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**Arctic Mining –
Presentation on EU Best Available Techniques
Reference Document for the Management of
Waste from Extractive Industries:
*Key principles and examples of BAT conclusions***

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Environmental issues, mitigation and pollution control for marine and coastal mining

Background

- Mining generates high amount of extractive waste that requires appropriate management
- In appropriate design and operation of extractive waste management may cause major accidents and have catastrophic impacts
- According to Extractive Waste Directive (2006/21/EC)
 - Member States shall ensure that operators responsible for the management of extractive waste **take all measures necessary to prevent or reduce as far as possible any adverse effects on the environment and human health** brought about as a result of the management of extractive waste. These measures shall be based, inter alia, on the **best available techniques** without prescribing the use of any technique or specific technology, but taking into account the technical characteristics of the waste facility, its geographical location and the local environmental conditions.
 - Member States shall take the necessary measures to ensure that competent authorities periodically reconsider and, where necessary, update permit conditions in light of the information exchange on substantial changes in best available techniques.
 - **Best available techniques** are the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for **providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole.**

The Best Available Techniques (BAT) Reference Document for the Management of Waste from Extractive Industries (MWEI BREF)

- The MWEI BREF document was published in December 2018
 - Available in:
<http://publications.jrc.ec.europa.eu/repository/handle/JRC109657>
 - It is a technical document representing the results of the exchange of information, organised by the European Commission, on BAT for the management of extractive waste and associated monitoring
- The MWEI BREF has been drawn up within the framework of the Extractive Waste Directive (EWD, 2006/21/EC), which is different from the Industrial Emission Directive (IED, 2010/75/EU) framework under which most BREFs by the European Commission are developed or reviewed



JRC SCIENCE FOR POLICY REPORT

Best Available Techniques (BAT) Reference Document for the Management of Waste from Extractive Industries

*in accordance with
Directive 2006/21/EC*

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2018



Application of MWEI BREF and BAT conclusions

- The MWEI BREF provides up-to-date information and data on the management of extractive waste
- It supports decision makers by providing a **list of identified BAT to prevent or reduce as far as possible any adverse effects on the environment and human health** brought about as a result of the management of extractive waste
 - Techniques listed and described in the MWEI BREF BAT conclusions are neither prescriptive nor exhaustive
 - Also, other techniques may be used that ensure at least an equivalent level of environmental protection
- The goal of the MWEI BREF is to **ensure the short-term and long-term safe and environmentally responsible deposition of extractive waste**
 - Taking into account the **technical characteristics of the waste facility, its geographical location and the local environmental conditions**
- MWEI BREF does not contain sector-specific BAT associated emission levels (BAT-AEL)
 - Provides site specific information on environmental performance levels and the conditions under which these levels were achieved
 - Limited data on emission levels and difficulty to derive sector-specific environmental performance levels or associated emission levels
→ no legally binding BAT-AEL

