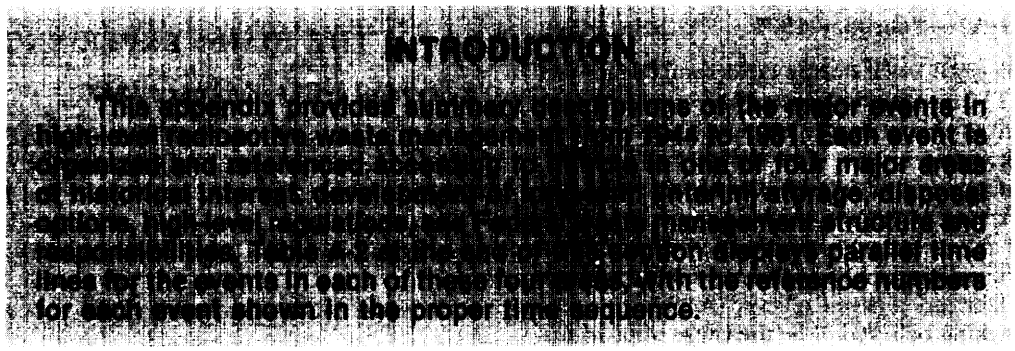
Appendix A-2
Major Events in Waste Management History—1944-81



PART I

Development of Long-Term (Interim) Storage

THE HANFORD EXPERIENCE

Reference: I-Al—December **1944**

Construction of the first storage tanks for high-level liquid radioactive waste is completed at the Hanford Reservation. The material that is put into those tanks came from reprocessing reactor fuel irradiated to produce the plutonium, some of which ultimately was used in the bomb that destroyed Nagasaki, Japan. The single-walled tanks were constructed out of carbon steel that was less durable, but more readily available and less expensive than stainless steel. The life expectancy of the tanks was estimated to be between 50 and 100 years. The use of carbon steel tanks required that the acidic liquid waste streams be made alkaline.

Reference: I-AZ—January 1952

Operations begin at the Redox reprocessing plant. This new chemical process for extracting plutonium from irradiated reactor fuel rods produces a significantly smaller volume of waste than did the original bismuth phosphate. Because of the greater concentration of fission products in the waste stream, however, the liquid waste from the first-cycle extraction system is self-boiling and must be stored in tanks with appurtenances for boiling waste. These tanks are still constructed of single-walled carbon steel and the waste is made alkaline prior to storage.

Reference: I-A3—January 1956

Operations begin at the large capacity Purex reprocessing plant. This new chemical process for extracting plutonium further reduces the volume of waste produced. The waste are still self-boiling and are stored in similarly designed single-walled carbon steel tanks.

Reference: I-A4—July 1958

The first leak of 55,000 gallons (gal) was detected in a tank containing nonboiling waste constructed in 1944. The leak was remedied and did not endanger the public as far as could be determined.

Reference: I-A5—March 1965

In order to reduce the number of new tanks to handle the waste from new production and to replace some old tanks, the Atomic Energy Commission (AEC) and the operators at Hanford embark on an in-tank solidification program. The purpose of this program is to reduce the liquid to a salt cake that would remain in the tanks even if cracks developed. The first waste to be solidified were those in the Y-tank farm and were nonboiling waste.

Reference: I-A6—June 1967

Because of their higher heat content, self-boiling waste could not be solidified in their tanks. To immobilize

those wastes, AEC and the Hanford operators begin waste fractionation. In this process, the long-lived, high heat generating fission products, cesium and strontium, are removed and the remainder of the waste is allowed to decay until it can be evaporated in tanks to a salt cake and sludge.

Reference: I-A7—February 1971

First double-shell waste storage tanks available for use at Hanford. The new tanks consist of a freestanding carbon steel tank inside a steel-lined reinforced concrete vault; a tank within a tank. This design provides secondary containment of the waste. Any leakage from the primary tank would be detected and corrective actions taken before any radioactive material comes in contact with the surrounding soil. The primary tank is also heat treated after fabrication (stress relieved) to prevent stress corrosion cracking believed to be the cause of previous tank leaks.

Reference: I-A8—May 1973

The largest leak occurs in the 106-T tank constructed in 1947. Over 100,000 gal of waste is released because the operators failed to monitor the liquid levels in a receiving tank during transfer from one tank to another. The leak was remedied and did not endanger the public as far as could be determined.

Reference: I-A9—November 1973

The waste Encapsulation and Storage Facility begins operation. This facility takes the separated cesium and strontium and packages the isotopes in a form that allows for their ultimate disposal. Until that time, the packages are stored in an engineered facility and cooled by circulating water.

THE SAVANNAH RIVER EXPERIENCE

Reference: I-Bl—November 1954

High-level liquid waste is first generated at the Savannah River Plant as part of the military production program. The waste results from reprocessing irradiated reactor fuel using a modified Purex process. The self-boiling waste is made alkaline and stored first in single-walled carbon steel tanks. Later on, double-walled carbon steel tanks are constructed and used at Savannah River.

