Global Benchmarking of Mining Waste Rules – Indonesia

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This report provides additional detail to support the completed excel document.

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EXECUTIVE SUMMARY

OVERVIEW

The objective of this report is to provide a comprehensive review of Indonesian regulations on mine tailings to an English-speaking audience together with complete English translations of key Indonesian documents. To the best knowledge of the author, these are the only English versions of the Indonesian regulations. Although Indonesia has no single document that contains all of the regulations regarding mine tailings, tailings or mine waste are explicitly mentioned in the following 10 documents:

1) "*Pedoman Keamanan Bendungan*" [Dam Safety Guidelines] (Department of Public Works, 1989)
2) "*Tata cara Penetapan Banjir Desain dan Kapasitas Pelimpah untuk Bendungan* [Procedures for Determining Design Flood and Spillway Capacity for Dams] (National Standardization Agency, 1994)
3) "*Tentang Pertambangan Mineral dan Batubara*" [Regarding Mineral and Coal Mining (Government of the Republic of Indonesia, 2009a)
4) "*Tentang Bendungan*" [Regarding Dams] (Government of the Republic of Indonesia, 2010a)
5) "*Tentang Reklamasi dan Pascatambang*" [Regarding Reclamation and Post-Mining] (Government of the Republic of Indonesia, 2010b)
6) "*Pedoman Teknis—Konstruksi dan Bangunan Sipil—Klasifikasi Bahaya Bendungan* [Technical Guidelines—Construction and Civil Engineering—Dam Hazard Classification] (Ministry of Public Works, 2011)
7) "Tentang Bendungan" [Regarding Dams] (Ministry of Public Works and People's Housing, 2015)
8) "*Tentang Pemanfaatan Limbah Bahan Berbahaya dan Beracun*" [Regarding the Utilization of Hazardous and Toxic Waste] (Ministry of Environment and Forestry, 2020)
9) "*Tentang Perubahan atas Undang-Undang Nomor 4 Tahun 2009 Tentang Pertambangan Mineral dan Batubara*" [Regarding Amendments to Law Number 4 of 2009 Regarding Mineral and Coal Mining] (Government of the Republic of Indonesia, 2020)

10) "*Tentang Penyelenggaraan Perlindungan dan Pengelolaan Lingkungan Hidup*" [Regarding Protection and Management of the Environment] (Government of the Republic of Indonesia, 2021)

The following two additional documents have some relevance to tailings, although without explicit reference to either tailings or mine waste:

11) "*Tentang Penanggulangan Bencana*" [Regarding Disaster Management] (Government of the Republic of Indonesia, 2007)
12) "*Tentang Perlindungan dan Pengelolaan Lingkungan Hidup*" [Regarding Environmental Protection and Management] (Government of the Republic of Indonesia, 2009b)

The author has prepared complete English translations of documents #2, #4, #5, #6, and #7, respectively, in the above list, which are available upon request [contact shemerman@gmail.com or info@earthworks.org]. Key passages from other documents are translated as needed.

The most general statement that can be made about the body of Indonesian tailings regulations is that they are largely devoid of standards and consist largely of procedures, such as procedures for obtaining permits. Examples of missing standards are a minimum separation between tailings dams and downstream communities, minimum factors of safety under static and seismic loading, and minimum design earthquakes. Thus, Indonesian tailings regulations have very little in common with "Safety First: Guidelines for Responsible Mine Tailings Management" (Morrill et al., 2022a), which is also available in Indonesian (Morrill et al., 2022b). Because of the general paucity of standards, careful reference will be made in the following sections to the few standards that do exist.

WATER-RETENTION DAMS AND TAILINGS DAMS

By and large, the Indonesian regulations are very clear in stating that the same regulations apply to both water-retention dams and tailings dams. According to Article 3 of "Dam Safety Guidelines," "*Bendungan adalah setiap penahan buatan, jenis urugan atau jenis lainnya, yang menampung air atau dapat menampung air baik secara alamiah maupun buatan, termasuk fondasi, bukit/tebing tumpuan, serta bangunan pelengkap dan peralatannya. Dalam pengertian ini termasuk juga bendungan limbah galian tetapi tidak termasuk bendung dan tanggul*" [A dam is any artificial barrier, whether embankment or other type, that holds water or can hold water either naturally or artificially, including foundations, retaining walls/cliffs, and ancillary structures and equipment. This definition also includes mine waste dams, but excludes weirs and embankments] (Department of Public Works, 1989). In the above passage, the ambiguity in the use of the word "embankment" occurs only in the English translation. In English, an "embankment dam" ("*bendungan urugan*") is a dam constructed out of earthfill or rockfill, as opposed to concrete. The word "embankment" ("*tanggul*") can also refer to a structure constructed out of earth or rock that is not meant for the long-term confinement of water or mine waste, such as a levee or a railroad embankment. Thus, the "Dam Safety Guidelines" clarify that any structure that confines water or mine waste

