

Consulting Experience in the Implementation of the Global Industry Standard on Tailings Management

Claudio Román, Ausenco, Chile

Fernanda Kunoh, Ausenco, Brazil

Gabriela Barbosa, Ausenco, Chile

Alix Becerra, Ausenco, Chile

Eric Chucos, Ausenco, Peru

Abstract

The launch of the Global Industry Standard for Tailings Management, GISTM, in 2020 has undoubtedly helped to gain a better understanding on how to develop safe and responsible management of tailings storage facilities (TSF) by incorporating social and environmental aspects into tailings management systems. The Standard has led mining stakeholders to rethink how TSF are being designed, built, operated, monitored, and closed nowadays; and even more important, how they are managed, reviewed, maintained, and governed.

This paper aims to show Ausenco's experience in implementing GISTM and assessing its conformance in different mining companies, focusing on the key concepts and approaches taken to address the 6 Topics, 15 Principles, and 77 Requirements covered by the Standard. This covers guidelines for initiating implementation of the Standard considering the context in which the TSF is situated, how the mining company should be involved, the importance of understanding the credibility of failure scenarios and associated risks, and finally, what happens after implementation.

Introduction

In response to increasing TSF catastrophic failures, tailings management has taken on a more prominent role in responding to growing public concerns about the negative social and environmental impacts of the mining industry.

Recent iconic failures of Mount Polley (Canada, 2014), Fundão (Brazil, 2015), and Córrego do Feijão (Brazil, 2019) have raised doubts about the high-risk levels involved in the mining industry, generating an atmosphere of uncertainty in which the social license to operate is being called into question.

Motivated by the above described, the International Council on Mining & Metals (ICMM), the United States Environment Programme (UNEP), and the Principles for Responsible Investment (PRI) decided to elaborate a guide as a tool to help preventing the occurrence of more tailings catastrophes, and jointly released the Global Industry Standard for Tailings Management, hoping it will be a major step towards recovering society's reliance in mining. The Standard rises as a comprehensive response to current international challenges and concerns, integrating the social aspect as one of the fundamental pillars.

The GISTM was elaborated through an independent process, including the support of a multidisciplinary expert panel, input from a stakeholder advisory group and an expanded public consultation that incorporated affected communities, government representatives, investors, multilateral organizations, and mining industry representatives. It was based on a comprehensive review of the international standards and guidelines, including the Towards Sustainable Mining's Mining Waste Protocol, Initiative for Responsible Mining Assurance's Standard for Responsible Mining, and ICMM's Tailings Governances Position Statements, among others (Global Tailings Review, 2020).

This Standard stands out by connecting technical tailings management with social performance, providing a more holistic and responsible approach to safe management. By incorporating the best available practices (BAP) of sustainable mining, the GISTM recognizes the need of involving local communities and indigenous groups, as well as to promote transparency and accountability, in decision making.

Traditionally, tailings management has been centered on operational continuity of mineral processing and mine waste disposal. The current scenario calls for a change in the course of action towards sustainable development through BAP and BAT (best available technologies), strengthening tailings management systems and the way in which the mining industry conducts its business.

This paper explores the most important aspects of GISTM implementation based on Ausenco's experience, providing recommendations for preliminary steps, and undertaking application of the Standard.

Key Aspects on GISTM Implementation

Since before 2020, Ausenco was already participating as a consulting firm in specialized studies, which were later formalized in the GISTM, such as Dam Breach Analyses (DBA), risks assessments under the FMEA (Failure Modes and Effect Analysis) methodology, Dam Safety Reviews (DSR) and Operation, Maintenance and Surveillance (OMS) manuals updates, among others.

Furthermore, Ausenco has developed a methodology for progressive evaluation of compliance in the implementation of the Standard in different TSF, based on the Conformance Protocols of ICMM, which

has allowed to identify gaps, elaborate plans to cover them and finally, assist in the development of follow-up mechanisms for proper functioning of tailings management systems.

Based on this experience, eight key aspects to consider during the GISTM implementation have been identified (Figure 1).



Figure 1: Key aspects on GISTM implementation

Where to Start

The GISTM covers six main topics, divided into 15 principles from which 77 requirements are derived, as shown in Figure 2. The implementation of the Standard is supported by three documents: the Conformance Protocols (ICMM, 2021), used to apply and verify the compliance of the 77 requirements; the Good Practices Guide (ICMM, 2021), which supports the use of BAP and BAT for tailings management; and the Tailings Governance Framework (ICMM, 2021), which states the context and management responsibilities in the governances of the TSF.

