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Relinquishment of Closed Mine Sites:

Policy steps for governments

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Relinquishment of Closed Mine Sites: Policy steps for governments

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Introduction

Mine closure policies and practices have advanced over recent decades, and most governments now recognize that closure is essential to sustainable mining and to the future of communities, and the environment affected by former mine sites. However, current practices fall short of achieving final closure, as mine sites are left in the hands of mine operators indefinitely, without a pathway to relinquish the site to the next landowner and to realize post-mining land uses, or as sites are relinquished without plans or funds to monitor and manage the site after closure and ensure those post-mining land uses are achieved.

Relinquishment, which is the legal transfer of responsibility for a closed mine site from the operator to the next landowner after all closure activities have been completed, is an important but generally absent consideration in modern mine closure policies or processes. There are limited global examples of successfully relinquished mines and few well-developed government policies on relinquishment, despite both industry and governments recognizing its importance to the current and future sustainable management of mineral resources.

This report reviews the concept of relinquishment and provides a high-level scan of global practices and policy. This is followed by a discussion of some of the challenges and key considerations that governments should take into account when developing relinquishment protocols. It concludes with a series of recommended steps to relinquishment that involve the following: 1) requiring comprehensive closure plans; 2) completing an independent inspection or audit of completed closure activities; 3) requiring a residual risk monitoring and management plan; 4) establishing a relinquishment funding mechanism; 5) executing legal transfer of the closed site; and 6) implementing the monitoring and management plan. Implementation of these steps will allow both industry and government to achieve relinquishment of mine sites and realize post-mining land uses for the benefit of communities and the environment.

Table of Contents

1.0 What Is Relinquishment, and Why Is It Important to the Post-Mining Transition?

Relinquishment is defined as the legal transfer of the responsibility for a closed mine site from the mine operator to government or the next landowner, after all closure commitments have been fulfilled and approved by the regulator. It is a concept that can apply to mines at all scales, but in this report, large-scale mining is the primary consideration.

The definition of relinquishment has three main aspects:

1. the legal transfer of mineral and land tenures such that the mine operator is no longer legally responsible for the site subject to other laws or legal requirements that may hold a company liable for impacts after relinquishment;
2. the transfer is to a clearly defined next landowner or manager who will take over responsibility for the site, including any known or unknown residual risks and liabilities; and
3. transfer occurs only after the mine operator has completed all closure activities and met completion criteria as defined in an approved closure plan, the closure has been signed off on by the appropriate regulatory authority, and funding is ideally in place for monitoring and to manage residual risk.

Residual risk or liability is an important aspect of relinquishment. It is defined here as the risk or liability that remains after all closure activities have been completed. It includes monitoring and maintenance to ensure that completed closure work has achieved (and continues to achieve) closure objectives, and future risks that were unknown at the time of closure and are identified through post-closure monitoring or through an unexpected event. As such, it could include known liabilities such as water or geotechnical stability monitoring or management of invasive weeds; unforeseen risks and liabilities, such as unusual weather events; or where completed closure work did not perform as expected, such as the failure of a waste rock pile.

Relinquishment provides benefits to governments and industry and is important to successfully achieving the post-mining transition for several reasons, including:

Meeting the Principles of Sustainable Development

Mining should be a temporary use of the land that with properly executed closure and relinquishment can provide for people and the environment both today and in the future. Without relinquishment, the land remains in the hands of the mine operator and may not be able to fully transition to alternative post-mining land uses.

Incentivizing Mine Operators

Without relinquishment, mine operators are left managing mine sites indefinitely. This may limit the incentive to apply the resources necessary to fully close mine sites to the highest standards since they are left holding the site.

Avoiding Mine Abandonment

Mine operators who hold a closed mine site with no end in sight to their obligations may abandon the mine or dissolve through a business closure or bankruptcy.

Improving Competitiveness

Clear relinquishment policies and processes are considered a distinct advantage by industry. Those jurisdictions that have implemented these processes are more attractive and competitive. Communities are also much more likely to support mining when there are clear processes to return mined lands to productive and environmentally sound post-mining uses.

Despite the benefits outlined above, relinquishment may not be the best option for some mine sites. For example, mine operators (or governments) may wish to retain a closed mine site in a state of care and maintenance if it hosts additional mineral resources that could be exploited in the future (e.g., re-mining of tailings). It may also be unrealistic to relinquish sites that contain significant residual environmental, social, or safety risks and liabilities. This could include ongoing water treatment or geotechnical instability, or where there is no clear future landowner, or the landowner is unable to take over the site. Some governments are also concerned that complicated relinquishment requirements may be too difficult to manage by government and could be seen as onerous by industry and thus impact jurisdictional competitiveness.


