Colorado Journal of International Environmental Law and Policy

Winter, 2005

16 COLO. J. INT'L ENVTL. L. & POL'Y 27

LENGTH: 23547 words

ARTICLE: The Contemporary Seabed Mining Regime: A Critical Analysis of the Mining Regulations Promulgated by the International Seabed Authority

NAME: Jason C. Nelson*

BIO: * **Jason C. Nelson** obtained his J.D., cum laude, at the University of Michigan Law School in December of 2004. He has previously earned an A.M. in Business Research (Organizational Behavior) from Stanford University, an A.M. in Sociology from Stanford University, an M.B.A. from Tulane University, and a B.S. in Finance, summa cum laude, from the University of Houston Clear Lake. Mr. Nelson also has professional experience in banking and finance, having worked with First Union Securities, Enron Energy Services, J.P. Morgan Chase & Co., and P.T. Freeport Indonesia.

SUMMARY:

... In 1982, the United Nations (UN) responded to the call for an ocean governance regime when it enacted the United Nations Convention on the Law of the Sea (UNCLOS), a treaty that represents a comprehensive global approach to managing ocean problems and resource rights in a "constitution for the oceans. ... Does the phrase "substantial evidence" equate to evidence of danger from prospecting activity that could cause serious harm to the marine environment - even if that harm would only occur in the case of an accident? Or, is the prohibition applicable to harm that occurs during the normal course of prospecting without incident? Are these subjective determinations reached by the ISA, the prospector, or some other independent body, or are there more precise objective measurements that prospectors should follow? If so, who determines these objective standards and where are they to be found? One might retort that the ISA intended the regulation to be read as a stringent form of the precautionary principle: seabed prospecting cannot be undertaken unless it is proven that the activity would not cause any harmful effects on the environment. ... Moreover, drafting crust and sulphide seabed mining regulations anew for prospecting and exploration would be substantially inefficient, and could also result in the ISA missing opportunities for improving regulations on all seabed mineral mining through information sharing, as the development and fine-tuning of the regulations for each mineral serves to inform the regulations of the others. ...

HIGHLIGHT: On 10 December 1982 we created a new record in legal history ... [but] the question is whether we achieved our fundamental objective of producing a comprehensive constitution for the oceans which will stand the test of time. My answer is in the affirmative ... .

Tommy T.B. Koh, President of the Third United Nations Conference on the Law of the Sea. [n1]

I. Introduction

The oceans were long subject to the freedom of the high seas doctrine, which is a seventeenth century principle that a nation's sovereign rights extend only to a narrow belt surrounding a nation's **[*28]** coastline. [n2] The remainder of the seas beyond this narrow belt was proclaimed to be free, belonging to no party. [n3] Although this view survived into the twentieth century, the increasing presence of maritime powers on the high seas, depletion of fish stocks, and the ever growing menace of pollution threatened to transform the oceans into an area of instability, conflict, and environmental degradation. [n4] When one considers that the oceans cover nearly three-quarters of the earth's surface, comprise nine-tenths of its water resources, and are home to ninety-seven percent of all life forms, there is no question that this state of affairs was unacceptable. The global community had to answer the call for action and create a regime for ocean governance. [n5]

In 1982, the United Nations (UN) responded to the call for an ocean governance regime when it enacted the United Nations Convention on the Law of the Sea (UNCLOS), a treaty that represents a comprehensive global approach to managing ocean problems and resource rights in a "constitution for the oceans." [n6] UNCLOS is based upon the cardinal notion that ocean problems are closely interrelated and must be addressed with a panoptic view. [n7] The scope of UNCLOS is vast, covering many topics such as navigation and overflight, living and non-living resource-use, marine environmental protection, and general concepts of law and order. [n8] Arguably, this perspective is the key to the success of UNCLOS - states approached and negotiated the treaty as a whole, rather than employing a piecemeal treaty-making process. [n9] The **[*29]** end product is an all-inclusive and exceedingly successful agreement that virtually all countries adhere to in practice, even those nations that are not yet parties. [n10] Of course, the success of UNCLOS does not imply that the road to an agreement was easy. [n11] In fact, UNCLOS consumed a substantial period of recent history prior to its conclusion, extending over two decades and three global conferences. [n12]

The purpose of this article is to offer an explication and critical assessment of the contemporary seabed mining code, which serves to meet seabed mining governance requirements under UNCLOS. [n13] Although the seabed mining code might appear to be a nondescript topic for scholarly inquiry, the importance of seabed mining regulations cannot be underestimated - regulations are critical to effectively manage marine mineral extraction, as well as to protect and preserve the oceanic environment. In order to properly grasp the significance of the seabed mining code and its role under UNCLOS, a historical review of the treaty-making process will behoove the uninformed scholar as well as those of us who cannot recount the treaty's history. Therefore, this article will present a concise history of UNCLOS and emphasize the seabed mining aspects of the treaty before introducing the role, structure, and functioning of the International Seabed Authority (ISA) [n14] - also referred to as the "Authority" [n15] - which is the organization established by UNCLOS to organize and control seabed mining activities in the "Area," a term UNCLOS defines as "the seabed and ocean floor and subsoil **[*30]** thereof, beyond the limits of national jurisdiction." [n16] Following this introduction, the paper will investigate the current and planned regulations for prospecting, exploring, and exploiting seabed minerals in order to show that these rules fail to effectively govern seabed mining and its accompanying environmental risks. [n17] The investigation involves two parts: first, the paper will critically analyze the rules and regulations for the prospecting and exploration of polymetallic nodules in the Area, specifically noting their inability to produce compliance; and second, the paper will consider whether planned mining regulations for the prospecting and exploration of cobalt-rich crusts and polymetallic sulphides in the Area should be enacted given the juvenile state of scientific knowledge about surrounding biological communities, and if so, whether these codes should parallel or be distinct from the mining code enacted for polymetallic sulphides, especially considering the harvesting technologies required to mine these minerals. [n18] Finally, the paper will conclude by presenting a summary of findings, specifically highlighting conclusions relating to the current polymetallic manganese nodule mining regulations, the prospective mining guidelines for cobalt-rich crusts and polymetallic sulphides, and the environmental impacts of seabed mineral exploitation.

II. The Path to UNCLOS

Near the turn of the century, nations developed an increasing awareness that the ocean contained vast mineral

resources. For example, in 1873, the ship H.M.S. Challenger, while on an oceanographic expedition, recorded that polymetallic nodules comprised of manganese, copper, nickel, and cobalt littered the ocean floor. [n19] Nevertheless, the **[*31]** belief that these minerals could be retrieved economically lay dormant until after the Second World War, when scientific discovery and technology entered a phase of rapid advancement. [n20] As technological innovation hinted that seabed mining could soon be economically viable, an increasing global population threatened fish stocks, industry and non-industry sources progressively fouled the oceans, and states began to quarrel over marine resource ownership. [n21] In short, concerted global action was required to quell these and other ocean-related difficulties.

The UN responded and convened the first of three conferences on the Law of the Sea in Geneva in 1958. [n22] This conference, CLOS I, was attended by eighty-six states, and produced four conventions: the Convention on the Territorial Sea and the Contiguous Zone; the Convention on the High Seas; the Convention on the Continental Shelf; and the Convention on Fishing and Conservation of Living Resources of the High Seas. [n23] However, CLOS I did not come to an agreement on the breadth of the territorial sea. [n24] In 1960, a second conference, CLOS II, convened to address territorial sea and fishery limits, but failed to reach an agreement on either matter. [n25] In fact, agreement on the breadth of the territorial sea would not be resolved until a third and final conference, CLOS III, drafted UNCLOS, more than fifty years after the issue first surfaced at CLOS I. [n26]

Neither CLOS I nor CLOS II addressed the question of establishing a legal regime for the seabed primarily because the technology necessary for seabed exploitation did not exist, and because nations did not yet appreciate the great wealth on the ocean floor. [n27] This state of affairs changed in November 1967 when the Maltese Ambassador, Avid Pardo, gave a speech before the UN General Assembly (UNGA). [n28] Pardo not only alerted the delegations to the potential wealth that lay on the ocean's floor, but he explained that technologically-developed nations might gain **[*32]** access to this bounty before less-developed nations had an equal opportunity to access them. [n29] He encouraged the UNGA to declare the deep seabed and ocean floor beyond the limits of national jurisdiction as the "Common Heritage of Mankind" (CHM). [n30] This proposal aimed to secure a demilitarization of the seabed, as well as to prevent a "land grab" for seabed resources. [n31] Fortunately, Pardo's call to action occurred at an opportune time - during the next five years the international community took a number of actions towards creating an environment conducive to establishing a comprehensive treaty. [n32] The end result was CLOS III, a third conference that began in 1973.

CLOS III commenced with delegates announcing that they would approach the negotiation for a new ocean treaty as a "package deal," which meant that each nation must accept the treaty as a whole, without reservations on any aspect. [n33] During the next nine years, more than 160 sovereign state representatives traveled between Geneva and New York, discussing issues, bargaining, and trading national rights and obligations in marathon negotiating sessions. [n34] This process culminated in the final treaty text of 1982, UNCLOS, which regulated all aspects of ocean uses and resources, including navigational rights, territorial sea limits, economic jurisdiction, seabed resources beyond national jurisdiction, passage of ships, living marine resource conservation and management, marine environment protection, and dispute settlement. [n35] Nonetheless, because UNCLOS required that sixty states ratify or accede to it, the treaty would not take effect for another twelve years. The United States (U.S.) and other industrialized countries disagreed with the treaty provisions on seabed mining governance contained within Part XI of UNCLOS. [n36] Stated succinctly, the UNCLOS seabed mining regime **[*33]** failed to provide developed states with a voice commensurate with their economic interests. [n37] Thus, several more years of negotiations ensued before the states concluded a subsequent agreement in 1994 entitled, "Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982" (1994 Agreement). [n38] When UNCLOS and the 1994 Agreement are conjoined, the seabed mining regime successfully balances the diverse interests at stake in the international community, "including those of industry, the environment, consumer states, land-based producer states, developed states and developing states." [n39] Although many states had not ratified UNCLOS, they did ratify the 1994 Agreement, and in the process, became parties to UNCLOS. [n40] As a result, UNCLOS became effective in 1994 upon the adherence of Guyana, the sixtieth state. [n41] Presently, 157 state parties have signed UNCLOS, and 145 of these nations have taken formal action to ratify the agreement. [n42] The U.S. is a signatory to the **[*34]** 1994 Agreement, but has yet to ratify it. However, a senior Bush administration official is currently urging the Senate to ratify the 1994 Agreement and accede to UNCLOS

because it provides stable and predictable rules for ocean uses. [n43]

A. The International Seabed Authority

UNCLOS Part XI - as modified by the 1994 Agreement - spells out the structure and functioning of the International Seabed Authority (ISA). [n44] There are three principal organs of the ISA: the Assembly; the Council; and the Secretariat. [n45] The Assembly is the supreme body of the ISA, consists of every ISA member, and is responsible for establishing the general policies and regularly reviewing the work of the ISA. [n46] The **[*35]** Council is the executive body of the ISA that establishes more specific policies, and approves or denies applications for mining exploration and exploitation. [n47] The Council also oversees the implementation of the UNCLOS provisions and those of the 1994 Agreement, as well as the rules and regulations promulgated by the ISA. [n48] The Council's thirty-six members are elected to four-year terms and each member represents specified geographic blocs and groups with economic interests impacted by seabed mining. [n49] The Secretariat is composed of staff members that oversee ISA's day-to-day activities, including information-gathering, monitoring, research, and contract maintenance with external governmental and non-governmental organizations. [n50]

Ostensibly, the structure of the ISA resembles many other intergovernmental organizations, but there is one significant distinction - the ISA is empowered to exploit minerals from the seabed through another principal organ, the Enterprise. [n51] Because the 1994 Agreement streamlined the organs of the ISA from an efficiency perspective, the Enterprise is not yet operational, and it will become a functioning body only if commercial seabed mining commences. [n52] Yet, economy and efficiency in all operations of the ISA remain a key **[*36]** contribution of the 1994 Agreement, [n53] and these are represented by the "evolutionary approach:"

> The setting up and functioning of the organs and subsidiary bodies of the Authority shall be based on an evolutionary approach, taking into account the functional needs of the organs and subsidiary bodies concerned in order that they may discharge effectively their respective responsibilities at various stages of the development of activities in the Area. [n54]

Hence, efficiency dictates that the role of the Enterprise is presently undertaken by the Secretariat. [n55] Similarly, the Council has two subsidiary bodies, the Economic Planning Commission (EPC) and the Legal and Technical Commission (LTC), [n56] but the work of the EPC is presently managed by the LTC. [n57] The LTC is an important body in the ISA, with broad responsibilities that include: supervision of activities in the Area upon Council's request; [n58] promulgation of recommendations to the Council on matters such as seabed mining applications [n59] and environmental protection, [n60] including emergency orders to suspend or adjoin mining operations; [n61] instituting cases before the Seabed Disputes Chamber [n62] and creating measures to enforce Chamber decisions; [n63] and **[*37]** drafting and revising the rules and regulations of the ISA. [n64] Aside from the LTC, the 1994 Agreement established another Council subsidiary body, the Finance Committee, to manage budgetary and related matters. [n65] Notably, UNCLOS empowers the Council to establish whatever additional subsidiary organs that it deems necessary to exercise its functions, giving "due regard to economy and efficiency." [n66]

What might be deemed the "contemporary seabed regime" became operational in 2001 when the ISA executed contracts with the initial group of organizations and governments that applied for authorization to explore the Area for polymetallic nodules. [n67] The ISA awarded these initial contracts to the "pioneer investors," which UNCLOS identified as already having made substantial investments in deep seabed mining ventures. [n68] Seven entities now have fifteen-year contracts with the ISA, including: China Ocean Mineral Development Association (COMDA); Deep Ocean Resources Development Company of Japan (DORD); Government of India; Government of the Republic of Korea; Institut francais de recherche pour l' exploitation de la mer/Association francaise pour l'etude et la recherche des nodules (IFREMER/AFERNOD), of France; Interoceanmetal Joint Organization (IOM), a consortium formed by Bulgaria, Cuba, Czech Republic, Poland, Russia Federation, and Slovakia; and Yuzhmorgeologiya, a state enterprise of the Russian Federation. [n69] The international community reached a notable milestone when the ISA executed these

exploration contracts, because UNCLOS and the 1994 Agreement now have the pragmatic effect of bringing the Area under a single governance regime. [n70]

[*38]

III. Regulations for Prospecting and Exploration of Polymetallic Nodules

The ISA adopted its first legislation in 2000, entitled "Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area" (Regulations), which made executing the initial exploration contracts possible. [n71] The Regulations focus exclusively on prospecting and exploration for nodules; therefore, commercial nodule mining, such as exploitation, is not addressed. [n72] Prospecting is defined in the Regulations as "the search for polymetallic nodules in the Area, including estimation of the composition, sizes, and distributions of polymetallic nodule deposits and their economic values, without any exclusive rights." [n73] In contrast, exploration is defined as "the recovery for commercial purposes of polymetallic nodules in the Area with exclusive rights, the analysis of such deposits, the testing of collecting systems and equipment...and the carrying out of studies...and other appropriate factors that must be taken into account in exploitation." [n74] Both of these activities concentrate on the search for nodules, with the primary definitional deviation being the absence of exclusive rights for acquisition in the case of prospecting. [n75] The actual mining of seabed minerals is described by exploitation, which is defined as "the recovery for commercial purposes of polymetallic nodules in the Area and the extraction of minerals therefrom, including the construction and operation of mining, processing and transportation systems, for the production and marketing of metals." [n76] Because seabed mining is not yet a commercial reality, the lack of an exploitation code in the initial Regulations is not unexpected.

