NUCLEAR WASTE MANAGEMENT: THE NEED FOR IMMEDIATE LEGISLATIVE REFORM

INTRODUCTION

One of the most serious, yet most neglected, health issues facing the United States today is the problem of nuclear waste disposal.[1] Ever-increasing energy consumption, coupled with the spiraling cost of oil, has led to greater public acceptance and use of nuclear energy.[2] Growing dependence on nuclear power contains a significant drawback: generation of radioactive wastes at each stage of nuclear fuel cycle. Yet, while production of lethal nuclear wastes continues, no acceptable method of disposal is in use at present.[3]

Despite the absence of adequate nuclear waste technology, management of radioactive wastes has consistently received only haphazard attention from both legislative and regulatory bodies. Relying upon the assumption that science and technology will ultimately provide a nuclear waste solution, agencies at both the state and federal levels have done little to manage increasing accumulations of nuclear wastes. Thus, even if demand for nuclear energy

1. The major classes of nuclear wastes are:

   High Level Wastes (HLW) are either intact fuel assemblies that are being discarded after having served their useful life in a nuclear reactor (spent fuel) or the portion of the wastes generated in the reprocessing of spent fuel that contain virually all of the fission products and most of the actinides not separated out during reprocessing. These wastes are being considered for disposal in geologic repositories or by other technical options designed to provide long-term isolation of the wastes from the biosphere.

   Transuranic (TRU) Wastes result predominantly from spent fuel reprocessing, the fabrication of plutonium to produce nuclear weapons, and, if it should occur, plutonium fuel fabrication for recycle to nuclear reactors. TRU waste is material containing more than ten nanocuries of transuranic activity per gram of material. These wastes would be disposed in a similar manner to that used for high level waste disposal.

   Low Level Wastes (LLW) contain less than ten nanocuries of transuranic containments per gram of material, or they may be free of transuranic contaminants, require little or no shielding have low, but potentially hazardous, concentration or quantities of radionuclides. Low level wastes are generated in almost all activities involving radioactive materials and are presently being disposed of by shallow land burial.

   Uranium mine and mill tailings are the residues from uranium mining and milling operations which contain low concentrations of naturally occurring radioactive materials. The tailings are generated in very large volumes and are presently stored at the site of mining and milling operations.

   Gaseous effluents are released into the biosphere and become thereby diluted and dispersed.

   The useful life of a nuclear power plant is 30-40 years. At the end of that time, decontamination and decommissioning (D&D), an activity that congenerate significant quantities of wastes, must occur. These wastes are voluminous, however, they are not unique and are categorized in the same manner as explained above. *See, generally: The Report to the President by the Interagency Review Group on Nuclear Waste Management,* March 1979 [hereinafter cited as *IRQ Report*].
2. R. Stobaugh and D. Yergin, *Energy Future: Report of the Energy Project at the Harvard Business School* at 7 (1979).
3. On February 12, 1980, President Carter set forth a proposed fifteen-year program for nuclear-waste storage and disposal. In a message to Congress, the President stressed the technological inadequacy and political unacceptability of past government efforts in this area. The plan proposed selection of the first disposal site by 1985, with final completion date of 1995. It advocated continued, intensive research and development on varying sites and disposal media; at the same time it recommended cancellation of the test disposal facility located at Carlsbad, New Mexico, the Waste Isolation Pilot Plant. By executive order, Mr. Carter established a nineteen-member State Planning Council, composed of state governors and federal officials, to alleviate political pressures on the waste issue, N.Y. Times, Feb. 13, 1980, at A1, Col. 1. *See* text accompanying notes 7-8, 63-85, *infra.*

decreases after the Three Mile Island accident,[4] the search for safe and reliable disposal methods requires immediate legislative guidance. If reliance on nuclear energy expands, the need for such waste disposal methods becomes even more critical.

This note will consider the problem of nuclear waste management by first reviewing the process of nuclear energy production. It will examine the existing regulatory framework and its deficiencies in dealing with nuclear waste disposal. The note will then discuss prospects for technological solutions for waste disposal. Finally, it will recommend possibilities for legislative resolution of the problem and review pending legislation.

WASTE GENERATION: A BYPRODUCT OF THE NUCLEAR FUEL CYCLE

The recent accident at Three Mile Island has heightened public concern over the safety of harnessing atomic energy. Despite increased attention, one of the most dangerous and problematic aspects of the nuclear industry, nuclear waste disposal, remains neglected.

Radioactive wastes, unavoidable byproducts of nuclear power,[5] are "[t]hose radioactive materials which are of sufficient potential hazard that they require special care and are of no present economic value to the nuclear industry."[6]

As nuclear power plants produce electricity,[7] they generate approximately thirty tons of highly radioactive wastes each year.[8] The lack of a definite waste-management program has resulted in an ever-growing accumulation of nuclear wastes, for which no disposal program has ever been formulated.

Yet, even more serious than the volume of the waste is its lethal character derived from its radioactive nature.[9] The exact cause-effect relationship of exposure to radioactive materials is not readily identifiable because it often

4. N.Y.Times, Mar. 29, 1979, at 1, col. 2; N.Y.Times, Mar. 30, 1979, at 1, col.2; N.Y.Times, Mar. 31, 1979, at 1, col.3.
5. Bishop, *Observations and Impressions on the Nature of Radioactive Waste Management Problems*, Essays on Issues Relevant to the Regulation of Radioactive Waste Management, NUREG-0412, 52 (1978) [hereinafter cited as NUREG-0412].
6. Joint Committee on Atomic Energy, *Report Assessing the Policies, Plans and Programs of the Executive Branch for the Safe Storage and Disposal of Radioactive Wastes Produced in the Commercial Nuclear Fuel Cycle*, Enclosure B, 94th Cong., 1st Sess. 83 (1975).
7. Nuclear energy is produced in commercial reactors through the process of splitting uranium atoms which releases energy in the form of heat. The "converter reactors" use the generated heat to boil water, creating steam to turn large turbine shafts that generate the production of electricity. Because ordinary or "light" water is used to control the heat and production of energy, the reactors are often referred to as "light-water reactors." Present commercial reactors are referred to as "converter reactors" because they convert fissionable fuel into energy; they are distinguished from "breeder reactors" which can produce their own fuel. U.S. Dep't of Energy, Factsheet 12, Conventional Reactors [hereinafter cited as DOE Factsheet].
8. *See, e.g.*, Cohen, *High-Level Radioactive Waste from Light Water Reactors*, 49 Rev. Mod. Physics 1 (1977).
9. Toxicity is determined by the quantity of radioactive material; the concentration of radionuclides in the waste, the half-lives of the radionuclides and the amount of exposure to the radioactive waste. *See, e.g.*, Office of Radiation Programs, U.S. Environmental Protection Agency, Considerations of Environmental Protection Criteria for Radioactive Waste: Background Report 7 (1978).

