

11-1045(L) & 11-1057(CON)
11-1051(CON), 11-1056(CON)

**United States Court of Appeals
for the District of Columbia Circuit**

STATE OF NEW YORK; STATE OF VERMONT; STATE OF CONNECTICUT,

Petitioners,

v.

NUCLEAR REGULATORY COMMISSION; UNITED STATES OF AMERICA,

Respondents,

STATE OF NEW JERSEY,

Intervenor for Petitioner,

NUCLEAR ENERGY INSTITUTE, INC.; ENTERGY NUCLEAR OPERATIONS INC.,

Intervenors for Respondent.

On Petition for Review of Final Action of
the United States Nuclear Regulatory Commission

JOINT APPENDIX — VOLUME 1 of 4 (JA1-JA288)

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Illuminating Company (Davis-Besse Nuclear Power Station, Units 1, 2 and 3) The Cleveland Electric Illuminating Company, et al. (Perry Nuclear Power Plant, Units 1 and 2).

Pursuant to the Board's Ruling of August 21, 1975 in which a schedule of events prior to the commencement of hearing in the above dockets is set forth, a prehearing conference is hereby scheduled for Thursday, September 18, 1975 at 10:00 a.m. at the Postal Rates Commission, 2000 L Street, N.W., Suite 500, Washington, D.C. for the following purposes:

- (1) Consideration of motions or arguments to curtail or eliminate issues;
- (2) Oral argument upon request relating to Applicants' Motion for Summary Judgment against AMP-O;
- (3) Other schedule details relating to the commencement of hearings on or about October 30, 1975.

Any of the parties desiring to place other matters on the agenda for prehearing conference No. 5 should make a request to the Board with information copies to other parties no later than Tuesday, September 16, 1975.

It is so ordered.

Dated at Bethesda, Maryland this 9th day of September 1975.

ATOMIC SAFETY AND LICENSING BOARD,
DOUGLAS V. RIGLER,
Chairman.

[FR Doc.75-24528 Filed 9-15-75;8:45 am]

[Docket Nos. 50-434 and 50-435]

SURRY POWER STATION UNITS 3 AND 4 Negative Declaration Regarding Proposed Changes to Construction Permits Nos. CPRR-124 AND CPRR-125

The Nuclear Regulatory Commission (the Commission) has considered the issuance of amendments to Construction Permits Nos. CPRR-124 and CPRR-125. These changes would authorize the Virginia Electric and Power Company (VEPCO) (the permittee) to construct the Surry Power Station Units 3 and 4 (located in Surry County, Virginia) with changes in the limiting conditions for protection of the environment during construction by eliminating the requirement for use of steel sheet piling to form cofferdams and allowing sloping sides for the excavations.

The U.S. Nuclear Regulatory Commission, Division of Reactor Licensing, has prepared an environmental impact appraisal for the proposed changes in paragraph 3E(3) of the Construction Permits Nos. CPRR-124 and CPRR-125, as described above. On the basis of this appraisal, the Commission has concluded that an environmental impact statement for this particular action is not warranted because there will be no environmental impact attributable to the proposed action other than that which has already been predicted and described in the Commission's Final Environmental Statement for Surry Units 3 and 4 published in May 1974. The environmental impact ap-

praisal is available for public inspection at the Commission's Public Document Room, 1717 H Street, NW., Washington, D.C., and at the Swem Library, College of William and Mary, Williamsburg, Virginia.

Dated at Rockville, Maryland, this 18th day of August 1975.

For the Nuclear Regulatory Commission.

GORDON K. DICKER,
Chief, Environmental Projects
Branch 2, Division of Reactor
Licensing.

[FR Doc.75-24530 Filed 9-15-75;8:45 am]

SPENT FUEL STORAGE

Intent To Prepare Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel

From the early days of the nuclear power industry in this country, electric utilities planning to construct and operate light water nuclear power reactors contemplated that the used or spent fuel discharged from the reactors would be chemically reprocessed to recover the remaining quantities of fissile and fertile materials (uranium and plutonium), and that the materials so recovered would be recycled back into fresh reactor fuel. It was contemplated by the nuclear industry that spent fuel would be discharged periodically from operating reactors, stored in onsite fuel storage pools for a period of time to permit decay of radioactive materials contained within the fuel and to cool, and periodically shipped offsite for reprocessing. Typically, space was provided in onsite storage pools for about one and one-third nuclear reactor cores. Assuming a four-year reactor fuel reload cycle, such onsite storage pools were planned to hold an average of one year's discharge with sufficient remaining capacity to hold a complete core should unloading of all of the fuel from the reactor be necessary or desirable because of operational difficulties. Under normal operating conditions, an average of five years' discharge could be accommodated before the pools were filled.

Persons planning to conduct commercial reprocessing of spent reactor fuels provided sufficient storage capacity for the spent fuels at their facilities to allow some operational flexibility. Typically, space has been provided or planned for several spent fuel core reloads. Three commercial reprocessing plants have been planned for operation in the United States. The only such plant that has actually operated, Nuclear Fuel Services (NFS) plant at West Valley, New York, was shut down in 1972 for extensive alterations and expansion. There is a pending proceeding before the Nuclear Regulatory Commission (Commission) on NFS's application for a permit to construct these alterations and expansion (docket no. 50-201). The second plant, General Electric Company's Midwest Fuel Recovery Plant at Morris, Illinois, has never operated and is in a decommissioned condition. The third

plant, Allied General Nuclear Services' (AGNS) proposed plant in Barnwell, South Carolina, is under construction and is the subject of pending proceedings before the Commission regarding the continuation, modification or suspension of the construction permit from an environmental protection standpoint, and the possible issuance of an operating license (docket no. 50-332), as well as a related matter (docket no. 70-1729).

On May 8, 1975, the Nuclear Regulatory Commission published a notice in the FEDERAL REGISTER setting forth its provisional views that, subject to consideration of comments, (1) a cost-benefit analysis of alternative safeguards programs should be prepared and set forth in draft and final environmental impact statements before a Commission decision is reached on wide-scale use of mixed oxide (recycle plutonium) fuels in light water nuclear power reactors, (2) there should be no additional licenses granted for use of mixed oxide fuel in light water nuclear power reactors except for experimental purposes, (3) with respect to light water nuclear power reactor fuel cycle activities which depend for their justification on wide-scale use of mixed oxide fuel in light water nuclear power reactors, there should be no additional licenses granted which would foreclose future safeguards options or result in unnecessary "grandfathering" and (4) the granting of licenses would not be precluded for fuel cycle activities for experimental and/or technical feasibility purposes.

In light of the status of the three planned commercial reprocessing plants in the United States, as outlined above, the earliest that spent fuel reprocessing could begin on a commercial basis, if authorized, would be late 1976. This assumes that the pending licensing proceedings are completed and licenses issued by this date. However, the spent fuel pools at a number of reactors may soon be filled, and still other reactors will have their pools filled before the end of 1978. Accordingly, even if limited reprocessing should begin in late 1976, there would still be a shortage in spent fuel storage capacity.

The existing pools at the GE and NFS reprocessing plants have some remaining marginal licensed storage capacity which may be able to accommodate the fuel discharges from some reactors; any increases planned at these plants may not be sufficient for industry in the future. Consequently, there is the possibility of a future shortage in licensed spent fuel capacity regardless of the outcome of the proceedings on the May 8th notice.

The Commission has not promulgated any regulation which specifies a given size for on-site reactor spent fuel pools; however, proposals by reactor licensees to significantly change the manner of spent fuel storage or spent fuel pool size would be subject to licensing review by the Commission. In the event that a particular on-site spent fuel pool should become filled, and no alternative form of spent fuel storage could be found,

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the reactor would be eventually forced to shut down and "store" the last spent reactor fuel in the reactor pressure vessel. While no serious adverse consequences to the public health and safety, the common defense and security, or the environment would likely result, the reactor shutdown would, of course, remove the plant from service, and this in turn could adversely affect the electric utility's ability to meet electrical energy needs, or force the utility to operate other plants that are less economical to operate or which have greater environmental impact, and thereby adversely affect the public interest.

There appear to be a number of possible alternatives for increasing spent fuel storage capacity including, among other things, increasing the storage capacity at present reactor sites, and construction of independent spent fuel storage facilities. The shortage of spent fuel storage capacity will occur at individual reactors, and the Commission could adequately address the issues involved on a case-by-case basis within the context of individual licensing reviews. Indeed, the Commission has not, to date, found it necessary, in the discharge of its licensing and related regulatory functions, to develop any overall program of action to deal with the problem. The Commission does, however, have the discretion to deal with issues of this type on a generic basis through the exercise of its rulemaking authority and/or the issuance of a "generic" environmental impact statement. Rulemaking proceedings and/or the issuance of a generic environmental impact statement might, as appropriate, serve as the context for the promulgation of more definitive criteria regarding size and design of spent fuel pools and/or the licensing of independent spent fuel storage facilities, and for consideration of possible revision of the fuel cycle environmental impacts set forth in 10 CFR § 51.20(e) in light of additional spent fuel storage and attendant transportation. Also, the possible implications of increased spent fuel storage on the options available for intermediate and long-term storage of nuclear waste materials could profitably be examined within this context.

One group of interested organizations (Natural Resources Defense Council, Sierra Club, and Businessmen for the Public Interest) has requested the Commission to prepare a generic environmental impact statement on the handling and storage of spent reactor fuel and related matters (letter to L. V. Gossick from Anthony Z. Rolsman, dated May 20, 1975, copy on file at the Commission's Public Document Room, 1717 H Street, NW., Washington, D.C.)

While the Commission believes, as earlier indicated, that the matter of spent fuel storage capacity can adequately be addressed on a case-by-case basis within the context of individual licensing reviews, it also believes that, from the standpoint of longer range policy, this matter can profitably be examined in a broader context. It views the preparation of a generic environmental impact state-

ment as a suitable vehicle for such an examination. Notice is hereby given that a generic environmental impact statement on the handling and storage of spent light water power reactor fuels will be prepared by the Commission. The statement will focus on the time period between now and the mid 1980's and will address:

(1) The magnitude of the possible shortage of spent fuel storage capacity;

(2) The alternatives for dealing with the problem, including, but not necessarily limited to:

(a) Permitting the expansion of spent fuel storage capacity at power reactors;

(b) Permitting the expansion of spent fuel storage capacity at reprocessing plants;

(c) Licensing of independent spent fuel storage facilities;

(d) Storage of spent fuel from one or more reactors at the storage pools of other reactors;

(e) Ordering that generation of spent fuel (reactor operation) be stopped or restricted;

(3) A cost-benefit analysis of the alternatives listed in (2), along with any other reasonably feasible alternatives, including:

(a) Impacts on public health and safety and the common defense and security;

(b) Environmental, social, and economic costs and benefits;

(c) Commitments of resources;

(d) Implications regarding options available for the intermediate and long-term storage of nuclear waste materials;

(e) Relationship between local short-term uses of the environment and long-term productivity;

(4) The impacts of possible additional transportation of spent fuel that may be required should one or more of the alternatives be adopted;

(5) More definitive standards and criteria to govern the licensing of one or more of the alternatives for dealing with the problem; and

(6) Possible amendments to 10 CFR § 51.20(e).

If appropriate, rulemaking proceedings on items (5) and (6) listed above, or on other issues related to the handling and storage of spent reactor fuel, will be initiated on or about that time of issuance of the draft generic environmental impact statement.

The Commission has also given careful consideration to the question whether licensing actions intended to ameliorate a possible shortage of spent fuel storage capacity, including such actions as the issuance of operating license amendments to permit increases in the storage capacity of reactor spent fuel pools or reprocessing plant spent fuel storage pools, or the licensing of independent spent fuel storage facilities, should be deferred pending completion of the generic environmental impact statement. Such a deferral was requested in the letter on behalf of Natural Resources Defense Council, Sierra Club, and Businessmen for the Public Interest noted above. In considering this matter, the

Commission had two basic objectives in mind: on the one hand, the generic impact statement should not serve as a justification for a fait accompli; on the other hand, the public interest considerations associated with such a deferral should be carefully weighed. The Commission has concluded that there should be no such general deferral, and that these related licensing actions may continue during the period required for preparation of the generic statement, subject to certain conditions. In reaching this conclusion, the Commission has considered the following specific factors:

(1) It is likely that each individual licensing action of this type would have a utility that is independent of the utility of other licensing actions of this type;

(2) It is not likely that the taking of any particular licensing action of this type during the time frame under consideration would constitute a commitment of resources that would tend to significantly foreclose the alternatives available with respect to any other individual licensing action of this type;

(3) It is likely that any environmental impacts associated with any individual licensing action of this type would be such that they could adequately be addressed within the context of the individual license application without overlooking any cumulative environmental impacts;

(4) It is likely that any technical issues that may arise in the course of a review of an individual license application can be resolved within that context; and

(5) A deferral or severe restriction on licensing actions of this type would result in substantial harm to the public interest. As indicated, such a restriction or deferral could result in reactor shutdowns as existing spent fuel pools become filled. It now appears that the spent fuel pools of as many as ten reactors could be filled by mid-1978. These ten reactors represent a total of about 6 million kilowatts of electrical energy generating capacity. The removal of these reactors from service could reduce the utilities' service margins to a point where reliable service would be in jeopardy, or force the utilities to rely more heavily on less economical or more polluting forms of generation that would impose economic penalties on consumers and increase environmental impacts.

The Commission expects that any licensing action intended to ameliorate a possible shortage of spent fuel storage capacity during this interim period would be accompanied by an environmental impact statement (10 CFR § 51.6 (a)) or impact appraisal (10 CFR § 51.6 (c)) tailored to the facts of the case. Since the Commission's general conclusions with respect to the five factors, as set forth above, may not fit the factual circumstances of particular licensing actions, the five factors will be applied, weighed and balanced within the context of these statements or appraisals in reaching licensing determinations.

Dated at Washington, D.C. this 10th day of September 1975.

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For the Nuclear Regulatory Commission.

SAMUEL J. CHILK,
Secretary of the Commission.

[FR Doc. 75-24531 Filed 9-15-75; 8:45 am]

[Docket Nos. 50-434 and 50-435]

VIRGINIA ELECTRIC AND POWER CO.
Issuance of Amendment to Construction Permits

Notice is hereby given that the U.S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 1 to Construction Permit Nos. CPPR-124 and PPPR-125 issued to the Virginia Electric and Power Company (the applicant) for the construction of the Surry Power Station, Units 3 and 4 (the facility), located on the applicant's site in Surry County, Virginia.

The Construction Permits are amended by deleting paragraph 3E(3) which states: "3E(3) Steel sheet piling will be driven to form cofferdams for the containment excavations. The excavation spoil placed onsite will be graded for storage use during construction."

The application for the amendment complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the amendment. Prior public notice of this amendment is not required since the amendment does not involve a significant hazards consideration. The Commission has determined that this amendment is not a major Federal action significantly affecting the quality of the human environment.

For further details with respect to this action, see (1) the application for amendment dated February 14, 1975, (2) Amendment No. 1 to Construction Permit Nos. CPPR-124 and CPPR-125, and (3) the Office of Nuclear Reactor Regulation's related evaluation. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N.W., Washington, D.C. and at the Swem Library, College of William and Mary, Williamsburg, Virginia.

A copy of items (2) and (3) may be obtained upon request addressed to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Director, Division of Reactor Licensing.

Dated at Bethesda, Maryland, this 8th day of September, 1975.

For the Nuclear Regulatory Commission.

A. SCHWENGER,
Chief, Light Water Reactors
Branch 2-3, Division of Reactor Licensing.

[FR Doc. 75-24529 Filed 9-15-75; 8:45 am]

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS, SUBCOMMITTEE ON INSPECTION AND ENFORCEMENT ACTIVITIES

Meeting

In accordance with the purposes of Sections 29 and 182 b. of the Atomic Energy Act (42 U.S.C. 2039, 2232 b.) the ACRS Subcommittee on Inspection and Enforcement Activities will hold a meeting on October 1, 1975 at 1717 H Street NW., Washington, D.C. 20555. The purpose of this meeting is to discuss third-party inspection and the roles of inspection and examination organizations in relation to nuclear safety.

The agenda for the subject meeting will be as follows:

Wednesday, October 1, 1975, 8:00 a.m.
The Subcommittee will meet in closed Executive Session, with any of its consultants who may be present, to explore their preliminary opinions, based upon their independent knowledge of inspection and examination practices and organizations, regarding the matters which should be covered during the following open meeting in order to formulate a Subcommittee report and recommendation to the full Committee.

8:30 a.m. until the conclusion of business: The Subcommittee will meet in open session to hold discussions with invited participants and members of the NRC Staff on topics pertinent to examination and inspection of safety related systems of nuclear power plants. At the conclusion of the open session, the Subcommittee will meet in closed session with members of the NRC Staff to discuss internal NRC policy and Staff recommendations on the subjects discussed in the open sessions. Possible changes in Staff positions on the distribution of responsibilities for inspection and examination of nuclear systems as well as the necessary qualifications of personnel and organizations performing those tasks will also be considered.

I have determined, in accordance with Subsection 10(d) of Public Law 92-463, that it is necessary to conduct the above closed session to protect the free interchange of internal views in the final stages of the Subcommittee's deliberative process (5 U.S.C. 552(b)(5)). Separation of factual material from individuals' advice and opinions, while closed Executive Sessions are in progress is considered impractical.

Practical considerations may dictate alterations in the above agenda or schedule. The Chairman of the Subcommittee is empowered to conduct the meeting in a manner that, in his judgment, will facilitate the orderly conduct of business, including provisions to carry over an incomplete open session from one day to the next.

With respect to public participation in the open portion of the meeting, the following requirements shall apply:

(a) Persons wishing to submit written statements regarding the agenda items may do so by mailing a readily reproducible copy thereof, postmarked no later than September 24, 1975 to Mr. Paul T.

Burnett, Office of the Executive Secretary, ACRS, NRC, Wash., D.C. 20555, or by filing at the ACRS Office a readily reproducible copy two working days prior to the meeting. Written statements should be limited to safety related areas which are within the purview of the Committee. Comments which fail to meet the time limitations noted above will be considered to the extent practicable.

(b) Those persons wishing to make oral statements regarding agenda items at the meeting should make a request to do so prior to the meeting, identifying the topics and desired presentation time so that appropriate arrangements can be made. The Committee will receive oral statements in safety related areas within the Committee's purview at an appropriate time chosen by the Chairman of the Subcommittee.

(c) Further information regarding topics to be discussed, whether the meeting has been cancelled or rescheduled, the Chairman's ruling on requests for the opportunity to present oral statements and the time allotted therefor can be obtained by a prepaid telephone call on September 30, 1975 to the Office of the Executive Secretary of the Committee (telephone 202/634-1394, Attention: Mr. Paul T. Burnett) between 8:15 a.m. and 5:00 p.m., Eastern Daylight Time.

(d) Questions may be propounded only by members of the Subcommittee and its consultants.

(e) The use of still, motion picture, and television cameras, the physical installation and presence of which will not interfere with the conduct of the meeting, will be permitted both before and after the meeting and during any recess. The use of such equipment will not, however, be allowed while the meeting is in session.

(f) A copy of the transcript of the open portion of the meeting will be available for inspection on or after October 8, 1975 at the NRC Public Document Room, 1717 H St. NW., Wash., D.C. 20555. Copies of the minutes of the meeting will be made available for inspection at the NRC Public Document Room, 1717 H St. NW., Wash., D.C. 20555 after January 5, 1976. Copies may be obtained upon payment of appropriate charges.

Dated: September 12, 1975.

JOHN C. HOYLE,
Advisory Committee
Management Officer.

[FR Doc. 75-24709 Filed 9-15-75; 8:45 am]

SECURITIES AND EXCHANGE COMMISSION

[File No. 24SF-4062]

AMERICAN SOLAR ENERGY CORP.

Order Temporarily Suspending Exemption, Statement of Reasons Therefor, and Notice of Opportunity for Hearing

SEPTEMBER 9, 1975.

I

American Solar Energy Corporation (the "Issuer") 2960 Westwood Street,

Jeanson, France; and Mr. L. Lewis (Duke Power Company), United States of America developed this draft from an IAEA collation during a meeting on May 16-27, 1977, and we are soliciting public comment on it. Comments on this draft received by August 19, 1977 will be useful to the U.S. representatives to the Technical Review Committee and Senior Advisory Group in evaluating its adequacy prior to the next IAEA discussion.

Single copies of this draft may be obtained by a written request to the Director, Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

(5 U.S.C. 522(a))

Dated at Rockville, Md., this 16th day of June 1977.

For the Nuclear Regulatory Commission.

ROBERT B. MINOGUE,
Director,

Office of Standards Development.

[FR Doc. 77-18811 Filed 7-1-77; 8:45 am]

[Docket No. PRM-50-18]

NATURAL RESOURCES DEFENSE COUNCIL

Denial of Petition for Rulemaking

Notice is hereby given that the Nuclear Regulatory Commission (hereinafter "NRC" or "Commission") has denied a petition for rulemaking submitted by letter dated November 8, 1976 by the Natural Resources Defense Council, Inc., 917 15th Street, NW., Washington, D.C.

A notice of the filing of the petition, Docket No. PRM-50-18, was published in the FEDERAL REGISTER on January 13, 1977 (42 FR 2730) and interested persons were invited to comment on the petition by February 14, 1977. The comment period was subsequently extended to February 22, 1977 (42 FR 9735, February 17, 1977). Eighteen letters were received which recommended denial of the petition while two letters supported the petition. Copies of the comments are available for public inspection in the Commission's Public Document Room at 1717 H Street, NW., Washington, D.C.

Natural Resources Defense Council (hereinafter "NRDC") petitioned the Nuclear Regulatory Commission (1) to conduct a rulemaking proceeding to determine "whether radioactive wastes can be generated in nuclear power reactors and subsequently disposed of without undue risk to the public health and safety, and (2) to refrain from acting finally to grant pending or future requests for operating licenses until such time as this definitive finding of safety can be and is made." (NRDC Petition, at 15). NRDC argued that the Commission is required by the Atomic Energy Act (42 U.S.C. 2011 et seq. (1972)) and the Energy Reorganization Act (42 U.S.C. 5801(a) (1972)) to ensure that the public health and safety are protected. The petitioner cited the requirements found in the Commission's regulations that the Commission must

make a finding that "there is reasonable assurance that the activities authorized by the operating license can be conducted without endangering the health and safety of the public" and that "the issuance of the license will not be inimical to the health and safety of the public" (§ 50.57(a)(3) and (a)(6)) and from these requirements argued that the NRC must make a finding, prior to issuing an operating license for a reactor, that permanent disposal of high-level radioactive wastes¹ generated by that reactor can be accomplished safely.

In contrast, those comments which favored denial of the petition argued that long-term storage or disposal of high-level wastes is beyond the scope of licenses for reactors and, therefore, that no finding need be made regarding safe disposal of high-level wastes until the NRC licenses an actual facility to handle such disposal. The two comments supporting the petition stated that such wastes could not be disposed of safely but gave no evidence to support this conclusion.

After thorough study of the petition and exhibits submitted therewith and analysis of the comments, the Commission has concluded that it is not obligated to make a "definitive" finding, nor is it appropriate to make the "definitive" finding requested by NRDC, the safe methods of high-level waste disposal are now available prior to the licensing of a reactor. Because the petition seeks a finding that safe waste disposal can be accomplished immediately, the Commission has determined that the rulemaking petition should be denied. The Commission notes that prior to any licensing of high-level waste disposal facilities, a detailed finding concerning the safety of the proposed facilities will be made. There is, we believe, a clear distinction between permanent disposal of wastes and their interim storage. The Commission must be assured that wastes generated by licensed power reactors can be safely handled and stored as they are generated. As part of the licensing process for an individual power reactor facility, the Commission does review the facility in question in order to assure that the design provides for safe methods for interim storage of spent nuclear fuel. But it is neither necessary nor reasonable for the Commission to insist on proof that a means of permanent waste disposal is on hand at the time reactor operation begins, so long as the Commission can be reasonably confident that permanent disposal (as distinguished from continued storage under surveillance) can be accomplished safely when it is likely to become necessary. Reasonable progress towards the development of permanent disposal facilities is

¹ The Commission's definition of high-level wastes for purposes of this notice, is the same as petitioner's definition which includes high-level wastes as defined in 10 CFR Part 50, App. F, spent fuel rods, and transuranic-contaminated wastes. (Petition, at 2).

presently being accomplished. Under these circumstances a halt in licensing of nuclear power plants is not required to protect public health and safety.

STATUTORY REQUIREMENTS

As petitioner states, the Atomic Energy Act clearly requires that some kind of safety finding be made prior to issuance of an operating license for a nuclear power reactor. (NRDC Petition, at 4-9). Section 103d of the Act provides that no license for a production or utilization facility may be issued if, in the opinion of the Commission, the issuance of the license would be inimical to the health and safety of the public. It seems clear, however, that the statutory findings required by section 103 apply specifically to the "proposed activities" and "activities under such licenses." (42 U.S.C. 2133). These activities include some interim storage activities for spent fuel. They do not include the permanent disposal of high-level wastes though wastes are, in fact, generated by operation of the reactor.

That detailed questions regarding the safety of permanent disposal of these wastes are to be addressed in connection with the licensing of an actual high-level waste disposal facility, rather than in connection with licensing of reactor operation, is clear from the statutory treatment of radioactive wastes.² Historically, the Atomic Energy Act has provided that nuclear materials licensing proceedings involving possession or use of nuclear materials off-site from the facility, which include high-level radioactive waste disposal proceedings, are to be treated as separate and distinct from the facility licensing proceeding itself.³ The Act provides for two-step facility licensing proceedings in sections 101-106, and 185 of the Act in sharp contrast to the one-step licensing provisions relating to byproduct, source, and special nuclear material covered by sections 53, 54, 57, 62, 63, 81, and 82. (42 U.S.C. 2131-2136; 2235; 2073-74; 2077; 2092-93; 2111-12).

Section 182 of the Atomic Energy Act, which sets forth the information which must be supplied by an applicant for a facility license gives further support to the proposition that on safety finding regarding ultimate disposal of high-level wastes is required in a reactor operating license proceeding. (42 U.S.C. 2232). This section sets forth in some detail what an applicant for a license to operate a

² This point was raised in several of the comments. See comments of LeBoeuf, Lamb, Leiby & MacRae, at 6-7; Shaw, Pittman, Potts & Trowbridge, at 4-6, and 23-25; and Westinghouse, at 2-3.

³ "Nuclear materials" include special nuclear materials defined in section 11a of the Act (42 U.S.C. 2014aa) and covered in sections 51-58 of the Act (42 U.S.C. 2071-2078), source material which is defined in 11c of the Act (42 U.S.C. 2014c) and covered in sections 61-69 of the Act (42 U.S.C. 2091-2099), and byproduct material which is defined in section 11e of the Act (42 U.S.C. 2014e) and covered in 81-82 of the Act (42 U.S.C. 2111-2112).

production or utilization facility must supply to enable the Commission to make the required safety finding. This information includes "the place of use (of special nuclear material), (and) the specific characteristics of the facility" as well as information regarding the technical and financial qualifications of the applicant.

The emphasis on information pertaining to the facility and applicant to be licensed is especially significant. No such information is required regarding high-level waste disposal facilities. Such information would be necessary were the Commission to make the detailed safety finding regarding high-level waste disposal activities requested by petitioner. Indeed, an applicant for a reactor operating license will have no responsibility for permanent disposal of high-level waste. (Appendix F, 10 CFR Part 50). This responsibility has been assumed by the Federal government, which, through ERDA, will research, design, build and operate high-level waste disposal facilities.

The statutory provisions cited above make it clear that no statutory requirement exists that the Commission determine the safety of ultimate high-level waste disposal activities in connection with licensing of individual reactors.

REGULATORY REQUIREMENTS

With regard to the petitioner's contention that the Commission's regulations require a finding regarding the safety of ultimate disposal of high-level wastes, while the Commission's regulations do deal with the handling of spent fuel and other high-level wastes, they do so only to the extent that such activities are related to on-site activities carried on by the licensee as an integral part of operation of the reactor. This scheme of regulations has been in effect for some time, and the Commission's findings have been limited to those findings required by the Act and the Commission's regulations—"that there is reasonable assurance that the activities authorized by the operating license (the operation of the reactor) can be conducted without endangering the health and safety of the public" and "the issuance of the license will not be inimical * * * to the health and safety of the public." (10 CFR 50.57(a)(3) and (a)(6)). These findings have not included findings with regard to safe permanent disposal of high-level radioactive wastes and, as is pointed out below, have been implicitly approved by Congress.

CONGRESSIONAL RATIFICATION OF NRC ACTION

The scope of the Commission's safety findings is well known to Congress, as is the extent of the development of systems for high-level radioactive waste

⁴ See General Criteria for Nuclear Power Plants, Appendix A, 10 CFR Part 50. See also comments by LeBoeuf, Lamb, Leiby, and MacRae, at 10-12; and Shaw, Pittman, Potts, and Trowbridge, at 7-9.

disposal. Congress has permitted continued licensing of reactors and the Commission has been given broad discretion in developing criteria for licensees. Such conduct constitutes implicit ratification of the Commission's handling of the high-level waste disposal question.⁴

As early as 1959, Congress held hearings on waste disposal problems.⁵ Six days of hearings were held and the printed hearing materials totaled over 3,000 pages. The hearings were followed by a detailed Joint Committee survey analysis. At that time, development of a permanent high-level waste repository was further from completion than it is today. Congress was made aware of the fact that the problem of permanent disposal of high-level waste had not been solved and that several years of research and testing would be required before engineering practicality could be demonstrated.

During the hearing, the AEC described generally its regulatory program for radioactive waste disposal.⁶ Comments regarding regulatory aspects of the high-level radioactive waste disposal problem were confined to the brief statement that "for the foreseeable future, all high-level wastes resulting from processing of spent fuel elements from licensed reactors will be returned to the Commission for processing and handling."⁷

Witnesses who testified in 1959 commented upon the Commission's handling of waste disposal problems, and one witness was questioned about whether he felt that the Commission had been meeting its responsibilities in the area of high-level waste disposal. He stated in response that the Commission had handled the problem quite well, but pointed out that temporary containment and custody was the only presently available method of handling high-level wastes and that a final and permanent solution to the problem might not ever be devised.⁸

In later hearings, in 1973 and 74, some witnesses urged that a moratorium on licensing be imposed until a solution to the high-level waste disposal question was reached.⁹ One witness cited the

⁵ This point was made repeatedly in the comments. See comments by LeBoeuf, Lamb, Leiby and MacRae, at 7-8; Shaw, Pittman, Potts, and Trowbridge, 6-7, 15-28; and Troy B. Conner, at 3-4.

⁶ "Industrial Radioactive Waste Disposal," Hearings before the JOAE Special Subcommittee on Radiation, Jan. 28-30, Feb. 2-3, and July 29, 1959, 86th Cong., 1st Sess., (1959).

⁷ Id. at 9-10.

⁸ Id. at 2515.

⁹ Id. at 11-13.

¹⁰ Hearing on S. 2744 before the Senate Subcomm. on Reorg., Research and Int'l Org. of the Senate Comm. on Government Operations, 93rd Cong., 1st Sess., (1973), see particularly the prepared statement of Daniel F. Ford, Union of Concerned Scientists, at 210-215; Hearings on S. 2135 and S. 2744 before the Subcomm. on Reorg., Research, and Int'l Org. of the Senate Comm. on Government

high-level waste disposal problem as one of several problems which in his opinion warranted a moratorium on continued construction of nuclear power reactors,¹¹ and another witness stated that "many people have come to believe that present nuclear power plant construction plans which imply accumulations of more radioactive wastes, should be halted until a proven method for safely storing radioactive wastes is available."¹² The AEC in response described the existing proposals for long-term waste management and disposal, but made no claim that methods for permanent disposal had been developed.¹³ Instead of ordering a moratorium on licensing, the Congress provided for NRC licensing of ERDA facilities for waste disposal in sections 202 (3) and (4) of the Energy Reorganization Act.

Thus, almost from the beginning of the reactor licensing program the basic issue presented by the NRDC petition—whether nuclear power reactors should be licensed in the absence of some "definitive" finding or conclusion that high-level wastes can be safely disposed of—was also presented to the Congress. Congress is and has been aware of the high-level waste disposal problem, aware of its connection to reactor operations, and aware that the Commission does not plan to defer licensing until the problem is resolved.

The question of continued licensing in the face of continued uncertainty respecting ultimate disposal technology is certainly a legitimate one to present to the Congress. It must make its judgments, as we do, with an eye to known prospects for the future, programs for implementing them, and current assessments of the risk that what is thought likely to succeed will in fact succeed. This Commission recognizes its responsibility to keep the Congress aware of its information and projections on these matters and has done so in the past. The Commission has confidence, given the on-going federal programs, that the problem of permanent disposal will be solved. This confidence was supported by the Congress when it passed major legislation dividing the Atomic Energy Commission into separate agencies and provided for NRC licensing of ERDA waste management facilities. At that time, it did not order a moratorium on reactor licensing and did not require that the Commission make specific findings with regard to high-level waste disposal in reactor licensing proceedings. As the Supreme Court said in *Power Reactor Development Corp. v. Electrical Union*

Operations, 93rd Cong., 2d Sess., (1974), testimony of Dr. Edward P. Radford, Johns Hopkins University, at 139, and prepared statements submitted by Sam Love, Environmental Action Foundation, at 141 and Anthony Roisman, at 212.

¹¹ Id., testimony of Sam Love, at 141.

¹² Hearings on S. 2135 and 2744, supra note 7, testimony of Daniel F. Ford, at 213.

¹³ Hearings on S. 2135 and S. 2744, supra note 7, at 398-47.

with regard to Congress' failure to act regarding the Commission's safety findings at the construction permit and operating license stages:

It may often be shaky business to attribute significance to the inaction of Congress, but under these circumstances, and considering especially the peculiar responsibility and place of the Joint Committee on Atomic Energy in the Statutory scheme, we think it fair to read this history as a de facto acquiescence in and ratification of the Commission's licensing procedure by Congress.¹⁴

In the instant case, Congress was clearly aware of the Commission's actions and the high-level waste disposal question, yet though major revisions of the legislation relating to the Commission's authority were made Congress neither amended the statutes to require such a finding nor did it direct the Commission to stop licensing reactors pending resolution of the waste disposal problem. Such a course of conduct reinforces the conclusion reached above, based on the clear language of the statute, that the Commission is not required to make a finding that radioactive wastes can be disposed of safely prior to the issuance of an operating license for a reactor. It presupposes, as well, a continuing dialogue between the Congress and the responsible federal agencies—a dialogue which has in fact been vigorous over the past months and promises to remain so. The Congress is entitled to the Commission's continuing assessment of this issue, and will have it.

CONCLUSION

NRDC cites several court cases in its petition in support of the proposition that the Commission must make a full safety finding prior to reactor licensing.¹⁵ The Commission agrees with NRDC that these cases interpreting the statute indicate that a definitive safety finding regarding operation of the facility must be made prior to licensing a reactor. However, NRDC gives no support for its conclusion that this finding must extend to safe permanent disposal of high-level wastes, as activity not performed by the facility. To the contrary, the previous discussion demonstrates that there is no statutory requirement that the Commission determine that high-level radioactive wastes can be permanently disposed of safely prior to the issuance of an operating license for a reactor. The legislative materials cited above support the view that Congress did not and does not require that the Commission make the finding requested by NRDC. Accordingly, the Commission has decided to deny NRDC's petition for rulemaking.

POLICY CONSIDERATIONS—SCOPE OF A REASONABLE SAFETY FINDING

The Commission believes that the direction and progress of the present over-

¹⁴ 387 U.S. 396, 409 (1961).

¹⁵ *Power Reactor Development Corp. v. Electrical Union*, supra note 13; *Nader v. NRC*, 513 F.2d 1045 (D.C. Cir. 1975) and *Citizens for Safe Power v. NRC*, 524 F.2d 1291 (D.C. Cir. 1975).

all high-level waste management program is satisfactory and provides a reasonable basis for continued licensing of facilities whose operation will produce nuclear wastes. Even if, contrary to the Commission's view, some kind of prior finding on waste disposal safety were required under the statutory scheme, such a finding would not have to be a definitive conclusion that permanent disposal of high-level wastes can be accomplished safely at the present time. There is no question that prior to authorizing operation of a reactor the Commission must find pursuant to section 182 that hazards which become fully mature with start-up will be dealt with safely from the beginning. But the quality of this reactor safety finding can be readily distinguished from the quality of findings regarding impacts on public health and safety which will not mature until much later, if ever. The hazards associated with permanent disposal will become acute only at some relatively distant time when it might be no longer feasible to store radioactive wastes in facilities subject to surveillance. The Commission would not continue to license reactors if it did not have reasonable confidence that the wastes can and will in due course be disposed of safely. The accumulating evidence as discussed below continues to support the Commission's implicit finding of reasonable assurance that methods of safe permanent disposal of high-level wastes can be available when they are needed. Given this, and the fact that at present safe storage methods are presently available and highly likely to remain so until a permanent disposal system can be demonstrated and licensed, the Commission sees no reason to cease licensing reactors.

The technology for disposal is reasonably available, and the studies done to date, while not conclusive, are nevertheless promising for timely and safe implementation of the technology. Most importantly, ERDA has dramatically expanded the U.S. program for development of a permanent high-level waste repository. ERDA has issued a report on technology for high-level waste repositories (ERDA-76-43), and has a programmatic EIS on high-level waste management in preparation. ERDA has greatly expanded its program for selection of sites for geologic disposal and is expected to apply to the NRC for a license for such a facility in early 1980 or before. In addition, ERDA is involved in programs to consider the effects on disposal of emplacement of spent fuel rods in a repository. Furthermore, it is involved in extensive program to develop methods of stabilizing (e.g., solidifying) high-level wastes to provide for optimum safety during transportation, storage and disposal should reprocessing be commenced sometime in the future. Finally, ERDA is engaged in developing interim storage sites in case federal custody of wastes becomes necessary before a working repository is available. Thus, there is now a coordinated Federal program to develop an actual disposal facility. Similarly, the NRC is expanding

its own program to set the regulatory requirements for such an operation. The NRC is presently developing a set of regulations to govern licensing of federal repositories to insure that permanent disposal of high-level radioactive wastes will be accomplished safely.

The NRC is also involved in several waste management related programs. The Commission recently completed an "Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle", NUREG-0116, which was published in October 1976, and a companion document NUREG-0216, published in March 1977. In the survey the light water power reactor uranium fuel cycle was taken as including alternatively (1) no reprocessing of spent fuel and follow-on interim and/or long-term storage or disposal of spent fuel or (2) reprocessing spent fuel for purposes other than recycle of plutonium, with follow-on interim and/or long-term storage or disposal of plutonium and wastes from reprocessing, with plutonium either separated from or included with the wastes. This survey served as the basis for an interim rule thereafter ("S-3") promulgated on March 14, 1977 (42 FR 13803) which quantified the environmental impacts from the reprocessing and radioactive waste management portions of the nuclear fuel cycle alternatives described above. The survey generally concluded that these impacts were not significant. A final rulemaking proceeding will be held shortly.

In addition, the Commission has been involved in a rulemaking proceeding on its final Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuel in Light Water Cooled Reactors, NUREG-0002 (hereinafter "GESMO"). While the Commission has recognized that President Carter's statement of April 7, 1977 regarding reprocessing raises significant issues requiring a reassessment of the course of the GESMO proceedings (42 FR 22964, May 5, 1977), these proceedings to date have furnished the Commission with information on waste management sufficient to convince the Commission that the technology for disposal does exist. More detailed information on NRC and ERDA programs is available in Appendices B and C of the S-3 Survey (NUREG-0116). It suffices to state here that these programs are designed to permit the NRC to meet its regulatory responsibilities in the field of waste management to protect the health and safety of the public. Of course, the additional work that is underway will produce more information on the technology and risks of high-level waste disposal and the momentum of the Federal program may change.

Beyond this, the selection and demonstration of an actual disposal site will likely be highly controversial, and a strong and continued national commitment to "get the job done" will likely be necessary. We see in the recent statements and actions of the Executive Branch regarding nuclear power and national energy policy, a firm commitment to carry through to completion a com-

NOTICES

prehensive high-level waste management program. Further, the Commission fully intends to press for vigorous pursuit of programs aimed at developing and implementing sound and timely arrangements for high-level waste disposal.

Dated at Washington, D.C., this 27th day of June, 1977.

For the Nuclear Regulatory Commission.

SAMUEL J. CHILK,
Secretary of the Commission.

[FR Doc.77-18816 Filed 7-1-77;8:45 am]

REGULATORY GUIDE

Issuance and Availability

The Nuclear Regulatory Commission has issued a guide in its Regulatory Guide Series. This series has been developed to describe and make available to the public methods acceptable to the NRC staff of implementing specific parts of the Commission's regulations and, in some cases, to delineate techniques used by the staff in evaluating specific problems or postulated accidents and to provide guidance to applicants concerning certain of the information needed by the staff in its view of applications for permits and licenses.

Regulatory Guide 3.27, Revision 1, "Nondestructive Examination of Welds in the Liners of Concrete Barriers in Fuel Reprocessing Plants," describes methods acceptable to the NRC staff for nondestructive examination to establish the leaktight integrity of welds in the metal liners of concrete confinement barriers in fuel reprocessing plants. This guide was revised following public comment and additional staff review.

Comments and suggestions in connection with (1) items for inclusion in guides currently being developed or (2) improvements in all published guides are encouraged at any time. Comments should be sent to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Branch.

Regulatory guides are available for inspection at the Commission's Public Document Room, 1717 H Street NW., Washington, D.C. Requests for single copies of issued guides (which may be reproduced) or for placement on an automatic distribution list for single copies of future guides in specific divisions should be made in writing to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Director, Division of Document Control. Telephone requests cannot be accommodated. Regulatory guides are not copyrighted, and Commission approval is not required to reproduce them.

(5 U.S.C. 552(a))

Dated at Rockville, Md., this 23d day of June 1977.

For the Nuclear Regulatory Commission.

RAY G. SMITH,
Acting Director,
Office of Standards Development.

[FR Doc.77-18812 Filed 7-1-77;8:45 am]

[Docket No. 50-485]

ROCHESTER GAS AND ELECTRIC CORP.,
(STERLING POWER PROJECT, NUCLEAR UNIT NO. 1)

Order Regarding Evidentiary Hearing

The evidentiary hearing in this matter will resume on Saturday, July 16, 1977, at 9:00 a.m., at The Education Center, Room No. 19, 233 West Utica Street, Oswego, New York.

Dated at Bethesda, Md., this 27th day of June 1977.

So ordered.