The LTC commenced work on the draft of the Regulations in 1997, but it did not formulate policy from ground zero. [n77] Instead, the LTC was able to build upon a significant amount of regulatory work that had been completed by the UNCLOS Preparatory Commission between 1984 and **[*39]** 1993. [n78] Despite having access to this valuable resource, the Regulations fall short in a number of respects and therefore require substantial improvement. Hence, this section of the paper will analyze the shortcomings in the Regulations, as well as suggest modifications to improve them. However, before proceeding with this analysis, the section will present a concise overview of polymetallic nodules, including the process for mining these minerals.

A. Background and Mining Techniques for Polymetallic Nodules

Polymetallic nodules (nodules) - also called manganese nodules - were discovered in 1868 in the Kara Sea, which is in the Arctic Ocean off the coast of Siberia. [n79] Later expeditions confirmed that nodules exist in most oceans throughout the world [n80] and are even found in lakes. [n81] Nodules are generally between five and ten centimeters in diameter, similar in size to golf and tennis balls, [n82] and are comprised of nickel, cobalt, iron, and manganese in varying concentrations. [n83] Geologically, nodules are rock concretions formed of concentric layers of iron and manganese hydroxides that surround a core, [n84] and their formation is exceedingly slow - roughly a centimeter of growth over one million years. Consensus is lacking on the process behind their formation. [n85] These minerals are found at various ocean depths, but the highest **[*40]** concentrations occur between 4,000 and 6,000 meters. [n86] Nodules generally lie half-buried in seabed sediment, but are completely buried in some areas. [n87] The most promising areas for manganese nodule deposits are the Clarion-Clipperton Fracture Zone (CCFZ) of the eastern equatorial Pacific Ocean, which lies between Central America and Hawaii, and a similar region located in the Indian Ocean. [n88] The CCFZ is "literally paved with nodules over an area of 1.35 million square miles." [n89] In some places, nodules cover more than seventy percent of the seabed floor. [n90]

Mining for polymetallic nodules is an enormous challenge that has been compared to standing on top of a skyscraper on a windy day and trying to suck marbles off the street with a vacuum cleaner hose. [n91] Although a whimsical analogy, in reality, the scenario is accurate. In many ways, the riches of the ocean might as well be on the moon because there are so many obstacles to retrieving them. [n92] Deep-sea mining vessels will be forced to ride out stormy seas thousands of kilometers from land, while attempting to maintain a sedentary position above roving mining

vehicles tethered beneath them, thousands of meters below in aphotic depths, "where half a tonne of water sits atop every square centimetre." [n93] These ships are expected to remain stationary for five-year periods, working around the clock, and transferring harvested minerals to auxiliary vessels. [n94] Despite such impediments, miners have persevered, developing a broad range of useful techniques and equipment to investigate the deep seabed and its surrounding environment. [n95]

[*41]

B. Prospecting

The Regulations on prospecting are a laudable attempt to manage the beginning phase of the mining cycle. Nonetheless, there are serious problems with the Regulations in their current format. An analysis of the prospecting guidelines as a whole is beyond the scope of this analysis, though it would be a worthy exercise. Here, there are two pressing matters on prospecting that will be addressed. First, the ISA must ensure that miners will comply with the Regulations. More particularly, the ISA should determine what incentives the Regulations provide to induce miner compliance, or alternatively, if there are sanctions that would accomplish the same. Second, the ISA must evaluate whether the Regulations properly measure the ramifications of prospecting on the marine environment. Such an evaluation involves considering what mechanisms are built into the Regulations to measure environmental impact and whether an independent organ should oversee the environmental impact measurement process.

As policy makers are aware, a determinative factor in the success of any rule or regulation is its ability to induce compliance. [n96] This point seems problematic for the Regulations because a miner that undertakes prospecting is burdened with numerous costs, but does not receive much in the way of benefits. This claim is best illustrated by considering several of the prospecting regulations. [n97] To begin, Regulation 2, Section 2 requires that miners should not prospect "if substantial evidence indicates the risk of serious harm to the marine environment." [n98] Although an apparently sensible restriction, this rule becomes progressively disconcerting as the prospector attempts to decipher what is meant by "substantial evidence" and "serious harm," especially given the nascent stage of seabed mining. There is presently no guidance in the Regulations to aid in deciphering this text. Moreover, a miner's duty to safeguard the environment does not end once prospecting commences. Rather, the prospector is under a continuing duty to notify the Secretary-General in writing if any incident arises that causes serious harm to the environment. [n99] The Secretary-General can choose to respond by issuing **[*42]** an emergency order to address the exigency pursuant to Regulation 32. [n100]

Assuming these rules on environmental protection do not discourage the prospector from moving forward, Regulation 3, Section 1 states: "A proposed prospector shall notify the Authority of its intention to engage in prospecting." [n101] Regulation 3 continues by explicating the format and requirements for this notification. [n102] According to Regulation 4, Section 1, the Secretary-General is required to notify the prospector in writing when the notification is received. [n103] Furthermore, Regulation 4, Section 3 states that the Secretary-General will notify the prospector within forty-five days if the area in which the prospector chooses to work is disapproved and the reasons for such disapproval. The prospector is subsequently permitted to submit an amended notification within ninety days. [n104] Under Regulation 4, Section 4, the prospector has the continuing obligation to inform the Secretary-General in writing of any change in information contained in the original notification. [n105] Also, pursuant to Regulation 5, Section 1, the prospector is required to submit an annual report to the ISA on the status of the prospecting activity within ninety days after the end of the calendar year. [n106] Although Regulation 6 requires the Secretary-General to maintain the confidentiality of the data submitted by prospectors under Regulation 5, [n107] excluding the case where a prospector grants permission to the Secretary-General to release prospecting information, [n108] Regulation 4, Section 5 requires that the Secretary-General "from time to time, inform all members of the Authority of the identity of prospectors and the general areas in which prospecting is being conducted." [n109]

[*43] Given the array of regulatory compliance measures required to undertake prospecting, the question remains what the prospector receives for complying with the Regulations. In short, the prospector receives the right to prospect

in the Area, and little else. [n110] Regulation 2, Section 4 is patently clear in confirming this conclusion: "Prospecting shall not confer on the prospector any rights with respect to resources." [n111] Hence, a crude cost-benefit analysis leads to one possible outcome - the cost of strict compliance with the Regulations is probably too high. This assertion does not connote bad faith on the part of the international mining community; the author is unaware of any evidence that prospectors are intentionally evading the Regulations. Instead, the argument illustrates that the Regulations are poorly crafted and create scant incentives for compliance because there is no discernible benefit for prospectors to meet the Regulations' standards.

This allegation is not without evidence, as the ISA recently noted that many of the seabed areas targeted by scientific researchers and bioprospectors are also of interest to seabed miners, [n112] and as a practical matter, "it is hard, if not impossible, to distinguish between scientific exploration and commercial research." [n113] Differentiating between these activities is crucial because the ISA does not regulate marine scientific research, which is subject to freedom of the high seas doctrine under UNCLOS, Article 87. [n114] Therefore, given the inherent problems in discerning among a variety of seabed activities, it is imperative that the Regulations create the proper compliance incentives in order to fulfill the **[*44]** objectives of the overall seabed mining regulatory scheme, especially regarding the objective of environmental protection.

1. Amendments to Improve the Regulations on Prospecting

There are several steps that the ISA can implement in order to improve the Regulations. First, the ISA must clarify the Regulations' prohibition on prospecting in Regulation 2, Section 2, which states: "prospecting shall not be undertaken if substantial evidence indicates the risk of serious harm to the marine environment." [n115] This rule is ambiguous and offers little guidance for the would-be prospector, especially given the scientific community's dearth of knowledge regarding the deep seabed environment. Moreover, in reading the text of the proscription, one immediately ponders what is meant by the words "substantial evidence" and "serious harm." Does the phrase "substantial evidence" equate to evidence of danger from prospecting activity that could cause serious harm to the marine environment - even if that harm would only occur in the case of an accident? Or, is the prohibition applicable to harm that occurs during the normal course of prospecting without incident? Are these subjective determinations reached by the ISA, the prospector, or some other independent body, or are there more precise objective measurements that prospectors should follow? If so, who determines these objective standards and where are they to be found? One might retort that the ISA intended the regulation to be read as a stringent form of the precautionary principle: seabed prospecting cannot be undertaken unless it is proven that the activity would not cause any harmful effects on the environment. [n116] Yet, the rule is neither drafted in a manner that supports this interpretation, nor do the Regulations provide an explicit standard on the burden of proof that a miner should meet if this interpretation was intended. Moreover, this rendering is not supported by Regulation 31, Section 2, which textually adopts the version of the precautionary approach reflected in Principle 15 of the Rio Declaration on Environment and Development (Rio Declaration) to the protection and preservation of the marine environment. [n117] This rendition **[*45]** of the precautionary approach mandates that prospectors adopt cost-effective measures to prevent environmental harm, but the definition offers little help in deciphering Regulation 2, Section 2. Thus, the prospector remains in an equivocal state.

If these points regarding Regulation 2, Section 2 appear to be "nitpicky" details in a regulation that was probably intended only to convey guidance at a broad level, then one should consider the amount of effort that the drafting committee expended in comprising other areas of the Regulations. For instance, Annex 4 copiously describes the standard clauses for the exploration contract in fourteen pages of text. [n118] Does expending time on this section of the Regulations, at the expense of developing environmental guidelines for prospecting, seem like a reasonable endeavor? Probably not, but this outcome is logical when one considers that the ISA is probably just as eager as the miners for commercial exploitation of seabed minerals. Notwithstanding, prospecting is an activity that is potentially more widespread, and there must be some formal guidance promulgated by the ISA in order to protect and preserve the marine environment. Yet drafting prohibitory guidelines based upon the scientific community's currently limited understanding of the deep sea marine environment seems ill-advised; the resulting regulatory framework will require

ongoing amendments as new scientific knowledge is garnered, and these amendments may create substantial miner confusion. Instead, perhaps, clarification on this regulation can be garnered from the work of the International Law Commission (ILC).

a. Deriving Risk Management Guidelines from the International Law Commission

The 2001 report from the International Law Commission (ILC) entitled, "Draft Articles on Prevention of Transboundary Harm from Hazardous Activities" (ILC Report) [n119] offers substantive guidance for the ISA in revising the Regulations. The project undertaken by the ILC **[*46]** focuses on managing "activities not prohibited by international law which involve a risk of causing significant transboundary harm through their physical consequences." [n120] Notably, though the prevention of transboundary harm is closely related to the assignment of international liability when harm does occur, the ILC decided to address the prevention of transboundary harm and international liability as separate issues. [n121] For the present purpose of exploring improvements to Regulation 2, Section 2 (such as the regulation on undertaking prospecting activities when there is evidence of harm), the work of the ILC on the prevention of transboundary harm is germane. The ILC Report discusses transboundary harm with a panoptic view in its nineteen articles, but three areas that provide helpful guidance in revising the regulations include a definition of "risk of causing significant transboundary harm," a requirement that an assessment of risk occur for activities that pose transboundary harm, and a mandate for interstate consultations on measures to prevent significant transboundary harm. [n122] Each of these areas and its potential application to the Regulations is discussed below.

To begin, though many of the sections in the ILC Report could assist in reformulating a guideline on when prospecting should and should not be undertaken, one important topic is explicated in Article 2 "Use of Terms." Article 2 explains that the phrase, "risk of causing significant transboundary harm," includes "risks taking the form of a high probability of causing significant transboundary harm and a low probability of causing disastrous transboundary harm." [n123] Although this definition may not appear more unequivocal than the current rule on prospecting in the Regulations, a dichotomy between "disastrous harm" and "other significant harm" founded upon probability creates an initial threshold by which a party can determine whether or not to move forward with an activity. By analogy, incorporating such language into the prospecting guidelines might result in a revised Regulation 2, Section 2 such as: "Prospecting shall be undertaken only if substantial evidence indicates that there is a low probability of causing disastrous harm to the marine environment."