Photo: Sibanye-Stillwater

2.0 Global Scan and Case Studies

Global practices, policies, and regulations on mine relinquishment were reviewed for more than 40 countries or mining jurisdictions for this report, through online research, discussions with representatives of mines ministries and industry, and through a survey of IGF members. This includes provinces and states in Canada, the United States, and Australia and countries in Africa, the Caribbean, Central America, South America, Europe, and Asia.[1]

This fulsome review revealed that there are very few jurisdictions that provide clear and achievable processes for the relinquishment of closed mine sites and that many jurisdictions do not reference relinquishment at all within their mining or closure policies.

A number of jurisdictions are in the process of updating and modernizing closure practices, but to date, many of those jurisdictions have not considered relinquishment in these updates. Nevertheless, discussions held with government representatives highlighted the importance of relinquishment to sustainability, to avoid an increasing number of abandoned mines, to limit future liabilities to government, to support acceptance of future of mines, and to support regional development plans and opportunities for communities and the environment in the future.

Among the jurisdictions that do reference relinquishment, it was noted that there are commonly two scenarios. At one end are some less developed mining jurisdictions that allow for relinquishment after somewhat limited site inspection and with little or no post-closure monitoring or legal responsibility remaining with the mine operator. While relinquishment is achieved, current and future environmental stability of the site is unclear, and no financial

1 Countries and jurisdictions investigated for this report include British Columbia, Alberta, Yukon, Saskatchewan, Ontario, Alaska, Nevada, Western Australia, Queensland, South Australia, Brazil, Chile, Argentina, Mexico, the Dominican Republic, Suriname, Panama, Jamaica, Burkina Faso, Cameroon, the Republic of the Congo, Côte D-Ivoire, Gabon, Guinea, Liberia, Mali, Morocco, Mauritania, Niger, the Democratic Republic of the Congo, the Central African Republic, Senegal, Chad, Togo, Tunisia, Lesotho, Georgia, Kazakhstan, Iran, Saudi Arabia, Germany, France, Poland, Indonesia, Cambodia, Papua New Guinea, Thailand, and the Philippines.

provisions are provided to address future issues. At the other end of the spectrum are more developed mining jurisdictions that outline what is needed to attain relinquishment, but where it is difficult to achieve due to government risk aversion, unclear or undefined processes, uncertain post-relinquishment management protocols, and an inability to arrive at a suitable financial provision for residual risk. Most countries that reference relinquishment fall between these two scenarios by requiring some level of inspection and monitoring before relinquishment and stipulating that legal responsibility for the site is maintained by the operator for a number of years after closure. However, few jurisdictions require post-closure funding or financial assurance.

A small number of jurisdictions have modernized their relinquishment policies in recent years and are working to integrate relinquishment with overall mine closure practices. Three good examples are Saskatchewan, Queensland, and Chile.

Saskatchewan, Canada, has one of the best-developed and -implemented processes for the relinquishment of mines, which includes clear approval of completed closure activities by the regulator, a period of post-closure monitoring of typically 10 or more years, and a relinquishment funding mechanism to cover future monitoring and maintenance costs as well as for unforeseen events. The process, called the Institutional Control Program, has been in place and governed by legislation since 2007, and there are 30 closed mines in the program as of January 2022 (Government of Saskatchewan, 2023). See Box 1 for additional information on this program.

Queensland, Australia, uses a process for the closure and final relinquishment of mines that is achieved through the surrender of an Environmental Authority, which involves submission and approval of a final rehabilitation report and a post-surrender management report (Queensland Government, 2020a). A residual risk assessment is also required along with payment to cover all potential costs and expenses associated with managing and protecting the environment at the site after the Environmental Authority has been surrendered (Queensland Government, 2020b). The estimated costs and expenses include management activities (such as monitoring and maintenance) as well as credible risk events that may require remedial action. The cost estimation must be worked out in a "stated" way based on the risk assessment and discussed with the authority prior to submission (Queensland Government, 2020b). Funds are administered by the state and must be received before the Environmental Authority can be surrendered. The Queensland Government is currently working on a residual risk calculator that can be used for this cost estimate, but it has not been released as of June 2023.

Chile has addressed post-closure aspects in its modern mine closure law that came into effect in November 2011 (Law 20551, 2020). The law requires that a mine closure plan include details of the site after closure, including monitoring and control measures and the expected duration and costs of these measures, all supported by a risk assessment (SERNAGEOMIN, 2020). Approval of final closure and issuance of a closure compliance certificate includes an audit to ensure the completed closure work meets the details of the approved plan and that post-closure measures and costs are appropriate. Law 20551 also requires that a fund is established to cover the costs associated with post-closure monitoring and control measures. The fund is to be managed by an independent financial institution, and the mine operator is required to make a non-refundable contribution to the fund equal to the present value of the cost of post-closure activities for the duration outlined in the closure plan. While the final audit and contribution to the fund allows for the relinquishment of the mine site, no mines have made this transition as of June 2023. It is also noted that relinquishment

is unlikely where there are significant ongoing liabilities, such as water treatment (Golder Associates Ltd., 2021).

