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INTERNATIONAL MANAGEMENT OF RADIOACTIVE WASTES

*Eugene Nathanson**

INTRODUCTION

The accumulation of radioactive wastes associated with the expanded production of nuclear energy is not a problem that is limited to the United States. For one thing, nuclear technology is expanding throughout the world. Furthermore, radioactive wastes are not solely the concern of the country in which they are produced. Since the problem is international in scope, radioactive wastes can apparently best be controlled by a cooperative approach among nations. Although some movement toward cooperation has begun, the broad multi-lateral attack that seems practical and non-controversial has not developed. The reason for this failure may be a general lack of goodwill among nations or a general nonrecognition that management of radioactive wastes can be separated from those aspects of nuclear physics where strategic needs dictate a cautious self-serving approach to international relations.

This article will briefly review the problem of radioactive wastes. It will then discuss the degree of international cooperation now existing in dealing with these wastes, and the possibility that world bodies may take over full responsibility for waste management.

I. THE RADIOACTIVE WASTE PROBLEM

A. *Wastes Associated with Nuclear Energy Production*

Radioactive wastes are classified by their concentration of radioactivity as low-, intermediate-, or high-level. Low-level wastes have a concentration up to about one thousand times that considered safe for immediate release. Intermediate-level wastes have a concentration about one hundred to one thousand times greater

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than low-level waste, with high-level wastes up to several billions times greater.¹ Since radioactive wastes can not be made harmless through chemical or physical treatment,² they remain active until natural decay of the atoms takes place. The rate of decay is measured by the isotope's half-life—the time it will take for one half of the atoms in a sample of the element to decay. As a “rule of thumb,” radioactive material should be segregated from the environment for about twenty half-lives.³

In view of the intractability of radioactive wastes, the options for dealing with them are limited. Wastes of low radioactive content can be diluted sufficiently so that they can be safely released directly into the environment, or they can be concentrated so that the non-radioactive material can be discharged and the remainder, a much smaller amount by volume, stored until decay renders it harmless.⁴ Sufficient dilution for discharge of high-level wastes is impossible.⁵

Wastes of various radioactive content and a wide range of half-lives are produced at different stages in the nuclear fuel cycle. Naturally occurring radioactive ores removed from their former isolated burial site are exposed at mines in the form of mill tailings, which contain very small concentrations of radioactivity. They do, however, contain Radium-226, which has a sufficiently long half-life (1,620 years) to necessitate some assurance that these materials will not be used as landfills or structural materials associated with human occupancy for a period of several thousand years.⁶

Gaseous and liquid low-level wastes are produced during fuel processing and energy generation and routinely discharged with little treatment.⁷ If the half-life of the radioactive elements they contain is short enough, they can be held for short periods of time, allowing for sufficient decay to render them harmless. Subsequently the wastes are discharged into the air or water, where hopefully those portions still active are quickly diluted.

¹ FOX, RADIOACTIVE WASTES 11-12, U.S.A.E.C. (rev. ed. 1969).

² *Id.* at 4.

³ P. EHRLICH, THE END OF AFFLUENCE 292 (1974).

⁴ Van De Voorde, *Revue des Techniques de Traitement*, in DISPOSAL OF RADIOACTIVE WASTE: PROCEEDINGS OF THE INFORMATION MEETING ORGANIZED BY NEA, 31 (Paris 1972) [hereinafter cited as NEA INFORMATION MEETING].

⁵ A concentration of plutonium-239 “no larger than an orange,” if dispersed throughout the environment, could threaten human survival. R. HALLMAN, TOWARDS AN ENVIRONMENTALLY SOUND LAW OF THE SEA, 7, (International Institute for Environment and Development 1974).

⁶ Lenneman, Parker and West, *Management of Radioactive Wastes*, IAEA BULL. vol. 17, no. 4, at 2 (August 1975) [hereinafter cited as Lenneman].

⁷ Fox, *supra* note 1, at 11.

The major problem area is the disposal of high-level wastes. When fuel which has been in use at a reactor for some time is treated at fuel reprocessing plants, uranium-235 and plutonium are separated from the accumulated waste products with half-lives as high as 25,000 years. While separating these elements with long radioactive lives from the remaining waste might be technically feasible, such a procedure would probably not produce benefits worth the cost.⁸ For the moment, these wastes are being held in temporary storage until safe permanent disposal sites can be engineered or discovered.⁹ The temporary storage sites require the expense of constant surveillance and maintenance. Such sites have also had control failures which fortunately have not yet produced any disastrous consequences.¹⁰ Proper disposal of these wastes involves isolation from the environment for up to several hundred thousand years. Retrievability is also an important consideration so that the waste can be recovered in the event of unforeseen emergencies, such as geological change. The possibilities for such disposal include engineered facilities or natural geological formations or some combination of the two. Salt, granite, shale and clay formations, which have remained dry and stable for millions or hundreds of millions of years, may be likely depositories.¹¹ Each potential location should, of course, be individually and carefully studied. No absolute guarantee exists that a geological site would permanently isolate the waste; if "temporary" storage is continued permanently with continuous surveillance, no absolute guarantee of perfect human monitoring exists either. The only certainty with a hazard of this magnitude is that expense considerations should not be allowed to outweigh safety considerations.