[*47] This reformulation automatically proscribes any activity that could realistically occur and devastate the marine environment, while leaving open the possibility of undertaking other activities that could pose significant harm to the marine environment, provided such activities are subject to additional guidelines on risk management. [n124] For instance, Article 3 of the ILC Report holds that "the state of origin shall take all appropriate measures to prevent significant transboundary harm or at any event to minimize the risk thereof." [n125] Also, Article 4 requires that "states concerned shall cooperate in good faith and, as necessary, seek the assistance of one or more competent international organizations in preventing significant transboundary harm or at any event in minimizing the risk thereof." [n126] At present, the language of the Regulations models the language in Article 4 of the ILC Report by requiring that the notifications from prospectors state that they shall comply with UNCLOS and ISA rules concerning protection and preservation of the marine environment. [n127] However, the ISA could add language similar to that in Article 5 of the ILC Report, encouraging prospectors to seek the assistance of international bodies with expertise in the marine environment, especially concerning harm to fauna, whenever there is any doubt as to the impact of a proposed prospecting activity. Moreover, the Regulations could move one step beyond prevention and empower the ISA to penalize the miners through a variety of methods, including monetary sanctions or prohibitions on future mining contracts, for harms that occur to the marine environment during prospecting when preventive measures could have forestalled environmental harm.

Second, the ILC Report holds that states should require authorization for certain activities undertaken in their territory. [n128] Similar language is presently incorporated into the Regulations by Regulation 3, which requires that prospectors notify the Authority. [n129] Notwithstanding, the ILC Report goes further and requires that any activity

undertaken that poses the risk of transboundary harm be based on an assessment of the possible risks of harm caused by that activity, which can include an environmental impact assessment. [n130] At present, there is no assessment **[*48]** of risk required in the Regulations for prospecting. Not only would a risk assessment requirement be useful to the ISA in collecting data on the marine environment, but it would also provide a benchmark from which the ISA could survey areas for environmental damage if heavy prospecting was thought to pose danger to fauna. Furthermore, the act of performing a formal risk assessment might also encourage miners to think more critically about the activities they are preparing to undertake. In addition, Article 13 of the ILC Report requires that states convey information on harmful activities and consequences to the public. [n131] By analogy, a risk assessment could provide a means for the ISA Secretary-General to communicate potential risks to the Assembly and Council in order to solicit their views regarding the utility of prospecting activities, especially regarding whether those activities should be undertaken.

Finally, the ILC Report addresses consultations aimed at preventive measures in Article 9. Under this article, the ILC requires states to enter consultations at the request of any state to cooperate in minimizing the risk of significant transboundary harm, and provides that states shall seek solutions based upon an "equitable balance of interests." [n132] Consultations would also be a helpful addition to the Regulations; the Authority could create amenable solutions in cases where prospecting poses risks to the environment, finding potential alternatives to an outright prohibition on the activity. Although consultations may be presently infrequent, such cases will become increasingly common as exploration and exploitation become a reality, and as more parties enter the seabed mining industry. Furthermore, the language in the ILC Report referring to "equitable interests" is covered in Article 10, which lists a variety of factors that should be accounted for in balancing state interests. [n133] Borrowing from **[*49]** the ILC Report, [n134] an amended regulation that considers the relevant factors and circumstances in balancing prospecting activities that pose a threat of environmental harm can include:

. The degree of risk of marine environmental harm and the means for preventing or minimizing the risk or repairing the harm;

. The importance of the prospecting activity, taking into account advantages of a social, economic, and technical character for the prospector, as well as humankind;

. The economic viability of future mining in relation to the costs of prevention of environmental harm from the prospecting activity, including the possibility of carrying out prospecting activity elsewhere;

. The degree to which the ISA is willing to contribute to the costs of the prevention as a result of potential future income sharing; and

. The standards of environmental protection that have been applied in similar prospecting undertakings.

Of course, this list of factors is far from exhaustive, but it provides a short overview of the types of criteria that might be important to consider when there is a consultation between the ISA and a prospector regarding potentially damaging environmental activity. By utilizing such factors in the consultative process between the ISA and the prospector, a consultation could produce creative solutions that allow activities that pose a threat of environmental harm to proceed, but which might otherwise be prohibited without a proper assessment and balancing of the interests of all affected parties.

b. Creating Incentives for Compliance

Aside from revising the Regulations to better incorporate environmental risk management principles, the question remains as to how the ISA can procure compliance with the prospecting guidelines. **[*50]** Without compliance, even the most skillfully crafted mining regulation fails to meet its purpose, and this failure becomes more and more

damaging as prospecting activity increases. For example, consider how widespread non-compliance with a regulation targeted at environmental protection could produce increasing ecological harm as more miners begin prospecting. Currently the prospecting regulations necessitate substantive effort from the miner but appear to offer little in the way of compliance incentives. For instance, prospectors are required to notify the ISA before commencing prospecting, [n135] as well as apprise the ISA of any changes in prospecting activity. [n136] Prospectors must also submit annual reports, [n137] and notify the ISA of any incidents that cause harm. [n138] In return for these efforts, the prospector receives no rights with respect to the resources located, [n139] and risks divulging its prospecting site when the Secretary-General notifies ISA members about who is prospecting in their general area. [n140] Moreover, assuming the ISA implements the proposed amendments to the Regulations, there will be additional requirements imposed on prospectors (although the miner will obtain some benefit in the form of increased certainty about prohibited mining activities, a risk management scheme, and a balancing of interests).

In short, the ISA has two likely options available to increase compliance with the Regulations: incentives (carrots) and sanctions (sticks). An optimal compliance scheme would implement amendments that address both components. For instance, simply adding sanctions to the Regulations might appear to be an effective way for the ISA to encourage contractors to comply with the present prospecting guidelines. However, the initial zeal that accompanied the seabed mining mineral bonanza has long since passed, and general interest in seabed mining has started to decline. In fact, the Secretary-General recently complained "that a large number of ISA members were in arrears in their assessed contributions, and it was difficult to secure a quorum at ISA meetings." [n141] So, instituting sanctions alone may not be the best option to induce compliance, as this move could backfire and deter prospecting. Instead, any newly instituted sanctions should be counterbalanced by incentives.

[*51] Therefore, the ISA should consider amending the Regulations to provide an incentive to miners in the form of a "right of first refusal" for those areas being prospected. Under a "right of first refusal," a miner prospecting in an area would have a limited amount of time to submit an application for exploration should another miner that is not prospecting in that area submit an application for exploration. Under such a scheme there would be less incentive for miners to withhold information from the ISA out of fear that other ISA members could discover the area that is being prospected, and more incentive to fulfill the information disclosure obligations under the Regulations in order to acquire a "right." Reporting information would provide those miners that follow the prospecting guidelines a priority claim over non-prospecting miners that submit exploration applications for a specified area. Hence, a modification to the Regulation 2, Section 4 might read as follows:

Prospecting shall not confer on the prospector any rights with respect to the resources. A prospector may, however, recover a reasonable quantity of minerals, being the quantity necessary for testing, and not for commercial use. In addition, should prospector B, who is not prospecting in the area being prospected by prospector A, submit an application for exploration for this area, prospector A shall have a ninety-day period in which to submit an application for exploration of the prospected area under the Regulations, and this application shall have priority consideration over the application submitted by prospector B, provided that prospector A is in compliance with the Convention and these Regulations (amended portion italicized).

Of course, a counterbalance to this incentive would be a set of sanctions for those miners that are not in compliance with UNCLOS and the Regulations.

Because there is no contract between the miner and the ISA during the prospecting period, a typical sanction such as a suspension of contract rights or contract termination is not possible. Thus, any deterrent effect could best be achieved through a joint system of fines and suspension of seabed mining rights. Fines should be stipulated to have immediate effect if it is discovered that a miner is prospecting in an area and has not notified the ISA pursuant to the Regulations. [n142] Moreover, **[*52]** the fines should be standardized and explicitly codified by the ISA in order to remove one potential appeal ground that a prospector could claim, thereby shortening the time from breach of the

Regulations to the payment of the fine. [n143] In addition, the ISA should have the authority to suspend seabed mining rights in cases where it determines that a violation of the Regulations is particularly egregious. For instance, consider a case where a miner has repeatedly violated the Regulations and failed to remit payment for fines. Such a scenario could merit a suspension of future exploration and exploitation rights for a given period of time. As a result, fines can be set at moderate levels to encourage a deterrent effect across a broad range of miner classes, rather than following a scheme where fines are set at extremely high levels. [n144] Accompanying the fine schedule with additional sanctions in cases where an entity chooses not to pay the fines or is willing to risk monetary sanctions adds a deterrent benefit without further discouraging miners from prospecting, which is arguably a serious risk given the current wane in global seabed mining interest.

In conclusion, the proposed amendments to the Regulations on prospecting provide miners with a more effective gauge for identifying prospecting activities that pose a threat to the environment, a formalized risk management scheme, and an improved balancing of interests in conflict management. Moreover, creating a right of first refusal for prospectors, while concurrently implementing a system of sanctions such as explicit fines and mining right suspensions, is a viable method to improve compliance with the Regulations. Arguably, compliance is already an essential matter for the ISA to address, but it will become an increasingly decisive issue if the ISA imposes additional requirements upon miners at the prospecting stage, such as the proposed risk assessment procedure. Nevertheless, these suggestions are neither a panacea nor an exhaustive list of potential remedies, but should instead serve to encourage maritime scholars to carefully consider the shortcomings in the current Regulations, and to begin offering improvements. Measured and deliberate thought must be expended on this topic because seabed mining has yet to become a reality, and the present time is opportune for fine-tuning and perfecting the mining code.

C. Exploration

The rules governing exploration are more comprehensive than those that govern prospecting. Nevertheless, many shortcomings in the present **[*53]** exploration regulations must be improved. Given the regulations that are forthcoming with respect to cobalt-rich crusts and polymetallic sulphides (two mining areas that involve delicately balanced ecosystems), it is particularly noteworthy that the current regulatory scheme addressing polymetallic nodules falls short in its endeavor to protect the environment. Hence, the purpose of this section will be to briefly introduce the rules on exploration, as well as what the guidelines are meant to achieve, and to explicate key shortcomings in the Regulations as they relate to environmental protection. Finally, a potential solution to the deficiency is promulgated through a comparative analysis with the U.S. Deep Seabed Hard Mineral Resources Act (DSHMRA). [n145]

"Exploration" is defined as the search for deposits of polymetallic nodules in the Area with exclusive rights accruing to the contractor, and includes a variety of activities such as deposit analysis, testing, and undertaking associated studies related to the environment and other relevant factors. [n146] The guidelines that govern exploration in the Regulations are broken down into several parts, and to comprehend these rules, one should review the pertinent sections in their entirety. Nonetheless, a brief breakdown of the exploration guidelines provides guidance. Part III covers the application and approval process for plans of work for exploration, and includes Annex 2 (application template for approval of a plan of work for exploration to obtain a contract); [n147] Part IV addresses contracts for exploration, and includes Annex 3 (Contract for Exploration template) and Annex 4 (definitions of standard clauses for the exploration contract); [n148] Part V deals with protection and preservation of the marine environment; [n149] Part VI addresses confidentiality; [n150] Part VII covers general procedures; [n151] Part VIII deals with the settlement of disputes; [n152] and Part IX covers resources other than polymetallic nodules. [n153] As should be apparent from this listing, the ISA put extensive thought into the exploration guidelines. The Regulations govern exploration in copious detail, especially concerning the provisions relating to the exploration contract, as is evidenced by the detailed annexes that provide a contract template as well as standard **[*54]** clauses for the contract. [n154] Yet, despite the deceptively comprehensive nature of the rules, the Regulations fail in their attempt to effectively preserve and protect the marine environment.

1. Amendments to Improve the Regulations on Exploration

Considering that the ISA has entered into seven exploration contracts to date, any environmental shortcomings in the Regulations that apply to the exploration phase should cause vexation in the international community. [n155] Though there are numerous environmentally related sections in the exploration guidelines that will likely be revised and improved as the exploration process continues its evolution, there are two salient areas in the Regulations that require analysis here as these sections are vitally important to the protection and preservation of the marine environment. First, the ISA must elucidate the parameters governing technology management for pollution control and other environmental hazards. In its present format, Regulation 31, Section 3 is equivocal and could subject each contractor to different measures of control. [n156] Second, Regulation 31, Section 4 requires that contractors establish environmental baselines, utilizing recommendations proffered by the LTC. [n157] Although the LTC has fulfilled its obligations in creating guidelines, the ISA has failed to consider whether contractors possess the level of sophistication necessary to undertake this role, and whether bias on the ISA's behalf impedes baseline accuracy as well as legitimacy in the eyes of the international community.

a. Deriving Technology Management Guidelines from DSHMRA

Regulation 31, Section 3 is seemingly ambiguous in providing guidance to contractors on managing pollution and other potential hazards that can impact the marine environment.

[*55]

Pursuant to Article 145 of the Convention and paragraph 2 of this regulation, each contractor shall take the necessary measures to prevent, reduce and control pollution and other hazards to the marine environment arising from its activities in the Area as far as reasonably possible using the best technology available to it. [n158]

Paragraph 2 of the regulatory language refers to Regulation 31, Section 2, which adopts Principle 15 of the Rio Declaration, holding that a lack of scientific certainty that activities cause environmental harm does not justify foregoing cost-effective measures to protect the environment. [n159] This principle is helpful in interpreting the meaning of Regulation 31, Section 3, and implies that the contractor shall not avoid measures of prevention, reduction, or control of pollution or other hazards because there is a question as to whether harm to the environment is certain. Even so, referring to a general principal accepted under the Rio Declaration does not elucidate why Regulation 31, Section 2 adds the additional language "as reasonably possible" with the "best technology available to it." [n160] This language might imply that what is "reasonably possible" will be a determination made on an individual contractor basis. If so, from a practical standpoint, because states such as the United States have access to better technology than lesser-developed countries, these states can be held to a higher standard. Moreover, the regulation's citation to Article 45 of UNCLOS provides minimal assistance as this article simply holds that the Authority shall adopt rules, regulations, and procedures to protect the environment. [n161]

[*56] One possibility for interpreting Regulation 31, Section 3 is to refer to UNCLOS because the language in this regulation is adopted from the convention. Specifically, Article 194 addresses measures to prevent, reduce, and control pollution of the marine environment. Article 194, Section 1 states:

States shall take, individually or jointly as appropriate, all measures consistent with this Convention that are necessary to prevent, reduce and control pollution of the marine environment from any source, using for this purpose the best practicable means at their disposal and in accordance with their capabilities, and they shall endeavour to harmonize their policies in this connection. [n162]

In reading this article, it is apparent that Regulation 31, Section 2 assumed similar language, making only minor changes. However, UNCLOS adopted broad and general language because it would be a superfluous exercise to attempt to explicate pollution control methods given the numerous bilateral and multilateral agreements on pollution that are

presently in place, [n163] as well as the evolving state of technology. Moreover, Article 209 in UNCLOS addresses pollution resulting from activities in the Area, and this article is important because it requires not only that international rules, regulations, and procedures be established **[*57]** to manage pollution under the authority of the ISA, but also that states adopt laws to control pollution by vessels or other devices flying their flag, under their registry, or otherwise operating under their authority. [n164] Nevertheless, explaining that Regulation 31, Section 3 originated by mimicking UNCLOS provisions is not a defense for its ambiguity. Here, the exploration regulation is specifically targeted at seabed mining, and there is a requisite amount of detail and specificity that is required to provide contractor guidance that the ISA has failed to systematize.