Reference: I-B2—October 1957

The first tank leak is detected at Savannah River but none of the material is released into the environment.

Reference: I-B3—March 1960

AEC and the operators of the Savannah River Plant begin an in-tank solidification program which, like the one at Hanford, reduces the waste to a dry salt cake and sludge.

THE IDAHO EXPERIENCE

Reference: I-Cl—February 1953

Reprocessing of irradiated fuel from AEC'S experimental reactor program and the Navy's nuclear fleet begins at what is now the Idaho National Engineering Laboratory. The waste streams are not neutralized but are instead stored in stainless steel tanks.

Reference: I-C2—December 1963

The acidic waste are solidified by means of a fluidized bed waste calcinator facility for the first time. The liquid waste is sprayed into a bed of calcine which is agitated by a flow of hot air and heated to the calcining temperature. The product is converted to granular solids which are pneumatically transported to storage facilities.

Reference: I-C3—May 1970

A fire at an AEC-owned weapons fabrication facility located at Rocky Flats, Colo., leaves considerable solid waste contaminated with transuranic material. The facility ships the waste for storage to the Idaho facility, Idaho's Governor and Senators protest the transfer and receive a pledge from AEC Chairman Seaborg that the waste will be removed by the end of the decade.

Reference: I-C4—October 1976

Construction begins on a new waste calcining facility to convert liquid high-level waste to a granular solid. The new facility will replace the older calcining facility, which was designed as a demonstration unit, and it will provide many operational improvements.

NUCLEAR FUEL SERVICES REPROCESSING OPERATION

Reference: 1-Dl—May 1963

After years of effort to encourage commercial ventures in fuel reprocessing AEC approves a construction permit for the Nuclear Fuel Services Corp. (NFS) to build such a facility in West Valley, N. Y,, NFS adopts the Savannah River model of liquid waste storage in tanks. New York $tate Atomic Development Authority

agrees to be responsible for safeguarding the waste and for maintaining the tanks in perpetuity. NFS pays into trust fund for the care of the waste.

Reference: I-D2—April 1966

NFS receives an operating permit and commences fuel reprocessing.

Reference: I-D3—March 1972

NFS ceases operation and closes down for remodeling and expansion. During its nearly 6 years of operating, the company reprocessed 160 metric tons of fuel from the commercial nuclear power industry and 480 metric tons of fuel from the military production reactors at Hanford. A total volume of 640,000 gal of uranium processing waste are stored in mild steel tanks and 12,000 gal of acid thorium waste are stored in stainless steel tanks.

Reference: I-D4—April 1976

The Getty Oil Co., current owners of the NFS facility, announces their withdrawal from the reprocessing business and request that New York State, in accordance with its 1963 agreement, take over responsibility for the liquid waste stored in tanks.

Reference: I-D5—July 1979

The Energy and Water Development Appropriation Bill for 1980 directs the Department of Energy (DOE), using funding provided to it for commercial waste management, to provide necessary technical support to study and recommend a nuclear waste solidification program at West Valley, N. Y., and to assist the State of New York as appropriate in developing such a program. Based on this direction, DOE initiates studies and announces its intent to prepare an environmental impact statement (EIS) on alternatives for solidification of the high-level liquid waste in storage at the NFS site.

THE RETRIEVABLE SURFACE STORAGE FACILITY

Reference: I-El—June 1972

AEC announces plans to construct an engineered retrievable surface storage facility (RSSF) to hold commercially generated high-level waste until the time when a geological repository is available for waste disposal. This initiative is prompted by the failure of the Lyons repository project. The RSSF would be essentially designed as mausolea and would be sited at large AEC or Federal sites in the sparsely populated portions of the Western United States.

Reference: I-E2—September 1974

AEC issues an EIS in support of the RSSF. The EIS draws critical comments from a wide range of groups and individuals including some Western Governors and the Environmental Protection Agency (EPA).

Reference: I-E3—April 1975

The Energy Research and Development Administration's (ERDA) Administrator Seamans, in one of his first official acts, withdraws the RSSF impact statement and requests that the proposed congressional authorization for the RSSF be deleted.

SPENT FUEL POLICY

Reference: I-Fl—April 1977

President Carter announces that, in pursuit of nonproliferation objectives, his administration would seek the deferral of commercial reprocessing and associated recycle of plutonium. Under this policy, spent fuel would become the waste form of the future.

Reference: I-F2—October 1977

DOE, with Presidential approvaI, announces a spent fuel policy which has three major components. First, the administration will construct a large away-from-reactor facility to store any spent fuel that utilities wish to transfer to the Government. The Government would then take title to the fuel and have responsibility for it until it is permanently disposed of. Second, at the time of transfer, the utilities would pay a one-time charge for the Government's services. The charge would fully pay for storage as well as disposal costs. Third, the United States would accept for storage and disposal limited amounts of foreign spent fuel if such an action would contribute to this country's nonproliferation objectives.