Within the literature, several recent publications discuss relinquishment and its challenges and provide case study examples. This includes Tiemann et al. (2019) and Tiemann et al. (2022), who review Australian relinquishment policies and provide policy recommendations; Beer at al. (2022) and Limpitlaw and Briel (2014), who review post-mining land uses that support relinquishment and discuss a number of case studies; and Sanders and Murphy (2019), who discuss challenges moving from progressive reclamation to relinquishment with a focus on the regulatory framework in British Columbia. Several publications also proposed a high-level process for relinquishment. These include Cowan et al. (2013), who review Canadian case studies and outline a five-step decision-making process for relinquishment, and the Commonwealth of Australia (2015), which outlines steps that could be used as a guide for the sign-off process with regulators and stakeholders. The Government of Western Australia (Department of Mines, Industry Regulation and Safety, 2021) has also produced guidelines on the evidence required to demonstrate completion of mine closure in order to achieve relinquishment.

BOX 1. SASKATCHEWAN'S INSTITUTIONAL CONTROL PROGRAM

The Canadian province of Saskatchewan has one of the best-developed processes for the relinquishment of closed mine sites, referred to as the Institutional Control Program (ICP). The ICP was established by the Reclaimed Industrial Act in 2007, and, as of April 2022, there are 30 former mine sites in the program (Saskatchewan, 2022). The aim of the program is to ensure protection of the environment for the health, safety, and well-being of future generations; provide greater certainty for the mining industry; and set out the conditions and funding mechanisms under which the Government of Saskatchewan will take over responsibility for a closed mine site. The program currently only applies to government-owned lands (referred to as Crown Land), and mine operators can elect to enter into the program—it is not a requirement of mine operation or closure.

The ICP has the following key elements:

- A mine site can only be accepted into the ICP once all closure activities outlined in the decommissioning and reclamation (closure) plan have been completed and approved by the regulator.
- A comprehensive post-closure monitoring program, with a typical minimum period of 10 years of active monitoring, is required before a site is accepted into the ICP. This is to provide assurance that the closure works have met their objectives as defined in the decommissioning and reclamation plan.
- The ICP comprises a Registry and two funds, called the Monitoring and Maintenance Fund and the Unforeseen Events Fund. The Registry maintains a formal record of accepted closed sites and manages the funds and accounts for any required monitoring or maintenance activities.
- The Monitoring and Maintenance Fund covers costs associated with expected long-term monitoring and maintenance of the site (such as inspections and sampling), and the Unforeseen Events Fund will cover unforeseen future event costs (such as a flood).

- Funds are managed separately from the provincial general revenue fund and overseen by an advisory committee that comprises staff from the Ministry of Energy and Resources, current mine operators, and representatives from the Saskatchewan Mining Association.
- The contribution to the Monitoring and Maintenance Fund is the present value of future costs associated with monitoring and maintenance activities. The amount is proposed by the mine operator based on an understanding of expected costs from many years of active monitoring and maintenance activities and approved by the regulator. As of April 2022, this fund has an approximate value of CAD 620,000 (Saskatchewan, 2022).
- The contribution to the Unforeseen Events Fund is set at 10% or 20% of the amount required for the Monitoring and Maintenance Fund. It is 10% for sites without tailings or engineered structures and 20% for those with tailings or engineered structures (such as underground mine workings). This is a pooled fund that can be used to address an unforeseen event at any of the sites in the program. As of April 2022, this fund has an approximate value of CAD 95,000 (Saskatchewan, 2022).
- Financial assurance, equal to the cost of a maximum failure event, is still currently required at closed sites in the ICP. The intention is that once the pooled Unforeseen Events Fund grows to a suitable amount, then financial assurance may no longer be required.
- The legislation that governs the ICP also provides a mechanism to transfer the responsibility associated with a site to a new operator who agrees to and has the capability to take on site responsibilities so that new economic opportunities may be explored.
- Entry into the ICP does not fully release the mine operator from future legal obligations under the "polluter pays" model. If an unforeseen event occurs, an investigation is undertaken to determine cause and responsibility. Funding to address the event may be required from the mine operator, the Unforeseen Events Fund, or the province.
- In situations where there is an increase in regulatory standard or requirement after the site has entered the program, costs would be categorized under "unforeseen event" and charged to that fund.