Processes and activities covered by the BAT Conclusions

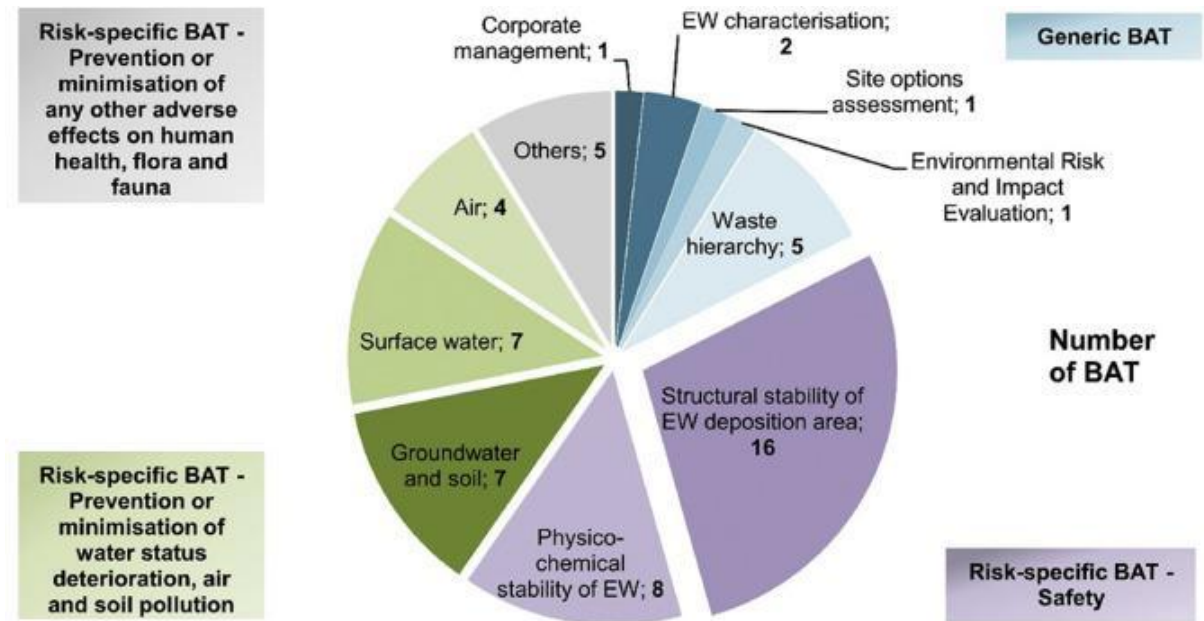
- **Management of extractive waste from onshore extractive activities**
- Handling/transport of extractive waste (e.g. loading, unloading and on-site transport)
- Treatment of extractive waste
- Deposition of extractive waste
- Activities directly associated with the management of extractive waste
 - Treatment of Extractive Waste Influenced Water (EWIW);
 - Preparing extractive waste to be placed back into excavation voids
- **Sea tailings disposal (STD) were not included in BAT conclusions**

BAT conclusions and risk-specific approach

- **A risk-specific approach** is applied in the document
 - Risk assessment overarching principle in MWEI BREF BAT conclusions
 - Enables to reflect the vast diversity in the extractive waste activities, extractive sectors, sectors and geographical, climatic and site-specific conditions in Europe
 - Understanding of the risks provides basis for achieving the most appropriate approach to be used to treat the risk
 - Based on risk assessment and management principles to identify, evaluate, and manage the potential impacts of an extractive waste facilities along the whole life cycle
- **An integrated approach** is required for the implementation of BAT
 - A number of important BAT conclusions are interlinked
 - Links between the BAT are introduced by cross-references
 - The applicability and relevance of some BAT conclusions depends on the result of others

BAT conclusions - Generic and Risk-specific BAT

- BAT conclusions are divided into Generic and Risk-specific BAT
 - **Generic BAT** are generally applicable in every site where extractive waste is managed
 - **Risk-specific BAT** are applicable to sites where specific environmental risks and possible impacts are identified
- BAT conclusions include specifics for application of the BAT during the different life cycle phases
- Evaluation of the site-specific applicability of the risk-specific BAT based on environmental risk and impact assessment



Garbarino et al. 2020. Available:
<https://doi.org/10.1016/j.resourpol.2020.101782>

Environmental Risk and Impact Evaluation (BAT 5) - the core BAT

- **Key part of the life cycle management** of extractive waste management site
 - Environmental risks and impacts are identified, analysed and evaluated over the whole life cycle
- Considers the full spectrum of hazards and risk elements, including source-pathway-receptor linkages
- Environmental risk and impact evaluation is based on e.g.
 - Initial characterisation of extractive waste
 - Extractive waste site options
 - Extractive waste management options (e.g. handling/transport, treatment and deposition alternatives)
 - Adapted to the site-specific conditions
- Applicability of the different risk-specific BAT is assessed on the base of the results of a proper of Environmental Risk and Impact Evaluation
 - Site-specific assessment of the suitability and application of the risk-specific BATs
 - Deployment of BAT is adapted according to an evaluation of the environmental risks and possible impacts
 - Updated over time to reflect changes in the operation or closure and after-closure based on monitoring findings

Design for closure approach (BAT 11) (1/2)