is a dam, but not similar types of structures that are not intended for the long-term confinement of water or mine waste.

The document entitled “Regarding Dams” (Government of the Republic of Indonesia, 2010a) is also clear in stating that the same regulations apply both to water-retention dams and tailings dams. Article 1 defines a dam as “*bangunan yang berupa urukan tanah, urukan batu, beton, dan/atau pasangan batu yang dibangun selain untuk menahan dan menampung air, dapat pula dibangun untuk menahan dan menampung limbah tambang (tailing), atau menampung lumpur sehingga terbentuk waduk*” [a structure in the form of an embankment, rockfill, concrete, and/or stone masonry that is constructed not only to hold and store water, but also to hold and store mine waste (tailings) or collect sludge to form a reservoir] (Government of the Republic of Indonesia, 2010a). Article 5 then confirms that “*Pembangunan bendungan untuk penampungan limbah tambang (tailing) dan penampungan lumpur mengikuti ketentuan dalam peraturan pemerintah ini*” [The construction of dams for mine waste (tailings) and sludge storage follows the provisions in this government regulation] (Government of the Republic of Indonesia, 2010a).

The 2015 document also entitled “Regarding Dams” (Ministry of Public Works and People’s Housing, 2015) uses very similar language. Article 1 defines a dam as “*bangunan yang berupa urukan tanah, urukan batu, dan beton, yang dibangun selain untuk menahan dan menampung air, dapat pula dibangun untuk menahan dan menampung limbah tambang, atau menampung lumpur sehingga terbentuk waduk*” [a structure in the form of earthfill, rockfill and concrete that is constructed to be able to store and hold water, or which can be constructed to hold and store mine waste or sludge, so that a reservoir is formed] (Ministry of Public Works and People’s Housing, 2015). In a similar way to the 2010 document, Article 5 confirms that “*Pembangunan bendungan untuk penampungan limbah tambang dan penampungan lumpur mengikuti ketentuan dalam Peraturan Menteri ini*” [Construction of dams for mine waste storage and sludge storage follows the provisions in this Ministerial Regulation.] (Ministry of Public Works and People’s Housing, 2015).

By contrast with the preceding relatively clear equivalence between water-retention dams and tailings dams, Chapter 1 of the document “Procedures for Determining Design Flood and Spillway Capacity for Dams” states “*Tata cara ini: 1) Berlaku untuk ... (2) Bendungan yang tidak berfungsi sebagai pengendali banjir, atau tidak berfungsi sebagai penampung limbah galian dan industry*” [These procedures: 1) Apply to... (2) Dams that do not function as flood control or do not function as reservoirs for mining and industrial waste] (National Standardization Agency, 1994). On the other hand, the related document “Technical Guidelines—Construction and Civil Engineering—Dam Hazard Classification” includes “*bendungan limbah tambang*” in the glossary and states “tailings dam” as the English equivalent (Ministry of Public Works, 2011). The Ministry of Public Works (2011) further states, “*Tipe bendungan akan mempunyai pengaruh signifikan terhadap bentuk rekahan dan debit puncaknya. Tipe bendungan dapat berupa urugan tanah, bendungan gravitasi beton, bendungan busur, bendungan galian tambang dan lain sebagainya*” [The type of dam significantly influences the shape of the breach and its peak discharge. Dam types can include

earthfill dams, concrete gravity dams, arch dams, tailings dams, and so on]. The preceding statement certainly implies that the dam hazard classification system applies to tailings dams, although without explicitly stating that.

