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Radioactive Waste: Gaps in the Regulatory System

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Radioactive wastes are among the most toxic substances known to man. They are produced throughout the nuclear fuel "cycle" — the chain of activities associated with the operation of nuclear power reactors, commencing with the mining of uranium ore and extending through the disposal of the radioactive waste products inevitably generated by those reactors. The release of radioactive wastes into the environment could cause immediate death, cancer, or genetic mutations in catastrophic proportions. Because some of these wastes remain dangerous for tens, and even hundreds, of thousands of years (depending on the particular waste product), they must be isolated from

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the biosphere for unprecedented periods of time to avoid harmful exposure to humans.

The need for stringent regulation of these hazardous waste products by an independent agency with technical expertise has been well recognized by Congress. The Nuclear Regulatory Commission (NRC), the federal agency with primary regulatory responsibility over radioactive wastes generated by commercial (as opposed to military) nuclear operations, was created for this explicit purpose.[1] Congress delegated broad authority to the NRC, applicable at every facet of the commercial nuclear fuel cycle, to ensure that the generation, management, and disposal of these radioactive wastes do not jeopardize public health and safety. The comprehensive regulatory scheme was established by both the Atomic Energy Act of 1954 (AEA), as amended by the Energy Reorganization Act of 1974 (ERA)[2] and the National Environmental Policy Act of 1969 (NEPA).[3]

Despite the need for stringent control and the NRC's statutory obligation to exercise that control, at each of the major steps in the nuclear fuel cycle — the mining and milling of uranium, the use of the fuels in nuclear reactors, and the stor-

1. Initially, responsibility for both the regulation and development of nuclear power was vested in the Atomic Energy Commission (AEC). However, conflicts arose when this single agency was responsible for these dual aspects of nuclear power. As a result, in 1974, pursuant to section 104 of the Energy Reorganization Act (ERA), 42 U.S.C. § 5814 (1976), the AEC was abolished and its functions split between the Energy Research and Development Administration (ERDA) and the NRC. 42 U.S.C. §§ 5814, 5841 (1976). ERDA was given responsibility for research and development programs related to nuclear activities, as well as for building and operating radioactive waste repositories. 42 U.S.C. § 5813 (1976). The NRC was given licensing responsibility over nuclear activities, including licensing of nuclear reactors, 42 U.S.C. § 5843 (1976), and waste disposal facilities, 42 U.S.C. § 5842 (1976). Pursuant to section 301 of the Department of Energy Organization Act, 42 U.S.C.A. § 7151 (Supp. 1977), ERDA's nuclear waste management development and research functions were transferred to the Department of Energy (DOE).

The Environmental Protection Agency (EPA) also has some regulatory responsibilities with regard to radioactive wastes. The EPA is authorized (1) under Reorganization Plan No. 3 of 1970, 3 C.F.R. 199, 200 (1970 Compilation), *reprinted in* 5 U.S.C. app., at 609 (1970) *and in* 84 Stat. 2086 (1970), to establish "generally applicable environmental standards for the protection of the general environment from radioactive material," and to provide broad federal guidance for all aspects of radiation protection; (2) under the Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. §§ 1411-1421 (1976)), to regulate the disposal of radioactive waste in the oceans; (3) under the Clean Air Act Amendments of 1977, 42 U.S.C.A. §§ 7401-7626 (Supp. 1977), to regulate radioactive effluents to the atmosphere.

2. 42 U.S.C. §§ 2011-2296 (1976); 42 U.S.C. §§ 5801-5891 (1976).

3. 42 U.S.C. §§ 4321-4361 (1976).

age and disposal of wastes generated — there are serious regulatory gaps for dealing with the radioactive wastes. The end result is the creation of a substantial risk to public health and safety and the undermining of the objectives of the AEA and NEPA to protect the public from the radiological hazards of radioactive wastes.

This article discusses a number of the most serious of these regulatory failings.[4] Specifically, it addresses the major, past and existing, inadequacies in the system for the licensing of uranium milling operations and nuclear reactors which generate the wastes, as well as flaws in the regulatory structure for the licensing of a permanent waste disposal facility.

These regulatory issues are currently of critical importance. As public attention has become more focused on the problems of radioactive waste, the federal government has increased its efforts to address the waste management and disposal problem. Major decisions, involving statutory, political, and technical considerations, are now being made with respect to the regulatory requirements to be applied at each of the phases of the commercial fuel cycle discussed herein.

I. THE WASTES — THEIR TOXICITY AND MAGNITUDE

The major categories of commercial radioactive wastes include the "tailings" from uranium mills, spent fuel rods, so-called "high-level" wastes, transuranic contaminated wastes, and low-level wastes.

A. *Uranium Mill Tailings*

The first step in producing enriched uranium fuel for nuclear power plants is the milling of the uranium ore. The ore, which is usually from a nearby mine, is crushed, ground, and chemically treated in a mill to extract and concentrate the uranium. The processed ore is then discharged into a tailings pond as a solids-laden liquid. The water seeps into the ground or evaporates, eventually leaving a dry pile of sandlike waste. Uranium tailings contain natural radionuclides that are highly toxic, and long lived. For example, thorium-230, which is a highly toxic isotope contained in large amounts within mill

4. This article is not intended as a general survey of all existing regulatory flaws associated with radioactive wastes. For example, numerous gaps associated in the regulation of military-generated wastes, with the disposal of commercially generated low-level waste and with away-from-reactor interim storage of commercial wastes are not addressed.

tailings, has a half-life (decay period) of 80,000 years, and, therefore, it must be isolated from man on the order of a million years or longer.

Human beings may be exposed to the radionuclide constituents of uranium mill tailings piles through the inhalation of wind-blown particulates from unstabilized piles, of radon gas which emanates from the piles, or of decay products from escaped radon.[5] Also, a person may be exposed by direct radiation from the piles, or through ingestion of contaminated water supplies.[6] To provide full protection, undue human exposure to the tailings from any of these possible pathways must be prevented.

In eight Western states, approximately twenty-five million tons of radioactive mill tailings have already accumulated at twenty-two mill sites, which are now inactive.[7] These sites have been abandoned by the operators, and the piles are largely unstabilized. While the potential dangers associated with these existing sites are grave enough, the problems in the coming two or three decades will be much greater. The annual amount of natural uranium required to fuel nuclear plants is projected to increase more than ten-fold by the end of this century.[8] As of August 1978, there were twenty-one mills in active operation throughout the United States, and the NRC estimates that 109 mills will be needed by the year 2000 to support the United States' commercial nuclear power industry.[9] Correspondingly, the accumulated volume of uranium mill tailings would increase by thirty-fold in that period.[10]

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5. Potentially, the most serious health hazard posed by the uranium mill tailings is the emanation of radon gas from tailings piles for hundreds of thousands of years. The escaped radon and its decay products would expose millions of people to low levels of radiation that probably would increase the rate of lung cancer. Some scientists have estimated that the radon released from uranium mill tailings resulting from fueling one large power reactor for a year would cause ultimately on the order of 400 lung cancer deaths. *See* Pohl, *Health Effects of Radon-222 From Uranium Mining*, 7 SEARCH 345, 346-348 (1976).

6. U.S. ATOMIC ENERGY COMMISSION, SUMMARY REPORT: PHASE I STUDY OF INACTIVE URANIUM MINE SITES AND TAILING PILES, 9-10 (October 1974).

7. U.S. GENERAL ACCOUNTING OFFICE, URANIUM MILL TAILINGS CLEANUP: FEDERAL LEADERSHIP AT LAST? 1 (June 20, 1978) [hereinafter G.A.O. MILL TAILINGS REPORT].

8. U.S. ATOMIC ENERGY COMMISSION, NUCLEAR POWER GROWTH 1974-2000, WASH-1139 at 29 (February 1974).

9. G.A.O. MILL TAILINGS REPORT, *supra* note 7, at 1.

10. J. BLOMCKE, C. KEE, & J. NICHOLS, PROJECTIONS OF RADIOACTIVE WASTES TO BE GENERATED BY THE U.S. NUCLEAR POWER INDUSTRY, ORNL-TM 3965 at 97 (February 1974).