THE ATOMIC SAFETY AND LICENSING BOARD,
EDWARD LUTON,
Chairman.

[FR Doc.77-18815 Filed 7-1-77;8:45 am]

[Docket No. 50-155]

CONSUMERS POWER CO.

Issuance of Amendment to Facility Operating License

The U.S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 13 to Facility Operating License No. DPR-6, issued to the Consumers Power Company (the licensee), which revised Technical Specifications for operation of the Big Rock Point Plant (the facility) located in Charlevoix County, Michigan. The amendment is effective as of its date of issuance.

The amendment authorized modification of the facility's liquid radioactive waste collection system in that it permits replacement of the presently installed liquid radwaste concentrator, feed pump, condenser, and associated piping and instrumentation with two cartridge filter units. The amendment also revised the Technical Specifications to delete reference to the components that will be removed during the modification of the waste collection system.

The application for the amendment complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment. Prior public notice of this amendment was not required since the amendment does not involve a significant hazards consideration.

The Commission has determined that the issuance of this amendment will not result in any significant environmental

impact and that pursuant to 10 CFR 51.5 (d) (4) an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with issuance of this amendment.

For further details with respect to this action, see (1) the application for amendment dated May 25, 1977, as supplemented by letter dated June 14, 1977, (2) Amendment No. 13 to License No. DPR-6, and (3) the Commission's related Safety Evaluation. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street NW., Washington, D.C., and at the Charlevoix Public Library, 107 Clinton Street, Charlevoix, Michigan 49720. A copy of items (2) and (3) may be obtained upon request addressed to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Director, Division of Operating Reactors.

Dated at Bethesda, Md., this 22nd day of June 1977.

For the Nuclear Regulatory Commission.

DON K. DAVIS,
Acting Chief, Operating Reactors Branch No. 2, Division of Operating Reactors.

[FR Doc.77-19069 Filed 7-1-77;8:45 am]

[Docket No. 50-330]

NORTHEAST NUCLEAR ENERGY CO.,
ET AL.

Issuance of Amendment to Facility Operating License

Notice is hereby given that the U.S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 29 to Facility Operating License No. DPR-65 issued to Northeast Nuclear Energy Company, The Connecticut Light and Power Company, The Hartford Electric Light Company, and Western Massachusetts Electric Company, which revised Technical Specifications for operation of the Millstone Nuclear Power Station, Unit No. 2, located in the Town of Waterford, Connecticut. The amendment is effective as of the date of issuance.

The amendment will provide (1) a modification of the action required to be taken, as stated in Technical Specification 3.1.1.5, in the event that the Reactor Coolant System (RCS) temperature becomes less than 515° F, and (2) a change in the limits of RCS pressure as a function of temperature as given in Technical Specification 3.4.9.1.

The applications for the amendment comply with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license

§ 201.77 [Amended]

In § 201.77 delete "packer, and licensee" and insert "and packer".

§ 201.94, 201.95, 201.97 [Amended]

In §§ 201.94, 201.95, 201.97, delete "dealer, and licensee" and insert "and dealer".

§ 201.96 [Amended]

In § 201.96 delete "dealers, or licensees" and insert "or dealers".

§ 201.95 [Amended]

In § 201.95 (Amended) delete "dealer, or licensee." and insert "or dealer."

§ 201.23 [Amended]

In § 201.23 delete "or licensee."
Due to the nature of these changes they shall become effective August 2, 1979.

Done at Washington, D.C. this 26th day of July 1979.

Chas B. Jennings,
Deputy Administrator, Packers and Stockyards, AMS.

[FR Doc. 79-23830 Filed 8-1-79; 8:45 am]
BILLING CODE 3410-02-M

NUCLEAR REGULATORY COMMISSION

10 CFR Part 51

Licensing and Regulatory Policy and Procedures for Environmental Protection; Uranium Fuel Cycle Impacts From Spent Fuel Reprocessing and Radioactive Waste Management

AGENCY: Nuclear Regulatory Commission.

ACTION: Promulgation of a final fuel cycle rule.

SUMMARY: The Commission promulgated on March 14, 1977 an interim rule identifying the environmental impact values for the uranium fuel cycle which are to be included in environmental reports and environmental impact statements for individual light water nuclear power reactors. After an extensive proceeding focused on the nuclear waste management and fuel reprocessing parts of the fuel cycle, the Commission now promulgates a final rule which sets out revised impact values. The rule also specifies fuel-cycle-related subjects that are to be considered in individual licensing proceedings as part of the environmental cost-benefit analysis for a power reactor. The Commission notes its intention to conduct a further supplementary rulemaking to adopt as

part of the rule an explanatory narrative addressing the environmental significance of the impact values tabulated in the final rule. A general update of the rule with respect to all aspects of the uranium fuel cycle is also in progress.

EFFECTIVE DATE: September 4, 1979.

FOR FURTHER INFORMATION CONTACT: E. Leo Slaggie, Office of the General Counsel, U.S. Nuclear Regulatory Commission, Washington, DC, 20555, phone 202-634-3224.

SUPPLEMENTARY INFORMATION: This notice announces the outcome of a final rulemaking by the Nuclear Regulatory Commission regarding the environmental effects of spent fuel reprocessing and radioactive waste management in the light water power reactor uranium fuel cycle. The rule adopted herein replaces an interim rule which identifies fuel cycle environmental impact values to be included in environmental reports and environmental impact statements for individual light water power reactors. The interim rule, 10 CFR 51.20(e) ("Table S-3", as revised), was published on March 14, 1977 (42 FR 13803) to be effective for 18 months and was extended several times, the final extension being to the effective date of this rule.

This final rulemaking concludes a proceeding which began on May 26, 1977 with a notice that a rulemaking hearing would be held to consider whether the interim rule should be made permanent or, if it should be altered, in what respects. 42 FR 26987. The Hearing Board took extensive written and oral testimony from more than twenty participants. On August 31, 1978 the Board submitted to the Commission a detailed summary of the evidentiary record, followed on October 26, 1978 by its Conclusions and Recommendations.

After studying the Hearing Board's recommendation and receiving written and oral presentations by rulemaking participants, the Commission has adopted as a final rule the modified Table S-3 recommended by the Hearing Board. The impact values in this table differ only slightly from the values in the interim rule. With two exceptions, these values will be taken as the basis for evaluating in individual light water power reactor licensing proceedings, pursuant to requirements of the National Environmental Policy Act (NEPA), the contribution of uranium fuel cycle activities¹ to the environmental costs of

¹ The fuel cycle activities addressed by the rule include uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, spent fuel storage and disposal.

licensing the reactor in question. The exceptions are radon releases, presently omitted from the interim rule (43 FR 15613, April 14, 1978), and technetium-99 releases from reprocessing and waste management activities, as discussed later in this notice. Appropriate values for these releases are open for consideration in individual proceedings.

Promulgation of the revised table is not the sole outcome of this rulemaking. The rulemaking record makes clear that effluent release values, standing alone, do not meaningfully convey the environmental significance of uranium fuel cycle activities. The focus of interest and the ultimate measure of impact for radioactive releases are the resulting radiological dose commitments and associated health effects. To convey in understandable terms the significance of releases in the Table, the Hearing Board recommended that the modified Table be accompanied by an explanatory narrative promulgated as part of the rule. The recommended narrative would also address important fuel cycle impacts now outside the scope of the Table, including socioeconomic and cumulative impacts, where these are appropriate for generic treatment. The Commission has directed the NRC staff to prepare by October 1 such a narrative, as described in more detail later in this notice. The narrative will be submitted for public comment in a further rulemaking.

Pending adoption of an explanatory narrative as part of the fuel cycle rule, the use of Table S-3 in individual proceedings must be accompanied by supplementary presentations. Accordingly, the Commission has directed the NRC staff to continue presenting in individual proceedings an evaluation of dose commitments and health effects from fuel cycle releases. In addition, the staff will address economic, socioeconomic, and possible cumulative impacts of fuel cycle activities and such other impacts of the fuel cycle as may reasonably appear to have a significance for individual reactor licensing sufficient to warrant attention for NEPA purposes. Those matters remain open for litigation in individual proceedings. The present rulemaking settles only the question of fuel cycle release values, with the

reprocessing of irradiated fuel, transportation of radioactive materials and management of low-level wastes and high-level wastes. The rulemaking proceeding concluded here dealt only with impacts of reprocessing and waste management and associated transportation, the so-called "back-end" of the fuel cycle. The impacts of transportation of cold fuel to the reactor and irradiated fuel and solid radioactive wastes lie outside the scope of the rule and are treated separately in the Commission's regulations. See 10 CFR 51.20(g).

exceptions noted above, and such other numerical data that appear explicitly in the Table.

In response to a recent decision by the United States Court of Appeals for the District of Columbia Circuit, *State of Minnesota v. NRC*, Nos. 78-1269 and 78-2032 (May 23, 1979), the Commission intends to conduct a generic proceeding which will consider the most recent evidence regarding the likelihood that nuclear waste can be safely disposed of and when that, or some other off-site storage solution, can be accomplished. That new generic waste disposal proceeding will be separate and different in scope and purpose from further fuel cycle rulemakings dealing with an S-3 narrative and general update of S-3, but will in part review and update the conclusions regarding waste disposal which have been reached in the present rulemaking. If available, the record compiled in the new generic waste disposal proceeding can be considered in, and made a part of the record in, the general update of S-3.

The background of this proceeding and the reasons underlying the Commission's decision are explained in the material which follows.

I. Need For a Fuel Cycle Rule in Power Reactor Licensing

The National Environmental Policy Act of 1969 (NEPA) requires that the Commission look closely at the environmental impact of a proposed nuclear power reactor before it may license the construction or operation of the facility. To comply with NEPA the Commission has adopted licensing and regulatory procedures presently set out in 10 CFR Part 51. Under these rules the environmental analysis in a power reactor licensing proceeding must include a cost-benefit analysis which, among other things, considers and balances the adverse environmental impacts of the nuclear plant against the expected environmental, economic, technical, and other benefits.

The environmental impact of operating a nuclear power reactor is not limited to effects specific to the plant itself, such as site alterations due to plant construction or the release of reactor effluents. The environment will also be affected by the fuel cycle activities necessary to support plant operation. Since operation of a nuclear plant involves a commitment to prepare fuel and dispose of spent fuel and waste, the environmental impacts considered in the NEPA analysis for a power reactor

should include contributions from uranium fuel cycle activities.²

Evaluating these contributions necessarily involves a wide-ranging inquiry and a certain amount of speculation. Fuel cycle facilities serve many reactors, and there is no way to ascertain with certainty which facility now in existence or to be operated in the future will contribute fuel to a given nuclear power reactor or will receive its irradiated fuel or wastes. Thus the fuel for a particular reactor cannot be identified at the start of the fuel cycle and traced through the various steps to final disposal. Instead, the fuel cycle impacts for a particular reactor must be estimated hypothetically, for example by apportioning the impacts of representative fuel cycle facilities to the number of reactors served. Determining these facility impacts also involves uncertainties, particularly for the back end of the cycle. For example, reprocessing of spent fuel, if it is done, would take place at newly designed facilities, not yet operational. Thus impacts based on previous reprocessing experience using outdated technology are not in the Commission's judgment representative of future impacts. For waste disposal many proposals have been put forth, but the method or methods which will finally be used are as yet unselected. A reasonable approach for determining waste disposal impacts is to focus on a system which seems likely to be deployed and to estimate its impacts conservatively, based on the best available information and analysis.

A study of fuel cycle impact thus involves difficult generic analysis and prediction well outside the normal scope of facility-specific subjects dealt with by a reactor licensing board. This does not mean that the subject can be ignored or deferred until the fuel cycle facilities themselves come up for licensing.³ It does mean that in reactor licensing fuel cycle impacts should be treated where possible by generic rulemaking rather than case-by-case adjudication.

The Commission's interim fuel cycle rule, 10 CFR 51.20(e), requires that the environmental costs to be considered in a power reactor licensing proceeding shall include contributions from uranium fuel cycle activities as set forth in a

² Activities comprising the nuclear fuel cycle are listed in note 1, above.

³ The court of appeals for the D.C. Circuit has specifically rejected such an approach and held that "absent effective generic proceedings to consider these issues, they must be dealt with in individual licensing proceedings." *NRDC v. NRC*, 547 F. 2d 663, 641 (1976), *rev'd on other grounds sub nom. Vermont Yankee Nuclear Power Corp. v. NRDC*, 435 U.S. 519 (1978).

table ("Table S-3, Summary of environmental considerations for uranium fuel cycle"). The adequacy of this interim rule, insofar as waste management and reprocessing impacts are concerned, was the original focus of the present rulemaking, as the background discussion in the section to follow indicates. As the rulemaking progressed, however, participants submitted a substantial amount of public comment and testimony addressing matters not dealt with by the interim rule, including economic and socioeconomic impacts, numerical uncertainties in the estimates, and long-term dose commitments and health effects. This implicit broadening of the rulemaking's scope called attention to problems which must be addressed in a further rulemaking, but also indicated there may be confusion regarding the proper objective of a fuel cycle rule.

The rule aimed at in this proceeding has a limited purpose. It applies only to environmental cost-benefit balances for power reactors and is in no way intended to be a tool for choosing among alternative uranium fuel cycle technologies. Although the rule should reflect as accurate an assessment as reasonably possible of uranium fuel cycle impacts, the rule clearly does not need the detail or the precision of an environmental analysis for licensing fuel cycle facilities themselves. A reasonable degree of uncertainty is unavoidable and is acceptable, given that basic decisions have not yet been made regarding reprocessing and the technology of waste disposal.

The rule need not be comprehensive in scope to be a useful and valid exercise of rulemaking authority. A record is not yet available to support a comprehensive rule dealing with all generic aspects of fuel cycle impacts relevant to reactor licensing, but the Commission is free to adopt a narrower rule that for the present leaves some of these matters for consideration in individual proceedings. The table of impacts adopted as a final rule in this proceeding serves as an important first step in this consideration, relieving adjudicatory boards from the need to determine those numerical impacts of the uranium fuel cycle which have been extensively considered in generic rulemaking. Ultimately, however, the impacts of the releases and not the releases themselves dictate the standards the Commission must set. Therefore, use of the table in individual licensing will not foreclose discussion of the significance of those impacts or other important aspects of the fuel cycle not addressed by the table. This point

needs emphasis in view of the background of the Commission's original S-3 rule, which at least initially was apparently interpreted as cutting off further discussion of fuel cycle impacts.

II. Background of the Fuel Cycle Rulemaking

1. Promulgation and Application of the Original Fuel Cycle Rule, "Table S-3"

In a Notice of Proposed Rulemaking published November 15, 1972 (37 FR 24191) the Atomic Energy Commission (AEC) announced a proceeding "that would specifically deal with the question of consideration of environmental effects associated with the uranium fuel cycle in the individual cost-benefit analysis for light water cooled nuclear power reactors." As a basis for this consideration the Commission's staff had published a report entitled "Environmental Survey of the Nuclear Fuel Cycle," dated November 6, 1972.⁴ Citing the Environmental Survey, the Notice set out two proposed alternatives for public comment and consideration at an informal hearing. Under one alternative, no consideration of fuel cycle impacts (apart from facility-specific effects of transporting cold fuel to the reactor and spent fuel and radioactive wastes from the reactor) would be required in individual proceedings, on the grounds that these impacts as analyzed in the Environmental Survey were sufficiently small not to affect significantly the cost-benefit balance for an individual reactor. Under the second alternative, impact values for fuel cycle costs of licensing a power reactor would be taken in individual licensing proceedings as set forth in Table S-3 of the Environmental Survey.⁵

Written comments were submitted by more than forty individuals and organizations. The hearing took place February 1 and 2, 1973 before the three-person hearing board, following legislative-type procedures announced by the Commission in a supplemental notice (38 FR 49).

Following the hearing and supplementary written submissions by participants, the board on July 6, 1973

presented to the Commission a 24-page report which identified the major issues at the proceeding but, in accordance with the Commission's direction, made no recommendation.

After consideration of the comments and the hearing record, the AEC on April 22, 1974 (39 FR 14189), adopted the second alternative, under which "the environmental effect associated with the uranium fuel cycle, albeit small, would be factored into individual cost-benefit analyses in the form of numerical values," as set out in Table S-3, with minor revisions to reflect corrections or changes suggested by the hearing record. The Commission noted its view that the values in the table reflected "substantial conservatism" and found it to be a "fact that the environmental effects of the uranium fuel cycle have been shown to be relatively insignificant." The Commission concluded accordingly that there was no need to apply the rule retrospectively.

The Commission stated that it preferred to adopt Table S-3, rather than the alternative of declaring by rule that fuel cycle impacts are not significant for reactor licensing, because in conformance with other regulations the table "quantifies, to the fullest extent practicable, the environmental effects of the uranium fuel cycle in individual cost-benefit analyses." Cf. 10 CFR 51.20(b), 51.23(c). Consistent with the Commission's view at that time that Table S-3 represented a full quantitative account of fuel cycle contributions, the text of the rule stated that in applicants' environmental reports and Commission impact statements in individual licensing proceedings this contribution "shall be as set forth in . . . Table S-3 . . . No further discussion of such environmental effects shall be required."

The Commission notice promulgating the rule did not specifically mention health effects, socioeconomic impacts, or cumulative impacts, either to require or preclude their discussions, although it might fairly be concluded that the notice's repeated observation that fuel cycle effects were "insignificant" amounted to a Commission judgment implicit in the rule that no discussion of these effects was formally required. The Commission's regulatory staff applied the rule in practice as allowing fuel cycle impacts to be addressed in reactor licensing proceedings solely by the formal act of displaying Table S-3 in impact statements, with no further discussion. In particular, impact statements prepared by the staff did not analyze fuel cycle impacts in terms of health effects which might be caused by the radioactive releases tabulated in the

rule and did not discuss socioeconomic or cumulative impacts.

Almost three years after the rule became effective, the Commission's Atomic Safety and Licensing Appeal Board issued a decision implying that discussion of fuel cycle health effects was desirable when the comparison between the proposed nuclear plant and an alternative coal plant was an issue in the licensing proceeding. *In the Matter of Tennessee Valley Authority* (Hartsville Nuclear Units), 5 NRC 92, 103 (1977). As part of its response to the Hartsville decision, the regulatory staff sought and received permission from reactor licensing boards to introduce evidence of the public health consequences of the nuclear fuel cycle compared with the coal fuel cycle. Cf. *In the Matter of Public Service Company of Indiana, Inc.* (Marble Hill Nuclear Generating Station), 7 NRC 179, 187 (1978). As the rule required, health effects in the staff's submissions were based on the tabulated radioactive release values in 10 CFR 51.20(e).⁶ By this time, however, the original Table S-3 had been replaced by the amended table in the interim rule as a result of legal developments discussed next.

2. The Vermont Yankee Decision

On a petition to review the adequacy of the fuel cycle rulemaking proceedings, the United States Court of Appeals for the District of Columbia Circuit on July 21, 1976 set aside those portions of the rule pertaining to waste management and spent fuel reprocessing. *Natural Resources Defense Council v. NRC*, 547 F. 2d 633, rev'd *sub nom. Vermont Yankee Nuclear Power Corp. v. NRDC*, 435 U.S. 519 (1978). After first holding that fuel cycle impacts must be addressed in reactor licensing,⁷ either by

⁴The Commission announced on April 14, 1970 an amendment to the fuel cycle rule which removed the release value for radon from the table and left radon impacts open for litigation in individual proceedings. 43 Fed. Reg. 15912. Subsequent to this amendment, the staff has been free to introduce evidence of radon-related health effects not based on Table S-3 release values. This notice also confirmed that the rule does not address health effects and does not preclude discussion of health effects in individual proceedings. The notice amended the second sentence of the rule to read: "No further discussion of the environmental effects addressed by the Table shall be required."

Mr. Marvin Lewis, one of the participants in this rulemaking, petitioned the Commission to "vacate" Table S-3 in its entirety, citing as grounds asserted severe health effects from radon releases. The Commission has denied this petition, noting that radon releases are no longer addressed by the table.

⁷The court of appeals consolidated the petition to review the fuel cycle rule with a petition to review an Appeal Board holding in the Vermont Yankee Nuclear Power Station licensing proceeding that environmental impacts of reprocessing or waste disposal need not be considered in individual reactor licensing proceedings. *In the Matter of*

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an effective rule or in the adjudicatory proceeding, the court found the rulemaking record insufficient to support the waste management and reprocessing parts of the rule because the procedures afforded during the hearing were inadequate, at least as applied by the hearing board.⁹ The court saw the significance of Table S-3 as an expression "in numerical terms [of] the conclusion that the environmental effects of the fuel cycle, including waste disposal, are insubstantial." *Id.* at 646. With regard to reprocessing and waste disposal, "the focal points for this appeal," the court found that the Environmental Survey failed to provide "detailed explanation and support" for this conclusion and that testimony presented at the hearing did not fill the gap. The court noted that "[t]he only discussion of high level waste disposal techniques was supplied by a 20-page statement by [AEC witness] Dr. Frank K. Pittman," which the court criticized for its "conclusory quality." *Id.* at 645, 651. The court found that the procedures employed at the hearing failed to expose this statement to any "probing of its underlying analysis," *id.*, and concluded that the Commission had been arbitrary and capricious to adopt a rule "cutting off consideration of waste disposal issues and reprocessing issues in licensing proceedings based on the cursory development of the facts . . . in this [rulemaking] proceeding." The court vacated those portions of the rule and remanded to the Commission.

In important respects, however, the court of appeals approved the Commission's overall approach to the

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Vermont Yankee Nuclear Power Corp., 4 AEC 830 (June 6, 1972). The court of appeals rejected the Appeal Board's decision and held that reprocessing and waste disposal issues must be dealt with either by an effective rule or in individual licensing proceedings. The Supreme Court did not disturb this holding when it later reversed the court of appeals. The Supreme Court noted that the Commission "acted well within its statutory authority" in requiring that fuel cycle impacts be considered in reactor licensing proceedings. *Vermont Yankee, Nuclear Power Corp. v. NRDC*, 435 U.S. 519, 539 (1978). The Commission in promulgating the fuel cycle rule had stated that the Appeal Board's Vermont Yankee decisions had no further precedential significance insofar as they differed from the rule. 39 *Fed. Reg.* 14188.

⁹ Interpreters of the opinion have differed over the relative weight which the court of appeals in reaching its decision attached to procedural inadequacies and to insufficiency of the record. The Supreme Court was persuaded that the "ineluctable mandate of the court's decision is that the procedures afforded during the hearings were inadequate." 435 U.S. 519, 542. The Supreme Court reversed the court of appeals on this procedural question and remanded for consideration whether the evidentiary record supported the rule. The court of appeals has held in abeyance its decision on the remand, pending completion of the Commission's final rulemaking.

fuel cycle rulemaking. The court rejected the argument that a fuel cycle rule is itself a major Federal action requiring an impact statement. The court found it sufficient that a NEPA impact statement is prepared when Table S-3 is incorporated into a proposal to license an individual reactor. The court also saw no necessity for a "plenary consideration of alternatives" in evaluating waste disposal impacts for the purposes of the rule, "provided a sufficiently conservative and credible assessment of a particular waste disposal method is used." *Id.* at 653, note 57.

3. Promulgation of the Interim Rule

In response to the *NRDC v. NRC* decision and a related decision, *Aeschliman v. NRC*, 547 F. 2d 622 (D.C. Cir. 1976), the Commission on August 16, 1976 issued a General Statement of Policy (GSP) (41 FR 34707) announcing an intention to reopen the fuel cycle rulemaking proceeding to supplement the existing record on waste management and reprocessing impacts and to determine whether or not the rule should be amended. The Commission directed the NRC staff to prepare on an expedited basis a revised and well-documented environmental survey as the basis for an interim rule on waste management and reprocessing impacts. The General Statement of Policy also directed that no new full-power operating licenses, construction permits, or limited work authorizations should issue, pending the conclusion of a notice-and-comment interim rulemaking. With regard to licenses already issued, the Commission indicated that, if requests for a show cause order based on fuel cycle grounds were received, licensing boards would be assigned to determine whether the licenses in question should be continued, modified, or suspended pending adoption of an interim rule.

The revised environmental survey, NUREG-0116—Supplement 1 to WASH-1248, was completed in early October, 1976, and on October 18 the Commission published a notice soliciting public comment on the survey and a proposed interim rule. (41 FR 45849). Comments received in response to that notice and the Commission's responses to those comments were later published in March 1977 as NUREG-0216, Supplement 2 to WASH-1248.

On November 11, 1976 the Commission announced that licensing could resume on a conditional basis (41 FR 49898). As factors in this decision the Commission noted that (1) the court of appeals had stayed its mandate, leaving

the S-3 rule formally in effect but conditioning new licenses on the outcome of petitions by licenses for Supreme Court review of the court's decision,⁹ and (2) NUREG-0116 provided significant support for the conclusion that waste management and reprocessing impacts are slight, so that the interim rule, when promulgated, would not be likely to produce results in reactor licensing different from the original rule. The Commission also suspended show cause proceedings on fuel cycle grounds against light water reactor licensees. The Commission directed that new licenses could be issued only if a separate analysis determined that use of the impacts in the proposed interim rule would not tilt the cost-benefit balance against the reactor.

On March 19, 1977 the Commission promulgated the interim rule (42 FR 13803) to be effective for eighteen months, subject to extension for good cause. 10 CFR 51.20(e). In support of the interim rule the Commission noted that the two environmental supplements, NUREG-0116 and NUREG-0216, provided a "sufficient informational basis for the interim rule . . ." The Commission acknowledged that "there are gaps in the information needed for a detailed assessment of waste management and disposal technology" but found that "the costs of not proceeding outweigh the risks of proceeding by interim rule," given that within a relatively short period the issues would be more thoroughly discussed in the final rulemaking proceeding. The Commission terminated show cause proceedings initiated pursuant to the General Statement of Policy, noting that "the values in the interim rule are not sufficiently different from the values in the original Table S-3 to warrant revocation or suspension on cost-benefit grounds [of previously issued licenses]." ¹⁰ 43 FR 43806.

⁹ The Supreme Court's subsequent grant of certiorari automatically continued the stay of mandate pending completion of Supreme Court Action. The Supreme Court's remand and subsequent action by the court of appeals have left unresolved for the present the question whether the waste management and reprocessing portions of the original S-3 rule were legally sufficient. See note 8.

¹⁰ Subsequently the Commission directed the Appeal Board to consider for the ten facilities affected by the terminated show cause proceedings "the particularized factual data essential to making a determination of the incremental effect. If any, that the use of the values in the interim rule would have on the NEPA cost-benefit balances for the particular facilities involved." 5 NRC 717, 7173 (1977). The Appeal Board found that fuel cycle impacts did not tilt the cost-benefit balance against any of the facilities in question, 6 NRC 25, 28-30, 6 NRC 33, 102-104, 6 NRC 206, 209 (1977), and concluded: "The effects assigned by the interim rule

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4. Initiation of the Present Rulemaking

Following promulgation of the interim rule, the Commission published a notice of hearing which initiated a final rulemaking. 42 FR 28987 (May 26, 1977). The procedures announced in the notice were the same as those applied in the original hearing, except that specific provision was made for the Hearing Board to entertain suggestions from participants regarding questions which the Board should direct to witnesses or other participants.¹¹ The subject of the hearing was "confined to the environmental effects of spent fuel reprocessing and radioactive waste management in the light water power reactor uranium fuel cycle, and to the question whether the outcome of the interim rulemaking should be made permanent for future use, or if it should be altered, in what respects."¹² Both NUREG-0116 and NUREG-0216 were specified for inclusion in the hearing record. The fuel cycle was to be taken to include alternatively (1) no reprocessing of spent fuel, or (2) reprocessing of spent fuel for purposes other than recycle of plutonium, with follow-on interim and/or long-term storage or disposal of plutonium and wastes from reprocessing, with plutonium either separated from or included with the wastes.¹³

The following parties participated in this reopened proceeding: the staff of NRC; the Environmental Protection Agency; the Department of Interior; the U.S. Geological Survey; the States of California (California Energy Resources Conservation and Development Commission), Delaware, Maryland, Ohio, Wisconsin and New York;

Footnotes continued from last page to the uranium fuel cycle are . . . extremely small (as the Commission itself has suggested). This being so, they could not possibly serve to call for the abandonment of any particular nuclear facility unless the cost-benefit balance for that facility was otherwise in virtual equipoise." 6 NRC at 104.

¹¹ On January 26, 1978 the Commission modified the procedures to allow participants to cross-examine witnesses on specific factual issues at the close of the legislative-type hearings, where it could be demonstrated with particularity that the procedure was necessary to prepare a record adequate for a sound decision. No cross-examination in fact occurred. After a special hearing to consider requests, the Board found that the requisite demonstrations had not been made.

¹² With regard to fuel cycle impacts not within the scope of the hearing, the notice observed that the staff had begun a general update which was expected to lead to a separate rulemaking proceeding. A proposed outline for this "update of WASH-1248" was announced by the staff on September 7, 1978. 43 Fed. Reg. 39801.

¹³ The impacts from reprocessing-waste management and transportation of wastes given in the interim rule are maximized for either of the two fuel cycles considered (no reprocessing and reprocessing only to recover uranium). See note 1 to Table S-3, 10 CFR 51.20 (1978).

Baltimore Gas and Electric Co., *et al.* (a group of 16 utilities); Commonwealth Edison Co., *et al.* (a group of 8 utilities); the Tennessee Valley Authority; the Allied-General Nuclear Services Co.; Exxon Nuclear Company; Westinghouse Electric Corporation; the Atomic Industrial Forum; the Natural Resources Defense Council; the Pacific Legal Foundation; Environmentalists, Inc.; the Sierra Club; the Union of Concerned Scientists; Mr. Marvin Lewis; and Dr. Chauncey Kepford.

At a prehearing conference held on July 28, 1977 the Hearing Board provided for the submission of written direct testimony by the participants, written questions and answers based on that testimony and follow-up questions, all prior to the start of the oral hearings. These hearings began on January 16, 1978 and concluded in March 1978 after ten days of testimony. During the hearings, in response to a petition by the State of New York, the Board expanded the scope of the proceeding to consider the economic feasibility of the model facilities on which the proposed Table S-3 values were based. The Board conducted all of the questioning during the oral hearings.

The Board compiled an extensive evidentiary record, including the staff's NUREG-0116 and NUREG-0216, the staff's testimony on the economic feasibility of its model facilities, the direct testimony of participants exceeding 1,100 pages, two rounds of written questions propounded by participants and several hundred pages of responses, more than 1,200 pages of transcript of oral hearings, written rebuttal testimony of the parties, and final concluding statements of the parties, filed June 26, 1978.

On August 31, 1978 the Hearing Board submitted a 137-page report to the Commission which summarized this record and outlined the significant issues raised by the participants. Also, responding to the Commission's request for the Board's views, the Board submitted on October 28, 1978 its Conclusions and Recommendations. The Board recommended that the Commission adopt as a final rule a modified Table S-3 proposed by the NRC staff, in which the majority of entries were unchanged from those in the interim rule. The Board also recommended that a "brief explanatory narrative" be adopted as part of the rule, which among other things would interpret the significance of the tabulated impacts in terms of environmental dose commitments. The Board's recommendations identified several aspects of the rule which in the

Board's view should be improved upon during the general update of the fuel cycle rule.¹⁴

Shortly before the Board's recommendations were issued, the Commission announced that it would receive participants' written statements commenting on the rulemaking record and the Hearing Board's recommendations. Nine participants submitted comments, including the NRC staff.¹⁵ Several participants argued that the record did not support adoption of the modified Table S-3. New York State asserted that the record showed the model facilities on which the table was based were not economically feasible. Other opponents of the table argued that the tabulated impact values did not adequately reflect underlying uncertainties revealed by the record. In particular, they questioned basing reprocessing impacts on model facilities rather than past operating experience. The omission of technetium-99 releases from the table was also criticized. Several parties who opposed adopting the table stressed that dose commitments and health effects, economic and socioeconomic impacts, and cumulative impacts were not addressed by the table and were required for an adequate description of fuel cycle environmental impacts. Those participants generally supported preparation of an explanatory narrative but urged a broader scope than the one proposed by the Board.

Other participants supported the Board's recommendation for adoption of the modified Table S-3 but questioned the need for an explanatory narrative. They pointed to procedural problems of providing adequate notice before a narrative could be incorporated as part of the rule. Some parties concluded, on the grounds that the D.C. Circuit had not criticized the portions of the original S-3 rule dealing with the front-end of the fuel cycle, that there was no legal requirement for a narrative or for consideration of fuel cycle environmental questions outside the scope of the original Table S-3.

The NRC staff favored adoption of the modified Table S-3 as a final rule but preferred that an explanatory narrative be deferred for preparation as part of the general update. The staff noted that explanatory material subject to litigation in individual licensing proceedings is presently introduced to

¹⁴ See note 12 above.

¹⁵ The nine commenters were Mr. Marvin Lewis, the Natural Resources Defense Council, the Sierra Club, the State of New York, the States of Ohio and Wisconsin, Baltimore Gas and Electric, *et al.*, Commonwealth Edison, *et al.*, the Tennessee Valley Authority, and the NRC staff.

accompany the use of Table S-3 in such proceedings and recommended that this practice continue.

On January 19, 1979 the Commission heard oral presentations from the commenters. These presentations provided a valuable elaboration of the parties' views but did not change the basic positions stated in the written comments. The Commission accepted brief supplemental written submissions following the oral presentations and then closed the record of this proceeding as of January 23, 1979.

III. Final Rulemaking

1. Adoption of the modified Table S-3

The Commission has found that except for technetium-99 releases the record supports adoption of the modified Table S-3 as a final rule, as recommended by the Hearing Board. The participants' comments and the Board's recommendations have made clear that the Table is not free of flaws, but for the reasons discussed below the Commission believes that these will not significantly impair the Table's usefulness as the starting point for considering fuel cycle impacts in individual reactor licensing proceedings.

To begin with, there can be little doubt that this rulemaking has been adequate from a procedural standpoint. The Supreme Court's *Vermont Yankee* decision confirmed that informal agency rulemaking is procedurally sufficient when the notice-and-comment requirements of the Administrative Procedure Act, 5 U.S.C. 553, are met. 435 U.S. 419 (1978). The fuel cycle rulemaking not only afforded these basic notice-and-comment procedures but also provided extensive additional written and oral procedures, including several not offered by the hearing board in the original S-3 rulemaking. A few participants expressed the view that the record might have been improved, had the Board exercised its discretion to permit cross-examination, but no one has argued that the record is legally deficient from a procedural standpoint.

As noted earlier, however, several comments to the Commission questioned whether the record provides sufficient evidence to support the numbers in the modified Table. The general thrust of these comments was that the model facilities analyzed by the staff were for one reason or another unacceptable as a basis for determining fuel cycle impacts. The Commission believes that the substance of these comments has been adequately addressed by the Hearing Board in the discussion supporting its

recommendations. Conclusions and Recommendations of the Hearing Board, Docket RM-50-3. The issues of greatest importance or special concern to commenters are reviewed in the following subsections.

a. *Economic Feasibility.* The proposed rule clearly would be open to serious question if the model facilities on which the values in Table S-3 are based would be prohibitively expensive to build and operate. In response to the Board's request for evidence on economic feasibility, viewed in this narrow sense, the staff submitted cost estimates based on material from the GESMO proceeding.¹⁶ From these estimates the Hearing Board found per-reactor costs of reprocessing and waste management to be on the order of ten percent of the total costs for building and operating an individual reactor. The Board concluded that such costs were not prohibitive. Recommendations, page 58.

Comments by the State of New York challenged the Board's conclusion that establishing fuel cycle costs at a few percent of total generating costs sufficed to demonstrate economic feasibility.¹⁷ New York cited testimony by its own witnesses asserting that the economics of nuclear power are precarious and that back-end fuel cycle costs will tip this doubtful balance against the nuclear option. This evidence, New York concluded, "mandates a finding of economic infeasibility of the back end of the uranium fuel cycle."

The Commission believes New York missed the distinction between the broad issue of nuclear power economics and the much narrower question of economic feasibility of specific models for waste management and reprocessing. Whether nuclear power is good business is not an issue in this rulemaking. The fuel cycle rule will be used only when someone has decided,

¹⁶Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuels in Light Water Cooled Reactors, NUREG-0002, August 1978.

¹⁷Also, during the hearing and in a separate motion filed before the Commission on December 18, 1978, New York, together with Wisconsin and Ohio, urged that dollar value impacts should be brought within the scope of the S-3 proceeding. The matter of dollar value economic impacts is separate from the issue of economic feasibility. The Commission made clear earlier in an order issued February 9, 1978, Docket RM-50-3, that this rulemaking "was not intended to encompass a full economic analysis leading to inclusion of economic costs in the uranium fuel cycle rule." The Order left open the possibility that the detailed economic costs of the fuel cycle might be dealt with in a later generic rulemaking. The Commission will refer the States' motion to the staff for treatment as a petition for rulemaking pursuant to 10 CFR 2.802. To the extent that fuel cycle dollar value impacts are relevant to the cost-benefit balance for a reactor they may at present be considered in individual licensing proceedings.

rightly, or wrongly, that nuclear power is sufficiently viable economically to warrant applying for a reactor license. Once the reactor has operated, back-end fuel cycle activities must be carried out, whatever the cost. This rulemaking addressed the environmental impact of those activities based on methods and facilities which could on technological grounds reasonably be employed. The economic feasibility question, correctly identified by the Hearing Board, is simply whether these methods might be so outlandishly expensive that there will be a "major incentive for reducing [costs] at the expense of increasing the radioactive effluents above the values . . . in Table S-3." Recommendations, page 58. The Commission believes that the fuel cycle cost estimates arrived at by the Hearing Board took adequate account of matters in controversy and provided a reasonable basis for the Board's conclusion that the staff's models are economically feasible in the sense described above.¹⁸

b. *Waste Management and Disposal.* In determining the impacts associated with waste management and disposal the staff assumed that high-level waste (or reactor spent fuel treated as waste) would be stored in interim facilities (water basins and retrievable surface storage facilities) for about twenty years and then disposed of by burial in a bedded salt geologic repository.¹⁹ The

¹⁸The Board's cost estimates took into account New York's vigorous objection to the staff's use of a 10 percent discount rate. The Board computed a range of estimated fuel cycle costs based on return on investment of 2 and 0 percent, suggested by New York as more realistic, and based its judgment on an overall cost estimate large enough to include the upper limit of the range. The Board also noted its view that costs of decommissioning a power reactor, a matter of controversy at the hearing, are facility-specific and should be considered in individual reactor proceedings rather than included among the costs of the fuel cycle activities which are the subject of the generic rule. The Commission finds the Board's reasoning correct on this point and confirms that reactor decommissioning costs are not relevant to this rulemaking.

¹⁹The program of interim storage followed by geologic disposal is in broad outline the same waste management model considered in the original fuel cycle rulemaking, but the record developed in the present proceeding is far more extensive, particularly with respect to disposal. Dr. Pittman's testimony at the original rulemaking in 1973 consisted largely of a description of a proposed retrievable surface storage facility for continuously monitored interim storage. Concerning ultimate disposal without further surveillance, Dr. Pittman noted that a major effort was underway to determine whether disposal in bedded salt was acceptable, but he did not describe the concept in any detail. In contrast, NUREG-0118, Section 4.4, provides a 30-page quantitative discussion of disposal of long-lived wastes in a bedded salt repository, with citations to many relevant technical documents prepared since 1973. The bedded salt concept was discussed extensively in written and oral testimony at the hearing. For example, the Board's oral examination of witnesses from the

Footnotes continued on next page

staff's interim storage model was not seriously questioned at the hearing. The technology for storing spent fuel elements under water in pools is well established; radioactive releases to the environment have in practice been extremely small and may be expected to remain small, even if pool storage is protracted by delays in establishing disposal facilities. The Commission concludes that the staff analysis of interim storage impacts was reasonable. In any case, the values in Table S-3 would not be significantly affected by any reasonably foreseeable variations from the time periods and models for interim storage assumed by the staff.

Analysis of waste disposal necessarily involves greater uncertainty than interim storage because disposal technology has not yet been selected. Consistent with the court of appeals' ruling that it suffices to assess one credible waste disposal method, rather than the full spectrum of alternatives, NUREG-0116 chose to analyze "deep emplacement in a stable geologic medium (bedded salt) under the continental U.S." The staff concluded that this technology "has the greatest amount of substantive information available from which to summarize environmental impacts" and would be "reasonably representative of impacts that would result from any appropriately designed geological emplacement." NUREG-0116, page 2-9.

The waste repository impacts of greatest concern are radioactive effluents which might escape to the biosphere during the thousands of years which must elapse before radioactivity in the waste has dropped to an insignificant level. For spent fuel disposal the staff made the conservative assumption that fission-product gases in the spent fuel, including all tritium, krypton-85, carbon-14, and iodine-129, would be released during handling and emplacement of the waste prior to sealing of the repository.²⁰ This

Footnotes continued from last page United States Geological Survey regarding the characteristics of salt beds as a repository medium occupies 37 pages of the hearing transcript, Tr. 699 ff. Docket RM-50-3. In addition, the present state of knowledge regarding nuclear waste disposal and its impacts has been extensively detailed in the Report to the President by the Interagency Review Group on Nuclear Waste Management ("IRG Report"), TID-29442 (March 1979) and the draft Subgroup Report on Alternative Strategies for the Isolation of Nuclear Waste, TID-28818 (Draft), October 1978.

²⁰ The numbers in Table S-3 reflect this assumed complete release. In the alternative that spent fuel is reprocessed rather than disposed of directly, the staff's reprocessing model assumed complete release of tritium, krypton-85, and carbon-14 but provided for capture of most of the iodine-129. The value for iodine-129 that appears in Table S-3 is for total release.

assumption reflects the possibility that the spent fuel storage canisters and the fuel rod cladding will be corroded by the salt during the period the repository is open (roughly 6 to 20 years), and volatile materials in the fuel will escape to the environment. The staff assumed, however, that after the repository is sealed there would be no further release of radioactive materials to the environment.²¹

With regard to this assumption of complete repository integrity, the Hearing Board identified as the major concern the question "whether water might enter, dissolve the radioactive materials, and transport them to the biosphere." The staff assumed such transport would not occur, for reasons summarized by the Board as "in part based on the fact that the salt in which the waste would be buried would have existed for millions of years free of water except for a small amount of entrapped brine, and could be expected to continue to so exist. The location would be one of low seismic and volcanic activity and with few resources important to man, so the probability of intrusion by nature or by humans would be small. Salt is plastic and would tend to heal some types of intrusions. Furthermore, if water were to reach the repository and dissolve the waste, natural barriers provided by media surrounding the salt would slow the rate of transport so that most of the radioactivity would decay before it would reach the biosphere." Conclusions and Recommendations of the Hearing Board, Docket RM-50-3, page 34.