The ISA can seek guidance to improve the environmental guidelines in Regulation 31, Section 3 by engaging in a comparative study of mining regulations and pollution controls in other countries. [n165] For example, one set of mining rules that can serve as a useful reference is the DSHMRA in the United States. [n166] The DSHMRA was enacted in 1980 [n167] and established an interim domestic legal regime for deep seabed mining pending the United States' acceptance of UNCLOS. [n168] The Act **[*58]** established a licensing framework that ensures the protection of the marine environment, safety of life and property at sea, prevention of unreasonable interference with other high seas uses, and conservation of mineral resources. [n169] DSHMRA also encourages other nations that engage in deep seabed mining to manage the activities of their nationals in a similar manner. [n170] In sum, DSHMRA is a comprehensive domestic solution to deep seabed mining that facilitates an eventual transition to the UNCLOS regime. [n171] The Act reflects many of the principles embodied in UNCLOS, yet also contains provisions that the United States felt were lacking in UNCLOS prior to the conclusion of the 1994 Agreement.

DSHMRA is similar to the Regulations in many respects, especially regarding the issuance of a contract for exploration. For example, DSHMRA defines exploration similarly, [n172] and requires the Administrator - defined as the Administrator of the National Oceanic and Atmospheric Administration [n173] - take a lead role in assessing permits for exploration as they relate to environmental impacts. [n174] However, in contrast to the Regulations, DSHRMA is explicit in what it requires from any contractor that seeks a permit to engage in exploration activities. The Act states:

The Administrator shall require in all activities under new permits, and wherever practicable in activities under existing permits, the use of the best available technologies for the protection of safety, health, and the environment... except where the Administrator **[*59]** determines that the incremental benefits are clearly insufficient to justify the incremental costs of using such technologies. [n175]

Not only does DSHRMA make explicit the requirement that the "best" technology be employed to protect the environment, it also includes the application of such technology for the safety and health of all parties involved in deep seabed exploration activities. This notion would seem to parallel the ideology originating within the CHM concept; not only is UNCLOS meant to protect the ecosystem, but the people working at sea also deserve guardianship. Moreover, the DSHRMA technology requirement applies not only to newly issued contracts, but to the extent feasible, to contracts that are issued and in force. In addition to these benefits, the statute is crafted in a sophisticated manner that provides for economy and efficiency by incorporating language requiring the Administrator to engage in a cost-benefit analysis when assessing new technologies. Following this protocol, exploration contracts with long life expectancies do not continue to generate unnecessary harm to the environment if there are cost-beneficial technologies that develop during the contract's life. This point is a key consideration that should not be readily discounted.

Parallel language should be adopted in the exploration regulations that deal with the environment. Amended language will not only provide a clearer standard for prospective contractors, but will also require continual updating of technologies in extant contracts, which is important given the nascent stage of exploration. A draft of the amended Regulation 31, Section 3 might read as follows:

Pursuant to article 145 of the Convention and paragraph 2 of this regulation, each contractor shall take the necessary measures to prevent, reduce and control pollution and other hazards to the marine environment arising from its activities in the Area by utilizing the best available technologies for the protection of the environment, as well as the safety and health of humankind, except where the Authority determines that the incremental benefits are patently insufficient to justify the incremental costs of using such technologies. (amended portion italicized).

[*60] By adopting a reformulated regulation, the ISA would make patently clear that all contractors are required to employ the best available technologies unless the ISA determines through a cost-benefit analysis that the incremental cost of the technology is patently unjust. Furthermore, the language would establish an ongoing duty for contractors to remain up to date with current technologies and would not allow miners to employ dated measures for environmental protection when new technologies come to market. [n176] This language would also clarify that all prospective contractors are measured by identical pollution control standards because only the ISA can determine whether the best available technology is suboptimal because it is cost prohibitive. Nonetheless, deferring to the ISA leads to another shortcoming in the current set of environmental regulations - lack of specialized knowledge and independent verification in the environmental assessment process.

b. Creating Accuracy and Legitimacy in Environmental Baseline Establishment

In Regulation 31, Section 4, the ISA carefully articulated guidelines relating to the collection and establishment of environmental baseline data as well as to the ongoing monitoring of the baseline to assess the impact of exploration activities. [n177] The LTC followed up pursuant to Regulation 31, Section 4 and issued a set of recommendations for the guidance of contractors relating to the assessment of possible environmental impacts arising from polymetallic nodule exploration (the Environmental Guidelines). [n178] A key component of the Environmental Guidelines was the inclusion of detailed baseline data collection requirements, including information related to physical oceanography, chemical oceanography, sediment properties, and data on biological **[*61]** communities and marine mammals. [n179] Not only does collecting this information serve a useful purpose in assessing the environmental impact of exploration activities within the Area, but the collected data will also be compiled into the ISA's Central Data Repository (CDR). [n180] The CDR is a significant project that attempts to collect and centralize all public and private data on marine mineral resources in one location, and it will eventually be accessible to members of the ISA via the Internet. [n181] The ISA is to be commended for implementing this project in the beginning stages of seabed mining operations because over time the wealth of information that is collected will be of tremendous benefit to miners and scientists alike. Despite these achievements, the ISA has committed an error in neglecting to carefully examine whether contractors have the ability to collect the requisite data to establish baselines [n182] and to complete environmental impact assessments. [n183] Moreover, the ISA has also failed to recognize a serious conflict of interest given its role in approving contracts of exploration.

Pursuant to Regulation 31, Section 4, "each contract shall require the contractor to gather environmental baseline data and to establish environmental baselines, taking into account any recommendations issued by the Legal and Technical Commission ... ." [n184] Before considering the recommendations promulgated by the LTC, one can readily surmise that establishing baselines for the marine environment is a scientific exercise that requires sufficient skill and expertise, especially when one considers the dearth of knowledge about the seabed environment as it exists in a pristine state. [n185] For instance, a study of **[*62]** samples taken from ocean floor mud identified at least one new species in each square foot of mud. [n186] Given this amount of species diversity, one begins to understand why it is necessary to establish accurate and representative baselines. Furthermore, because harvesting manganese nodules is not likely to be a precision process, and will utilize mining techniques such as a "tractor-like" device scouring across the ocean floor collecting nodules, many animals will most certainly be destroyed if lying in the dredging paths. [n187] As one commentator noted, the question "is not whether seabed mining will kill sea creatures but how great the carnage will be." [n188]

These points are buttressed by the complex information the Environmental Guidelines require miners to collect

initially as well as during the exploration process. [n189] The end result is an unrequited **[*63]** query - do miners possess the requisite skills for these tasks? In all likelihood, some contractors will have access to skilled marine scientists, and other contractors will not be so privileged. Therefore, it would behoove contractors if the ISA established a group of accredited organizations, [n190] or at least specified a minimum educational threshold or certification for a scientific party, so that miners could contract with qualified parties to perform baseline analyses, [n191] ongoing environmental monitoring, [n192] and environmental impact assessments. [n193] Not only would **[*64]** this policy ensure the global community that the marine environment is being adequately monitored and protected, but the policy would also facilitate the requisite ongoing data collection for the ISA, [n194] improve data consistency and integrity for the CDR, [n195] and provide a convenient forum for scientific researchers involved in the environmental assessment process to cooperate, share knowledge, and propose new techniques and modifications to the data collection process.

There is an additional reason that supports the recommendation that the ISA certify a group of individuals or organizations to perform environmental assessments for contractors. These parties can also serve as independent auditors of environmental baseline assessments at the initial exploration stage, as well as in an ongoing environmental monitoring capacity for the ISA. The primary reason this process would benefit the ISA is because an inherent conflict of interest exists on the ISA's behalf: the ISA desires that the exploitation process should begin as quickly as possible. This claim results not only from the current loss of zeal that existed in the early days of seabed mining ballyhoo, [n196] but also is inherent in the ISA's role as a money-making entity through the Enterprise. [n197] In short, the ISA stands to profit from any exploitation of seabed minerals. This argument does not insinuate that the ISA would intentionally risk the safety of the ocean's ecosystem for seabed mining operations, but instead suggests a bias in favor of risk-taking on the part of a fledgling organization that prefers to be self-sufficient sooner rather than later. By adding an independent accrediting body to the environmental assessment process, the ISA would add an aura of legitimacy to the establishment of baselines as well as proficient ongoing environmental monitoring, and the ISA would contemporaneously insulate itself from any allegation of poor decision-making and bias should seabed mining operations result in unforeseen environmental harm. Furthermore, having an independent scientific entity external to the ISA involved in the environmental assessment process creates a permanent and tangible link between the ISA and external scientists, which can indirectly facilitate a learning regime whereby the ISA's members are educated on scientific findings and burgeoning research techniques in the global community. [n198] A more comprehensive **[*65]** knowledge base can assist the ISA in improving the Environmental Guidelines, which are not well developed for exploring nodules. [n199]

In summary, Regulation 31, Sections 3 and 4, are both critically important to environmental protection and preservation of the marine environment. First, should the ISA amend Regulation 31, Section 3 by adopting the proposed amendment created through comparative analysis with the DSHMRA - or alternatively adopting an amendment created through comparative analysis with a similar state mining code - the ISA can create a standardized process for technology management for new exploration contracts, as well as for contracts already in force. This outcome is required in order to create equivalent standards of technology management for all contract parties and to establish the ISA, or another independent expert body, as the final arbiter of the appropriate technology management level via a cost-benefit analysis. Second, Regulation 31, Section 4 requires a level of responsibility for contractors that they may not be able to satisfy. By providing guidance through recommended expert organizations, the ISA can protect the marine environment while simultaneously improving the data quality that it obtains. Moreover, from a policy standpoint, the ISA will create legitimacy for the baseline establishment process by allowing an independent organization to verify baseline data. As a result, these suggestions deserve serious consideration by the ISA.

[*66]

IV. Regulations For Prospecting and Exploring Cobalt-rich Crusts and Polymetallic Sulphides

There are more questions than answers regarding the adequacy of the Regulations governing the prospecting and exploration of nodules. One can hypothesize that the environmental matters the ISA must consider in the case of mining cobalt-rich crusts (crusts) and polymetallic sulphides (sulphides) are at least as arduous, if not more so, than the issues involved with nodules. This hypothesis is accurate, and the prior recommendations made regarding suggested

improvements to the guidelines on polymetallic nodule prospecting and exploration will apply a fortiori to pending draft regulations for crusts and sulphides.

The purpose of this section is to consider whether the guidelines for prospecting, exploration, and exploitation of crusts and sulphides should be parallel to or unique from the regulations governing nodules. In order to aid the reader, the section will first present a concise overview of crusts and sulphides and how the mining techniques for exploitation of these minerals differ from the methods employed for nodule harvesting. Following this overview, the pertinent environmental issues related to crusts and sulphides will be discussed. The culmination of the evidence will produce a judicious conclusion that although prospecting and exploration of crusts and sulphides is probably acceptable and necessary, utilizing a fixed set of guidelines based upon the current Regulations is unacceptable. Instead, guidelines must be established that are flexible and amenable to change as new information is ascertained with the caveat that any exploitation of crusts and sulphides should be undertaken in limited circumstances with extensive ISA oversight, because of the delicate nature of the marine ecosystems surrounding these geological formations.

A. Background and Mining Techniques for Crusts and Sulphides

Crusts are found where the currents have swept the ocean floor clear of sediment over millions of years; they are typically located on the flanks and summits of submarine mountains, ridges, and plateaus. [n200] Submarine mountains can be huge - sometimes rivaling the mountain ranges on the continents - and the richest deposits of minerals on these **[*67]** mounts are found in the Pacific Ocean. [n201] Crusts are found at water depths from 400 to 4,000 meters, and are formed by one of the slowest natural processes on earth, taking up to sixty million years to form. [n202] Notably, crusts found in shallow waters contain the richest deposits of minerals, which is an important factor for exploitation. [n203] Crusts contain a variety of minerals including cobalt, titanium, cerium, nickel, platinum, manganese, phosphorus, thallium, tellurium, zirconium, tungsten, bismuth, and molybdenum. [n204] However, cobalt is by far the most predominant mineral found, with some estimates predicting that one Pacific crust mine site could produce twenty-five percent of the annual global cobalt demand. [n205]

In contrast, sulphides are found on the ocean floor where chimney-like volcanic formations of dark rock sit on top of sulphide mounds that spew hot water, and the formations are surrounded by unique animal species. [n206] These formations known as "black smokers" are an outgrowth of the formation of new ocean crust that originates though seafloor spreading as tectonic plates under the earth's surface shift. [n207] Hydrothermal fluids seep into subterranean chambers, where they are heated by the molten rock beneath the crust, and are then discharged by the black smokers at temperatures exceeding 400 degrees Celsius. [n208] As the fluids mix with the frigid surrounding water, metal sulphides in the water settle on the chimneys and nearby seabed. [n209] Sulphide deposits have generally been found in the Pacific Ocean, range in size from several thousand to 100 million tons, and contain high concentrations of base metals such as copper, zinc, and lead, as well as precious metals like gold and silver. [n210] Notably, sulphide deposits are found at sites that are no longer volcanically active. [n211]

The technology utilized for mining crusts and sulphides differs **[*68]** drastically from that employed in nodule harvesting, as nodules are scattered loosely on the seabed and can be scooped up. [n212] In the case of crusts, these are attached weakly or strongly to ocean rocks, [n213] and assessing their presence and metal content involves digging or drilling ores from a solid rock bed. [n214] Although technologies for exploitation are still in development, several innovative ideas with future potential include fragmenting crusts attached to substrate rocks via bottom-crawling vehicles, water-jet stripping of crust from rock, and chemical leaching of crusts from submarine mounts. [n215] Each case involves a variation of the strip-mining process as the crust is "peeled" from seabed rock. Similarly, while mining technologies have not yet been developed for sulphides, they will likely focus on relatively small areas of the seafloor by utilizing either some type of surface mining procedure (strip-mining) or shallow subsurface mining (open cast mining). [n216]

B. Environmental Impacts from Crust and Sulphide Mining

Because there is little known about the surrounding biological communities, the environmental impact of crust and sulphide mining is difficult to assess. [n217] Hence, given the current state of knowledge about prospective mining techniques for each mineral, it appears that nodule mining involves the least detrimental threat to fauna and surrounding biological communities, sulphide mining involves the most detrimental threat, and crust-mining provides a level of threat which probably falls somewhere in between.