B. *Reactor Generated Wastes*

Once the uranium is removed from the ore and fabricated into fuel, it is utilized in nuclear power plants. These plants generate electricity through the fissioning, *i.e.*, splitting, of uranium and plutonium atoms in the core of nuclear reactors.[11] This fission process produces heat which converts water into steam which in turn powers electric generators. As the fissionable isotopes in the fuel are depleted, the resulting waste product, the "spent fuel rods," are then withdrawn from the nuclear reactor cores.

Until recently, the federal government and the nuclear power industry had planned on chemically treating, or "reprocessing," spent fuel in order to remove the un-fissioned isotopes of plutonium and uranium for use in fresh fuel. When reprocessing occurs, so-called "high-level radioactive wastes" are produced.[12] However, in April 1977, President Carter announced that reprocessing would be deferred indefinitely, because of the additional risks to public health and safety arising from the separation and wide-spread utilization of plutonium that could be used to fabricate nuclear explosive devices.[13] Under this new policy, spent fuel is the final form of high-level waste for ultimate disposal.

Other wastes created as by-products of the nuclear fuel cycle include "transuranic" wastes and "low-level" wastes. These wastes are comprised of materials such as clothing, glass, and metal that become contaminated with radioactivity. Transuranic wastes (so-called because the atomic numbers of some of the radionuclides in the waste are higher than uranium on the periodic table of elements) are produced primarily at reprocessing plants and facilities where plutonium is incorporated into fresh fuel. Thus, if there is no commercial reprocessing, no significant additional commercial transuranic wastes

11. Plutonium is absent in "fresh" fuel, but it builds up in the reactor core during the operation of power plants. Some of the plutonium eventually fissions and contributes to the release of energy.

12. 10 C.F.R. § 50 app. F (1978), provides in pertinent part: " '[H]igh-level liquid radioactive wastes' means those aqueous wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuels."

13. EXECUTIVE OFFICE OF THE PRESIDENT, ENERGY POLICY AND PLANNING, THE NATIONAL ENERGY PLAN 70 (April 29, 1977).

will be generated. Low-level wastes, on the other hand, are produced at nuclear reactor sites themselves. While there is much overlap in the general types of materials constituting low-level and transuranic wastes, the low-level wastes do not include the "heavier" radionuclides with atomic numbers higher than uranium.

Like the uranium mill tailings, the wastes produced by power plants are highly toxic, and their management and disposal represents one of the most difficult problems of the nuclear era. For example, one of the most dangerous of the radionuclides generated by nuclear reactors, plutonium-239, is so toxic that as little as three micrograms — a "speck" — can cause lung cancer in animals.[14] Moreover, because of its exceedingly long half-life of 24,000 years, the large quantities of plutonium produced in reactors will remain potentially harmful to mankind for at least several hundred thousand years.

Significant quantities of extremely toxic radioactive wastes have already been produced by the operation of commercial nuclear reactors and sizeable increases in quantity are projected. At present, about seventy commercial nuclear power reactors are operating within this country,[15] and by the year 2000, the NRC has projected that over 500 such reactors may be operating.[16] Over 600,000 gallons of commercial liquid high-level wastes[17] and about 4,000 metric tons of commercial waste in spent fuel rods already exist.[18] When measured by long-lived radioactivity (an indicator of potential hazard), the current inventory of these radioactive wastes is expected to double within three or four years, and will be twenty times greater by the end of the century.[19]

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14. Bair & Thompson, *Plutonium: Biomedical Research*, 183 SCIENCE 715, 720 (1974).

15. U.S. DEPARTMENT OF ENERGY, NUCLEAR GENERATING UNITS IN THE UNITED STATES AS OF JUNE 30, 1978 (August 9, 1978).

16. U.S. NUCLEAR REGULATORY COMMISSION, FINAL GENERIC ENVIRONMENTAL STATEMENT ON THE USE OF RECYCLED PLUTONIUM IN MIXED OXIDE FUEL IN LIGHT WATER COOLED REACTORS, NUREG-0002, EXECUTIVE SUMMARY, at S-12 (August 1976).

17. M. WILLRICH AND R.K. LESTER, RADIOACTIVE WASTE, MANAGEMENT AND REGULATION 14 (1977).

18. U.S. DEPARTMENT OF ENERGY, REPORT OF TASK FORCE FOR REVIEW OF NUCLEAR WASTE MANAGEMENT (Draft), DOE/ER-0004/D 66 (February 1978) [hereinafter DEUTCH REPORT].

19. U.S. NUCLEAR REGULATORY COMMISSION, PUBLIC COMMENTS AND TASK FORCE RESPONSES REGARDING THE ENVIRONMENTAL SURVEY OF THE REPROCESSING AND WASTE

II. The Unsatisfactory History of Waste Management

The history of the management of these various radioactive waste products has been checkered with missteps, changes in direction, and aborted planning, which serve to underscore the need for an improved regulatory apparatus. For example, in 1952 through 1966, mill tailings were used extensively as construction fill in houses, schools, businesses, sidewalks and highways in Grand Junction, Colorado. The serious threat to public health from this material was not recognized until later. A remedial program was commenced in 1972, and it is estimated that hazardous tailings fill must be removed from about 700 locations.[20] Yet, six years later, the remedial program is only half completed. It remains entirely voluntary and apparently few local contractors are interested in performing the remedial work.[21] No regulatory action was ever undertaken by the federal government to prevent this occurrence or to compel an effective cleanup.

Elsewhere, uranium milling operations have contaminated public water supplies. As early as 1958, investigators discovered that the drinking water in two towns along the Animas River below Durango, Colorado — Aztec and Farmington, New Mexico — contained concentrations of radioactivity exceeding federal standards.[22] Furthermore, as a result of the sequestration of minerals in the river food chains, radium concentrations in the river flora and fauna were 100 to 10,000 times the concentrations found in the river water itself.[23] Indeed, grasses and alfalfa irrigated with the water and consumed by livestock, contained concentrations of radium 100 times greater than the river water.[24]

The contamination of ground water near active mill sites continues to be a problem. In 1974 the Environmental Protection Agency (EPA) surveyed water discharges from uranium milling and mining complexes in the Grants Mineral Belt in New Mexico. EPA found that ground water in the vicinity of the uranium mills exceeded EPA limits for certain poisonous

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Management Portions of the LWR Fuel Cycle, NUREG-0216 (Supp. 2 to WASH-1248) 3-113 (March 1977).

20. G.A.O. Mill Tailings Report, *supra* note 7, at 21.

21. *Id.* at 22-25.

22. Union of Concerned Scientists, The Nuclear Fuel Cycle 47 (1975).

23. *Id.*

24. *Id.*

chemicals by as much as 7,300 percent.[25] The study also found that radioactive contamination of the drinking water near some of the mills grossly exceeded drinking water standards and posed a health hazard to the employees and their families.[26]

The wastes generated by the operation of commercial nuclear reactors have also been seriously mismanaged in a number of instances. For example, all of the commercial high-level liquid wastes resulting from previous reprocessing of spent fuel are currently stored at West Valley, New York. The initial plans contemplated that these wastes would be stored indefinitely in liquid form in near-surface storage tanks. It was envisioned that repeated transfers of these wastes to new tanks would be made as the old storage tanks deteriorated.

The West Valley program, however, was marked from the beginning by inadequate study and unforeseen safety problems. First, no plan was established in advance to ensure that the wastes could be safely removed from the older tanks when it came time to transfer them to new ones. Then, in 1970, the Atomic Energy Commission (AEC) promulgated new regulations requiring all high-level wastes generated in the future to be solidified within five years of their generation, thus belatedly recognizing that the practice it had licensed at West Valley was inadequate.[27] The new policy also provided that a specific proceeding on the future of West Valley wastes would be initiated, because of the particular problems in solidifying the existing wastes there.[28] Nonetheless, eight years later, no such proceeding has been commenced. Even worse, no satisfactory, safe method of removing the wastes from existing tanks has been developed, and additional special research must now be conducted to rectify past errors in decisionmaking.

