

# Towards a Global Research Consortium on Tailings

A concept note for discussion

Sustainable Minerals Institute



## A Concept Note

**The management of mine and mineral processing wastes are one of humanity's greatest challenges. Tailings arguably represent the most significant risk that the mining industry poses to the environment and communities globally.**

Tailings spills, dam failures, seepage, unrehabilitated sites and cases of direct discharge into waterways can leave environmental, social and economic legacies for thousands of years. They have disproportionately shaped the reputation of the minerals industry, eroded public trust and the willingness of governments and communities to support new operations, and are reshaping the calculations of risk made by financial institutions and investors.

Investment in research by industry and the public sector has expanded the approaches available to address tailings management challenges but much of this learning remains underutilised. Innovations such as thickened tailings, dry stacking and paste backfill, have yet to find widespread uptake, and the safety and stability of a large number of existing conventional tailings storage facilities is in question. A global coordinated effort is necessary to meet the scale of the tailings challenge.

The disasters at Brumadinho, Mt Polley and Mariana are reminders that despite being core to the Mining, Minerals and Sustainable Development Project's call to action nearly 20 years ago, tailings remain unfinished business.

A Global Research Consortium on Tailings is an opportunity for leading companies to invest in the solutions needed for a sustainable future.

## An Integrated Global Research Agenda

**The University of Queensland is proposing to convene a Global Research Consortium on Tailings to bring together the world's leading thinkers in tailings and mine waste management: researchers, practitioners, industry professionals, regulators, civil society and community representatives. The vision of the consortium is a 3-year multi-party collaborative initiative at the scale of \$3-5M/year to develop transdisciplinary knowledge-solutions (science, technology and practices) to address the social, environmental and economic risks of tailings.**

Together, the consortium would tackle a bold and globally significant research agenda with the potential for meaningful impact. Consortium partners will participate in defining the research questions, which could include:

- How can research support the shift to safer, cost-effective, and better performing alternatives to wet tailings storage facilities? What are the opportunities of paste and thickened tailings and how can the operational and economic barriers be overcome? How can mining and minerals processing be designed to optimise rheology, mineral recovery, water and energy inputs, economics, Acid and Metalliferous Drainage, rehabilitation and the social outcomes of tailings?

- Is the production of benign tailings feasible? If so what processing techniques, technologies, geo-metallurgical and geochemical testing methods are needed? What are the effects on the properties of the tailings and what are the implications for storage and rehabilitation?

- What monitoring, control and rehabilitation practices are most effective to ensure the safety, stability, environmental and social performance of the large number of existing and decommissioned conventional tailings storage facilities that are currently in the landscape? What are the opportunities for reprocessing and re-re-use?

- What are the downstream environmental, social and economic risks of tailings from chronic and catastrophic events? What is the extent of risk exposure that communities face due to tailings and mine waste, how do communities interpret such risks, and how can community relations practitioners become more central to tailings management on mine sites?

- How do we bring stakeholders who are not traditionally involved in tailings research, such as technology and equipment providers and environmental and engineering consultancies into the research agenda?

The proposition of the consortium is that with renewed, coordinated and dedicated action a dramatic scale-up of global efforts can develop the knowledge-solutions necessary for on the ground impact. A consortium would extract value from existing knowledge, prioritise research in areas that require collective effort, support evidence-based policy-making, and contribute to increased education and communication between all stakeholders. Members of the consortium would benefit from robust, transdisciplinary, game-changing research with University partners that have deep knowledge of the sector.

## Designing Tailings for Environmental, Social and Economic Outcomes

**Tailings research cuts across multiple disciplines, geographies, commodities, and technologies. The properties of mine tailings and their environmental, social and economic outcomes are the result of the transformation of minerals at each step along the mining lifecycle within their distinct geographical (physical and social) context. Tailings are not solely an engineering problem. They are the end point of a complex set of actions and reactions during the mining process and interact with their surrounding environment.**

Risks are borne by industry, local community, ecosystems, governments, investors and by future generations. Solutions that respect these multiple perspectives are needed – solutions for site-based problems at a globally significant scale. Insights could be drawn from parallel fields, such as the long-term disposal of hazardous wastes.

Tailings occur at the intersection of a complex system that connects a mine with physical and social environments – over space and time. History has shown us that complex systems cannot be managed through engineered solutions alone.



## Proposed Approach

- Develop a detailed prospectus that outlines the approach of the Consortium and invites partners to join.
- Convene and invite individuals and institutions with deep knowledge of tailings and mine waste management to join this global effort.
- Facilitate a dialogue between researchers, practitioners and those impacted by tailings risks to guide the research of the consortium.
- Collate the state of the art of global research and practice on tailings and share case studies reflecting all dimensions of tailings and risk (economic, technical, social, environmental and governance).
- Define an agreed program of applied research with consortium members addressing the critical knowledge gaps in the planning and management of tailings.
- Create a forum for knowledge exchange and research translation with industry, government and others with an interest in the issue.
- Incubate innovations and ideas, seed research and undertake feasibility studies to implement innovations.
- Grow a portfolio of research solutions to address tailings and mine waste risks that are transferrable across multiple sites.

