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I. Introduction

A. The Problem of Radioactive Pollution of the Environment

Since the 1970's, world public opinion has become more informed about the environmental consequences of the peaceful uses of nuclear energy. However, at the dawn of the nu-

clear age in the 1950's there was great enthusiasm about the use of nuclear energy throughout the world.[1] Nuclear energy was perceived to be capable of curing social diseases, such as poverty and hunger, and biological diseases, such as cancer. There was a belief that if used for peaceful purposes, nuclear energy would be an inexpensive and absolutely safe source of power.[2] Only military uses of nuclear energy were clearly understood to present a serious danger for people and the Earth's environment.[3] For this reason, international lawmaking in this area primarily focused on the cessation of the nuclear arms race, the disarmament of nuclear weapons and the establishment of a regime for the non-proliferation of nuclear weapons.[4] Although the international regime that developed in this respect is not perfect,[5] it represents an important achievement of international law and politics, and provides, inter alia, for international verification of States' compliance with non-proliferation obligations including on-site inspections of nuclear facilities and processes. As a former deputy director general of the International Atomic Energy Agency for Safeguards described it, the non-proliferation regime "was a political quantum leap changing the perception of unlimited national sovereignty - a consequence of the

1. N.L. Char & B.J. Csik, *Nuclear Power Development: History and Outlook*, IAEA BULL., Vol. 29 No. 3 1987, 19.

2. PAUL C. SZASZ, THE LAW AND PRACTICES OF THE INTERNATIONAL ATOMIC ENERGY AGENCY (1970).

3. MANSON BENEDICT ET AL., NUCLEAR CHEMICAL ENGINEERING (1981).

4. On the regime for the non-proliferation of nuclear weapons see JOZEF GOLDBLAT, TWENTY YEARS OF THE NON-PROLIFERATION TREATY: IMPLEMENTATION AND PROSPECTS (1990); NUCLEAR NON-PROLIFERATION AND GLOBAL SECURITY (David B. Dewitt ed., 1987); RICHARD K. BETTS ET AL., NONPROLIFERATION AND U.S. FOREIGN POLICY (Joseph A. Yager ed., 1980).

5. *See, e.g.*, KATHLEEN C. BAILEY, STRENGTHENING NUCLEAR NONPROLIFERATION (1993). Some writers argue even to the general illegality of nuclear weapons. *See* Burns H. Weston, *Nuclear Weapons and International Law: Prolegomenon to General Illegality*, 4 N.Y.L. SCH. J. INT'L & COMP. L. 227 (1983); Burns H. Weston, *Nuclear Weapons Versus International Law: A Contextual Reassessment*, 28 MCGILL L.J. 542 (1982-83); FRANCIS A. BOYLE ET AL., IN RE: MORE THAN 50,000 NUCLEAR WEAPONS, ANALYSES OF THE ILLEGALITY OF NUCLEAR WEAPONS UNDER INTERNATIONAL LAW (1991).

technical quantum leap in destructive power prompted by the discovery of nuclear energy."[6]

The last twenty years have shown that even peaceful, non-military uses of nuclear energy can pose a serious danger to the Earth's population and the environment. The nuclear accidents at Three Mile Island in the United States and at Chernobyl in the Ukraine were grave manifestations of this danger.[7] Chernobyl demonstrated that an accident at a nuclear facility, regardless of the location, can have severe transboundary consequences due to environmental transportation of radioactive effluents.[8] Today another "quantum leap" in international law is pending, this time in the area of environmental protection from radioactive pollution. This article discusses the present state of the international law protecting the environment from radioactive pollution, the issues awaiting solution, the new developments underway and speculates the best ways to implement these developments.

This author takes an environmentalist approach in this discussion, that is not to say that the problem of protecting people from the hazards of nuclear energy is neglected. Individuals, as well as the environment, are victims of radioactive emissions from nuclear incidents. However, by complementing a regime for environmental protection with the protection of human beings, superior protection for human beings would result since the focus would be aimed at ensuring healthy living conditions in all parts of the world. Planning for future environmental consequences constitutes a

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6. H. Grümm, *IAEA Safeguards: Milestones In Development & Implementation*, IAEA BULL., Vol. 29 No. 3 1987, 29. He further stated, "in the beginning, the motivation of States to accept safeguards was perhaps dominated by the desire to participate in a new technology with unforeseeable prospects. Later on, the main motive became the understanding that it is in the very security interest of non-nuclear weapon States to refrain from acquiring nuclear weapons." *Id.* On the International Atomic Energy Agency safeguards see for example DAVID FISHER & PAUL SZASZ, SAFEGUARDING THE ATOM: A CRITICAL APPRAISAL (Jozef Goldblat ed. 1985); BAILEY, *supra* note 5, at 67-78.

7. *See* GRIGORI MEDVEDEV, THE TRUTH ABOUT CHERNOBYL (1989).

8. *See* Barry Smith & Arthur Chanlesby, *The Radioactive Release from Chernobyl & its Effects, in* THE CHERNOBYL ACCIDENT AND ITS IMPLICATIONS FOR THE UNITED KINGDOM 25 (1988).

more disciplined approach to protecting the place we live, namely the Earth, and will yield returns in the long run.

When an accident occurs, people suffering the effects of radiation receive treatment or are evacuated. However, the environment bears the radioactivity left by human action. In the long run, the deadly debt of radioactivity in the environment will be paid by the people. No words can express the grief and suffering that Chernobyl brought to the people in the adjacent areas of Ukraine, Russia, and Byelorus.[9] The land suffered together with the people; the eighteen mile area around the nuclear power plant will remain contaminated for decades to come. Moreover, all Byelorus was declared an ecological disaster zone after Chernobyl.[10]

Although, there are instances when people do not suffer direct or immediate injury from released radiation, once released into the environment, radiation will accumulate. For instance, discharges from a nuclear reprocessing plant at Sellafield, England, caused major radioactive contamination in the Irish Sea. Once in the sea, radionuclides are deposited on the sea floor, so that the sea becomes a major sink for the radionuclides.[11] Due to these long-term effects of radiation contamination, nuclear waste disposal at sea is a highly controversial issue. The previously unknown practice of the Soviet military dumping its high-level and low-level nuclear waste in the Pacific Ocean has now come to the attention of international environmentalist organizations.[12]

There are instances where urgent environmental response measures have limited human exposure to radioactive

9. For a minute-by-minute account on the Chernobyl tragedy, MEDVEDEV, *supra* note 7. *See also* CHERNOBYL: A POLICY RESPONSE STUDY (Boris Segerstahl ed. 1991); DR. ROBERT PETER GALE & THOMAS HAUSER, FINAL WARNING: THE LEGACY OF CHERNOBYL (1988).

10. "Each reader of THE TRUTH ABOUT CHERNOBYL must understand that Chernobyl was a universal tragedy, that the harm done by it is still going on today, that millions of people are still living on land contaminated with radiation, and that they need help and compassion." MEDVEDEV, *supra* note 7, at xi.

11. COMMISSION OF THE EUROPEAN COMMUNITIES, THE STATE OF THE ENVIRONMENT IN THE EUROPEAN COMMUNITY 279 (1987) [hereinafter THE STATE OF THE ENVIRONMENT IN THE E.C.].

12. William J. Broad, *Soviet Dumping of a Waste-Stunning Report*, S.F. CHRONICLE, Apr. 27, 1993, at A1.

environmental pollution. For example, in 1966, United States bombers carrying atomic bombs crashed at the village of Palomares in Southern Spain causing two of the bombs to catch fire, and dispersing radioactive substances over an area of several hundred hectares.[13] A ten centimeter layer of earth was removed, transported and treated as radioactive waste in some places while other contaminated surfaces were turned over to a depth of thirty centimeters.[14] The soil in the area is still contaminated to some extent; however, the population's exposure to radiation resulting from this contamination is extremely low.[15]

Nuclear science has developed two disciplines which are used in developing environmental protection from nuclear hazards: radiation protection and nuclear safety.[16] Although these are technical disciplines, standards that are adopted by individual States in the area of radiation protection and nuclear safety comprise a part of their national nuclear law. If those standards are adopted internationally, they will serve as a basis for the international regulation of nuclear energy for the purpose of protecting the environment.

Radiation protection is concerned with the protection of the individuals, their progeny and mankind as a whole, while allowing necessary activities that may result in exposure to radiation.[17] Radiation protection is ensured by establishing: "(a) maximum permissible doses compatible with adequate safety; (b) maximum permissible levels of exposure and contamination; and (c) . . . measures for the health surveillance of workers."[18]

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13. EUR. PARL., Written Questions with Answers, No. 171/86, 1988 O.J. (C 123) 1.

14. *Id.*

15. *Id.*

16. *See, e.g.*, Char & Csik, *supra* note 1, at 19.

17. *See* 1990 RECOMMENDATIONS OF INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION, USER'S EDITION (H. Smith ed. 1992) [hereinafter 1990 RECOMMENDATIONS OF ICRP].

18. TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, TREATIES AMENDING THESE TREATIES, SINGLE EUROPEAN ACT 644 (Office for Official Publications of the European Communities ed. 1987) [hereinafter TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES]. The International Atomic Energy Agency prescribes in the Basic Safety Standards for radiation protection maximum per-

The primary aim of nuclear safety is to keep the population's and worker's exposure to radiation from nuclear facilities as small as reasonably possible both during normal operation and in the event of an accident.[19] Nuclear safety provides measures for: (a) safety of nuclear power plants (i.e. safe design, construction, operation and siting of nuclear facilities); (b) safety of other nuclear facilities in the nuclear fuel cycle; and (c) safety of transport of nuclear materials.[20]

Because nuclear safety concerns itself with design and operation of nuclear facilities, the author refers to it as a technology-based method of regulating the use of nuclear energy. In contrast to nuclear safety, radiation protection can be labeled a biology-based method of regulation. It sets forth the maximum permissible doses and levels of radiation, i.e. doses received per unit of time that can be received by human beings without harm to their health.[21] If radiation protection would set forth limits for the levels of radioactivity in the ambient air, water and soil, it could be labelled a media-based method of control. This is the primary contradiction in the discipline of radiation protection. On one hand, radiation protection serves as a basis for environmentally oriented protective measures. On the other hand, however, as a branch of science, radiation protection does not include the environment per se within the sphere of its concerns. According to the International Commission on Radiation Protection (ICRP),[22] the basic criteria that underlies the radiation protection regulations is defined as follows:

> [E]nvironmental control needed to protect man to the degree currently thought desirable will ensure that other species are not put at risk. Occasionally, individual mem-

missible doses and dose limits. THE AGENCY'S SAFETY STANDARDS AND MEASURES 1, IAEA Doc. INFCIRC/18 (Apr. 1976).

19. INTERNATIONAL ATOMIC ENERGY AGENCY & WORLD HEALTH ORGANIZATION, NUCLEAR POWER, THE ENVIRONMENT AND MAN 81 (1982) [hereinafter NUCLEAR POWER].

20. *Id.* at 81-102.

21. *See infra* notes 132, 247-55 and accompanying text.

22. The ICRP was established in 1928. The ICRP is a non-governmental organization and issues recommendations on the use of ionizing radiation and processes that generate radiation and radioactive materials. *Id.* at 1.

> bers of non-human species might be harmed, but not to the extent of endangering whole species or creating imbalance between species. At the present time, the Commission concerns itself with mankind's environment only with regard to the transfer of radionuclides through the environment since this directly affects radiological protection of man.[23]

Thus, the ICRP is only concerned with the protection of man and not of other species.[24] The ICRP plays a central role in formulating the radiation protection standards applied throughout the world. The ICRP's recommendations directly influence the radiation protection laws and the regulations of most States, as well as international standards on radiation protection.[25]

This author believes that it is necessary to complement the definition of radiation protection by including criteria for the protection of the environment. There are no independent criteria for the protection of the environment in the current definition of radiation protection.[26] According to the ICRP's definition of radiation protection, any element of the environment is considered to be sufficiently protected if human beings are sufficiently protected.[27] If this definition were complemented by a criterion for the protection of the environment it would reflect reality and, more importantly, provide an impetus for the international community to regulate the environment globally.

Although nuclear safety and radiation protection form the basis for the regulation of nuclear energy in regard to environmental protection, not every aspect of these methods relate to the protection of the environment. For instance, certain events, such as radon in buildings, although connected with radiation protection, would not have environ-

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23. *Id.* at 3-4.

24. *Id.* at 1.

25. An examination of radiation protection laws and regulations in individual States shows that the ICRP's radiation protection principles have been incorporated in almost every case, albeit with different wordings and varying degrees of emphasis.

26. *Id.* at 3-4.

27. *Id.*

mental consequences. In analyzing the development of international regulation for environmental protection, this author concentrates on those aspects of nuclear safety and radiation protection that have environmental impacts.

B. Nuclear Energy: Why Is It Dangerous to the Environment?

In this section, the author will show, first, that nuclear facilities, especially nuclear reactors, are inherently dangerous to the environment and only through the use of special safety systems and operational measures can radioactivity produced by nuclear reactors be curbed.[28] Therefore, the isolation of radioactivity from the environment depends upon nuclear safety. Second, this author will demonstrate that, although there are only a few basic designs of nuclear reactors, there can be many variations in these designs. For example, use of different coolants,[29] moderators,[30] or alloys of the rod assemblies[31] can alter the paths of escape of radioactive materials from the reactors in both normal operations and accidents. Nuclear safety systems and operating techniques also vary with the use of different types of reactors.[32]

Nuclear energy is currently applied in diverse areas of human activity, such as medicine, nuclear research, agriculture, and food preservation. However, the primary danger to the environment emanates from the generation of nuclear power. This is because the nuclear power plant, the principal section in the nuclear fuel cycle chain,[33] is the place where

28. *See infra* notes 129-66 and accompanying text.

29. "A substance circulated through a nuclear reactor to remove or transfer heat. Common coolants are water, air, carbon dioxide, liquid sodium, and sodium potassium alloy." GEOFFREY G. EICHHOLZ, ENVIRONMENTAL ASPECTS OF NUCLEAR POWER 667 (1976).

30. "A moderator is a delay element used in nuclear reactors to slow down nuclear fission. Moderators are normally constructed from graphite or deuterium." DAVID DOOLEY & NEIL KIRKPATRICK, ENVIRONMENTAL GLOSSARY 109 (1993).

31. *See infra* note 48.

32. *See infra* notes 58-96 and accompanying text.

33. Some of the major elements of the nuclear fuel cycle include; uranium mining and ore processing, uranium refining, conversion and enrichment, fuel fabrication, electricity production on a nuclear power plant, spent fuel manage-

the fission process occurs.[34] During this process, hundreds of artificial radionuclides are produced.[35] Although many of these radionuclides are short-lived, it is their substantial quantities that cause concern:

> [The] quantities of the radioactive fission products and transuranic radionuclides produced in a single nuclear power plant, in terms of their associated radioactivity, are staggering. A standard 1,000 mega-watt nuclear generating plant contains more than 15 billion curies of radioactivity in its core after 300 days of operation. This is about equal to the natural radioactivity contained in all the oceans.[36]

In normal operation, a nuclear power plant produces a certain amount of radioactive emissions; but, because of the enormous volume of short-lived and long-lived radionuclides accumulated in the reactor, an outburst of radionuclides which could result from a nuclear accident can be disastrous.[37]

In a conventional power station, heat is produced by a chemical reaction.[38] The coolant removes the heat and generates steam to drive turbines.[39] This produces electricity.[40] In a nuclear plant, heat is produced by nuclear reaction.[41]

At the core of a nuclear power plant is the nuclear reactor.[42] The reactor is the primary source of the ra-

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ment and transportation of nuclear materials. NUCLEAR POWER, *supra* note 19, at 19-56.

34. *Id.*

35. John-Mark Stensvaag, *Regulating Radioactive Air Emissions from Nuclear Generating Plants: A Primer for Attorneys, Decisionmakers and Intervenors*, 78 NW. U. L. REV. 1, 9 (1983).

36. *Id.* at 9-10 (footnotes omitted).

37. *See id.*

38. DRAGANIC ET AL., RADIATION AND RADIOACTIVITY ON EARTH AND BEYOND 249 (1990).

39. *Id.*

40. *Id.*

41. *Id. See generally* NUCLEAR POWER, *supra* note 19, at 29; BENEDICT ET AL., *supra* note 3; EICHHOLZ, *supra* note 29, at 143.

42. DRAGANIC ET AL., *supra* note 38, at 250.

dionuclides.[43] The fuel used in nuclear reactors is usually uranium[44] or plutonium.[45] These radioactive elements are placed into fuel rods, which are thin metal tubes.[46] The fuel rod shell is called the "cladding."[47] Several fuel rods are attached together to form 'fuel assemblies' in a configuration that allows the coolant to flow between the rods.[48]

The coolant is used to avoid the melting of the uranium assembly.[49] In some reactors, the coolant also serves as a moderator to absorb the prompt neutrons released in a chain fission reaction to keep the rate of the chain reaction constant.[50] The substances that are currently used as coolant include: ordinary or heavy water (deuterium) and the gases helium and carbon dioxide.[51] Graphite can also be used as a moderator, particularly in gas-cooled reactors.[52]

The various radioactive substances that are by-products of nuclear power generation end up as nuclear wastes.[53] Generally, waste-production is a by-product of any type of electricity production.[54] In the case of nuclear power genera-

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43. *Id.*

44. "A heavy silvery-white metallic element, radioactive . . . [t]he element occurs in several minerals . . . from which it is extracted and processed for use in research, nuclear fuels, and nuclear weapons." THE AMERICAN HERITAGE DICTIONARY 1329 (2d ed. 1982).

45. "A naturally radioactive, silvery, metallic transuranic element, occurring in uranium ores and produced artificially by neutron bombardment of uranium . . . [i]t is radiological poison . . . ." *Id.* at 955.

46. Stensvaag, *supra* note 35, at 5.

47. *Id.*

48. *Id.*

49. EICHHOLZ, *supra* note 29 at 667.

50. BENEDICT ET AL., *supra* note 3.

51. DRAGANIC ET AL., *supra* note 38, at 250. In addition to this,

> [s]odium, a soft and silvery white metal which melts at 98 degrees Celsius is used as a coolant in fast neutron reactors in which large amounts of heat are released in a small volume.
>
> At present, nuclear energy production is based mainly on the thermal neutron fission process. The contribution of power reactor using fast neutrons was less than 1 percent in the mid-1980's.

Id.