The cost of remedying the waste disposal problem at West Valley has been estimated as high as $600 million, and implementation of an effective cleanup operation may take as long as fourteen years.[29] Among the unresolved questions is who will

25. U.S. ENVIRONMENTAL PROTECTION AGENCY, WATER QUALITY IMPACTS OF URANIUM MINING AND MILLING ACTIVITIES IN THE GRANTS MINERAL BELT, NEW MEXICO, No 6/9/75/002 58 (September 1975).

26. *Id.* at 60.

27. 10 C.F.R. § 50 app. F (1978).

28. *Id.*

29. HOUSE COMM. ON GOVERNMENT OPERATIONS, WEST VALLEY AND THE NUCLEAR DILEMMA, H.R. REP. No. 755, 95th Cong., 1st Sess. 16 (1977).

pay for and carry out this operation, the commercial site operator, the state of New York, or the federal government.

To date, governmental efforts to establish a permanent repository for commercial radioactive wastes have also been unsatisfactory. Twenty-five years after Congress authorized the commercial development of nuclear power, no permanent waste repository has been built, and there is no approved plan for such a facility. Instead, one proposal after another has been explored and abandoned.[30] Indeed, the NRC admits that up to about 1970, whatever waste management policy existed "had been more or less *ad hoc*."[31]

Shortly after passage of the AEA, the AEC and its advisors focused on bedded salt deposits as the most likely underground geological formation for disposal of the long-lived commercial wastes.[32] In the late 1960's, the government finally selected an abandoned salt mine near Lyons, Kansas, as the location for a pilot repository for the wastes. However, later investigation disclosed, among other things, that water from adjacent mining operations might seep into the repository and dissolve the salt containing the waste. In early 1972, the Lyons, Kansas, site was abandoned.[33]

Next, in May 1972, the AEC announced its plan to build a so-called "retrievable surface storage facility" or "RSSF" — an engineered facility constructed near the surface of the earth — to store the commercial wastes for an indeterminate period of time, while the prolonged search for an acceptable, safe geological site continued. Three years later, however, the waste program changed direction once again. In the spring of 1975, the Energy Research and Development Administration (ERDA) withdrew the request for congressional appropriations for the RSSF, although it was purportedly retained as a backup system in case "other repository plans failed."[34]

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30. NUCLEAR FUEL CYCLE COMM., CALIFORNIA ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION, STATUS OF NUCLEAR FUEL REPROCESSING, SPENT FUEL STORAGE AND HIGH-LEVEL WASTE DISPOSAL (Draft) 117-118 (January 11, 1978).

31. U.S. NUCLEAR REGULATORY COMMISSION, ENVIRONMENTAL SURVEY OF THE REPROCESSING AND WASTE MANAGEMENT PORTIONS OF THE LWR FUEL CYCLE — A TASK FORCE REPORT, NUREG-0116 (Supp. 1 to WASH-1248) at D-3 (October 1976).

32. *Id.* at D-2.

33. *Id.* at D-3.

34. *Id.* at D-4.

With a resurrected near-term emphasis on the development of a deep geologic repository, ERDA expanded its efforts to locate a potential geologic formation for commercial wastes and in 1976 focused on a salt formation in the state of Michigan for investigation. However, in June 1977, after residents of northern Michigan had voted overwhelmingly to prohibit the siting of a waste repository within their state, the federal government abandoned its efforts to locate the repository in the state of Michigan.[35]

The draft report of a recent Department of Energy (DOE) task force on radioactive waste management[36] makes clear how much uncertainty surrounds the government's current efforts to establish a repository for the permanent storage of radioactive wastes. At the outset, the task force report notes that the "federal government, as an entity, has not formally reached a conclusion on ultimate disposal of high level wastes."[37] The report then highlights the uncertainties surrounding this endeavor. First, the report concludes that the federal government's previous target deadline of 1985 for the establishment of a waste repository will now be delayed until 1988, at "the earliest date."[38] Second, it is apparent from the report that fundamental questions continue to exist about the threshold determination of what geologic medium is appropriate for waste disposal. The report now questions the government's almost exclusive focus upon bedded salt deposits and recommends that a variety of other geologic media be considered more seriously.[39] Finally, the report recognizes that several important technical issues remain unresolved. In general, the report calls for additional efforts in "developing scientific data, safety analysis and systems models to improve the scientific bases for specific media choice, site selection and repository designs."[40]

Important unresolved scientific and technical problems concerning waste disposal have been highlighted recently in

35. U.S. GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS, THE UNITED STATES NUCLEAR ENERGY DILEMMA: DISPOSING OF HAZARDOUS RADIOACTIVE WASTES SAFELY 15 (September 9, 1977).

36. *See* DEUTCH REPORT, *supra* note 18.

37. *Id.* at 7.

38. *Id.* at 12.

39. *Id.* at 9, 52.

40. *Id.* at 3, 9, 26.

other government studies as well.[41] Most recently an interagency review group[42] (IRG) prepared a comprehensive report reviewing the nuclear waste disposal issue and recommending changes to improve the existing program. The draft report acknowledges that management of radioactive wastes for the past three decades can be characterized by "inadequate integration of waste management R&D (research and development) efforts . . . caused in part by inadequate perceptions of the additional technological and scientific capabilities needed to develop an acceptable disposal capability . . . ."[43] Among other things, the report calls for legislative change to increase the federal government's regulatory powers over various nuclear waste forms,[44] and for adherence to a comprehensive work schedule directed towards completion of a high-level waste repository by 1995.[45] Following public comment, the report will be forwarded to the President for his consideration and guidance in further action.[46] If adopted and implemented, it appears the IRG recommendations will improve the nuclear waste management program, but it will not resolve the problem. The IRG report is incomplete and, in some instances, recommends policies inconsistent with full protection of the public and the environment. The IRG report, for instance, does not make the link between continued operation of nuclear power plants and the lack of progress in developing a permanent waste disposal facility for the wastes created by the plants. The IRG report also recommends against comprehensive regulation of the government's own wastes by the NRC. Moreover, significant doubt remains about the ability to implement the program recommended by the IRG report. Thus, although the IRG effort may be an important advance in federal decisionmaking, substantial uncertainty still remains about the adequacy of the waste management and disposal program.

41. Carter, *Nuclear Wastes: The Science of Geologic Disposal Seen as Weak*, 200 SCIENCE 1135 (1978).

42. INTERAGENCY REVIEW GROUP, REPORT TO THE PRESIDENT BY THE INTERAGENCY REVIEW GROUP ON NUCLEAR WASTE MANAGEMENT TID-28817 (Draft) (October 1978).

43. *Id.* iv.

44. *Id.* x, xiv.

45. *Id.* xxi-xxiii.

46. *Id.* iii.

III. DEFICIENCIES IN THE REGULATORY SYSTEM

A. *Uranium Mill Tailings*

In the past, inconsistent state and federal licensing programs over uranium mill tailings have created a major flaw in the regulation of this radioactive waste product. A number of states' programs have failed to adequately protect the public health and safety. In an effort to rectify this regulatory deficiency, on November 8, 1978, President Carter signed into law the Uranium Mill Tailings Control Act of 1978.[47] This new legislation makes more explicit the states' obligation to develop regulatory programs over uranium mill tailings that are more consistent with that of the federal government. This legislation, if fully implemented, will mark a substantial advance in the management and control of uranium mill tailings.

The NRC is empowered by section 63 of the AEA[48] to issue source material licenses for possession of uranium. This license is necessary for the operation of a uranium mill. Pursuant to section 274 of the AEA,[49] however, the NRC may delegate this and certain other licensing responsibilties to the states under the so-called Agreement State Program.[50] Twenty-five states have become agreement states.[51] As of August 1978, eleven of the twenty-one active uranium mills in the United States were located in the agreement states of New Mexico, Colorado, Texas, and Washington, and were licensed directly by those states. The other ten active mills were in non-agreement states and were licensed by the federal government.