1 - 6 months

- Develop a detailed prospectus
- Invite partners and secure funding
- Collate the state of the art of tailings research
- Facilitate dialogue to identify the research focus

3 - 9 months

- Define the program of research
- Prioritise challenges and define research questions
- Create a forum for knowledge exchange and translation
- Identify potential solutions

6 - 18 months

- Incubate innovations and initiate feasibility studies
- Seed individual projects and trials
- Fail-fast prospective projects

12 - 36 months

- Implement the program of research
- Grow the portfolio of research solutions

## Convened through The University of Queensland

**The University of Queensland has unparalleled strength, breadth and depth of research capability relevant to tailings. The University is ranked first in the world for mining and mineral engineering by the 2018 Shanghai Rankings and has existing and growing partnerships with mining-focussed Universities in Australia, Canada, Chile, Africa, US and Europe. The University will host the International Conference on Acid Rock Drainage (ICARD) in 2021 and the 10th Australian Acid and Metalliferous Drainage Workshop in 2020. These global networks illustrate and support extensive convening power.**

Within the University, the Sustainable Minerals Institute (SMI) delivers integrated, industry-oriented research and is committed to developing knowledge-based solutions to the sustainability challenges of the global resource industry, and to training the next generation of industry and community leaders. The Institute can draw together deep knowledge from its many centres of expertise and across UQ including the following:

**The Centre for Mined Land Rehabilitation** was the first university centre in the world dedicated to research focussed on tailings and mined land rehabilitation. The centre works with government and industry to understand, predict and monitor the geochemical and ecological evolution of tailings and develop technologies and practices to re-establish stable ecologies, mitigate acid and metalliferous drainage, cap, cover, reprocess and re-use tailings.

**The Schools of Earth, Environmental and Biological Sciences** have collaborated with the Centre for Mined Land Rehabilitation to develop world-leaders in bacteria-mineral interactions, the use of metallophytes plants in phytomining; geo-microbial ecology, mineral bioweathering and geo-rhizosphere biology; tailings re-use and byproducts; as well as the ecological engineering of ferrous and base metal mine tailings into functional technosols

**The Centre for Water in the Minerals Industry** has specialised skills in flood estimation (precipitation, hydrology and inundation observation and modelling) as well as mine site water accounting and recovery, hydrochemistry and aquatic ecology.

**The Julius Kruttschnitt Mineral Research Centre** is one of the oldest mineral processing research centres in the world and a partner of choice for mining companies concerned with tailings management. The Centre boasts capability in: dry tailings, filtration, coarse particle flotation and thickening (conventional and paste); separation of deleterious materials (e.g. arsenic management); value recovery, sulphide flotation and desulphidation; microwave dewatering; and preconcentration through High Voltage Pulse.

**The WH Bryan Mining and Geology Research Centre** has expertise in ore body characterisation and determining geometallurgical and geoenvironmental properties across the mining value chain. It specialises in predicting waste characteristics at the early life-of-mine stages to aid mine planning through establishing best practice waste management strategies. The Centre is also experienced in examining filtration amenability for dry stacked tailings and biooxidation of mine waste for metal recovery.

**The Geotechnical Engineering Centre** at UQ's School of Civil Engineering specialises in the application of geotechnical engineering principles to mine waste management; geomaterial modelling and computational geomechanics; advanced laboratory and field characterisation and testing, modelling, and monitoring of slurries, soils and rocks; and the application of spatial Time Domain Reflectometry (TDR) and the dielectric permittivity of geomaterials to monitor and predict their geotechnical engineering parameters and behaviour.

**The Centre for Social Responsibility in Mining** is unique in the world as a centre of excellence on the social aspects of mining. The Centre has expertise in tailings induced human displacement, the social impacts of chronic and catastrophic tailings failure events, the development of classification schemes to understand land cover change and the evolution of mining footprints, the interface of artisanal and small-scale mining and large-scale mining in circumstances where tailings are an ASM resource, and community understandings of mine waste and tailings impacts and risks.

A feature of the **Sustainable Minerals Institute's** approach has been the ability to partner with Universities and research institutions globally. One example of such a partnership is the development and coordination of a global network of University partners to deliver the Global Mineral Industry Risk Management (GMIRM) program. Key partners include the Universities of Cape Town and Witwatersrand in South Africa, Camborne School of Mines in the UK, and Laurentian University in Canada. Additionally, UQ convenes the Global Comminution Collaborative – a research collaboration to address the challenges of sustainable comminution in the mining industry.

The University of Queensland invites discussion about the tailings challenges facing the industry and the research platforms required to develop game changing solutions. We are interested in developing a global research consortium, promoting collaborative research and trusted partnerships between individuals and institutions with a track record in tailings.

### More information

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