Saskatchewan's ICP contains thorough protocols for facilitating the relinquishment of mine sites back to the government. The program provides a funding mechanism, managed by a third party, for ongoing monitoring and maintenance as well as for any unforeseen future events and a process for the redevelopment of a relinquished site in the future. The program is continuing to mature with the addition of new sites in 2022 and potentially multiple new sites in 2023. An excellent detailed summary of the ICP program as well as annual reports and records can be found on the ICP website (Saskatchewan, n.d.).

3.0 Key Considerations to Achieving Relinquishment

Discussions with government and industry representatives and a review of government policies and published literature have identified a number of considerations and challenges that governments should take into account when developing or implementing relinquishment policies and processes. Relinquishment cannot occur without first ensuring that modern closure regulations and guidance have been adopted and enforced. Relinquishment occurs at the end of the closure regime, and thus it is necessary for jurisdictions to have current and comprehensive closure policies in order to facilitate relinquishment. As part of this, the key issues for relinquishment that require consideration include requiring closure plans and post-closure monitoring; selecting post-mining land uses that support relinquishment; accepting and managing risk; assessing residual risk and costs; requiring post-closure funding; establishing legal processes for relinquishment; and effective coordination between regulatory authorities and government departments. These are discussed below.

Closure Plans, Completion Criteria, and Monitoring

Relinquishment follows implementation, completion, and approval of the activities defined in a closure plan. As such, comprehensive closure plans with well-defined objectives, activities, and completion criteria are a pre-requisite to relinquishment. Poorly designed or unrealistic closure activities that cannot achieve physical or chemical stability or where long-term maintenance and treatment are required create challenges with approving final closure and, in turn, relinquishment. Likewise, completion criteria need to be well constructed so that mine operators can demonstrate the success of their closure work and regulators can approve and sign off on closure. Consideration needs to be given early on to the long-term viability of the closure activities outlined in the plan and the residual risk that may remain after these activities have been completed. Use of leading global standards, progressive reclamation, and early implementation of closure activities all support successful closure and relinquishment, as does avoidance of closure objectives that involve long-term management (e.g., active water treatment).

Monitoring is also important. It was noted that many jurisdictions require limited post-closure monitoring that is insufficient to ensure closure activities are performing as planned and to assess residual risk. Completion criteria should have a temporal component that can only be achieved through a reasonable period of post-closure monitoring. For example, the completion criteria for a reclaimed waste rock facility could include a component where monitoring must show no physical instabilities above defined thresholds for at least 5 consecutive years after the completion of reclamation activities. Queensland recommends that there is a minimum of 5 years of monitoring for grazing land and a minimum of 15 years for native ecosystems that contain tree species in order to demonstrate sustainable growth of reclaimed land (Queensland Government, 2020b).

Post-Mining Land Uses

Selection of post-mining land uses is one of the most important elements of closure planning, as many closure activities are defined based on the next use of the land. For relinquishment, these land uses should include clear identification of, and be compatible with, the post-mining landowner or manager who will take over responsibility for the site. Consideration should also be given to land uses that continue active use of the site and, where possible, generate revenue that could reduce closure liabilities and offset monitoring and maintenance costs. These potential land uses might include development of solar power facilities, use of waste rock for aggregate, use of site water for irrigation, leasing parts of the site to legally registered small-scale miners, and repurposing facilities for training, warehousing, or business ventures.

Risk Acceptance and Management

Even the most successfully closed mine sites have residual risk and liability. This risk needs to be assessed, accepted, and managed by governments, industry, and stakeholders for relinquishment to be a reality. However, discussions with industry and government representatives for this report indicated that there is often an unwillingness or a lack of process for governments and stakeholders to accept residual risk, particularly in well-developed mining jurisdictions. This unwillingness is likely borne from legacy issues at historically closed mines, the challenge of identifying and costing residual risks for issues that might not arise until well into the future, and a lack of political will, transparency, and effective public policy and processes. Governments should make an effort to develop relinquishment processes and funding solutions that reduce risk and allow for acceptance of relinquishment while recognizing that some risk will always remain. Involvement of all relevant government departments and stakeholders in closure planning, implementation, and risk assessment is needed for broad-based acceptance of residual risk.

Residual Risk and Post-Closure Funding

Assessment of residual risks and provision of funding to cover those risks are some of the biggest challenges with achieving relinquishment. Residual risk can be divided into two

main aspects: monitoring and maintenance to ensure the closure works have achieved and continue to achieve closure objectives; and future risks that were unknown at the time of closure and are identified through post-closure monitoring or through an unexpected event.

