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CASE HISTORIES OF EA DOCUMENTS FOR NUCLEAR WASTE

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ABSTRACT

Nuclear power programs and policies in the United States have been subject to environmental assessment under the Nation Environmental Policy Act (NEPA) since 1971. NEPA documentation prepared for programmatic policy decision-making within the nuclear fuel cycle and concurrent federal policy are examined as they relate to radioactive waste management in this paper. Key programmatic environmental impact statements that address radioactive waste management include: the Atomic Energy Commission document on management of commercial high level and transuranium-contaminated radioactive waste, which focussed on development of engineered retrievable surface storage facilities (RSSF); the Nuclear Regulatory Commission (NRC) document on use of recycled plutonium in mixed oxide fuel in light water cooled reactors, which focussed on plutonium recycle and RSSF; the NRC statement on handling of spent light water power reactor fuel, which focussed on spent fuel storage; and the Department of Energy (DOE) statement on management of commercially generated radioactive wastes, which focussed on development of deep geologic repositories. DOE is currently pursuing the deep geologic repository option, with monitored retrievable storage as a secondary option.

In the more than 30 years since the beginning of the nuclear energy era, ever increasing amounts of radioactive wastes have been generated by national defense programs, by nuclear power industry, and by medical, industrial, and research activities. During this time, federal regulators have struggled with radioactive waste management issues and programmatic policy decisions. The history of nuclear power regulatory responsibility is summarized in Table I. Nuclear power programs and policies have been subject to environmental impact assessment under the National Environmental Policy Act (NEPA) since 1971 (when the courts ruled in the case of Calvert Cliffs Coodinating Committee V. U.S.AEC).

NEPA, which was implemented in 1970, has two primary aims: (1) ensuring that federal decision-makers consider the environmental impact of their actions, and (2) providing a means by which the public is informed of and can participate in analysis of environmental impacts of a proposed action.[1] Although NEPA does not specifically require preparation of programmatic environmental impact statements (EISs), the courts require their preparation when the institution of a program forecloses decisions on whether to approve individual projects that themselves require EISs.[2]

In many instances the purposes of NEPA [Section 102(2)(c)] will best be served by a programmatic EIS. A programmatic EIS may be prepared at the time the general rules for conduct of the program are issued, or may result from the thorough reexamination NEPA requires for ongoing programs. The programmatic EIS affords an occasion for a more comprehensive consideration of effects and alternatives than is practicable in a statement on an individual action and it avoids duplicative discussion of basic policy questions. A programmatic EIS can be supplemented or updated as necessary to account for changes in circumstances or public policy and to measure cumulative impacts over time. However, a programmatic EIS would not satisfy Section 102(2)(c) if it were superficial or limited to generalities. The very rationale for a programmatic EIS requires that environmental considerations be fully analyzed. When all significant issues cannot be treated adequately in connection with the program as a whole, assessments of more limited scope will be necessary on some or all individual actions to complete the analysis.[3]

Programmatic NEPA documents, which deal with broad policy options within the nuclear fuel cycle, are presented in Table II. The fuel cycle includes those steps involved in removing uranium ore from the earth and transforming it into reactor fuel (i.e., mining, milling, conversion, enrichment, and fuel fabrication) and steps occurring after uranium fuel is spent (i.e., storage, reprocessing, and waste disposal).

NEPA documentation prepared for programmatic policy decision-making within the nuclear fuel cycle and concurrent federal policy are examined as they relate to radioactive waste management in this paper. Programmatic statements directly related to radioactive waste management are summarized (i.e., Purpose and Scope; Findings) in Table III.

President Nixon, in his energy policy message to Congress in June 1971, stressed the need for development of the liquid metal fast breeder reactor (LMFBR).[3] Again emphasizing the future of nuclear energy in his State of the Union Message on Natural Resources and the Environment, 15 February 1973, President Nixon pointed out that the major alternative to fossil energy for the remainder of the century was nuclear energy.[4] Additionally, he indicated that development of the LMFBR was the highest priority target for nuclear research and development. In the same year, 12 June 1973, the Court of Appeals for the District of Columbia ruled that the AEC must file an environmental impact statement on the LMFBR program.

President Nixon also emphasized in his State of the Union Message that additional funding was being provided to assure that the rapidly growing reliance on nuclear power would not compromise public health and safety. This included supporting work on systems for safe surface storage of radioactive waste and exploring the possibility of underground burial for long-term containment of radioactive waste produced by nuclear reactors.[4]

In his 1974 statement on energy, President Nixon emphasized the following, relative to nuclear power: (1) before 1985, widespread introduction of nuclear power must occur; (2) beyond 1985, considerable payoffs from programs in nuclear breeder reactors should occur; and (3) programs in nuclear fusion and advanced breeder reactors appear to be keys to the future.[5] Additionally, he called for creation of the Energy Research and Development Administration (ERDA) and the Department of Energy and Natural Resources.