The unknown factor is that it is unclear as to whether the statements in the two documents entitled “Regarding Dams” (Government of the Republic of Indonesia, 2010a; Ministry of Public Works and People’s Housing, 2015) that the definition of “dam” includes tailings dams apply only to the provisions in those two documents or whether they should be interpreted to mean that all other Indonesian regulations on dams also apply to tailings dams, including earlier documents, such as “Procedures for Determining Design Flood and Spillway Capacity for Dams” (National Standardization Agency, 1994). The preceding concern is connected with a general confusion among both the government and civil society organizations as to the extent to which Indonesian tailings regulations should be understood in a strictly literal sense. This confusion is discussed more widely in this report in the section entitled “Ambiguities and Gaps in Indonesian Regulations.”

AMBIGUITIES AND GAPS IN INDONESIAN REGULATIONS

Numerous recent studies have drawn attention to the gaps in and lack of implementation of Indonesian mining regulations, especially in the areas of tailings dams and mine reclamation (Bersikhan Indonesia, 2020; Sinaga et al., 2020; Narendra et al., 2021; Nasir et al., 2022, 2023;) . Emerman (2023) has noted the lack of any dam break analysis for the proposed DPM lead-zinc mine in North Sumatra, despite the presence of numerous homes and houses of worship within 1000 meters downstream from the tailings dam, as well as the village of Parongil (population 2010) 1800 meters downstream from the dam. A review of tailings dams in Asia (Baker et al., 2025) summarized the Indonesian situation, “There are government regulations and policies as well as a reclamation fund to ensure effective post mining reclamation and restoration (Pratiwi et al 2021). However, there is a history of poor compliance with these post mining obligations (Narendra et al 2021). More than 60% of companies holding a mining concession license (known as an Izin Usaha Pertambangan (IUP)) in 2018 had not lodged the required reclamation or post mining guarantee funds. Despite being a legal requirement of a mining license, non-compliance generally has little adverse impact on mining companies (Sinaga et al 2020). A report by the NGO, Bersihkan Indonesia (2020), included an evaluation of corruption vulnerability within post-mining guarantee fund policies. It had 4 major conclusions:

- Licensing mechanisms do not audit reclamation and post mining guarantee fund deposit compliance.
- Reclamation and post mining obligations are not considered by mining companies to be an integral part of business operations.
- The scope of reclamation activities provides opportunities to evade responsibility for rectifying the environment to its original condition.
- The guarantee fund is set up in a way that does not provide environmental protection” (Baker et al., 2025).

Baker et al. (2025) continued, “Recognising these shortcomings, the report [by Bersikhan Indonesia (2020)] makes several recommendations:

- Make compliance mandatory prior to upgrading a license from exploration to production.
- Include reclamation guarantee funds in state budgets.
- Develop a mechanism for billing companies when reclamation costs exceed deposited funds.
- Institute harsher penalties for non-compliance.”

A persistent source of confusion has been the discrepancy between what both government officials and civil society organizations say that the Indonesian tailings and dam safety regulations say and the literal text of those regulations. Thus, to some degree, it is unclear as to whether the Indonesian regulations are meant to be interpreted in a strictly literal manner. Further discussion as to the proper means of interpreting an Indonesian regulation is beyond the expertise of the author.

As an example, officials with the Dam Safety Unit of the Indonesian Ministry of Public Works and People’s Housing have claimed that Indonesia has strong dam safety standards that do not appear anywhere in Indonesian regulations. According to a 2015 publication by Anissa Mayangsari and Tri Bayu Adji, “So in this paper, it will going to explain the dam safety in Indonesia based on Water Law No. 11 of 1974 and Ministerial Regulation Number 72/PRT/1997 about Dam Safety … Nowadays dam safety concept in Indonesia was adopted by dam safety concept from Swiss Dam … The dam, including dam body, appurtenance structure, reservoir and foundation, should be safe for: - All possible loading, include earthquake and flood. Consequently, the design must be based on the largest possible events at the site when it comes to the natural hazards of flood and earthquake” (Mayangsari and Adji, 2015). In other words, based upon the preceding quote, all dams in Indonesia, with no stated exception for tailings dams, should be designed to withstand the Probable Maximum Flood (PMF) and the Maximum Credible Earthquake (MCE). The definition of the PMF as stated in National Standardization Agency (1994) was given in the section “Design Flood and Spillway Capacity.” The concept of the MCE is not defined in Indonesian regulations. The Australian National Committee on Large Dams (ANCOLD) defines the MCE as “the largest hypothetical earthquake that may be reasonably expected to occur along a given fault or other seismic source” (ANCOLD, 2012, 2019). Similar definitions can be found in many guidance documents.

