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Operationalization of the best available techniques and best environmental practices in deep seabed mining regime: a regulatory perspective

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Best Practices, including Best Available Techniques (BAT) and Best Environmental Practices (BEP), are typically included to provide for or promote particular practices, methods, measures, or standards in respect of the efficient recovery of a resource and the level of environmental protection. Deep seabed mining (DSM) is an activity to obtain mineral resources from the deep sea, which may have certain adverse impacts on the marine environment. International Seabed Authority (ISA), the regulator of DSM activities in the Area authorized by the United Nations Convention on the Law of the Sea (UNCLOS), has introduced those terms in its Mining Code as critical tools for the reduction in environmental risks arising from DSM. Terms that are not included by the UNCLOS, such as BAT and BEP, are commonly invoked, yet often without specification in the regulatory discourse for DSM. In the absence of precise definitions and operational details, the terms BAT and BEP may not be able to function as anticipated in the DSM domain. Against this backdrop, this paper attempts to explore possible means by which the ISA might enable the contractor to operationalize the BAT and BEP, including providing definitions, their placement in the exploitation regulations, and the criteria for its operationalization in the Standards and Guidelines. This paper cites the existing international instruments that incorporate the terms BAT and BEP and takes particular note of DSM into account to highlight specific considerations for their practical implementation for DSM.

KEYWORDS

International Seabed Authority, deep seabed mining, Draft Exploitation Regulations, Best Available Techniques (BAT), Best Environmental Practices (BEP)

1 Introduction

The international seabed area beyond national jurisdictions (the Area) contains a large volume of diverse mineral resources including essential metals such as copper, nickel, cobalt, and manganese (Sharma and Smith, 2019) potentially to generate enormous economic benefits, which leads to great interest in mining these resources by an

increasing number of countries and companies. However, such increasing interest in the exploitation of mineral resources in the Area has been accompanied by the environmental concerns cited by the international community in their arguments (Allsopp et al., 2013; Van Dover et al., 2014; Kim, 2017; Jones et al., 2020). Indeed, the choice of technology or method of mining is closely linked to the environmental impacts of mining activities. As the International Court of Justice observed, the obligation to prevent pollution and protect and preserve the marine environment entails careful consideration of the technology to be used. Appropriate technologies and measures taken enable to reduce environmental impacts of mining activities. Best Practices, including the Best Available Scientific Evidence (BASE), the Best Available Techniques (BAT), and the Best Environmental Practices (BEP), are typically included to provide for or promote exemplary models for the selection of particular practices, methods, measures, or standards in respect of the efficient recovery of a resource and the level of protection afforded to health and safety and the environment (International Seabed Authority, 2019a). Best Practices collectively established by corporations and business groups within an industry are most likely to lead to a common approach to a problem (Dickerson, 2010). They are characterized by their flexible and informal nature and non-legally binding status so as to be used in rapidly advancing fields of science and technology (Dickerson, 2010), such as the deep seabed mining (DSM). Moreover, Best Practices are generally served as an intermediate point to fill gaps in the legislative process. Specifically, Best Practices can help to provide specific minimum standards that entities should follow as continuing to study the issue (Dickerson, 2010) when there is a need to respond to a problem yet to be identified. The characteristics of Best Practices are perfectly applicable to a specific situation of DSM activities. Therefore, Best Practices are deemed as critical tools to minimize the adverse environmental effects of DSM.

Currently, the major challenge is how to function the role of Best Practices in the DSM regime. The 1982 UNCLOS and Agreement Relating to the Implementation of Part XI of the UNCLOS (1994 Implementing Agreement) stipulate basic legal requirements and provide a legal framework for DSM. The UNCLOS designates the Area and these resources as the common heritage of mankind.¹ Under the framework, mining activities in the Area are organized, carried out, and controlled by the ISA on behalf of mankind as a whole,² and the ISA is mandated to develop rules, regulations, and procedures (RRP) to provide details for the development of the Mining Code. The UNCLOS requires the ISA to strike a balance between its responsibilities to develop the mineral resources and to provide adequate protection for the marine environment from the harmful effects of activities in the Area (Warner, 2020). In doing so, the ISA has introduced some terms and measures that are not dealt with by the UNCLOS to fulfill the regulatory role for developing mineral resources and environmental protection, one of such terms is Best Practices.