The licensing system administered by an agreement state is supposed to provide the same level of protection for public health and safety as the NRC would require. At the federal level, however, the procedures mandated by the National Environmental Policy Act are an integral part of NRC licensing of

47. Pub. L. No. 95-604.

48. 42 U.S.C. § 2093 (1976).

49. 42 U.S.C. § 2021 (1976).

50. The NRC is empowered to delegate regulatory responsibility to the state for the regulation of by-product material, source materials and special nuclear materials in quantities not sufficient to form a critical mass. 42 U.S.C. § 2021(b) (1976). A definition of these materials is contained in 42 U.S.C. § 2014 (1976).

51. Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Oregon, South Carolina, Tennessee, Texas and Washington.

mills in non-agreement states. NEPA imposes strict responsibilities on federal agencies to ensure that environmental values are considered.

Section 102 of the Act requires that each agency shall "to the fullest extent possible" prepare an environmental impact statement (EIS) which discloses, *inter alia,* the full range of impacts and alternatives to a proposed action on all "major Federal actions significantly affecting the quality of the human environment."[52] Thus, if a mill is licensed directly by the NRC, an EIS is always prepared.[53] The EIS provides an independent assessment of the impacts of the proposed mill upon the environment, alternative disposal methods and mill sitings, as well as potential accidents and problems posed by decommissioning the mill site once milling operations have been discontinued. It is through this independent environmental analysis that the most appropriate health and safety requirements to be applied to milling operations can be determined.

On the other hand, in the agreement of states, no EIS is prepared by the federal government under NEPA. While some agreement states have enacted state laws that parallel NEPA and require the preparation of environmental analyses, the agreement states of Colorado, New Mexico, and Texas,[54] where nine of the active mills are located, have lacked any state law counterpart to NEPA. The licensing of uranium mills in these states has been subject to far less stringent reviews and procedures than would have applied if the mills had been licensed directly by the federal government. Thus, the three states which have not required an EIS lacked an essential vehicle for ensuring that important environmental considerations were fully reviewed and incorporated into the decisionmaking process. The end result has been that these states have imposed less stringent substantive standards than those imposed by the

52. 42 U.S.C. § 4332(c) (1976).

53. 10 C.F.R. § 51.5(a)(5) (1978). Although the NRC requires an applicant for a uranium mill license in a non-agreement state to submit an environmental report, 10 C.F.R. §§ 51.20, 51.21 (1978), the agency is required to conduct its own independent evaluation of environmental factors and independently prepare the draft and final EIS's. 40 C.F.R. § 1500.7(c) (1978).

54. The State of Washington has a state law, similar to NEPA, which requires the preparation of state environmental impact statements and makes the state program more analogous to that administered by the federal government. State Environmental Policy Act of 1971, WASH. REV. CODE § 43.21C (1971).

federal government, and less stringent standards than the states themselves might have demanded were the mill licensing decisions subject to a thorough and independent environmental review.

Moreover, the procedures employed by these states to facilitate public participation in the licensing process have been sorely inadequate and widely divergent from those utilized by the NRC. None of the states has had specific provisions for public hearings to assess the far-ranging and long-term environmental impacts of a proposed mill.[55] Public notice of the receipt of licensing applications is often perfunctory. In New Mexico, for example, notices of receipt of applications have been published only in certain local newspapers at unspecific times.

In contrast, NRC regulations require public hearings on each application for a mill license in non-agreement states, at the request of the applicant or any affected party or on its own motion.[56] Notice of receipt of all applications, as well as notice of the public hearing, must be published in the *Federal Register*.[57] Public participation is also solicited in the commenting process on the draft environmental impact statement prepared by the NRC on a proposed mill, and the availability of the draft is announced in the *Federal Register*.[58]

Finally, the regulatory programs of these three agreement states have not prohibited the construction of a mill prior to the completion of the licensing process (even of the perfunctory environmental analysis of the project that was conducted). In contrast, the NRC regulations provide that the commencement of any mill construction activities while the licensing process is underway may result in the denial of the license.[59] Clearly, this restriction is necessary to avoid a premature commitment of resources and the creation of inappropriate momentum towards a particular mill site or disposal methodology.

The inconsistencies between the uranium mill licensing

55. U.S. NUCLEAR REGULATORY COMMISSION, WORKSHOP ON THE FEDERAL-STATE REGULATION OF URANIUM MILLS NUREG/CR-0029 at 2 (February 1978).

56. 42 U.S.C. § 2239 (1976); 10 C.F.R. § 2.105 (1978); 10 C.F.R. § 2.714(a) (1978); 10 C.F.R. § 2.103(b)(2) (1978).

57. 10 C.F.R. § 2.105 (1978); 10 C.F.R. § 2.104 (1978).

58. 10 C.F.R. § 51.50(c) (1978); 10 C.F.R. § 51.24(f) (1978).

59. 10 C.F.R. § 40.32(e) (1978).

programs of the federal government and the agreement states arguably violated the requirement of the AEA, even before it was amended and strengthened by the Uranium Mill Tailings Control Act of 1978. The unamended AEA required that the two programs be "compatible," and established two prongs to this requirement. Under section 274(d)(2), the NRC had to find prior to a delegation of authority to the state "that the State program is compatible with the Commission's program for the regulation of such materials, and that the State program is adequate to protect public health and safety with respect to the materials covered by the proposed agreement."[60] And, in section 274(g), the Commission was directed "to assure that State and Commission programs for protection against hazards of radiation will be coordinated and compatible."[61]

As the language suggests, the purpose of these provisions is to ensure that the delegation of authority from the Commission to the State does not result in a relaxation of the Act's mandate to protect the public health and safety from the hazards of radioactive materials. The decided shortcomings in the procedures utilized by the agreement states, as enumerated above, appear to handicap the fulfillment of this mandate and render these state programs incompatible with the Commission's program.

Apart from the requirements of the AEA, NEPA itself appears to require that the agreement states at least prepare environmental impact statements or their equivalent, in licensing uranium mills. Despite the delegation of licensing authority to the agreement states, the federal government remains substantially involved in the process for licensing uranium mills in those states. For example, the NRC: (1) retains the right to reassert its own licensing authority; (2) conducts annual reviews of the overall operations of the agreement state pro-

60. 42 U.S.C. § 2021(d)(2) (1976). Section 204(b) of the Uranium Mill Tailings Control Act, Pub. L. No. 95-604, has strengthened this provision of the AEA by inserting the phrase "in accordance with the requirements of subsection o and in all other respects" before the word "compatible." Subsection "o" of section 204 of the new legislation in turn makes more explicit the state's obligation, prior to issuance of a uranium mill license, to provide a number of important procedural safeguards and to ensure that state substantive standards are at least equivalent to those of the federal government.

61. 42 U.S.C. § 2021(g) (1976). This provision of the AEA was not amended by the Uranium Mill Tailings Control Act of 1978, Pub. L. No. 95-604.

grams, including the states' licensing decisions and environmental programs; (3) provides training, technical assistance and inspection of the state program; (4) reviews and comments upon all license applications filed with these states; and (5) expends sizeable federal funds in administering the agreement state program. In some cases, this level of ongoing federal involvement has sufficed to compel the preparation of an EIS under NEPA, although state or private parties were vested with substantial responsibilities for the action in question.[62]

The Council on Environmental Quality (CEQ), the federal agency primarily charged with administering and interpreting NEPA, has expressed informally its view that EIS's are required in agreement states under both the compatibility provisions of the AEA and under NEPA.[63] CEQ concluded that NEPA's policies must be taken into account in interpreting the requirement of compatibility. It further noted that delegation of authority to a state does not remove the Commission from the process for purposes of NEPA, and that the disparity in the implementation of NEPA between agreement and non-agreement states was "anomalous."