The requirement for design of all dams to withstand the PMF and MCE, regardless of the consequences of dam failure, would give Indonesia the strongest dam safety standards in the world. Switzerland is generally regarded as having the strongest dam safety standards in the world. Although Mayangsari and Adji (2015) refer to Swiss regulations, no explicit connection is made between any particular Swiss and Indonesian dam safety regulations. Mayangsari and Adji (2015) do not clarify how or whether the requirement to design all dams to withstand the PMF is connected with the regulations they mentioned, which were Water Law No. 11 of 1974 and Ministerial

Regulation Number 72/PRT/1997. There do not appear to be any Indonesian regulations that would require dams to be designed to withstand a particular earthquake.

As a second example, it is sometimes stated, especially by civil society organizations, that all tailings are automatically classified as B3 Waste, regardless of any measurements on the toxicity of the tailings. For example, according to Yayasan Tanah Merdeka (YTM) (2025a-b), "*Peraturan pemerintah (PP) Nomor 22 Tahun 2021 tentang Penyelenggaraan Perlindungan dan Pengelolaan Lingkungan Hidup mengelompokkan tailing sebagai Bahan Beracun dan Berbahaya (B3) Spesifik Khusus dengan kategori bahaya 2 (dua) yang dianggap memiliki toksisitas kronis dan berjangka panjang terkait dampak terhadap manusia dan lingkungan hidup. Oleh karena itu, tailing harus diolah sebagai limbah B3*" [Government Regulation (PP) Number 22 of 2021 concerning the Implementation of Environmental Protection and Management classifies tailings as Specific Toxic and Hazardous Materials (B3) with hazard category 2 (two) which are considered to have chronic and long-term toxicity related to impacts on humans and the environment. Therefore, tailings must be processed as B3 waste]. However, Indonesian regulations do not explicitly state that tailings must necessarily be regarded as hazardous waste in the absence of testing to confirm that they are hazardous nor that the assumption that tailings are hazardous waste is the default condition in the absence of testing. At the same time, the potential implications in Article 400 of Government of the Republic of Indonesia (2021) that all tailings are B3 Waste should also be noted.

RECLAMATION OF TAILINGS DAMS

This section reviews the Indonesian regulations regarding mine reclamation with special attention to reclamation of tailings storage facilities. The terms "reclamation" and "post-mining" are defined in the document entitled "Regarding Mineral and Coal Mining" (Government of the Republic of Indonesia, 2009a). According to Article 1 of Government of the Republic of Indonesia (2009a), "*Reklamasi adalah kegiatan yang dilakukan sepanjang tahapan usaha pertambangan untuk menata, memulihkan, dan memperbaiki kualitas lingkungan dan ekosistem agar dapat berfungsi kembali sesuai peruntukannya*" [Reclamation is an activity carried out throughout the mining business phase to organize, restore, and improve the quality of the environment and ecosystem so that it can function again according to its intended purpose], while "*Kegiatan pascatambang, yang selanjutnya disebut pascatambang, adalah kegiatan terencana, sistematis, dan berlanjut setelah akhir sebagian atau seluruh kegiatan usaha pertambangan untuk memulihkan fungsi lingkungan alam dan fungsi sosial menurut kondisi lokal di seluruh wilayah penambangan*" [Post-mining activities, hereinafter referred to as post-mining, are planned, systematic, and ongoing activities after the completion of some or all mining operations to restore the natural environment and social functions according to local conditions throughout the mining area].

The remainder of the 2009 mining law (Government of the Republic of Indonesia, 2009a) clarifies that reclamation and post-mining are obligatory, that the reclamation and post-mining plans must be included within the mining permit, that reclamation and

