TOWARDS AN EFFECTIVE LEGAL REGIME FOR MONITORING NUCLEAR WASTE DISPOSAL

Dissertation submitted to the Jawaharlal Nehru University
in partial fulfilment of the requirements
for the award of the Degree of
MASTER OF PHILOSOPHY

ARUN DEV GAUTAM

CENTRE FOR STUDIES IN DIPLOMACY,
INTERNATIONAL LAW AND ECONOMICS
SCHOOL OF INTERNATIONAL STUDIES
JAWAHARLAL NEHRU UNIVERSITY
NEW DELHI-110067, INDIA
1991

JAWAHARLAL NEHRU UNIVERSITY
NEW DELHI - 110 067

ILG/CSDILE/SIS JULY 1991

CERTIFICATE

This is to certify that this dissertation entitled TOWARDS AN EFFECTIVE LEGAL REGIME FOR MONITORING NUCLEAR WASTE DISPOSAL submitted by ARUN DEV GAUTAM in fulfilment of six credits out of a total requirement of twenty four credits for the award of the degree of MASTER OF PHILOSOPHY (M.Phil.) is his original work and may be placed before the examiners for evaluation. This dissertation has not been submitted for the award of any other degree of this university or of any other university, according to the best of our knowledge.

CHAIRPERSON
(CSDILE/SIS)
PROF. ASHOK GUHA

SUPERVISOR
PROF. RAHMATULLAH KHAN

CONTENTS

Acknowledgement

As an author of this work, I have cultivated a common field. So all others, who earlier ploughed the common field deserve my gratitude.

I am particularly indebted to professor Rahmatullah Khan, who supervised my work and gave me great encouragement which has been indispensable for completion of the work.

My gratitude goes in full measure to Professor R.P. Anand, Professor V.S. Mani, Dr. B.S. Chimni and Dr. Y.K. Tyagi, who played a key role in creating a very conducive academic environment with freedom for open dialogue and discussion, without which individual endeavours would not have led to fruition.

My friends Ajay, Dipak, Jhanna, Ashutosh, Madhusoodanan, Anand, Santosh, Akhilesh and Aditya deserve thanks who provided me all sorts of cooperation, help and encouragement.

ARUN DEV GAUTAM

INTRODUCTION

INTRODUCTION

As countries around the world have groped for solutions to their energy problems, development of nuclear power to generate electricity has often been touted as the best way to reduce dependence on foreign oil, as well as to ensure ultimately a limitless, clean and economic supply of energy for the future. Use of radioisotopes for medical purposes as well as in research institutions is also another positive use of the nuclear power. But destructive uses of nuclear energy, particularly the awesome destructive capability of atomic bombs made people react emotionally to the radioactivity.

Until the late 197Øs, nuclear policy was largely a matter determined and decided by governments mesmerised by the alchemy of nuclear innovation and the economic prosperity based on technological progress. A mystique was created around the nuclear issue which was said to be a fact in which value must not creep in. This was the era of value-fact dichotomy. The so-called 'front end' of electricity production was glamourised while the accumulating problem of nuclear wastes was largely ignored or buried in the technical reports in the atomic research complexes.

In the 198Øs, however, the nuclear issue moved beyond the customary secretive dicision-making into a sphere of open political debate and conflict. With the Chernobyl accident, a

new element in the lexicon of nuclear jargon has emerged, symbolising the catastrophe and disaster.

Nuclear Energy has mainly three drawbacks :

1. Differentiation between civil and military use is impossible so the possibility of misuse by diversion of plutonium in secretly developing nuclear weapons or other sabotage activities by terrorists.
2. Nuclear accidents and the resulting nuclear fallout.
3. Nuclear Waste Diposal.

This work deals with the last one:

As wastes from nuclear power plants, government projects and various fields of science continue to amass, attention is being focused to search for a viable sink for these wastes. The debate on the issue of radioactive wastes and their management is very understandable as the public is confronted with the fact that some residues from nuclear power generation release radioactivity of almost instant mortal level if no protection is provided and others maintain their toxic character over a period many times exceeding history of man.

Radioactive waste is generated as a by-product at every stage of the nuclear fuel-cycle. 'Uranium milltailings' is generated at the very first stage of the nuclear fuel cycle-i.e. mining of the uranium . After uranium is mined, it is transported

to a mill to be crushed allowing the chemical extraction and concentration of the uranium, which can be further processed for reactor fuel or bombs. The radioactive residue from the crushed ore, a fine powdery material, is referred to as mill 'tailings'. Over the years, tailings which have accumulated at mill sites in enormous piles have received minimal, if any, attention.[1]

The worst radioactive spill in the USA's history originated at a uranium mill. In July 1979, a dam holding a pond full of tailings at the United Nuclear Corporations's Church Rock mill gave way, releasing 10 million gallons of radioactive wastes into New Mexico's Puerco river. The resulting flashflood carried radioactive material and toxic heavy metals across the Arizona state line, through a Navajo reservation, and 80 miles downstream of the mill. On the day of the dam failure, samples in the Puerco showed radioactive contamination 6,000 times greater than the allowable limit for drinking water. Residents were advised not to swim in, drink from or otherwise touch the river water and to prevent their livestock from drinking it.[2]

The middle stage wastes from nuclear reactors are divided into the following groups:

---

1. For more details, see Handl, Gunther, " Managing Nuclear Wastes: The International Connection", Natural Resource Journal, Vol. 21, 1981, pp.281-289.

2. Abbots , John, "Who Pays for Radioactive Rubbish", Bulletin of Atomic Scientists, Aug.- Sep., 1984, p.25.

1. Spent nuclear fuel
2. Operating waste (Reactor Waste)
3. Core components and reactor internals
4. Decommissioning waste.

The spent nuclear fuel contains approximately 99% of the radioactive substances that are formed in a nuclear power plant. The notion of treating spent fuel as a waste is a recent one. Traditionally , planning for nuclear power reactors was based on the assumption that spent fuel would be reprocessed to recover usable uranium and plutonium. However, concerns over the nuclear proliferation aspects of plutonium recycled led many countries, particularly the USA. to defer the reprocessing indefinitely. Thus the primary source of wastes in future will be spent fuel and not reprocessing plants.

During the operation and maintenance of the reactor stations, operating waste is generated. This mainly consists of ion-exchange resins from water clean-up, replaced components, protective clothing, plastic covers etc. The operating waste is low or of intermediate level and mainly contains short-lived radionuclides. Similar waste also comes from spent fuel storage and from research facilities.

Components located in or near the reactor core, core components, are exposed to a strong neutron flux and become activated, some of these components have a high activity level,

when discharged from the reactor. They also contain a certain amount of long-lived radionuclides, which needs to be taken into consideration for disposal.

Decommissioning is another great potential source of nuclear wastes. Now, as first generation nuclear power stations are nearing the end of their operational lives, decommissioning is emerging as another back-end issue not fully anticipated or assessed. When a nuclear reactor is decommissioned, parts of the facility are radioactive and must therefore be disposed of in a safe manner. Most of the radioactivity is found in the reactor vessel and its internals, that are similar to core components. The remainder is similar in activity levels to the operating waste. The safe disposal of nuclear powered vessels or nuclear submarines after decommissioning is another global concern. In the US alone, it is reported that over 100 nuclear submarines are to be decommissioned at a rate of three to four ships a year. It has already sunk many decommissioned nuclear vessels in deep sea after defuelling them.[3]

---

3. Burman, Shibdas ,"Sea-disposal of Nuclear Wastes", Yojana, Vol. 34, n.10, 1990, p.27. --- When a naval vessel is removed from active service it is said to be decommissioned. Before the vessel is removed from service, the fuel is removed from its reactor pressure vessel in a process called defueling. Even after defueling, radioactivity remains in the vessel. In USA approximately 62,000 curies of radioactive materials remain in each defueled submarine. Furthermore , there are approximately forty eight nuclear warheads and seven nuclear power reactors on the bottom of the oceans as a result of various accidents, according to J. Handler and W.M Arkin's report on naval accidents between 1945-88 (June 1989).

All waste materials, which may conceivably have become contaminated by radioactive substances must be regarded in the first instance as radioactive wastes. Thus, virtually everything in use in such processes may, at one time or another, appear as radioactive wastes, and these may therefore take a wide variety of physical and chemical forms. In fact, it is important to establish at the outset that the term 'radioactive waste' does not relate to a single homogenous commodity but covers a range of different materials to which very different considerations apply.

For this reason, several classification systems have been adopted according to local or national circumstances. Some refer to liquid, gaseous and solid nuclear waste categories; others as low-level , intermediate-level and high-level wastes. The International Atomic Energy Agency has also made efforts to standardize the classification and it has adopted the later one which is based on specific activity level of the wastes.

Though the IAEA (International Atomic Energy Agency) defines high-level waste on the basis of activity concentration but it is too technical to understand for a layman. But for our purpose, high level wastes generally have longer half- lives and consist mainly of spent fuel from nuclear reactors and nuclear weapons. Since the vast majority of spent fuel rods have not been reprocessed, spent fuel can be considered as high-level wastes. High-level waste is characterized by high-levels of

penetrating radiation, high rates of heat generation and long half-life.

Low-level wastes include equipment and materials used in the weapons program, power plant operation, medical activities and industrial nuclear activities. The major problem resulting from low-level wastes tend to be related to the great volumes in which they are produced rather than to their level of radio-activity. The huge amount of low-level wastes come from decommissioning and uranium mill tailings which demand extensive burial space.

There is much confusion and debate over precise distinctions between high and low-level wastes. There is even confusion over classifying wastes as falling into only the high or low-level categories. To illustrate, before 1970, no distinction was made between low-level wastes and transuranic wastes and both were buried together at a number of sites. But now the latter is treated akin to high-level waste. Even Plutonium-239 is regarded as transuranic waste, which is one of the most toxic transuranics and can cause cancer if inhaled in minute quantities. This element has a half-life of 24,000 years, which means it takes 24,000 years to loose half of its radioactivity and then another 24,000 years to loose half of its remaining activity.[4] Thus the present classification accepted by

---

4. Jackson, Thomas C., "Introduction", in Nuclear Waste Management - The Ocean Alternative,(ed.), Jackson, Thomas C., Pergamon, 1981, pp.5-6.

the IAEA, and which also forms the basis of the London Dumping Convention (1972) regulating nuclear waste in the ocean, can not be regarded as an undisputed, flawless scientific 'fact' to be relied upon. In the context of this technical detail, the first chapter of this work deals with the environmental effects of different nuclear waste disposal methods. Radiation induced genetic damages are particular human tragedies associated with nuclear wastes. Amongst others are leukaemia, skin damage, cataracts and impaired fertility and risk of developmental abnormalities. Besides this, biological effect of radiation on animals, fish, and other marine organisms may be transferred through food chain to humans.

In the second chapter, international efforts to regulate nuclear waste disposal have been analysed. Apart from the customary law and general principles, conventional law has been critically examined. The present international law is still based on the framework of sovereign nation state system, so any harmful effect on environment of a state must be related to the interests of nation state, since, if no state interests including the rights of citizens protected by a state are violated ,no claim could arise under international law. There may be four basic modes of jurisdiction.

1. States' sovereignty or exclusive management authority (e.g. inland waters, territorial sea and economic or resource zones)

2. Joint control (e.g shared resources such as international lakes and river systems)

3. Common property (e.g. high seas resources)

4. Potential international ownership (possibly including the seabed outside national jurisdiction)[5].

In areas subject to state sovereignty such as internal waters and territorial sea, states are generally conceded to have the sovereign right to exploit their own resources pursuant to their own environmental policies, which flows from the principle of permanent sovereignty over natural resources. But they have also the responsibility to ensure that the activities within their jurisdiction or control do not cause damage to the environment of oher states or of areas beyond the limits of national jurisdiction. But to what extent the rights and obligations inherent in the concept of sovereignty over natural resources will apply to activities in the fisheries zone or Exclusive Economic Zone - including nuclear activities is currently unclear. Similarly the controversy over 'seabed emplacement' is also unresolved yet. The seabed beyond national jurisdiction has been proclaimed the common heritage of mankind by several U.N. General Assembly resolutions and the 1982 UN Law

---

5. See generally , Finn, Daniel P., "Nuclear Waste Management Activities in the Pacific Basin and Regional Cooperation on Nuclear Fuel Cycle", Ocean Development and International Law Journal, Vol. 13, No. 2, 1983, pp. 218-223.

of the Sea Convention. A state emplacing highlevel radioactive wastes in the deep seabed could be expected to exclude activities of or authorized by other states, unauthorized parties or an international body that could disturb the wastes. These are some of the controversial issues to be taken into consideration. Some of these have been discussed in the second chapter of this work.

The third chapter includes some of the equity issues relevant to nuclear waste disposal. There is no burden/benefit concordance in this area. The distribution of burdens and benefits of energy systems is particularly troublesome in the case of radioactive wastes, for what is beneficial for some people often is harmful or burdensome to others. High degrees of uncertainty characterize both benefits and burden, and beneficiaries and those burdened are separated by great distances or long expanses of time. Thus the wide divergence between the beneficiaries and those sharing ecological load created by time and space (geographical and generational divergence) is the major equity issue to be addressed by any international or national legal regime in order to be effective.

Finally some suggestions have been solicited to make the international legal regime effective.

CHAPTER – I

Chapter I

ENVIRONMENTAL IMPACT OF DIFFERENT NUCLEAR WASTE DISPOSAL TECHNIQUES

Radioactive waste is an issue on which views are often solidly fixed. There are those who claim that radiation is routinely causing cancer and genetic abnormalities. And there are those who claim with equal fervour that radiation is harmless, perhaps even healthful. This paradox is well expressed in the speech of a US senator Matsunaga who said -

> "I could spend several hours citing facts and figures indicating that nuclear dumping in the seabed is unsafe. Then I could spend several more hours citing facts and figures indicating just the reverse that nuclear dumping may even improve our health".[1]

Scientific research into the effects of nuclear waste dumping is vast and can not be reviewed here. Experts in government, industry, and science claim to know more about radiation than about any other potential health hazard. Radiation is agreed to be the most exhaustively studied single environmental insult worldwide. We know more about the effects of ionizing radiation than about the effects of practically any other toxic agent that man exposes himself to.[2] Scientists and

---

1. Matsunaga, Spark M., U.S. Congressional Record (Senate), 97th Congress, 2nd session, April 1, 1982.

2. Liverman, J., quoted in Forevermore-Nuclear Waste in America by Barlette, Donald L. and Steele, James B.W.W., Norton and Company, New York, 1985, p.297.

experts know that radiation causes leukemia and almost every type of cancer and that it will shorten a person's life span by months, years or decades. They know that it will cause cataracts and weaken bodily defenses. They know that, if ingested or inhaled, some radioactive substances will be more harmful to certain body organs than to others. Strontium behaves like calcium and is observed in the bones. Radioactive iodine concentrates in the thyroid gland. Radon gas clings to particles that lodge in the lungs, as does plutonium. Radioactive sodium spreads through the body. The tiniest amount of radiation to the reproductive cells will cause mutations.

Scientists know all this and much more. Yet their ignorance dwarfs their knowledge. No one understands why radiation is more harmful to the young than to the old, or why some people develop cancer from small doses of radiation and others do not. No one can identify those who are not susceptible to radiation-induced cancer. On the most elementary level, it is impossible to say why radiation will cause a single cell to become cancerous and over time reproduce billions of other cancerous cells.

Decades often elapse between the time when cancer is induced by radiation and then it is finally detected - often too late. Scientists do not know why some cancer cells proliferate more rapidly than others. They do not know why some cells are

more sensitive to radiation than others. Most important of all, they do not know how small a dose of radiation is required to turn a healthy cell into a cancerous cell. It may be ten rems or one rem. There is no irrefutable physical evidence to demonstrate the effects of low-dose radiation.

This scientific uncertainty in this area creates another big problem. A common scenario is one in which technological experts and scientists embrace science as the primary means of resolving disagreement over a proposed project. Arguing that solutions to the problems of a technology should come from technology, they exclude relevant discussions of conflicting values. They want to keep science unaffected by the social, political and economic issues.[3]

But due to scientific uncertainty in this area, the values of scientists inevitably creep into and influence the interpretation of findings. This increasingly contributes to the decline in the legitimacy of science in this area. Under these circumstances, science is no longer the vehicle for consensus that it has been, and attention is shifting to issues of social, political and economic value as a basis for forging agreements.