There is no provided official definition of BASE, BAT, or BEP in Part XI and Annex III of the UNCLOS. Nevertheless, BASE is mentioned in Article 234 (Ice-Covered Areas) of Part XII (Protection and Preservation of the Marine Environment), and some regulatory discussions related to this term under the UNCLOS framework (Nordquist et al., 1991; Bartenstein, 2011; Proelss et al., 2017) are also applicable to the DSM. Hence, this paper focuses on BAT and BEP, which are not yet dealt with in the UNCLOS. Despite the ISA Exploration Regulations on Sulphides and the standard clauses for exploration of contracts incorporate the term BEP for the first time in the section on environmental protection³, BEP *per se* exists without any operational details as a requirement for sponsoring states and contractors. Afterwards, BEP is applied in the ISA Exploration Regulations on Cobalt-Rich Crust and Nodules.⁴ In its recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from the exploration for marine minerals in the Area (International Seabed Authority, 2013a), the Legal and Technical Commission (LTC) recommends using the BAT, the best available methodology, and a combination of both. However, neither the BAT nor the BEP is defined in the ISA Exploration Regulations or the LTC's recommendations. The ISA Draft Exploitation Regulations further develops the BAT and BEP by providing both definitions to be discussed at a later stage. The Seabed Disputes Chamber of the International Tribunal for the Law of the Sea (Seabed Disputes Chamber) indicates that the BEP is a direct obligation of the sponsoring State that becomes liable if it breaches this obligation.⁵ However, in the absence of Guidance, it would be difficult for sponsoring states and contractors to fulfill this obligation. As Japan comments, there may exist different understandings or interpretations among individual stakeholders without detailed specifications regarding BAT and BEP, and it is essential to identify the common understanding of those techniques, required specifications of equipment, and practices in the relevant guidelines (Government of Japan, 2019). Inaccurate definitions, the lack of operational guidance, coupled with the prospect of uncertainty and subjectivity in their implementation may further hinder the BAT and BEP from functioning in protecting the marine environment and, consequently, devalue the impact of the principle of the common heritage of mankind. Most importantly, it is rather difficult to meet the tight 2-year deadline for the completion of the exploitation regulations (July 2023) invoked by Nauru based on section 1(15) of the Annex to the 1994 Implementing Agreement (International Seabed Authority, 2021). It is not ruled out that the entity may submit an application for exploitation at that time (Singh, 2021; Willaert, 2021; Singh, 2021b).

Therefore, it is desirable and timely to examine the definitions and discuss the operational details of the BAT and BEP together

1 UNCLOS, article 136.

2 UNCLOS, article 153(1).

3 See eg ISA Sulphides Exploration Regulations, regulation 33(2) and Annex 4, section 5.1.

4 Ibid.

5 SDC Advisory Opinion, paragraph 136.

with the ongoing Draft Exploitation Regulations. To this end, *Section 2* of the paper examines the application of the BAT and BEP in the existing international conventions, summarizing the typical characteristics of the operational details following the introductory note. *Section 3* proposes specific definitions for both terms and considers whether it is appropriate to place them in the current draft exploitation regulations. It also discusses further approaches to providing operational details in the Standards and Guidelines. *Section 4* concludes this paper.

2 BAT and BEP in the existing international conventions

The term Best Practices is used across a broad spectrum of areas, such as the protection of international human rights and labor rights, the regulation of international finances, international environmental protection, and the promotion of sustainable development (Dickerson, 2010). Their variants can also be found in other sectors, for instance, good oil field practices in the context of petroleum exploration and production. They have had a positive effect in addressing social, economic, and environmental challenges by providing exemplary modes for specific actions (Dickerson, 2010).

One of the most important areas of the promotion of best practices is to take it as a critical tool in reducing environmental risks. The terms are commonly invoked concepts in international and regional instruments and in national instruments (International Seabed Authority, 2019a). These two terms have been included with implementing details in a variety of legal documents of international environmental protection, such as the Convention for the Protection of the Marine Environment of the North-East Atlantic (1992 OSPAR Convention), the Convention on the Protection of the Black Sea Against Pollution (1992 Black Sea Convention), Convention on the Protection of the Marine Environment of the Baltic Sea Area (1992 Helsinki Convention), and Stockholm Convention on Persistent Organic Pollutants (2001 Stockholm Convention). This section will go through these conventions and investigate definitions, implementing guidance, and other common characteristics of BAT and BEP to better understand the operationalization of these two terms.

The 1992 OSPAR Convention provides definitions for BAT and BEP, while other international conventions follow the definitions and modality of BAT and BEP under the 1992 OSPAR Convention with slight changes. Appendix 1 of the 1992 OSPAR Convention stipulates that BAT means “the latest stage of development (state of the art) of process, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste.”⁶ BEP means “the application of the most appropriate combination of environmental control measures and strategies.”⁷ These reflect a forward-looking and dynamic approach (International Seabed Authority, 2019a). Both

terms imply that they are subject to change, meaning their definitions will be adjusted with time in the light of technological advances, economic and social factors, scientific knowledge, and understanding advances. The wording “latest development stage” and “most appropriate” give operators the flexibility to determine specific measures and strategies but leave operators with no definitive guidance for decision making. To assist the operators, the 1992 OSPAR Convention provides a set of criteria to help select the specific measures and strategies that correspond with the definitions of the BAT and BEP. In determining whether a set of processes, facilities, and methods of operation constitute the BAT, the operator is encouraged to consider comparability, technological advances and changes, economic feasibility, time limits for installation, and the nature and volume of the discharges and emissions concerned.⁸ In the case of the BEP, the *Appendix* contains a list of a graduated range of nine measures for selecting individual cases and seven measures for determining the combination of measures for general or individual cases.⁹ In providing implementing details, the 1992 OSPAR Convention also implies “learning by doing,” i.e., adaptive management, as it states that “[i]f the reduction of inputs resulting from the use of best environmental practice does not lead to environmentally acceptable results, additional measures have to be applied and best environmental practice redefined.”¹⁰ Similar language also applies to the BAT.¹¹ Therefore, these criteria for BAT and BEP need to be reviewed periodically.

