LEGAL, POLITICAL, AND INSTITUTIONAL IMPLICATIONS OF THE SEABED ASSESSMENT PROGRAM FOR RADIOACTIVE WASTE DISPOSAL

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DISCLAIMER

LEGAL, POLITICAL, AND INSTITUTIONAL IMPLICATIONS OF THE SEABED ASSESSMENT PROGRAM FOR RADIOACTIVE WASTE DISPOSAL

Sub-seabed disposal of high-level radioactive waste presents a complex set of political, legal, and institutional issues. While its exact status under international law remains uncertain, initial investigations show that this disposal concept is banned (at least beyond the pilot plant stage) under existent U.S. law. Past and continuing marine disposal practices complicate the political and institutional aspects of an inherently controversial concept; this is especially the case on the international level (see attached paper for details on legal, political, and institutional aspects). Yet it is still so early in the research and development process than any findings in the political, legal, and institutional arenas must be regarded as tentative. Much more complete analysis of the sub-seabed disposal concept must be done, and full comparative evaluations of all serious high-level radioactive wast disposal options should follow.

Containment within natural barriers forms the basis of this disposal program. Dilution and dispersal in the oceans underlies all past marine disposal practice. It is already crystal clear that the feasibility of eventually implementing some form of sub-seabed disposal program will be directly related to the extent to which it is perceived as similar to, or different from, past ocean disposal practices. It thus becomes legally and politically crucial to carefully differentiate between past or proposed dumping into the oceans and possible containment within the seabed. But past practice is not the only problem in this area.

British investigators of the concept of dumping vitrified high-level radioactive wastes onto the seabed are greatly complicating the international political situation for sub-seabed disposal. Using the cover of the International Seabed Disposal Program -

established jointly in 1976-1977 by Japan, France, the U.K. and the U.S. to assess the feasibility of containing radioactive waste underneath the sea floor - they are apparently attempting to establish high-level radioactive waste disposal onto the seabed as a viable option. This is, of course, completely at odds with both the early conclusion of the ERDA Seabed Assessment team that the water column cannot be relied on as a major barrier and the recent conclusion of the U.K.'s Royal Commission on Environmental Pollution that the two reasonable options for the permanent disposal of vitrified wastes are geologic formations on land and below the ocean floor. It is also completely impractical from the legal, political, and social viewpoints since early results in this area indicate that high-level waste dumping onto the seabed could never be a nationally or internationally acceptable option. This has been further confirmed by recent work at the International Atomic Energy Agency on regulating radioactive waste disposal at sea. Public and governmental association of an on-the-seabed dilution and dispersal option with the sub-seabed containment concept could thus pose a real political and legal problem for the ERDA Seabed Assessment Program and the International Seabed Disposal Program.

Nevertheless, the ERDA study of sub-seabed containment is contributing strongly to the concept of containment as an international guideline or rule for all radioactive waste disposal at sea. And all involved countries, except the U.K., are firmly behind the containment philosophy as the only alternative, at least for high-level materials. Another important implication of the U.S. ERDA Program is the potential availability of a high-level radioactive waste disposal option for nations which are unlikely to have any local alternative. Although it is still too early in this study to determine if international disposal sites in the deep seabed would be more or less politically and legally viable than land-based sites, it is now clear that even land-based sites for only local radioactive wastes will encounter very strong opposition in most countries. Finally, there is a possibility - which

merits additional investigation - that an international sub-seabed disposal site could become an important element of an international spent fuel storage (or reprocessing) facility designed for tighter control over the global circulation of plutonium.

SUB-SEABED DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTE: PREVENTION OR MANAGEMENT?

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INTRODUCTION

Decisions on nuclear energy development worldwide are increasingly driven by social rather than scientific issues. This seems to hold particularly well for radioactive waste management. Sub-seabed disposal of high-level waste could well follow this trend. It presents a complex web of national and international political, legal, institutional and social obstacles.

Yet some solution to the high-level waste disposal problem must be developed, including a way to deal with wastes from an increasing number of countries which are unlikely to have local options. And sub-seabed disposal - in areas beyond national jurisdictions - could offer some important opportunities for international cooperation on nuclear waste management, and perhaps also on nuclear non-proliferation.

Where do we stand at present on the national and international paths towards a sub-seabed option? For the past three years, a scientific and technical team has been exploring the possibility of emplacing and containing high-level radioactive waste within the deep seabed.[1] Although it is still early in the research process, the legal, political and institutional implications of the option have been under investigation since 1975.[2] Early initiation of United States policy planning in this area has led to the establishment of a joint R&D program with France, Japan, the U.K. and United States through the Nuclear Energy Agency.[3] We can say that the option is scientifically and technically plausible, but that it could turn out to be unworkable from a legal and political point of view. On the other hand, the national and international mechanisms exist that could, if judiciously set in motion, make it the most viable of all alternatives.