Post-closure monitoring and maintenance costs can be based on the known costs for these activities prior to relinquishment. For example, in Saskatchewan, post-closure monitoring for a minimum of typically 10 years prior to relinquishment allows for a good understanding of future monitoring and maintenance costs. The types of monitoring and maintenance activities will vary from one mine site to another, but could include surface and groundwater monitoring, geotechnical assessment of containment structures and waste rock storage facilities, measurement of revegetation progress, and site security.

Estimating costs for unknown events is much more difficult and requires a costing methodology supported by a risk assessment. Queensland is developing a calculator that identifies the risk to different types of closure works (for example, the method used to close a mine shaft) and assigns a discounted future cost to address the potential failure of that feature. Saskatchewan, on the other hand, applies a set cost for future unknown events at 10% or 20% of monitoring and maintenance costs depending on whether engineered structures (such as mine tailings dams) are present or absent at the closed mine site.

Funding for post-closure costs incurred by the mine operator also presents challenges. In contrast to most financial assurance mechanisms for operating mines, post-closure funding provided by the mine operator is generally non-refundable and may need to be managed indefinitely. Consideration will need to be given to how long monitoring and maintenance activities will be needed, whether future costs are discounted to a present value, what form the funding should take, and who will hold and manage the funds.

Legal Processes for Relinquishment

A well-defined legal process that facilitates the transfer of responsibility for a closed mine site from the mine operator to the next landowner is a necessary requirement for relinquishment. However, this is lacking in most jurisdictions, including those that consider relinquishment in their mining regulations. For example, in British Columbia, relinquishment is referenced in the Health, Safety and Reclamation Code for Mines (Section 10.7.2; Ministry of Energy, Mines and Low Carbon Innovation, 2022), but there is no guidance or process document for how relinquishment can be achieved. Additionally, while release from further obligations under the Mines Act is provided for in the Code, it is not clear if the mine operator would be released from other legal acts or regulations (for instance, those under the British Columbia Contaminated Sites Regulation). Sanders and Murphy (2019) state that they are not aware of any sites in British Columbia that have been relinquished under the current framework. The challenge outlined above extends to other major mining jurisdictions such as those in Australia. Tiemann et al. (2022) note that despite improvements in mine closure and relinquishment policies over the past few decades, “there is still no multi-agency regulatory policy framework integrating mine closure and relinquishment in any Australian jurisdiction” (para. 2). An additional challenge is that other laws or legal precedent in countries such as Australia and Canada may dictate that the mine operator is liable for future environmental issues even if they were unknown at the time of relinquishment and government has taken over and accepted responsibility for the site.

Coordination Between Regulatory Authorities

Final approval of closure activities and relinquishment of mine sites often involves a number of different regulatory authorities, ministries, and laws or regulations. This could include the need to relinquish mine, water, and land-use permits, environmental or health and safety authorizations, and transfer of land ownership and site responsibility from one government authority to another. Industry has noted that there is often a lack of coordination between the various governmental authorities, leading to delays or difficulty in achieving relinquishment. A clear process that outlines responsibilities and steps for each authority and where each authority should be involved from the early closure-planning stages is necessary.

4.0 Recommendations—Steps to Relinquishment

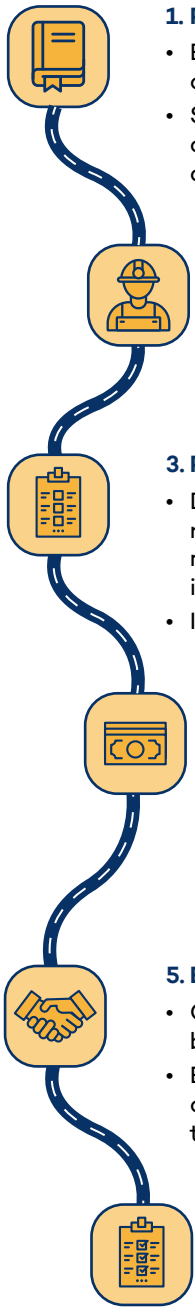
Considerable work is needed by government and industry, in collaboration with communities, to complete the mine life cycle and achieve the principles of sustainable development by implementing processes and policies for relinquishment. At present, effective relinquishment regulations are hampered by a lack of fundamental mine closure policies, such as the requirement for well-developed closure plans, an aversion to accepting any level of risk, failure to layout provisions for post-closure funding, and the absence of clear legal processes that outline procedures and responsibilities for government, industry, and landowners.

To support governments with the development and implementation of relinquishment, a series of recommended policy and process steps are outlined below. Some of these steps are fundamental to good closure practices (e.g., closure plans and final inspections), and others are specific to relinquishment, such as residual risk assessment and funding. While these steps are considered good practice, it is recognized that many jurisdictions may not be ready to fully implement every step. Governments should strive to implement those steps or components of each step that are realistically achievable given capacity, experience, and resources, and improve on those initial steps as is practical. However, time is of the essence. Many jurisdictions are facing multiple mine closures in the coming years, so the sooner policies and processes are implemented, refined, and improved, the more prepared jurisdictions will be for not only the closure of existing mines but for the new mines that will open, to address the need for metals and minerals for the low-carbon economy.