- **To achieve environmentally responsible management of extractive waste its deposition is planned and designed for closure from the very beginning**
 - Potential impacts on the environment and human health can be reduced substantially by **considering the whole life cycle of the EWFs** from the very beginning
 - Identification of the closure strategy
 - Quantification of the long-term environmental behavior and structural stability of the deposition area
 - Focus on **progressive rehabilitation** whenever possible
 - Design that takes into consideration of premature closure
 - Assessment of costs related to the proposed and alternative closure strategies (e.g. a cost benefit analysis)
 - Details on the final landform and surface rehabilitation, long-term stability analyses and monitoring

Design for closure approach (BAT 11) (2/2)

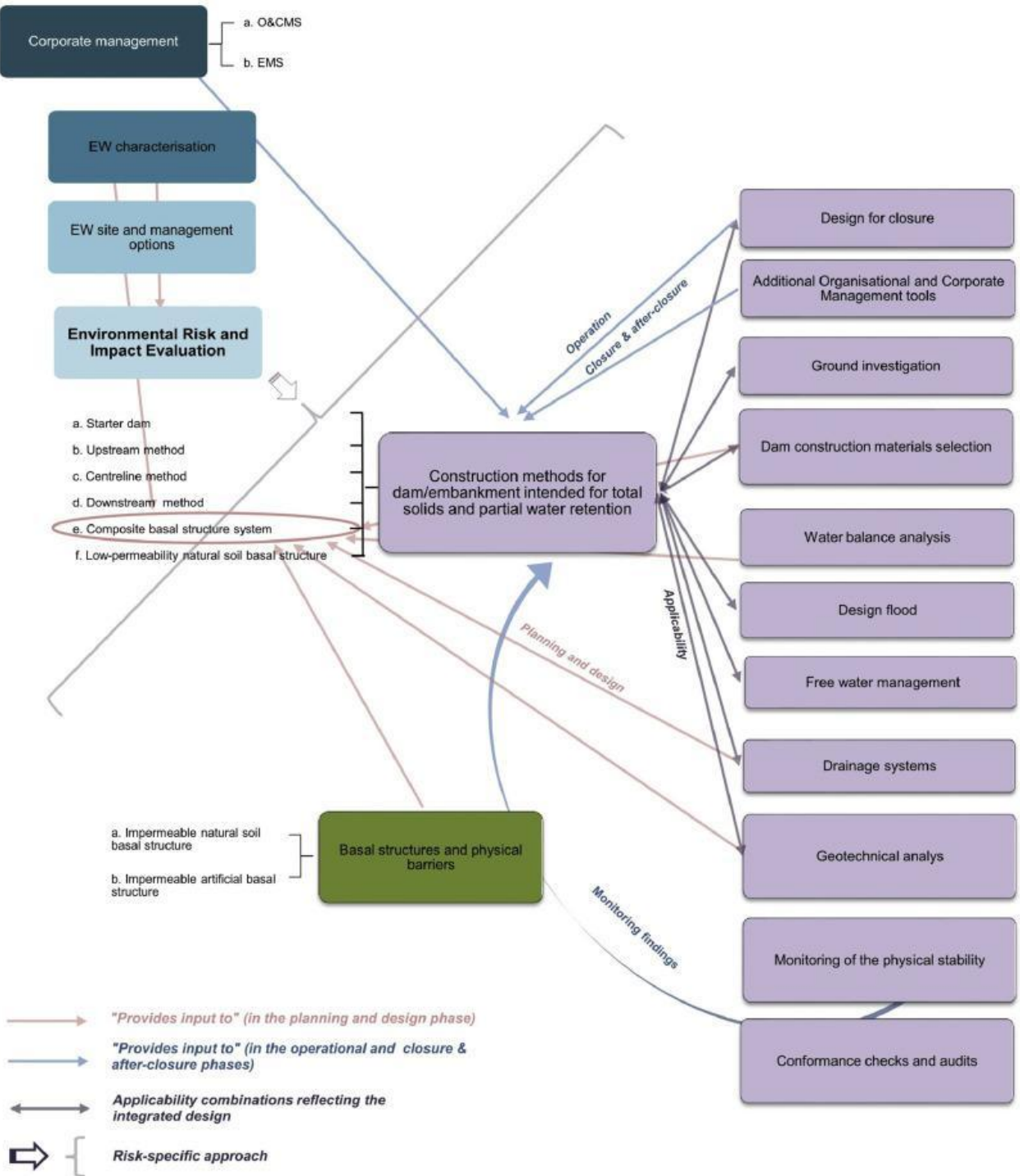
- The management of extractive waste deposition areas and **closure plans continuously adapted and improved**
 - Initial closure and after-closure plan already in the planning and design phase
 - During the operational phase closure and after-closure plans are reviewed
 - Update of the closure design assumptions
 - Final closure plan reviewed and updated in the closure phase
- **Integration of the EWF closure and after-closure planning into the periodic extraction plans**