THE U.S. REGULATORY POSTURE

The United States, after many years of being a leading contributor to the pollution of the marine environment, has now taken a principal role in some fields involving its protection. This new interest took root in 1970, when the Council on Environmental Quality forwarded a report to former President Nixon.[4] This report served as the basis for national legislation and international proposals on the prevention of marine pollution by dumping. U.S. efforts in this regard were particularly intensive prior to the 1972 UN Conference on the Human Environment; one important result was the U.S. Marine Protection, Research, and Sanctuaries Act of October 23, 1972.[5]

Since the definition of "dumping" included in this act probably covers sub-seabed disposal of high-level radioactive waste and the act bans the transport to sea for dumping of high-level waste, this disposal method would seem to be banned for all U.S. vessels, as well as for foreign vessels loaded in American ports.[6] While the EPA has the authority under the act to issue permits for the dumping of low- and medium-level radioactive wastes, it has no similar control over high-level wastes.[7] Thus, Congress would have to amend the act, if the government decided to implement any form of sub-seabed disposal of high-level wastes. Whether or not Congress would have to limit its changes to the discretion provided in the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (ratified by the U.S. in April, 1974 and in force August, 1975) would depend on how the Convention's definition of "dumping" is interpreted vis-a-vis seabed disposal.[8]

Congressional intent in the area of the U.S. definition of dumping and its potential application to sub-seabed disposal is not clear. In the 1972 act Congress declares it to be U.S. policy "... to prevent or strictly limit the dumping into ocean waters of any material which would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities."[9]

But if sub-seabed disposal proves to be an accepted U.S. disposal option for high-level wastes, it will probably not be either "dumping into ocean waters" or a real threat to man or the environment. This is because it is a containment system, not an extension of past practice involving dilution and dispersal in the oceans.[10]

Yet Congress also established a goal of conducting research and "studies for the purpose of determining means of minimizing or ending all dumping of materials within five years of the effective date" of the act.[11] This comes due in October 1977. So if sub-seabed disposal is a form of dumping, and the intent is to end all dumping (the EPA interprets the intent to be strict regulation rather than elimination of dumping), Congress could be very hesitant to amend the act, especially for a material which is now completely banned.[12]

Conducting a major R&D program - but very low level when compared to the land-based program - on a concept which could not now be implemented under U.S. law raises some key issues. Should we be seriously pursuing this option given existing legal constraints? Is there a reasonable chance that Congress would support the necessary legislative changes if the idea turns out to be scientifically and technically sound? There may be some real advantages - from a social viewpoint - to having a legal ban on this high-level waste disposal option during the research and development process. Then, if the public and the Federal government eventually support use of seabed disposal, the required legal adjustments could be made as final decisions on the program were formulated. This cautious approach would also provide a clear signal of our wait and see intentions to other nations.

It is not clear whether an experimental high-level radioactive waste disposal project would constitute dumping if the wastes were emplaced in the deep seabed for testing in a retrievable condition. Such a pilot program would seem to be allowed by the act, which exempts from dumping "the intentional placement of any device..in the submerged land beneath such (ocean) waters, <u>for any purpose other than disposal</u>,

when such...emplacement is otherwise regulated by Federal or state law[13] or occurs pursuant to an authorized Federal or state program." The question would center on how "scientific research" and "disposal" were defined, based on such factors as the extent to which retrievability could be shown and the intent of the program at the time the unit was established.

ERDA is responsible, under the National Environmental Policy Act of 1969, for the environmental assessment of planned high-level waste disposal techniques. It must, the act states, "utilize a systematic, interdisciplinary approach, which will insure the integrated use of the natural and social sciences."[14]

Given the policy of the President's Council on Environmental Quality (that significant impacts outside of the U.S. must also be considered), ERDA's assessments will likely include the international implications of U.S. participation in a sub-seabed program.[15] A separate assessment would be expected for each potential site.

For domestic research and development programs, the timing of environmental impact statements must be "late enough in the development process to contain meaningful information, but early enough so that this information can practically serve as input in the decision-making process."[16] One implication of this requirement for sub-seabed disposal is that it will be assessed at an earlier stage of development (since it is not on the same time table as the land-based program) as one potential alternative or supplement to salt or rock disposal techniques. Its later time table also means that the NRC work on goal, criteria and standard formulation will probably be done in time to influence much of the program development (it now seems that land-based programs will be well advanced - perhaps to the point of final site selection - before NRC completes these efforts).

It is now clear that environmental assessment of high-level waste disposal programs must prevent the process of incremental decision-making for which the overall waste disposal program was recently criticized.[17] Forecasts are to be based on

predictions from present technology and developments that can be extrapolated from it.[18] Recognized errors from past programs must be avoided.

With respect to the dumping of non-high-level radioactive wastes into the sea, the NRC now has concurrent jurisdiction with the EPA based on a rule established by the old Atomic Energy Commission in 1971. The AEC stated that it would

> ...not approve any application for a license for disposal of licensed material at sea unless the applicant shows that sea disposal offers less harm to man or the environment than other practical alternative methods of disposal.[19]

This was a significant shift of the burden of proof to the disposing party, though it is unclear as to whether "sea disposal" would apply to sub-seabed emplacement. If Congress were to amend the Marine Protection, Research, and Sanctuaries Act to allow sub-seabed disposal, the existing regime for non-high-level materials might be extended to cover high-level wastes. Permission for such disposal would then be required from the NRC and the EPA.

Current NRC regulations, incidentally, now require that high-level radioactive waste be disposed of in a federal repository on federal land.[20] While the establishment of a U.S. owned repository in the deep seabed is out of the question, it is possible that an acceptable degree of control could be developed by a group of nations acting with or under an international organization. This is discussed further below in the section on future possiblities.

