD committee is focussing on the technical aspects of tailings management in the expectation that the ICMM Global Standard will be focussed on governance and will need technical support. In this way the ICOLD Bulletin should complement the ICMM document.

The ICOLD document is expected to incorporate the best advice from the CDA, ANCOLD and new information where the committee sees the need for improvement.

ANCOLD

ANCOLD has recently published Addendum No 1 to the 2012 ANCOLD Guidelines on Tailings Dams, Planning, Design, Construction, Operation and Closure (ANCOLD, 2019b), to coincide with the new ANCOLD Guidelines for Design of Dams and Appurtenant Structures for Earthquake (ANCOLD, 2019a). This addendum was prompted to ensure compatibility between the two Guidelines but also addresses issues of governance of tailings dams and provides additional guidance on the serious issue of static-liquefaction. A promotion and education workshop is being planned for late 2019.

In addition, ANCOLD is supportive of the ICOLD Tailings Dam Safety Bulletin initiative and actively assisting in its development.

CDA

CDA has been progressively updating their Dam Safety Guidelines of 2013 (CDA, 2013) and have produced a technical bulletin "Application of Dam Safety Guidelines to Mining Dams" (CDA, 2014). Current revisions are proposed to revise factors of safety (FOS) for tailings dam design, changes to accountability and responsibility and finally a method for assessing when a tailings dam can be considered as a landform rather than a dam as part of closure considerations. These revisions are currently in the final stage of review and adoption.

MAC

MAC has produced guidelines particularly directed at governance of tailings dams with the latest 2017 update to A Guide to the Management of Tailings Facilities (MAC, 2017) being recognised as providing appropriate guidance to address the issues of accountability and responsibility. In particular MAC identified the recommendation for an "Engineer of Record" (EOR) to be appointed to each tailings dam. This concept has been taken up by CDA with their own definition of an EOR and ANCOLD has described a responsible technical person in their 2019 Addendum (ANCOLD, 2019) MAC have also

produced a Guideline on preparation of an Operation, Maintenance and Surveillance (OMS) Manual which is well regarded (MAC, 2019). ANCOLD also provide guidance on the scope of an OMS Manual but not in such detail.

ICMM

The Church of England Pensions Board and the Council on Ethics of the Swedish National Pension Funds wrote to 683 extractive companies, including ICMM's 26 company members in early 2019, asking them to disclose details of their tailings dams. ICMM is supportive of greater transparency on this important issue and members have responded to this request and have published details of the tailings dams that they own or operate on their websites. These are accessible by the public.

The request has led to the ICMM, UNEP and the Principles for Responsible Investment (PRI) to co-convene a global tailings dam review to establish an international standard. This review is being led by Dr Bruno Oberle, with the aim to complete a Standard by the end of the year.

The review will evaluate current global good practices in the mining industry, and beyond, as well as evidence and lessons learned from catastrophic failures of tailings dams at Brumadinho (2019), Mariana (2015), Mount Polley (2014) and others, to develop the standard.

The details of the standard will be defined through the review process but will at a minimum include:

- A global and transparent consequence-based tailings facility classification system.
- Requirements for emergency planning and preparedness.
- A system for credible and independent assurance of the safety of tailings dams.
- Accountability

The standard will become an ICMM company member commitment, alongside other sustainable development performance expectations. All co-convening partners will encourage other mining and metals companies to join in advocating for it to be accepted more broadly. The review will also consider governance options to ensure uptake of, and compliance with, the standard.

ICMM hope that the findings of the review will be published by the end of 2019 alongside broader recommendations for the industry on behavioural, cultural, and structural factors (which may not be included as specific provisions in the standard). The Chair is empowered to independently propose recommendations, and the parties subject to the recommendations will respond to them as appropriate.

The detailed scope of the review will be refined through a process of engagement with representatives from civil society, industry, investors, and multilateral organisations but will likely:

- Contextualise tailings dams globally.
- Evaluate strengths and weaknesses of existing tailings dam classification systems.
- Explore different testing, monitoring and inspection regimes that apply to TSFs.
- Seek to understand the economic and financial costs of TSF management, including consequences of failure.
- Assess safety considerations for mine workers, communities in the proximity and the environment.
- Identify relevant behavioural, cultural, and structural factors.

Implications for Australian mining

Until the International Standard is produced it is not possible to anticipate precise implications on the Australian Mining Industry. However, ANCOLD considers that our Australian Guidelines are technically very strong and the ICOLD Guidelines likely to be referred to by ICMM are expected to closely mirror these. In this case, the effect on companies that have developed tailings dams in accordance with ANCOLD Guidelines will not see major changes other than a possible more stringent requirement for appointment of Engineers of Record (Responsible Technical Persons in ANCOLD vocabulary). The definition of the role of Engineer of Record is evolving and is now generally recognised as not removing overall responsibility from dam owners. It will be interesting to see what comes out in the ICMM International Standard on this item.

Given the interest in development of guidelines and standards from many organisations, there is likely to be conflicting advice and ANCOLD will need to carefully review the outcome over coming years and adjust our guidance accordingly. ANCOLD is preparing for this by refreshing the tailings sub-committee and anticipating a rewrite of the tailings guideline within the next two years. This is likely to take the form of a document providing Australia specific detail to the International Standard as it becomes adopted by the major mining companies and filters through to the industry in general.

One issue that hopefully will be clarified by the new "Standard" will be educating the public and press regarding the purpose and meaning of "Consequence Category" which has erroneously been referred to as "risk".

References

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