

International Institute for Sustainable Development (IISD)

Mine Waste Management: Case Studies from Ghana and Canada

Author(s): Jenifer Hill and Matthew Gillman

International Institute for Sustainable Development (IISD) (2021)

Stable URL: <https://www.jstor.org/stable/resrep40506>

Accessed: 05-05-2025 07:50 UTC

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <https://about.jstor.org/terms>



International Institute for Sustainable Development (IISD) is collaborating with JSTOR to digitize, preserve and extend access to this content.



IGF

INTERGOVERNMENTAL FORUM
on Mining, Minerals, Metals and
Sustainable Development

IGF CASE STUDY

Mine Waste Management: Case Studies from Ghana and Canada

Secretariat hosted by



Secretariat funded by



Kingdom of the Netherlands



INTRODUCTION

Mining typically involves moving and processing large amounts of materials to extract the target commodity. This excess material is known as mine waste. For many operations, the scale of this waste can be significant; in addition, some mine waste can have mineralization that may be reactive or that could be released from the rock when it is mined, crushed, exposed, and dispersed in air and water, to the detriment of the receiving environment. As such, mining companies often spend significant amounts of time and resources on managing these wastes effectively, including through waste rock piles, tailings management facilities, spent heap leach facilities, and overburden. Given the potentially significant or even catastrophic environmental and social impacts that poorly managed mine waste can have on operations, communities, and ecosystems, governments play a central role in ensuring that these by-products of the mining sector are effectively and safely managed.

The governments of Ghana, Africa, and the Province of British Columbia (BC), Canada, both show leadership in this area. Mining is an important industry in both economies, and the two jurisdictions show that countries can adopt best practices for mine waste governance irrespective of the size of their economy or their history of large-scale

mining. Jurisdictions with long histories of mining—like BC—can provide lessons on how to avoid the pitfalls associated with the long-term legacies of poorly managed mine waste. Ghana, a country with a relatively shorter history of large-scale mining, also has lessons on managing waste materials to share. The case studies below review how legal frameworks pertaining to mine waste management are working, show how they align with leading international practice, and explore how the governments of both Ghana and BC are identifying and responding to mine waste management risks.

LEADING PRACTICES IN MINE WASTE MANAGEMENT POLICY

The overall objectives of mine waste management are to minimize the volume of waste produced and then ensure the physical and chemical stability of mine waste and its management facilities for the long term.

Minimizing the volume of mine wastes should consider innovation, reprocessing, repurposing, and liability reduction. These objectives support the United Nations Sustainable Development Goals (specifically, goals 6, 8, 13, 14, and 15) in that small, stable mine waste facilities will protect water resources, life below water, and life on land



while still supporting the mining needed in many areas for local economic prosperity.

Key mine waste management policy requires:

- Clear standards for good waste management
- Specific (technical) requirements for tailings facilities
- Corporate accountability requirements
- Review of waste management plans prior to project approvals
- Financial mechanisms to manage long-term risks
- Financial and human resources for compliance reviews and enforcement.

Similar to corporate management structures, legal frameworks benefit from following a plan–do–check–act process for continual improvement. The first step in jurisdictions beginning to develop their legal framework around mine waste management is setting controls over the planning stage of mine waste management and ensuring that the mine waste management plans cover all phases of mining through post-closure. Setting specific standards for high-risk facilities is the next step in advancing the framework. Monitoring for compliance and enforcement is critical for the effective implementation of the legislation and standards. The entire framework needs to be well supported in its development, implementation, and enforcement; therefore, government needs to allocate sufficient human and financial resources and mechanisms for assessing compliance. Financial assurance requirements protect the governments and the public from long-term liabilities that can be associated with mine waste management facilities. Once all components are in place, there is always room for improvement through supporting programs, such as ongoing promotion of good practice and auditing.

The development of a strong policy on mine waste governance takes time. The following sections provide a summary of key legal framework elements for supporting good mine waste management performance based on experience and a review of international best practices and legal frameworks from around the world. Governments can institute interim policies requiring companies to meet international or other jurisdictions' standards while theirs are developed. More support can be found in the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development's (IGF) 2021 *Guidance for Governments: Environmental Management and Mining Governance*.