At first glance, the idea of verifying compliance with the 77 requirements may sound overwhelming. Although Topic I “Affected Communities” is the core of the Standard – which is not in doubt –, it is convenient to start from what is more familiar to the Operator: Topic III “Design, Construction, Operation and Monitoring of the Tailings Facility”. The application and verification of conformance with this topic allows to quickly understand the magnitude of the potential impacts associated with the TSF risks, based on the utilized design criteria. Identifying potential failure modes of a facility and their potential consequences is fundamental when developing a tailings management system based on risk management.

From Topic III results natural to move on to Topics II and IV, identifying the affected area by the facility through the development of an interdisciplinary “Integrated Knowledge Base”, and review of the governance structure that supports the management system.

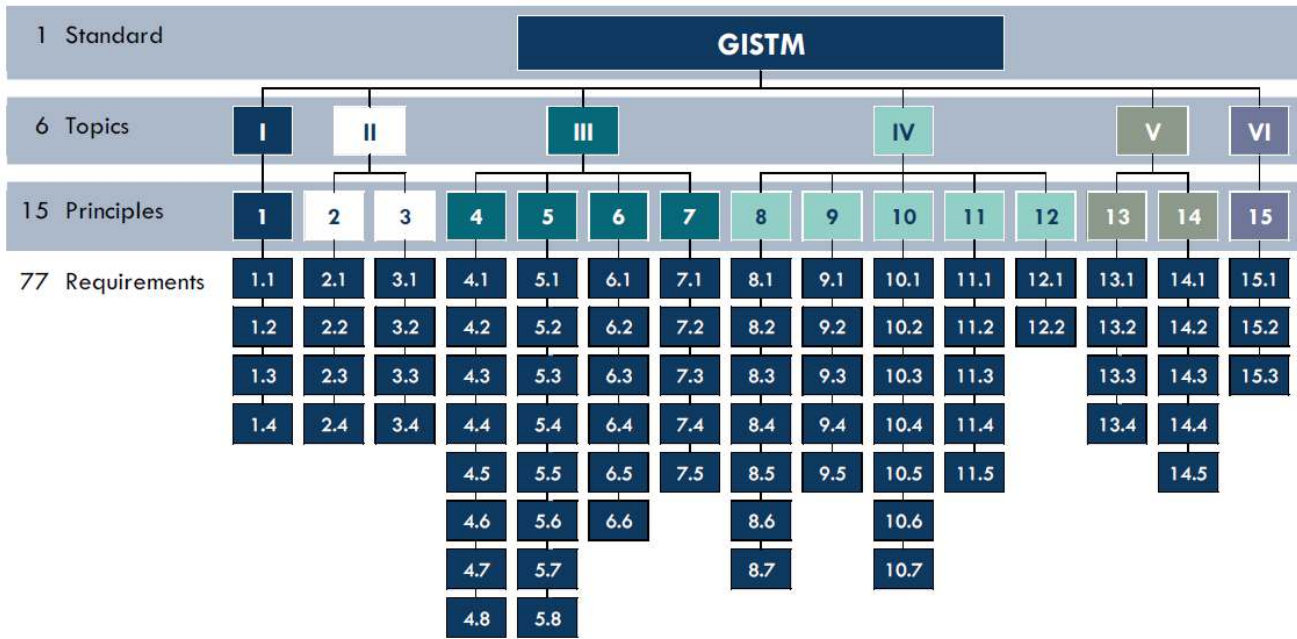


Figure 2: Distribution of GISTM Topics, Principles and Requirements

Having accomplished the development of the above topics, it is possible to move on to Topic I “Affected Communities” and Topic V “Emergency Response and Long-Term Recovery”, which are connected as they are directly related to the “meaningful engagement” of affected communities in the co-development of plans. Regarding these topics, it should be pointed out that “meaningful engagement” is to be interpreted as the achievement of effective understanding between both parties (communities and mining company) for joint decision making. The mining company must characterize their respective communities, understand, and actively listen their requests and propositions in order to build long-lasting rapport in time.

Last but not least, is the public disclosure of the information to support public accountability, as stated in Topic VI “Public Disclosure and Access to Information”, which primary objective is to report the most important evaluated aspects and their support in a clear and simple manner for all stakeholders.

Local and International Context

On the other hand, when starting the implementation of the Standard, it is necessary to consider the local and global context in which the TSF and the mining company are immersed.