The 1992 OSPAR Convention clearly provides the purpose of the application of the BEP in article 2 as follows: “The OSPAR Convention requires Contracting Parties to apply BAT and BEP, including, where appropriate, clean technology, in their efforts to prevent and eliminate marine pollution” (emphasis added). Other international environmental conventions present a similar purpose for the application of the BAT or BEP; for instance, the 2001 Stockholm Convention requires the application of BAT to minimize their releases of Persistent Organic Pollutants from unintentional production (emphasis added).¹² In contrast, SCAR (2011) ANTABIF will use the BAT to integrate, share and disseminate all available information on Antarctic Biodiversity (emphasis added). It is paramount to implement the BAT and BEP with an explicit objective. As presented above, in implementing the BAT and BEP, the operators have discretion to make a subjective selection according to objective criteria. In this circumstance, the objectives would be highly relevant for operators selecting specific measures or techniques. Unsurprisingly, operators whose goal is to reduce

6 1992 OSPAR Convention, Appendix 1, paragraph 2.

7 1992 OSPAR Convention, Appendix 1, paragraph 6.

8 1992 OSPAR Convention, Appendix 1, paragraph 2.

9 1992 OSPAR Convention, Appendix 1, paragraphs 6 and 7.

10 1992 OSPAR Convention, Appendix 1, paragraph 9.

11 1992 OSPAR Convention, Appendix 1, paragraph 4.

12 2001 Stockholm Convention, Article 5.

pollution choose more diverse techniques rather than those whose goal is to disseminate information.

Regarding the placement of the BAT and BEP under the conventions, the two terms are incorporated within the text and annexes by the 1992 OSPAR Convention. Article 2, paragraph 3 (b) (ii) of the 1992 OSPAR Convention provides that “in implementing the Convention, contracting parties are required to ensure the application of best available techniques and best environmental practice in carrying out programmes and measures.”¹³ These two terms are reiterated in annexes on the prevention and elimination of pollution from land-based and offshore sources, respectively. The terms BAT and BEP are stipulated as a general obligation of the contracting parties and tools to help the contracting parties to reach a particular goal, i.e., preventing and reducing pollution, under the 1992 OSPAR Convention.

3 Incorporating and operationalizing BAT and BEP in the Draft Exploitation Regulations

Incorporating BAT and BEP into international conventions as the means of emission/pollution prevention and reduction is considered significant for environmental protection at the regional and global level (Richter and Steinhäuser, 2003). Therefore, they are expected to be critical tools for reducing environmental risks arising from DSM activities in the Area and to contribute to Good Industry Practice (GIP). However, they are often ambiguous concepts in DSM regulatory discourse. It is expected that ISA will provide more details, including definitions, placement in the exploitation regulations, and criteria for implementation, to enable the Contractor to implement the requirements of BAT and BEP.

3.1 Defining the terms

As aforementioned, ISA Exploration Regulations and LTC’s recommendations do not provide definitions for BAT and BEP. It is gratifying that the ISA Draft Exploitation Regulations has made a breakthrough in this field. ISA Draft Exploitation Regulations (March 2019) (International Seabed Authority, 2019b) defined the BAT in Schedule 1 as follows:

the *latest* stage of development, State of the art processes, of facilities or of methods of operation that indicate the practical suitability of a particular measure for the prevention, reduction and control of pollution and the protection of the Marine Environment from the harmful effects of Exploitation Activities, taking into account the guidance set out in the applicable Guidelines. (Emphasis added)

This definition is borrowed from the 1992 OSPAR Convention, which emphasized time efficiency, since it requires that the techniques adopted by Contractors must be the newest or most recent, as implied by the word “latest” in the first sentence. This definition seems debatable, since the newest techniques are not

necessarily the most effective and advanced and may fail to reach the objective of “the prevention, reduction and control of pollution and the protection of the Marine Environment from the harmful effects of Exploitation Activities.” Germany recommended that the current definition should be replaced by that established by the European Industrial Emissions Directive (Schedule 1),¹⁴ which replaced the word “latest” with “most effective and advanced” (Federal Republic of Germany, 2019). In other words, the techniques implemented by a contractor must be effective and advanced regardless of the time when the technology was produced. Germany’s proposal is favorable, since it highlights the consequences of the techniques taken by contractors in achieving a generally high level of protection of the environment. Nauru Ocean Resources Incorporated (NORI), a contractor, shared a similar opinion and stated that in certain circumstances techniques used by the Contractor may be a low-tech yet elegant solution, which may not be state of the art but may be more effective than the high-tech state of the art solution (NORI, 2019). Considering the responsibility of protecting the marine environment, the paper’s authors support replacing the wording “latest” in the definition of BAT with “effective and advanced.”

