NYKOS - Informasjonsdag

BREF – Best Available Techniques Reference Document Process

BAT Reference Document for the Management of Waste from Extractive Industries (MWEI BREF)

November 2018

Roar Sandøy

NYKOS - Informasjonsdag

Content

- Background

- BREF definitions

- BAT Reference Document for the Management of Waste from Extractive Industries (MWEI BREF)

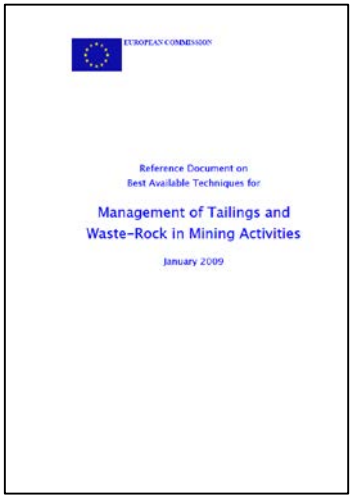
- MWEI BREF process

Background

2000 – Need for a BREF document on tailings and waste-rock management

- Tailings dam bursts in
  - Aznalcollar (Los Frailes mine, Spain, 1998)
  - Baia Mare cyanide spill (Romania 2000)

- Starting point for the EU BREF on waste from extractive industries
  - Cover activities related to tailings and waste-rock management of ores that had the potential for a significant environmental impact.
  - The intention was to **raise awareness of "good practice", and promote their use**.


EUROPEAN COMMISSION

Reference Document on
Best Available Techniques for

Management of Tailings and
Waste-Rock in Mining Activities

January 2009

Baia Mare


Aznalcollar

BREF Definitions

BREF – Best Available Techniques Reference Document

BAT = Best Available Techniques (best tilgjengelig teknikk – beste måten å gjøre noe på)
- The available techniques which are the best for preventing or minimising emissions and impacts on the environment.

BREF = BAT Reference Document
- Ex:
  BAT Reference Document for the Management of Waste from Extractive Industries (MWEI BREF)
  BAT Reference Document for the Food, Drink and Milk Industries

Created from a:
- Review process with exchange of information between experts from EU Member States, industry, environmental non-governmental organisations, and the European Commission (Technical Working Group).

Created by:
- Secretariat:
  European Commission's Joint Research Centre (JRC) (EC's science and knowledge service)
- Technical Working Group (TWG)

MWEI BREF

BREF for the Management of Waste from Extractive Industries

Important for the Waste Management for extractive industries BREF:

BREFs are based on an EU directive:
- Most BREFs are based on the IED/IPPC Directive (Industriutslippsdirektivet)
  - Shall be the **reference for setting the permit conditions** to installations covered by the Directive.
  - BATs with **legally binding** Associated Emission Levels (BAT-**AEL**s) linked with its use.

BAT Reference Document for the Management of Waste from Extractive Industries (MWEI BREF)
- Based on the Extractive Waste Directive (Mineralavfallsdirektivet → nytt kapittel 17 i avfallsforskriften)
- The MWEI BREF is **not a legally binding document**
- The document shall **not propose emission levels**.

MWEI BREF

BREF for the Management of Waste from Extractive Industries

Not legally binding

The role and proper use of BAT is explained in the Extractive Waste Directive:
"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**."

The MWEI BREF, and more specifically the BAT Conclusions, should therefore be seen as a **reference** aiming at:
- Enhancing the **consistent application** of the Extractive Waste Directive
- Supporting 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, duly taking into account that the **techniques listed** and described in this chapter **are neither prescriptive nor exhaustive** and that **other techniques may be used** that ensure at least an **equivalent level of environmental protection.**