post-mining include tailings storage facilities, and that reclamation and post-mining must be guaranteed by funds deposited in advance of mining. The 2009 mining law describes the requirements for the "*Izin Usaha Pertambangan*" (IUP) [Mining Business Permit] and the "*Izin Usaha Pertambangan Khusus*" (IUPK) [Special Mining Business Permit]. The distinction between the IUP and the IUPK is the area within which mining is carried out and is largely irrelevant for tailings regulations. Article 39 of Government of the Republic of Indonesia (2009a) states that "*IUP Operasi Produksi memuat ketentuan sekurang-kurangnya: ... j. lingkungan hidup termasuk reklamasi dan pascatambang; k. dana jaminan reklamasi dan pascatambang*" [A Production Operation IUP must contain provisions for at least: ... j. the environment, including reclamation and post-mining; k. reclamation and post-mining guarantee funds]. Article 79 of Government of the Republic of Indonesia (2009a) states the same obligations for holders of a Production Operation IUPK. Article 96 then states "*Dalam penerapan kaidah teknik pertambangan yang baik, pemegang IUP dan IUPK wajib melaksanakan: ... c. pengelolaan dan pemantauan lingkungan pertambangan, termasuk kegiatan reklamasi dan pascatambang; ... e. pengelolaan sisa tambang dari suatu kegiatan usaha pertambangan dalam bentuk padat, cair, atau gas sampai memenuhi standar baku mutu lingkungan sebelum dilepas ke media lingkungan*" [In implementing good mining engineering principles, IUP and IUPK holders are required to implement: ... c. management and monitoring of the mining environment, including reclamation and post-mining activities; ... e. management of mining waste from a mining business activity in solid, liquid, or gaseous form until it meets environmental quality standards before being released into the environment]. The notes to Article 96 clarify that "*Yang dimaksud dengan sisa tambang meliputi antara lain tailing dan limbah batubara*" [Mining waste includes, among other things, tailings and coal waste].

The document entitled "Regarding Reclamation and Post-Mining" (Government of the Republic of Indonesia, 2010b) was intended to further clarify the requirements for reclamation and post-mining in the 2009 mining law (Government of the Republic of Indonesia, 2009a). The first clarification is that reclamation and post-mining explicitly include guarantees of the permanent stability of tailings storage facilities. According to Articles 3 and 4 of Government of the Republic of Indonesia (2010b), "*Pelaksanaan reklamasi dan pascatambang oleh pemegang IUP Operasi Produksi dan IUPK Operasi Produksi wajib memenuhi prinsip: a. perlindungan dan pengelolaan lingkungan hidup pertambangan … Prinsip perlindungan dan pengelolaan lingkungan hidup pertambangan paling sedikit meliputi: ... c. penjaminan terhadap stabilitas dan keamanan timbunan batuan penutup, kolam tailing, lahan bekas tambang, dan struktur buatan lainnya*" [The implementation of reclamation and post-mining activities by holders of Production Operation IUP and Production Operation IUPK must comply with the following principles: a. protection and management of the mining environment … The principles of protection and management of the mining environment … include at least: … c. guaranteeing the stability and safety of overburden embankments, tailings ponds, former mined areas, and other artificial structures].

The second clarification in Government of the Republic of Indonesia (2010b) is that the reclamation guarantee funds must be fully deposited in advance and cannot be

promised on the basis of anticipated mining revenues. According to Article 31 of Government of the Republic of Indonesia (2010b), "*Jaminan reklamasi ... dapat berupa: a. rikening bersama pada bank pemerintah; b. deposito berjangka pada bank pemerintah; c. bank garansi pada bank pemerintah atau bank swasta nasional; atau d. cadangan akuntansi*" [The reclamation guarantee … may be in the form of: a. a joint account at a government bank; b. a time deposit at a government bank; c. a bank guarantee at a government bank or a national private bank; or d. an accounting reserve]. The third clarification is that mining companies cannot simply forgo their reclamation and post-mining guarantee funds as a substitute for actually carrying out the reclamation and post-mining activities. Articles 32 and 38 state "*Penempatan Jaminan Reklamasi tidak menghilangkan kewajiban pemegang IUP dan IUPK untuk melaksanakan reklamasi … Penempatan jaminan pascatambang tidak menghilangkan kewajiban pemegang IUP Operasi Produksi dan IUPK Operasi Produksi untuk melaksanakan pascatambang*" [The placement of the Reclamation Guarantee does not relieve the IUP and IUPK holders of their obligation to carry out reclamation … The placement of the post-mining guarantee does not eliminate the obligation of the holder of a Production Operation IUP and Production Operation IUPK to implement post-mining].