Meanwhile, the ability of AEC to manage radioactive waste was severely questioned by the public. In 1974, the AEC shelved indefinitely two proposals to store radioactive wastes from nuclear power plants--the Lyons, Kansas Salt Mines and the Savannah River bedrock program.[4] The proposals were ultimately abandoned because of uncertain environmental impacts identified by AEC and public analyses conducted through the EIS process.[6]

Subsequently, in September 1974, AEC issued the first programmatic draft EIS on radioactive waste management.[7] The proposal it contained, to construct and operate a retrievable surface storage facility (RSSF), was widely criticized by citizen and environmental groups as well as by EPA for many reasons. In particular, because it did not respond to the need for ultimate disposal of radioactive wastes.[6] During this time frame AEC also proposed, in the draft EIS for the LMFBR, that high-level radioactive wastes be deposited for an interim period in RSSF, pending development of a suitable method for permanent storage.[5] Some comments criticized the RSSF proposal as being of unproven reliability, security, and cost-effectiveness.

The issue of priorities in the conduct of federal energy research and development did receive detailed scrutiny by the Congress and the executive branch during 1974 and early 1975.[6] The federal energy research and development (R&D) budget had been weighted heavily toward nuclear power with particular emphasis on the LMFBR program. Recent energy supply problems, the perceived limited payoff from nuclear R&D, and increasing concern with the environmental and public safety implications of nuclear power resulted in passage of several energy-related acts, including the Energy Reorganization Act of 1974. The Act abolished AEC and created ERDA and Nuclear Regulatory Commission (NRC). In April 1975, ERDA withdrew the AEC September 1974 draft EIS on radioactive waste management stating that a new study would be prepared evaluating all environmentally significant waste-producing steps of the fuel cycle and ultimate disposal of radioactive wastes. ERDA published a national energy plan for research and development in mid-1975.

The generic draft EIS on the use of recycle plutonium in mixed oxide fuel in light water cooled reactors (GESMO) was issued in August 1974 by AEC.[8] In its draft EIS dealing with plutonium recycle, the AEC had recognized the importance of adequate safeguards for the plutonium in various parts of the fuel cycle, but took the position that the decision to permit plutonium recycle could be made in mid-1975 before a system of safeguards was designed, so long as the system was operational before recycle proceeded.[6] In January 1975, the President's Council on Environmental Quality (CEQ) expressed the view that the AEC draft EIS was incomplete because there wasn't a comprehensive analysis of the safeguards issue. The CEQ believed that such a presentation should be made by NRC prior to its final decisions on plutonium recycle. Subsequently, NRC deferred its decision on plutonium recycle until alternative safeguards systems were complete and a safeguards program designed and subjected to public review. In November 1975 the NRC announced its schedules and procedures for completing GESMO and its decision on whether to permit recycling of plutonium.[9] The U.S. Court of Appeals for the Second Court reversed and remanded to NRC that portion of the order dealing with interim licensing of plutonium recycle facilities prior to NRC final decision on widescale use of plutonium.

President Carter submitted his National Energy Plan to Congress during April 1977. The plan identified the following steps his Administration would take to deal with domestic nuclear safety and spent fuel storage: an improved inspection program; mandatory reporting of all mishaps and failures; development of improved siting criteria; a review of the entire licensing process; and a review of the ERDA radioactive waste management activities.[10] The plan called for creation of the Department of Energy (DOE) to succeed ERDA. In April 1977, President Carter also announced a major redirection of policy, proposing to avoid nuclear proliferation and postponing use of plutonium as a commercial fuel. The following October the Carter Administration requested termination of GESMO and NRC halted proceedings in December 1977.

During April 1977, the Carter Administration also announced foreign and domestic policies for providing adequate and safe storage of spent nuclear fuel.[11] Domestic policy allowed U.S. nuclear powerplants to turn spent nuclear fuel over to the federal government for storage and disposal. On 18 October 1977, DOE announced that the federal government would accept and take title to spent nuclear fuel from utilities upon payment of one-time storage fees.[12] DOE policy actions presumed continued light water operation power generation with discharge of spent fuel and government responsibility for the storage and disposition of spent fuel. Subsequently, NRC published the programmatic draft EIS for handling and storage of spent light water power reactor fuel (March 1978).[12] Major findings of the EIS were that storage would have an insignificant impact on the environment and that if an operational geologic repository were in place before the year 2000, away-from-reactor storage requirements would not be great.