The following six steps to relinquishment are discussed below and summarized in Figure 1:

1. Require comprehensive closure plans.
2. Complete independent inspection and approve completed closure activities.
3. Require a residual risk monitoring and management plan.
4. Establish a relinquishment funding mechanism.
5. Execute a process for legal transfer of closed sites.
6. Implement a residual risk monitoring and management plan.

FIGURE 1. Steps on the pathway to relinquishment



1. Require comprehensive closure plans

- Ensure regularly updated closure plans are required in regulations and provide guidance on their development and implementation.
- Support progressive reclamation and require closure completion criteria that include a period of monitoring before they can be achieved.

2. Complete independent inspection and approve final closure

- Require an independent inspection or audit of closure activities after an appropriate period of monitoring.
- Involve relevant government ministries, post-mining landowners, and other stakeholders with rights over the relinquished site.

3. Require residual risk monitoring and management plan

- Define monitoring and maintenance requirements after relinquishment and how they will be managed. Include maintenance or equipment replacement that may occur well into the future.
- Include a cost estimate to implement the plan.

4. Establish relinquishment funding mechanism

- Secure funding to implement the residual risk monitoring and management plan.
- Recognize that funds may be required for decades.
- Consider a range of options including retaining mine financial assurance, pooled funds, use of third-party management, and transfer of site responsibility to a new owner.

5. Execute process for legal transfer of closed site

- Complete transfer of the site to the next landowner, who should be prepared to accept responsibility for the site.
- Ensure legal liabilities of the mine operator and next landowner are clearly defined, including any legal liabilities that remain with the mine operator and cannot be extinguished.

6. Implement residual risk monitoring and management plan

- Implement the plan, maintain an oversight role, and ensure issues are addressed according to the plan.
- Support landowners and communities with achieving post-mining land uses.

1. REQUIRE COMPREHENSIVE CLOSURE PLANS

The first step to achieving relinquishment is the requirement that mine operators prepare and maintain a comprehensive closure plan across the mine life that is developed in consultation with communities, stakeholders, and government and approved by regulators. Closure plan requirements should be the foundation of policy and guidance for the post-mining transition. Without a closure plan, there is no definition of what closure should look like or criteria to define when closure has been achieved and, by extension, no framework for approving relinquishment. Key aspects of closure plans that support relinquishment include well-defined completion criteria that are often time-bound and require a period of monitoring before they

can be achieved and post-mining land uses that are compatible with the next landowner and, where appropriate, include continued use of the site, reduce residual risk, and generate revenue to offset long-term monitoring and maintenance costs. Good reference sources for governments on mine closure, including closure plans, are the *Mine Closure Checklist for Governments* (Asia-Pacific Economic Cooperation, 2018), *Mine Closure: A Toolbox for Governments* (World Bank, 2021), and *Integrated Mine Closure: Good Practice Guide* (2nd ed.) (International Council on Mining and Metals, 2019).

2. COMPLETE INDEPENDENT INSPECTION AND APPROVE COMPLETED CLOSURE ACTIVITIES

A well-defined process should be in place to complete an independent inspection or audit of closure activities and approve them according to the completion criteria defined in the closure plan. This should take place after an appropriate period of monitoring as defined in the closure plan and undertaken in collaboration with the mining regulator, other government agencies, and post-mining landowners and users. Progressive reclamation throughout the mine life will support this process, as some of the closure work will have been completed, monitored, and approved well before a final independent inspection.

Independent Inspection or Audit

Mine closure can be a complex undertaking that requires a wide range of expertise and experience. Governments should require an independent final inspection or audit of closure activities by national or international experts. Even where government and regulators have the expertise to review all aspects of closure, it is recommended that an independent review is undertaken. It is also reasonable that the cost of this independent inspection is paid for by the mine operator—something that should be clearly defined in closure regulations or authorizations.

Collaboration With Other Agencies and Responsible Parties

The government ministry or agency responsible for mining should ensure that other government authorities, the next landowner, and any other parties with rights or responsibility over the relinquished site are integrated into the inspection and approval processes. In fact, collaboration and engagement with these entities should occur much earlier, when mine closure plans and post-mining land uses are being developed, and continue through to a final inspection. This will ensure that all post-mining landowners approve closure and are prepared for their responsibility after relinquishment.