These deficiencies in the Agreement State Program were challenged in an action now pending in the Federal District court in New Mexico, *Natural Resources Defense Council, Inc. v. NRC*.[64] In particular, the suit challenges New Mexico's issuance of a license for a specific uranium mill without preparing

62. *See, e.g.*, Scientists' Institute for Public Information, Inc. v. AEC, 481 F.2d 1079 (D.C. Cir. 1973); Davis v. Morton, 469 F.2d 593 (10th Cir. 1972); Named Individual Members of the San Antonio Conservation Soc'y v. Tex. Highway Dep't, 446 F.2d 1013 (5th Cir. 1971), *cert. denied*, 406 U.S. 933 (1972).

63. Letter from Charles Warren, Chairman, CEQ, to Joseph Hendrie, Chairman, NRC (September 6, 1977).

In draft regulations CEQ also made clear its view that in all instances, a delegation of licensing authority does not relieve the federal government of responsibility to insure that an EIS is prepared, if otherwise required. 43 Fed. Reg, 25,230, 25,245 (1978).

However, in response to public comments suggesting that "application of NEPA in such circumstances is a highly complicated issue; that its proper resolution depends on a variety of factors that may differ significantly from one program to the next and should be weighed on a case-by-case basis . . . ," 43 Fed. Reg. 55, 978, 55,989 (1978), CEQ in its final regulations determined not to address this issue. While CEQ has thus declined to express an official opinion on NEPA's application across the board when licensing authority is delegated to a state, it has opted for a case-by-case approach for the time being. With respect to delegation of licensing authority over uranium mills, through its opinion letter from Charles Warren to Joseph Hendrie, CEQ has indicated its view that NEPA clearly applies.

64. No. 77-240(B), filed May 3, 1977.

an EIS or providing adequate public participation, and requests that an EIS be prepared, accompanied by all the procedural safeguards enumerated above for the mill in question. In the alternative, the suit asks that the Agreement State Program with New Mexico be terminated, and that the NRC resume direct licensing and EIS responsibility over the mill. The claims *are* asserted both under the "compatibility provisions" of the AEA and under NEPA.

In part in response to this litigation, Congress passed the Uranium Mill Tailings Control Act of 1978.[65] The legislation addresses, among other issues,[66] many of the specific inadequacies challenged in the litigation and makes explicit the states' obligation, prior to the issuance of licenses for uranium mills, to require the preparation of environmental analyses analogous to EIS's, to conduct public hearings, based on a record subject to judicial review, and to prohibit the construction of a uranium mill until an adequate environmental analysis has been completed.[67] The legislation further makes more explicit the states' obligation to impose substantive standards for uranium mill licenses that are equivalent to or more stringent than those imposed by the federal government in its licensing process.[68] If the states fail to bring their regulatory

65. Pub. L. No. 95-604.

66. The new legislation also rectifies a number of other serious problems in the regulation of mill tailings that existed with respect to regulation of inactive mill sites. In the past the NRC has not exercised regulatory control over tailings piles at these sites. By narrowly defining the term "source material" to exclude any material which contains less than 0.05 percent of uranium and/or thorium by weight, the NRC has excluded the tailings piles themselves. 10 C.F.R. § 40.4(h) (1978). At active mill sites the NRC has taken the position that the tailings piles can be regulated under the source material license issued for the mill. However, once a mill is closed, and its source material license has been terminated, the NRC has maintained that its regulatory involvement is concluded. The new legislation, however, resolves the problem by amending the AEA definition of the term "by-product" material to include specifically uranium mill tailings and thereby make explicit continuing NRC jurisdiction over the tailings piles at inactive sites. Pub. L. No. 95-604 § 201.

The Uranium Mill Tailings Control Act of 1978 also rectifies another problem related to long term control over tailings piles that has arisen under past land ownership practices which permitted private mill operators to own the tailings disposal sites. Since the mill tailings must be isolated for tens of thousands of years, it is essential to have assurance that the entity owning the land will have long term viability. The new legislation recognizes there is no such assurance with a private operator and requires federal or state ownership of the disposal site unless the NRC makes a specific determination that private ownership poses no threat to the public health and safety. *Id.* § 83a.

67. *Id.* § 204 o(3).

68. *Id.* § 204 o(2).

programs into line with the new legislation the NRC can revoke the states' licensing authority over uranium mills in order to protect the public health and safety.[69]

The extent to which the states will be willing and able to comply with the requirements of the Uranium Mill Tailings Control Act of 1978 is still an open issue. There is, however, no question that this new legislation is a tremendous advance towards remedying a number of the regulatory deficiencies described above and a tremendous step towards reducing a serious potential health consequence.

B. *The Reactor Licensing Process*

Radioactive wastes with higher levels of toxicity are generated by the nuclear power plants which utilize the fuel rods fabricated after the uranium milling process. These wastes are the inevitable by-products of the licensing of additional power reactors. Any commitment to responsible decisionmaking, therefore, would seem to dictate that the environmental impact of these wastes and the feasibility of their safe permanent storage be given the fullest consideration in the licensing of the reactors which generate these wastes. Without these kinds of analyses, the wastes generated by new plants will greatly add to the dimension of a problem which may prove intractable.

In any reactor licensing proceeding, the NRC must make an environmental analysis pursuant to NEPA, disclosing the full range of the impacts of the proposed project. The NRC must also make an explicit finding pursuant to the AEA that the decision to license the reactor will not jeopardize the public health and safety. Unfortunately, the NRC's review of the radioactive waste problem in both the NEPA and the AEA contexts is sorely deficient.

C. *The Reactor NEPA Review*

It is now well settled that the environmental analysis conducted pursuant to NEPA during reactor licensing must extend to an evaluation of the environmental impacts of the radioactive wastes generated by the reactor. Only through a

69. 42 U.S.C. § 2021(y) as amended by the Uranium Mill Tailings Control Act, Pub. L. No. 95-604, § 204(d).

consideration of these impacts can the true costs of an individual reactor be assessed. Particularly in instances where projected demand for the energy is uncertain or acceptable alternative technologies are available to meet demand, the NRC hearing board's weighing of the impacts of the radioactive wastes may tip the balance against the issuance of a reactor license. While the logic of this approach seems clear, it has yet to be implemented adequately by the NRC.

Initially, this issue was excluded from consideration in reactor licensing. In a hearing on the license application for the Vermont Yankee Nuclear Power Station, the Appeals Board held that the NEPA review of radioactive wastes when they leave the reactor should be limited to the environmental effects of the transportation of the wastes from the reactor to reprocessing plants and that the impact of the reprocessing plants or the disposal of wastes need not be evaluated.[70]

Shortly thereafter, the AEC instituted a rulemaking proceeding to reconsider whether the environmental effects of all stages of the nuclear fuel cycle should be included in the NEPA cost-benefit analysis for licensing individual reactors.[71] The AEC concluded that although the waste disposal impacts were "relatively insignificant,"[72] it was desirable to consider them in this forum. The AEC then promulgated a rule — the so-called Table S-3 — to be factored into the cost-benefit analysis for individual nuclear reactors.[73]

Table S-3 is a numerical tabulation of the postulated impacts of the radioactive wastes resulting from the operation of a single nuclear reactor. The Table attempts to identify the adverse impacts of the nuclear fuel cycle by listing the amount of radioactive effluents that will be released to the environment, as well as the land and water resources that will be committed to waste management and disposal efforts at all phases of the fuel cycle. The rulemaking envisioned that Table S-3 would be incorporated into individual environmental impact statements prepared on light water reactors considered for

70. Vermont Yankee Nuclear Power Corp., ALAB 56, 4 A.E.C. 930 (June 6, 1972).
71. 37 Fed. Reg. 24191 (1972) (codified in 10 C.F.R. § 50 (1978)).
72. 39 Fed. Reg. 14188, 14190 (1974) (codified in 10 C.F.R. § 51.20(e) (1978)).
73. *Id.* at 14191.

licensing, and that it would suffice as the sole discussion of these matters within the EIS.[74]

The adequacy of the rulemaking was challenged in *Natural Resources Defense Council, Inc. v. NRC.*[75] The court of appeals found that the evidence presented by the AEC in the proceeding left important questions unresolved and that credibility of the rule was not adequately tested. The court held that more extensive procedures than traditional notice and comment rulemaking should have been afforded participants in the proceeding. The court ordered a remand of the matter to the NRC for a more thorough review of these issues. In *dictum,* the court also identified a number of deficiencies in the format of the Table S-3.