52. EICHHOLZ, *supra* note 29, at 145.

53. DRAGANIC ET AL., *supra* note 38, at 250.

54. *Id.*

tion, waste is radioactive and consists of fission products[55] and actinides[56] in the spent fuel, in addition to various solid, liquid and gaseous materials which are formed during the operation or reprocessing of the fuel elements.[57]

There are several main types of nuclear reactors in operation throughout the world. Reactors can differ according to the fuel used, cladding material, moderator and coolant used.[58] The gas-cooled graphite moderated reactors were first developed in the United Kingdom and France.[59] A further development of this type, which has not yet reached full commercial utilization, is the high-temperature gas-cooled reactor,[60] that cools at a temperature of 900 degrees celsius.[61] There are two basic types of reactors that use light water as coolant: the pressurized water reactors (PWR)[62] and boiling water reactors (BWR)[63] (sixty one percent are PWR and twenty three percent are BWR).[64]

The PWR and BWR are the two basic types of reactors in the former Soviet Union's nuclear power program.[65] Some reactors are BWR which use light water as the coolant and graphite as the moderator.[66] The fuel is natural ura-

55. "[A] nuclide produced either by fission or by subsequent radioactive decay of the nuclides formed in the fission process." EICHHOLZ, *supra* note 29, at 668.

56. "A series of radioactive elements in the seventh row of the periodic table having atomic number 89 to 103, commencing with Actinium, and including elements such as plutonium and uranium." DOOLEY & KIRKPATRICK, *supra* note 30, at 2.

57. DRAGANIC ET AL., *supra* note 38, at 250.

58. NUCLEAR POWER, *supra* note 19, at 31.

59. *Id.*

60. *Id.* at 30-31.

61. *Id.*

62. In a PWR heat is transferred from the core to a heat exchanger by overpressurized water. This allows it to reach high temperatures without boiling. EICHHOLZ, *supra* note 29, at 671.

63. In a BWR, water is used as a coolant and a moderator. The water is boiled in the core and produces steam that drives the turbine. *Id.* at 666.

64. DRAGANIC ET AL., *supra* note 38, at 250. Heavy-water reactors have been operating in several countries, including Canada, Germany, India, Argentina and Pakistan. *See* NUCLEAR POWER, *supra* note 19, at 33.

65. NUCLEAR POWER, *supra* note 19, at 33.

66. *See id.*

nium.[67] Other countries also use a design similar to the Chernobyl-type.[68] After the Chernobyl accident, the oldest of four reactors supplying plutonium for weapons in the United States was temporarily shut down.[69] Like the Chernobyl reactor, it had a graphite-moderated and water-cooled core and no concrete containment dome.[70]

The PWR and BWR are in common use in the United States.[71] Both types of reactors use light water as the coolant. The main difference between them is that the PWR is a two-circuit reactor, whereas the BWR is a one-circuit reactor.[72] In the PWR, water, which is under a pressure of about one hundred fifty atmospheres, circulates from the reactor core to a steam generator, and from there back to the core in a closed system called a "primary" circuit.[73] When heat is transferred to this generator it produces steam in a "secondary" circuit, the steam drives the turbine producing electricity.[74]

In the BWR, the water flows through the reactor at low pressure, this causes the water to boil and partially convert to steam as it flows through the reactor.[75] The coolant leaving the reactor is separated into water and steam.[76] The water is recycled and the steam goes directly to the turbine.[77] There is no external steam generator, the reactor provides this function.[78]

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67. *See* MEDVEDEV, *supra* note 7, at 61. *See also* NUCLEAR POWER, *supra* note 19, at 33.

68. *See e.g.*, Joel Havemann, *Chernobyl: Five Years Later*, L.A. TIMES, Apr. 23, 1991, at H7; *Chernobyl Type Reactor to be Closed for 6 Months*, L.A. TIMES, Dec. 14, 1986, at 1.1 [hereinafter *Chernobyl Reactor Closed*]; Kenneth Jautz, *Soviets to Inform Us About Reactors Being Built in Cuba*, BOSTON GLOBE, Sept. 26, 1986, at 3.

69. *Chernobyl Reactor Closed*, *supra* note 68.

70. DRAGANIC ET AL., *supra* note 38, at 260.

71. BENEDICT ET AL., *supra* note 3, at 8.

72. DRAGANIC ET AL., *supra* note 38, at 251-52.

73. *Id.* at 251.

74. *Id. See also* BENEDICT ET AL., *supra* note 3, at 7.

75. BENEDICT ET AL., *supra* note 3, at 8.

76. *Id.*

77. *Id.*

78. *Id.* In a BWR the fuel and moderator remain in place and the coolant flows through the reactor to a steam generator, the coolant is cooled by heat

> During the nuclear reaction, the reactor fuel accumulates sizable inventory of fission products representing an enormous source of radioactivity. Since the cladding is only a fairly thin metal sheath around the fuel, which is subject to thermal stresses, mechanical forces, internal gas pressures and corrosive action by the coolant, almost inevitably small cracks will develop in it during operation that will permit a small but finite fraction of the fission products to leak into the coolant.[79]

Theoretically, in the PWR, the radioactive coolant circulates only in the primary circuit, but, in practice, contamination can occur in the second circuit due to leaks in the conduits.[80] In the BWR, there is only one circuit in which the radioactive coolant flows.[81] Thus, the turbine should be sealed in a leakproof casing, this casing also collects the steam losses and circulates them back to the reactor.[82]

Coolant is the main pathway through which radioactive fission products escape the reactor.[83]

> Some of the radioactive fission products and transuranic elements that escape to the coolant are in solid form and tend to stay with the liquid water, from which they eventually are removed by demineralizers. Other escaping radionuclides are more volatile, however, tending to diffuse into the atmosphere.[84]

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exchange with feedwater. The feedwater is converted to steam, which drives a steam turbine. *Id.* at 7. The problem with this type of reactor can be that though the water effectively takes up heat from the fuel elements, the graphite moderator also collects heat and has to be cooled separately. In order to prevent overheating of the graphite and the risk of fire, a separate cooling system circulates a gaseous mixture of helium and nitrogen. *See* DRAGANIC ET AL., *supra* note 38, at 253.

79. EICHHOLZ, *supra* note 29, at 172.

80. DRAGANIC ET AL., *supra* note 38, at 251.

81. *Id.* at 252-53.

82. *Id.* Though this author has long believed that the two-circuit reactor should be "safer" than the one-circuit reactor, being a lay person, the author vainly seeked for proof of her view point until she came across the following conclusion of Grigori Medvedev: A two-circuit plant is cleaner because it has less extensive pipeline communications, and the discharges are less radioactive, therefore, it is safer. *See* MEDVEDEV, *supra* note 7, at 62.

83. Stensvaag, *supra* note 35, at 12-13.

84. *Id.* (footnotes omitted).

Their escape or removal takes place in various ways, depending on the type of reactor.[85] These radionuclides constitute one type of radioactivity that occurs in the coolant.[86] Activation of the crud[87] in the coolant is also a source of activation products.[88] Crud generation at BWR's and PWR's differs significantly primarily because of the different alloys used in the coolant loops.[89]

Due to the differences of design, escape paths for the activities differ between reactor types. In the BWR:

> [S]team is raised immediately above the reactor core, within the reactor containment. This steam is then passed to the turbine without an intervening heat exchanger and subsequently condensed and cleaned. An escape of steam via the turbine, and seals or condensate phase separators will introduce some radioactivity in gaseous form into the building atmosphere. Consequently any release of radioactivity in BWR is most likely by way of the airborne effluents traveling up the stack.[90]

In the PWR:

> [T]he primary coolant passes through a heat exchanger still in the liquid state. In such a system, escape of activity is less probable and would proceed mainly through cracks and defects in the primary loop piping, boiler tube defects, and pump shaft and valve steam seal leaks.[91]

The nuclear power plant, as the main element of the nuclear fuel cycle, generates an enormous amount of ra-

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85. *Id.*

86. *Id.* at 13. A second type of radionuclide does not originate in the fuel. They are the result of neutron activation of the corrosion and wear products of the material composing the coolant loop. These materials can be different depending on the type of reactor. *See* EICHHOLZ, *supra* note 29, at 174.

87. "[V]arious structural materials in the primary loop, - pumps, values, piping, the reactor vessel, and the like - corrode and erode under operating conditions creating fine particulates. . . called crud." Stensvaag, *supra* note 35, at 15 n.48.

88. *Id.* at 14-15.

89. *Id.* at 15 n.48; EICHHOLZ, *supra* note 29, at 175.

90. EICHHOLZ, *supra* note 29, at 178.

91. *Id.*

dionuclides that pose a serious danger to the environment if they escape the containment of the reactor facility.[92] Other parts of the nuclear fuel cycle include the transportation of nuclear materials and the management and transportation of spent fuel and nuclear waste.[93] Although these parts are not associated with the production of new radionuclides, they can also pose a danger to the environment.[94] The main way to protect the environment from pollution resulting from these activities is the reliable isolation and containment of the radioactive materials that are transported or deposited.[95]

The foregoing information demonstrates the diversity of nuclear technology in the countries that use nuclear power for electricity generation. An understanding of this technology is necessary to approach the problem of the harmonization or internationalization of nuclear safety standards. In light of the diversity of nuclear technology, one would not be surprised that "[n]o single set of detailed binding standards could hope to encompass the differences in plant design, location, operating philosophy, and legal and regulatory institutions among countries."[96]

II. Present Responses of International Law to the Problem of Radioactive Pollution: Regulation by International Organizations

A. The International Atomic Energy Agency[97]

1. Introduction

Although the International Atomic Energy Agency (IAEA or the Agency) and the European Atomic Energy Com-

92. *Id.*
93. *Id.* at 477.
94. *Id.* at 546.
95. *See* NUCLEAR POWER, *supra* note 19, at 35-56; EICHHOLZ, *supra* note 29, at 477-500, 555-616. *See also* BENEDICT ET AL., *supra* note 3, at 457-626 (comprehensive discussion of fuel reprocessing and radioactive waste management).
96. Morris Rosen, *A Formal International Nuclear Safety Regime: The First Steps*, IAEA BULL., Vol. 34 No. 2 1992, 8.
97. For more information on the Agency see generally LAWRENCE SCHEINMAN, THE INTERNATIONAL ATOMIC ENERGY AGENCY AND WORLD NUCLEAR ORDER (1987); SZASZ, *supra* note 2.

munity (Euratom) have different international legal status, both represent the international community's cooperation in the peaceful use of nuclear energy, and actively regulate nuclear energy. The next sections of this article will examine these two agencies and the role they play in the development of international regulation of nuclear energy.

The IAEA is one of the major organizations involved in the international cooperation for the peaceful uses of nuclear energy.[98] According to Article II of the IAEA's enabling statute (IAEA Statute), entitled "Objectives":

> The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose.[99]

Although there are no provisions in the IAEA Statute that explicitly provide for environmental protection from radioactive pollution, the Agency relies on the provisions of Article III of the IAEA Statute dealing with health and safety matters to regulate this area.[100] The fact that the drafters of the IAEA Statute did not include a specific provision on environmental protection is not surprising. The IAEA Statute was negotiated and signed at the dawn of the nuclear age, when the dangers of the peaceful uses of nuclear energy (including environmental hazards that could be associated with it) were not as evident as those that were associated with the production and use of nuclear weapons. Thus, the negotiators of the IAEA Statute focused on the latter problem in order to ensure that the growth in the field of nuclear energy

98. As of December 1993, there were one hundred twenty-four Member States in the Agency. *See* IAEA BULL., Vol. 35 No. 4 1993, back inner cover page.

99. INTERNATIONAL ATOMIC ENERGY AGENCY, STATUTE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY, AS AMENDED UP TO JUNE 1, 1973 (1973) [hereinafter IAEA STATUTE].

100. *Id.* at 5-9. *See infra* note 118.

production and application would not lead to nuclear weapon proliferation.

The drafters of the IAEA Statute entrusted the Agency with powers that distinguished it from any other international organizations, giving it a special legal standing among international organizations.[101] The Agency's international control is exercised through the use of safeguards. These safeguards are procedures used to verify a State's compliance with its international obligation to use nuclear energy solely for peaceful purposes.[102] The IAEA Statute's provisions on the IAEA's safeguards describe the procedures in general terms.[103] The IAEA's safeguards are elaborated in two docu-

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101. *Id.*

102. *Id.* at 26-29.

103. According to Article XII of the IAEA Statute, the Agency had the following rights and responsibilities:

> 1. To examine the design of specialized equipment and facilities, including nuclear reactors, and to approve it only from the viewpoint of assuring that it will not further any military purpose, that it complies with applicable health and safety standards and that it will permit effective application of the safeguards provided in this article;
>
> 2. To require the observance of any health and safety measures prescribed by the Agency;
>
> 3. To require the maintenance and production of operating records to assist in ensuring accountability for source and special fissionable materials used or produced in the project or arrangement;
>
> 4. To call for and receive progress reports;
>
> 5. To approve the means to be used for the chemical processing of irradiated materials solely to ensure that this chemical processing will not lend itself to diversion of materials for military purposes and will comply with applicable health and safety standards . . . to require that special fissionable materials recovered or produced as a by-product be used for peaceful purposes under continuing Agency safeguards . . .;
>
> 6. To send into territory of the recipient State or States inspectors . . . who shall have access at all times to all places and data and to any person . . . as necessary to account for source and special fissionable materials supplied and fissionable products and to determine whether there is compliance with the undertaking against use in furtherance of any military purpose . . . with the health and safety measures . . . .

Id. at 26-27.

ments; the safeguards document[104] and the Non-Proliferation Treaty safeguards document.[105]

The main objective of the IAEA's safeguards, according to the model agreement, is "[t]he timely detection of diversion of significant quantities of *nuclear material* from peaceful nuclear activities to the manufacture of nuclear weapons or other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection."[106] The basic IAEA's procedural safeguards are as follows: the State in question shall keep accounting records of the nuclear material in use in that State; the State shall provide the Agency with reports based on these accounting records and notice of all the inventory changes in the State; the IAEA shall have a right to carry out on-site inspections to verify the information contained in the reports, to check whether the reports are consistent with the accounting records, and make checks of the actual nuclear material.[107] These provisions permit IAEA inspectors to enter the State and gain access to its nuclear facilities and to the material used therein to determine whether use of these facilities and material is proper.[108] "IAEA safeguards are not self-executing and depend for im-

104. The first IAEA safeguards agreement was signed in 1960. These safeguards have been continuously revised and expanded. *Id.*

105. *Id.* In 1990 the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) was enacted, requiring each non-nuclear-weapon states who was a party to the Treaty to make safeguard agreements with the IAEA which covered all nuclear material even in for peaceful uses. To carry out this function, the Agency devised a safeguards approach appropriate for the entire fuel cycle. *The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons* 1, IAEA Doc. INFCIRC/153 (May 1971) [hereinafter INFCIRC/153].

106. *Id.* at 9 (emphasis in original).

107. *Id.* at 15-24.

108. *Id.* at 3. The model agreement for the application of the NPT safeguards provides that the Agency shall "secure the consent of the State to the designation of Agency inspectors to that State." *Id.* But once the candidates for inspectors are agreed upon they can come to that State without any additional permission. Furthermore, the model agreement provides for unannounced inspections that can be carried out without advance notification and in accordance with the principle of random sampling as a supplementary measure to announced inspections. INFCIRC/153 *supra* note 106, at 23.

plementation on an agreement between the agency and the nation concerned."[109]

Insofar as technical procedures are concerned, the Agency's staff relies primarily on containment and surveillance.[110] Essentially, the Agency's inspectors apply seals on vessels containing nuclear material and install cameras within nuclear facilities. The inspectors later examine the seals and the videotapes to determine whether the nuclear material has been removed from the facility.[111] Moreover, inspectors can weigh the nuclear material or take samples of it for subsequent measurement and analysis.[112] It is these unprecedented powers of international control that have given the IAEA a special legal status in the United Nations system.

Unlike the United Nations' specialized agencies, that have an independent responsibility in their respective areas of activities and establish a relationship of cooperation and coordination with the United Nations,[113] the relationship between the IAEA and the United Nations is based on a different principle. According to the agreement between the IAEA and the United Nations, the United Nations shares the responsibility for the activities in the area of nuclear energy with the Agency.[114] As a result of this, the Agency unlike any other international organization is entitled to have direct recourse to the Security Council in cases where peaceful cooperation is in jeopardy.[115]

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109. SCHEINMAN, *supra* note 97, at 127.

110. INTERNATIONAL ATOMIC ENERGY AGENCY, NEWS IN BRIEF SPECIAL ISSUE (Apr. 1990).

111. *Id.*

112. *See, e.g.*, D.L. Donohue & R. Zeisler, *Behind The Scenes: Scientific Analysis Of Samples From Nuclear Inspections In Iraq*, IAEA BULL., Vol. 34 No. 1 1992, 25.

113. *See, e.g.*, INTERNATIONAL ATOMIC ENERGY AGENCY, AGREEMENTS REGISTERED WITH THE INTERNATIONAL ATOMIC ENERGY AGENCY (1989).

114. *Id.*

115. This is exactly what happened when the Agency discovered that Iraq was in violation of its obligation under the NPT. *See* INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA INSPECTIONS AND IRAQ'S NUCLEAR CAPABILITIES (Apr. 1992).

2. The Regulation of Environmental Protection by the IAEA

Although the IAEA Statute does not specifically provide for environmental protection from radioactive pollution, "more than 80% of the IAEA activities [are] in [the area of] nuclear safety, and about half of those [are] in [the] fields of nuclear power, nuclear fuel cycle, and nuclear applications, [which] support environmental objectives."[116] The Agency's environmental activities are based on the IAEA Statute's provisions that relate to health and safety matters.[117] Article III of the IAEA Statute, entitled "Functions," grants the Agency authority to apply health and safety standards to any State's nuclear activities by means of a special agreement with the IAEA.[118] This provision is clearly drawn along the same lines as the IAEA Statute's provision on safeguards.[119] Moreover,

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116. INTERNATIONAL ATOMIC ENERGY AGENCY: HIGHLIGHTS OF ACTIVITIES 24 (1990) [hereinafter HIGHLIGHTS OF ACTIVITIES]. In general the activities of the IAEA have developed into four major programs: "Nuclear Energy and the Fuel Cycle", "Nuclear Applications", "Nuclear Safety and Radiation Protection", "Safeguards", the first three of these programs have environmental aspects. INTERNATIONAL ATOMIC ENERGY AGENCY, THE AGENCY'S PROGRAMME AND BUDGET FOR 1991 AND 1992 XVII-XXI (1990) [hereinafter THE AGENCY'S PROGRAMME FOR 1991-92].

117. IAEA STATUTE, *supra* note 99, at 7, 24, 26.

118. Article III of the Statute reads as follows:

> The Agency is authorized . . . [t]o establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property (including such standards for labor conditions), and to provide for the application of these standards to its own operations as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, at the request of the parties, to operations under any bilateral or multilateral arrangement, or, at the request of a State, to any of that State's activities in the field of atomic energy . . . .

Id. at 7.

