Global Benchmarking of Mining Waste Rules – EU

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

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1. Overview and History

The European Union's (EU) Extractive Waste Directive is the primary EU rule governing the management of wastes from the exploration, extraction, processing, and storage of mineral resources and quarries (EU, 2006, or EWD). The EU has not updated the EWD in nearly 20 years. Over the years, limited parts of the EWD have been amended, and several related documents have come in and out of force. An overview of selected documents that the EWD requires or refers to, and documents that reference the EWD or other associated documents, is presented in Figure 1. The ecosystem of documents related to the EWD, and Directives that are only partially amended and often have different names, makes it challenging to fully evaluate and compare the EWD against Safety First, Guidelines for Responsible Mine Tailings Management (Safety First; Morrill et al., 2022), which is the aim of the study presented in this memorandum. Safety First is a set of protective guidelines for the management of tailings facilities that responds to the increasing number of tailings dam failures around the world and aims to minimize adverse effects on communities, human rights, and the environment. Safety First was originally released in 2020, updated in 2022, and has been endorsed by a large and diverse set of scientists, organizations, and Indigenous communities and Tribal Nations.

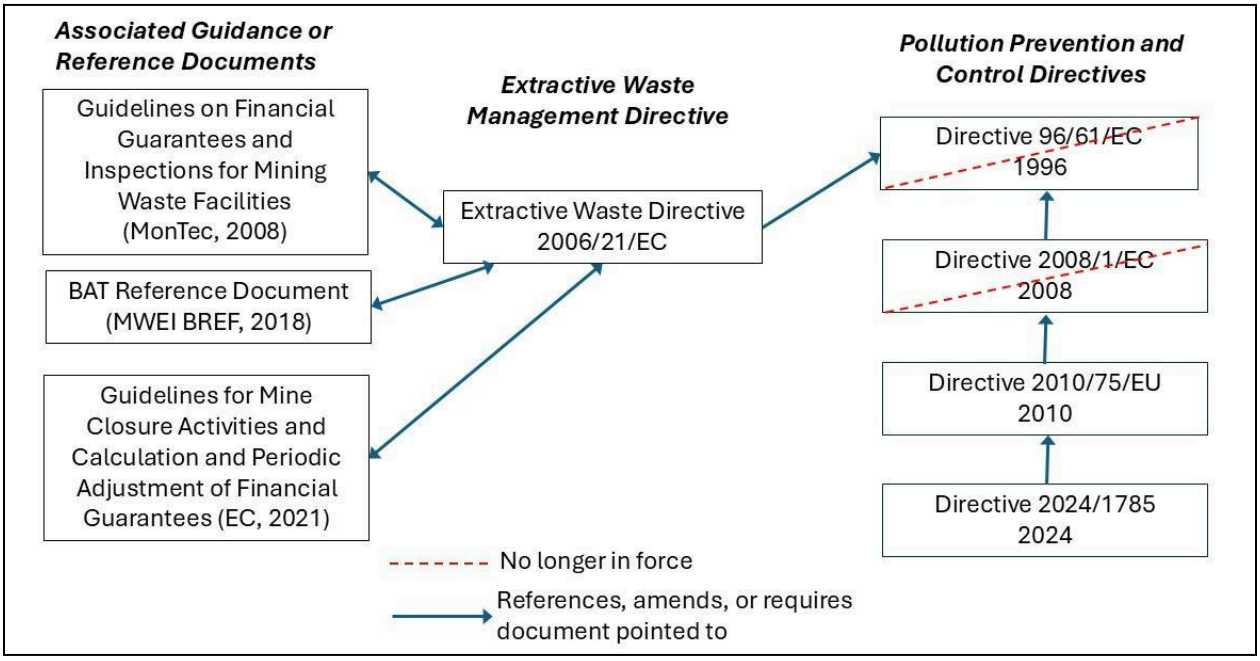

Figure 1. EU Extractive Waste Directive (2006/21/EC) and selected associated documents over the years.

1.1 Best available techniques and integrated pollution prevention and control

According to the EWD, extractive waste management measures should be based on best available techniques (BATs) as defined in another Directive referenced in the EWD, Directive 96/61/EC (EU, 1996). Directive 96/61/EC addresses BATs for integrated pollution prevention and control applied to waste rock and tailings from mining activities and was updated in 2008, 2010, and 2024. Yet the EWD refers to the 1996 Directive that is no longer in force (see Figure 1). Directive 2008/1/EC (EU, 2008) concerning integrated pollution prevention and control is also no longer in force; its validity ended in June 2014. Directive 2010/75/EU (EU, 2010) on industrial emissions (integrated pollution prevention and control) is in force but has been amended by EU Directive 2024/1785 (EU, 2024) that also amends Council Directive 1999/31/EC on the landfilling of waste. Therefore, Directive 2024/1785 is the most recent Directive related to integrated pollution prevention and control and the landfilling of waste.

In 2018, a Best Available Techniques (BAT) document, abbreviated as MWEI BREF (EC, 2018), was published that provides information on extractive waste management, including options for BATs. This document was published pursuant to Article 21(3) of the EWD. The EWD explains that Member States shall ensure that mine operators take all measures necessary to prevent or reduce as far as possible any adverse effects on the environment and human health resulting from the management of extractive waste. The EWD further explains that these measures shall be based on BATs without prescribing the use of any technique or specific technology but taking into account the technical characteristics of the waste facility, its location, and local environmental conditions (MWEI BREF, pg. i). Therefore, neither the EWD nor the MWEI BREF document mandates the use of any of the BAT approaches described in the MWEI BREF.

1.2 Guidelines and Directives related to accident prevention, environmental assessments, and financial guarantees

Article 6 of the EWD requires that Member States identify and incorporate elements to prevent major accidents into the design, construction, operation and maintenance, closure, and after-closure of the waste facility. Directive 2012/18/EU (EU, 2012) addresses accident prevention related to dangerous substances. Finally, Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (environmental impact assessments) is in force but has been changed to the 2014 consolidated version. Therefore, Directive 2014/52/EU is the most recent Directive related to environmental impact assessments, and it contains amendments to Directive 2011/92/EU in Article 1.

In 2008 the European Commission contracted the creation of non-binding “Guidelines on Financial Guarantees and Inspections for Mining Waste Facilities” (MonTec, 2008)

and in 2021 commissioned “Guidelines for Mine Closure Activities and Calculation and Periodic Adjustment of Financial Guarantees” (EC, 2021) in support of the EWD.