takes the human body years to manifest its reaction.[10] One known effect is genetic damage which may take the form of uncontrolled cellular growth—that is cancer.[11] There is no method for modifying the duration of toxicity of the wastes; this unalterable period may be as long as a half million years.[12]

There are several stages of the nuclear fuel cycle. Wastes are unavoidably produced at each of the many stages, including the mining of uranium,[13] the milling[14] and enriching[15] of the uranium ore, and the fabricating[16] of fuel rods. Wastes pose the most intricate conundrums at the "back-end" of the fuel cycle, which involves waste management and decommissioning.

Most power plants operate on a three-year cycle, demanding that one-third of the fuel rods be removed and replaced each year.[17] The plants were originally designed to temporarily store used fuel rods, called spent fuel, in water-cooled pools[18] while some of the most intense, but short-lived, radioactivity decays. The spent fuel would then be packaged and shipped to reprocessing centers where the still useful fissionable fuel would be recovered.[19]

The reprocessing option was indefinitely postponed in 1977 when President Carter issued a directive expressly forbidding recycling of spent nuclear

10. Delayed reaction to radiation exposure has resulted in the failure of most to appreciate and understand the magnitude of the inherent dangers of radioactivity. Further, once released into our biosphere, there is little if anything that can be done to halt the spiraling effect of its damage. Radionuclides released into the biosphere through air, water or soil contamination in very minor doses may enter into the food chain and concentrate along the way to cause fatal damage to humans and lower life forms. Different chemicals are often concentrated by an organism in different cells or organs, for example calcium is concentrated in the bones, and iodine in the thyroid. Therefore even if a radioactive chemical is diluted before being released into the biosphere it could be concentrated on the way up the food chain. Two radionuclides are often cited as the most dangerous not only because of their abundance and longevity but because strontium, like calcium, deposits in the bones, and cesium, like potassium, in the muscles and nerves. Passing from living organism to living organism radioactive waste will reappear in man's food chain at unpredictable times and places for centuries. *See* S. Novick, *The Careless Atom* (1969).
11. Plutonium, one of the major byproducts of the nuclear fuel cycle, is among the most dangerous known carcinogens. Today, more than thirty years after the nuclear holocausts at Hiroshima and Nagasaki, the areas are plagued with extrordinary rates of leukemia and other cancers attributed to radiation exposure. *See* NUREG-0412 *supra* note 5, at 60,67.
12. *Id.*
13. The uranium currently used in nuclear reactors is a rare isotope, uranium235, which comprises less than one percent of common uranium ore. Uranium occurs in most rock: therefore, the nuclear fuel cycle begins with an attempt to locate ore that is rich enough to mine, a concentration of approximately two percent. Uranium is mined in a manner similar to that of coal, and many of the problems are similar: scarred landscapes, disposal of removed materials, revegetation, poor working conditions and dangers in the underground mines. See P. Ehrlich, A. Ehrlich and J. Holdren, *Ecoscience* (3d ed 1977) [hereinafter cited as *Ecoscience*].
14. The raw ore is then "milled" or concentrated into a product that is about eighty percent uranium. This process leaves behind a large quantity of mildly radioactive and chemically toxic liquid wastes and a solid residue referred to as "mill tailings." *See:* Comey, *The Legacy of Uranium Tailings* (1976).
15. The natural uranium that has been "milled" then undergoes an enrichment process to increase the concentration of uranium235 from 0.7 percent to approximately three percent. This fuel-producing process, "gaseous diffusion," converts the ore to gaseous uranium hexafluoride. The byproducts of this stage of the fuel cycle, referred to as "tails," consist largely of uranium238 *See: Ecoscience, supra* note 13, at 434-435.
16. Converter reactors require, that the fuel be fabricated into solid pellets and placed within fuel rods. This process, though not inherently environmentally perilous, is extremely delicate and contains the potential for enormous danger without utmost exercise of caution. *Id.*
17. *See, e.g.,* DOE Factsheet *supra* note 7.
18. Jakimo and Bupp, "Nuclear Waste Disposal: Not in My Backyard," Harvard Graduate Sch. Bus. Ad. Tech. Rev., March-April 1978. The President's recently proposed fifteen-year program for waste disposal *(see* note 3, *supra)* calls for storage of nuclear wastes in reactor-site cooling pools pending the operation of a permanent disposal facility. Given the fact that these on-site pools have served in this capacity for years, this proposal amounts to no more than tacit approval of the status quo. N.Y. Times, Feb. 13, 1980, at Al, col. 1. *See also* text accompanying notes 21-25, *infra.*
19. Bupp, "The Nuclear Stalemate," in *Energy Future: Report of the Energy Project at the Harvard Business School,* 122, 127 (R. Stobaugh and D. Yergin eds. 1979) [hereinafter cited as Bupp].

fuel.[20] This decision intensified the burden of discovering a nuclear waste solution since previous research had relied on reprocessing to neutralize the threat of spent fuel.

As a result of the termination of the reprocessing alternative, most commercial wastes are accumulating at reactor sites. Such facilities were originally designed to hold the equivalent of approximately five years of spent fuel.[21] Consequently, the majority of nuclear power plants have redesigned their aqueous cooling systems.[22] This alteration involves racking the spent fuel rods more closely. While allowing higher density storage, the re-racking process significantly alters the waste-to-water safety ratio.[23]

Recent criticism of this technique by the President's Commission on the Accident at Three Mile Island[24] may soon curtail licensing of the re-racking option. In any event, redesign of the holding tanks, at best, will only permit temporary relief from the problem of spent fuel storage, as most on-site facilities will be filled by 1985 and several by 1983.[25]

In addition to the wastes generated at reactor sites, the U.S. will soon be receiving wastes generated at foreign nuclear power plants. Under its policy for international cooperation on atomic power, the United States contracts to receive nuclear wastes whenever power plants are sold to another nation.[26] Once again, the desire to restrain weapons proliferation has, unwittingly, intensified the urgency of the waste management dilemma.