119. The provision in Article III relating to safeguards states:

> The Agency is authorized . . . [t]o establish and administer safeguards designed to ensure that special fissionable and other materials, services , equipment, facilities, and information made available by the Agency or at its request or under its supervision or

the IAEA Statute provides that the Agency has the right to carry out verification of compliance with the Agency's health and safety standards, including health and safety inspections.[120] The IAEA Statute clearly combines the Agency's procedures in the area of health and safety and those relating to safeguards.[121] In fact, some of the same procedures, including the IAEA inspections, are prescribed for the purposes of safeguards as well as health and safety.[122] Additional evidence that the drafters of the IAEA Statute envisioned a close nexus between these Agency's functions, is the fact that the Agency's regulations on inspectors explicitly includes verification of health and safety matters within the scope of the IAEA inspectors's duties.[123]

There has not been the same type of "safeguards regime" as far as health and safety matters are concerned. The Agency's practice has departed from the letter of the IAEA Statute.[124] This is not uncommon in the Agency's practice.[125] Though the main function of the Agency in the area of health

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control are not used in such a way as to further any military purpose; and to apply safeguards, at the request of the parties, to any bilateral or multilateral arrangement, or, at the request of a State, to any of that State's activities in the field of atomic energy.

Id. at 6.

120. *Id.* at 26-28.

121. *Id.*

122. Article XII of the IAEA Statute deals with the procedures for safeguards and for health and safety. *See supra* note 103 and accompanying text.

123. *The Agency's Inspectorate* 1-3, IAEA Doc. GC(V)/INF/39 (Aug. 28 1961). Agency inspectors for health and safety measures may perform inspections in accordance with each individual agreement, which may necessitate:

> (a) Tests of radiation sources, of radiation detection and monitoring instruments and of other equipment or device in connection with the use, storage, transportation or disposal as waste of radiation sources;
>
> (b) Examination of facilities wherein radiation sources are used or stored, of waste disposal facilities and of all records on which reports to the Agency are based; and (c) Examinations related to the evaluation of the radiation exposure of persons who have or may have been over-exposed.

Id. at 2.

124. SZASZ, *supra* note 2, at 454-56.

125. For example, Paul C. Szasz wrote the following about the way the Agency's technical assistance had developed:

and safety is to work out standards, it has simultaneously developed safety review missions.[126]

The IAEA Statute empowers the Agency to adopt regulations in the area of health and safety which in practice amount to radiation protection and nuclear safety.[127] To determine the legal force of these regulations it is necessary to examine the provisions of Article III.A.6 of the IAEA Statute. According to this Article, health and safety standards are automatically binding with respect to the Agency's own activities.[128] In all other cases, standards become binding when they are included in instruments that have a binding character, e.g. international treaties or agreements.

a. Radiation Protection Regulation

The primary regulation issued by the Agency in this area is "Basic Safety Standards for Radiation Protection" (Basic Safety Standards).[129] This regulation is aimed at the protection of human beings from the effects of radiation, but does not contain measures for the protection of the environ-

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> The founders of the Agency did not initially foresee technical assistance as one of the principal functions of the organizations they were planning. However, as the group of States involved in the drafting of the Statute was widened, first in the Working Level Meeting and then in the Conference on the Statute, it became obvious that at least in the early years the provisions of technical assistance would be of greater interest to most prospective Members than the supply of fuel for reactor projects or the safeguards and the health and safety functions.
>
> It is therefore noteworthy that the expression "technical assistance" does not appear in the Statute, especially since at the time of its formulation this term had already gained currency and was well accepted within the UN system.

Id. at 453-54.

126. *See infra* notes 130-37. These services are in fact called "inspections" by some authors who write about international nuclear law. *See, e.g.*, Alan E. Boyle, *Nuclear Energy And International Law: An Environmental Perspective*, 60 BRITISH Y.B. INT'L L. 257, 265-66 (1989).

127. *See infra* notes 129-81 and accompanying text.

128. IAEA STATUTE, *supra* note 99, at 5-9.

129. INTERNATIONAL ATOMIC ENERGY AGENCY, BASIC SAFETY STANDARDS FOR RADIATION PROTECTION, Safety Series No. 9, at foreword (1982) [hereinafter Safety Series No. 9].

ment.[130] The core of the regulation is the limitation of doses for exposure from controllable sources.[131] The regulation authorizes maximum permissible doses of radiation exposure for three categories of human beings: workers, individual members of the public, and the whole population.[132] The regulation provides that the genetic dose of radiation exposure to the whole population over a period of thirty years shall not exceed five rem and shall be kept to a minimum.[133] The regulation further states that the dose limit is the actual doses received by individuals and varies depending on factors such as difference in their age, size, metabolism, and customs.[134]

In order to ensure compliance with the maximum permissible levels and dose limits, monitoring, surveillance, and control methods should be established.[135] Surveillance and monitoring includes estimating radiation levels and environmental contamination outside nuclear facilities.[136] Control over the release of radioactive waste is also required to ensure conformity with the Basic Safety Standards.[137] However, the regulation does not set limits for radioactive emissions, and does not identify principles for monitoring and control. These procedures are included in other IAEA instruments issued within the Agency's Safety Series.

One such monitoring procedure is covered within a separate regulation titled a "Manual on Environmental Monitoring in Normal Operation."[138] Limits for the release of

130. *Id.*

131. *Id.* at 2.

132. *Id.* For workers the maximum dose for the whole body is set at five rem in any one year (rem is the unit of dose of ionizing radiation which gives the same biological effect as that due to one roentgen of X-rays). *Id.* at 6. The maximum whole body dose for individual members of public should not exceed 0.5 rem per year. *See* Safety Series No. 9, *supra* note 129.

133. *Id.* at 8.

134. *Id.* at 9.

135. *Id.*

136. *Id.*

137. *See generally*, Safety Series No. 9, *supra* note 129.

138. INTERNATIONAL ATOMIC ENERGY AGENCY, MANUAL ON ENVIRONMENTAL MONITORING IN NORMAL OPERATION, Safety Series No. 16 (1966). Other instruments of this group include: INTERNATIONAL ATOMIC ENERGY AGENCY, ENVIRONMENTAL MONITORING IN EMERGENCY SITUATIONS, Safety Series No. 18 (1966); INTERNATIONAL ATOMIC ENERGY AGENCY, MONITORING OF AIRBORNE AND LIQUID

radioactive materials are set out in "Principles for Limiting Releases of Radioactive Effluents into the Environment"[139] and "The Application of the Principles for Limiting Releases of Radioactive Effluents in the Case of Mining and Milling of Radioactive Ores" published in the Agency's Safety Series.[140] Other IAEA regulations on radiation protection that relate to environmental protection include "Emergency Planning and Preparedness for Nuclear Facilities,"[141] "Emergency Planning and Preparedness for Accidents Involving Radioactive Materials Used in Medicine, Industry, Research and Teaching,"[142] and "Regulation for the Safe Transport of Radioactive Material."[143]

In the past few years, there have been important developments in the Agency's regulation of radiation protection. The focus of the IAEA's work in this area from the 1950's to the early 1980's was on the preparation of standards and guidelines. In the late 1980's, the focus was shifted to *the implementation of* environmental assessment, protection stan-

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RADIOACTIVE RELEASES FROM NUCLEAR FACILITIES TO THE ENVIRONMENT, Safety Series No. 46 (1978); INTERNATIONAL ATOMIC ENERGY AGENCY, OBJECTIVES AND DESIGN OF ENVIRONMENTAL MONITORING PROGRAMMES FOR RADIOACTIVE CONTAMINANTS, Safety Series No. 41 (1975).

139. INTERNATIONAL ATOMIC ENERGY AGENCY, PRINCIPLES FOR LIMITING RELEASES OF RADIOACTIVE EFFLUENTS INTO THE ENVIRONMENT, Safety Series No. 77 (1986) [hereinafter Safety Series No. 77]. This publication is a complete revision of INTERNATIONAL ATOMIC ENERGY AGENCY, PRINCIPLES FOR ESTABLISHING LIMITS FOR THE RELEASE OF RADIOACTIVE MATERIALS INTO THE ENVIRONMENT, Safety Series No. 45 (1978).

140. INTERNATIONAL ATOMIC ENERGY AGENCY, THE APPLICATION OF THE PRINCIPLES FOR LIMITING OF RADIOACTIVE EFFLUENTS IN THE CASE OF THE MINING AND MILLING OF RADIOACTIVE ORES, Safety Series No. 90 (1989). This document provides general guidance on the application of Safety Series No. 77, "to the setting of limits for the release of radioactive substances during the normal operation of mining and milling of radioactive ores, as well as general guidance on assessing the resulting individual and collective doses" of radiation. *Id.* at foreword.

141. INTERNATIONAL ATOMIC ENERGY AGENCY, EMERGENCY PLANNING AND PREPAREDNESS FOR NUCLEAR FACILITIES, Proceedings Series STI/PUB/701 (1986).

142. INTERNATIONAL ATOMIC ENERGY AGENCY, EMERGENCY PLANNING AND PREPAREDNESS FOR ACCIDENTS INVOLVING RADIOACTIVE MATERIALS USED IN MEDICINE, INDUSTRY, RESEARCH AND TEACHING, Safety Series No. 91 (1989).

143. INTERNATIONAL ATOMIC ENERGY AGENCY, REGULATION FOR THE SAFE TRANSPORT OF RADIOACTIVE MATERIAL AS AMENDED, Safety Series No. 6 (1990).

dards and guidelines that would *"ensur[e] coherence and consistency from country to country."*[144] The implementation process has been carried out through *Subprogramme H.3: Radiation Protection of the Public and the Environment, Project H.3.01*, the Agency's goal for 1991-92 was "[t]o complete the preparation of a comprehensive set of internationally recognized guidelines for *the application* of the principles contained in the Agency's *existing standards and guides* on limiting releases of radioactive effluents into the environment."[145]

Within the aforementioned Subprogramme, "The International Chernobyl Project" (the Project) was launched in 1990.[146] The two main objectives of the Project are to "assess the environmental and health situation in the areas of the [then] Soviet Union [Russia, Ukraine and Byelorussia] contaminated by the Chernobyl accident and to evaluate the measures taken by the [local] authorities . . . ."[147] Some two hundred scientists from twenty-five countries were involved in the Project and almost fifty missions were carried out in the Soviet Union under the Project.[148]

The International Advisory Committee set up to oversee the Project made recommendations to the local authorities. The committee members suggested that water sampling and analytical techniques should be improved to comply with established procedures.[149] As a result of the Project, *Subprogramme H.8: Radiological Consequences of the Chernobyl Accident*, was added in 1993 to the Agency's radiation protection programme.[150]

Under this new Subprogramme, the Agency plans to issue several new regulations for the control of radioactive

144. THE AGENCY'S PROGRAMME FOR 1991-92, *supra* note 116, at 212 (emphasis added).

145. *Id.* (emphasis added).

146. INTERNATIONAL ATOMIC ENERGY AGENCY, THE AGENCY'S PROGRAMME FOR 1993-94 104 (1992) [hereinafter THE AGENCY'S PROGRAMME FOR 1993-94].

147. *Id.*

148. *Id.* at 104-5.

149. INTERNATIONAL ADVISORY COMMITTEE, THE INTERNATIONAL CHERNOBYL PROJECT, AN OVERVIEW 8-9 (1991).

150. THE AGENCY'S PROGRAMME FOR 1993-94, *supra* note 146, at 111.

materials dispersed into the environment. The control of radiation after such environmental contamination requires continued harmonization of methodologies for calculating, establishing, and applying numerical guidelines for intervention levels.[151] *Subprogramme H.8* takes into account the new ICRP recommendations and the knowledge acquired from the Project.[152] The IAEA "will continue [to harmonize] international approaches and methods for modelling radionuclide transport into the environment" and collect environmental monitoring data.[153] Furthermore, the Agency will cooperate with the United Nations Scientific Committee on the Effects of Atomic Radiation, the World Health Organization, the World Meteorological Organization and the Commission of the European Communities.[154] Moreover, an approximate forty percent increase in the IAEA's budget, as compared to 1992, is planned for these purposes.[155]

Under *Subprogramme H.4: Safe Transport of Radioactive Material*, the IAEA carried out a review of its "Regulations for the Safe Transport of Radioactive Material" published in Safety Series Number 6, and its supporting materials published in Safety Series Numbers 7, 37 and 80.[156] In 1993-94, the Agency concentrated on "efforts to assist Member States and international organizations *in implementing* the transport regulations."[157]

Within *Subprogramme H.5: Emergency Planning and Preparedness*, the Agency proceeded to carry out its obligations under the Conventions on Early Notification of a Nuclear Accident and the Convention on the Assistance in Case

151. *See generally* 1990 RECOMMENDATIONS OF THE ICRP, *supra* note 17.

152. THE AGENCY'S PROGRAMME FOR 1993-94, *supra* note 146, at 111.

153. *Id.* at 106.

154. *Id.*

155. *Id.*

156. *Id.*

157. THE AGENCY'S PROGRAMME FOR 1993-94, *supra* note 146, at 107 (emphasis added).

of a Nuclear Accident of Radiological Emergency.[158] Accordingly,

> the Agency has set up a 24-hour Emergency Response System [ERS] . . . . The system was . . . put into operation on 18 January 1989 . . . . The ERS can respond rapidly and authoritatively to emergencies by informing national authorities about the accidents and by coordinating assistance that Member States, the Agency and other international organizations could provide. Communication can be by telephone, telex or telefax, as well as through the Global Telecommunication System . . . of the WHO [World Health Organization], which can simultaneously transmit voluminous data to many countries.[159]

Within *Subprogramme H.6: Control and Safe Use of Radiation Sources, Project H.6.01*, the Agency planned "to establish safety standards, codes and guides and develop technical guidelines for the control and safe use of radiation sources, to formulate recommendations for improvement in the design of sources and devices and to assist Member States in the implementation of these recommendations."[160] The 1993-94 Programme states that by 1994, the majority of these safety standards, codes and guides will be completed.[161] It also states that it is obvious from the Agency's experiences that the situation in the Member States regarding the safety of sources has not improved.[162]

The preceding analysis of the IAEA regulations on radiation protection illustrates that the principal regulation of the Agency in this area, the Basic Safety Standards, does not establish limits for radioactive emissions into the environment. Radioactive emissions are addressed in other IAEA regulations.[163] This demonstrates the Agency's recognition of an

158. *Convention on Early Notification of a Nuclear Accident*, 25 INT'L L. MATERIALS 1370 (1986); *Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency*, 25 INT'L L. MATERIALS 1377 (1986).

159. HIGHLIGHTS OF ACTIVITIES, *supra* note 116, at 40.

160. THE AGENCY'S PROGRAMME FOR 1991-92, *supra* note 116, at 220.

161. THE AGENCY'S PROGRAMME FOR 1993-94, *supra* note 146, at 109.

162. *Id.*

163. Safety Series No. 77, *supra* note 139.

environmentalist approach to the regulation of radiation protection. The IAEA coverage of radiation protection through its regulations is broader than the ICRP's recommendations.[164] Thus, within the IAEA, the notion of radiation protection becomes a truly media-based (in addition to being biology-based) method of control over nuclear energy.[165]

The main corollary regarding the Agency's progress in radiation protection is that in the future the Agency will switch from issuing new guidelines to providing assistance to Member States in "*implementing* the Agency's recommendations and guidelines."[166]

b. Nuclear Safety Regulation

One of the early regulations concerning environmental issues of nuclear safety was the "Environmental Aspects of Nuclear Power Stations."[167] Regulatory suggestions in this area were prepared as part of the Nuclear Safety Standards programme of the Agency, relating to nuclear power plants, and were published in the Agency's Safety Series in the form of Safety Guides: "Operational Management for Radioactive Effluents and Wastes Arising in Nuclear Power Plants,"[168] "Quality Assurance During Operation of Nuclear Power Plants,"[169] "Reactor Coolant and Associated Systems in Nuclear Power Plants: A Safety Guide,"[170] and others.[171]

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164. *See supra* notes 17-27 and accompanying text.

165. *See supra* notes 17-22 and accompanying text.

166. THE AGENCY'S PROGRAMME FOR 1993-93, *supra* note 146, at 109 (emphasis added).

167. INTERNATIONAL ATOMIC ENERGY AGENCY, ENVIRONMENTAL ASPECTS OF NUCLEAR POWER STATIONS, Proceedings Series STI/PUB/261 (1971).

168. INTERNATIONAL ATOMIC ENERGY AGENCY, OPERATIONAL MANAGEMENT FOR RADIOACTIVE EFFLUENTS AND WASTES ARISING IN NUCLEAR POWER PLANTS: A SAFETY GUIDE, Safety Series No. 50-SG-011 (1986).

169. INTERNATIONAL ATOMIC ENERGY AGENCY, QUALITY ASSURANCE DURING OPERATION OF NUCLEAR POWER PLANTS: A SAFETY GUIDE, Safety Series No. 50-SG-QA5 (Rev. 1) (1986).

170. INTERNATIONAL ATOMIC ENERGY AGENCY, REACTOR COOLANT AND ASSOCIATED SYSTEMS IN NUCLEAR POWER PLANTS: A SAFETY GUIDE, Safety Series No. 50-SG-D13 (1986).

171. INTERNATIONAL ATOMIC ENERGY AGENCY, SAFETY ASPECTS OF FOUNDATIONS OF NUCLEAR POWER PLANTS: A SAFETY GUIDE, Safety Series No. 50-SG-S8 (1986); INTERNATIONAL ATOMIC ENERGY AGENCY, SAFETY IN DECOMMISSION-

The Agency's priorities in the area of nuclear safety differ from those in radiation protection. As discussed earlier, a solid body of safety standards and related regulations in radiation protection has been developed, and a significant degree of unification has been reached. The principal problems with international cooperation in radiation protection within the Agency is the application, implementation and universal adherence to existing principles. The Programmes of the Agency reflect its inability to focus on the implementation of nuclear safety standards, because the standards are still not generally accepted.

Thus, the main objective of the Agency in the area of nuclear safety, according to *Subprogramme I.1: Basic Nuclear Safety and Criteria, Project I.1.01*, is "to examine current safety issues and to propose solutions for them *with a view to establishing commonly shared safety principles and objectives* . . . [and] [t]o advise on safety policy and criteria in order to ensure a consistent approach to nuclear safety compatible with evolving radiation protection philosophy and criteria."[172] The main focus of the Agency's 1993-94 Programme in nuclear safety was "on improving *national nuclear safety regulatory systems* by identifying good regulatory practices and structures and providing assistance with their implementation."[173]

The Agency's standards and guides issued in the area of nuclear safety concern: Safe siting and design of nuclear installations aimed at developing criteria and techniques for evaluating external hazards in nuclear installations;[174] identifying design or operational weakness that could jeopardize plant safety;[175] estimating safety impacts of nuclear power plant aging;[176] estimating operational safety of nuclear power

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ING OF RESEARCH REACTORS, Safety Series No. 74 (1986); INTERNATIONAL ATOMIC ENERGY AGENCY, SUMMARY REPORT ON THE POST-ACCIDENT REVIEW MEETING ON THE CHERNOBYL ACCIDENT, Safety Series No. 75-INSAG-1 (1986).

172. THE AGENCY'S PROGRAMME FOR 1991-92, *supra* note 116, at 232 (emphasis added).

173. THE AGENCY'S PROGRAMME FOR 1993-94, *supra* note 146, at 119.

174. THE AGENCY'S PROGRAMME FOR 1991-92, *supra* note 116, at 235.

175. *Id.* at 236.