There is a dearth of knowledge about the biological communities surrounding crusts, beyond the fact that these communities are complex and varying. [n218] For instance, two submarine mounts on the seabed at identical depths can have completely different biological make-ups. [n219] The fauna compositions of these communities are determined by "current patterns, topography, bottom-sediment and rock types and coverage, **[*69]** seamount size, water depth, and seawater oxygen content." [n220] In addition, because seabed mountains are obstructions that impact the ocean currents as a result of their physical size, mining techniques and equipment must be developed with their unique ecosystem roles in mind. Removing the mountains would impact seawater current flow thereby impacting the dispersal of seawater mineral resources to biological communities. [n221] Moreover, given that crusts are attached to seabed rock, the prospecting and exploration process, as well as the actual mining will likely generate substantial seabed noise. [n222] Because underwater sound is capable of traveling long distances, it is a type of pollution. [n223] There are presently no international legal standards that address seabed mining noise pollution and its related impact on wild fauna. [n224]

Sulphide mining presents a grave physical threat to hydrothermal vents and their biological communities. [n225] In comparison to crust mining sites, marine scientific research is a common activity at hydrothermal vent sites, [n226] and hundreds of specially adapted organisms have been discovered, including chemoautotrophic microbes, symbiotic tubeworms, a variety of mollusks, and eyeless shrimp and crabs. [n227] In fact, some 500 previously unknown animal species have been discovered around vent areas. [n228] Hence, as the ISA has aptly recognized, if a unique base population in a vent area is destroyed by mining, "the result could be the extinction of rare species." [n229] Because strip-mining or open mining appears to be the likely mining technique, animals such as vital hyperthermaphilic bacteria could easily be buried and killed, [n230] and noise pollution will remain a threat to species outside the immediate mining **[*70]** area. In addition, destruction of vent sites can substantially impact crust formation because vents distribute concentrated polymetallic sulphide deposits and metals into the ocean, which contribute to the accumulation of crusts. [n231] Mining proponents have countered such criticisms of vent site mining by arguing that mining can take place at vent sites that are no longer active. These vent sites, in reality, might harbor vast amounts of mineral resources. [n232] Though there is no evidence that shows the existence of ecological systems at inactive vent sites, a pragmatic implication of this strategy is that it is difficult for miners to locate inactive vent sites without the aid of a "telltale thermal plume that marks the active vent." [n233]

In the case of mining either crusts or sulphides, there are general risks at the exploitation stage similar to polymetallic nodule mining. Depending upon the mining technology used, mine tailings that are discharged at sea could adversely impact a variety of organisms - including zooplankton, fishes, and deep diving mammals [n234] - as a result of the following: impaired transmission of sunlight to lower levels due to suspended sediments, [n235] oxygen depletion due to bacterial growth on discharged particles, and dissolution of heavy metals and their incorporation into the food chain. [n236] Therefore, aside from the inherent risks to the extant ecosystems at the crust and sulphide mining sites, there are additional environmental threats at the exploitation stage to the complex surrounding ecological communities.

C. Guidelines for Prospecting, Exploration, and Exploitation of Crusts and Sulphides

Given the dissimilarities among mining techniques for polymetallic nodules, cobalt-rich crusts, and polymetallic sulphides, one might assume that the regulations for prospecting, exploration, and exploitation of crusts and sulphides should be constructed independently. Notwithstanding, the greatest environmental threat to crusts and sulphides probably exists at the exploitation stage rather than at the **[*71]** prospecting or exploration phases. Moreover, drafting crust and sulphide seabed mining regulations anew for prospecting and exploration would be substantially inefficient, and could also result in the ISA missing opportunities for improving regulations on all seabed mineral mining through information sharing, as the development and fine-tuning of the regulations for each mineral serves to inform the

regulations of the others.

Therefore, there does not appear to be a workable argument against adopting the current Regulations as a base for both crusts and sulphide prospecting and exploration. Instead, these new guidelines must be flexible and amenable to change as the scientific community continues to learn about the ecosystems in crust and sulphide areas. [n237] In addition, there will be some immediate changes required in the Regulations in areas such as the parallel scheme of mineral sharing envisioned for exploration contracts because, unlike nodule mining areas that can be equally divided between the contractor and the Enterprise, crusts and sulphides occur in more concentrated areas, are unevenly distributed, and have varying metal contents. [n238]

Although the Regulations can serve as a template to craft prospecting and exploration rules for crusts and sulphides, developing exploitation guidelines is a different matter. In fact, opponents of crust and sulphide mining could argue that, given the emergent level of scientific knowledge about the biological systems that surround these minerals, the ISA should declare a moratorium on crust and sulphide harvesting. The call for a moratorium is bolstered by a key fact - there are adequate reserves of necessary terrestrial minerals, especially given recent discoveries of land-based reserves in Canada and elsewhere. [n239] Nevertheless, a moratorium is not an optimal solution for at least two reasons. First, there will be a point at which terrestrial mineral resources are exhausted, and so controlled exploitation at an early stage - including the development of an effective governance regime in the process - presents humankind with an opportunity to be proactive rather than reactive in effectively planning for future natural resource demand. Second, many known crust and sulphide deposits are located within the exclusive economic zone (EEZ) of states, which means that these mineral deposits are subject to state jurisdiction. [n240] Thus, crust and sulphide mining will inevitably begin even should the ISA declare a moratorium on mining in the Area. By proceeding with the development **[*72]** of a regulatory regime for crust and sulphide exploitation now, the ISA can benefit from knowledge garnered as states begin to exploit seabed resources within their own jurisdictions.

In summary, mining polymetallic nodules is a substantially different activity than mining crusts and sulphides, because these minerals require different mining techniques and support unique biological communities. These distinctions justify separate regulations for prospecting, exploration, and exploitation, but the regulations will share some common characteristics, and each mineral's harvesting guidelines can serve to inform refinements in the others'. For example, the earlier recommendation for the participation of an independent organization in establishing nodule area baselines would also add accuracy and legitimacy to baseline establishment at crust and sulphide sites. Though prospecting and exploration are probably the most similar processes across all seabed minerals at this juncture, the ISA should not fear exploitation at crust or sulphide sites. Rather, the ISA should encourage such activities under controlled circumstances in order to further scientific knowledge about crust and sulphide ecosystems, as well as to further general knowledge regarding mining processes and obstacles. [n241]

V. Conclusion

Currently, marine minerals are estimated to generate approximately one trillion dollars in revenue each year. [n242] As burgeoning technologies for seabed mining continue to evolve, and the exploitation of polymetallic nodules, cobalt-rich crusts, and polymetallic sulphides becomes a commercial reality, the potential increase in this revenue figure is enormous. Nevertheless, along with the vast resources that the ocean promises to deliver humankind comes the potential for miners to inflict devastating harm to delicately balanced marine ecosystems, driving species to extinction that have yet to be documented or understood. The Regulations are commendable and deserve the recognition of the international community as a first step in attempting to protect and preserve the marine environment from the ill-effects of seabed mining, but these guidelines remain deficient in numerous respects.

[*73] Although the ISA should carefully analyze the Regulations in their entirety, this article has specifically scrutinized existing regulations governing the prospecting and exploration of polymetallic nodules, as well as planned regulations governing the prospecting, exploration, and exploitation of cobalt-rich crusts and polymetallic sulphides. To begin, an amendment to Regulation 2, Section 2 was proposed in order to clarify for miners when prospecting activity

should be proscribed because of the looming potential for environmental harm. Further, the addition of a formal risk assessment procedure was suggested in order to allow the prospector, as well as the ISA, the opportunity to systematically assess the potential for an undesirable environmental impact. Not only would a formal risk assessment aid miners in determining whether or not there could be negative ramifications for engaging in prospecting activity, including the imposition of proposed penalties such as fines or the suspension of mining rights, a documented risk assessment would better position the ISA to enter into consultations with miners when it becomes necessary to determine whether prospecting activity should be prohibited. In making a decision through these negotiations, this paper avers that a balancing of interests of all relevant parties is critical in order to reach the most desirable outcome.

Nevertheless, if the ISA imposes additional regulatory burdens on contractors, the threat of regulatory noncompliance by miners will likely increase. Because the ISA recently stated that it is difficult to distinguish between mining and scientific activities on the seabed floor, [n243] the threat of additional noncompliance should serve as an impetus for the ISA to create incentives along with sanctions to improve conformity with the Regulations. An amended Regulation 2, Section 4 would establish a right of first refusal for the contractor, thus creating an incentive for the miner to comply with the prospecting guidelines by providing a substantive right to lay claim to a section in the Area with the promise of a mineral harvest. Yet sanctions are also required to counterbalance this incentive, such as a standardized set of fines that are widely disseminated to contractors. Also additional sanctions, such as mining right suspensions, should be considered for those parties which are guilty of particularly egregious violations (such as repeat offenses) as an added deterrence mechanism.

The guidelines on exploration also require attention, especially Regulation 31, Section 3, which has poorly crafted language regarding the standards of technology which should be employed in exploratory activity. A comparative study with the U.S. mining code - DSHRMA - yielded a potential resolution: an amendment requiring that only the best **[*74]** available technologies be employed for the protection of the environment and humankind, except where the ISA determines that the incremental benefits of such technologies do not justify the additional costs. By adopting this rationale, the ISA could determine whether a specific technology is or is not justified, and thereby apply like standards to contractors in both new and extant contracts. In addition, the ISA should recommend either credentialing standards or organizations through which miners can contract to assist in establishing environmental baselines. Not only would this process assist miners and the ISA in establishing a more accurate measure of the environment in its pristine state, but it would add legitimacy to the baseline establishment process in the eyes of the global community, as well as curtail any risk of unnecessary risk-taking on behalf of the ISA in its quest to become self-sufficient. As an additional perk, working with outside scientists in the baseline establishment process would provide the ISA with access to current happenings in the marine research community, thereby improving the ISA's state of knowledge on the deep seabed.

Finally, the complex issues that surface when scrutinizing the rules governing nodules seem dwarfed when one considers the matters involved with prospecting, exploring, and exploiting cobalt-rich crusts and polymetallic sulphides. Not only is the mining process for these minerals arguably more devastating to the marine environment, but given the nascent stage of knowledge surrounding these minerals' vibrant ecological communities, there is the imminent risk of extinguishing poorly understood or unknown fauna. Moreover, the effects of mining externalities, such as noise pollution, are largely unknown, thus posing additional threats to a variety of marine species. [n244] Nevertheless, there remain similarities in mining techniques, harvesting obstacles, and environmental threats across each mineral, and these shared characteristics present the international community with an opportunity to achieve synergy in refining its existing knowledge base. Because the mining of crusts and sulphides will likely occur in the near future in the sovereign waters of states, which are beyond the control of the ISA, there is no viable argument against the ISA assuming a proactive stance and drafting a set of mining regulations. By utilizing the current Regulations as a base of rule development, a regulatory code for crust and sulphide mining could be developed - provided that the guidelines remain flexible and amenable to change and that any permitted mining activities are closely monitored and scrutinized in order to minimize the potential for environmental harm.

The Global Environmental Facility recently noted that one of the **[*75]** greatest threats to the world's oceans is the physical alteration or destruction of marine habitats. [n245] Hence, the common thread running through the cited

deficiencies in the Regulations, as well as the overriding concern with the future guidelines for mining crusts and sulphides, relates to the protection and preservation of the marine environment. The onus rests upon the ISA to carefully weigh these recommendations in order to hone the seabed mining code, and thereby ensure that the sustenance the oceans provide humankind will continue for future generations.