Notwithstanding the fact of limited storage space in the on-site cooling systems, their use as de facto long-term repositories increases the threat of leakage of toxic wastes because of the potential corrosion of the waste canisters. This danger underscores the need for an alternative waste storage solution. A waste management program must be initiated immediately.

DEVELOPMENT OF NUCLEAR POWER: A HISTORICAL PERSPECTIVE

Nuclear research and development in the United States originated under the auspices of the U.S. Army during the Second World War. Led by Enrico Fermi, this research resulted in the first manual atomic reaction at the University of Chicago in 1942.[27] The Manhattan Project, a top secret government project designed to produce the atomic bomb, was unveiled with the bombing of Hiroshima in August of 1945.

20. Directorate of Energy Research, U.S. Department of Energy, *Draft Report of the Task Forces for Review of Nuclear Waste Management* 45, 48 (1978). Fears that reprocessed plutonium might be used for the proliferation of nuclear weapons or an illicit seizure by terrorists for manufacture of atomic bombs prompted the presidential veto.
21. Bupp *supra* note 19, at 127.
22. *Ecoscience, supra* note 13, at 449.
23. As of early 1979, fifteen utilities received permission to increase their storage capacities. NRC, Proceeding From the NRC—IAEA Spent Fuel Storage Meeting (NUREG-0498) II-12 (1978).
24. Newsweek, Nov. 12, 1979, at 38; N.Y. Times, Oct. 31, 1979, at Al, col. 6.
25. *See* Bupp *supra* note 19, at 128.
26. *Id.* Due to concerns that the export of nuclear technology leads to proliferation, some Carter Administration officials have suggested that these nuclear exports be more closely supervised, reducing or stripping the NRC of its power of review in this area. N.Y. Times, Feb. 11, 1980, at A16, col. 2.
27. Bupp *supra* note 19, at 113.

After the war, Congress passed the Atomic Energy Act of 1946.[28] The Act placed fissionable nuclear materials within the exclusive control of the federal government and mandated a research and development program aimed at the expansion of technical knowledge of nuclear theory and processes.[29] The Atomic Energy Commission (AEC) was established to assure continued scientific progress regarding civilian uses of nuclear power.[30]

In the early fifties, President Eisenhower launched an "Atoms for Peace" program, thereby making a commitment to commercial use of nuclear energy.[31] The resulting legislation replaced the 1946 Act and eliminated the federal government's monopoly over civilian uses of nuclear materials.[32] Called the Atomic Energy Act of 1954,[33] it gave the AEC the conflicting responsibilities of both promoting atomic energy and protecting the public from its health and safety dangers.[34]

The AEC encouraged the growth of the atomic energy industry through massive funding.[35] As a result, the first commercial atomic reactor succeeded in generating electricity in 1957 at Shippingport, Pennsylvania.[36] American utilities began ordering nuclear power plants in 1965.[37] Today, there are seventy-two reactors in operation in the United States, supplying the nation with thirteen percent of its total output of electricity.[38]

REGULATION OF NUCLEAR WASTE DISPOSAL: OVERVIEW AND ANALYSIS

A. Statutory Scheme

Licensing for nuclear power generation has never been linked to the ability to dispose of nuclear waste products. Indeed, not until 1973 did the AEC request any type of legislated controls for waste disposal sites.[39] Congress responded by passing the Federal Energy Reorganization Act of 1974,[40] which was the first Congressional act explicitly addressing the nuclear waste issue.

28. Atomic Energy Act of 1946, ch. 724, 60 Stat. 755 (1946).
29. Several corporations including Westinghouse Electric Corporation and General Electric Company conducted research programs under the direction of the Atomic Energy Commission during the period 1946-1954. Their work greatly enhanced the state of technology regarding construction and design of nuclear reactors. Raymond L. Murray, *Nuclear Energy: An Introduction to the Concepts, Systems and Applications of Nuclear Processes* (1975).
30. The legislative history for the Atomic Energy Act of 1954 compares the "perspective of 1946 and that of 1954: It was commonly believed 8 years ago that the generation of useful power from atomic energy was a distant goal, a very distant goal . . . . Statutory provisions which were in harmony with the state of atomic development in 1946 are no longer consistent with the realities of atomic energy in 1954." S. Rep. No. 1699, 83d Cong., 2d Sess., *reprinted in* [1954] U.S. Code Cong. & Ad. News 3456, 3458, 3459.
31. NUREG-0412 *supra* note 5, at 78.
32. 42 U.S.C. § 2011(b) (1976).
33. 42 U.S.C. §§ 2011-2296 (1976).
34. S. Rep. No. 95-164, 95th Cong., 1st Sess., *reprinted in* [1977] U.S. Code Cong. & Ad. News 854, 855-857.
35. *See* 42 U.S.C. §§ 2012(g), 2051 (1976).
36. Bupp *supra* note 19, at 114.
37. *Id.*, at 115.
38. N.Y.Times, Oct. 31, 1979, at A22.
39. [1973] AEC Ann. Rep. 61, 62-63. Early regulatory policy consisted of a series of *ad hoc* decisions. In 1970, the AEC undertook formalization of regulatory policy regarding radioactive wastes. The AEC took over an experimental disposal site, developed by the Oak Ridge National Laboratory, constructed in an abandoned salt mine near Lyons, Kansas. Political opposition necessitated discontinuance of the Lyons project.

The policy elected to fill the vacuum advocated development of Retrievable Surface Storage Facilities (RSSF); upon construction of a permanent federal repository, wastes would be transported to that site for ultimate disposal. This proposal was incorporated into the Energy Reorganization Act of 1974. However, the EPA doubted that RSSF would actually be used on an interim basis, given the financial investment required. *See* NUREG-0412 *supra* note 5, at 2-3.
40. 42 U.S.C. §§ 5801-5891 (1976); 5 U.S.C. §§ 5313-5316 (1976).

The 1974 Act abolished the AEC and split developmental and regulatory functions between two new agencies.[41] The first of these, the Energy Research and Development Administration (ERDA), assumed the duties of developing adequate waste technology and of creating proper disposal sites.[42] The second agency, the Nuclear Regulatory Coimmission (NRC), was authorized to evaluate waste disposal proposals[43] and to license waste disposal facilities.[44]

These reforms were short-lived, however. Shortly after passage of the 1974 Act, the Environmental Protection Agency (EPA) rejected ERDA's nuclear waste proposals.[45] This assessment rendered the Act ineffectual, for ERDA was unable to propose a suitable alternative policy during its remaining years of existence.[46] The NRC, moreover, determined that Congress intended its licensing authority to be prospective only.[47] As a consequence, existing disposal facilities remained unregulated.