176. *Id.* at 237.

plants aimed at formulating requirements ensuring the safe and flexible operation of nuclear power plants;[177] and collecting, evaluating, assessing and disseminating information on unusual events of safety significance.[178] In order to disseminate information on unusual events, a special system known as the Incident Reporting System (IRS) was created.[179]

The Agency has initiated work on international nuclear safety based on the September 1991 International Conference on the Safety of Nuclear Power and the recommendations of the IAEA General Conference.[180] This work could lead to the globalization and unification of nuclear safety standards and approaches.[181]

c. Nuclear Waste Management Regulation

Recently, the Agency published a number of its regulations in the area of nuclear waste management, especially in its Proceedings Series and Technical Reports Series.[182] The Agency's major goals for the world nuclear community in the 1990's, with regard to the controversial topic of nuclear waste, are to ensure that all nuclear facilities are environmentally safe and benign, and continue to work out solid plans in regard to nuclear waste.[183] At the same time, the

177. *Id.* at 239.

178. *Id.* at 241.

179. THE AGENCY'S PROGRAMME FOR 1993-94, *supra* note 146, at 122. *See also* E. Yaremy & K. Hide, *A More Vigorous Approach to IAEA Safety Services*, IAEA BULL., Vol. 34 No. 2 1992, 19.

180. THE AGENCY'S PROGRAMME FOR 1993-94, *supra* note 146, at 119.

181. On a convention on nuclear safety, *see infra* notes 402-15 and accompanying text.

182. *See, e.g.*, INTERNATIONAL ATOMIC ENERGY AGENCY, MANAGEMENT OF ABNORMAL RADIOACTIVE WASTES AT NUCLEAR POWER PLANTS, Technical Reports Series No. 307 (1989); INTERNATIONAL ATOMIC ENERGY AGENCY, MANAGEMENT OF LOW AND INTERMEDIATE LEVEL RADIOACTIVE WASTES 1988, Proceedings Series No. STI/PUB/784 (1989). More recent documents include: INTERNATIONAL ATOMIC ENERGY AGENCY, UNDERGROUND DISPOSAL OF RADIOACTIVE WASTES, Proceedings Series No. STI/PUB/528 (1990); INTERNATIONAL ATOMIC ENERGY AGENCY, SITING, DESIGN AND CONSTRUCTION OF UNDERGROUND REPOSITORIES FOR RADIOACTIVE WASTES, Proceedings Series No. STI/PUB/715 (1986).

183. INTERNATIONAL ATOMIC ENERGY AGENCY, MEASURES TO STRENGTHEN INTERNATIONAL CO-OPERATION MATTERS RELATING TO NUCLEAR SAFETY, Doc. GC(XXXIV)/919, at 8-9 (1990).

Agency argues that radioactive waste, in comparison with wastes from other activities, arise in small quantities and the hazards associated with them decrease over time.[184] To illustrate this point, the Agency reasons that coal-fired power plants, producing the same amount of electricity as a nuclear power plant, will probably release, apart from huge quantities of CO_2, SO_2 and NO_X, greater amounts of toxic heavy metals than the nuclear power plants release in spent fuel.[185] Furthermore, the heavy metals remain toxic forever.[186] However, a number of countries have refused to rely on nuclear power because of their lack of confidence in nuclear waste disposal plans.[187] The Agency has issued a number of recommendations concerning standards and criteria for high-level waste disposal and low-level waste disposal. For example, in 1989, the Agency published "Safety Principles and Standards for the Underground disposal of high-level radioactive waste."[188]

A deeper concern around the world is caused by marine nuclear waste disposal. Since 1940, the marine environment has been the disposal grounds for radioactive waste.[189] The First United Nations Conference on the Law of the Sea in 1958 addressed this issue. This discussion led to research into the problem and issuance of the regulation, "Radioactive Waste Disposal into the Sea," which was replaced in 1981.[190]

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184. *The International Atomic Energy Agency's Contribution to Sustainable Development, A report prepared at the request of the IAEA general conference for the presentation to the United Nations General Assembly* (May 19, 1989) at 19 [hereinafter *IAEA's Contribution to Sustainable Development*].

185. *Id.*

186. *Id.*

187. *See* Char & Csik, *supra* note 1, at 22. Sweden has passed legislation prohibiting development of nuclear power in the country. Austria has also decided not to pursue its nuclear power programme and to shut down its only nuclear reactor. *Id.*

188. INTERNATIONAL ATOMIC ENERGY AGENCY, SAFETY PRINCIPLES AND TECHNICAL CRITERIA FOR THE UNDERGROUND DISPOSAL OF HIGH LEVEL RADIOACTIVE WASTES, Safety Series No. 99 (1989).

189. *IAEA's Contribution to Sustainable Development*, *supra* note 184, at 20.

190. *Id.* at 21; *See also*, INTERNATIONAL ATOMIC ENERGY AGENCY, RADIOACTIVE WASTE DISPOSAL INTO THE SEA, Safety Series No. 5 (1962); INTERNATIONAL ATOMIC ENERGY AGENCY, CONTROL OF RADIOACTIVE WASTE DISPOSAL INTO THE MARINE ENVIRONMENT, Safety Series No. 61 (1983).

In 1984, the regulation called "Environmental Assessment Methodologies for Sea Dumping of Radioactive Wastes" was published.[191]

In 1975, the Convention on the Prevention of Marine Pollution by the Dumping of Wastes and Other Matter (London Dumping Convention)[192] became effective. The London Dumping Convention "gave the Agency specific responsibilities for definition of high-level radioactive wastes unsuitable for dumping at sea, and for making recommendations to national authorities in matters concerning the issuance of special permits for the ocean dumping of radioactive wastes" the IAEA has not prohibited.[193] The Agency has subsequently revised its recommendations.[194] Presently, there exists a de facto moratorium on the dumping of nuclear wastes at sea, though according to non-official information, dumping still takes place.

Another issue that requires a response from international law is the transboundary movement of nuclear wastes. In 1990, the Agency established a Code of Practice on the International Transboundary Movements of Radioactive Waste (the Code).[195] The main principles set forth in the Code include the following: States should exercise their right to regulate movements of radioactive waste into, from or through their territories in accordance with the Code; a State should readmit the radioactive waste that was transferred from it in non-compliance with the Code; and States should cooperate to prevent movements that are not in compliance with the

191. INTERNATIONAL ATOMIC ENERGY AGENCY, ENVIRONMENTAL ASSESSMENT METHODOLOGIES FOR SEA DUMPING OF RADIOACTIVE WASTES, Safety Series No. 65 (1984).

192. Convention On The Prevention Of Marine Pollution By Dumping Of Wastes And Other Matter, 1140 U.S.T.S. 377.

193. *IAEA's Contribution to Sustainable Development*, *supra* note 184, at 21.

194. The latest was published in 1986. INTERNATIONAL ATOMIC ENERGY AGENCY, DEFINITION AND RECOMMENDATIONS FOR THE CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER 1972, Safety Series No. 78 (1986 ed.).

195. *General Conference Resolution of 21 September 1990 on Code of Practice on the International Transboundary Movement of Radioactive Waste*, 30 INT'L L. MATERIALS 557, 560-64 (1991).

Code.[196] The provisions of the Code are designed to be included within bilateral, multilateral or regional agreements of States.[197]

In addition to the adoption of its standards on radiation protection, nuclear safety, and waste management, the Agency has developed the relatively new activity of sending experts, at the request of a State, to diagnose the state of affairs of radiation protection, nuclear safety and waste management in that State. These missions have been referred to by some authors as the "Agency's safety inspections."[198] This term is applied to such institutions of the IAEA as the Radiation Protection Advisory Team, Operational Safety Review Team, Assessment of Safety Significant Events Team, Waste Management Advisory Programme and Technical Review Programme. These services are becoming increasingly important as the demand for them, by both developing and developed States, grows every year.[199] But these needs are being only partially met due to the adverse effects of the zero-growth budgeting of the Agency over the past few years.[200]

3. Concluding Analysis

Despite extensive activities in the regulation of nuclear safety and radiation protection, the Agency's regulation suffers a number of serious legal shortcomings. These regulations must be considered and revised to provide a better standard for nuclear energy relating to the protection of the environment from radioactive pollution.

IAEA standards and regulations that could form a basis for international legislation, in either radiation protection or in nuclear safety, have no binding legal force. However, there is a difference in the stages of the development of standards in these areas. In radiation protection, the IAEA has reached a stage of sufficient universality and general applicability, which will allow the Agency to focus on the implementation

196. *Id.*
197. The author is unaware of any such agreements in force.
198. *See* Boyle, *supra* note 126, at 265-66.
199. THE AGENCY'S PROGRAMME FOR 1993-94, *supra* note 146, at 112.
200. *Id.*

and application of standards.[201] In nuclear safety, the IAEA standards still require further unification before the issue of implementation and application can be raised.

The difference in the level of unification and acceptability between the standards in those two areas appear to be largely due to differences in the technical nature of the standards themselves. While radiation protection is attained by means of setting admissible exposure doses and levels,[202] nuclear safety addresses safety requirements for the design and construction of nuclear reactors.[203] As the material in the Introduction demonstrates, there are several principal types of nuclear reactors used for power generation. Moreover, in different countries, varied models of the same basic reactor type are found.[204] The state of development in nuclear technology used for peaceful purposes throughout the world does not facilitate the unification and global acceptability of the safety standards. In an attempt to address this problem, the IAEA is presently working on *Subprogramme I.8: Safety of Future Nuclear Power Plants*.[205] Presumably, a unification and globalization of nuclear safety standards should be preceded by a unification of the nuclear technology used for nuclear power generation.

One significant feature of the Agency's advisory mission is that it applies IAEA standards and compares the actual situation to them upon "inspection" of the safety or radiation condition of the facility in question. It thereby creates a body of international quasi-legal requirements in the respective areas. At the same time, there is a principle distinction between the safety review missions and the Agency's inspections that ensure peaceful, as opposed to military, uses of nuclear energy. In order to obligate a State to use its nuclear facilities and materials for peaceful purposes and to apply the Agency's safeguards, that State has to enter into a special

201. *See supra* notes 129-66 and accompanying text.

202. *See supra* notes 17-18 and accompanying text.

203. *See supra* notes 19-20 and accompanying text.

204. *See supra* notes 58-96 and accompanying text.

205. THE AGENCY'S PROGRAMME FOR 1993-94, *supra* note 146, at 127.

agreement with the Agency.[206] In order to make the Agency's health and safety standards a binding basis for inspection, a State must so provide in a relevant agreement.[207]

Nevertheless, there are substantial differences between the practical implementation of those two IAEA functions. In order for a State to acquire nuclear materials and equipment, it has to undertake to use the said materials and equipment for peaceful purposes. However, it does not have to make a similar promise with respect to health and safety if the State wishes to obtain and maintain a nuclear facility.

One explanation for this can be found in the fact that there are significant technical and technological differences between the Agency's safeguards with respect to peaceful uses of nuclear power and its measures in respect to health and safety. Applying IAEA standards to peaceful use of nuclear energy is a comparatively uncomplicated and inexpensive task.[208] The technical measures applied by the Agency to perform its safeguards are relatively uncomplicated.[209] Inspection of nuclear facilities to determine their adherence to nuclear safety standards appears to be a far more complicated and cumbersome procedure. This is mainly due to the differences in the designs of nuclear reactors and other nuclear facilities in various countries which lead to a variety of potentially dangerous circumstances. In the absence of uniform and binding safety standards, and in the reality of the wide diversity of nuclear technology used for peaceful purposes, safety "inspections" only take place on a case by case basis.

206. IAEA STATUTE, *supra* note 99, at 6.
207. *Id.* at 7. *See also supra* note 118 and accompanying text.
208. SZASZ, *supra* note 2, at 660.
209. *See supra* notes 110-12 and accompanying text.

B. The European Atomic Energy Community (Euratom)

1. Introduction

a. The State of Radioactivity in the Euratom Member States

In the Member States of the Euratom, just as in other States, the quantity and composition of radioactive emissions varies from power station to power station over time.[210] Power stations emit radioactive substances in varying forms, such as "noble gases [like] krypton-15 and argon 41, as radioactive halogens . . . as radioactive particulates and as tritium and carbon-14."[211] However, these radioactive emissions are minimal when compared to those emitted by nuclear fuel reprocessing plants.[212] For example, the reprocessing plants in "Sellafield [England] and La Hague [France] each release more krypton-85 than all the nuclear power stations in [the Community] combin[ed]."[213] The Sellafield and La Hague reprocessing plant's tritium emissions are generally greater than those from power stations.[214] Sellafield's discharges furnish a major input of radioactivity to the Irish Sea.[215] The La Hague emissions also furnish an input to the English Channel.[216] Some of this radioactivity is deposited on the sea floor, while some gets carried into the Atlantic and the North Sea.[217]

Recently, improvements in nuclear technology have caused a reduction of emissions from power stations.[218] However, nuclear energy production has increased with more power stations operating.[219] Consequently, atmospheric

210. THE STATE OF THE ENVIRONMENT IN THE E.C., *supra* note 11, at 164.
211. *Id.*
212. *Id.*
213. *Id.*
214. *Id.*
215. THE STATE OF THE ENVIRONMENT IN THE E.C., *supra* note 11 at 282.
216. *Id.*
217. *Id.*
218. *Id.* at 164.
219. *Id.*

emissions of radioactivity from power stations has remained the same, or possibly increased slightly.[220]

b. The International Legal Status of the Euratom

The international legal status of the Euratom is derived from its position as one of the three international organizations[221] which form the European Communities (EC).[222] The Maastricht Treaty[223] established the European Union which is founded on the EC.[224] This international entity has received a lot of publicity because of the dramatic developments associated with these treaties. Much has been written on the SEA[225] and the Maastricht Treaty and their impact on European environmental policy.[226]

While the Maastricht Treaty mandates that, "the High Contracting Parties establish among themselves a European Union . . . founded on the European Communities, [and] supplemented by the policies and forms of cooperation established by this Treaty," it has not completely merged the three European Communities.[227] The Declaration on Civil Protection, Energy and Tourism, adopted by the Conference on the Maastricht Treaty states, "the Commission declares that

220. THE STATE OF THE ENVIRONMENT IN THE E.C., *supra* note 11, at 164.

221. These three organizations are; the European Coal & Steel Community, the European Economic Community and the European Atomic Energy Community. TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18.

222. *Id.* at 823-51.

223. *Treaty on European Union*, 31 INT'L L. MATERIALS 253-373 (1992) [hereinafter The Maastricht Treaty].

224. *Id.* at 255. On the legal status of the European Communities *see, e.g.*, J.H.H. Weiler, *The Transformation of Europe*, 100 YALE L.J. 2403 (1991); Philip Allott, *The European Community is Not the True European Community*, 100 YALE L.J. 2485 (1991); Philippe Sands, *European Community Environmental Law: The Evolution of a Regional Regime of International Environmental Protection*, 100 YALE L.J. 2511 (1991); Henry G. Schermers, *Comment on Weiler's "The Transformation of Europe,"* 100 YALE L.J. 2525 (1991).

225. *See* TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18.

226. *See, e.g.*, Christian Zacker, *Environmental Law of the European Economic Community: New Powers Under the Single European Act*, 14 B.C. INT'L & COMP. L. REV. 249 (1991); Frederick Abbott, *Regional Integration and the Environment: the Evolution of Legal Regimes*, 68 CHI.-KENT L. REV. 173 (1992).

227. THE MAASTRICHT TREATY, *supra* note 223, at 255.

Community action in those spheres [i.e. in civil protection, energy and tourism] will be pursued on the basis of the present provisions of the Treaties establishing the European Communities."[228] Thus, recognizing the individual communities remains valid.

2. The Regulation of Environmental Protection by Euratom

According to the Treaty establishing the European Atomic Energy Community (Euratom Treaty), Euratom has the responsibility "to contribute to the raising of the standard of living in the Member States and to the development of relations with the other countries by creating the conditions necessary for the speedy establishment and growth of nuclear industries."[229] Like the IAEA Statute, the Euratom Treaty does not contain specific provisions for protecting the environment from radioactive pollution. The Euratom Treaty gives the Community the power to create "Uniform Safety Standards" aimed at protecting the health of the general public and workers health, as well as, ensure the application of the Uniform Safety Standards.[230] Article 30 of the Euratom Treaty defines the phrase "basic standards" to mean: "(a) maximum permissible doses compatible with adequate safety; (b) maximum permissible levels of exposure and contamination; [and] (c) the fundamental principles governing the health surveillance of workers."[231] This definition covers only matters of radiation protection, and does not address nuclear safety. In fact, on several occasions, the Commission of the European Communities (Commission) has emphasized that its responsibilities under the Euratom Treaty "are confined to radiation protection aspects, [and] to the exclusion of technological safety problems."[232]

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228. *Id.*

229. TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 218, at 623.

230. *Id.* This entitlement is further developed in a separate chapter of the Euratom Treaty entitled "Health and Safety." *Id.* at 644-47.

231. *Id.* at 644.

232. EUR. PARL. Written Questions with Answers, No. 1983/88, 1989 O.J. (C 187) 30.

a. Radiation Protection Regulation

According to the Euratom Treaty, it is the responsibility of the Commission to establish the Uniform Safety Standards for radiation protection.[233] Once the Commission establishes the Uniform Safety Standards, the Council of the European Communities (Council),[234] with the aid of European Parliament,[235] adopts them.[236]

The Euratom Treaty entrusts significant powers to the Communities' governing bodies in establishing the Uniform Safety Standards. While the Commission and the Council play the primary role in creating the Uniform Safety Standards,[237] it is the Commission which must ensure that the

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233. *See* Zacker, *supra* note 226, at 253.

> The Commission is the quasi-executive organ of the Communities. . . . The Commission represents and defends the interests of the Community vis-a-vis the member states and ensures the proper functioning and development of the common market. This duty obliges the Commission to guarantee that the Community institutions and member states apply the EEC Treaty [as well as the Treaties establishing the other two Communities] and secondary legislation, to issue recommendations and opinions . . . to negotiate international agreements . . . . The Commission may initiate legislative proposals . . . .

Id.

234. The most important legislative body of the Communities is the Council. It makes final decisions on most European Community legislation. *Id.* at 253-54. *See generally* J. ANDREW SCHLICKMAN & THOMAS MCMAHON, INTERNATIONAL ENVIRONMENTAL LAW AND REGULATION E.C.6 (1993) [hereinafter SCHLICKMAN & MCMAHON].

235. "The European Parliament is not a traditional representative body because its 518 representatives represent more than one people and lack legislative powers. The Parliament acts principally as a supervisory body of the Commission of the European Communities (Commission) and an advisory body to the Council." Zacker, *supra* note 228, at 255. At the same time as long as the Members of the Parliament are now directly elected, it can be said that this institution is in fact intended to represent the peoples of the Community. *See* SCHLICKMAN & MCMAHON, *supra* note 234, at E.C.6, 7.

