

BR03 - Bauxite Residue Management Governance in the Americas and the Future Global Focus on Critical Minerals

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Abstract

At its fourth session, in 2019, the United Nations Environment Assembly adopted a resolution on the topic of mineral resources governance and mining (UNEA res 4/19). Following subsequent intergovernmental discussions, in 2022, a follow-up resolution was proposed to cover environmental aspects of minerals and metals management across the full life-cycle (UNEA res 5/12) - this was included as mining is being viewed as critical for the low-energy transition. As part of the implementation of the UNEA 5/12 resolution, intergovernmental regional meetings took place from April to July 2023. The regional meeting for Latin America and the Caribbean (LAC) highlighted that several decades of operations of bauxite mines and alumina refineries in key Caribbean territories (Jamaica, Guyana and Suriname) meet the criteria for attention as part of national sustainability and governance approaches. It is particularly important to address the need for the safe remediation of former bauxite residue disposal sites, their long term management and wherever possible, reuse, or the recovery of the chemical constituents in the bauxite residue. There are four key areas to be addressed for bauxite and alumina operations:

1. Environmental indicators as part of the approach of regional governments.
2. The capability of governments to ensure adequate oversight, especially for risk assessment and the management and monitoring of facilities.
3. Legacy sites and closure planning.
4. To encourage the reuse of the bauxite residue wherever possible in order to maximise the use of natural resources.

The challenge of bauxite residue utilisation from legacy sites has had limited traction in this context, as there are more options for operating sites. There is growing focus in some regions, especially the European Union, to encourage the circular economy by supporting research and pilot scale projects which will hasten bauxite residue reuse options. The LAC region has not pursued such an approach and lacks the financial resources to match the EU funded work. Additionally, the duality of community attitudes against mining and the roles of ENGO's act at a counterpoint to the private-public endeavours to make positive social impacts.

Keywords: Bauxite residue management, Environmental Governance, Sustainable Development Goals (SDGs), Risk assessment, Community impacts

1. Introduction

At its fourth session, in 2019, the United Nations Environment Assembly adopted a resolution on the topic of mineral resources governance and mining (UNEA Res. 4/19); this was in fact the first resolution on mining of the UNEA [1]. Initially, this resolution requested the United Nations Environment Programme (UNEP) to collate information on practice, gaps and approaches for sustainable management of metal and mineral resources.

Some suggested actions were collated in a report: 'Mineral Resource Governance and The Global Goals: An Agenda For International Collaboration' [2] and this was the basis for subsequent

discussions at the second part of the fifth UNEA, which resulted in the adoption of resolution UNEP/EA.5/12 [3] on the environmental aspects of minerals and metals management. The imperative is recognised as mining is being viewed as critical for the low-energy transition and central to the triple planetary crisis of climate change, biodiversity loss and pollution. Figure 1 below outlines the key discussion areas for the Group of Latin America and Caribbean Countries (GRULAC) from the background document [4].

The resolution specifies the following:

1. **Encourages Member States**, and invites relevant stakeholders along the full life cycle of minerals and metals, from both the public and private sectors, **to align their mining practices and their investments in mining with the 2030 Agenda for Sustainable Development** and with their obligations and decisions under multilateral environmental agreements, as appropriate;
2. Requests the Executive Director, subject to available resources, to **convene transparent and inclusive intergovernmental regional consultations**, including with relevant international organizations, with regional and multilateral environmental agreements, and with relevant stakeholders acting as observers, to feed into a global intergovernmental meeting, **with the aim of developing non-prescriptive proposals to enhance the environmental sustainability of minerals and metals along their full life cycle**, in line with the 2030 Agenda for Sustainable Development;
3. Decides that the intergovernmental regional consultations will: (a) **Take stock of existing activities and actions** in the public and private sectors and by other relevant stakeholders to enhance the environmental sustainability of minerals and metals and identify, among other things, best practices, responsible business practices, standards, guidelines, technical tools, environmentally sustainable technologies and the use of renewable energy in mining; (b) **Identify opportunities for enhanced international cooperation**, including with a view to fostering capacity-building and technological, technical and scientific cooperation in the mining sector, in particular with developing countries; (c) **Identify possible ways forward** for consideration by the Environment Assembly at its sixth session, as appropriate;
4. Requests the Executive Director, through the Global Resource Information Database (GRIDGeneva), to strengthen scientific, technical and policy knowledge with regard to sand, and to support global policies and action regarding the environmentally sound extraction and use thereof;
5. Also requests the Executive Director, subject to the availability of resources, with the engagement of the secretariats of relevant multilateral environmental agreements, organizations and stakeholders, as appropriate, and bearing in mind the launch of the **Global Industry Standard on Tailings Management**, to **compile a report on knowledge gaps in relation to the environmental aspects of tailings management**;
6. Further requests the Executive Director to report to the United Nations Environment Assembly at its sixth session on the progress achieved in the implementation of the present resolution, including through a **summary report on the consultations for consideration by the Environment Assembly at that session**.