The final waste problem associated with any nuclear plant, which has not until recently received sufficiently serious consideration, is the decommissioning of an obsolete plant.¹² During operation, structural materials and equipment become activated through the absorption of neutrons from the radioactive fuel.¹³ These activation products must be as surely isolated from the biosphere as other

⁸ Lenneman, *supra* note 6, at 8.

⁹ Fox, *supra* note 1, at 29.

¹⁰ PROGRESS AND PROBLEMS IN PROGRAMS FOR MANAGING HIGH-LEVEL RADIOACTIVE WASTE 22, 31 (U.S. Gen. Acct. Office 1971).

¹¹ The only "credible" pathway to the biosphere is through water transport. Lenneman, *supra* note 6, at 9.

¹² *Id.* at 6.

¹³ *Id.*

radioactive wastes. Three courses of decommissioning are possible: (1) abandoning the plant and totally restricting entry to the area; (2) attempting to convert the plant to other uses while restricting entry; and (3) removing all of the irradiated structures.¹⁴ The first would dot the landscape with radioactive monuments. The second solution requires finding a practical alternative use of the facility. The cost of the third solution is estimated to equal or exceed the original facility cost. Alternatively, if decommissioning is to be considered at the time of construction, construction and operation design features will have to be changed at some expense.¹⁵ Hopefully, as more attention is devoted to the decommissioning problem, more attractive solutions will be discovered.

B. *World-Wide Expansion of Nuclear Power Generation*

The magnitude of the radioactive waste problem is directly related to the amount of waste produced, and world energy demands are resulting in a great increase in the number of nuclear generating plants and a concomitant increase in the quantity of wastes produced. As of the end of 1974, 149 power reactors were operating in 19 countries, with plans for reactors on the drawing boards in 23 additional countries and a projected seven-fold increase in generating capacity by 1985.¹⁶ The growth is not limited to oil importing countries. Iran, for instance, with four power reactors under construction, is planning the purchase of \$700 million of uranium from South Africa,¹⁷ and "sees better and more economic ways of using its oil than burning it to make steam for a generator."¹⁸

Unless rising expectations and pressing needs in the developing countries and the energy demands of the developed countries can be met by a more environmentally sound source, worldwide use of nuclear reactors will in the future meet an increasingly large percentage of world energy needs. Although growing pressure to slow or halt reactor production in the United States and other developed nations has occurred, divergent national goals and international differences render doubtful the possibility that all or most nations will agree or can be compelled to agree to halt the spread of nuclear

¹⁴ *Id.*

¹⁵ *Id.*

¹⁶ U.S. NEWS AND WORLD REPORT Sept. 30, 1974, at 51.

¹⁷ Boston Globe, Oct. 12, 1975, at 15.

¹⁸ Paul Turner, Vice-president of the Atomic Industrial Forum, quoted in U.S. NEWS, *supra* note 16, at 51.

energy.¹⁹ Equally unlikely is the probability that nuclear exporting countries will restrict their sales to the have-not nations. Economic competition is a significant factor in the sale of reactors by nuclear exporters, and American industry spokesmen expect that any slack created from restrictions on United States exports will be quickly taken up by other nations.²⁰ The revenues from exports are substantial and very important for some companies.²¹ Reduced United States sales due to environmental opposition greatly increase pressure to develop the export market.²²

The radioactive waste which has been and will be produced by this increased number of nuclear reactors is a problem of concern to the nations of the world, individually and as a group. "The extensive applications of atomic energy for peaceful purposes transcend national boundaries and, as a minimum, they call for common international rules."²³ Among the low-level wastes, tritium, krypton-85, and iodine-129 are of particular worldwide concern.²⁴ The global concentrations of tritium and krypton-85 will probably approach unacceptable limits during the first half of the twenty-first century.²⁵

Also of general concern is the discharge of waste into common waterways. When several nuclear plants discharge wastes into a single river, a central authority would clearly be helpful in coordinating and controlling the individual discharges so that otherwise harmless quantities do not accumulate, poisoning a water supply.²⁶ Any radioactive deposit into the sea, the world's major common waterway, is of concern to the entire human community, particularly since these radioactive substances can be dispersed over vast areas by biological mechanisms.²⁷ Furthermore, some elements,

¹⁹ Zellers, Saunders and Angino, *Discussion*, 29 BULL. OF THE ATOMIC SCI. 2, 54 (April 1973).

²⁰ New York Times, August 20, 1975, at 74, col. 4.

²¹ Reactor exports provided 12% of Westinghouse's 1974 revenues, and, it is estimated, \$25-million pretax income out of a total net income of \$28 million. New York Times, August 17, 1975, at 36, col. 5.