Reference: I-F3—March 1981

The new Reagan administration declines to continue efforts to construct an away-from-reactor storage facility.

PART II

Development of Disposal Options

GENERIC STUDIES AND INVESTIGATIONS

Reference: II-Al—August 1957

The National Academy of Sciences (NAS) Committee, providing advice to AEC, reports on the possibility of disposing radioactive waste in geological formations. The Committee is convinced that "radioactive waste can be disposed of safely in a variety of ways and at a large number of sites in the United States." The Committee also maintains that "disposal in salt is the most promising method for the near future." Furthermore, the Committee notes that "disposal could be greatly simplified if the waste would be gotten into solid form of relatively insoluble character. Significantly, the Committee observes that "the necessary geologic investigation of any proposed site must be completed and the decision as to safe disposal means established before authorization for reactor construction is given. Unfortunately, such an investigation might take several years and cause embarrassing delays in the issuing of permits for construction. This situation can only be handled by starting investigations now of a large number of potential future sites as well as the complementary laboratory investigations of disposal methods.

Reference: 11-A2—February 1959

The Joint Committee on Atomic Energy (JCAE) holds hearings on Industrial Radioactive Waste Disposal. Scores of witnesses from Government, industry, the national laboratories, and academia testify and present scientific papers on the manifold aspects of radioactive waste storage and disposal. The hearings led AEC and JCAE to conclude that: 1) radioactive waste management practices have not resulted in any harmful effects on the public, its environment, or its resources; and 2) the general problem of radioactive waste need not retard the future development of the nuclear energy industry with full protection of the public health and safety.

Reference: 11-A3—November 1962

In a report to President Kennedy on civilian nuclear power, AEC maintains that the waste management problem is "technically soluble" and that "aside from the central reactor development program proper, no other phase of the entire program is more important than that of waste disposal."

Reference: 11-A4—March 1971

JCAE returns to the subject of waste management and conducts extensive hearings on the proposed repository in Lyons, Kans. Following those hearings, the Committee reports out an authorization bill providing funds for the facility. The implementation of the project is conditioned upon a finding by an advisory committee, appointed by the President, that "the establishment and burial of high-level waste can be carried out safely.

Reference: 11-A5—January 1972

AEC publishes the first version of its plan for managing waste generated as part of the defense program. The plan details AEC intentions for short- and long-term storage of liquid high-level, low-level, solid, and gaseous waste.

Reference: 11-A6—May 1974

AEC publishes its first technical analysis of potential alternative methods for long-term management of high-level radioactive waste. The document is based on reports written for AEC by the Battelle Pacific Northwest Laboratory. Neither the Battelle report nor the AEC summary reaches any conclusion about a preferred disposal option.

Reference: 11-A7—November 1975

JCAE holds its first oversight hearings specifically on the waste management question since 1959. The Committee hears reports from the program managers of ERDA, the Nuclear Regulatory Commission (NRC), and EPA.

Reference: 11-A8—May 1976

ERDA releases the so-called Technical Alternatives Document (TAD) which describes the technologies available for managing radioactive waste from commercial nuclear power. TAD updates and expands the analyses reported by Battelle 2 years previously. Like its predecessor, TAD makes no evaluation of the competing technologies nor does it reach any policy-relevant conclusions. Work on TAD was undertaken in response to a request from JCAE. The document was also required to provide technical support for the preparation of a Generic Environmental Impact Statement on Commercial Radioactive Waste Management (GEIS).

Reference: 11-A9—October 1976

ERDA publishes a proposed Table of Contents for its GEIS and requests public comment.

Reference: 11-AIO—April 1979

After undertaking one major version of the document, DOE publishes a draft version of its GEIS. The impact statement is intended to support a programmatic decision to concentrate, in the near term, on mined geological repositories as a means for waste disposal.

Reference: II-All—October 1980

DOE publishes final version of the GEIS.

Reference: 11-A12—July 1977

The U.S. Geological Survey (USGS) releases Circular 770, "Geologic Disposal of High-Level Radioactive Wastes—Earth Sciences Perspectives." Although expressing confidence that "acceptable geologic repositories can be constructed," the circular's authors did conclude that "the earth-science problems associated with disposal of radioactive waste are not simple, nor are they completely understood." The circular noted "many weaknesses in geologic knowledge' particularly with respect to disposal of waste in salt.

Reference: 11-A13—January 1978

The American Physical Society (APS) released its study on the nuclear fuel cycle and waste management. The APS group affirms that ' 'effective long-term isolation for spent fuel high-level or transuranic waste can be achieved by geologic emplacement." Moreover, the group concludes that "many waste repository sites with satisfactory hydrogeology can be identified in the continental United States in a variety of geologic formations. Bedded salt . . . can be a satisfactory medium for a repository, but certain other rock types, notably granite and possibly shale, could offer even greater long-term advantages.