Integrated design approach (1/2)

- A design that takes into account **all the relevant parameters in order to optimize the overall environmental, human health and safety aspects in the short and long-term**
 - Selection of the dam construction method construction method is based on the results of a proper Environmental Risk and Impact Evaluation
 - BAT is to design the dam using modern engineering principles to ensure that the embankments are adequately drained, that an appropriate beach length is guaranteed at all times and that the phreatic surface is controlled
 - **The dam** is monitored and maintained during the operational phase and the closure and after-closure phase, while applying corporate management systems and a design for closure approach
 - BAT is also to include **a basal structure**, whose structure and permeability are related to the nature of the extractive waste to be contained
- **To ensure long term structural stability of the EWF and long-term chemical and physical stability of the extractive waste**

Integrated design approach (2/2)

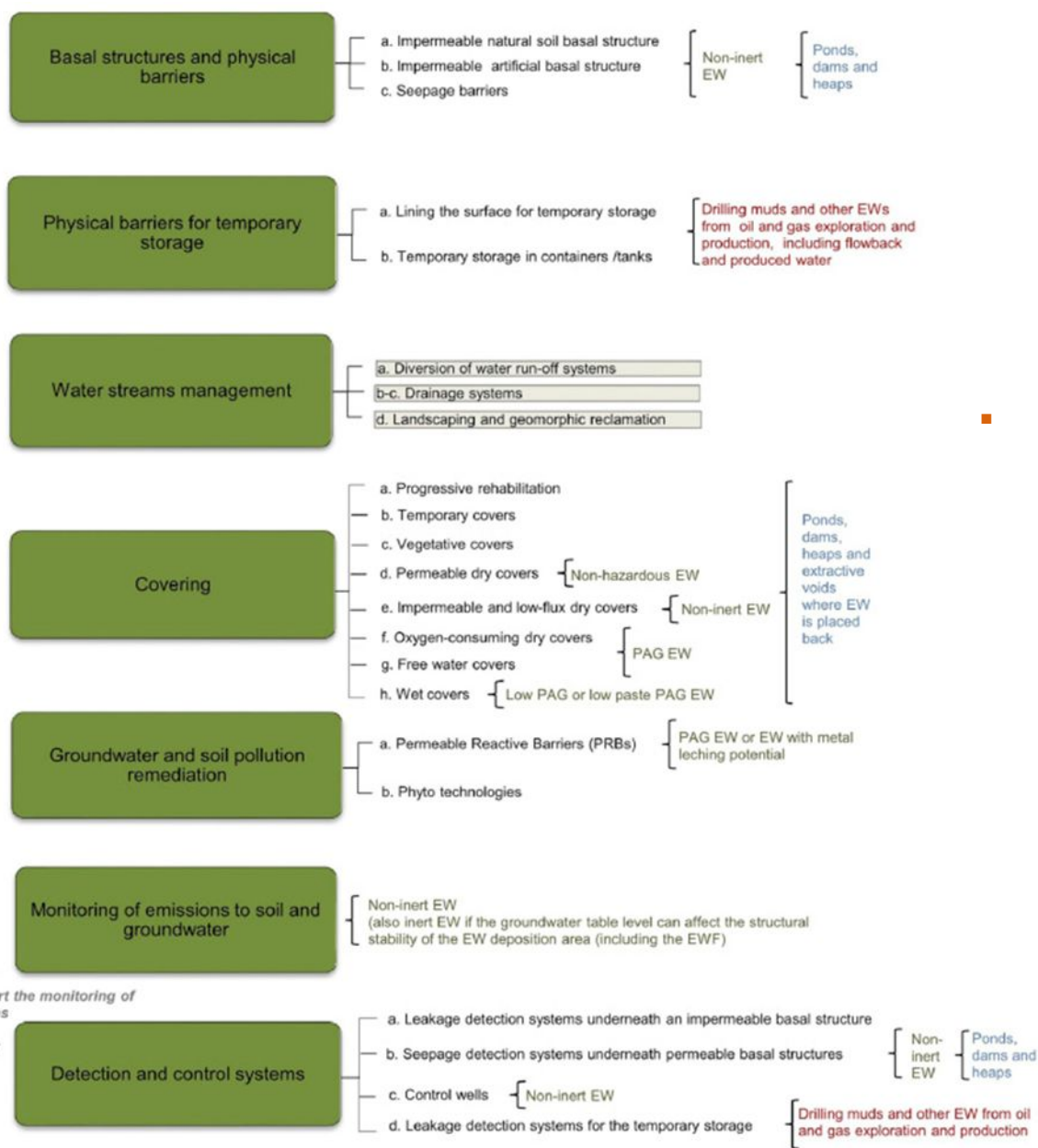
- The integrated design approach consists of the following:
 - **Selecting the dam construction method by considering all the relevant parameters from the design for closure, e.g.**
 - Ground investigation
 - Dam construction materials selection
 - Design flood evaluation
 - Free water management
 - Drainage systems
 - Geotechnical analyses
 - **Designing a (composite) basal structure (an impermeable basal structure) in combination with a proper drainage system based on e.g.**
 - Hydraulic conductivity of the basal structure
 - Extractive waste characteristics
 - Water balance
 - On the design criteria resulting from the dam construction material selection and the geotechnical analysis
- Similar principles and approaches apply for the BAT on construction methods for heaps