This memorandum benchmarks elements in the EWD and associated Directives and documents against those in Safety First. The primary topics addressed include: (1) banning of upstream dams at new mines; (2) mandating the use of best available technologies for filtered tailings; (3) putting in place appropriate monitoring systems to identify, disclose, and mitigate risks; (4) ensuring safer loser with no credible failure modes; (5) addressing financial risks, including proper financial assurance and insurance; (6) making information regarding mine safety publicly available in relevant languages; (7) climate change; and (8) banning new tailings facilities where inhabited areas are in the path of a tailings dam failure. A summary of findings and references cited are included at the end of the memorandum.

2. Benchmarking of Elements

Annex I presents guidelines and questions from Safety First and responses to the questions found in the EWD and related Directives and documents. The set of documents reviewed is included in Section 6, References. The primary EU documents cited include the EWD, the non-binding BAT Reference Document for Waste Management (MWEI BREF), the non-binding “Guidelines on Financial Guarantees and Inspections for Mining Waste Facilities (MonTec, 2008),” and the non-binding “Guidelines for Mine Closure Activities and Calculation and Periodic Adjustment of Financial Guarantees (EC, 2021).” These elements are related to (1) banning of upstream dams at new mines; (2) mandating the use of best available technologies for filtered tailings; (3) putting in place appropriate monitoring systems to identify, disclose, and mitigate risks; (4) ensuring safer loser with no credible failure modes; (5) addressing financial risks, including proper financial assurance and insurance; (6) making information regarding mine safety publicly available in relevant languages; and (7) climate change.

3. Methodology

To respond to all eight Safety First elements and associated questions, the authors searched for key terms in the EWD and related EU Directives and documents. For example, for the question “Does the jurisdiction make, or require operating companies make, the name, exact location, ownership, date of initial operation, footprint, and height of all tailing facilities publicly available?,” the key terms searched were: "name," "location," "ownership," "footprint," "height," "public," and "disclose/ure." In addition to searching for key terms, in most cases the entire document was reviewed for sections related to tailings facilities and other elements of the benchmarking comparison, especially in the case of the MWEI BREV, which is the most important document on best available technologies for management of tailings facilities, and of course the EWD.

4. Discussion of Elements in the EWD Benchmarked against Safety First

The focus of benchmarking the EWD and related documents against Safety First is to determine whether and how EU legislation on managing extractive wastes should be updated.

4.1 Banning of Upstream Dams at New Mines

The EU does not ban the upstream tailings dam construction method for new and/or proposed facilities, nor does it require a halt to expanding existing facilities using the upstream method or the closure of existing upstream facilities. The EWD does not consider a "modified centerline" construction method equivalent to an upstream construction method. Instead, the MWEI BREF considers the centerline method an alternative and a compromise between the upstream and downstream methods.

4.2 Mandating the Use of Best Available Technologies for Filtered Tailings and Backfilling

The language in the questions we are responding to for this element is firm on *mandating* or *requiring* the use of Best Available Technologies (BAT) for tailings management. Neither the MWEI BREF nor the EU Directives require or mandate the use of BAT with regard to the use of filtered or "dry stack" tailings or backfilling.

As noted in the independent evaluation of the Mount Polley spill in British Columbia, Canada, in 2014 (British Columbia, 2015), the most direct method of reducing the number of tailings dam failures is to store the majority of the tailings below ground in mine excavations (backfilling). Backfilling can be accomplished by depositing tailings in mined-out pits or underground workings. Beyond backfill, surface storage using filtered tailings is also a prime BAT candidate.

Although the EU Directives support the use of BAT, very few specifics are included. For example, Directive 2024/1785 (25) (pg. 5) encourages[1] the creation of an Environmental Management System (EMS) that prevents waste generation and optimizes resource use and water reuse, but the Directive falls short of mandating the establishment and implementation of an EMS.

Filtered tailings: MWEI BREF (pg. 70) describes "dry stack" tailings but erroneously states that the waste deposit "does not require the construction of retention dams." However, designing perimeter ditches and a drainage system to manage surface runoff within the facility is mentioned on pg. 314, and the possible need for dam structures or retaining dykes and a composite basal structure in regions with heavy rainfall or a wet climate (not defined) is mentioned on pg. 315. Figure 2.3 in the MWEI BREF (pg. 70) shows, on the positive side, that wet and "dry" tailings filter cakes have efficient water and process chemical recovery, minimal water management, minimal containment requirements, negligible seepage losses, and facilitates progressive rehabilitation. On

[1] "Should" is used rather than shall.

the negative side, the figure shows that the approach results in very high CapEx and OpEx but low rehabilitation costs. It is not clear from the text or the figure that “dry stack” tailings are considered BAT relative to using hydraulic tailings or a thickened/paste tailings as management techniques. It is simply one option to consider.

Required analysis during permitting: It is unclear if an analysis is *required* for the use of filtered tailing or the use of backfilling. The MWEI BREF states in BAT 4 (pg. 494) that "BAT *is to use* all of the following techniques: …," which include identifying extractive waste handling/transport, treatment and deposition *options* during the planning phase. Options for permanent deposition of waste from mineral processing (e.g., tailings) include "dry stacking," and deposition in excavation voids (backfilling) (pg. 495).

Backfilling of tailings and subaqueous disposal: Maximizing of backfilling is not required. Article 5 (2. (a)(iii)) of the EWD states that an objective of the waste management plan is to place extractive waste back into the excavation void after extraction of the mineral, as far as is technically and economically feasible and environmentally sound in accordance with existing environmental standards at Community level and with the requirements of this Directive where relevant. But maximizing backfilling is not required. Subaqueous disposal is not banned and is instead encouraged for potentially acid generating (PAG) wastes. MWEI BREF (pg. 495) includes as BAT the permanent deposition of slurried extractive waste from mineral processing (which includes tailings) in ponds and dams. Deposition of slurried tailings in ponds and dams would include subaqueous disposal. The applicability of backfilling depends on site-specific conditions (such as location, mineral deposit, extractive waste characteristics) and is assessed individually for each type of excavation void. Placing extractive waste back into excavation voids is not applicable under the following conditions: for PAG extractive waste, unless deposited under water cover; for partially oxidized extractive waste with residual ARD potential; during operation if it inhibits the extraction activities; at closure if it would cause instability or a negative environmental impact (pg. 317). The considerations for backfilling imply that deposition under a water cover for PAG waste is the preferred BAT approach.

More protective provisions than Safety First: While not related to filtered tailings or backfilling, the MWEI BREF describes desulfurization and other separation methods to minimize the formation of acid drainage (pg. 324) by removing pyrite and other acid-forming sulfide minerals, but these methods are not required. Safety First does not include methods to separate acid-forming minerals and materials to minimize the formation of acid drainage. Unlike Safety First, MWEI BREF also discusses preventing the generation of extractive waste by using the wastes as construction materials and secondary raw materials and reusing and recycling extractive waste (pg. 59-61).