Reference: 11-A14—February 1978

DOE completes a major internal review of its waste management programs. The reviewers urge expansion of the Department's technical efforts in the area of geologic disposal, maintain that reprocessing is not required for the safe disposal of commercial spent fuel, recognize that a repository for commercial waste may not be ready by 1985, and reaffirm the principle that the responsibility for ultimate disposal of radioactive waste must rest with the Federal Government.

Reference: 11-A15—March 1978

President Carter establishes an Interagency Review Group on Nuclear Waste Management (IRG) composed of representatives from 14 governmental units. The group is instructed to formulate recommendations for an administration policy with respect to long-term management of nuclear waste and supporting programs to implement this policy.

Reference: 11-A16—October 1978

The draft IRG report to the President is released for public comment along with a Subgroup Report on Alternative Strategies for the Isolation of Nuclear Waste. The draft Presidential report drew heavily on the analysis of the Subgroup report and its appendix which assessed the status of knowledge with regard to geological disposal. In the draft Presidential report, all 14 agencies agree that: the waste disposal program should proceed on the assumption that the first disposal facilities for high-level waste will be in mined repositories; site characterization work in a variety of geological environments should be accelerated; funding should be increased for near-term technical alternatives to geologic disposal; initial placement of waste in a repository should be done on a technically conservative basis and should permit retrievability; and opportunities should be pursued, if available, to site a licensed intermediate-scale facility in which as many as 1,000 spent fuel rods or waste canisters would be emplaced with the possibility but not necessarily the expectation of their removal. The agencies disagreed about the strategy to be employed in choosing sites to be submitted for licensing and on the future of the proposed Waste Isolation Pilot Plant (WIPP).

Reference: 11-A17—February 1980

President Carter announces his administration's comprehensive waste management policy. He ratifies all the unanimous IRG recommendations. He resolves the two controversial issues of site selection strategy and WIPP. He decides to adopt a siting approach in which four to five sites in a variety of environments are characterized extensively before a license application for one of them is submitted to NRC. The President also decides to recommend to Congress the termination of the WIPP project.

INVESTIGATIONS IN SALT

Reference: 11-Bl—November 1965

Following over 3 years of preparation, the first canister of Experimental Test Reactor (ETR) irradiated fuel is emplaced in the abandoned Carey salt mine in Lyons,

Kans. This initiates the main phase of Project Salt Vault. The project is designed to determine the thermal and radiation effects of high-level waste on salt and to demonstrate waste handling techniques. The project is carried out by personnel from the Oak Ridge National Laboratory.

Reference: 11-B2—June 1967

The last canister of ETR fuel is removed from the abandoned salt mine, thereby ending the experimental phase of Project Salt Vault.

Reference: 11-B3—May 1966

NAS reviews AEC'S waste management program once again. It reaffirms its 9-year-old view that "salt beds as permanent storage sites for high-level radioactive solids has promise of being successful and satisfactory. " The Committee also strongly supports efforts to solidify high-level waste.

Reference: 11-B4—June 1970

AEC announces that a site in the salt deposits near Lyons, Kans., had been "tentatively selected" for the country's first repository. The choice is contingent on confirmatory tests being carried out.

Reference: 11-B5—July 1970

Political opposition to the repository begins to develop in Kansas with Congressman Joseph Skubitz and Governor Robert Docking taking the lead. They are supported in their opposition by the new head of the Kansas Geological Survey, William Hambleton.

Reference: 11-B6—November 1970

The NAS Radioactive Waste Management Committee issues a report on the suitability of the Lyons site. The Committee deems the site "satisfactory" but withholds final judgment pending the completion of additional studies. That additional research would focus on understanding the uniformity of the salt beds, developing techniques for plugging nearby oil and gas wells and boreholes, refining methods of backfilling to prevent subsidence in the salt, and understanding the thermal and mechanical properties of key geologic structures.

Reference: II-B7—September 1971

The AEC program manager for the Lyons repository returns to Washington from a trip to Kansas persuaded that newly discovered technical difficulties severely threaten the project's future. The difficulties involve the discovery of numerous, previously unknown, oil and gas wells and boreholes. These might not be successfully plugged. In addition, water used to solution mine salt and a neighboring mine had "disappeared. This event seemed to suggest that the geological integrity of the proposed site might be inadequate.

Reference: 11-B8—February 1972

AEC abandons plans for a repository at Lyons citing the technical uncertainties and problems in political and public acceptance.