The Commission finds that these characteristics of a bedded-salt repository afford a reasonable basis for the staff's conclusion that the repository can maintain its integrity, provided that sites meeting the selection criteria can in fact be found and developed. On this key issue the evidence in the record is tentative but favorable. At the hearing a witness for the U.S. Geological Survey testified that he believed it possible to find sites for repositories that would give the low release rates estimated by the staff. Transcript at 729. Although no

²¹ NUREG-0116 states (pages 2-10, 2-11): "Long term impacts will be nonexistent if the repository performs as expected and maintains the wastes in isolation. The rationale . . . follows a simple line: since the [bedded salt] formation has been demonstrably undisturbed for many millions of years, there is reason to believe that it will remain undisturbed into the future, even though mildly modified by placing the wastes into it." Supplementing this basic rationale, Section 4.4 of NUREG-0116 provides a detailed review of reasons for believing that a bedded salt disposal system, suitably selected, will prevent significant releases for the full period needed for waste detoxification.

specific location has yet been identified as meeting the criteria, the widespread distribution of salt deposits favors the view that suitable sites can be found.²² Such general evidence, coupled with the absence of any strong argument that a site cannot be found, probably affords as strong a record as can be made on the issue until a specific site has been thoroughly investigated and found to be suitable.²³

For these reasons and based on this record it is the Commission's judgment that a suitable bedded-salt repository site or its equivalent will be found, but the Commission notes and agrees with the Interagency Review Group on Waste Management that areas of uncertainty remain regarding both the likelihood of finding a site and the probability that it will perform as expected.²⁴ The Commission's judgment in this regard is limited to the purposes for which this proceeding was brought—namely to specify for NEPA purposes the environmental impacts to be considered in individual licensing proceedings as part of the environmental cost-benefit analysis for a power reactor. It is in no way intended to be a judgment for choosing among alternative technologies

²² NUREG-0116 notes that salt deposits have been found in 24 of the 50 States. Sec. 4.4.1.2.

²³ In view of the often-cited experience at Lyons, Kansas, it is worth mentioning that the failure of a particular site to meet selection criteria, though discouraging, cannot of itself disprove the feasibility of the bedded-salt repository concept. At Lyons, Kansas, an initially promising site later proved unsuitable because of previously undiscovered bore holes and adjacent mining operations that compromised the integrity of the site. These problems were specific to the site rather than inherent in the concept.

²⁴ These residual uncertainties were noted in the Report to the President by the Interagency Review Group on Waste Management, TID-29442, March 1979, which was discussed in draft form at the January 19, 1979 oral presentation. Responding to comments on the feasibility of waste disposal in mined repositories, the IRG report states on page 42: "No scientific or technical reason is known that would prevent identifying a site that is suitable for a repository provided that the systems view is utilized vigorously to evaluate the suitability of sites and designs, and in minimizing the influence of future human activities. A suitable site is one at which a repository would meet predetermined criteria and would provide a high degree of assurance that radioactive waste can be successfully isolated from the biosphere for periods of thousands of years. For periods beyond a few thousand years, our capability to assess the performance of the repository diminishes and the degree of assurance is therefore reduced. The feasibility of safely disposing of high level waste in mined repositories can only be assessed on the basis of specific investigations at and determinations of suitability at particular sites. . . . [E]ven at the time of decommissioning some uncertainty about repository performance will still exist." The Commission believes the IRG Report's view that suitable sites can be identified but that uncertainty about repository performance cannot be entirely eliminated is consistent with the record compiled in the fuel cycle rulemaking.

for waste disposal. That kind of judgment is in the first instance to be made by the Department of Energy and will be subject to further review in a Commission licensing proceeding when a particular proposal comes before us. Nor is the Commission making judgments in this proceeding as to the likelihood of waste disposal being accomplished safely. That issue has been addressed separately by the Commission.²⁵

Furthermore, the Commission intends in the near future to conduct a generic proceeding to reassess the outlook for the availability of safe waste disposal methods in light of new data and recent developments in the Federal waste management program.²⁶

In view of the uncertainties noted regarding waste disposal, the question then arises whether these uncertainties can or should be reflected explicitly in the fuel cycle rule. The Commission has concluded that the rule should not be so modified. On the individual reactor licensing level, where the proceedings deal with fuel cycle issues only peripherally, the Commission sees no advantage in having licensing boards repeatedly weigh for themselves the effect of uncertainties on the selection of fuel cycle impacts for use in cost-benefit balancing. This is a generic question properly dealt with in this rulemaking as part of choosing what impact values should go into the fuel cycle rule. The Commission concludes, having noted that uncertainties exist, that for the limited purpose of the fuel cycle rule it is reasonable to base impacts on the assumption which the Commission believes the probabilities favor, *i.e.*, that bedded-salt repository sites can be found which will provide effective

²⁵ 42 Fed. Reg. 34391, July 5, 1977. See also *Natural Resources Defense Council v. NRC*, 582 F. 2d 160 (2d Cir. 1978).

²⁶ The immediate occasion for this proceeding is the D.C. Circuit's remand to the Commission of *State of Minnesota v. NRC*, Nos. 78-1269 and 78-2032 (May 23, 1979) to consider whether there is reasonable assurance that an off-site storage solution for nuclear wastes will be available by the years 2007-09, the expiration dates for licenses of certain nuclear plants where the Commission has granted permits to expand on-site spent fuel capacities and if not, whether there is reasonable assurance that the fuel can be stored safely at the site beyond those dates. A continuing reassessment of the Commission's views on waste disposal is part of the commitment which the Commission has made to Congress. The final IRG report, which was available to the fuel cycle rulemaking participants only at the close of the rulemaking and only in draft form, will be part of the new information which the Commission will consider in its reassessment. The Commission will announce at a later date the specific procedures to be adopted for this proceeding and its precise scope.

isolation of radioactive waste from the biosphere.²⁷

Assuming an initially suitable site is found, the Board noted that particular concern had been expressed regarding the possibility that heat released by radioactive decays in the waste might alter conditions in the salt so as to give access to water and promote migration of the waste. As the Board points out in its recommendations, however, the average temperature rises in the salt will depend on the density of waste emplacement. Increasing the amount of land committed to the repository reduces this density and may be expected to be an effective measure for meeting concerns about temperature effects. During the proceeding the staff proposed a modification to Table S-3 raising the acreage committed to waste disposal. This modification is included in the table adopted as the final rule.

Even allowing for some eventual leakage of water into the repository, information in the record indicates that transport of materials out of the repository area would take tens of thousands of years. The only apparent natural mechanisms cited which might reasonably cause major releases involved very low probability catastrophic events such as a large meteor strike on the repository or formation of new geologic faulting intersecting the area. Releases through accidental intrusion by man remain possible but in the Commission's view unlikely since casual intrusions should be virtually impossible and sites should be selected in areas offering little incentive for deliberate intrusion in search of natural resources. Given the staff's assumption that volatile fission products are totally released before the repository is sealed, the Commission finds that taking post-sealing releases as zero does not significantly reduce the overall conservatism of the table.

In summary, the Commission concludes, based on the above considerations and the more detailed analysis given in the Board's recommendations, that the staff's model for assessing impacts of waste disposal

²⁷ Even if, contrary to the evidence in the record and the Commission's expectation, bedded-salt repositories should ultimately be found not adequate, the strong incentive to develop sound waste disposal methods and the major effort now directed to this goal make it likely that a means of effective isolation will be found among the many geologic disposal techniques being considered. The IRG Report (see note 24 above) notes on page 3 that "increased levels of support . . . and broader range of disciplines involved have led to a greatly increased accumulation of knowledge within the [waste management] program. The current rate of growth of knowledge is very large."

is reasonable and adequate for the purposes of the fuel cycle rule.

c. Reprocessing. The reprocessing alternative considered in this proceeding involved reprocessing of spent fuel for purposes other than recycle of plutonium.²⁸ In considering this alternative, the Commission expresses no view on the likelihood that such reprocessing will take place.²⁹ Under this alternative the staff assumed that spent fuel after 160 days cooling at the reactor would be shipped to a model reprocessing facility, where the uranium, plutonium, and fission products would be separated by the Purex solvent extraction process into three liquid fractions. The uranium would be converted to uranium hexafluoride for recycling at an enrichment plant. The plutonium, still containing about five percent of the fission products to deter diversion, would be converted to plutonium oxide and packaged for disposal in a Federal waste repository. The high-level liquid waste (HLLW), containing the bulk of the fission products, would be stored up to five years in tanks and then calcined and formed into glass for repository disposal.

No significant question was raised at the hearing regarding the staff's choice of processes, but considerable controversy arose concerning the staff's assumption that the performance of the model facility would show a significant improvement over previous commercial reprocessing experience. The only commercial experience in the United States with reprocessing spent uranium oxide fuel from light water reactors was obtained at the Nuclear Fuel Services plant (NFS) in West Valley, New York.

²⁸ On December 23, 1977, in response to President Carter's nuclear non-proliferation policy, the Commission terminated proceedings on pending or future plutonium recycle-related license applications and halted proceedings on the Generic Environmental Statement on Mixed Oxide Fuel (GESMO) to determine under what condition uranium and plutonium might be recycled from spent light water reactor fuel and fabricated into fresh mixed oxide fuel on a wide scale. In the Matter of Mixed Oxide Fuel, 6 NRC 861 (1977). See also 7 NRC 711 (1978).

²⁹ The Commission's instructions to the S-3 Board of January 26, 1978 (Commissioner Gilinsky dissenting) noted that "Although the 'once-through' fuel cycle is currently the reference case for United States policymaking purposes, the possibility of some form of reprocessing for waste management purposes is not excluded and therefore the Commission decided that this alternative should be included as well. The Commission paid particular attention to the fact that the spent fuel processing surveyed in this proceeding would treat plutonium solely as a waste product and would not make plutonium available in a form suitable for use as reactor fuel. The Commission emphasized that its refusal to cut back the scope of the fuel cycle rulemaking is not to be allowed to convert this rulemaking into a GESMO proceeding."

This relatively small plant, which is no longer in operation, had the capacity to process on the order of one metric ton of spent fuel per day but in practice achieved a capacity factor of only 0.33 as compared with an expected 0.8. A high level of radioactive effluent releases was experienced during the NFS operation.

The staff based its reprocessing impact estimates on performance predictions for future facilities rather than on the NFS operation. The staff's model reprocessing facility is intended to be representative of the as-yet-unoperated Allied Gulf Nuclear Service Plant at Barnwell, South Carolina, built with a capacity of 5 metric tons/day, and Exxon Nuclear's proposed Nuclear Fuel Recovery and Recycling Center, designed for an ultimate capacity of 7 metric tons/day. The staff assumed that the model facility would operate with a capacity factor of 0.8 and would reprocess spent fuel from 57 model reactors.³⁰ The staff assumed that effluent control measures proposed for the model facility would achieve for several radioactive effluents a degree of decontamination greatly exceeding that demonstrated at NFS.³¹

The Hearing Board found that equipment was presently available or reasonably likely to be developed that would enable operation of a reprocessing facility on the scale assumed by the staff. The Board noted that design improvements intended to overcome operational difficulties experienced at NFS have been incorporated in Barnwell and that in any case no problems identified in the record appeared too difficult for solution by sound engineering and additional experience. The Board found that the capacity factor of 0.8 assumed by the staff was probably too optimistic but that a factor of 0.7 was likely to be achieved. Even with this lower capacity factor, the Board found that because the staff had probably overestimated the amount of spent fuel discharged annually per reactor the staff's model facility would still be able to reprocess spent fuel from 57 reactors, as assumed. In any event, the Board observed, radioactive releases and natural gas consumption, which are the major reprocessing impact contributions to Table S-3, are primarily dependent on

the amount of spent fuel processed per reference reactor year and are not much affected by reprocessing plant size or capacity factor.

With regard to radioactive effluents from reprocessing plants, the Board found that the impact values "are reasonable and in most instances are overestimates of the impacts that would actually occur." Recommendations at 17. The Board noted that the staff assumed spent fuel would be reprocessed after 160 days decay, while in all likelihood any spent fuel actually reprocessed in the foreseeable future will probably have been stored five years or more following removal from the reactor. In this period iodine-131 (8-day half-life) will have decayed away, ruthenium-106 (368-day half-life) will be reduced by a factor of about 30, and tritium and krypton-85 will be reduced by a factor of 1.3 or more.

The Board observed that the control measures which the staff relied on to achieve decontamination factors greatly superior to NFS experience "have not been operated in the combinations proposed, and some have been tested only in the laboratory." Recommendations at 20. Nevertheless the Board found these tests sufficiently convincing to support the staff's conclusion that the assumed decontamination factors can be achieved and probably surpassed. The low decontamination factors at NFS were, in the Board's view, largely caused by faulty design and perhaps faulty operation. The Board concluded that the staff had probably overestimated the amounts of ruthenium, non-volatile fission products and transuranic nuclides likely to be released during normal operation of a model reprocessing facility.³²

In its comments to the Commission, the Sierra Club stressed its view that reprocessing impacts (including occupational exposures) should be based on the NFS historical experience rather than on "idealized hypothetical facilities," or alternatively that the table should be amended to include two sets of reprocessing estimates, one based on historical experience and the other on model facilities. The Sierra Club also

called attention to the omission of technetium-99 releases from Table S-3 and argued that these releases would be significant.³³

The Commission does not accept the view that historical experience should be the definitive measure for reprocessing impacts. The Commission finds that the staff and the Board were reasonable in recommending that reprocessing impact estimates take account of expected technological improvements, especially where most if not all of those improvements are not simply "hypothetical" but are already designed, constructed, and installed in an existing facility (Barnwell). As the comments pointed out, Barnwell has not operated, and there is always uncertainty whether untested facilities will work as well as planned. But even if one agrees with the observation made in several of the comments that in nuclear technology things almost never work as well as planned, it would seem that reasonable allowance for this factor is included within the staff's many conservatisms and overestimates of releases noted by the Hearing Board.

Furthermore, the Commission does not believe that including in the table a separate set of impact estimates based on NFS experience would illuminate the uncertainty issue. NFS impacts are not likely to be a meaningful measure, even as a limiting case. It is clear from the general dissatisfaction with the NFS facility that further commercial reprocessing ventures will not be attempted unless their proponents have sound reason to expect much better performance, including reduced occupational exposure.³⁴

Accordingly, the Commission concludes, as in the matter of waste disposal uncertainties, that uncertainties in reprocessing impacts should be

³² Technetium-99 is a relatively volatile radionuclide with a half-life of 213,000 years. The Hearing Board found that the assumption that all iodine-129 is released "tends to compensate" for the neglect of technetium. The Board concluded also that technetium releases could probably be contained at least as well as ruthenium releases, which in the Board's view the staff had overestimated. The Board recommended that technetium release impacts be considered explicitly as part of the general update.

³⁴ Thus the NFS facility is not representative of "existing technology" in the sense of an ongoing activity which will continue at a present level of impact until technical breakthroughs occur. The court of appeals' comment, 547 F. 2d 636, note 13, noted by the Sierra Club, that it might be desirable to have alternative impact estimates, one "based only on existing technology" and another which takes account of anticipated developments, does not in the Commission's view apply to the reprocessing situation as it now exists. The court of appeals also stated that it had "no occasion in this case to decide whether a court could ever require such a procedure." *Id.*

³⁰ As of March 1979 there were seventy light water power reactors licensed to operate in the United States.

³¹ These include ruthenium-106, strontium-90, cesium-137, plutonium and other transuranic nuclides. The staff assumed decontamination factors on the order of 10⁶. Decontamination factors of about 10⁵ were measured at NFS for ruthenium, strontium, and cesium. See Recommendations at 22.

³³ With regard to volatile radionuclides, as noted previously (see note 20), the staff assumed all tritium, krypton-85, and carbon-14 in spent fuel would be released, either in reprocessing or during the operating phase of a waste disposal repository. The Board found the release values for krypton-85 and tritium to be overestimates and the carbon-14 emission value of 24 curies to be "reasonable." The Board found that the staff had also overestimated iodine-129 releases from reprocessing, but this estimate is of no consequence since the iodine-129 value in Table S-3 is based on total releases from spent fuel during waste repository operation.

resolved within this rulemaking by adopting tabulated impacts based on model facilities using technology most likely to be employed. Except for technetium-99 releases, the Commission has therefore found that the modified Table S-3 provides an adequate treatment of reprocessing impacts. It appears from the record that technetium releases from the fuel cycle will occur but are not included in the table. The Commission believes that Table S-3 should be supplemented during the general update by inclusion of an appropriate value for technetium releases. Pending this supplementation, both the magnitude and the environmental significance of technetium releases from back end fuel cycle activities may be considered in individual reactor licensing proceedings which have not been noticed for hearing on environmental matters prior to the effective date of this final rule. In view of the Hearing Board's conclusion that the conservative assumption of complete release of iodine-129 tends to compensate for the omission of technetium from Table S-3, the Commission finds it unnecessary to reopen closed proceedings or to disturb consideration of environmental issues in presently pending proceedings to provide for consideration of technetium-99 releases.

2. The Explanatory Narrative.

As the comments indicate, this rulemaking grew well beyond a narrow inquiry into the evidentiary basis supporting the numbers tabulated in the interim rule. The broader perspective taken by the participants and the Hearing Board has helped clarify many aspects of fuel cycle environmental impacts not covered by Table S-3 which need to be addressed, at least conceptually, in a comprehensive fuel cycle rule. Until such a rule is developed important generic fuel cycle issues must continue to be litigated in individual reactor licensing proceedings. These issues include—but are not necessarily limited to—environmental dose commitments and health effects from fuel cycle releases, fuel cycle socioeconomic impacts, and possible cumulative impacts. Pending further treatment by rulemaking, the NRC staff is directed to address these matters in the environmental analysis accompanying a proposal to issue a limited work authorization; construction permit, or operating license for a power reactor.

The Commission has accepted the Hearing Board's recommendation that an explanatory narrative which

addresses these subjects should be prepared and adopted as part of the fuel cycle rule. Although such a narrative is not legally required, provided an adequate description of fuel cycle impacts is given in individual proceedings, the same reasons which favor treatment of fuel cycle impacts by generic rulemaking also favor evaluating the significance of those impacts by rulemaking, rather than by repeated adjudication. The Commission agrees, however, that adoption of a narrative by rulemaking will require adequate notice and opportunity for public comment and therefore cannot be done without a further proceeding. Since the narrative must address important basic issues in arriving at a method for evaluating the significance of fuel cycle impacts,³⁵ the Commission has determined that such a proceeding should begin promptly.

The Commission has directed the staff to prepare by October 1, 1979, a draft narrative for the Commission's review prior to issuance for public comment.

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, the National Environmental Policy Act of 1969, as amended, and sections 552 and 553 of Title 5 of the United States Code, the following amendment to 10 CFR Part 51 is published as a document subject to codification, to be effective on September 4, 1979.

10 CFR Part 51 is amended by revising § 51.20(e) and 51.23(c) as follows:

§ 51.20 Applicant's Environmental Report—Construction Permit Stage.

(e) The Environmental Report required by paragraph (a) for light-water-cooled nuclear power reactors shall take Table S-3, Table of Uranium Fuel Cycle Environmental Data, as the basis for evaluating the contribution of the environmental effects of uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel,

³⁵ Among these issues is the question of the time period over which dose commitments from long-lived radioactive effluents should be evaluated. The court of appeals observed with regard to waste disposal that "[T]he toxic life of the waste under discussion far exceeds the life of the plant being licensed. The environmental effects to be considered are those flowing from reprocessing and passive storage for the full detoxification period." 547 F. 2d 639, note 12. The analysis required by NEPA is, of course, subject to a rule of reason. See *Vermont Yankee Nuclear Power Corp. v. NRC*, 435 U.S. 519, 531 (1978); *NRDC v. Morton*, 437 F. 2d 827, 837 (D.C. Cir. 1972). How dose commitment evaluations over extended periods of time might be performed and what their significance might be are subjects which the Commission expects an explanatory narrative would address.

transportation of radioactive materials and management of low level wastes and high level wastes related to uranium fuel cycle activities to the environmental costs of licensing the nuclear power reactor. Table S-3 shall be included in the Report and may be supplemented by a discussion of the environmental significance of the data set forth in the Table as weighed in the cost-benefit analysis for the proposed facility. This paragraph applies to any applicant's environmental report submitted on September 4, 1979, or thereafter.

§ 51.23 Contents of Draft Environmental Statement.

(c) The draft environmental impact statement will include a preliminary cost-benefit analysis which considers and balances the environmental and other effects of the facility and the alternatives available for reducing or avoiding adverse environmental and other effects, as well as the environmental, economic, technical and other benefits of the facility. The contribution of the environmental effects of the uranium fuel cycle activities specified in § 51.20(e) shall be evaluated on the basis of impact values set forth in Table S-3, Table of Uranium Fuel Cycle Environmental Data, which shall be set out in the draft environmental impact statement. With the exception of radon-222 and technetium-99 releases, no further discussion of fuel cycle release values and other numerical data that appear explicitly in the Table shall be required.³⁶ The impact statement shall take account of dose commitments and health effects from fuel cycle effluents set forth in Table S-3 and shall in addition take account of economic, socioeconomic, and possible cumulative impacts and such other fuel cycle impacts as may reasonably appear significant. The cost benefit analysis will, to the fullest extent practicable, quantify the various factors considered. To the extent that such factors cannot be quantified, they will be discussed in qualitative terms. The cost-benefit analysis will indicate what other interests and consideration of Federal policy are thought to offset any adverse environmental effects of the proposed action identified pursuant to paragraph (a). Due consideration will be given to

³⁶ Values for releases of Ra-222 and Tc-99 are not given in the Table. The amount and significance of Ra-222 releases from the fuel cycle and Tc-99 releases from waste management or reprocessing activities shall be considered in the draft environmental impact statement and may be the subject of litigation in individual licensing proceedings.

compliance of the facility construction or operation and alternative construction and operation with environmental quality standards and requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection, including applicable zoning and land-use regulations and water pollution limitations or requirements promulgated or imposed pursuant to the Federal Water Pollution Control Act. The environmental impact of the facility will be considered in the cost-benefit analysis with respect to matters covered by such standards and requirements irrespective of whether a certification or license from the appropriate authority has been obtained, including any certification obtained pursuant to section 401 of the Federal Water Pollution Control Act. While satisfaction of Commission standards and criteria pertaining to radiological effects will be necessary to meet the licensing requirements of the Atomic Energy Act, the cost-benefit analysis will, for the purposes of NEPA, consider the radiological effects of the facility and alternatives.

Separate Views of Commissioner Bradford on S-3

I am concurring in the latest version of the S-3 table with the understanding that it is to be extensively supplemented. Today's decision does improve somewhat on the present interim version. However, it remains a document with four weaknesses that will have to be improved through the promised narrative and update proceeding. The weaknesses are the zero release repository judgment, the reprocessing scenario, the procedural underpinning, and the absence of a clear statement of the health effects and time commitments involved. Additionally, I do not agree with the ambiguous and pointless restriction on the litigation of the technetium issue and would prefer to handle it as was agreed to by four Commissioners on May 3, 1979.

I can concur in the "zero release" number only because it is better founded than the same figure in the present interim version, and because, as the Commission states, this assumption does not appear to affect the S-3 table's overall conservatism. Nonetheless, there are uncertainties here, and the Board's summary of the record has not done them justice.¹ The forthcoming narrative will, in my view, need to address this subject.

¹ See for example, Transcript, p. 729. The Commission improves upon the Board's understatement in its Footnote 24, p. 40. However, the IRG report itself at that point contains a dissenting view from members who felt that insufficient attention was given to "significant gaps and uncertainties in our current technical understanding."

Table S-3.—Table of Uranium Fuel Cycle Environmental Data¹
 [Normalized to model LWR annual fuel requirement (WASH-1248) or reference reactor year (NUREG-0116)]

Environmental considerations	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
NATURAL RESOURCES USE		
Land (acres):		
Temporarily committed ²	100	
Undisturbed area.....	79	
Disturbed area.....	22	Equivalent to a 110 MWe coal-fired power plant.
Permanently committed.....	13	
Overburden moved (millions of MT).....	2.8	Equivalent to 95 MWe coal-fired power plant.
Water (millions of gallons):		
Discharged to air.....	160	= 2 percent of model 1,000 MWe LWR with cooling tower.
Discharged to water bodies.....	11,090	
Discharged to ground.....	127	
Total.....	11,377	< 4 percent of model 1,000 MWe LWR with once-through cooling.
Fossil fuel:		
Electrical energy (thousands of MW-hour).....	323	< 5 percent of model 1,000 MWe LWR output.
Equivalent coal (thousands of MT).....	118	Equivalent to the consumption of a 45 MWe coal-fired power plant.
Natural gas (millions of scf).....	135	< 0.4 percent of model 1,000 MWe energy output.
EFFLUENTS—CHEMICAL (MT)		
Gases (including entrainment):³		
SO ₂	4,400	
NO _x ⁴	1,190	
Hydrocarbons.....	14	Equivalent to emissions from 45 MWe coal-fired plant for a year.
CO.....	29.6	
Particulates.....	1,154	
Other gases:		
F.....	.67	Primarily from UF ₆ production, enrichment, and reprocessing. Concentration within range of state standards—below level that has effects on human health.
HCl.....	.014	
Liquids:		
SO ₂	9.9	From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are:
NO _x ⁵	25.8	NH ₃ —600 cfs.
Fluoride.....	12.9	NO _x —20 cfs.
Ca ⁺⁺	6.4	Fluoride—70 cfs.
Cl ⁻	8.5	From mills only—no significant effluents to environment.
Na ⁺	12.1	Primarily from mills—no significant effluents to environment.
NH ₃	10.0	
Fe.....	.4	
Tailings solutions (thousands of MT).....	240	
Solids.....	91,000	
EFFLUENTS—RADIOLOGICAL (CURIES)		
Gases (including entrainment):		
Rn-222.....		Presently under reconsideration by the Commission.
Ra-226.....	.02	
Th-230.....	.02	
Uranium.....	.034	
Tritium (thousands).....	18.1	
C-14.....	24	
Kr-85 (thousands).....	400	
Ru-106.....	.14	Primarily from fuel reprocessing plants.
I-129.....	1.3	
I-131.....	.83	
Tc-99.....		Presently under consideration by the Commission.
Fission products and transuranics		
	203	
Liquids:		
Uranium and daughters.....	2.1	Primarily from milling—includes tailings liquor and returned to ground—no effluents; therefore, no effect on environment.
Ra-226.....	.0034	From U ₃ O ₈ production.
Th-230.....	.0015	
Th-234.....	.01	From fuel fabrication plants—concentration 10 percent of 10 CFR 20 for total processing 26 annual fuel requirements for model LWR.
Fission and activation products		
	5.9 × 10 ⁶	
Solids (buried on site):		
Other than high level (shallow).....	11,300	9,100 Ci comes from low level reactor wastes and 1,500 Ci comes from reactor decontamination and decommissioning—buried at land burial facilities. 600 Ci comes from mills—includes in tailings returned to ground.

Table S-3.—Table of Uranium Fuel Cycle Environmental Data¹—Continued

[Normalized to model LWR annual fuel requirement (WASH-1248) or reference reactor year (NUREG-0116)]

Environmental considerations	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MW _e LWR
TRU and HLW (deep)	1.1 × 10 ³	Buried at Federal Repository
Effluents—thermal (billions of British thermal units)	4,063	<5 percent of model 1,000 MW _e LWR
Transportation (person-rem):		
Exposure of workers and general public	2.5	
Occupational exposure (person-rem)	22.6	From reprocessing and waste management.

¹In some cases where no entry appears it is clear from the background documents that the matter was addressed and that, in effect, the Table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed at all in the Table. Table S-3 does not include health effects from the effluents described in the Table, or estimates of releases of Radon-222 from the uranium fuel cycle or estimates of Technetium-99 released from waste management or reprocessing activities. These issues may be the subject of litigation in the individual licensing proceedings.

Data supporting this table are given in the "Environmental Survey of the Uranium Fuel Cycle," WASH-1248, April 1974; the "Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle," NUREG-0116 (Supp. 1 to WASH-1248); the "Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle," NUREG-0218 (Supp. 2 to WASH-1248); and in the record of the final rulemaking pertaining to Uranium Fuel Cycle Impacts from Spent Fuel Reprocessing and Radioactive Waste Management, Docket RM-50-3. The contributions from reprocessing, waste management and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor which are considered in Table S-4 of § 51.20(g). The contributions from the other steps of the fuel cycle are given in columns A-E of Table S-3A of WASH-1248.

²The contributions to temporarily committed land from reprocessing are not prorated over 30 years, since the complete temporary impact accrues regardless of whether the plant services one reactor for one year or 57 reactors for 30 years.

³Estimated effluents based upon combustion of equivalent coal for power generation.

⁴1.2 percent from natural gas use and process.

It is so ordered.

For the Commission.

Samuel J. Chilk,

Secretary of the Commission.

Dated at Washington, D.C. this 27th day of July, 1979.

Furthermore, I think that the Commission goes too far in terming its assumption that a "bedded salt repository or its equivalent will be found" to be a "judgment." I think that little more can be said by a prudent regulatory agency at this time in the face of this record and the general uncertainty than that the direction of current federal programs makes a bedded salt repository a responsible working assumption for NEPA purposes. That is really all that I think the staff testimony supports.²

More seriously, I continue to disassociate myself from the optimistic assessment of the waste management program cited by the majority that is in 42 Fed. Reg. 34391.³ In July 1977, the Commission reached a sweeping conclusion on the sufficiency of what then passed for a waste management program without benefit even of a notice and comment proceeding, never mind a formal review. For this Statement of Considerations to reference that denial of a requested rulemaking as an expression of a Commission view on the safety of a waste repository proceeding is procedural farce of a low order. It should not be done here, especially in light of the commitment to a new generic proceeding.

As to reprocessing, I have concluded that Commissioner Gilinsky was in many respects correct in his dissenting views from our January 26, 1978 Memorandum on the scope of this rulemaking. Nevertheless, the record has now been built on what may be an unlikely case, and it seems to me the

Commission's decision so circumscribes it that the worst harms foreseen by Commissioner Gilinsky cannot result from any responsible reading of the current Statement of Considerations.

II

By memorandum of January 20, 1978, to the Fuel Cycle Rulemaking Hearing Board, the Commission ordered that the Board entertain requests for cross-examination of particular witnesses on specific factual issues where a showing could be made with particularity that this procedure was necessary for an adequate record. While the Commission left the decisions on cross-examination to the sole discretion of the Hearing Board, it expected that the Hearing Board would apply the procedures "in a sensitive and careful fashion so as to assure the ventilation and consideration of waste management issues called for in *NRDC v. NRC*, 547 F.2d 633 (D.C. Cir. 1976)." I dissented from the extraordinary discretion delegated to the Board and the restrictive criteria for cross-examination.

The Board was neither sensitive nor careful in its decision to deny all cross-examination. Rather than assuring the ventilation and consideration of waste management and disposal issues, the Board stifled full exploration of crucial and difficult subjects even when the staff, to its credit, did not object.

The denial of cross-examination on two particular issues serves to illustrate the consequences. The Sierra Club sought to cross-examine several witnesses on the release of technetium from the waste

management and disposal fuel cycle facilities. The Board denied the request in general terms,⁴ stating that many of the matters were not involved in this proceeding or not in serious dispute. Moreover, the Board said its review indicated that each subject was "fully ventilated" through other procedures. The Commission's finding on technetium rejects these conclusions of the Board. The Commission found that technetium releases should be included in Table S-3. However, because there was not sufficient evidence in the record to derive a release figure, the Commission ordered that the issue be litigable in individual proceedings. Thus the Commission, contrary to the Board, viewed the release of technetium both as being insufficiently serious dispute and so inadequately ventilated as to require further litigation.

By avoiding a full record on technetium, the Board has shown the futility of the Commission's procedural shortcut. As I noted in my January 26, 1978 dissent, the delays caused by withholding cross-examination can far exceed the "delays" inherent in cross-examination. The issue of technetium release now may be litigated in every individual licensing proceeding. Instead of being cross-examined once, staff witnesses are potentially subject to cross-examination in many proceedings, with licensing boards, the Appeal Board, and possibly the Commission reviewing the record of each case.

The Board also refused to allow cross-examination regarding the uncertainties of bedded salt as a waste medium. This refusal was particularly unfortunate since, as noted by the petitioner for cross-examination, it came immediately after the DOE Task Force on Nuclear Waste Management stated it was "aware of scientific issues concerning the adequacy of salt as suitable geologic medium for emplacement of concentrated waste exhibiting high surface temperatures." (Report of Task Force for Review of Nuclear Waste Management, U.S. DOE at 9, February 1978).

One of the issues on which NRDC requested cross-examination was the staff's lack of analysis of media other than salt. Now, without this inquiry, the Commission makes a "judgment" that an "equivalent" to a bedded salt repository will be found. This statement rests on some statements from the IRG Report, issued after the hearing was over.⁵ Thus the Commission has, through the dubious procedural device of its "irrevocable delegation," treated a subordinate board like a distant and separate part of the government and has thereby cost itself any chance to correct the weakness of the record.

In refusing to permit cross-examination on waste disposal, the Board has kept perfect the past record of the Commission's obsessive need not to know about the uncertainties regarding its waste disposal assumptions. While continuing to express "confidence" that the wastes can and will be disposed of safely and while judging that a bedded salt repository or its equivalent will

⁴Memorandum and Order, May 4, 1978.

⁵Report to the President by the Interagency Review Group on Waste Management, TID-29442, March 1979.

be found which will have a zero release after it is sealed, the Commission has never allowed a proceeding to take place where witnesses supporting these views could be cross-examined.

While this approach has been found by courts not to be inconsistent with Congressional intent, it is inconsistent with an accurate appraisal of the consequences of new licensing actions. I would rather that this agency had looked less for the legally acceptable minimum procedures and more for a process that gave the Commission and ultimately the public the most accurate possible conception of the environmental commitments being made on its behalf.

Separate Views of Commissioner Gilinsky on Final Adoption of the S-3 Rule

In February the Commission decided to go forward with a final table of nuclear fuel cycle environmental impacts (S-3) without waiting for the narrative explanation which it directed the NRC staff to prepare to accompany the table. Without such an explanation of the effluent release values in terms of radiological dose commitments and associated health effects, there is not much use a licensing board can make of the table in deciding whether or not to approve a license. The new table is in fact almost identical to the interim table in use now. The major effect of adopting a final rule now without an explanatory narrative is to relieve pressure for the narrative's preparation. To avoid this result I earlier urged the Commission to hold up promulgation of a final rule until the narrative is available and approved by the Commission.

At issue is each reactor's share of effluent releases from the operation of the overall nuclear fuel cycle. But the table values do not depend on the characteristics of the specific powerplant that is the subject of a licensing proceeding—they do not distinguish among reactors. As a consequence, it is virtually inconceivable that the table would affect the outcome of any such a licensing proceeding before one of our boards. A finding that the reactor's share of the fuel cycle effluents outweighs the benefits of the plant in terms of the electric power it delivers is tantamount to a conclusion that no reactor should be licensed.¹ As a practical matter, such a finding, reaching the very core of NRC decisionmaking could—and should—come only from the Commission itself. If there is doubt about the outcome of this question the Commission should address it directly. By not addressing it and by dealing instead with the fuel cycle environmental impacts in reactor licensing proceedings by handing the licensing boards a table of effluent releases the Commission is in effect saying that these impacts should not affect the outcome. That may in fact be the right conclusion; but if it is, the Commission should state it clearly and not hide behind a table of numbers.

There is another reason for my disagreement with the Commission's action in approving the final rule. I would not adopt

¹ The notion that the fuel cycle effluents add to one side of the "NEPA balance" and thus might tip it in some cases and not in others is naive.

at least one of the values in the table—the zero expected release from a high level waste repository. I am concerned that the Commission's expressed confidence in the perfect long term operation of such a waste depository may be misplaced, especially in view of its being based on a general examination by the Board in this proceeding of the bedded salt repository concept.

In this regard, I note that the D.C. Circuit Court of Appeals in *Minnesota v. NRC* has remanded to the Commission the question of whether there is reasonable assurance that wastes can be disposed of safely and at what point in time disposal can reasonably be effected. I think that the generic proceeding which the Commission plans to conduct in response to the D.C. Circuit's decision will give us an appropriate vehicle for a thoroughgoing evaluation of the problems involved in the government's commitment to a waste disposal solution and the likelihood that such a program is not only feasible but is also on course.

No such repository has yet operated. The prospective constructors of such a repository have not yet agreed on a design or even chosen a geologic medium. It seems anomalous, at this stage, for the regulators to express more confidence on this score than the repository designers and builders themselves have expressed.

I would add two brief comments. I previously argued that there was no need to include in this analysis an option for reprocessing, especially the contrived reprocessing mode which was considered in this hearing. The inclusion of this option has indeed complicated and lengthened the proceeding.

Also, I have come to agree with Commissioner Bradford that the Commission should not have delegated to the S-3 Hearing Board the discretion to make final determinations on whether or not to allow cross-examination on issues arising in the course of the proceeding.

[FR Doc. 79-23668 Filed 8-1-79; 8:45 am]

BILLING CODE 7590-01-M

10 CFR Part 51

Uranium Fuel Cycle Impacts for Spent Fuel Reprocessing and Radioactive Waste Management; Extension of Interim Fuel Cycle Rule

AGENCY: Nuclear Regulatory Commission.

ACTION: Extension of the interim fuel cycle rule.

SUMMARY: The Commission promulgated March 14, 1977 (42 FR 13803) an interim rule identifying the environmental impact values for the uranium fuel cycle which are to be included in environmental reports and environmental impact statements for individual light water nuclear power reactors. The interim rule was made effective for 18 months with the

possibility of extension for good cause. The Commission has made five extensions for the period of effectiveness of the interim rule. The most recent extension enlarged this period to July 30, 1979. The Commission now finds good cause to enlarge this period until September 4, 1979, the effective date of the final rule.

DATE: The interim rule published at 42 FR 13803, March 14, 1977 (10 CFR 51.20(e)) is extended until September 4, 1979.

FOR FURTHER INFORMATION CONTACT: Stephen Eilperin, Office of the General Counsel, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, phone 202-834-3224.

SUPPLEMENTARY INFORMATION: Notice is hereby given that the Nuclear Regulatory Commission has extended through September 4, 1979, the effectiveness of the interim fuel cycle rule 10 CFR 51.20(e) ("table S-3; as revised). The Commission finds this extension desirable so that there is no gap prior to the effective date of the final rule.

Background

The status of the Commission's interim rule cycle rule and the course of the final rulemaking up to the submission of the Hearing Board's report on the extensive evidentiary record were reviewed in the notice of September 18, 1978 (43 FR 41373), which extended the interim rule through March 14, 1979. Additional extensions have proved necessary, most recently because the Commission needed additional time to consider its course of action in light of the D.C. Circuit's decision in *State of Minnesota v. NRC*, No. 78-1269 (May 23, 1979).

The Commission has now completed its consideration of the final fuel cycle rule and that rule is being made effective as of September 4, 1979. In order that there be no gap prior to that effective date the Commission finds good cause to extend the period of effectiveness of the interim rule until September 4, 1979.

It is so ordered.

For the Commission.

Dated at Washington, D.C., this 27th day of July, 1979.

Samuel J. Chalk,
Secretary of the Commission.

[FR Doc. 79-23625 Filed 8-1-79; 8:45 am]

BILLING CODE 7590-01-M

or breakdown of irrigation equipment or facilities shall not be considered as a failure of the water supply from an unavoidable cause.

(c) Insurance shall not attach on an irrigated basis on acreage otherwise insurable on such basis unless it is so reported and designated by such practice at the time the acreage is reported.

4. *Annual Premium.* If there is no break in the continuity of participation, any premium adjustment applicable under section 5 of the policy shall be transferred to (1) the contract of the insured's estate or surviving spouse in case of death of the insured, (2) the contract of the person who succeeds the insured if such person had previously participated in the farming operation, or (3) the contract of the same insured who stops farming in one county and starts farming in another county.

(b) If there is a break in the continuity of participation, any reduction in premium earned under section 5 of the policy shall not thereafter apply; however, any previous unfavorable insurance experience shall be considered in premium computation following a break in continuity.

5. *Claim for and Payment of Indemnity.* (a) Any claim for indemnity on a unit shall be submitted to the Corporation on a form prescribed by the Corporation.

(b) In determining the total production to be counted for each unit, production from units on which the production has been commingled will be allocated to such units in proportion to the liability on each unit.

(c) There shall be no abandonment to the Corporation of any insured tobacco acreage.

(b) In the event that any claim for indemnity under the provisions of the contract is denied by the Corporation, an action on such claim may be brought against the Corporation under the provisions of 7 U.S.C. 1508(c); *Provided*, That the same is brought within one year after the date notice of denial of the claim is mailed to and received by the insured.

(e) Any indemnity will be payable within 30 days after a claim for indemnity is approved by the Corporation. *However*, in no event shall the Corporation be liable for interest or damages in connection with any claim for indemnity whether such claim be approved or disapproved by the Corporation.

(f) If the insured is an individual who dies, disappears, or is judicially declared incompetent, or the insured is an entity other than an individual and such entity is dissolved after the

tobacco is planted for any crop year, any indemnity will be paid to the person(s) the Corporation determines to be beneficially entitled thereto.

(g) The Corporation reserves the right to reject any claim for indemnity if any of the requirements of this section or section 8 of the policy are not met and the Corporation determines that the amount of loss cannot be satisfactorily determined.

6. *Subrogation.* The insured (including any assignee or transferee) assigns to the Corporation all rights of recovery against any person for loss or damage to the extent that payment hereunder is made by the Corporation. The Corporation thereafter shall execute all papers required and take appropriate action as may be necessary to secure such rights.

7. *Termination of the Contract.* (a) The contract shall terminate if no premium is earned for five consecutive years.

(b) If the insured is an individual who dies or is judicially declared incompetent, or the insured entity is other than an individual and such entity is dissolved, the contract shall terminate as of the date of death, judicial declaration, or dissolution; *However*, if such event occurs after insurance attaches for any crop year, the contract shall continue in force through such crop year and terminate at the end thereof. Death of a partner in a partnership shall dissolve the partnership unless the partnership agreement provides otherwise. If two or more persons having a joint interest are insured jointly, death of one of the persons shall dissolve the joint entity.