236. The principal institutions of the Euratom, the Council and the Commission, were merged with those of the other European Communities pursuant to the Treaty Establishing a Single Council and a Single Commission of the European Communities (Merger Treaty) on April 8, 1965. D. LASOK & J.W. BRIDGE, LAW & INSTITUTIONS OF THE EUROPEAN COMMUNITIES 18 (5th ed. 1992).

237. Zacker, *supra* note 226, at 253-54. Title III of the Euratom Treaty promulgates the provisions governing the institutions of the Community. Powers of the Council and of the Commission are specified in section I and II, re-

Member States comply with the Uniform Safety Standards.[238] For example, the Commission, in accordance to Article 33, reviews the Member States' draft provisions and issues recommendations with the intent to create uniform provisions throughout the Community.[239] These recommendations are issued prior to the adoption of the respective standards by the national authorities.[240] The Commission has the additional right to enter the Member States' environmental radioactivity monitoring facilities in order to ensure the Member States' compliance with the Uniform Safety Standards.[241]

The Council first adopted Uniform Safety Standards in 1959, in the form of a Council Directive (Directive).[242] They were subsequently modified in 1976, 1980 and 1984[243] to re-

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spectively under chapter I of the institutions of the Community. *See also*, TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18.

238. TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18, at 690-95.

239. *Id.* at 645.

240. *Id.* at 646.

241. *Id.*

242. 1959 O.J. (L 11) 221. The principal forms of the Community legislation are defined in Article 161 of the Euratom Treaty and are made up of Regulations, Directives and Decisions. Unlike Regulations, that are directly applicable in particular Member States without those States having to take any action, the Directives are not directly applicable. In the normal course of events, a Member State must implement a particular Directive by bringing in appropriate national provisions by the date specified in the Directive. However, in certain circumstances, a Directive that has not been implemented can be directly effective after the date on which it should have been implemented. The essential difference between a Regulation and a Directive is that, in case of a Directive, the Member States has a right to choose the form and methods for attaining the objectives of the Directive. *See* TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18, at 704-05. *See also* SCHLICKMAN & MCMAHON, *supra* note 234, at E.C.10,11.

243. Council Directive of 1 June 1976 Laying Down the Basic Safety Standards for the Health Protection of the General Public and Workers Against the Dangers of Ionizing Radiation 79/579, 1976 O.J. (L 187) 1 (Euratom); Council Directive of 27 March 1979 Amending Directive 75/579/Euratom Laying Down the Basic Safety Standards for the Health Protection of the General Public and Workers Against the Dangers of Ionizing Radiation 79/343, 1979 O.J. (L 83) 18 (Euratom); Council Directive of 15 July 1980 Amending the Directives Laying Down the Basic Safety Standards for the Health Protection of the General Public and Workers Against the Dangers of Ionizing Radiation 80/836, 1980 O.J. (L 246) 1 (Euratom) [hereinafter Council Directive 80/836]; Council Directive of 3

flect and incorporate scientific developments in the area of radiation protection and the recommendations of the ICRP. The Directive established the maximum safe level of human exposure to the peaceful uses of nuclear energy.[244] Although the Directive's primary purpose is to protect people, it is formulated in a way that helps to preserve the environment. Article 6 of the Directive stated,

> The limitation of individual and collective doses resulting from controllable exposures shall be based on the following general principles:
>
> (a) every activity resulting in an exposure to ionizing radiation shall be justified by the advantages which it produces;[245]
>
> (b) all exposures shall be kept as low as reasonably achievable.[246]

The latest version of the 1980 Directive (with minor amendments in 1984) categorizes all persons who may potentially be affected by nuclear radiation into the following groups: (1) exposed workers;[247] (2) apprentices and students; and (3) members of the public.[248] The maximum safe level of exposure differs for each group.[249]

September 1984 Amending Directive 80/836/Euratom as Regards the Basic Safety Standards for the Health Protection of the General Public and Workers Against the Dangers of Ionizing Radiation 84/467, 1984 O.J. (L 265) 4 (Euratom) [hereinafter Council Directive 84/467].

244. Council Directive 80/836, *supra* note 243 at 6.

245. This provision was amended in Council Directive 84/467 to state, "the various types of activities resulting in an exposure to ionizing radiation shall have been justified in advance by the advantages which they produce." Council Directive 84/467, *supra* note 243, at 5.

246. Council Directive 80/836, *supra* note 243, at 6.

247. Exposed workers are defined as "persons subjected, as a result of their work, to an exposure liable to result in annual doses exceeding one-tenth of the annual dose limits laid down for workers." *Id.* at 4.

248. *Id.* at 6-8. Members of the public are defined as, "individuals in the population excluding exposed workers, apprentices and students during their working hours." *Id.*

249. *Id.*

The limits for exposed workers are 50 mSv[250] (5 rems) per year for whole body exposure.[251] The dose limitations for apprentices and students vary according to their age,[252] with lower limits for younger people.[253] For the general public, the dose limit for whole body exposure is 5 mSv (0.5 rem) per year.[254] The dose limit for partial body exposure, for the general public, shall be 5 mSv (0.5 rem) per year, with the average dose in each of the organs or tissues involved not exceeding 50 mSv (5 rem) per year.[255]

In evaluating the effects of the 1980 Directive's standards on preserving and protecting the environment, this author's primary concern is the impact on the general public. The protective measures for exposed workers, apprentices and students might not include measures to protect the environment at large. Measures for exposed workers, apprentices and students include various local shielding, such as, special clothes, gloves and hats, where protection of the public at large inevitably requires protection of the environment because the public is generally only affected by environmental radiation.

Article 13 of the 1980 Directive provides that "[e]ach Member State shall ensure that the contribution to the exposure of the population as a whole from each activity is kept to the minimum amount necessitated by that activity, taking account of the principles set out in Article 6 (a) and (b)."[256]

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250. Sievert, symbol: Sv, is "A unit of radiation dose which gives a measure of the effect of radiation on its target." DOOLEY & KIRKPATRICK, *supra* note 30, at 153.

251. Council Directive 80/836, *supra* note 237 at 6. "In case of partial body exposure, the effective dose limit shall be 50 mSv (5 rems) in a year; the average dose in each of the organs and tissues involved shall not exceed 500 mSv (50 rems) in a year." *Id.* at 7.

252. *Id.*

253. The limitations for persons of this category aged eighteen years or over are the same as for exposed workers. The limitations for apprentices and students who are between sixteen and eighteen years old are set lower than that—namely the dose shall be equal to the three-tenths of the annual dose limits for exposed workers. The dose limits for apprentices and students who are younger than sixteen are those that are set forth for members of the public. *Id.*

254. *Id.* at 8.

255. Council Directive 80/836, *supra* note 243, at 8.

256. *Id.*

The 1980 Directive, establishes radiation exposure limits for different groups based on their potential risk of exposure, yet fails to provide for the environmental protection explicitly. However, it does enumerate certain principles and guidelines for the Member States to follow in protecting their environment at large. Thus, it provides that the effective dose limits set forth for exposed workers and members of the public shall be taken into account when calculating the limits of annual exposure as set out in Annex III of the 1980 Directive. These annual limits are then used to derive radiational concentration limits for the air and water.[257] This procedure has been included in Annex III of the 1980 Directive.[258] Thus, Annex III sets forth limits of annual intake, through inhalation of radionuclides, for exposed workers and members of the public.[259] In addition, Annex III sets forth the derived limit of concentration of radionuclides in the ambient air.

Certain provisions in the 1980 Directive do relate to environmental protection. For instance, Title I, "Definitions," contains terms that are distinctly environmentally significant.[260] "Radioactive contamination," for example, is defined as "the contamination of any material, surface or environment or of a person by radioactive substances . . . ."[261] The concept of radioactive contamination is reiterated in Title VII which applies to the protection of the population.[262] Title VII requires, not only surveillance of the public's health, but also: "a) assessment[s] of external exposure, indicating, where appropriate, the quality of radiation in question; [as well as] b) assessment[s] of radioactive contamination, indicating the

257. Council Directive of 3 September 1984 Amending Directive 80/836/ Euratom as Regards the Basic Safety Standards for the Health Protection of the General Public and Workers Against the Dangers of Ionizing Radiation Annex III 84/467, 1984 O.J. (L 265) 10 (Euratom) [hereinafter Annex III 84/467]. *See generally* Council Directive of 15 July 1980 Amending the Directives Laying Down the Basic Safety Standards for the Health Protection of the General Public and Workers Against the Dangers of Ionizing Radiation Annex III 80/836, 1980 O.J. (L 246) (Euratom) [hereinafter Annex III 80/836].

258. *Id.*

259. Annex III 80/836, *supra* note 257, at 26.

260. Council Directive 80/836, *supra* note 243, at 4.

261. *Id.*

262. *Id.* at 13.

nature and the physical and chemical state of the radioactive contaminants and their activity and determination of their concentration."[263] While the 1980 Directive requires the assessment of radioactive contamination in the environment, it does not provide a standard with which the assessments can be compared.[264] Thus, the assessments of the radioactivity in the environment are to ensure compliance with the basic doses and levels for the protection of the general public and workers set forth in the 1980 Directive. After analyzing the provisions of the 1980 Directive, it is clear that although they focus on protecting people, and consider the protection of the environment a subsidiary means for protecting people, the provisions provide a basis for future work on the protection of the environment.

1. Implementation of Euratom Legislation

Although the 1980 Directive is binding on the Member States,[265] the Community's structure places the responsibility on the Member States to incorporate the Community's legislation into their respective laws and administrative acts.[266] That is why the requirements of the 1980 Directive are addressed to all Member States in general, and not to their relevant authorities, e.g. nuclear regulatory bodies.[267] From this it follows that the Member States must set up the relevant

263. *Id.* at 13-14.

264. *Id.*

265. *See generally* TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 218.

266. *Id.*

267. *See* Council Directive 80/836 *supra* note 243. *See also* Commission Recommendation 92/444 of 26 July 1991 Application of the Third and Fourth Paragraphs of Article 33 of the Euratom Treaty, Annex, 92/444, 1991 O.J. (L 238) 33 (Euratom)[hereinafter Article 33]. Another area in which the commission has the power to make recommendations is emergency planning. Even though emergency planning is not a field in which the Commission can take binding measures, it has a right to review the respective legal provisions of Member States and recommend steps to make them more uniform throughout the whole Community. As long as the procedures of paragraphs 2, 3 and 4 of Article 33 are designed for the harmonization of the legislation of the Member States, the Member States are requested in the Recommendation not to finally adopt any draft provisions until the period of three months granted to the Commission under paragraph 4 of Article 33 has elapsed. Thus, the Commission

domestic structures to implement the Euratom legislation.[268] The 1980 Directive specifies neither the organs nor the procedures that the Member States should establish to comply with its provisions.[269] This system often leads to problems in the implementation of the Community's legislation.

As previously mentioned, the latest amendments to the Directive were promulgated by the Community on July 15, 1980 and September 3, 1984.[270] Certain Member States found it difficult to adapt and supplement their laws in accordance with the latest amendments by the scheduled deadlines.[271] Therefore, to ensure full implementation of the 1980 Directive, the Commission requested that all the Member States[272] evaluate the progress of the incorporation into their national laws.[273]

Along with implementation, enforcement of compliance with the Directives is also in the hands of the Member States.[274] Article 45 of the 1980 Directive reads:

> Each Member State shall establish a system of inspection to supervise the protection of the health of the population, to interpret, in terms of the effects on health, the results of the assessments provided for in Article 44 (3) [the assessment of the doses received by the specific groups of workers and the population, as well as radioactive contamination of the environment] and to check compliance with the dose limits laid down on Article 12 [dose limits for members of the public].[275]

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would have a real chance to influence the activities of the Member States in emergency planning. Article 33, *supra* at 32.

268. Council Directive 80/836, *supra* note 243, at 13-14.

269. EUR. PARL., Written Questions with Answers, No. 129/87 (1987) O.J. (C 315) 18 [hereinafter No. 129/87]. The Member States were given eighteen months to revise their laws and administrative rules accordingly. *Id.*

270. *See supra*, note 243 and accompanying text.

271. No. 129/87, *supra* note 269, at 18.

272. *Id.* The Commission has not approached the United Kingdom and Greece, who have already adopted the new measures laid down in the Directive as amended. *Id.*

273. *Id.* at 18. Special attention has been paid to Spain and Portugal, which have been allegedly lagging behind in implementing the Directives. *Id.*

274. Council Directive 80/836, *supra* note 243, at 14.

275. *Id.*

Under this system questions arise such as, what happens if a Member State seems to be in violation of the basic standards? and what measures are available to the Community, if violations do occur? For instance, Spain was accused, by other Member States, of not complying with the 1980 Directive.[276] The Spanish government notified the Commission of national measures it was taking to implement the 1980 Directive. After considering those measures, the Commission initiated infringement proceedings for failure to comply with the 1980 Directive.[277] Meanwhile, the Spanish authorities sent the Commission a draft royal decree which solved the problems in the way the Commission suggested.[278] In this instance, the problem was solved, though only after intervention from the Commission.

2. Enforcement by the Commission

Now suppose the 1980 Directive had been successfully adopted by all of the Member States, however there are instances of violations, the question remains: does the Community have any significant control over the enforcement of the 1980 Directive? The best way to answer this question is to look at a hypothetical instance when a State has violated the standards.

One would expect that since the Community plays a significant role in the establishment of the standards, the incidents that involve a violation or may result in such violation should be reported to the Community. However, neither the 1980 Directive itself nor any subsequent documents require the Member States to report any incidents to the Community. It should be noted, that Article 45 requires that, "[a]ny accident involving exposure of the population must be notified as a matter of urgency, when the circumstances so require, to neighboring Member States and to the Commission."[279]

276. EUR. PARL, Written Questions with Answers, No. 2275/91 and 2276/91, 1992 O.J. (C 162) 15-16.

277. *Id.*

278. EUR. PARL, Written Questions with Answers, No. 2986/91 and 2987/91, 1992 O.J. (C 162) 39.

279. Council Directive 80/836, *supra* note 243, at 14.

Thus, notification is only required when accidents are involved.[280] Even with respect to the notification of accidents there is a qualification, "when the circumstances so require."[281] This qualification raises many questions. What kind of circumstances require notification? Does it mean that only accidents that result in exceeding the Standards require notification? What if the accident does not result in exceeding the Standards for members of general public, but does cause exposure to workers? Is it up to the State to determine whether notification is required? Could or should other States be invited to take part in the decision-making process? The 1980 Directive does not answer these questions.

The application of the 1980 Directive has demonstrated that when an accident does not involve a violation of the Standards, it is within that Member State's discretion to decide whether the incident should be reported to the Commission.[282] If a State does not report an incident, then the Commission assumes that the incident is not important.[283] For example, when the Commission received a written question about an incident in 1982, in which a container at Garigliano power station in Campania, Italy, leaked radioactive water, it replied, "[o]bviously the event in question was not regarded as important enough to warrant notifying the Commission."[284]

Furthermore, the Commission trusts the Member States to accurately measure the amount of radioactivity in the environment. For instance, answering a written question by a Member of the European Parliament concerning emergency shutdowns of the Cattenom nuclear reactor in France, the Commission's representative stated, "[i]t is for Member States to decide what controlled discharge levels can be tolerated, always provided that the Community's standards are respected, in particular, the resulting exposure must remain

280. *Id.*
281. *Id.*
282. EUR. PARL., Written Questions with Answers, No. 1776/82, 1983 O.J. (C 100) 28, 29.
283. *See id.*
284. *Id.*

as low as reasonably achievable below the limits stipulated."[285] As far as the shutdown in question was concerned, the representative of the Commission stated,

> [w]hile incidents at nuclear installations do not require to be reported to the Commission, a weekly summary is received for France from the Service Central de Protection contre les Rayonnements Ionisants. Since the relevant summary makes no mention of any incident at Cattenom on 12 March, any such incident is assumed to be of no particular significance.[286]

At present, even incidents involving safety-system activated shutdowns are not required to be reported to the Commission.[287] When an incident on the Fessenheim nuclear power station in France occurred, the Commission giving another interpretation to Article 45 of the 1980 Directive, said:

> [A]ccording to information contained in a bulletin published by the French Ministry concerned, the quantity of radioactive gases released through the stack was less than a thousandth of the annual permissible quantity, and leaking liquids were recovered by the building's drainage system. Exposure of the population was therefore absolutely minimal, *and Article 45 does not apply*. As far as the Commission is aware, the Baden-Wurtemberg measuring equipment has not detected any environmental effects.[288]

Though there is no requirement of notification of all nuclear incidents within the Community, the Commission and the Parliament have been developing an information exchange system with respect to nuclear incidents or unusually high levels of radioactivity within the Community.[289] Their

285. EUR. PARL., Written Questions with Answers, No. 1124/87, 1988 O.J. (C 263) 6.

286. *Id.*

287. EUR. PARL., Written Questions with Answers, No. 116/87, 1987 O.J. (C 315) 17.

288. EUR. PARL., Written Questions with Answers, No. 345/86, 1987 O.J. (C 143) 4 (emphasis added) (footnotes omitted).

289. *See, e.g.*, Draft Proposal for a Council Decision on a Community System of Rapid Exchange of Information in cases of Unusually High Levels of Radioac-

efforts have been reinforced since the Chernobyl accident. In June of 1986, the Commission sent an outline communication to the Council on the consequences of the Chernobyl accident.[290] The Commission then transmitted to the Council, the Parliament and the "Economic and Social Committee"[291] a communication "on the development of Community measures for the application of Chapter III of the Euratom Treaty, 'Health & Safety.' "[292] The Communication was accompanied by a draft proposal for a Council Decision on a Community system of rapid information exchange in cases of unusually high levels of radioactivity or a nuclear accident.[293] The Commission also suggested that the Community should act in conjunction with the IAEA, which at that time was working on the Conventions on early notification and on assistance in case of a nuclear accident.[294]

Since the Community is still working on the issues of notification and the exchange of information by its Member States, a question has arisen as to whether the Community is entitled to inspect the nuclear facilities of the Member States, to assure compliance with the Directives. Article 35 provides for the Commission's "right of access" to monitoring facilities. It states that:

> Each Member State shall establish the facilities necessary to carry out continuous monitoring of the level of radi-

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tivity or of a Nuclear Accident, Annex I, COM(86)434 final at 1 [hereinafter Rapid Exchange of Information].

290. Outline Communication from the Commission to the Council on the Consequences of the Chernobyl Accident, COM(86)327 final.

291. "The Committee is an advisory body made up of 189 representatives from employer, worker, and other interest groups." SCHLICKMAN & MCMAHON, *supra* note 234, at E.C.-7.

292. Commission Communication to the Council, The Development of Community Measures for the Application of Chapter III of the Euratom Treaty 'Health and Safety', COM(86)434 final [hereinafter Application of Chapter III].

293. *See* Rapid Exchange of Information, *supra* note 289.

294. The Commission and the Parliament adopted a whole set of documents regarding new measures that the Euratom should undertake in connection with the environmental dangers of nuclear energy that became more vivid as a result of the Chernobyl accident. Given that these documents are pertinent to many of the issues raised and discussed in this work, they will be analyzed separately. *See infra* notes 354-359 and accompanying text.