The reclamation regulations were strengthened in the document entitled "Regarding Amendments to Law Number 4 of 2009 Regarding Mineral and Coal Mining" (Government of the Republic of Indonesia, 2020). The first strengthening is the explicit statement that reclamation and post-mining are expected to be completely successful. According to Article 123A of Government of the Republic of Indonesia (2020), "*Eks pemegang IUP atau IUPK yang IUP atau IUPK berakhir wajib melaksanakan Reklamasi dan Pascatambang hingga mencapai Tingkat keberhasilan 100% (seratus persen) serta*" [Former IUP or IUPK holders whose IUP or IUPK has expired are required to carry out Reclamation and Post-Mining until they reach a success rate of 100% (one hundred percent)].

The more recent amendments also establish strong penalties for failure to carry out reclamation or to deposit reclamation funds, including the option of imprisonment. According to Article 161B, *"(1) Setiap orangyang IUP atau IUPK dicabut atau berakhir dan tidak melaksanakan: a. Reklamasi dan/atau Pascatambang; dan/atau b. penempatan dana jaminan Reklamasi dan/atau dana jaminan Pascatambang, dipidana dengan pidana penjara paling lama 5 (lima) tahun dan denda paling banyak Rp 100.000.000.000,00 (seratus miliar rupiah). (2) Selain sanksi pidana sebagaimana dimaksud pada ayat (1), eks pemegang IUP atau IUPK dapat dijatuhi pidana tambahan berupa pembayaran dana dalam rangka pelaksanaan kewajiban Reklamasi dan/atau Pascatambang yang menjadi kewajibannya"* [(1) Any person whose IUP or IUPK is revoked or expires and who fails to carry out: a. Reclamation and/or Post-Mining; and/or b. placement of Reclamation and/or Post-Mining guarantee funds shall be subject to a maximum imprisonment of 5 (five) years and a maximum fine of IDR 100,000,000.00 (one hundred billion rupiah) [about 6.2 million US dollars] (2) In addition to the criminal sanctions referred to in paragraph (1), former holders of IUP or IUPK may be subject to additional penalties in the form of payment of funds to carry out their Reclamation and/or Post-Mining obligations].

INDEPENDENT EXPERT REVIEW PANELS

Indonesian regulations require independent expert review panels for tailings dams, but only in certain circumstances. According to Article 150 of Ministry of Public Works and People's Housing (2015), "*Dalam pelaksanaan pembangunan dan pengelolaan bendungan dengan kriteria tertentu, Pembangun dan Pengelola bendungan berkewajiban menunjuk panel ahli bebas. (2) Bendungan dengan kriteria tertentu sebagaimana dimaksud pada ayat (1), meliputi:*

a. bendungan dengan tinggi 75 (tujuh puluh lima) meter atau lebih diukur dari lembah terdalam dengan daya tampung waduk sekurang-kurangnya 100.000.000 (seratus juta) meter kubik;
b. bendungan yang mempunyai permasalahan teknik yang kompleks; atau
c. *bendungan yang menerapkan teknologi baru sesuai dengan rekomendasi Komisi Keamanan Bendungan*"

[In carrying out the construction and management of dams with certain criteria, the Dam Builder and Dam Manager are obligated to appoint a panel of independent experts. 2) Dams with certain criteria as referred to in item (1) include:

a. dams with a height of 75 (seventy-five) meters or more measured from the deepest valley with a reservoir capacity of at least 100,000,000 (one hundred million) cubic meters;
b. dams that have complex engineering problems; or
c. dams implementing new technology in accordance with the recommendations of the Dam Safety Commission].

The expressions "*permasalahan teknik yang kompleks*" [complex engineering problems] and "*teknologi baru"* [new technology] are not otherwise explained in Ministry of Public Works and People's Housing (2015). Thus, there is considerable latitude for all but the largest tailings dams to forgo the advice of an independent expert review panel.

CONSEQUENCES OF TAILINGS DAM FAILURE

The Indonesian regulations are quite emphatic in the requirements to develop the emergency action plan based on input from the downstream communities, to communicate the emergency action plan to the downstream communities, and to keep the emergency action plan updated in response to changes in the downstream communities. According to Article 53 of Government of the Republic of Indonesia (2010a), "*Rencana tindak darurat yang telah disusun ... dikonsultasikan kepada bupati/walikota dan gubernur yang wilayahnya terpengaruh potensi kegagalan bendungan*" [The emergency action plans that have been prepared … are consulted with the regents/mayors and governors whose areas are affected by the potential for dam failure]. According to Article 57 of Government of the Republic of Indonesia (2010a), "*Rencana tindak darurat yang telah ditetapkan harus disosialisasikan oleh Pembangun bendungan kepada masyarakat yang terpengaruh potensi kegagalan bendungan serta*