Example of different BAT related to integrated design for dam/embankment for total solids and partial water retention

Garbarino et al. 2020. Available: <https://doi.org/10.1016/j.resourpol.2020.101782>

=> to prevent or minimise groundwater status deterioration and soil pollution



- Scheme of risk-specific BAT to prevent or minimise groundwater status deterioration and soil pollution

EW: Extractive Waste; EWF: Extractive Waste Facility; PAG: Potentially Acid Generating; Cross-references

Relevance: EW other than EW from oil and gas exploration and production (green); EW from oil and gas exploration and production (red); deposition areas (blue)

Garbarino et al. 2020. Available:
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BAT in management and treatment of extractive waste impacted water

- In MWEI BREF specific focus is given to the management and treatment of EWIW
- Proper management of water is crucial to help ensuring the structural stability of the EWF and the physical stability of the waste
- **Management of water is based on applying following BAT:**
 - ✓ Re-use or recycling of excess water
 - ✓ Diversion of water run-off during operation
 - ✓ Landscaping and geomorphic reclamation (aim at preventing or minimising the EWIW generation)
 - ✓ Water balance analysis
 - ✓ Water management plan
 - ✓ Free water management
 - ✓ Drainage systems
 - ✓ Geotechnical analysis
 - ✓ Monitoring
 - ✓ Solid/liquid control and compaction
 - ✓ Consolidation and deposition of extractive waste
 - ✓ Emissions to surface water are minimised by applying following BAT:
 - ✓ Removal of suspended solids
 - ✓ Removal of suspended liquid particles
 - ✓ Removal of dissolved substances
 - ✓ Neutralization of EWIW prior to discharge by active or passive treatments
 - ✓ Monitoring