> oactivity in the air, water and soil and to ensure compliance with the basic standards.
>
> The Commission shall have the right of access to such facilities; it may verify their operation and efficiency.[295]

The provisions of the second paragraph of Article 35 have been dormant for most of the time that Euratom has existed. After the Moscow Treaty[296] banned atmosphere, underwater and outerspace nuclear weapons testing, the level of radioactivity in the atmosphere was reduced substantially, and the Commission declined to perform further inspections.[297] The Commission also declared that the measurement technique had been harmonized throughout the Community and there was no need to carry out inspections on all the monitoring facilities.[298] This is yet another excuse to not perform the Article 35 inspections. The Commission has deemed it sufficient to receive and process data from the Member States.[299] The

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295. TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18, at 646.

296. This treaty was signed in Moscow on August 5, 1963.

297. EUR. PARL., Written Questions with Answers, No. 1844/79, 1980 O.J. (C 156) 61 [hereinafter No. 1844/79].

298. *Id.*

> Since 1958 the Commission has exercised its right to inspect the national facilities established to monitor the level of environmental radioactivity. Today, however, the fact that there are virtually no more nuclear explosions in the atmosphere, and consequently radioactive fallout from this source has been substantially reduced, has, together with the harmonization of the measurement techniques, decreased the practical value of inspecting such facilities.
>
> The Commission has considered it more appropriate to direct the monitoring of levels of radioactivity . . . towards the measurement of background radioactivity and . . . an examination of the effluents from nuclear installations, such as nuclear power stations and reprocessing plants . . . .

Id.

299. EUR. PARL., Written Questions with Answers, No. 1845/79, 1980 O.J. (C 150) 39.

> The Commission is regularly informed by the Member States of the position regarding environmental radioactivity in their territories; the information notified under Article 36 of the Euratom Treaty related to the results of the measurements of fallout levels together with those of the radioactivity in the air, water and milk. These

issue of the Commission's inspection, similar to the issue of the notification of nuclear incidents, was reviewed by the Community after the Chernobyl accident.[300] The European Parliament,[301] as well as certain Member States urged the Community, through the Commission, to introduce mandatory inspections of radiation levels in the Community.[302] Responding to these recommendations, the Commission included in its communication "on the development of the Community measures for the application of Chapter III of the Euratom Treaty"[303] a proposal to explore the idea of a Community Inspection Force in the radiation protection field.[304]

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data form the basis of annual reports published by the Commission and addressed to the Parliament.

Id. "The Commission [also] publishes annual data on the operation of all the nuclear power stations in the Community in the series 'Energy and Industry' (theme 4—series C). This is issued by Eurostat." EUR. PARL., Written Questions with Answers, No. 2002/88, 1989 O.J. (C 187) 31.

300. *See infra* notes 376-80 and accompanying text.

301. In general, there is no obligation on the part of either the Council or the Commission to take into account the Parliament's opinion. "However, since the adoption in 1986 of the SEA, in some instances, the Parliament has enhanced powers whereby its approval is needed to ratify a decision by a qualified majority rather than unanimity." SCHLICKMAN & MCMAHON, *supra* note 234, at E.C.-7.

The Maastricht Treaty contains a specific provision that relates to the Parliament's powers as far as the Euratom Treaty is concerned. According to Title IV of the Maastricht Treaty entitled "Provisions Amending the Treaty Establishing the European Atomic Energy Community," the Parliament "may, acting by a majority of its members, request the Commission to submit any appropriate proposal on matters on which it considers that a Community act is required for the purpose of implementing this Treaty." THE MAASTRICHT TREATY, *supra* note 223, at 314.

302. EUR. PARL., Written Questions with Answers, No. 321/90, 1990 O.J. (C 266) 25.

303. EUR. PARL., Written Questions with Answers, No. 230/87, 1988 O.J. (C 61) 08.

304. *Id.* the Commission has the power to undertake independent investigation when the Member States expect it and request it. For example, on several occasions concern was expressed within the Euratom about the excessive tritium discharges into the River Meuse from the nuclear station at Chooz, France and Tirange, Belgium. The Commission set up a group of experts to examine the radiological impact of the discharges in the Meuse in 1983. The group subsequently published a series of reports based on the results of the measurements that it undertook. *See* EUR. PARL., Written Questions with Answers, No. 604/87, 1987 O.J. (C 351) 43.

The Commission has the power to undertake independent investigation when the Member States expect it and request it. Also, the Commission has been involved in monitoring of the environment after the Chernobyl accident,[305] by "participat[ing], along with other international organizations, in the evaluation by the IAEA of the consequences of the Chernobyl accident in the [former Soviet Union] requested by the Soviet authorities."[306] The Commission collaborates with the Chernobyl Center for International Research,[307] in an effort to learn about the situation in contaminated areas and create strategies that will help mitigate the consequences.[308]

In connection with the above analysis of the Commission's activities in measuring radioactivity in the environment, and its Article 35 powers to conduct inspections of monitoring facilities in Member States, one question remains: How could the Commission's activities in this regard be effective if there are no unified and enforceable standards on acceptable levels of radioactivity in the ambient environment? This lacuna would seem even deeper if the Commission's activities in monitoring the Member States' environment and inspecting their monitoring facilities were expanded.

The powers of the Commission to make recommendations to the Member States in the area of radiation protection may be useful in making up for this lacuna. There are several types of recommendations that the Commission can send to Member States.[309] According to the provisions of Article

305. EUR. PARL., Written Questions with Answers, No. 784/91, 1992 O.J. (C 55) 6.

306. *Id.* at 7.

307. *Id.*

308. *Id.*

309. Articles 33 and 38 provide for the Commission recommendations in the area of radiation protection. Article 38 generally deals with the Community infringement action, and the recommendations provided for in the first paragraph of this article if interpreted in the context of this article, constitute a preliminary step that the Community can take before it actually initiates an infringement action against a State that allegedly does not observe safety standards. (Paragraph 1 of Article 38 states that "[t]he Commission shall make recommendations with regard to the level of radioactivity in the air, water and

33 paragraph 4 of the Euratom Treaty, the Commission makes recommendations regarding the safety standards of the Member States.[310] Paragraph 2 of Article 33 empowers the Commission to make appropriate recommendations for harmonizing the provisions applicable in the field of health and safety. Although this could significantly enhance the role of the Commission in developing Community radiation protection regulations, the Commission has failed to take advantage of the powers under paragraph 2. Using paragraph 2, the Commission could, together with the Member States, work toward establishing uniform radiation protection standards.[311] In addition, paragraph 2 could serve as the basis for creating standards for acceptable radioactivity levels in the environment.[312]

The preceding analysis demonstrates that forward thinking decision-making can help develop the Euratom Treaty, to provide for more far-reaching legislation. An eloquent example of this is the subsequent secondary legislation adopted in

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soil.") TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18, at 611.

The Commission also relied on the provisions of Article 124 paragraph 2, which issued recommendations on special problems of radiation protection. *Id.*

310. The Commission has recognized that experience has been gained in the application of the third and fourth paragraphs of Article 33 of the Euratom Treaty. *See* Commission Recommendation, 1991 O.J. (L 238) 31-32 [hereinafter Commission Recommendation].

311. Whereas specific recommendations issued under Article 33, of the Euratom Treaty give the Commission a level to influence future provisions in the Member States, general recommendations according to para. 2, can focus on the existing state of legislation in the Member States. In this way, on the basis of Article 33 of the Euratom Treaty and of the Directives issued pursuant to Articles 30 et seq. of the Treaty, the Commission can, with the aid of general and specific recommendations, work together with the Member States towards the establishment of uniform European radiation protection standards. TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18.

312. *See* TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18. Within its radiation protection legislation, the Community has developed certain provisions for emergency planning. According to Article 45 of the Basic Standards Directive, Member States should develop emergency plans on their own; the Commission is not involved in this process. *Id.*

regard to Article 37 of the Euratom Treaty. This Article is directly related to the matters of nuclear safety.[313]

b. Nuclear Safety Regulation

On its surface, Article 37 deals with nuclear waste. According to the Commission's Recommendation on the Application of Article 37 (Recommendation),[314] nuclear waste is interpreted as any form of radioactive substance.[315] This is an incredibly broad interpretation of the term "nuclear waste." Apparently it includes; nuclear waste proper (high-level and low-level), spent fuel, and radioactive effluents emitted in the process of the utilization of nuclear energy (both in normal operation and in case of an accident).[316] According to the Recommendation, the "general data" to be submitted to the Commission under Article 37 in connection with waste disposal should include: The site of the nuclear installation (geographical, topographical and others); the plant (the design and main features); the release of radioactive substances in normal operation; the unplanned releases of radioactive effluents; and, environmental monitoring.[317] Since the Recommendation gives such a broad interpretation of Article 37, it can compensate for the absence of Treaty provisions establishing uniform nuclear safety standards in the Community. In addition, as the Recommendation contains provisions requiring that the Member States submit data about radiation protection measures to the Commission, it can assist the Commission and the Member States in harmonizing their radiation protection standards.

Nuclear safety, unlike radiation protection, is not covered by the Euratom Treaty.[318] In the Commission's re-

313. NUCLEAR ENERGY LAW AFTER CHERNOBYL 43-44 (Peter Cameron et al. eds., 1988) [hereinafter NUCLEAR ENERGY LAW AFTER CHERNOBYL].

314. Commission Recommendation of 7 December 1990 on the Application of Article 37 of the Euratom Treaty, 91/4, 199 O.J. (L 6) 16-24 (Euratom) [hereinafter Recommendation].

315. *Id.*

316. *Id.*

317. *Id.*

318. TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18 at 646-47.

sponse to a written question from a Member of Parliament about the results of a safety test at the French-Belgium nuclear power station at Chooz, France, the Commission replied that:

> Since the safety of nuclear installations is the responsibility *solely* of the Member States, the results of the safety tests which are carried out by the bodies approved by the Member States concerned are communicated only to the operators and the competent authorities of that Member State; hence they are not notified to the Commission.[319]

Moreover, on a number of occasions the Commission stressed that nothing concerning nuclear safety is within its jurisdiction.[320]

At the same time, Euratom as a whole has not completely excluded nuclear safety from its sphere of influence. On July 22, 1975, the Council adopted a resolution that included a program for future cooperation within the Euratom on nuclear safety issues.[321] In the resolution, the Council agreed, inter alia, to take a course of action, through the Commission, toward the harmonization of safety standards.[322] The stated goal being to provide protection, to both the population and the environment, from the possible harms of radiation from nuclear activities.[323] The Council tried to console those who were apprehensive that the more uniform the nuclear safety standards would become lower. It stated that this course of action should "assist the development of trade on the understanding that such harmonization should

319. EUR. PARL., Written Questions with Answers, No. 604/87, 1987 O.J. (C 351) 43 (emphasis added).

320. Including technological safety of nuclear installations. EUR. PARL., Written Question with Answers, Nos. 370/87 and 378/87, 1987 O.J. (C 351) 24-25; EUR. PARL., Written Question with Answers, No. 1983/88, 1989 O.J. (C 187) 30.

321. COUNCIL RESOLUTION OF 22 JULY 1975 ON THE TECHNICAL PROBLEMS OF NUCLEAR SAFETY, 1975 O.J. (C 185) 1.

322. *Id.* at 1.

323. *Id.*

not involve any lowering of the safety level already attained . . . ."[324] The stages of harmonization included:

> (1) accounting for industrial development in the area of high-power nuclear reactors; (2) comparing the requirements used; (3) balancing similarities and differences; (4) promulgating recommendations pursuant to the Euratom Treaty; and (5) submitting draft provisions to the Council.[325]

In 1984, the Parliament adopted a resolution in which it requested an immediate departure from studying the matter, in order for the Commission to prepare binding standards in the areas of physical safety installations, for submission to the Council.[326] Unfortunately, the resolution's call to draw uniform safety standards "as soon as possible," has gone unheeded. Thus, the Community has squandered a chance to be a model of mandatory standards in nuclear safety for the rest of the international community. However, it appears that the Community, being a union with a high degree of homogeneity and the necessary structure of organs with far-reaching powers, is the right place to look for unified and mandatory international requirements of this kind.

Despite the vigorous tone of the Resolution, cooperation in the area of nuclear safety is proceeding at a slow pace.[327] It has proved to be an area in which the Member States are particularly reluctant to put any internationally agreed limits upon their sovereignty.[328] Prior to the Chernobyl accident, cooperation and regulation in this area was at a stand still.

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324. *Id.*

325. *Id.* at 1-2.

326. Council Resolution of 30 March 1984 on Closing the Procedure for Consultation of the European Parliament on the Communication from the Commission of the European Communities to the Council Concerning the Community's Role as Regards the Safety of Nuclear Installations and the Protection of Public Health and the Draft Resolution on Trans-Frontier Radiological Problems, 1984 O.J. (C 117) 189.

327. *See infra* note 381 and accompanying text.

328. NUCLEAR ENERGY LAW AFTER CHERNOBYL, *supra* note 326, at 44.

c. Radiation Protection and Nuclear Safety After Chernobyl

i. Radiation Protection

The Community's activities in the field of environmental protection, was spurred by Chernobyl. In its report to the Council and the European Parliament, the Commission stated that it,

> has undertaken recently an examination of current Community instruments and measures relevant to radiological protection. This was in part prompted by incidents and accidents that occurred over the last few years, but mainly brought about by events following the Chernobyl accident. As announced in its Framework Communication, the Commission has concluded that *existing measures for the application of Chapter III are in need of review*.[329]

In 1986, the Commission submitted a communication on the "Development of Community Measures for the Application of Chapter III of the Euratom Treaty," to the Council, the Parliament and the Economic and Social Committee.[330] This communication mainly concerned matters of radiation protection,[331] because Chapter III of the Euratom Treaty does not cover nuclear safety issues.[332] The communication outlined the problems faced by the Commission when implementing the Chapter III provisions of the Euratom Treaty, and addressed necessary steps, on the part of both the Member States and the Commission, to ensure effective cooperation in the realization of all the possibilities provided in Chapter III.[333] The Commission was frustrated by the fact that after the Chernobyl accident, the Member States came up with conflicting data on radiation levels.[334] This data "did not al-

329. The Chernobyl Nuclear Power Plant Accident and its Consequences in the Framework of the European Community, COM(86)607 final at 20 (emphasis added).

330. *See* Application of Chapter III, *supra* note 292.

331. *Id.*

332. TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18.

333. Application of Chapter III, *supra* note 292, at 2-9.

334. *Id.* at 5.

low a proper assessment of potential hazard[s] from airborne activity and, subsequently, from contaminated foodstuffs. Sampling procedures varied, results were expressed in different units and formats and data were frequently delayed and incomplete."[335] The Commission concentrated on the problems that it was facing in the areas of: (1) harmonizing radiation protection; (2) monitoring radioactivity in the environment; (3) disposing radioactive waste; (4) transporting radioactive materials; and (5) emergency planning and supporting activities.[336]

The Commission faced difficulties in harmonizing radiation protection because of a conflict between the need for frequent amendments to the standards to keep up with scientific developments and the inability of Member States to reach agreements promptly:

> The length of time needed to agree on revisions is so long that, before they can be implemented, revisions are already out of date. . . . Frustrated by the slow progress in amending safety provisions, some Member States have preferred to adopt national solutions. This has led to a divergence of national laws enforcing the Basic Standards which has in turn made more difficult the task of the Community to harmonize radiation protection.[337]

The Commission concluded that this has led to weak provisions for radiation protection.[338]

The Commission noted that in the area of monitoring the environment, in the early years of the Euratom Treaty, it had exercised its Article 35 right of access to the facilities in the Member States to verify their operation, but later discontinued this procedure.[339] However, as the Commission pointed out, "there w[ere] cases where the discharges from an installation c[ould] be detected in the environment of a neighbouring Member State," necessitating "independent verification of

335. *Id.*
336. *Id.* at 2-3.
337. *Id.* at 5.
338. Application of Chapter III, *supra* note 292 at 5.
339. *Id.*

the discharges and environmental contamination levels . . . ."[340] The Commission's Recommendation on the application of Article 37 of the Euratom Treaty, requires that Member States provide the Commission with data on radioactive discharges at regular intervals.[341] The Commission pointed out that an overview of this data, which it publishes regularly, "is often incomplete due to missing data returns from the Member State."[342]

In emergency planning and supporting activities, the Commission noted that "the independent attitude" taken by Member States has limited the Commission's work.[343] In this context the Commission referred to a communication that it submitted to the Council along with a Council Resolution on "emergency planning and contamination of rivers and seas" that was never adopted.[344]

The Commission, relying on the reassessment of the progress made in the areas discussed above, created a number of suggestions. Stating that there was a need to reassert the objective of the Euratom Treaty and its goal to establish safety standards in radiation protection, with an emphasis on uniformity and harmonization.[345] In order to expedite the process of adopting the 1980 and 1984 Directives as national legislation (originally scheduled to be completed by April 1984), the Commission decided to use all its Euratom Treaty powers, including legal proceedings.[346]

The Commission stated that it was not completely satisfied with the legal form of Directives on the standards. It said:

> The siting of many nuclear plants close to the border of neighbouring Community countries and the ease with which radioactive emissions can travel through air and water make this essential both to protect public health and

340. *Id.* at 7.
341. *Id.*
342. *Id.*
343. Application of Chapter III, *supra* note 292, at 8.
344. *Id.*
345. *Id.* at 10.
346. *Id.*

> to establish public confidence. In order to achieve harmonization or even uniformity it may be necessary in [the] future to use other Community instruments such as a Regulation or a Council Decision. This explains why the Commission chose the form of a regulation as being particularly appropriate in the context of limits for foodstuffs.[347]

This demonstrates the Commission's newly adopted environmentally-oriented approach to radiation protection. In this vein, it discussed the need for the Community to monitor levels of radioactivity in the environment. It also discussed enforcement tools, such as the establishment of a Community Inspection Force, which was proposed by the Resolutions of the European Parliament and the Member States.[348] The Commission concluded that to have any effect, an inspection force would need to be large.[349] Evidently, establishing such a force would not be feasible and could possibly duplicate the work of national inspections.

As part of its future activities in emergency planning and a rapid information exchange system, the Commission again referred to its powers of inspection under Article 35.[350] The Commission emphasized that it was aware of and was contributing to the activities of the IAEA on the drafting of the early notification and assistance conventions.[351]

On the whole, the communication seemed to touch upon the most pressing issues concerning the protection from radioactive pollution, that became even more vivid after the Chernobyl accident. Yet, the Commission remained conservative about certain points. For example, the Commission said that there were no uniform limits on radioactive discharges throughout the Community, but failed to make a con-

347. *Id.* The Council Regulation set general tolerance levels for specific classes of foodstuffs. *See also* Commission Regulation 1675/86 of 30 May 1986 Fixing the Premiums to be Added to the Import Levies on Rice and Broken rice, Annex II, 1986 O.J. (L 146) 8, 10.