Hence, the UNEA resolution 5/12 requests UNEP to convene transparent and inclusive intergovernmental regional consultations (i.e. the process underway now, supported by this Background Paper) to feed into a global intergovernmental meeting, with the aim of developing non-prescriptive proposals to enhance the environmental sustainability of minerals. The scope of resolution 5/12 excludes mineral fuels and includes the full life cycle of minerals and metals, including extraction, on-site and offsite processing, refining, management of mining waste and tailings, rehabilitation of sites and closed or abandoned mines, manufacturing, and recycling.

Figure 1. Specifics of the resolution [4].

1.1 Bauxite/Alumina in CARICOM and the 2030 Agenda

Global production of bauxite for the Caribbean countries (Jamaica, Guyana, Suriname, Haiti and the Dominican Republic) was particularly significant between 1950 – 1970 [5]. The first three, for which general governance is discussed here, are the nations that would have had the most developed industrial activities and to present, continue to either be operational, have shuttered industrial infrastructure or ongoing potential for future exploitation for bauxite mining, refining and smelting.

For the purposes of global groupings, the Caribbean countries of Jamaica, Guyana and Surinam are joined with Latin America; however, the scale of their mineral reserves and exploitation history is quite different – ultimately a function of the geological environments of formation. This results in each of these three nations having its own governance challenges of operations, closure and legacy issues.

The main objective of this paper is to examine the UNEA 5/12 resolution for implications for the bauxite and alumina industries in the Caribbean nations with a view to understanding the local governance implications from the global perspective. The focus on Jamaica will illustrate the diversity of issues, some of which have previously been discussed - closure planning, coherence of addressing legacy issues with national objectives, and aligning the management of bauxite residue disposal sites with the Global Industry Standard on Tailings Management [6,7,8,9].

2. Regional Collaboration

In line with the specific objectives, #2 in Figure 1 below, the GRULAC meeting was held in May 2023, with the broader objective to develop non-prescriptive proposals to enhance the environmental sustainability of minerals and metals along their full life cycle, in line with the 2030 Agenda for Sustainable Development.

The approach of different nations in large international meetings are varied, however, technical officials, as those dealing with mining governance typically are, bring rich perspectives and illustrate the plethora of issues. In the GRULAC cohort, certainly the role of Brazil for bauxite and alumina operations dwarf those of the bauxite bearing CARICOM countries (Jamaica, Guyana, Suriname, Haiti and the Dominican Republic). The bauxite industry of Venezuela is mentioned, however, the barrier to operation in that country is recognised as political [10]. Furthermore, the much smaller CARICOM nations have mature industries – initiated over a century ago in Guyana and Suriname, and approaching seventy years in Jamaica [5]; the bauxite operation in the Dominican Republic (Hispanola) and Haiti were short lived. The other countries in the group present other priority metals in the context of future decarbonisation.

En bloc, the Latin American group has development challenges; these are characterised as being rich in natural resources, have emerging economies and high variability in the governance structures. In each CARICOM location, the bauxite/alumina industry has had different aspects that are to be addressed by governance frameworks, an attempt to collate the broad areas are presented in Table 1 below. The primary factor that determines all operations is the geological setting of the bauxite formation, and the resultant deposit type [11,12]. This in turn dictates methods of exploitation and processing. These two factors are where environmental and social impacts are realised and hence the need for governance frameworks [7].

It is clear there are different permutations for the impacts of the bauxite and alumina industry for each nation, and additionally governance structures, policy and implementation are varied. With technical capacity limitations, it is more useful to take advantage of regional skills and

experiences and access avenues for technical cooperation – these may need to be created, and existing agreements reviewed. It is also clear that for the companies that have existing operations, the matter of political and environmental governance stability is a consideration.

The highest environmental risk of this industry in these Caribbean nations, are the bauxite residue disposal sites. Evans in 2016 [13] has elaborated on the variability in the bauxite residues, the variety of disposal methods and sites, as well as the potential future utilisation. The need for the safe remediation of former bauxite residue disposal sites, their long term management and wherever possible re-use of the chemical constituents in the bauxite residue, or the reuse must be adequately considered in the governance approaches.

Table 1. Bauxite deposit types and governance considerations [11,12].