→ **Reference «tool box» for management of waste from the extractive industry**

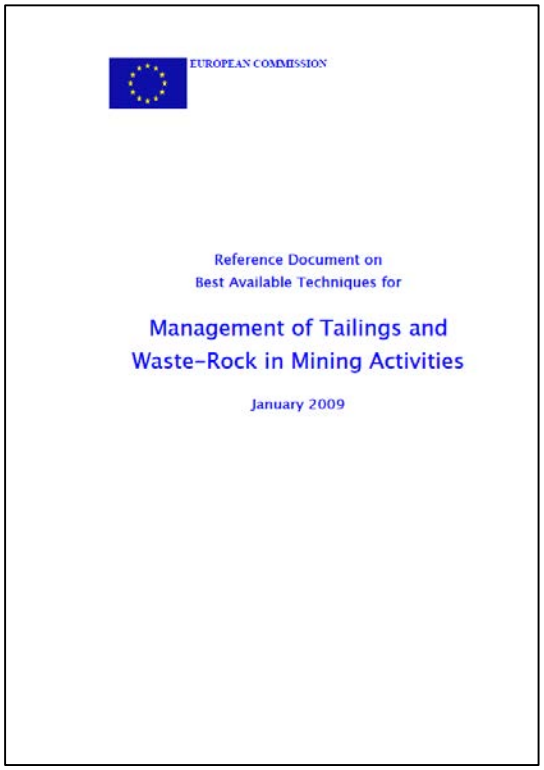
Why include sea tailings in the MWEI BREF ?

MWEI BREF process

BREF for the Management of Waste from Extractive Industries

The process from the first BREF of 2009 to the new BREF of 2018/2019
- Relation to sea tailings disposal and the NYKOS BAT activities

First BREF of 2009



Management of Tailings and Waste-Rock in Mining activities
MTWR
557 p

New BREF – Final draft 2018

Management of Waste from the Extractive Industries
MWEI
692 p

MWEI BREF process

2009 – MTWR BREF published

2009

- The reference document on best available techniques (BAT) on the management of tailings and waste-rock in mining (MTWR BREF) published by the European Commission in January 2009

Chapter 5 – Identifies techniques that are considered to be BAT
- Sea tailings disposal is not mentioned

The information at hand was incomplete and did not allow BAT conclusions to be reached.

Further information was required to decide on BAT conclusions for STP.
- Clearer description of the technique and
- Information on the applicability, cross-media effects and the economics of this technique

The 2009 MTWR BREF was mainly drafted during 2001-2004.
- Thus, the 2009 BREF was drafted before the adoption of Directive 2006/21/EC (Mineral waste directive)

→ Already when published in 2009 the document was ready for a review to align it with the Mineral Waste Directive.

The review process of the Management of tailings and Waste-rock in mining activities (MTWR) BREF was started in 2013.

MWEI BREF process

2012 – Start of MTWR BREF review process

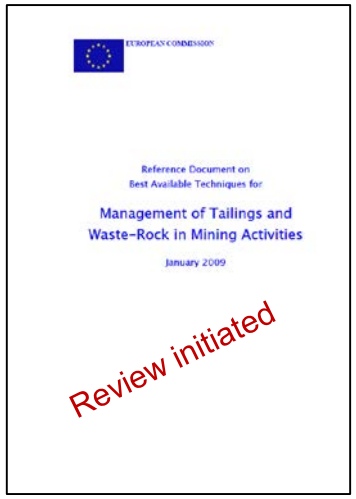
2012

- The BREF document was evaluated for an update.

→ The Norwegian Mining and Quarrying Industries (Norsk Bergindustri) recommended such an update of the document regarding marine tailings management.

2013

- The European Commission initiated the review process of the (MTWR) BREF document.



Norwegian position:
The experience with the Sea Tailings Disposal techniques from Norway, and other countries, should contribute with sufficient documentation to decide on Best Available Techniques on this field.