8. *Coverage Level and Price Election.* (a) If the insured has not elected on the application a coverage level and price at which indemnities shall be computed from among those shown on the actuarial table, the coverage level and price election which shall be applicable under the contract, and which the insured shall be deemed to have elected, shall be as provided on the actuarial table for such purposes.

(b) The insured may, with the consent of the Corporation, change the coverage level and/or price election for any crop year on or before the closing date for submitting applications for that crop year.

9. *Assignment of Indemnity.* Upon approval of a form prescribed by the Corporation, the insured may assign to another party the right to an indemnity for the crop year and such assignee shall have the right to submit the loss notices and forms as required by the contract.

10. *Contract Changes.* The Corporation reserves the right to change

any terms and provisions of the contract from year to year. Any changes shall be mailed to the insured or placed on file and made available for public inspection in the office for the county at least 15 days prior to the cancellation date preceding the crop year for which the changes are to become effective, and such mailing or filing shall constitute notice to the insured. Acceptance of any changes will be conclusively presumed in the absence of any notice from the insured to cancel the contract as provided in section 13 of the policy.

This proposal has not been classified "significant" and is being published under emergency procedures, as authorized by Executive Order 12044 and Secretary's Memorandum No. 1955, without a full 60-day comment period. It has been determined by James D. Deal, Manager, Federal Crop Insurance Corporation, that an emergency situation exists which warrants less than a full 60-day comment period on this proposal because the final regulations and policies covering tobacco must be published and be available in the FCIC county offices not later than December 15, 1979, to afford the farmers an opportunity to examine them before the cancellation date of December 31, 1979. A Draft Impact Analysis has been prepared and is available from Peter F. Cole, Secretary, Federal Crop Insurance Corporation, Room 4088, South Building, U.S. Department of Agriculture, Washington, D.C. 20250.

Note.—The reporting requirements contained herein have been approved by the Office of Management and Budget in accordance with the Federal Reports Act of 1942 and OMB Circular A40.

Approved by the Board of Directors on September 6, 1979.
Peter F. Cole,
Secretary, Federal Crop Insurance Corporation.

[FR Doc. 79-32005 Filed 10-24-79; 8:45 am]
BILLING CODE 3410-08-M

NUCLEAR REGULATORY COMMISSION

10 CFR Parts 50 and 51

Storage and Disposal of Nuclear Waste

AGENCY: U.S. Nuclear Regulatory Commission.

ACTION: Notice of Proposed Rulemaking.

SUMMARY: The United States Nuclear Regulatory Commission is conducting a generic proceeding to reassess its degree of confidence that radioactive wastes produced by nuclear facilities will be

safely disposed of, to determine when any such disposal will be available, and whether such wastes can be safely stored until they are safely disposed of. This rulemaking has been initiated in response to the decision of the United States Court of Appeals for the District of Columbia Circuit in *State of Minnesota v. NRC*, Nos. 78-1269 and 78-2032 (May 23, 1979), but it also is a continuation of previous proceedings conducted by the Commission in this area. 42 FR 34391 (July 5, 1977).

This notice describes the procedures the Commission will employ to conduct that proceeding and how members of the public can participate. If the Commission finds from this proceeding reasonable assurance that radioactive wastes from nuclear facilities will be safely stored or disposed of off-site prior to the expiration of the license for the facility, it will promulgate a rule providing that the safety and environmental implications of radioactive waste remaining on site after the anticipated expiration of the facility licenses involved need not be considered in individual facility licensing proceedings. In the event the Commission determines that on-site storage after license expiration may be necessary or appropriate, it will issue a proposed rule providing how that question will be addressed.

DATES: Notices of intent to participate must be filed by November 26, 1979. Other deadlines are described below.

ADDRESS: Send comments to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Branch. All filings will be available for public inspection in the Commission's Public Document Room at 1717 H. Street, N.W., Washington, D.C.

FOR FURTHER INFORMATION CONTACT: Stephen S. Ostrach, Office of the General Counsel, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. (202) 634-3224.

SUPPLEMENTARY INFORMATION:

Background

On May 23, 1979 the United States Court of Appeals for the District of Columbia Circuit remanded two licensing actions to the Commission to consider whether an off-site storage solution for nuclear wastes will be available by the years 2007-09, the expiration dates of the licenses of the Vermont Yankee and Prairie Island nuclear plants to which the Commission had granted permits to increase the on-site waste storage facilities, and, if not, whether that waste can be stored at the

sites past those dates and until an off-site solution is available. In response to the D.C. Circuit's decision the Commission has decided to undertake a generic reconsideration of the radioactive waste question so that it can: (1) reassess its confidence that safe off-site disposal of radioactive waste from licensed facilities will be available; (2) determine when any such disposal or off-site storage will be available; and (3) if disposal or off-site storage will not be available until after the expiration of the licenses of certain nuclear facilities, determine whether the wastes generated by those facilities can be safely stored on-site until such disposal is available. Previously, in connection with a petition for rulemaking filed by the Natural Resources Defense Council the Commission considered the related question of the likelihood that waste disposal will be accomplished safely, and at that time it found reasonable assurance that methods of safe permanent disposal of high-level waste would be available when they were needed. 42 FR 34391, 34393 (July 5, 1977), *pet. for rev. dismissed sub nom. NRDC v. NRC*, 582 F.2d 168 (2nd Cir. 1978). However, in denying the NRDC petition, the Commission announced its intent to reassess this finding periodically. This new proceeding will offer an opportunity for the Commission to reassess its earlier finding, to obtain wider public participation in its decision and also to take account of new data and recent developments in the federal waste management plan, most notably the Report to the President by the Interagency Review Group on Waste Management, TID-29442 (March, 1979) (the "IRG Report").

Purpose of Proceeding

The purpose of this proceeding is solely to assess generically the degree of assurance now available that radioactive waste can be safely disposed of, to determine when such disposal or off-site storage will be available, and to determine whether radioactive wastes can be safely stored on-site past the expiration of existing facility licenses until off-site disposal or storage is available. In addition to information submitted by public participants and government agencies, this proceeding will draw upon the record compiled in the Commission's recently concluded rulemaking on the environmental impacts of the nuclear fuel cycle (44 FR 45362-74 (August 2, 1979)), and the record compiled herein will be available for use in the general fuel cycle rule update discussed in that rulemaking. However, this proceeding is not designed to reach quantitative

conclusions about waste repository impacts or performance. The Commission will consider economic issues in this proceeding in the same fashion such issues were considered in the recent fuel cycle rulemaking: namely, a waste disposal model will not be considered realistically available if it would be prohibitively expensive to build and operate such a proposed facility. Cf. 44 FR at 45367.

During this proceeding the safety implications and environmental impacts of radioactive waste storage on-site for the duration of a license will continue to be subjects for adjudication in individual facility licensing proceedings. The Commission has decided, however, that during this proceeding the issues being considered in the rulemaking should not be addressed in individual licensing proceedings. These issues are most appropriately addressed in a generic proceeding of the character here envisaged. Furthermore, the court in the *State of Minnesota* case by remanding this matter to the Commission but not vacating or revoking the facility licenses involved, has supported the Commission's conclusion that licensing practices need not be altered during this proceeding. However, all licensing proceedings now underway will be subject to whatever final determinations are reached in this proceeding.

If the Commission finds reasonable assurance that safe, off-site disposal for radioactive wastes from licensed facilities will be available prior to expiration of the facilities' licenses, it will promulgate a final rule providing that the environmental and safety implications of continued on-site storage after the termination of licenses need not be considered in individual licensing proceedings. In the event the Commission determines that on-site storage after license expiration may be necessary or appropriate, it will issue a proposed rule providing how that question will be addressed.

Procedures

The Commission has chosen to employ hybrid rulemaking procedures for conducting this proceeding. Within thirty days after publication of this notice members of the public may file a notice of intent to participate as a "full participant" in the further stages of the proceeding discussed below. The notice of intent should set forth the person's or group's identity, technical or other qualifications to participate, tentative positions on the issues to be considered, and a discussion of any special matters or concerns sought to be raised. Furthermore, at that time those members of the public who do not wish to be full

participants but who wish to file comments on the issues addressed in this rulemaking should file their comments.

The individuals or groups who have chosen to participate as full participants shall be supervised by a "presiding officer" to be named by the Commission at a later date. That officer's principal responsibility will be to monitor the early stages of the proceeding for the Commission, and to assist the Commission in conducting the later portions. To those ends he or she will have authority to order consolidation of individuals or groups in the same fashion provided in 10 CFR 2.715a. The presiding officer may take appropriate action to avoid delay, including, if necessary, holding pre-hearing conferences or certifying matters to the Commission.

The Commission's staff will compile a full bibliography on the subjects relevant to the proceeding which will be made available to the public at an early stage of this proceeding. In addition to that bibliography the Commission will maintain a publicly available data bank which will include relevant information on waste storage and disposal. The data bank will include the IRG Report, the background material the IRG collected in preparing the report, the Generic Environmental Impact Statement on Waste Management being prepared by the Department of Energy, and a collection of other principal works that the Commission staff will compile on the subject of radioactive waste storage and disposal. Furthermore, the Commission will solicit the views of a number of federal agencies on the questions involved in this proceeding and on the conclusions of the IRG Report and make the responses of those agencies available in the data bank so that the participants can address them in their papers. The Commission expects that full participants will voluntarily make relevant documents in their possession available to other full participants to the extent practical and will reference and produce on request the documents on which they rely.

The Commission is considering whether additional procedures should be employed. One proposal is to strictly control inter-participant discovery and to provide that requests for interrogatories, depositions or other formal discovery will not be entertained unless the Commission finds compelling justification therefor. If this proposal were adopted, the Commission expects that there would be at most only a few exceptional circumstances in which such justification could be

demonstrated. An alternative proposal which is also under consideration would be to apply to this proceeding the discovery procedures set forth in 10 CFR Part 2 and to have any discovery supervised by the presiding officer. Participants or other members of the public who wish to express views on this matter should file those views with their notices of intent or comments which are due November 28, 1979. In particular participants should discuss whether imposition of the discovery provisions of Part 2 or their absence would be likely to alter their willingness to participate in this rulemaking or to affect the quality of their contribution to the record. The presiding officer will then summarize the views expressed and present his or her recommendations to the Commission. The Commission will issue a prompt decision on this matter so that the participants' preparation of their statements will not be adversely affected by uncertainty as to the extent of data that may be available to them.

Approximately 30 days after the notices of intent are filed, the officer will issue a prehearing order resolving all preliminary issues including consolidation. Following the prehearing order the participants will have approximately 60 additional days (the exact time to be set in the prehearing order) to prepare and file their statements of position. The statements will be the participants' principal contribution to the waste confidence proceeding, and participants should focus their preparation on them. The statements should set forth the participants' views on the issues discussed above, and on the underlying assumptions and scenarios, both technical and institutional, upon which those views are based. After the statements are filed, the participants will be given approximately 60 days (to be set by the order) to prepare cross-statements discussing statements filed by other participants. The cross-statements should be limited to material discussed in the statements and should not be used to introduce new material.

After the statements and cross-statements have been received, the Commission with the assistance of the presiding officer will issue a second prehearing order. This order will set out the procedures to be followed for the remainder of the hearing and may provide for further written submissions from the full participants, or for the scheduling of an oral hearing. If the Commission desires oral presentations, the participants may be further consolidated to ensure that the oral

presentations will be efficient and useful. Unless different procedures are set out in the second prehearing order, the hearing will begin with delivery of prepared statements from the representatives, both technical and legal, of the groups into which the participants have been consolidated. These statements should succinctly summarize the participants' views previously set forth in their statements and cross-statements. Participants should ensure that their representatives will be able to address the merits of the legal, technical and institutional issues that have been raised in this proceeding. After the prepared remarks the speakers will be questioned by the members of the Commission. Furthermore, other participants will be given the opportunity to submit written questions to the Commission for it, in its discretion, to ask of participants.

The Commission reserves the option of providing a final stage at which representatives of the participants may be cross-examined by other participants. The Commission will defer deciding whether to permit any cross-examination until after the hearing is over. To obtain cross-examination a participant will be required to identify the issue or issues as to which cross-examination is sought, and the representative or participant involved, and to demonstrate that cross-examination is necessary to prepare a record adequate for a sound decision.

Based on the material received in this proceeding and on any other relevant information properly available to it, the Commission will publish a proposed or final rule in the Federal Register. Any such final rule will be effective thirty days after publication.

Comments, notices of intent to participate and any other documents filed in this proceeding should be filed by serving a copy on the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C., 20555, Attention: Docketing and Service Branch. All filings will be available for public inspection in the Commission's Public Document Room at 1717 H Street NW., Washington, D.C.

Dated: October 18, 1979.

For the Commission.

Samuel J. Chilk,
Secretary of the Commission.

BILLING CODE 7590-01-M

The cognizant Designated Federal Employee, Mr. Gary Quittschreiber or the Staff Engineer, Mr. Don Buccil (telephone 202/634-3287) between 8:15 a.m. and 5:00 p.m., a.d.t.

Dated: November 1, 1982.

John C. Hoyle,

Advisory Committee Management Officer.

(FR Doc. 83-3081 Filed 11-5-82; 8:45 am)

BILLING CODE 7590-01-M

Advisory Committee on Reactor Safeguards; Subcommittee on Clinch River Breeder Reactor; Working Group on Structures and Materials; Meeting Date Change

The ACRS Subcommittee on Clinch River Breeder Reactor (CRBR) Working Group on Structures and Materials scheduled for November 18, 1982 has been changed to December 1, 1982, Room 1048, 1717 H Street, NW., Washington, D.C.

All other items regarding this meeting remain the same as announced in the Federal Register published Tuesday, October 28, 1982 (47 FR 47505).

Further information regarding topics to be discussed, whether the meeting has been cancelled or rescheduled, the Chairman's ruling on requests for the opportunity to present oral statements and the time allotted therefor can be obtained by a prepaid telephone call to the cognizant Designated Federal Employee, Mr. Anthony Cappucci (telephone 202/634-3287) between 8:15 a.m. and 5:00 p.m., EST.

Dated: November 2, 1982.

John C. Hoyle,

Advisory Committee Management Officer.

(FR Doc. 83-3080 Filed 11-5-82; 8:45 am)

BILLING CODE 7590-01-M

Licensing and Regulatory Policy and Procedures for Environmental Protection; Uranium Fuel Cycle Impacts

AGENCY: Nuclear Regulatory Commission.

ACTION: Statement of policy.

Earlier this year a decision of the United States Court of Appeals for the District of Columbia Circuit vacated three Commission rules which govern the treatment of uranium fuel cycle environmental impacts in individual nuclear power reactor licensing proceedings. *Natural Resources Defense Council, et al. v. NRC*, No. 74-1586 and consolidated cases (decided April 27,

1982).¹ By its order of September 1, 1982, the D.C. Circuit stayed its mandate pending the filing of application for review of the decision by the Supreme Court. The Solicitor General, on behalf of the Nuclear Regulatory Commission, on September 27, 1982, filed with the Supreme Court a petition for a writ of *certiorari*. Other parties to the case have also filed petitions for Supreme Court review. In this Statement of Policy the Commission provides guidance to the Commission's staff and licensing boards and the interested public regarding ongoing licensing proceedings and the status of licenses already issued, pending final action by the Supreme Court.²

1. Background of the Decision in NRDC v. NRC

The rules in question form part of the Commission's procedures for compliance with the National Environmental Policy Act of 1969 (NEPA). 10 CFR Part 51. The Commission has interpreted NEPA as requiring that the environmental impacts of the uranium fuel cycle be considered in environmental impact statements for individual light water nuclear power reactors.³ The Commission determined some time ago that a generic rule would be the most effective means for considering such impacts in individual reactor licensing proceedings. The most recent version of the Commission's fuel cycle rule, the "Final" fuel cycle rule, was promulgated in 1979. 44 FR 45362 (August 2, 1979). 10 CFR 51.20, 51.23. The rule is frequently referred to as "Table S-3," after the table of impacts which the rule prescribes for use in evaluating the fuel cycle contribution to the environmental costs of licensing an individual nuclear power reactor. In issuing reactor construction permits and

operating licenses the Commission has relied on this fuel cycle rule or its predecessors (the "Original" and "Interim" rules) since adoption of the Original rule in 1974. 39 FR 14188 (April 22, 1974).

Litigation involving the fuel cycle rules began with the Original S-3 rule. In a decision issued July 21, 1976 the United States Court of Appeals for the District of Columbia Circuit set aside those portions of the Original rule pertaining to waste management and spent fuel reprocessing. *Natural Resources Defense Council v. NRC*, 547 F.2d 833, rev'd *sub nom. Vermont Yankee Nuclear Power Corp. v. NRC*, 435 U.S. 519 (1978); but the court stayed its mandate pending review on a petition for *certiorari* to the United States Supreme Court. The Supreme Court reversed the Court of Appeals and remanded for further proceedings. The Court of Appeals consolidated the remanded case with challenges to the Commission's Interim and Final fuel cycle rules and issued a decision on April 27, 1982. *NRDC v. NRC*, No. 74-1486 and consolidated cases.

2. The Holding by the Court of Appeals

In the D.C. Circuit's decision in *NRDC v. NRC*, Judge Bazelon, speaking for the majority, held the Commission's Original, Interim and Final Table S-3 rules invalid "due to their failure to allow for proper consideration of the uncertainties that underlie the assumption that solidified high-level and transuranic wastes will not affect the environment once they are sealed in a permanent repository." Slip Op. at 69. The court's opinion acknowledged that in promulgating the Final rule the Commission considered and disclosed uncertainties concerning permanent disposal of spent fuel and high-level wastes from power reactors. See the Commission's notice of final rulemaking, 44 FR 45362 (August 2, 1979). The court did not suggest that the evidentiary record for the Commission's final rulemaking omitted any substantial body of material regarding waste disposal uncertainties which might have been available at the time of the rulemaking. Nevertheless, the court held it to be a violation of NEPA that the rule binds Licensing Boards to evaluate fuel cycle impacts on the basis of waste disposal impacts in Table S-3, which does not explicitly include uncertainties.⁴

¹ Concerning the choice not to include uncertainties explicitly in Table S-3, the Commission stated in promulgating the rule:

In view of the uncertainties noted regarding waste disposal, the question then arises whether these

¹ On June 30, 1982 the D.C. Circuit denied the Commission's petitions for rehearing and rehearing *en banc*.

² The Commission dealt with a previous invalidation of a fuel cycle rule by the D.C. Circuit in 1976 by issuance of a policy statement. *Natural Resources Defense Council v. NRC*, 547 F.2d 833, rev'd *sub nom. Vermont Yankee Nuclear Power Corp. v. NRC*, 435 U.S. 519 (1978). See General Statement of Policy, 41 Fed. Reg. 34707 (August 16, 1976), and Supplemental General Statement of Policy, 41 Fed. Reg. 49698 (November 11, 1976). For reasons discussed in the text below, the Commission does not believe that the major, though temporary, disruption in licensing announced by the policy statement of August 1976 is a necessary or appropriate response to the D.C. Circuit's latest decision.

³ In addition to the operation of the nuclear power reactor itself, the uranium fuel cycle includes uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, spent fuel storage and disposal, possible reprocessing of irradiated fuel, transportation of radioactive materials and management of low- and high-level wastes.

Although the court concluded that uncertainties could be dealt with generically, rather than on a case-by-case basis, the court held that the Table S-3 rule in question "does not allow the uncertainties concerning permanent storage to play a role in the ultimate licensing decision. That omission, and hence, the Rule, which causes it, constitutes a blatant violation of NEPA." Slip Op. at 48. The dissenting opinion by Judge Wilkey rejected the majority's analysis and would have upheld the Final rule on the grounds that in dealing with uncertainties the Commission had considered the relevant factors and arrived at a reasonable policy judgment.

An additional challenge had been raised on the Original and Interim rules that they improperly precluded Licensing Boards from considering health effects that might result from radioactive effluents set out in Table S-3 and also precluded consideration of socioeconomic and possible cumulative impacts of the fuel cycle.⁴ No such preclusion appeared explicitly in the rules, and the Commission had maintained before the court that no preclusion had been implicitly intended or ever actually applied. Nevertheless, the majority held that the Original rule and the Interim rule, prior to an amendment in 1978, "effectively eliminated the consideration and disclosure of the health, socioeconomic and cumulative impacts of fuel-cycle activities." Slip Op. at 57. Accordingly, the majority held that the Original and

uncertainties can or should be reflected explicitly in the fuel cycle rule. The Commission has concluded that the rule should not be so modified. On the individual reactor licensing level, where the proceedings deal with fuel cycle issues only peripherally, the Commission sees no advantage in having licensing boards repeatedly weigh for themselves the effect of uncertainties on the selection of fuel cycle impacts for use in cost-benefit balancing. This is a generic question properly dealt with in this rulemaking as part of choosing what impact values should go into the fuel cycle rule. The Commission concludes, having noted that uncertainties exist, that for the limited purpose of the fuel cycle rule it is reasonable to base impacts on the assumption which the Commission believes the probabilities favor, i.e., that bedded-salt repository sites can be found which will provide effective isolation of radioactive waste from the biosphere.

⁴ 44 FR 45389 (footnote omitted).

⁵ This challenge was not raised against the Final rule, which specifically requires that environmental impact statements "shall take account of dose commitments and health effects from fuel cycle effluents set forth in Table S-3 and shall in addition take account of economic, socioeconomic, and possible cumulative impacts and such other fuel cycle impacts as may reasonably appear significant." 10 CFR 51.23(c). Since ongoing licensing proceedings depend on the Final rule, this aspect of the court's decision does not bear on the Commission's decision whether to continue licensing.

Interim rules, in addition to their failure to provide for proper consideration of uncertainties, also failed to allow for proper consideration of health, socioeconomic and cumulative fuel cycle effects.

On the issue whether the waste management and reprocessing models underlying the entries in Table S-3 would be economically feasible, a majority of the panel (Judge Bazelon and Judge Wilkey) upheld the Commission's finding of feasibility.

3. Effect on the Power Reactor Licensing Program

The D.C. Circuit's decision does not call into question the Commission's awareness of waste disposal uncertainties or the adequacy of the evidence regarding uncertainties in the record on which the Commission relied.⁶ The state of the Final rulemaking record does not suggest that supplementary studies of uncertainties are likely to produce evidence that would change licensing decisions. The Commission continues to address the uncertainty over whether and when a permanent repository, or equivalent system of disposal, will be developed. Slip Op. at 45. The Commission has stated that it would not license plants without reasonable confidence that safe waste disposal will be available when needed, and has found that it has such reasonable confidence. 42 FR 34301 (July 5, 1977), *NRDC v. NRC*, 581 F.2d 166 (2d Cir. 1978). The Commission is now entering the final stages of the so-called "waste confidence" proceeding, a proceeding designed to reassess whether there is reasonable assurance that safe waste disposal will be available when needed. 44 FR 61372 (1979). The Court of Appeals has made clear that licensing need not be suspended pending the outcome of this reassessment. See *Potomac Alliance v. NRC*, ___ F.2d ___ (D.C. Cir. No. 80-1862, decided July 20, 1982). In view of these considerations and the high cost of delaying the issuance of licenses for qualified facilities, the Commission concludes that power reactor licensing

⁶ The Commission thus views the present decision by the D.C. Circuit not as a finding of fault with the evidentiary record on waste management impacts and uncertainties but rather as a rejection of the Commission's policy judgments regarding the weight and effect which those impacts and uncertainties should exert in reactor licensing. By way of contrast, after the D.C. Circuit issued its 1978 decision the Commission suspended licensing pending the outcome of a supplementary environmental survey of waste management and reprocessing impacts to remedy what the Commission perceived as gaps in the record identified by the court. 41 FR 43707, 43708, col. 2.

may continue. Should the "waste confidence" proceeding arrive at an outcome inconsistent with this policy judgment, the Commission will immediately inform the Congress and will reassess the positions taken in this policy statement.

Next the question arises what role the fuel cycle rules should play in continued licensing. As the Commission interprets the D.C. Circuit and Supreme Court decisions which bear on environmental analysis of fuel cycle impacts, the Commission could conduct individual licensing proceedings by addressing fuel cycle impacts on a case-by-case basis without a generic rule. The Commission already deals with the matter partly in this fashion. In application of the Commission's Final rule a number of significant generic fuel cycle issues, including health effects associated with the effluents given in Table S-3, are presently treated on a case-by-case basis, pending further progress toward an expanded generic rule. To move further toward case-by-case litigation would reintroduce the significant burdens the rule was intended to relieve. Use of the S-3 rule has served the important purpose of providing the underlying basis for consideration of fuel cycle impacts, and the Commission believes that an attempt to proceed without the rule would probably prove unworkable. In principle, and quite possibly in practice, contested licensing cases could rapidly evolve into replays of the S-3 rulemaking.⁷ The resulting delay and drain on staff resources would be substantial, and would not only delay licensing of qualified facilities, but would also substantially disrupt the Commission's regulatory program, including its program to develop safety standards for high-level waste disposal facilities.

The most straightforward way of proceeding is to continue using the S-3 rule in licensing, pending possible supplementation to be discussed later in this statement, insofar as such use is permissible. The Commission notes that after the *NRDC v. NRC* decision of 1976 invalidating the Original S-3 rule, 547 F.2d 833, the court, by staying its mandate, in effect permitted the continuation of licensing pursuant to the rule pending further judicial proceedings provided that future licenses be conditioned on the outcome of those proceedings. See Supplemental General

⁷ The same result could follow if the Commission amended the rule to allow Licensing Boards to take evidence on uncertainties in the Table S-3 entries. Such a proceeding could readily lead to complete reexamination of the Table by each board.

Statement of Policy, 41 FR 49898 (November 11, 1976). The D.C. Circuit's current stay of mandate and the filing of petitions for Supreme Court review place the present case in a similar posture. Indeed the NRC advised the D.C. Circuit that it would proceed in reliance on the rule should the court grant its request to stay the mandate. The Commission anticipates that the mandate will not issue until the Supreme Court has either declined review or taken review and addressed the merits of the lower court's decision. Accordingly, the Commission directs its Licensing and Appeal Boards to proceed in continued reliance on the Final S-3 rule until further order from the Commission, provided that any license authorizations or other decisions issued in reliance on the rule are conditioned on the final outcome of the judicial proceedings.

With regard to licensing proceedings now closed in which there was reliance on any of the fuel cycle rules, the Commission has concluded that for the present, at least, show-cause proceedings based on issues raised by the D.C. Circuit's decision should not be initiated. The Court of Appeals specifically noted that it expressed no view as to the validity of licenses already issued pursuant to the rules and that the matter of the validity of each would be addressed in subsequent judicial proceedings. Slip Op. at 69. Several cases which have been held in abeyance pending disposition of the main case challenge the validity of licenses and permits issued for specific facilities.* The Commission believes these cases should remain in abeyance, pending final Supreme Court action and has advised the courts of this position. The Commission does not intend to initiate show-cause proceedings *sua sponte* for these or other licenses, pending further direction by the courts. The Commission directs that any petitions for such proceedings filed pursuant to 10 CFR 2.206, insofar as they raise issues associated with validity of the S-3 rules, be held in abeyance pending a further order from the Commission.

*The court cited five cases now before the D.C. Circuit in which individual licenses granted under the Original or Interim rules have been challenged on that ground. These include *Lloyd Harbor Study Group, Inc. v. NRC*, No. 73-2286; *Aschliman v. NRC*, No. 73-1778; *Saginaw Valley Study Group v. NRC*, No. 73-1867; *NRDC v. NRC*, No. 74-1383; *Coalition for the Environment v. NRC*, No. 77-1905. Also, there is pending in the First Circuit a challenge to a reactor construction permit involving as an issue the validity of the fuel cycle rule. *New England Coalition on Nuclear Pollution v. NRC*, No. 76-1525.

4. Supplementation of the Record

As the Commission noted in promulgating the Final rule, events which might lead to major releases from the bedded-salt repository used as the model for the S-3 rule appear remote in probability while any releases which might reasonably be expected eventually to occur appear very small. Accordingly, the Commission found that the staff's assumption that the integrity of the repository would be maintained after sealing was a reasonable description of the performance of a properly selected repository and, when taken together with the staff's highly conservative assumption that all volatile fission products in reactor spent fuel would be released to the atmosphere prior to repository sealing, left Table S-3 overall a conservative description of fuel cycle impacts. See 44 FR 45368, col. 2. Considering the rule's limited purpose and taking into account the Commission's "waste confidence" proceeding, the Commission continues to believe that the record of the final S-3 rulemaking contains adequate information on waste disposal uncertainties to support continued use of the fuel cycle rule.

The Commission notes that over the past few years considerable effort has been devoted to the development of the national standards for a repository by the Environmental Protection Agency. These draft standards are essentially complete and should be issued soon as formal proposals. The NRC staff has informed the Commission that the release limits contained in the EPA standards and the studies done in support of the standards may provide additional information on releases associated with waste disposal. The Chairman of the NRC has urged early issuance of these important standards and the supporting documents.

The NRC staff has been directed to examine the EPA standard when published for comment and supporting documentation as it becomes available to determine the degree to which it could be used in Table S-3. This examination will include releases under both normal and abnormal conditions. The NRC staff should be prepared to provide recommendations on possible revisions within 60 days of publication of the EPA standards for comment.

Dated at Washington, D.C. this 29th day of October, 1982.

Samuel J. Chilk,
 Secretary of the Commission.

[FR Doc. 82-30348 Filed 11-5-82; 8:45 am]
 BILLING CODE 7580-01-M

PACIFIC NORTHWEST ELECTRIC POWER AND CONSERVATION PLANNING COUNCIL

Reserves and Reliability Subcommittee Meeting

AGENCY: Pacific Northwest Electric Power and Conservation Planning Council (Northwest Power Planning Council)

ACTION: Notice of meeting.

STATUS: Open.

SUMMARY: The Northwest Power Planning Council hereby announces a forthcoming meeting of the Reserves and Reliability Subcommittee of its Scientific and Statistical Advisory Committee.

DATE: Thursday, November 11, 1982, 10:00 a.m.

ADDRESS: The meeting will be held at the Council's Central Office located at 700 S.W. Taylor Street, Suite 200, Portland, Oregon.

FOR FURTHER INFORMATION CONTACT: Ms. Torian Donohoe, (503) 222-5181.

Edward Sheets,
 Executive Director.

[FR Doc. 82-30287 Filed 11-5-82; 8:45 am]
 BILLING CODE 5000-00-M

PENSION BENEFIT GUARANTY CORPORATION

Exemption From Bond Escrow Requirement Relating to Sale of Assets by an Employer Who Contributes to a Multiemployer Plan: Leonard Silver Manufacturing Company, Inc.

AGENCY: Pension Benefit Guaranty Corporation.

ACTION: Notice of exemption.

SUMMARY: The Pension Benefit Guaranty Corporation has granted Leonard Silver Manufacturing Company, Inc. an exemption from the bond/escrow requirement of section 4204(a)(1)(B) of the Employee Retirement Income Security Act of 1974, as amended. A notice of the request for exemption from this requirement was published on August 9, 1982 (47 FR 34476). The effect of this notice is to advise the public of the decision on the exemption request.

ADDRESS: The request for an exemption and the PBGC response to the request are available for public inspection at the PBGC Public Affairs Office, Suite 7100, 2020 K Street, NW., Washington, D.C. 20006, between the hours of 9:00 a.m. and 4:00 p.m. A copy of these documents may be obtained by mail from the PBGC

NUCLEAR REGULATORY COMMISSION

10 CFR Parts 50 and 51

Waste Confidence Decision

AGENCY: Nuclear Regulatory Commission.

ACTION: Final Waste Confidence Decision.

SUMMARY: The Nuclear Regulatory Commission initiated a rulemaking proceeding on October 25, 1979 to assess generically the degree of assurance now available that radioactive waste can be safely disposed of, to determine when such disposal of off-site storage will be available, and to determine whether radioactive wastes can be safely stored on-site past the expiration of existing facility licenses until off-site disposal or storage is available. This proceeding became known as the "Waste Confidence Rulemaking" and was conducted partially in response to a remand by the U.S. Court of Appeals for the D.C. Circuit. *State of Minnesota v. NRC*, 602 F.2d 412 (1979). The Commission also stated that in the event it determined that on-site storage of spent fuel would be necessary or appropriate after the expiration of facility licenses, it would propose a rule addressing the environmental and safety implications of such storage.

The Commission's decision is summarized in the following findings:

(1) The Commission finds reasonable assurance that safe disposal of high level radioactive waste and spent fuel in a mined geologic repository is technically feasible.

(2) The Commission finds reasonable assurance that one or more mined geologic repositories for commercial high-level radioactive waste and spent fuel will be available by the years 2007-09, and that sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of existing commercial high level radioactive waste and spent fuel originating in such reactor and generated up to that time.

(3) The Commission finds reasonable assurance that high-level radioactive waste and spent fuel will be managed in a safe manner until sufficient repository capacity is available to assure the safe disposal of all high-level radioactive waste and spent fuel.

(4) The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of that

reactor's operating licenses at that reactor's spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

(5) The Commission finds reasonable assurance that safe independent onsite or offset spent fuel storage will be made available if such storage capacity is needed.

In keeping with its commitment to issue a rule providing procedures for considering environmental effects of extended onsite storage of spent fuel in licensing proceedings, the Commission is issuing, elsewhere in this issue, final amendments to 10 CFR Parts 50 and 51.

FOR FURTHER INFORMATION CONTACT: Dennis Rathbun or Clyde Jupiter, Office of Policy Evaluation, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, telephone (202) 634-3295, or Sheldon Trubatch, Office of the General Counsel, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555; telephone (202) 634-3224.

The Commission's Decision

In the Matter of RULEMAKING on the Storage and Disposal of Nuclear Waste (Waste Confidence Rulemaking) [PR-50, -51 (44 FR 61372)]

August 22, 1984.

Contents

Commission's decision
Addendum to the decision
Appendix

Decision

1.0 Introduction

1.1 Initiation of the Waste Confidence Rulemaking Proceeding

In response to the remand of the U.S. Court of Appeals for the District of Columbia Circuit (*State of Minnesota v. NRC*, 602 F.2d 412 (1979)), and as a continuation of previous proceedings conducted in this area by NRC (44 FR 61372), the Commission initiated a generic rulemaking proceeding on October 25, 1979. In its Notice of Proposed Rulemaking, the Commission stated that the "purpose of this proceeding is solely to assess generically the degree of assurance now available that radioactive waste can be safely disposed of, to determine when such disposal or off-site storage will be available, and to determine whether radioactive wastes can be safely stored on-site past the expiration of existing facility licenses until off-site disposal or storage is available." The Commission also stated that in the event it determined that on-site storage of spent fuel would be necessary or appropriate after the expiration of facility licenses, it would propose a rule addressing the

environmental and safety implications of such storage. The Commission recognized that the scope of this generic proceeding would be broader than the Court's instruction, which required the Commission to address the questions of whether off-site storage for spent fuel would be available by the expiration of reactor operating licenses and if not, whether spent fuel could continue to be safely stored on-site (44 FR 61373).

However, the Commission believed that the primary public concern was whether nuclear waste could be disposed of safely rather than with an off-site solution to the storage problem per se. Moreover, as stated in the Federal Register Notice of October 25, 1979, the Commission committed itself to reassess its basis for reasonable assurance that methods of safe permanent disposal of high level waste would be available when they are needed. In conducting that reassessment, the Commission noted that it would "draw upon the record compiled in the Commission's recently concluded rulemaking on the environmental impacts of the nuclear fuel cycle (44 FR 45362-45374 [August 2, 1979])" (44 FR 61373).

The Department of Energy (DOE), as the lead agency on nuclear waste management filed its statement of position (PS) on April 15, 1980. Statements of position were filed by 30 participants by June 9, 1980, and were followed by cross statements (CS) from 21 of the participants by August 11, 1980.

1.2 Establishment of the Working Group

On May 28, 1980, the Commission directed the staff to form a Working Group to advise the Commission on the adequacy of the record to be compiled in this proceeding, to review the participants' submissions and identify issues in controversy and any areas in which additional information would be needed. The Working Group submitted a report to the Commission on January 29, 1981. The report summarized the record, identified key issues and controversies, and commented on the adequacy of the record for considering the key issues. The participants were invited to submit comments on the adequacy of the Working Group's summary of the record and its identification and description of the issues. Such comments were made by 20 participants by March 5, 1981.

1.3 Commission's Order for Oral Presentations

The Commission found additional limited proceedings to be useful to allow the participants to state their basic

positions directly to the Commissioners and to enable the Commissioners to discuss specific issues with them. In addition, the Commission invited comment on the following policy developments: (1) the Administration's announcement¹ of a policy favoring commercial reprocessing of spent fuel and instructing the Secretary of Energy to proceed swiftly toward deployment of a means of storing and disposing of commercial high-level radioactive waste, and (2) the submission of information to the Presiding Officer in this proceeding by DOE on March 27, 1981, concerning the DOE decision to "discontinue [its] efforts to provide federal government-owned or controlled away-from-reactor (AFR) [spent fuel] storage facilities." The participants were asked to comment on the significance to the proceeding of issues, particularly institutional concerns, resulting from these policy developments and to comment on the merits of DOE's new projection of spent fuel storage requirements and on the technical and practical feasibility of DOE's suggested alternative storage methods.

To implement the additional limited proceedings, the Commission consolidated the participants into the following identifiable groups: (a) federal government, (b) state and local participants, (c) industry, and (d) public interest groups (Second Prehearing Memorandum and Order, November 6, 1981). Prehearing statements (PHS) were provided by the consolidated groups, as well as by individual participants. The oral arguments were presented to the Commissioners on January 11, 1982.

The extensive record, comprised of all written and oral submissions provides the primary basis for the Commission's decision regarding the safe storage and disposal of spent fuel and nuclear waste. However, while the Commission was preparing this Waste Confidence decision, the Nuclear Waste Policy Act of 1982 (NWPA) was enacted. The Commission found that this Act had a significant bearing on the Commission's decision, and the Commission has considered the NWPA in reaching its conclusions. The Commission believes that the NWPA had its most significant impact in narrowing the uncertainties surrounding institutional issues. Moreover, although the NWPA is intrinsically incapable of resolving technical issues, it will establish the necessary programs, milestones, and funding mechanisms to enable their resolution in the years ahead.

¹ Presidential Nuclear Policy Statement, October 9, 1981.

The Commission's preliminary decision in the Waste Confidence proceeding was served on the consolidated participants on May 17, 1983. However, the parties to this proceeding had not yet had an opportunity to comment on what implications, if any, the NWPA had on the Commission's decision. Further, the Commission's discussion of the safety of dry storage of spent nuclear fuel, in its preliminary decision, relied substantially on material not yet in the record. Therefore, the preliminary decision was issued as a draft decision. The Commission requested the consolidated groupings of participants to comment on either or both of these issues. In addition, the Commission found that onsite storage after license expiration might be necessary or appropriate, and therefore, in accordance with its notice initiating this proceeding, it proposed a rule to establish how the environmental effects of extended onsite storage would be considered in licensing proceedings (48 FR 22730, May 20, 1983), as amendments to 10 CFR Parts 50 and 51.

Subsequently, in response to public comments on the proposed amendments to 10 CFR Part 51, the Commission reopened the comment period to address the environmental aspects of the fourth finding of the Commission's Waste Confidence decision, on which the proposed amendment to Part 51 is based (48 FR 50746, November 3, 1983). Public comments were requested on: (1) The environmental aspects of the fourth finding—that the Commission has reasonable assurance that, if necessary, spent fuel can be stored without significant environmental effects for at least 30 years beyond the expiration of reactor operating licenses at reactor spent fuel storage basins, or at either onsite or offsite independent spent fuel storage installations; (2) the determination that there are no significant non-radiological consequences which could adversely affect the environment if spent fuel is stored beyond the expiration of operating licenses either at reactors or at independent spent fuel storage installations; and (3) the implications of comments on items (1) and (2) above for the proposed amendment to 10 CFR Part 51.

After reviewing these additional comments, the Commission found no reason to modify its fourth finding or the supporting determination.

The analysis of comments, together with the Commission's response is summarized in the Addendum to the Commission's decision.

The Commission notes that two relevant developments have occurred subsequent to the closing of the record in the Waste Confidence proceeding. They are the publication of DOE's draft Mission Plan for the Civilian Radioactive Waste Management Program (April, 1984) and the Commission's concurrence in DOE's General Guidelines for Recommendation of Sites for Nuclear Waste Repositories (July 3, 1984). These developments are a matter of public record, and in the case of the Commission's concurrence was the conclusion of a separate public proceeding. The Commission has considered the effects of these developments on its previously announced decision in this proceeding and determined that these developments do not substantially modify the Commission's previous conclusions.

The decision is summarized as five Commission findings in Section 2.0. The detailed rationale for these findings, including references to the record developed in this proceeding, is contained in the Appendix to this document. The Commission considers these five findings to be a response to the mandate of the U.S. Court of Appeals for the District of Columbia Circuit and, in addition, a generic determination that there is reasonable assurance that radioactive waste can and will be safely stored and disposed of in a timely manner.

In keeping with its commitment to issue a rule providing procedures for considering environmental effects of extended onsite storage of spent fuel in licensing proceedings, final amendments to 10 CFR Parts 50 and 51 are being issued simultaneously with this decision.

2.0 Commission Findings²

(1) The Commission finds reasonable assurance that safe disposal of high level radioactive waste and spent fuel in a mined geologic repository is technically feasible.

(2) The Commission finds reasonable assurance that one or more mined geologic repositories for commercial high-level radioactive waste and spent

² All findings by the Commission in this proceeding are limited to the storage and disposal of high-level radioactive waste and spent fuel generated by nuclear power reactors required to be licensed under sections 103 or 104 b of the Atomic Energy Act of 1954 (42 U.S.C. 2133 and 2134(b)), and to facilities intended for such storage or disposal. The Commission's findings in this proceeding do not address the storage and disposal of high-level radioactive waste or spent fuel resulting from atomic energy defense activities, research and development activities of the Department of Energy, or both. This is consistent with the Nuclear Waste Policy Act of 1982, section 8(c).

fuel will be available by the years 2007-09, and that sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of existing commercial high level radioactive waste and spent fuel originating in such reactor and generated up to that time.

(3) The Commission finds reasonable assurance that high-level radioactive waste and spent fuel will be managed in a safe manner until sufficient repository capacity is available to assure the safe disposal of all high-level radioactive waste and spent fuel.

(4) The Commission finds reasonable assurance, that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of that reactor's operating license at that reactor's spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

(5) The Commission finds reasonable assurance that safe independent onsite or offsite spent fuel storage will be made available if such storage capacity is needed.