²² *Id.* at col. 4.

²³ Dr. Sigvard Eklund, Director-General of the International Atomic Energy Agency, quoted in *Foreword*, in NUCLEAR LAW FOR A DEVELOPING WORLD, LECTURES GIVEN AT THE TRAINING COURSE ON THE LEGAL ASPECTS OF PEACEFUL USES OF ATOMIC ENERGY (IAEA Vienna 1969) [hereinafter cited as IAEA TRAINING COURSE].

²⁴ Sousselier, *Situation Actuelle Et Previsions Pour L'Avenir Des Problemes Poses Par Les Dechets Radioactifs*, in NEA INFORMATION MEETING, *supra* note 4, at 210, 212.

²⁵ Lenneman, *supra* note 6, at 7.

²⁶ See Browder and Parsons, *Control of Radioactive Waste Disposal*, in IAEA TRAINING COURSE, *supra* note 23, at 232.

²⁷ For example, radioactivity from the Bikini Island hydrogen bomb tests was broadly

if discharged into coastal waters, may reconcentrate on suspended matter and be deposited on beaches.²⁸ Tides and currents may disperse material and allow radioactive substances to "turn up to destroy the health and life of species half a world away."²⁹ The sea suffers from the further danger of its misleading appearance as a limitless sump, capable of absorbing all the planet's garbage. A state can, with little moral anguish, distribute to the world at large the harmful consequences of its production of radioactive wastes rather than concentrating the problem in its own territory.³⁰

The most critical problem for the world at large as well as for the producing State is the storage or disposal of high-level, long lasting waste. Since this waste is so lethal, and may last for so long, an accidental discharge at one nation's storage or disposal area could appear on another nation's territory while still dangerously radioactive. Any State can reasonably be concerned over the security at another State's waste disposal site. In addition, if permanent geological disposal sites become practicable, they will not necessarily match up with the national boundaries of the waste producers,³¹ a situation which raises an area of possible future conflict. Finally, over the hundreds of thousands of years that this waste will remain a hazard, present national boundaries and national considerations will lose their meaning. A problem which will persist for that long, even if effectively isolated in a small area, is necessarily a world concern.

II. PRESENT SCOPE OF INTERNATIONAL REGULATION

A. *International Organizations*

The need for common principles of radiation protection has resulted in a unique situation where international rather than local action has been in the forefront of setting bases for regulation.³² In

dispersed by fish following ocean currents, Feldt, *Behavior of Radioactivity in the Marine Environment*, NEA INFORMATION MEETING, *supra* note 4, at 69, 71.

²⁸ Morley, *Critical Pathways and Derived Working Limits*, in NEA INFORMATION MEETING, *supra* note 4, at 92, 96.

²⁹ HALLMAN, *supra* note 5, at 6-7.

³⁰ Goldie, *A General View of International Environmental Law, A Survey of Capabilities, Trends and Limitations*, in COLLOQUIUM, 1973: THE PROTECTION OF THE ENVIRONMENT AND INTERNATIONAL LAW 37 (Academie de Droit International 1975).

³¹ Rose and Kubo, *Nuclear Waste Disposal in the Oceans*, 185 SCIENCE 1183, 1184 (Sept. 27, 1974).

³² *International Co-operation in the Field of Radioactive Transfrontier Pollution*, 14 NUCLEAR LAW BULL. 55, 56 (1974).

1928, the International Commission on Radiological Protection (ICRP) was established by the International Congress of Radiology to set standards for radiation exposure in the medical field. In 1950, the ICRP was reorganized to deal with more widespread uses of radioactive elements. As a non-political group made up of 13 "internationally recognized experts" from various countries in various scientific fields, its exposure recommendations are well received and serve as the touchstone for most national and international regulation.³³

The world organ in the area of nuclear energy is the International Atomic Energy Agency (IAEA), established in 1956 under the aegis of the United Nations. It consists of over 100 member States, and, except for the People's Republic of China, includes all the States making use of nuclear power. The objective of the IAEA is to promote the use of atomic energy for "peace, health and prosperity throughout the world," with particular attention to preventing the use of nuclear energy for military purposes.³⁴ The Statute of the IAEA gives it the authority to set "standards of safety for protection of health and minimization of danger to life and property," and to apply these standards in three areas of activity: (1) IAEA operations; (2) operations carried out with IAEA support; and (3) operations under multi-lateral or bi-lateral treaties or individual State activities, at the request of the parties involved.³⁵ The promulgation of safety standards has been called "one of the most significant and useful activities of the Agency."³⁶ These standards, based on ICRP recommendations, involve the establishment of maximum permissible radiation doses for humans and procedures for specific technical operations.

The conditions for application of health and safety standards are set forth in the IAEA Health and Safety Document.³⁷ The aim presented is not to protect the world community but to "render valuable assistance and useful support to its members." Thus, great latitude is given to a State to apply its own standards if they are determined adequate.³⁸ The State is required to submit to the IAEA a statement of the type and amount of radioactive material released to the environment, the type and amount disposed of as waste, and

³³ NUCLEAR POWER AND THE ENVIRONMENT 72 (IAEA 1973).