With respect to local regulations, one might ask: are they aligned with the best practices and requirements of the GISTM? How? In general, countries with characteristics as high seismicity require regulatory compliance with stringent seismic design criteria. Also, global mining companies tend to have corporate standards that comply with the best practices in tailings management.

Consideration should also be given to the maturity of the mining industry in the location of the TSF, since it is not the same to implement the Standard in one country or another. In this case, some helpful questions may be: How developed is the mining industry in this location? What is the social perception of the company? Have there been any conflicts with nearby communities? How is the social license and stakeholders' confidence supported?

An understanding of this context will help to adapt and interpretate the GISTM requirements from a local point of view, and find the better way to implement these principles in any TSF.

Mining Company Vision

GISTM implementation is not just about developing reports and standards and tracking them to display a badge indicating that the company complies with the Standard. The long-term vision, commitment and empowerment of the Operator are key elements.

The mining company must immerse in the philosophy behind the Standard, its pillars, and guiding principles. The motivation of the stakeholders involved in the Standard and social, environmental, and economic benefits must be comprehended, as well as that the ultimate goal is for society to regain confidence in the mining industry and become part of it, in order to embark on the path towards sustainable development through responsible investment, which will also enhance the recovery of the mining industry's reputation.

Besides the above, it should not be forgotten that this joint process must be monitored and controlled for continuous improvement. A strong governance system, which can ensure continuity of roles, should support this monitoring and handover of information. This may be particularly relevant for older TSF which may not have up-to-date and/or supported data.

Establishing a Company Coordinator

This aspect is strongly connected with the previous one. When contracting a third party to assist in the implementation of the Standard, the mining company must not lose sight of the scope that the consultant will cover in this role, which is generally focused on providing guidelines, conducting independent revisions, and developing specific studies for successful implementation and follow-up continuity.

Even if the implementation of the Standard is developed with or without the advice of a consultant, the assignment of a GISTM company coordinator – or team –, with a high level of dedication to this process has been proven to be key. The coordinator should have direct contact with the operators, responsible entities and key roles identified by the GISTM, such as the Engineer of Record (EoR) and the Responsible Tailings Facility Engineer (RTFE). In case of working with a third party, this coordinator should also have direct contact with the consultant.

Figure 3 shows an example of evolution tracking of GISTM compliance for a single TSF (and how complex it can result), according to the criteria described in the Conformance Protocols (ICMM, 2020) and the staged assessment methodology used by Ausenco in its evaluations. As presented in the diagram, this process may require several (more than one) evaluations, and a specific follow-up on each requirement and its associated criteria, without forgetting the overall vision.