The Supreme Court reversed and remanded the decision of the court of appeals. The Court's opinion focused exclusively on the question of the adequacy of the procedures used by the NRC in conducting the generic rulemaking. The Court determined that the agency's utilization of traditional notice and comment rulemaking procedures was sufficient to permit an adequate review of the waste impact issue. In remanding the matter, the Supreme Court specifically left open the question of whether the particular record developed by the agency in support of Table S-3 was adequate in fact to sustain the rule.[76] The Supreme Court did not consider whether the format of Table S-3 was adequate.

As to the adequacy of Table S-3, the court of appeals had suggested that the approach taken was misleading and tended to minimize the environmental impacts. Specifically, it observed that "the toxic life of the wastes under discussion far exceeds the life of the plant being licensed," and it suggested that Table S-3 improperly abbreviated consideration of the environmental impacts of radioactive wastes generated by a nuclear reactor to the operating life of any given reactor (some

74. *Id.*

75. 547 F.2d 633 (D.C. Cir. 1976), *rev'd and remanded on other grounds sub nom.* Vermont Yankee Nuclear Corp. v. Natural Resources Defense Council, Inc., 98 S.Ct. 1197 (1978).

76. Vermont Yankee Nuclear Corp. v. Natural Resources Defense Council, Inc., 98 S.Ct. 1197, 1207 n.14 (1978). The question of the adequacy of the record to sustain the initial S-3 rule is currently pending before the court of appeals. Natural Resources Defense Council, Inc. v. NRC, No. 74-1385 (D.C. Cir.) *remanded* April 3, 1978.

40 years).[77] The court of appeals stated that the "full detoxification period" for these wastes would provide a more appropriate time period for the environmental assessment.[78]

The court also concluded that Table S-3's "focus on only the *incremental* impact of waste generated by an additional reactor," rather than the prospective cumulative effects of all operating light water reactors, was misleading.[79] Finally, the court stated that meaningful assessment of the potential environmental impacts of waste disposal might include a discussion of the feasibility and availability of the technology underlying the environmental predictions.[80]

After the decision of the court of appeals[81] and while the matter was still pending in the Supreme Court, the NRC reopened the S-3 rulemaking proceedings in May 1977, to develop the final S-3 rule.[82] The reopened administrative proceeding was conducted over the course of some thirteen months, and the evidentiary record was closed June 26, 1978.[83]

In its existing format, Table S-3 would appear to violate the most rudimentary requirements of NEPA — including the deficiencies which the court of appeals identified. The current S-3 rule lacks any narrative accompanying the Table which would describe in clear and understandable terms the many uncertainties and non-quantifiable factors inherent in the calculations underlying the numbers in the Table. It fails to disclose the actual adverse health impacts on man in terms of genetic mutations and cancers, relying instead upon a quantification of the curies of radioactive waste released. The Table limits its impact analysis to a fifty year cut-off point, rather

77. Natural Resources Defense Council, Inc. v. NRC, 547 F.2d 633, 639 n.12 (D.C. Cir. 1976).

78. *Id.*

79. *Id.*

80. *Id.* at 640 n.13.

81. Immediately following the court of appeals decision, the NRC staff drafted an interim S-3 rule. This interim S-3 rule was modeled on a numerical chart identical to the initial Table S-3 with revisions limited to a few of the numbers contained in the chart. This interim S-3 rule was seen as a temporary measure that would be utilized in EIS's in individual reactor licensing proceedings pending completion of the generic proceeding to develop a final S-3 rule. 42 Fed. Reg. 13,803, 13,806 (1977). A challenge to this interim rule is also currently pending before the court of appeals. Natural Resources Defense Council, Inc. v. NRC, No. 77-1448 (D.C. Cir., filed May 13, 1977).

82. 42 Fed. Reg. 26,987 (1977).

83. Memorandum and Order from the Hearing Board, Docket No. RM 50-3 (May 4, 1978); as amended by the Memorandum and Order of May 10, 1978.

than calculating adverse health impacts over the entire time period the radionuclides remain toxic. And finally, it lacks any assessment of the cumulative impacts of all operating reactors throughout the country, evaluating instead only the impacts of one year's operation of a single reactor.

It is axiomatic under NEPA that an EIS must be written in a form "understandable to nontechnical minds and yet contain enough scientific reasoning to alert specialists to particular problems within the field of their expertise."[84] An EIS must identify limitations upon the ability to assess fully environmental impacts,[85] and must also discuss the "history of success and failure of similar projects."[86] NEPA also requires that an EIS disclose "to the fullest extent possible" the environmental effects of a proposed action[87] and the cumulative effects of a series of actions or projects.[88]

Measured against these standards, the Table appears seriously deficient. A chart of numbers such as Table S-3 affords little opportunity for critical evaluation by the lay public, as required by the full disclosure objectives of NEPA. Indeed, without an accompanying narrative explaining how the figures were derived, and translating numerical values into understandable concepts, Table S-3 is meaningless to the public at large. Nor can a chart of numbers disclose the numerous uncertainties and the wide diversity of scientific opinions that exist concerning the true environmental impacts of the waste disposal system postulated in Table S-3 and the validity of the Table's calculations. Similarly, a numerical chart cannot convey the long history of waste management problems and unsuc-

84. Environmental Defense Fund, Inc. v. Corps of Engineers, 348 F. Supp. 916, 933 (N.D. Miss. 1972), *aff'd*, 492 F.2d 1123 (1974); *See also* Natural Resources Defense Council, Inc. v. Grant, 355 F.Supp. 280, 286 (E.D.N.C. 1973); Sierra Club v. Morton, 510 F.2d 813, 820 (5th Cir. 1975); Guidelines of the Council on Environmental Quality, 40 C.F.R. § 1500.8(b) (1977).

85. Scientists' Institute for Public Information, Inc. v. A.E.C., 481 F.2d 1079, 1092 (D.C. Cir. 1973). *See also* Environmental Defense Fund, Inc. v. Corps of Engineers, 325 F.Supp. 728 (E.D. Ark. 1971).

86. Natural Resources Defense Council, Inc. v. Grant, 355 F.Supp. 280, 288 (E.D.N.C. 1973); *See also* Sierra Club v. Morton, 510 F.2d 813, 824 (5th Cir. 1975).

87. Calvert Cliffs' Coordinating Committee, Inc. v. AEC, 449 F.2d 1109, 1114 (D.C. Cir. 1971). *See also* Scientists' Institute for Public Information, Inc. v. A.E.C., 481 F.2d 1079, 1092 (D.C. Cir. 1973); Natural Resources Defense Council, Inc. v. NRC, 547 F.2d 633, 639 (D.C. Cir. 1976).

88. Kleppe v. Sierra Club, 427 U.S. 390, 409-10 (1976); Natural Resources Defense Council, Inc. v. Callaway, 524 F.2d 79, 88 (2d Cir. 1975).

cessful waste disposal efforts that have characterized waste management activities in this country to date.[89] Finally, the chart's truncation of the time period for the evaluation of adverse health effects to only one year's operation of a single nuclear reactor, rather than its full operating life, appears to violate the NEPA principles as described above.

As yet, no final NRC action has been taken with respect to the modifications necessary to establish an adequate final rule.[90] Unless substantial modifications in the rule are made, no doubt the final rule will be legally deficient and will be subject to challenge. Uncertainty resulting from the lack of a final rule will continue to surround nuclear licensing, and the public and decisionmakers will continue to be deprived of adequate information on which to base their reactor licensing decisions.

D. *The Atomic Energy Act Reactor Safety Review*

As part of the pervasive concern for public safety in the AEA,[91] the NRC is required to undertake a safety review of

89. *See* text accompanying notes 7-13 *supra*.

