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The new ISO standard for mine closure and reclamation planning

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Abstract

This paper provides an overview of the new ISO standard (ISO 21795) Mine Closure and Reclamation Planning. The Standard contains two separate Parts: Part 1 provides key requirements while Part 2 provides recommendations and guidance. The two overarching objectives of the Standard are to provide a key international resource that encapsulates best practices and related guidance across the many areas of specialty involved with planning for mine closure; and to make this available to a wide range of stakeholders, especially for countries with minimal access to best practices and planning guidance. The intended audience for the Standard includes those with responsibility for, or an interest in, planning for mine closure and reclamation. This includes mine planners and designers, mine operators, regulators, environmental assessors, communities, Indigenous Peoples, and financial stakeholders, amongst others. The Working Group that developed the Mine Closure and Reclamation Planning Standard was made up of over 60 experts representing 13 countries, including several developing countries that can benefit from the best practices and guidance encapsulated by these two documents. The two Parts of ISO 21795 have been prepared to cover the lifecycle of requirements, recommendations, and supporting information that apply to mine closure and reclamation planning, including consideration of mine closure and reclamation objectives, technical procedures, consideration and mitigation of socio-economic impacts, financial planning and assurance, unplanned and post-closure activities, as well as data and knowledge management. This paper describes these requirements, recommendations, and supporting information.

Keywords: *standards, mine closure, guidance*

1 Introduction

1.1 Background

In 2016 a new Standard development was launched through the International Organization for Standardization (ISO), led by Canada, to develop an international Standard on the topic of mine closure and reclamation planning. The overarching objective of the project and ensuing international standard was to promote consistency and quality in planning for mine closure and reclamation internationally.

The Standard, formally titled 'ISO 21795', was developed for use by those with a responsibility for, or an interest in, planning for mine closure and reclamation. This would include mine planners, designers, mine operators, regulators, environmental assessors, communities, Indigenous Peoples, and financial stake holders.

The Working Group that developed the standard had representatives from 13 different countries. The Canadian Standards Association (CSA) supported both the Project Leadership and International Working Group by providing the International Secretary for the project. CSA Group also managed a Canadian Mirror Committee to the parent ISO Committee through which ISO 21795 was developed thereby allowing Canada the possibility to adopt this Standard once published. Other countries were able to do the same.

The International Standard ISO 21795 contains two separate Parts: Part 1 which provides the key requirements while Part 2 provides guidance and recommendations.

1.2 The need for an international standard on mine closure and reclamation planning

The development of a mine site can have significant environmental impacts and leave behind a sizable environmental legacy upon closure if adequate controls are not put in place at both the start of the mine and during its operations. Similarly, closing a large mine will have far reaching social impacts with the loss of employment and a local revenue generator, but will also provide opportunities throughout the life of the mine to maximize the potential social benefits of mining and to minimize the impacts once the mining activity ceases.

Although adequate mine closure and reclamation planning is of paramount importance globally, this is especially true when considering the role of mines in lesser developed and developing economies. Often, the effects of such large industrial projects in such regions are exacerbated compared to more developed economies since they have such a more pronounced local impact. In addition, often these countries rely on the best practices employed by the respective mine company in terms of both limiting the environmental impact of the mine site and maximizing the socio-economic benefits of the mining activity.

Advancing best practices with respect to early and continuous planning for mine closure and reclamation and making these widely available, such as through an international standard, is therefore essential to minimize the global environmental impacts of mining and maximize the social and economic benefits. Early and continuous mine closure and reclamation planning can:

- Lead to greater protection of the environment, usually at a lower cost than if mine closure and reclamation planning is not done from the beginning of the mining project.
- Reduce risks and liabilities throughout the mine's operational life.
- Foster stakeholder involvement.
- Help build trust with governments, stakeholders and international communities.
- Allow companies to better integrate closure and reclamation activities with operations.
- Provide time to identify, research and develop new technologies for mine closure strategies and mine closure treatments that increase robustness and resilience of mine closure and reclamation.
- Bolster the provision for and schedule of closure and reclamation funding by companies.
- Help manage the socio-economic impacts as the mining operation ceases.

It is recognized that there are other guidance documents related to mine closure and reclamation planning available in various jurisdictions and used by some mining companies and stakeholders. It was the intent that the international standard would help encapsulate the knowledge of such guidance documents so that this information could be applied globally.

1.3 Objectives of working group and standard

From the outset of the development of the Standard, two broad-based objectives have underlain the work and efforts of the Working Group, including:

1. To provide a key international resource that encapsulates best practices and related guidance across the many areas of specialty involved with planning for mine closure and reclamation
2. To make this available to a wide range of stakeholders, but especially countries with minimal access to best practices and guidance on the topic area

As per the first point above, it must also be recognized that planning for the closure and reclamation of a mine site is very interdisciplinary and subsequently involves a wide range of areas of expertise and

knowledge. For example, this includes the domains of soil science, biology, ecology, hydrology, hydrogeology, water management and treatment, civil, geotechnical and environmental engineering, stakeholder engagement, amongst others. As such, the topic areas covered by this standard are broad and diverse – as detailed in section 3 of this paper.