3.0 Future Actions by the Commission

The Commission's Waste Confidence decision is unavoidably in the nature of a prediction. While the Commission believes for the reasons set out in the decision that it can, with reasonable assurance, reach favorable conclusions of confidence, the Commission recognizes that the possibility of significant unexpected events remains open. Consequently, the Commission will review its conclusions on waste confidence should significant and pertinent unexpected events occur, or at least every 5 years until a repository for high-level radioactive waste and spent fuel is available.

4.0 For Further Information Contact

Dennis Rathbun or Clyde Jupiter, Office of Policy Evaluation, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, telephone (202) 634-3295, or Sheldon Trubatch, Office of the General Counsel, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555; telephone (202) 634-3224.

Dated at Washington, D.C. this 22nd day of August, 1984. Commissioner Zech did not participate in this action.

For the Nuclear Regulatory Commission,
Samuel J. Chilk,
Secretary of the Commission.

Addendum to the Commission's Waste Confidence Decision

Introduction

On May 17, 1983, the Commission issued its proposed decision in the Waste Confidence proceeding, and asked the consolidated groups of participants to comment on two aspects of the decision: the implications of the Nuclear Waste Policy Act (NWPA) for the decision and the Commission's discussion of the safety of dry storage of spent nuclear fuel, which relied substantially on material not in the record. The analysis of these comments is subdivided into several issue categories and presented, with NRC's responses, in Part I below. The membership of the consolidated groups responding to the Commission's request as well as the abbreviations used to identify the groups are provided in Section 3 of Part I.

Subsequently, in response to public comments on the Commission's proposed amendment to 10 CFR Part 51 (48 FR 22730, May 20, 1983), the Commission reopened (48 FR 50746, November 3, 1983) the comment period to address the environmental aspects of the fourth finding of the Commission's proposed Waste Confidence decision on which the proposed amendment to Part 51 is based. Public comments were requested on: (1) The environmental aspects of the fourth finding—that the Commission has reasonable assurance that, if necessary, spent fuel can be stored without significant environmental effects for at least 30 years beyond the expiration of reactor operating licenses at reactor spent fuel storage basins, or at either onsite or offsite independent spent fuel storage installations; (2) the determination that there are no significant non-radiological consequences which could adversely affect the environment if spent fuel is stored beyond the expiration of operating licenses either at reactors or at independent spent fuel storage installations; and (3) the implications of comments on items (1) and (2) above for the proposed amendment to 10 CFR Part 51. The analysis of public comments and NRC's responses are presented in Part II of this document. The list of respondents to this reopened comment period and the abbreviations used to identify them are given in Section 4 of Part II.

The Commission notes that two relevant developments have occurred subsequent to the closing of the record in the Waste Confidence proceeding. They are the publication of DOE's draft Mission Plan of the Civilian Radioactive

Waste Management Program (April, 1984) and the Commission's concurrence in DOE's General Guidelines for Recommendation of Sites for Nuclear Waste Repositories (July 3, 1984). These developments are a matter of public record, and in the case of the Commission's concurrence was the conclusion of a separate public proceeding. The Commission has considered the effects of these developments on its previously announced decision in this proceeding and determined that these developments do not substantially modify the Commission's previous conclusions.

Part I. Analysis of the Consolidated Groups' Comments on the Commission's Waste Confidence Decision and NRC Responses

1. Effect of the Nuclear Waste Policy Act on the Commission's Decision

A. General

(1) *Summary of Comments.* The Consolidated Industry Group agreed with the Commission's view that the NWPA contains provisions pertinent to all of the major elements relevant to mined geologic disposal of high level radioactive wastes (Industry, p. 3). The Industry Group called attention to the comprehensive nature of the NWPA which authorizes DOE to undertake steps leading to the construction, operation and maintenance of a deep geologic test and evaluation facility; requires DOE to prepare a waste management mission plan; establishes a prescribed schedule for repository siting, construction and operation; defines the decision-making roles of affected states and Indian tribes in repository site-selection and evaluation; provides for the continuity of Federal management of the nuclear waste program and continued funding; and facilitates the establishment of an overall integrated spent fuel and waste management system. The Industry Group suggested that these features of the Act should increase the Commission's confidence that waste can and will be disposed of safely. The Group pointed out that the Act also contains special procedures to facilitate the licensing of spent fuel storage capacity expansion and transshipments; directs DOE research, development and cooperation with utilities in developing dry storage and rod compaction; and provides for federally supplied interim storage capacity to supplement that of industry (Industry, pp. 4-8).

The Industry Group believed that the NWPAs enactment—in and of itself—provides a sound basis for confidence that institutional difficulties can and will continue to be resolved. At the same time, Industry stated that the NWPAs enactment was not essential for the Commission to reach an affirmative decision in this proceeding (Industry, p. 9).

In contrast, the Consolidated Public Interest Group (CPIG) believed that the NWPAs provides an insufficient basis for the Commission's decision in this proceeding with respect to the availability or timing of a nuclear waste repository. The CPIG contended that the NWPAs contains many areas of ambiguity, and gave as examples:

(i) Section 114(a) of the NWPAs requires DOE to make a recommendation to the President for the first repository site, accompanied by the preliminary comments by the Commission concerning the suitability of three alternative candidate sites for licensing under 10 CFR Part 60. DOE interprets this section to require such preliminary comments *before* site characterization begins * * * The Commission staff interprets that section * * * to require a judgment of suitability under 10 CFR Part 60 *after* site characterization has occurred.

(ii) DOE originally interpreted Sec. 112(f) to permit continuation of ongoing site characterization at Hanford before completion of the DOE siting guidelines. DOE now concedes that such site characterization work must await completion of an environmental assessment prepared in accordance with final DOE siting guidelines (CPIG, pp. 2-3).

(2) *NRC Response.* The Commission has considered the effect of enactment of the Nuclear Waste Policy Act of 1982 and concludes that the Act provides support for timely resolution of technical uncertainties and reduces uncertainties in the institutional arrangements for the participation of affected states and Indian tribes in the siting and development of repositories and in the long-term management, direction and funding of the repository program. The bases for the Commission's conclusion are set forth in the decision and will not be repeated here. The passage of the Act provides evidence of a strong national commitment to the solution of the radioactive waste management problem.

The Commission recognizes the possibility of differing interpretations regarding the implementation of the NWPAs. With respect to CPIG's discussion of Section 114(a), the Commission is unaware of any differences between DOE and NRC in the interpretation of this section of the Act. We note that DOE's recommendation of a repository site to

the President would necessarily be made after DOE's preliminary determination that three sites are suitable for development. DOE and NRC now agree that the preliminary determination of site suitability for the alternative sites should be made following site characterization (Commission's Final Decision on the U.S. Department of Energy's General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories [July 3, 1984]).

Concerning Section 112(f), DOE has continued site characterization at Hanford during formulation of the siting guidelines; in accordance with the views of the states and environmental groups, DOE has deferred drilling of the exploratory shaft pending the completion of the guidelines, submission of the site characterization plan to NRC and preparation of an environmental assessment of site characterization activities.

B. Technical Aspects

(1) *Summary of Comments.* The Consolidated Industry Group believed that the Act contained provisions pertinent to all of the major elements relevant to disposal (Industry, p. 3). The Consolidated Public Interest Group, on the other hand, contended that the NWPAs did not resolve technical uncertainties concerning repository development and safety (CPIG, p. 5). The Consolidated State Group did not believe that the NWPAs supported a finding of confidence because it failed to resolve technical questions and merely set target dates for deciding on the site of the first waste repository. The State Group noted that if technical problems are not resolved by the dates proposed by Congress, the milestone dates will have to be postponed. The State Group contended too that, although the Act authorizes DOE to conduct research on unresolved technical issues, the research could uncover additional problems (States, p. 2). However, DOE pointed out that the NWPAs provides for a focused, integrated and extensive research and development program for the deep geologic disposal of high-level waste and spent fuel. DOE believed that Sec. 215 of the Act enhances confidence in the timely availability of disposal facilities by authorizing a research facility to develop and demonstrate a program for waste disposal. DOE also stated that the schedule for a Test and Evaluation Facility would require the *in situ* testing described in Sec. 217 of the Act to begin not later than May 8, 1990, thus allowing for research and development results to be incorporated

in the repository which is scheduled to open in 1993 (DOE, pp. 11, 12).

(2) *NRC Response.* As the record of this proceeding shows, there are no known technical problems that would make safe waste disposal impossible. Clearly, further engineering development and site-specific evaluations will be required before a repository can be constructed. The Commission did not propose to rely on the NWPAs as the basis for resolving technical uncertainties. Rather, the Commission found that the NWPAs provides a framework for facilitating the solution of the remaining technical issues. Title II of the Act authorizes DOE to undertake steps leading to the construction, operation and maintenance of a deep geologic test and evaluation facility and to conduct the necessary research and development as well as to establish a demonstration program. The schedule set forth in the Act is consistent with the objective of assuring repository operation within the time period discussed in the Waste Confidence decision. The "Mission Plan" which is required by the Act will provide an effective management tool for assuring that the many technical activities are properly coordinated and that results of research and development projects are available when needed.

C. Institutional Aspects

(1) *Summary of Comments.* The Consolidated State Group believed that the NWPAs failed to resolve institutional questions. The States argued that their cooperation cannot be assumed in the event that the general public in the vicinity of a proposed site is opposed to the location. Further, the States contended that, if a site is vetoed by a host state or Indian tribe, there is no assurance that Congress will vote to override the veto. Moreover, if the veto is overridden, a legal challenge is likely and the outcome is uncertain (States, p. 3).

The Consolidated Public Interest Group also believed that the NWPAs has not significantly reduced institutional uncertainties regarding participation and objections of affected states and Indian tribes. As examples of institutional difficulties, CPIG pointed out that state officials and Indian tribes still have concerns regarding the adequacy of time to monitor and comment upon agency proposals, the lack of agency response to their concerns, and inadequate funding to support their full participation. Further, CPIG noted that the Act (Sec. 115) provides states and Indian tribes with

strong new authority to veto the siting of a repository within their borders (CPIG, p. 5).

DOE, on the other hand, believed that Sections 116 and 117 of the NWPA will reduce Federal-state institutional uncertainties (DOE p. 9).

(2) *NRC Response.* It would be unrealistic to expect that the NWPA will resolve all institutional issues. However, it does provide specific statutory procedures and arrangements for accomplishing such resolution. The right of affected states and Indian tribes to disapprove a site designation under the NWPA might create uncertainty in gaining the needed approvals. Nevertheless, the NWPA's establishment of a detailed process for state and tribal participation in the development of repositories and for the resolution of disputes should minimize the potential for substantial disruption of plans and schedules. The Commission does not expect that the NWPA can eliminate all disagreement about development of waste repositories. However, in providing for information exchange, financial and technical assistance to affected groups, and meaningful participation of affected states and tribes in the decision-making process, the Act should minimize the potential for direct confrontations and disputes.

D. Funding Aspects

(1) *Summary of Comments.* The Consolidated Industry Group expressed its general belief that the NWPA assures adequate funding for interim storage and disposal of radioactive waste (Industry, pp. 6, 7). Similarly, DOE believed that the funding mechanism provided by the NWPA should largely remove uncertainties in assuring adequate resources to complete the program (DOE, pp. 10, 11). On the other hand, the Consolidated States Group contended that, since the law can be changed at any time, the NWPA assures neither an adequate level of funding nor a prolonged Congressional commitment (States, p. 4).

(2) *NRC Response.* The Commission believes that the general approach prescribed by the NWPA is to operate DOE's radioactive waste program on a full cost recovery basis. It seems clear that Congress intended to establish a long-term program for waste management and disposal, with built-in reviews and adjustments of funding as necessary to meet changing requirements. In this regard, the Act provides that DOE must annually review the amount of the established fees to determine whether collection of the fees will provide sufficient revenues to offset

the expected costs. In the event DOE determines that the revenues being collected are less than the amount needed to recover costs, DOE must propose to Congress an adjustment to the fees to ensure full cost recovery. The Act also provides that, if at any time, the monies available in the waste fund are insufficient to support DOE's nuclear waste program, DOE will have the authority to borrow from the Treasury. The Commission believes that long-term funding provisions of the Act will ensure adequate financial support for DOE's nuclear waste program for FY 1984 and beyond.

The Commission believes that uncertainties regarding the adequacy of financial management of the nuclear waste program have also been reduced by the NWPA requirement that an Office of Civilian Radioactive Waste Management be established within the Department of Energy. This Office is to be headed by a Director, appointed by the President with Senate confirmation, who will report directly to the Secretary of Energy. Further, the Act stipulates that an annual comprehensive report of the activities and expenditures of the Office will be submitted to Congress and that an annual audit of the Office will be conducted by the Comptroller General, who will report the results to Congress.

Some concern has been expressed that the Congress may amend the funding provisions of the NWPA and thereby undermine the financial stability of the Federal radioactive waste management program. Commenters have not provided any basis for this belief. The Commission considers this possibility to be most unlikely. It is reasonable to assume that the long-range public health and safety and political concerns which motivated the Congress over the past several years to pass the NWPA will continue to motivate the Congress in considering amendments to the NWPA.

E. Schedule

(1) *Summary of Comments.* DOE contended that the NWPA provides additional assurance that a repository will be available by 1998. As the basis for this belief, DOE stated that sections 111 through 125 of the NWPA provide specific schedules and reporting requirements for the timely siting, development, construction, and operation by 1998 of a repository for high level waste and spent fuel (DOE, p. 6). DOE believed that these schedules and reporting requirements will ensure that deadlines are met. The Commission notes that DOE recognizes that there has been a delay of about 1-year in its

schedule for meeting early milestones such as publication of its siting guidelines; nevertheless, DOE continues to maintain that its date for completion of repository development will be met (DOE Draft Mission Plan for the Civilian Radioactive Waste Management Program, April 1984).

The Consolidated Public Interest Group, however, did not believe that the provision of specific dates in the NWPA gives assurance that they will be met. CPIC cited, for example, the delay in preparing DOE's site selection guidelines, which were due by June 1983, and were expected to be delayed further (CPIC, p. 4).

Further, the CPIC contended that a date for the availability of a repository is not certain since both the President and the NRC have explicit authority to reject any or all site proposals that are submitted to them (CPIC, p. 4). Also, CPIC believed that the legislation contemplates the possibility of delay beyond statutory deadlines and NWPA's legislative history indicates that the timing of repository availability remains uncertain (CPIC, p. 5).

(2) *NRC Response.* One of the primary purposes of the NWPA is "to establish a schedule for the siting, construction, and operation of repositories that will provide reasonable assurance that the public and the environment will be adequately protected from the hazards posed by high-level radioactive waste and such spent nuclear fuel as may be disposed of in a repository." (Sec. 111(b)(1)). The Commission believes this purpose will be achieved.

As the Commission noted in the proposed decision, the Congress would not be able to legislate the schedules for the accomplishment of fundamental technical breakthroughs if it believed that such breakthroughs were necessary. They are not necessary. Rather, it is the Commission's judgment that the remaining uncertainties can be resolved by the planned step-by-step evaluation and development based on ongoing site studies and research programs. The Commission believes the Act provides means for resolution of those institutional and technical issues most likely to delay repository development, both because it provides an assured source of funding and other significant institutional arrangements, and because it provides detailed procedures for maintaining progress, coordinating activities and rectifying weaknesses.

The Commission believes that the milestones established by the Act are generally consistent with the schedules presented by DOE in the Waste

Confidence proceeding and that those milestones are generally reasonable. Achievement of the scheduled first date of repository operation is further supported by other provisions of the Act which specify means for resolution of issues most likely to delay repository completion. One of the earlier milestones—publication of DOE's general guidelines for the recommendation of sites for a repository—was about a year behind schedule and the Commission was concerned that his delay could result in corresponding delays in DOE's nomination of at least five sites for characterization work. However, DOE has indicated in its draft Mission Plan (April, 1984) that the subsequent milestones have been scheduled to provide completion of the first repository by 1998. The Commission believes that the timely attainment of a repository does not require DOE's program schedule to adhere strictly to the milestones set out in the NWPA over the approximately 15 year duration of the repository development program. Delays in some milestones as well as advances in others can be expected.

The Commission has no evidence that delays of a year or so in meeting any of the milestones set forth in the NWPA would delay the repository availability date by more than a few years beyond the 1998 date specified in the NWPA. The Commission found reasonable assurance that a repository would be available by 2007-09, a decade later than that specified in the NWPA, and a date which allows for considerable slippage in the DOE schedule. The Act also requires that any Federal agency that determines that it cannot comply with the repository development schedule in the Act must notify both the Secretary of Energy and Congress, provide reasons for its inability to meet the deadlines, and submit recommendations for mitigating the delay. The Commission notes that the Act also clarifies how the requirements of the National Environmental Policy Act are to be met. These provisions of the Act, as well as the provisions for research, development and demonstration efforts regarding waste disposal, increase the prospects for having the first repository in operation not later than the first few years of the next century.

The repository development schedule may have to accommodate such contingencies as vetoes of proposed repository sites, prolonged public hearings, protracted litigation, possible project reorientation, or delay in promulgation of siting guidelines. The schedule now incorporated into the Act

allows substantial time for these possibilities.

2. Discussion of the Safety of Dry Storage

A. Summary of Comments

DOE believed that the availability of dry storage techniques provides further reasonable assurance of the ability to safely store nuclear wastes at least 30 years beyond the expiration of reactor operating licenses. DOE stated that the citations quoted in the Commission's rationale are reliable and representative of the literature in the area, and that the Commission's technical judgment on dry storage conforms with DOE's experience and is accurate and correct (DOE, p. 16). The Consolidated Industry Group also stated that the pertinent points in the Commission's discussion appear to be adequately supported with appropriate references (Industry, pp. 10, 11).

In further support of the safety of dry storage, DOE cited the following:

—Extensive world-wide experience shows that dry fuel handling and storage is safe and efficient. Irradiated fuel has been handled, shipped, and safely stored under dry conditions since the mid-1940's. All types of irradiated fuel have been handled dry at hot cells, where a variety of phenomena have been observed in detail. The passive nature of most dry storage concepts contributes to the safety of interim storage by not requiring active cooling systems involving moving parts (DOE, p. 16).

—Regarding specific experience, DOE stated that a reactor fuel has been successfully stored in dry vaults licensed under Part 50 at the Hallam sodium-cooled graphite research reactor in Nebraska and the Fort St. Vrain HTGR prototype facility in Colorado. In addition, dry storage of zircaloy-clad fuel has been successfully conducted in drywells and in air-cooled vaults at DOE's Nevada Test Site. There is favorable foreign experience with dry storage at Wylfa, Wales in Great Britain, at Whitesell in Canada, in the Federal Republic of Germany, in France where vault dry storage of vitrified waste is routine, and in Japan, where a dry storage vault has been recently constructed (DOE, p. 17).

—To date, all dry storage tests have indicated satisfactory storage of zircaloy-clad fuel without cladding failure over the temperature range of 100 degrees C to 570 degrees C, in inert atmospheres. Existing data which support the conclusion that spent fuel can be stored safely in an inert atmosphere for at least 30 years

is being augmented by additional ongoing research (DOE, pp. 17, 18).

None of the consolidated groups of participants offered comments which were critical of the Commission's discussion of the safety of dry storage.

B. NRC Response

The Commission is confident that dry storage installations can provide continued safe storage of spent fuel at reactor sites for at least 30 years after expiration of the reactor operating licenses.

3. List of Respondents

Consolidated Participants as Respondents to the Commission's Waste Confidence Decision

1. Department of Energy (DOE)
2. Consolidated States Representative ¹ (States)
3. Consolidated Public Interest Representative ² (CPIR)
4. Consolidated Industry Representative ³ (Industry)

PART II: Commission Consideration of Additional Comments on Its Fourth Finding

1. Introduction

On November 3, 1983, the Commission reopened the comment period in this proceeding to receive comments on: (1)

¹The Consolidated States Group consists of the Attorney General of the State of New York, Minnesota (by its Attorney General and the Minnesota Pollution Control Agency), Ohio, South Carolina and Wisconsin. The remaining participants previously consolidated in the States Group have not joined in these comments.

²The Consolidated Public Interest Group is represented here by the Natural Resources Defense Council, Inc., the New England Coalition on Nuclear Pollution, the Sierra Club, the Environmental Coalition on Nuclear Power, Wisconsin's Environmental Decade, Mississippians Against Disposal, Safe Haven, Ltd., John O'Neill, Jr., and Marvin Lewis.

³The Consolidated Industry Group is represented by: American Institute of Chemical Engineers; American Nuclear Society; Association of Engineering Geologists; Atomic Industrial Forum; Bechtel National; Consumers Power; General Electric; Neighbors for the Environment; Scientists and Engineers for Secure Energy; Tennessee Valley Authority; the Utilities Group (Niagara Mohawk Power Corporation, Omaha Public Power District, Power Authority of the State of New York, and Public Service Company of Indiana, Inc.); and the Utility Nuclear Waste Management Group—Edison Electric Institute. In order to emphasize the independent nature of its participation, the American Nuclear Society has chosen to proceed separately. ANS continues to protest its assignment to the Consolidated Industry Group and has offered separate comments on the Commission's Waste Confidence decision. Since only the consolidated groups of participants were invited to comment on the proposed decision, the ANS's separate comments are not discussed here. Further, TVA, as a Federal agency, wishes to stress the independent nature of its participation.

The environmental aspects of its fourth finding—that it has reasonable assurance that, if necessary, spent fuel can be stored without significant environmental effects for at least 30 years beyond the expiration of reactor operating licenses at reactor spent fuel storage basins, or at either onsite or offsite independent spent fuel storage installations; (2) the determination that there are no significant non-radiological consequences which could adversely affect the environment if spent fuel is stored beyond the expiration of operating licenses either at reactors or at independent spent fuel storage installations; and (3) implications of comments on items (1) and (2) above for the proposed amendment to 10 CFR Part 51 (48 FR 50746).

The Commission has considered those comments and, for the reasons discussed below, finds no reason to substantively modify its fourth finding or other related aspects of its decision in this proceeding. The Commission has, however, made revisions in its fourth finding to clarify its original intent.

Thirteen comments were received. Seven commenters identified various reasons which they believed argued against the finding.⁴ Six commenters supported the finding.⁵ In addition to the issues on which the Commission specifically requested comments, some commenters raised additional issues regarding the Commission's compliance with the National Environmental Policy Act (NEPA).

2. Environmental Aspects of Extended Storage of Spent Fuel

A. Radiological Consequences of Spent Fuel Storage

The Commission's proposed fourth finding stated:

The Commission finds reasonable assurance that, if necessary, spent fuel can be stored safely without significant environmental effects for at least 30 years beyond the expiration of reactor operating licenses at reactor spent fuel storage basins, or at either onsite or offsite independent spent fuel storage installations.

The public was invited to submit additional comments on the environmental aspects of this finding. Those comments, and the Commission's responses to them, are set out below:

⁴Department of Law of the State of New York, Maryn Lewis, Sierra Club, Safe Haven, Ltd., Attorney General of the State of Minnesota, Department of Justice of the State of Wisconsin and Natural Resources Defense Council, Inc.

⁵Scientists and Engineers for Secure Energy, Inc. American Institute of Chemical Engineers, American Nuclear Society, Utility Nuclear Waste Management Group—Edison Electric Institute, and U.S. Department of Energy.

The State of Minnesota ("Minnesota"), through its Attorney General, and the Sierra Club believe that an event at the spent fuel pool for Prairie Island Nuclear Generating Station ("Prairie Island") indicates that irradiated spent fuel assemblies are degrading rapidly with time. In December 1981, during a fuel transfer operation at Prairie Island, the top nozzle assembly separated from the remainder of a spent fuel assembly due to stress corrosion cracking of the spent fuel assembly while it was in the spent fuel pool. Minnesota and the Sierra Club acknowledge that this separation was an isolated event; over 5,000 similar spent fuel assemblies have been moved successfully at other plants. These commentors also acknowledge that television examination showed no corrosion cracking of similarly designed fuel assemblies at other nuclear power plants: Zion, Trojan, Kewanee and Point Beach. They also acknowledge that even though the water contaminant contributing to stress corrosion cracking has never been identified, the possibility that it may have been sulfates has led the Commission to suggest that Prairie Island monitor the sulfate levels of its spent fuel pool.

However, the Sierra Club contended⁶ that the NRC staff essentially ignored the opinion of Mr. Earl J. Brown, an NRC engineer, that sulfate contamination is a generic problem at Pressurized Water Reactors (PWRs). The Sierra Club also believes that television inspection of spent fuel assemblies in spent fuel pools cannot reveal the initial signs of stress corrosion cracking. For these reasons, the Sierra Club and Minnesota believe that there is no assurance that spent fuel can be stored safely in spent fuel pools for 30 years after reactor shut down or for 60 years after irradiation.

The NRC investigated the Prairie Island event and found it to be an isolated event without generic impact. The staff also concluded that if a fuel assembly were to drop due to top nozzle failures, such an event would not lead to a criticality hazard in a spent fuel pool and that such an accident would result in radiation levels at the site boundary well within the limits in 10 CFR Part 100. The NRC Staff Assessment Report ("SAR") and associated memoranda,

⁶Sierra Club also stated that the staff did not consider an Oak Ridge report (ORNL 3884, Nov. 1984) which identified water vapor as contributing to corrosion of the type of steel used in spent fuel assemblies. That report is not germane to light water reactor fuel because it addressed the sensitization of stainless steel in a high temperature gas cooled reactor environment, which is very different from the environment of a light water reactor. Refer to the discussion in Sec. 2.4A of the Appendix to the Commission's decision.

although already publicly available in the Commission's Public Document Room, have been added to the docket of this proceeding. That SAR concluded that the event was caused by intergranular stress-corrosion cracking due to an unidentified corrodant temporarily present in the spent fuel pool.

As for the Sierra Club's specific comments, the staff recognized that sulfate contamination was suspected to have contributed to the corrosion and recommended that licensees administratively control sulfate level concentrations in spent fuel pools. Such monitoring had been recommended by Mr. Brown as the only action that should be taken in response to the incident. Although Mr. Brown stated that in his opinion the event was a "potential" generic issue for PWRs, subsequent staff investigation revealed that the event was an isolated incident. The staff also considered the properties of the steel used in the spent fuel assemblies and acknowledged that they could have contributed to the event. However, the absence of any similar events for 5,000 other spent fuel assemblies indicated that the type of steel was not critical. Accordingly, the Commission finds no basis for reconsidering the Safety Assessment Report's finding that the Prairie Island event was an isolated incident and recommendation that sulfate control was an adequate response, or for altering its conclusion concerning the potential environmental impacts of stored spent fuel.

Wisconsin, Safe Haven, Ltd. and NRDC contended that the environmental effects of extended spent fuel storage are site specific and should be considered on a case-by-case basis.⁷ Safe Haven believes that the individuality of each plant and its environmental surroundings necessitate separate evaluations of extended storage of spent fuel, but identified no site-specific factors which would result in significant environmental impacts. NRDC listed some site specific factors: geology, hydrology, seismicity, ecological factors and individual proposals for spent fuel management and storage. However, NRDC did not suggest how these factors could lead to significant site-specific environmental impacts that would preclude the

⁷Safe Haven also suggested that a full environmental and safety review should accompany any utility's proposed plans submitted pursuant to 10 CFR 50 (§ 50.54(a)) for extended storage of spent fuel. The Commission will treat its review of any such utility proposal in accordance with the established procedures for considering any application for a license amendment.

Commission from making a generic finding. Similarly, Wisconsin listed as relevant factors proximity to population centers, highways, geologic faults, dams, flood plains or shorelines affected by erosion, but offered no suggestion of how these factors could affect the Commission's generic determination. For example, there has been no discussion of why the Commission's seismic design requirements, though site specific, are not generically adequate to assure that spent fuel can be stored for up to 30 more years in a spent fuel pool designed to withstand the largest expected earthquake at each reactor site. Mr. Marvin Lewis contended that the fourth finding had no basis because the Commission had little or no experience with storing spent fuel for 30 years or with storing fuel that could be up to 70 years old. Mr. Lewis also asserted that the pyrophoricity of the zircaloy tubes containing spent fuel for 30 years presents an unknown fire danger. This comment is based on a private communication to Mr. Lewis regarding the condition of the spent fuel at Three Mile Island, Unit 2. By the terms of that letter, any fire danger associated with pyrophoricity of zircaloy arises from the accident conditions at TMI-2. NRC has previously studied the effects of loss of water from pools on the temperature of stored spent fuel (NUREG/CR-0649, "Spent Fuel Heatup Following Loss of Water During Storage" [March, 1979]). While this study noted that oxidation could become self-sustaining for temperatures in the neighborhood of 850-950° C (NUREG/CR-0649, page 13), the study shows that such oxidation can only occur for extreme temperature conditions and for spent fuel that has been stored for a relatively brief storage period. In order for rapid oxidation to occur, the age of the spent fuel (30,000 MWD/MT burnup) would have to be in the range of less than 10 days to less than two years, depending on the density at which it is stored (see page 55, Figure 17 of NUREG/CR-0649). Moreover, one must assume a continuing oxygen supply adequate to sustain the oxidation. Any damaged spent fuel such as that from TMI-2, would be canned to avoid particulate loss and would have already aged several years. Neither the heat load leading to temperatures capable of initiating rapid oxidation nor the presence of an adequate supply of oxygen to sustain a pyrophoric reaction would seem to be present in any storage configuration or under conditions that would receive NRC approval. While it is correct that spent fuel has not been

stored for over 30 years, the record shows that utilities have successfully stored spent fuel for over 20 years, and that there are no known physical processes which would indicate that it is impractical to extrapolate that experience to make predictions about the behavior of spent fuel for 70 years of storage.

The Utility Nuclear Waste Management Group—Edison Electric Institute and the U.S. Department of Energy referred to several documents in the record which show that the relatively low energy content of spent fuel and the relatively benign static environment of spent fuel storage render insignificant the radiologic impacts arising from extended storage of spent fuel. As discussed in more detail below, these documents also show that there are no significant non-radiologic environmental impacts arising from such extended storage. Under these circumstances, the Commission finds that it has sufficient experience with spent fuel storage to predict spent fuel behavior during 70 years of storage and to find that such storage will not result in significant environment effects.

B. Non-Radiological Consequences of Spent Fuel Storage

The Commission's fourth finding rested in part on the Commission's determination that there are no significant non-radiological consequences due to the extended storage of spent fuel which could adversely affect the environment. The public was invited to comment also on this finding and to provide a detailed discussion of any such environmental impacts. Mr. Marvin Lewis asserted that the continuous storage of spent fuel under water for 30 years or more requires unprecedented institutional guarantees. He also noted that there had been no consideration of financial, economic and security implications of storage for 30 or more years. Mr. Lewis did not expand upon these assertions to explain how they would result in significant non-radiological environmental consequences. In any event, the more than twenty years of experience with storing spent fuel demonstrates that storage of spent fuel for 30 years or more does not require unprecedented institutional guarantees or raise unique questions regarding finances, economics or the security of extended spent fuel storage. Further, the Commission will require all reactor licensees, 5 years before expiration of their operating license to provide a plan for managing the spent fuel prior to disposal. Moreover, the record

documents referred to by UNWWMG-EEL, DOE and AIF show that there are no significant non-radiological environmental impacts associated with the extended storage of spent fuels. The amount of heat given off by spent fuel decreases with time as the fuel ages and decays radioactively. No additional land needs to be devoted to storage facilities because reactor sites have adequate space for additional spent fuel pools or dry storage installations. The additional energy and water needed to maintain spent fuel storage is also environmentally insignificant. No commentator has challenged these assessments of environmental impacts and the Commission has no reason to question their validity. Under these circumstances, the Commission has no reason to reassess its prior determination that extended storage of spent fuel will present no significant non-radiological consequences which could adversely affect the environment.

3. Commission Compliance With NEPA

Several participants challenged the Commission's compliance with NEPA. The States of New York ("New York") and Wisconsin contend that since its inception, this proceeding has focused on the availability and safety of spent fuel storage, and has been conducted outside the scope of NEPA. New York supports this contention with the following quote from the First Prehearing Conference Order (February 1, 1980):

This rulemaking proceeding does not involve a major federal action having a significant impact on the environment, and consequently an environmental impact statement is not required by NEPA.

New York asserts that this statement caused the participants not to consider NEPA in their filings. Accordingly, New York believes that the Commission cannot now transform the Waste Confidence Proceeding into a NEPA proceeding. In New York's view, joined by the Natural Resources Defense Council, Inc. ("NEDC"), NEPA required the Commission to prepare an environmental impact statement ("EIS") or environmental assessment to consider the environmental impacts of spent-fuel storage at reactor sites beyond the expiration dates of reactor licenses. The Utility Nuclear Waste Management Group-Edison Electric Institute ("UNWWMG-EEI") believes that it has been clear from the outset of this proceeding that the Commission intended to develop environmental regulations appropriate to the issues considered here. UNWWMG-EEI cites several factors in support of its position:

(1) this proceeding was the direct outgrowth of a NEPA case, *Minnesota v. NRC*, 602 F.2d 412 (D.C. Cir. 1979); (2) the Notice of Proposed Rulemaking explicitly stated a Commission intent to deal with environmental aspects of spent fuel storage; (3) the proceeding was docketed under Part 51, the Commission's regulations implementing NEPA; (4) the Commission stated that it would draw on the record of the rulemaking on environmental impact of the nuclear fuel cycle (Table S-3) and included in the NRC Data Bank for this proceeding sources of information on the environmental impacts of spent fuel storage; and (5) several participants included in their statements information pertaining to the environmental impacts of spent fuel storage.

The Commission believes that from the very beginning of this proceeding, participants were on notice that environmental aspects of spent fuel storage were under consideration. The notice initiating this proceeding stated, in pertinent part:

If the Commission finds reasonable assurance that safe, off-site disposal for radioactive wastes from licensed facilities will be available prior to expiration of the facilities' licenses, it will promulgate a final rule providing that the *environmental and safety implications of continued on-site storage after the termination of licenses need not be considered in individual licensing proceedings*. In the event the Commission determines that on-site storage after license expiration may be necessary or appropriate, it will issue a proposed rule providing how that question will be addressed.

Based on the material received in this proceeding and on any other relevant information properly available to it, the Commission will publish a proposed or final rule in the Federal Register. Any such final rule will be effective thirty days after publication.

44 FR 61372, 61273-61374 (1979). (Emphasis supplied).

It is clear from this notice that if the Commission found that onsite storage after termination of reactor operating licenses would be necessary or appropriate, then it would propose a rule for dealing with the question of environmental and safety implications of continued onsite storage. New York's reference to the statement in the First Prehearing Conference Order is inapposite. That statement addressed the issue of whether a decision in this proceeding would be a proposal for major federal action having significant impact on the environment so as to require an EIS. The Presiding Officer found that the decision itself would not require an EIS. His decision in no way implied a change in the scope of the

proceeding as announced in the notice initiating it.

There is also nothing about the Commission's fourth finding which requires an EIS. Neither New York nor NRDC has explained how this finding is a major federal action having a significant impact on the human environment. The finding provides a basis for a rule that provides that environmental impacts from extended storage of spent fuel are so insignificant as not to be required to be included in an impact statement. The validity of such a rule depends on the procedures used to promulgate it and the record supporting it. An EIS is not required because such a rule itself has no environmental impacts, significant or otherwise.⁸ To require an EIS here would be essentially to require an EIS to show that no EIS is required. Clearly such a result would be incorrect. Accordingly, the Commission finds that NEPA does not require an EIS to support the fourth finding.

4. List of Respondents

Respondents to the Commission's November 3, 1983 Order (48 FR 50746) To Reopen the Period for Limited Comment on the Environmental Aspects of the Commission's Fourth Finding in the Waste Confidence Proceeding

1. Attorney General of the State of New York (N.Y.)
2. Marvin Lewis (Lewis)
3. Sierra Club Radioactive Waste Campaign (Sierra)
4. Scientists and Engineers for Secure Energy, Inc. (SE2)
5. Safe Haven, Ltd. (S.H.)
6. American Institute of Chemical Engineers (AICE)
7. Atomic Industrial Forum, Inc. (AIF)
8. Utility Nuclear Waste Management Group—Edison Electric Institute (UNWMC-EEI)
9. Natural Resources Defense Council, Inc. (NRDC)
10. Attorney General of the State of Wisconsin (Wis.)
11. U.S. Department of Energy (DOE)
12. American Nuclear Society (ANS)
13. Attorney General of the State of Minnesota (Minn.)

Appendix—Rationale for Commission Findings in the Matter of the Waste Confidence Proceeding

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1.0 Introduction

⁸ See, for example, *Natural Resources Defense Council, Inc., v. U.S. Nuclear Regulatory Commission*, 547 F.2d 633, 653, n. 57 (D.C. Cir. 1976), reversed on other grounds, *sub nom. Vermont Yankee Nuclear Power Corp. v. NRC*, 435 U.S. 519 (1978).

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2.4 Fourth Commission Finding

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1.0 Introduction

The rationale for the five Commission findings resulting from the Waste Confidence proceeding is summarized below. This rationale is based principally on the record of the proceeding which includes participants' position statements, cross-statements, pre-hearing and oral statements (in the discussion below, the participants are identified by the citations defined in the Reference Notation at the end of this document). The Commission also relied on the provisions of the Nuclear Waste Policy Act of 1982 (NWPA), and other substantive material not originally included in the record relating to the discussion of the safety of dry storage of spent nuclear fuel in the Commission's Fourth Finding; the NWPA and the dry storage material have now been incorporated into the record along with the relevant comments of participants in this proceeding.

The Commission notes that two relevant developments have occurred subsequent to the closing of the record in the Waste Confidence proceeding.

They are the publication of DOE's draft Mission Plan for the Civilian Radioactive Waste Management Program (April, 1984) and the Commission's concurrence in DOE's General Guidelines for Recommendation of Sites for Nuclear Waste Repositories (July 3, 1984). These developments are a matter of public record, and in the case of the Commission's concurrence was the conclusion of a separate public proceeding. The Commission has considered the effects of these developments on its previously announced decision in this proceeding and determined that these developments do not substantially modify the Commission's previous conclusions.

2.0 Rationale for Commission Findings

2.1 First Commission Finding

The Commission finds reasonable assurance that safe disposal of radioactive waste and spent fuel in a mined geologic repository is technically feasible.

The Commission finds that safe disposal of high-level radioactive waste and spent fuel is technically possible and that it is achievable using existing technology. Although a repository has not yet been constructed and its safety and environmental acceptability demonstrated, no fundamental breakthrough in science or technology is needed to implement a successful waste disposal program. Those participants who questioned the availability of a repository did not contend that fundamental scientific breakthroughs were required, but questioned whether technical problems could be resolved in a timely manner. The record supports the conclusion that the safe disposal of high level radioactive waste and spent nuclear fuel from licensed facilities can be accomplished.

The Department of Energy's (DOE) position is that disposal in mined geologic repositories can meet the goal of providing safe and effective isolation of radionuclides from the environment (DOE PHS pp. 2, 4; Tr. p. 11). A number of participants stated that waste containment and isolation from the biosphere are scientifically feasible (USGS PS p. 4; NRDC PS p. 9; UNWGM-EEI PS, Doc. 1 p. 22, Doc. II p. II-6; Consolidated Industry Group Tr. p. 16; Consolidated States Group Tr. p. 98). This view is consistent with the conclusions of the *Report to the American Physical Society by the Study Group on Nuclear Fuel Cycles and Waste Management (Rev. Mod. Phys., Vol. 50, No. 1, Pt. II, p. S6, Jan. 1980)* and the *Report to the President of the Interagency Review Group on Nuclear*

Waste Management (Final Report, March, 1979, p. 38).

The conclusion that safe radioactive waste disposal is technically feasible is based on consideration of the basic features of repository design and the problems to be solved in developing the final design. A mined geologic repository for disposal of high-level radioactive waste, as developed during the past three decades, will be based on application of the multi-barrier approach for isolation of radionuclides. The high-level radioactive waste or spent fuel is to be contained in a sealed package and any leakage from the package is to be retarded from migrating to the biosphere by engineered barriers. These engineered barriers include backfilling and sealing of the drifts and shafts of the mined repository. We believe that the isolation capability and long-term stability of the geologic setting provide a final barrier to migration to the biosphere.

The selection of a suitable geologic setting is one of the key technical problems which DOE must solve. Other problems include development of waste packages that can contain the waste until the fission product hazard is greatly reduced and engineered barriers that can effectively retard migration of radionuclides out of the repository. The Commission recognizes that these three problems are not only the ones which DOE's program must solve, but they are critical components of the multi-barrier approach for nuclear waste isolation. Much of the discussion in this proceeding has focused on these problems. We have reviewed each of these issues and have concluded that they do not present an insoluble problem which will prevent safe disposal of radioactive waste and spent fuel.

A. The Identification of Acceptable Sites

There is general agreement among the participants that the period during which the wastes must be isolated from the biosphere is at least several millennia and that such prolonged isolation can be achieved in a deep mined repository provided the geologic setting is suitable. The geologic setting is the "final" isolating barrier. If the waste package and engineered barriers fail to perform as expected, the geologic barrier must prevent harmful quantities of radioactive materials from entering the human environment.

The Commission believes that technically acceptable sites exist and can be identified. In many locations in the continental United States there are geologic media potentially suitable for a waste repository. These media occur in

large, relatively homogeneous and unfaulted formations and have properties (e.g., mechanical strength, thermal stability, impermeability to water) which qualify them as potential host rocks for radioactive wastes. The potential host rocks include those being investigated by DOE—that is, domed salt, bedded salt, tuff, basalt, granite, and shale (DOE PS pp. II-70 to II-80). Thousands of square miles of the United States are underlain with formations containing extensive masses of such potential host rocks. Moreover, more than one-half of the United States is underlain with rock that has been stable against significant deformation and disruption for over ten million years. The potential sites being investigated by DOE are in regions of relative tectonic stability (USGS PS pp. 19, 23, 24, 25, 26, 28; Tr. p. 236).

Host rock suitability and formation stability are not the only relevant technical factors to be considered in repository site selection. Geohydrologic conditions—particularly the absence of significant groundwater flow from the repository to the biosphere—must be favorable for effective isolation of the wastes (USGS PS p. 11). DOE's investigations reveal that the hydrologic characteristics of a major portion of the sites underlain with stable formations of potential host rock appear to be suitable for repository location (Tr. p. 236; DOE PS p. II-77).

These general conclusions about the extent of potential repository sites are based on the results of DOE's site exploration program (DOE PS Appendix B) and the extensive body of earth-sciences information available at the United States Geological Survey—the Federal agency principally concerned with earth-sciences issues and, under a DOE-USGS Memorandum of Understanding, a primary source of geologic, hydrologic and mineral resource data for the National Waste Terminal Storage program (USGS PS p. 2 and Appendix A; DOE PS p. III-44).