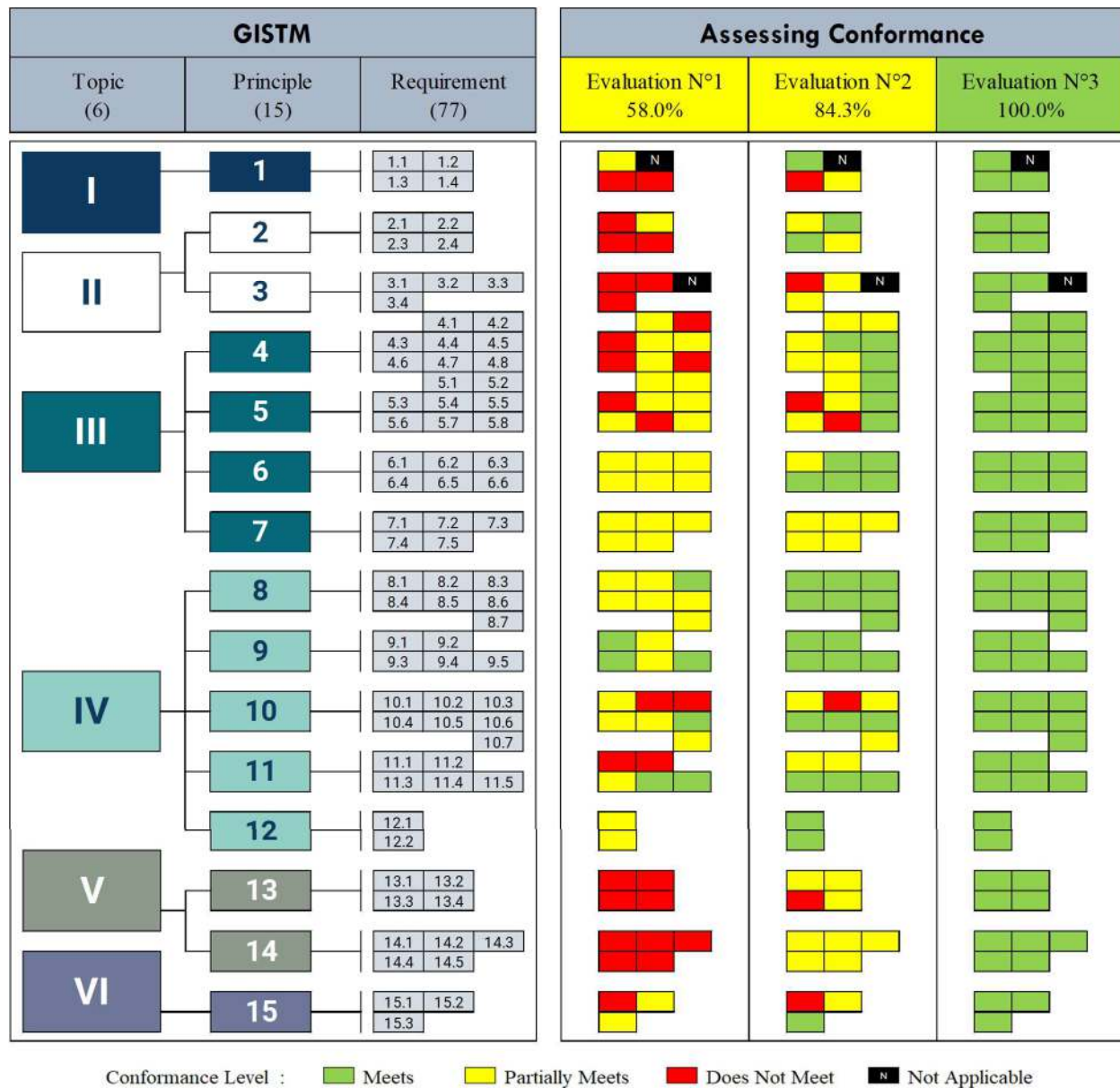


Figure 3: Example of follow-up on the GISTM implementation

The assignment of this role may significantly contribute to unify and align criteria in different areas of the mining company such as operation, construction, environment and legal, in addition to facilitate the implementation process.

Different People, Different Results

People play a fundamental role in the implementation of the Standard. Not only because communities are at the center, but also because people are in charge of the implementation, evaluations, and updates in line with the Global Tailings Review guidelines.

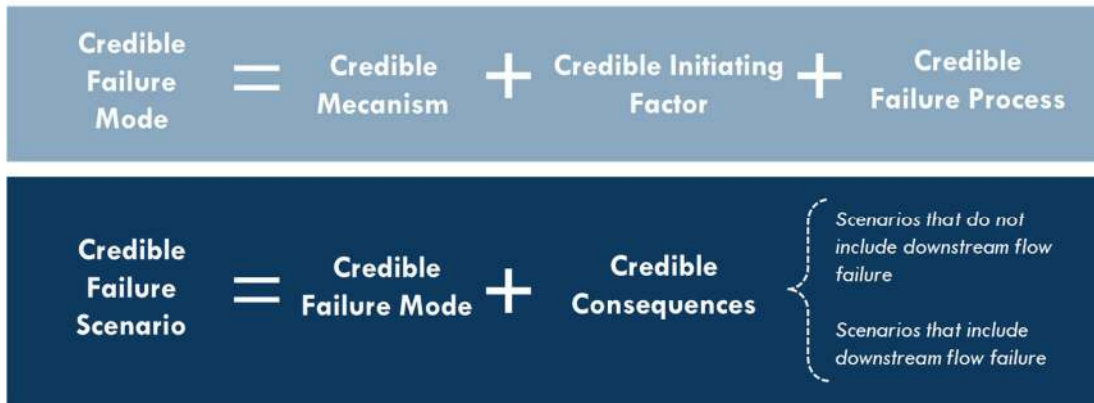
Although GISTM aims to standardize the way things are being done, it is inevitable that the results may vary depending on who executes them. Since the implementation has a great influence of the vision, motivation, and experience of those participating, it is quite likely that different people (companies and/or consultants) will arrive to different results, with a common base of tailings management knowledge.