Sites That Require Ongoing Management

Monitoring and inspection of mine sites working toward final closure may identify issues that will require ongoing active management for the foreseeable future (such as water treatment) or where the defined completion criteria cannot be achieved. Where possible, these issues should be addressed through corrective action before relinquishment. However, some issues could be integrated into the residual risk assessment and monitoring and management plan so relinquishment can still be achieved. For example, the long-term costs of running and maintaining a water treatment plant by a third party could be included in relinquishment funding provided by the mine operator. In some cases, there could be a business case for these issues, where, for example, treated water could be sold or provided for agriculture and unstable waste rock piles could be re-mined for aggregate.

3. REQUIRE RESIDUAL RISK MONITORING AND MANAGEMENT PLAN

Mine operators should be required to prepare a residual risk monitoring and management plan that is supported by a risk assessment and cost estimate. This plan could be integrated into the requirements for closure plans, as is the case in Chile, or it could be a stand-alone plan that is required toward the end of the mine life, such as in Queensland.

This plan should include provisions for:

Long-Term Monitoring

In most cases, periodic long-term monitoring should be undertaken at relinquished sites to ensure it remains chemically and physically stable and environmentally sound. Monitoring time frames should be based on results and meeting defined completion criteria rather than specific timelines. However, if monitoring results are stable and meeting criteria and the credible risk assessment is low, a monitoring time frame of 5–15 years after relinquishment is likely reasonable for many mine sites.

Maintenance or Replacement Requirements

Most relinquished mine sites will require periodic site maintenance or equipment replacement, in some cases years or decades in the future. Maintenance could be required on water, air, or geotechnical monitoring equipment, corrective action on erosional features, or maintenance of a constructed wetland used for passive water treatment. Maintenance requirements, frequency of occurrence, and estimated costs should be outlined in the plan.

Residual Risk Assessment

The plan should be supported by a risk assessment particularly related to the potential for unexpected future failure events, such as failure of a waste rock storage facility. The assessment should identify "credible" physical and chemical risks at the closed site. An example of how to assess risk is outlined in Section 7 and Tool 8 of the International Council on Mining and Metals's (2019) *Integrated Mine Closure: Good Practice Guide* (2nd ed.).

Management Protocol

Management responsibilities for the plan and as-needed site security should be described and costed in the plan. Responsibility will be linked to the post-closure landowner and funding mechanism and could fall to a government department, a third-party manager, or an independent body set up to manage the relinquished site.

Cost Estimation

Methods and approaches to cost estimating for relinquishment are not yet well developed. In general, estimates are needed for monitoring and maintenance, potential failure events, or contamination occurrences, such as the generation of acid-rock drainage from a waste rock storage facility, and for unforeseen events, such as a flood. In Saskatchewan, monitoring and maintenance costs are based on the actual costs for these activities in the 10 or more years prior to relinquishment, adjusted for inflation and third-party management and discounted to present value. Costs for unforeseen events are determined as a blanket multiplier of the monitoring and maintenance costs (Saskatchewan Ministry of Energy and Resources, 2018, and see Box 1 above). Queensland, on the other hand, is developing a calculator to estimate costs for relinquishment that considers monitoring, maintenance, and credible risk events (such as failure of a shaft plug). It is recommended that governments work together with industry and, as needed, independent consultants to arrive at reasonable monitoring

and maintenance costs specific to the mine site and for a reasonable future timeframe along with a methodology to estimate risk-adjusted costs for credible failure events or unforeseen events.

4. ESTABLISH RELINQUISHMENT FUNDING MECHANISM

In comparison to financial assurance for operating mines, funds for relinquishment are generally non-refundable and need to be managed for an extended period of time—possibly indefinitely. This introduces challenges as to who should manage the funds such that they are secure into the future and retained for their intended purpose. In the Queensland model, the state manages the funds in an account separate from general revenue, in Chile, an independent financial institution will be the manager, and in Saskatchewan, funds are held by government in a separate account from general government revenue that is managed by an advisory committee. Mackenzie (2016) reviews other examples where mine operators have created a "self-perpetuating" fund for relinquishment that is managed at arms' length to government.

Given the unique aspect of each mine and jurisdiction and the general lack of well-established models for relinquishment funding, governments will likely need to develop their own mechanism(s) in collaboration with mine operators.

Some options to consider in developing a funding mechanism include the following:

Retain Financial Assurance

One option is to retain a level of mine closure financial assurance that was in place during mine operation for a period of time after relinquishment to address a significant failure or issue with the closure works. This is a good option if a risk assessment indicates that there is a reasonable chance that one or more issues may arise. Financial assurance could be required as long as a risk assessment or monitoring indicates the reasonable potential for a failure or contamination event. Saskatchewan currently still requires financial assurance to cover the cost of a maximum failure event until its Unforeseen Events Fund is better capitalized. The challenge with this option is that the mine operator will still need to pay for financial assurance after relinquishment and thus is still tied to the site. However, it may be possible to structure financial assurance as a one-time payment at the point of relinquishment, such as a letter of credit or insurance policy with a 10–15-year term.