Recent European Commission guidance on best practices of extractive sector

- [Study supporting the elaboration of guidance on best practices in the extractive waste management plans](#)
- [A review of European Union legal provisions on the environmental impact assessment of non-energy minerals extraction projects](#)
- [Guidelines for mine closure activities and calculation and periodic adjustment of financial guarantees](#)
- [Study supporting the development of general guidance on the implementation of the Extractive Waste Directive](#)
- [Collection of available techniques for the prevention or reduction of environmental impacts in non-energy extractive industries \(NEEI\)](#)
- Also, [guidelines for best risk management approaches in the extractive sector](#) are being developed
- In addition to MWEI BREF, these documents are important European guidance to support sustainable mining and environmentally safe extractive waste management

Guidance on best practices in the EWMPs

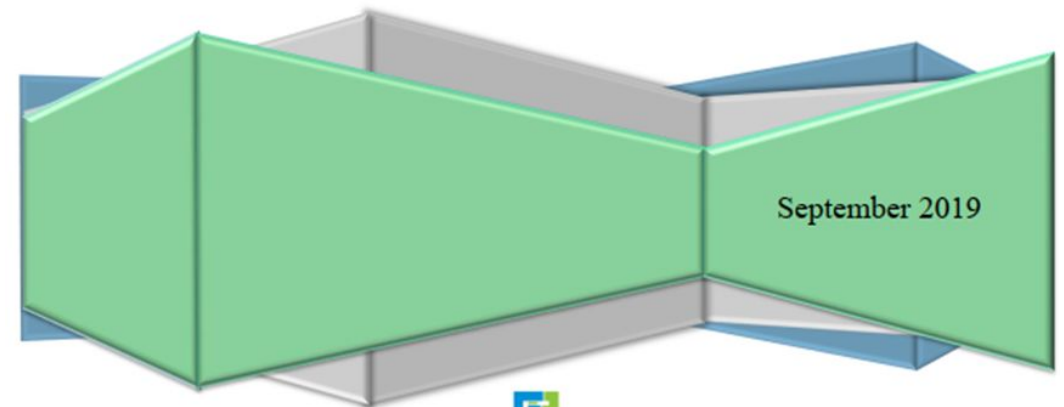
- Study supporting the elaboration of guidance on best practices in the Extractive Waste Management Plans
- For waste facilities that require a permit, the **EWMP is part of the permit application**
- The publication describes **guidelines for best practices and methodology to develop EWMPs**
- The focus is on (a) the prevention or reduction of extractive waste generation and of its harmfulness, (b) the recovery of extractive waste (by recycling, re-use or reclaiming), as well as (c) the assurance of short- and long-term safe disposal of extractive waste
- The key principle of guide is the utilization of an **iterative, risk-based assessment** in the preparation of the waste management plan
 - This means identifying risks during the whole life cycle of the extractive operation, assessing risks and impacts, and planning actions to prevent and reduce risks and impacts as part of the preparation of the waste management plan
- The publication consist of two parts, which were developed based on risk assessment principles:
 - The first part focuses on the **circular economy during the life cycle of an extractive project** and the promotion of the utilization of extractive waste
 - The second part focuses on **ensuring the environmental safety of extractive waste at each stage of the life-cycle of an extractive waste facility**



Study supporting the elaboration of guidance on best practices in the Extractive Waste Management Plans

Final Report

Eco Efficiency Consulting and Engineering Ltd.
in collaboration with WEFalck, Pöyry Finland Oy, Botond Kertész & CRS Ingeneria



Guidance on mine closure plans

- [Guidelines for Mine Closure Activities and Calculation and Periodic Adjustment of Financial Guarantees](#)
- **The EWMP must include a closure plan**, including site rehabilitation, after-closure procedures and monitoring
 - Often a separate closure plan
 - **Parallel, periodic review** of the plans
- Contains guidance for:
 - Collection and description of the **Closure Best Practices** by Mining Typology
 - **FG calculation** prior to the commencement of waste deposit, and **FG periodic adjustment**
 - **Content of the closure plan**
 - **Elaboration of updated closure plans** taking into account the environmental impact of the operations
 - **Approaches for determining the cost** of the respective activities to implement the closure plan



Guidelines for Mine Closure Activities and Calculation and Periodic Adjustment of Financial Guarantees



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Thank you for your attention!

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