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LEGAL, POLITICAL, AND SCIENTIFIC RESPONSE TO OCEAN DUMPING AND SUB-SEABED DISPOSAL OF NUCLEAR WASTE

JAMES WACZEWSKI*

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I. INTRODUCTION

The oceans cover about seventy-one percent of the Earth's surface.[1] Just one century ago it would be hard to imagine that humans could significantly pollute these large bodies of water. But the great technological developments of the last one hundred years not only improved our lifestyles, but also gave us the ability to cause great damage to the environment, including the oceans.

Arguably, humanity's greatest threat to the oceans comes from the development of the nuclear industry since the discovery of fission in the late 1930s.[2] "In the [fifty-seven] years since the discovery of fission, nuclear power has become a major source of the world's electric energy."[3] By 1989, 416 nuclear power plants were in operation worldwide, providing approximately seventeen percent of the world's

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1. *See* Craig Amerigian & Michael T. Ledbetter, *Ocean and Sea, in* THE NEW GROLIER MULTIMEDIA ENCYCLOPEDIA 1 (1993).

2. *See* Kent F. Hansen, *Nuclear Energy, in* THE NEW GROLIER MULTIMEDIA ENCYCLOPEDIA 1, 2 (1993).

3. *Id.* at 4.

power generation.[4] Thirty-two nations rely on nuclear power plants as a source of electricity.[5]

The United States has the largest nuclear energy program in the world, with 108 operating plants producing more than twenty percent of U.S. electricity.[6] Other countries with extensive nuclear energy programs include France, Japan, Russia, Switzerland and others.[7] There are many uses for nuclear technology including medicine, research, and other industrial applications.[8] All of the above applications of nuclear technology produce a great amount of nuclear waste that remains radioactive for thousands of years and must be disposed of in a safe manner to avoid the radioactive contamination of this and future generations.[9]

For the purpose of disposal, nuclear wastes are divided into two main categories: low-level waste (LLW), which includes several substances used in connection with nuclear reactors, and high-level waste (HLW), which consists primarily of spent fuel from nuclear reactors and weapons, and take longer to degrade than LLWs.[10] Spent fuel, which constitutes most HLW, can be recycled by either chemical reprocessing or through partitioning and transmutation.[11] France and many other countries recycle extensively, but the United States has been slow in developing a program to reprocess spent nuclear fuel.[12]

Presently, most countries that produce nuclear waste agree that the oceans should be kept free from radioactive waste, and have, instead, opted to search for geological sites to bury their nuclear waste. Nevertheless, nuclear waste was and continues to be dumped into the oceans. Part II of this paper discusses the past and present use of the oceans as a dumping site for nuclear waste. Part III of this paper analyzes the international legal response to the problem of ocean dumping. Finally, part IV of this paper analyzes sub-seabed disposal, both sea-accessed and land-accessed, and the future role these options

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4. *See id.*
5. *See id.*
6. *See id.*
7. *See id.* at 7.
8. *See Nuclear Energy, in* 8 THE NEW ENCYCLOPAEDIA BRITANNICA 819, 820 (15th ed. 1993).
9. *See id.*
10. *See* David G. Spak, *The Need for a Ban on All Radioactive Waste Disposal in the Ocean*, 7 J. INT'L L. BUS. 803, 804 n.2 (1986).
11. *See* Mikhail Kh Khankhasayev & Hans S. Plendl, *Preface to the First Edition* of NUCLEAR METHODS FOR TRANSMUTATION OF NUCLEAR WASTE: PROBLEMS, PERSPECTIVES, COOPERATIVE RESEARCH, at v (Mikhail Kh Khankhasayev et al. eds., 1997). "Transmutation of nuclear waste means conversion of highly radioactive and toxic wastes containing long-lived radionuclides to low-level and short-lived nuclear wastes by means of nuclear technologies." *Id.*
12. *See* Betsy Tompkins, *High-level Waste*, NUCLEAR NEWS, June, 1992, at 78.

will play in the continuous relationship between the oceans and nuclear waste.

II. OCEAN DUMPING OF NUCLEAR WASTES

The United States began the practice of dumping nuclear waste into the oceans by dumping "an estimated 112,000 drums or containers at [thirty] sites in the Atlantic and Pacific Oceans before the Senate declared a moratorium on the activity in 1982."[13] In 1983, an international moratorium on ocean dumping was proclaimed, and a complete inventory of underwater radioactive waste was published, divulging that European countries (mainly the United Kingdom) had dumped about 150,000 metric tons of radioactive waste, between 1949 and 1982, in the Atlantic Ocean.[14] The United Kingdom continued dumping LLW into the ocean until 1983.[15]

The United States suspended ocean dumping in 1970, not for environmental reasons, but because this practice was not considered as economically efficient as other forms of disposal.[16] The Netherlands stopped dumping nuclear waste into the oceans in response to public opinion.[17] Japan, on the other hand, stopped its plan to dump wastes in the Pacific only after protests from countries near the disposal sites.[18] Presently, only Russia has refused to stop dumping nuclear waste into the oceans, but may do so soon.[19]

A. A Closer Look at Russia's Ocean Dumping

The Former Soviet Union (Russia), when creating its nuclear program, did not give special attention to finding solutions for the problems caused by the accumulation of radioactive waste.[20] The Soviet Union first dumped nuclear waste, 600 cubic meters of LLW, into the oceans in 1959.[21] In 1960, the Soviet Union began its practice of dumping liquid wastes; in 1964, it began dumping solid wastes as well.[22] Until 1992, the Russian Navy continued to regularly dump

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13. Ann MacLachlan, *French Lawmaker Wants Sea Dumps Added to Radwaste Inventories*, NUCLEONICS WK., Nov. 2, 1995, at 14.

14. *See id.*

15. *See All Signatories to London Convention Except Russia Accept Total Ban on Dumping*, INT'L ENV'T REP. CURRENT REP., Feb. 23, 1994, at 156 [hereinafter *Signatories*].

16. *See* Spak, *supra* note 10, at 819.

17. *See id.* at 820.

18. *See id.*

19. *See* Mark Hibbs, *Yeltsin Pledge on Waste Dumping Paved with Western Assistance*, NUCLEONICS WK., May 2, 1996, at 16.

20. *See* Jason H. Eaton, *Kicking the Habit: Russia's Addiction to Nuclear Waste Dumping at Sea*, 23 DENV. J. INT'L L. & POL'Y 287, 289 (1995).

