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Mine Waste Classification and Management

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About This Series and MLRI

This *Working Papers Series on International Best Practice*s is prepared within the scope of the **Mining Legislation Reform Initiative (MLRI)**, a project of the **AUA Center for Responsible Mining**. MLRI is a multi-year effort, funded by the **Tufenkian Foundation**, to improve Armenia's legislation ensuring that mining in Armenia provides sufficient benefits to the country and local communities. The initiative involves drafting and passing legislation that elevates the socio-economic benefits of mining, while reducing the negative environmental and public health impacts. A key component of the MLRI is collaborating and partnering with civil society, advocacy groups, academic institutions, and relevant national and international organizations. MLRI works with the key governmental and legislative bodies in getting the draft legislation passed into law. For more information visit http://mlri.crm.aua.am.

About the AUA Center for Responsible Mining

The American University of Armenia (AUA) Center for Responsible Mining promotes the creation and adoption of global best practices in socially, environmentally, and economically responsible Mining in Armenia and the region. To achieve this, the Center conducts research, training, and advocacy engaging all key stakeholders including industry, civil society, financial institutions, and the public sector. For more info, visit http://crm.aua.am.

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Introduction

The mining industry is the world's largest producer of waste, producing around 70 billion tons annually. A mineral deposit without a viable waste disposal option is not a viable mine. Technological advances and changes in regulatory regimes have resulted in significant changes in waste management practices over the past two decades.

The management of mine waste is a worldwide issue. For example, California has thousands of abandoned mine sites. Waste, such as acid mine drainage, has a significant adverse impact on aquatic life in waterways. Metallic waste contributes dramatically to the deposition of metallic material into large watercourses and dams. Acid mine drainage can occur over long periods of time, and costs an enormous amount to clean up, if it is even capable of being fully rehabilitated.[1] Australia faces similar problems.[2]

Rehabilitation of mines is very expensive and the costs are increasing each year. Smaller mining companies will look closely at legislation to see what savings may be made when complying with rehabilitation requirements. Even though progressive rehabilitation has become the norm in sophisticated mining states, there is no income generated by the rehabilitation activity. As a result, the classification systems used to define mine waste are often interpreted beneficially by the miner to save money on these costs.

Consequently, it is necessary to design mine waste classification systems with clarity and precision so that laws cannot be easily circumvented. If the miner manages to develop a legal argument which saves money on waste management, significant adverse effects on the environment might occur. Subsequently, the miner may be able to avoid prosecution or limit any penalties for environmental harm because the regulations governing mine waste classification are not well crafted.

Current situation in Armenia

The Mining Code includes broad provisions on mine waste management in that it requires the operator to "ensure processing, assessing, eliminating and minimizing mine waste", and that it should "adhere to norms and rules on waste collection, transportation, preservation, processing, and burying". For further regulation, it refers to the Law on Waste, most recently amended in 2015. The Law on Waste defines the key policy principles on waste management (including mining waste) in order to:

[1] #13397 Legislative findings by California legislature, see http://www.waterboards.ca.gov/centralvalley/water_issues/mining/water_board_mining_laws_reg.pdf.
[2] See http://theconversation.com/what-should-we-do-with-australias-50-000-abandoned-mines-18197.

- establish main conditions, requirements and rules for environmentally safe waste management;
- ensure minimal waste disposal and improved utilization in economic activities; and
- minimise the hazardous impact of waste on human health and the environment.

The Mining Code also requires proponents to produce a mine closure plan, which should include a waste monitoring plan.

While the Law on Waste and the Mining Code were amended in 2015 to include some terminology on mine waste (e.g. definitions of mine waste, tailings and overburden), both laws are overly general and do not include detailed mine waste management regulations and guidelines, including, for example, evaluation criteria for environmental performance, classification of mining waste or safety factors against dam wall failure and other aspects that help minimise physical stability risks. There is also no specification of minimum technical safety monitoring, inspection and auditing requirements specific to mining waste facilities.[3]

The Ministry of Territorial Administration and Emergency Situations (MTAES) is responsible for the safety examination of mining permit applications, including the assessment of the technical and safety aspects of tailings dams. The construction and permitting of tailings storage facilities (TSFs) have been done without adequate risk assessment due to inadequate technical capacity and a regulatory gap. Regarding the regulatory gap, the exact process for the approval of dam constructions remains unclear. Dam design and risk assessment are required as part of project-level environmental impact assessment. The MTAES is responsible for regulation and risk assessment in this regard. There is inadequate level of technical expertise with regards to tailings dam construction and management both within the MTAES and other relevant government institutions.[4]

Classification systems: elements of best practice

The following component parts should make up a successful mine waste classification system:

1. A means to determine the technical (geological, geotechnical and geochemical) nature of the waste;
2. A clear articulation of the nature of the hazard constituted by the type of waste (that is, the likely effects on the receiving environment if the waste is not appropriately dealt with); and
3. The best practice means of managing the waste.[5]

[3] The World Bank (2016), Armenia: Strategic Mineral Sector Sustainability Assessment, April.
[4] Ibid.
[5] This has been compiled by reference to the waste classifications schemes in Queensland and New South Wales (NSW), Australia, and the European Union (EU). The NSW scheme creates waste classes based on the

In practice, this means regulation at each stage. The practice of the mining industry is too variable, as a whole, for it to be self-regulating. A well-supported, technically skilled, transparent, regulatory system is an integral part of sustainable mining and safe management of mine waste.