In the very new regulatory area of high-level radioactive waste disposal, it is not so much how present regulations read as what they will say after the NRC, EPA, and ERDA update them. This is especially true of the NRC's responsibility to license ERDA facilities for high-level waste disposal. According to recent testimony by NRC before the Joint Committee on Atomic Energy:

> New regulations will be structured to require conformance with a fixed set of minimum acceptable performance standards (technical, social, and environmental) for waste management activities, while providing for flexibility in technological approach.[21]

While specific criteria and standards for new regulations are still to be developed, recently proposed NRC goals include: 1) "isolation of radioactive wastes from man and his environment for sufficient periods to assure public health and safety, and preservation of environmental values"; and 2) reduction, to as low as reasonable achievable, of a) the risk to public health both from chronic exposure associated with waste management operations and possible accidental releases of radioactive materials from waste storage, processing, handling or disposal"; and reduction of b) "long-term commitments (land-use withdrawal, resource commitment, surveillance requirements, proliferations, etc.)"[22] Thus, the ultimate evaluation of the potential ERDA sub-seabed disposal concept by the NRC will be made with a specific set of technical, social, and environmental standards in mind.

The EPA interprets its role in this area to include the development of standards and criteria that will provide general guidance on environmental acceptability. In the case of seabed disposal, these standards and criteria would be employed by the NRC as an aid in evaluating the methodology, the sites selected, and the operational aspects.[23]

The EPA also has direct regulatory responsibility for issuing ocean disposal permits.[23(a)] So, if the Congress were to amend the Marine Protection, Research, and Sanctuaries Act of 1972 to allow ERDA to employ sub-seabed disposal of high-level wastes, the EPA would likely be given the permit-granting authority. Based on present work and trends within the EPA, the primary criterion for any decision on radioactive waste disposal in the marine environment, especially disposal of high-level

wastes, would be effective containment, outside the biosphere.[23(b)] The EPA can also be expected to play a major role in assessing public perception of the risks involved in high-level waste disposal options.

EPA and CEQ responses will strongly influence the ERDA process of developing environmental impact statements. Discussions of long-term alternative uses of proposed disposal areas, such as present and potential resource exploitation, will receive special attention.[23(c)]

Though now inadequate, the U.S. regulatory posture in this area is changing and building. Increasing regulatory input will be required for the development of an acceptable sub-seabed disposal option, but no immediate legal action should be necessary. Sub-seabed disposal is tightly constrained by existing and potential U.S. legal controls. But it is still too early to predict how adaptable these controls would or should be to new scientific and technical development. Decisions here should depend heavily on the extent of regional and international management and control which is developed over the international sub-seabed disposal program. U.S. legal restrictions certainly provide assurance of a full public debate prior to any national participation in a seabed disposal program.[23(d)]

THE INTERNATIONAL REGULATORY SITUATION

The definition of marine pollution that seems to have gained the widest international acceptance during the last five years includes:

> The introduction by man, directly or indirectly, of substances or energy into the marine environment that results, or is likely to result, in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fishing and other legitimate uses of the

sea, impairment of quality for use of sea water and reduction of amenities.[24]

Given that the containment system for radioactive wastes must conform to some acceptable performance level before sub-seabed disposal could become a viable option, the only way to label this as pollution might be as a "hindrance to marine activities." Yet effects on foreseeable potential uses of the seabed or oceans would appear to be minimal. The only essential ban would be on activities involving penetration of small areas of the seabed where wastes have been emplaced.

If we assume that seabed disposal of radioactive wastes would constitute pollution of the marine environment in some sense or other, it is important to determine what category of pollution would apply for purposes of regulation and control, or prevention. The negotiating text of the UN Law of the Sea Conference mentions three potentially relevant categories:

1. "Pollution from installations and devices used in the exploration and exploitation of the natural resources of the seabed and subsoil." This comes close to applying to sub-seabed disposal, but use of the area for high-level waste disposal would not, without some strain in interpretation, fall under resource exploitation.

2. "Pollution from all other installations and devices operating in the marine environment." This may be the closest to describing seabed disposal. It is a catchall to cover sources besides pollution from the continents, the atmosphere, vessels, dumping, and seabed exploitation.

3. "Release of toxic, harmful and noxious substances, especially those which are persistent, by dumping." This reintroduces the topic of the international dumping regime. Throughout 1971 and 1972 and particularly in preparation for the UN Conference on the Human Environment there was a strong push for an international agreement on ocean dumping. The outcome: the Convention on

> the Prevention of Marine Pollution by Dumping Wastes and Other Matter in the Oceans (London Convention) of December 29, 1972. With 15 ratifications, it entered into force on August 30, 1975, and by September 1976, twenty-nine countries had ratified or acceded to the Convention, including the United States, the Soviet Union, Britain, Canada, Mexico, Norway, Panama, and Spain.[25]

Though the "release of toxic...substances" would not apply to an acceptable containment system within the seabed, dumping may apply, depending on how nations interpret the London Convention. The Convention defined dumping as "any deliberate disposal at sea of wastes...from vessels...at sea".[26] There are at least two possible interpretations of the wording "at sea" in this context: 1) that it refers to the location of the disposing party, i.e., any disposal from vessels that are at sea constitutes dumping, regardless of whether there is any possibility of the wastes eventually reaching the water (thus, sub-seabed disposal would be dumping); and 2) that any disposal from vessels resulting in the discharge of wastes, whether containerized or not, into the water and/or onto the seabed constitutes dumping (sub-seabed disposal would not be dumping).

The London Convention assigned to the IAEA the task of defining high-level radioactive wastes that are unsuitable for dumping at sea. The first draft of the IAEA definition, since superseded, included the following comment on the sub-seabed disposal of wastes:

> Certain methods of radioactive waste disposal although not feasible at this time, may eventually be developed technically to the point of proposing the long-term isolation of wastes by emplacement beneath the seabed. Such methods should be evaluated as variations of deep geological burial on land and are excluded from the scope of this document because they will not contribute to the radioactivity of the sea.[27]

A series of three advisory group meetings, running from December 1976 to July 1977 will attempt to develop a more acceptable definition based on a revised oceanographic model.[28] Present intentions are to have a fully accepted definition of high-level waste unsuitable for dumping for submission to the IAEA Board of Governors and the parties to the London Convention in 1978.