³⁴ Statute of the IAEA, 8 UST 1094, TIAS 3873, Art. II (1956).

³⁵ *Id.*, Art. III(6).

³⁶ P. SZASZ, THE LAW AND PRACTICES OF THE IAEA 668 (Vienna 1970).

³⁷ IAEA INFCIRC/18.

³⁸ *Id.* para. 12.

the method of disposal.³⁹ If the operation involves more than a prescribed minimum of radioactive materials, the IAEA may require submission of "all facts necessary to evaluate the potential radiation hazard," including the details of the waste disposal operation.⁴⁰ If this minimum is surpassed, the Agency may carry out inspections,⁴¹ and the IAEA may require any other method to ensure observance of safety standards.⁴²

The Health and Safety Document is incorporated into aid agreements with Member States in accordance with the Guiding Principles and General Operating Rules to Govern the Provision of Technical Assistance by the IAEA.⁴³ Under the Statute of the IAEA, the granting of assistance may be made conditional on the adequacy of proposed health and safety standards.⁴⁴ As of 1972, agreements requiring the application of IAEA safety standards were in effect with 17 countries.⁴⁵ While the Statute allows the IAEA to apply IAEA safety standards, the Health and Safety Document limits the IAEA's activity to supervising the State's application of its own standards. Even within this limited scope of activity the IAEA has not exerted its full authority. The staff of inspectors provided for under Article XII(b) and (c) of the Statute was never fully established,⁴⁶ and in the early 1960's inspection operations were discontinued altogether.⁴⁷ Health and safety controls, although originally thought to be "self-evident and non-controversial," now are considered by some to be not only as serious an intrusion on sovereign rights as safeguards against diversion of radioactive material to military purposes, but also far more costly, and logically chargeable only to the operators of the project, a financial burden the operator might not wish to bear.⁴⁸ Such an "intrusion on sovereign rights," however, should cause no objection by a good faith participant in the IAEA. Short of prohibiting reactor construction, any required safety measures operate to the benefit of the nuclear operator since harmful effects from radioactive discharges will immediately dam-

³⁹ *Id.* para. 25(b).

⁴⁰ *Id.* para. 29(a), (b).

⁴¹ *Id.* para. 31.

⁴² *Id.* para. 30.

⁴³ IAEA GC(IV)/RES/65, Annex.

⁴⁴ Statute of the IAEA, 8 UST 1094, TIAS 3873, Art. XI(3) (1956).

⁴⁵ Ha Vinh Phuong, *IAEA Safety Standards, their legal status and implementation*, in *EXPERIENCE AND TRENDS IN NUCLEAR LAW* 3, 6, IAEA LEGAL SERIES No. 8, STI/PUB/333 (1972).

⁴⁶ Szasz, *supra* note 36, at 695.

⁴⁷ *Id.* at 696.

⁴⁸ *Id.* at 685.

age the local area before a possible spread will distribute the harm to the world at large. Each nation will benefit by operating its nuclear installations with strict practical safety precautions. IAEA controls would act primarily to assist a nation concerned with such safety by alerting it to possible harmful effects, and voluntary compliance with such controls would not disturb the affected nation's sovereignty.

A nation's unwillingness to pay for safety measures is a much more troublesome problem. Pollution from industrial installations is not the result of a malevolent scheme on the part of the polluter to infect the environment. Where knowledge of the harmful effect exists, the impediment to correction is the expense of corrective measures. The analysis of cost, harm to be guarded against, and beneficial result of the expense will vary depending on the particular circumstances of the nation involved: "the attitude in a developing country avid for power to raise its living standard may be very different from the country fairly satisfied with its standard of living but anxious to preserve the environment for enjoyment."⁴⁹ Any expenses related to increased safety measures will immediately decrease any economic benefit obtained by the conversion of a nation's energy production to nuclear power. Further, the mandating of safety measures by an outside agency may result in an ineffective implementation by a nation operating under a different set of values, not greatly increasing the degree of safety.⁵⁰

In the less sensitive areas of technical cooperation and assistance, and the sharing of information, the IAEA has been the effective device behind a broad range of international collaboration. From 1957 through August 1974 the IAEA had published some 51 reports on waste management alone, as well as sponsoring or co-sponsoring 56 informational meetings and seminars on both technical and legal matters.⁵¹ In its programs of direct assistance to individual States, members of the IAEA Legal Division have been assigned to various countries to assist in drafting nuclear regulatory legislation.⁵²

In providing technical assistance through its activities in helping to establish the power program in a country rather than through mandating controls, the IAEA has a great opportunity to see that a

⁴⁹ Kenny, *Administrative and Legal Control of the Release of Wastes*, in NEA INFORMATION MEETING, *supra* note 4, at 183.

⁵⁰ SZASZ, *supra* note 36 at 689.