21. *See id.* at 292.

22. *See id.*

solid radioactive waste, with its peak dumping period between 1967 and 1982.[23] However, the Russian Navy continues to dump liquid radioactive waste at sea because it lacks funds to build storage facilities on land.[24]

The Russian government, through the Interagency Commission on Environmental Security of the Russian Federation National Security Council, headed by former environmental adviser to President Boris Yeltsin, Alexei Yablokov,[25] issued a report (Yablokov Report) which attempted to document what the Soviet Union dumped into the Arctic and the Pacific Oceans from 1959 to 1992.[26] This report listed the following radioactive contamination sources disposed of by the Soviet Union in the Arctic Ocean:

- 13 submarine nuclear reactors
- 1 complete submarine K-27 with liquid metal cooled reactor
- 3 damaged reactors from icebreaker Lenin
- 7 of the above plants contain nuclear fuel
- over 17,000 containers of liquid and solid radioactive waste
- power plant and other nuclear process plants effluents into major rivers
- explosion fallout
- additional sources yet to be identified. [27]

According to the limited radionuclide data from the Russian Arctic available in 1993, the level of artificial nuclides in that area was low in comparison to other contaminated marine environments, such as the Irish Sea.[28] Further studies are being conducted by Russian scientists to assess the contamination in the Barents and Kara Seas from the sources mentioned above.[29] The Yablokov Report also determined that 2,500,000 curies of radioactive waste were dumped into the Arctic

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23. *See id.* No information is available about solid radioactive waste that Russia may have dumped after 1992. *See id.*

24. *See id.*

25. *See U.S. Lawmaker Calls for Consortium to Oversee Nuclear Waste Sites Worldwide*, INT'L ENV'T REP. CURRENT REP., Dec. 13, 1995, at 943 [hereinafter *Call for Consortium*]. For a critique of Professor Yablokov's work and the nuclear waste data he uses, see Alexander Shlyakhter & Richard Wilson, *The Myths of Yablakov* (visited Jan. 26, 1998) <http://www.wdn.com/asf/wilson1.html>.

26. *See Hearings on Nuclear Waste Disposal on the Arctic Region Before the Subcomm. on Oceanography, Gulf of Mexico, and the Outer Continental Shelf of the House Merchant Marine and Fisheries Comm.*, 103d. Cong. 40 (1993).

27. *Id.* at 32.

28. *See id.* at 35.

29. *See id.*

Ocean.[30] The full scope of the nuclear waste problem in Russia and its effect on the ocean are still uncertain. According to Alexei Yablokov, radioactive pollution on Russia's land and water is at least six billion curies, as compared to the fifteen curies pollution level from the Three Mile Island accident in the United States.[31]

Russia currently controls sixty percent of the world's nuclear reactors.[32] By the year 2000, Russia will have about 180 submarines awaiting decommission, with about 300 reactors waiting to be scrapped.[33] At its current decommissioning speed, it will take Russia several decades to complete the job.[34] The Russian storage facilities are almost filled to capacity, and there is no room for the radioactive waste produced by the Russian Navy.[35]

In 1993, Russia expelled 31,500 cubic feet of LLW into the Sea of Japan.[36] Because of international pressure, Prime Minister Victor Chernomyrdin announced shortly after this incident that Russia would stop dumping nuclear waste into the ocean.[37] Russia's Minister of Ecology, however, admitted that Russia would ultimately continue ocean dumping because it "has no alternative for disposing of some 700,000 cubic feet of liquid waste its navy alone accumulates every year."[38] In an effort to address international concern surrounding the inevitable fate of Russia's nuclear waste, Deputy Nuclear Energy Minister of Russia Nikolai Yegorov recently said in a 1996 press conference that "the situation with nuclear waste in the country is controllable, and is not catastrophic in an overall sense, although some regions are close to a catastrophic situation."[39] According to Yegorov, Russia is ready to stop dumping nuclear waste into the oceans, but it needs to be ensured of the international community's commitment to aid Russia in the building of storage areas and waste processing plants.[40]

Russia has used its "critical situation" and its continued dumping of nuclear waste into the oceans as a way to obtain foreign funds. Russian government leaders have hinted that Russia's ability to stop

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30. *See* Barbara Borst, *Environment: Arctic Nations Coordinate Fight Against Pollution*, INTER PRESS SERVICE, June 27, 1996.

31. *See Call for Consortium*, *supra* note 25.

32. *See* Eaton, *supra* note 20, at 290.

33. *See id.*

34. *See id.* at 291.

35. *See id.*

36. *See Signatories*, *supra* note 15, at 156.

37. *See id.*

38. *Id.*

39. Andrei Khalip, *Some Russian Nuclear Waste "Near Catastrophic,"* REUTER EUR. BUS. REP., April 19, 1996.

40. *See id.*

ocean dumping is dependent on the availability of international funds to help Russia build storage facilities.[41] Russia has been receiving help from northern European Countries, the United States, and Japan through the Program for the Handling of Liquid and Radioactive Wastes.[42] The United States appropriated ninety million dollars for Russia to construct a new long-term storage facility for radioactive materials from dismantled nuclear weapons in 1994 and pledged another fifty million dollars for other projects for the 1995-1996 fiscal year.[43]

In 1993, Russia's Ecology Minister Viktor Danilov-Danilian explained Russia's need for foreign aid in order to stop ocean dumping: "The only alternative to dumping at sea is processing liquid waste into solid substance . . . [and] Russia does not have a single processing plant in the Far East, the home base to its fleet of nuclear submarines which accounts for most of the waste, but is counting on international aid to help build one."[44] Russia's insistence on foreign aid as a prerequisite to discontinuing its dumping of radioactive waste into the oceans has evoked the criticism of many environmental groups.[45] "While Greenpeace recognizes Russia's need for Western aid to handle radioactive waste, dumping cannot be contingent on receiving that aid."[46] Nevertheless, Japan is working with Russia to build a liquid radioactive waste storage and processing plant in the Far Eastern region of Russia in an attempt to prevent Russia's future ocean dumping in that region.[47]

B. The Effects of Nuclear Waste Dumping on Ocean Ecosystems

All living organisms on our planet are subject to continuous background, or naturally occurring, radiation emanating from within the earth and space.[48] However, the radiation emanating from HLW and LLW is much higher than the natural level of exposure, and is

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41. *See Yeltsin Hosts G-7 for Nuclear Security Summit; Yeltsin: Russia Favors Joint Designing of Safe Nuclear Power Facilities, Is Adopting Nuclear Safety Laws, Aiming to Control Nuclear Dumping at Sea, Retrieving Nuclear Arms from CIS States, Dismantling Them, Building Repository; 500 Tons of Weapons Uranium to be Reprocessed*, CURRENT DIG. POST-SOVIET PRESS, May 15, 1996, at 1 (citing IZVESTIA, April 11, 1996, at 1-3).