Reference: 11-B9—May 1974

After searching by USGS for over 2 years for a new potential repository site in bedded salt, ERDA decides to begin site characterization at a location outside of Carlsbad, N. Mex. The agency intends this to be a WIPP which would be used to dispose of transuranic contaminated waste, most of which is stored at Idaho, and up to 1,000 canisters of high-level defense waste.

Reference: 11-BIO—February 1978

An internal agency review of DOE's waste management program recommends that the pilot plant's mission be expanded to include disposal of up to 1,000 commercial spent fuel assemblies and that it be licensed by NRC.

Reference: 11-Bll—October 1978

DOE issues a draft EIS in support of the WIPP project.

Reference: 11-B12—February 1980

President Carter attempts to terminate the WIPP project.

Reference: 11-B13—June 1980

Congress overrules the President on the WIPP termination.

Reference: II-B14—September 1980

DOE issues the final EIS for WIPP.

INVESTIGATION OF THE BEDROCK FORMATIONS AT SAVANNAH RIVER

Reference: II-Cl—June 1958

The Du Pent Co., the operator of the Savannah River Project under contract to AEC, suggests that the possibility of disposing of the partially crystallized high-level waste in the bedrock underneath the facility be studied.

Reference: 11-C2—May 1966

After nearly 6 years of intermittent review of the bedrock proposal, a majority of the NAS Radioactive Waste Management Committee calls the project "dangerous and not worth sinking the exploratory shaft. A minority calls for continuation of experiments and sinking the exploratory shaft, a view which AEC adopts several months later.

Reference: 11-C3—October 1970

AEC announces that work would proceed on selection of the bedrock site and on the design of the shaft and exploratory tunnels.

Reference: 11-C4—September 1972

The NAS Committee issues a report in which it now concludes that there was a reasonable prospect that the waste could be safely contained in bedrock vaults.

Reference: 11-C5—November 1972

AEC decides to abandon the bedrock project, citing technical uncertainties and political opposition of South Carolina Senator HcNings.

EXPANSION OF THE PROGRAM FOR GEOLOGICAL DISPOSAL

Reference: 11-Dl—February 1972

AEC contracts with USGS to undertake a study of possible sites in salt formations that might be suitable for a repository. The USGS investigation is expanded several years later to include sites in formations other than salt.

Reference: 11-D2—October 1975

ERDA policymakers decide to embark on a multiple-site strategy which would lead to the development of several repositories by 2000. The first two of those would be in salt formations; the others might be in other geological media. Letters are sent to 36 State Governors informing them of these plans and asking their cooperation in site exploration activities.

Reference: 11-D3—October 1976

Because reactions from many State executives were quite negative and because permission to explore was often denied, the multisite program is forced to retrench. It also suffers budget cuts in the Office of Management and Budget. Site investigations do commence in Texas, Louisiana, Mississippi, Washington, and Nevada.

PART III

Development of High-Level Waste Regulations

NUCLEAR FUEL SERVICES REPROCESSING OPERATION

Reference: III-Al—May 1963

After years of effort to encourage commercial ventures in fuel reprocessing, AEC approves a construction permit for NFS to build such a facility in West Valley, N.Y. NFS adopts the Savannah River model of liquid waste storage in tanks. New York State Atomic Development Authority agrees to be responsible for safeguarding the waste and for maintaining the tanks in perpetuity. NFS pays into a trust fund for the care of the waste.

Reference: 111-A2—April 1966

NFS receives an operating permit and commences fuel reprocessing.

Reference: 111-A3—March 1972

NFS ceases operation and closes down for remodeling and expansion. During its nearly 6 years of operation, the company reprocessed 160 metric tons of fuel from the commercial nuclear power industry and 480 metric tons of fuel from the military production reactors at Hanford. A total volume of 640,000 gal of uranium processing waste are stored in mild steel tanks and 12,000 gal of acid thorium waste are stored in stainless steel tanks.

Reference: 111-A4—April 1976

The Getty Oil Co., current owners of the NFS facility, announce their withdrawal from the reprocessing business and request that New York State, in accordance with its 1963 agreement, take over responsibility for the liquid waste stored in tanks.

GENERAL ELECTRIC REPROCESSING OPERATION

Reference: 111-Bl—December 1967

AEC grants a construction permit to the General Electric Corp. to construct a commercial reprocessing facility at Morris, Ill. The plans for the facility call for the conversion of cooled liquid high-level waste into a solid form using a calcination process. In 1974, the company decides not to seek an operating permit because of the design flaws in the plant's maintenance systems.

ADOPTION OF APPENDIX F

Reference III-Cl—August 1970

After over a year of consideration, AEC adopts appendix F to its regulations (10 CFR 50). The impetus behind the adoption comes from Milton Shaw's Reactor Development and Technology Division. Commissioner Ramey is a strong supporter of the regulation. Both the Production Division and the Division of Industrial Participation express reservations. Commissioner Thompson dissents on the final vote. Appendix F requires that the reprocessed high-level liquid waste be converted to a suitable solid form within 5 years after their production, that the solidified waste be transferred to a repository within 5 years after conversion, and that the repository be operated by the Federal Government and located on Federal land.