1.4 Working group membership

The International Working Group developing ISO 21795 had a broad membership in terms of number of countries (13 represented in total) and regions of the world represented, including a number of countries with developing economies that would benefit from both the involvement in the standards development process as well as the best practices and guidance encapsulated by these two documents once published.

The countries involved as well as the number of experts appointed by each country to contribute to the Working Group is provided in Table 1.

Table 1. Country membership and appointed experts contributing to the Working Group

Country	Number of appointed experts
Canada	8
Australia	7
Burkina Faso	4
Chile	2
China	3
Côte d'Ivoire	3
France	2
Iran, Islamic Republic of	1
Korea, Republic of	8
Mali	1
Morocco	1
Senegal	4
United States	2

2 ISO standards development process

The development of international standards through ISO followed a systematic process through six separate stages which allowed for the progressive development of the document. This included a distinct series of activities involving the Working Group developing the content of the standard, a review and ballot of the parent committee to which the working group reports (optional), and one to two reviews and ballots at the international level. The overall process, including the stage and state of the document, is shown in Figure 1.

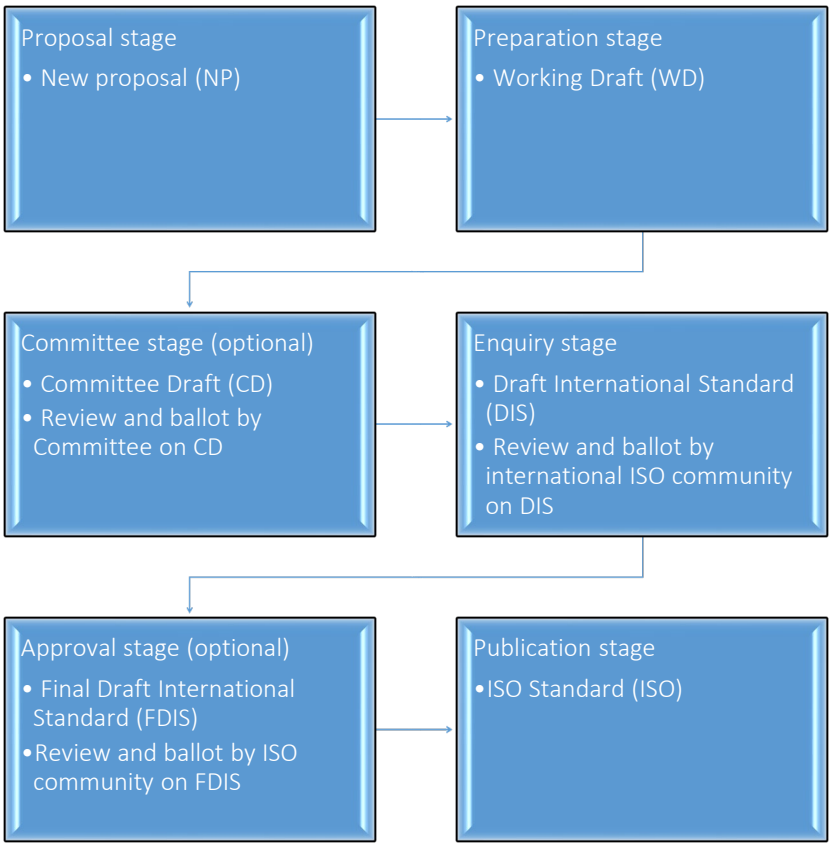

Figure 1 Schematic of ISO development process (ISO, 2007)

The first stage was initiated by a proposal for a new proposal (NP), which involved either a new piece of work based on as little as a table of contents or the adoption of an existing document that was used to initiate the international standard. New international standards are proposed through a specific parent committee with a scope that includes the topic area of the standard. These parent technical committees are made up of members from individual countries that either have voting privileges or act as observing countries to the process. Countries who have voting privileges on a committee can propose new work items; in doing so, they are also responsible for appointing an international convenor who will act to lead the working group responsible for developing the technical content of the standard. New work items are voted upon in terms of their market demand and the relevance of the standard on a global scale.

Another important element of this phase was the creation of the Working Group, composed of international experts who developed the actual content of the standard. The WG was made up of 46 experts from thirteen different countries.

The preparatory stage involved the preparation of the working draft (WD) of the standard. This work was done within the relevant ISO working group.