42. *See id.*

43. *See* Kathleen Hart, *Clinton-Yeltsin Summit Yields Agreements on Nuclear Materials*, NUCLEAR FUEL, Oct. 10, 1994, at 20.

44. *Russia Halts Nuclear Waste Dumping, Seeks Foreign Aid to Build Processing Plant*, INT'L ENV'T REP. CURRENT REP., Nov. 3, 1993, at 802.

45. *See id.*

46. *Id.* (quoting Joshua Handler, Greenpeace's nuclear specialist in Moscow).

47. *See The Moscow Summit on Nuclear Safety and Security*, BELLONA, Apr. 1996, (Oct. 6, 1997) <http://www.mofa.go.jp/energy/summit.html>.

48. *See* Eaton, *supra* note 20, at 294.

harmful to life.[49] The effect of ocean dumping of nuclear waste on the ocean ecosystems, and ultimately on humankind, is a question many scientists are still trying to answer.[50]

Some nations argue that not enough is known about the possible effects that oceanic radioactive waste disposal has on ocean ecosystems to conclude that the ocean is a viable disposal site for radioactive wastes.[51] These nations argue that until scientists are certain that ocean dumping of radioactive wastes is safe, such practices should be banned.[52] There is international recognition of the danger nuclear waste poses as a marine pollutant because of its long life and its ability to concentrate in some parts of the ecosystem, including fish, plants, and other organisms.[53] The ecological effects of such radioactive accumulations are hazardous to human health.[54] On the other hand, the Russian Government argues that ocean dumping does not pose a danger to anyone, and that if it is unable to find means to build radioactive waste processing plants on shore, Russia will be forced to continue discharging radioactive waste into the sea.[55] The United Kingdom agrees, according to Agriculture Minister Gillian Shephard who said that controlled dumping "causes no harm to the marine environment and poses no threat to human health."[56]

A recent scientific study sponsored by Japan, Russia, and South Korea, found radioactivity to be within normal background levels at dumping sites in the Sea of Japan.[57] A study sponsored by the OECD Nuclear Energy Agency's (NEA) waste management committee concluded that the dumping conducted since 1982 in the northeast Atlantic Ocean will not cause radiological problems to the environment or to humans.[58] Several studies are under way to determine the effects of Russia's dumping of nuclear waste into the Arctic Ocean. The North

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49. All research groups that study radiation hazards agree that radiation damage should be considered to be directly proportional to the dose of exposure. No level of exposure is considered risk-free, including exposure to background radiation. *See* Glenn Paulson, *Nuclear Energy: Environmental and Health Hazards*, *in* 20 ENCYCLOPEDIA AMERICANA, 511h, 511t (1979).

50. *See* Eaton, *supra* note 20, at 294.

51. *See* Spak, *supra* note 10, at 804-05.

52. *See* Eaton, *supra* note 20, at 295.

53. *See* Paulson, *supra* note 49, at 511t.

54. *See* Spak, *supra* note 10, at 814.

55. *See Pacific Fleet Commander Denies Japanese Submarine Radiation Danger Story*, BBC SUMMARY OF WORLD BROADCASTS, Apr. 23, 1994 (translating ITARTASS, 0136 GTM, Apr. 22, 1994), *available in* LEXIS, World Library, BBCSWB File (statement of Vice Admiral Georgiy Gurinov).

56. *Signatories*, *supra* note 15, at 156. However, the United Kingdom realized that dumping was impractical and therefore accepted the ban. *See id.*

57. *See Okean Expedition Find no Ecological Damage from Nuclear Waste Dumping*, BBC SUMMARY OF WORLD BROADCASTS, Apr. 29, 1994 (translating Russian broadcast from Vladivostok, 0715 GMT, Apr. 20, 1994), *available in* LEXIS, World Library, BBCSWB File.

58. *See France*, NUCLEAR FUEL, May 6, 1985, at 13.

Atlantic Treaty Organization (NATO) is also studying the effects of military radioactive pollution on the oceans.[59] Depending on the result of these studies, scientific evidence may actually help Russia, the United Kingdom, Belgium, and other countries that support ocean dumping, change the general international consensus, and raise support for continued "controlled" ocean dumping of radioactive wastes.

III. INTERNATIONAL RESPONSE TO OCEAN DUMPING OF RADIOACTIVE WASTE

The First United Nations Conference on the Law of the Sea[60] (UNCLOS I) in 1958 produced the first major global treaty addressing ocean dumping of radioactive waste.[61] The Geneva Convention on the High Seas required states to take measures to prevent pollution of the seas from the dumping of radioactive waste.[62] However, the High Seas Convention failed to ban disposal of radioactive waste into the oceans.[63] In 1972, the international community directly addressed this failure in the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, also known as the London Convention.[64] The dumping of nuclear waste has since been governed by the London Convention.[65]

A. The London Convention (1972-1996)

The London Convention entered into force on August 30, 1975.[66] As of 1994, seventy-two countries, including the countries that produce most of the nuclear waste, were members of the London Convention.[67] These countries include the United States, United Kingdom, Russia, Norway, France, Japan, and Belgium.[68] The convention prohibits or limits the dumping of specified pollutants into the oceans, including

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59. *See* Eaton, *supra* note 20, at 295.

60. The First United Nations Conference on the Law of the Sea, April 29, 1958, 450 U.N.T.S. 11.

61. *See* Spak, *supra* note 10, at 806.

62. *See* Geneva Convention on the High Seas, April 29, 1958, 13 U.S.T. 2312, T.I.A.S. No. 5200, 450 U.N.T.S. 82.

63. *See* Spak, *supra* note 10, at 808.

64. *See* Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention), Dec. 29, 1972, 26 U.S.T. 2403, T.I.A.S. No. 8165, 11 I.L.M. 1294 [hereinafter London Convention]. In the United States, ocean dumping is regulated by the Marine Protection, Research, and Sanctuaries Act (Ocean Dumping Act), 33 U.S.C. §§ 1401-1445 (1997 Supp.).