The definition of BEP has been developed in different versions of the ISA Draft Exploitation Regulations. The ISA Draft Exploitation Regulations (January 2017) provides a dedicated definition of the BEP, specifically, “...the application of the most appropriate combination of environmental control measures and strategies, [including Best Available Techniques]” (International Seabed Authority, 2017a). However, BAT in the bracket has been removed from the definition in the 2018 version of ISA Draft Exploitation Regulations and “taking into account the criteria set out in the applicable Guidelines” has been added (International Seabed Authority, 2018). This definition was further developed by the Draft Exploitation Regulations (March 2019) (Schedule, Use of terms and scope): “the application of the most appropriate combination of environmental control measures and strategies, *that will change with time in the light of improved knowledge, understanding or technology*, taking into account the guidance set out in the applicable Guidelines.” (Emphasis added) (International Seabed Authority, 2019b).

In fact, the Draft Exploitation Regulations (March 2019) also borrowed the definition of BEP from the 1992 OSPAR Convention, which adopted a forward-looking and dynamic approach. However, the definition in the Draft Exploitation Regulations has been modified and enriched according to the unique situation of the DSM. First, the characteristic of adaptability is moved from the guidelines in a non-legally binding appendix to the definition in legally binding regulation, which adds weight to the concept of “adaptability.” Second, “economic and social factors” is deleted

¹³ 1992 OSPAR Convention, Article 2, paragraph 3 (b) (ii).

¹⁴ Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control), Article 3, para. 10.

from the parameters, whereas “improved knowledge, understanding or technology” is kept. Economic and social considerations have been raised in several DSM discussions, albeit not yet having reached an agreement (International Seabed Authority, 2017b; International Seabed Authority, 2017c). Retaining the latter accords with the situation of DSM, since knowledge gaps, lack of data, and unsatisfactory technologies are consistently hindering scientists’ and practitioners’ predictive efforts in the assessment of the impacts of DSM on the marine environment (Levin et al., 2016; Gollner et al., 2017; Jones et al., 2017). Therefore, “improved knowledge, understanding or technology” should be the primary focus for DSM activities.

The United States (US) proposed reinstating BAT in the definition of the BEP—namely, BEP “means the application of the most appropriate combination of environmental control measures and strategies, based on the Best Available Scientific Information and Best Available Technology,…” (emphasis added) (United States, 2019). One question that needs to be clarified is how BEP is related to BAT? Is the latter subsumed in the former, or are they separate? (Pew Charitable Trusts, 2019a). In fact, the original version of the first ISA exploration regulation, i.e., Nodules Exploration Regulations, adopted the terminology “best technology available,” rather than BEP (International Seabed Authority, 2000). The Sulphides Exploration Regulations first adopted the terminology BEP, and then, this term was applied to Cobalt-Rich Crust Exploration Regulations and later modified in the Nodules Exploration Regulations (International Seabed Authority, 2013b). The express requirement for BEP under the regulations and standard clauses is a broader concept than BAT. Likely, Seabed Disputes Chamber analyzed the BEP as “higher standards.”¹⁵ The latter appears to be limited by what is technologically achievable, while a survey of the former in a variety of international instruments shows that it requires the application of the most appropriate combination of environmental control measures and strategies (Anton et al., 2011). Draft Exploitation Regulations incorporate these two terms simultaneously, which is less a denial of the previous relationship between the two than a choice to apply one or both according to the different emphases in different contexts. In any case, it is important to comprehensively consider and determine the relationship between the two terms in the Draft Exploitation Regulations and ensure coherence and consistency.

Additionally, Micronesia proposed the incorporation of traditional knowledge in the definition of BEP. To be specific, “traditional knowledge of Indigenous Peoples and local communities” should be highlighted as part of the knowledge in the definition (Federated States of Micronesia, 2019). During the first session of the 27th Council meetings, the delegation from Micronesia further proposed the inclusion of traditional knowledge into the Draft Exploitation Regulations and explained the scope and function of traditional knowledge, including that it helps to inform scientific understanding and determine the selection of the Area of Particular Environmental Interest (APEI) of the Regional Environmental Management Plan (REMP). Traditional knowledge about the ecology of a particular

place or natural resource that has been accumulated by Indigenous Peoples and local communities (IPLCs) over multiple generations is essential in informing strategies for the conservation and sustainable use of marine species and habitats by enriching the diversity of available approaches, experiences, and solutions (Vierros et al., 2020). The consideration of traditional knowledge in policy is not new; IPLCs and their knowledge have been included in international conventions and processes, for example, in the work of the Convention on Biological Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC), and the legal instruments for the Arctic (Vierros et al., 2020). The Intergovernmental Conference on Marine Biodiversity of Areas Beyond National Jurisdiction (BBNJ) negotiation also included the significance of traditional knowledge in the discussion and draft text, although ambiguities in application still exist (Mulalap et al., 2020). In the field of DSM, whether and how, and to what extent traditional knowledge and its holders can be incorporated into the Draft Exploitation Regulations are still under discussion. Traditional knowledge is beneficial for effective environmental management, since it is conducive to the development of guiding principles for Strategic Environmental Assessments and REMP at the regional level, and it provides feedback into the key elements of the environmental management system at the contract level (Escobar et al., 2021). Therefore, traditional knowledge should be included in the definition of the BEP. But before that, a core question needs to be considered is contractors’ implementation and compliance if such definition is retained considering the BEP’s nature as an obligation. Numerous questions need to be considered and discussed, including main types of traditional knowledge of particular relevance to the DSM, domains of the application of such knowledge, and approaches for incorporation of such knowledge and its holders into the governance and decision-making process. For traditional knowledge to be incorporated in the definition of BEP, it is necessary to explicitly specify these issues and establish them as standards or guidelines, since only when these issues are clearly identified will the BEP incorporating traditional knowledge be operational.