ALLIED GENERAL NUCLEAR SERVICES REPROCESSING OPERATION

Reference: 111-Dl—December 1970

AEC grants a construction permit to the Allied General Nuclear Services Corp. to construct a commercial reprocessing facility at Barnwell, S.C. The Barnwell facility never receives an operating license and is mothballed pending a decision to resume commercial reprocessing.

DEVELOPMENT OF URANIUM FUEL CYCLE RULE

Reference: III-El—November 1972

AEC announces that it will hold hearings on the environmental impact of the uranium fuel cycle. The purpose of the hearings would be to help formulate a rule that would quantify the annualized impacts arising from the operation of a 1,000-MW reactor. Those impacts would then be considered as part of the required National Environmental Policy Act analysis undertaken when reactors are licensed.

Reference: 111-E2—April 1974

AEC issues its rule on the environmental effects of the uranium fuel cycle. The purpose of the hearings would be to help formulate a rule that would quantify the annualized impacts arising from the operation of a 1,OOO-MW reactor. Those impacts are quantified and

presented in the S-3 Table. Almost immediately thereafter, several environmental and public interest groups challenge the rule in court.

Reference: 111-E3—July 1976

The U.S. Court of Appeals for the District of Columbia overturns the S-3 rule in National ***Research Defense Council (NRDC) v. NRC.*** The court holds that AEC'S consideration of the environmental effects of fuel reprocessing and waste management was not adequately supported by the formal record. Reactor licensing is brought to a halt.

Reference: 111-E4—October 1976

After 3 months of intensive effort, NRC publishes a supplement to AEC analysis of the environmental effects of the uranium fuel cycle. The supplement provides a more complete and thorough consideration of the effects of reprocessing and waste management. At the same time, NRC publishes a proposed interim rule and modifications of the S-3 Table. The interim rule is adopted in March 1977. Preparations are made to hold hearings which will lead to the adoption of a final rule. Reactor licensing is resumed.

Reference: 111-E5—April 1978

The Supreme Court reverses the Court of Appeals in ***NRDC v. NRC.*** The Supreme Court holds that the Appeals Court incorrectly imposed more extensive participatory requirements on AEC than were required by the Administrative Procedures Act. The Supreme Court takes no position on the substantive issue of the adequacy of the S-3 Table.

Reference: 111-E6—August 1979

NRC adopts a final version of Table S-3 with Commissioners Bradford and Gilinsky dissenting. The Commission recognizes that some explanatory material is necessary to interpret the long-term, cumulative effects of the fuel cycle. NRC also accepts the need to put the health effects in some more easily understood context. Work begins to formulate that explanatory material.

DEVELOPMENT OF PLUTONIUM RECYCLE RULE

Reference: 111-Fl—August 1974

AEC publishes a draft EIS on mixed oxide fuel, Generic Environmental Statement on Mixed Oxide Fuels (GESMO), and a proposed rule to specify the conditions under which commercial reprocessing and the recycling of plutonium might be permitted.

Reference: 111-F2—December 1977

NRC announces that, in response to President Carter's request, commercial reprocessing and plutonium recycling will be deferred indefinitely; it is terminating its GESMO hearings. As a result, commercial nuclear waste takes on the form of spent fuel rather than solidified reprocessing waste.

DEVELOPMENT OF THE TRANSURANIC WASTE RULE

Reference: 111-Gl—September 1974

AEC announces a proposed rule which would require that all material contaminated with transuranic elements at a concentration of greater than 10 nanocuries per gram be disposed of at a Federal repository. The Commission uses the RSSF EIS as a vehicle for supporting the rule.

Reference: 111-G2—April 1975

ERDA withdraws the RSSF impact statement. The withdrawal leaves the rule in limbo.

Reference: 111-G3—September 1979

NRC releases a study on waste classification specifying five types of waste: Class A—waste destined for a repository; Class B—waste which must be administratively controlled after disposal at intermediate depths; Class C—waste which can be buried at intermediate depth without administrative control; Class D—waste which can be disposed of by shallow land burial coupled with administrative control; Class E—waste which can be disposed of by shallow land burial without administrative control.

PASSAGE OF ENERGY REORGANIZATION ACT

Reference: III-Hi—October 1974

Congress passes the Energy Reorganization Act of 1974 abolishing AEC and creating a developmental agency, ERDA and an independent regulatory commission, NRC. The act gives NRC licensing and related regulatory authority over ERDA, now DOE, facilities "used primarily for the receipt and storage of high-level radioactive waste.