65. *See* London Convention, *supra* note 64; *see also* Eaton, *supra* note 20, at 296.

66. *See* 4 United States Treaties Index 42, 42-43 (1991).

67. See Pearl Marshall, *U.K., China Agree to Abide by London Convention Sea Dump Ban*, NUCLEONICS WK., Feb. 24, 1994, at 14.

68. *See id.*; *see also* Eaton, *supra* note 20, at 296 ("Russia accepted the convention as part of its assumption of the USSR's obligations.").

EEZs and territorial seas, but does not prohibit dumping in internal waters.[69] The convention prohibits dumping of all substances it lists in Annex I, the "black list" of pollutants, and requires the issue of special permits by the flag state for the dumping of wastes it lists in Annex II, the "grey list" of pollutants.[70] The dumping of HLW, which is listed in Annex I, is therefore banned by the London Convention.[71] Low-level wastes, however, were originally listed in Annex II, meaning that LLW could continue to be dumped by member states, "but only after careful analysis and impact studies are completed and special permits are issued by the IAEA [International Atomic Energy Agency[72]] . . . and recorded under the convention."[73] The convention left it for the IAEA to define what constituted HLW or LLW.[74]

Since the early 1980s, the London Convention appears to have been influenced by the Principle of Precautionary Action.[75] The Principle of Precautionary Action is an important doctrine of environmental policy "that provides a conservative basis from which to solve future problems."[76] This principle should be applied when possible damage to the ocean ecosystems or human health may be serious, because to wait for complete clarification of scientific uncertainties would be irresponsible.[77] Dr. Lothar Gundling has proposed the following understanding of the precautionary principle, which represents an emerging standard of customary international law:

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69. *See* Robert A. Kaplan, Comment, *Into the Abyss: International Regulation of Subseabed Nuclear Waste Disposal*, 139 U. PA. L. REV. 769, 777 (1991).

70. *See id.* at 778.

71. *See id.*

72. The IAEA maintains a register of the releases of radioactive substances into surface waters, and establishes guidelines regarding the dumping and transportation of nuclear wastes. *See* LYNTON KEITH CALDWELL, INTERNATIONAL ENVIRONMENTAL POLICY: EMERGENCE AND DIMENSIONS 281 (2d ed. 1990). The IAEA was established pursuant to a 1954 U.N. General Assembly resolution [810(IX)], and, together with the U.N., has built a comprehensive network of global nuclear cooperation in the areas of international security, social development, and the environment.

> The Agency undertakes to conduct its activities in accordance with the Purposes and Principles of the United Nations Charter to promote peace and international co-operation, and in conformity with policies of the United Nations furthering the establishment of safeguarded world-wide disarmament and in conformity with any international agreements entered into pursuant to such policies.

Sheel Kant Sharma, *The IAEA and the UN Family: Networks of Nuclear Co-operation*, IAEA BULL. (1994).

73. Spak, *supra* note 10, at 811.

74. *See id.* at nn. 70 & 71.

75. *See* FREEDOM FOR THE SEAS IN THE 21ST CENTURY: OCEAN GOVERNANCE AND ENVIRONMENTAL HARMONY 316-17 (Jon M. Van Dyke et al. eds.,1993) [hereinafter FREEDOM FOR THE SEAS].

76. *Id.* at 316.

77. *See id.*

> "Precautionary action" is a more stringent form of preventive environmental policy. It is more than repair of damage or prevention of risks. Precautionary action requires reduction and prevention of environmental impacts irrespective of the existence of risks. This, however, must not be understood in the sense that aspects of risks are not relevant; the crucial point is that environmental impacts are reduced or prevented even before the threshold of risks is reached. This means that precautionary action must be taken to ensure that the loading capacity of the environment is not exhausted, and it also requires action even if risks are not yet certain but only probable, or, even less, not excluded.[78]

In 1983, the members of the London Convention present during that year's meeting voted for a suspension of all radioactive dumping pending completion of an expert's study.[79] This study proved inconclusive, and in 1985, overriding the United States, Britain, and four other countries, delegates of the London Convention voted to continue an indefinite suspension of radioactive waste dumping at sea.[80] The resolution called for further studies on the effects of radioactive waste dumping at sea.[81] The spirit of the Precautionary Principle apparently influenced the delegates.

Observers of that year's consultative meeting said that it appeared a positive vote on ocean dumping of radioactive wastes would only come about if proponents proved with certainty that sea-dumping was not harmful to humans or the environment.[82] "It is clear [the convention delegates] have accepted that the burden of proof is on harmlessness."[83] A proposal to permanently ban all radioactive waste dumping, however, was defeated at that meeting.[84]

On November 12, 1993, at the Sixteenth Consultative Meeting of Contracting Parties to the London Convention, a formal total ban on ocean dumping of radioactive waste was finally adopted.[85] The United Kingdom, Belgium, France, China, and Russia abstained from voting on this resolution.[86] Of the five countries that abstained, only Russia

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78. Lothar Gundling, *The Status in International Law of the Principle of Precautionary Action*, 5 INT'L J. ESTUARINEN & COASTAL L. 23, 26 (1990).

79. *See* Stephanie Cooke, *London Convention Votes to Continue Ban on Radwaste Dumping at Sea*, NUCLEONICS WK., Oct. 3, 1985, at 7.

80. *See id.*

81. *See id.*

82. *See id.*

83. *Id.*

84. *See id.*

85. *See Signatories*, *supra* note 15.

86. *See id.*

has not yet accepted the total ban on radioactive waste disposal at sea.[87]

The Soviet Union was a signatory to the 1972 London Convention, and Russia accepted the convention in its assumption of the USSR's obligations.[88] Russia recognizes that its practice of dumping radioactive waste in the ocean violates the London Convention.[89] Additionally, Russia is a member of the Convention on the Protection of the Black Sea Against Pollution,[90] banning radioactive waste dumping into the Black Sea. However, on February 18, 1994, Russia deposited its reservation to the London Convention's 1993 ban on all dumping of radioactive waste.[91] Therefore, Russia is not bound by the London Convention's amendment. The world is still waiting for President Yeltsin to fulfill his pledge to sign the London Convention's ban of all nuclear waste dumping.[92] On April 20, 1996, Russia signed the Moscow Nuclear Safety and Security Summit Declaration.[93] This declaration included a provision stating that the signatories "commit [themselves] to ban dumping at sea of radioactive waste and encourage all states to adhere at an earliest possible date to the 1993 amendment to the London Convention."[94]