Country	Deposit Type	Governance Framework Aspects	Potential Environmental Impact	Risks
Jamaica	Discrete orebodies in karst (limestone) terrain	Surface Mining – landscape impact; Export of bauxite and alumina; All reserves allocated; Operational and legacy sites for bauxite residue	Dam failure potential Closure Plan Legacy issues	Ground/Surface water contamination Community pushback/marginalisation of vulnerable groups
Guyana	Lateritic deposits (refractory grade bauxite)	Potential to smelt; Reserves remain for future potential exploitation	Community engagement issues Closure Plan Legacy issues	Marginalisation of indigenous and other vulnerable groups
Surinam	Lateritic deposits	Existing operations terminated in 2016; Reserves remain for future potential exploitation	Issues related to impoundments Closure Plan Legacy issues	Ground/Surface water contamination Community pushback/marginalisation of vulnerable groups

3. Challenges and Opportunities

Given the experience of general environmental management of the Jamaican operations, there are a number of lessons learned or gaps that have been identified for future research and development. The legal framework in environmental management typically will be oriented to conservation of natural resources, assessments, pollution control and mitigation of all perceived risks. Admittedly this is best applied to operating sites but wherever possible should be considered for legacy sites.

3.1 Environmental Indicators as Part of the Approach of Regional Governments

Appropriate environmental indicators are core to dealing with bauxite residue management. However, the relevant indicators should be tied to a robust risk assessment matrix. Elements of the matrix would include engineering design parameters, clear identification of environmental aspects affected and an informed emergency response scenario. In Jamaica, the indicators include water quality monitoring, objectives for site drainage, use of piezometers and site integrity reviews amongst other criteria [8].

3.2 The Capability of Governments to Ensure Adequate Oversight, Especially for Risk Assessment and the Management and Monitoring of Facilities

The coordination of government agencies with varied objectives and mandates can be fraught, with a high variation in capacity – primarily in terms of sufficient officers with relevant experience and training. This becomes compounded by staff turnover and challenges with inadequate written institutional memory. Additionally, the need for climate adaptation strategies is increasingly an imperative to be addressed; in particular, storm intensity in the hurricane season has created environmental emergencies. New terminology is being used for Risks from Natural Hazards at Hazardous Installations and other types of *natural* hazard triggered *technological* accidents – shortened to the term, Natech [14].

3.3 Legacy Sites and Closure Planning

The risk of site abandonment, even within an operating location is another type of challenge. The attitude that is promoted is that sites no longer used, and are not likely to be returned to use, should be addressed. With clear financial implications, operating companies have delayed addressing sites or proposing thorough closure plans to mitigate environmental risks. The example of the closure and remediation of the Kirkvine Ponds was described in 2011 [6] and became a well referenced location for the best practice of bauxite residue closure technology by the International Aluminium Institute [15].

3.4 Reuse of Bauxite Residue Wherever Possible in Order to Maximise the Use of Natural Resources

In the context of the CARICOM economies, the connection of bauxite residue management and circularity in the economy is not simply to elucidate as this stems from the constraints for utilisation of waste streams. As indicated previously, there is only a slightly better opportunity for an operating plant, where the bauxite residue has not yet created other challenges for disposal management. In 2012, a project was initiated by Nippon Light Metals and the Government of Jamaica to extract rare earth elements (REE's) from the Jamaican residues [16]. The project was technically successful, however, the economic viability needed to be assessed prior to moving to implementation; there would also have to be careful consideration for the current environmental implications. There has been much work done internationally to look at uses, and Hindalco has successfully used bauxite residue in cement manufacture [17]. This was also trialled in Jamaica, but the potential percentage utilisation is quite small and creates logistical challenges to implement.

3.5 Community, Community, Community

Ultimately, all of the foregoing is now intricately intertwined with the need for the social licence to mine. The ideas about environmental social and governance (ESG) is the natural evolution of concerns about industrial operations, particularly in developing nations. As previously discussed, Jamaica presents the scenario of very close settlement to all facets of the bauxite and alumina industry [18] and the bauxites residue sites are no different. A fish kill that resulted from the overflow of a bauxite residue disposal site on one of the major rivers dominated the news and social media in the Jamaican holiday period in August 2022 (Jamaica has Emancipation day on August 1st and Independence day on August 6th) [19]; whilst the location had an environmental permit, construction for additional capacity was underway. The incident affected livelihoods of persons using the river (including fisherfolk) as well as emptying into a river that provides significant public water supply.

It also bears mentioning that despite over seventy years of operations, one of the companies in the Jamaican landscape, which is partially government owned, is the defendant in a case that is challenging that bauxite mining impacts persons' constitutional rights – specifically the right to an environment free from degradation.

4. Conclusion

Many nations of the Americas are emerging economies with sustainable development challenges; however, they are committed to embrace the move towards 'Net Zero', the circular economy and the drive to use the world's resources more effectively. The CARICOM nations with former and present bauxite and alumina operations are grappling with a multiplicity of environmental management issues – primarily in governance. There is a clear need for strong oversight and climate adaptation strategies from the regional governments for bauxite residue management. The regional participation in crafting non-prescriptive proposals in the UNEA 5/12 implementation related activities allows for the inclusion of specific challenges that are experienced at the local level. The evolving role of communities and non-governmental groups is creating the need for innovation in methods and forms of engagement. The CARICOM countries are engaged and defining their niche as the mineral needs of the future become more evident.

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