348. Application of Chapter III, *supra* note 292, at 12.

349. *Id.*

350. *Id.* at 13.

351. *Id.*

clusion that the Community needed to establish harmonized uniform standards limiting radioactive discharges.[352]

The Commission issued this communication on August 20, 1986.[353] On April 8, 1987, the European Parliament, in the wake of the Chernobyl accident, adopted a series of resolutions on nuclear energy.[354] One resolution reflected the Parliament's dissatisfaction with the Commission's inaction in remedying "obvious shortcomings in the Euratom Treaty" revealed by the Chernobyl accident.[355] The resolution called for a revision of the Euratom treaty, including, in particular:

> (b) the establishment of common standards for radioactive emissions;
>
> (e) an improvement of the basic norms for radiation protection which must immediately be transformed into the law of the Member States;

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352. *Id.* Instead it drew up the following rather vague passage:

> The derivation of authorized discharge limits for nuclear installations is at present left to the Member States. The Framework Communication broaches the concept of Community emission standards and the Commission will, as part of its work in this area, hold consultations to review existing practices. It is desirable that emission standards should be based on the application of the present state of technology and the Commission will take account of this in its review of emission standards.

Application of Chapter III, *supra* note 292, at 13.

353. *Id.*

354. Resolution on the Follow-Up Report on the 1995 EC Energy Objectives, 1987 O.J. (C 125) 86; Resolution on the Future of Nuclear Energy, 1987 O.J. (C 125) 88 [hereinafter Future of Nuclear Energy]; Resolution on the Problem of Contamination of Foodstuffs Following the Chernobyl Disaster, 1987 O.J. (C 125) 91; Resolution on the Reaction of the Community to Chernobyl, 1987 O.J. (C 125) 92; Resolution on the Safety of Nuclear Power Stations and the Question of Mutual Assistance and Compensation, 1987 O.J. (C 125) 94 [hereinafter Mutual Assistance]; Resolution on the Consequences of the Chernobyl Accident and on the Outline Communication from the Commission of the European Communities to the Council on the Consequences of the Chernobyl Accident, and the Communication from the Commission of European communities to the Council on Community Actions to be Taken in Response to the Chernobyl Accident, 1987 O.J. (C 125) 96 [hereinafter Resolution on Consequences of Chernobyl Accident].

355. *See* Resolution on Consequences of Chernobyl Accident, *supra* note 354.

(g) the establishment of a Community Inspectorate for monitoring the application of Community standards, including standards on radiation protection.[356]

The Parliament's resolution is much more outspoken about the establishment of the Community's common standards for radioactive emissions.[357]

ii. Nuclear Safety

The Chernobyl accident incited the work of the Commission, and the Community as a whole, in the area of nuclear safety. After the Council adopted a resolution on technological aspects of nuclear safety on July 22, 1975,[358] and before the Chernobyl accident occurred, little progress was made in this area. After the Chernobyl Accident, several resolutions were passed by the Parliament concerning nuclear safety.

An interesting contrast results from the comparison of standpoints between the Parliament and the Commission on matters of nuclear safety. In its communication, the Commission says that it performed harmonization/intercomparison of national standards on nuclear safety even before the Council Resolution of July 22, 1975 came into existence.[359] It had always been aware that the harmonization would benefit both safety and market openings.[360] Harmonization opens markets by standardizing component design, manufacture and quality control.[361] Furthermore, harmonization of material specifications, result in removal of technological obstacles motivated by safety concerns.[362]

The Commission states that the process of harmonization of safety criteria, codes, and standards, in relation to all types of nuclear power installations, has had problems as

356. Resolution on Consequences of Chernobyl Accident, *supra* note 354, at 97.

357. Application of Chapter III, *supra* note 292.

358. Technological Problems of Nuclear Safety, COM(87)96 final [hereinafter Technological Problems].

359. *Id.*

360. *Id.* at 4.

361. *Id.*

362. *Id.*

well as achievements.[363] For example, one of the problems has been identifying similarities and differences in the safety regulation of light water reactors due to the rapid developments in the areas of nuclear power installation and regulatory practices.[364] However, the Commission praises the achievements made in the field of liquid metal fast breeder reactors which have taken place in part because of the harmonization work begun prior to commercial application, and in part because of the fast reactor developments, due to the joint effort in research by the Member States.[365] The Commission found this encouraging, given the "complexity of the subjects to be treated and the large number of participants" with different interests, such as; utilities, constructors, licensing authorities, and research organizations.[366]

The Parliament, in one of the resolutions adopted after the Chernobyl accident, stressed that "even the existing but modest competencies of the Euratom concerning safety had been largely neglected."[367] With that in mind, the Parliament should draft a plan as to how the Euratom Treaty should be amended and how it should respond to the new requirements. The main themes the amendments should address include:

> (a) establishment of common safety standards for nuclear installations [completely new provisions to be included into the Treaty]; (b) the establishment of common standards for radioactive emissions [which would complement a lot of the Commission's activities]; (c) the consultation procedure[s] for the siting of nuclear power stations in frontier regions; . . . (f) the establishment of common information and control systems in case of nuclear incidents; (g) the establishment of a Community Inspectorate for monitoring

363. Technological Problems, *supra* note 358, at 11.

364. *Id.*

365. *Id.* at 12.

366. *Id.* at 12. The Commission emphasizes, "[f]urthermore, *most of these organizations are reluctant to envisage a central role of the Community on regulatory matters, beyond that enshrined in Chapter III of the Euratom Treaty.*" *Id.* (emphasis added).

367. Resolution on Consequences of Chernobyl Accident, *supra* note 354, at 97.

> the application of Community standards for reactor safety . . . .[368]

Compared to the position of the Commission, the Parliament, as is obvious from this plan, is taking a more radical approach to create co-operation between the Euratom Member States in radiation protection and nuclear safety. If such a plan is adopted, many pending issues in these areas would be removed from Euratom's agenda.

When discussing the issue of nuclear safety standards, the Parliament stated that it,

> [d]eplores the fact that there are no binding international standards on the safety of nuclear power stations, [and that it] [c]onsiders that the non-binding standards set in the NUSS Programme (Nuclear Safety Standards) establish a basis on which mandatory international rules could be drawn up; stresses the importance also of bringing the East European countries within the ambit of these standards; considers that, at the very least, binding safety standards must be introduced within the EEC by means of appropriate addition to the Euratom Treaty and that such standards should not be based on compromise but on the strictest provisions currently in existence.[369]

On the border installations issue, the Parliament called for a very stringent provision, requiring that before a power plant is operated 100 kilometers from the border of an adjacent Member State, that adjacent Member State must consent to the operation of the plant.[370] If the adjacent Member State does not consent, the power plant is not to be operated.[371]

On the issue of nuclear safety inspections, the Parliament insisted that nuclear reactors could not be constructed in the European Community before the safety of their design has been verified by competent, *international experts*, paying attention to environmental factors.[372] It went on to say that

368. *Id.*
369. Mutual Assistance, *supra* note 354, at 94.
370. *Id.*
371. *Id.*
372. *See id.* at 95.

it approved of the IAEA's use of OSART missions and called on all states to provide access to their nuclear power plants for examination by IAEA experts.[373] The Parliament addressed some of the issues raised in these resolutions prior to their adoption. Moreover, some of those issues had at one time prompted negative reactions from the Member States or their representatives.[374]

For example, arguing against setting up a Community Inspection Force, the government experts from France stated, "[n]either the word nor the spirit of this Article could be interpreted in favour of setting up a 'Community Inspection Force.'"[375] For a diametrically opposed opinion, this author cites a work on Euratom, written by a group of Belgian authors immediately after the organization was set up in 1958. The book was published before the Directive was in its initial form, and thus the interpretation of the Euratom Treaty contained in the book is an interpretation of the "word" and the "spirit" of the Treaty. The book interprets the provisions of Article 35 to mean that:

> The Commission's right of 'access to such [monitoring] facilities' and its right 'to verify their operation and efficiency,' implies that the Commission can send special inspectors to perform these functions. This provision al-

373. *Id.*

374. For example, to consider the issue of setting up a Community inspection force, a meeting of national experts was held on 15 November 1985. The report adopted by the meeting stated inter alia: the nine delegations present were unanimous in opposing the setting up of a Community Inspection Force as envisaged in the Resolution of the Parliament. Present record-keeping procedures were judged satisfactory and any failure by operators to respect the procedures in full, as occurred at Sellafield (in November 1983 an accident resulting from operational errors occurred on a German reprocessing nuclear plant at Sellafield) could not be prevented by a Community Inspection Force which would be expensive to operate and would serve only to duplicate existing national arrangements. Support was expressed by some delegations for a comparative analysis of national approaches to deriving discharge limits and to application of ALARA (As Low As Reasonably Achievable). A more transparent, uniform interpretation of the procedures applicable might prove beneficial. *See* Report of the Meeting of National Experts to Consider Setting Up a Community Inspection Force in the Field of Radiation Protection as Proposed in a Resolution of the European Parliament, 10 September 1985, COM(86)434/3 final at 1.

375. *Id.* at 5.

> lows the Commission to ensure, among other things, that the methods of performing measurement adopted at different monitoring facilities furnish data that are sufficiently precise and compatible. The Commission could play a very useful role by encouraging, or even creating, the standardization of the methods of control.[376]

Amazingly, it took the Chernobyl accident for the Parliament to get back to the issues concerning radiation protection, and nuclear safety inspections. The fact that the Parliament resurrected the inspections issue indicates that the population of the European Communities, through the Parliament, expressed that they would feel more confident if an international inspectorate monitored national nuclear energy activity.

If we try to measure the degree of radicalism of approach these bodies take with respect to the level of harmonization/internationalization of radiation protection and nuclear safety regulation, the Parliament must be considered a radical force within the Community, followed by the Commission, and the more conservative Member States. It should be noted that even with their differing views, on the issue of information exchange in cases of radiological emergency, an agreement has been reached between the Member States and the Euratom. The Council's Decision that created interest in this area was issued following the Convention on Early Notification of a Nuclear Accident, under the auspices of the IAEA.[377] Instead of reinforcing the Member States' obligations under the IAEA convention, the Decision is applied

376. "Le droit de la Commission d'accéder à ces postes de contrôle et d'en vérifier le fonctionnement et l'efficacité', implique que la Commission pourra déléguer des inspecteurs spécialisés en cette matière. Cette disposition doit permettre à la Commission de s'assurer notamment que les méthodes de mesure adoptées dans les différants postes fournissent des données suffisament précises et comparables entre elles. La Commission pourrait jouer un rôle extrêmement utile en favorisant, sinon en créant, une standardisation des méthodes de contrôle." *See* Euratom. *Analyse et Commentaire du Traité* 93 (1958).

377. Council Decision 87/600 on Community Arrangements for the Early Exchange of Information in the Event of a Radiological Emergency, 1987 O.J. (L 371) 77 (Euratom).

"whenever a Member State decides to take measures of a wide-spread nature in order to protect the general public in case of a radiological emergency . . . ."[378] At the same time, the Commission, as it promised in its Communication on the application of Chapter III of the Euratom Treaty on August 20 1986, started legal proceedings in the European Court of Justice[379] against Member States who failed to implement the Euratom Directives.[380]

In the field of *nuclear safety*, the Euratom's achievements have not been impressive. On June 18, 1992, the Council adopted a Resolution on technological problems of nuclear safety in which it encouraged coordinated action by the Member States and the Commission in the international arena, within the IAEA framework, toward the creation of international safety criteria on nuclear safety.[381] The Community was acknowledging the important responsibility upon the IAEA of regulating environmental protection from radioactive pollution.

3. Concluding Analysis

There is a conflict in Euratom as far as the "regulation" of environmental issues is concerned. This conflict centers on the degree of harmonization of the regulatory processes. The analysis of the Community's legislative activities shows that the Euratom Treaty has not undergone amendments comparable to the changes introduced by the Single European Act and the Maastricht Treaty. In fact, all attempts by the European Parliament to introduce radically new approaches into

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378. *Id.*

379. The Court of Justice ensures that Community institutions and Member States observe and implement Community law. In infringement action the Court of Justice may entertain an action alleging a Member State's failure to fulfil its obligations under primary or secondary Community law. This action may be brought by the Commission under article 141 of the Euratom Treaty or by a Member State under article 142. *See* TREATIES ESTABLISHING THE EUROPEAN COMMUNITIES, *supra* note 18, at 698; Zacker, *supra* note 226, at 254-55.

380. *See, e.g.*, Court of Justice, Action Brought on 2 September 1988 by the Commission of the European Communities Against the Italian Republic 1988 O.J. (C 255) 4.

381. Council Resolution on the Technological Problems of Nuclear Safety, 1992 O.J. (C 172) 2-3 [hereinafter Problems of Nuclear Safety].

the Euratom Treaty have been rejected by the Member States. The Euratom Members, as a Community of States, cannot agree on the issue of uniform emission standards - where international regulation has been most successful, through the IAEA on the global level. Of course, nuclear safety continues to be the most guarded area by the Member States against any tangible intrusion on the part of the European organs. One way to resolve this complex issue is to determine why the Member States of the Euratom, as well as the States in general (including those that are Members of the IAEA), are reluctant to allow a higher degree of international "regulation" in this area. Once the reasons behind their reluctance has been determined, work can begin toward a truly integrated system of radiation protection and nuclear safety.

III. Future Responses of International Law

A. Factors Influencing the International Regulation of Nuclear Energy

The analysis undertaken in Part II shows that international regulation by international organizations in the area of environmental protection faces many problems. No dramatic progress has been achieved so far. However, progress is possible since the international regulation of nuclear energy has a solid foundation in a body of international structures, organizations and regulations. There are several important factors that influence the process of harmonization/ internationalization in the area of environmental protection from the adverse effects of nuclear energy. These factors are considered in the discussion that follows.

First is the legal factor. Nuclear law in general, and the law of protection from nuclear radiation in particular, is a part of the general legal system of a State. Each legal system has its own developmental history. Pelzer, a nuclear lawyer, quotes Montesquieu, stating that; "[t]he political and civil laws of each nation . . . must be so absolutely appropriate for the people for whom they are made, that it is a great coinci-

dence when laws of one nations are fit for another,"[382] and concluding that "the wilful act of putting together parts of national legislation to an internationally harmonized legislation might be called an even 'plus grand hazard.' "[383] Similarly we should refrain from harmonizing national laws on an international level.[384] But, Pelzer observes that many national legal systems have developed by way of borrowing from other national legal systems.[385] Moreover, regulation and legislation in the area of radiation protection has always developed with the significant involvement of international agencies, such as the ICRP and the IAEA.[386] Pelzer continues:

> The harmonizing effect of international expert knowledge is assisted by the character of radiation protection law. That field of law is a young one, which is not overburdened with national legal dogmatism. It is dealing with technical facts more than with specific legal structures and traditions, and thus remains open for new legal approaches.[387]

Nuclear safety also deals with scientific facts. Unlike radiation protection, it is influenced by national dogma. The difference between these areas is related to the fact that radiation protection is realized through the setting of doses and levels of permissible radiation,[388] where nuclear safety is ensured by the safe design of a nuclear installation, as well as safe siting and safe operating of nuclear facilities.[389] Nuclear safety has a more applied character and can be more intrusive with respect to national nuclear programs. When the is-

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382. "Les lois politiques et civiles de chaque nation. . .doivent être tellement propres au peuple pour lequel elles sont faites, que c'est un grand hazard si celles d'une nation peuvent convenir à une autre." Norbert Pelzer, *On Harmonizing Nuclear Energy Law Introductory Remarks to the General Theme of Nuclear Inter Jura '85, in* INTERNATIONAL HARMONIZATION IN THE FIELD OF NUCLEAR ENERGY LAW PROCEEDINGS OF NUCLEAR INTER JURA '85, 39 (Norbert Petzer, ed. 1986) [hereinafter *Harmonizing Nuclear Energy*].

383. *Id.* at 39.

384. *Id.*

385. *Id.*

386. *Harmonizing Nuclear Energy*, *supra* note 382, at 40-42.

387. *Id.* at 42.

388. *See supra* note 18 and accompanying text.

389. *See supra* notes 19-20 and accompanying text.

sue is about nuclear safety regulation, there is more involvement by the national nuclear establishment than in radiation protection matters. This is because nuclear safety standards are technical norms and requirements that have acquired a legal form. For this reason, when new nuclear safety standards are developed, regardless of whether they are introduced by a domestic government or by an internationally authorized body, they can have a crucial effect on the nuclear policy of the State in question.

The harmonization/internationalization of nuclear safety standards can infringe substantially upon national interests in this area—legal as well as scientific and technical. Thus, *the second factor* to influence the harmonization/internationalization of the protection of the environment from nuclear energy is *scientific and technical.* Scientific and technical isolationism of a given nation can be coupled with a feeling of superiority in the field of nuclear energy.[390] A vivid expression of this position is found in the following consideration:

> The existence of a body of international safety principles or rules might be viewed as beneficial by less technologically sophisticated countries. However, the more sophisticated countries would be unlikely to accept them and the less sophisticated countries would be unlikely to see any advantage in[ ] entering into international instruments that would obligate the country to use of the principles or rules . . . 'Few nations would be willing to relinquish to others the authority to set the ground rules for these choices [national safety, economic, and energy] as respect plants within their jurisdiction.'[391]

A fear that an international harmonization of nuclear safety standards would inevitably mean levelling down to the lowest common denominator is another aspect of the scientific and technical factors. Hence, if an international standard is es-

390. Human error is always a safety concern.

391. John K. Restrick, *U.S. Licensing Requirements and Recommendations on International Principles and Rules on Licensing, in* INTERNATIONAL HARMONIZATION IN THE FIELD OF NUCLEAR ENERGY LAW PROCEEDINGS OF NUCLEAR INTER JURA '85, 130 (Norbert Petzer, ed. 1986).

tablished and it turns out to be lower than that of a particular country, that country's enforceable standards would inevitably drop down to the international level. If the standards are low, there is no incentive to further develop safer nuclear technology. Thus, there would be no progress around the world in moving to safe nuclear energy.

The issue of the lowest common denominator as part of a unified regulation arises in many cases where there is a complex entity involved in issuing regulations addressed to its component parts. This is regardless of whether it is a federal State or an international organization with strong regulatory powers such as those of the European Communities.[392]

In the internal relationships of a complex entity with its constituent parts, there will always be two opposing tendencies: one toward unified regulation and control, and the other toward independence of the constituent parts. Proponents of either of these tendencies espouse equally reasonable arguments to justify their respective positions. For example, when the issue of harmonization was discussed in connection with the application of the Euratom Standards on radiation protection, a view expressed was that harmonization of the Euratom standards would only be possible if every Member State adopted the standard's principles in a "uniform or identical manner."[393]

The Member States' practice in implementing the Community regulations does not provide an answer as to whether they choose to set forth more stringent standards than those established by the Community. A question posed to the Commission in the Parliament was, "can the Commission say which Member States have since implemented Directives 80/836/Euratom and 84/467/Euratom?" and "can the Commission say whether the Member States that have implemented the Directive have adhered to the standards in the Directive or are there Member States that have introduced other

392. European Union in the language of the Maastricht Treaty.

393. Abel J. González, *Fundamental Principles of Protection and Safety for Nuclear Power*, IAEA BULL., Vol. 34 No. 2 1992, 10.