Third-Party Management

Many in industry consider the option of third-party management to be a good choice that ensures the funds are professionally managed and retained for their intended purpose. This could be a financial institution, an accounting or legal firm, or even a regional development bank such as the African Development Bank. These firms would manage the investments, contract out monitoring and maintenance activities, and report to government and landowners. Fees for this management would be included in relinquishment costing. An additional advantage of this approach is that government could avoid the burden of managing funds and monitoring and maintenance activities.

Pooled Funds

In jurisdictions with several closed and relinquished mine sites, an option to consider is a pooled fund. Each mine contributes to the fund, and the assets of the fund are used to address an issue at any of the closed mine sites. Pooled funds recognize that it is unlikely

that a major failure event will arise at every closed mine site and thus the risk is shared across all closed sites. An example is in the Northern Territory of Australia where active mining operations are charged an annual non-refundable levy of 1% of the security or financial assurance for the mine. These funds go into a pooled fund that is used to address issues at legacy sites, including those that have been relinquished (Northern Territory Government, n.d.). The challenge is that it can take time for a pooled fund to be capitalized sufficiently to cover the costs of a major event, and thus other options need to be used in the meantime. This is the case in Saskatchewan, where the Unforeseen Events Fund is a pooled fund but mine operators are still required to hold financial assurance. Once the Unforeseen Events Fund is sufficiently capitalized, the government may determine that financial assurance is no longer required—something that is still many years away.

Transfer of Site Responsibility

As part of post-mining land-use decisions and relinquishment, business opportunities may be identified that could take over some or all of the responsibility for monitoring, maintenance, and future risks. A variety of options could be considered for each site, including transfer of land or mineral rights to other mineral exploration or mining companies. Some businesses may also be willing to take on responsibility for monitoring, maintenance, and residual risk in return for receiving the relinquishment funds if they believe they can obtain a greater return on the funds than the cost of monitoring and maintenance activities. In any of these sorts of arrangements, it is recommended that businesses are required to hold insurance or some form of financial assurance in favour of government as protection against default or failure to maintain relinquishment requirements.

5. EXECUTE PROCESS FOR LEGAL TRANSFER OF CLOSED SITES

A clear legal process should be in place to discharge permits and responsibility for the site from the mine operator to government or the next landowner and to implement the residual risk monitoring and management plan, including the funding provided for in the plan.

Key steps include the following:

The Next Landowner Is Ready and Willing to Accept the Site

The next landowner should have been engaged and part of decision making early in the closure and relinquishment process so responsibilities are clear and they are prepared to take over the site once final closure has been approved. Particular attention should be paid to situations where the transfer of responsibility occurs between government ministries. As noted earlier, lack of internal government communication and coordination can delay relinquishment.

Funding and Management Are in Place for Monitoring and Maintenance

The funding mechanism and the appropriate level of funds should be in place along with management plans to implement the residual risk monitoring and management plan.

Legal Liabilities of the Mine Operator and Next Landowner Are Clearly Defined

With a monitoring and management plan and funding in place, the mine operator should be fully released from future obligations on the site. However, legal frameworks and precedents in some jurisdictions, such as Canada and Australia, do not allow for a complete release of legal liabilities. Under a “polluter pays” concept, the mine operator could be responsible for future environmental issues, even if those issues were not identified at the time of closure and

the mine operator fully complied with its closure plan and obligations. In Saskatchewan's ICP, an analysis is undertaken to determine the cause and responsibility for an unforeseen event, should it occur. Depending on the outcome of the analysis, funding to address the issue may come from the Unforeseen Events Fund, the former mine operator, or the province.

6. IMPLEMENT RESIDUAL RISK MONITORING AND MANAGEMENT PLAN

The final step in the process is to implement the residual risk monitoring and management plan. Each plan and the funding that supports it will be unique to the mine and the governments involved. However, if government is not actively managing the site, it should maintain an oversight role where possible and receive periodic reports on the status of the site. This is particularly important if an impactful failure event should occur, as government may need to support actions to address the issue. Government may also need to support communities or the post-mining landowner(s) with issues about the site or to realize post-mining land uses. For example, the government could provide training on safe and environmentally sound small-scale mining practices or on agricultural practices suitable for the site if those are possible uses for the land. Government may also be responsible for community infrastructure such as systems to harness water in a pit lake for agriculture.

Eventually, with a well-executed closure and a period of post-relinquishment monitoring, physically and chemically stable closed mine sites can achieve the principles of sustainable development by fully transitioning to new land uses for the benefit of the people and environment around the site.

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