The resulting policy vacuum was only partially filled by the passage of the Department of Energy Organization Act of 1977.[48] which created the Department of Energy (DOE). As successor to ERDA, the DOE inherited ERDA's responsibilities regarding waste policy formulation. Supervision of existing waste facilities and development of permanent disposal facilities were also placed within the purview of the DOE.[49] Regulatory responsibilities of the NRC were left intact.

This new legislative framework has proven inadequate to resolve the waste disposal stalemate. Only with regard to uranium mill tailings has remedial action been taken for wastes generated during the nuclear fuel cycle. Passage of the Uranium Mill Tailings Radiation Control Act of 1978[50] resulted in prompt promulgation[51] of regulatory controls for the accumulating mill wastes.[52] Hence, express legislative authorization appears to be the stimulus necessary to spur progress toward ultimate waste disposal.[53]

41. 42 U.S.C. § 5801(b) and (c) (1976).
42. The statutory delegation of authority did not specifically mention nuclear waste management. *See* 42 U.S.C. § 5813 (1976). ERDA, however, undertook the "responsibility of developing, demonstrating, implementing and operating high-level radioactive waste repositories." *Workshop Materials for State Review of USNRC Site Suitability Criteria for High-level Radioactive Waste Repositories* 17, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, NUREG-0326, 13 (1977) [hereinafter cited as NUREG-0326].
43. 42 U.S.C. § 5842(3) (1976) and 42 U.S.C. § 5843(b) (1976).
44. *Id.* This licensing authority encompasses two stages: first, at construction and second, for operation.
45. NUREG-0412 at 3-5. The EPA criticized ERDA's proposals for temporary RSSF *(see* note 39, *supra).*
46. ERDA was not specifically given authority to compose plans for nuclear waste disposal, outside of those within the 1974 Act itself at 42 U.S.C. § 5842 (1976). For the areas of authority delegated to ERDA, *see* 42 U.S.C. § 5813 (1976).
47. This decision was affirmed in Natural Resources Defense Council v. Administrator, 451 F. Supp. 1245 (D.D.C. 1978). The Court stated that the NRC licensing authority is triggered at that time when sites are designated as part of ERDA's ultimate management plan for nuclear wastes. (42 U.S.C. § 5842(4) (1976).) A separate case, Natural Resources Defense Council v. U.S. Nuclear Reg., 582 F.2d 166 (2d Cir. 1978), approved a decision by the NRC regarding regulation of temporary holding tanks located near reactor sites. The cases may be distinguishable because of differences in NRC authority to grant licenses for disposal sites, as opposed to licenses for operating reactors. Licensing of reactors includes regulation of on-site holding tanks for safety, as well as for storage, purposes.
48. 42 U.S.C. §§ 7101-7351 (1977 Supp.).
49. 42 U.S.C. § 7133(a) (8) (C) (1977 Supp.).
50. 42 U.S.C.A. §§ 7901-7942 (West Supp. 1978).
51. *See* 44 Fed. Reg. 50,015 (1979) (to be codified in 10 C.F.R. §§ 30.33, 40.1-40.32, 70.23, 150.3, 150.15, 150.31-150.32, 170.2-170.3).
52. Mill tailings contain, proportionately, only small amounts of naturally occurring radiation and thus pose fewer technological unknowns in their disposal. *See* H.R. Rep. No. 95-1480, 95th Cong., 2d Sess. 25, *reprinted in* [1978] U.S. Code Cong. & Ad. News 7433, 7452.
53. *See IRG Report, supra* note 1, at 22-23.

B. Regulatory Framework

Existing agency regulations on management of nuclear wastes also reflect the lack of comprehensive legislation on nuclear waste disposal. Regulations presently in effect are cursory and limited in applicability, for none of the disposal procedures outlined can safely accommodate highly irradiated wastes. Current regulations pertain only to aqueous radioactive wastes created during reprocessing[54] or to slightly contaminated wastes posing a less significant environmental threat.[55]

Recent pronouncements by the NRC, however, foreshadow the genesis of effective regulatory policy on nuclear waste. For example, NRC regulations of August 2, 1979, require that the socioeconomic consequences of nuclear plants on local communities be assessed prior to licensing.[56] In addition, environmental effects of nuclear wastes must now be analyzed as a condition to NRC licensing of reactor construction. Furthermore, on October 25, 1979, the NRC published a proposed regulation relating development of waste storage facilities to reactor licensing.[57]

Despite such hopeful signs, fragmented legislative and regulatory policy can only foster the impasse over nuclear waste disposal.[58] Three agencies—the DOE, EPA and NRC—now share in regulation of the nuclear industry. Congress has further complicated these agencies' exercise of delegated authority by creating both overlaps and unnecessary constraints of functions.[59] As one example, the DOE, while given primary responsibility over waste-policy formation, is subject to the NRC's prerogative to provide advisory input.[60] The weight to be accorded such advice, however, depends on the discretion of the DOE. As another example, EPA guidelines regarding acceptable levels of environmental radioactivity measure the adequacy of both DOE programs and NRC regulations. However, at this time EPA approval is impossible, for the agency has promulgated no radiation protection standards for high-level waste disposal.[61] Not until November 1978, in fact, did the EPA propose criteria simply defining types of radioactive waste.[62]