STANDARDS

Standards for mine waste management set clear goals that mine operations need to meet. Governments should set mandatory standards for minimum design criteria, such as those relating to slopes, safety, hydrometeorological events, and seismic events within development or mining policy and in mining legislation. Standards for mine waste facilities need to be based on risk and consider local conditions, such as existing facilities, meteorological and geotechnical conditions, engineering capacity, and emergency response capacity in the country.

TAILINGS FACILITY REQUIREMENTS

Tailings facility failures can have catastrophic consequences; Vale's tragic Corrego do Feijão mine tailings facility failure in Brazil on January 25, 2019, is but one recent example. This incident, along with other recent tailings facility failures (such as the Mount Polley dam failure discussed below), provided part of the impetus for the development of the Global Industry Standard on Tailings Management (GISTM) (International Council on Mining & Metals et al., 2020).



Legal frameworks on mine waste management should include tailings-specific requirements due to the higher potential risk and complexity of tailings storage facilities and the potential negative impacts of their failure. International standards and best practices regarding tailings facilities' design, construction, and management provide a strong basis for a legal framework built on lessons learned throughout the world. The 2020 GISTM is the most recent, comprehensive standard. The overriding goal of the GISTM is working toward zero harm, which means that operators must have zero tolerance for harm to people and the environment.

The overriding objectives in legislation regarding tailings facility stability should be ensuring the long-term physical and chemical stability of the tailings facility to protect the surrounding environment and communities for the full life of the facility—including after the mine has closed.

CORPORATE ACCOUNTABILITY

Mining companies use a variety of management systems that function well but vary in structure depending on what the company prefers, which makes a management system difficult to regulate and enforce. However, a legal framework can promote effective management systems, protect communities and the environment, and simplify enforcement by setting requirements for accountability and responsibility for key corporate, management, and engineering positions. This puts the onus for the performance and cost of the facility on the company and promotes the development of an effective corporate management and reporting system.

WASTE MANAGEMENT PLANS

Mine waste management facility designs and plans, including plans for the closure of the facilities, need to be developed and

reviewed in detail prior to mine approval. The level of design required to be presented for government review should be commensurate with the level of risk for the proposed facilities. In general, a pre-feasibility-level design should be expected for the environmental and social impact assessment and feasibility-level design for construction permits.

Technical experts should be contracted by the government for technical reviews of submitted designs and management plans, especially for high-risk facilities. Governments can also look to good international standards and practice guides, as well as other organizations, for assistance with capacity building.

The legal framework should include mechanisms for the consultation and participation of affected communities. Communities should be involved in the planning stage to meaningfully participate in the selection of waste management alternatives for waste storage facilities that could affect them.

FINANCIAL MECHANISMS TO MINIMIZE LONG-TERM RISK

Financial mechanisms should be required to fund closure and reclamation of the entire mine, and these should be based on detailed cost estimates commensurate with the level of design stage and risk and with appropriate contingencies. A secure financial mechanism should be in place to protect the government from future facility management costs by minimizing the risks around the future solvency of an owner.

The financial mechanism should be calculated and posted prior to construction and updated as the project advances. Financial sureties (or a portion of the sureties) are returned to the proponent at the end of the post-closure period, dependent on outstanding liabilities and/or risks.



COMPLIANCE AND ENFORCEMENT

Monitoring and reporting requirements for mine waste management should be specified in permit conditions, guidance, and standard templates for efficient review. Regular inspections of mine waste storage facilities enforce compliance with follow-up inspections on corrective measures.

A key component of a legal framework for the governance of mine waste management is enforcement. The effectiveness of a legal framework relies on strong and consistent political will combined with the requisite human and financial resources for enforcement. Appropriate consequences must be included in the legislation to manage situations where non-compliance is discovered from reviews of the monitoring reports, from inspections, or in response to incidents. The consequences should be tied to the level of risk of non-compliance. Enforcement should also consider compliance with the implementation of progressive reclamation and closure plan updates to minimize long-term risks.

GOVERNANCE IN GHANA AND BC, CANADA

Both Ghana and BC have comprehensive legal requirements for planning mine waste management. In Canada, mine waste management is mainly regulated within the

provincial legal framework. Both case studies demonstrate the importance of following a risk-based framework that looks at both worldwide and local issues.

At the worldwide scale, legal frameworks for both jurisdictions have looked to leading international practices to develop the breadth of detail needed to manage complex mine waste storage facilities. Both jurisdictions are now responding to gaps identified during the implementation of the GISTM principles.