⁵¹ The Agency's Programme for 1975-80 and Budget for 1975 at j.14, IAEA GC(XVIII)/526 (1974) [hereinafter cited as Programme].

⁵² IAEA Activities, 13 NUCLEAR LAW BULL. 29 (1974).

nation maintains a reasonable level of safety controls. Programs now in progress for the establishment of nuclear power in ten developing nations include provisions for waste management.⁵³ Once again, however, to the extent that charges are assessed to the nuclear operator and the IAEA does not itself maintain the waste disposal program, the effectiveness of safety controls will depend upon the particular values of the individual nuclear operator and not upon the common good of the planet.

B. Regional Organizations

Western Europe presents a clear model for international concern over the possible harmful effects of nuclear energy. With many nations using nuclear energy, sharing relatively close borders and international waterways, this group of nations has recognized that many problems are associated with reactors, particularly the management of radioactive wastes, which will not be solved except through common effort.⁵⁴ Two organizations have developed in this context: the Organization for Economic Co-operation and Development Nuclear Energy Agency (NEA)⁵⁵ and the European Atomic Energy Community (Euratom).

The function of the NEA is informational and coordinating; it does not mandate practices on the part of its members. It has published various technical guides, safety standards and recommendations, and held scientific and legal meetings, often in conjunction with the IAEA. Its special place in the area of waste management has arisen under its mandate to promote cooperation and harmonization of local activities, and particularly the formation of joint undertakings.⁵⁶ The members of NEA have collaborated, over the period from 1967 to 1972, on a series of ocean radioactive waste disposal operations, the only multi-lateral operations of this sort. These disposals are illustrative of an effective division of responsibility between the local government and the international body. As the entire series was carried out in a substantially similar manner, a description of the first disposal will serve for the entire set.⁵⁷

The entire plan was generated by an international group of ex-

⁵³ Programme, *supra* note 51, at c.5.

⁵⁴ EUROPEAN NUCLEAR ENERGY AGENCY, 13TH ANNUAL REPORT 5 (1971).

⁵⁵ Formerly the European Nuclear Energy Agency (ENEA), this organization was reconstituted as NEA in 1972 with the admission of Japan and Australia as full members, and will be referred to as NEA in the text, regardless of the date under discussion.

⁵⁶ Statute of ENEA, 53 Am. J. Int. L. 1012, Arts. 1(b), 5(a), 11(a)(i) (1957).

⁵⁷ ENEA 13TH ACTIVITY REPORT 39-41 (1971).

perts which determined that the plan was feasible and not unduly hazardous. Detailed planning and direction was then assigned to an Operations Executive Group comprised of representatives of the participating countries and other interested parties. The individual nations were left to arrange the transport of their own waste to a designated port where the international phase would begin with loading of the waste onto an NEA commissioned ship. Thus all questions of local regulation and security were left to the local government. In addition, the national government also was given the responsibility of ensuring that the waste containers met the standards of the entire operation, a matter of more general concern.⁵⁸

The international phase began with the arrival of the wastes at the port of loading. The NEA ship, supervised by NEA-appointed Escorting Officers, arrived at the various ports in a schedule coordinated with the national phase to provide for minimal port storage time. The loading, the dumping operation itself, and ultimately the decommissioning of the ship were all handled through the NEA.⁵⁹ Costs such as loading costs which could be attributed to a single country were assessed to that country, the remaining expenses were shared in proportion to the tonnage of waste supplied by each country.⁶⁰

In these disposal operations, at the least, a very thorough risk assessment was carried out,⁶¹ an advantage of a multi-national operation. If parochial considerations are to predominate they will at least be on a somewhat broader scale. A better solution would be to carry out such planning on a worldwide level, especially in connection with the ocean dumping of radioactive wastes which is itself controversial. The Soviet Union, for example, has taken the position that international agreements prohibit the disposal of wastes of any degree of radioactivity into the ocean.⁶² Of additional benefit is the development of an experienced corps of managers and technicians under an international authority, necessary if international operations are to continue.

Euratom is established along the same lines as the European Common Market and the European Coal and Steel Community.⁶³

⁵⁸ RADIOACTIVE WASTE DISPOSAL OPERATION INTO THE ATLANTIC 1967 at 25. (ENEA 1968).

⁵⁹ *Id.* at 33.

⁶⁰ *Id.* at 53.

⁶¹ Brown, *International Law and Marine Pollution: Radioactive Waste and "Other Hazardous Substances"*, 11 NAT. RES. J. 221, 233 (1971).

⁶² Goldie, *supra* note 30, at 55.

⁶³ Glaesner, *The European Atomic Energy Community*, in IAEA TRAINING COURSE, *supra* note 23, at 39, 40.