pemerintah provinsi dan kabupaten/kota yang wilayahnya terpengaruh potensi kegagalan bendungan" [The emergency action plan that has been determined must be disseminated by the Dam Builder to the community affected by the potential for dam failure as well as the provincial and district/city governments whose areas are affected by the potential for dam failure]. Article 58 continues, "*Pengelola bendungan harus meninjau kembali rencana tindak darurat apabila terjadi perkembangan kondisi sumber daya air, lingkungan, dan perkembangan keadaan sosial di hilir bendungan*" [The Dam Manager must review the emergency action plan if there are changes in the condition of water resources, the environment, or social conditions downstream of the dam] (Government of the Republic of Indonesia, 2010a).

The corresponding document by Ministry of Public Works and People's Housing (2015) uses very similar language and, in some cases, is even more emphatic in the necessity for an emergency action plan and in the need for input from the downstream communities. According to Article 53 of Ministry of Public Works and People's Housing (2015), "*Kesiapsiagaan tindak darurat ... ditujukan agar pengelola bendungan selalu siap menghadapi kondisi terburuk dari bendungan yang dikelolanya ... Untuk memenuhi kesiapsiagaan tindak darurat ... pengelola bendungan melakukan: a. penyusunan rencana tindak darurat; ... c. pemutakhiran rencana tindak darurat sesuai kondisi terkini; ... e. sosialisasi terhadap unsur masyarakat-masyarakat yang terpengaruh potensi kegagalan bendungan; dan f. sosialisasi terhadap pemerintah daerah provinsi dan pemerintah daerah kabupaten/kota yang wilayahnya terpengaruh potensi kegagalan bendungan*" [Emergency preparedness … is intended so that Dam Managers are always ready to face the worst conditions of the dam that they manage … To fulfill emergency preparedness … the Dam Manager shall: a. prepare an emergency action plan; … c. update the emergency action plan according to current conditions; … e. outreach to elements of society who are affected by the potential for dam failure; and f. outreach to provincial and district/city regional governments whose areas are affected by the potential for dam failure]. The significance of the express "*kondisi terburuk*" [worst condition] will be further considered in the section "Ambiguities and Gaps in Indonesian Regulations." According to Article 54 of Ministry of Public Works and People's Housing (2015), "*Dalam menyusun rancangan rencana tindak darurat, pembangun bendungan memperoleh masukan teknis dari pengelola sumber daya air pada wilayah sungai dan masukan dari unsur masyarakat yang terpengaruh terhadap potensi kegagalan bendungan*" [In drafting an emergency action plan, the Dam Builder obtains technical input from the manager of water resources in the river basin and input from members of the public who are affected by the potential for dam failure].

DEEP SEA TAILINGS DISPOSAL

In 2021 the government of Indonesia announced that no new permits will be issued for deep sea tailings disposal (Nangoy and Ungku, 2021). However, in the same year, the document "Regarding Protection and Management of the Environment" (Government of the Republic of Indonesia, 2021) established the conditions under which deep sea tailings disposal could legally be carried out. The preceding discrepancy

is consistent with the thesis of this report that, in general, Indonesia lacks standards for mine tailings, but instead, makes decisions regarding proposed tailings projects at the permit level, that is, on a case-by-case basis. According to Article 392 of "Regarding Protection and Management of the Environment" states, "*Limbah B3 yang dapat dilakukan Dumping (Pembuangan) Limbah B3 ke media Lingkungan Hidup berupa laut ...*

a. tailing dari kegiatan pengolahan hasil pertambangan;
b. serbuk bor dari hasil pemboran Usaha dan/atau Kegiatan eksplorasi dan/atau eksploitasi di laut menggunakan lumpur bor berbahan dasar sintetis (synthetic-based mud); dan
c. *serbuk bor dan lumpur bor dari hasil pemboran Usaha dan/atau Kegiatan eksplorasi dan/atau eksploitasi di laut menggunakan lumpur bor berbahan dasar air (water-based mud)"*

[B3 waste that can be dumped (disposal) into the Environmental media in the form of the sea ...

a. tailings from mining processing activities;
b. drill cuttings from drilling results of exploration and/or exploitation businesses and/or activities at sea using synthetic-based mud; and
c. drill cuttings and drill mud from drilling results of exploration and/or exploitation businesses and/or activities at sea using water-based mud]

(Government of the Republic of Indonesia, 2021).