After the WG was satisfied on the technical merits of the working draft, this document was put forward to the Working Group's parent committee for comment and vote. Although technically this stage is optional, most new standards go through this stage. This stage, which is termed the committee stage of the development process, is where each participating member country registered its official comments and votes on the WD: a yes vote means that the working draft meets the requirements to move on to the next phase. Successive committee drafts may be considered until consensus, which is reached when at least two-thirds of the P-members register a yes vote. Once agreed upon, the text is finalised for submission as a draft international standard (DIS).

The fourth stage, or the enquiry stage, involved the DIS being circulated by ISO to all the member countries of ISO for voting and comment over a three-month period. This was the second voting stage. The member countries, in turn, were encouraged to make the DIS text available to the widest range of national stakeholders possible in order to obtain the national vote of each member body. In general, the text is approved if two-thirds of the working group members of the committee under which the work item falls vote in favour and if not more than one-quarter of the total votes cast are negative.

The fifth stage of development was the approval stage. This involved the Final Draft International Standard (FDIS) being circulated to all ISO member bodies for a final two-month yes or no vote. The text is approved for the final stage, the publication stage, using the same criteria as for the enquiry stage. The final document was then published by ISO as an official ISO international standard.

The ISO standards development process has been structured in such a way so to allow for, and ultimately encourage, the widest possible participation and consultation of experts and stakeholders involved. From the start, an international working group was comprised of individuals with expertise on mine closure or the various science, social science, or engineering disciplines associated with mine closure. This was meant to encourage unfettered input of technical content as a starting point for the standard.

The successive review and commenting stages were structured to encourage a progressively widening consultation process. The broadest of these stages was at the enquiry stage when the ISO document under development was made available to all member bodies of ISO. ISO is made up of 121 member countries that can vote on ISO standards. This means that 121 countries will ultimately be given access to the standard and encouraged to seek the input of stakeholders in these countries to inform their national position.

International standards developed through ISO are developed following a consensus-based approach, whereby consensus amongst member countries is sought at multiple stages. This process of consensus building helps ensure unbiased content and technical integrity of the standard being developed.

Consensus building starts at the very beginning of the ISO standards development process, where new work items being proposed will only pass if a majority of the voting countries of the particular committee approves the work item. At the working group level, consensus building is focused on developing the technical content of the work item and does not involve voting; during the committee stages of review, consensus is sought through reviewing, commenting, and voting on the document. This occurs at three distinct stages, namely, at the committee, enquiry, and approval stages, as discussed above.

3 ISO 21795: A two-part standard on mine closure and reclamation planning

3.1 Introduction

Through the development process of ISO 21795, it became evident that there are key requirements for both mine closure and reclamation planning, and related guidance and information spanning the multiple aspects involved with planning for the closure and reclamation of a mining site. As such, ISO 21795 had been organized into two distinct Parts. Part 1 provides key requirements (i.e. ‘shalls’) for effective mine closure and reclamation planning, while Part 2 contains no requirements but guidance (i.e. ‘should’, ‘can’, ‘may’) as well as supporting information.

Each Part can be used on its own and adopted individually by member countries. Since Part 1 contains requirements, it can also be used for the purpose of assessing compliance with the Standard. Since Part 2 contains only recommendations, it is not used for compliance assessment.

The two Parts therefore have distinctly different intentions in terms of the ultimate potential use. It is intended that Part 1 be used by both industry and other stakeholders to help foster consistency in the use of key best practices in planning the closure and reclamation of a mine site. Further, it is hoped the standard can be used to support proactive mine closure and reclamation planning that can be assessed for the

purposes of compliance. Part 2 is meant to be a resource that provides detail on some of the complexities involved with mine closure and reclamation planning. The intent is that countries as well as other stakeholders that do not have access to best practices spanning the interdisciplinary and diverse practice of mine closure and reclamation planning will benefit from this support.

In general, neither Part of ISO 21795 is meant to provide detailed survey, testing or monitoring methods, detailed engineering procedures, detailed product requirements, or detailed construction and operational procedures. Occupational health and safety management related to closure and reclamation, construction and exploration activities are also excluded.

Finally, a decision was also made that the standard is not intended to be applied to closure and reclamation of abandoned mines. A separate standard is under development through ISO TC 82/SC7 on the topic of abandoned mine management.

3.2 Part 1 requirements

As highlighted earlier, Part 1 of ISO 21795 provides key requirements for mine closure and reclamation planning. It does so by first providing a framework meant to help lay out the major 'building blocks' of mine closure and reclamation planning, as shown in Figure 2:

Figure 2 Mine closure and reclamation planning framework

Each framework element is further explained below.