At the local scale, Ghana is also focused on managing mine waste through the formalization of artisanal mining—an area at high risk of continued environmental damage in Ghana. Also at the local scale, BC has had to improve inspection, enforcement, and policies in response to the Mount Polley tailings facility failure in 2014. BC has also implemented an audit office to continue to assess and improve the implementation of the mine waste management framework based on local mine and government performance.

Table 1 provides a summary of the status of legal framework components in Ghana and BC. The next sections then discuss the applicable legislation in place, strengths of the legal framework, initiatives being taken, areas for improvement, and conclusions for each jurisdiction.



TABLE 1. SUMMARY OF GHANA'S AND BC'S WASTE MANAGEMENT LEGAL FRAMEWORKS

Component/ principles	Ghana	BC, Canada
Mine waste standards	Detailed mine waste standards are in place. An artisanal mining initiative is being formalized to manage additional mine waste risks.	Detailed mine waste standards are in place.
Tailings facility requirements	Requirements for an impact assessment and facility plans and designs are comprehensive. Improvements are needed to fully conform to GISTM principles.	A legal framework conforms with GISTM principles. Making improvements on details and change management.
Corporate accountability	Partially addressed but can be strengthened with requirements for a polluter-pays principle and defined roles and responsibilities for the Engineer of Record and corporate roles.	Polluter-pays principle is applied. Detailed corporate roles and responsibilities are defined.
Mine waste management plans	Requirements are in place.	Requirements are in place.
Financial mechanisms to minimize long-term risk	A closure bond is required, with details to be strengthened.	Reclamation securities are required to cover all closure risks and liabilities, to be updated regularly.
Compliance and enforcement	Improvements to be made.	Making improvements on coordination and data systems for verification.



CASE STUDY 1: GHANA

Ghana has a long history of artisanal mining. Large-scale mining with foreign investment then came to the forefront in the 1980s (International Trade Administration, 2020). Ghana is the largest gold producer in Africa; it also produces manganese, bauxite, and diamonds (International Trade Administration, 2020). Metallic mineral production contributed 8.5% to Ghana's gross domestic product (GDP) in 2018 (International Council on Mining & Metals, 2020). Currently, there are 16 major operating mines in Ghana (Ghana Minerals Commission 2021). There are also approximately one million people engaged in artisanal mining (McQuilken & Hilson, 2016).

Ghana reports 21 tailings storage facilities with risk ratings ranging from "not applicable" to "extreme consequences." Approximately half of the dams are comprised of upstream construction design, and the other half is made up of downstream or downstream with upstream or centreline construction design (Global Tailings Portal, 2021).

Mine waste in Ghana is managed using the following main pieces of legislation:

- 1992: Ghana's Constitution enshrines human rights and provides the basis for an environmental protection policy. It provides the commitment and foundation to support sound mine waste management.
- 1993: The Local Government Act (Act 462) includes the basis for regional land-use planning and environmental management.
- 1994: The Environmental Protection Agency (EPA) Act supports the structure and power for environmental regulation and defines responsibility for inspections, monitoring, compliance, enforcement, capacity, and structure.
- 1999: Environmental Assessment Regulations have requirements for impacts to be assessed and management plans to be developed for mine waste storage facilities. The assessments must also take into consideration climate change. In addition, the company must:
 - Obtain an environmental certificate from the EPA within 24 months of operation commencing that confirms that the mine complies with its mitigation commitments and has submitted its first annual environmental report.
 - Submit a reclamation plan and post a reclamation bond based on the reclamation work plan for all disturbances, including the mine waste facilities.
 - Submit environmental management plans every 3



years of operations and report non-compliances in their annual reports.

- 2006: The Whistleblower Act (Act 720) provides protection for individuals disclosing unlawful, illegal, or corrupt conduct.
- 2006: The Minerals and Mining Act requires the acquisition of permits before mining.
- 2012: The Minerals and Mining (Health, Safety and Technical) Regulations provide:
 - Requirements for detailed design requirements for waste rock and tailings facility and management, including hazard classifications, management plans, site analysis, inundation study, stakeholder analysis, and engineer qualifications.
 - Requirements for detailed operations requirements, including management responsibilities and annual dam safety audits. This legislation provides the standards for mine waste management, corporate accountability, and mine waste management plan requirements for good governance.
 - Requirements for emergency preparedness and response plans.
 - Allowance for the Chief Inspector of Mines to conduct regular inspections, compliance follow-up inspections, environmental inspections, and inspections in response to complaints and emergencies.
- 2013: The Commission on Human Rights and Administrative Justice Act protects human rights in Ghana.
- 2015: The Minerals and Mining (Amendment) Act revises the payment of royalties and the penalties for illegal small-scale mining.