B. The Third United Nations Conference on the Law of the Sea

Another major international treaty that addresses ocean dumping of radioactive waste, although in more general terms, is the United Nations Convention on the Law of the Sea (UNCLOS).[95] UNCLOS

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87. *See id.*
88. *See* Eaton, *supra* note 20, at 296.
89. *See id.*
90. Convention on the Protection of the Black Sea against Pollution, 32 I.L.M. 1110 (1993).
91. *See Signatories*, *supra* note 15. Article XV of the London Convention states:

> An amendment shall enter into force for the Parties which have accepted . . . . [A]mendments to the Annexes approved by a two-thirds majority of those present at a meeting called in accordance with Article XIV shall enter into force for each Contracting Party immediately on notification of its acceptance to the Organisation and 100 days after approval by the meeting for all other Parties except for those which before the end of the100 days make a declaration that they are not able to accept the amendment at that time. . . . A Party may at any time substitute an acceptance for a previous declaration of objection and the amendment previously objected to shall thereupon enter into force for that party. An acceptance or declaration of objection under this Article shall be made by the deposit of an instrument with the Organisation.

London Convention, *supra* note 64, 26 U.S.T. at 2413.
92. *See* Hibbs, *supra* note 19.
93. *Moscow Nuclear Safety and Security Summit Declaration*, BELLONA, Apr. 20, 1996.
94. *Id.*
95. Third United Nations Conference on the Law of the Sea, December 10, 1982, 21 I.L.M. 1261 [hereinafter UNCLOS].

was signed by the United States on July 29, 1994.[96] The Convention finally entered into force on November 16, 1994.[97] UNCLOS is "the strongest comprehensive environmental treaty now in existence or likely to emerge for quite some time."[98] Part XII of UNCLOS addresses all sources of marine pollution, such as pollution from vessels, seabed activities, ocean dumping, and land-based sources; and establishes, for the first time, "a comprehensive legal framework for the protection and preservation of the marine environment."[99] The general environmental purpose of UNCLOS is to prevent and reduce pollution of the marine environment from any source.[100] UNCLOS broadly defines such pollution as

> the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, 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.[101]

Although the definition does not explicitly mention radioactive waste, there is no doubt that this broad definition also covers nuclear waste. The member-states have several obligations regarding the marine environment under UNCLOS.[102] Article 192 establishes the legal duty of all parties to protect and preserve the marine environment.[103] Articles 192 through 196 require states, *inter alia*, to adopt pollution control measures to ensure that activities under their control are conducted so as not to cause environmental damage to other States or result in the spread of pollution beyond their own offshore zones.[104] According to President William J. Clinton, "the Convention promotes continuing improvement in the health of the world's oceans."[105]

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96. *See Message from the President of the United States and Commentary Accompanying the United Nations Convention on the Law of the Sea and the Agreement Relating to the Implementation of Part XI Upon Their Transmittal to the United States Senate for its Advice and Consent*, 7 GEO. INT'L ENVTL. L. REV. 77 (1994) [hereinafter *Message*].

97. *See id.*

98. *Id.* at 120.

99. *Id.*

100. *See* Spak, *supra* note 10, at 816.

101. UNCLOS, *supra* note 95, at 1271.

102. *See id.*

103. *See id.* at 1308.

104. *See id.*

105. *Message*, *supra* note 96, at 78.

C. *The 1996 Protocol to the London Convention*

In a special meeting of the contracting parties to the London Convention, between October 28 and November 8, 1996, the 1996 Protocol to the 1972 London Convention [Protocol] was adopted.[106] When the Protocol enters into force, it will supersede the London Convention as between the Contracting Parties to the Protocol that are also Parties to the London Convention.[107] Among the seventy-two parties contracting to the 1972 London Convention, only forty-three states actually participated in the special meeting including the United States, Russian Federation, United Kingdom, Norway, France, Japan, and Germany.[108]

According to Article 4 of the Protocol, "Contracting Parties shall prohibit the dumping of any wastes or other matter with the exception of those listed in Annex I."[109] Annex I provides a list of materials that may be considered for ocean dumping, but also adds that materials containing radioactivity levels greater than *de minimis* concentrations, as defined by the IAEA,

> shall not be considered eligible for dumping; provided further that within 25 years of 20 February 1994, and at each 25 year interval thereafter, Contracting Parties shall complete a scientific study relating to all radioactive wastes and other radioactive matter other than high level wastes or matter, taking into account such other factors as Contracting Parties consider appropriate and shall review the prohibition on dumping of such substances in accordance with the procedures set forth in article 22.[110]

As a result, ocean dumping of both HLW and LLW will still be prohibited for at least the next twenty-two years if the Protocol enters into force.

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106. 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 and Resolutions Adopted by the Special Meeting, November 7, 1996, 36 I.L.M. 1 (1997) [hereinafter Protocol]. "This Protocol shall be open for signature by any State at the Headquarters of the [International Maritime Organization] from [April 1], 1997 to [March 31], 1998 and shall thereafter remain open for accession by any State." *Id.* art. 24. "This Protocol shall enter into force on the thirtieth day following the date on which at least 26 States have expressed their consent to be bound by this Protocol" (at least 15 of these must have been Contracting Parties to the London Convention). *Id.* art. 25.

107. *See id.* art. 23.

108. *See id.* art. 4.

109. Protocol, *supra* note 106.

110. *Id.* at annex 1. Article 22(2) states:

> Amendments to the Annexes [I and II] . . . will be based on scientific or technical considerations and may take into account legal, social and economic factors as appropriate. Such amendments shall be adopted by a two-thirds majority vote of the Contracting Parties present and voting at a Meeting of Contracting Parties or Special Meeting of Contracting Parties designated for this purpose.

Id. art. 22.

IV. THE FUTURE OF RADIOACTIVE WASTE DISPOSAL IN THE OCEANS

Although all parties of the London Convention may soon adhere to the ban on all radioactive waste dumping into the oceans, the threat radioactive waste poses to the oceans will not be over. Most of the current land-disposal options, particularly the proposed radioactive waste dump site at Yucca Mountain, Nevada,[111] face many complex legal and political obstacles.[112] Many of the countries that have agreed to comply with the ban, such as the United Kingdom, still support ocean disposal.[113] Additionally, several questions remain concerning the London Convention's applicability to alternative ways of disposing nuclear waste into the oceans. These alternatives include sub-seabed disposal or "deep ocean isolation," and seabed disposal via a land-based tunnel.