Additional considerations: *For filtered tailings*: In regions with heavy rainfall or a wet climate, the deposited extractive waste may become chemically and/or physically unstable during extreme rainfall. In such regions, dry stacking may require additional

dam structures or retaining dykes and composite basal structure to prevent spreading of extractive waste as a result of heavy rains. (MWEI BREF, pg. 315). *For backfilling*: The applicability depends on site-specific conditions (such as location, mineral deposit, extractive waste characteristics) and is assessed individually for each type of excavation void. Placing extractive waste back into excavation voids is not applicable: to PAG extractive waste, unless deposited under water cover; to partially oxidized extractive waste with residual ARD potential; during operation if it inhibits the extraction activities; at closure if it would cause instability or a negative environmental impact (pg. 317). The considerations for backfilling imply that deposition under a water cover for PAG waste is the preferred BAT approach.

4.3 Putting in Place Appropriate Monitoring Systems to Identify, Disclose, and Mitigate Risks

Adaptive Management Plans: None of the EWD's assorted Directives mentions required Adaptive Management Plans (AMPs) or Observational Methods for monitoring tailings facilities. As such, there is no requirement that an AMP and its raw data be made public or that a meeting be held to explain the results to affected communities and other interested stakeholders. Although an Adaptive Management Plan is not specifically mentioned, the MWEI BREF states that "when prediction of geotechnical behaviour is difficult during the design phase and when the design is reviewed during construction, …the observational method according to Eurocode 7–1 or equivalent" should be applied (pg. 524). The "observational method" is another term used for adaptive management.

Although there might not be required AMPs that include reporting responsibilities for the operating company and responses by the regulatory agency and to relevant stakeholders, the EWD references broad reporting on monitoring. The required reporting of monitoring results in the EWD is generally to the competent authorities rather than the public, and reporting to the public is generally "upon request." The EWD's Article 11 states that, at least annually, "the operator shall report" monitoring results demonstrating permit conditions compliance and "increasing knowledge of … waste facility behaviour." Under Article 17, "Member States shall require" the operator to keep updated waste management operations records and make them available for inspection by competent authorities. However, the Guidelines on Financial Guarantees and Inspections for Mining Waste Facilities (MonTec, 2008) note that, across the EU, the "inspectorates" largely vary, creating an inconsistent and complex supervision system. Under Article 18 of the EWD, every year Member States shall transmit to the Commission information on events likely to affect the stability of the waste facility and any significant adverse environmental effects revealed by the control and monitoring procedures of the waste facility. The Commission shall make this information available to the Member States upon request, who shall make the information available to the public on request.

An annual report is not required by the EWD or the MWEI BREF, and there is no mention of making the underlying data available to the public or holding a meeting to explain the

results to the affected communities and other interested stakeholders. Similarly, no information or requirements related to evaluating the effectiveness of installed mitigation measures could be found in the EU Directives or the MWEI BREF.

In lieu of an annual AMP report that reviews any triggers met or exceeded, mitigation actions taken, the effectiveness of the actions, and any AMP modifications needed, the MWEI BREF references two other reports that can assess risks and actions. The Environmental Risk and Impact Evaluation includes “reporting,” identifies risks like “potential triggers and failure modes,” plans risk reduction measures; and a developed emergency plan can help minimize the consequences of a failure. Further, the Operation, Supervision, and Maintenance Manual can cover monitoring, reports, the dam safety organization, and an emergency preparedness plan. Numeric trigger levels are not mentioned. However, control and monitoring procedures during operations (MWEI BREF, Section 2.1.1.8) "may" include extractive waste characteristics and stability; some examples of monitoring include conformance checks of the facilities and surrounding areas for groundwater pressure, seismic events, increased or new seepage areas, and monitoring and controlling hydrogeology to ensure systems are performing according to design criteria. A water management plan includes criteria to manage water levels within safe limits, a water balance analysis that is compared to monitoring results, defining acceptable seepage, and monitoring and controlling to ensure systems are performing as designed. Some of these monitoring elements are very similar to adaptive management measures.

Independent Tailings Review Board (ITRB): The EU does not specifically require an ITRB, but independent review and oversight of waste facilities and their components are mentioned in multiple documents. For example: EWD’s Article 11 states that “the competent authority may decide” that an independent expert needs to validate the annual monitoring report the operator submits. In Directive 2024/1795, “Member States shall require the operator” to prepare an Environmental Management System, which “shall be audited” by July 2027 and thereafter audited at least every 3 years. Independent review, or "third-party" review and oversight, is discussed in the MWEI BREF but usually by an implied single expert rather than a board. For example, in Section 2.1.2 construction of the extractive waste facility is supervised by an independent qualified engineering/geotechnical specialist, and independent audits of the dam with a sign-off by the third-party auditor are frequently conducted to avoid incidents. The MWEI BREF also defines, in Section 2.1.2.2, the possibility of independent auditing of an extractive waste facility as “consist[ing] of the evaluation of the performance and safety of a facility on a regular basis by a qualified and experienced expert, who has never been associated with the design or operation of the EWF [extractive waste facility].”

More protective provisions than Safety First: Safety First mentions prevention measures to minimize seepage from tailings facilities (pg. 15) but does not require a water balance model or comparing water levels and flows against model predictions. The water management plan in the MWEI BREF (Section 2.1.1.8) mentions a water balance

analysis that is compared to monitoring results. Safety First mentions risks associated with seismic events and using a Factor of Safety related to the strongest seismic acceleration theoretically possible (pg. 27), but it does not include a requirement to monitor seismic events during operations. The MWEI BREF (Section 2.1.1.8) includes monitoring of seismic events during operations, although it is not clear that the monitoring is required. The MWEI BREF includes recommendations for providing appropriate training of operational personnel on incipient fault diagnosis and creating effective mechanisms for the reporting of faults are established and maintained (Section 2.1.2). Fault monitoring, evaluation, and reporting is not mentioned in Safety First.

Additional considerations: The waste management plan required by Article 5 of the EWD promotes creating a design that will require "minimal and, if possible, ultimately no monitoring, control and management of the closed waste facility." In reality, all closed mine waste facilities require long-term monitoring and evaluation, and most likely mitigation. In addition, The European Union currently has 28 Member States. The EWD provides a very general set of requirements for financial assurance that must be implemented in each of the Member States, which have, in some cases, different currencies and different banking structures. The enforcement of the requirements across the Member States will therefore be difficult, especially because many of the requirements are vague or out of date.

4.4 Towards Safer Closer with no Credible Failure Modes

Some of the elements in this section include questions about financial assurance, which is also covered in Section 4.5. Therefore, some overlap in the responses in the two sections may occur.