- 2016: The EPA Grievance Redress Mechanism Operational Manual supports public involvement and communication.

STRENGTHS AND INITIATIVES

Ghana has comprehensive legal requirements for the environmental assessment process and waste management standards. The Environmental Assessment Act (2009) ensures that waste management designs and plans are developed and reviewed prior to mine approval and mine development and that the planning includes all phases of the mine life cycle through post-closure.

The Minerals and Mining (Health, Safety, and Technical) Regulations (2012) provide the standards to ensure the physical and chemical stability of all waste management structures. There are detailed tailings design standards pertaining to features, such as:

- Hazard classes for upstream, downstream, and centreline dam designs
- Foundation characterization and preparation
- Construction materials
- Dam drainage and collection systems
- Facility liners, permeability criteria, and drainage collection systems
- Water diversions
- Emergency spillways, freeboard, and water management return period criteria
- Ponds and water treatment
- Static and dynamic loads
- Tailings spigotting
- Emergency power and equipment.

Emergency preparedness and response plans are also required in Minerals and Mining (Health, Safety and Technical) Regulations 11 and 237. Emergency measures also pertain to gold mines using cyanide. To reduce the



risk of liabilities for governments, emergency measures need to be in place for the entire mining operation, including the waste rock and tailings storage facilities.

The waste from artisanal and small-scale mining (ASM) also carries with it considerable risk in Ghana. In response, Ghana's Ministry of Lands and Natural Resources initiated a Multilateral Mining Integrated Project (MMIP) to formalize artisanal mining and address the suite of challenges associated with ASM (Ministry of Lands and Natural Resources, 2017). An interesting aspect of the project is the technological approach of using satellite imagery to locate, quantify, and monitor ASM. The analysis of imagery determined that there was an average land conversion of -2,600 ha/year from artisanal mining in southwest Ghana from 2005 to 2019 (Berenblitt et al., 2020). Formalizing ASM through the MMIP is intended to reduce the impacts and better implement environmental safeguards for mine waste management and water protection.

AREAS OF IMPROVEMENT

The role of monitoring and inspections for tailings facilities compliance lies with the Ghana Minerals Commission, under the Ministry of Lands and Natural Resources. Although this leverages the technical expertise and capacity in the Ghana Minerals Commission, there appears to be limited independence, transparency, and information sharing with the public. Previously, Ghana's EPA had instituted the AKOBEN program, which published a report card on each gold mine's performance. However, the program is no longer reported on government websites. One study determined that the AKOBEN program had not resulted in improved controls over water and soil quality (Bedu-Addo et al., 2019). Although the program may not have been as successful as desired, it did increase transparency. It is important for governments

to continue to implement new initiatives, measure program success, and make adjustments based on lessons learned.

Accountability is another area that requires additional government support to meet the GISTM principles. One option for improvement is to codify specific responsibilities of a company's engineers and managers regarding tailings facility management and performance. The polluter-pays principle is also a key requirement driving accountability for mine waste management (Campbell et al., 2020). The Minerals and Mining Act could be improved by including a polluter-pays clause to further reduce government risk. Provisions for payment for pollution and liabilities, similar to clauses 81 to 84 of Ghana's Petroleum (Exploration and Production) Law, 2016 (Act 919), could be adapted to better protect the state.

Closure bonding is required by Ghana's Environmental Assessment Regulations; however, the current legislation does not specify that financial security needs to cover all outstanding reclamation work for the given extent of mining. Due to pressures to support foreign investments, governments often accept less security than the outstanding liabilities at the mine, given rationales of corporate stability and cash flow limitations. This has resulted in abandoned mine legacies in many jurisdictions throughout the world.

Campbell et al. (2020; T. Hussain, personal communication, June 16, 2021) made several recommendations for improvement during a review of Ghana's conformity with the GISTM, including:

- Requirements for roles and responsibilities should specify facility responsibility by a Responsible Tailings Facility Engineer.
- Requirements to minimize risks linked to the local socio-economic context to support a robust design.