Decision-making for all wastes, including radioactive wastes has until recently been dominated by the industrialised

---

3. Spiller, Judith and Hayden Cynthia "Radwaste at Sea: A New Era of Polarization or a New Basis for Consensus", Ocean Development and International Law, Vol. 19, 1988, p. 351.

nations, most committed to domestic nuclear programmes. These countries possess years of experience in the areas of nuclear technology and radioactive waste management. The industrialized countries' monopoly on scientific expertise also affects the use of science in decision-making. Because the values and objectives of these nations are fairly homogeneous, consensus has been relatively easy to achieve through science. Nations lacking scientific expertise in this area face problems in acting as equals in the science-driven decision-making process. Moreover, differing social, political and economic objectives have splintered these developing nations.[4]

This is evident from the nuclear waste dumping policies of industrialized countries, particularly UK, Belgium and USA. They generate the bulk of radioactive wastes while pursuing their country's well-being. They are unlikely to renounce this technology despite the combination of geography, geology, and population distribution that make land disposal difficult and costly. Rather, they will probably continue to seek domestically less unpopular and costly methods to dispose of these wastes. Thus, though couched in science, their policy serves their social, political and economic objectives.

Countries dependent on the oceans for their livelihood and located near existing or proposed dump sites are unlikely to

---

4. ibid., p. 350.

modify their beliefs that their marine resources and ultimately their citizens' health may be threatened by other countries' radioactive wastes. These nations (South-Pacific nations in particular) share the position that because ocean resources are central to their economies, any risk to these resources is unacceptable. Some of these nations have extensive experience with the costs of nuclear technology without experiencing any attendant benefits. Nuclear testing was imposed on the South-Pacific region. Many now suffer the health and environmental effects of programmes conducted without their consent and carried out with false reassurances of safety by the industrialized nations.

The objective of disposal is the permanent isolation of the wastes from all contact with living organisms, especially from human beings. But the question of the disposal of radioactive wastes has not yet found a satisfactory solution and radioactive wastes continue to accumulate, temporarily held in storage, threatening to contaminate the soil, water and air.

There are two basic approaches to the problem of radioactive waste disposal. First is the 'concentrate and contain' approach, and the second is 'dilute and disperse'. The 'dilute and disperse' approach is applicable to wastes with generally low concentrations of radioactive materials and to environments with adequate dilution capacity.

The 'concentrate and contain' approach applies multibarrier principle, as in the case of reactor safety itself. In brief, the plans call for maximum possible immobilization of the wastes or irradiated fuel, especially against solution or suspension in water; encapsulation of the immobilized wastes in long-lasting, corrosion-proof canisters or capsules, often multiple; incorporation of the encapsulated wastes in buffering material designed to retard water-penetration, while freely permitting heat release; choice of site for the engineered repository in deep rock or in the ocean floor, so as to minimise water migration past the wastes, and to retard the migration of radionuclides in such migrating water; choice of site for the repository remote from earthquake or volcanic hazards, possible economic resources, and with good access to the required transportation links.[5]

Several methods for storage and disposal have been considered in the literature, but none of these methods has been accepted internationally as being really feasible or satisfactory. These methods include - (i) geologic disposal, (ii) ice-sheet disposal, (iii) ocean disposal and (iv) extra terrestrial or space disposal.

---

5. Hare, F.Kenneth and Aikin, A.M. "Nuclear Waste Disposal: Technology and Environmental Hazards" in Nuclear Power : Assessing and Managing Hazardous Technology, [ed.) by Pasqualetti, Martin J. and Pijawka, David K., Westview, London, 1984, p.327.

Among these, two are the most practiced methods, viz. geologic and ocean disposal, which will be discussed at length because of their real danger of international dimension. Meanwhile, the environmental hazards associated with other disposal options may be taken for consideration.

Studies have been made with regard to the possibility of emplacement of wastes in either Antarctica or Greenland. But the alleged advantages of ice-sheet disposal in a cold remote area and in a medium that would isolate the wastes from man for many thousand years cannot be proven.

Ice-sheet disposal would have the advantages of remoteness, low temperatures, and the isolating effects of the ice. But technical feasibility of this option depends on the long-term stability of the ice-sheets. Ice-dynamics are uncertain and the adverse climatic effects of 'global warming may melt the ice which can transport radioactivity to biosphere. "In 1973, it was suggested that underlying the ice-sheets of Antarctica there were a number of lakes which are now believed to be in direct communication with each other and with the oceans. Thus the slow but inevitable grinding of the blocks by the ice on the basement rocks would lead to leaching and a pathway back to the biosphere for the actinides."[6] The consequence of release of

---

6. Royal Commission on Environmental Pollution, Sixth Report, 1976, HMSO, London, p.15Ø, Para 395.

radioactive decay heat to the ice are also uncertain. So the polar ice which is already endangered by the 'global warming' phenomenon can never be an environmentally safe disposal option.

Space disposal has been suggested as a unique option for permanently removing high-level nuclear wastes from the earth's environment. In this disposal method, high-level waste is formed into a ceramic-metal matrix, and packaged in special flight containers for insertion into a solar orbit other than that of the earth and the planets or escape from the solar system, where it would be expected to remain for at least one million years. The National Aeronautics and Space Administration (NASA) has studied several space disposal options since the early 197Øs. The concept involves the use of a special space shuttle that would carry the waste package to a low earth orbit where a transfer vehicle would separate from the shuttle and place the waste package and another propulsion stage into an earth escape trajectory. The transfer vehicle would return to the shuttle while the remaining rocket stage inserts the wastes into a solar orbit.

But it is an impracticable and economically unviable option. The space disposal option appears feasible for only a small proportion of selected long-lived radionuclides, the separation of which still defies technological solution. Moreover, the space environment itself has not unlimited accumulative capacity. The increasing space - debris and

radioactivity in space can not bear the radioactive wastes accumulation for an unlimited period. More fool-proof space launching rockets are also needed because risks of launch pad accidents and low earth orbit failures have still not been eliminated.

Geological disposal of radioactive wastes is the disposal of radioactive wastes in conventionally mined repositories deep within the geological formations of the earth. It includes the concept of the use of multiple barrier to provide a series of independent checks to the release of radionuclides to the biosphere.

The multiple barriers that could contain nuclear waste in deep-mined repositories fall into two categories- (1) geological or natural barriers and (2) engineered barriers. Geologic barriers are expected to provide isolation of the waste for at least 10,000 years after the waste is emplaced in a repository and probably will provide isolation for millenia thereafter.[7]

The two most important components of the geologic barrier to be considered in choosing a nuclear waste site are the

---

7. Hoskins, Earl R. and Russel James E. "Geologic and Engineering Dimensions of Nuclear Waste Storage" in Nuclear Waste: Socio-Economic Dimensions of Long- term Storage, (eds) Murdock Steve H., Leistritz Larry F. and Hamm Rita R. , Westview Press, Colorado, 1983, p. 23.

host rock itself and the geologic surroundings. Assuming the ultimate failure of the waste canisters, the geological strata should have properties that would provide a barrier to the radioactive materials released within the repository. Tectonic stability and a non-communicating hydrologic regime would ideally be combined with the properties of host rock to maintain long-term repository strength and isolation integrity.

Dispersion of radionuclides by migrating ground water and the possibility of future human intrusion in search for resources are the two most important potential risks associated with the concept of geological disposal. Man also could indirectly interfere with the waste isolation system by changing the environmental parameters which control the rate of geologic process and, therefore. bringing about truly exceptional change. For example, man could induce climatic changes, or increase erosion rates, or increase the amount of ground water reaching the disposal formation. [8]

Ground water intrusion and transport is, by far, the most important process for the return to the biosphere of radionuclides placed in a deep geologic repository. As a matter of fact, it is difficult to conceive of a geologic repository for

---

8. Gera, Ferroccio , "Geologic Predictions and Radioactive Waste Disposal" in Predictive Geology: With Emphasis on Nuclear Waste Disposal,(eds) De Marsily Ghistain and Merriam Danil F,. Pergamon Press, 1982, p. 18.

which the eventual intrusion of ground water can be ruled out. Even repositories in salt, which is the driest host rock, eventually, will be invaded by ground water, once the geologic barrier has been removed by dissolution. Besides salt, some other rocks are also being used as natural geological barrier, e.g. clays, shales and igneous rocks for their strength, permeability, thermal conductivity and expansion, and radiation resistance.

Ocean disposal option has always been attractive in respect of not only nuclear wastes but all wastes. Both the approaches - 'concentrate and contain' and 'dilute and disperse' - apply in ocean disposal. The second approach, however, was temporarily suspended by the parties to the London Dumping Convention in 1983, and the onus of proof of the harmlessness of sea dumping put on practitioners. The first approach, i.e. 'concentrate and contain' includes burial or emplacement of radioactive waste in sedimentary deposits beneath the bottom of the deep sea.

The seabed disposal option has certain advantages:

(1) Developing marine technology may provide the means to design, implemented and monitor a disposal system.

(2) Deep seabed sediments which would tend to trap released radionuclides from high-level waste, constitute one of the most geologically stable environments in the world.

(3) The ocean provides a medium of dilution for any wastes released from a repository.

(4) Ocean sites would provide resistance to future human intrusion.

(5) Ocean repositories would reduce domestic political pressures associated with selecting land-based sites. Densely populated countries also have scarcity of land.

(6) There are many layers of defence all of which would have to be significantly breached before posing a danger to man.

But the ocean disposal option involves several troubling risks too.

(1) Wastes are irretrievable once they have been placed in the ocean. What may appear to be acceptable today may prove unacceptable tomorrow. It is necessary to maintain the option of future remedial action because we do not have a full understanding of the ecological consequences of ocean disposal of redioactive wastes.

(2) The bioaccumulation (refers to those processes by means of which organisms take up chemicals from the physio-chemical environment and incorporate them into some or all of their tissues) of radionuclides is poorly understood. High levels of pollutants which bioaccumulate have led to "bio-concentration" and "biomagnification" that kills or causes

serious diseases to marine organisms or anything which feed on them.

More serious is the long-range impact of wastes on the marine environment. Some radionuclides have a tendency to affect some species more than others. The resulting diminution of species variety is known to upset the eco-balonce.[9]

Given the long half-lives and extremely hazardous nature of radionuclider in high-level wastes, no seabed disposal R and D programme has (nor can it be expected to have in the near-term) the engineering capability or sufficiently precise long-term risk assessment foresight to assure the world at large that such disposal will not cause harm to the marine environment.[10] Of course, it is true that almost everything put into the sea is either diluted to insignificant concentrations or broken down by physical and biological action or stored harmlessly on the seabed-Unfortunately, however, dilution is not the only process which goes on in the sea. Bioaccumulation and biomagnification cause severe ecological repercussions on species and biological processes and could contaminate food chains that result in hazard to human health.

---

9. Kindt, Warren, "Ocean dumping", Denver Journal of International Law, Vol. 13, 1984, p. 347.

10. Curtis, Clifton E., "Legality of Seabed Disposal of High Level Radioactive Wastes Under the London Dumping Convention", Ocean Development and International Law, Vol. 14, , Revelle, Roger and Scharfer, M.B.,1985, p. 391.

In contrast to land masses, the oceans are a continuous space and all parts of the ocean and its bordering seas are in communication with each other. What happens at any one point in the sea ultimately affects the waters everywhere.[11] So ocean disposal taking place within territorial waters or contiguous zone of a country due to considerations of convenience and high transportation costs will pose a typical environmental problem of 'divergence between the loci of action and loci of consequences'. This is particularly true about radioactive pollution because it disturbs the whole marine ecology by the process of 'bioconcentration' in certain species.

The divergence between the loci of action and the consequences is also created by exporting of radioactive wastes from one country to another. The countries of south-pacific have been, since immediate post-War period, bearing the consequences of nuclear activities, the fruits of which went to USA and France. These countries have dumped the radioactive wastes from their weapon production and commercial use of nuclear power. As a result, the population of the islands suffered severe genetic disorders and cancerous illness. A nuclear test caused a crack

---

11. "Oceanic Research Needed for Safe Disposal of Radioactive Wastes at Sea", in Waste Treatment and Environmental impact of Atomic Energy, Vol.18, Proceedings of The IInd U.N. Conference on the Peaceful Uses of Atomic Energy, U.N., Geneva, 1958.

in the atoll and radiation leaked into the sea. The US senator Matsunaga has put this problem as follows:

> "A generation ago, US set off the world's first hydrogen bomb on an island in an ocean enshrined in western consciousness for the images it evokes of peace and tranquility. After several more demonstrations of our heretofore undreamed of capacity for destruction we departed , leaving behind an uninvisibly, as yet undetermined, lethal radioactive environment and traumatized community."[12]

Matsunaga also exposes the duality in US policy towards nuclear non-proliferation, which under the cover of this policy actively promotes reactor sales abroad and finances their construction with Export-Import Bank loans at the most favourable rates. He warns the US against the simmering discontent in the whole South-Pacific, sometimes manifested in the form of "Nuclear Free Pacific" movement. "We may bend them (Pacific Islanders) to our will, employing the leverage of foreign aid, but all history argues that in that case we would be sowing the seeds of resentment that would one day grow to haunt us, as in fact already beginning to occur."[13]

Referring to the French nuclear testing, that had virtually destroyed one Pacific atoll and then threatened to do the same to another while leaking radioactive materials into the sea, Matsunaga suggested the US government to make known its

---

12. op. cit., n. 1.

13. op. cit., n. 1.

opposition to the construction of interim nuclear waste storage facilities on remote Pacific islands or atolls. He said :

> If we can not guarantee the security of disposal sites on the American continent, how can we possibly guarantee them on tiny, comparatively fragile Pacific Islands, especially for high level wastes such as spent fuel. Since we obviously can not guarantee security, should we then rekindle nightmares that we ourselves had induced? In that context it is worth pointing out that as the senior users of nuclear power, we are only just beginning to discover how complex and uncertain are the safety measures surrounding its production and containment".[14]

Another environmental hazard may occur during transportation of the radioactive wastes to the final disposal or temporary storage site. Even if an accident does not occur, sometimes the surface radioactivity is increased manifold. In case of transfrontier movement of radioactive wastes, through surface, air or oceans, the en route countries' population or environment may be endangered by the radioactivity in case of an accident. Though, in case of the disposal site being distant from the source of waste material requiring long-distance marine, air or surface transport, nations apply regulations and safeguards; yet, sometimes false-labelling is done and high-level waste is transported under the label of low-level waste. It was reported that a West German firm, Transnuklear, in January 1988, had transported 2400 barrels of highly radioactive material falsely labelled as low-level waste, to the Belgian nuclear

---

14. op. cit., n. 1.

research centre at Mol, by paying bribes to enable the transports.[15]

This type of possibilities are always there which can lead to increase in the level of radioactivity in the high seas or endanger the countries through which the wastes pass. This is the dilemma of environmental pollution where the 'benefits' of some could dearly cost many others. The costs and benefits do not converge or coincide but they are divergent. This is particularly true of the radioactive wastes whose so called 'back end' and 'front end' go in different directions.

---

15. Keesing's Record of World Events, Vol. 34, 1988, p. 35725.

CHAPTER - II

PART - A

Chapter II

Part-A

CRITIQUE OF THE EXISTING INTERNATIONAL LEGAL REGIME

Given the long-term hazards associated with nuclear wastes, there is always a possibility that in the long run significant amounts of waste material will reach the transnational environment. In fact, like all other environmental problems, the problem of nuclear waste disposal is also essentially transnational. "From any anthropological perspective it is easy to observe that humankind is today confronted with not merely some important transnational problem, but that practically all of humankind's important problems are transnational and interconnected in origin and impact."[1] Because of this transnational origin and interdetermination in impact, any effective and continuing solutions for these problems must be equally transnational and comprehensive.

The international aspects of radioactive waste management have also to be recognised notably in view of possible accidental releases of longlived radionuclides and of improper storage or disposal conditions in one country which might affect neighbouring regions through rivers and groundwater movements.

---

1. See Mc Dougal, quoted in Handl, Gunther "Managing Nuclear Waste: The International Connection" , Natural Resources Journal, Vol. 21, 1981, p. 267.

In this respect present national borders have no real significance given the long -term hazards of some radioactive wastes. Even if the actual risks of disposal can be reduced to extremely low levels, possible implications of a global nature might be envisaged and this aspect of radioactive waste management deserves careful consideration by the international community.[2]

National management efforts are fundamentally inter-dependent, and safe management of radioactive wastes is achievable only through considerable international cooperation and coordination. In this respect nuclear waste management is another example of the growing spectrum of human activities which render the notions of national boundaries and domestic jurisdiction obsolete.