Developing closure plans during permitting: The EU requires closure plans to be developed during siting and design. The relevant provision is the EWD's Article 5 on a waste management plan, whose objective "shall" be to dispose of extractive waste safely. Thus, during the design phase, the plan management considers the "management during the operation and after-closure of a waste facility." At the least, the waste management plan "shall" include the proposed closure plan, rehabilitation, after-closure procedures, and monitoring. The MWEI BREF further lists "considerations usually taken into account when collecting … environmental baseline information for use in site selection, design and operation," which also helps develop closure plans.

Defining closure consistent with Safety First: For the most part, but for the terms "safely," "perpetuity," and "no credible failure modes," the EWD defines closure in a manner consistent with Safety First. Safety First defines closure as: "A tailings facility is safely closed when deposition of tailings has ceased and all closure activities have been completed so that the facility requires only routine monitoring, inspection and maintenance in perpetuity or until there are no credible failure modes." The EWD's Article 12(3)–(4) provide:

> "A waste facility may be considered as finally closed only after the competent authority has, without undue delay, carried out a final on-site inspection, assessed all the reports submitted by the operator, certified that the land affected by a waste facility has been rehabilitated and communicated to the operator its approval of the closure….The operator shall be responsible for the maintenance, monitoring, control and corrective measures in the afterclosure phase for as long as may be required by the competent authority, taking into account the nature and duration of the hazard, save where the competent authority decides to take over such tasks from the operator, after a waste facility has been finally closed…."

The EWD, however, could be stronger by beginning with "is" rather than "may," defining "without undue delay" and "for as long as may be required," and mentioning the non-existence of a "hazard" rather than its possibility. The MWEI BREF offers some guidance, like "structural monitoring and inspections" continue for all extractive waste facilities after they are decommissioned, "as appropriate."

Assessments by regulatory agencies related to safe closure: The EU does not require that regulatory agencies perform assessments before permit approval to determine whether an operating company can carry out perpetual care and financial responsibility at the site or can eliminate all credible failure modes. The EWD requires that "Category A" waste facilities (which includes tailings facilities), whose potential failure could lead to a major accident, contain a major accident prevention policy in the waste management plan. Nevertheless, Member States can flexibly decide on the waste management plan approval procedures. Although a permit application "shall" contain a waste management plan, a financial guarantee (FG), and an environmental impact assessment, if necessary, the process for granting a permit is broad. That is, "the competent authority shall only grant a permit if it is satisfied that … the operator complies with the relevant requirements under this Directive." The Implementing Decision 2020/248 (EU, 2020, Part D) covers inspections that "shall be taken into consideration" before waste deposition occurs, including inspection of closure plans, FGs, and measures to ensure the facility's stability. However, these inspections do not clearly precede permit approval. The MWEI BREF similarly offers that long-term aftercare follows closure "in certain circumstances," and can require a plan that includes long-term maintenance and financial assurance.

Construction of facilities in locations with unacceptable failure consequences: The EU does not quite have regulations to ensure that facilities are not constructed in locations where the consequences of failure at some future time are unacceptable. Rather, the Directives focus on avoiding the consequences of failure. Under the EWD, Member States "shall" ensure that the necessary features are incorporated into plans when major-accident hazards are identified to prevent accidents and limit adverse consequences. The competent authority "shall satisfy itself" that the operator ensures

the facility is “suitably located.” Similarly, Directive 2012/18 dictates that Member States “shall pursue” the objective of limiting the consequences of accidents by placing controls on “the siting of new establishments” in land-use policies. Members “shall” ensure land-use policies “take account of the need … to maintain appropriate safety distances” between facilities and residential areas.

Transparent disclosure by companies of cleanup costs during permitting: The EU does not quite require operating companies to present transparent documentation during permitting of the estimated cost of the cleanup of a mine site, including closure and reclamation, and all monitoring and maintenance. It appears that costs related to closure are part of the FG. Decision 2009/335/EC (EU, 2009a) holds that Member States “shall” calculate the FG on assessing “the costs necessary to ensure land rehabilitation, closure and after closure including possible after closure monitoring.” The MWEI BREF explains that the operator “prepares a documented rationale” for the selected site, which can include closure cost considerations. The Guidelines for Mine Closure Activities and Calculation and Periodic Adjustment of Financial Guarantee (EC, 2021) notes that the FG is “requested” for exploration and exploitation, and a fee is paid in advance for rehabilitation of the exploration activities. However, the timing of disclosing costs for full operation and closure/post-closure is not mentioned. Finally, the Guidelines on Financial Guarantees and Inspections for Mining Waste Facilities (MonTec, 2008) notes that, as the waste management plan must be reviewed every five years, so too should the FG, review of which “can lead to changes of the estimated closure cost.” The FG should also account for closure and post-closure monitoring costs for a “period which is at least as long as environmental mitigation measures are expected.”

Allowing operating companies to declare bankruptcy or sell to avoid monitoring and liability: The EU does not allow operating companies to declare bankruptcy or sell to junior companies to avoid closure monitoring and liability. The EWD does not mention bankruptcy. Yet, the Guidelines on Financial Guarantees and Inspections for Mining Waste Facilities (MonTec, 2008) underlines that EU Member States’ commercial and penal law “makes unexpected bankruptcies very unlikely, and strongly limits the consequences of financial strain of a company with respect to environmental obligations.” And the Guidelines for Mine Closure Activities and Calculation and Periodic Adjustment of Financial Guarantees (EC, 2021) explains that a correct FG value “cover[ing] the mine decommissioning and rehabilitation cost including post closure monitoring and maintenance,” needs “a calculation methodology which is a) high enough to be sure that in the case of bankruptcy the tax payer does not need to step in, but also b) low enough in order to attract investment.”

More protective provisions than Safety First: No EU measures are more protective than those in Safety First, but the MWEI BREF does include perpetual treatment as an element in closure planning (Section 2.1.1.9).

Additional considerations: EC, 2021, Section 3.5.5 encourages a proposal for review of the closure plan. Typically, after-closure plans must be reviewed annually and proposed amendments thereto notified to the competent authority for agreement (Environmental Protection Agency of Ireland, 2014).

4.5 Addressing Financial Risks, Including Proper Financial Assurance and Insurance

Two documents in addition to the EWD are relevant for this section:

- MonTec (2008) Guidelines on Financial Guarantees and Inspections for Mining Waste Facilities.
- European Commission (2021) Guidelines for Mine Closure Activities and Calculation and Periodic Adjustment of Financial Guarantees.

Both documents are guidelines, and the difference between options or recommendations vs. requirements is not clear. In that sense they are similar to the 2018 MWEI BREF (see Figure 1). The MonTec (2008) guidelines were created in response to Article 22 of the EWD, which requires the Commission to adopt technical guidelines for the establishment of the FG in accordance with the requirements of Article 14(2). The relevant section in MonTec (2008), Section 7, is titled Recommendations on Financial Guarantees. The EC (2021) guidelines were created in response to some Member States requesting additional technical guidance for the implementation of the FG provisions. The MWEI BREF is focused more on best technical and management practices and does not cover financial assurance in any detail.