DOE's site exploration efforts are focused on four host rocks (domed salt, bedded salt, basalt, and tuff) in six regions (Gulf Interior, Paradox Basin, Permian Basin, Salina Basin, DOE Hanford Site, DOE Nevada Test Site) (DOE PS Appendix B). Although investigations of granite sites in the U.S. have been limited, DOE is developing data on the potential of granite as a host rock in collaboration with foreign investors. A Swedish-American cooperative program (DOE's Lawrence Berkeley Laboratory is the U.S. principal in the program) has involved a series of *in situ* tests in a granite formation

conducted at the Stripa mine in Sweden. The investigations included determinations of thermally induced stresses and deformations in the granite rock mass. Another cooperative study at Studsvik in Sweden involved experiments in nuclide migration in fractured subsurface crystalline rocks (DOE PS p. II-258).

Some participants objected to the fact that most of DOE's site exploration involved federally-owned or -controlled areas, arguing that this would result in ignoring sites that were technically better (NRDC PS p. 17; Tr. p. 208). This objection, apparently based on the assumption that Federal lands investigated were limited in area and geologic diversity, is not supported by the record. The Federal lands being investigated by DOE are extensive and geologically diverse; moreover, they are more readily accessible to DOE and some of them, such as Nevada Test Site, have been previously subjected to extensive geologic assessment. These latter factors are significant advantages (DOE PS Appendix B; UNWMC-EEI CS p. IV B-4). Although, as the United States Geological Survey pointed out, there may be advantages from a purely earth-science viewpoint in examining all parts of the country for their potential as repositories, time and resource limitations require that site exploration efforts be concentrated in limited regions fairly early so that detailed site-specific characterization efforts can be undertaken in a timely way (USGS PS p. 17).

A specific site has not yet been identified as technically acceptable, and investigations of potential sites have shown some to be unsuitable. This does not necessarily mean that DOE's site selection program will be unsuccessful in identifying technically acceptable sites. The elimination of some sites is to be expected in a pursuit of the site selection program and is not, as some participants implied, an indication that suitable sites cannot ultimately be found.

Although the record of this proceeding does not show that DOE has progressed far enough in site characterization to confirm the existence of an acceptable site, the record does indicate that DOE's site characterization and selection program is technically sound. The data obtained in each stage of the screening process are analyzed and compared against criteria that must be satisfied for adequate performance of the total isolation system. DOE's program is providing information on site characteristics at a sufficiently large number and variety of sites and geologic

media to support the expectation that one or more technically acceptable sites will be identified (DOE PS pp. III-8 to III-24; CS p. II-140). As discussed above, DOE's site screening efforts have concentrated on a diverse set of potentially suitable geologic media and are directed to an examination of large areas of the country on both federally-owned and non-federal lands (USGS PS p. 17).

The technology for site identification is particularly well-advanced (UNWMC-EEI PS p. III-A-B79). The record describes numerous site characterization techniques, both remote sensing and *in-situ*, which are being used to evaluate sites (DOE PS pp. II-84 to II-103). The location and demonstration of acceptability of repository sites are problems which can be solved by the investigative and analytical methods now available (AEG PS p. 1). Site selection criteria are being refined (DOE PS pp. II-80 to II-83; 48 FR 5671, February 7, 1983) and the technology exists for site characterization (DOE PS pp. II-84 to II-103). Areas have been found where most natural geologic and hydrologic processes operate at rates favorable to long-term containment in a mined repository (DOE PS p. II-128; Consolidated Industry Group PHS p. 9).

The Commission recognizes that there are gaps in the current state of knowledge about potential repository sites and geologic media, and about geochemical processes which affect radionuclide migration (e.g., CEC PS pp. 17, 54; NRDC PS pp. 18, 50, 64; NY pp. 38, 80; USGS CS pp. 5, 6). The gaps include a lack of a detailed understanding of such relevant processes as sorption of radionuclide-bearing molecules by the geologic media, leaching of the wastes by groundwater, and radionuclide migration through subsurface formations. Some participants contend that these gaps and uncertainties in knowledge make it difficult to predict on the basis of any effort less than a detailed on-site investigation whether a candidate repository site will be technically suitable (e.g., NRDC PS pp. 18, 50, 53; ECNP PS pp. 3, 4; NECNP PS pp. 20, 21, 22).

The Commission recognizes that detailed site characterization is necessary to confirm that a proposed site is indeed suitable. The Commission does not believe, however, that all uncertainties must be resolved as a pre-condition to repository development. The performance of a repository may be bounded by using conservative values for controlling parameters, such as waste form solubility, ground water

travel time and retardation of radionuclides. Furthermore, bounding analyses can be useful to take residual gaps in knowledge and uncertainties into account. If it can be established that a repository can perform its isolation function using established, conservative values for the controlling parameters, then it is not necessary to resolve uncertainties in the range of value these parameters may exhibit (DOE CS pp. II-83, II-84, II-130, III-9, III-12).

The statements of those participants who are pessimistic about timely accomplishment of disposal tend to assign equal importance to all areas of uncertainty. Hence, they contain few attempts to assess the consequences of gaps in knowledge or to project the benefits of expected results from ongoing research and development efforts. It is the Commission's belief that the waste isolation system elements are adequately understood so that major unforeseen surprises in results of research and development are highly unlikely. This view is supported by USGS (USGS CS pp. 1-2).

A further concern of some participants is that, even if DOE were to identify a potentially acceptable repository site, the *in-situ* testing required to determine acceptability would breach the integrity of the candidate site (NY PS pp. 59, 63-65). If, for example, boreholes essential to characterize a potential site result in penetration of aquifers which are not amenable to effective sealing, this might make the site unacceptable (DOE PS pp. II-161 to II-164). However, no persuasive evidence was presented in the record to support the position that *in-situ* tests for site characterization work are likely to compromise the integrity of candidate sites. The Commission believes that *in-situ* tests can be successfully accomplished without adversely affecting site integrity for the following reasons. Many non-destructive remote sensing methods are available for determining site characteristics. Further, boreholes can be located in shafts or pillars of the future repository to minimize the possibility of leakage through them.

As discussed later, borehole sealing methods are expected to be adequate. The number of boreholes necessary to adequately characterize a site can be minimized by careful planning and by use of remote sensing methods in conjunction with the drilling program (DOE PS pp. II-84 to II-103, II-181). Finally, the Commission believes that if a site is found to be sufficiently sensitive to the testing program so that its integrity would be destroyed, then

that site would necessarily be found unacceptable.

In summary, the Commission believes that technically acceptable sites for disposal of radioactive waste and spent fuel exist and can be found. There are a number of suitable host rock type to select from; many areas are underlain with massive, stable formations containing these host rocks; the areas being investigated by DOE contain such rock formations; and the uncertainties in knowledge of the earth and material sciences relevant to the identification of an acceptable repository site are not fundamental uncertainties that would prevent the identification of technically acceptable sites. Further, *in-situ* testing required to characterize a candidate site would not necessarily compromise its integrity.

B. The Development of Effective Waste Packages

1. *Waste Package Considerations.* An important technical aspect of safe waste disposal is to assure that the waste form and the balance of the waste package, including the primary container and ancillary enclosures, are capable of containing the radioactivity for a time sufficient for the hazard from fission-product activity to be significantly reduced (e.g., DOE PS p. II-8). Decay heat, groundwater and nuclear radiation could cause the waste package components to interact with each other or with the host rock materials in such a way as to degrade the ability of the package to contain the radionuclides. These items are discussed below.

To assure long-term containment, DOE's conceptual design of a waste package is based on a defense-in-depth approach and involves a number of components including spent fuel, stabilizer (or filler), waste canister, overpack, and an emplacement hole sleeve. The stabilizer is intended to improve heat transfer from the spent fuel, to provide mechanical resistance to possible canister collapse caused by lithostatic pressure, and to act as a corrosion-resistant barrier between the spent fuel and the canister. Selection of canister overpack and emplacement hole sleeve materials will be based on tests of their chemical and physical integrity at various temperatures and levels of radiation and under various conditions of groundwater chemistry, as well as tests of their compatibility with each other and with the host rock materials under repository conditions. The canister, overpack, and sleeve should constitute relatively impermeable elements of the waste package. A variety of candidate materials is being considered for these

elements. The various waste package components are to be combined in a conservative design that will compensate for the overall technical uncertainties in containment capability. The requirement for retrievability during some specified period after emplacement places conditions (e.g., ruggedness) on waste package design which are added factors to be considered in its development (DOE PS p. II-129 to II-152, II-282).

It is apparent from the foregoing that the development of an effective waste package depends on obtaining engineering data on those materials that appear to be promising candidates for package components. DOE is studying over 28 candidate materials for canisters and overpack (DOE PS p. II-143). The DOE evaluation program indicates that many of these materials are promising. For example, iron alloys have demonstrated long term durability (DOE PS p. II-144, Reference 383), and titanium alloys and nickel alloys show high resistance to corrosion (DOE PS p. II-144, Refs. 315, 338, 342). Ceramics are resistant to chemical degradation and have many other desirable properties (DOE PS p. II-145, Refs. 337, 347, 348 and 349). Preliminary analysis indicates that mild steel canisters with an appropriate backfill material would be a feasible waste package for either a salt or hard rock repository. For more demanding requirements, such as brine applications, the alloys of titanium, zirconium or nickel appear to represent alternate choices (DOE PS p. II-150, Refs. 337, 382). The DOE program also includes experimental studies of the release of radioisotopes from spent fuel exposed to simulated repository conditions (e.g., salt brine and fresh water with varying dissolved oxygen content). The studies are being conducted under temperature and pressure conditions that bound and exceed repository conditions (DOE PS pp. II-139 to II-141).

Not all participants were optimistic about waste package development. One participant asserted that in spite of DOE's efforts to develop a package that would remain inert and stable under repository conditions, none had yet been found and the DOE program would not succeed in finding one (NRDC PS p. 46). Other participants pointed to the limits of present knowledge, particularly about the leaching of radioisotopes from spent fuel in a groundwater environment, and concluded that it is not possible to select a waste form which will prevent radioisotopes from migrating to the biosphere (e.g., CEC PS p. 51). They also pointed out that chemical and physical

properties of spent fuel varied widely and depended on burnup, location within the reactor core, age, and physical integrity; design of a system of barriers to accommodate this heterogeneity within the context of a given geohydrologic environment would be a major undertaking (NY PS p. 83).

The Commission recognizes the difficulties which must be overcome in developing a suitable waste package. A large body of experimental data must be accumulated and applied to a variety of candidate arrangements of waste package components. Suitably conservative assumptions must be postulated to define the repository conditions. Data from experiments of relatively short duration have to be used to predict behavior for much longer periods. It is common practice in materials research to perform short-duration experiments under physical or chemical conditions much more severe than those expected for the longer duration and, from known fundamental properties of the materials under investigation, to extrapolate the experimental data to predict long-term behavior. Conservatism can usually be assured by making the experimental conditions sufficiently severe.

The complex composition of the mixture of radionuclides in fission products and their basic chemical properties are known and have been the subject of investigation for more than three decades. The large body of published data on fission product chemistry and experience with fission product mixtures should provide considerable support for predicting the behavior of spent fuel and high-level radioactive waste in waste package designs.¹ The Commission, therefore, concludes that the chemical and physical properties of spent nuclear fuel and high-level radioactive waste can be sufficiently understood to permit the design of a suitable waste package.

The Commission also concludes that the DOE program is capable of developing a suitable waste package which can be disposed of in a mined geologic repository. This conclusion is based upon the large number of candidate materials being considered by DOE, the detailed evaluation of these

¹Published compilations of such data, although not specifically included in the record of this proceeding, are well known to the nuclear science and engineering community. Examples are the three volumes of the National Nuclear Energy Series, "Radiological Studies: The Fission Products," by C. D. Coryell and N. Sugarman, McGraw-Hill, 1951; "Reactor Handbook," Second Edition, Vol. II, Fuel Reprocessing, edited by S.M. Stoller and R.E. Richards, Interscience Publishers, Inc., New York, 1961).

materials to be conducted as part of the DOE program and the results of DOE's preliminary analysis of candidate materials, as described above [see Sec. 2.1(b)(1)]. The Commission's conclusion that the development of a suitable waste package is technically feasible is also consistent with other material in the record. For example, a study sponsored by the National Academy of Sciences (NAS) concluded that no insurmountable technical obstacles were foreseen to preclude safe disposal of nuclear wastes in geologic formations (UNWMC-EEL PS Doc. 2 p. II-6). The United States Geological Survey stated that a long-lived canister is within the capability of materials science technology to be achieved in the same time frame as repository site identification, qualification and development (USGS PS p. 11). The National Research Council, after reviewing the Swedish waste disposal work (DOE PS p. II-335 Ref. 380), concluded that the Swedish waste package could contain the radionuclides in spent fuel rods for hundreds of thousands of years (DOE CS p. II-98).

2. Effect of Reprocessing on Waste Form and Waste Package. The waste form itself (spent fuel or other high-level waste) serves as the first barrier to radionuclide release and thus supplements the containment capability of the other components of the waste package as well as the repository's natural isolation capability. Throughout this proceeding it has been assumed that the waste form would be spent fuel discharged from light water reactors, with mechanical disassembly for volume reduction and packaging in a canister as the only potential modifications. The relevant properties of the spent fuel (irradiated uranium dioxide pellets and zircaloy cladding) are known. DOE's program has been directed toward providing data to determine the behavior of spent fuel as a waste package component under repository conditions. In its Position Statement DOE stated that the "representative case" to be considered in this proceeding is the disposal and storage of spent fuel from commercial reactors and that this does not foreclose "other approaches, such as the reprocessing of spent fuel and solidification of resultant nuclear wastes" (DOE PS p. I-2).

⁴ On August 27, 1981 the National Resources Defense Council filed a Motion for Judgment requesting a prompt ruling that, on the basis of the present record, there is not reasonable assurance that off-site storage or disposal will be available by the year

2007-09. NRDC stated that, because the present Administration¹ had changed Federal policy towards commercial reprocessing of spent fuel (reprocessing was deferred "indefinitely" in April 1977 by the previous Administration), the disposal of spent fuel would be contrary to the present Administration's policy, and thus spent fuel was no longer a valid "reference waste form" for this proceeding. As a consequence, according to NRDC, DOE schedules and timetables, which were based on spent fuel storage and disposal, were irrelevant. The NRDC view was challenged by DOE as well as by seven participants representing utilities and the nuclear industry. The Commission took note of the NRDC filings and the responsive filings by other participants, considering them part of the record, and in its November 6, 1981 Second Prehearing Memorandum and Order asked the participants to address the significance of commercial reprocessing to the Commission's decision in the waste confidence proceeding. In response, the participants addressed this change in government policy in their prehearing statements filed in December 1981.

In response to those who argued that the change of reprocessing policy invalidated DOE's position, DOE stated that the program for development of the technology is not dependent on the waste form. Moreover, DOE pointed out that the purpose of this proceeding—"to determine whether there is at least one safe method of disposal or storage for high-level radioactive waste" is not changed by this Administration's support of reprocessing of spent fuel (DOE PHS pp. 2-3). Some participants who agreed with DOE commented that spent fuel disposal involves greater difficulty than disposal of solidified reprocessing waste because of its higher radioactivity and less easily handled form; in addition, they asserted that the removal of the uranium and most actinides by reprocessing would ease the requirements for safe long-term storage and simplify the waste disposal problem (UNWMC-EEL PHS p. 16; SE2 PHS p. 4). Others contended that spent fuel is a more difficult waste form because heat dissipation and packaging problems involved in disposal appear to be more severe than in disposal of solidified reprocessing waste (AIF PHS p.8; ANS PHS p. 5).

The Commission recognizes that the proceeding has been primarily

¹The NRDC statement was based on DOE testimony before a Congressional committee. The President's Nuclear Policy Statement of October 8, 1981 confirmed the DOE testimony.

concerned with storage and disposal of spent fuel. However, the Commission does not believe that the possibility of future reprocessing, and the potential need to dispose of high-level radioactive waste resulting from reprocessing, significantly alters the technical feasibility or the schedule for developing a mined geologic repository and the design of its multiple barriers.

With regard to technical feasibility, the effect of spent fuel reprocessing on the commercial radioactive waste disposal problem is not a new consideration. The disposal of waste from reprocessing spent fuel has been studied for a longer time than the disposal of spent fuel. Until 1977, the commercial waste management program was directed primarily toward disposal of waste from spent fuel reprocessing, and those efforts have continued. A variety of waste forms has been studied (DOE PS pp. II-153 to II-160). Thus, considerable information is already available on the technical feasibility of developing a suitable waste form for reprocessed high-level radioactive waste. In fact, there is evidence that the disposal of reprocessed high-level waste may pose fewer technical challenges than the disposal of spent fuel (Tr. p. 29). Moreover, commercial reprocessing of spent fuel cannot be undertaken in this country in the absence of a full NRC licensing review. That review will consider, among other things, the waste form to be produced by the reprocessing method and its implications for waste disposal. Unless the Commission determines that commercial reprocessing and management of its products assure adequate protection to the public health and safety and the common defense and security, spent fuel will continue to be the predominant commercial waste form available for disposal in a repository.

With regard to the impact on DOE's repository schedule, the Commission recognizes that DOE's waste package development program will eventually be affected to some extent by the nature of the waste form under development. However, the direction taken in research and evaluation of materials being conducted in the DOE program is expected to produce results which would be relevant to the waste package design, regardless of which waste form is used (DOE PS pp. II-141 to II-152, CS pp. II-98 to II-100). Moreover, the choice of waste form will not significantly affect other elements of the DOE repository program. The storage and disposal of reprocessed waste would involve substantially the same problems as those being addressed for spent fuel;

and a change in waste form would not alter the site-selection program or the program for development of suitable engineered barriers (DOE PHS p. 3). Thus, DOE's program is proceeding on a basis that would permit the disposal of either high-level waste or spent fuel. This approach is consistent with the recommendations of the Interagency Review Group in its March 1979 report to the President (IRG Final Report, p. 73) and with the direction in the Nuclear Waste Policy Act of 1982 (Sec. 111(a)(2)). Finally, as noted above, any decision to permit the commercial reprocessing of spent fuel will include consideration of the reprocessed waste form and its implications for waste disposal. For these reasons, the Commission concludes that the possibility of commercial reprocessing does not substantially alter the technical feasibility of, or the schedule for, developing a suitable waste package.

The Commission concludes that the basic knowledge of spent fuel and high-level waste and its behavior in a repository environment, together with DOE's ongoing development and testing program, are sufficient to provide assurance that a waste package can be developed that will provide adequate containment until the potential hazard from the fission product activity is sufficiently reduced.

C. The Development of Effective Engineered Barriers for Isolating Wastes From the Biosphere

1. *Backfill Materials.* In DOE's conceptual design, one engineered barrier consists of backfill materials for filling voids between canister, overpack, sleeve and host rock. The materials are chosen to retard radionuclide migration. The task is to design and test barrier materials which will be effective for very long periods of time. Candidate materials include bentonite, zeolites, iron, calcium or magnesium oxide, tachyhydrite, anhydrite, apatite, peat, gypsum, alumina, carbon, calcium chloride, crushed host rock, and others (DOE PS p. II-147). Host rock or other materials would also be used to backfill drifts and shafts within the repository.

The California Department of Conservation (CDC) contends that repository shaft and borehole backfill material performance may be degraded as a result of increased temperature and other factors (CDC PS pp. 19-22). However, the expected temperature rise in the shaft backfill material will be only about 10 Farenheit degrees, and will cause no significant degradation of the shaft backfill material (DOE, PS p. II-347 Ref. 527 NUREG/CR 0495). Other participants believe that there is

inadequate information to permit development of long-lived engineered barriers that will effectively contain high-level radioactive wastes (NRDC PS pp. 18, 32; I11 PS pp. 3-4; NECNP PS p. 18). CDC further contends that at this time, no information appears to have been developed that specifies the best type of backfill material to be used in particular geologic media (CDC PS pp. 19-22). However, the choice of backfill must take into account the rock media at the selected site as well as the waste package material. Thus, the backfill cannot be selected until a repository site has been selected. The NWTS program has as its objective, providing information on a practical range of options for backfill materials. Although a considerable amount of work remains to be done, an active research and development program on backfill materials is underway (DOE PS p. II-147). Further, that program is providing information to evaluate the backfill material options, as well as to establish a basis for selection of a suitable material for the geologic media being considered. The Commission believes that this approach provides an adequate basis for concluding that effective backfill materials will be identified in a timely fashion.

In the National Waste Terminal Storage program a wide range of candidate backfill materials have been and are continuing to be evaluated (DOE PS II-129 to II-152). The DOE studies include measurements of the appropriate properties of backfill material including nuclide sorption capacities, capability to prevent or delay ground water flow, thermal conductivity, mechanical strength, swelling, plastic flow and methods of backfill emplacement. Data on available candidate materials show significant radionuclide sorption capabilities and sorptive properties can be maintained at elevated temperature and in the presence of radiation (DOE CS pp. II-98, II-99). Analyses indicate that several of the materials could provide adequate performance characteristics (DOE PS, Part II, Ref. 339, 340, 346, 372, 374, 376). As an example of the development of effective engineered barriers, the results of Swedish studies on radionuclide release in a repository were cited. The studies showed that a bentonite clay backfill, in conjunction with a thick copper canister (with spent fuel inside) could prevent the release of radionuclides to the host rock in the presence of granitic ground water for thousands to hundreds of thousands of years. In the Swedish experiments, the clay barrier provided sorptive properties

which were predicted to delay the breakthrough of various radionuclides for thousands of years and also served to chemically condition the ground water, reducing its corrosive effect on the canister (DOE PS pp. II-145, II-148). The use of certain clays to retard the transport of radionuclides released by the waste package is applicable to repository designs here in this country. While DOE has not proposed using thick copper canisters as employed in the Swedish studies, this example of a durable combination of waste package and backfill material which was demonstrated to be effective in isolating radionuclides for very long times, indicates that the basic approach is reasonable. The use of clays, combined with other appropriate materials, could provide an effective means for radionuclide retardation and corrosion control.

In sum, the Commission believes that DOE's ongoing developmental studies reported in this proceeding (DOE PS pp. II-129 to II-152) are technically sound and provide a basis for reasonable assurance that engineered barriers can be developed to isolate or retard radioactive material released by the waste package.

2. *Borehole and Shaft Sealants.* A major factor in repository performance is the effective sealing of boreholes and shafts during repository closure operations. All penetrations provide potential pathways for radionuclides to reach the biosphere or for ground water to enter the repository. The penetrations must be sealed for an extended period of time. Further, the geology and hydrology at a particular site, as well as the expected temperature and pressure conditions during repository lifetime, must be understood in order to make a proper choice of the borehole and shaft sealing materials and to develop effective borehole and shaft seals.

Some participants concluded that current information concerning the technology for the sealing of the boreholes and shafts is inadequate. They also questioned the capability of the DOE program to develop sufficient information to allow effective seal design (CDC PS pp. 19-22; NRDC PS p. 5). The views of several participants who expressed concern about sealing were reflected in the comments of CDC. The Commission's response to each of the points raised by CDC on borehole and shaft sealing issues is discussed below.

CDC indicated that since long-term effects of heat and radiation on seal materials were not a factor in past oil and gas borehole sealing experience,

such experience is not applicable to repository sealing.³ However, at distances of more than several feet from waste canisters emplaced in a repository, radiation exposures are small and the temperature rise at seals in the shafts and boreholes is insignificant for sealing purposes (DOE CS II-108).

CDC also believes that the tests of cement seals with epoxy resins in bedded salt deposits discussed by DOE are insufficient to provide assurance of seal stability over a period of 10,000 years, especially when the effects of higher temperature and radiation are not included. As noted above, temperature and radiation effects on seals are expected to be negligible.

While these tests may not provide conclusive proof of performance for 10,000 years, they are expected to provide useful information for seal development.

CDC states that the results of field tests described by DOE as continuing over the next few years will not be completed in time to contribute to seal design criteria which are to be completed⁴ in 1982. However, the final seal design for the selected site is scheduled for two years after a site is selected (DOE PS p. II-184). Testing up to that date is expected to be useful in designing an effective seal.

CDC questioned whether tests of waste package system component interactions with the surrounding media in bedded salt described by DOE will be completed in time for location of a repository. However, the Commission finds no basis for this assertion in the record. The DOE program appears to be adequately addressing this issue. Studies are in progress to characterize further the interactions between candidate backfill-gel materials and waste container alloys. These studies include investigations of dry rock salt/metal interactions and high intensity radiation/salt/brine/metal interactions. (DOE PS p. II-149, II-150).

CDC asserts that DOE has not discussed designing backfill material and penetration seals to allow for safe reentry if retrieval should become necessary. However, the provision to retrieve high-level waste and spent fuel for a number of years after the repository is filled has been addressed

by DOE (DOE PS pp. II-280 to II-283). Although it has not yet been established whether backfilling and sealing will be conducted before repository closure, these operations may be reserved until a final decision for closure is made. In any event, CDC provides no basis for concluding that providing for retrievability will necessarily create any major difficulties for the design of backfill material and penetration seals.

According to one participant, "There is no established way to seal a repository so as to prevent radionuclide release to the biosphere for the necessary period of time. DOE has termed the sealing problem a 'key unknown' but there is no consensus that the technology which is currently anticipated will provide adequate seals for even a few decades" (Consolidated States Group PHS p. 8). Other participants maintained that seals must perform as well as the host rock in preventing radionuclide migration (NRDC PS p. 55). The DOE position is that the seal should provide a barrier with sufficient integrity to ensure acceptable consequences and sealing adequacy should be determined only on a site-specific basis (DOE CS p. II-106). DOE asserted that its program will successfully resolve remaining uncertainties in repository sealing technology (DOE CS pp. II-106 to II-109).

DOE has been studying cement-based borehole plugging and has examined use of grout materials for application to the Waste Isolation Pilot Plant (WIPP) and other potential repository sites. Earth-melting technology for plugging in salt and use of compacted natural earth materials are also being investigated (DOE PS p. II-183, CS p. 106-109). There is a considerable body of experience in sealing subsurface formations in the oil, gas, and other mineral extraction industries. However, related industrial experience and requirements for sealing a repository differ in one important respect: repository sealing must be effective for a very long time while most other sealing applications are for relatively short time periods (DOE PS p. II-182). Future DOE effort will be needed to verify borehole seal performance and durability for each candidate medium. An important aspect of DOE's work is to determine the rate of degradation of seal performance as a function of time. DOE plans to determine seal performance specifications for a particular site on the basis of calculated predictions of radionuclide release and transport to the accessible environment (DOE PS p. II-182). These predictions are expected to

indicate that a site whose characteristics for waste isolation are clearly superior may not require sealing performance specifications as stringent as those for a less favorable site.

Based upon the extensive experience with shaft and borehole sealing in other industries and DOE's detailed program for evaluating the long-term performance of seals, the Commission believes that there is a reasonable basis to expect that long-term effective borehole and shaft seals can be developed.

D. Summary of Views on the Technical Feasibility of Safe Waste Disposal

The Commission notes that participants in the Waste Confidence Rulemaking proceeding have generally agreed there are no known fundamental technical problems which would make safe waste disposal impossible. Where they differ is the extent to which the technical problems of disposal technology and siting have already been solved and the capability of DOE to solve them, and particularly to solve them by 2007-09 or by the expiration date of reactor operating licenses (e.g., NY PS p. 3; NECNP PS p. 171; Minn PS pp. 13-20 of Enclosure).

The Commission believes that the record provides a basis for reasonable assurance that the key technical problems can be solved. Technically acceptable sites exist and can be found among the various types of geologic media and locations under investigation by DOE. Currently developed geophysical methods for site evaluation appear capable of adequately characterizing the site, and the residual uncertainties in earth sciences data do not seem to be an insurmountable impediment. Further, the Commission believes that the multi-barrier approach to waste package design is sound and that package development is being adequately addressed by DOE. DOE's development work on backfill materials and sealants provides a reasonable basis to expect that backfill materials and long-term seals can be developed. Reprocessing of spent fuel would only become a licensed commercial activity if disposal of reprocessing waste in a mined repository would be established as technically feasible. While the Commission recognizes that more engineering development and site-specific work on disposal technology will have to be conducted before a waste repository can be constructed and operated, the Commission concludes that it is technically feasible to safely dispose of high-level radioactive waste

³The Commission notes that the extensive oil and gas borehole sealing experience has not been concerned with very long-term sealing. Therefore, DOE's sealing research and development must provide a basis to extend that experience for the development of long-term seals for a repository.

⁴DOE has published "Schematic Designs for Penetration Seals For a Reference Repository in Bedded Salt," ONWI-405, November, 1982.

and spent fuel in a mined geologic repository.

2.2 Second Commission Finding

The Commission finds reasonable assurance that one or more mined geologic repositories for commercial high-level radioactive waste and spent fuel will be available by the years 2007-09, and that sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time.

While the record of the proceeding supports a finding that disposal is technically achievable, the Federal government has, in the past, made inadequate progress in developing sound waste management policies and programs. The Commission notes that DOE has stated in its April 1984 draft Mission Plan that the first repository will begin operations in 1998, and that the second will start up in 2004. However, it is recognized that both technical and institutional issues contribute to uncertainties concerning DOE's ability to complete one or more mined geologic repositories for high-level radioactive waste by those dates. The technical issues concern DOE's ability to find technically acceptable sites in a timely fashion and the timely development of waste forms, packages, and engineered barriers. The institutional issues concern primarily Federal-state relations and the management and funding of the Federal program.

The Commission has considered the effect of enactment of the Nuclear Waste Policy Act of 1982 and concludes that the Act helps to reduce these scheduling and institutional concerns. The Act provides support for timely resolution of technical uncertainties by: (1) Establishing specific milestones for all the key tasks; (2) coordinating the activities of all the involved Federal agencies; (3) providing for time schedules and a mission plan for the accomplishment of the tasks; and (4) providing a mechanism for monitoring progress, for identifying failures to meet the schedules and the milestones, and for adjusting the future elements of the program in the event that such failures occur. In order to further enhance the resolution of technical uncertainties regarding rock thermal-geomechanics the Act provides for the establishment of a Test and Evaluation facility to carry out *in-situ* studies of rock at repository depth. The Act also reduces uncertainties in the institutional arrangements for the participation of

affected states in the siting and development of repositories and in the long-term management, direction and funding of the repository program. The Commission's assessment of both the technical and institutional factors is discussed below.

A. Technical Uncertainties

The ability to construct and operate a mined geologic repository that will provide for the safe disposal of high-level radioactive waste and spent fuel by the years 2007-09 has been challenged by several participants. In addition to the institutional issues which must be resolved, interrelated technical problems have to be solved in a coordinated and timely fashion. The Department of Energy is confident the technical problems can be solved as scheduled in the National Waste Terminal Storage Program plans (DOE PS p. III-86, CS p. III-13; DOE draft Mission Plan, April 1984). Other participants conclude that because of unresolved technical problems, DOE's schedule cannot be met (e.g., Consolidated Public Interest Group PHS pp. 2-7; Consolidated State Group PHS pp. 1-13). For convenience, we consider the technical controversy in two categories: (a) finding technically acceptable sites in a timely fashion, and (b) the timely development of waste packages and engineered barriers.

1. Finding Technically Acceptable Sites in a Timely Fashion. To assure the adequacy of a candidate site requires extensive onsite investigations including drilling or excavating, as well as analyses and technical evaluations. Although DOE has not yet begun subsurface site characterization to enable identification of an acceptable site, the record does indicate that DOE's site screening and selection program is providing information on site characteristics at a sufficiently large number and variety of sites and geologic media to support the expectation that one or more technically acceptable sites will be identified.

DOE is investigating four geologic media at a number of sites: domed salt (Gulf Interior Region); bedded salt (Paradox Basin, Permian Basin, Salina Basin); basalt (DOE's Hanford Site), and volcanic tuff (DOE's Nevada Test Site). Investigations in a fifth media (granite) are planned, but sites have not yet been determined (DOE PS Appendix B). Exploratory shaft excavation at three sites in different geologic media was to begin for basalt in April, 1983, for volcanic tuff in October, 1983, and for salt in December, 1983 (Tr. pp. 241-242). However, the Nuclear Waste Policy Act of 1982 (NWSA) imposed new

conditions which made it necessary to revise this schedule. The NWSA specified that DOE had to prepare environmental assessments for each of five nominated sites, from which three sites would be recommended to the President for characterization. DOE's preparation of environmental assessments and recommendation of three sites were to be accomplished in keeping with the provisions of the repository siting guidelines required by the NWSA. The Commission's concurrence in DOE's siting guidelines on July 3, 1984, enables DOE to proceed to nominate and recommend repository sites for characterization. DOE has recently published a revised schedule for site selection milestones in its April, 1984 draft Mission Plan. As described in its Mission Plan, the current status of DOE's site selection schedule calls for the issuance of environmental assessments for five nominated sites and the recommendation of three of those sites for characterization by December, 1984. DOE's schedule for work in the various geologic media is summarized below.

Salt: Resolution of the identified key screening issues in FY 1984 is expected to permit nomination of a candidate salt dome site in December, 1984. DOE is still choosing from among several salt domes in the Gulf Coast interior region (Tr. pp. 243-244; DOE Draft Mission Plan, April, 1984). For bedded salt, primary effort has been focused on the Palo Duro Basin in Texas, the Paradox Basin in Utah, and the Permian Basin, particularly the Delaware basin in the Los Medanos area, the site considered for the proposed WIPP. The Bureau of Land Management issued the report "Environmental Assessment of DOE Proposed Location and Baseline Studies in the Paradox Basin, Utah-Final" UT-060-51-2-11, in July, 1982. Each of the seven potentially acceptable salt sites has been evaluated for environmental conditions, and a site characterization plan is expected to be issued for salt in September, 1985. DOE will start land access and permitting activities for salt after negotiating agreements with affected states and Indian tribes (DOE Draft Mission Plan, April, 1984).

Basalt: The basalt formations at the Hanford reservation in the center of the Pasco basin (Columbia Plateau, central Washington) are prime candidates for repository sites. DOE expects to issue a site characterization plan for basalt in January, 1985 and start drilling for the exploratory shaft in March, 1985 (DOE Draft Mission Plan, April 1984).

Volcanic Tuff: The Nevada Test Site offers several suitable candidates for

waste repository siting. The primary focus is welded tuff on Yucca Mountain, where DOE has begun a program of drilling and geophysical evaluation. DOE expects to issue site characterization plan for tuff in March, 1985 and begin shaft work in September 1985 (DOE Draft Mission Plan, April 1984).

Granite: Granite and other crystalline rock media are being considered for the second repository (DOE Draft Mission Plan, April 1984). DOE has conducted only limited investigations of granite at the Nevada Test Site (DOE PS pp. B-86, B-72), but is developing data on the potential of granite as a repository medium in collaboration with Swedish investigators (DOE PS p. II-258). This project has already produced a large amount of rock thermal-mechanics data at repository depth for use in repository designs in granite media in this county (DOE PS pp. II-258 to II-260).

As indicated in our discussion of technical feasibility, the identification of technically acceptable sites is a key problem and the date of successful solution of this problem is a critical milestone in the repository program. Those participants who believe DOE could not meet its site selection schedule asserted that determination of the acceptability of proposed repository sites requires information that will not be available when needed. They maintained that DOE's knowledge is seriously incomplete with respect to all of the potential sites considered to date. Further, they asserted that because new information could disqualify any of the potential sites, as it did at the Palestine dome, there is, as yet, no basis for reasonable assurance that an acceptable repository site will be available in the time period under consideration (NRDC PS p. 44; NECNP PS p. 24). The Commission recognizes that if the DOE program were further along, e.g., in the middle of exploratory shaft work, there would be much more site-specific information available (including the results of *in-situ* tests) and a firmer basis for assessing whether DOE's revised schedule can be met. However, the Commission can make a reasonable prediction with the information now before it.

Underlying the pessimism of some participants is apparently a belief that DOE's past record in solving technical problems undermines the possibility of finding confidence in DOE's ability to solve the waste disposal problems in a timely way. The Commission acknowledges that in the past the waste programs of DOE and its predecessor organizations have experienced

difficulty in making timely progress toward a solution of the nuclear waste problem. However, the Commission need not rely on this past record in making its confidence determination. The DOE program is now adequately addressing the issues yet to be resolved in identifying an acceptable site and DOE's schedule is a reasonable one (see the discussion in Section 2.2 B.4 of this document). The qualifications and professional experience of the many scientists and engineers on the overview committees and peer review groups who advise and consult on the DOE program should provide confidence in DOE's efforts (DOE CS Appendix D). The support of the USGS in the earth sciences field (USGS PS Appendix A) clearly contributes to confidence that the technical problems associated with identifying an acceptable repository site will be solved. As noted before, no fundamental technical breakthroughs are necessary. Rather, completing the program is a matter of step-by-step evaluation and development based on ongoing site studies and research programs.

The Commission believes that the enactment of the Nuclear Waste Policy Act of 1982 provides impetus to that program and helps ensure that it will be completed on a schedule consistent with the Commission's findings. The Nuclear Waste Policy Act establishes a detailed step-by-step plan for developing a waste repository. The Act directs DOE to prepare a comprehensive Mission Plan which will establish programmatic milestones for research, development, technology demonstration and systems integration. The Act also requires the various Federal agencies involved in the program to coordinate their activities. Involved agencies must report their progress, or lack thereof, to Congress, explain any slip in schedule and set a new schedule for activities. Thus, the Act provides a framework and schedule for developing a repository.

The schedule set forth in the Act calls for the identification of adequate sites in time to meet the final decision date on construction authorization by the NRC and well before the time at which such action would be necessary to assure repository operation within the time period discussed in this decision. The time between sinking of an exploratory shaft and the completion of site characterization contemplated by the Act (Sec. 112, 114) is 26 months, with an extension to 38 months under certain conditions; the DOE schedule for these activities is generally compatible with this schedule (see Section 2.2 B.4 below).

The Nuclear Waste Policy Act also puts in place procedures (Sec. 115, 116, 117, 118, 119) which the Commission believes will help to resolve potential institutional problems that might affect the schedule for site selection. These are discussed in detail hereafter. The Commission believes that the provisions of the Act should also provide resources (Sec. 302, 303) to adequately fund the site selection and characterization work.

Given all of these considerations, the Commission concludes that there is reasonable assurance that technical uncertainties—unsolved technical problems and information gaps—will be removed in time for DOE to meet its proposed schedule. DOE's program is adequate and its schedule is reasonable. The Act provides a greater degree of confidence than existed previously that site selection will proceed within the general time frame that DOE has described in its position statement.

2. Timely Development of Waste Packages and Engineered Barriers. Some participants have expressed strong reservations concerning DOE's ability to develop waste forms, packages, and engineered barriers in a timely fashion. The DOE technical effort to solve problems was characterized as only just being defined in many significant areas, including the prevention of corrosion of waste canisters (NRDC PS p. 18). Other participants contended that: the design and evaluation studies of penetration seals and backfill material might not be completed soon enough to meet the goal of achieving an operational repository by 1997 to 2006; the long-term effects of heat and radiation on the integrity of the seal materials are not known; tests of cement seals with epoxy resin in bedded salt deposits are insufficient to assure stability of such seals over a period of 10,000 years; and field tests of liquid permeability during a period of three months cannot provide confidence concerning the stability of seals during a period of 10,000 years. Participants also contended that no information had yet been provided which specified the type of backfill material most suitable for specific geological media and capable of withstanding thermal stress (CDC PS pp. 19-22).

Although technical problems associated with the development of waste packages and engineered barriers could delay DOE's schedule, DOE believes that the uncertainties surrounding the waste package would be resolved or bounded as a result of implementation of its program (DOE PS p. II-160, CS p. II-96). The DOE Waste Package Program Plan (ONWI-96)

which was issued in August 1980, updated in June 1981 (NWTS-96) and updated further in DOE's April, 1984 Draft Mission Plan, sets forth details of DOE's program. Waste package performance criteria will be developed in the near future. Final action on the criteria will be contingent upon the final issuance of NRC's technical criteria [10 CFR Part 60, Subpart E], the publication of the relevant regulatory guides on waste packages, and the ONWI-33 series of criteria documents, i.e., the reports DOE/NWTS-33 (1), (2), (3), "NWTS Program Criteria For Mined Geologic Disposal of Nuclear Wastes."

Earlier, DOE had planned to complete the waste package preliminary designs for salt in September 1982, for basalt in June 1985, for tuff in June 1984, for granite in September 1984, and for argillaceous rock in December 1984, and to establish a baseline for waste form specifications by June 1983 (ONWI-96). According to DOE's April, 1984 draft Mission Plan, the current reference canister material for basalt is carbon steel. Alternative materials include an iron-chromium-molybdenum alloy, copper and a copper-nickel alloy. On the basis of preliminary corrosion-test results, carbon steel has also been selected as the reference canister material for salt. The titanium alloy Tricore 12 has been designated as an alternative material. Type 304L stainless steel has been identified as the reference container material for tuff; other austenitic stainless steels, Inconel and copper are alternatives. Waste-package conceptual designs have been developed for basalt, salt and tuff. [The conceptual design for tuff is based on saturated conditions; a conceptual design for the unsaturated zone will be available in late FY 84 [DOE draft Mission Plan, April 1984]].

Tests with spent fuel and borosilicate glass have been initiated under site-specific conditions for basalt, salt and tuff. Preliminary waste acceptance requirements have been developed for basalt and salt. In addition, for salt media, interim waste-acceptance requirements for borosilicate glass and draft waste acceptance requirements for spent fuel were prepared in FY 83. Preliminary requirements for tuff will be prepared in FY 84. DOE intends to submit the baseline waste form specifications developed during the conceptual design studies for acceptance by NRC. The specifications will be subjected to configuration control for application throughout the waste processing and disposal program.

According to the DOE Draft Mission Plan the complete waste package

performance model will be verified and validated by September 1989. Further, the program plan calls for completion of the waste package final design that takes into account the selected site environmental conditions, after completion of in-situ testing in FY 89 and FY 90. Packing material is included in the reference waste package only for basalt. The reference packing material for basalt is a mixture of crushed basalt and sodium-bentonite clay. Ongoing physical property testing of reference packing material is expected to be completed in FY 87 and ongoing radionuclide sorption, solubility and diffusion testing are to be completed by September, 1989.

Some participants' statements are pessimistic assessments based on the fact that the DOE program has not yet reached the critical milestones—e.g., establishment of waste form specifications, completion of waste package preliminary designs, verification of a waste package performance model, and qualification of barrier materials. However, the Commission believes that these technical problems will be solved without delaying a repository schedule. DOE has put in place an extensive nuclear waste research program that addresses each of these technical problems. Research results already reported on waste form packaging and barrier materials indicate that these research efforts, although not yet completed, can reasonably be expected to provide solutions to those problems when those solutions are needed to meet the DOE schedule [DOE PS pp. II-129 to II-197, CS pp. II-93 to II-100].