90. The administrative hearing board in charge of this rulemaking proceeding has, however, recommended to the NRC Commissioners (1) that a table of numbers, revised only to the most limited extent, be adopted as a "final" rule, (2) that an extremely brief accompanying narrative be developed at some unspecified time and (3) that various additional modifications (such as inclusion of cumulative impacts and adverse impacts in terms of man-rems of radiation) be made in a future S-3 update proceeding. *Conclusions and Recommendations of the Hearing Board*, NRC Docket No. RM 50-3 (October 26, 1978). These recommendations appear to fall far short of NEPA's requirements both because they fail to encompass the wide range of modifications necessary in the S-3 rule and because they defer indefinitely and unnecessarily the limited modifications that are proposed.

91. In section 2 of the AEA, Congress specifically found that the "processing and utilization" of nuclear materials "must be regulated . . . to protect the health and safety of the public," and that "regulation by the United States of the production and utilization of atomic energy and of the facilities used in connection therewith is necessary . . . to protect the health and safety of the public." 42 U.S.C. § 2102(d), (e) (1976). Numerous provisions in the Act mandate consideration of public health and safety in the exercise of regulatory responsibilities. *See, e.g.*, 42 U.S.C. § 2014(v) (production facility defined in terms of impact on public health and safety); § 2014(cc) (utilization facility defined in terms of impact on public health and safety); § 2021(d) (licensing authority delegated to the states contingent upon protection of the public health and safety); § 2039 (reactor safeguard committee established to report on potential hazards of reactor safety); § 2051(a)(5) (research program shall be directed, *inter alia*, to protect the public health and safety); § 2073(e)(7) (licenses for special nuclear material issued pursuant to standards to protect public health and safety); § 2099 (licenses to handle source material issued only if they will not be inimical to public health and safety); § 2111 (nuclear by-product material exempt from licensing only if there will be no unreasonable risk to the public health and safety); § 2134(a) (medical

proposed reactor licenses and to make an explicit, definitive finding that the activities authorized by the license can be conducted safely.[92] Section 103(b) of the AEA directs the NRC to issue reactor licenses to only those persons who will observe "such safety standards to protect health and to minimize danger to life or property as the Commission may by rule establish."[93] Section 103(d) precludes the issuance of a license for the production or utilization of nuclear materials if it "would be inimical to . . . the health and safety of the public."[94] Section 182 requires the Commission to make explicit findings in reactor licensing proceedings that the utilization and production of special nuclear material "will provide adequate protection to the health and safety of the public," and authorizes the Commission to obtain whatever information it deems necessary to make such a finding.[95]

The NRC's safety review in reactor licensing encompasses a full range of risks and hazards associated with reactors — with the important exception of the feasibility of permanently disposing of the radioactive wastes generated by the reactor. The NRC considers only the adequacy of *interim* storage of radioactive wastes at the reactor site.[96] The agency maintains that it has no statutory obligation to consider explicitly ultimate waste disposal in the reactor licensing context. The NRC thus avoids making any regulatory link between the continued licensing of reactors and the problem of disposing of their output of radioactive waste. The agency does contend that it makes an "implicit finding" of confidence that a waste disposal facility will be available when needed. It asserts that this informal judgment of confidence provides ample justification for the

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therapy utilization facilities subject to regulation necessary to protect health and safety); § 2134(c) (licenses for utilization facilities used in research subject to regulations to protect public health and safety); § 2164 (international cooperation and disclosure of data on health and safety issues authorized).

92. Power Reactor Development Co. v. International Union, 367 U.S. 396, 406-407 (1961).

93. 42 U.S.C. § 2133(b) (1976).

94. 42 U.S.C. § 2133(d) (1976).

95. 42 U.S.C. § 2232(a) (1976).

96. The NRC's regulations require each applicant to submit information concerning the production, onsite storage, onsite packaging and shipment offsite of radioactive waste. 10 C.F.R. §§ 50.34(b)(2)(i) (1978); 50.34(b)(3) (1978); 50.34a(a) (1978); 50.34a(c)(1) (1978). No information concerning ultimate disposal is solicited or considered.

continued licensing of nuclear reactors.[97]

On its face, the NRC's refusal to make an explicit public finding of the safety of waste disposal would appear to violate the requirement of the AEA that a definitive, unqualified finding of safety be made in licensing reactors. Moreover, the agency's reliance on an "implicit" finding of safety runs counter to basic precepts of administrative law requiring explicit findings on all issues material to the agency's decision.[98] Finally, by analogy, the principles of agency decisionmaking established in judicial interpretations of other environmental protection laws would appear to require public consideration of permanent waste disposal in reactor licensing. For example, it has been firmly established under NEPA that an agency must consider the indirect or second order effects of the immediate projects proposed, and must abjure any limitation of perspective to the immediate boundaries or site of a project.[99] Also, in several cases decided under NEPA, the courts have held the effects of radioactive wastes or the use of potentially hazardous nuclear technologies must be assessed fully before facilities employing these technologies are licensed by the NRC.[100] The reasoning of these cases would logically dictate that the safety of ultimate waste disposal be fully considered within the reactor licensing process.

There is no express enactment of Congress to support the asserted exemption of this matter from the broad directive in the AEA to protect public health and safety. The NRC's interpretation of its mandate rests almost entirely on its belief that Congress has given *tacit* approval to the agency's contrary practice, subsequent to the passage of the AEA.[101] The agency points to statements made by its officials in Congressional sub-

97. 42 Fed. Reg. 34,391 (1977).

98. International Union v. Marshall, 584 F.2d 390 (D.C. Cir. 1978); International Harvester Co. v. Ruckelshaus, 478 F.2d 615, 651-652 (D.C. Cir. 1973) (Bazelon, J., concurring); Greater Boston Television Corp. v. F.C.C., 444 F.2d 841, 852 (D.C. Cir. 1970), *cert. denied*, 403 U.S. 923 (1971).

99. Greene County Planning Bd. v. F.P.C., 455 F.2d 412, 424 (2d Cir.), *cert. denied*, 409 U.S. 849 (1972); Sierra Club v. Coleman, 421 F.Supp. 63, 67 (D.D.C. 1976).

100. Natural Resources Defense Council, Inc. v. NRC, 547 F.2d 633, 641 (D.C. Cir. 1978); Natural Resources Defense Council, Inc. v. NRC, 539 F.2d 824, 841 (2d Cir. 1976); Scientists' Institute for Public Information v. AEC, 481 F.2d 1079, 1089 (D.C. Cir. 1973).

101. 42 Fed. Reg. 34,391, 34,392-34,393 (1977).

committee hearings that no solution to ultimate waste disposal had been found yet and that no permanent waste repository was available yet. From Congress' failure to halt nuclear reactor licensing in the face of such representations, the NRC deduces a Congressional sanction of its practice of exempting the question of safe waste disposal from its reactor safety review.[102]

In cases which have previously considered similar arguments, however, the courts have consistently refused to find tacit legislative approval of an agency's interpretation or practice, absent a showing of explicit Congressional knowledge of particular agency interpretation or practice.[103] In this instance, the NRC is unable to point to any evidence that Congress was ever made aware that the NRC had dispensed with any written, express determination of the feasibility of safe, permanent waste storage in licensing the reactors which generate that waste.

The NRC further justifies the exclusion of waste disposal safety from its reactor safety review on the grounds that the agency in licensing a permanent waste repository pursuant to section 202 of the ERA[104] will make such a finding. In the NRC's view, the requisite safety review merely has been deferred, not eliminated. It appears, however, that due to the timing and the scope of the section 202 safety finding, the character of such a review will be markedly different from a safety review undertaken in the reactor licensing context. The section 202 finding will be made after wastes requiring disposal have been generated and will focus on the adequacy of a specific disposal site. This review will insure that no license will issue for an inadequate repository, but will give no assurance that a safe disposal site will ever be developed.

The NRC denied a petition filed by the Natural Resources Defense Council to obtain such a definitive safety finding, and a petition for review of that decision was filed in the Court of Appeals for the Second Circuit. The suit asked that the NRC be required to hold an administrative proceeding to determine, prior to the issuance of reactor licenses, whether a reasonable assurance exists that radioactive wastes can be disposed of

102. *Id.*

103. Tennessee Valley Authority v. Hill, 98 S. Ct. 2279, 2300 (1978); SEC v. Sloan, 98 S. Ct. 1702, 1712 (1978); Thompson v. Clifford, 408 F.2d 154, 167 (D.C. Cir. 1968).