- A technical working group (TWG) was established for the review process
  - Norwegian representatives:
    - Glenn Kristian Storbråten (Norwegian Environmental Agency)
    - Maria Thornhill (NTNU)
    - Roar Sandøy (Norwegian Mining and Quarrying Industries)
  - Orgalime
    - Sverre Alhaug Høstmark (Federation of Norwegian Industries)

2014

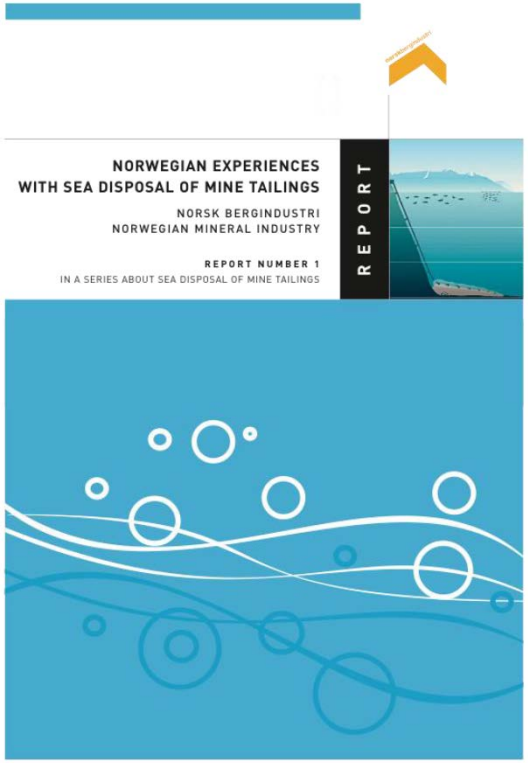
- MTWR BREF Review Kick-off meeting in Seville (**Norway only observatory status**)

MWEI BREF process

2014-2016 Data collection phase

2014-2016

- Data Collection phase (Literature, reports and MWEI BREF questionnaire)



Jens Skei and NBI Deponigruppe, 2015

Ingar Walder 2015

MWEI BREF questionnaires from

- OMYA
- Sibelco
- Sydvarager
- Titania

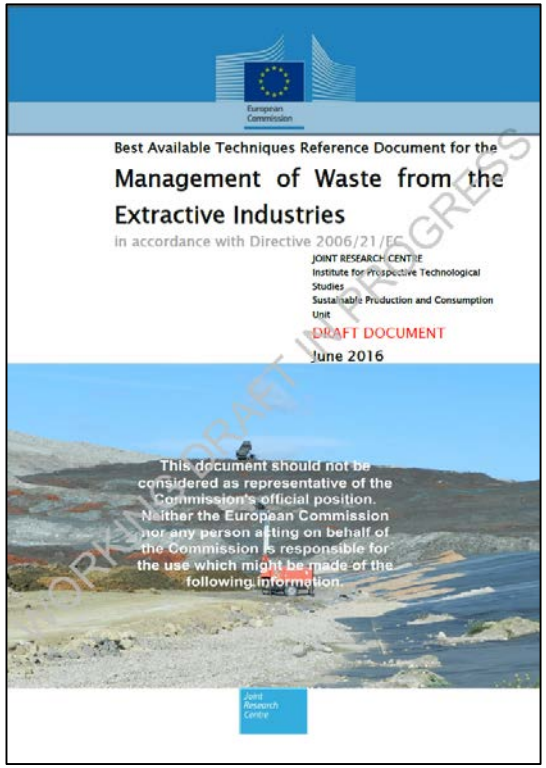
MWEI BREF process

2016 MWEI BREF document – first draft

2016

- MWEI BREF document – first draft

New BREF document – Draft 2016



Management of Waste from the Extractive Industries
MWEI
644 p

Structure of document

Chapter 1 - **General information** on the extractive industries sector

Chapter 2 - Common **extractive/processing methods** and general overview of the different **management techniques** for extractive waste.

Chapter 3 – **Collected data and information** (from questionnaires) on the environmental performance of the extractive waste management techniques, in terms of emission levels, and consumption levels of water, raw materials and energy.

Chapter 4 - Describes **techniques to consider in the determination of BAT**.