Parties to the London Convention will exert influence over the revision process through their annual meetings and the permanent secretariat at the Intergovernmental Maritime Consultative Organization.

Another indication of how the London Convention definition on dumping will be interpreted can be drawn from the national dumping legislation passed by countries which have ratified the London Convention. The Canadian definition--"any deliberate disposal from ships...at sea of any substance"--would certainly include the seabed disposal of wastes. The wording of the British definition -- "permanently deposited in the sea" -- would clearly exclude seabed disposal. Earlier legislation from Finland, Norway, Sweden, and Denmark would not define seabed disposal as dumping because of the use of the phrase "disposal into, or in, the high seas". Finally, the European Economic Community (EEC) seems to be moving toward a definition that would exclude seabed disposal. They would consider "any deliberate disposal of substances and materials into the sea..." as constituting dumping.

Dumping thus may or may not include the sub-seabed disposal of radioactive waste under international law. If it does, more immediate international legal control is available, but if a group of nations later desire to use this disposal method, it could be difficult to amend the Convention. If it does not, the seeds for a new international control regime should be sown as sooon as possible. Legal development would have to keep pace with the science and technology. In any case, the risk of unilateral use by other countries seems to be held to a very low level by political as well as legal constraints. Governmental attitudes toward just

participating in an international research and development program on seabed disposal are very cautious.

INTERNATIONAL SEABED GUIDELINES

There are some guiding principles for use of the deep seabed that should help us in judging the international acceptability of nuclear waste disposal in this area. There is wide agreement among nearly all countries in the UN that the seabed beyond the limits of national jurisdiction (or "Area")[23(a)]: 1) should be managed internationally; 2) must be used in accordance with international law and the UN charter; 3) must be reserved for peaceful purposes; and 4) is the common heritage of mankind. These principles have been derived from the work of the UN General Assembley and have been reinforced during the third UN Conference on the Law of the Sea.

International management has so far been narrowly defined in Law of the Sea (LOS) negotiations due to an obsession with the issue of potential mining of manganese nodules. Though this part of the LOS negotiating test is unsettled, it appears certain that any International Seabed Authority would have jurisdiction only over "activities in the Area," or all exploration for, and exploitation of resources. Furthermore, the definition of resources would be limited to in situ minerals.

While waste disposal does not fall under exploiting minerals, there are three avenues by which an International Seabed Authority might acquire some role in potential sub-seabed program:

1. The general coverage of scientific research in the Area. A sub-seabed program would involve detailed work at each site for several years and some form of monitoring for longer periods. There is nothing in the very general coverage of the LOS negotiating text to date that would restrict this type of research.[29]

2. The need to protect the marine environment. The treaty to date offers only very specific coverage of harmful effects from "activities in the Area."

It appears that the International Seabed Authority will not receive, at least initially, a strong and comprehensive mandate to protect this section of the marine environment.[30]

3. An obligation to accommodate other activities in the marine environment with mining activities. Though the Authority will probably not be given jurisdiction here, this obligation means that use of any parts of the Area for sub-seabed disposal cannot unreasonably restrict other uses, including resource development.[31]

As referred to at the beginning of this section, the second guiding principle -- use of the seabed in accordance with international law and the UN charter -- is even less developed than that of international management. There is, however, a significant body of developing international law, including increasing evidence of a relatively high-level commitment to protect the marine environment. The basis of this developing law, largely contained in the results to date of the LOS conference, is the recent and reticent recognition by many states that

> a growing class of environmental problems, because they are regional or global in extent or because they affect the common international realm, will require extensive cooperation among nations and action by international organizations in the common interest.[32]

The ultimate disposal of high-level radioactive waste is clearly within this class of problems both because it is global in extent and because it could very well affect the "common interest" in various ways.

For all nations, the general obligations of marine environmental law as set forth in the LOS negotiating text are:

1. To protect and preserve the marine environment.
2. To take all necessary measures to ensure that pollution from incidents or activities under their jurisdiction or control does not spread beyond

areas of national sovereignty.

3. To take all necessary measures to prevent, reduce, and control marine pollution from any source.[33]

All nations may eventually be obliged to conform to the specific requirements of developing international environmental law. These requirements also would become immediate obligations for all states signing and ratifying any future Law of the Sea treaty.

A third guiding principle -- that use of the Area should be reserved for "peaceful purposes" -- remains undeveloped because of disagreement over interpretation. Certain countries would probably object to the disposing of high-level military wastes from weapons programs. However, there are pervasive health, safety, and nonproliferation reasons for treating all high-level waste as a unit.

The final principle--that the Area is the common heritage of mankind--is the least defined of all. Although it has never been formally accepted by the United States, there is agreement that this principle entails sharing potential mineral resources, furthering an international communal interest, and banning any national appropriation of the Area.

One possible legal and social implication of a sub-seabed program might be its effect on the "common international realm," which was mentioned in the preamble to the Stockholm Conference in 1972 with reference to the growing number of regional and global environmental problems. If a section of the Area were to be closed for resource exploitation, this might constitute national appropriation. It might then follow that specific consent from the international Seabed Authority, would be required because

> no individual member of the community can assert a claim or right to enjoy the benefits of this "resource" except pursuant to arrangements which that community has sanctioned.[34]

This goes considerably beyond the point to which the "common heritage" principle has been developed. So far, the applicable international arrangements consist of developing international standards to protect the Area from environmental damage, and a general commitment to its safe development and rational management.