Independently guaranteed and reliable: Regarding whether the financial assurance is required to be independently guaranteed and reliable, EC (2021) presents the pros and cons of the possible financial instruments but does not require that the FG be independently guaranteed or reliable. Figure 7 in EC (2021) depicts different categories of FGs and which are more or less likely to put the risk onto the government and taxpayer, but none are required. The same figure is presented in MonTec (2008), and a statement is made on pg. 21 that "the more independent the FG is, the less it is affected in case of a bankruptcy." But more independent and reliable FGs are not required.

Readily liquid: The EWD (Article 14, 1(b)) does require that the FG have "funds readily available at any given time for the rehabilitation of the land affected by the waste facility, as described in the waste management plan prepared pursuant to Article 5 and required by the Article 7 permit...."

Limitations on the use of funds for mine-related cleanup activities: The EWD defines "rehabilitation" (Article 3 (20)) as “the treatment of the land affected by a waste facility in such a way as to restore the land to a satisfactory state, with particular regard to soil quality, wild life, natural habitats, freshwater systems, landscape and appropriate beneficial uses.” However, the uses of the FG in the EWD are nearly always described as applying to land rehabilitation. See, for example, EWD, Article 14, 1(b) above. It is not

clear that, for example, capture and treatment of mine-influenced water is included in rehabilitation. However, MonTec (2008, Section 7.1.4) states: "A time estimate for the closure period and post closure activities such as water treatment must be made in order to calculate the long-term costs to be covered by the financial guarantee." Although the requirement for long-term treatment is not clear, this statement implies that the FG is intended to cover long-term treatment.

Third-party review: Article 14 (2(b)) of the EWD states that the calculation of the guarantee ... shall be made on the basis of ... the assumption that independent and suitably qualified third parties will assess and perform any rehabilitation work needed. However, there is no mention of review of the FG by a third party.

Review period for the FG: Article 14(3) of the EWD states that the size of the guarantee shall be "periodically adjusted" in accordance with any rehabilitation work needed to be carried out on the land affected by the waste facility. Article 5 (4) of the EWD requires that the waste management plan be reviewed every five years and/or amended, as appropriate, in the event of substantial changes to the operation of the waste facility or to the waste deposited. MonTec (2008, Section 7.1.5) states: "This period [every five years] should also be applied as a maximum period for review of the financial guarantee." Safety First requires a review at least every three years or whenever there is a material change either to the tailings facility or to the social, environmental, and local economic context.
EC (2021, Section 2.1.14) states that "...after the reception of the environmental rehabilitation works for the previous year, the value of the FG shall be adjusted. The annual FG amount update is also necessary because of potential price changes." In the same section, and in apparent contradiction, EC (2021) notes that the time period for FG periodic adjustment should be dependent on the level of risk. "In case of a medium risk and likelihood of environmental consequences the periodic adjustment might be conducted every 3 years, in case of a low risk and likelihood of environmental consequences every 6 years." A recommended review period for high-risk facilities is not mentioned.

Post-closure value calculation period: The EWD does not mention a post-closure value calculation period (it would be in Article 14). Similarly, EC (2021, Section 2.1.4) does not specify a time period: "Long-term commitments (e.g., monitoring, after care, etc.) have to be taken into account on a best-estimate basis, even though no clear official calculation methods exist." MonTec (2008) also does not specify a numeric calculation time period. Section 7.1.4, Time Estimates, notes: "A time estimate for the closure period and post closure activities such as water treatment must be made in order to calculate the long-term costs to be covered by the FG. The time needed to treat the effluents from a waste facility is usually difficult to predict especially if neither the precise composition of the effluent nor the exact details of the contaminant sources and pathways are known. However, an approximate estimate can still be made and

would provide at least an order of magnitude for the time scales to be plausibly expected."

Public liability insurance: The EU does not specifically public liability insurance. The EWD does not mention public liability insurance or its equivalent. MonTec (2008) discusses insurance policies but falls short of requiring public liability insurance and notes that such policies to not cover environmental liabilities: "General forms of insurance policies are the premium financing, commercial general liability and professional indemnity, for instance, which normally do not cover environmental liabilities or long term rehabilitation costs." (pg. 27) and "Through regularly exercised inspections most of mining companies aim at gaining insurance against environmental impact liability. However, an insurance policy against environmental accidents and incidents is at present not very common or possible to obtain." (pg. 85) EC (2021, Section 2.1.2 simply states "A combination of financial provisions may be used by operators to cover the full liability."

Self-bonding and corporate guarantees: The EWD (Article 14 (1)) lists the types of FG allowed, including a financial deposit, including industry-sponsored mutual guarantee funds or equivalent. MonTec (2008) reviews the types of financial instruments used by different international entities, including self-bonding and corporate guarantees (Table 3.3-1) and discusses the pros and cons of self-bonding (Table 3.3-2), but does not allow or disallow the practice. EC (2021) defines "self-provision" (pg. 41) and "parent company guarantee" (pg. 42) and lists the pros and cons of self-guarantees (Table 1) but does not promote or disallow the practice.

Bankable feasibility study: In general, feasibility studies published by mining companies do not include much detail on the environmental or social risks of developing a project. The EU does not require a bankable feasibility study that considers all technical, environmental, social and economic risks of the project, including evaluations of potential failure modes and costs for all new or expanding facilities. Neither the EWD nor MonTec (2008) mentions a feasibility study. EC (2021) lists the elements of a feasibility study in Section 5.2.3, but technical, environmental, and social risks of the project are not included.

More protective provisions than Safety First: Early or unplanned closure is not well addressed in Safety First or any of the EU documents. The categories of closure are generally limited to closure and “after-closure” in the EU documents. FGs should include estimated costs for worst-case scenarios for both permanent early closure and temporary closure. Multiple terms are used across the reviewed documents for this type of closure including “sudden,” “premature,” “early,” and “unplanned.”

In Guideline 12, Safety First notes “Financial assurance must be independently guaranteed, reliable, and readily liquid to ensure that funds will be available in the event of bankruptcy by the operating company. This means that all required funding must be

immediately available upon request of the regulatory agency, and there must be no limitations on the use of funds for mine-related cleanup activities." However, bankruptcy is not the only cause of unplanned closure. In addition, adverse impacts could occur during temporary closure, which often occurs for economic or commodity price reasons. Having the financial assurance be readily available is one element of protecting the environment and communities in the case of early closure, but the amount of the guarantee must also be adequate to cover early closure.