3.2 Placement in the Draft Exploitation Regulations

Under the ISA Draft Exploitation Regulations (March 2019), the term BEP is mentioned in eight provisions, whereas the BAT is mentioned in 10 (see Table 1).¹⁶ This section examines whether these two terms are in the proper places. Generally, the Draft Exploitation Regulations (March 2019) incorporate the BAT and BEP in the following four categories (see Table 1): first, approaches to developing BEP; second, taking BAT and BEP as environmental obligations; third, incorporating BAT and BEP as a reference criterion for whether to take action in certain assessments or as trigger mechanisms; and fourth, which is most often utilized, taking

¹⁵ SDC Advisory Opinion, para. 136.

¹⁶ Regulation 55(d) also incorporated the BAT. However, the informal working group for the environment agreed to delete it. Thus, it is not included in Table 1.

TABLE 1 Incorporation of the BAT and BEP in the ISA Draft Exploitation Regulations (March 2019).

	Part	Section	Regulation	Contents of the regulation
An approach to develop BEP (and BAT)				
	Part I Introduction	/	Regulation 3 Duty to cooperate and exchange of information	(e) Contractors, sponsoring States and members of the Authority shall cooperate with the Authority in the establishment and implementation of programs to observe, measure, evaluate and analyze the impacts of Exploitation on the Marine Environment, to share the findings and results of such programs with the Authority for wider dissemination and to extend such cooperation and collaboration to the implementation and further development of Best Environmental Practices in connection with activities in the Area;
BAT and BEP as an obligation				
	Part IV Protection and preservation of the Marine Environment	Section 1 Obligations relating to the Marine Environment	Regulation 44 General obligations	The Authority, sponsoring States and Contractors shall each, as appropriate, plan, implement and modify measures necessary for ensuring effective protection for the Marine Environment from harmful effects in accordance with the rules, regulations and procedures adopted by the Authority in respect of activities in the Area. To this end, they shall: (b) Apply the Best Available Techniques and Best Environmental Practices in carrying out such measures;
BAT and BEP as a reference criterion				
	Part II Applications for approval of Plans of Work	Section 3 Consideration of applications by the Commission	Regulation 13 assessment of applicants	3. In considering the technical capability of an applicant, the Commission shall determine in accordance with the Guidelines whether the applicant has or will have: (c) Established the necessary risk assessment and risk management systems to effectively implement the proposed Plan of Work in accordance with Good Industry Practice, Best Available Techniques and Best Environmental Practices and these Regulations, including the technology and procedures to meet health, safety and environmental requirements for the activities proposed in the Plan of Work; (e) The capability to utilize and apply Best Available Techniques.
	Part III rights and obligations of Contractors	Section 5 Incidents and notifiable events	Regulation 32 Risk of Incidents	The reasonable practicability of risk reduction measures shall be kept under review in the light of new knowledge and technology developments and Good Industry Practice, Best Available Techniques and Best Environmental Practices.
	Part V Review and modification of a Plan of Work	/	Regulation 58	At intervals not exceeding five years from the date of signature of the exploitation contract, or where, in the opinion of the Secretary-General, there have occurred any of the following events or changes of circumstance: (f) Changes in Best Available Techniques;
BAT and BEP as a guideline				
For the preparation of specific documents	Part IV Protection and preservation of the Marine Environment	Section 2 Preparation of the EIS and the EMMP	Regulation 47 EIS	3. The EIS shall be in the form prescribed by the Authority in annex IV to these Regulations and shall be: (d) Be prepared in accordance with the applicable Guidelines, Good Industry Practice, Best Available Scientific Evidence, Best Environmental Practices and Best Available Techniques.
		Section 2 Preparation of the EIS and the EMMP	Regulation 48 EMMP	3. The Environmental Management and Monitoring Plan shall cover the main aspects prescribed by the Authority in annex VII to these Regulations and shall be: (c) Prepared in accordance with the applicable Guide lines, Good Industry Practice, Best Available Scientific Evidence and Best Available Techniques, and consistent with other plans in these Regulations, including the Closure Plan and the Emergency Response and Contingency Plan.
	Part VI Closure plans	/	regulation 59 Closure Plan	2. The objectives of a Closure Plan are to ensure that: (a) The closure of mining activities is a process that is incorporated into the mining life cycle and is conducted in accordance with Good Industry Practice, Best Environmental Practices and Best Available Techniques;
Maintain the currency and adequacy of specific documents	Part IV Protection and preservation of the Marine Environment	Section 4 Compliance with EMMP and performance assessments	Regulation 51 Compliance with the EMMP	A Contractor shall, in accordance with the terms and conditions of its Environmental Management and Monitoring Plan and these Regulations: (c) Maintain the currency and adequacy of the Environmental Management and Monitoring Plan during the term of its exploitation contract in accordance with Best Available Techniques and Best Environmental Practices and taking account of the relevant Guidelines.
			Regulation 53 Emergency Response and	1. A Contractor shall maintain: (a) The currency and adequacy of its Emergency Response and Contingency Plans based on the identification of potential Incidents and in accordance with Good Industry Practice, Best Available Techniques, Best Environmental Practices and the applicable standards and Guidelines;