Despite the relatively undeveloped nature of the international law governing use of the deep seabed, the ongoing law of the sea negotiations and state practice will eventually formulate and solidify rules. In the case of sub-seabed disposal of radioactive waste, strong political and diplomatic pressure can also be expected to restrict unilateral state actions in the interim. It now seems clear that a considerable degree of consent would be required from the international community before high-level radioactive waste could be emplaced within the deep seabed.

A LOOK INTO THE FUTURE

While adequate structures for implementation of an international sub-seabed program are lacking, there are useful regulatory and supervisory mechanisms that could help provide guidance. The task at home is to investigate the ways in which these existing mechanisms, or new ones, can be developed on a parallel basis with science and technology. One means of such structuring is to consider the feasible scenarios, or management models, under which a sub-seabed disposal program might be conducted. A useful matrix can be established by lining up the key characteristics of any such program with the likely actors (Table 1).

Four management models result (Table 2). The first (Model 1) involves the possibility that some form of sub-seabed disposal would be organized, operated, and regulated along corporate lines (with public as well as private management in most countries). The second (Model 2) is heavily governmental in nature, with some influence from internationally established standards and regulations. Next (Model 3), is a regional plan with joint financing, development, and regulation coordinated by an

Table 1

Likely actors

Key Characteristics		Corporation(s)	Governments(s)	Group(s) of governments	Large number of governments
	Source of financing	Corporate	Governmental/ corporate	Governmental/ regional	Governmental regional international
	Technical framework	Corporate	Governmental/ corporate	Governmental/ regional	Governmental regional international
	Source of standards and regulations	Corporate/ governmental	Governmental/ regional international	Governmental/ regional international	International/ regional Governmental
	Responsible and liable parties	Corporate/ governmental	Governmental	Governmental regional	Governmental/ regional international
	Institutional structures	Corporate/ governmental	Governmental	Regional/ international	International regional
	Source of enforcement and supervision	Corporate/ governmental	Governmental	Governmental/ regional	Regional/ international

Table 2

MODEL 1
Corporate

Largely corporate characteristics with significant governmental regulation if exclusively a private corporation.

MODEL 2
Governmental

Characteristics dominated by individual national governments; minimal direct regional/international influence.

MODEL 3
Regional

Joint financing, development, and regulation coordinated by regional (international) organization(s); regulatory and institutional aspects influenced directly by international agencies.

MODEL 4
International

Use of political and geographic international regions to coordinate broad international development, regulation, and control of sub-seabed disposal program; strong possibility of incorporation into broader international waste management or nonproliferation structure.

international body. Finally, there is an international structure (Model 4) that would make use of political and geographic international regions to coordinate joint development, regulation, and control of a sub-seabed disposal program.

The four models are complementary. It is quite conceivable, for example, that some form of corporate participation could be included in Models 2, 3, or 4. Moving from Model 1 toward the greater levels of international participation in Models 2, 3 and 4 should increase the probability of effective regulation and enforcement. It is impossible, however, to rule out a responsible unilateral action.

The evidence strongly suggests that a sub-seabed program could be prevented or delayed by several national or international enforcement tools. All of our earlier examples of marine disposal practice show the growing trend toward unilateral and international action to prevent the disposal of hazardous wastes in the oceans. This took place under pressure from national, regional, and international sources through various mechanisms.

In addition to the international dumping regime, a widely accepted Law of the Sea treaty could also prevent the use of sub-seabed disposal, especially in the form of Models 1 or 2. This might be accomplished through a ban on national appropriation of deep seabed areas or by interpreting the definition of pollution in such a way as to forbid sub-seabed disposal.

On the other hand, it seems that a sub-seabed program under Model 3 or 4 could be effectively supervised. Unprecedented levels of international cooperation in the specific area of radioactive waste disposal would be essential to implement such an effort. The basic expertise and structures for supervising such a cooperative program, however, either exist or are well within reach.

While the main problem would be reaching agreement among participating nations on essential provisions, a significant portion of a draft treaty could be derived from work done in the late 1950's and early 1960's on low-level radioactive waste disposal. These efforts led to very strong recommendations for regulating and controlling low-level radioactive waste disposal into the oceans. They included provisions for national

and international registration of all disposals, prior notification and consultation with affected nations and appropriate international bodies, and national international licensing of disposal practices and sites.[35] The recommendations also would sanction the IAEA to investigate and object to intended practices; assist nations with negotiations, site evaluation, and regulation and monitoring; monitor disposal operations and sites; and initiate certain penalties or sanctions.[36] Close coordination with the UN Environment Program (UNEP) in this area would be crucial. UNEP was established in 1973 under the UN General Assembly to coordinate and oversee the environmental programs of all UN and associated bodies.

This is the basic framework, minus some system of strict liability and financial guarantees and/or incentives and a joint commission at the regional or international agency level, that would be required to ensure the type of regulation and control envisioned in Model 4.