Legal Topics:

For related research and practice materials, see the following legal topics:
Energy & Utilities LawExploration, Discovery & RecoveryGeneral OverviewEnergy & Utilities LawMining IndustryGeneral OverviewInternational Trade LawTrade AgreementsEnvironmental ProvisionsGeneral Overview

FOOTNOTES:

n1. Tommy T.B. Koh, A Constitution for the Oceans, Remarks by the President at the final session of the Third United Nations Conference on the Law of the Sea at Montego Bay, Jamaica. (Dec. 11, 1982), available at http://www.un.org/Depts/los/convention_agreements/texts/koh_english.pdf.

n2. Division for Ocean Affairs and Laws of the Sea, United Nations, The United Nations Convention on the Law of the Sea (A Historical Perspective) (1998), available at http://www.un.org/Depts/los/convention_agreements/convention_historical_perspective [hereinafter Division for Ocean Affairs and Laws of the Sea].

n3. Id.

n4. Id.

n5. Facts and Figures About the Oceans: Did You Know?, in United Nations Convention on the Law of the Sea - 20th Anniversary (1982-2002) 13 (United Nations, 2002), available at http://www.un.org/partners/civil_society/docs/documents/losenbk.pdf.

n6. John Temple Swing, What Future for the Oceans?, Foreign Affairs, Sept./Oct. 2003, at 139, available at http://www.foreignaffairs.org/20030901faessay82511/john-temple-swing/what-future-for-the-oceans.html.

n7. The Marine Environment: Are We Destroying the Oceans?, in United Nations Convention on the Law of the Sea - 20th Anniversary (1982-2002), supra note 5, at 1 [hereinafter The Marine Environment].

n8. Id.

n9. Id. For a comprehensive overview of the negotiating process of the United Nations Convention on the Law of the Sea (UNCLOS), which illustrates in great detail the strategies and techniques involved in negotiating the treaty, see Tommy T.B. Koh & Shanmugam Jayakumar, The Negotiating Process of the Third United Nation Conference on the Law of the Sea, in United Nations Convention on the Law of the Sea 1982 - A Commentary 29 (Myron H. Nordquist ed., 1985).

n10. The Marine Environment, supra note 7. Not all maritime scholars agree that UNCLOS is a successful agreement. For example, some American policy analysts argue that UNCLOS is a faulty document and remains substantially inimical to American interests. See Doug Bandow, Faulty Repairs: The Law of the Sea Treaty is Still Unacceptable (Cato Foreign Policy Briefing No. 32, 1994), available at http://www.cato.org/pubs/fpbriefs/fpb-032.html. See also Doug Bandow, UNCLOS III: a Flawed Treaty, 19 San Diego L. Rev. 475, 476 (1982).

n11. See Koh & Jayakumar, supra note 9.

n12. The UN Convention on the Law of the Sea: A Historical Background, in United Nations Convention on the Law of the Sea - 20th Anniversary (1982-2002), supra note 5, at 9 [hereinafter A Historical Background].

n13. See, e.g., United Nation Convention on the Law of the Sea, done Dec. 10, 1982, art. 160, para. 2(f)(ii), U.N. Doc. A/CONF.62/122, reprinted in 21 I.L.M. 1245 (entered into force Nov. 16, 1994) [hereinafter UNCLOS], available at http://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf, http://www.un.org/Depts/los/convention_agreements/texts/unclos/closindx.htm.

n14. The role of the ISA is discussed throughout UNCLOS Part XI, Section 4, although the role here is explicated in UNCLOS Article 157, Section 1. Id.

n15. Id. art. 1, para. 1(2).

n16. Id. art. 1, para. 1(1).

n17. Throughout the paper, the terms "prospecting," "exploration," and "exploitation" are used. Hence, it will behoove the reader to garner an understanding of these terms, which are derived from the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area. Decision of the Assembly relating to the regulations on prospecting and exploration for polymetallic nodules in the Area, U.N. International Seabed Authority Assembly, 6th Sess., 76th mtg., Annex, U.N. Doc. ISBA/6/A/18 (2000) [hereinafter Regulations], available at http://www.isa.org.jm/en/documents/OFFICIAL_DOCUMENTS/DOC_2000/ISBA_6_A_18_E.pdf. "Prospecting" means the search for seabed minerals. Id. Regulation 1, para. 3(e). "Exploration" means the search for seabed minerals with exclusive rights. Id. Regulation 1, para. 3(b). "Exploitation" means the commercial recovery of seabed minerals. Id. Regulation 1, para. 3(a).

n18. If readers are unfamiliar with these differing mineral deposits, fear not, as they will be discussed in detail throughout the paper.

n19. John Alton Duff, UNCLOS and the New Deep Seabed Mining Regime: The Risks of Refuting the Treaty, 19 Suffolk Transnat'l L. Rev. 1, 5 (1995), citing Conrad G. Welling, Mining of the Deep Seabed in the Year 2010, 45 La. L. Rev. 1249, 1257 (1985).

n20. Id.

n21. See A Historical Background, supra note 12, at 9.

n22. Id.

n23. R. R. Churchill & A. V. Lowe, The Law of the Sea 15 (3d ed. 1999).

n24. Id. In fact, this issue first surfaced in 1930 at a conference instigated by the League of Nations. Id. at 14. Unfortunately, the conference, which convened at The Hague, also failed to reach agreement on the territorial sea boundary. Id.

n25. A Historical Background, supra note 12, at 9.

n26. Churchill & Lowe, supra note 23, at 15.

n27. Id. at 16.

n28. Id. at 226.

n29. Duff, supra note 19, at 5.

n30. Nicolaas Jan Schrijver, Sovereignty Over Natural Resources: Balancing Rights and Duties in an Interdependent World 203 (1995) (unpublished thesis on file with University Library Groningen), citing U.N. GAOR, 1st Comm., 22nd Sess., U.N. Doc. A/C.1/PV.1515 (1967), available at http://www.ub.rug.nl/eldoc/dis/jur/n.j.schrijver. Earlier in 1967, the United Nations General Assembly had declared outer space, including the moon, to be "the province of all humankind." Id., referring to Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, Oct. 10, 1967, art. 1, 610 U.N.T.S. 205 (1967), available at http://www.oosa.unvienna.org/Reports/ostE.pdf.

n31. Churchill & Lowe, supra note 23, at 226.

n32. A Historical Background, supra note 12, at 9.

n33. Id.

n34. Division for Ocean Affairs and Laws of the Sea, supra note 2.

n35. Id.

n36. Churchill & Lowe, supra note 23, at 228. The United States and other developed nations disagreed with the role of the International Seabed Authority (ISA) in UNCLOS Part XI. Id. While the less developed nations wanted the ISA to have the power to engage in seabed mining and collect royalties from mining States to be distributed as the Common Heritage of Mankind (CHM), the developed nations saw the ISA as little more than a registry of national claims, with little power to interfere in mining operations. Id. Moreover, the developed nations also feared the UNCLOS provisions on mandatory technology transfer to the ISA. Id. at 228 n.19. For a full account of the initial disputes surrounding UNCLOS Part XI, see id. at 228-38. See also E.D. Brown, The Legal Regime of Deep Seabed Mining: An Overview, 4 EEZ Technology 21 (1999).

n37. Wesley S. Scholz, The Law of the Sea Convention and the Business Community: The Seabed Mining Regime and Beyond, 7 Geo. Int'l Envtl. L. Rev. 675, 679 (1995).

n38. Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, G.A. Res. 263, U.N. GAOR, 48th Sess., U.N. Doc. A/RES/48/263 (1994), reprinted in 33 I.L.M. 1309 [hereinafter 1994 Agreement], available at http://www.un.org/Depts/los/convention_agreements/convention_overview_part_xi.htm.

n39. Jonathan I. Charney, Entry into Force of the 1982 Convention on the Law of the Sea, 35 Va. J. Int'l L. 381, 394 (1995).

n40. Churchill & Lowe, supra note 23, at 238. The 1994 Agreement - and its effect upon UNCLOS - gives rise to many complex questions of treaty law that will not be addressed here. See id. at 238 n. 45.

n41. Division for Ocean Affairs and Laws of the Sea, supra note 2. See also UNCLOS, supra note 13, art. 308.

n42. United Nations, Status of the United Nations Convention on the Law of the Sea: Table recapitulating the status of the Convention and related Agreements, at http://www.un.org/Depts/los/reference_files/status2005.pdf (last visited Jan. 24, 2005). The 145 members ratifying UNCLOS include: Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Australia, Austria, Bahamas, Bahrain, Bangladesh, Barbados, Belgium, Belize, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Cameroon, Canada, Cape Verde, Chile, China, Comoros, Cook Islands, Costa Rica, Cote d'Ivoire, Croatia, Cuba, Cyprus, Czech Republic, Democratic Republic of the Congo, Djibouti, Dominica, Egypt, Equatorial Guinea, European Community, Fiji, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iraq, Ireland, Italy, Jamaica, Japan, Jordan, Kenya, Kiribati, Kuwait, Lao People's Democratic Republic, Lebanon, Lithuania, Luxembourg, Madagascar, Malaysia, Maldives, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Micronesia (Federated States of), Monaco, Mongolia, Mozambique, Myanmar, Namibia, Nauru, Nepal, Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Philippines, Poland, Portugal, Qatar, Republic of Korea, Romania, Russian Federation, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia and Montenegro, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, Solomon Islands, Somalia, South Africa, Spain, Sri Lanka, Sudan, Suriname, Sweden, The former Yugoslav Republic of Macedonia, Togo, Tonga, Trinidad and Tobago, Tunisia, Tuvalu, Uganda, Ukraine, United Kingdom of Great Britain and Northern Ireland, United Republic of Tanzania, Uruguay, Vanuatu, Vietnam, Yemen, Zambia and Zimbabwe. Int'l Seabed Auth., Members of the Authority, at http://www.isa.org.jm/en/default.htm (last visited Jan. 10, 2005).

n43. Press Release, U.S. Dept. of State's Bureau of Int'l Information Programs, Bush Administration Urges Approval of Sea Treaty (Mar. 24, 2001), available at http://usinfo.state.gov/ei/Archive/2004/Mar/24-600179.html. See also Marjorie Ann Browne, Congressional Research Service, The Law of the Sea Convention and U.S. Policy, available at http://www.ncseonline.org/NLE/CRSreports/Marine/mar-16.cfm (Feb. 2001).

n44. See UNCLOS, supra note 13, art. 158. As of June 4, 2004, there were 145 members of the ISA. Press Release, Int'l Seabed Auth., Assembly Concludes Historic Tenth Session of Authority SB/10/19 (June 4, 2004), available at http://www.isa.org.jm/en/default.htm.

n45. UNCLOS, supra note 13, art. 158. The ISA is headquartered in Kingston, Jamaica. Id. art. 156.

n46. Int'l Seabed Auth., The International Seabed Authority: Structure and Functioning 1 [hereinafter ISA - Structure and Functioning], available at http://www.isa.org.jm/en/seabedarea/TechBrochures/ENG2.pdf (last visited Jan. 10, 2005). See also UNCLOS, supra note 13, art. 159. Notably, the 1994 Agreement modified the role of the Authority by providing that decision-making should generally be by consensus, and also weakened the power of the Authority by specifying that the general policies of the ISA should be established by the Assembly in collaboration with the Council. 1994 Agreement, supra note 38, Annex, 3, paras. 1-2.

n47. Int'l Seabed Auth., The International Seabed Authority 3 [hereinafter ISA - International Seabed Authority], available at http://www.isa.org.jm/en/seabedarea/TechBrochures/ENG1.pdf (last visited Jan. 10, 2005).

n48. Id.

n49. Id. The complexity of Council composition and voting can only be fully appreciated by referring to UNCLOS, Article 161. See UNCLOS, supra note 13, art. 161. See also Churchill & Lowe, supra note 23, at 240-42.

n50. ISA - Structure and Functioning, supra note 47, at 1. The Secretariat is currently separated into four main functional areas: Office of the Secretary-General; Office of Administration and Management; Office of Legal Affairs; and Office of Resources and Environmental Monitoring. Report of the Secretary-General of the International Seabed Authority under Article 166, paragraph 4, of the United National Convention on the Law of the Sea, U.N. International Seabed Authority, 9th Sess., U.N. Doc. ISBA/9/A/3 (2003) [hereinafter Article 166 Report], available at http://www.isa.org.jm/en/documents/9thSession/Assembly/isba9A_3.pdf.

n51. Id. See also UNCLOS, supra note 13, arts. 158, 170 (establishing the Enterprise).

n52. Churchill & Lowe, supra note 23, at 244. In addition, even should commercial seabed mining commence, the Enterprise will initially operate through joint ventures with mining companies and/or states. 1994 Agreement, supra note 38, Annex, 2, para. 2.

n53. Scholz, supra note 37, at 680.

n54. 1994 Agreement, supra note 38, Annex, 1, para. 3.

n55. See id. 2, para. 1.

n56. UNCLOS, supra note 13, art. 163, para. 1(a)-(b).

n57. 1994 Agreement, supra note 38, Annex, 1, para. 4.

n58. UNCLOS, supra note 13, art. 165, para. 2(c).

n59. Id. art. 165, para. 2(b).

n60. Id. art. 165, para. 2(d).

n61. Id. art. 165, para. 2(k).

n62. Id. art. 165, para. 2(i).

n63. Id. art. 165, para. 2(j). The Seabed Disputes Chamber (SDC) is established in Article 14 of UNCLOS Annex VI, which creates the International Tribunal for the Law of the Sea (ITLOS). Id. Specifically, the SDC is established in Section 4 of UNCLOS Annex VI, and is discussed in Articles 35 to 40. Id. The SDC is composed of 11 members, selected from ITLOS by a majority, who serve three year terms. Id. Annex VI, art. 35, paras. 1, 3. The SDC must establish a three person ad hoc chamber to settle disputes submitted under UNCLOS Article 188(1)(b); SDC jurisdiction is granted to adjudicate ISA matters under UNCLOS Article 187. Id. For further reading on dispute settlement under UNCLOS, see Churchill & Lowe, supra note 23, at 447-62. Readers may also be interested in visiting the official web site for ITLOS. See Int'l Tribunal for the Law of the Sea, International Tribunal for the Law of the Sea, available at http://www.itlos.org (last visited Jan. 10, 2005).

n64. UNCLOS, supra note 13, art. 165, para. 2(f-g).

n65. See 1994 Agreement, supra note 38, Annex, 9. The Finance Committee was mandated by UNCLOS, which stated that the Council

"establish a subsidiary organ for the elaboration of draft financial rules, regulations and procedures." UNCLOS, supra note 13, art. 162, para. 2(y). The Finance Committee is composed of 15 members with qualifications in financial matters. 1994 Agreement, supra note 38, Annex, 9, para. 1. The members are elected by the Assembly for five-year terms. Id. Annex, 9, paras. 3-4.

n66. UNCLOS, supra note 13, art. 162, para. 2(d).

n67. ISA - International Seabed Authority, supra note 47, at 3.

n68. Id. See also Churchill & Lowe, supra note 23, at 230 (a discussion of UNCLOS Resolutions I and II).

n69. ISA - Structure and Functioning, supra note 46, at 29-30. For additional detail on each of these contracts, see Int'l Seabed Auth., International Seabed Authority Handbook 29 (2003) [hereinafter ISA Handbook], available at http://www.isa.org.jm/en/whatsnew/ISA%20Handbook%202003.pdf.