DEVELOPMENT OF "CONFIDENCE" RULEMAKING

Reference: III-Ii—June 1976

The State of California passes three laws specifying the conditions under which nuclear reactors could be

sited within the State. One law prohibits reactor siting until a finding has been made that "a demonstrated technology or means of permanent, terminal disposal of high-level nuclear waste exists and has been approved by the United States through its authorized agency."

Reference: 111-12—December 1976

NRC receives a petition from NRDC which requests that the Commission conduct a "rulemaking proceeding to determine whether radioactive waste can be generated in nuclear power reactors and subsequently disposed of without undue risk to the public health and safety and that the Commission refrain from acting to grant pending or future requests for operating licenses until such time as this definitive finding of safety can be and is made."

Reference: 111-13—June 1977

NRC denies the NRDC petition. The Commission concludes that it "would not continue to license reactors if it did not have reasonable confidence that the waste can and will in due course be disposed of safely. The accumulating evidence continues to support NRC's implicit finding of reasonable assurance that methods of safe permanent disposal of high-level waste can be available when they are needed. Given this, and the fact that at present safe storage methods are . . . available and highly likely to remain so until a safe disposal system can be demonstrated, the Commission sees in the waste disposal question no reason to cease licensing reactors."

Reference: 111-14—May 1979

The D.C. Circuit Court of Appeals rules in a case involving expansion of spent fuel storage capacity at the Prairie Island, Minn., reactor that NRC should reconsider its statement of confidence issued in response to the NRDC petition. Such reconsideration would be "in the interest of sound administration' given developments in the S-3 case and other recent events such as an IRG report.

Reference: 111-15—October 1979

NRC initiates a rtdemaking proceeding on the storage and disposal of nuclear waste. The proceeding is intended to provide NRC an opportunity to reassess its degree of confidence that radioactive waste produced by licensed nuclear facilities will be safely disposed of offsite, to determine when any such disposal or offsite storage will be available, and if disposal or offsite storage will not be available until after the expiration of the licenses of certain nuclear facilities, to determine whether the waste generated by those facilities can be safely stored onsite until such disposal is available.

DEVELOPMENT OF WASTE MANAGEMENT GOALS

Reference: 111-Jl—June 1978

NRC publishes for comment a task force report on ***Proposed Goals for Radioactive Waste Management.*** The report and accompanying ***Essays on Issues ReZevant to the Regulation of Radioactive Waste Management*** had been completed 18 months earlier but had been held by NRC.

DEVELOPMENT OF SPENT FUEL STORAGE REGULATIONS

Reference: 111-Kl—October 1978

NRC reveals a proposed new regulation that specifies procedures and requirements for issuance of licenses to store spent fuel in an independent spent fuel storage installation. The proposed regulation contains requirements for the siting, general design criteria, and certain operational aspects of such an activity.

DEVELOPMENT OF HIGH-LEVEL COMMERCIAL WASTE REGULATIONS

Reference: 111-Ll—November 1978

NRC publishes for comment a Proposed General Statement for Policy outlining procedures for licensing geologic high-level radioactive waste repositories to be constructed by DOE.

Reference: 111-L2—December 1979

NRC withdraws its Proposed General Statement of Policy and substitutes proposed licensing procedures for a high-level repository. The procedures mandate a site characterization review, specify that several, three to five, sites in different geological environments must be characterized at depth, and indicate that approval must be obtained prior to repository operation and upon its decommissioning.

Reference: 111-L3—May 1980

NRC publishes an advanced notice of proposed rulemaking setting forth its current views about the technical criteria which should govern the licensing of a repository. The proposed rule addresses these issues: the use of multiple barriers, the process of model validation, the treatment of geologic uncertainties, and the problem of human intrusion. One performance objective proposed is that waste packages be designed so that "there is reasonable assurance that radionuclides will be contained for at least the first 1,000 years after decommissioning and for as long thereafter as reasonably achiev-

able given expected processes and events as well as various water flow conditions including full or partial saturation of the underground facility.

Reference: 111-L4—February 1981

NRC adopts final procedural regulations for licensing a high-level waste repository.

Reference: 111-L5—March 1981

NRC formally proposed the technical regulations for a high-level waste repository.

PART W

Federal Waste Management Structure and Responsibilities

Reference: IV-A1—1955-70

The responsibility for radioactive waste management was highly fragmented. The organizations within AEC with major involvement included:

Division of Production.—Responsible for programs for high-level waste management and long-term storage of radioactive waste from AEC chemical processing operations located at Hanford, Savannah River, and Idaho-after 1936. Most of the work and policy development is delegated to the contractors operating those facilities.

Division of Operational Safety .—Responsible for developing radiation protection standards and for appraising and evaluating the performance of AEC, field offices in the protection of health, safety, and property.

Division of Reactor Development and Technology. —Responsible for planning and technical direction of research and development on processes for the treatment and storage of high-level radioactive waste resulting or expected to result from chemical reprocessing operations in connection with the nuclear power industry. Much of its work in waste management is undertaken by Oak Ridge National Laboratory, the Pacific Northwest Laboratory, and other national laboratories.