U.S. NUCLEAR POLICY

Given the new thrust of U.S. nuclear policy,[36(a)] there are crucial questions to be asked of sub-seabed disposal: Is it as acceptable as other options for a throwaway fuel cycle (spent fuel disposal); and how does it rank with other disposal options based on criteria for international arrangements to control plutonium? While it is still too early to really answer either, we can tentatively say that seabed disposal seems to be at least as acceptable as land-based options for handling spent fuel bundles and controlling plutonium. If the additional long-term heat problem created by the uranium and plutonium in spent fuel turns out to require wider spacing in the disposal media, this would drive certain costs, such as mining, of land-based options up considerably and would not affect this aspect of seabed disposal costs at all. Yet to date we do not know the full consequences of heating any of the potential high-level waste disposal media, and this is more important than potential costs.

Because one of the serious obstacles to developing an international spent fuel storage (and/or disposal) site is strong national opposition to accepting wastes, or even potential wastes, from many other countries, especially for disposal, the deep seabed could become an important part of an international effort to control plutonium. From the political viewpoint, Harvey Brooks finds seabed disposal to be the most attractive of the high-level waste disposal options.[35(b)] It is, however, still impossible to say what the exact U.S. and international political reaction to this concept will be.[36(c)]

INTERNATIONAL POLITICAL ACCEPTABILITY

The most vital factor in gaining international political acceptability may be the extent to which national governments comprehend and respond on the basis of the major difference between the future containment concept of a sub-seabed disposal program, and the past, present, and proposed disposal by dilution in the oceans. If the sub-seabed program is seen as another category of the geologic disposal option, it could eventually prove to be more acceptable than any land-based alternative.

Although the recent report of the (British) Royal Commission on Environmental Pollution states that geologic disposal under land or the seabed are the two reasonable options for high-level radioactive waste,[37] certain British investigators cling to the notion that it is probably safe to dump high-level wastes <u>onto</u> the seabed.[37] A broad international group of oceanographers working under the International Atomic Energy Agency has rejected the dilution and dispersal model on which this British work was based and has replaced it with a new oceanographic basis for regulating radioactive waste disposal at sea. British research proposals which were recently formulated also include study of <u>on</u> the seabed disposal.[38] This type of work will further blur the distinction, in public perception terms, between the philosophies of containment within the seabed and dilution and dispersal within the water column.

But U.S. study of sub-seabed possibilities seems to be contributing strongly to the growing movement toward a containment philosophy for all radioactive waste disposed of at sea.

Of the utmost importance to the political acceptance of a sub-seabed program is the extent to which it becomes an international effort. If there are a number of nations and some international agencies involved at the research and development (R&D) or pilot unit stage, the chances are greatly enhanced for building at least national and international acquiescence for this use of the seabed.

The largest international effort to date in this respect was the First International Workshop on the Seabed Disposal of High-Level Radioactive Wastes. It was sponsored by the NEA and ERDA at Woods Hole, Massachusetts, in February 1976. It turned out, as intended, to be a scientific and technical effort to map a potential international program for the investigation and assessment of seabed disposal. There were representatives at the workshop from Australia, Canada, France, West Germany Japan, the United States, Britain, the European Economic Community Commission, and the IAEA. France, Japan, and Britain have since indicated an interest in participating with the United States in a joint R&D effort.

A Second International Workshop on Seabed Disposal of Radioactive Waste was held on March 1-3, 1977, in Washington, D.C. A seabed working group and smaller task groups for each area of inquiry were established with individuals from France, Japan, the U.K. and the U.S. Results from national efforts will be exchanged and joint cruises and experiments will be encouraged. The establishment of a multilateral R&D program through the International Energy Agency (IEA) and Nuclear Energy Agency would be the most highly developed international cooperative effort to date on radioactive waste management.

Also important to the political acceptability of a sub-seabed program is the international organization through which it is conducted. Both the IEA and the NEA are regional groups of highly industrialized nations, bearing the stigma of definitive political associations. Therefore, any international sub-seabed program might best be developed outside the existing IEA/NEA framework.

Yet IEA/NEA framework already exists and functions in radioactive waste management. It has as members most of the countries which are seriously concerned about high-level waste disposal. And this mechanism is trusted by the countries with major commitments to nuclear energy programs.

Key to the adoption of such a program is the extent to which common ground can be developed between waste management and attempts to prevent the proliferation of nuclear weapons. (The management of spent fuel is affected by nonproliferation objectives and waste management may provide incentives for participation in nonproliferation arrangements.) The close interrelationship between these two areas of activity means that decisions made on nonproliferation matters could be vitally important to the acceptability of a sub-seabed program. If part or parts of the nuclear fuel cycle are internationalized, there could very well be at least one international waste disposal site.

If any of the nuclear powers harbor sites for international reprocessing facilities, there is a strong chance that some form of international waste disposal arrangement will be required. If reprocessing is either delayed or eliminated, there still will be strong incentive to establish an international spent fuel storage facility. This would then require some provision for conversion to a disposal site or other offsite arrangements for final waste disposal

CONCLUSION

The outcome, of course, will be determined largely by the national political stances taken toward a sub-seabed disposal program. Political and diplomatic responses from individual countries should be expected to be heavily influenced by the number, type, and timing of options available for high-level waste disposal.

The budgetary and institutional support Washington gives to the sub-seabed program will have a crucial influence on the progress of sub-seabed science and technology over the next three to five years. Despite the growing need of nations, such as Japan and Britain, for a high-level waste disposal option, a sub-seabed program will probably not be employed if it is not strongly funded and supported by the United States.

Clearly, there are enough level and political obstacles to destroy or delay a sub-seabed disposal program. The non-technical hurdles to seabed disposal at least equal the scientific and technical ones. But, on the other hand, there are important potential social and political benefits to be gained from any serious attempt to mount a successful sub-seabed program. These lie principally in international cooperation on waste management, environmental protection, nonproliferation of nuclear weapons, and governing the deep seabed.