Chapter 5 - **BAT conclusions**

Chapter 6 - Overview on "**emerging techniques**"

Chapter 7 – Presents **concluding remarks and recommendations for future work**

Structure of the BREF based on land based disposal facilities
- Difficult to incorporate BATs on sea tailings disposal

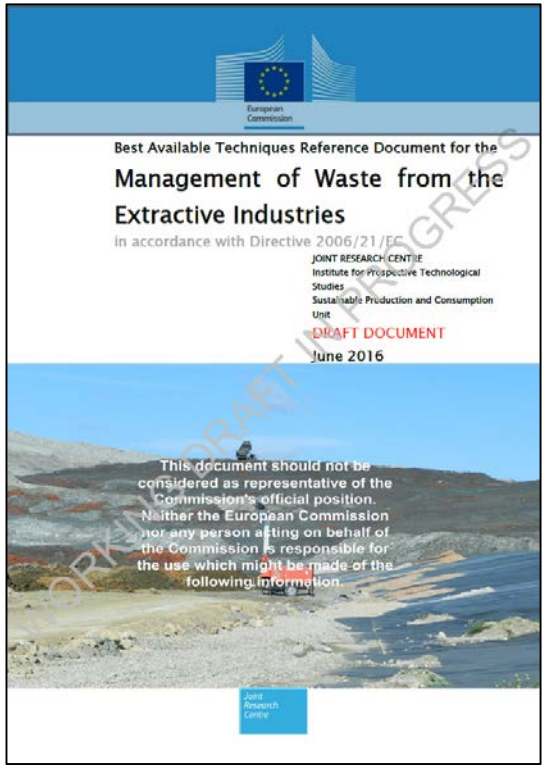
MWEI BREF process

2016 MWEI BREF document – first draft

2016

- MWEI BREF document – first draft

New BREF document – Draft 2016



Management of Waste from the Extractive Industries
MWEI
644 p

Sea Tailings Disposal in BREF draft:

Only in Chapter 2

2.3.4.5 Subaqueous tailings disposal

- Only negative effects described.
  - Mixinig sea tailings disposal and wet covers techniques.

Two sentences in the 644 pages document that when taken together could prevent the use of sea tailings disposal.

2.3.6 Prevention and control of emissions to water

- When tailings are disposed in the water bodies, e.g. sea tailings disposal, the extractive waste itself can also be considered as an emission.

Table 5.7 section 5.4.2.2.4

The table suggested a BAT-associated emission level (BAT-AELs) for direct discharges to a receiving water body of Total Suspended Solids (TSS) of 5-35 mg/l.

MWEI BREF process

2016 Comments to MWEI BREF document – first draft

2016

- Comments for chapter 2: Input to text on sea tailings disposal
- Several modifications to the proposed BATs, and 7 new BAT suggestions from Norway on sea tailings disposal

Norwegian position:

- Not a question whether Sea Tailing Disposal is BAT or not, but to define BAT for Sea Tailings Disposal in order to minimising impacts on the environment.

General BAT template:

In order to [achieve an environmental performance],
BAT is to….[BAT proposal]

Monitoring (BAT 2-8)

New BAT - **Monitoring of sea tailings disposal**

BAT 7 Bis:. In order to control emissions to seawater, for sea tailings disposal (potential leaching and tailings dispersal outside the designated deposition area), **BAT is to monitor the sea tailings disposal in accordance with EN standards**. If EN standards are not available, BAT is to use ISO, national or other international standards or official guidelines that ensure the provision of data of an equivalent scientific quality. Parameters to be monitored should be site specific depending on the tailing characteristics and the receiving environment, but should include turbidity measurements/particle dispersion and relevant physiochemical parameters.

MWEI BREF process

2016 Comments to MWEI BREF document – first draft

2016

- Several modifications to the proposed BATs, and 7 new BAT suggestions from Norway on sea tailings disposal

Extractive waste facility construction and management (BAT 14-32)

New BAT – ESIA

BAT 15 bis

In order to obtain stakeholder and regulatory acceptance for siting a new sea tailings disposal, **BAT is to conduct an Environmental and Social Impact Assessment** (ESIA), to identify, predict, evaluate and mitigate environmental and social effects of the sea tailings disposal, and to establish what is acceptable impact. When sea tailings disposal is considered, a comparison with a land deposit alternative should be made. BAT is to choose the alternative that best combines a high level of physical safety with an acceptable environmental and social impact.