54. 10 C.F.R., Part 50, Appendix F (1979).
55. 10 C.F.R. §§ 20.301-20.305 (1979). Although the low concentrations of radioactivity of these wastes do not pose grave technological problems, the lack of uniformity in both method and enforcement has resulted in leakage problems. In recent years more than 3,000,000 cubic feet of low-level waste have been buried annually. The IRG has recommended initiation of a coordinated national program for low-level waste management and research and development for improved and alternative disposal methods. *IRG Report, supra* note 1, at 77-80.
56. 44 Fed. Reg. 45,362 (1979) (to be codified in 10 C.F.R. §§ 51.20, 51.23).
57. 44 Fed. Reg. 61,372 (1979) (to be codified in 10 C.F.R., Parts 50, 51). This notice was in response to State of Minnesota v. NRC, No. 78-1269 (D.C. Cir. 1979).
58. *See: IRG Report, supra* note 1, at 22.
59. New regulations also risk dilution through interpretation. *See e.g.,* 44 Fed. Reg. 45,362 (1979). For instance, previous applications of the NRC test enforcing radiation standards, which restricts radiation exposures to a level "as low as reasonably achievable," (*see* 10 C.F.R. § 20.1 (c) (1979)) have been translated into a more fluid cost-benefit analysis.
60. NUREG-0326 *supra* note 42, at 7-9.
61. The EPA first announced its intention to propose environmental radiation protection standards for high-level radioactive waste at 41 Fed. Reg. 53,363 (1976) (to be codified at 40 C.F.R., Part 260). At 43 Fed. Reg. 2,223 (1978), the agency reiterated this goal, stating that it had "now developed an initial formulation of proposed guidance for radioactive waste storage and disposal." In late 1978, the EPA published its proposed "environmental protection criteria for storage and disposal of all forms of radioactive waste" and invited public comment (43 Fed. Reg. 53,262 (1978)). The EPA has not yet published a finalized set of these radiation protection standards, as required by 42 U.S.C. § 2021(h) (1976).
62. 43 Fed. Reg. 53,262 (1978). Previously, waste disposal had been specifically excluded from EPA regulation. *See* 40 C.F.R. § 190.02(b) (1979).

PROSPECTS FOR TECHNOLOGICAL SOLUTIONS FOR NUCLEAR WASTE DISPOSAL

Present technology suggests several solutions, some viable, others merely conjectural. The Report to the President by the Interagency Review Group on Nuclear Waste Management (hereafter "IRG Report")[63] evaluated six technical strategies for ultimate disposal of radioactive wastes: placement in mined repositories,[64] placement in deep ocean sediments,[65] placement in very deep drill holes,[66] placement in mined cavities leading to rock melting,[67] partitioning of reprocessed reactor wastes and geologic disposal of fission products,[68] and ejection into space.[69] The IRG concluded that each of these techniques requires further research and development.[70]

For the present, the IRG Report has recommended that the first high-level waste disposal facilities be mined repositories.[71] Although bedded salt has long been considered the primary medium for permanent waste disposal, the stability, and hence the safety, of salt repositories is now in question.[72] Thus, the IRG endorsed geohydrologic analysis of various disposal media in trial disposal projects. Prior to the selection of permanent depository sites, the IRG suggested that wastes be stored only in facilities permitting retrieval.[73] Concurrently, research and development would proceed on alternative disposal options.[74]

63. The Interagency Review Group was formed by President Carter in 1977. Based upon the DOE's Draft Report of Task Force for Review of Nuclear Waste Management, it was to outline administrative policy and programs in radioactive waste management. It was assisted by a Technical Advisory Committee. The group itself included representatives of DOE, EPA, NRC, Department of Commerce, Department of the Interior, Department of State, Department of Transportation, National Aeronautics and Space Administration, Arms Control and Disarmament Agency, Office of Management and Budget, Council on Environmental Quality, Office of Science and Technology Policy, Office of Domestic Affairs and Policy, National Security Council.
64. Placement in mined repositories is the most advanced technical option. It involves isolation of wastes in geologic bed rock. Although technology appears competent to make initial site (media) selection, additional research on waste forms and engineered barriers between the wastes and the environment is needed. *IRG Report, supra* note 1, at 37-39, 41-43.
65. Placement in deep ocean sediments is similar to disposal in mined repositories, except that burial takes place in geologic bedrock below the ocean bed. The necessity of ocean transport is a further hazard associated with this method of disposal *Id.*, at 35.
66. The very deep hole concept isolates waste in geologic bed rock by lowering wastes through a long shaft. Questions regarding engineering capability and rock strength which are affected by pressures and temperatures of radioactive wastes restrain use of this option; however, it may present a feasible alternative for high-level wastes within 15-20 years. It could not accommodate large volumes of low-level and transuranic wastes. *Id.*
67. High-level wastes are placed in underground cavities at great depth. The intense heat from radioactive decay causes the surrounding rock to melt, eventually dissolving the wastes. Over time the rock refreezes into a relatively stable molecular matrix. Significant technological and engineering break-throughs are necessary before rock melting is a feasible option. Again, disposal of large volumes is probably unrealistic with this proposal. *Id.*
68. Reprocessing involves separation of reusable plutonium and uranium residues in spent fuel from the highly irradiated fission waste products. The reusable residues are theoretically recycled into other reactor fuel cores, while the fission products are permanently stored. This option was ruled out by the President's Spent Fuel Policy; the IRG recommended vigorous pursuit and legislative action on this policy. *Id.*, at 99.
69. This exotic solution offers the attractive advantage of permanent isolation of wastes from earth's environment. However, serious questions of safety and environmental impacts and of energy efficiency plague its development. This option exists largely in concept only. *Id.*, at 35.
70. *Id.*, at 42-44.
71. *Id.*, at 61. The IRG Report developed an Interim Strategic Planning basis in accord with the National Policy Act (42 U.S.C. § 4332(1)(c) (1975)); this program stressed two goals: technological conservation and steady progress toward long-term disposal.
72. *Id.* at 38-42. *See also: National Waste Terminal Storage Program: Office of Nuclear Waste Isolation Technical Program Plan.* Vol. 1., Office of Nuclear Waste Isolation, U.S. Department of Energy, ONWI-19, Feb. 16, 1979 [hereinafter cited as ONWI-19].
73. *IRG Report, supra* note 1, at 57.
74. *Id.*, at 35-36.

The DOE, in its Draft Environmental Impact Statement on Management of Commerically Generated Radioactive Waste (hereafter, "DOE Statement"),[75] concurred in the need for further nuclear waste research and in the use of geologic disposal. As the mass of scientific data deals with geologic disposal, the DOE placed even greater reliance on geologic disposal than did the IRG.[76]

The DOE advocated immediate action toward creation of a geologic depository, considering other disposal options as no more supplements to geologic disposal.[77] Nevertheless, the agency did suggest four other options, in addition to the six strategies studied by the IRG: chemical resynthesis,[78] island disposal,[79] icesheet disposal[80] and reverse-well disposal.[81]

Aside from the development of suitable nuclear waste technology, a second constraint on resolution of the waste-disposal dilemma is posed by political dissension. Scientific debate over the existence or potential development of technologically safe disposal methods[82] translates into a political clash stymieing legislative resolution of the issue. Reliance upon assertions that dependable waste technology is presently available, moreover, is often disputed on the basis of the repeated leakages at existing disposal sites.[83] Such discord is