The CEQ, in their 1978 report on the environment, indicated that for many years the view of AEC and later ERDA was that basic scientific and technical information for safe disposal of nuclear waste was available and that a method only needed to be demonstrated.[11] CEQ, however, cited a recent General Accounting Office report which concluded that the future of nuclear power in the U.S. was threatened by the unsolved radioactive waste disposal issues.

President Carter, in his message to Congress on Environmental Priorities and Programs (August 1979), cited as accomplishments since 1977 the following: (1) the 1977 Nuclear Non-Proliferation Act and (2) indefinite deferral of other activities that might lend to weapons proliferation, particularly nuclear fuel reprocessing and commercialization of the breeder reactor.[13] Additionally, President Carter indicated that he would soon announce a national waste management policy designed to deal effectively with nuclear wastes from all sources, including commercial, defense, medical, and research activities. The nuclear waste management policy was to be based primarily on recommendations presented by the Interagency Review Group (IRG) on Nuclear Waste Management (March 1979). Some important findings of their report included:

- Existing and future nuclear waste from military and civilian activities, including discarded spent fuel from the once-through nuclear fuel cycle, should be isolated from the biosphere so that it does not pose a significant threat to public health and safety.

- The responsibility for establishing a waste program should not be deferred to future generations.

- A broader research and development program for waste disposal, particularly geologic isolation, should begin promptly.

- Public participation should be developed and strengthened for all aspects of nuclear waste management programs.

The IRG also recommended that by 1981, DOE and NRC should review existing and alternative low-level radioactive waste (LLW) disposal techniques.[13] The IRG considered safe disposal of mill tailings a matter of great urgency and importance. The IRG indicated that dealing with institutional issues in nuclear waste management was as important and difficult as technical problems--perhaps more so.

The NRC published two programmatic EISs on management of radioactive waste for determining regulatory requirements (i.e., uranium milling on September 1980;[14] and licensing requirements for land disposal of LLW on November 1982).[15] The NRC identified management alternatives for uranium mills and mill tailings that could achieve congressional aims of adequately controlling emissions without ongoing maintenance at a reasonable cost. The 1982 final EIS was limited in scope in that all issues associated with disposal of LLW were not analyzed. Rather, the final EIS provided the decision analysis for licensing requirements in 10 CFR Part 61. NRC staff analyzed alternative courses of action and requirements were selected with consideration of costs, environmental impacts, and health and safety effects to current and future generations. The Low-Level Radioactive Waste Policy Act of 1980 delegated responsibility for LLW disposal to the states. States are in the process of forming regional compacts for managing and disposing of LLW.

On 12 February 1980, President Carter announced the first radioactive waste management program. DOE subsequently published the programmatic final EIS on management of commercially generated radioactive waste (October 1980). The proposed action reflected the Carter Administration policy/interim planning strategy, which was to receive emphasis pending DOE NEPA review. DOE concluded that a decision to proceed with the proposed action of disposing of commercially generated radioactive wastes in deep geologic repositories was warranted. The no-action alternative (i.e., indefinite storage) was found to be undesirable because the temporary alternative was found to be contrary to presidential proclamation.

In his October 1981 policy statement on nuclear power, President Reagan addressed the radioactive waste problem by directing the DOE, working with industry and state governments, to proceed swiftly toward deploying the means of storing and disposing of commercial high-level radioactive wastes. President Reagan signed into law the Nuclear Waste Policy Act of 1982 on 7 January 1983. The Act provided for the development of repositories for disposal of high-level radioactive waste and spent nuclear fuel and established a program of research, development, and demonstration regarding disposal of high-level radioactive waste and spent nuclear fuel. The Act required DOE to site, license, and operate repositories for spent nuclear fuel and high-level radioactive waste in a manner that would provide reasonable assurance that the public and the environment will be adequately protected. The program developed by DOE to fulfill requirements of the Act was published in the 1984 Draft Mission Plan for the Civilian Radioactive Waste Management Program.[17] DOE gave notice, of the availability of draft environmental assessments for nine potentially acceptable sites for a repository for permanent disposal of spent nuclear fuel and high-level radioactive waste, on 20 December 1984.

In conclusion, programmatic NEPA documentation has been prepared for radioactive waste management programmatic policy decision-making. This NEPA documentation has provided a means by which the public is informed of and can participate in analysis of environmental impacts of a proposed action. EIS findings, however, have tended to support existing federal policy for radioactive management, for example, the DOE final EIS for management of commercially generated radioactive wastes. Additionally, radioactive waste management policy has tended to be set by presidential proclamation, which in some cases has preceded NEPA.