Early closure, or the equivalent, is not mentioned in the EWD. MonTec (2008, pg. 13) address "premature closure" and notes shortcomings in the EWD as follows: "The limited scope of Article 14 [of the EWD] is problematic, for example, if an open pit is only incompletely minedout. In this case, most mining legislations require that the pit will not be backfilled as initially intended, but merely conserved. Non-inert soil and non-hazardous wastes placed on intermediate storage sites for the purpose of backfilling are covered by the MWD [EWD], in the case the deposition or accumulation exceeds a period of more than one year (Article 3 (15)). This issue should be resolved by ensuring that closure plans properly address premature closure." MonTec (2008) further addresses premature closure on pg. 56: "Unplanned or premature closure requires explicit consideration. In many cases, the maximum cost of closure and hence, the level of guarantee required by the MWD will result from early closure. This risk of early closure should be avoided by evaluating the operator's ability to meet the objectives of the waste management plan at any time of deposition operations."

EC (2021, Section 2.1.10) describes conditions related to plausible worst case scenarios, which refers to the plausible event that poses the maximum environmental liability in the case of foreseen liabilities, i.e. consequence, during the period to be covered by the financial provision. The document goes on to emphasize the importance of providing for premature closure in the FG, provides a risk-based approach for evaluating severity, and notes that premature closure, whether permanent or temporary suspension of operations must be considered in the mine closure plans early in the development process.

More specific guidance and requirements should be included in a revised EWD for estimating the costs of unplanned closure as part of the FG.

Additional considerations: The European Union currently has 28 Member States. The EWD provides a very general set of requirements for financial assurance that must be implemented in each of the Member States, which have, in some cases, different currencies and different banking structures. The enforcement of the requirements across the Member States will therefore be difficult, especially because many of the requirements are vague or out of date. This additional consideration may apply to all elements examined as part of benchmarking against Safety First.

4.6 Making Information Regarding Mine Safety Publicly Available in Relevant Languages

Requiring operating companies to make the name, exact location, ownership, date of initial operation, footprint, and height of all tailing facilities publicly available: The EU only requires certain elements to be made public. The EWD's Annex I lists the operator's name and the waste facility's address as information to be communicated to the public concerned.

Making information on tailings failures immediately available to the public: The EU requires Member States to publicly disclose, or requires operating companies to immediately publicly disclose, the date, location, amount of tailings released, and impacts on surrounding areas following any tailings failure upon request. According to the EWD, "the operator shall, without undue delay and in any event not later than 48 hours thereafter, notify the competent authority of any events likely to affect the stability of the waste facility and any significant adverse environmental effects revealed by the control and monitoring procedures of the waste facility" and "[f]ollowing closure of a waste facility, the operator shall, without delay, notify the competent authority of any events or developments likely to affect the stability of the waste facility, and any significant adverse environmental effects revealed by the relevant control and monitoring procedures." Member States "shall" annually transmit to the European Commission any such notifications. The European Commission "shall" make this information available to Member States upon request and then Member States "shall in their turn make the information available to the public concerned on request." Decision 2009/358/EC (EU, 2009b) clarifies that such notifications "shall" include the facility's name and address; "[i]nformation on the permit issued including date of issuing, period of validity, category of waste facility" and type of waste; the incident's nature, description, how it was revealed, location and timing; the "[t]iming and description of the information transmitted by the operator to the competent authorities and of the information given to the public;" and the possible environmental and health impacts and consequences on the facility's stability. Moreover, per Directive 2012/18, Member States "shall" ensure that information about how the public will be warned and appropriate behavior in the case of a major accident is permanently available. They "shall" also ensure that everyone "likely to be affected" by a major accident of an upper-tier establishment [with larger tons of dangerous substances] receives "regularly and in the most appropriate form, without having to request it, clear and intelligible information on safety measures and requisite behaviour in the event of a major accident." Directive 2012/18 also orders that the European Commission "shall" create a major accidents database "at the disposal of Member States" and "shall make publicly available the non-confidential part of the data." Under 2012/18, "Member States shall ensure, in the interests of transparency, that the competent authority is required to make any information held pursuant to this Directive available to any natural or legal person who so requests in accordance with Directive 2003/4/EC [on public access to environmental information (EU, 2003)]." Yet, Directive 2012/48 allows the possibility for the competent authority to refuse or restrict disclosure.

Making all information relevant to the safety and stability of tailings facilities publicly available: The EU does not disclose environmental baseline studies on ground stability, geology, watersheds, fault lines, documents related to permitting and monitoring, or all information related to emergency preparedness and response. Directive 2012/18 merely notes that the safety report of an upper-tier establishment "is made available to the public upon request." The safety report includes the establishment's description and "its environment including the geographical location, meteorological, geological, [and] hydrographic conditions."

Most questions about the EU making or requiring operating companies to make all information relevant to the safety and stability of tailings facilities publicly available are answered in the negative. EWD's Article 8(2)(a) on public participation very broadly dictates that "Member States shall ensure that, within appropriate time frames … in accordance with national legislation, the main reports and advice transmitted to the competent authority at the time when the public were informed" be made available to the public concerned. In this way, the EU mandates the publication of reports required by and filed with governmental agencies.

But, Dam Safety Reviews (DSRs); consequence or hazard classification and decisions made by the board of directors or corporate management to approve the classification; design, maintenance, and monitoring documents; documentation of facility's stability, including a record of past stability issues, dam break studies and assessments of social, economic, and environmental impacts; environmental monitoring and Social Management System summaries and reports; Independent Tailings Review Board reports; Adaptive Management Plan reports; impact and mitigation plans for affected communities, including compensation and indemnification criteria; and complaints and grievance procedures are not required to be publicly available. The EU also does not mandate Member States to respond to or require operating companies to respond to all stakeholder requests for information regarding the tailings facility to the fullest extent possible in formats and languages that are understandable to all stakeholders.

Some questions about the EU making or requiring operating companies to make all information relevant to the safety and stability of tailings facilities publicly available are answered in the affirmative. Directives 2014/52 and 2011/92 require that environmental impact assessments be made publicly available. Nonetheless, Directive 2014/52's Article 2(5) provides flexibility to Member States that "may exempt" a project from public consultation if it is adopted by a specific act of national legislation, provided that the Directive's objectives are met. The EU requires that Emergency Preparedness and Response Plans be made publicly available. Directive 2006/21 requires that each operator "shall" create a major-accident prevention policy, a safety management system, and an internal emergency plan before beginning operations. The emergency plan "shall" have the objective of communicating the "necessary information to the public." Furthermore, the competent authority "shall" create an external emergency plan. Member States "shall ensure that the public concerned are given early and effective

opportunities to participate" in preparing or reviewing the external emergency plan. The BAT Ref. Doc. for Waste Management reinforces that the emergency plan aims to ensure that the public "is provided with the necessary information." Despite the EU not requiring documentation of FPIC and community consent processes to be public, the EWD requires public participation concerning permitting, but leaves open how Member States organize publicizing such participation. The public "shall" be informed of the "details of the arrangements for public participation," which the Member States determine. The public "shall" be entitled to opine and comment to the competent authority before a permit decision is made.