While no permits for dumping radioactive wastes have been issued, since 1974 the EPA has conducted field studies - of the old U.S. radioactive waste dump sites - designed to amplify these requirements (see R. Dyer, "Ocean Disposal of Radioactive Wastes," 1 EPA Journal 7 (July/August 1975), at 4).

Any radioactive waste dumping would require a special permit via the following steps:

1. Site designation: draft EIS, public comment, and final EIS;

2. Completed application showing containment and isolation of radioactivity;

3. Newspaper publication, hearings, final permit decision; and

4. Site monitoring.

> The EPA concept of dumping envisions a system of containment on or in the ocean bottom rather than in dry land. The same rules for waste isolation should apply in the ocean as on the land... we see the ocean not as a waste dilution media but as a disposal location which will assure undisturbed isolation and containment. (Statement of W. D. Rowe, Deputy Assistant Administrator, EPA, before the Subcomm. on Energy and the Environment, Comm. on Interior and Insular Affairs, U.S. House of Representatives, July 26 and 27, 1976, Ser. no. 94-69.

Their development schedule for low-level waste dumping calls for site-selection criteria and monitoring requirements by 1978 and packaging criteria by 1979.

(c) Though only advisory in nature, the role of the National Academy of Sciences' Committee on Radioactive Waste Management will become important as a panel is established in 1977 to assume continuous oversight over sub-seabed disposal for the U.S. NRC.

(d) A number of Congressional hearings have already dealt with ERDA's sub-seabed disposal program; see, for example, Hearing on Matters Pertaining to Radiological Contamination of the Oceans, before the Subcommittee on Energy and Environment of the Comm. on Interior and Insular Affairs, U.S. House of Representatives, July 26 and 27, 1976, Ser. no. 94-69.

24. U.N. Doc. A/CONF.62/WP.8/Rev.1/Part III, Article 1 (emphasis added).

25. Id., Article 4.

26. Supra note 9, Article 3 (emphasis added)

27. I.A.E.A., GOV/1622, Appendix, at 7, Sept. 3, 1973.

28. I.A.E.A., INFCIRC/205/Add. 1, Jan 10, 1975, "Convention on the Prevention of Pollution by Dumping of Waste and Other Matter;" this provisional definition was determined to be legally binding by the Parties to the London Convention at their first consultative meeting (London, September 1976), despite the U.S.

REFERENCES

1. The most recent and concise statement of these efforts is contained in Oceanus 20 (1), Winter 1977

2. See D. A. Deese, "Seabed Emplacement and Political Reality," Oceanus 20 (1), Winter, 1977, p.47.

3. See D. R. Anderson, et al., ed., Report to the Radioactive Waste Management Committee on the First International Workshop on Seabed Disposal of High-Level Wastes, Woods Hole, Mass., Feb. 16-20, 1976 and Report to the NEA Radioactive Waste Management Committee on the Second International Workshop on Seabed Disposal of Radioactive Waste, Washington, D.C., March 1-3, 1977.

4. Council on Environmental Quality. 1970. Ocean Dumping: A National Policy. A Report to the President. Wash., D.C.: U.S. CEQ.

5. 33 U.S.C. ## 1401 et seq. (Supp. IV, 1974).

6. 33 U.S.C. # 1413(a) (Supp. IV, 1974).

7. 33 U.S.C. # 1412(a) (Supp. IV, 1974).

8. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Dec., 29, 1973; in force Aug. 30, 1975; in ILM 1291 (1972), [hereinafter cited as the London Convention]; the definition of dumping will be discussed below; the London Convention bans dumping of high-level wastes - as defined by International Atomic Energy Agenycy - at sea (Article 4 and Annex 1).

9. 33 U.S.C. # 1401(b) (Supp. IV, 1974).

10. Congress considered high-level radioactive wastes to "pose a hazard of unknown but substantial dimensions," H.R. REP. No. 361, 92d Cong., 1st Sess. 14 (1971), at 13. Since the reason for the ban on high-level waste dumping is in part a lack of knowledge, it could eventually be argued that sub-seabed disposal should be considered on its own merits, i.e., on the validity of its new scientific and technical findings.

11. 33 U.S.C. # 1443 (Supp. IV, 1974).

12. "It is our interpretation of the statute that it is the intent of the Congress that, with the exception of the prohibited materials, ocean dumping should not be banned, but should be strictly regulated." EPA Responses to Questions Submitted by Senate Committee on Commerce, Hearings on the Marine Protection, Research and Sanctuaries Act of 1972 before the Sub-Comm. on Oceans & Atmosphere of the Senate Comm. on Commerce 94th Cong., 1st Sess., ser. 32, at 29 (1975).

13. 33 U.S.C. # 1402 (f); this is the same exemption which, by implication, seems to define sub-seabed disposal as dumping.

14. 83 STAT. 853, Sec. 102(A).

15. United States: Council on Environmental Quality Memorandum to U.S. Agencies on Applying the Environmental Impact Statement Requirement to Environmental Impacts Abroad (September 24, 1976) in 15 ILM 1426 (1976).

16. 40 C.F.R. #1500.6(d) (2); factors to be used in deciding on the timing of program assessments "include the magnitude of Federal investment in the program, the likelihood of widespread application of the technology, the degree of environmental impact which would occur if the technology were widely applied, and the extent to which continued investment in the new technology is likely to restrict future alternatives." "Statements on technology research and development programs should include an analysis not only of alternative forms of the same technology that might reduce any adverse environmental impacts but also of alternative technologies that would serve the same function as the technology under consideration;" this guideline is originally from Scientists' Institute v. AEC(1975)-(need correct citation).