The Commission's positive assessment is strengthened by provisions in the Nuclear Waste Policy Act of 1982. Title II of the Act authorizes DOE to undertake steps leading to the construction, operation and maintenance of a deep geologic test and evaluation facility and to establish a focused and integrated research, development and demonstration program. In the area of waste package design, the Act directs that DOE's Mission Plan identify a process for solidifying high-level radioactive waste or packaging spent fuel with an analysis of the data to support selection of the solidification process or packaging technique. The Act calls for a schedule for implementing such a plan and for an aggressive research and development program to provide a high-integrity disposal package at a reasonable price [Sec. 301(a)(8)]. The Commission notes that DOE's published Draft Mission Plan (April, 1984) addresses these issues in

detail. Congressional authorization of those programs, together with the assurance of necessary funding, provides the Commission additional confidence that the required research work will be done in a timely manner.

The Commission also notes that the programs to solve the major technical problems relating to the timely development of waste forms, waste packages, and engineered barriers can proceed in parallel. Because the waste repository must be designed as a system, the problems are interrelated; however, the relationships are such that solving one problem need not await the solution of another. DOE could proceed for a number of years on waste package development before making a decision on the form of the waste, without affecting the repository availability schedule.

B. Institutional Uncertainties

The principal institutional issues that affect the schedule for availability of a mined geologic repository include: measures for dealing with Federal-state disputes; an assured funding mechanism that will be sufficient over time to cover the period for developing a repository; an organizational capability for managing the high-level waste program, whether this be DOE or a successor organization; and a firm schedule and establishment of responsibilities which will lead to repository development in a reasonable period of time. Each of these is discussed in turn.

1. *Measures for Dealing with Federal-State-Local Concerns.* The President and Congress have recognized the need to involve state and local governments in the decision-making process and have taken steps, including enactment of the Nuclear Waste Policy Act of 1982, to establish an institutional framework to accomplish this end. DOE pointed out that Presidents Carter and Reagan have considered state involvement in site selection an important aspect of the high-level radioactive waste disposal program. President Carter, in his message to Congress, directed "the Secretary of Energy to provide financial and technical assistance to States and other jurisdictions to facilitate full participation of State and local government in review and licensing proceedings." He committed the Federal Government to work with state, tribal and local governments in the siting of high level waste repositories. Within a framework of "consultation and concurrence," a host state would have a continuing role in Federal decision-making involving the siting, design and construction of a high-level waste

repository (DOE CS pp. 11-11, 13-14). President Reagan's statement of October 8, 1981 similarly instructed DOE to work closely with industry and state governments in developing methods of storing and disposing of commercial high-level waste.

Although industry groups believed that DOE had made substantial progress in cooperating with state and local authorities by encouraging their direct participation in planning and preliminary site selection activities (UNWMC-EEI CS pp. V-27, V-28), states and environmental groups were skeptical that the mechanisms proposed by DOE for incorporating state and local views (e.g., consultation and concurrence) would work satisfactorily. Many states asserted a lack of confidence in DOE's claims that it would be able to gain agreement from states by persuasive measures (e.g. Ohio PS p. 5; NY PS p. 74; Wis PS Kelly p. 5) and noted that information sharing was inadequate to reduce or overcome a state's resistance to a repository (e.g., NY PS p. 74; NRDC PS p. 69). The states also believed that DOE had underestimated potential state and local opposition to the siting of a repository (CEC PS p. 27, Ohio PS p. 12) and that consultation and concurrence must include a mechanism for resolving intergovernmental disputes (Vt PS p. 3). Other participants argued that many states had already imposed bans on waste disposal (NECNP PS p. 32) and that DOE had presented no means for resolving state nonconcurrence (NRDC PS p. 69). Still others claimed that the state's role in the site selection process must be specifically defined (Del PS p. 6); but the DOE had provided no basis for optimism that this could be done (NECNP PS p. 69). Some participants suggested that local opposition to waste repositories could be overcome by providing financial compensation to nearby communities (AIChE PS p. 6) but that DOE had not adequately considered compensation to host communities for socioeconomic impacts (Ohio PS p. 14).

The recently-enacted Nuclear Waste Policy Act of 1982 defines the roles of the states and Indian tribes in repository site selection, and thereby reduces some of the uncertainties in settling disputes between the Federal government and affected states and Indian tribes. By providing for information exchange, for financial and technical assistance, and for processes of consultation, cooperation, negotiation and binding written agreement, the Act should help to minimize the potential for more formal objections and confrontations.

Specifically, the Act requires DOE to identify the states with one or more potentially acceptable sites for a repository and to notify the governing bodies of the affected states or Indian tribes of those sites (Sec. 116(a)). The Act establishes detailed procedures for consultation with the states and Indian tribes regarding repository sites selection (Sec. 117). DOE, NRC and other agencies involved in the construction, operation, or regulation of any aspect of a repository in a state must provide to the state and to any affected Indian tribe, timely and complete information regarding plans made with respect to the site characterization, development, design, licensing, construction, operation, regulation, or decommissioning of such a repository (Sec. 117(a)(1)). If DOE fails to provide such information requested by the state or affected Indian tribe in a timely manner, it must cease operations at the site (Sec. 117(a)(2)). The Act also provides that DOE must consult and cooperate (Sec. 117(b)) with the affected states and Indian tribes and must enter into a binding written agreement (Sec. 117(c)) setting forth the procedures under which information transfer, consultation and cooperation is to be conducted.

Following consultation with affected states and Indian tribes, the Secretary of Energy is to recommend to the President three sites suitable for characterization as candidates for selection as the first and second repositories (by July 1, 1985 and July 1, 1989 respectively) (Sec. 112(b), (B), (C)). The President must then submit to Congress his recommendation of sites qualified for construction authorization for a first and second repository (no later than March 31, 1987 and March 31, 1990 respectively) (Sec. 114(a)(2)(A)). Following submission by the President of a recommended site to Congress, the Governor or legislature of the state, or the Indian tribe in which such site is located may disapprove the site designation and submit (within 60 days) a notice of disapproval to Congress (Sec. 116(b)(2)). The site is disapproved unless Congress passes a joint resolution within 90 days to override the state or Indian tribe disapproval (Sec. 115 (c)). The Commission recognizes that the latter provision may create uncertainty in gaining the needed approvals of repository sites from the affected states or Indian tribes. Nevertheless, the Commission believes that, on balance, this Congressional action to establish a detailed process for state and tribal involvement in the development of repositories will reduce overall

uncertainties by encouraging Federal-state cooperation and by limiting the potential for formal state or Indian tribe objections that could lead to disruption of project plans and schedules. This conclusion is consistent with the views expressed by state participants in this proceeding that a mechanism for state participation, including the resolution of state objections and nonconcurrences, is necessary for state cooperation and for progress in repository development (Tr. pp. 117, 119, 120). Further, the Act fixes the point in time at which a state may raise formal objections. Once that time has passed, this should reduce uncertainties at later stages.

The Act stipulates that DOE will reimburse costs incurred by affected states and Indian tribes in participating in the activities identified above. The Act provides that the Secretary of Energy shall make financial grants (Secs. 116, 118) to each state or affected Indian tribe notified by DOE that a potentially acceptable repository site exists within its jurisdiction. These grants are made to enable the state or affected Indian tribe to participate in the review and approval activities required by the Act (Secs. 116, 117), or authorized by written agreement entered into with DOE. Further, DOE is to make financial grants (Secs. 116, 118) to each state or affected Indian tribe where a candidate site for a repository is approved, to enable the state or Indian tribe to conduct the following activities: (a) Review activities taken for purposes of determining impacts of such a repository, (b) develop a request for impact assistance, (c) engage in site monitoring, testing or evaluation, (d) provide information to its residents, and (e) request information. In addition, the Act specifies that financial assistance will be provided to mitigate any economic, social, public health and safety, or environmental impacts of the development of a repository. The Act also provides that state and local government units shall receive payments equal to the amount they would receive from taxing such site characterization and repository development activities in the same manner that they tax other real property and industrial activities (Sec. 116). By providing a tangible benefit to those localities or Indian reservations where repository sites are being investigated, this provision should address one concern frequently expressed by state and tribal organizations, and may result in a more willing acceptance of a repository site.

In sum, the Commission believes that the provisions of the Nuclear Waste

Policy Act of 1982 reduce uncertainties regarding the role of affected states and Indian tribes in repository site selection and evaluation, and minimize the potential for direct confrontation between the Federal government and the states or tribal organizations with respect to the disposal of commercial high-level waste and spent fuel. By reducing these uncertainties, the Act should help minimize the potential that differences between the Federal government and states or Indian tribes will substantially disrupt or delay the repository program. Further, as discussed previously in this Section, the decision-making process set up by the Act provides a detailed, step-by-step approach which builds in regulatory involvement. This should also provide confidence to states and Indian tribes that the program will proceed on a technically sound and acceptable basis.

2. *Continuity of the Management of the Waste Program.* The Commission recognizes that the waste disposal program involves activities conducted over a period of decades. Thus, there is a need for long-term stability of management and organization. The Commission's Second Prehearing Memorandum and Order of November 6, 1981, sought comments on the implications of the possible dismantling of the DOE and assignment of its functions to other Federal agencies. In response, DOE stated: "The ability of the Federal Government to implement the waste isolation program would not be affected by the President's September 24, 1981 proposal to dismantle DOE. As demonstrated by his Nuclear Policy Statement of October 8, 1981 the President is committed to the swift deployment of means of storing and disposing of commercial high-level nuclear waste. Thus, some governmental unit will continue the program aggressively if DOE is dismantled" (DOE PHS p. 8). The DOE statement was amplified by the Deputy Secretary of Energy in the oral presentations on January 11, 1982: "as far as the reorganization is concerned, the plan is not, I think, to do away with the activities of the Department of Energy. The plan, as it has been announced so far, is to in fact merge the activities, in particular, these activities into the Department of Commerce. And we do not visualize at this time any significant changes in the way in which the program relating to waste management would be altered, either technically or from a management point of view" (Tr. p. 13).

The nuclear industry participants agreed with DOE's view on this question

(Consolidated Industry Group PHS p. 18; AIF PHS p. 7; SE2 PHS p. 6; ANS PHS p. 8, UG p. 2). However, state participants and intervenor groups disputed the DOE view. They saw the potential dismantlement of DOE as leading to further delay in resolution of the radioactive waste disposal problem and asserted that DOE's possible abolition made representations regarding the future success of its waste program useless (Consolidated State Group PHS, pp. 2, 9; Minn PHS pp. 6-8).

The Commission does not believe that the Administration's proposal to transfer the activities of the Department of Energy to the Department of Commerce introduces substantial new uncertainties regarding the continuity of Federal management of the nuclear waste program. As the Department of Energy stated, the Administration's proposal, if adopted, would simply transfer the nuclear waste program functions from one Federal agency to another. Moreover, Congressional action is needed to adopt the Administration's proposal. Yet, in the three years since the Administration's proposal to dismantle DOE was made, there has been no discernible action by the Congress to proceed with adoption of the proposal. Because the Congress has not taken action toward adoption of the Administration's proposal, and because the proposal, even if adopted, would consist of only a transfer of the program from one agency to another, the Commission does not believe that the Administration's proposal constitutes a significant source of management uncertainty for the nuclear waste program.

The Commission believes that residual uncertainties regarding the continuity of Federal management of the nuclear waste program have also been reduced by the Nuclear Waste Policy Act of 1982. The Act provides for the establishment of an Office of Civilian Radioactive Waste Management within the Department of Energy. This Office is to be headed by a Director appointed by the President, with Senate confirmation, who will report directly to the Secretary of Energy (Sec. 304). Further, the Act raises the activities of this Office to a high level of visibility and accountability by stipulating that an annual comprehensive report of the activities and expenditures of the Office will be submitted to Congress and that an annual audit of the Office will be conducted by the Comptroller General, who will report the results to Congress. The Act also requires two additional elements that provide added assurance of continuity: a "Mission Plan" and a

schedule of activities for DOE. The Mission Plan is a detailed and comprehensive report which is intended to provide "an informational basis sufficient to permit informed decisions to be made in carrying out the repository program and the research, development, and demonstration programs required under this Act." The Secretary of Energy has already submitted a draft Mission Plan to the states, the affected Indian tribes, the Commission and appropriate government agencies for their comments; after revising the plan, DOE must submit it to the appropriate Congressional committees (Sec. 301 (a) and (b)). The schedule of DOE's activities in conducting this program was discussed in Section 2.2 A.1 above. Taken together, the provisions of the Nuclear Waste Policy Act establish a detailed management framework for the conduct of the repository program that should help ensure both sound management and continuity—whether the responsibility for the repository program is retained in DOE or is transferred to another Federal agency.

3. *Continued Funding of the Nuclear Waste Management Program.* There is general agreement among all participants that the program to develop a mined geologic repository for nuclear wastes will require more than a decade of effort at a total cost of several billion dollars. A steady source of funding will be needed to assure the timely success of the program. DOE pointed out that it would request an adequate level of funding for the National Waste Terminal Storage (NWTS) Program as stated in the Department's Position Statement (DOE CS p. II-30). In addition, DOE stated that Congress' commitment to the commercial waste disposal program was demonstrated by the continuous increase in the level of funding since 1976. The funding level was increased by more than a factor of 10 between 1976 and 1980 (DOE CS p. II-30). Some participants disagreed with DOE's optimism concerning the future availability of funds and pointed out the competing priorities for Federal funds could deprive DOE of the necessary resources (CDC PS p. 7; Lewis PS p. 9; NRDC PS p. 28; Tr. p. 203).

Congress passed a continuing resolution for FY 1983 funding of DOE's nuclear waste program at the level of \$259.4 million. This is about \$10 million more than DOE's earlier FY 1983 request of \$249 million. Additionally, the Nuclear Waste Policy Act authorizes the Secretary of Energy to enter into contracts and collect a fee of 1 mill per kilowatt-hour of electricity generated by nuclear reactors in return for the Federal

government's acceptance of title, subsequent transportation, and disposal of high-level radioactive waste or spent fuel (Sec. 302(a)(2)). In order to be able to use a Federal repository, the Act required the generator or owner of such waste or spent fuel to enter into a contract by June 30, 1983 or the date on which generation is commenced or title is taken, whichever occurs later (Sec. 302(b)(2)). The Commission must require the negotiation of such contracts as a precondition to the issuance or renewal of a license (Sec. 302(b)(1)(B)). The Commission notes that all such contracts have been executed. DOE testified in the January 11, 1982 hearing that it expected the funds collected under such a program would allow support of the DOE waste program at an initial level of \$185 million. Under the program subsequently adopted by the Congress, these funds are to be placed into a nuclear waste fund to support DOE's repository program. The general approach prescribed by the Act is to operate DOE's nuclear waste program on a full cost recovery basis. In this regard, the Act provides that DOE must annually review the amount of the fees established to evaluate whether collection of the fees will provide sufficient revenues to offset the costs expected. In the event DOE determines that the revenues being collected are less than the amount needed in order to recover the costs, DOE must propose to Congress an adjustment to the fee to insure full cost recovery. The Act also provides (Sec. 302(e)(5)) that, if at any time, the monies available in the Waste Fund are insufficient to support DOE's nuclear waste program, DOE will have the authority to borrow from the Treasury. The Commission believes that the long-term funding provisions of the Act should provide adequate financial support for DOE's nuclear waste program.

4. DOE's Schedule for Repository Development. The DOE reference schedule described in its April, 1984 draft Mission Plan establishes the earliest date of repository availability as 1998 and delineates the logic and the period of activities that are deemed achievable under current program assumptions. While DOE acknowledges that contingency time is required in the schedule to accommodate such factors as institutional uncertainties, public hearings, or possible project reorientation, it believes that an appropriate amount of time has, in fact, been allowed in the reference schedule. Under the reference schedule, DOE expects that disposal facilities will be operational in 1998 (DOE draft Mission

Plan, April 1984). DOE's updated repository development schedule specifies the critical milestones prior to commencing construction of the first repository as:

March 1985 (basalt), September 1985 (tuff), _____ (salt).	Commencement of exploratory shaft work* at three sites (three different media: salt, basalt and tuff).*
August 1990 _____	Submission of application for authorization to construct the first repository.
August 1993 _____	Construction authorization for the first repository.

* Including borehole drilling.

** An October, 1982 update of this information indicated that a pilot borehole was started in September 1982 for an exploratory shaft on tuff at the Nevada Test Site. In May 1982, DOE initiated work on surface preparation, construction of drilling pads and support buildings for the drilling operation at the BWIP basalt site. In January 1982, a borehole was begun at a point 300 feet from the BWIP planned exploratory shaft location to provide data for planning the shaft excavation. No exploratory shaft work has begun at the Paradox Basin bedded salt site. As noted in the string discussion under the Second Commission Finding, the Nuclear Waste Policy Act of 1982 requires DOE to complete certain actions before site characterization. These include issuance of siting guidelines concurred in by NRC, preparation of environmental assessments, notification of state and affected Indian tribes where sites are located, and holding of public hearings in the vicinity of each site.

The Commission concurred in DOE's repository siting guidelines on July 3, 1984, enabling DOE to proceed to complete the other site selection tasks. The Commission notes that DOE's draft Mission Plan (April 1984) anticipated the completion of the siting guidelines by Mid-Summer 1984 and DOE revised its site selection schedule accordingly. Final environmental assessments for five nominated sites (including salt, basalt and tuff media) are to be completed in December 1984, at which time three of the five sites will be recommended for characterization.

NRC's construction authorization (under 10 CFR Part 60) would mark the end of the site selection process.

Some participants believe that DOE cannot have a waste disposal facility available by 2007. These participants concluded that DOE's slow progress in the past suggests that DOE may be unable to solve the many problems that will arise in the future and that DOE's schedule for repository development is unduly optimistic (e.g., Minn. PS p. 6; Ill. PS p. 2; OCTLA PS pp. 8-9; CDC PS p. 7).

One of the primary purposes of the recently enacted Nuclear Waste Policy Act of 1982 is "to establish a schedule for the siting, construction, and operation of repositories that will provide reasonable assurance that the public and the environment will be adequately protected from the hazards posed by high-level radioactive waste and such spent nuclear fuel as may be disposed of in a repository." (Sec. 111(b)(1)). The Commission recognizes that, if fundamental technical breakthroughs were necessary, it would not be possible for Congress to legislate their solution or specify schedules for their accomplishment. However, as discussed previously, such breakthroughs are not necessary. Rather, the remaining uncertainties are reflected in the need for step-by-step evaluation and development based on ongoing site studies and research

programs. The Commission believes the Act provides means for resolution of those institutional and technical issues most likely to delay repository development, both because it provides an assured source of funding and other significant institutional arrangements, and because it provides detailed procedures for maintaining progress, coordinating activities and rectifying weaknesses. For these reasons, the Commission believes that the selection and characterization of suitable sites and the construction of repositories will be accomplished within the general time frame established by the Act, or within a few years thereafter.

The provisions of the Nuclear Waste Policy Act of 1982 that establish schedules for repository development are elaborate and allow for various contingencies. A number of steps are involved before NRC considers authorization of construction. DOE is to nominate five sites it believes suitable for site characterization for possible repository development (Sec. 112(b)). DOE is to recommend for site characterization three candidate sites to the President (Sec. 112(b)(1)(B)); the President is to recommend one of the characterized sites to the Congress (Sec. 114(a)(2)(A)); the affected state or Indian tribe is given an opportunity to submit a notice of disapproval of the Congress (Secs. 115(b), (118)(b)(2), 118(a)); the Congress may overturn a state or Indian tribe's disapproval of the site by passing a resolution of approval (Sec. 115(c)); and, if Congress approves or no notice of disapproval is submitted by a state or Indian tribe, then DOE is to apply for construction authorization (Sec. 114(b)).

DOE's revised reference schedule (DOE draft Mission Plan, April 1984) states that the application for repository construction authorization will be submitted to the Commission in August 1990. Under the terms of the Act the Commission is expected to reach a decision within 3 years of the application date, or by August 1993 (Sec. 114) (under certain conditions, extension by 1 year would be permitted). If the NRC decision is favorable, the repository would be constructed and begin operation, according to DOE's "reference schedule," in January 1998. Earlier dates can be achieved if the Presidential review time is reduced, if DOE promptly files the construction authorization application, if NRC provides a construction authorization in less than 3 years, or if DOE constructs the repository in a shorter period than provided in its estimated schedule. However, it is prudent to assume that

such a contraction of the schedule will not be realized.

The Nuclear Waste Policy Act of 1982 establishes "not later than January 31, 1998" as the date when DOE is to begin disposal of high-level radioactive waste or spent fuel (Sec. 302(a)(5)(B)). This is consistent with the current dates of the DOE schedules discussed above and with the detailed step-by-step milestones established by the Act. The schedule established by the Act would assure the operation of the first repository well before the years 2007-2009, i.e., the period of concern in the present proceeding.

Despite the delays in DOE's earlier milestones, the Commission believes that the program established by the Act is generally consistent with the schedule presented by DOE in this proceeding and that DOE's milestones are generally both realistic and achievable. Achievement of the scheduled first date of repository operation is further assured by other provisions of the Act which specify means for resolution of those institutional and technical issues most likely to delay repository completion. In addition to those provisions discussed previously, the Commission notes that the Act clarifies how the requirements of the National Environmental Policy Act are to be met (e.g., Secs. 113 (c), (d); 114 (a), (f); 119(a); 121(c)). The Act also requires that any Federal agency determining that it cannot comply with the repository decision schedule in the Act must notify both the Secretary of Energy and Congress, explaining the reasons for its inability to meet the deadlines. The agency must also submit recommendations for mitigating the delay (Sec. 114(e)(2)). These provisions of the Act, as well as those that support the technical program—the provisions for research, development, and demonstration efforts regarding waste disposal (Title II of the Act), increase the prospects for having the first repository in operation not later than the first few years of the next century.

The Commission also finds reasonable assurance that sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of commercial high-level radioactive waste and spent fuel generated up to that time. The Nuclear Waste Policy Act of 1982 establishes Federal responsibility and a clearly defined Federal policy for the disposal of such waste and spent fuel and creates a Nuclear Waste Fund to implement Federal policy. The Act establishes as a matter of national policy that this

responsibility is a continuing one, and provides means for the Secretary of Energy to examine periodically the adequacy of resources to accomplish this end.

The Commission notes that as of September 30, 1982, the generating capacity of all commercial nuclear power plants in the U.S. with operating licenses or construction permits was 131 electrical gigawatts (GWe) and the capacity of those under construction permit review was about 5 GWe (NUREG-0871, Vol 1, No. 4, p. 2, 8). DOE, in its letter of March 27, 1981 to the presiding officer of this proceeding, provided an estimate of 180 GWe for the capacity of operating LWRs in the year 2000. This value is significantly lower than the value (276 GWe) presented in DOE's 1980 position statement (DOE PS p. V-4) and lower than that (202 GWe) presented in the NRC's Generic Environmental Impact Statement on spent fuel handling and storage (NUREG-0575, Vol. 1, p. 2-4). The validity of the latter predictions has been affected by the cancellations of a number of proposed units during the past two years. The DOE 1981 estimate of 180 GWe in the year 2000 appears to be a reasonable estimate of the likely installed capacity at that time. On this basis, during the 40 years of operation of each plant, using as a realistic assumption a 60 percent capacity factor, the electrical energy generation would be about 4300 GWe-years. Assuming 38 metric tons of heavy metal (MTHM) is discharged for each gigawatt-year (IRG Final Report p. D-6; NUREG-0575, Vol. 1 p. 2-4) the total discharged spent fuel from these plants would likely be about 160,000 metric tons. The capacity of each proposed repository will depend on such factors as the thermal loading limit in waste emplacement, space limitations within the host rock, nuclear power generation capacity in the region to be serviced by the repository, and economy of scale considerations (DOE PS pp. III-70 to 79; IRG Final Report p. D-21). In its cross statement DOE's estimate that three to six repositories might be needed was based on the assumption that nuclear power generation capacity grows to 250 GWe by the year 2000 and remains at that level until 2040 (DOE CS p. II-53). The representative characteristics of each repository used by DOE were 2000 acres and a 40 to 100 kW/acre loading, corresponding to a repository capacity of about 70,000 to 170,000 metric tons of uranium, respectively (DOE PS p. III-76). Reflecting the reduction in nuclear power projections, DOE estimated in the January 1982 hearing that the ultimate

reactor capacity would be about 200 GWe (Tr. p. 236). DOE then assumed a repository capacity of 100,000 metric tons and concluded that "between two and three" repositories would be needed (Tr. p. 237). To accommodate the 160,000 metric tons we have assumed, two repositories each with 100,000 metric tons capacity would appear to be sufficient.

Repository completion and operation at three-year intervals would result in having adequate capacity about three years after initial operation of the first repository (DOE PS p. III-86). As noted earlier, emplacement of spent fuel in the first repository should begin not later than the first few years of the next century. Thus, if the first repository begins to receive spent fuel in the year 2005, the second may begin operation as early as 2008, in which case all spent fuel would be emplaced by about 2026, assuming DOE's estimated receiving rates (DOE PS p. III-71) and operation of each repository as completed. Because the rate of waste emplacement during the first five years of operation would be about 1800 metric tons per year (DOE PS p. III-71), only 5400 metric tons would be emplaced in the first repository by the time the second began operation. This would satisfy the requirements of Section 114(d) of the Nuclear Waste Policy Act, i.e., the prohibition of emplacement of more than 70,000 metric tons in the first licensed repository before the second repository is in operation. If the DOE estimated emplacement rates (which would increase to 6000 metric tons/year after the first five years) are realized, it will take about 15 years to emplace 70,000 metric tons in the first repository.

For the foregoing reasons, the Commission finds reasonable assurance that one or more mined geologic repositories for commercial high-level radioactive waste and spent fuel will be available by the years 2007-09, and that sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time.

2.3 Third Commission Finding

The Commission finds reasonable assurance that high-level radioactive waste and spent fuel will be managed in a safe manner until sufficient repository capacity is available to assure the safe disposal of all high-level radioactive waste and spent fuel.

Nuclear power plants whose operating licenses expire after the years

2007-09 will be subject to NRC regulation during the entire period between their initial operation and the availability of a waste repository. The Commission has reasonable assurance that the spent fuel generated by these licensed plants will be managed by the licensees in a safe manner. Compliance with the NRC regulations and any specific license conditions that may be imposed on the licensees will assure adequate protection of the public health and safety. Regulations primarily addressing spent fuel storage include 10 CFR Part 50 for storage at the reactor facility and 10 CFR Part 72 for storage in independent spent fuel storage installations (ISFSI). Safety and environmental issues involving such storage are addressed in licensing reviews under both Parts 50 and 72, and continued storage operations are audited and inspected by NRC. NRC's experience in more than 80 individual evaluations of the safety of spent fuel storage shows that significant releases of radioactivity from spent fuel under licensed storage conditions are extremely remote (see discussion in Section 2.4).

Some nuclear power plant operating licenses expire before the years 2007-09. For technical, economic or other reasons, other plants may choose, or be forced, to terminate operation prior to 2007-09 even though their operating licenses have not expired. For example, the existence of a safety problem for a particular plant could prevent further operation of the plant or could require plant modifications that make continued plant operation uneconomical. The licensee, upon expiration or termination of its license, may be granted (under 10 CFR Part 50 or Part 72) a license to retain custody of the spent fuel for a specified term (until repository capacity is available and the spent fuel can be transferred to DOE under Sec. 123 of the Nuclear Waste Policy Act of 1982) subject to NRC regulations and license conditions needed to assure adequate protection of the public. Alternatively, the owner of the spent fuel, as a last resort, may apply for an interim storage contract with DOE, under Sec. 135(b) of the Act, until not later than 3 years after a repository or monitored retrievable storage facility is available for spent fuel. For the reasons discussed above, the Commission is confident that in every case the spent fuel generated by those plants will be managed safely during the period between license expiration or termination and the availability of a mined waste repository for disposal.

To assure the continuity of safe management of spent fuel, the Commission, in a separate action, is preparing an amendment to 10 CFR Part 50 which would require licensees of operating nuclear power reactors to submit, no later than 5 years before expiration of the reactor operating license, written notification to the Commission, for its review and approval, of the actions which the licensee will take to manage and provide funding for the management of all irradiated fuel at the reactor site following expiration of the reactor operating license, until ultimate disposal of the spent fuel in a repository. The licensee's notification will be required to specify how the licensee will fund the financial costs of extended storage or other disposition of spent fuel. It is possible for the funding of the storage to be provided by an internal reserve fund or special assessment during that 5-year period to cover the costs of storage of the spent fuel after the expiration of the reactor operating license. The storage costs are not large relative to power generation costs. A representative figure is \$1-million/year for storage of spent fuel in reactor basins beyond the operating license expiration [Addendum 2 to "Technology, Safety and Costs of Decommissioning a Reference BWR Power Station," NUREG/CR 0130 (July 1983); Addendum 1 to "Technology, Safety and Costs of Decommissioning a Reference PWR Power Station," NUREG/CR 0672 (July 1983)].

Additional assurance that the conditions necessary for safe storage will be maintained until disposal facilities are available is provided by the Commission's authority to require continued safe management of the spent fuel past the operating license expiration or termination (10 CFR 50.82). If a utility should have technical problems in continuing its commitment to maintain safe storage of its spent fuel, NRC as the cognizant regulatory agency would intervene and the utility would be required to assure safe storage. If a licensee fails financially, or otherwise must cease its operations, the cognizant state public utility commission would be likely to require an orderly transfer to another entity. The successor would take over the licensee's facilities and, provided the conditions for transfer of licenses prescribed in NRC regulations (10 CFR 50.80) were met by the succeeding entity, operation of the original licensee's facilities would be permitted to continue. Moreover, an orderly transfer to a successor organization would be mandatory to protect the substantial capital

investment. Further, the Commission believes that the possibility of a need for Federal action to take over stored spent fuel from a defunct utility or from a utility that lacked technical competence to assure safe storage is remote, but the authority for such action exists (sections 186c and 188 of the Atomic Energy Act of 1954, as amended; 42 U.S.C. 2238, 2238).

Interim storage capacity may be required for plants whose operating licenses expire or are terminated before sufficient repository capacity is available. As discussed in the rationale for the fifth finding, the Nuclear Waste Policy Act of 1982 includes a number of provisions to assure the availability of interim storage capacity for spent fuel during the period before repository operation (Secs. 131 through 137). Provisions are made for Federal government supplied interim storage capacity (up to 1900 metric tons) for civilian power reactors whose owners cannot reasonably provide adequate storage capacity.

In all cases where the interim storage is at a licensee's site, safe management will be assured by compliance with NRC regulations and specific license conditions. Where DOE provides the interim storage capacity, except in the use of existing capacity at Government-owned facilities, DOE is to "comply with any applicable requirements for licensing or authorization" (Sec. 135(a)(4)). If existing federally-owned storage facilities are used, NRC is required to determine "that such use will adequately protect the public health and safety" (Sec. 135(a)(1)). These provisions of the Act would assure that spent fuel will be managed in a safe manner until repository capacity is available. Facilities for reprocessing high-level waste, should any be constructed or become operational before a repository is available, would be licensed under 10 CFR Part 50, and solidification and interim storage of high level waste would be provided for at such facilities. For the foregoing reasons, the Commission finds reasonable assurance that high-level waste and spent fuel will be managed in a safe manner until sufficient repository capacity is available for its safe disposal.

2.4 Fourth Commission Finding

The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of that reactor's operating license at that

reactor's spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

Although the Commission has reasonable assurance that at least one mined geologic repository will be available by the years 2007-09, the Commission also realizes that for various reasons, including insufficient capacity to immediately dispose of all existing spent fuel, spent fuel may be stored in existing or new storage facilities for some periods beyond 2007-09. The Commission believes that this extended storage will not be necessary for any period longer than 30 years beyond the term of an operating license. For this reason, the Commission has addressed on a generic basis in this decision the safety and environmental impacts of extended spent fuel storage at reactor spent fuel storage basins or at either onsite or offsite spent fuel storage installations. The Commission finds that spent fuel can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of reactor operating licenses. To ensure that spent fuel which remains in storage will be managed properly until transferred to DOE for disposal, the Commission is proposing an amendment to its regulations (10 CFR Part 50). The amendment will require the licensee to notify the Commission, five years prior to expiration of its reactor operating license, how the spent fuel will be managed until disposal.

The Commission's finding is based on the record of this proceeding which indicates that significant releases of radioactivity from spent fuel under licensed storage conditions are highly unlikely. It is also supported by the Commission's experience in conducting more than 80 individual safety evaluations of storage facilities.

The safety of prolonged spent fuel storage can be considered in terms of four major issues: (a) The long-term integrity of spent fuel under water pool storage conditions, (b) structure and component safety for extended facility operation, (c) the safety of dry storage, and (d) potential risks of accidents and acts of sabotage at spent fuel storage facilities. Each of these issues is discussed separately below, in light of the information provided by the participants in this proceeding, and NRC experience in regulating storage of spent fuel.

A. Long-Term Integrity of Spent Fuel Under Water Pool Storage Conditions

The Commission finds that the cladding which encases spent fuel is highly resistant to failure under pool storage conditions. As noted by DOE in

its Position Statement, there are up to 18 years of continuous storage experience for zircaloy-clad fuel and 12 years continuous storage experience for stainless-clad fuel (DOE PS p. IV-73). Corrosion studies of irradiated fuel at 20 reactor pools in the United States suggest that there is no detectable degradation of zircaloy cladding. Data from corrosion studies of spent fuel stored in Canadian pools also support this finding (A.B. Johnson, Jr., "Behavior of Spent Nuclear Fuel in Water Pool Storage," (UC-70) Battelle Pacific Northwest Laboratories (BNWL-2256, September, 1977) pp. 10-11, 17).

The long-term integrity of spent fuel in storage pools, which has been confirmed by observation and analysis, was cited by industry participants (e.g., Consolidated Industry Group; PHS pp. 3-6; UNWMC-EEI PS Doc. 4, p. 8; UG p. 2). No degradation has been observed in commercial power reactor fuel stored in onsite pools in the United States. Extrapolation of corrosion data suggests that only a few hundredths of a percent of clad thickness would be corroded after 100 years (A.B. Johnson, Jr., "Utility Spent Fuel Storage Experience," PNL-SA-6863, presented at the American Nuclear Society's Executive Conference on Spent Fuel Policy and its Implications, Buford, Georgia (April 2-5, 1978). The American Nuclear Society cited a study (G. Vesterbend and T. Olsson, BNWL-TR-320, May 1978, English Translation of RB78-29), which concluded that degradation mechanisms such as general corrosion, local corrosion, stress corrosion, hydrogen embrittlement, and delayed hydrogen cracking are not expected to produce degradation to any significant extent for 50 years (ANS PS p. 34).

Canadian experience, including occasional examination during 17 years of storage, has indicated no evidence of significant corrosion or other chemical degradation. Even where the uranium oxide pellets were exposed to pool water as a result of prior damage of the fuel assembly, the pellets have been inert to pool water, an observation also confirmed by laboratory studies ("Canadian Experience with Wet and Dry Storage Concepts," presented at the American Nuclear Society's Executive Conference on Spent Fuel Policy and Its Implications, Buford, Georgia (April 2-5, 1978)). Another Canadian study concluded that "50 to 100 years under water should not significantly affect their [spent fuel bundles] integrity" (Walker, J.F., "The Long-Term Storage of Irradiated CANDU Fuel Under Water," AECL-6313 Whiteshell Nuclear Research Establishment, January 1979). This appraisal was based on findings

such as no deterioration by corrosion or mechanical damage during 16 years of storage in water, no release of fission products from the uranium dioxide matrix during 11 years of storage in water, and no fission-product induced stress corrosion cracking anticipated during water storage at temperatures below 100°C (Hunt C.E.L., J.C. Wood and A.S. Bam, "Long-Term Storage of Fuel in Water" AECL-6577, Chalk River Nuclear Laboratories, June 1979).

The ability of spent fuel to withstand extended water basin storage is also supported by metallurgical examination of Canadian zircaloy clad fuel after 11 years of pool storage, metallurgical examination of zircaloy clad PWR and BWR high burn-up fuel after five and six years in pool storage, and return of Canadian fuel bundles to a reactor after 10 years of pool storage. Periodic hot cell examination of high burn-up PWR and BWR bundles over 6 years of pool storage at the WAK Fuel Reprocessing Plant in Germany has also confirmed that spent fuel maintains integrity under pool storage conditions. Other countries having favorable experience with pool storage of zircaloy-clad spent fuel include: the United Kingdom, 13 years; Belgium, 12 years; Japan, 11 years; Norway, 11 years; West Germany, 9 years; and Sweden, 7 years (op. cit., A. B. Johnson, Jr., p. 7). Programs of monitoring spent fuel storage are being conducted in Canada, the United Kingdom and the Federal Republic of Germany (DOE PS pp. IV-59 to IV-61; UNWMC-EEI PS Doc. 4, p. 23).

The only fuel failures which have occurred in spent fuel pools involved types of fuel and failure mechanisms not found at U.S. commercial reactor facilities, e.g., degradation of zircaloy-clad metallic uranium fuel from the Hanford N-Reactor as a result of cladding damage in the fuel discharge system. The system differs from the fuel discharge systems of commercial reactors. Moreover, metallic uranium fuel is not used in commercial power reactors. NRDC cited some conclusions drawn by Mr. Justice Parker regarding his lack of confidence in long-term storage of spent fuel, based on the Windscale Inquiry in Great Britain in 1978, which involved stainless-steel-clad gas-cooled reactor fuel (NRDC PS p. 92). This is not pertinent to pool storage of commercial spent fuel since the high temperature conditions in a gas-cooled reactor which can cause sensitization of the cladding are not experienced by fuel in boiling or pressurized water reactors (op. cit., A.B. Johnson, Jr., pp. 17-18).

Some participants did not agree that there is an adequate basis for

confidence in safe extended-term spent fuel storage. Although agreeing with the extent of experience cited by DOE and other participants, the Natural Resources Defense Council, for example, stressed that more experience is needed before one can be confident of safe extended storage. NRDC considered the length of storage experience cited by DOE as insufficient to establish that spent fuel can be stored safely for periods well in excess of 40 years (NRDC PS pp. 88-92). A similar position was taken by the State of Minnesota (Minn PHS pp. 8-9). NRDC referred to the problem of the long-term storage of spent fuel reported in the Windscale Inquiry Report by the Hon. Mr. Justice Parker, Vol. 1, pp. 29-30. However, the conclusion quoted from the report, when taken in context, refers only to irradiated fuel from AGR (advanced gas-cooled) nuclear power plants. As noted earlier, the conditions to which the fuel cladding is exposed in gas-cooled reactors differs from those in U.S. commercial light water reactors. Moreover, the cladding of AGR fuel is identified as stainless steel in the Windscale Inquiry Report. Only two commercial LWR nuclear power plants operating in the U.S. today use stainless steel clad. Most U.S. nuclear fuel is zircaloy clad, and reactor operators have not seen evidence of degradation of LWR spent fuel, either zircaloy or stainless steel clad, in storage pools (*Nuclear Technology*, "Spent Fuel Storage Experience," A.B. Johnson, Jr., p. 171, Vol. 43, Mid-April 1979). Further, as stated earlier, cladding degradation caused by stainless steel sensitization in an AGR high temperature environment is not pertinent to the lower temperature environment of LWR's. Therefore, the problem of long-term storage of spent fuel reported in the Windscale Inquiry is not relevant to U.S. spent fuel.

After expiration of a reactor operating license, the fuel storage pools at the reactor site would be licensed under 10 CFR Part 72. The requirements of 10 CFR Part 72 provide for operation under conditions involving a careful control of pool water chemistry to minimize corrosion. The required monitoring of the pool water would provide an early warning of any problems with defective cladding, so that corrective actions may be taken. Experience indicates that, under licensed storage conditions, significant releases of radioactivity are highly unlikely. The Commission is confident that the regulations now in place will assure adequate protection of the public health and safety and the environment during the period when the spent fuel is in storage ("Final Generic

Environmental Impact Statement on Handling and Storage of Spent Light Water Reactor Fuel," NUREG-0575, August 1979: Vol. 1, pp. ES-12, 4-10 to 4-17).

Although confidence that spent fuel will maintain its integrity during storage for an additional 30 years beyond the facility's license expiration date involves an extrapolation of experience by a factor of two or three in time, the extrapolation is made for conditions in which corrosion mechanisms are well understood. Technical studies cited above support the conclusion that corrosion would have a negligible effect during several decades of extended pool storage. The Commission finds that this extrapolation is reasonable and is consistent with standard engineering practice.

B. Structure and Component Safety for Extended Facility Operation For Storage of Spent Fuel in Water Pools

Questions were raised concerning the adequacy of structural materials and components of spent fuel storage basins to function effectively during periods that are double those assumed in the base design. This concern was expressed in connection with the possible necessity for longer storage times if permanent disposal is not available by the year 2006 (Del PS p. 4). The experience at the General Electric Company Morris Operation in Illinois, where a mechanical failure caused contaminated water to leak into the environment, was cited as an example of an unforeseen failure that could jeopardize the safety of spent fuel storage (NECNP PS p. 65). A generic problem regarding pipe cracks in borated water systems at PWR plants was also cited as evidence of uncertainty that long-term interim storage would be safely accomplished without modification and fuel shuffling (NECNP PS p. 64). The Commission notes that the latter problem was discussed in detail in the Atomic Safety and Licensing Board Notification, "Pipe Cracks in Stagnant Borated Water Systems at PWRs" dated August 14, 1979, in the ASLB consideration of a proposed licensing amendment to permit modification of a spent fuel storage pool [11 NRC 245 (1980)]. The Notification referred to by NECNP indicated that cracks had occurred in safety-related type-304 stainless steel piping systems which contained stagnant borated water. Apparently, the cracking was attributable to stress corrosion caused by the residual welding stresses in heat-affected zones. The NRC staff review found that such cracking was not directly related to spent fuel pool

modifications, and that necessary repairs could be readily made. The staff concluded that cracks in low-pressure spent fuel cooling system do not have safety significance.

Extensive experience with storage pool operation has demonstrated the ability of pool components to withstand the operating environment (DOE CS pp. II-145 to II-148). In the relatively few cases of equipment failure, pool operators have been able to repair the equipment or replace defective components promptly (UNWMC-EEI PS Doc. 4, p. 25; UG p. 2). The Commission finds no reason why spent fuel storage basins would not be capable of performing their cooling and storage functions for a number of years past the design-basis period of 40 years if they are properly maintained.