(Continued)

TABLE 1 Continued

	Part	Section	Regulation	Contents of the regulation
			Contingency Plan	
	Part VI Closure plans	/	Regulation 59	4. A Contractor shall maintain the currency and adequacy of its Closure Plan in accordance with Good Industry Practice, Best Environmental Practices, Best Available Techniques and the relevant Guidelines.
For other purposes	Part IV Protection and preservation of the Marine Environment	Section 1 Obligations relating to the Marine Environment	Regulation 44 General obligations	The Authority, sponsoring States and Contractors shall each, as appropriate, plan, implement and modify measures necessary for ensuring effective protection for the Marine Environment from harmful effects in accordance with the rules, regulations and procedures adopted by the Authority in respect of activities in the Area. To this end, they shall: (c) Integrate Best Available Scientific Evidence in environmental decision making, including all risk assessments and management undertaken in connection with environmental assessments, and the management and response measures taken under or in accordance with Best Environmental Practices;

BAT and BEP as guidelines for specific actions for the purpose of the protection and preservation of the marine environment.

First is a discussion on approaches to developing BEP (and BAT). In Part I of the Introduction, regulation 3 (e) stipulates that Contractors, sponsoring States, and members of the ISA have a duty to cooperate with the ISA and exchange information to develop the BEP. Indeed, in a traditional best-practices regime, the regulated entities together devise a set of practices, i.e., establishing standards or guidelines through horizontal cooperation rather than top-down direction (Dickerson, 2010). This approach has not changed, fundamentally, albeit regulatory agencies widely use Best Practices. As such, public or private entities are the ones who devise or provide the industrial practices, and then, regulatory agencies officially adopt such practices. Therefore, it is critical for Contractors, sponsoring States, and member States to cooperate with the ISA in the establishment and implementation of programs to observe, measure, evaluate, and analyze the impacts of exploitation on the marine environment in contributing to the development of the BEP. Regulation 3 does not utilize the language of BAT. Indeed, BAT, as an element of the best practices category, requires a similar approach to the BEP in its development. For this reason, BAT should also be included in this regulation. Apart from the duty to cooperate and exchange information, two other points are relevant to the development of BEP, albeit not to be included. A primary consideration for the BEP is the collection of adequate quantity and quality baseline data (Jaekel, 2015). Baseline means the starting point (a certain date or state) against which the changes in the condition of a variable or a set of variables are measured (International Seabed Authority, 2017a). The ISA should issue guidelines or standards to provide further details as to robust and comparable baseline data required from Contractors, since baseline data are a point of reference to monitor impacts and to measure the success of recovery or rehabilitation (Pew Charitable Trusts, 2019a). In addition to the collection of baseline data, collecting environmental monitoring data is also critical for improving the BEP. A monitoring program or guidelines and standards as to the optimum time, proper manner, and appropriate parameters for analysis should be provided by the ISA.

Second, we look at BAT and BEP as obligations. In Part IV on the protection and preservation of the marine environment, regulation 44

stipulates that applying BAT and BEP is a general environmental obligation for the ISA, sponsoring States and Contractors. The use of BAT and BEP as general obligations is similar to that outlined in the 1992 OSPAR Convention and other relevant international conventions. Unlike their legal status as conventional obligations in OSPAR, BAT and BEP are both conventional obligations (for the sponsoring States) and contractual obligations (for the Contractors) in the Exploitation Regulations. The 2011 Advisory Opinion is relatively clear in terms of the performance of the conventional obligations by the sponsoring States. The Seabed Disputes Chamber opines that applying BEP is one of the direct obligations of sponsoring States and equally recognizes that it is also “in general terms” an element of the broader due diligence obligation (French, 2011).¹⁷ In the event of failure to comply with due diligence obligation or direct obligations, it is not possible for the sponsoring State to claim exemption from liability. There may be some difficulties when the Contractors actually perform the contractual obligations of BAT and BEP. For instance, the economic feasibility of the technology is a key factor in the implementation of BEP (Ebbesson, 2000). One potential scenario is that Contractors may avoid choosing expensive technologies for short-term economic interests (Tanaka, 2013). Obviously, whether it is expensive or not is not regarded as the sole criterion for determining the Contractor’s selection of the “best” technology. As demonstrated in Section 3.1, “best” in the definitions of BAT and BEP should be interpreted as “most effective.” If the techniques or practices used by the Contractor prove not to be “most effective,” then the Contractor fails to fulfill its contractual obligations, which would result in the issuance of compliance notice, suspension, and even termination of exploitation contract under Regulation 103 of the Draft Exploitation Regulations. The challenge is which procedure could be applicable to assess the suitability of the technology in question. A review of activities under a plan of work could be an opportunity. However, this regulation (Regulation 58) only includes the Contractor’s application for change, rather than the active intervention of the ISA. The Draft Exploitation Regulations do not authorize ISA to require the Contractor in question to modify its mining work plan.