Deep sea disposal of tailings should not be carried out in sensitive areas. Moreover, it is preferred to carry out deep sea disposal of tailings in areas that have a permanent thermocline, a surficial layer of warm water that would suppress upwelling. Article 395 of Government of the Republic of Indonesia, 2021) states, "*Lokasi tempat dilakukan Dumping (Pembuangan) Limbah B3 sebagaimana ... harus memenuhi persyaratan yang meliputi:*

a. terletak di dasar laut pada laut yang memiliki lapisan termoklin permanen; dan
b. tidak berada di lokasi tertentu atau di daerah sensitif sesuai dengan ketentuan peraturan perundang-undangan"

[The location where B3 Waste Dumping is carried out as ... must meet the requirements which include:

a. located on the seabed in the sea which has a permanent thermocline layer; and
b. not located in a specific location or in a sensitive area in accordance with the provisions of laws and regulations].

However, deep sea disposal of tailings can still be carried out in areas where there is no permanent thermocline as long as certain other requirements are met. Article 395 continues, "*Dalam hal tidak terdapat laut yang memiliki lapisan termoklin permanen ... lokasi tempat dilakukan Dumping (Pembuangan) Limbah B3 berupa tailing dari kegiatan pengolahan hasil pertambangan harus memenuhi persyaratan lokasi yang meliputi:*

a. terletak di dasar laut dengan kedalaman lebih dari atau sama dengan 100 m (seratus meter);
b. secara topografi dan batimetri menunjukkan adanya ngarai dan/atau saluran di dasar laut yang mengarahkan tailing ke kedalaman lebih dari atau sama dengan 200 m (dua ratus meter); dan

c. *tidak ada fenomena up-welling"*

[In the absence of a sea that has a permanent thermocline layer ... the location where the dumping of B3 Waste in the form of tailings from mining processing activities is carried out must meet the location requirements which include:

a. location on the seabed with a depth of more than or equal to 100 m (one hundred meters);
b. topographically and bathymetrically showing the presence of canyons and/or channels on the seabed that direct the tailings to a depth of more than or equal to 200 m (two hundred meters); and
c. no upwelling phenomenon].

The Indonesian tailings regulations do not prohibit the disposal of tailings into rivers or other inland water bodies. However, the only mine in Indonesia with a permit to discharge tailings into a river is the Grasberg copper-gold mine in West Papua, which is currently owned and operated by PT Freeport Indonesia, a joint venture of the American company Freeport-McMoRan (48.8%) and the Indonesian state-owned company PT Indonesia Asahan Aluminum, (51.2%). There are no operating Indonesian mines that discharge tailings into lakes, wetlands, or other water bodies, although the practice is not specifically prohibited.

ABOUT THE AUTHOR

Dr. Steven H. Emerman has a B.S. in Mathematics from The Ohio State University, M.A. in Geophysics from Princeton University, and Ph.D. in Geophysics from Cornell University. Dr. Emerman has 31 years of experience teaching hydrology and geophysics, including teaching as a Fulbright Professor in Ecuador and Nepal, and has over 70 peer-reviewed publications in these areas. Since 2018 Dr. Emerman has been the owner of Malach Consulting, which specializes in evaluating the environmental impacts of mining for mining companies, as well as governmental and nongovernmental organizations. Dr. Emerman has evaluated proposed and existing tailings storage facilities in North America, South America, Europe, Africa, Asia and Oceania, and has testified on tailings storage facilities before the U.S. House of Representatives Subcommittee on Indigenous Peoples of the United States, the European Parliament, the United Nations Permanent Forum on Indigenous Issues, the United Nations Environment Assembly, the Permanent Commission on Human Rights of the Chamber of Deputies of the Dominican Republic, and the Minnesota Senate Environment, Climate and Legacy Committee. Dr. Emerman is the former Chair of the Body of Knowledge Subcommittee of the U.S. Society on Dams, one of the authors of "Safety First: Guidelines for Responsible Mine Tailings Management," and the author of the report for Earthworks entitled "Filtered Tailings in Indonesia: The Catastrophic Failure of a Disruptive Technology."

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