The earliest attempt to develop a cooperation, coordination and harmonization between various national management systems and to establish most widely accepted principles of radiation protection was made by the International Commission on Radiological Protection (ICRP). It was set up in 1928, under the name of International X-Ray and Radium Protection Commission by the Second International Congress of Radiology, and assumed its present name and organizational form in 1950s, in

---

2. Nuclear Energy Agency, OECD: Objectives, Concepts and Strategies for the Management of Radioactive Waste Arising From Nuclear Power Programmes, 1977, p.61.

order to cover more effectively the rapidly expanding field of radiation protection. ICRP is a private association of experts, who are elected on purely scientific ground and who are independent of any political or commercial interests.[3]

The ICRP issues from time to time recommendations on radiation protection which are continuously revised to cover the increasing number and scope of radiation hazards and to take account of new knowledge concerning the effects of ionizing radiations.

The ICRP recommendations have had, and continue to have a considerable influence on the regulatory activities of the competent international organizations as well as on national law-making in the field of radiation protection. But, ICRP does not avail itself of any institutional powers to implement its recommendations.[4] It deals with basic principles of radiation protection and leaves to the various national protection committees the right and the responsibility of introducing the detailed technical regulations, recommendations or codes of practice best suited to the needs of their individual countries. The ICRP recommendations also provide a scientific and technical basis for the safety standards of the International Atomic Energy

---

3. see Nuclear Law for developing World, Collection of Lectures - IAEA, Vienna, 1969 , pp. 211-12.

4. OECD: Nuclear Energy Agency, Regulations Governing Nuclear Installations and Radiation Protection, 1972, p. 12.

Agency (IAEA). The IAEA has produced radiation protection safety standard based on these recommendations(of ICRP) which are not only applied to their own operations and projects assisted by them, but were also recommended to their member states as standards to conform to in drawing up their national regulations. But these recommendations do not have a legally binding effect, although these are often adopted into national law. They lack the force of treaties. Thus, here, national sovereignty, and with it the freedom to set national standards, by and large, prevails. The result is that international regulation of nuclear energy in general and nuclear waste in particular is unsatisfactorily weak.[5]

A distinction is often drawn between the "promotional" and the "regulatory" work of the IAEA. With the Chernobyl accident, the IAEA is pursuing more and more regulatory work . "The Chernobyl accident demonstrated that the fundamentally benign view of nuclear power adopted in the 195Øs now required modification, with new emphasis on stronger international control of safety measures. Thus the priorities have been altered; the Agency now attaches high importance to its nuclear safety role. Rather like the IMO (International Maritime Organisation) after the Torry Canyon disaster, it has acquired a new environmental

---

5. Boyle, Alan E., "Nuclear Energy and International Law - An Environmental Perspective.", The British Yearbook of International Law, 1989, pp. 26Ø-61.

perspective as perhaps the one positive result of Chernobyl".[6]

The statute requires the IAEA to establish 'standards' for protecting health and minimizing danger to life and property. In addition, its health and safety document sets out a policy on the inclusion of safety standards in agreement with states. This refers to 'standards, regulations, rules or codes of practice established to protect man and the environment against ionising radiation and to minimise danger to life and property.[7] The IAEA standards, regulations, codes of practice, guides and other related instruments cover such subjects as radiation protection, transport and handling of radioactive materials and radioactive waste disposal. The Nuclear Safety Standards Programme, revised in 1988, sets basic minimum safety standards and guiding principles for the design, construction, siting and operation of nuclear power plants. The important point is that the Agency has competence over a wide range of safety and health issues relating to all aspects of the use of nuclear energy; what it lacks is the ability to give these standards obligatory force".[8]

Nothing in the statute confers any binding force on the IAEA standards or requires member states to comply with them.

---

6. ibid, pp. 261-62.

7. For details see, Nuclear Law for Developing World, IAEA, Vienna, 1969, pp. 3-4.

8. op. cit., n.5, p.262.

Only where the Agency supplies materials, facilities or services to states does the statute give it the power to ensure, through project agreements, that acceptable health safety and design standards are adopted. In such cases only it has also the right to examine the design of equipment and facilities to eusure compatibility with its standards and the right to send inspectors to verify compliance. If these are not met, further assistance may be terminated and membership of the Agency withdrawn.

These powers over safety relate only to materials or facilities supplied by or through the IAEA; states can not be required to place their other facilities or materials under its standards merely because they seek its assistance, although they may do so voluntarily.[9]

The process of adoption of the IAEA health and safety standards confirms their legal status. In most cases, they are not approved by the Agency's general conference in which member states are represented, but by the Board of Governors. It is thus difficult to describe them even as 'soft law' or to regard them as representing a standard of 'due diligence' for states to meet.[10]

---

9. For details see Szasz, The Law and practices of the IAEA, (Vienna, 1970) Chapters 1 and 2.

10. op. cit., n. 5, p. 264.

Despite their non-binding character, the IAEA health and safety standards are a significant contribution to controlling the risks of nuclear wastes and other risks associated with nuclear fuel cycle. Governments are consulted during the formulation stage and in some cases drafting is carried out in cooperation with specialist bodies such as the International commission on Radiological Protection (ICRP).[11] The Agency's standards thus reflect a large measure of expert and technical consensus, and it is for this reason, and not because of their legal status, that they have been influential and do serve as important guidelines for most states in regulating their nuclear facilities.[12]

In a few cases, other treaties do give IAEA standards a greater legal standing. The High Seas Convention (1958) requires states to take account of them in preventing pollution of the seas from dumping of radioactive waste. The 1972 London Dumping Convention allows the IAEA to determine what high level waste is unsuitable for dumping at sea, and confirms the duty of states to take account of Agency standards when dumping low level waste.[13]

The European Atomic Energy Community (Euratom) is another international body that sets uniform safety standards to

---

11. Smith, IAEA Bulletin, 3Ø (1988), p.42.

12. Szasz, op. cit., n.9, p. 673.

13. op. cit., n. 5, p. 264.

protect the health of workers and general public against radiation in EEC member states. Unlike the IAEA, however, the EEC has power to require member states to implement safety directives and to ensure that they are enforced. Since 1959, Community directives have laid down basic radiation standards for health protection. The object of these is to ensure that community citizens are protected to internationally agreed levels, and that all exposures are adequately regulated and kept as low as is reasonably achievable.

Article 37 of the Euratom treaty (1957) requires notification to be given to the Commission when radioactive substances are to be discharged which may contaminate other states, for example by disposal at sea or into rivers. But in this case, the Commission may only comment on the proposal. It cannot veto the proposal; nor issue directives to take adequate measures to prevent the radioactive emissions into air or water. So, despite having clear advantage over the IAEA that Euratom can give legal force to its safety measures, it has adopted the safety measures which are limited in scope.

The Community has no power of independent inspection and both the Euratom treaty and Community law fall well short of creating an obligation for member states to submit nuclear installations to independent environmental or safety assessment by the Community. Thus despite its apparent advantage, the

Euratom treaty has proved little more effective than the IAEA statute as a basis for regulating environmental hazards of nuclear energy.[14]

The Nuclear Energy Agency (NEA) is yet another organization of the OECD, which aims to encourage the adoption of common standards for national nuclear legislation dealing with public health and the prevention of accidents. Standards on such matters as radiation protection and waste management have been developed in collaboration with the IAEA and other bodies, but once again there is no power to compel compliance. The main achievements of the NEA appear to lie in the dissemination of information among states and the harmonization of national policies on the basis of consensus.[15]

Given the above organizational frame-work, let us now review the customary and conventional law concerning nuclear wastes disposal. there are certain customary law obligations concerning transboundary pollution and environmental harm which are also applicable in the case of nuclear wastes. One of them is the principle of 'good neighbourliness'. International law does not allow states to conduct activities within their territories, or in common spaces, without regard for the rights

---

14. For details, see, op. cit., n.3, pp. 39-45; and op. cit., n.4, p.14.

15. see op. cit., n. 4, p. 15.

of other states or for the protection of the environment. States are required to take adequate steps to control and regulate sources of serious environmental pollution or transboundary harm within their territory or subject to their jurisdiction. Support for this principle of harm prevention can be found in a small number of arbitral and judicial decisions. In the well known Trail Smelter arbitration, a tribunal awarded damages to the United States and prescribed a regime for controlling emissions from a Canadian smelter which had caused air pollution damage. It concluded that 'no state has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another.'[16]

The jurisprudence of the International Court supports a similar principle. In the Corfu Channel case, the Court held Albania responsible for damage to British warships caused by a failure to warn them of mines in territorial waters. It indicated that it was 'every state's obligation not to allow knowingly its territory to be used for acts contrary to the rights of other states.[17].

Continued international support for this broad principle that states must control sources of harm to others or to the global environment is reflected in the United Nations

---

16. op. cit., n. 5, pp. 269-270.

17. Ibid, P. 270

resolutions, in Principle 21 of the Stockholm Declaration of 1972, in Articles 192 and 194 of the Law of the Sea Convention, 1982, in UNEP Principles and in the work of the International Law Commission. These instruments indicate also that the older formula referred to in the cases which protected only states, has now been superseded by a wider principle which protects common spaces including the high seas, deep seabed and outer space, and also atmosphere from pollution.

Principle 21 of the Stockholm Declaration is particularly important which runs as follows:

> States have, in accordance with the charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction".[18]

Professor Sohn explains that Principle 21 attempts to balance the right of States to be free from external interference with that of state responsibility; nevertheless, he argues, and correctly so, that a state may not cause damage beyond its territory. It must be regrettably conceded that Principle 21 recognized practically complete freedom provided that only

---

18. Report of the UN Conference on the Human Environment, stockholm, 1972, UN Doc. A/Cont. 48/14/Rev. 1

External consequences result.[19]

But in case of nuclear wastes, the application of this principle is problematic. Most interpretations of the principle refer to an obligation to prevent harm or damage to other states or to the global environment and usually assume that this must reach some level of seriousness before it becomes wrongful.[20] But it is very difficult to define or assess the threshold in the case of radioactivity. More problematical is the view that this threshold is essentially relative and conditional on equitable considerations or a balance of interest. This approach has the effect of converting an obligation to prevent harm into an obligation to use territory equitably and reasonably, or into a constraint on abuse of rights.

Another possible limitation on the principle that harm must be prevented focuses on the type of interest protected, or on the type of harm which must occur. The Trail Smelter arbitration took a narrow view. Its concentration on property loss places no value on wider environmental interests such as wild life, aesthetic considerations or the unity of ecosystem. Although there has been a tendency to broaden the original, and clearly out-dated, approach in Trail Smelter, it is uncertain how

---

19. Gormley, Paul W. Human Rights and Environment : The Need for International Cooperation (A.W Sijthoff Leyden), 1976, p.36.

20. op. cit., n. 5 , p. 276

far the obligation not to harm other states extends to environmental injury not quantifiable in material terms. For that reason nuclear wastes and the radioactivity is unlikely to amount to serious harm unless long term effects are presumed.[21]

Moreover, the interpretation of Principle 21 by Professor Sohn becomes erroneous because of the time factor involved in the effects of nuclear wastes. In case of nuclear waste, nations cannot argue that they are free to adopt a waste management policy by invoking the principle of territorial sovereignty and claiming that state action is not subject to international review as long as its effects are felt only within national boundaries. The reason is simple that the nuclear wastes remain hazardous for millions of years which "transcends the narrow confines of the territorially defined social organization and ideology that are responsible for the initial national commitment. At the time of the original decision, the allocation of resources and risk was presumably based on consensus within the territorially defined society. The decision's effect may have been deemed to be truly national".[22]

Careful reflection, however, leads to the conclusion that such a decision holds additional transnational implications.

---

21. ibid, p. 276.

22. Handl, Gunther, "Managing Nuclear Waster : The International Connection", Natural Resources Journal, Vol. 21, 1981 p.273.

During the time at issue here, societies may undergo extensive changes. Their organizational structures and territorial parameters by which they may be defined will experience considerable evolution. Yet a commitment of the above kind represents an implicit projection of present day conditions into a very distant future. It implies a social organization which pursues similar values as a fundamental characteristic of that social entity.[23]

While there may be disagreement over the degree of unreasonableness of such projections, there appears little room for doubt that future patterns of global social interaction and organization will undergo drastic changes. The authority by which a territorially organized society makes decisions regarding nuclear waste systems within that territory may ultimately belong to what is known as the international community as a whole. It follows then that nuclear waste management decisions in a given society may not merely be seen as serious moral issues for the society on whose national territory the system is to be implemented, but rather must be recognised as a matter of international concern. Effects of such decisions might be felt long after concepts such as territorial sovereignty have become anachronistic. since decisions could significantly affect groups of people whose organizational context can not be anticipated the

---

23. Ibid, P. 273-74.

decision directly concerns mankind as a whole.[24]

Principle 24 anticipates international cooperation on matters concerning protection and improvement of environment; and under Principle 25, states have an obligation to ensure that international organizations play a 'coordinated, efficient and dynamic role' for this purpose. Principle 26 seeks to protect "man and his environment" from the effects of nuclear weapons and all other means of mass destruction and to promote disarmament.

International cooperation in controlling transboundary pollution and environmental risks was again fostered by Article 3 of the Charter of Economic Rights and Duties of States --

> "Each state must cooperate on the basis of a system of information and prior consultation in order to achieve optimum use of such resources without causing damage to the legitimate interests of others."

Article 30 of the aforesaid charter is yet another reiteration of the general principle that states should prevent pollution, particularly pollution that causes damage to other states. It runs as follows:

> "The protection, preservation and enhancement of the environment for the present and future generations is the responsibility of all states. All states shall endeavour to establish their own environmental and developmental policies in conformity with such

---

24. For some pertinent thoughts on such an evolutionary and a Developmental view of the world - see the writings of Richard Falk, S. Hoffman, Mc dougal and Singer etc.

responsibility. All states have the responsibility to ensure that activities within their jurisdiction do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction. All states should cooperate in evolving international norms and regulations in the field of the environment".[25]

Besides these, Principle 6 and 7 of the Stockholm Declaration, 1972 are of particular importance while dealing with nuclear waste disposal. Principle 6 postulates that "the discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon the eco- system". Under Principle 7, "states shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities and to interfere with other legitimate uses of the sea".[26]

Many of these policy prescriptions laid down by the above declarations and charter are based on general principles of international customary and conventional law. The principle that

---

25. Charter of Economic Rights and Duties of States, G.A. Res., 832 (1975).

26. Stockholm Declaration of the United Nations Conference on the Human Environment, June 16, 1972, U.N. doc. A/Conf. 48/14, Reprinted in ILM. 1416 (1972).

it is "every state's obligation not to allow knowingly its territory to be used for acts contrary to the rights of other states" is well established in international law and forms the foundation for all anti-pollution law today. The new jus cogens that all "global commons" constitute the 'common heritage of mankind' has permitted the extension of this anti-pollution principle to the environment of space, oceans, and to some extent Antarctica also.[27]

The preceding discussion centred on waste management principles and practices within national territory producing incidental but significant transboundary effects. The following pages will focus on the increasingly important phenomenon of management operations conducted outside national territory, in areas not subject to exclusive national jurisdiction and control. The 'international commons' or 'res communes' that might be used for radioactive waste disposal includes oceans, the Antarctica, celestial bodies and outer space. It is pertinent now to evaluate the conventional law in this respect.

Under the terms of the present Antarctic Treaty, the Antarctica does not really constitute an 'international commons' or 'res communes', as claims to territorial sovereignty in the area have been merely "frozen" for the duration of the Treaty.

---

27. Mani, V.S., "Ocean-Dumping of Nuclear Waste : Law and Politics", Indian Journal of International Law, 24(2), April-June, 1984, p.230.

There is, however, a possibility that the future status of Antarctica might be that of a "common heritage of mankind".

The Antarctic Treaty[28] embodied at least three provisions relevant to ocean- dumping of nuclear wastes. Article V specifically prohibits the 'disposal' of radioactive wastes in the Antarctica. Under Article VIII, each state party is entitled to designate observers, who, subject to their national state jurisdiction have complete freedom of access at all times to monitor compliance with all obligations under the treaty and evidently, these obligations include the obligation of state parties not to dump radioactive wastes in the Antarctica. Finally, Article X embodies an undertaking of parties "to exert appropriate efforts, consistent with the Charter of the United Nations" to ensure that there shall be no dumping of radioactive wastes in the Antarctica.

It is clear from these provisions of the Antarctic Treaty that dumping of nuclear wastes is forbidden in the Antarctica. Nevertheless, as the Treaty comes in for review in 1991, attempts are likely to be made by the dumping countries to review it to provide for ice-sheet disposal option.

The treaty was signed by 13 nations, including 7 space powers. Although this treaty divided the use of the Antarctica

---

28. Antarctic Treaty, December 1, 1959.

among the 13 signatories, it still has a flavour of viewing the Antarctica as 'res communes' (though admittedly for a ' communes' of 13) and as such, deserving some environmental protections.

The legal regime which presently governs the pollution of outer space particularly by radioactive wastes is weak and scattered over many international treaties and agreements.