It has power to establish standards with which the Member States must comply through their own legislation.⁶⁴ Each Member State must set up permanent facilities to control the level of radioactivity in nuclear installations, with access available to the Commission⁶⁵ and reports regularly required.⁶⁶ Data on disposal operations must be reported with sufficient detail to "enable the Commission to determine whether the implementation of such plan is likely to involve radioactive contamination of the water, soil or airspace of another Member State."⁶⁷ Finally, the Commission may issue directives requiring the State to take "measures necessary to prevent the basic standards from being exceeded and to ensure observance of any applicable provisions."⁶⁸ Unfortunately, despite this broad authority, implementation of health and safety regulations in national legislation in accordance with Euratom standards has been spotty.⁶⁹ Competition also arose, with France particularly expanding its own program at the expense of the joint effort.⁷⁰ This result was particularly unfortunate since one of the perceived advantages of the Community was that safety considerations, especially the protection of workers, would not be affected by competition within the Community.⁷¹

Apparently concern over safeguards has overshadowed safety problems, and once again implementing safety protections was left in the hands of the operator state. For example, safeguard regulation in Euratom is under the direct supervision of the central authority, and thus operates independently of that of the Member States, whereas health and safety regulations operate only as directives to the States.⁷² Even though mandatory, the ultimate effectiveness of the latter regulations turns on the State's individual responsibility in carrying them out.

C. *International Agreements and Declarations*

International agreements and declarations on the environment

⁶⁴ Euratom Treaty, 298 UNTS 167, Art. 30, 33 (1958).

⁶⁵ *Id.* Art. 35.

⁶⁶ *Id.* Art. 36.

⁶⁷ *Id.* Art. 37.

⁶⁸ *Id.* Art. 38.

⁶⁹ Dickstein, *National Environmental Hazards and International Law*, 23 INT. AND COMP. L. Q., 426, 444 (1971).

⁷⁰ Smith, *The European Atomic Energy Community: The Limits of Supra-nationalism*, 1 CAL. WESTERN INT. L. J. 33, 44 (1970).

⁷¹ Glaesner, *supra* note 63, at 41-42.

⁷² *Id.* at 41.

have been proliferating with the same rapidity that environmental concerns have spread intranationally. Especially in the field of the law of the sea, "this recent proliferation of international Conventions . . . has resulted in a passage from [a] relative legal vacuum . . . to a situation which could be qualified as excessive."⁷³ Insofar as radiation pollution has been considered, it has been recognized that specialized agencies exist which are already attempting to deal with the problem. As early as 1958 the parties to the Convention on the High Seas,⁷⁴ nearly all the nuclear energy states, agreed to take measures to prevent pollution of the seas by the dumping of radioactive waste, considering the standards and regulations promulgated by international organizations, and to "co-operate with the competent international organizations in taking measures for the prevention of pollution of the seas or air space above, resulting from any activities with radioactive materials or other harmful agents."⁷⁵ Contemporaneous with this Convention, a resolution appointed the IAEA to promulgate regulations and prepare standards for the protection of the marine environment.⁷⁶ In 1959 the IAEA issued the Brynniellsson Report,⁷⁷ which discussed recommendations on ocean waste disposal. A subsequent panel issued comprehensive regulations of which radioactive wastes could be disposed of at sea, and the procedures that should be followed. The authority of these recommendations was somewhat diluted by a strong dissent, led by the Soviet expert on the panel, who argued that the Convention prohibited any deposit of radioactive waste in the ocean.⁷⁸

More recently, under the Convention on the Dumping of Wastes at Sea (London Convention),⁷⁹ with 80 countries participating as well as representatives from several international agencies, the States party pledged themselves "to promote, within the competent specialized agencies and other international bodies, measures to protect the marine environment against pollution caused by . . . radioactive pollutants from all sources."⁸⁰ The IAEA has been specifically designated as the international body in the field of radioac-

⁷³ *Note on International Conventions Relating to Radioactive Marine Pollution*, 13 NUCLEAR LAW BULL. 39, 54 (1974).

⁷⁴ 13 UST 2312, TIAS 5200, 450 UNTS 82 (1958).

⁷⁵ *Id.* Art. 25.

⁷⁶ UN DOC. A/CONF. 13/1.56 (1958).

⁷⁷ RADIOACTIVE WASTE DISPOSAL INTO THE SEA, IAEA SAFETY SERIES NO. 5, (1961).

⁷⁸ SZASZ, *supra* note 36, at 715-16.

⁷⁹ 11 Int. L. M. 1291 (1972).

⁸⁰ *Id.* Art. XII(d).

tive waste⁸¹ and has begun promulgating recommendations under that authorization.⁸²

The United Nations Action Plan for the Human Environment,⁸³ promulgated as a result of the United Nations Conference on the Human Environment held at Stockholm in 1972, via Recommendation 75, the only recommendation concerned with radioactivity on a list of 109, contains more specific recommendations for international action. First, governments are to explore with IAEA and the World Health Organization the developing of a registry of significant releases of radioactive materials. Also, the governments are to support and expand international cooperation on waste problems, working with the IAEA and other organizations, "including coordination of plans for the siting of fuel re-processing plants in relation to the siting of the ultimate storage area." Implementation of this second recommendation would place the most significant portion of the waste problem under international control.