- Requirements for verification during construction and monitoring through all stages of the facility.
- Requirements for improved public disclosure and publication of monitoring results. Currently, access to construction reports requires consent by the mineral titleholder and payment of fees. Other records and reports are confidential.
- Regulatory amendments with reference to providing humanitarian aid in response to an emergency.

CONCLUSIONS FOR GHANA

Ghana has incorporated important components and requirements for good mine waste management within its Environmental Assessment Act and Minerals and Mining Act and Regulations. These acts and their supporting regulations govern the planning stage of mining projects—which is a fundamental part of mine governance. Strengthened governance during the planning stage should be the targeted first steps for countries developing their legal framework around mine waste management. Compliance and enforcement are then critical steps for ensuring the legal standards are effectively implemented. Strengthening requirements for corporate accountability and financial securities are the next steps for governments to minimize the risk of incurring high liabilities and

costs of abandoned mines and legacy sites. For continual improvement of tailings management, countries should consider strengthening the other components linked to the principles of the GISTM surrounding stakeholder engagement and disclosure.

There are many roads to implement change. How the legal framework evolves depends on a country's politics, its history of mining, lessons learned, initiatives, aid sources, and policies. Ghana continues to build upon a strong foundation of environmental assessment and standards, is taking a broad-scale view of environmental management with its 2019 Environmental and Social Management Framework, and continues to look at international best practices—including the GISTM—to strengthen its mine waste management performance.



CASE STUDY 2: BRITISH COLUMBIA, CANADA

The Canadian province of BC has a long history of large-scale mining. Today, mineral production includes mainly copper, molybdenum, gold, coal, and industrial minerals (Mining Association of Canada, 2020). The minerals and metals industry contributed 3.5% to the GDP of Canada in 2019 (Mining Association of Canada, 2020), and the extractive industry, which includes mining and oil and gas, contributed 4.3% to the GDP of BC in 2019 (BC Ministry of Finance, 2021, p. 82). As a result of this level of activity and its long history of mining, there were approximately 98 tailings dams recorded in BC in 2015 (BC Ministry of Farming, Natural Resources, and Industry, 2015).

Mining legislation, environmental protection, and environmental assessment in the province stretch back to the start of mineral staking legislation in 1859 and include pollution control laws applicable to mining in 1965 and legal environmental impact assessment requirements in 1981 (UVic Environmental Law Club, 2018). The current main pieces of national and provincial legislation governing and promoting good mine waste management in BC are:

- 1996: The BC Freedom of Information and Protection of Privacy Act allows

the public access to information used by regulatory agencies, which extends to information about mine waste storage management and compliance.

- 1996: The BC Emergency Program Act provides the framework for provincial emergency response and cost recovery from persons deemed responsible due to their actions or omissions.
- 1999: The Canadian Environmental Protection Act provides requirements for pollution prevention and enforcement provisions.
- 2003: The BC Environmental Management Act provides requirements for contaminated sites, pollution prevention, emergency preparedness, and cost recovery for emergency response.
- 2014: The BC Water Sustainability Act protects groundwater and requires licences for diversion and use of water at applicable tailings management facilities.
- 2016: The Dam Safety Regulation provides dam requirements based on height and capacity.
- 2018: The BC Environmental Assessment Act provides a process for



reviewing mine waste facility designs, impacts, and management plans.

- 2019: The Canadian Impact Assessment Act provides a process for reviewing mine waste facility designs, impacts, and management plans.
- 2020: The BC Mines Act sets responsibilities for chief auditors, inspectors, and permitting officers, as well as mine permit requirements, enforcement, and penalties.
- 2021: The Health, Safety, and Reclamation Code for Mining in BC provides detailed technical requirements (including mine waste facilities) for mine construction, operation, and closure.

Mining legislation and policy continue to change as a result of a changing social climate and in response to mining legacies and incidents. Tragically, the Mount Polley tailings dam failed on August 4, 2014, in BC, releasing millions of cubic metres of tailings and water into downstream Polley Lake, Hazeltine Creek, and Quesnel Lake. Thankfully, no human lives were lost. Extensive investigations were conducted initially to determine the root cause, which was found to be an unidentified weak clay layer under the dam foundation made more challenging by issues regarding overriding production priorities, gaps in qualified engineers, long-range planning, site integration, management oversight, and barriers to moving issues up the chain of management (Hoffman, 2015; Hopkins, 2020; Morgenstern et al., 2015). A broad range of environmental impact studies and remediation work on the dam and the downstream environment has resulted in improved environmental conditions in the affected area, including rainbow trout returning to the restored spawning habitat in the creek immediately downstream of the tailings facility (Mount Polley Mining Corporation, n.d.). Annual environmental and restoration progress monitoring programs

continue to be carried out and indicate the mine is now compliant (Mount Polley Mining Corporation, 2020). Studies on impacts from the failure are likely to extend decades into the future.