¹⁷ SDC Advisory Opinion, paras 121 and 122.

Third is utilizing BAT as a reference criterion for certain assessments or a trigger mechanism for whether to take action. The typical example for the former is regulation 13: whether the applicant has sufficient capability to apply BAT is one of the criteria used by the LTC to assess the technical capability of an applicant. Regulation 32 presents BAT and BEP as triggers, namely, the reasonable practicability of risk reduction measures shall be kept under review in the light of BAT and BEP. Similarly, regulation 58 incorporates BAT as a reference criterion for the modification of a Plan of Work, i.e., changes in the BAT will result in the modification of the Plan of Work. In this case, the function of the BAT is enriched compared with that in other international conventions.

Fourth, which is utilized most often, taking BAT and BEP as guidelines for specific actions for the purpose of the protection and preservation of the marine environment, including the preparation of specific documents, i.e., the Environmental Impact Statement (EIS), the Environmental Management and Monitoring Plan (EMMP) and the Closure Plan (regulations 47, 48, and 59), and maintaining the currency and adequacy of specific documents, i.e., EMMP, Emergency Response and Contingency Plan and Closure Plan (regulations 51, 53, and 59). It is questionable that the Draft Regulation 48(3)(c) does not refer to BEP in connection with the preparation of an EMMP, considering BEP is a critical tool for environmental management (Federated States of Micronesia, 2019). Likewise, Section 3 on pollution control and management of waste under the Part IV on the protection and preservation of the marine environment does not refer to BAT and BEP, which is unusual, since it is common practice for other international environmental convention to utilize these two terms.

3.3 Recommendation for standards and guidelines

The ISA consults the Guidelines as a priority of development for BAT and BEP, as the definitions of BAT and BEP indicate that it is the Guidelines that complement the operationalization and implementation of these two approaches (International Seabed Authority, 2019c). Although the nature and category of standards and guidelines are still under discussion, in general, the Standards that are legally binding in nature will be divided into process standards and performance standards, whereas the recommended Guidelines will provide process and practice guidance (International Seabed Authority, 2019c). It is unreasonable to decide to adopt “guidelines” without planning the specific content of the documents supporting BAT and BEP. A hybrid approach (some standards and some guidelines) might be more attractive than sole guidelines. Whether to adopt “standards” or “guidelines” should be determined by the content and nature of certain matters, that is, whether they relate to process standards, performance standards or practice guidance, etc.

Standards and Guidelines for BAT and BEP should provide interpretive guidance and minimum standards of conduct. Several elements need to be clarified in the Guidelines to provide interpretive guidance. First is the scope of techniques. The 1992 OSPAR Convention provides “‘Techniques’ include both the technology used and the way in which the installation is designed, built, maintained,

operated and dismantled.” Such an explanation is also suitable to the situation of DSM. These techniques will be important for the establishment of environmental performance thresholds (OECD, 2020). “Available techniques” means those developed on a scale that allow implementation in the relevant industrial sector under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator (Federal Republic of Germany, 2019). NORI suggested the inclusion of the wording “with reasonable technical and economic constraints” and stated that it is important that those two terms are defined in such a way as to make the requirement commercially viable and based on reasonable economic and practical constraints, given that regulation 44 (b) creates a legal obligation on the Contractor to ensure the application of BAT and BEP (NORI, 2019). Indeed, considering that the technical and economic feasibility in determining the BAT is typical for international legal instruments. As discussed in Section 3.1, it should be reiterated that “best” is not necessary to direct Contractors to the “top” or “latest” ones. Instead, it means the most effective in achieving a high general level of protection of the environment as a whole (Federal Republic of Germany, 2019).

To provide minimum standards of conduct, considering DSM’s dynamic and high-tech nature, the adoption of a forward-looking approach with built-in flexibility is recommended, which can be understood from two perspectives. First, they should not necessarily prescribe specific techniques or measures to be deployed but provide the development of suitable criteria to assist the Contractor in making a selection for an individual case (International Seabed Authority, 2017c). It is the Contractor’s discretion to choose specific techniques or measures under economically and technically viable conditions, taking into consideration the costs and advantages. It should be noted that Contractor’s discretion is not absolute but on the premise of fulfilling the minimum requirements of “most effective” technologies or measures. There is a hierarchy, which means that effectiveness takes the priority and then technologies or measures of economic interest can be selected. Second, they should be sufficiently flexible to be adaptive and responsive to new technology, information, and knowledge. It needs to be reviewed annually. Moreover, the Guidelines should explicitly present that additional measures must be applied if BAT or BEP do not lead to environmentally acceptable results.