III. PROSPECTS FOR THE FUTURE

Clearly, States making use of nuclear power can only benefit from a centralized radioactive waste management authority providing a greater assurance of nuclear safety. Radioactive wastes are "probably the most hazardous material on earth"⁸⁴ and an imperative need exists for near fail-safe certainty that harmful amounts will not be discharged into the environment. Even with good faith attempts on the part of nuclear States to dispose of wastes safely, a wide disparity exists in the actions of the various States. Wastes classified high-level in one are classified intermediate-level in another, and practices unacceptable in one are satisfactory in another.⁸⁵ If "[i]nternational nuclear waste management resembles a modern day Tower of Babel,"⁸⁶ then it follows that some nation's procedures do not meet international standards.

The ability to rely on a competent international agency to handle the problem of radioactive waste, one of the major problems presented by nuclear power, may help decrease the opposition to nu-

⁸¹ *Id.* Annex I(6).

⁸² Programme, *supra* note 51, at j. 18.

⁸³ REPORT OF THE UN CONFERENCE ON THE HUMAN ENVIRONMENT, Stockholm, June 5-16, 1972, at 7 (1973).

⁸⁴ Dreschoff, Saunders and Zeller, *International High Level Nuclear Waste Management*, 30 BULL. OF THE ATOMIC SCI. 33 (Jan. 1974).

⁸⁵ *Id.* at 29.

⁸⁶ *Id.* at 33.

clear reactors. For example, in the United States, a strong factor in the fears over nuclear expansion has been a mistrust of the ability of the Atomic Energy Commission to deal with the risks.⁸⁷ If a competent international organization assumes the function of caretaker of radioactive wastes, it may serve to assuage some of the doubts of nuclear energy's opponents.

In view of the current high degree of world disharmony, the lack of sustained effort to provide for radioactive waste disposal through an international agency is not surprising. Considering all the circumstances, however, little is standing in the way of such an organization. That this is an area where political controversy is at a minimum⁸⁸ was early recognized, and political issues should not cause significant interference. Perhaps a problem is that when radioactive materials are at issue, concern over nuclear weapons, and thus national defense and security, immediately arises. The multi-lateral atomic energy organizations all have safeguards as a major concern: protecting against the diversion of nuclear materials to military purposes. Unlike safety regulations, safeguards, by definition, can not be left in the hands of the individual operator. Thus an agency with limited resources will concentrate on safeguards. The only serious multi-lateral waste disposal operation was carried out by the NEA, an organization whose safeguards functions are very limited.

An additional problem of the apparent closeness of safeguards and safety regulation is the possible sensitivity of an operator State that safety operations carried out by an outside agency may intrude on its plans for nuclear weapon acquisition or accumulation. But it should certainly be possible, as a basis for immediate action, to separate at least some of the waste disposal operation from any strategically sensitive activity. Dr. Dixy Lee Ray, then head of the Atomic Energy Commission, in an address to the 18th session of the general conference of the IAEA, said:

If each country that moves into nuclear-generated electricity is faced with the necessity to develop its own means of handling the spent fuel, then each country will have to develop the technology for this purpose. As an alternative, the establishment of internationally approved facilities to handle all the spent fuel arising from power reactors may be helpful to participating countries. It may also be reassuring to the rest of the world.⁸⁹

⁸⁷ ABRAHAMSON, ENVIRONMENTAL COST OF ELECTRIC POWER, 14 (Scientist's Institute for Public Information 1970); EHRlich, *supra* note 3, at 53-54.

⁸⁸ REPORT OF THE ADVISORY COMMITTEE ON US POLICY TOWARD THE IAEA TO THE JOINT COMMITTEE ON ATOMIC ENERGY, May 19, 1962, at 19, 20 [hereinafter cited as POLICY REPORT].

⁸⁹ 71 U.S. DEP'T OF STATE BULL. 552, 555-56 (Oct. 21, 1974).

While this remark is precisely applicable to the problem of high-level radioactive wastes arising at fuel reprocessing plants, it was uttered in the context of weapons development and thus illustrates the problems in separating the two areas. Effective high-level waste management would best begin at the fuel re-processing plant, but this plant is also the source of enriched plutonium usable in nuclear weapons.⁹⁰ It would be unfortunate if national security unnecessarily prevented international control of wastes beginning at the time of re-processing. Aside from the safety factors, an IAEA "cursory" study has shown that regional, as opposed to individual, re-processing plants, taking into account all the expenses of waste management, would be some 50% cheaper.⁹¹

The nuclear exporter countries are in an obvious position to assign waste management operations to an international body; however they have taken few steps in this regard. The United States Atomic Energy Commission, for example, when supplying atomic materials to foreign nations, must do so pursuant to an agreement for cooperation to which such nation is a party.⁹² As of January 1975, the United States had in force such agreements for cooperation with 28 countries.⁹³ These agreements provide that the United States has the right to consult with the foreign government in the matter of health and safety.⁹⁴ United States policy is to, wherever possible, transfer its authority under bi-lateral agreements to the IAEA.⁹⁵ The United States also recognized that the IAEA was the most effective avenue for the promulgation of waste management standards, and that "[t]here must be a positive assignment of these functions, and the capability to discharge them effectively must be built on a program of actual participation in a wide range of activities related to atomic energy."⁹⁶ Transfers of safeguard authority to the IAEA,⁹⁷ but no equivalent transfer of safety functions, have occurred. Once again, safeguards have overshadowed safety, and the nuclear operator has been relied on to enforce its own safety standards.