n70. ISA Handbook, supra note 69, at 30.

n71. ISA - Structure and Functioning, supra note 46, at 3.

n72. Regulations, supra note 17.

n73. Id. Regulation 1, para. 3(e).

n74. Id. Regulation 1, para. 3(b).

n75. The crux of the argument hinges upon the definitional difference between prospecting and exploitation in the Regulations. Manifestly, the Regulations impose differential burdens upon the miner contingent upon how the activity is categorized. For a full appreciation of the differences in the burdens imposed, the Regulations should be read in their entirety.

n76. Id. Regulation 1, para. 3(a).

n77. Michael Lodge, The International Seabed Authority and the Development of the Mining Code, in Oceans Policy 47, 48 (Myron H. Nordquist and John Norton Moore eds., 1999).

n78. Id.

n79. Int'l Seabed Auth., Polymetallic Nodules 1 [hereinafter ISA - Polymetallic Nodules], available at http://www.isa.org.jm/en/seabedarea/TechBrochures/ENG7.pdf (last visited Jan. 10, 2005).

n80. Id.

n81. Id. at 3.

n82. Id. at 1.

n83. Int'l Seabed Auth., Marine Mineral Resources 2 [hereinafter ISA - Marine Mineral Resources], available at http://www.isa.org.jm/en/seabedarea/TechBrochures/ENG6.pdf (last visited Jan. 10, 2005).

n84. ISA - Polymetallic Nodules, supra note 79, at 1. For a photo of a polymetallic nodule cross section, see the ISA web site at http://www.isa.org.jm/images/nodules1.jpg.

n85. Id. at 2. There are several theories that propose to explain polymetallic nodule formation. Id. Two of the more popular theories are: first, a hydrogenous process occurs where nodules are formed by slow precipitation of the metallic components from seawater; and second, a diagenetic process occurs where the manganese is remobilized in the sediment column and precipitation comes about at the sediment/water interface. Id. Other proposed mechanisms include a hydrothermal process, a halmyrolitic process, and a biogenic process. Id.

n86. Id. at 1.

n87. Id. For a photo of polymetallic nodules littered across the ocean floor, see the ISA web site at the following link: http://www.isa.org.jm/en/data-rep/nodule.png.

n88. ISA - Marine Mineral Resources, supra note 83, at 2.

n89. Division for Ocean Affairs and Laws of the Sea, supra note 2.

n90. ISA - Polymetallic Nodules, supra note 79, at 1.

n91. Division for Ocean Affairs and Laws of the Sea, supra note 2.

n92. Int'l Seabed Auth., Seabed Technology 1 [hereinafter ISA - Seabed Technology], available at http://www.isa.org.jm/en/seabedarea/TechBrochures/ENG10.pdf (last visited Jan. 5, 2005).

n93. Id.

n94. Division for Ocean Affairs and Laws of the Sea, supra note 2.

n95. ISA - Seabed Technology, supra note 92, at 1. Exploration of the deep seabed involves techniques such as remote sensing, where a remotely operated vehicle crawls along the seabed floor. Id. at 2. Other techniques include side-scan sonar, seismic profiling, and satellite-based global positioning systems (i.e., GPS). Id.

n96. Moreover, rules and regulations must have the ability to evolve, as experiential learning exhibits shortcomings in extant rules and regulations. For a thorough overview of this process, see James G. March et al., The Dynamics of Rules: Changes in Written Organizational Codes (2000).

n97. The reader should review the regulations on prospecting in their entirety in order to better comprehend this analysis. See Regulations, supra note 17.

n98. Id. Regulation 2, para. 2.

n99. Id. Regulation 7.

n100. The process for issuing an emergency order in response to prospector notification or otherwise requires the Secretary-General to take a number of enumerated steps, including notifying the Council and the LTC. See id. Regulation 32. However, the Secretary-General can take immediate measures of a temporary nature that are practical and reasonable under the circumstances in order to minimize environmental harm. Id. Regulation 32, para. 2.

n101. Id. Regulation 3, para. 1.

n102. Id. Regulation 3, paras. 2-4.

n103. Id. Regulation 4, para. 1.

n104. Id. Regulation 4, para. 3.

n105. Id. Regulation 4, para. 4.

n106. Regulation 5 recites information that the prospector is required to include in the annual report. If the prospector intends to claim prospecting expenditures as part of development costs expended prior to commencing actual mining production, these expenditures must be submitted along with the annual report in a certified accounting format. Id. Regulation 5, paras. 1-2.

n107. Id. Regulation 6, para. 1.

n108. Id. Regulation 6, para. 2.

n109. Id. Regulation 4, para. 5.

n110. Another potential benefit in the Regulations is found in Regulation 5 Section 2, which says that the prospector may submit a certified accounting of expenses with the annual report if the prospector seeks to claim these development costs as expenditures incurred prior to commencing commercial production. See id. Regulation 5, paras. 1, 2. However, the prospector likely fails to recognize this regulation as a benefit for two reasons. First, the ISA has no control over the accounting practices the prospector employs to recognize revenues and

expenses in the home jurisdiction. Second, the Regulations contain no language stating that if the prospector fails to report these expenses at this stage in the mining process that the expenses are not allowable. Instead, the prospector may be able to report these expenses during the Exploration stage. See id. Annex 4, para. 10.2(c).

n111. Id. Regulation 2, para. 4.

n112. Int'l Seabed Auth., Reporting Material for the Report of the Secretary-General on Oceans and the Law of the Sea to the 58th Session of the General Assembly [hereinafter Report to the 58th Session], available at http://www.un.org/Depts/los/general_assembly/contributions58.htm (last visited Jan. 10, 2005).

n113. Article 166 Report, supra note 50, at 18.

n114. UNCLOS, Article 87, Section 1(f) states that freedom of scientific research is subject to UNCLOS Parts VI and XIII. UNCLOS, supra note 13, art. 87, para. 1(f); see also id. art. 143.

n115. Regulations, supra note 17, Regulation 2, para. 2.

n116. See Jan Magne Markussen, Deep Seabed Mining and the Environment: Consequences, Perceptions, and Regulations, in Green Globe Yearbook of International Co-operation on Environment and Development 31, 37 (Helge Ole Bergesen & Georg Parmann eds., 1994).

n117. Principle 15 of the Rio Declaration on Environment and Development [hereinafter Rio Declaration] states: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." Report of the United Nations Conference on Environment and Development: Rio Declaration on Environment and Development, U.N. GAOR, Annex I, U.N. Doc. A/CONF.151/26 (Vol. I) (1992) [hereinafter Rio Declaration], available at http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm.

n118. Regulations, supra note 17. Annex 4 in the Regulations has 29 sections in all, covering standard regulatory provisions such as

"Definitions" in Section 1, as well as more advanced planning contingencies such as the "Transfer of Rights and Obligations" in Section 22. Id. Annex 4.

n119. Report of the International Law Commission on the work of its Fifty-third session, U.N. GAOR, 56th Sess., Supp. No. 10, ch. V.E.1, U.N. Doc. A/56/10 (2001) [hereinafter ILC Report], available at http://www.un.org/law/ilc/texts/prevention/prevention_articles%28e%29.pdf.

n120. Id. art. 1.

n121. Report of the International Law Commission on the work of its Fifty-fourth session, U.N. GAOR, 57th Sess., Supp. No. 10, P 437, U.N. Doc. A/57/10 (2002), available at http://157.150.195.28/law/ilc/reports/2002/2002report.htm. See generally Thomas Gehring & Markus Jachtenfuchs, Liability for Transboundary Environmental Damage: Towards a General Liability Regime?, 4 Eur. J. Int'l L. 92 (1993), available at http://www.ejil.org/journal/Vol4/No1/index.html.

n122. ILC Report, supra note 119, arts. 2, 7, 9.

n123. Id. art. 2(a).

n124. Any change in Regulation 2, Section 2 on prospecting will also require an amendment to the language in Regulation 7, which requires notification to the Secretary-General when incidents occur that could cause serious harm to the environment. Regulations, supra note 17.

n125. ILC Report, supra note 119, art. 3.

n126. Id. art. 4.

n127. Regulations, supra note 17, Regulation 3, para. (4)(d)(i).

n128. ILC Report, supra note 119, art. 6.

n129. Regulations, supra note 17, Regulation 3, para. 1.

n130. ILC Report, supra note 119, art. 7.

n131. Id. art. 13.

n132. Id. art. 9, paras. 1-2.

n133. The specific language of Article 10 is as follows:

In order to achieve an equitable balance of interests as referred to in paragraph 2 of article 9, the States concerned shall take into account all relevant factors and circumstances, including:

The degree of risk of significant transboundary harm and of the availability of means of preventing such harm, or minimizing the risk thereof or repairing the harm;

The importance of the activity, taking into account its overall advantages of a social, economic and technical character for the State of origin in relation to the potential harm for the States likely to be affected;

The risk of significant harm to the environment and the availability of means of preventing such harm, or minimizing the risk thereof or restoring the environment;

The degree to which the State or origin and, as appropriate, the State likely to be affected are prepared to contribute to the costs of prevention;

The economic viability of the activity in relation to the costs of prevention and to the possibility of carrying out the activity elsewhere or by other means or replacing it with an alternative activity; [and]

The standards of prevention which the State likely to be affected applies to the same or comparable activities and the standards applied in comparable regional or international practice.

Id. art. 10.

n134. Id.

n135. Regulations, supra note 17, Regulation 3, para. 1.

n136. Id. Regulation 4, para. 4.

n137. Id. Regulation 5.

n138. Id. Regulation 7.

n139. Id. Regulation 2, para. 4.

n140. Id. Regulation 4, para. 5.

n141. Houston Putnam Lowry, Recent Developments in the International Law of the Sea, 35 Int'l Law. 787, 792 (2001).

n142. See Markussen, supra note 116, at 38.

n143. Id.

n144. See id.

n145. Deep Seabed Hard Mineral Resources Act, 30 U.S.C. 1401-1473 (2003) [hereinafter DSHMRA].

n146. Regulations, supra note 17, Regulation 1, para. (3)(b).

n147. Id. Regulations 9-22; see also id. Annex 2.

n148. See id. Regulations 23-30; see also id. Annexes 3-4.

n149. Id. Regulations 31-34.

n150. Id. Regulations 35-36.

n151. Id. Regulations 37-38.

n152. Id. Regulation 39.

n153. Id. Regulation 40.

n154. See id. Annexes 3-4.

n155. ISA Handbook, supra note 69, at 29-30. The exploration contracts that the ISA has executed are with the following parties: the Government of India (signed Mar. 25, 2002); Institut francais de recherche pour l' exploitation de la mer/Association francaise pour l'etude et la recherche des nodules (IFREMER/AFERNOD) (signed June 20, 2001); Deep Ocean Resources Development Company (DORD) of Japan (signed June 20, 2001); State Enterprise Yuzhmorgeologiya of the Russian Federation (signed Mar. 29, 2001); China Ocean Minerals Resources Research and Development Association (COMRA) of the People's Republic of China (signed May 22, 2001); Interoceanmetal Joint Organization (IOM), a consortium formed by Bulgaria, Cuba, Czech Republic, Poland, Russian Federation, and Slovakia (signed Mar. 29, 2001); The Government of the Republic of Korea (signed Apr. 27, 2001). Id.

n156. Regulations, supra note 17, Regulation 31, para. 4.

n157. Id.

n158. Id. Regulation 31, para. 3.

n159. Rio Declaration, supra note 117.

n160. In the Regulations, Annex 2 describes the requirements for an application plan of work for exploration to obtain a contract. Regulations, supra note 17, Annex 2. Section IV of Annex 2 describes the plan of work for exploration, and states in paragraph 24(d) that the

contractor must submit "[a] description of the proposed measures for the prevention, reduction and control of pollution and other hazards, as well as the possible impacts, to the marine environment." Id. Although requiring a description of pollution management measures arguably assists the ISA in evaluating an application for exploration contract, this section neither provides clarity on what the ISA requires in Regulation 31 Section 3, nor explains minimum threshold pollution control measures that contractors should meet. Hence, there is no substantive guidance found in Annex 2.

n161. Article 145 states:

Necessary measures shall be taken in accordance with this Convention with respect to activities in the Area to ensure effective protection for the marine environment from harmful effects which may arise from such activities. To this end the Authority shall adopt appropriate rules, regulations and procedures for inter alia:

(a) The prevention, reduction and control of pollution and other hazards to the marine environment, including the coastline, and of interference with the ecological balance of the marine environment, particular attention being paid to the need for protection from harmful effects of such activities as drilling, dredging, excavation, disposal of waste, construction and operation or maintenance of installations, pipelines and other devices related to such activities;

(b) The protection and conservation of the natural resources of the Area and the prevention of damage to the flora and fauna of the marine environment."

UNCLOS, supra note 13, art. 145.

n162. Id. art. 194, para. 1.

n163. See Churchill & Lowe, supra note 23, at 370-79. However, one must consider the situation that exists when a state has ratified UNCLOS, but is not a party to one of the bilateral or multilateral agreements addressing pollution. In this scenario, the rationale provided by Churchill and Lowe is specious. See Martin R. Lee, Marine Pollution, in Oceans & Coastal Resources: A Briefing Book (CRS Report 97-588 ENR, 1997), available at http://www.ncseonline.org/NLE/CRSReports/BriefingBooks/Oceans/r.cfm.

n164. Article 209 states:

1. International rules, regulations and procedures shall be established in accordance with Part XI to prevent, reduce and control pollution of the marine environment from activities in the Area. Such rules, regulations and procedures shall be re-examined from time to time as necessary.

2. Subject to the relevant provisions of this section, States shall adopt laws and regulations to prevent, reduce and control pollution of the

marine environment from activities in the Area undertaken by vessels, installations, structures and other devices flying their flag or of their registry or operating under their authority, as the case may be. The requirements of such laws and regulations shall be no less effective than the international rules, regulations and procedures referred to in paragraph 1.