***New BAT* - Baseline study of receiving environment**

BAT 15 Cis:

In order to prevent or reduce negative environmental impacts of sea tailings disposal, identify if the site is already influenced by man-made activities, and act as a benchmark for monitoring programmes carried out during operation and after closure, **BAT is to perform a baseline study of the receiving environment prior to establishing the disposal site**. The baseline study will usually be performed as part of the ESIA. The baseline study should cover investigations of water, sediments and biota (prior to disposal), to describe the natural spatial and temporal (seasonal) variations of the receiving environment. Studies are site specific but should include hydrographical studies as current velocity and direction, haloclines and thermoclines and could include elements as marine life (benthos and nekton), seawater chemistry and bathymetry.

MWEI BREF process

2016 Comments to MWEI BREF document – first draft

2016

- Several modifications to the proposed BATs, and 7 new BAT suggestions from Norway on sea tailings disposal

Extractive waste facility construction and management (BAT 14-32)

BAT 16 – Planning, *Site Selection*

In order to prevent or reduce the risk of failure and prevent or reduce negative environmental impacts, BAT is to select the site by considering the whole life-cycle of the EWF and all relevant expert studies covering geotechnical aspects, environmental aspects, local conditions and hazards identification, by reflecting the results of the risk assessment (see BAT 15) and by foreseeing the possible impacts during operation, closure and after-closure.

In the case of sea tailings disposal, **BAT is to conduct a site specific site selection**, considering elements like:

- minimising impact on biological sensitive ecosystems
- deposition of sandy/muddy tailings on sandy/muddy seabed will generally give less changes in habitats, as compared to deposition on a rocky seabed.
- risk of displacement of tailings, after deposition
- timespan for the natural recovery of the designated deposition area

MWEI BREF process

2016 Comments to MWEI BREF document – first draft

2016

- Several modifications to the proposed BATs, and 7 new BAT suggestions from Norway on sea tailings disposal

Extractive waste facility construction and management (BAT 14-32)

New BAT - Designated deposition area - Design phase - Extractive waste facility construction methods

BAT 21 bis

In order to ensure a defined size and localisation of the sea tailings disposal WF, **BAT is to define a designated deposition** area with X,Y & Z coordinates for the WF. Water and seafloor outside the designated deposition area should have a turbidity level near background values, while sedimentation of tailings particles outside the depositing area should be so low that the natural benthic habitat is not altered.

New BAT - Application control - Design phase - Extractive waste facility construction methods

BAT 21 cis

In order to ensure that the tailings are deposited well within the designated deposition area, **BAT is to design the tailings pipe arrangement in a way that allows for controlled deposition**, access for maintenance, and an efficient utilization of the depositing area.

MWEI BREF process

2016 Comments to MWEI BREF document – first draft

2016

- Several modifications to the proposed BATs, and 7 new BAT suggestions from Norway on sea tailings disposal

Extractive waste facility construction and management (BAT 14-32)

Emissions to water

New BAT: Emissions to water (*Density control of tailings*)

BAT37 bis

In order to reduce potential negative environmental impacts of sea tailings disposal (eg. possible increased turbidity, particle dispersal outside the designated deposition area, and potential upwelling in the photic zone), **BAT is to ensure that the density difference between the deposited tailings slurry and the receiving seawater should be optimized**, to keep the tailings moving as a gravity plume towards the seafloor when leaving the tailings pipe. The following techniques should be considered

- thickening of the tailings,
- substitute parts of the fresh water content of the tailings with seawater
- deaerate the tailings slurry to remove air bubbles that may interfere with the settling of the gravity plume.