17. U.S. COA - Natural Resources Defense Council v. NRC, Nos. 74-1385 and 74-1586 (D.C. Circ. July 21, 1976), at 11, 12.

18. Id., at 9, 10.

19. 10 C.F.R. Sec. 20.302

20. For detailed coverage of the complex Federal and State regulatory situation for radioactive waste management, see M. Willrich, Radioactive Waste Management and Regulation (Report to the U.S. ERDA from the M.I.T. Energy Laboratory). 1976.

21. Statement of Marcus A. Rowden, Chairman U.S. NRC, Before the Joint Committee on Atomic Energy, May 12, 1976, on the Subject of Nuclear Waste Management, at 11.

22. Id., at 12.

23. Statement of Roger Strelow, Assistant Administrator for Air and Waste Management, EPA, Before the Subcommittee on ERDA, Environment, and Safety, Joint Committee on Atomic Energy, May 12, 1976, at 3, 4.

    (a) For EPA's final regulations governing the ocean dumping permit program, see 38 Fedl. Reg. 28609 (1973).

    (b) Under the Marine Protection, Research, and Sanctuaries Act of 1972, EPA's Office of Radiation Programs published the following two initial requirements for ocean dumping of non-prohibited wastes:

        1. Radioactive wastes should be containerized, and

        2. The wastes must radiodecay to innocuous levels within the life expectancy of the containers and/or their inert matrix.

position that revision would have to precede legal effectiveness. The underlying oceanographic model is now generally accepted to be inadequate and misleading in the direction of allowing much more dumping than can be reasonably demonstrated to be safe.

(a) The "Area" refers to the international seabed, or the seabed, ocean floor, and subsoil beyond the limits of national jurisdiction.

29. U.N. Doc. A/CONF.62/WP.8/Rev.1/Part I, Article 19.

30. Id., Articles 12, 31, 32.

31. Supra note 30, Article 16.

32. Report of the U.N. Conference on the Human Environment, U.N. Doc. A/CONF. 48/14 at 2-65, and Corr. 1 (1972), Preamble, para. 7.

33. Supra note 30, Articles 2, 4.

34. J. L. Hargrove, "Environment and the Third Conference on the Law of the Sea," in Hargrove, ed., Who Protects the Oceans? West, 1975, at 218.

35. As a result of the First Consultative Meeting of the Parties to the London Convention in September, 1976, the Secretariat (IMCO) recently conducted a study, in cooperation with the IAEA, the OECD, and other international organizations, of notification and prior consultation procedures for radioactive waste dumping. This was urged by Denmark, Sweden, Portugal, and Canada as a means to ensure that all possible land-based alternatives were adequately considered. Agreement now seems to be coming on a greatly improved multilateral document on prior notification and consultation procedures, including - for the first time - the prospect of a significant oversight role for the Nuclear Energy in the annual European radioactive waste dumping operations. The U.S. should lend strong support to the implementation of such procedures as a minimum concession to the countries which would prefer to end all radioactive waste dumping. In an even more stringent and widely accepted form, this is the type of system which would be essential to any sub-seabed disposal program.

36. These are actions which far exceed the present capabilities of IAEA - and the willingness of involved states, but urging from and coordination with other institutions (IMCO, UNEP and law of the sea mechanisms) and determined states with high-level waste problems might turn out to be more effective then the IAEA for managing and regulating sub-seabed disposal. Recent OECD work on controlling sea dumping operations would also be useful.

(a) See, for example, Statement by the President on Nuclear Policy of Oct. 27, 1976; the Ford Foundation report, Nuclear Power: Issues and Choices of April, 1977; and President Carter's recent statements on energy policy and nuclear energy. This apparently includes a new emphasis on the once defunct RSSF; see L. J. Carter, "Radioactive Wastes: Some Urgent Unfinished Business," 195 Science 666 (18 Feb. 1977).

(b) Denver meeting of July, 1976, last two pages of his paper.

(c) If a future U.S. breeder option is left open and U.S. reprocessing is deferred, the RSSF could be used to provide more time for work on final disposal options or to backup a land-based plan rejected on political or social grounds. This could end up killing the seabed program, because of a focus on one land-based option, or bringing the seabed program up to the same time scale as land-based programs, based on a delay in the ambitious goal to have a complete repository by 1985. Ultimately, the seabed option could also become a backup for a land-based program or an additional U.S. or international program.

37. Royal Commission on Environmental Pollution. 1976. Report on Nuclear Power and the Environment. London: British Government, at 150, 152, and 203.

38. Proposals for Research on the Aspects of Nuclear Power, the Natural Environmental Research Council. Jan. 1977. British Government.

39. Although it seems very unlikely, unilateral use of an on the seabed disposal plan for high-level radioactive waste by the British cannot be ruled out. The British Dumping at Sea Act of 1974 does not explicitly ban this, but it is clearly illegal under the London Convention of 1972 - to which Britain is a Party. Control over radioactive waste management, including disposal at sea, will apparently be shifted to the U.K.'s Department of the Environment under the upcoming White Paper on nuclear policy.

Nevertheless, all three high-level waste disposal options - under land, under the seabed, and on the seabed - will apparently be assessed for possible future use. This seems unwise in light of noted trends, including the statement by the Royal Commission on Environmental Pollution, note 38, that it appears doubtful whether direct ocean disposal of vitrified high-level wastes will be acceptable.