1. The Test Ban Treaty of 1963

Entitled the "Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water," it was the first treaty signed by the 'space powers' to limit the abuse of outer space by harmful contamination. In its preamble, the Treaty's goal is to "put an end to the contamination of man's environment by radioactive substances". This Treaty clearly prohibits contamination of outer space by nuclear materials, although it only addresses contamination by explosion. It does not cover shooting of radioactive wastes from earth by rocket.[29]

2. The Outer Space Treaty of 1967

"The Treaty on Principles Governing the Activity of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies" addresses space pollution more

---

29. See generally Schafer, Major Bernard, "Solid, Hazardous and Radioactive Wastes in Outer Space : Present Controls and Suggested Changes", California Western International Law Journal, Vol. 19, 1988-89, p.11.

directly than any other international treaty. This Treaty designates the realm of space as a 'res communes' or 'Common Heritage of Mankind' used by all but never to be owned.[30]

The 'Common Heritage of Mankind' principle is presented in the Preamble, Article 1 and IX which state that the Treaty recognized "the common interest of all mankind in the progress of the exploration and use of outer space should be carried on for the benefit of all peoples, in the interest of all countries, irrespective of their degree of economic or scientific development". These words indicate that no state has the right to foul space as if it were its own territory.

Article IX states that parties shall "pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and where necessary, shall adopt appropriate measures for this purpose. If a party has 'reason to believe that an activity or experiment planned by it or its nationals in outer space would cause potentially harmful interference with the activities of other parties in the peaceful exploration and use of outer space, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A party "may request consultation concerning the activity or experiment of other parties, if it has reason to

---

30. ibid, p.12.

believe the activity or experiment of the other party would cause potentially harmful interference with its activities."

This language clearly prohibits the pollution of outer space. It places a duty on potential polluters to notify others of harmful activities by the state or private enterprise.

3. Agreement Governing the Activities of States on the Moon and other celestial Bodies.[31] Known as the Moon Treaty, this 1979 agreement has been signed by only two of the world's space powers - the Netherlands and France. Nonetheless, it is a treaty open for signature to the world's nations, and eleven have chosen to do so. Aside from referring to the moon and other celestial bodies as the common heritage of mankind, this Treaty reflects a state of the art appreciation for the need to protect the environment of the moon and celestial bodies. Article VII states:

1. In exploring and using the moon, state parties shall take measures to prevent the disruption of the existing balance of its environment whether by introducing adverse changes in such environment, its harmful contamination through the introduction of extra-environmental matter or otherwise.

2. State parties shall inform the Secretary General of the

---

31. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 1979, G.A. Res. 34/68, UN. GAOR Supp (No.46) at 77, UN Doc. A/Res/34/68.

United Nations of the measures being adopted by them in accordance with paragraph 1 of this article and shall to the maximum extent feasible notify him in advance of all placements by them of radioactive materials on the moon and of the purposes of such placements.

These words reflect a deep concern for the environment of space bodies. In contrast to the outer space treaty, there is a sophistication here which reflects the growth of environmental awareness in the world. Here there is an affirmative duty to report the environmental protective measures taken.

Carl Christol, examining nuclear power sources in outer space, stated that the general principles of international law prohibit a state from using radioactive materials in space in such a way as to cause harm to another states' interests. In examining pollution in outer space in general, he concluded:

"Harms to natural environment of outer space, per se, the moon and other celestial bodies can result from the intentional and unintentional conduct of juridical and natural persons. Such activities can produce the legal duty to provide compensation to those who have experienced detriment. Such detriment can be caused by physical debris. It can also be caused by non-physical or intangible contamination pollution".[32]

---

32. Carl Christol, Quoted in n-29, p.30.

On the basis of the outer space treaty as well as other relevant international law, the conclusion was reached that states have an affirmative duty to avoid allowing debris, and contaminants, from constituting harmful interferences in the beneficial and peaceful uses of the natural environment of outer space. The consultative provisions and 'due regard clause' Article 9 of the outer space Treaty have particular relevance to a procedure whereby this duty can be implemented. Thus the space environment can not be treated as an area open to the wholly unregulated conduct of the states, e.g. shooting radioactive wastes in outer space.

However, there are significant flaws in the present system of international space pollution law. First, the rules primarily relate to pollution which causes harm to another state. Generally speaking until a piece of space debris hurts somebody, it does not become a problem under law, but by then it is too late. Second, Unlike the sea where there is at least the chance for someone to catch the polluter doing its dirty work, the remoteness of space makes it far more difficult to police the waste handling practices of space manufacturing industries. Third, although the system of compensation for harm caused by space activities is in place, there may, in the future, be serious proof problems in establishing whose waste caused the harm.

Recognizing that the marine environment and the living organisms which it supports are of vital importance to humanity, and all people have an interest in assuring that it is so managed that its quality and resources are not impaired; with the fact that the capacity of the sea to assimilate wastes and render them harmless, and its ability to regenerate natural resources is not unlimited,[33] the International efforts to control pollution of the sea by dumping of wastes, particularly radioactive wastes, started with UNCLOS I (United Nations Law of the Sea Conference 1958). Although they were unable to agree on the primary issue before them - nuclear weapon testing - the conferees did recognize "the need for cooperative international action to control disposal of radioactive wastes in the sea". The Geneva Convention on the High Seas adopted as part of UNCLOS I, laid the groundwork for international cooperation in controlling radioactive waste pollution of the ocean. This convention states --

1. Every state shall take measures to prevent pollution of the seas from the dumping of radioactive waste, taking into account any standards and regulations which may be formulated by the competent international organization.

2. All states shall cooperate with the competent international organizations in taking measures for the prevention of pollution

---

33. See Preamble of the London Dumping Convention, (1972), Reprinted in International Legal Material 1294 (1972).

of the seas or airspace above resulting from any activities with radioactive materials or other harmful agents.[34]

UNCLOS I called upon the International Atomic Energy Agency (IAEA) and other organizations to "pursue whatever studies and take whatever action" necessary to control the problem of radioactive waste disposal at sea. Furthermore, the treaty encouraged these organizations to propose regulations for the prevention of ocean pollution resulting from wastes which "adversely affect man and his marine resources".

There are varying interpretations of the treaty's efforts to control radioactive waste disposal at sea. Yet regardless of interpratation, the failure of UNCLOS I to ban explicitly radioactive waste disposal in the oceans has not meant that it is reasonable to dump all radioactive wastes in the seas. The IAEA did not recommend disposing highly radioactive wastes; it did say that low-level wastes might be dumped, but only under tightly controlled circumstances. The IAEA also emphasized that its recommendations were provisional pending the results of important research on the effects of radioactive wastes on ocean environment.[35]

---

34. Article 25 of the Convention on the High Seas (!958), UN. Doc. A/conf. 13/L.53.

35. See generally Spak, David G., "The need for a Ban on All Radioactive Wastes Disposal in the Ocean", North Western Journal of International Law and Business, Vol.7,(1986).

UNCLOS I stood alone in the field of international agreements on ocean dumping until the late 1960s and easly 1970s. At that time, a flurry of activity, including several United Nations resolutions, led to the London Dumping Convention 1972. It was this convention which established a specific framework for international control of waste disposal in the oceans. Now it is pertinent to discuss it in greater detail.

The London Dumping Convention (Convention on the Prevention of Marine Pollution from Dumping of wastes and Other Matter) is the only global agreement concerned solely with the disposal of wastes in the marine environment by dumping. Written in 1972, this convention is administred by the International Maritime Organization (IMO). Having come into force in 1975, the London Dumping Convention (LDC) has been ratified by 62 states.[36] Its regulations are largely embodied in three annexes. Annexe I is a 'black list' specifying materials that must not be dumped at sea except in trace amounts. Annexe II is a 'greylist' of materials that may be dumped subject to the satisfaction of so called 'special care' provisions. The issuance of permits for dumping by appropriate national authorities is subject to conditions set out in Annexe III of the convention.[37]

---

36. As on 26 July 1988, Sixty two Govts. have ratified to the London Dumping Convention. India is not a contracting Party to the LDC.

37. Bewers, J.M. and Garrett, C.J.R, "Analysis of the Issues Related to Sea Dumping of Radioactive Wastes", Marine Policy, April, 1987, p.107.

Some general regulations also apply. In particular, under Article 1 of the LDC , the contracting parties agree "to take all practical steps to prevent pollution of the sea by the dumping of wastes and other matter that is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

Thus the London Dumping Convention called for a complete prohibition on the dumping of high-level nuclear waste (see annex I para 6. read with Article iV (1) (a) and makes the disposal of low-level radioactive waste subject to a permit system based on internationally accepted criteria for disposal. The responsibility for defining high-level radioactive waste and for recommendations for the terms for ocean dumping of other radioactive waste has been assigned to the International Atomic Energy Agency. among the standards to be established by IAEA is the depth of the water at which, if at all, radioactive disposal will be allowed. In general, the result is to defer the technical issues to the technical community, but to back up these standards with an enforcement system that can make them effective.[38]

It is important to establish the degree of authority

---

38. Richardson, Elliot, "Subseabed Disposal in the Context of the Law of the Sea", in Nuclear Waste Management : The Ocean Alternative, (ed) Jackson, Thomas C.(Pergamon, 1981), p.84.

vested in the IAEA for its oversight of radioactive waste disposal at sea. The IAEA gives advice to countries for their guidelines covering non-high level wastes. Countries are required to consider this advice as they enact their legislation and carry out their policies. For high-level wastes that are unsuitable for dumping at sea, which are to be defined by the IAEA, their advice to countries is legally binding. But the guidelines given by IAEA, as required by Annex II, are merely exhortative and recommendatory. But sometimes more legal force is introduced by some other means. To illustrate, the 4,000 meter limit for dumping low-level wastes was accepted as a guideline at the IAEA. In their meeting of October, 1979, this guideline was accepted as a resolution. This procedure brings even the guidelines for low-level wastes much closer to an actual legal requirement that is binding on every country that has ratified the treaty. Countries in Fourth Consultative Meeting (October 1979) also resolved "to implement the IAEA recommendations to the best of their ability".[39]

Another troubling controversy relates to the 'seabed emplacement' of radioactive wastes. Some countries differentiate between the two things i.e. 'dumping' and 'emplacement'. They suggest that instead of 'dumping' radioactive wastes at sea, they be 'implanted' in the sea- bed.

---

39. See Generally Deese, David A., "International Policy Cosiderations in the Ocean Disposal Debate", in the same as op. cit., n.38, p.95.

It is problematic because it is possible to argue that the LDC neither bars nor regulates such activity. In the LDC's definition of 'dumping' the phrase 'disposal at sea' could be interpreted narrowly to mean the final resting place of wastes - with seabed disposal excluded from coverage because those wastes are not in direct contact with 'marine waters.'

The question whether the LDC covers seabed disposal was raised seriously for the first time at the Seventh Consultative Meeting of the contracting parties in 1983. At that meeting, several nations expressed either doubts or concern as to the coverage of the LDC. The primary reason for this concern was that option for radioactive waste disposal at the time of the original drafting received no serious consideration. Thus there exists no supplementary interpretative guidance derived from preparatory treaty work circumstances surrounding the LDC's conclusion or discussion of this issue at previous consultative meetings. This creates an impediment in interpreting a treaty in accordance with Article 32 of the Vienna Convention on the Law of Treaties.[40]

The Vienna Convention of the Law of Treaties also provides in Article 33 that with respect to multi-lingual

---

40. See Generally Curtis, Clifton E., "Legality of Seabed Disposal of High Level Radioactive Wastes Under the London Dumping Convention", Ocean Development and International Law, Vol. 14, No. 4, 1985, pp.391-93.

treaties (such as the LDC where there are four equally authentic texts and contain different meaning) "the meaning which best reconciles the texts having regard to the object and purpose of the treaty shall be adopted". Analysing the LDC in this light, we can see that the basic philosophy of the LDC is that the nations of the world will work together to ensure that the marine environment becomes safe from the dangers of dumping. Protection of the marine environment, broadly defined, is the foundation of the LDC - its object and purpose. In its preamble, articles and annexes, the LDC repeatedly emphasises this concern as its driving force.

A key consideration pertinent to the contracting parties' interpretation of the convention in relation to seabed disposal is the definition of dumping. Article III (1) (a) defines the term 'dumping' as:

(i) any deliberate disposal at sea of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea.[41]

---

41. Article III (i) also defines activities which are not considered to be dumpimg. In this regard Article III (i) (b) (ii) exempts from the scope of dumping the placement of matter for non-disposal purposes. This provision in theory might allow "retrievable storage" either as a systematic disposal option or as a test programme to determine whether there were any risks of harm to the marine environment. However absent assurances (1) that such retrieval is guaranteed, and (ii)that the Wastes could not harm the marine environment, such retrievable storage would conflict with a related portion of that exemption which requires that such placement not be 'contrary to the aims of the convention'.

Because of the double use of the phrase 'at sea', this language can mean either that the convention covers all disposal operations that take place from a boat or structure that exist at sea, or only such operations in which the final resting place of the waste is at sea. For those analysts who support the first of these two interpretations, some have suggested that this more comprehensive approach is more appropriate because:

1. The final position of the high-level wastes deposited would be at geographic coordinates covered by ocean waters, and/or

2. The ocean sediments into which the waste would be emplaced are indisputedly formed by geological processes operating within the ocean basins and are not geologically related to the underlying rock of the sea floor.[42]

While the articles of the LDC previously discussed focus on dumping, Article XII describes the collective pledge of the contracting parties "to promote, within the competent specialized agencies and other international bodies, measures to protect the marine environment against pollution caused by" a wide range of other human activities such as radioactive pollutants from all sources, including vessels. The express listing of radioactive substances in this broader context reinforces the extreme caution and restraint that is reflected by the contracting parties' decision to prohibit the dumping of high-level wastes.

---

42. op. cit., n.40, p.395-96.

The factors for issuing permits listed in Annex III support the above reading. Those factors include consideration of accumulation and biotransformation "in sediments (A.6) and bottom characteristics (e.g. topography and geological characteristics and biological productivity)" (B.7). Such attention to factors involving the seabed and subsoil further supports the view that the protection of the marine environment is intended to be defined broadly[43], and for the purpose of disposing radioactive wastes at sea, no distinction should be made between maritime waters and the seabed and subsoil.

It is relevant hare to quote Elliot Richardson who answered a question, " does the LDC or the Law of the sea Treaty cover burial beneath the bottom of the sea? And if so, and if radioactive wastes are 3Ø meters down below the seabed, would that be affected by the Law of the Sea Treaty or the LDC?

He answered as follows:-

> "Well, I understand that to be a question as to the applicability of the London dumping Convention itself, in the first instance. And the question whether or not it is under the LDC turns on the predictable effect on the environment in the area of the dumpsite. I think that if you could find that there was a risk to the eco-system of that part of the bottom, it would not only come under the LDC but the very same findings would also bring it under the Law of the Sea Treaty. Conversely, I think if you could find that the waste was buried deeply enough so that there was in fact no effect outside the layer or above the layer of sediment in which the waste was buried in some capsule, and if you

---

43. ibid, p. 398.

never found only such effect, then I think it would be taken outside the scope of both international agreements -- and probably should be".[44]

Here we can clearly see that the lawyers have a considerably easier role to play. Basically the approach taken in the LDC as well as the Law of the Sea Treaty (to be discussed a little later) is an approach which "bucks" the ball back to the scientists and technologists. But in the first chapter of this work, we have seen how science serves the interest of the stronger, particularly when factual malleability or scientific uncertainty exists.

That is why Elliot Richardson, having made the earlier quoted statement, raises certain questions "well, if you start out with assumption that the capsule is buried deep enough and is shielded by the layer of sediment, how will you know whether or not that remains true?" And given the possibility of shifts in the sea bottom and the opening up of fissures, and so on, under what legal auspices or jurisdiction is any monitoring responsibility placed?" These questions ought to be considered in establishing a really adequate long-term regime for dealing with this subject.[45]

Furthermore, even assuming (but not admitting) as correct the artificial distinction between 'disposal' and

---

44. op. cit., n. 38, pp. 85-86.

45. ibid, p. 86.

'emplacement' what is likely to harm the seabed and subsoil there of is also likely to harm the superjacent waters. What is more, canisters can not reach the seabed or subseabed except through the medium of the water column. Therefore, the principle of the functional effectiveness dictates that seabed emplacement of high-level radioactive wastes be deemed to be proscribed.[46]

The international seabed area and the subsoil thereof have by now come to be covered by a new peremtory norm of international law, namely the 'Common Heritage of Mankind: Under the Vienna Convention on the Law of Treaties, 1969, the juridical character of a peremptory norm is based on its acceptance by the general community of states. The principle that the international seabed area and the subsoil thereof constitute the common heritage of mankind has been accepted by the general community of states and this principle imposes an obligation upon all states not to use the seabed and subsoil thereof in any manner detrimental to the operationality of the principle.[47]

Ocean dumping and emplacement of high-level radioactive wastes is also likely to interfere with the freedoms of other states. Such emplacement will tantamount to an abuse of right under both the international conventional and customary law.