MWEI BREF process

2016 Comments to MWEI BREF document – first draft

2016

- Section 4.3.3.7 Sea Tailings Disposal
  - New proposed chapter in: Chapter 4: Techniques to Consider in the Determination of BAT

Chapter 4: Techniques to Consider in the Determination of BAT

New proposed chapter:

4.3.3.7 Sea tailings disposal

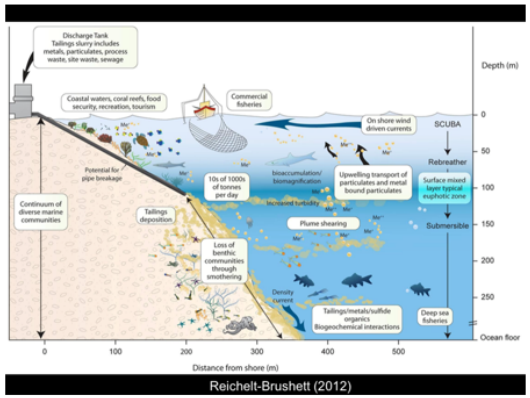
This chapter is written, based on the 10 points depicted by the Sevilla secretariat,

1. Description

In countries where mineral resources are located close to the sea, sea disposal may be an option. Sea disposal has been applied in countries with coastal basins, acting as confined sites (see EU Waste Management Directive, article 3, def. 15).

Transport of tailings to these submarine basins can be done without the risk of influencing water quality at depths shallower than the depth of discharge. This is because the density of the tailings plume leaving the pipeline is high and the finest fraction of the tailings slurry flocculates in contact with seawater, increasing the settling velocity. Additionally, seawater is a good buffer in cases where the tailings slurry has a low pH. Finally, after closure of the operation, the recovery of the sea bed influenced by tailings deposits takes place during a period of maximum 10 years in fjord basins where the natural rate of sedimentation is several millimetres per year (Jensen, 2009). Based on the factors described above, sea disposal should be considered as BAT in fjords and coastal basins which have been defined as suitable for sea disposal.

A conceptual model of marine disposal of mine tailings is shown below. Credit: Reichelt-Brushett, A. J. (2012)



Jens Skei, 2016

This chapter is written, based on the 10 points depicted by the Seville secretariat for the proposal of a BAT candidate:

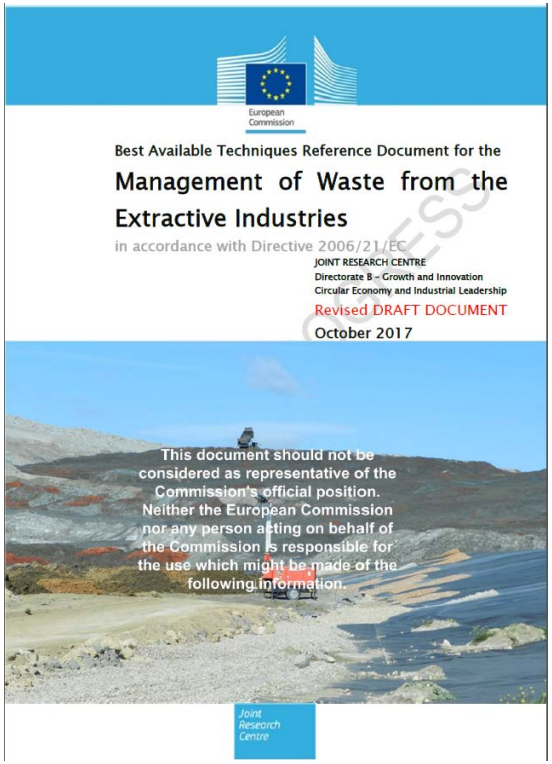
- 1. Description
- 2. Technical description
- 3. Achieved environmental benefits
- 4. Environmental performance and operational data
- 5. Cross-media effects
- 6. Technical considerations relevant to applicability
- 7. Economics
- 8. Driving force for implementation
- 9. Example sites
- 10. Reference literature