The IAEA does anticipate that in the future its major efforts will

⁹⁰ Commoner, *A Reporter at Large, Energy-II*, THE NEW YORKER, Feb. 9, 1976, at 40.

⁹¹ Lenneman, *supra* note 6, at 11.

⁹² 42 U.S.C. § 2074 (1964).

⁹³ Treaties in Force, Jan. 1, 1975.

⁹⁴ *E.g.*, Treaty with Brazil on Cooperation for Civil Uses of Atomic Energy, 23 UST 2477, TIAS 7439, Art. XI(B)(6) (1972).

⁹⁵ POLICY REPORT, *supra* note 88, at 2.

⁹⁶ *Id.* at 7.

⁹⁷ Treaty with Brazil, *supra* note 94, Art. XII.

shift to those significant safety and waste management problems which are becoming more serious with the growth of power installations,⁹⁸ and has noted particular concern over the management of the release of radioactive elements which may cross national boundaries and the storage or disposal of high-level wastes.⁹⁹ In this latter area, the IAEA has already held a panel meeting to discuss the establishment of international sites.¹⁰⁰ In the limited area of waste depositaries, at least, no strategic implications are present. An international depositary will still face the same technical problems that national governments are encountering, but full co-operation should enable these problems to be overcome more quickly. Even cost should not prove a significant obstacle. Waste depositaries serving a large area may well be cheaper than the aggregate cost of scattered local depositaries. A reasonable basis for the allocation of expenses, perhaps the quantity of waste produced, should not be difficult to establish. Considering the scope of the risk, the governments of the world would be short-changing their citizens by being niggardly with an organization charged with such a serious responsibility; any expenses in keeping high-level waste away from the biosphere are easily justified.

Establishing international depositaries for high-level waste, while politically the easiest step forward in the world's response to the dangers of nuclear energy, is far from a final solution, and may not even be adequate to alleviate concern over reactor construction. It would certainly be far better if international responsibility could begin one step earlier in the fuel cycle, at the re-processing of spent fuel. The welcome effect of slowing the proliferation of nuclear weapons would result; the environmental advantage would be an extra benefit.

At an even earlier stage in the fuel cycle, essentially the entire waste problem could be put under international control by allowing a competent international organization to take full responsibility for specific low level waste disposal activity at individual nuclear energy plants. Any discharge of radioactive waste would be under the immediate supervision of employees of the international agency which could prescribe particular measures that must be taken. The costs for these prophylactic controls could be assumed by the international agency, which would have a budget taken from the funds

⁹⁸ Programme, *supra* note 51, j.3.

⁹⁹ *Id.* at j.17.

¹⁰⁰ *Id.* at j.15.

States are now spending individually on their own waste management programs.

Measures to protect against radioactive waste cannot be imposed on nuclear power States from outside. Even if an organization like the IAEA was prepared to take the step of mandating safety controls, no world authority is capable of enforcing its orders. Any steps that are taken will have to be voluntarily accepted by each State, recognizing that full cooperation with an international authority is to its own benefit. No reason exists why, in the limited areas of radioactive waste management, political differences can not be put aside so that the planet can be relieved of the risk of environmental disaster. The activity involved is well delineated; no encroachment on critical national interests should result; the problem transcends national boundaries. Nations producing radioactive waste have a grave responsibility to see that it be handled with intelligence and maturity. Internationalism in the abstract has been a well respected ideal; in practice it has not kept the nations of the world from teetering on the brink of cataclysmic war for over two decades. If the public expressions by national leaders about international goodwill have been made in good faith, these leaders should welcome the opportunity to join together in mutual assistance in an area where no risk of compromising vital national interests is present, where so much is at stake, and where international cooperation is so essential.

The basic political framework has already been developed. If the IAEA is unacceptable because of its involvement with safeguards, the establishment of a new agency with more limited functions should be simple, making use of the IAEA's experience and accumulated resources. The scientists, engineers and technicians from the various nations who will need to work together to implement an international radioactive waste disposal agency have long been extensively sharing their research and information. An agency capable of assuming the responsibility needs only the authorization to come full-blown into existence.

A crisis situation of resources and energy exists on this planet. Nuclear energy may be part of the solution to this crisis; one severe misstep and it may itself prove the final crisis. All nations must do all they can to prevent such a misstep. The voluntary cession of a non-vital portion of their national sovereignty is a small price to pay for the future security of the Earth.