UNCLOS, supra note 13, art. 209.

n165. In fact, the ISA is undertaking a comparative study in its quest to create a regulatory scheme for the prospecting and exploration of cobalt-rich crusts and polymetallic sulphides. See Information from relevant national legislation relating to issues associated with the draft regulations on prospecting and exploration for polymetallic sulphides and cobalt-rich crusts in the Area, U.N. International Seabed Authority Legal & Technical Commission, 9th Sess., U.N. Doc. ISBA/9/LTC/5 (2003), available at http://www.isa.org.jm/en/documents/9thSession/LTC/isba9LTC_5.pdf.

n166. DSHMRA, supra note 145, 1401-1472.

n167. E.g., Dictionary of Mining, Mineral, and Related Terms: Legislation Related to Mining and Minerals, at http://xmlwords.infomine.com/legislation.htm (last visited Jan. 10, 2005).

n168. Ocean Planning and Information System (OPIS) Southeast, National Oceanic and Atmospheric Administration Coastal Service Center, Legislative Summaries: Deep Seabed Hard Mineral Resources Act (30 U.S.C. 1441 et seq.), available at http://www.csc.noaa.gov/opis/html/summary/dshm.htm (last visited Jan. 10, 2005).

n169. Id.

n170. See id.

n171. Id.

n172. DSHMRA defines the term "exploration" as:

(A) Any at-sea observation and evaluation activity which has, as its objective, the establishment and documentation of:

(i) The nature, shape, concentration, location, and tenor of a hard mineral resource; and

(ii) The environmental, technical, and other appropriate factors which must be taken into account to achieve commercial recovery; and

(B) The taking from the deep seabed of such quantities of any hard mineral resource as are necessary for the design, fabrication, and testing of equipment which is intended to be used in the commercial recovery and processing of such resource.

DSHMRA, supra note 145, 1403(5).

n173. Id. 1403(12).

n174. See id. 1419.

n175. Id. 1419(b).

n176. Because the application requirements for contracts of exploration are contained in the Regulations, Annex 3, an amendment to Regulation 31, Section 3 will probably require modifications to the application for exploration. For instance, in Annex 3, paragraph 24(d), the ISA might consider adding language that states: If the measures the contractor chooses to utilize for pollution management do not embrace the best available technology, then the contractor shall provide a detailed explanation of why utilizing the best technology for pollution management is not justified at the present time. Moreover, the application details should include language that clarifies to the contractors that they will be under an ongoing duty to update the ISA as they adopt better technologies that come to market during the life of the contract.

n177. Regulations, supra note 17, Regulation 31, para. 4.

n178. Recommendations for the guidance of the contractors for the assessment of the possible environmental impacts arising from the exploration for polymetallic nodules in the Area, U.N. International Seabed Authority Legal & Technical Commission, 7th Sess., U.N. Doc.

ISBA/7/LTC/1/Rev.1 (2001) [hereinafter Environmental Guidelines], available at http://www.isa.org.jm/en/documents/7thSession/Ltc/isba7_ltc_1_Rev1.pdf.

n179. Id. III(A)(8).

n180. The ISA's Central Data Repository [hereinafter CDR] is available online. Int'l Seabed Auth., The ISA's Central Data Repository, available at http://www.cdr.isa.org.jm (last visited Jan. 10, 2005). Presently, there are databases online for polymetallic nodules, crusts, and sulphides. Id. The Secretariat is also planning to begin work on a digital atlas of the seabed area that will show boundaries, geological features, seafloor topography, and known mineral deposit locales. Press Release, Int'l Seabed Auth., Seabed Authority to Resume Study of Hydrothermal Sulphides and Cobalt Crusts, 28 July to 8 August, SEA/1777 (July 24, 2003), available at http://www.un.org/News/Press/docs/2003/sea1777.doc.htm.

n181. Status of the International Seabed Authority's central data repository on marine mineral resources, U.N. International Seabed Authority Legal & Technical Commission, 9th Sess., U.N. Doc. ISBA/9/LTC/3 (2003) [hereinafter Status of the ISA's CDR], available at http://www.isa.org.jm/en/documents/9thSession/LTC/isba9LTC_3.pdf.

n182. See Environmental Guidelines, supra note 178, III(A)(8).

n183. Id. IV(B).

n184. Regulations, supra note 17, Regulation 31, para. 4.

n185. In addition, one should recognize that mining not only disturbs the seabed floor's biological community, but it also has the potential to disrupt the ocean's surrounding ecosystem. Barbara Ellen Heim, Note, Exploring the Last Frontiers for Mineral Resources: A Comparison of International Law Regarding the Deep Seabed, Outer Space, and Antarctica, 23 Vand. J. Transnat'l L. 819, 824 (1990). For further reading on this topic, see Markussen, supra note 116, at 31-36.

n186. Dick Russell, Deep Blues: The Lowdown on Deep-Sea Mining, Amicus J., Winter 1988, at 25, 27.

n187. Id. at 29. For a brief overview of the four basic ways to mine, see ISA - Seabed Technology, supra note 92. For a more detailed understanding of mining techniques, see Yuwen Li, Transfer of Technology for Deep Sea-Bed Mining: The 1982 Law of the Sea Convention and Beyond 142-44 (1994).

n188. Russell, supra note 186, at 28 (quoting William J. Broad, The Universe Below: Discovering the Secrets of the Deep Sea 266 (1997)).

n189. For example, consider the complex baseline data requirements that contractors must contend with pursuant to the Environmental Guidelines, Section III(A)(8). To set up the environmental baseline in the exploration area as required under regulation 31, paragraph 4, the Contractor, utilizing the best available technology, shall collect data for the purpose of establishing the spatial and temporal variability, including:

(a) For physical oceanography;

(i) Collect information on the oceanographic condition, including the current, temperature and turbidity regimes, along the entire water column and particularly near the seafloor;

(ii) Adapt the current measurement program to the topography and regional hydrodynamic activity in the upper water column and on the sea surface;

(iii) Measure the currents and particulate matters at the depth of the forecasted discharge during the testing of collecting systems and equipment;

(iv) Measure the particle concentration to record distribution along the water column;

(b) For chemical oceanography: collect information on the water-column chemistry, including the water overlaying the nodules;

(c) For sediment properties: determine the basic properties of the sediment, including measurement of soil mechanics, to adequately characterize the surficial sediment deposits which are the potential source of deep-water plume; sample the sediment taking into account the variability of the sediment;

(d) For biological communities:

(i) Gather data on biological communities, taking samples representative of the variability of bottom topography, sediment characteristics, abundance and types of nodules;

(ii) Collect data on the seafloor communities specifically relating to megafauna, macrofauna, meiofauna, microfauna, nodule fauna and demersal scavengers;

(iii) Assess pelagic communities;

(iv) Record levels of trace metals found in dominant species;

(v) Record sightings of marine mammals, identifying the relevant species and behaviour;

(vi) Establish at least one station to evaluate temporal variations;

(e) For bioturbation: gather data of the mixing of sediments by organism;

(f) For sedimentation: gather data of the flux of materials from the upper water column into the deep sea.

Environmental Guidelines, supra note 178, III(A)(8). For further reading on the plethora of complex issues that surface when determining baselines in relation to polymetallic nodule exploration, see Deep Seabed Polymetallic Nodule Exploration: Development of Environmental Guidelines (Executive Summary), U.N. International Seabed Authority, U.N. Doc. ISA/99/02 (1988), available at http://www.isa.org.jm/en/publications/99_02_execsumm.pdf.

n190. For example, the ISA could choose to certify firms for contractor use such as ICF/EKO, which provides numerous environmental and related consulting services, including environmental consulting, environmental impact assessment, and environmental auditing, to various private and public clients in Russia. ICF/EKO, ICF/EKO - Environmental Consulting, at http://www.icfeko.ru/engnew/index.htm (last visited Jan. 10, 2005). ICF/EKO has provided services for numerous global clients, including the World Bank, European Bank for Reconstruction and Development, US Environmental Protection Agency, and several of the largest companies in Russia, including Gazprom, Tyumen Oil Company, and Alrosa. ICF/EKO, ICF/EKO - Clients, at http://www.icfeko.ru/engnew/clients.htm (last visited Jan. 10, 2005).

n191. See Environmental Guidelines, supra note 178, III(A).

n192. Id. V.

n193. Id. IV(B).

n194. Id. V.

n195. See Status of the ISA's CDR, supra note 181.

n196. See Lowry, supra note 141, at 792.

n197. Recall that the Enterprise has yet to be established, but will be the commercial arm of the ISA that is empowered to conduct exploration and exploitation activities on behalf of the international community. ISA - Structure and Functioning, supra note 46, at 4.

n198. Since 1998, the ISA has conducted a series of workshops on issues particularly related to deep seabed mining, with participation by internationally recognized scientists, experts, and researchers. Article 166 Report, supra note 50, X(C)(40). As a direct result of these technical workshops, the ISA is currently coordinating on a project with the University of Hawaii to further scientific understanding of the environment in the Clarion-Clipperton Fracture Zone. Id. X(C)(41). However, commercial scientists and academic researchers are obviously pursuing a variety of other activities, and the ISA may not have contact with these individuals via the workshops. For instance, in April of 2003 the U.S. and Japan signed a memorandum of cooperation for an Integrated Ocean Drilling Program (IODP). Press Release, Nat'l Science Foundation, United States and Japan Sign Memorandum of Cooperation for Integrated Ocean Drilling Program, NSF PR 03-41 (Apr. 22, 2003), available at http://www.nsf.gov/od/lpa/news/03/pr0341.htm. IODP will focus on the deep biosphere and sub-seafloor ocean, the processes and effects of environmental change, and solid earth cycles and geodynamics. Id. On the U.S. side, a commercial contractor will be involved with the program. Id. Hence, eventual access to commercial researchers that participate in such projects could prove invaluable to the ISA and the world community if their host organizations were certified as environmental auditors.

n199. See Lyle Glowka, Bioprospecting, Alien Invasive Species, and Hydrothermal Vents: Three Emerging Legal Issues in the Conservation and Sustainable Use of Biodiversity, 13 Tul. Envtl. L. J. 329, 352 (1999-2000).

n200. Int'l Seabed Auth., Cobalt-Rich Crusts 1 [hereinafter ISA - Cobalt-Rich Crusts], available at http://www.isa.org.jm/en/seabedarea/TechBrochures/ENG9.pdf (last visited Jan. 10, 2005).

n201. Id.

n202. Id. at 2.

n203. Id.

n204. Id.

n205. ISA - Marine Mineral Resources, supra note 83, at 2.

n206. Int'l Seabed Auth., Polymetallic Sulphides 1 [hereinafter ISA - Polymetallic Sulphides], available at http://www.isa.org.jm/en/seabedarea/TechBrochures/ENG8.pdf (last visited Jan. 10, 2005).

n207. Id.

n208. Id.

n209. Id.

n210. Id. Importantly, only about 5% of the seabed has been systematically explored. ISA - Marine Mineral Resources, supra note 83, at 2.

n211. ISA - Polymetallic Sulphides, supra note 206, at 1.

n212. See Summary Presentations on Polymetallic Massive Sulphide Deposits and Cobalt-Rich Ferromanganese Crusts, U.N. International Seabed Authority Assembly, 8th Sess., U.N. Doc. ISBA/8/A/1 (2002), available at http://www.isa.org.jm/en/documents/8thSession/Assembly/ISBA_8_A1.pdf.

n213. ISA - Cobalt-Rich Crusts, supra note 200, at 2.

n214. See id. at 3.

n215. Id.

n216. ISA - Polymetallic Sulphides, supra note 206, at 3.

n217. See ISA - Cobalt-Rich Crusts, supra note 200, at 3.

n218. Id.

n219. Id.

n220. Id.

n221. Id.

n222. See Elena M. McCarthy, International Regulation of Transboundary Pollutants: The Emerging Challenge of Ocean Noise, 6 Ocean & Coastal L. J. 257 (2001).

n223. Id. at 260.

n224. Id. at 281. There have been a number of studies focusing on the noise generated from oil and gas exploration. See R.S. Gales, Effects of Noise of Offshore Oil and Gas Operation on Marine Mammals: An Introductory Assessment (Naval Ocean Sys. Ctr. Tech. Rep. No. 844, 1982).

n225. Glowka, supra note 199, at 350.

n226. See Craig H. Allen, Protecting the Oceanic Gardens of Eden: International Law Issues in Deep-Sea Vent Resource Conservation and Management, 13 Geo. Int'l Envtl. L. Rev. 563, 573 (2001).

n227. Id. at 568.

n228. ISA - Polymetallic Sulphides, supra note 206, at 4.

n229. Id.

n230. Donald K. Anton, Law for the Sea's Biological Diversity, 36 Colum. J. Transnat'l L. 341, 351 (1997).

n231. ISA - Polymetallic Sulphides, supra note 206, at 1.

n232. Allen, supra note 226, at 582. See also ISA - Polymetallic Sulphides, supra note 206, at 1.

n233. Allen, supra note 226, at 582-83.

n234. Jochen Halfar & Rodney M. Fujita, Precautionary Management of Deep Sea Mining, 26 Marine Pol'y 103, 105 (2002), http://www.environmentaldefense.org/documents/736_DeepSeaMining.pdf.

n235. Allen, supra note 226, at 582.

n236. Halfar & Fujita, supra note 234, at 105.

n237. See Report to the 58th Session, supra note 112.

n238. ISA - Cobalt-Rich Crusts, supra note 200, at 4.

n239. Churchill & Lowe, supra note 23, at 253.

n240. UNCLOS, supra note 13, art. 56.

n241. See ISA - Cobalt-Rich Crusts, supra note 200, at 4.

n242. Marine Resources: An Ocean of Riches, in United Nations Convention on the Law of the Sea - 20th Anniversary (1982-2002), supra note 5, at 6. Presently, harvested marine minerals include offshore oil and gas, gold, tin, diamonds, sand, and gravel. Id.

n243. Article 166 Report, supra note 50, P 64.

n244. McCarthy, supra note 222, at 281.

n245. Facts and Figures About the Oceans: Did You Know?, supra note 5, at 14.