The first two components are usually addressed by permits or approvals granted by a regulatory body, along with the provisions of bonds or financial assurances to be held by the regulatory body for both clean-up purposes and use by the regulatory body should the holder of the permit go into administration or liquidation.[6] The last component is regulated by way of classification of waste management facilities, prohibitions or restrictions on disposal, recycling or reprocessing of mine waste (such as mine tailings) and price signals via waste management levies to attempt to change behaviour in waste disposal.

Element 1: technical nature of the waste

Assessments of the technical nature of the waste are in best practice jurisdictions carried out during the environmental impact study (EIS) prior to the final approval of the project. The Terms of Reference for the EIS should contain detailed requirements for the assessment of mine geology, and geotechnical characteristics and geochemical behaviour of the waste rock. Without this assessment, detailed permit or licence conditions cannot be developed to ensure the proponent does not expose the environment or human health to harm.[7] It is often the responsibility of those who generate waste to classify that waste.

In the European Union's (EU's) *Mining Waste Directive*, assessment of the technical nature of the waste is referred to as waste characterisation for extractive industries.[8] The UK's *Environmental Permitting Guidance* and *Additional Guidance for Mining Waste Operations* interpret the EU Directive and provide detailed implementation guidelines.[9] In New South Wales, Australia, the *Waste Classification Guidelines* provide detailed instructions for

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level of risk they pose to the environment and human health, see *Protection of the Environment Operations Act 1997 (NSW)*, http://www.legislation.nsw.gov.au/#/view/act/1997/156.

[6] Queensland's Auditor-General reported in 2014 on the significant shortfall in financial assurances held by the State to address such eventualities: https://www.qao.qld.gov.au/sites/all/libraries/pdf.js/web/viewer.html?file=https%3A%2F%2Fwww.qao.qld.gov.au%2Fsites%2Fqao%2Ffiles%2Freports%2Frtp_environmental_regulation_of_the_resources_and_waste_industries.pdf. In the UK, financial guarantees are required for all mining operations involving the deposition of mine waste, see https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69323/pb13636-ep2010miningwaste.pdf, at paragraph 4.67. See also *Environmental Permitting (England and Wales) Regulations 2010.*

[7] For a general analysis of the basic science of mine waste characterisation, see http://www.environmentalearthsciences.com.au/wp-content/uploads/2012/12/Easy-Guide-Mine-Waste.pdf.

[8] See Commission decision 2009/360/EC http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009D0360, under Directive 2006/21/EC of the European Parliament.

[9] See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69323/pb13636-ep2010miningwaste.pdf and https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296493/LIT_8451_eb68e4.pdf.

classifying waste. Generators and waste facilities are required to follow the procedures in the Guidelines to ensure they comply with applicable laws and safeguard protection of the environment and human health.[10] The US Environmental Protection Agency's *SW-846 Compendium* provides 214 analytical methods for sampling and analysing waste in compliance with the Resource Conservation and Recovery Act regulations.[11]

Element 2: nature of the hazard constituted by the waste

The results of element 1 will determine whether the waste will cause acid mine drainage (AMD), saline or sodic drainage or leaching and mobilisation of metallic substances or compounds. Each of these types of effects causes different impacts on the receiving environment. The permit or approval issued to allow mining activities to take place often address specific effects in detail and require the proponent to take steps to prevent these effects. In many jurisdictions, this is done by:

1. setting standards for the levels of toxicity or adverse impact permitted in the receiving environment;
2. requiring the proponent to conduct testing of land and waters in the vicinity of the mine on an annual or semi-annual basis and report on those tests; and
3. penalising or sanctioning the proponent for exceeding these levels.

The application for a permit or approval for large projects often involves a public notification stage, allowing the public to make submissions on, amongst other things, the nature of the permit conditions to be applied to the types of waste rock that will be present at the relevant mine site.[12]

In some jurisdictions, authorities require a detailed waste management plan (WMP) before they will issue a mining permit. In Canada, WMPs are developed as part of the approval process, consisting of waste storage area selection and design, strategies to address problematic waste and long-term stabilisation of waste as part of mine closure.[13] In New South Wales, Australia, WMPs must be submitted within three months of mine approval.[14]

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[10] See http://www.epa.nsw.gov.au/resources/wasteregulation/140796-classify-waste.pdf. For types of waste, see http://www.epa.nsw.gov.au/waste/types.htm.

[11] See https://www.epa.gov/hw-sw846/sw-846-compendium.

[12] See for instance *Environmental Protection Act 1994 (Qld)* Chapter 5, Part 4 Division 1; *Environmental Planning and Assessment Act 1979 (NSW)*, Part 4 Division 2; *Environmental Planning and Assessment Regulation 2000 (NSW)* Part 6 Divisions 5, 6 and 7; planning permission in the UK necessarily involves the local authority and public participation through local authority assessment of the mining proposal.