A. Sub-seabed Disposal of Nuclear Waste

"What better place to bury high-level nuclear wastes than deep in the mud of remote, geologically inert ocean sites? . . . That the world's 30 nuclear-power nations aren't considering sub-seabed disposal is more a matter of political timidity than of scientific difficulties or valid environmental concerns."[114]

Sub-seabed disposal does seem to be a feasible way to dispose of nuclear waste. Some of the reasons given by scientists to support this technology are: 1) the vast depth of the water column isolates from humans radionuclides that may leak from the site; 2) the ocean contains some of the most stable geological formations on earth; and 3) these sites contain thick layers of ocean sediments that bond with radionuclides to immobilize them.[115] The areas where sub-seabed

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111. In 1987, Congress directed the DOE to study the feasibility of a desert ridge called Yucca Mountain, about 100 miles northwest of Las Vegas, as the site for a permanent disposal site for the nation's nuclear waste. *See* Curt Suplee, *A Nuclear Problem Keeps Growing; Finding a Site to Hold High-Level Radioactive Waste Vexes Nation*, WASH. POST, Dec. 31, 1995, at A1. The site faces strong opposition from many scientists, however, who are concerned that the water table beneath the mountain could rise and permeate the repository, contaminating the water and allowing radioactivity to leak. *See id.* Others argue that the site is unsafe because of the risk of earthquakes in the area (the mountain lies near active seismic faults and a volcano that erupted less than 10,000 years ago). *See id.*; *see also* Steven Nadis, *The Environment—The Sub-Seabed Solution*, ATLANTIC MONTHLY, Oct. 1996, at 3. In 1996, Congress required that a viability assessment be completed by 1998, but the DOE emphasizes that it will not be ready, yet, to make a positive site recommendation. *See* Remarks by Dr. Daniel A. Dreyfus, Director, Office of Civilian Radioactive Waste Management, DOE, *Program Status and Outlook*, Oct. 9, 1996.

112. *See Wastes and Hazardous Substances Nuclear Waste Roundup*, GREENWIRE, Nov. 2, 1994 [hereinafter *Wastes*].

113. *See Signatories*, *supra* note 15.

114. *Wastes*, *supra* note 112 (quoting Michael Stachell).

115. *See* Kaplan, *supra* note 69, at 775-76. Tests suggest that if nuclear waste canisters were deposited ten meters below the ocean floor, the toxic substances that leaked out of the

disposal would supposedly take place are biologically unproductive and far from currents that flow near the continents.[116]

Under one of the proposed methods of sub-seabed disposal, nuclear wastes would be packed into torpedo-shaped metal "penetrometers," and transported by ship to the chosen dump site.[117] The containers would then be either dropped into the ocean sediment, propelled into place by engine, or inserted into pre-drilled holes and capped.[118] After some decades, the containers would corrode and release their radioactive contents, but gravity and the adhesiveness of the clay would prevent the wastes from migrating.[119] The holes that the emplacement of the penetrometers would create would seal themselves because of the plastic-like properties of the deep-sea clay.[120] Finally, the vast water column would dilute any radionuclides that actually escape the site.[121]

The option of sub-seabed disposal was the subject of a thirteen-year, eight-nation, $100,000, 000 study that was cancelled in 1986 after the United States cut funding in favor of land-based disposal.[122] According to Nobel Laureate Henry Kendall, "[e]nding the research was a serious technological blunder."[123] As a result, much of the technology of sub-seabed disposal remains theoretical and mostly untested.[124]

There is legal debate as to whether sub-seabed disposal of radioactive wastes would constitute dumping. If it is so characterized, sub-seabed disposal will be subject to regulation and subsequent banning by the London Dumping Convention. Article III, section 1(a) of the

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containers would be bound to the clays that have blanketed the mid-ocean basins for millions of years. *See* Nadis, *supra* note 111.

116. *See* Kaplan, *supra* note 69, at 775. One possible location, about 600 miles north of Hawaii and with an area four times the size of Texas, has been unperturbed by volcanic activity or by the shifting of tectonic plates for 65 million years. *See* Nadis, *supra* note 111.

117. *See* Kaplan, *supra* note 69, at 775.

118. *See id.*

119. *See Wastes*, *supra* note 112.

120. *See* Kaplan, *supra* note 69, at 776.

121. *See id.*

122. *See Wastes*, *supra* note 112. Studies conducted by an international team of scientists from 1974 to 1986 support the proposition that the mid-ocean basins may be the best burial grounds for nuclear waste. *See* Nadis, *supra* note 111. Nevertheless, in 1986, the Department of Energy stopped funding research of alternative solutions for the disposal of nuclear waste, such as sub-seabed disposal, and decided, instead, to focus solely on developing a land-based geological depository. *See id.* To conclude research on the viability of sub-seabed disposal, researchers estimate that they would need only ten years and about $250 million. *See id.* The United States has already spent $2 billion on studies of Yucca Mountain, and has not yet decided whether that site is viable. *See id.*

123. *Id.*

124. *See* Kaplan, *supra* note 69, at 774-75; *see also* E. MILES, ET AL., NUCLEAR WASTE DISPOSAL UNDER THE SEABED: ASSESSING THE POLICY ISSUES 23 (1985).

convention defines dumping as "any deliberate disposal at sea of wastes or other matter from vessels, aircrafts, platforms or other man-made structures at sea."[125] The parties to the London Convention recognized the ambiguity of this definition as applied to seabed implantation. Their first attempt at resolving the uncertainty was at the Seventh Consultative Meeting in 1983.[126] Failing to come to an agreement, the parties then called an intercessional meeting of legal experts to analyze the definitional question.[127] While the experts did not reach an agreement, three views prevailed from the debate.[128] Norway concluded that the London Convention bans sub-seabed disposal unless scientists can isolate radioactive waste from the biosphere.[129] The United Kingdom and France, on the other hand, concluded that the London Convention does not cover sub-seabed disposal because the activity was undeveloped at the time of the 1972 Convention.[130] Finally, the United States and West Germany adopted a middle ground, concluding that the parties should accept any method of sub-seabed disposal not harming the environment, and that future regulation should be based on the technology being applied.[131]

During the Thirteenth Consultative Meeting in 1990, the parties to the London Convention approved the "Spanish Resolution," which provides that disposal of wastes into sub-seabed repositories, when accessed from the sea, is a form of dumping and is banned by the London Convention.[132] The United States, United Kingdom, Soviet Union, and France voted against the proposal, and consider the resolution non-binding.[133] Yet, they have expressed some willingness to comply voluntarily with the ban.[134]