Although the EWD does not name the publication of closure plans or documentation of financial assurance and public liability insurance (including insurance estimates) as requirements, the Guidelines on Financial Guarantees and Inspections for Mining Waste Facilities (MonTec, 2008) offer some guidance. In an Annual Report and/or the Sustainable Development/Corporate Social Responsibility Report, mining companies "should" disclose to the public the closure plan's scope, "closure and rehabilitation measures, including long-term liabilities," "progressive closure and rehabilitation works completed in the reporting period," these measures' cost estimate," and the "financial instruments" used for the FG.

Making all information available, including raw data, at no charge, as soon as possible, in relevant languages, in an accessible format, in plain language, and input parameters used in models: The EU does not have provisions for these elements of public access to information. However, the EU requires that some information about permits be made freely and accessibly available. The EWD instructs that Member States "shall" ensure that information about safety measures and actions required in the case of an accident "is provided, free of charge and as a matter of course, to the public concerned." Directive 2024/1785 emphasizes that the "competent authority shall make available to the public, including systematically via the internet, on a webpage which is easy to find, free of charge and without restricting access to registered users" the decision to grant, reconsider, or update a permit.

Responding to all stakeholder requests to the fullest extent possible in understandable formats and languages – and if requests are not fully met or not met in a timely manner written justification is required: The EU does not have provisions for these elements of public access to information. However, Directive 2014/52 notes that "taking into account unsolicited comments that might have been received from other sources, such as members of the public or public authorities, even though no formal consultation is required at the screening stage, constitutes good administrative practice." And Directive 2011/92, Article 11(1) requires that Member States ensure that members of the public can review and challenge the substantive or procedural legality of decisions, acts or omissions subject to the public participation provisions of this Directive.

More protective provisions than Safety First and additional considerations: Safety First's provisions for public disclosure are more extensive and favorable to communities than those in the EU. An additional consideration is that different Member States will have different requirements and allowances for public disclosure of information.

4.7 Climate Change

Even if the failure of a tailings dam would have no potential for the loss of human life, Safety First Guideline 5 requires that the facility be designed to withstand a 10,000-year flood and a 10,000-year earthquake.

EWD: The EWD does not mention climate change, storm, modeling, or flood in any context. The waste management plan objectives in the EWD (Article 5, 2(c)) do include ensuring short and long-term safe disposal of the extractive waste by choosing a design that prevents or minimizes any long-term negative effects and ensures the long-term geotechnical stability of any dams or heaps above the pre-existing ground surface, but no details are provided. Similarly, Article 11 on construction and management of waste facilities mentions constructing, managing, and maintaining the waste facility to ensure its physical stability, but no details on storm event, return period, or climate change are included.

MonTec (2008) does not mention climate change. In its Table 1.3.3-1, Criteria for closure of tailings and mine waste facilities, it lists as an objective considering climatic factors such as rainfall, storm events, and seasonal extremes, but again, no specifics are provided. MonTec (2008) mentions predictive modeling and the different types of modeling tools that could be used but emphasized the uncertainty in the results from modeling rather than any specifics.

EC (2021) discusses collecting climate/meteorologic data but does not mention climate change. Certainly by 2021, the effects of climate change on facility design, hydrologic/hydraulic modeling, and other factors affects the environmental performance of tailings facilities were widely known. Without directly mentioning climate change, EC (2021; Section 2.1.10) requires a less protective return period than prescribed in Safety First: “During the design, extraordinary meteorological situations, particularly forecasts of 100 and 1000 years rain events must be taken into account.”

MWEI BREF: Consideration of the effects of climate change is included as a best practice in the BAT reference document. Climate change is described as a factor to consider in the siting of extractive waste facilities (p. 45), in designing extractive waste pond capacity (p. 68), for extractive waste site and management options (p. 179), in considering the design of all ponds with dams retaining extractive waste (p. 255), for impoundment supernatant management (p. 261), for drainage systems for heaps (p. 273), and for dry stack drainage controls (p. 314). The effects of climate change are discussed in terms of considerations rather than requirements.

4.8 Ban new tailings facilities where inhabited areas are in the path of a tailings dam failure

None of the documents reviewed ban tailings facilities under any circumstances.

5. Summary of Findings

General comment on EWD shortcomings and requirements: The EU sets out general requirements for extractive waste management in the EWD, which is the primary focus of this report. It has major shortcomings. The EWD is characterized by piecemeal legislation and accompanied by non-binding documents, leading to confusion about managing extractive wastes. The EWD has vague requirements for Member States' responsibility to fulfill their objectives and broadly requires Member States to develop guidelines and requirements. That is, the requirements could and will be different in different countries in the EU. Indeed, the EWD and related Directives use a mix of "shalls," "shoulds," and even "shall be taken into consideration," implying weak enforcement as Member States are left to interpret how the Directives apply in their jurisdictions.

A summary of the primary points follows for each of the Safety First guidelines compared to EU Directives and associated documents, with an emphasis on improvements needed in an updated EWD and BAT document.

1. Ban upstream dams at new mines, and safely close existing upstream facilities.
   - The EU does not ban the upstream tailings dam construction method for new and/or proposed facilities, nor does it require a halt to expanding existing facilities using the upstream method or the closure of existing upstream facilities. A hierarchy of recommended dam construction methods should be clarified in an updated BAT document, with upstream dams banned except under very limited conditions.

2. Mandate the use of Best Available Technologies, in particular for filtered tailings.
   - The MWEI BREF document contains a thorough review of best mine management practice at the time (2018). This document needs to be updated, especially regarding the use of filtered tailings and depositing PAG wastes under a water cover. The use of filtered tailings should be required except under certain well-defined conditions. In addition, an updated version of the EWD needs to refer specifically to the updated BAT document. None of the BATs are actually required, but distinctions should be made in the document about the most preferred methods. Best available techniques emphasized in Safety First include using filtered tailings and not depositing PAG tailings under a water cover. No EU document requires the use of filtered tailings, and slurry deposition of PAG tailings and wastes, including having a water cover, is still considered best practice in the EU.