[13] For an example from Nunavut, see http://ftp.nirb.ca/03-monitoring/00MN059-JERICHO%20DIAMOND%20MINE/02-MONITORING%20AND%20MANAGEMENT%20PLANS/Landfill,%20Waste%20and%20Hazardous%20Materials/110601-00MN059-Waste%20Management%20Plan.pdf.

[14] For NSW examples, see http://www.vale.com/australia/EN/aboutvale/regulatory-reports/integra-complex-regulatory-information/Management%20Plans/Integra%20Complex%20-%20Waste%20Management%20Plan.pdf and

Element 3: the best practice means of managing waste

Technology in waste management is constantly evolving. Technological advances have resulted in significant changes in waste management practices over the past two decades. The science of geochemical and geotechnical analysis is also subject to development.

The EU is required to produce guidance and exchange information on Best Available Techniques (BAT) for waste management measures to be taken by operators.[15] The European BAT reference document, entitled *Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities*, provides over 500 pages of detailed guidance for most mineral commodities.[16]

Holders of environmental approvals in Australia are regulated by the comparison of levels of toxicity identified in the continual testing of their mine sites against the standards they are required to meet for these levels in their approval. The authorities in Australia leave it to the operator to determine the best and most efficient means of compliance, rather than requiring operators to consider new technologies or methods as part of their permit conditions. Similarly, California does not require the use of BAT in the development of remediation plans.[17]

Corporate accountability for most of the environmental and social impacts of mining is the norm in leading practice jurisdictions. In leading practice jurisdictions, regardless of mine ownership, holders of mining rights are liable for damages incurred by their work, including any damage to the environment and public health from tailings. The "polluter-pays principle" implies that proponents are responsible for the costs of damage caused by their activities. This is the best incentive for such damage to be avoided in a cost-effective manner.

The *Minerals and Metal Policy of Canada* endorses the concept of pollution prevention and recognises the "polluter-pays principle" under which operators have the responsibility for environmental performance and for stewardship of minerals and metals.[18] Similarly, in Queensland, Australia, *Rehabilitation Requirements for Mining Resource Activities: Guidelines* are based on the "polluter pays principle", i.e. those who generate pollution and waste should bear the cost of containment, avoidance or abatement.[19]

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http://www.glencore.com.au/EN/who-we-are/baal-bone/Management%20plans%20and%20programs/BB%20Waste%20Management%20Plan%202014_FINAL.pdf.

[15] See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69323/pb13636-ep2010miningwaste.pdf, at paragraph 4.9.

[16] See http://eippcb.jrc.ec.europa.eu/reference/BREF/mmr_adopted_0109.pdf.

[17] See #13398.3(e) in http://www.waterboards.ca.gov/centralvalley/water_issues/mining/water_board_mining_laws_reg.pdf.

[18] See http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201212_02_e_37711.html.

[19] See https://www.ehp.qld.gov.au/assets/documents/regulation/rs-gl-rehabilitation-requirements-mining.pdf, p. 4.

International standards

The Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF) is a unique global venue for sustained dialogue between 55 member states, mining companies and industry associations. The IGF is working to advance good governance practices and policies that support sustainable development through its *Mining Policy Framework for Mining and Sustainable Development* (MPF). As a non-binding policy guidance tool, the MPF lays out current international best practice in mining law and policy.[20] With regards to managing mine waste, the MPF recommends that the governments:

- ensure that structures such as waste dumps and TSFs are planned, designed, and operated such that geotechnical risks and environmental impacts are appropriately assessed and managed throughout the entire mine cycle and after mine closure;
- require that proponents design, operate and maintain mine waste structures according to internationally recognised standards; and
- require that proponents commission independent expert reviews and report to governments prior to development approval, when changes in design are proposed, and at regular intervals during the operating phase.[21]

Conclusions and recommendations

Historically, regardless of whether state-run entities or the private sector left mining legacies, governments had to pay the environmental and social costs left behind by closing mines. However, current practice in leading jurisdictions demonstrates that these problems and the associated financial and human costs can be avoided. This requires sound governance and planning processes prior to mining or well in advance of cessation of activities. It also requires the environmental legislation to be premised on the polluter-pays principle. Financial assurances are a tangible example of the polluter-pays principle in action, since the project proponent or operator is expected at the outset to cover all costs associated with environmental protection, site reclamation, longer-term protection of closed sites and damages from accidents (for more detail, see Working Paper 2).

In the Armenian context, the Law on Waste and the Mining Code are overly general and require detailed mine waste management regulations and guidelines, including, for example, minimum technical safety monitoring, inspection and auditing requirements and evaluation criteria for environmental performance. There is inadequate level of technical expertise with regards to tailings dam construction and management within the MTAES and other relevant agencies, which requires immediate attention. Capacity building and training is required in order to address the regulatory gap in terms of permitting and controlling TSFs (for detailed recommendations, see Working Paper 5).

[20] For more information about the MPF, see http://globaldialogue.info/framework.htm.
[21] See http://globaldialogue.info/MPFOct2013.pdf.

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