104. 42 U.S.C. § 5842 (1976).

safely. The briefs filed in the case emphasized that such a finding would not necessitate a showing that a permanent waste facility was in actual operation. Rather, reasonable assurance could be based on a definitive finding that at a minimum: (1) technology exists for safe permanent disposal although it need not be in place now; (2) the appropriate technology will be fully implemented; and (3) reactor licenses are conditioned on the establishment of and compliance with appropriate deadlines for the development of safe waste disposal facilities. The court of appeals accepted the NRC's argument and denied the petition.[105] The court's decision thus allows the NRC to avoid a formal, focused review of this technical safety question, and fosters a major regulatory flaw in the licensing of nuclear power reactors.

E. *The Licensing of a Permanent Waste Repository*

The urgency for the development of a permanent waste repository increases as interim storage facilities fill to capacity, but the licensing process to be applied to such a facility is clouded with uncertainty. Section 202 of the ERA provides the only explicit statutory authority for the NRC to license a DOE waste management facility.[106] Subsection (3) of section 202 deals specifically with commercially generated wastes and requires an NRC license for waste facilities used primarily "for the receipt and storage of high-level radioactive wastes resulting from activities licensed under such Act [AEA]."[107]

A narrow construction of section 202 would leave a major loophole in the NRC's licensing jurisdiction over an ultimate waste repository for commercial waste.[108] The statute speaks in

105. Natural Resources Defense Council, Inc. v. NRC, No. 77-4157 (2d Cir. July 5, 1978), *petition for rehearing denied* (September 26, 1978).

106. 42 U.S.C. § 5842 (1976).

107. 42 U.S.C. § 5842(3) (1976).

108. There are also serious gaps in the regulatory system for licensing a repository for military wastes. Subsection (4) of section 202 of the ERA requires an NRC license for "facilities authorized for the express purpose of subsequent long-term storage of high-level radioactive waste generated" by the DOE which are not part of "research and development activities." 42 U.S.C. § 5842(4) (1976). In the past, the NRC has taken the position that storage of more than twenty years is long-term. *Oversight Hearing Before the Subcomm. on Energy and the Environment, Comm. on Interior and Insular Affairs*, 95th Cong., 1st Sess. 208 (May 16, 17, & 20, 1977) (testimony of Dr. Clifford V. Smith, Jr.). Since current plans call for emplacement of military-generated wastes on a retrievable basis, it may be argued that Water Isolation Pilot Plant (WIPP) would not constitute a long-term storage facility pending a decision to leave the wastes there permanently. Moreover, since WIPP is to be the first actual

terms of "high-level" radioactive waste. If this term is construed according to the "official" definition of "high-level" wastes,[109] spent fuel rods and transuranic contaminated wastes, which do not fall under this narrow definition, would be excluded from the licensing requirements.[110] This sort of restrictive interpretation of the NRC's licensing authority makes no practical sense. At the time the definition of "high-level" waste was developed, federal policy contemplated the reprocessing of spent fuel so that the fission products, along with transuranic nuclides, would be separated from usable uranium and plutonium. NRC regulations therefore defined "high-level" waste as those highly radioactive liquids resulting from the separation process, or their equivalent. The regulations further required that such high-level wastes be solidified and sent to a federal repository. Now, however, with the indefinite deferral of commercial reprocessing,[111] spent fuel will be the ultimate waste form requiring disposal.

As a practical matter it no longer makes sense to differentiate the regulatory treatment of high-level wastes, spent fuel rods, and transuranic contaminated wastes. These wastes have similar properties and pose similar hazards, and thus require similar levels of public protection. Moreover, it is the NRC's responsibility under the AEA and the ERA to ensure that potentially hazardous products resulting from the continued development of nuclear energy should be subject to the separate scrutiny of an independent regulatory agency. A narrow approach to the NRC's licensing authority over permanent waste repositories, therefore, would undercut the fundamental purposes of the regulatory structure established by those acts.

The NRC has recognized the desirability of subjecting a commercial waste repository to the licensing process and has taken the position that section 202 of the ERA as currently

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operating repository and DOE will be "experimenting" with the waste disposal techniques, it may be argued that the "research and development" exemption is available.

109. 10 C.F.R. § 50 app. F (1978).

110. Indeed, certain electric utilities raised this very question in Natural Resources Defense Council, Inc. v. NRC, No. 77-4157 (2d Cir. July 5, 1978), *petition for rehearing filed, denied* (September 26, 1978), the case which sought a definitive safety finding on waste disposal from the NRC. *See* text accompanying notes 104-105 *supra*, Brief for Intervenors Power Authority of the State of New York, *et al.* at 4 (January 13, 1978).

111. *See* text accompanying notes 12-13 *supra*.

drafted can be read appropriately to vest the agency with the authority to license the receipt of both high-level waste and spent fuel in such a facility.[112] Both the NRC and DOE have recognized, however, that NRC licensing jurisdiction over ultimate disposal of commercial transuranic wastes under the existing legislation is uncertain. The recent special DOE task force urged that legislative changes be sought to close this regulatory failing.[113] In response, several bills have been introduced in Congress to remove the potential licensing gaps in section 202 of the ERA as currently drafted and to make explicit NRC licensing jurisdiction over commercial repositories for high-level wastes, spent fuel rods, and transuranic wastes.[114]

Because plans to develop a facility to house commercial wastes exclusively have lagged seriously behind schedule,[115] the DOE is now considering combining military-generated wastes and some commercial wastes in the Waste Isolation Pilot Plant (WIPP), the most recent proposal by the federal government for a deep salt bed geologic repository. This project is slated for development near Carlsbad, New Mexico. Although the facility was planned initially for the disposal of military transuranic wastes only, the most recently announced WIPP "mission" envisions that the facility will provide for: (1) the permanent disposal of defense-generated transuranic waste; (2) experimental studies conducted with military high-level wastes; and (3) possibly up to 1,000 commercial spent fuel assemblies. Under current plans, all of these various types of wastes would be stored in a retrievable manner, until it is determined that they may be allowed to remain safely in WIPP in perpetuity.[116]

If DOE holds true to this agenda and to the position that existing NRC licensing authority applies to spent fuel rods as well as high-level wastes, at a minimum that portion of the facility engineered for commercial waste disposal would be subjected to NRC review. The narrow wording of the NRC's statutory jurisdiction over waste repositories, however, raises doubts about the breadth of the NRC's mandate. For instance,

112. Testimony of Dr. Clifford V. Smith, Jr., *supra* note 108 at 212.

113. *See* DEUTCH REPORT, *supra* note 18, at 6.

114. H.R. 9190, 95th Cong., 1st Sess. (1977). S. 2804, 95th Cong., 2nd Sess. (1978). S. 3146, 95th Cong., 2nd Sess. (1978).

115. *See* text accompanying notes 30-41 *supra*.

116. 43 Fed. Reg. 30,331 (1978).

licensing consideration of the disposal of spent fuel may be avoided. There is uncertainty, furthermore, whether commercial transuranic wastes buried at WIPP (if the scope of that facility is expanded) or at another repository for commercial wastes would come under licensing review. Despite their tremendous importance, permanent waste disposal facilities may slide through a regulatory gap and be subject to inadequate licensing review unless these uncertainties in the regulatory structure are removed.

IV. CONCLUSION

Serious flaws pervade the regulatory system for the management and disposal of radioactive waste. These deficiencies are due in part to the Nuclear Regulatory Commission's failure to exercise fully its clear statutory authority and in part to uncertainty concerning the scope of that authority. Initial advances have been made recently in rectifying deficiencies in the regulation of uranium mill tailings. The closing of remaining regulatory loopholes through more vigorous agency action, perhaps accompanied by more explicit authorizing legislation, is essential to ensure adequate protection of public health and safety against the hazards of the nuclear industry.