75. *Draft Environmental Impact Statement on the Management of Commercially Generated Radioactive Wastes,* U.S. Department of Energy, DOE/EIS-0046-D, April, 1979 [hereinafter cited as *DOE Statement*].
76. *Id. at 1.1. See also: Earth Science Technical Plan for Mined Geologic Disposal of Radioactive Waste,* Office of Nuclear Waste Management, U.S. Department of Energy and U.S. Geological Survey, U.S. Department of the Interior, TID-29018 (Draft), January, 1979 [hereinafter cited as *Technical Plan*].
77. *DOE Statement, supra* note 75, at 1.7. The DOE has proposed that the earliest waste facilities be test facilities for research purposes. *See Technical Plan, supra* note 76, at 50.
78. The DOE defines this option as a variation of geologic disposal. It involves alteration of nuclear wastes into synthetic minerals chemically designed for compatibility with the host rock. Resynthesis would render wastes inert and insoluble, enhancing the safety factor. Potential reduction in risk must be balanced against the need for substantial research and costs of implementation. *DOE Statement, supra* note 75, at 1.23-1.24.
79. Island disposal refers to conventional geologic disposal in stable crystalline rock formations beneath deserted islands. The necessity of sea transportation complicates use of this option. *Id.*, at 1.26.
80. Although disposal of nuclear waste beneath polar ice-sheets offers the advantage of remoteness from population centers, the uncertain interactions between glacial masses and nuclear wastes pose a major obstacle to the future of this disposal option *Id.*, at 1.27.
81. Reverse-well disposal comprehends two distinct techniques. In the first liquid waste is injected into a porous rock layer completely overlain by impermeable rock. The second method proposes injection of a mixture of waste, clay, cement and other substances into shale; the wastes are entrapped in that shale stratum as the mixture solidifies. These techniques are employed by the oil and gas industry, indicating technological feasibility. Nevertheless, they are impracticable to the extent that the volume of low-level and transuranic waste could not be accommodated. Twenty-eight states either regulate or prohibit this disposal method. *Id.*, at 1.28-1.29.
82. NUREG-0412 *supra* note 5, at 21.
83. Massive leakages have been reported at the Hanford, Washington Reservation, one of three military waste disposal sites. Minor leakages have been detected at the Savannah River Plant at Aiken, South Carolina; the Idaho Falls, Idaho site, providing storage for about three percent of defense wastes, has experienced no leakage. Metlay, NUREG-0412 *id.*, at 1; Jaksetic, *Legal Aspects of Radioactive High-level Waste Management,* 9 Envt'l L. J. 347 (1979).

evidenced by state statutes limiting repository development.[84] The fundamental question is one of risk assessment.[85]

RECOMMENDED LEGISLATIVE SOLUTIONS

From the previous discussion it is clear that resolution of the nuclear waste dilemma will be achieved only in response to a strong, legislated catalyst. Only a potent stimulus can effect replacement of the present fragmented regulatory scheme by a comprehensive framework for waste disposal.

Though controversial, an initial measure is the imposition of an immediate moratorium on licensing further construction and operation of nuclear reactors pending the opening of temporary waste-storage facilities. A linkage between licensing of nuclear power plants and disposal of their waste products would pressure private industry into partially accepting the burden of developing waste technology. Imposition of a moratorium would hasten technological advances in feasible storage and disposal methods.

Another advantage of such a moratorium would be official recognition of the presently de facto suspension of nuclear plant construction, as it would dramatize the need for a legislated waste policy. Given the present lack of actual storage space for future nuclear wastes, generation of more wastes from plants now under construction would be logistically imprudent. Hopefully, this moratorium would also spur concentrated development of renewable energy resources.

Secondly, any legislated waste-management program[86] must clearly delineate responsibilities among the federal agencies involved.[87] The existing decentralization of policy formation and the lack of communication among relevant federal, state and local agencies calls for, at the very least, a thoughtful reorganization of the supervisory agencies. Such revamping would eliminate overlapping functions and assign specific tasks according to a realistic timetable.[88] A second, frequently suggested alternative is the creation of an entirely new agency, free of the promotional philosophy of the NRC. This proposal is flawed by the transitional period required for the creation of any new agency.

84. State statutes regarding limitations on high-level-waste disposal fall into three general categories: laws banning construction of repositories within the state's borders, laws requiring state approval prior to construction of repositories within the state's borders, laws controlling various aspects of disposal within the state. For express prohibitions on waste disposal, *see* the following category one statutes: Mich. Stat. Ann. § 14.528 (351) (Callaghan Supp. 1979); Or. Rev. Stat. § 469.525 (1977). In the second category *see:* Minn. Stat. Ann. § 1160.72 (West Supp. 1979); S.D. Comp. Laws Ann. § 34-21-1.1 (Allen Smith 1977); Vt. Stat. Ann. § 10.6501 (Equity Supp. 1979). Included in the various regulations comprising category three are Conn. Gen. Stat. Ann. § 19-409d (West Supp. 1979), Ga. Code Ann. § 88-1302 (b) (1) and § 88-1306.1 (Harrison Supp. 1979), Minn. Stat. Ann. § 116C.73 (West Supp. 1979), Mont. Rev. Code Ann. §§ 69-5817— 69-5821 (Allen Smith Supp. 1977).

Statutes in two other states link construction of nuclear reactors to resolution of waste-disposal problems; *see* Cal. Publ. Res. Code § 25,524.2 (West 1977) and Me. Rev. Stat. §§ 10.253—10.256 (West Supp. 1979).

85. Bupp *supra* note 19, at 128. Such considerations have delayed the projected completion date for a high-level-waste repository from the original date of 1985 first to 1988 and now in the President's proposed fifteen-year plan *(see* note 3, *supra)* to 1995. *See* N.Y. Times, Feb. 13, 1980, at Al, col. 1.

86. A precise definition of nuclear waste, as generated at each step of the nuclear fuel cycle, is prerequisite to reconsideration of statutory grants of authority, however. Extension of the regulatory agency's authority to military wastes also presents a consideration.

87. The President's Commission on the Accident at Three Mile Island criticized the absence of a "well-thought-out, integrated system" within the NRC, recommending a "total restructuring of the agency." N.Y. Times, Oct. 31, 1979, at A22, col. 1.