The Third United Nations Conference on the Law of the

---

46. op. cit., n. 27, pp. 242-243.

47. ibid, p. 243.

Sea, 1982 (UNCLOS III) is disappointing from the point of view of environmental law. The provisions hardly represent crystallization and development of operative rules of marine pollution law. They leave it to 'competent international organizations or diplomatic conferences' to take initiative in the establishment of 'applicable rules and standards. Which of the organizations are 'competent', how are they going to resolve the claims of overlapping competences and what role will the International Seabed Authority have in relation to them, are all but a few important practical questions left untouched by the UNCLOS III. It hardly helps in the realm of ocean-dumping.

Two provisions relate to ocean dumping viz. Article 210 and 216. Article 210 endorses the right of states to adopt laws and regulations in respect of dumping. It also calls upon states to endeavour to establish global and regional rules, standards and recommended practices and procedure for the purpose, acting through competent international organizations or diplomatic conference. Article 216 provides for enforcement of such rules etc. by states. UNCLOS III also reinforces the themes presented in the other international resolutions, declarations and treaties in general terms. International equity, protection of the environment, responsibility to future generations and international cooperation are repeatedly stressed in the document particularly in Part XII. But it does little to concretise the general principles of environmental law regulating marine pollution by radioactive wastes and other matter.

Thus it is clear that the international regulatory legal regime for nuclear waste disposal is scattered over many instruments and it is neither comprehensive nor capable of regulating the rapacious dumping of radioactive wastes. "The conventions (LDC and UNCLOS III) do not provide explicit procedures for punishing violators other than the general treaty enforcement powers assigned to each nation. It is unlikely that any nation which either dumps radioactive wastes at sea or allows an industry within its jurisdiction to do the same would prosecute the dumping party for violating international law. Additional problems, such as proof of damage to specific victims, would also be difficult to solve. Consideration of this question would be reached only if the plaintiff could establish standing. finally, impartial international courts do not exist to try such a case and award damages, or order a clean up. While arbitration is possible, no competent international body can bring suit against a polluter, enter a judgement and enforce the penalty assessed."[48]

This weakness of the enforcement mechanism led the Great Britain to dump low-level radioactive wastes into the north eastern Atlantic. This activity did not cease with the adoption of the LDC and the British government did not conduct the obligatory impact studies or grant the necessary permit required

---

48. op. cit., n. 35, p. 820.

by the LDC. The dumping did not stop even in 1982, when the European Parliament adopted a resolution urging the cessation of radioactive waste dumping in the north-eastern Atlantic either through 'action within the community framework or through international agreements. The British government still refused to stop when the LDC adopted the two year moratorium on all radioactive waste disposal at sea.

Britain in 1982 accounted for 90% of all radioactive waste dumped in the world's oceans and still it continues to hold this 'position'. Only three other countries continue to use the sea for radioactive waste disposal, viz. Belgium, Switzerland and Holland. The United Kingdom Energy Authority's nuclear plant at Windscale, on the cumbrian coast, is the most heavily polluting of all the world's nuclear establishments. Plutonium distributed in the Cumbrian coastal strip was equal to that deposited in radioactive fall out from atmospheric nuclear tests.[49]

Five Nordic countries - Sweden, Denmark, Finland, Iceland and Norway- officially protested the British refusal to comply with international law and its plan to increase by 60% the amount of radioactive wastes being dumped. The British National Union of Seamen also protested the governments action.[50] The

---

49. Marine Pollution Bulletin, Vol. 13, (1) (1982), p. 4.

50. op. cit., n. 35, p. 821.

annual sea disposal operation was delayed by two days as a result of the Green-Peace protesters' use of high speed rubber dinghies to 'buzz' the vessel chartered by the UKAEA. But they failed to force the cancellation of the dumping which involved 2697 tonnes of packaged solid and solidified waste being deposited at a site 300 miles off land end.[51]

When dumping has been stopped it usually has not been as a result of an international agreement. The United States suspended dumping in 1970, in part, in reaction to the Council on Environmental Quality report on ocean dumping. That report noted that radioactive waste dumping at sea was not as economical as other forms of radioactive waste disposal. The Netherlands stopped the sea disposal of radioactive wastes in response to public opinion as one Dutch Government official stated "this ministry is convinced that ocean dumping is a safe disposal for wastes. But it is clear that our society does not want ocean dumping. Japan changed its plans due to protests from Pacific Islanders near the disposal sites.[52]

Perhaps the major reason that international law generally, and the LDC and UNCLOS III specfically, have not been effective is that they lack enforcement provisions to punish violators. There is little recourse for the contracting parties

---

51. Mrine Pollution Bulletin, Vol. 13 (8) (1982), p. 373.

52. op. cit., n. 35, p. 821.

to the International Court of Justice to stop a nation or its industry from violating the treaties.

One other major problem with regard to the goals of international law concerning radioactive waste disposal at sea is the changing standards defining which materials may be dumped and determining how those materials may be dumped. Several international agencies have issued guidelines and recommendations gi on the various rules for site selection, packaging, monitoring and allowable exposure levels. For example, it is unclear which agency-regulations members of the OECD must follow, as many OECD members are also members of the LDC. Both the OECD's Nuclear Energy Agency and the IAEA have issued guidelines.

This problem is again worsened by the regional conventions like Oslo and South Pacific Nuclear Free Zone Treaties. The close similarity of the conventions and the specialized nature of the expert advice involved leads to concern over possible unnecessary duplication between the global (London) Conventions and regional conventions (not only Oslo but other regional conventions such as the Helsinki and Barcelona conventions).[53]

Some scholars solve this problem by separating the roles of the two. The LDC should concern itself with matters of truly

---

53. Norton, M.G., "The Oslo and London Dumping Conventions", Marine Pollution Bulletin, Vol. 12, No. 5, May 1981, p. 148.

global interest and provide a broad framework within which regional conventions would lay down more detailed or stringent measures to reflect regional conditions and priorities.

This general philosophy is not shared by all however, and a further problem is that many contracting parties to the LDC do not belong to a regional convention and thus look to the LDC to meet their regional needs as well. In practice therefore it may prove difficult to develop firm principles on the relationships between the global and regional conventions.[54]

---

54. ibid,

CHAPTER – II

PART – B

Chapter II

Part-B

LIABILITY FOR NUCLEAR DAMAGE AND ENVIRONMENTAL HARM

This part contains only a short resume of the principles of state responsibility and of third party nuclear liability as they affect nuclear waste disposal and its impact on environment. It does not purport to be comprehensive in terms of an extended discussion of the complexities of the law of state responsibility. This subject remains important both in providing a basis for remedying breaches of obligation by states and in allocating the cost of resulting environmental damage. Without it, a legal regime cannot be effective but will remain merely a regime of giving rights without remedies.

The foundation of responsibility lies in the breach of an obligation undertaken by states or imposed on them by international law. In general terms we can say that state responsibility arises when-

(1) There is a breach of an international obligation of the actor.

(2) A breach or violation of an international right of the victim.

In order to determine whether a nation has breached either its international obligation or international right of

another state, there must be established liability standards by which to measure that nation's conduct. Since there are as yet no conventions establishing such standards for nuclear activities[1] it is necessary to look for them in the general customary rules governing state responsibility for extra-territorial damage.

In order to discover and define the principles of law applicable to transfrontier movement of radioactivity, several questions must be answered. First, do states in conducting or permitting nuclear activities within their jurisdiction incur a legal duty of care to prevent injury to other nations? Second, if such obligation exists, what standards of care and theories of liability are applicable? Can liability arise from the fact of injury alone, or does a state's liability arise only upon its failure to meet certain internationally accepted standards of conduct which require certain specified minimal safety features in nuclear activities?

This chapter concludes that states, do have an obligation under existing international law to prevent injury to other states resulting from nuclear mishaps. In light of the difficulties associated with relying on a negligence standard, and because of the special risks created by nuclear activities, strict liability standard is appropriate in this field.

---

1. The IAEA has developed health and safety standards applicable to nuclear activities, but they are not binding, creating neither concrete international obligations nor rights.

Prior to the twentieth century a state's freedom of action within its own territory rarely conflicted with the rights of other states. The Trail Smelter arbitration between the USA and Canada is generally regarded as the first decision recognising international liability for damage caused to the environment of another state where no existing treaty created an obligation to prevent such damage. The Trail Smelter decision implies that states have a duty to regulate activities with potentially harmful trans-border effects, and that failure to properly regulate such activities give rise to an obligation to compensate when injury to another results. Furthermore, the decision suggests that a state may be ordered to limit the harmful activity occurring within its jurisdiction.

This principle has been recognised by other subsequent judicial decisions as well as conventions and declarations. The Corfu Channel case recognized the duty of state to prevent harm to other state by activities within its jurisdiction. A recent accident causing serious pollution of the Rhine River gave rise to numerous claims for compensation based in part on state's failure to adequately regulate a potentially dangerous activity being conducted by a corporation within its jurisdiction. In November 1986, a fire in a Swiss chemical storage warehouse resulted in the discharge of a large quantity of toxic chemicals into the Rhine; the discharge killed fish and rendered the water undrinkable for downstream . West Germany

claimed that the Swiss authorities had negligently failed to enforce, and the chemical company to follow, safety regulations. Switzerland eventually admitted that it had failed to warn downstream states of the danger in a timely fashion, as required by agreements then in force between the various states, and agreed to pay compensation to injured downstream nations conceding that its anti-pollution regulations fell below the standards established by a European Community convention (to which it was not a party). Switzerland also agreed to consider strengthening its rules for the storage and use of dangerous chemicals. It is therefore possible that Switzerland paid compensation in part because of its failure to prevent the accident by adequately regulating its chemical industry.[2]

International support for this broad principle that states must control sources of harm to others or to the global environment is reflected in principle 21 of the Stockholm Declaration of 1972 in Articles 192 and 194 of the Law of the Sea Convention, 1982, in UNEP-inspired Principles and in the work of the International Law Commission [3]

The responsibility of a state may become involved as the result of an abuse of a right enjoyed by virtue of international

---

2. Barron, Jillian, "After Chernobyl : Liability for Nuclear Accidents Under International Law", Columbia Journal of Transnational Law, Vol. 25 No. 3 (1987), p.652.

3. For more details, see part a of Chapter 2 of this work.

law. This occurs when a state avails itself of its right in an arbitrary manner in such a way as to inflict upon another state an injury which can not be justified by a legitimate consideration of its own advantage. Thus a state substantially affecting other states by nuclear tests , fumes, air or water pollution, emanating within its borders is not only abusing its own right but also interfering with the rights of another, for the integrity and inviolability of territory of the injured state is infringed. The acting state is in breach of a duty of non-interference established in the customary international law maxim: Sic utero tuo ut alienum non laedas.

Sovereign equality of all nations and the principle of non-interference is the cardinal principle of the international legal system. That is why the principle of territorial sovereignty becomes the analytical starting point for assessing state responsibility for extra- territorial effects of activities conducted on national territory. But the basic question that arises here is : to what extent do extra-territorial effects of a state activity, lawful per se, give rise to state responsibility? It is a situation which has two conflicting sides: first, a state is sovereign within its boundaries and should therefore, be permitted to conduct any activity not per se illegal within its territory; second, sovereignty entails freedom from outside interference and externally caused harms. This principle of territorial sovereignty was one of the arguments put forward by Australia in the Nuclear Test cases. The

deposits of radioactive fall out on the territory of Australia and its dispersion in Australian airspace without Australia's consent, it was argued, violated Australian sovereignty over its territory and impaired Australia's independent right to determine what acts should take place within its territory and in particular whether Australia and its people should be exposed to radiation from an artificial source.

Strong reliance was placed on the violation of Australian sovereignty through the dispersion of radioactive fall-out on Australian territory instead of proving specific consequences of French Nuclear tests. This seems to point to an Australian strategy in the Court to play down as much as possible, the critical question of radiation damage. It was claimed that the fact of the violation of territorial sovereignty by nuclear fall-out did not require Australia to establish the exact damages of these radioactive materials as evidence of the legal injury sustained. Indeed, it was a dispute arising from the exercise of equal sovereign rights defined in terms of territory. The right, as France saw it, to carry out activities lawful per se in its own territory as the essential consequence of its sovereignty, and the right that was being claimed by Australia to determine itself what acts might take place within its territory based on the very same notion of sovereignty.[4]

4. See generally, Handl, Gunther, "Territorial Sovereignty and Trans-boundary Pollution in International Law", American Journal of International Law, vol. 74 (1980), p. 525.

The problem is whether in such cases, international law requires proof of injury in the sense of material damage as the conditio sine qua non of state responsibility or whether the mere fact of extra-territorial effects without regard to their nature, may entail responsibility similar to liability from a case of trespass in common law system.

Opinions of scholars vary on this point. Some argue that injury in the sense of material damage is the foundation of state responsibility in cases where a state activity, lawful per se, entails extra-territorial environmental effects. The mere fact of the violation of sovereignty implicit in the transfrontier crossing of pollutants does not in itself amount to a violation of sovereignty in terms of infliction of a legal injury which could be the basis of the polluting state's liability vis-a-vis the affected state. International law requires proof of material damage as a precondition of the polluting state's responsibility to the affected state. The state affected by transnational pollution therefore cannot succeed with a claim based on an alleged infliction of a moral injury, a violation of its sovereignty suffered in the fact of a proven transfrontier crossing of pollutants into its territory.

But this test of responsibility is not very helpful in case of radioactive pollution by nuclear activities, particularly nuclear waste disposal. The difficulty is caused by the fact that bodily injury and the gradual and constant impairment of

environment induced by radioactivity may not appear for many years after the nuclear incident (like breaching of repository or reactor) has actually occurred. One has also to bear in mind that the longer the time before making a claim, the more difficult is it likely to be to prove the necessary causation and even the source of the hazard.

That is why several other scholars have argued that the principle of strict liability is appropriate for regulating activities relating to nuclear power. Under the law of torts, liability depends on fault. In the nuclear field, however, such a rule is quite unacceptable. Not only would it be extraordinarily difficult for a claimant to establish the existence of any fault but there might well be cases when damage was caused without any fault at all. In other cases it might not even be possible to establish with certainty the origin of the occurrence which caused the damage.

However, apart from this general rule, there has evolved in a number of countries a much stricter form of liability for damage caused by dangerous activities. In England, for example, we have what is known as the Rylands V. Fletcher rule in which a person is held liable if damage is caused by letting a substance escape, irrespective of whether he was negligent or careful,howsoever, in trying to prevent its escape. Strict liability may be said to exist where compensation is due from an

individual or enterprise for injuries caused to others, despite the agents' compliance with required standards of care. The basis of strict liability is said to be in the limitations of science and engineering in many fields. The Rylands V. Fletcher rule has many qualifications, founded as it is upon the law of nuisance. For example, Act of God and act of a third party may be grounds for exoneration from liability. [5]

The straight forward connection between responsibility and the fact of harm is strongly emphasized by writers such as Goldie and Schneider. They see the Trial Smelter and Corfu Channel cases as pointing to the emergence of strict liability as a principle of international law.Goldie's argument is a sophisticated one which draws on equity as the doctrinal basis of a system of strict liability for states. He treats risk creation as a form of expropriation of the adjacent state's use of its territory, and invokes the notion of unjust enrichment [6]

Jenks identifies ultra-hazardous activities as a distinct category for which strict or absolute liability as an exceptional principle is justified as a means of shifting the burden of proof and ensuring a more equitable distribution relevant to nuclear activities. They do not allow states to

---

5. Trevor, J.P.H, "Principles of Civil Liability for Nuclear Damage", Nuclear Law for a Developing World, collection of lectures, IAEA, Vienna, 1969. pp. 109-110.

6. Quoted in Boyle Alan E., n.8, p.290.

escape responsibility on the ground that the harm was unavoidable[7] However, these arguments do not reflect on the admissibility as such of prospective damage as a basis for a claim grounded in the extra -territorial environmental effects of state activity that is lawful per se.

Thus it is apparent that a strict or absolute standard of liability for failure to prevent harm enjoys some support among commentators as an exceptional principle applicable to ultra-hazardous activities of which nuclear waste disposal may be an example. But as far state practice and case law is concerned, states are perceived in general to be responsible for environmental damage only if it results from a want of due diligence and this view is supported by writers like Dupuy, Handl and others. They see this as the dominant theory supported by state practice.