MWEI BREF process

2017 MWEI BREF document – Revised draft document

2017
- MWEI BREF document – Revised draft document

New BREF – Revised draft 2017



Management of Waste from the Extractive Industries
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Mentioning of Sea Tailings Disposal:

Enough information was given on sea tailings disposal to evaluate BAT proposals:

No change from the 2016 draft regarding sea tailings disposal

Argument of the JRC secretariat:
- Too controversial
- Not relevant for Europe

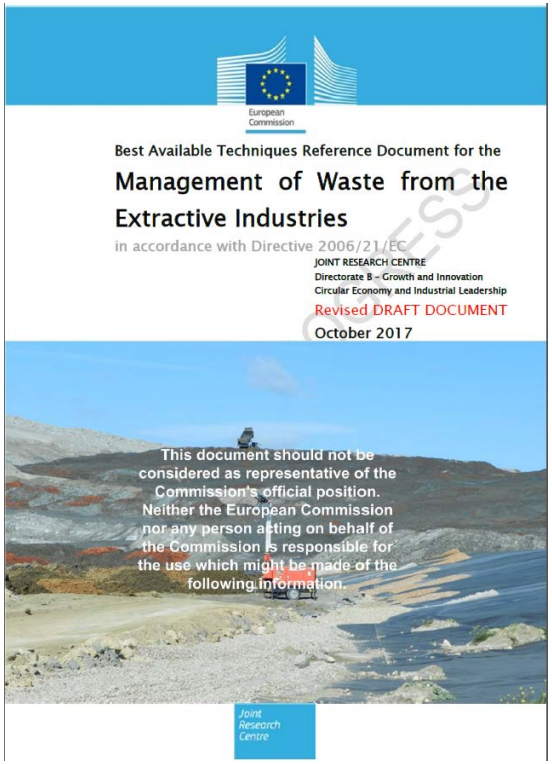
No technical arguments given

MWEI BREF process

2017 MWEI BREF document – Revised draft document

2017
- MWEI BREF document – Revised draft document

New BREF – Revised draft 2017



Management of Waste from the Extractive Industries
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Mentioning of Sea Tailings Disposal:

However:
New structure on the BAT conclusions – better for sea tailings disposal

Generic BAT,
- Generally applicable

Risk-specific BAT
- Applicable to sites where specific risks of adverse effects on the environment or human health are identified through a proper **Environmental Risk and Impact Evaluation.**

→ No longer need to suggest so many modifications to the proposed BATs
→ In the process Norway became a full member of TWG

MWEI BREF process

2017 Comments to MWEI BREF document – Revised draft document

2017

- Risk-specific BAT suggestions from Norway

BAT 3B

Include sea tailings disposal as an option for permanent deposition of extractive waste

BAT 25bis : Designated deposition area for STD.

In order to ensure a **defined size and location** of the submarine EWF, BAT is to define a designated deposition area with X,Y & Z coordinates for the EWF. Water and seafloor outside the designated deposition area should have a turbidity level near background values, while sedimentation of tailings particles outside the depositing area should be so low that the natural benthic habitat is not altered.

BAT 25cis : STD design - Application control

In order to ensure that the tailings are **deposited well within the designated deposition area**, BAT is to design the tailings pipe arrangement in a way that allows for controlled deposition, access for maintenance, and an efficient utilization of the depositing area.

BAT 25dis : Density control of tailings for STD

In order to reduce potential negative environmental impacts of STD (eg. possible increased turbidity, particle dispersal outside the designated deposition area, and potential upwelling in the photic zone), BAT is to ensure that the **density difference** between the deposited tailings slurry and the receiving seawater **should be optimized**, to keep the tailings moving as a gravity plume towards the seafloor when leaving the tailings pipe. The following techniques should be considered:

- thickening of the tailings,
- substitute parts of the fresh water content of the tailings with seawater
- deaerate the tailings slurry to remove air bubbles that may interfere with the settling of the gravity plume.