Several standards were written into BC's Health, Safety and Reclamation Code as a result of the Morgenstern et al. (2015) Independent Review Panel report following this incident. In addition, the Mount Polley site was one of the mines reviewed by the Expert Panel when developing the text for the GISTM principles (Oberle et al., 2020, p. 7).

STRENGTHS AND INITIATIVES

BC has among the most comprehensive regulations for tailings storage facilities in the world, conforming to the principles in the GISTM (BC Mine Audits and Effectiveness Unit, 2021).

Organizational weaknesses found during the root cause analysis of the Mount Polley dam breach included logistical limitations, lack of clear responsibility, lack of coordination, no mechanism for employees to escalate issues, and production and capacity needs driving mine decisions (Hopkins, 2020). As a result, some key changes to the 2016 Dam Safety Regulations and the 2016 Health, Safety and Reclamation Code included:

- An Independent Tailings Review Board and an Engineer of Record must be designated for all tailings facilities.
- The Mine Manager is responsible for the safety of all tailings facilities on the site and for designating a Qualified Person for the tailings storage facility.

The root cause of the failure of the Mount Polley dam from a design perspective was an unidentified weakness in surficial geology underlying part of the dam. The dam failure resulted in damage to the downstream creek and lake, Indigenous traditional cultural lands, and trauma to the Indigenous



community (Joyce & Kemp, 2020). In response, the government revised the Dam Safety Regulations (2016) and the Health, Safety and Reclamation Code to include the following:

- Physical stability is now included in the code as the primary objective; all available technologies (such as dry-capped tailings) should be considered in the design phase, and water should be removed from tailings.
- The alternatives assessment needs to include environmental, societal, and economic considerations in addition to technical considerations.
- Risk assessments and a breach and inundation study must be completed for proposed tailings storage facilities prior to approval.

AREAS OF IMPROVEMENT

A strength of BC's legal framework is the role of the Auditor General, an independent, non-partisan body in the legislature that can independently check government performance. Following the Mount Polley dam failure, the Auditor General audited compliance and enforcement in the mining sector and found a lack of adequate resources and independence for inspections and enforcement. One important response to the findings was a commitment of CAD 20 million to mine regulatory effectiveness in the 2019 budget. Another important response to the audit recommendations was the separation of compliance and enforcement from permitting divisions in the BC Mines Act in August 2020 and the appointment of the first Chief Auditor of the new Mines Audit Unit in September 2020 (Mining Association of British Columbia, 2021). The purpose of the Mines Audit Unit is to check the ongoing effectiveness of mining regulations in BC and make public recommendations for improvements (Government of British Columbia, n.d.). Work from this committee is producing

further improvements to BC controls and performance in the mining industry.

Through the auditing process, further improvements are being made to an already comprehensive legal framework for tailings facilities. The BC Mine Audits and Effectiveness Committee published their Audit of Code Requirements for Tailings Storage Facilities (BC Audits and Effectiveness Committee, 2021) in 2021. Recommendations from the audit were to:

- Improve the understanding and consistency of regulations and responsibilities across ministries and legislation.
- Develop a "change management" procedure for revising the mining regulatory framework to align with the current industry best practice for tailings storage facilities.
- Clarify definitions, remove ambiguity in requirements, and improve consistency of interpretation of requirements.
- Develop policies and procedures for the government's geotechnical requirements at each stage of the mine, compliance, and enforcement.
- Improve consistency in the use of data systems for compliance verification.

CONCLUSIONS FOR BC

BC has developed a comprehensive legal framework around mine waste management that has been strengthened over decades as a result of contamination events and failures such as the Mount Polley incident. Lessons have been drawn from the past inadequacy of enforcement, and the resulting installation of an auditing process has provided the opportunity for more subtle (but just as important) aspects of the legal framework to be identified. An auditing program completes the plan-do-check-act circle needed for continual improvement and would



benefit many countries working to improve their legal frameworks.