Division of Materials Licensing.—Under the Director of Regulation: Responsible for licensing facilities for reprocessing irradiated source and special nuclear materials and therefore concerned with the adequacy of waste management activities at those facilities. Also responsible for low-level waste disposal activities.

It should be noted that most of these divisions underwent several metamorphoses during this 15-year period. Their names changed; their programs grew in size and were assigned to varying subunits.

Reference: IV-Bl—May 1970

Division of Waste and Scrap Management formed as a staff division. It took over some responsibilities from the Division of Operational Safety, the Production Division, the Division of Operational Safety, and the Division of Reactor Development and Technology but had no independent budget. Thus, it had policy, planning, and appraisal functions but was not a strong technical division.

Reference: IV-Cl—June 1971

Division of Waste Management and Transportation created. It has its own budget and took over policymaking for management of waste from the commercial nuclear industry.

Reference: IV-Dl—January 1975

AEC is abolished; ERDA and NRC are established in its place. The Division of Production, Operational Safety, and Waste Management and Transportation become part of ERDA. A waste management branch is established as part of the Office of Nuclear Material Safety and Safeguards at NRC.

Reference: IV-El—June 1975

ERDA reorganizes its waste management program. The Division of Waste Management and Transportation is abolished and its programs transferred to two new divisions. Commercial and military waste programs are brought under the umbrella of the Division of Nuclear Fuel Cycle and Production. All program planning, nearterrn research, development, demonstration, and operation of facilities for treatment, storage, and disposal of commercial radioactive waste, and the establishment and operation of Federal repositories for the ultimate disposal of all radioactive waste become the responsibility of an Assistant Director for Reactor Products and Inventory Management. A Division of Environmental Control Technology takes over responsibility for very, long-term waste management research. The Division of Nuclear Fuel Cycle and Production later becomes known as the Division of Waste Management, Production, and Reprocessing.

Reference: IV-Fl—January 1976

ERDA contracts with Oak Ridge National Laboratory to create an OfEce of Waste Isolation (OWI). OWI was responsible for managing the research and development aspects of the National Waste Terminal Storage Program.

Reference: IV-Gl—March 1977

NRC expands its waste management organization. An Assistant Director for Waste Management position is created. The Assistant Director is in charge of two branches, one dealing with high-level and transuranic waste, the other dealing with low-level waste.

Reference: IV-Hi—October 1977

DOE comes into existence. Policymaking takes place largely in the Office of the Director of Energy Research. Operations are carried out in the OffIce of Nuclear Waste Management. That OffIce contains three major divisions: Waste Isolation, Waste Products, and Transportation and Fuel Storage. The Office initially reports to the Director of Nuclear Programs. Later on, ONWM reports to the Assistant Secretary for Energy Technology. The change is designed to give the Office of Nuclear Waste Management more public visibility and significance.

Reference: IV-Ii—October 1978

The contract with OWI expires and is not renewed at the request of Union Carbide, the operator of Oak Ridge National Laboratory. Battelle Memorial Institute is selected to take over the management of the National Terminal Waste Storage Program. Battelle creates the Office of Nuclear Waste Isolation to carry out this task.

Reference: IV-Jl—January 1979

NRC further expands its waste management operations, creating a Division of Nuclear Waste Management.

Table A-2.–Time Line–Parts I-IV, 1944-81

Year	Part I	Part II	Part III	Part IV
1944	Al	—		—
1952	A2	—		—
1953	C1,C2	—		—
1954	B-1	.		—
1955	–	—		Al
1956	A-3	—		Al
1957	B-2	Al		Al
1958	A-4	c l		Al
1959	—	A2		Al
1860	*B-3*	—		Al
1961	-	—		Al
1962	–	A3	—	Al
1963	C2,DI	—	Al	Al
1964	–	—	—	Al
1965	A5	B1	—	Al
1966	D2	B3,C2	A2	Al
1967	A6	62	61	Al
1968	–	—	—	Al
1969	—	—	—	Al
1970	C3	B4,B5,B6,C3	C1,D1	A1,B1
1971	A7	A4,B7	—	c l
1972	D3,E1	A5,B8,C4,C5,D1	A3,E1	—
1973	A8,A9	—	—	—
1974	E2	A6,B9	E2,F1,G1,H1	—
1975	E3	A7,D2	G2	D1,E1
1976	C4,D4	A8,A9,D3	A4,E3,E4,11 ,12	F2
1977	F1,F2	A12	F2,13	G1,H1
1978	–	A13,A14,A15,A16, B1O,B1 1	E5,J1,K1,L1	I-I
1979	D5	AIO	E6,G3,14,15	J1
1980	–	Al 1,A17,B12,B13,B14	L3	—
1981	F3		L4.L5	—