However, in light of the difficulties associated with relying on the negligence standard and because of the special risks created by nuclear activities it may be suggested that a strict liability standard is appropriate in this field, and that such a standard should be firmly established by an international convention. At the same time prospective damage also should be taken into consideration because waiting for the appearance of actual radiation-induced damage would render the establishment

---

7. Quoted in Boyle Alan E., n.8, p.291

of the causal link between artificial radioactivity and actual damage too difficult,which would be tantamount to exonerating the defendant of his liability.

Placing the burden of proof on the polluter for ultra-hazardous activiies such as nuclear activities is the other suggestion substituting due diligence. Nor in the case of nuclear damage is due diligence an easy standard to administer. As we have seen, it is not possible to identify clearly accepted international standards defining the content of state responsibility in the case of nuclear activities.

Yet another possiblity is to rely on a reformed system of civil liability conventions hoping that these will attract more support from states. These conventions (national laws) do not preclude the possibility of state responsibility for harmful nuclear activities , but their scheme involves states only as guarantors of the operator's strict liability and providing additional compensation funds.

Civil Liability for Nuclear Damage

An alternative method for dealing with trans-boundary environmental damage is to facilitate civil liability proceedings by the individual victims. This requires removal of jurisdictional obstacles for foreign plaintiffs and shifting the burden of liability away from the state and on to private

parties as operators of the industry or activity concerned. An important advantage of this approach is that by moving the issue away from responsibility in international law it frees the injured party from reliance on diplomatic claims pursued by his government [8]

The principle of equal access and non-discrimination is one form of this civil liability model of loss distribution. The foreign plaintiff is given access to judicial and administrative remedies on the same terms as nationals and trans-boundary nuisances are treated like those with national borders. The OECD has endorsed this approach as a policy for trans-boundary environmental harm and it has also been adopted in several treaties which deal with nuclear risks.[9]

There are mainly four international conventions on civil liability in the field of nuclear energy --(1) The Convention on Third Party Liability in the Field of Nuclear Energy,the Paris Convention of 29 July , 196Ø,coupled with the Supplementary Convention on Third Party Liability in the Field of Nuclear Energy of 31 January, 1963, (2) the Convention on Civil Liability for Nuclear Damage of 21 May,1963 (the Vienna Convention), (3) the Brussels Convention on the Liability of

---

8. Boyle, Allan E. "Nuclear Energy and International Law : An Environmental Perspective", The British Yearbook of International Law, (1989), p.295.

9. ibid., p. 296

Operators of Nuclear Ships,1962 and (4) the Brussels Convention Relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material, 1971.The Paris Convention of 1960 adopted by the OECD, applies to nuclear incidents within West European member states, the Vienna Convention of 1963, offers a comparable scheme for global participation, while the other two treaties deal with nuclear ships and maritime carriage of nuclear materials.[10]

The Conventions have similar frameworks. Rather than establishing state liability for nuclear accidents, they impose liability on the operator of the installation or ship. By requiring contracting states to enact legislation following criteria set forth in the Conventions, they harmonize the various domestic provisions on liability and remedies.[11] Under each of these conventions, the operator of a nuclear installation or ship is held strictly liable for damage proven to have been caused by an incident involving nuclear fuel, radioactive products or radioactive wastes from the installation or ship.[12] States, party to these conventions, must require nuclear operators within their jurisdictions to carry insurance sufficient to meet their

---

10. For greater detail, see, The International Maritime Organization, (ed.) Samir Mankabady (Croom Helm, Australia, 1984), pp. 115-119.

11. Barron, Jillian, n.2, p.664.

12. Paris Convention (Art. 3); Vienna Convention (Art. III) ; Brussels Convention Art. II (i).

potential liability[13]. Should the insurance be insufficient, the state,hosting or licensing installations or ship, must ensure the payment of claims up to the established limit. In other words, residual liability rests with the state which hosts installation or issues licenses to ships. The state might intervene not only in its legislative capacity but also whenever necessary make up the balance of compensation owed to victims.

The conventions also provide specific procedures for bringing claims based on civil liability for nuclear damage. Under the Paris and Vienna conventions, for example, only tribunals of the country in which the incident occurred have jurisdiction[14]. In the case of incidents involving nuclear ships, suit may be brought in the licensing state or in a contracting state in which damage has been sustained.[15] Access to court and remedies available are to be determined without regard to the nationality, domicile or residence of the injured party.[16] Judgments rendered in one contracting state are enforceable in the courts of other contracting state.[17]

---

13. Paris Convention, Art. (1Ø) ; Vienna Convention Art. VII (i); Brussels convention Art. III (2)

14. Paris Convention , Art. 13; Vienna Convention Art. XI.

15. Brussels Convention, Art. X (1)

16. Paris Convention, Art. 14 (a); Vienna Convention, Art. XIII; Brussels Convention Art. XII (3)

17. Paris Convention Art. 13 (d) ; Vienna Convention, Art. XII; Brussels Conventions Art. XI (4) (b).

The purpose of the conventions is to ensure a remedy to those injured by a nuclear accident. By making proof of fault unnecessary, by removing residential restrictions on access to courts and by imposing all liability on one party, which must be insured, the conventions make it easier for injured parties to seek redress. The conventions also have the advantage of allowing those actually injured to seek compensation directly rather than through the traditional and unwieldy mechanism of using the state as a claimant for its nationals. The conventions, however, do not prohibit states from exercising these same remedies against the operator.[18]

The conventions cover most, but not all, potential sources of nuclear damage. The Paris and Vienna conventions apply to nuclear installations, a term broadly defined to include reactors, reprocessing, manufacturing and storage facilities, where nuclear fuel, nuclear material and radioactive products or wastes are used or produced. They also apply to the transport of nuclear material or the handling of nuclear waste. The Brussels convention covers nuclear powered ships, their fuel and incidental waste, but not the carriage of nuclear material by sea. The latter is subject to conventional regimes. Most uses and by-products of civil nuclear power will thus fall under one or other of these headings, and only nuclear tests, nuclear

---

18. Barron, Jillian, n.2, p.665.

weapons and peaceful nuclear explosions are excluded.[19]

(In these conventions the liability standard was strict liability which was justified on several grounds; it would relieve courts of the difficulty of setting appropriate standards of reasonable care, and plaintiffs of the difficulty of proving breach of those standards, in a relatively new, complex and highly technical industrial process. The risk of very serious and widespread damage, despite its low probability, placed nuclear power in the ultra-hazardous category. Thus, the arguments are broadly comparable to those used in the case of state responsibility.)[20]

At present, there is a tendency in both the legislation and jurisprudence of western Europe to rule that the exercise of a dangerous activity implies a presumption of liability for hazards created. It is logical to admit this presumption in respect of liability for nuclear activities because of the special dangers involved in the nuclear activities and in view of the difficulty of proving that a fault has been committed due to the newness of the techniques involved. But it does not mean that the mere fact or circumstance of initiating a nuclear activity is considered as creating by itself a presumption of

---

19. Boyle, Alan E. n.8 p.301.

20. ibid, p.302.

fault; but where an incident occurs, the liability of the operator of a nuclear installation is absolute.[21]

The entire liability is concentrated on one person : the operator of the nuclear installation at which incident occurs or begins to the exclusion of any other liability. To eliminate doubts, the operator of a nuclear installation is defined in the conventions as the person designated or recognised by the competent public authority as the operator of that installation (Paris Convention Article 1 (a) (vi). This definition is in agreement with that given in Article 1 (c) of the Vienna convention and also with reference to nuclear ships, with that given in Article 1.4 of the Brussels convention.

The channelling of all liability to the operator of nuclear installation or nuclear ships has the advantages of simplifying the plaintiffs' choice of defendant and establishing a clear line of responsibility. The possibility of transferring liability to a carrier of nuclear material[22] or a handler of radioactive waste[23] does not materially diminish. It provides

---

21. Lasurtegui, Santos A. de los, "Nuclear Liability; Study of a National Legislation in the Light of International Conventions" Nuclear Law for Developing World; collection of lectures, IAEA, Vienna,1969, p.119.

22. Vienna Convention, Art. II (2); Paris Convention, Art. 4 (d).

23. Vienna Convention, Art. II (2); There is no comparable provision in the Paris Convention; Brussels Convention Art. II (4).

for an alternative and more extended definition of who is an operator and recognizes that there may be a need for special treatment in such cases.[24] Several operators may also be held jointly and severally liable for the same nuclear incident.[25] And the conventions provide rules for determining when liability for materials in transport passes from one operator to another and when operators become or cease to be liable for material imported or exported.[26]

Nuclear incidents arising in the course of transport have their own peculiar difficulties. It might be expected that as in the case in other fields, liability will fall on the carrier, There are good reasons why this is not the case. As we know very special precautions regarding the packing and containment of nuclear material are necessary in the interests of safety. Not only must these be the responsibility of the consignor but the carrier is, generally speaking, in no position to assure himself that these have been duly taken. Liability has therefore been placed on the operator[27]

---

24. Vienna Convention, Art. II (1) ; Paris Convention, Art. 4.

25. Vienna Convention, Art. II (3),(4); Paris Convention, Art. 5 (d); Brussels Convention, Art. VII.

26. Vienna Convention, Art. II (1); Paris Convention, Art. 4 (a), (b).

27. Trevor, J.P.H., n.5, p.114.

It having been decided that liability should be placed on the operator, it was necessary to decide whether it should be placed on the consigning or on the receiving operator. The principle adopted is that it should be the consigning operator who is liable, as he is responsible for packing and containment.

It is important to note that it makes no difference for the purposes of channelling liability that the operator of a nuclear installation or ship will in many cases be a state or a state entity that the operator of a nuclear installation or ship will in many cases be a state or a state entity. The civil liability conventions ensure that states or their organs are precluded from invoking jurisdictional immunities, except in relation to the execution of judgments[28] Apart from this exception, states sued under the convention in their own courts will be subject to the same liability, and enjoy the same defences, as other categories of defendants.

It is now accepted as a general rule that the state should participate in payment of compensation whenever the damage sustained exhausts – because of its catastrophic extent – the sums provided as financial cover by the insurance policy or other

---

28. Vienna Convention, Art. XIV ; Paris Convention, Art. 13 (e); Brussels convention, Art. X (3). The exclusion of jurisdictional immunities was opposed by Soviet bloc representatives at the Vienna conference, and the inclusion of this provision is one of the reasons for their failure to sign the Convention.

financial security required for licensing or start - up of a nuclear installation. State participation is also justified by the assumption that persons suffering from nuclear damage may appear after the standard expiry of a period - the period which we might describe as 'normal' for the bringing of claims - has elapsed, so that an extraordinary period for delayed damage must be envisaged.[29] This is a unique feature of the nuclear conventions; it indicates an acknowledgement of the residual responsibility of States to compensate for damage caused by nuclear activities, the operator is unable to do so, or is itself a state.

None of the conventions categorically extends the benefit of its provisions to claimants who suffer damage in the territory of a non-contracting state or to incidents which arise there. Similarly these conventions can do nothing when the case of liability of a non-party is involved. None of the provisions of conventions is helpful in the case of accidents like Chernobyl, since the issue there involves the liability of a non-party operator. They cannot be held liable under any of the conventions, and jurisdiction will in such cases be determined by ordinary rules of national law, with all the usual jurisdictional difficulties. Participation in the conventions by nuclear states - the source of potential defendants is for this reason the best

---

29. Lasurtegui, Santos A de los, n.21, p. 139.

way of gauging international acceptance of the civil liability regime. That is what makes the civil liability regime. That is what makes the Vienna convention a particularly weak precedent, since so few nuclear states are parties to it.[30]

Thus it is clear that despite its novelty and sophistication, the most significant feature of the common scheme in these conventions is its lack of widespread international support. This becomes more important with the spread of nuclear power world wide and the global implications of major accidents, such as Chernobyl. Of the ten parties to the Vienna convention, only two possess nuclear facilities. Neither the USA nor the USSR has chosen to ratify it. Although the Brussels Convention on nuclear ships has six parties, it is not yet in force, because no state licensing such ships has become a party.

Despite these lacunae, the positive features of these conventions, like making individual access to legal remedies much easier than for any other form of trans-boundary environmental harm, eliminating or minimizing difficult issues of proof and liability standards, etc. should not ignored. These conventions also follow strict liability standards. Thus, if some of the alterations, like wider environmental perspective included within the ambit of 'damage' and widening international support;

---

30. See generally Boyle, Alan E., n.8,pp.38-39.

providing some concrete positive basis for the customary principles; including some mechanism to compensate future or prospective harms, can be made, then these conventions may become effective instruments for preventing the harm as well as adequately compensating it in case of harm already done.

CHAPTER – III

Chapter III

EQUITY AND NUCLEAR WASTE DISPOSAL

Although all major environmental issues involve an equity[1] dimension, the nuclear waste disposal problem has particularly strong links with equity. Because of questions related to their safety and to the very long periods of time over which they will affect society, and because nuclear waste disposal involves equity issues requiring that one generation decide that one region of the nation must bear the risks for the entire nation for generations to come, nuclear waste issues are imbued with particularly significant ethical piognance. Such major issues as those involving the just resolution of regional and generational questions of risk and uncertainty, geographical equity, intergenerational responsibility must be addressed.

In examining these issues, it is assumed that there are two basic criteria for determining the satisfactoriness or

---

1. In this chapter, the term "equity" has been used in a broad, loose sense, which refers to the quality of being fair or impartial in matters of justice. Equity issues have been raised in the particular context of nuclear waste disposal because in order to be effective, the legal regime must address these issue. In fact, Law has two essential components -- authority and value. With the gradual sophistication of legal systems and advancement of human civilization, the authority element does not necessarily draw its sustenance from coercive power of the state but by the sanctity accorded to it by the people whose sense of justice is satisfied by the value element in law. So to make any environmental law, and particularly the law regulating nuclear waste disposal effective, it must address the values and equity issues discussed in this chapter.

unsatisfactoriness of a waste management proposal: safaty and permanence. President Carter told the Congress on 12 February, 198Ø: "My Paramount objective in managing nuclear wastes is to protect the health and safety of all Americans both now and in the future." By 'safety' we mean protection of the biosphere from radioactive contamination; that is, keeping the level of radiation as low as reasonably achievable. By permanence we mean that future generations will enjoy the same safety protections we wish for ourselves.[2] The recent concept of 'sustainable development' also has a flavour of some futuristic content which gives the inter-generational responsibility more credibility.

The benefit/burden concordance principle is frequently recogniged in discussions of equity. In environmental law field, the recent concept of "polluter must pay" seems to be the logical corollary of this principle, in fact, the first stipulation. That beneficiaries should bear the burden is widely recognised in American legal precedents. "Undoubtedly the most visible and volatile equity problem currently is the geographical separation of beneficiaries and those who will bear burdens within this generation. Nearly every state in the United States has adopted or considered legislation restricting the transport of radioactive wastes and/or search for a high-level waste

---

2. Quoted in 'Nuclear Waste: Socioeconomic Dimensions of Long-Term storage' (eds) Murdock, Steve H; Leistritz, F. Larry; and Homm, Rita R.,(Westview Press, 1983), p. 41

repository site. By 1981, for example, over one half of the states had adopted bans or moratoria on the siting of such a repository. An equal number of states had restrictions on radio active waste transport through their territories". [3]

But this problem gets vitiated and acquires international dimension when there is an international transboundary movement of radioactive wastes. To illustate, the small island countries of South Pacific have been used as dumping ground for American nuclear activities and the resulting wastes. It is the golden rule of ethics and law "Do unto others as you would have them do unto you." The people of South Pacific (who are given assurance of safety of disposal) can well say "Well, if it is so safe, why do not you put it in your own backyard". Those in charge of siting disposal facilities will have to affirm in all honesty that they are not asking others to shoulder responsibilities they themselves are unwilling to shoulder.

Of the equity issues provoking the most intense and visible conflict, the legacy problem, harming future generations for current gain, appears as the most pervasive and troublesome. Traditionally, international law has focussed on spatial

---

3. Kasperson, Roger E.; Derr, Patrick G.; and kates, Robert W.; confronting Equity in Radioactive Waste Management: Modest Proposals for a Socially Just and Acceptable Program in Nuclear Power : Assiessing and Managing Hazardous Technology (eds) Pasqualetti, Martin J.; and Pijawka, K.; David.; (Westview Press: 1984), P. 360.

relationships among the present generation, such as relationships between countries in the oceans, in outer space, or in managing land resources. The limited intertemporal doctrine that does exist relates the present to the past. Now the global environmental crisis requires that we develop the intertemporal dimension of international law to relate the present to the future.[4]

Many of our actions may impose serious environmental burdens on future generations. The way we dispose of waste affects the quality of the environment that we will pass on to our children and their children. If we reap short- term benefits from the cheap disposal of wastes in the air, land, freshwater, ocean or even outer space, we may pass staggering costs on to future generations. Because of its very long life (thousands of years) and the long-term effects like genetic mutation, nuclear wastes may prove "genetic time-bomb" for future generations.