Many lessons can be learned from BC's experience. Other countries could consider incorporating provisions found in BC's Health, Safety, and Reclamation Code for Mining to improve their mine waste management legal frameworks to a standard that conforms to many of the GISTM principles. However, as experienced in BC, this process needs to be coupled with diligent and well-resourced enforcement and capacity building to support the legislation and avoid learning the hard way.



REFERENCES

- Barenblitt, A., Payton, A., Lagomasino, D., Fatoyinbo, L., Asare, K., Aidoo, K., Pigott, H, Som, C. K., Smeets, L., Seidu, O. & Wood, D. (2021). The large footprint of small-scale artisanal gold mining in Ghana. *Science of the Total Environment*, 781, 146644. <https://doi.org/10.1016/j.scitotenv.2021.146644>.
- BC Mine Audits and Effectiveness Committee. (2021). *Audit of code requirements for tailings storage facilities*. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/mineral-exploration-mining/documents/mine-audits-and-effectiveness-unit/audit_of_code_requirements_for_tailings_storage_facilities_final_2021_04.pdf
- BC Ministry of Farming, Natural Resources, and Industry. (2015). *Tailings dam terms and FAQ*. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/mineral-exploration-mining/faq_tailingsdam_jan_30_2015_final.pdf
- BC Ministry of Finance. (2020, September). *2020 British Columbia financial and economic review* (80th ed.). <https://www2.gov.bc.ca/assets/gov/british-columbians-our-governments/government-finances/financial-economic-review/financial-economic-review-2020.pdf>
- Bedu-Addo, K., Ofori-Kuragu, M., & Arthur, A. (2019). The AKOBEN programme as a tool towards responsible gold mining in Ghana, business as usual or a commitment towards sustainable development. *Heliyon*, 5, e01925. <https://doi.org/10.1016/j.heliyon.2019.e01925>
- Campbell, R., Hussain, T., Wright, O., Voulaz, S., & Infante, F. (2020). Comparative analysis of tailings-related legislation in key mining jurisdictions. In B. Oberle, D. Brereton, & A. Mihaylova (Eds.), *Towards zero harm: A compendium of papers prepared for the Global Tailings Review*. Global Tailings Review. <https://globaltailingsreview.org/compendium>
- Environmental Protection Agency. (2016). *Grievance Redress Mechanism: Operational manual*. Government of Ghana.
- Ghana Minerals Commission. (2021). *Major operating mines in Ghana*. <https://www.mincom.gov.gh/operating-mines/>
- Global Tailings Portal. (2021). <https://tailing.grida.no/disclosures>
- Government of British Columbia (n.d.). *Mine Audits Unit*. <https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/mine-audits-unit>
- Hoffman, A. (2015). *Mount Polley mine tailings storage facility breach, August 2014*. Ministry of Mines and Energy, British Columbia. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/mineral-exploration-mining/documents/directives-alerts-incidents/chief-inspector-s-report-page/m-200_mount_polley_2015-11-30_ci_investigation_report.pdf
- Hopkins, A. (2020). Addressing the organisational weaknesses that contribute to disaster. In B. Oberle, D. Brereton, & A. Mihaylova (Eds.), *Towards zero harm: A compendium of papers prepared for the Global Tailings Review*. Global Tailings Review. <https://globaltailingsreview.org/compendium/>



- Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development. (2021). *Guidance for governments: Environmental management and mining governance*. <https://www.igfmining.org/our-work/environmental-management/>
- International Council on Mining & Metals. (2020). *Role of mining in national economies. Mining Contribution Index (MCI)* (5th ed.). https://www.icmm.com/website/publications/pdfs/social-performance/2020/research_mci-5.pdf
- International Council on Mining & Metals, United Nations Environment Programme, & Principles for Responsible Investment. (2020). *Global industry standard on tailings management*. https://globaltailingsreview.org/wp-content/uploads/2020/08/global-industry-standard_EN.pdf
- International Trade Administration. (2020, August 31). *Mining industry equipment*. Ghana: Country commercial guide. <https://www.trade.gov/knowledge-product/ghana-mining-industry-equipment>
- Joyce, S., & Kemp, D. (2020). Social performance and safe tailings management: A critical connection. In B. Oberle, D. Brereton, & A. Mihaylova (Eds.), *Towards zero harm: A compendium of papers prepared for the Global Tailings Review*. Global Tailings Review. <https://globaltailingsreview.org/compendium/>
- McQuilken, J., & Hilson, G. (2016). *Artisanal and small-scale gold mining in Ghana: Evidence to inform an 'action dialogue.'* International Institute for Environment and Development. <https://pubs.iied.org/sites/default/files/pdfs/migrate/16618IIED.pdf>
- Mining Association of British Columbia. (2021, June 18). *Backgrounder: Government of BC and mining industry actions to improve the management and operation of mine tailings storage facilities (TSFs) in BC* [News release]. <https://www.mining.bc.ca/news-releases/backgrounder-government-bc-and-mining-industry-actions-improve-management-and>
- Mining Association of Canada. (2020). *Facts & figures 2020: The state of Canada's mining industry*. <https://mining.ca/wp-content/uploads/2021/02/FF-2020-EN-Web.pdf>
- Ministry of Finance. (2019). *Ghana Economic Transformation Project (P166539), Environmental and Social Management Framework (ESMF)*. Government of Ghana. <https://documents1.worldbank.org/curated/ru/725341554804431382/pdf/Environmental-and-Social-Management-Framework.pdf>
- Ministry of Lands and Natural Resources. (2017). *Multilateral Mining Integrated Project (MMIP). Sanitization of illicit mining activities in Ghana*. Government of Ghana. https://www.academia.edu/36801578/MULTILATERAL_MINING_INTEGRATED_PROJECT_MMIP_Sanitization_of_Illicit_Mining_Activities_in_Ghana_MINISTRY_OF_FOREIGN_AFFAIRS
- Morgenstern, N., van Zyl, D., & Vick, S. (2015). *Report on Mount Polley tailings storage facility breach*. Independent Expert Engineering Investigation and Review Panel. <https://www.mountpolleyreviewpanel.ca/>
- Mount Polley Mining Corporation. (2020). *2019 annual environmental report*. <https://www.imperialmetals.com/assets/docs/mt-polley/2019-Mount-Polley-Annual-Environmental-Report.pdf>



Oberle, B., Mihaylova, A., & Hackett, A. (2020). Global tailings review at a glance: History and overview. In B. Oberle, D. Brereton, & A. Mihaylova (Eds.), *Towards zero harm: A compendium of papers prepared for the Global Tailings Review*. Global Tailings Review. <https://globaltailingsreview.org/compendium/>

UVic Environmental Law Club. (2018). *A timeline of mining law and contamination events in British Columbia*. http://www.elc.uvic.ca/wordpress/wp-content/uploads/2018/10/MLR-Timeline-ELC-Club-Research-a-thon-Report_2018Feb2.pdf

© 2021 The International Institute for Sustainable Development
Published by the International Institute for Sustainable Development

This publication is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

This case study was written by Jenifer Hill, Senior Consultant, of the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF), with support from Matthew Gillman, Water Management Specialist.

IISD

The International Institute for Sustainable Development (IISD) is an award-winning independent think tank working to accelerate solutions for a stable climate, sustainable resource management, and fair economies. Our work inspires better decisions and sparks meaningful action to help people and the planet thrive. We shine a light on what can be achieved when governments, businesses, non-profits, and communities come together. IISD's staff of more than 120 people, plus over 150 associates and consultants, come from across the globe and from many disciplines. With offices in Winnipeg, Geneva, Ottawa, and Toronto, our work affects lives in nearly 100 countries.

IISD is a registered charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Province of Manitoba and project funding from governments inside and outside Canada, United Nations agencies, foundations, the private sector, and individuals.

IGF

The Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF) supports more than 70 nations committed to leveraging mining for sustainable development to ensure negative impacts are limited and financial benefits are shared. It is devoted to optimizing the benefits of mining to achieve poverty reduction, inclusive growth, social development and environmental stewardship.

The IGF is focused on improving resource governance and decision making by governments working in the sector. It provides a number of services to members including: in-country assessments; capacity-building and individualized technical assistance; guidance documents and conferences which explore best practices and provide an opportunity to engage with industry and civil society.

The International Institute for Sustainable Development has served as Secretariat for the IGF since October 2015. Core funding is provided by the governments of Canada and the Netherlands.



IGF

INTERGOVERNMENTAL FORUM
on Mining, Minerals, Metals and
Sustainable Development