Regarding guidance for Contractors to select specific techniques or measure, existing ones should be considered. Quite a lot of codes or guidelines occurring through the industry, classification societies, and regional or national bodies are purportedly aimed at guiding Contractors. Pew has concluded existing guidelines that may serve as reference materials for ISA Standards and Guidelines (Pew Charitable Trusts, 2019b), including the International Finance Corporation (IFC) Performance Standards (IFC, 2012),¹⁸ the family of International Organization for Standardization (ISO) standards (Seta, 2019), and the International Marine Mineral Society.¹⁹ To be specific, in respect of environmental principles and objectives and Environmental Impact Assessment (EIA), ISA can refer to IFC Performance Standards on Environmental and Social Sustainability and IMMS Code for Environmental Management of Marine Mining (IMMS, 2011). Performance Standard 1 of IFC 2016—Assessment and Management

of Environmental and Social Risks and Impacts—underscores the importance of managing environmental and social performance throughout the life of a project. One of its objectives is to identify and evaluate environmental and social risks and impacts of the project, which is perfectly matched with the EIA standards and guidelines of ISA. In addition, one of the IMMS Code functions is to provide environmental principles and guidelines where these are absent or could be improved upon, within the scope of the principles. ISA could draw on the principles outlined in the IMMS Code, consistent and in accordance with Part XI of the UNCLOS and 1994 Agreement. As for the Development of Environmental Management and Monitoring Plan, ISA could take references to IFC 2016. On the Development of Environmental Management System and Environmental Risk Assessment, ISA can refer to ISO standards, respectively, ISO14001:2015: Environmental Management Systems and ISO 31000:2018: Risk Assessment. ISA could use ISO standards as references, which are internationally agreed by experts and existing and potentially transferable. Currently, the ISA does not clearly outline the practices that Contractors are required to adopt and implement, which inevitably causes ambiguities (Gerber and Grogan, 2020). Considering the obligatory nature of the BAT and BEP, it is beneficial for the ISA to adopt a restricted approach, which means that the ISA formally adopts, endorses, or issues the required guidelines and standards for BAT and BEP and explicitly requires Contractors to adhere to those guidelines (Gerber and Grogan, 2020).

Moreover, the ISA could collaborate with other international organization to foster standards and guidelines. For instance, ISO/TC 8/SC 13 (Marine technology) is the sub-committee of Technical Committee 8 (Ships and marine technology), whose responsibility is to standardize test methods, operation, design, construction, and logistics of equipment, systems, infrastructure, and technology used for observation, exploitation, and protection of the ocean and sea areas.²⁰ The Chair of the ISO/TC8/SC13 expressed that this committee is willing to provide technical assistance in the development of international standards relating to marine technology for exploitation and exploration of the deep seabed resources (Li, 2019).

4 Conclusion

In order to reduce the impacts on the marine environment and ensure the effective regulation of DSM activities, it is essential that

18 The IFC Performance Standards form an integrated part of the IFC Sustainability Framework. The former comprises eight standards that parties responsible for implementing and operating a project financed by the IFC need to meet throughout the life of the particular investment.

19 It should be borne in mind that following and adhering to the principles and guidelines contained in the Code are voluntary in nature. The aim of the IMMS Code is to complement applicable binding national and international regulations for the protection of the marine environment with regard to marine mining where these regulations exist and to provide environmental principles and guidelines for marine mining companies where these are absent or could be improved upon.

fundamental concepts, such as BAT and BEP, are formalized and adopted together with the regulations. To this end, the paper explores possible means for the ISA to enable the Contractor to operationalize the BAT and BEP, including defining the terms, determining their placements in the exploitation regulations, and proposing possible approaches to the provision of operational details in the Standards and Guidelines. They are critical for the Contractors to operationalize the BAT and BEP effectively. It is worth noting that the paper concentrates on terms BAT and BEP *per se* and excludes certain relevant discussions, since they are beyond the scope of this paper. For instance, this paper does not seek to engage with terms like BASE and GIP. It also does not discuss the link between BEP and the ecosystem approach or ecosystem-based management (EBM), i.e., there is an increasing recognition of EBM as a concept related to BEP (Guilhon et al., 2021; Christiansen et al., 2022). Nevertheless, this does not mean that the aforementioned issues are not important; on the contrary, they need more discussion.

Conceptualizing these operational practices for the purpose of regulating a frontier industry that has not yet begun is a challenging endeavor, particularly in the operationalization of BAT and BEP. This paper strives to contribute to the ongoing discussions with the expectation that BAT and BEP can be more firmly grounded in the regulatory process through the Mining Code. Efforts should be taken by the ISA to actually encourage Contractors to meet requirements of BAT and BEP. In addition, it requires the joint efforts of other DSM participants, including Contractors and sponsoring States. Cooperation between the ISA and other international organizations and industrial groups is also required to achieve synergies in environmental protection.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Author contributions

XX drafted the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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