The concern over the impact of radioactive waste upon future generations is predicated upon our technical inability (or at least our uncertainty regarding such inability) to meet one of the two criteria for satisfactory waste disposal; that is permanence. It is now not possible to guarantee permanence on the basis of present disposal technology. Even with the most optimistic technical estimates regarding the effectiveness of the

---

4. Weiss, Edith Brown; "In Fairness to Future Generations," Environment Vol. 32, no. 3 (1990) P. 7-8.

technology and future behaviour of buried nuclear waste, some vigilance would be required of our descendants in order to maintain their own safety. They may be required some institutional arrangement to monitor and service the repositories in order to protect their own safety and well being.[5] But how far is it just to decide for others in advance? It tantamounts to projecting, or imposing the same social structure and values on future generations.[6] As Thomas Paine has writen in his book "The Rights of Man".

> "There never did, there never will, and there never can, exist a parliamnt, or any description of men, or any generation of men, in any country, possessed of the right or the power of binding and controlling posterity to the 'end of time', or of commanding for ever how the world shall be governed, or who shall govern it. Every age and generation must be as free to act for itself in all cases, as the age and generation which preceded it. The vanity and presumption of governing beyond the grave is the most ridiculous and insolent of all tyrannies.[7]

Man has no property in man; neither has any generation a property in the generations which are to follow. The parliament or the people of 1688, or of any other period, had no more right to dispose of the people of the present day, or to bind or

---

5. Peters, Ted F. "Ethical Considerations Surrounding Nuclear Waste Repository Siting and Mitigation" in, op.cit., n.2, P. 51.

6. For some more partinent discussion, see chapter II of this work, and the writings of Richard Falk.

7. Quoted in "Discrimination Against Future Generations: The Possiility of Constitutional Limitation, Gardner, Jim , Environmental Law. Vol. 9, 1978, p. 57.

control them in any shape whatever, than the parliament or the people of the present day have to dispose of, bind, or control those who are to live a hundred or a thousand years hence."[8]

There is another line of argument also which started with Edmund Burke and recently it is widely supported by writers like Edith Brown Weiss , who view the planet earth as a trust. Indeed the two basic principles which formed the basis of liberalism, capitalism, and industrial revolution and continued upto the "Age of Reason" (French revolution) were questioned in the light of environmental awareness among the people. Those principles were--

(1) Premise of abundance

(2) Belief in inevitable progress of human civilization.

Man's capacity to alter planet Earth irreversibly, on a global scale; the depleting natural resources and the polluting environment not only prove the first belief that the human race has always been progressively improving and will continue to develop in the same way. Thus the global environmental crisis that is so clearly advancing upon us can destroy our civilization non-violently. So the human species faces a grave obligation to conserve this fragile planet earth for future generations.

Every generation receives a natural and cultural legacy in trust from its ancestors and holds it in trust for its

---

8. ibid, p. 58.

descendants. This trust imposes upon each generation the obligation to conserve the environment and natural and cultural resources for future generations. The trust also gives each generation the right to use and benefit from the natural and cultural use and benefit from the natural and cultural legacy of its ancestors. These rights and obligations, form the corpus of a proposed new doctrine of intergenerational equity in international law.[9]

The theory of intergenerational equity says that humans as a species hold the natural and cultural environment of Earth in common both with other members of the present generation as both a trustee or custodian of the planet for future generations and a beneficiary of previous generations' stewardship. Thus understanding intergenerational equity entails viewing the human community as a partnership among all generations. Edmund Burke observed that, "as the ends of such a partnership can not be obtained in many generations, it becomes a partnership not only between those who are living, but between those who are living, those who are dead, and those who are yet to be born". [10]

Every generation wants to inherit the common patrimony of the planet in as good a condition as it has been for previous generations and to have as much access to it as did previous

---

9. op. cit., n.4, p.7

10. ibid, p.8.

generations. The theory of intergenerational equity thus calls for equality among generations and among members of a generation with the understanding that all are entitled to a certain level of quality and access.

This notion of equality has deep roots in international law. The preamble to the Universal Declaration of Human Rights, for example, states that "recognition of the inherent dignity and of the equal and inalienable rights of all members of the human family is the foundation of freedom, justice and peace in the world." The United Nations charter, the International Covenant on Civil and Political Rights, the Convention on the Prevention and Punishment of the Crime of Genocide, the American Convention on Human Rights, and other accords affirm the fundamental equality of human beings and protect their dignity and equality of rights.

Thus the actual problem is that how the current generation must balance its own interests with those of future generations and species. This problem could be solved by creating a perpectual trust for future generations through positive law. This trust would require the current trustees - the generation now controlling the planet's future - to meet a standard of behaviour equal to that of any trustee: that of a prudent person dealing with their own property. The corpus of the trust would be the resources of the earth, its basic purpose

would be "to sustain the welfare of future generations. This central purpose is broken down into three subdivisions:

1. Sustaining the life support systems of the planet;

2. Sustaining the systems necessary to the survival of the human species, and

3. Sustaining a healthy environment.[11]

There are a variety of ways to consider the interests of future generations with respect to natural resources. The preservation of resources requires that each generation leave future generations resources in approximately the same condition. Another way to respect future interests is to prohibit waste. This idea is contained in a number of environmental treaties relating to radioactive waste disposal at sea e.g. the LDC including the Stockholm Declaration and UNCLOS III. Still other forms of trust administration, such as economic efficiency, diversification of risk, and preservation of quality of the trust assets, might also be considered.

The duty of the planetary trustees is "to sustain the welfare of future generations." There are four principles to guide the selection of trust administration ideas:-

---

11. Spak, David G., "The Need for a Ban on All Radioactive Waste Disposal in the Ocean", Northwestern Journal of International Law and Business; 7 (1986), p. 8Ø3.

1. Equity among generations; The present generation would not have licence to use resources to the exclusion of future generations or to burden unreasonably the present generation in favour of future generations.

2. Flexible values among generations. The present generation is not required to predict the values of future generations.

3. Clarity in the administration of the trust. The trustees must administer the trust with regard to forseeable situations;

4. The principles should be shared by different cultural traditions. Since the planetary trust is global it should not favour one economic or political system.[12]

Radioactive waste disposal at sea or other 'global commons' would violate these principles unless the current generation could guarantee the safety of such disposal. Ocean-dumping would violate equity among generations if it damaged the marine environment and its resources. This suggests that safety should be of paramount concern because, once resources are destroyed, future generations will not be able to take advantage of them. The harm to marine environment resulting from radioactive wastes would also violate the flexibility principle as it decreases the options available for future generations in

---

12. see generally, op. cit., n.4

ordering their values. The foreseeability principle dictates that the current generation refrain from damaging the marine environment by dumping known hazards, including radioactive wastes. Finally, radioactive waste disposal at 'global commons' violates the cultural equity principle by damaging a shared resource. Dumping benefits only those nations with nuclear capacities at the expense of developing nations.[13]

In addition to these principles, two other requirements should guide the administration of the trust: conservation of options and conservation of quality. The conservation of options entails preserving biological natural resources and cultural diversity. The former is particularly important in terms of radioactive waste disposal

While no one would claim that all existing species are ecologically essential to human culture, scientists do not yet know the critical threshold at which the extermination of the species will seriously disrupt our ecosystem. We do know, however, that it takes thousands of years for species to evolve and that extinction is final.[14]

Radioactive wastes clearly have the potential to harm our ecosystems. That we do not know the impact of these

---

13. op. cit., n.11.

14. Weiss, Edith Brown, "The Planetary Trust : Conservation and Intergenerational Equity," Ecology Law Quarterly, vol. 11, 1984, p. 827.

materials on ocean ecosystem should lead to great restraint based upon principles of equity. The present generation should not force future generations to bear the burden of cleaning up inherited radioactive wastes because the future generations can not share the earlier benefits[15].

Adminttedly, establishing the trust as positive law is not probable today. Nonetheless, it is possible to create the same effect by implementing the fiduciary duty as part of customary international law as expressed in prohibitions against genocide and slavery. While not specifically mentioning the planetary trust, treaties and other international agreements aimed at protecting the environment represent progress towards this ideal. The LDC's prohibition on dumping high-level radioactive wastes at sea recognises, at least implicitly, the need to protect the environment for future generations. Nonetheless, the LDC and other agreements are only rudimentary first steps as national and international organizations are equipped to handle only those problems lasting a few years, not generations.[16] So it is imperative that this generation develop a global strategy to make us accountable to future generations at the same time that we exercise our right to use the natural environment for our own benefit. The strategy includes:-

-- representation of future generations in decision-making

---

15. Ibid, p. 534

16. ibid, p. 563

-- the development of a global information network;
-- the promotion of scientific research;
-- intergenerational trust funds financed by small, global user's fees or tolls, which could be regarded as the price each generation pays for using the planet and to fulfill into obligation to future generations; and
-- education to foster a new planetary ethos rooted in a sense of belonging to a community of past, present, and future generations - all of which are responsible for the use and care of planet Earth.[17]

Only by adhering to such principles and strategies will each generations treat future generations fairly, and not meanly and pitifully. For this international cooperation, global union, faith and honour are necessary. The least fracture now will be like a name engraved with the point of pin on the tender rind of a young oak; the wound will enlarge with the tree and posterity read it in full grown characters."[18]

---

17. Weiss, Edith brown op. cit., n.4, p. 10.

18. Thomas Paine, quoted in op. cit., n. 7, p. 38.

CONCLUSION

CONCLUSION

The foregoing considerations show the inherently transnational and transgenerational ramifications of nuclear waste management. The whole planet Earth is under the threat but still the countries are busy to further their short term interests. The tragedy of humanity is that the Earth is one but the World is not. The radioactive waste has posed a threat to freshwater sources, which are, according to a Russian estimate, amounts to merely Ø.77% of the total water volume. Besides, the global commons, particularly oceans are under great potential threat because of rapacious dumping and the possible seabed emplacement of high-level wastes. As we know, the oceans cover nearly 3/4 of the world surface occupying a critical role in maintaining livable environment. Given the extremely hazardous nature of radioactive waste and their tendency of 'bioaccumulation' and 'biomagnification', they can incur irreparable damage to ocean environment and disrupt the delicate ecological balance. Ultimately radioactivity reaches to humans through food-chain causing several diseases and the worst genetic disorders. So it is compelling to so regulate the nuclear waste disposal that it neither causes injury to biota nor environment.

But hitherto existing international legal regime, despite its promise to protect and preserve the environment for future geneations has been ineffective in achieving the said

objective. There is a earth of meaningful information on environmental impacts associated with radioactive waste dumping. Of course, there are some international instruments, e.g. the LDC, the IAEA, the UNCLOS III and some other resolutions and declarations. But the basic problem has been that there has been no effective legal means to ensure compliance with such international measures.

There has been a serious void in this regard in the existing international law. The lack both of binding international standards for nuclear waste disposal and of a strong system of international inspection and monitoring indicates the main weakness of the attempt at international regulation of nuclear waste disposal. Despite its influence on states, the ability of the IAEA lacks sufficient funds and other resources to supervise even the Non-Proliferation Treaty obligations which have been entrusted on it, let alone the supervision of all dumping operations. So if the IAEA has to supervise and regulate nuclear waste disposal all over the world, enormous transfer of resources to the IAEA and its restructuring becomes imperative. (By restructuring is meant its western bias or dominance by pro-industry people should end and interests of non-nuclear power states and vulnerable small poor states' interest and above all an environmental perspective must be inducted into the Agency.)

Secondly, the decision-making process for developing the safety standards has really been backward. The criteria has been adopted to accommodate the industry rather than the public health and safety. This clearly seems to be the approach that is occuring with the disposal of radioactive waste. The decision-making process in the IAEA is virtually dominated by individuals with a vested interest in nuclear industry. For example, the National Commission on Radiological Protection and International Commission on Radiological Protection include the same people. They are mostly people who have a vested interest in the radiation exposure by the industry. In the ICRP they go to the international meetings; they make recommendations, they go back to their own countries, take off one hat and put on another hat and accept the recommendations that they have just made. And in making their recommendations for exposure of population at large, or for occupational exposure, they have always looked over their shoulders to see what the nuclear power industry could accommodate rather than setting rigid criteria that would force the engineers who were designing these systems to come up with systems that would meet the appropriate criteria when judged against public health and safety.[1]

Furthermore, uncertainty regarding the content and character of the obligation to prevent serious harm to the

---

1. See generally, Alan, in Nuclear Waste Management - The Ocean Alternative, (ed.), T. C. Jackson, Pergamon, 1981, p. 115.

environment diminishes the cogency of consensus on the existence of such an obligation. Both the standard of conduct required of states in controlling nuclear waste disposal and the standard of responsibility for environmental damage require clarification by means of an international agreement. Specific operational criteria rather than general objectives of national waste management programmes should be matters of tangible concern to international community. It is worth to rememebr here that the fundamental principle of radiation protection promulgated by the ICRP which sets merely broad objectives and minimum protection standards while leaving to the various national authorities the responsibility of formulating codes of practice or regulations that are best suited to the needs of their individual countries. But these are vague and cannot be adequate and effective regulatory instruments.

The so called 'radiation dose limit' developed on the basis of scientific and technical information by the ICRP is, in fact, a very vague and unique concept which simply bears a testimony to the fact how science functions as a legitimizing cover for the socio-political interests of the nuclear nations with least consideration for environment or human health. It is very difficult to set a 'threshold dose' on the basis of empirical evidence because science still does not know how small a dose of radiation is required to turn a healthy cell into a cancerous cell. It may be ten rems or one rem. This is evident as we see the history of the ICRP, which shows a constant

decreasing radiation dose limit[2].

The approach adopted in impact assessment on marine environment of ocean-dumping is also impeded because of the uncertainty in assessing long- term impacts of low-level waste dumping. Short -term environmental analysis has further complicated the problem situation and led to dangerously flawed decisions for waste disposal via ocean-dumping. The major fault with this approach is that a high threshold is generally adopted ignoring gradual yet constant impairments.

The international community is now becoming increasingly skeptical of low-level radio-active wastes as well. The restrictive IAEA's 1978 and 1986 recommendations and the strong language used in the LDC and UNCLOS III also evidence this trend. A mere cursory reading of the 1978 recommendations gives rise to the inference that the IAEA was extremely reluctant to allow special permits for the disposal of even low-level radioactive wastes at sea under the LDC. The recommendations suggest that extreme caution be taken given the uncertainties surrounding such disposal actions.

Yet another controversial issue associated with nuclear waste disposal is the 'seabed emplacement' which is, at least for

---

2. For some pertinent thoughts on this see, Forevermore : Nuclear Waste in America, by Barlette, Donal L. and Steele, James B., W.W. Norton and Company, New York ,1985.

some, different from disposal. It is not exactly clear whether seabed emplacement should be considered "dumping at sea" within the scope of the LDC. But it appears unlikely that the coverage of the convention could be restrictively construed to exclude such an activity, specially in the light of the environmental protection objectives of the convention , at least in the absence of a superordinate international regime including such radioactive waste management responsibilities along with authority to control other aspects of the nuclear fuel cycle.

Furthermore, whatever the institutional path chosen by proponents of seabed emplacement, such an extraterritorial disposal scheme especially one involving global commons, is likely to become subject to special scruitiny by Third World nations especially coastal states. Such a development, posing certain risks to the common marine environment, could be viewed as inequitably utilizing ocean resources for the benefit of the technologically advanced nations.

Therefore some form of direct international institution should be there to supervise the dumping operations. For this purpose, the IAEA can be entrucsted with the responsibility of international supervision. As discused earlier the IAEA issues recommendations, which are exhortatory lacking legal binding force, under Annex II of the LDC. These guidelines or recommendations should be made mandatory and the provision of

'special permits' should be issued only after taking all such recommendations of the IAEA into consideration.

There is also a possibility of giving some jurisdiction on seabed emplacement to the International Seabed Authority. Although the International Seabed Authority's jurisdiction is purported to be limited to the control and management of the exploration of deep seabed resources, the exploitable resources of the deep seabed would come within its jurisdiction as distinguished from the resources of the water column above the seabed. However, International Seabed Authority would have ample authority to establish regulations for the protection of the marine environment as the consequence of the exploitation of any seabed resource. Therefore, if seabed emplacement anyway interferes with either exploitation of seabed resources or causes any harm to such resources, the International Seabed Authority may assume jurisdiction to prevent or regulate seabed emplacement of radioactive wastes. But ofcourse, it does not follow that an authority set up only to manage the exploitation of seabed resources and to protect the marine environment from the consequence of such exploitation could protect the seabed generally.