(stricter) standards?"[394] The Commission answered that "certain Member States had found it difficult to adapt and supplement their laws by the scheduled deadlines."[395] However, "the United Kingdom [UK] and Greece . . . ha[d] already adopted the measures laid down in the above mentioned Directives."[396] With regards to the strictness of the standards adopted, neither the UK nor Greece adopted limits stricter than those established in the Directives.[397] "Furthermore, the Commission was currently evaluating the progress in the incorporation of these two Directives into the national laws of Spain and Portugal."[398]

Harmonization of environmental protection regulation from nuclear energy, does not have to mean the establishment of standards that amount to the lowest common denominator making it a fruitless effort. On the contrary, if one looks at the same issue of harmonization/internationalization in the area of environmental protection and safety, armed with a different set of facts, the opposite conclusion occurs. When the Euratom Commission issued its report on the implementation of the Council resolution of June 22, 1975, it made it clear that collaboration by the Member States led to two beneficial effects. The fast reactor development and demonstration improved, and it made the harmonization work systematic and easier because it started at the research level, well in advance of commercial applications.[399] This shows that the harmonization of nuclear safety standards can be attained without impeding on the development of nuclear science, when it goes hand in hand with the internationalization of research in this field. In addition, the internationalization of nuclear research can in turn contribute to fast developments in the nuclear reactor industries.

394. EUR. PARL., Written Questions with Answers, No. 129/87, 1987 O.J. (C 315) 18.

395. *Id.*

396. *Id.*

397. *Id.*

398. *Id.*

399. *See* Technological Problems, *supra* note 358, at 12.

One more aspect adding to the complexity of the scientific and technical factor of the harmonization of nuclear safety standards, is the close connection between peaceful and military technologies in the field of nuclear energy. Knowledge in the peaceful sector can benefit the military sector and vice versa. This is relevant for both the IAEA Member States, as well as the Euratom Member States.

The *third factor is the economic one.* Specifically, whether such harmonization would impair economic cooperation and competition in the area of nuclear industry. For some writers, it seemed obvious in 1964, after only a few years of Euratom's existence, that harmonization in the area of radiation protection and nuclear safety would help economic competition within Euratom. For example, Jaroslav Polach wrote the following:

> Needless to say, imposing health and safety standards affects production costs. Consequently, the greater uniformity exists among such standards throughout Euratom, the greater the tendency to equalize production costs directly imputable to these provisions. Moreover, as safety and health protection arrangements become more nearly uniform in the six states [there were only six Member States in Euratom in 1964], they cease being obstacles to labor mobility. Thus, in both respects uniform safety rules tend to increase competition.[400]

B. The Development of New Legal Instruments for the Environmental Protection from Nuclear Energy

Having explored the factors that influence the process of harmonization/internationalization of radiation protection and nuclear safety, the author now turns to analyzing what may be the future responses of international law to this problem.

Probably the most noticeable developments in international law in the area of environmental protection from radio-

400. Jaroslav G. Polach, *Euratom. Its Background, Issues and Economic Implications* 94 (1964).

active pollution have taken place under the auspices of the IAEA. The role of the IAEA has been so important to the international community that the Euratom seems to be ready to give the IAEA the bulk of its work in the areas of nuclear safety and radiation protection.[401]

In early September of 1991, the IAEA held an International Conference on Nuclear Safety in Vienna. The Conference's final document declared that there was a "need to consider an integrated approach to all aspects of nuclear safety . . . which would be adopted by all Governments . . . ."[402] Later that same month, the IAEA's General Conference passed a resolution in which it invited the Director General to prepare, for the Board's consideration in February 1992, a draft nuclear safety convention.[403] This resulted in an outline of a potential agenda for a nuclear safety convention, taking into account the activities and roles of relevant international and intergovernmental bodies.[404]

In the meantime, while the Secretariat of the Agency was working on the draft Convention, a discussion was published as "a proposed basis for a harmonized approach to radiation protection and nuclear safety."[405] Among the persons involved in this discussion were Morris Rosen, Director of the IAEA Division of Nuclear Safety, and Abel J. González, Dep-

401. In the series of resolutions passed by the European Parliament in the wake of the Chernobyl accident it expressed hope that,

> the European Community acting in the framework of international bodies and in particular the IAEA, will play a more active part with regard to . . . the drawing up of safety standards and rules for the construction and operation of reactors in particular with regard to inspection provisions [and stressed, in connection with the concern about the safety of nuclear reactors in Eastern Europe, that] the IAEA is the most suitable body at international level for these tasks, as Eastern European states are also members.

Resolution on Consequences of Chernobyl Accident, *supra* note 354, at 98. *See also* Problems of Nuclear Safety, *supra* note 381.

402. Morris Rosen, *A Formal International Nuclear Safety Regime: The First Steps*, IAEA BULL., Vol. 34 No. 2 1992, 6.

403. *Id.* at 6.

404. *See id.* at 6-9; González, *supra* note 393. *See also* INTERNATIONAL ATOMIC ENERGY AGENCY, YEARBOOK 1992 D60, D66-67 (1992).

405. González, *supra* note 393, at 10.

uty Director of the IAEA Division of Nuclear Safety.[406] There is a slight difference in the approaches of the two authors to the concept of the convention. Rosen writes about a nuclear safety convention; González proposes a protection and safety convention where "protection and safety" is a notion that encompasses radiation protection and nuclear safety.[407] Since the main principles presented by the two authors overlap, and given the fact that González has a more extensive analysis of the principles, the author concentrates on his article. The regime of the convention should be based on the following main principles:

> [1] regulation by governments . . . [2] justification of nuclear power . . . [3] protection of individuals . . . [4] preservation of the environment . . . [5] optimization of protection and safety . . . [6] procedures of defense-in-depth . . . [7] application of sound technical criteria . . . [8] attainment of a protection and safety culture . . . [9] responsibility of operators . . . [10] reduction of de facto exposures.[408]

Here the protection of individuals principle, is complemented by the environmental preservation principle. This evidences a move toward recognizing the environmentalist approach to nuclear energy. This notion encompasses several main ideas, including an understanding that; "[a] nuclear power must not jeopardize the general natural state of the environment . . . [b] the environment is generally preserved within its normal variations, and . . . [c] the availability of natural resources needed for a sustainable development is not compromised."[409]

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406. *See* Rosen, *supra* note 402, at 6; Gonzàlez, *supra* note 393, at 10.

407. González, *supra* note 393, at 10-14.

408. *Id.* at 11-14.

409. González, *supra* note 413, at 11. The principle also states the following important understanding:

> [N]uclear power produces radioactive byproducts and wastes that, in the long term, might not remain isolated from the regions of the earth's crust and the atmosphere occupied by life forms, i.e. from the biosphere. Therefore, the expected inflow rate of radioactive materials into the biosphere caused by the disposal of these byproducts and wastes should be a small fraction of the predicted inflow rate to the biosphere of comparably hazardous natural radioactive

The underlying concept for the convention is the regulation by governments. This is articulated in González's definition of the term international regime as "an international system aimed at the global harmonization of radiation protection and nuclear safety whereby States retain prime responsibility, preeminence, and hegemony in its regulation."[410] Governments should, in accordance with this theme, be primarily responsible in adopting and using nuclear power, and in controlling nuclear installations and their radioactive emissions.[411] The principle also states that governments should establish a framework of "*independent regulatory organizations*" to ensure the protection from and safe use of nuclear power.[412]

The positions asserted by González and Rosen go no further than the general framework for an international protection and safety regime. They do not set unified or harmonized nuclear safety or radiation protection standards. However, the fact that they constitute a first step in the complicated and controversial terrain of the internationalization of safety and protection standards is significant in and of itself. This shows that:

> The time seems ripe for making a proposal that may eventually evolve into a new fundamental principle of radiation protection and nuclear safety, namely: the institution of an international regime to support a globally harmonized approach to all aspects of radiation and nuclear safety.[413]

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materials (which would either naturally enter the biosphere from the geosphere of be produced in the biosphere). Moreover, as local environmental concentrations of radioactive materials could affect populations of species in the biota, the inflow rate of such materials to the environment shall be limited to ensure that *neither whole species be endangered nor imbalance be created among species.*

Id. at 12 (emphasis added).

410. *Id.* at 13.

411. *Id.* at 11.

412. *Id.* at 11.

413. González, *supra* note 393, at 14.

It is difficult to predict what form a convention on safety and protection will take.[414] At the same time, the preceding analysis concerning the experience of the two major "nuclear" international organizations in establishing international radiation protection and nuclear safety standards compels certain recommendations.

First, with regards to drafting an international convention on nuclear safety and radiation protection, a distinction between these two areas should be made, and separate legal processes should be developed accordingly. If it is justifiable to combine nuclear safety and radiation protection when the basic principles of an international regime of protection from adverse effects of nuclear energy are considered, it is not feasible to combine these areas when drawing specific international standards. International "regulation" of nuclear safety and radiation protection has reached different levels.

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414. After this article had been submitted for publication, a Convention on nuclear safety was adopted by a diplomatic conference convened by the IAEA and opened for signature at the IAEA headquarters. *Convention on Nuclear Safety* Annex, IAEA Doc. INFCIRC/449 (July 1994). The adoption of the convention in its present form does not persuade the author to change her position on the future developments on the International law in this area. As a matter of fact, a brief review of its contents reinforces the author's position. The convention is applied to both nuclear safety and radiation protection. *Id.* at art. 3, 15, 17-19. The main principle that underlies the provisions that deal with nuclear safety and radiation protection is that the convention puts the primary emphasis on the national activities of States in these areas. Thus, the convention states that it is the responsibility of States to "establish and maintain a legislative and regulatory framework," to ensure the safety of nuclear installations. *Id.* at art 7,8. In siting, design and construction, as well as operation of nuclear installations, States should ensure that "appropriate steps or procedures" are taken or established. *Id.* at art. 17, 18, 19. In radiation protection States undertake to ensure that national dose limits are not exceeded. *Id.* at art 15. Because the convention provides for a mechanism of reporting and review meetings, it is presupposed that a certain internationalization of these national activities of States should take place. Even given so, the convention states in its preamble that it ". . . entails a commitment of fundamental safety principles for nuclear installations rather than of detailed safety standards . . . ." *Id.* at Preamble. Thus, confining the cooperation of States to the most general and unspecified standards of nuclear safety and radiation protection. This brief review of the conventional provisions is not meant to diminish the significance of this instrument in promoting the exchange of information on the state of affairs with nuclear safety and radiation protection in party States or other issues of cooperation between States in these areas.

In the area of radiation protection, the IAEA has established internationalized standards, even as far as setting the maximum levels of radioactive emissions. The problem in this area is ensuring the implementation of these standards by all the countries that use nuclear energy for power generation. The area of nuclear safety is far more complicated due to various political and other vested interests concerned with the use of nuclear energy. Nuclear safety standards in various countries remain, to a very large extent, the domain of the national legislation, regulation and control. Even within the seemingly homogeneous Euratom a process of harmonization of nuclear safety standards is now taking its first steps. In fact, as was shown previously,[415] this work is still at the stage of determining the similarities and differences in the regulation of nuclear safety by different countries.

Thus, work on two different conventions must begin separately. Both of them should be based on the main principles discussed by González and Rosen. These should be complemented by the principle of international control of the compliance of States with the established standards. Standard-setting and compliance verification, should be performed by the IAEA. All other "nuclear" international organizations should participate in the process of standard-setting. The IAEA and Euratom could reach an agreement on cooperation in radiation protection and nuclear safety, and the IAEA should learn from Euratom's experience in its attempt to harmonize nuclear safety standards.

A convention on radiation protection can be more specific in character. It should establish stringent mandatory standards for the protection of workers, the nearby population, and the general public. Likewise it should establish the maximum permissible radioactive emissions from nuclear installations. The convention should include provisions on international control of compliance with the standards. It should also include a system of global monitoring of the levels of radioactivity in the air, soil and water in various regions of the world. These should focus on the more vulnerable re-

415. *See supra* notes 363-64 and accompanying text.

gions, determined by either the density of the population or the character of nature. An obligatory incident reporting system should be created, comparable to the one established by the International Civil Aviation Organization and based on the IAEA's own experience in the operation of its Emergency IRS established in 1989.[416] The convention should provide for international control by an international body (possibly, by a subdivision of the IAEA) over the compliance of States with the standards set forth in the convention.

International control over the radiation protection standards does not seem to be a technically complicated endeavor, as opposed to the control over nuclear safety matters. The IAEA experience in the area of safeguards over the peaceful uses of nuclear energy serve as a model for such control. In addition, the experience with the IAEA Radiation Protection Advisory Service (RAPAT)[417] services should be used to establish a body of inspectors.

A convention on nuclear safety would bear a more general and abstract character than the convention on radiation protection. Before international standards on nuclear safety can be drawn, a process of the harmonization of national safety standards (including safety philosophies and operating techniques) should be completed. The experiences of both the IAEA and the Euratom show that harmonization of nuclear safety is difficult in respect to the reactors that have reached the stage of commercial exploitation. The harmonization process is more efficient if it is done with the cooperation of States in researching reactor safety, or specifically in designing and constructing reactors. In this context, it is worth recalling that outside the Euratom (as well as other international organizations), certain States have developed a practice of entering into international agreements on cooper-

416. On the IAEA Emergency IRS, *see supra* notes 158-59 and accompanying text. Another international organization—International Civil Aviation Organization (ICAO)—also has an incident reporting system. Unlike the IAEA Emergency Reporting System, in which participation is general but not obligatory, the ICAO system requires obligatory incident reporting and also includes accident investigation. *See* Rosen, *supra* note 402, at 7.

417. 1 YEARBOOK OF INTERNATIONAL ORGANIZATIONS 785 (Union of Int'l Assoc. ed., 31st ed. 1994).

ation in matters of nuclear safety, more specifically reactor safety. The United States has extensive practice of concluding such agreements.[418]

The convention on nuclear safety should include a special section on the internationalization of nuclear science. States must develop a different approach to the whole area of nuclear research and development (including reactor development and demonstration). An open exchange of research would spare national nuclear sectors from a blind-valley type of development. It is true that the number one reason for the Chernobyl accident was the secrecy in which the national nuclear industry was developing. This atmosphere of secrecy surrounding nuclear science and technology in the then Soviet Union resulted in the suppression of alternative domestic nuclear reactor designs with enhanced safety features, such as Fast Neutron Reactors.[419] Effective coordination of national research in the matters of safety of nuclear reactors should be established.

It would be premature to speak about a system of international verification over nuclear safety matters when there is no unified mandatory system of nuclear safety standards. While the process of harmonizing the safety standards applicable to the existing reactors is under way, a system of international missions to the existing nuclear installations should be established. A good starting point for this is in the Euro-

418. *See, e.g.*, Arrangement on Technical Information Exchange and Research and Development on Reactor Safety, Nov. 21, 1974, U.S.-Swed., 27 U.S.T. 2710; Agreement on Reactor Safety Experiments, Nov. 10, 1976, U.S.-U.K., 28 U.S.T. 6740; Agreement on Reactor Safety Experiments, Jan. 24, 1975, U.S.-other gov. (Fr., Germ., Japan, Den., Fin., Nor. & Swed.), 28 U.S.T. 629; Agreement on Reactor Safety Experiments, Apr. 14, 1977, U.S.-other gov. (Fr., Den., Fin., Nor., Swed. & Neth.), 30 U.S.T. 129; Agreement on Research Participation and Technical Exchange in Reactor Safety, May 2, 1978, U.S.-Fr.-Germ., 30 U.S.T. 7595; Agreement on Technical Information Exchange and Reactor Safety Research, Apr. 26, 1977, U.S.-Germ, 29 U.S.T. 4207; Agreement on Technical Information Exchange on Light Water Reactor Safety Research, Sept. 23, 1974, U.S.-Fr., 27 U.S.T. 3401.

419. Future of Nuclear Energy, *supra* note 354, at 89. After the Chernobyl accident, the European Parliament requested the Commission to "evaluate the feasibility of the wider use in the EC of reactor types with enhanced safety features, [among them] the Fast Neutron Reactors working in France, the United Kingdom and the USSR." *Id.*

pean Community's lead in seeking, independent of drafting binding international agreements, or in the event of it being impossible to reach such agreements, that all States should allow their power plants to be examined by IAEA experts. This should be done, if necessary, without a formal right of appeal.

Operational Safety Review Teams (OSART's)[420] brief must be related more specifically to principles of reactor safety. The teams should also be able to put forward practical and realistic suggestions for improvements. This modified role of OSART presupposes that the teams will no longer be so large and will not be as international in composition, but will comprise only a few, very highly qualified experts with considerable experience. "[R]epresentatives of the operators and manufacturers of nuclear power plants can be involved in safety checks but not safety assessments."[421]

C. Concluding Analysis

A considerable degree of harmonization/internationalization of the regulation of the environmental aspects of nuclear energy has been achieved, especially in the area of radiation protection. This author would probably surprise the reader if at this point she raised the question of how a higher degree of international regulation would contribute to better environmental protection from hazards of nuclear energy. In fact, is it at all possible to guarantee environmental protection through *international* regulation?

The inherent dangers of nuclear energy make some writers on this subject argue that nuclear energy should not and cannot be placed in the list of other sources of energy.[422] According to this point of view, nuclear energy should constitute a separate category of energy sources and be viewed as such. In this context, the reader can ask whether nuclear energy should be treated the way nuclear weapons are treated. The

420. 1 YEARBOOK OF INTERNATIONAL ORGANIZATIONS 785 (Union of Int'l Assoc. ed., 31st ed. 1994).

421. Mutual Assistance, *supra* note 354, at 95.

422. This list includes gas, oil, coal, and hydropower.

comparison between the environmental effects of different sources of energy, including nuclear energy, is valid only until a nuclear accident occurs. The consequences of a nuclear accident would then outweigh the negative effects of all other energy sources combined.

Regardless of how nuclear energy is considered, one has to be aware that nuclear energy is not a given and predetermined reality. It was discovered by the human mind and it is the human mind that has made it serve the various needs of the people, including destructive purposes. Likewise, it is at the discretion of people to decide that the time has come to renounce the use of nuclear energy for any purpose. Any decision of this magnitude is a political decision based on technical and scientific knowledge in this area.

International law will play its role in whatever events occur. In case nuclear energy is renounced, international law would be recruited to provide the legal basis for dismantling nuclear industries and eliminating their heritage. Today, international law should provide for the establishment of the free exchange of information in the area of nuclear energy. This way will enhance public understanding of the problems of nuclear energy and facilitate political decision making. It is important to point out that the more countries, organizations and institutions (governmental and non-governmental) that become involved in the international legal process, the less likely the process will find itself under the influence of a strong international nuclear establishment.