The Spanish Resolution did not end the debate, however, and there is still much support for sub-seabed disposal. For example, a British delegate to the 1990 meeting stated: "We have no plans to dump radioactive waste, but we are not prepared to eliminate options that we may later regret."[135] In 1993, Russian Atomic Energy Minister Viktor Mikhailov stated: "It is very difficult to define the word 'dumping.'"[136]

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125. London Convention, *supra* note 64, 26 U.S.T. at 2407; Kaplan, *supra* note 69, at 778.
126. *See* Kaplan, *supra* note 69, at 780.
127. *See id.*
128. *See id.*
129. *See id.*
130. *See id.*
131. *See id.* at 780-81.
132. *See id.* at 781.
133. *See id.*
134. *See id.* at 781-82.
135. *Id.* at 782 n.69.
136. Naoaki Usui, *Mikhailov, in Tokyo, Pledges No More Waste Dumping in Japan Sea,* NUCLEONICS WK., Oct. 28, 1993, Vol. 34, no.43, at 10.

Even in the United States, there is still some support for sub-seabed disposal. In 1995, proponents of deep ocean isolation succeeded in including language in the Department of Commerce's appropriation bill to fund research into sub-seabed disposal.[137] "As our understanding of the deep ocean environment increases, we may find that deep ocean placement technology provides a disposal option for some materials that will improve near-coastal water quality and avoid the need to develop additional land-based disposal alternatives," said Representative Don Young (R-Alaska) during a hearing held jointly by the House National Security Subcommittee on Military Research and Development, and the House Resources Subcommittee on Fisheries, Wildlife, and Oceans.[138]

A Swiss Company may present the most serious challenge yet to the Spanish Resolution. Oceanic Disposal Management (ODM), incorporated in the British Virgin Islands and headquartered in Switzerland, plans to use stainless steel, lead-lined free-fall penetrometers to dispose of radioactive waste in deep ocean sediments.[139] The company, which will first use a similar method to dump asbestos, will wait at least three years before attempting to dispose of nuclear waste under the ocean's seabed.[140] ODM's technical director, George Comario, said that the company is looking for ocean sites already used for explosive ordinance disposal, which are marked in maritime charts and avoided by vessels.[141]

It appears the Spanish Resolution lacked the endurance to constitute a final answer to whether the London Convention bans sub-seabed disposal. Despite the continuing uncertainty, certain provisions of UNCLOS may provide some guidance. According to UNCLOS, the seabed, ocean floor and subsoil beyond the limits of national jurisdiction, "the Area," are "beyond the territorial jurisdiction of any nation and are open to use by all in accordance with commonly accepted rules."[142] This is grounded in the principle that the Area and its resources are "the common heritage of mankind," not belonging exclusively to any country.[143] As such, its resources must be preserved.[144]

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137. *See Call for Consortium, supra* note 25.

138. *Id.*

139. *See Swiss Company Pushes Ahead with Sub-Seabed Disposal Plans*, ENVTL. REMEDIATION TECH., Feb. 21, 1996.

140. *See id.*

141. *See id.*

142. UNCLOS, *supra* note 95, at 1261; *see also Message, supra* note 96, at 152.

143. UNCLOS, *supra* note 95, Art I, at 1261.

> This principle has its roots in political and legal opinion dating back to the earliest days of the Republic. President John Adams stated that "the oceans and its treasures are the common property of all men." With respect to the seabed in

Article 137 advances this principle by providing that "[n]o State shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor shall any State or natural or juridical person appropriate any part thereof."[145] One might argue that sub-seabed disposal[146] of nuclear waste would constitute an appropriation of the Area's seabed, violating this principle, and consequently UNCLOS.[147] While UNCLOS may not directly prohibit sub-seabed disposal of nuclear waste, other provisions setting obligations on member states, such as articles 192 through 196,[148] apply to this activity. Yet, the duties imposed by these provisions, such as the duty "to protect and preserve the marine environment,"[149] are too general to pose a serious obstacle to sub-seabed disposal. Thus, sub-seabed disposal of nuclear waste may still be "legal" despite the London Convention and UNCLOS.

If the 1996 Protocol to the 1972 London Convention enters into force, however, the legality of sub-seabed disposal of nuclear waste may be easier to determine. Because the Protocol lacks specific language addressing sub-seabed disposal of nuclear waste, one must look to its definition of "dumping" to determine whether it covers sub-seabed disposal—the same inquiry made into the provisions of the London Convention.

Article 1(4) of the Protocol defines dumping as:

> 1. any deliberate disposal into the sea of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea;
>
> 2. any deliberate disposal into the sea of vessels, aircraft, platforms or other man-made structures at sea;
>
> 3. any storage of wastes or other matter in the seabed and the subsoil thereof from vessels, aircraft, platforms or other man-made structures at sea; and

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particular, President Lyndon Johnson declared that "we must ensure that the deep seas and the ocean bottoms are, and remain, the legacy of all human beings." *Message*, *supra* note 96, at 152.

144. Kaplan, *supra* note 69, at 773 n.20.

145. UNCLOS, *supra* note 95, at 1293; *see also Message*, *supra* note 96, at 153; Kaplan, *supra* note 69, at 784-85 (quoting article 137 of UNCLOS).

146. *See infra* pages 17-24 for a detailed discussion of sub-seabed disposal of nuclear waste.

147. *See* UNCLOS, *supra* note 95, at 1293.

148. *See* UNCLOS *supra* note 95, at 1308; *Message*, *supra* note 96, at 120; *see also supra* page 16.

149. UNCLOS, *supra* note 95, at 1308.

> 4. any abandonment or toppling at site of platforms or other man-made structures at sea, for the sole purpose of deliberate disposal.[150]

Although article I(4)(3) does not use the term "sub-seabed disposal," it seems specifically applicable to this technology because it refers to "storage of wastes . . . in the seabed and the subsoil thereof."[151] Thus, because nuclear waste is not a material that can be dumped under Annex I, the Protocol in effect prohibits sub-seabed disposal of nuclear waste, at least until about 2019, when nuclear waste ocean disposal will be reconsidered by the Contracting Parties.