88. For a suggested timetable, *see* ONWI-19 *supra* note 72, at VI-1.

Therefore, a comprehensive waste-management plan should aim at reform of the federal regulatory network. To avoid uncoordinated agency action, regular inter-agency conferences should be established for review of nuclear waste policy. Meeting at monthly intervals, such conferences should assure steady progress according to an established timetable.[89] They would provide exchange of technical assistance and information and delegate specific responsibilities to designated administrators. Finally, published reports of these conferences should be made available to the public.

A third legislative need is funding for intensive research and development on waste disposal. Disposal methods for all types of nuclear waste—including tailings, low-level waste, transuranic waste, high-level waste and spent fuel—must be developed. This research should be consolidated under the aegis of one agency—the DOE.[90] To achieve the most expeditious solution possible, the United States should actively pursue international exchange of nuclear waste technology.

Further study of the reprocessing option is also needed so that a determination as to its utility and safety may be made. The ramifications of reprocessing, which are largely political in nature, must be explored in the meantime as a basis for final decision. At present, plans for waste disposal should proceed under the assumption that reprocessing is not an option in accordance with the President's spent fuel policy.[91] A stalemate on this issue must not impede progress towards an ultimate solution to the problem of disposal of nuclear wastes.

A fourth legislative objective should be authorization of regionally based, interim storage facilities.[92] Such facilities would be temporary in nature, permitting retrievability upon final selection of permanent disposal methods. Given the present state of technology, early storage facilities should be geologic repositories and be sited in geologically safe areas, remote from population centers.

Finally, legislation regarding waste policy must effectively defuse political opposition, a major obstacle to it adoption. Channels for expression of public opinion and for arbitration of disagreements are vital to political consensus. Reduction of dissent is imperative, for in certain areas the overriding need for environmentally safe disposal facilities may dictate site selection over local opposition. Use of an absolute state veto on this could bring any federal waste program to a standstill.

Thus, an effective waste disposal program must include a formal arbitration process for resolution of disputes over selection of disposal sites. A task force, composed of representatives of the federal regulatory agencies (DOE, EPA, NRC), the state or tribal government[93] involved, and local citizen groups, should be appointed by the governor of the state in which disposal is proposed.

89. Preferably, a rough schedule would be set up by Congress, specifying target dates for major objectives like the opening of temporary, long-term storage facilities. A more detailed timetable would be established by the agencies involved.
90. At present certain research and development functions are assigned to other agencies, specifically the EPA and the U.S. Geological Survey, which is a department within the Department of the Interior.
91. *See* text accompanying note 20, *supra*.
92. *See IRG Report, supra* note 1, at 49; *Technical Plan* at 50.
93. Nuclear waste sites located on lands owned by Indian tribes require approval of the tribal, as opposed to state government involved. *See* the Uranium Mill Tailings Radiation Control Act of 1978, 42 U.S.C.A. §§ 7901-7942 (West Supp. 1978).

This task force would conduct public hearings regarding feasibility of nuclear waste disposal at the proposed site. If the task force cannot agree on the proposed site, both the DOE and NRC, as well as the task force itself, must immediately report to Congress regarding the advisability of the disputed site selection. Within thirty to sixty days thereafter, both houses of Congress must vote, ultimately deciding whether disposal facilities will be built at the disputed site.

PENDING LEGISLATION

Numerous legislative proposals on the topic of nuclear waste management have been introduced in the 96th Congress. However, at this writing none of the bills have been voted out of committee. Furthermore, almost without exception, the bills address specific issues[94] within the problem of waste management. Adoption of any of these specialized bills would continue the same ineffective, piecemeal treatment that has been given waste management in the past. The comprehensive legislative enactment that is imperative seems far from passage in either house.

There are two proposals that approach the level of comprehensiveness that is required. The first is the Nuclear Waste Management Act of 1979, H.R. 3298, introduced by Representative Jeffords.[95] This bill proposes establishment of a new independent executive agency, the Nuclear Waste Management Authority (NWMA).

The NWMA would have sole responsibility for developing a plan for the decontamination, storage and disposal of all nuclear wastes including surplus, obsolete or abandoned radioactive facilities. The Secretary of Energy and the NWMA would conduct the research necessary for the Authority to exercise its responsibilities. Duties of the NWMA would include directing the EPA to promulgate health and safety standards and directing the NRC to license the siting, design and construction of waste facilities.

Adopting a plan for inter-agency cooperation, the bill requires the Department of Defense, the DOE and the NRC to furnish the Authority with a complete inventory of any nuclear wastes or remains of radioactive materials in their possession or in the possession of private parties. The Authority would be required to report annually to the President, the Congress and the International Atomic Energy Commission regarding any loss of fuel or wastes.

The bill also directs the Authority to monitor the licensing process. In the event that disapproval of radioactive waste storage sites creates a shortage of storage capacity, the Authority must determine whether licensing of utilization, production and reprocessing facilities should continue.

94. Various categories of legislation addressing specific issues of waste management were introduced in the first session of the 96th Congress; they include:
State participation in site selection: H.R. 1070, H.R. 1791, H.R. 2365, H.R. 2762, H.R. 3298, H.R. 5923, S. 594, S. 701, S. 1360, S. 1443, S. 1521.
Transportation of nuclear wastes: H.R. 3692, H.R. 4455, S. 685.
Moratorium on licensing construction and/or operation of new facilities: H.R. 3581, H.R. 4455, S. 1178.
Demonstration or trial disposal sites and further research and development: H.R. 1852, H.R. 4019, H.R. 4361, H.R. 4818.
Greater NRC licensing authority over disposal facilities for various types of waste: H.R. 2586, H.R. 2611, H.R. 5809, H.R. 6116, H.R. 6212, S. 797, S. 798, S. 1521.
Other legislative proposals involving nuclear waste management: H.R. 3010, H.R. 3193, H.R. 3305, H.R. 4174, S. 798, S. 1389.
95. H.R. 3298. 96th Cong., 1st Sess. (1979).

This bill propounds public hearings in each state affected by proposed selection of waste sites. This scheme provides that a governor may object to the Authority's choice of any nuclear-waste site located within his state. However, the bill also requires that the Director of the Authority designate such sites as are necessary for storage and permanent disposal of wastes, regardless of veto by the governor involved.

The bill calls for several transfers of authority. All functions, powers and duties of the DOE relating to wastes are assigned to the Authority. All EPA regulatory and licensing powers with regard to disposal of nuclear wastes are turned over to the NRC.

Lastly, the bill requires the NWMA, DOE, EPA and the NRC to make annual reports to the President and Congress concerning their efforts toward waste disposal. Those agencies, in addition, must prepare detailed statements of their goals and plans for the ensuing two years.