- *Responsibility*: Inherent to the entire mine closure and reclamation planning process is company responsibility, which includes engagement with stakeholders. Of critical importance is financial management and provisioning for closure.
- *Integration*: Mine closure and reclamation planning is an integral part of the mining life cycle, and includes establishing physical and chemical controls for sustainable land and water use. Mine closure and reclamation is required to be resilient. Managing the socio-economic transition from

operations to closure is paramount. Engagement with stakeholders on mine closure and reclamation is also a critical element.

- *Design*: The closure design process is focused on meeting closure and reclamation objectives which in turn are developed in consultation with stakeholders. Robust life cycle design is needed to achieve successful long-term mine closure and reclamation.
- *Risk and opportunity assessment and management*: This process is essential to identifying and managing mine closure and reclamation risks and identifying and acting on opportunities that arise throughout the mining life cycle.
- *Evaluation and improvement*: Quality assurance provides for maintaining the mine closure and reclamation planning standards established for the corporate and operational level. The process of adaptive management facilitates continuous improvement through the life of mine.
- *Knowledge*: Developing knowledge, filling identified data gaps, and managing, disseminating, and retaining knowledge and data that support mine closure and reclamation planning throughout the life of mine and beyond is essential.

The objective of the Part 1 chapters is to develop cost-effective mine closure and reclamation plans and designs that can be implemented and that address the needs of regulators and stakeholders. The outcome of closure planning is a documented mine closure plan that provides a record of planned activities and how they were arrived at. The plans are endorsed by the mine operator's senior management. Since conditions and operations can change over time, these plans shall be updated as necessary.

Part 1 chapters are as follows:

Chapter 1. Mine closure and reclamation plan objectives and commitments

Chapter 2. Technical procedures and techniques, including the following sections:
- 2.1 Mine site characterization
- 2.2 Physical and chemical stability
- 2.3 Contaminated media
- 2.4 Infrastructure decommissioning and disposal
- 2.5 Post-closure land use plan
- 2.6 Alternatives and opportunities analyses
- 2.7 Reclamation
- 2.8 Progressive mine closure and reclamation
- 2.9 Mine closure and reclamation schedule
- 2.10 Mine closure and reclamation cost estimate
- 2.11 Management of risks and opportunities

Chapter 3. Mitigating socio-economic impacts

Chapter 4. Financial assurance and associated planning

Chapter 5. Mine closure and reclamation planning for unplanned closure

Chapter 6. Post-closure management plan

Chapter 7. Mine closure and reclamation plan documentation

3.3 Part 2 guidance

Part 2 of ISO 21795 has much more technical detail. This was intentional as key technical details are combined into one document and will be useful for those without access to all the various sources. The guidance is composed on industry good practice based on proven best methods.

The purpose of chapter one is to provide key considerations when assessing and designing the main mine site components requiring closure. Not all these components are at all sites but the components in the standard are the most common issues where the most experience exists.

The purpose of chapter two is to describe the land reclamation and landform considerations as the closure assessment and designs are developed. Because of the interaction of water with landform and reclamation water management is included in this section. Water management includes water balance and clean water diversions as well as passive and active treatment.

Chapters three describes best practices in stakeholder engagement. This covers a few approaches of how stakeholder engagement is implemented across the lifecycle of the project.

Finally, chapter four covers various supporting tools to be used as the closure plan is developed. It is helpful to have some commonly used tools when determining design levels, cost estimating, options analysis, and performance monitoring. Risk management techniques and adaptive management concepts are also described to support operations as well as decision making.

Recommendations and guidance are provided in the following chapters provided in the guidance document of the Standard:

Chapter 1. Closure and reclamation of mine site:

1.1 Tailings storage facilities
1.1. Water storage facilities
1.2. Waste rock management facilities
1.3. Heap leach facilities
1.4. Open pits
1.5. Underground workings
1.6. Mine infrastructure
1.7. Temporary closure

Chapter 2. Land reclamation and water management:

2.1 Landforms
2.2 Surface preparation
2.3 Vegetation establishment
2.4 Water management
2.5 Covers
2.6 Climate change effects

Chapter 3. Stakeholder engagement

Chapter 4. Decision and analysis tools:

4.1 Design levels
4.2 Alternatives identification and analysis
4.3 Designing and operating for closure and reclamation
4.4 Risk assessment and management

4.5 Cost estimating
4.6 Performance monitoring and reporting
4.7 Adaptive management
4.8 Application to the long-term care phase

4 Conclusion

The ISO 21795 Standard, Mine Closure and Reclamation Planning was published in 2022 and is available for global industry and governments. In this paper we have provided the background, ISO context, and content overview of the new international standard on mine closure and reclamation planning (ISO 21795 'Mine Closure and Reclamation Planning'). The intent is that it will help support mine closure and reclamation planning activities globally, thereby bolstering sustainability, environmental protection, and the local economies and communities that depend on mining.

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References

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