Proponents of sub-seabed disposal of nuclear waste oppose the Protocol's new definition of dumping. They argue that it is impossible to argue objectively that sub-seabed burial is dumping, and point out that even the IAEA considers it a "variation of deep geologic disposal on land."[152] These critics also attack the United States' 1994 "flip-flopping" on this issue, claiming that the new American position opposing sub-seabed disposal of nuclear waste is not a position based on scientific or legal matters, but, instead, is "a political decision attributable to the fact that the environmental community has access to Al Gore and, through him, to President Clinton."[153]

Although there may be some truth to this statement, the United States' "flip-flop" was more likely influenced by international support for the Principle of Precautionary Action. Nevertheless, scientists fear that without the international community's support for sub-seabed disposal, it is unlikely that the United States will fund the research for an apparently viable technology. "[W]ithout any additional research there will be nothing to reconsider twenty-five years from now."[154]

B. Sub-seabed Disposal via a Land-Based Tunnel

While sub-seabed disposal of nuclear waste-filled canisters thrown from vessels apparently is regulated by the London Convention, and will certainly be regulated by the Protocol, sub-seabed disposal is not prohibited or regulated by the London Convention when accessed via land-based tunnels. Sweden has been practicing this method of sub-seabed disposal since 1988, when a repository for reactor wastes was

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150. Protocol, *supra* note 106, at 2.
151. *Id.*
152. *See* Nadis, *supra* note 111, at 5.
153. *Id.*
154. *Id.* (quoting Edward Miles, an expert on international marine policy at the University of Washington).

opened sixty meters below the Baltic seabed.[155] This project has been widely cited by politicians from other countries as a great example of solving the nuclear waste problem.[156]

Because of Sweden's initiative, nuclear waste is already being deposited under the seabed. Other countries could follow Sweden's example and dispose of nuclear waste under the seabed via land-based tunnels. Special attention must be given to shore-accessed seabed burial of nuclear waste because current international coverage of this problem is extremely deficient.[157] Neither the London Convention nor the Protocol regulates this activity because the waste is not dumped from the ocean, but from land. UNCLOS does not regulate this activity because it occurs outside the Area and within the national jurisdiction of Sweden.[158]

UNCLOS does, however, impose some obligations on Sweden and those countries planning to undertake similar projects. Article 208 of the Convention requires that "laws governing pollution from seabed activities be no less effective than international rules and standards."[159] However, international rules relating to pollution from deep seabed mining (which could apply to Sweden's project by analogy) have not yet been developed.[160] Nevertheless, countries planning to follow Sweden's example must respect the UNCLOS provisions relating to the protection of the marine environment.

This issue must be addressed either through a global treaty or by strengthening and expanding the London Convention. Otherwise, radioactive waste might continue to make its way to the seabed via land-based tunnels, possibly endangering the marine environment and without the world's consent or the availability of appropriate international research concerning the safety of this option.

V. CONCLUSION

Nuclear power is an industrially-available source of energy that will certainly continue to play an important role in the future of our

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155. *See* Simon Rippon, *The Quest for Disposal Sites in Europe*, NUCLEAR NEWS, Feb. 1, 1990, at 91. The initial tunnels for the repository were about 1,400 meters long and fifty meters under the seabed. *See* Dennis A. Young, *Sweden to Store Nuclear Waste Under Sea*, RES. & DEV., Mar., 1984, at 55.

156. *See* Rippon, *supra* note 155.

157. *See* FREEDOM FOR THE SEAS, *supra* note 75.

158. If the tunnel extended beyond the national jurisdiction of Sweden, Sweden would probably be violating the "common heritage of mankind" principle, and consequently UNCLOS, because it would be appropriating the seabed. Such a tunnel, however, would have to be at least 200 miles long. *See* UNCLOS, *supra* note 95, at 1293.

159. UNCLOS, *supra* note 95, at 1310; *See Message*, *supra* note 96, at 123.

160. *See id.*

planet. A solution must be found, however, to protect the environment from wastes generated by the use of nuclear technology.

Nuclear wastes have been dumped in the ocean for almost as long as nuclear technology has existed. The practice has not yet ceased, as Russia continues to dump radioactive waste into the ocean and has yet to sign the London Convention's formal ban of this practice. Ocean dumping is an irresponsible way of dealing with nuclear waste because the effects of introducing these wastes into the marine ecosystems have not been conclusively determined. These practices clearly have violated and continue to violate the Principle of Precautionary Action and have, in the Soviet and Russian cases, violated the London Convention.

While ocean dumping of nuclear waste must be presently suspended, the option of using the oceans for future nuclear waste disposal must not be completely abandoned. Studies to determine the effects of LLW dumping and sub-seabed disposal of both LLW and HLW must be continued. The land-accessed site in Sweden can also help determine whether the oceans are harmed by the presence of radioactive waste under the seabed. If the Protocol enters into force, the contracting parties to the London Convention will have succeeded in ensuring that sea-accessed sub-seabed disposal of nuclear waste is prohibited pending further study. Nevertheless, the London Convention, the 1996 Protocol and UNCLOS must be strengthened, or further international conventions must be adopted, to regulate or prohibit land-accessed sub-seabed disposal of nuclear waste pending scientific conclusions as to that technology's safety.

We must go further—we must stop passing on our nuclear waste problems by burying it, only to be discovered by future generations. The recycling of radioactive wastes and research of transmutation technologies must be stepped up, particularly in the United States, which is lagging behind in this area. Maurice Allegre, chairman of ANDRA (the French radioactive waste organization) said during the Third Annual International High-level Radioactive Waste Management Conference in 1992, that in France, transmutation appears to be the most ecologically sound solution to the radioactive waste problem.[161] The keynote speaker at that convention, Dixy Lee Ray, also urged another look at recycling by reprocessing spent nuclear fuel and the transmutation of actinides.[162]

The relationship between ocean and nuclear waste will continue to exist for thousands of years, as vast amounts of radioactive waste have

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161. *See* Tompkins, *supra* note 12.
162. *See id.*

already been dumped into the ocean or are being deposited under the seabed. It is our generation's obligation to ensure that the spirit of the Principle of Precautionary Action continues to influence the parties to the London Convention, and that irresponsible dumping is finally put to an end. While science must be given a chance to determine the feasibility of using the oceans as disposal sites for nuclear waste, we must be responsible towards the environment and future generations. According to Dik Tromp, chairman of the London Convention, "[i]f scientists cannot agree, it's better not to risk the marine environment."[163]

163. *Nations Agree on Limits to Sea Dumping*, REUTERS WORLD SERV., Oct. 7, 1994.