Moreover, it is probable that all stakeholders have different particular goals based on their needs. While mining companies may be interested in achieving higher productivities, affected communities may want to eliminate their negative externalities, authorities may want safer and environmentally friendly operations, and investors may be concerned about risk control and profits. Because of the above, and given that the implementation requires the interpretation of conformance criteria, it is important for all participants to be aware of biases that may arise, and to stay open-minded in order to reach agreements in which none of the parties is left behind and the interests of all are safeguarded.

Credibility of Failure Scenarios

Understanding the credibility of the TSF failure scenarios is a key aspect to establish the design intent and compliance with all requirements associated with the facility. This requires the analysis of the credibility of failure modes and consequences. Conducting risk assessments through the Failure Modes & Effects Analysis (FMEA) methodology contributes significantly to this purpose.

According to Section 2.7.2 of the Good Practice Guide (ICMM, 2021), a credible failure scenario requires both failure mode and consequences to be credible, and when consequences – evaluated in a dam breach analysis (DBA) – are catastrophic, so is the scenario, as illustrated in Figure 4.



* Each element must be credible on its own for the failure mode or failure scenario to be credible.

Figure 4: Credibility of Failure Scenarios

These potential catastrophic scenarios require controls to prevent the occurrence of failures, rigorous monitoring over time, and a stricter implementation of the GISTM principles. According to Hopkins & Kemp (2021), the risk-based approach requires decision making to be primarily based on the severity of consequences, rather than probability of occurrence. If the consequences of a risk are sufficiently serious, no matter how low the probability, actions must be taken to prevent the risk from occurring.

Therefore, having a good understanding for application of these concepts is key to establish the Consequence Classification of the TSF, which will imply certain effects on the implementation of the Standard depending on the level of consequence. Whilst the Standard recommends different design criteria according to the TSF Consequence Classification, the use of the criteria associated with the highest consequence categories, if possible, allows for a better management of the facility’s risks.

ALARP

As stated by the GISTM, “As Low As Reasonably Practicable” (ALARP) *“requires that all reasonable measures be taken with respect to ‘tolerable’ or acceptable risks to reduce them even further until the cost and other impacts of additional risk reduction are grossly disproportionate to the benefit”*.

This concept is mentioned 12 times throughout the Standard, and is explicitly incorporated into four of the requirements. ALARP can be applied using different semi-quantitative, qualitative or experimental methods, depending on the project conditions (e.g. geographical location, social constraints, environmental aspects, etc.) and its complexity. Regardless of the used method, the process itself is a powerful tool to document the approaches taken to reduce risks during the life cycle of the TSF to a level tolerable by society and in line with good practices.

Figure 5 illustrates the understanding according to some authors (Hartford, 2022) of the ALARP concept on how regulations and good practices relate to the tolerance ranges that society would have in relation to risk. It also shows that it is a dynamic concept that sets increasingly demanding limits over time.