MWEI BREF process

2017 Final Technical Working Group (TEG) meeting, Seville

2017

- Final Technical Working Group (TEG) meeting, Seville

JRC decided not to include the remarks and BAT proposals on Sea Tailings Disposal put forward by Norway, and supported by Euromines, IMA and UEPG.

7. For the sake of completeness, STD is mentioned in Chapter 2 as one of the applied techniques in the sector but has not been included in Chapter 4 as a candidate BAT and hence not identified as BAT in Chapter 5, for a number of important reasons.
STD is a site-specific technique applied in specific geographical conditions (such as fjords in Norway) as an alternative to land-based deposition, according to the specific results of an EIA.
Information on STD provided by the TWG is specific to one geographical type of site and demonstrates the need for in depth and specialised studies. Therefore, it cannot be considered as a generally applied extractive waste management technique.
According to peer-reviewed literature, there are still many knowledge gaps on the environmental impacts and it remains a controversial technique to many experts. In addition, legal or de facto restrictions on the technique apply in many countries in Europe and worldwide.

- Disussion in the TWG:
  - **Compromise suggested by JRC**.
    Sea tailings disposal BAT conclusions not included, but acknowledging the improved knowledge in Norway on the consequences of sea tailings disposal, and its continued use in Norway.

MWEI BREF process

2018 MWEI BREF document – Final draft document

2018

- MWEI BREF document – Final draft document

New BREF document – Final draft 2018

Management of Waste from the Extractive Industries
MWEI
692 p

Mentioning of Sea Tailings Disposal:

Chapter 2

2.1.1.1 Environmental baseline studies

- Topics for baseline studies for sea tailings disposal

2.1.1.5 Environmental Risk and Impact Evaluation

- For sea tailings disposal
  Comparisons are made between land disposal alternatives and sea disposal to evaluate the environmental acceptance and the technical feasibility of any relevant alternatives.

2.1.1.9 Plan for closure, including rehabilitation, and after-closure procedures moniand toring

- Monitoing during operations and after closure
  Prerequisite for the sea disposal permit in Norway

MWEI BREF process

2018 MWEI BREF document – Final draft document

2018

- MWEI BREF document – Final draft document

New BREF document – Final draft 2018

Management of Waste from the Extractive Industries
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692 p

Mentioning of Sea Tailings Disposal:

Chapter 2

2.4 Management of wastes from mineral excavation and treatment of mineral resources

- Listed among the most common methods for managing and depositing extractive waste, but stating sea tailings disposal disposal is uncommon in the EU.

2.4.6 Deposition in submarine or sublacustrine extractive waste deposition areas (including EWFs)

- Negative and positive effects are now described.
- NYKOS mentioned:
  A five-year research program (NYKOS) has been initiated in Norway to obtain new knowledge about the environmental risks related to the disposal of extractive waste from mineral processing in coastal basins.

Link between emission level for Total Suspended Solids and that the extractive waste itself can also be considered as an emission, for sea tailings disposal, has been removed.

MWEI BREF process

2018 MWEI BREF document – Final draft document

2018

- MWEI BREF document – Final draft document

New BREF document – Final draft 2018

Management of Waste from the Extractive Industries
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Mentioning of Sea Tailings Disposal:

Chapter 5 – BAT Conclusions

The **TWG acknowledges that progress has been made in improving the knowledge base on sea tailings disposal** (STD) but, following the exchange of information, no consensus has been reached either on the inclusion or on the exclusion of BAT for STD in this document. The TWG encourages the technoscientific community to further expand the knowledge base on impacts and benefits of STD.

Finally, the **TWG acknowledges that Norway continues to acquire experience in this field** and has shared experience to this extent.

Relevance for NYKOS

→ NYKOS should try adress the objections to sea tailings disposal raised in chapter 2 of the BREF document.

→ Further work on BATs for sea tailings disposal in NYKOS should incorporate the work already done in the BREF process (Discuss/review the documents, structure and BAT proposals)