The primary defect in the Jeffords bill is the creation of a new executive agency. This would cause an intolerable delay in action on nuclear waste management. Further, the express delineation of agencies' responsibilities that is imperative would not be adequately achieved through adoption of this legislative scheme. A less grievous shortcoming of this bill is the transfer of all regulatory and licensing powers of the EPA concerning nuclear waste disposal to the NRC. The EPA should retain the responsibility for enforcing radiation standards. The proposal is further crippled by its failure to provide definite timetables with which to work. Additionally, the bill would benefit through incorporation of a moratorium on new reactor licensing, pending operation of a waste storage facility.

The Nuclear Waste Management Reorganization Act of 1979[96] suggests an alternative to an entirely new executive agency.[97] The proposal establishes a fifteen-member Nuclear Waste Management Planning Council as an independent instrumentality of the executive branch. Comprised of elected officials of state or local governments or of Indian tribes, the Council would provide input on federal nuclear waste policy.

96. S. 742. 96th Cong. 1st Sess. (1979).

97. Another less successful attempt at a comprehensive legislative plan was introduced by Representative Goldwater, H.R. 4019: The Nuclear Waste Management, Research, Development and Demonstration Act of 1979. The bill directs the Secretary of Energy to make a determination regarding a repository site for spent fuel and nuclear waste. The Secretary would also be responsible for developing technology for design, construction and operation of the repository. Further, the DOE would dictate the procedure for transporting nuclear waste to the repositories. The Secretary of the Department of Transportation (DOT) would issue the requisite regulations for shipment of the wastes.

The NRC would have two years to reach a decision on approval and licensing after receiving an application from DOE. The repository would have to be in operation by September 30, 1988, with the EPA responsible for promulgating standards for environmentally safe storage of the wastes. The DOE would have to inform the governor of the appropriate state of study regarding potential and final site selection. If the state objects to a federal nuclear waste repository within its borders, the DOE must resolve the matter with the state. In the event that no resolution can be reached, the matter would be referred to both houses of Congress for review. Only if both houses, by concurrent resolution, determine within sixty days that the proposed site balances both state and national interests would the project proceed.

The major flaw of this piece of legislation is the failure to provide public hearings and a formal arbitration process in the event of state rejection of the repository site. The bill calls for the DOE to promulgate regulations for shipment of nuclear wastes; however, the DOE lacks the technical expertise in this area. That responsibility more aptly falls under the auspices of the NRC. The timetable suggested in the bill are, unfortunately, too optimistic and should be modified.

A Nuclear Waste Coordinating Committee would also be established by this legislation. Representatives of various federal agencies and departments—including the Waste Management Planning Council, DOE, NRC and the EPA,[98] would serve as members of the Committee. Chaired by the delegate from the DOE, the Committee would coordinate the activities of the federal agencies represented on the Committee and thereby minimize duplication of effort and unnecessary delay in nuclear waste management programs. The Committee would also prepare Repository Development Reports and an annual Nuclear Waste Management Plan.

This proposal requires the Committee to notify the governor of any state which is under study by any federal agency or department as a possible site for a nuclear waste repository. Once the governor receives such notification, (s)he has the authority to establish a Nuclear Waste Repository Review Panel to facilitate state and local participation in the planning and development of such a repository. This Panel will review the Committee Repository Development Report. If the Panel does not approve of the repository site, it may raise formal objections with Congress. Within sixty days of submission of the Committee Report and of the Panel's objections, Congress may, by concurrent resolution, determine that the proposed development of that nuclear waste repository equitably balances state, local and national interests. Only with such Congressional approval may the federal government begin emplacing wastes in any repository not approved by the local review panel.

Although the bill approaches the requisite level of depth and breadth herein advocated, it contains a few specific flaws. The proposal fails to address the critically neglected issue of research and development, especially with respect to the reprocessing option. The frequency of Committee meetings, as well as the inclusion of appropriate timetables, is also omitted from this legislative proposal. Further, it is questionable whether the bill's delineation of responsibilities among federal agencies is sufficiently clear to be effectual. Apparently, such unblurred delegation of authority can only be achieved through explicit statutory determination. A moratorium on further licensing of reactors, pending the opening of a nuclear waste repository, should also be considered.

Neither the Nuclear Waste Management Act nor the Nuclear Waste Management Reorganization Act are as all-inclusive as expediency requires. However, because of its proposed creation of a new executive agency, the Jeffords bill would work as a bottleneck within the already complex regulatory scheme surrounding nuclear waste management. While the other proposal lacks many imperative policy considerations, adoption of the Nuclear Waste Management Reorganization Act would be a positive step toward an acceptable regulatory strategy in nuclear waste management.

98. Additional members of the Committee would include representatives from the Council on Enviornmental Quality, the Office of Science and Technology Policy, the Department of Interior, the Department of Transportation, the Department of State, and the head of any other federal agency or department designated by the President.

CONCLUSION

Advocates of nuclear power insist that the environmental consequences of present energy sources pose a greater ecological threat than does nuclear energy[99] and that increasing reliance on foreign energy sources menaces American stability and independence.[100] Detractors question the actual potential of nuclear energy as the savior of the American energy crisis. They object to the moral and philosophical implications of bequeathing to future generations risks of uncalculated proportion in order to satisfy the present generation's demands.[101] A balance between these two viewpoints must be struck. The hazard posed to human and environmental survival must be weighed against the immediate needs for economic security.

The continued production of commercial radioactive waste is becoming an increasingly more significant constraint on generation of nuclear power at a time of rising energy costs and constricted energy supplies. It is an issue demanding an immediate, yet considered, legislative response. Congress must organize a political framework in which the inherent risks can be equitably distributed with a minimum of dissension. Regardless of the ultimate decision on nuclear power's future, an environmentally wise and politically acceptable management program must be developed and implemented posthaste.

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99. Bodansky and Schmidt, *The Nuclear Alternative*, 30 Mercer L. Rev. 395 (1979).
100. This issue, of course, cuts across idiological lines. *See* Stobaugh and Yergin *supra* note 19, at 1-4. However, it provides a major pillar of support for nuclear advocates. *E.g.*, Bodansky and Schmidt *supra* note 99, at 396.
101. *E.g.*, Hallmark, *Radiation Protection Standards and the Adminstrative Decision-making Process*, 8 Envt'l L. J. 785 (1978).