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13. Council on Environmental Quality, Environmental Quality--1979, Washington, D.C. (1979).

14. United States Nuclear Regulatory Commission, "Final Generic Environmental Impact Statement on Uranium Milling," NUREG-0706 (1980).

15. United States Nuclear Regulatory Commission, "Final Environmental Impact Statement 10 CFR Part 61, Licensing Requirements for Land Disposal of Radioactive Waste," NUREG-0945 (1982).

16. United States Department of Energy, "Final Environmental Impact Statement, Management of Commercially Generated Radioactive Waste," DOE/EIS-0046F (1980).

17. United States Department of Energy, "Mission Plan for the Civilian Radioactive Waste Management Program," DOE/RW-0005 Draft (1984).

TABLE I

History of Nuclear Power Regulatory Responsibility in the United States

Army Corps of Engineers (COE)--COE, under the Manhattan District Project, controlled development of nuclear energy (atomic weapons program in World War II).

Atomic Energy Commission (AEC)--Atomic Energy Act of 1946 transferred control over development of nuclear energy to AEC. From 1946 to 1954 the federal government retained ownership of all nuclear materials and facilities. Atomic Energy Act of 1954 allowed the private sector to possess nuclear materials and to build and operate nuclear reactors under AEC license.

Nuclear Regulatory Commission (NRC)--Energy Reorganization Act of 1974 assigned regulatory functions of AEC to NRC. NRC has the power to regulate specific facilities and to enforce radiation standards. NRC is to supplement DOT transport regulations for radioactive materials that have a high potential hazard. NRC and DOT have responsibility for developing safety standards for packaging materials. The Atomic Energy Act of 1954 allowed NRC to transfer some of its authority to state governments.

Energy Research and Development Administration (ERDA)--Energy Reorganization Act of 1974 assigned research and development functions of AEC to ERDA.

Department of Energy (DOE)--Energy Organization Act of 1977 transferred ERDA functions to DOE

Environmental Protection Agency (EPA)--The President's Reorganization Plan No. 3 of 1970 transferred the environmental standard setting functions from AEC to EPA. Federal Radiation Protection Council functions were also transferred to EPA. EPA regulates disposal of radioactive wastes into oceans.

Department of Transportation (DOT)--DOT is responsible for developing overall transport regulations for safe shipment of radioactive materials.

TABLE II

Programmatic EISs Prepared for Steps in the Nuclear Fuel Cycle

Steps in Fuel Cycle--Generic EIS.

Mining--None.

Milling--Final Generic Environmental Impact Statement on Uranium Milling, NUREG-0706, September 1980 (Prepared by NRC).

Final Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites, 40 CFR 192, EPA 520/4-82-013-1, October 1982 (Prepared by EPA).

Conversion--None.

Enrichment--Final Environmental Statement, Expansion of U.S. Uranium Enrichment ERDA-1543, April 1976 (Prepared by ERDA).

Fuel Fabrication--None.

Commercial Power Generation--Final Environmental Impact Statement, Liquid Metal Fast Breeder Reactor Program, ERDA-1535, 1975 (Prepared by ERDA).

Final Environmental Statement, Expansion of U.S. Breeder Reactor Progaram, ERDA-1541, June 1976 (Prepared by ERDA).

Final Environmental Statement, Manufacture of Floating Nuclear Power Plants by Offshore Power Systems, Part I, NUREG-75 091, 1976; Part II NUREG-0056, 1978; Part III NUREG-0127, 1978 (Prepared by NRC).

Reprocessing--Final Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuel in Light Water Cooled Reactors, NUREG-0002, August 1976 (Prepared by NRC).

Spent Fuel Storage--Final Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel, NUREG-0575, August 1979 (Prepared by NRC).

Final Environmental Impact Statement, U.S. Spent Fuel Policy, DOE/EIS-0015, May 1980 (Prepared by DOE).

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Transportation--Final Environmental Impact Statement, Transportation of Radioactive Material by Rail, IC-1-32-R-1, August 1977 (Prepared by DOT).

Final Environmental Statement on the Transportation of Radioactive Materials by Air and Other Modes, NUREG-0170, December 1977 (Prepared by NRC).

Transportation of Radionuclides in Urban Environs: Draft Environmental Assessment, NUREG-CR-0743, July 1980 (Prepared by NRC).

Decommissioning--Final Generic Environmental Impact Statement on Uranium Milling, NUREG-0706, September 1980 (Prepared by NRC).

Final Environmental Impact Statement, Management of Commercially Generated Radioactive Waste, DOE/EIS-0046F, October 1980 (Prepared by DOE).

Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, NUREG-0586, January 1981 (Prepared by NRC).

Final Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites, 40 CFR 192, EPA 520/4-82-013-1, October 1982 (Prepared by EPA).

Radiation Protection Standards--Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle, Final Environmental Statement, 40 CFR 190, EPA 520/4-76-016, November 1976 (Prepared by EPA).

Final Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites, 40 CFR 192, EPA 520/4-82-013-1, October 1982 (Prepared by EPA).

TABLE III

SUMMARY OF PROGRAMMATIC NEPA DOCUMENTATION FOR RADIOACTIVE WASTE MANAGEMENT

Draft Environmental Statement, Management of Commercial High Level and Transuranium-Contaminated Radioactive Waste (Intent to Prepare, October 1973; Draft, September 1974; Final, Cancelled)

Purpose and Scope. The EIS addressed the AEC program to develop repositories for storage or disposal of commercial high-level radioactive waste, which must be transferred to AEC custody under existing regulation, and with plans for handling commercial transuranium-contaminated waste, which was expected to be transferred to AEC custody under anticipated new regulation. The basic purpose was to assess the environmental consequences of developing an engineered retrievable surface storage facility (RSSF) for commercial high-level waste; of evaluating geologic formations and sites for the purpose of developing a repository for permanent disposal; and of providing retrievable storage for commercial transuranium-contaminated waste pending availability of permanent disposal.

Findings. Overall impact of actual construction and operation of RSSF was expected to be beneficial, providing interim waste storage to allow the necessary time--expected to be two to three decades--to develop permanent disposal.

Final Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuel in Light Water Cooled Reactors (GESMO) (Intent to Prepare, February 1974; Draft, August 1974; Final, August 1976)

Purpose and Scope. The EIS was to assist NRC in arriving at a decision as to whether or not the use of fixed oxide fuel (a mixture of plutonium oxide and uranium oxide) in light water reactors should be permitted and if so, under what conditions. The final EIS analyzed the health, safety, and environmental impact costs and benefits of implementing any one of the three options for the light water reactor fuel cycle: uranium and plutonium recycling, uranium recycling, and no recycling.

Findings. The AEC staff concluded in the draft EIS that widescale use of mixed oxide fuel should be approved. The draft EIS did not set forth a detailed cost-benefit analysis of alternative programs for safeguarding plutonium, but concluded that the problem would not be unmanageable. Principal findings in the final included: safety at reactors and fuel cycle facilities was not affected significantly by recycle nonradiological impacts were smaller under the recycle option; plutonium recycle extended uranium resources and reduced enrichment requirements; widescale recycle has a likely economic advantage; differences in health effects attributable to recycle provided no significant basis for selecting a fuel cycle option; and no waste management considerations were identified that would bar recycle of uranium and plutonium.

Final Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel (Intent to prepare, September 1975; Draft, March 1978; Final, August 1979)

Purpose and Scope. The NRC directed the staff to analyze alternatives for handling and storage of spent light water power reactor fuel, with particular emphasis on developing long-range policy. Accordingly, the staff examined alternative methods of spent fuel storage as well as possible restriction or termination of the generation of spent fuel through nuclear power plant shutdown.

Findings. Storage of light water reactor spent fuel in water pools had an insignificant impact on away-from-reactor sites. Use of alternative dry passive storage techniques for aged fuel appeared to be equally feasible and environmentally acceptable. Curtailment of spent fuel generation, by closing existing power plants when their spent fuel pools become filled and by prohibiting construction of new nuclear plants was found to be undesirable and not necessary. Assuming that the national objectives of an operational geologic repository for high-level nuclear wastes and possible disposal of spent fuel was attained by or before year 2000, the staff concluded that the amount of spent fuel requiring away-from-reactor storage would not be great.

Final Environmental Impact Statement, Management of Commercially Generated Radioactive Wastes (Draft, April 1979; Final, October 1980)

Purpose and Scope. DOE has responsibility to develop technologies for management and disposal of certain classes of commercially generated radioactive wastes (i.e., high-level and transuranic). The EIS compared three programmatic alternatives for management of commercially generated radioactive wastes (i.e., disposal in deep geologic repositories, parallel development of several disposal technologies, and indefinite storage).

Findings. DOE concluded that a decision to proceed with the proposed action of disposing of commercially generated radioactive wastes in deep geologic repositories was warranted. The conclusion applied whether wastes were generated in the once-through or in the reprocessing fuel cycle option. The no-action alternative (i.e., indefinite storage) was found undesirable because waste storage was temporary, additional facilities needed to be constructed, and the no-action alternative contradicted presidential proclamation.