Prevention of significant radioactive pollution by radioactive waste disposal, thus, requires a comprehensive and effective legal regime to fill the present legal void and among other things, adoption of specific substantive and procedural

management standards with internationally binding effect. Binding international criteria for the performance of waste forms and waste sites would help assure that individual nations would refrain from taking short cuts, which prejudice the required long-term containment of wastes by compromising safety standards. Such guiding criteria would help reduce the long term risks of transnational radioactive pollution by accident, and create that measure of confidence among potential victim nations without which coexistence among national societies has become unthinkable in this era of technology- intensive industrial activities.

Moreover, the 'internationalization' of basic safety standards, quality assurance programmes and proof of compliance with strict internationally desired standards might in individual cases, enhance the credibility of national management efforts and mitigate domestic opposition to given features of a national waste management programme. A strong case can, thus, be made for international agreements adopting criteria for the performance of waste forms and site utilizing a common methodology for the safety assessment of disposal options and establishing an international data bank with files identifying the specific characteristics of all nationally (and internationally) operated waste sites. These policies presuppose a close cooperation among nations, pooling research data and easing technology transfers. The advantage of such internationalization is quite clear: long-term nuclear waste disposal safety would be enhanced, duplication

characteristifs,) of national research and development avoided and the cost of individual national programmes reduced.

Neither the law of state responsibility, nor the alternative system of international conventions harmonizing principles of civil liability provides a satisfactory basis for allocating the costs of environmental damage. Both systems indicate a failure to endorse the strict or absolute responsibility of 'source' states in cases of any nuclear accidents and may leave a heavy burden of loss on 'victim states'. In this context the "Trail Smelter" principledoes not help a lot. Since radioactivity is imperceptible by bare senses, it becomes difficult to establish material damage particularly when damage is not immediately visible. Sometimes long term effects of radioactivity become obvious hundreds of years later after the exposure.

So the effectiveness of international institutions in implementing international standards for protecting the environment should be now a more important perspective than older tort- based principles which merely redistribute the costs of transboundary nuisances. Nevertheless, in the control of nuclear waste disposal, the basic structure of this legal system remains significantly unsettled and the pace of progressive development through the international agreements, state practice, and international institutions has been uneven. So a comprehensive and effective international legal regime is

necessary not only to assure safety of the health and environment for present generation but also to hand over the environment intact to future generations. Since the current generation has discreated the problem of radioactive waste disposal, it is incumbent upon this generation both to contain and solve the problem. This generation can start first by recognizing the themes repeatedly expressed by international law makers over the past three decades. The interests of future generations must be fully considered and assured. Future generations deserve to inherit a healthy, robust environment. Cooperation based on a system of international equity is essential if the present generation intends to meet the goals established by international law.

BIBLIOGRAPHY

BIBLIOGRAPHY

Primary Sources

Convention on The Prevention of Marine Pollution By Dumping of Wastes and Other Matter, London, 1972, Reprinted in International Legal Materials, 1972, pp.1291-1314.

Convention on the Liability of Operators of Nuclear Ships, May 1962, Reprinted in 57 American Journal of International Law, 268 (1963).

Convention Relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material, December 17, 1971, (Brussels Convention) : Reprinted in International Legal Materials, 1972, pp.277-283.

Convention on Third Party Liability in the Field of Nuclear Energy, July 29, 1960 (Paris Convention) : Reprinted in International Legal Materials, 1963, pp.727-45.

Convention on Civil Liability for Nuclear Damage, May 21, 1963 (Vienna Convention) : Reprinted in International Legal Materials, 1963, pp.685-702.

HMSO (1976) Nuclear Power and the Environment, Sixth Report of the Royal Commission on Environmental Pollution (Flowers Report) : London, HMSO (September).

International Atomic Energy Agency, Dumping of Nuclear Wastes General Conference Resolution-GC (XXXII)/Res/490.

_____, Code of Practice on The International Transboundary Movement of Radioactive Waste", General Conference - 34th Regular Session, GC(XXXIV)/920.

_____, Safety Principles and Technical Criteria for the Underground Disposal of High-level Radioactive Wastes, Safety Series 99, 1989.

_____, "Revised Definition and Recommendation Concerning Radioactive Waste", Reprinted in International Legal Materials, 1979, p.826.

OECD Geological Disposal of Radioactive Waste, Research and Investigations in OECD Countries, 1985.

OECD : Long Term Management of Radioactive Waste, 1984.

———————, Nuclear Energy Agency, Regulations Governing Nuclear Installations and Radioation Protection, 1972.

———————, Nuclear Energey Agency, Objectives, Concepts and Strategies for the Management of Radioactive Waste Arising from Nuclear Power Programmes, 1977.

Proceedings of the Second United Nations Conference on the Peaceful Uses of Atomic Energy, Waste Treatment and Environmental Impact of Atomic Energy, United Nations, Geneva, 1958.

Report of the United Nations Conference on the Human Environment, Stockholm, June 5-16, 1972, UN Doc. A/Conf.48/Rev.1 : Reprinted International Legal Materials, 1416 (1972).

The Third United Nations Conference on the Law of the Sea, UN Doc. A/Conf. 62/122.

The South Pacific Nuclear Free Zone Treaty, August 6, 1985, Reprinted in International Legal Materials, 1442 (1985).

United States Congressional Record, 97th Congress, Second Session, 1 April 1982.

United Nations Conference for the Promotion of International Cooperation in the Peaceful Uses of Nuclear Energy, Technical Reports, Vol. V, 1987, Spent Fuel and Radioactive Waste Management.

———————, Technical Reports, Vol.VI, 1987, Practices and Experiences in Legal, Administrative and Regulatory aspects.

US DOE (Department of Energy), 1980, Final Environmental Impact Statement : Management of Commerically Generated Radioactive Waste, Washington DC.

Secondary Sources

Books

Barlette, Donald L., and Steele, James B., Forevermore : Nuclear Waste in American, (W.W. Norton, New York, 1985).

Blowers, Andrew and Pepper, David, Nuclear Power in Crisis, eds., (Nicholas Publishing Co. New York, 1987).

Browlie, Ian, System of the Law of Nations : State Responsibility-Part I, (Clarendon Press, Oxford, 1983).

De Marsily, Ghislain, and Merriam, Daniel F., Predictive Geology : With Emphasis on Nuclear Waste Disposal, eds. (Pergamon Press, London, 1982).

Deese, D. A. Nuclear Power and Radioactive Waste : A Subseabed Disposal Option, (Lexington, 1978).

El-Hinnawi, Essam E., Nuclear Energy and the Envionment : A UNEP Study, (Pergamon Press, London, 198Ø).

Geoffrey, G. Eicholz, Environmental Aspects of Nuclear Power, (Ann Arbor Science Publishers, Washington DC., 1976).

Glasstone, Samuel and Walter, H. Jordan, Nuclear Power and its Environmental Effects, American Nuclear Society (Law Grange Park, Illinois, 198Ø).

Gormley, Paul W., Human Rights and Environment : The Need for International Cooperation, (A.W. Sijthoff, Leyden, 1976).

International Atomic Energy Agency-A collection of Lectures, Nuclear Law for Developing Countries, (IAEA, Vienna, 1969).

Jackson, Thomas C., Nuclear Waste Management : The Ocean Alternative, ed., (Pergamon, London, 1981).

Johasson, Thomas B. and Peter Steen, Radioactive Waste from Nuclear Power Plants, (Berkeley, California : Univerusity of California Press, 1981).

Kasperson, Roger E., Equity issues in Radioactive Waste Management, ed., (Gunn and Hain Publishers, 1983).

Luther, J. Carter, Nuclear Imperatives and Public Trust : Dealing with Radioactive Waste, (Resources for the future - Washington DC. 1987).

Mankabady, Samir, The International Maritime Organization, ed. (Croom Helm, Sydney, 1984).

Mason, Willrich and Richard, K. Lester, Radioactive Waste Management and Regulation, (MacMillan 1984).

Maxey, Margaret N., Bioethical Perspective on Acceptable Risk Criteria for Nuclear Waste Management, (Lawrence Livermore Laboratory, 1977).

Murdock, Steve H., Leistritz, F. Larry Hamm and Rita R., Nuclear Waste : Socio Economic Dimensions of Long-Term Storage, (Westview Press, 1983).

National Academy of Sciences, National Research Council The Disposal of Radioactive Waste on Land, (National Academy of Scienses Washington DC : 1957).

Pasqualetti, Martin J.; Pijawka, David K., Nuclear Power : Assessing and Managing Hazardous Technology, (Westview Press-London, 1984).

Roberts, L.E.J., Nuclear Power and Public Responsibility, Combridge University Press 1984).

Rochlin, Gene I., Plutonium, Powers and Politics : International Arrangements for Disposition of Spent Nuclear Fuel, (University of California Press 1979).

Sorensen, Max, Manual of Public International Law, ed. (Macmillan Press 1968).

Szasz, P., The Law and Practice of the IAEA, (Vienna, 197Ø).

Articles

Abbots, J., "Radioactive Waste : A Technical Solution". The Bulletin of the Atomic Scientists, 35, (1979).

Abrams, Nancy E. and Joel R. Primack, "Helping the Public Decide-The Case of Radioactive Waste Management" Environment, 22, (198Ø).

Angino, E.E., "High-Level and Long-Lived Radioactive Waste Disposal" Science, 198 (1977), 885.

Barness, A. James, "The Growing International Dimension to Environmental Issues", Columbia Journal of Environmental Law, Vol 13, No.2, 1988, pp.389-396.

Barron, Jillian, "After Chernobyl : Liability for Nuclear Accidents Under International Law", Columbia Journal of Transnational Law, Vol. 25, No.3, 1987, pp.647-72.

Bauman, Judith C. and John Platt, "Case note : May a State Say 'no' to Nuclear Power ? Pacific Legal Foundation Gives a Disappointing Answer", Environmental Law, 10 (1979).

Bernard, K. Schafer, "Solid, Hazardous and Radioactive Wastes in Outer Space : present Controls and Suggested Changes", California Western International Law Journal, Vol.19, No.1, 1988-89.

Blomeke, J.O.; Nicholas, J.P.; and Mc Clain, W.C., "Managing Radioactive Wastes", Physics Today, Vol.26, No. 8 (1973):36.

Boyle, Alan E., "Nuclear Energy and International Law : An Environmental Perspective", The British Yearbook of International Law, 1989.

Burman, Shibdas, "Sea Disposal of Nuclear Wastes", Yojna, Vol.34, No.10, (1990), pp.25-28.

Burroughs, R.H., "Ocean-Dumping Information and Policy Development in the USA", Marine Policy, Vol.12, No.2, 1988, pp.96-104.

Christiansen, Boehmer S.A., "Marine Pollution Control-UNCLOS III, as the Partial Codification of International Practice", Environmental Policy and Law, Vol.7, No.2, 1981, pp.71-74.

_____, "An end to Radioactive Waste Disposal 'at sea' ?, Marine Policy, Vol. 10, No.2, 1986, pp.119-31.

Curtis, Clifton E., "Legality of Seabed Disposal of High-Level Radioactive Wastes Under the London Dumping Convention", Oceon Development and International Law, Vol.14, No.4, 1985, pp.383-415.

De Marsily, G., "Nuclear Waste Disposal : Can the Geologist Guarantee Isolation ?", Science 197, (1977): 519.

Dyke, John M. Van, "Ocean Disposal of Nuclear Wastes", Marine Policy, Vol.12, No.2, 1988, pp.82-95.

Eric, J. Barron, "Nuclear Waste Disposal : A Climate Problem ? an Editorial", Climatic Change, Vol. 10, No.2, 1987, p.107.

Finn, Daniel, "Ocean Disposal of Radioactive Wastes-The Obligation of International Cooperation to Protect the Marine Environment", Virginia Journal of International Law, Vol.21, 1981, pp.621-32.

_____, "Nuclear Waste Management Activities in the Pacific Basin and Regional Cooperation on the Nuclear Fuel Cycle", Ocean Development and International Law, Vol.13, No.2, 1983, pp.213-246.

Froster, Malcolm J., "London Dumping Convention in the Ranks of Tuscany ?", Environmental Policy and the Law, Vol. 16, No.1, 1986, pp.7-11.

Gardner, Jim, "Discrimination Against Future Generations : The Possibility of Constitutional Limitation", Environmental Law, Vol.9, 1978.

Haimbaugh, George D. Jr., "Protecting the Seas from Nuclear Pollution", South Carolina Law Review, Vol.33, 1981, pp.197-225.

Handl, Gunther, "Territorial sovereignty and the Problem of Transnational Pollution", American Journal of International Law, Vol.69, 1975, p.54.

_____, "Managing Nuclear Wastes : The International Connection," Natural Resource Journal, Vol.23, April, 1981, pp.267-312.

Harrison, J.H., "Disposal of Radioactive Wastes" Science Vol, 226, No.467Ø, 1984, pp.5 and 12.

Hart, Gary W., "Symposium : Nuclear Waste Management", South Carolina Law Review, Vol. 32, 1981.

Heller, Michael A., "Chernobyl Fall-Out : Recent IAEA Conventions Expand Transboundary Pollution on Law.", Stanford Journal of International Law No.23, No.2, 1987, pp.651-64.

Jacksetic, Emilio, "Legal Aspects of Radioactive High-Level Waste Management", Environmental Law, Vol.9, 1979.

Kindt, Warren, "Ocean-Dumping", Denver Journal of International Law, Vol.14, 1984.

_____, "Radioactive Wastes", Natural Resource Journal, Vol.24, 1984, pp.967-1Ø14.

Kubo, A. S., and Rose, D.J., "Disposal of Nuclear Wastes", Science, 182 (1973) : 12Ø5.

Lang, Winfried, "Environmental Protection : A Challenge for International Law", Journal of World Trade Law, Vol.2Ø, No.5,1986, pp.489-96.

La porte, Todd R., "Nuclear Waste: Increasing Scale and Social Impacts", Science, 2Ø1, 1978.

Lewis, J. B., "The Case for Deep Sea Disposal" Atom, No.317, March, 1983, pp.49-52.

Lucas, Alastair R., "Legal Foundation for Public Participation in Environmental Decision-Making", Natural Resources Journal, 16, 1976.

Luther, J. Carter, "Social and Economic aspects of Radioactive Waste Management : Considerations for Institutional Management", Environment, Vol. 27, No.2, March, 1975, pp.25-29.

Mobbs, Shelly, "Seabed Disposal of Waste Where Do We Go From Here ?", Atom, 386, Dec., 1988.

Mac Caffrey, Stephen C., "An Update On the Contributions of the International Law Commission to International Environmental Law", Environmental Law, Vol.15, No.4, 1985, pp.667-678.

Magraw "Transboundary Harm : The ILC's Study of "International Liability", 8Ø, American Journal of International Law, 3Ø5 (1986).

Mani, V.S. , "Ocean Dumping of Radioactive Wastes-Law and Politics", Indian Journal of International Law, 24(2) April-June 1984, pp.224-44.

Norton, M.G., "The Oslo and London Dumping Conventions", Marine Pollution Bulletin, Vol.12, No.5, May, 1981. pp.145-149.

Pleat and Lennenman, "Considerations for Long Term Waste Storage and Disposal at USAEC Sites", Atomic Energy Law Journal, 1966.

Rochlin, G.I., "Nuclear Waste Disposal : Two Social Criteria", Science 195 (1977) : 23.

Rotblat, J., "Hazards of Low-Level Radiation -- Less Agreement, More Confusion", Bulletin of Atomic Scientists, Vol.37, 1981, pp.31-37.

Sharma, Dhirendra, "Nuclear Waste Hazards", Hindustan Times : 4 Jan., 1990.

Spark, David, G., "The Need For a Ban on All Radioactive Waste Disposal in the Ocean", North Western Journal of International Law and Business, Vol.7, No.4, 1986, pp.803-832.

Spiller, Judith, "Radwaste at Sea : A New Era of Polarization or a New Basis for Consensus ?", Ocean Development and International Law, Vol.19, 1988, pp.345-366.

Srinivasan, M.R., "Environmental Aspects of Nuclear Power", Nuclear India, 26(3-4) : 1988.

Subrahmanyam, K., "Nuclear Power : Waste Separate Issue", Times of India, 28 March, 1988.

_____, "Radiological Weapons : Possible Use of Nuclear Waste" Times of India, 3 Feb., 1988.

Weiss, Edith Brown, "The Planetary Trust : Conservation and Intergenerational Equity", Ecology Law Quarterly, Vol.11, 1984.

_____, "In Fairness to Future Generations", Environment, Vol.32, No.3, 1990, pp.7-11and 30-31.

Williams, "Public International Law governing Transboundary Pollution", Queensland Law Journal, Vol.6, No.1, 1988.