3. Appropriate monitoring systems must be in place to identify, disclose, and mitigate risks.
    - None of the EWD's assorted Directives mentions required Adaptive Management Plans (AMPs) or Observational Methods for monitoring tailings facilities. As such, there is no requirement that an AMP and its raw data be made public or that a meeting be held to explain the results to affected communities and other interested stakeholders. The required reporting of monitoring results in the EWD is generally to the competent authorities rather than the public, and reporting to the public is generally "upon request." Numeric trigger levels that would activate adaptive management are not mentioned. Similarly, no information or requirements related to evaluating the effectiveness of installed mitigation measures could be found in the EU Directives or the MWEI BREF. The water management plan encouraged (but not required) in the MWEI BREF comes close to being an adaptive management plan for water in that it includes criteria to manage water levels within safe limits, a water balance analysis that is compared to monitoring results, defining acceptable seepage, and monitoring and controlling to ensure systems are performing as designed.
    - The EU does not specifically require an ITRB, but independent review and oversight of waste facilities and their components are mentioned in multiple documents. Independent review, or "third-party" review and oversight, is discussed in the MWEI BREF but usually by an implied single expert rather than a board.
    - Monitoring requirements in an updated BAT document should follow the adaptive management plan approach and require trigger levels and evaluation of the effectiveness of mitigation measures installed to correct tailings facility issues observed through monitoring. In addition, releasing monitoring and adaptive management results to the public using an annual meeting approach should be incorporated into the updated EWD. A board (ITRB) rather than an individual expert should be required in an updated EWD. The board should be composed of experts who espouse the precautionary principal, which is taken seriously in Europe.

4. Towards safer closure with no credible failure modes.
    - The EWD aligns closure with Safety First principles but does not require ongoing monitoring or maintenance until all credible failure modes are addressed. These requirements should be explicitly included in an updated EWD.
    - EU regulations do not mandate pre-permit assessments to ensure companies can provide perpetual care and financial responsibility, or to guarantee that all failure modes are eliminated. Current inspections occur before waste deposition but not necessarily before permits are issued. Updating the EWD to require assessments prior to permit approval would strengthen safety.

- The EU does not require operators to fully disclose mine site cleanup costs, including closure, reclamation, and ongoing maintenance, during permitting. Although inspections of closure plans and financial guarantees occur, they are not always tied to permit approval.
- EU Directives prioritize avoiding failure consequences but don't prevent facilities from being built in high-risk locations. Directive 2012/18 requires consideration of safe distances but doesn't prohibit siting in hazardous areas. The revised EWD should use dam failure models to guide facility placement and avoid unacceptable risks.
- An upfront rehabilitation fee is required for exploration (EC, 2021), but there is no clear timeline for disclosing cleanup costs for closure after operations cease. Full cost estimates should be provided during permitting and updated at least every three years.

5. Address financial risks, including proper financial assurance and insurance.
   - EC (2021) presents the pros and cons of the possible financial instruments but does not require that the FG be independently guaranteed or reliable. The EWD requires that funds are readily available at any given time for the rehabilitation of the land affected by the waste facility, but it is not clear that other costs, especially for collection and treatment of mine-influenced waters, must be readily available. In a revised EWD, rehabilitation and associated costs should always clearly include all costs, including water treatment and non-land rehabilitation costs.
   - The EWD requires that the calculation of the FG assume that the rehabilitation work will be carried out by a qualified third party, but there is no mention of review of the FG itself by a third party. Independent review of the FG should be included in the revised EWD.
   - Safety First requires review of the FG at least every three years. The Guidelines for Mine Closure Activities and Calculation and Periodic Adjustment of Financial Guarantee (EC, 2021) states that the review period for the FG “might be” every three years for a medium risk facility and every six years for a low-risk facility. The time period for a high-risk facility is not included. The review period for the FG should be more firm in EU Directives, following guidelines laid out in Safety First.
   - Safety First requires that operating companies have public liability insurance in perpetuity to cover economic, social and environmental damages from sudden, accidental, or gradual pollutant releases including waste dump and tailings dam failures. No requirements for public liability insurance are included in any of the EU Directives or associated documents, and MonTec (2008) states that an insurance policy against environmental accidents and incidents is at present not very common or possible to obtain. If public liability insurance for tailings failure and other adverse effects is attainable in the EU, it should be required in a review EWD.

- MonTec (2008) and EC (2021) discuss the pros and cons of self-bonding, which does not require an operator to set aside money, but do not recommend allowing or disallowing the practice. Self-bonding should be disallowed in a revised EWD.
- Neither the EWD nor MonTec (2008) requires or even mentions a feasibility study. EC (2021) lists the elements of a feasibility study, but technical, environmental, and social risks of the project are not included. A feasibility study for all new or expanding facilities should include costs for all identified risks should be included in a revised EWD.

6. Make information regarding mine safety publicly available in relevant languages.
   - In general, the EWD and associated documents require that operators report tailings facility information and mine safety incidents to the "competent authority" in the Member States, Member States then report such incidents annually to the European Commission, the Commission makes this information available to Member States upon request, and the Member States must report the information to the public, upon request. The four-step process between when the company is aware of safety incidents and the public receives this information after specifically requesting it is far too long and does not reflect best practice in transparency of information. Instead, as required in Safety First, operating companies must immediately publicly disclose the date, location, amount of tailings released, and impacts on surrounding areas following any tailings failure.
   - Most questions about the EU making or requiring operating companies to make all information relevant to the safety and stability of tailings facilities publicly available are answered in the negative. All information relevant to the safety and stability of tailings facilities must also be made publicly available in understandable formats and in relevant languages.
   - Directive 2024/1785 requires decisions to grant, reconsider, or update a permit available to the public, via the internet, on a webpage which is easy to find, free of charge and without restricting access to registered users. However, the EU does not require that all information be made publicly available, including raw data, at no charge, as soon as possible, in relevant languages, in an accessible format, in plain language, and input parameters used in models.

7. Climate change.
   - Climate change is not mentioned in the EWD, MonTec (2008), or EC (2021). EC (2021) requires that a less protective return period be considered during the design phase (100- and 1000-year rain events) than Safety First (which requires facilities to be designed to withstand a 10,000-year flood).
   - The only document that includes recommendations for taking climate change into account is the MWEI BREF. However, the effects of climate change are discussed in terms of considerations rather than requirements. The effects of

climate change on facility design, hydrologic/hydraulic modeling, and other factors affecting the environmental performance of tailings facilities have been widely known for more than a decade. Requirements to plan for and design facilities to withstand higher return period storms should be included in an updated EWD.

8. Ban new tailings facilities where inhabited areas are in the path of a tailings dam failure.
    - As noted summary point 1, none of the documents reviewed ban tailings facilities under any circumstances.

Instances where EU provisions may be more protective than those in Safety First:

- Early or unplanned closure is not well addressed in Safety First or any of the EU documents. However, MonTec (2008) at least recognizes the shortcoming and notes that this issue should be resolved by ensuring that closure plans properly address premature closure, and EC (2021) emphasizes the importance of providing for premature closure in the FG. More specific guidance and requirements should be included in a revised EWD for estimating the costs of unplanned closure as part of the FG.

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