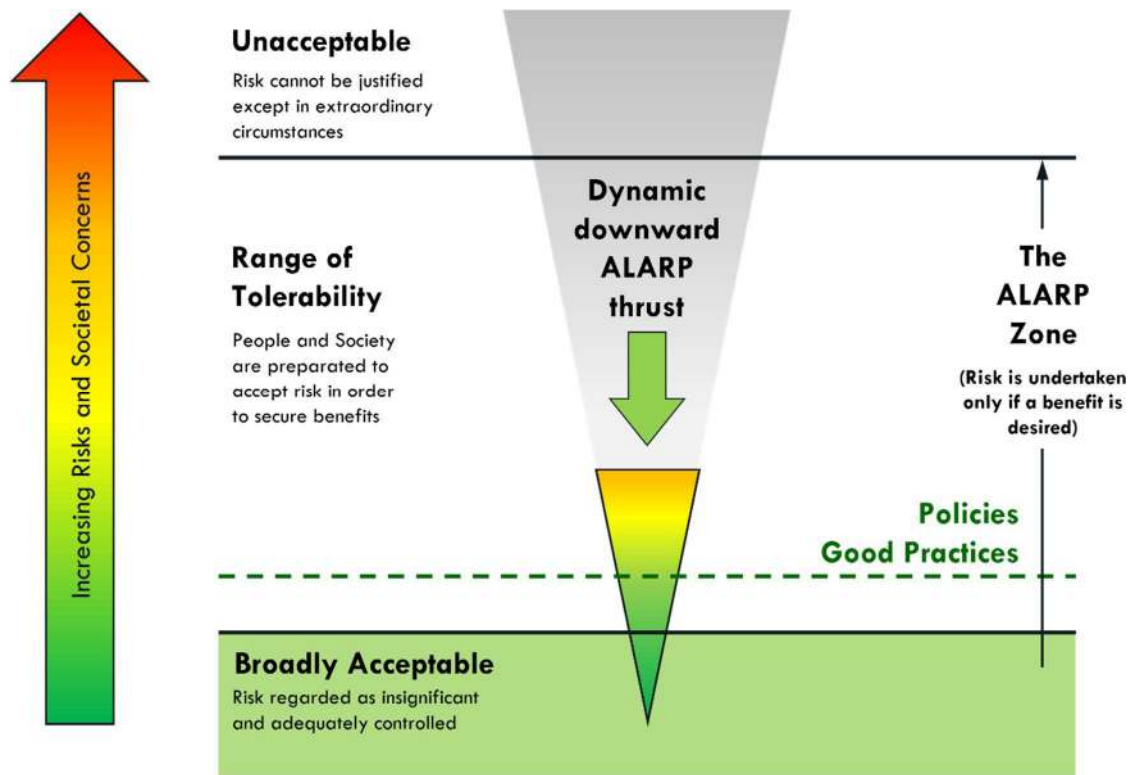


Figure 5: Understanding the ALARP Concept (adapted from Hartford, 2022)

Nevertheless, as it has been seen in recent years, putting this concept into practice is not easy. Considering that there are different points of view on how to implement it, it is difficult to reach a consensus. In fact, in the current scenario, there are groups with divergent positions regarding the ALARP approach. Adding independent lines of review to this process could be helpful in developing a deeper and more complete understanding.

This concept has definitely generated reflection and discussion in the mining industry, since the interpretation and application of this approach may vary according to the regulations dictated by the competent authorities in each jurisdiction, and the internal policies of each mining company.

Beyond Implementation

The process initiated by the launch of the GISTM does not end with the declaration of conformance in its implementation. Mining companies adopting the Standard should develop robust and understandable follow-up mechanisms, similar to the diagram shown in Figure 3.

The GISTM has stressed the importance of having robust governance systems in place (Topic IV “Management and Governance”), ensuring the recording and disclosure of the TSF information (Topic VI: “Public Disclosure and Access to Information”), and emphasizing the need to adopt a continuous improvement approach over time with clearly designated roles. In the other hand, technical causes of TSF failures have been extensively studied, but the same has not necessarily happened for organizational causes (Hopkins & Kemp, 2021). Therefore, having an integral tailings management system, which is periodically reviewed and updated to keep the knowledge base up to date with the current state of art, is essential for safe operation.

Conclusion

The publication of the Global Industry Standard on Tailings Management, GISTM, is a milestone for the evolution of responsible practices in mining, adding the pillars of meaningful participation of affected communities and environmental preservation as a basis for tailings management systems. This has brought significant advances in moving from a prescriptive design to a performance and risk-based approach.

This paper has identified eight key aspects to consider in the process of implementation of the Standard, from a consultant’s point of view, based on Ausenco’s experience in implementation and conformance assessment of the GISTM. Stakeholders’ engagement – including affected communities-, continuous development of knowledge bases, disclosure of operational information and deeper understanding of tailings facilities risks have been recognized as essential elements for safe and transparent management.

Considering the deadline for publication of progress on GISTM implementation for tailings storage facilities with “very high” and “extreme” consequences has already expired, several mining companies have disclosed information on the status at their operations, which has led us to reflect... Does the publication of this information imply that communities are better informed or more involved today? Does this mean that companies are committed to adopt continuous improvement in the implementation of these principles? Have these efforts been focused on involving society or on winning back investors?

Although this first step of implementation has been completed for a number of larger facilities, the task is far from complete. Tailings management is a dynamic field, and therefore it is expected that new knowledge and technologies will continue to emerge. Given the above, it is vital that all stakeholders take a more proactive stance to maintain this process of continuous improvement, truly placing communities at the center, and not wait for another catastrophe to happen before taking action.

Mining companies must develop comprehensive tailings management systems, with clear action plans and robust governance, in collaboration with all stakeholders – communities, governments representatives, consultants, investors, and even other companies – to keep up to date with best practices for safe and

sustainable operation. Let's not forget that the causes of tailings storage facilities failures can also be related to organizational deficiencies, so periodic internal and reviews are vastly valuable and enriching.

In the end, multidisciplinary work and research, innovation, cooperation with a critical view, and a clear long-term vision, are essential to move forward on addressing the current global challenges on the tailings field.

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