As one participant pointed out, "... the pool structure as well as the racks are designed to withstand extreme physical conditions set forth in NRC licensing requirements. These include seismic, hydrologic, meteorological and structural requirements" (UNWMC-EEI PS Doc. 4 p. 25; UG p. 2). The design requirements are set forth in 10 CFR Parts 50 and 72. The design-basis siting conditions for storage pools at reactor sites are those of the reactor itself. Siting conditions are reviewed by the NRC staff, the Advisory Committee on Reactor Safeguards and the Atomic Safety and Licensing Board at the construction permit stage and then reviewed again in connection with the issuance of the facility's operating license. In issuing a power reactor operating license, the Commission is, in effect, expressing its confidence that the design-basis siting conditions will not be exceeded during the 40-year license period. If pool storage facilities were used to store spent fuel after expiration of reactor operating licenses, the utilities would be able, as part of their continuing maintenance of storage facilities, to replace defective components in a timely way, if needed, so as to avoid any safety problems. Some participants (e.g., NECNP PS pp. 63-63; Minn PHS pp. 8-9; and Del PS p. 4), do not place the same weight which the Commission does on experience at spent fuel storage facilities and on studies cited by DOE and certain others which support the argument that the structural integrity of these basins can be readily maintained (DOE CS pp. II-145, III-13; UNWMC-EEI PS Doc. 4 p. 19). The disagreements appear to center largely on the extent to which present experience may be relied upon as a basis for predicting the safety of spent

fuel storage over a period two or three times the design period.

The degradation mechanisms involved in spent fuel pool storage are well understood. The resulting changes in fuel cladding and pool systems and components are gradual and thus provide sufficient time for the identification and development of remedial action without subjecting plant personnel or the public to significant risk. The fuel storage racks are designed to maintain their integrity for many decades; if they fail in any way, they may be replaced. There are a number of routine and radiologically safe methods for maintenance at spent fuel storage basins to ensure their continued effective performance. These include replacing racks or other components, or moving spent fuel to another storage facility. The Commission finds that the extensive operating experience with many storage pools adequately supports predictions of long-term integrity of storage basins.

The Commission concludes that the experience with spent fuel storage provides an adequate basis for confidence in the continued safe storage of spent fuel in water pools either at or away from a reactor site for at least 30 years after expiration of the plant's license.

C. Safety of Dry Storage of Spent Fuel

While the record of this proceeding has focussed on water pool storage, the Commission notes that dry storage of spent fuel has also been addressed to a limited extent (e.g., DOE PS pp. IV-12 to IV-22 and IV-63 CS p. II-147, PHS p. 9; UNWMO-PS Doc. 4 pp. 16-17 and CS pp. III-6-7; Tr. pp. 69-72). The NRC's regulation 10 CFR Part 72 specifically covers dry storage of spent fuel (Section 72.2(c)), and experience with dry storage was a subject of public comment in the rulemaking ("Analysis of Comments on 10 CFR Part 72," NUREG-0587, pp. II-12 to II-13). NRC reports, the "Final Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Reactor Fuel" (NUREG-0575) and "Dry Storage of Spent Nuclear Fuel, A Preliminary Survey of Existing Technology and Experience" (NUREG/CR-1223) which have been referenced in this proceeding, examined potential environmental impacts and experience with interim dry storage of spent fuel. The GEIS (Final Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Reactor Fuel, NUREG-0575, Vol. 1, p. 8-2, August 1979) contained the conclusion that the use of alternative dry passive storage techniques for aged fuel, now being

investigated by the Department of Energy, appears to be as feasible and environmentally acceptable as storage of spent fuel in water basins. Prior to the adoption of Part 72, dry storage of irradiated fuel had been licensed under Part 50 at the Hallam sodium graphite reactor. Dry storage is also presently licensed under Part 50 at the Ft. St. Vrain high temperature gas reactor.

Although the number of years of experience with dry storage systems is less than that with water pool storage, the understanding of some of the material degradation processes experienced in water pool storage should be applicable to dry storage. As discussed below, dry storage involves a simpler technology than that represented by water basin storage systems.³ Water basin storage relies upon active systems such as pumps, renewable filters, and cooling systems to maintain safe storage. Favorable water chemistry must also be maintained to retard corrosion. On the other hand, dry storage reduces reliance upon active systems and does not need water which together with impurities may corrode spent fuel cladding. With convective circulation of an inert atmosphere in a sealed dry system, there is little opportunity for corrosion.⁴ For these reasons, the Commission believes that safe dry storage should be achievable without undue difficulty. New dry storage experience with light water reactor (LWR) fuel is becoming available for examination, and the evaluations discussed below suggest that the favorable results of up to almost two decades of dry storage experience with non-LWR spent fuel can also be obtained for LWR spent fuel in adequately designed dry storage installations.

A recent review of dry storage experience by A.B. Johnson, Jr., et al. in "Behavior of Spent Nuclear Fuel and Storage Components in Dry Interim Storage" (PNL-4169, August 1982), provides an update of dry storage activities, particularly with respect to zircaloy-clad spent fuel. In this report, (pp. 18-24) the experimental data base for non-zircaloy-clad spent fuel, including stainless steel clad fuel and the data base for zircaloy-clad fuel are

³ See, for example, K. Einfeld and J. Fleisch, "Fuel Storage in the Federal Republic of Germany," and R.J. Steffen and J.B. Wright, "Westinghouse Advanced Energy Systems Division," Proceedings of the American Nuclear Society's Topical Meeting on Options for Spent Fuel Storage, in Savannah, Georgia, September 20 through 23, 1982; also A.B. Johnson, Jr., E.R. Gilbert, and R.J. Guenther, "Behavior of Spent Nuclear Fuel and Storage System Components in Dry Interim Storage," PNL-4169, August 1982.

⁴ K. Einfeld and J. Fleisch, *Ibid.* p. 3.

discussed. Tests conducted to verify the integrity of zircaloy cladding have not indicated any degradation in dry storage (p. 27). In summary, the report states (pp. 44-45):

Operating information is available from fueled dry well, silo, vault, and metal cask storage facilities. Maximum operational histories are:

	All fuel	Zircaloy-clad fuel
Dry wells	Up to 18 years	Up to 3 to 4 years
Vaults	Up to 18 years	Up to 1 year
Silos	Up to 7 years	Up to 7 years
Metal casks		<1 year

All times related to 1982.

Operational history with interim storage in metal casks is minimal; however, there is extensive experience with metal shipping casks. In addition, metal storage casks have been designed and tested, and cask tests with irradiated fuel are currently under way in the Federal Republic of Germany and are planned in Switzerland and the United States. The integrity of zircaloy-clad fuel in a given demonstration test is relevant to predicting fuel behavior in other dry storage concepts under similar conditions.

Information on experience with dry cask storage in other countries is also becoming available. K. Einfeld and J. Fleisch's paper, "Fuel Storage in the Federal Republic of Germany" discussed the results of dry storage research on spent fuel in an inert atmosphere. They note on page 3 of their report:

Several tests have been conducted to verify the integrity of LWR spent fuel cladding in dry storage. To date none of the integrity tests has indicated that the cladding is degrading during long-term storage. Even under conditions more severe than in the casks, the fuel shows no cladding failures. From the tests listed in Table II it can be concluded that dry storage under cask conditions even with starting temperatures to 400° C is not expected to cause cladding failures over the interim storage period.

Einfeld and Fleisch continue, in their report (pp. 3-4) to comment on the successful demonstration of cask storage:

A technical scale demonstration program with a fuel CASTOR cask is underway in the FRG since March 1982. The 16 assemblies which are subject to that program originate from the Wurgassen boiling water reactor. They resided in the core during 4 cycles of operation, burning up to about 27.8 GWD/t U.

The general objectives of the demonstration with a fully instrumented cask and fuel bundles are the verification of cask design parameters, the operational experience in cask handling and the expansion of the data base on fuel performance. Fig. 2 shows a schematic

drawing of the cask design and the axial thermocouple locations.

The operational experiences and corresponding test data confirm the assumptions made about the cask concept and the cask loading and handling procedure. In addition, the technology data base for operating an interim storage plant could be expanded.

- In-pool loading of a large storage cask and specific cask handling has been successfully demonstrated.
- The passive heat transfer capabilities of the cask and fuel cladding integrity have been verified. The maximum local fuel rod temperatures for fuel with about one year decay time were within the expected range.
- The total radiation shielding characteristics (<10 mrem/h) are verified in practice" (references deleted).

The authors conclude:

The realization of the transport/storage cask concept, which is well under way in the Federal Republic of Germany, will provide sufficient interim spent fuel storage capacity with the facilities planned or under construction. Dry interim storage is a proven technology and thus it constitutes an essential step in closing the backend of the nuclear fuel cycle.

R.J. Steffens and J.B. Wright's paper⁷, "Drywell Storage Potential," discussed drywell storage experience with pressurized water reactor spent fuel at the Nevada Test site. On page 6 of the paper, the authors note:

Another drywell performance assessment method being employed during the demonstration storage period is that of periodically monitoring the storage canister atmosphere for fission products, specifically krypton-85 gas. Samples drawn to date have shown no detectable concentrations of this product after approximately 3 years of storage, indicating a maintenance of the fuel cladding integrity.

A third paper presented at the same Topical Meeting, by E.R. Gilbert and A.B. Johnson, Jr., "Assessment of the Light-Water Reactor Fuel Inventory for Dry Storage," focuses on dry spent fuel storage with respect to an acceptable temperature range for storage in air. They conclude on page 8 of their report:

Dry storage demonstrations now in progress suggest that by 1986 a major fraction of the U.S. PWR spent fuel inventory that was placed in water storage before 1981 can be stored in dry storage facilities below 150 to 200 °C.

The LWR fuel inventory offers good prospects that the thermal characteristics of consolidated fuel will be acceptable for dry storage by proper selection of fuel.

⁷Proceedings of the American Nuclear Society's Topical Meeting on Options for Spent Fuel Storage, In Savannah, Georgia, September 26 through 29, 1982.

Dry storage of LWR fuel with defective cladding may be tolerable in inert cover gases or at temperatures below the threshold for significant oxidation in oxidizing cover gases. The range of acceptable storage temperatures is being investigated.

With respect to dry storage of spent fuel, the Commission notes the summary statement from A.B. Johnson, Jr., et al., "Behavior of Spent Nuclear Fuel and Storage Components in Dry Interim Storage" (PNL-4189), page xvii:

Operational problems in vaults and dry wells have been minor after up to 18 yr. of operation (in 1982); and 7 yr. of silo experience suggests that decades of satisfactory operation can be expected. Demonstration tests with irradiated fuel in metal storage casks are just beginning, but metal shipping casks with mild steel chambers have been used since the mid-1940s. Metal storage/shipping casks have successfully survived fire, drop, and crash tests.

Thus, with respect to the storage of spent fuel under dry conditions at storage installations located either at reactor sites or away from reactor sites, the Commission believes that current dry-storage technology is capable of providing safe storage for spent nuclear fuel. The modular character of dry storage installations enhances the ability to perform maintenance or to correct mechanical defects, if any should occur. The Commission is confident that its regulations will assure adequate protection of the public health and safety and the environment during the period when the spent fuel is in storage.

The Commission notes that section 211(2)(B) of the Nuclear Waste Policy Act authorizes the Secretary of Energy to carry out research on, and to develop facilities to demonstrate, dry storage of spent nuclear fuel. Although this provision indicates a judgment on the part of the Congress that additional research and demonstration is needed on the dry storage of spent fuel, the Commission believes the information discussed above is sufficient to reach a conclusion on the safety and environmental effects of extended dry storage. All areas of safety and environmental concern (e.g., maintenance of systems and components, prevention of material degradation, protection against accidents and sabotage) have been addressed and shown to present no more potential for adverse impact on the environment and the public health and safety than storage of spent fuel in water pools.

The technical studies cited above support the conclusion that corrosion would have a negligible effect during

several decades of extended dry storage. The Commission's confidence in the safety of dry storage is based on an understanding of the material degradation processes, rather than merely on extrapolation of storage experience—together with the recognition that dry storage systems are simpler and more readily maintained. For these reasons, the Commission is confident that dry storage installations can provide continued safe storage of spent fuel at reactor sites for at least 30 years after expiration of the plant's license.

D. Potential Risks of Accidents and Acts of Sabotage at Spent Fuel Storage Facilities

The Commission finds that the risks of major accidents at spent fuel storage pools resulting in off-site consequences are remote because of the secure and stable character of the spent fuel in the storage pool environment, and the absence of reactive phenomena—"driving forces"—which may result in dispersal of radioactive material. Reactor storage pools and independent spent fuel storage installations have been designed to safely withstand accidents caused either by natural or man-made phenomena. Even remote natural risks such as earthquakes and tornados and the risks of human error such as in handling or storing spent fuel are addressed in the design and operational activities of storage facilities and in NRC's licensing reviews thereof under its regulations. Under 10 CFR Parts 50 and 72, spent fuel is stored in facilities structurally designed to withstand accidents and external hazards, such as those cited above, and to preclude radiation and radioactive material emissions from spent fuel that would significantly endanger the public health and safety. In order to preclude the possibility of criticality under normal or accident conditions, the spent fuel is stored in racks designed to maintain safe geometric configurations under seismic conditions. The spent fuel itself consists of solid ceramic pellets which are encapsulated in metal clad rods held in gridded assemblies and stored underwater in reinforced concrete structures or in sealed dry storage installations such as concrete dry wells, vaults and silos or massive metal casks. The properties of the spent fuel [which in extended storage has decayed to the point where individual fuel assemblies have a heat generation rate of several hundred watts or less] and of the benign storage environment result in spent fuel storage being an activity with very little potential for

adversely affecting the environment and the public health and safety. While any system employing high technology is subject to some equipment breakdowns or accidents, water pool storage facilities have operated with few serious problems (DOE PS at IV-56 to IV-57; UNWMC-EEI PS Doc. 4 p. 26). In these cases, the events at spent-fuel pools have been manageable on a timely basis. Similarly, dry storage of spent fuel, as discussed in Section C above, appears to be at least as safe as water pool storage. A discussion of risks related to spent fuel storage is provided below.

Comments from participants on the subject of accidents and their potential consequences at spent-fuel storage facilities included a description of nonspecific references to numerous "accidents" in spent-fuel storage facilities, a discussion of cases of leaks and inadvertent releases of contaminated storage pool water, and a suggestion that waste storage should be physically separated from reactor operation to reduce the risk of damage to the storage facility in the event of a reactor accident, and vice versa (NY PS pp. 102-107; OCTLA PS p. 12). The State of New York, in its discussion of possible accidents at spent-fuel storage pools, cited reports of an accident in the Soviet Union that is believed to have involved reprocessing plant wastes stored in tanks at a waste storage facility (NY PS pp. 107-108). The situation, as reconstructed from limited data, cannot be compared to the storage of ceramic fuel in metal cladding, placed in water storage pools. The issue raised, therefore, is not relevant to this proceeding. The need for continued management of pool storage facilities over an extended time period was considered by some participants as creating a potential hazard because of the increased possibility of human errors or mismanagement (NRDC PS pp. 89-90). The State of New York characterized the Three Mile Island reactor accident as caused by multiple technical and human failures, and postulated that such failures are possible at storage facilities, and would result in serious off-site consequences (NY PS p. 107).

These observations do not appear to take account of the numerous safety analyses that have been made of water pool storage and of alternative long-term storage methods which have demonstrated storage to be both safe and environmentally acceptable. Of course, the possibility of human error cannot be completely eliminated. However, Commission regulations (e.g.,

10 CFR Part 55; 10 CFR Part 72, Subpart I) include explicit requirements for operator training, the use of written procedures for all safety-related operations and functions in the plant, and certification or licensing of operators, with the objective of minimizing the opportunity for human error. Unlike the accident at the Three Mile Island reactor, human error at a spent fuel storage installation does not have the capability to create a major radiological hazard to the public. The absence of high temperature and pressure conditions that would provide a driving force essentially eliminates the likelihood that an operator error would lead to a major release of radioactivity (DOE CS pp. II-156 to 158). In addition, features incorporated in storage facilities are designed to mitigate the consequences of accidents caused by human error or otherwise (DOE PS IV-34).

The possibility of terrorist attacks on nuclear facilities was advanced as an argument against the acceptability of extended interim storage of spent fuel (NRDC PS p. 90). The intentional sabotage of a storage pool facility is possible, and NRC continues to implement actions to further improve security at such facilities. The consequences would be limited by the realities that, except for some gaseous fission products, the radioactive content of spent fuel is in the form of solid ceramic material encapsulated in high-integrity metal cladding and stored underwater in a reinforced concrete structure. Under these conditions, the radioactive content of spent fuel is relatively invulnerable to dispersal to the environment (Final Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel, NUREG-0575, Vol. 1.). Similarly, dry storage of spent fuel in dry wells, vaults, silos and metal casks is also relatively invulnerable to sabotage and natural disruptive forces, because of the weight and size of the sealed, protective enclosures which may include 100-ton steel casks, large concrete lined near-surface caissons and surface concrete silos (NUREG/CR-1223, p. IV-C-2).

E. Summary

In summary, the Commission finds that spent fuel can be stored safely at independent spent fuel storage installations or at reactor sites for at least 30 years beyond the expiration of reactor operating licenses. This finding is based on extensive experience and on many factors that are not site-specific. These factors include the substantial capability of the fuel cladding to

maintain its integrity under storage conditions, a capability verified in extensive technical studies and experience; the extreme thermal and chemical stability of the fuel form, enriched uranium oxide pellets; the long-term capability of spent fuel storage facilities to dissipate spent fuel heat and retain any radioactive material leakage; and the relatively straightforward techniques and procedures for repairing spent fuel storage structures, replacing defective components or equipment, or undertaking other remedial actions to assure containment of radioactivity (A.B. Johnson, Jr., "Behavior of Spent Nuclear Fuel in Water Pool Storage", (UC-70) Battelle Pacific Northwest Laboratories (BNWL-2256, September 1977)). These factors contribute to the assurance that spent fuel can be stored for extended periods without significant impact on the public health and safety and the environment. Moreover, any storage of spent fuel at independent spent fuel storage installations or reactor sites beyond the operating license expiration will be subject to licensing and regulatory control to assure that operation of the storage facilities does not result in significant impacts to the public health and safety.

For the reasons discussed previously (Sections 2.4 A through D above), the Commission also concludes, from the record of this proceeding, that storage of spent fuel either at or away from a reactor site for 30 years beyond the operating license expiration would not result in a significant impact to the environment or an adverse effect on the public health and safety. The Commission's findings are also supported by NRC's experience in more than 80 individual safety evaluations of spent fuel storage facilities conducted in recent years. The record indicates that significant releases of radioactivity from spent fuel under licensed storage conditions are highly unlikely. This is primarily attributable to the resistance of the spent fuel to corrosive mechanisms and the absence of any conditions that would result in offsite dispersal of radioactive material. The Commission concludes that the possibility of a major accident or sabotage with off-site radiological impacts at a spent-fuel storage facility is extremely remote because of the characteristics of spent-fuel storage. These include the inherent properties of the spent fuel itself, the benign nature of the water pool or dry storage environment, and the absence of any conditions that would provide a driving force for dispersal of radioactive material. Moreover, there are no

significant additional non-radiological impacts which could adversely affect the environment if spent fuel is stored beyond the expiration of operating licenses for reactors. The non-radiological environmental impacts associated with site preparation and construction of storage facilities are, and will continue to be, considered by the NRC at the time applications are received to construct these facilities, which are licensed under NRC's regulations in either 10 CFR Part 50 for reactors or 10 CFR Part 72 for independent spent fuel storage facilities. The procedure to be followed in implementing the Commission's generic determination is the subject of rulemaking which the Commission has conducted.

2.5 Fifth Commission Finding

The Commission finds reasonable assurance that safe independent onsite spent fuel storage or offsite spent fuel storage will be made available if such storage capacity is needed.

The technology for independent spent fuel storage installations as discussed under the fourth Commission Finding, is available and demonstrated. The regulations and licensing procedures are in place. Such installations can be constructed and licensed within a five-year time interval. Before passage of the Nuclear Waste Policy Act of 1982 the Commission was concerned about who, if anyone, would take responsibility for providing such installations on a timely basis. While the industry was hoping for a government commitment, the Administration had discontinued efforts to provide those storage facilities (Tr. pp. 157-158). The Nuclear Waste Policy Act of 1982 establishes a national policy for providing storage facilities and thus helps to resolve this issue and assure that storage capacity will be available.

Prior to March 1981, the DOE was pursuing a program to provide temporary storage in off-site, or away-from-reactor (AFR), storage installations. The intent of the program was to provide flexibility in the national waste disposal program and an alternative for those utilities unable to expand their own storage capacities (DOE PS p. I-11; DOE CS p. II-86).

Consequently, the participants in this proceeding assumed that, prior to the availability of a repository, the Federal government would provide for storage of spent fuel in excess of that which could be stored at reactor sites. Thus, it is not surprising that the record of this proceeding prior to the DOE policy change did not indicate any direct commitment by the utilities to provide AFR storage. On March 27, 1981 DOE

placed in the record a letter to the Commission stating its decision "to discontinue its efforts to provide Federal government-owned or controlled away-from-reactor storage facilities." The primary reasons for the change in policy were cited as new and lower projections of storage requirements and lack of Congressional authority to fully implement the original policy.

The record of this proceeding indicates a general commitment on the part of industry to do whatever is necessary to avoid shutting down reactors or derating them because of filled spent fuel storage pools. While industry's incentive for keeping a reactor in operation no longer applies after expiration of its operating license, utilities possessing spent fuel are required to be licensed and to maintain the fuel in safe storage until removed from the site. Industry's response to the change in DOE's policy on federally-sponsored away-from-reactor (AFR) storage was basically a commitment to do what is required of it, with a plea for a clear unequivocal Federal policy (Tr. pp. 157-159). The Nuclear Waste Policy Act of 1982 has now provided that policy.

The Nuclear Waste Policy Act defines public and private responsibilities for spent fuel storage and provides for a limited amount of federally-supported interim storage capacity. The Act also includes provisions for monitored retrievable storage facilities and for a research, development and demonstration program for dry storage. The Commission believes that these provisions provide added assurance that safe independent onsite or offsite spent fuel storage will be available if needed.

In Subtitle B of the Act, "Interim Storage Program," Congress found that owners and operators of civilian power reactors "have the primary responsibility for providing interim storage of spent nuclear fuel from such reactors" by maximizing the use of existing storage facilities onsite and by timely additions of new onsite storage capacity. The Federal government is responsible for encouraging and expediting the effective use of existing storage facilities and the addition of new storage capacity as needed. In the event that the operators cannot reasonably provide adequate storage capacity to assure the continued operation of such reactors, the Federal government will assume responsibility for providing interim storage capacity for up to 1900 metric tons of spent fuel (Sec. 131(a)). Such interim storage capacity is to be provided by the use of available capacity at one or more Federal facilities, the acquisition of any

modular or mobile storage equipment including spent fuel storage racks, and/or the construction of new storage capacity at any reactor site (Sec. 135(a)(1)).

The Nuclear Waste Policy Act authorizes the Secretary of Energy to enter into contracts with generators or owners of spent fuel to provide for storage capacity in the amount provided in the Act (Sec. 138(a)(1)). However, such contracts may be authorized only if the NRC determines that the reactor owner or operator cannot reasonably provide adequate and timely storage capacity and is pursuing licensed alternatives to the use of Federal storage capacity (Sec. 135(b)).⁸ Further, any spent fuel stored in the "interim storage program" is to be removed from the storage site on facility "as soon as practicable" but in no event later than 3 years following the availability of a repository or monitored retrievable storage facility (Sec. 135(e)). The Act establishes an "Interim Storage Fund" for use in activities related to the development of interim storage facilities, including the transportation of spent fuel and impact assistance to state and local governments (Sec. 130(d)).

In addition to providing for interim storage capacity, Congress found that "the long-term storage of high level radioactive waste or spent nuclear fuel in monitored retrievable storage facilities is an option for providing safe and reliable management of such waste or spent fuel." By June 1, 1985, the Secretary of Energy must complete a detailed study of the need for, and feasibility of, such a facility and submit to Congress a proposal for the construction of one or more such facilities. The Act also directs the Secretary of Energy to establish a demonstration program, in cooperation with the private sector, for the dry storage of spent nuclear fuel at reactor sites and provide consultative and technical assistance on a cost-sharing basis to assist utilities lacking interim storage capacity to obtain the construction, authorization and appropriate license from the NRC. Such assistance may include the establishment of a research and development program for the dry storage of no more than 300 metric tons of spent fuel at federally-owned facilities (Sec. 218, (a)(b)(c)).

The Commission's confidence that independent on-site and/or off-site

⁸ Accordingly, the Commission has published proposed "Criteria and Procedures for Determining the Adequacy of Available Spent Nuclear Fuel Storage Capacity," 10 CFR Part 63 (48 FR 10382, April 29, 1983).

storage capacity for spent fuel will be available as needed is further supported by the strong likelihood that only a portion of the total spent fuel generated will require storage outside of reactor storage basins (DOE PS pp. V-3 to V-13). Estimates of the amount of spent fuel requiring storage away from reactors have declined significantly over the duration of this proceeding (DOE March 27, 1981 letter from O. Brown II, DOE Office of General Counsel, to M. Miller NRC, Presiding Officer in this proceeding).

DOE reported that cumulative spent fuel discharges, previously estimated as 100,000 metric tons of uranium (MTU), dropped to 72,000 MTU through the year 2000. Projected requirements for additional spent fuel storage capacity begin in 1986 (instead of 1981) and increase to 9500 MTU per year by 1997. Earlier projections indicated a need for 16,000 MTU per year for additional storage capacity in 1997.⁹ DOE pointed out that additional storage requirements could be satisfied in a number of ways, including: (a) Use of private existing AFR storage facilities; (b) construction of new water basins at reactor facilities or away from reactor facilities by private industry or the utilities; (c) transshipment of spent fuel between reactors operated by different utilities; (d) disassembly of spent fuel and storage of spent fuel rods in canisters; and (e) dry storage at reactor sites.

Subsequently, DOE published new estimates for additional spent fuel storage capacity ("Spent Fuel Storage Requirements", DOE/RL-82-1, June, 1982). These estimates show a maximum required away-from-reactor (AFR) storage capacity of 8610 metric tons uranium of spent fuel in the year 1997. This is a decline from DOE's previously published planning-base case. The information in Table 1 below is excerpted from DOE/RL-83-1 and provides a range of projections of additional storage capacity needs. The first column is a projection of storage capacity needed over and above the currently existing and planned storage capacity. The second column provides projected values of additional storage capacity needed if maximum re-racking is conducted at existing or planned reactor basin storage pools. The storage capacity needs shown in the second column are somewhat smaller than in the first column. A further decrease in additional needed storage capacity is shown in the third column, which takes into account the possibility of

⁹ DOE's planning-base studies assume maximum basin re-racking at reactors and the maintenance of full-core reserve in reactor basins.

transshipment of fuel from one reactor basin to another basin owned by the same utility. The projected values of needed storage capacity in the first and third columns provide a range of upper and lower bound values, respectively. The most likely outcome expected by DOE corresponds to the values in the second column. This was formerly known as the planning base case and is now termed the reference case. All projections shown in the table assume the maintenance of a full core reserve. The magnitude of need for additional spent fuel storage capacity projected by DOE has continued to decline, even though DOE has not assumed the use of newly developed technology, such as fuel rod consolidation.

The cumulative amount of spent fuel to be disposed of in the year 2000 is expected to be 58,000 metric tons of uranium [Spent Fuel Storage Requirements (Update of DOE/RL-82-1) DOE/RL-83-1, published January, 1983]. The additional required storage capacity of 13,000 metric tons of uranium projected in the second column for the year 2000 is less than 25% of the total quantity of spent fuel projected to be in storage. It is expected that additional storage will be provided at the reactor site, with some smaller portion to be moved offsite.

TABLE 1.—ADDITIONAL CUMULATIVE SPENT FUEL STORAGE REQUIREMENTS, OVER AND ABOVE CURRENT AND PLANNED STORAGE AT REACTOR STORAGE BASINS (METRIC TONS OF URANIUM)¹

Year	No change in current or planned storage capacity	Use maximum re-racking of current and planned storage capacity	Maximum re-racking plus transshipment
1982	0	0	0
1983	0	0	0
1984	13	13	0
1985	13	13	0
1986	110	110	3
1988	550	473	63
1990	1,550	1,300	310
1985	5,610	5,663	3,653
2000	14,760	13,000	10,370

¹ Spent Fuel Storage Requirements (Update of DOE/RL-82-1) DOE/RL-83-1, published January, 1983.

In response to the Commission's Second Prehearing Memorandum and Order (Nov. 6, 1981) the participants commented on the significance to the proceeding of issues resulting from the DOE policy change on spent fuel storage. The utilities generally limited their written responses to a restatement of the safety of interim storage and an affirmation of the technical and practical feasibility of the alternatives to Federal AFR storage facilities. An implied commitment by industry to

implement AFR storage if necessary using one of the several feasible spent fuel storage alternatives is evident from the responses of the utilities, the nuclear industry, and associated groups (i.e., Tr. p. 159).

Based upon the foregoing, the Commission has, then, reasonable assurance that safe independent onsite or offsite spent fuel storage will be available if needed. The technology is demonstrated and the licensing procedures in place. The Nuclear Waste Policy Act establishes a national policy on interim storage of spent fuel and provides for contingency Federal storage capacity to augment that provided by industry. Further, the amount of fuel which may have to be stored in independent spent fuel storage facilities is less than was originally thought.

Reference Notation

The following abbreviations have been used for the reference citations in the Appendix:

- PS Position Statement
 - CS Cross-Statement
 - PHS Pre-Hearing Statement
 - Tr. Transaction* of January 11, 1982 public meeting with the Commissioners
- Participants have been identified by the following citations:

Citation and Participant

- AICHe—American Institute of Chemical Engineers
- ANS—American Nuclear Society
- AEG—Association of Engineering Geologists
- AIF—Atomic Industrial Forum, Inc.
- Becht—Bechtel National, Inc.
- CDC—California Department of Conservation
- CEC—California Energy Commission
- CPC—Consumers Power Company
- Del—State of Delaware
- DOE—U.S. Department of Energy
- ECNP—Environmental Coalition on Nuclear Power
- GE—General Electric Company
- Ill—State of Illinois (PS includes Roy affidavit)
- Lewis—Marvin L. Lewis
- Lochstet—Dr. William A. Lochstet
- Minn—State of Minnesota
- MAD—Mississippians Against Disposal
- NECNP—New England Coalition on Nuclear Pollution
- NIE—Neighbors for the Environment (PS includes papers by Domsife, Rae, and Strahl)
- NRDC—Natural Resources Defense Council, Inc.
- NY—State of New York

*The Commission considers this transcript to be part of the administrative record in this rulemaking. However, the transcript has not been reviewed for accuracy by the Commission on the participants, and therefore is only an informal record of the matters discussed.

OCTLA—Ocean County and Township of Lower Alloway Creek
Ohio—State of Ohio
SC—State of South Carolina
SE2—Scientists and Engineers for Secure Energy, Connecticut Chapter
SHL—Safe Haven, Ltd.
SMP—Sensible Main Power, Inc.
TVA—Tennessee Valley Authority
UNWMC—EEL—Utility Nuclear Waste Management Group—Edison Electric Institute
USGS—United States Geological Survey
Vt—State of Vermont
Wis—State of Wisconsin (PS includes comments by Deese, Mudrey, Kelly, and Leverance)
UG—The Utilities Group (Niagara Mohawk Power Corp., Omaha Public Power District, Power Authority of the State of New York, and Public Service Company of Indiana, Inc.)

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10 CFR Parts 50 and 51

Requirements for Licensee Actions Regarding the Disposition of Spent Fuel Upon Expiration of Reactor Operating Licenses

AGENCY: Nuclear Regulatory Commission.

ACTION: Final rule.

SUMMARY: The Nuclear Regulatory Commission is amending its regulations to incorporate the following provisions: (1) The Commission has reasonable assurance that no significant environmental impacts will result from the storage of spent fuel for at least 30 years beyond the expiration of nuclear reactor operating licenses. Accordingly, no discussion of any environmental impact of spent fuel storage for the period following expiration of the license or amendment applied for, is required in connection with the issuance or amendment of an operating license for a nuclear reactor or in connection with the issuance of an initial license or an amendment to an initial license for an independent spent fuel storage installation. (2) Operating nuclear power reactor licensees are required no later than 5 years before expiration of the reactor operating license, to submit for NRC review and approval, their plans for managing spent fuel at their site until the spent fuel is transferred to the Department of Energy for disposal.

EFFECTIVE DATE: November 29, 1984.

FOR FURTHER INFORMATION CONTACT: Dennis Rathbun or Clyde Jupiter, Office of Policy Evaluation, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, telephone (202) 634-3295, or Sheldon Trubatch, Office of the General

Counsel, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, telephone (202) 634-3224.

SUPPLEMENTARY INFORMATION:

Background

By a Notice of Proposed Rulemaking dated October 25, 1979 (44 FR 61372), the Nuclear Regulatory Commission ("Commission" or "NRC") began a generic rulemaking proceeding "to reassess its degree of confidence that radioactive wastes produced by nuclear facilities will be safely disposed of, to determine when any such disposal will be available, and whether such wastes can be safely stored until they are safely disposed of." This proceeding became known as the "Waste Confidence" rulemaking proceeding, and was conducted partially in response to a remand by the United States Court of Appeals for the D.C. Circuit. *State of Minnesota v. NRC*, 602 F.2d 412 (1979). *State of Minnesota* involved a challenge to license amendments to permit the expansion of spent fuel pool storage capacities at two nuclear power plants. It was contended that uncertainty regarding ultimate disposal of commercial nuclear wastes required the Commission to consider the safety and environmental implications of storing spent fuel in the pools for an indefinite period following expiration of the plants' operating licenses. The Commission had excluded consideration of such long-term onsite storage from the license amendment proceedings, relying on its earlier finding (42 FR 34391, July 5, 1977) that safe permanent disposal of reactor wastes would be available when needed.

The Court of Appeals agreed with the Commission that, in accordance with the "rule of reason" implicit in the National Environmental Policy Act (NEPA), impacts of extended on-site storage of spent fuel need not be considered in licensing proceedings unless such storage was reasonably foreseeable and not merely a theoretical possibility. The Court held, however, that the Commission's statement of reasonable confidence in the timely availability of waste disposal solutions was "not the product of a rulemaking record devoted expressly to considering the question" and furthermore did not address the particular problem whether disposal solutions would be available before the expiration of plant operating licenses. *Id.* at 417. Accordingly, the D.C. Circuit remanded to the Commission for determination "whether there is reasonable assurance that an off-site storage solution will be available by the years 2007-2009, the expiration of the plants' operating licenses, and if not,

whether there is reasonable assurance that the fuel can be stored safely at the site beyond those dates." *Id.* at 418. The Court noted that "the breadth of the questions involved and the fact that the ultimate determination can never rise above a prediction suggest that the determination may be a kind of legislative judgment for which rulemaking would suffice." *Id.* at 417. The Court agreed that the Commission "may proceed in these matters by generic determinations." *Id.* at 419. *Accord, Potomac Alliance v. NRC*, 602 F.2d 1030 (D.C. Cir. 1982).

Amendment to Part 51

Elsewhere in this issue, the Commission announced the conclusions it reached in the Waste Confidence rulemaking proceeding. The Commission found that there is reasonable assurance that one or more mined geologic repositories for commercial high-level radioactive waste and spent fuel will be available by 2007-2009. However, some reactor operating licenses may expire without being renewed or some reactors may be permanently shut down prior to this period. Since independent spent fuel storage installations have not yet been extensive by developed, there is then a probability that some onsite spent fuel storage after license expiration may be necessary or appropriate. In addition, the Commission also realizes that some spent fuel may be stored in existing or new storage installations for some period beyond 2007-2009.

The Commission hereby adopts a rule providing that the environmental impacts of at-reactor storage after the termination of reactor operating licenses need not be considered in Commission proceedings related to issuance or amendment of a reactor operating license. This rule has the effect of continuing the Commission's practice, employed in the proceedings reviewed in *State of Minnesota*, of limiting considerations of environmental impacts of spent fuel storage in licensing proceedings to the period of the license in question and not requiring the NRC staff or the applicant to address the impacts of extended storage past expiration of the license applied for. The rule relies on the Commission's generic determination in the Waste Confidence proceeding that the licensed storage of spent fuel for 30 years beyond the reactor operating license expiration either at or away from the reactor site is feasible, safe, and would not result in a significant impact on the environment. For the reasons discussed in the Waste Confidence decision, the Commission believes there is reasonable assurance

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 SC—State of South Carolina
 SE2—Scientists and Engineers for Secure Energy, Connecticut Chapter
 SHL—Safe Haven, Ltd.
 SMP—Sensible Main Power, Inc.
 TVA—Tennessee Valley Authority
 UNWMC—EEI—Utility Nuclear Waste Management Group—Edison Electric Institute
 USGS—United States Geological Survey
 VT—State of Vermont
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10 CFR Parts 50 and 51

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ACTION: Final rule.

SUMMARY: The Nuclear Regulatory Commission is amending its regulations to incorporate the following provisions: (1) The Commission has reasonable assurance that no significant environmental impacts will result from the storage of spent fuel for at least 30 years beyond the expiration of nuclear reactor operating licenses. Accordingly, no discussion of any environmental impact of spent fuel storage for the period following expiration of the license or amendment applied for, is required in connection with the issuance or amendment of an operating license for a nuclear reactor or in connection with the issuance of an initial license or an amendment to an initial license for an independent spent fuel storage installation. (2) Operating nuclear power reactor licensees are required no later than 5 years before expiration of the reactor operating license, to submit for NRC review and approval, their plans for managing spent fuel at their site until the spent fuel is transferred to the Department of Energy for disposal.
EFFECTIVE DATE: November 29, 1984.
FOR FURTHER INFORMATION CONTACT: Dennis Rathbun or Clyde Jupiter, Office of Policy Evaluation, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, telephone (202) 634-3295, or Sheldon Trubatch, Office of the General

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The Court of Appeals agreed with the Commission that, in accordance with the "rule of reason" implicit in the National Environmental Policy Act (NEPA), impacts of extended on-site storage of spent fuel need not be considered in licensing proceedings unless such storage was reasonably foreseeable and not merely a theoretical possibility. The Court held, however, that the Commission's statement of reasonable confidence in the timely availability of waste disposal solutions was "not the product of a rulemaking record devoted expressly to considering the question" and furthermore did not address the particular problem whether disposal solutions would be available before the expiration of plant operating licenses. *Id.* at 417. Accordingly, the D.C. Circuit remanded to the Commission for determination "whether there is reasonable assurance that an off-site storage solution will be available by the years 2007-2009, the expiration of the plants' operating licenses, and if not,

whether there is reasonable assurance that the fuel can be stored safely at the site beyond those dates." *Id.* at 418. The Court noted that "the breadth of the questions involved and the fact that the ultimate determination can never rise above a prediction suggest that the determination may be a kind of legislative judgment for which rulemaking would suffice." *Id.* at 417. The Court agreed that the Commission "may proceed in these matters by generic determinations." *Id.* at 419. *Accord, Potomac Alliance v. NRC*, 682 F.2d 1030 (D.C. Cir. 1982).

Amendment to Part 51

Elsewhere in this issue, the Commission announced the conclusions it reached in the Waste Confidence rulemaking proceeding. The Commission found that there is reasonable assurance that one or more mined geologic repositories for commercial high-level radioactive waste and spent fuel will be available by 2007-2009. However, some reactor operating licenses may expire without being renewed or some reactors may be permanently shut down prior to this period. Since independent spent fuel storage installations have not yet been extensively developed, there is then a probability that some onsite spent fuel storage after license expiration may be necessary or appropriate. In addition, the Commission also realizes that some spent fuel may be stored in existing or new storage installations for some period beyond 2007-2009.

The Commission hereby adopts a rule providing that the environmental impacts of at-reactor storage after the termination of reactor operating licenses need not be considered in Commission proceedings related to issuance or amendment of a reactor operating license. This rule has the effect of continuing the Commission's practice, employed in the proceedings reviewed in *State of Minnesota*, of limiting considerations of environmental impacts of spent fuel storage in licensing proceedings to the period of the license in question and not requiring the NRC staff or the applicant to address the impacts of extended storage past expiration of the license applied for. The rule relies on the Commission's generic determination in the Waste Confidence proceeding that the licensed storage of spent fuel for 30 years beyond the reactor operating license expiration either at or away from the reactor site is feasible, safe, and would not result in a significant impact on the environment. For the reasons discussed in the Waste Confidence decision, the Commission believes there is reasonable assurance

that adequate disposal facilities will become available during this 30-year period. Thus, there is no reasonable probability that storage will be unavoidable past the 30-year period in which the Commission has determined that storage impacts will be insignificant.

The same safety and environmental considerations apply to fuel storage installations licensed under Part 72 as for storage in reactor basins. Accordingly, in licensing actions involving (a) the storage of spent fuel in new or existing facilities, or (b) the expansion of storage capacity at existing facilities, the NRC will continue to require consideration of reasonably foreseeable safety and environmental impacts of spent fuel storage only for the period of the license applied for. The amendment to 10 CFR Part 51 confirms that the environmental impacts of spent fuel storage in reactor facility storage pools or independent spent fuel storage installations for the period following expiration of the reactor or installation storage license or amendment applied for need not be addressed in any environmental report, impact statement, impact assessment, or other analysis prepared in connection with the reactor operating license or amendment to the operating license, or initial license for an independent spent fuel storage installation, or amendment thereto.

The Commission's conclusions with respect to safety and environmental impacts of extended storage beyond expiration of current operating licenses are supported by the record in NRC's Waste Confidence proceeding and by NRC's experience in more than 80 individual safety and environmental evaluations conducted in storage licensing proceedings. The record of the Waste Confidence proceeding indicates that significant release of radioactivity from spent fuel under licensed storage conditions is highly unlikely because of the resistance of the spent fuel cladding to corrosive mechanisms and the absence of any conditions that would provide a driving force for dispersal of radioactive material. The non-radiological environmental impacts associated with site preparation and construction of storage facilities are and will continue to be considered by the NRC at the time applications are received to construct these facilities, which are licensed under NRC's regulations in either 10 CFR Part 50 for reactors or 10 Part 72 for independent spent fuel storage installations. There are no significant additional non-radiological impacts which could adversely affect the environment for

storage past the expiration of operating licenses at reactors and independent spent fuel storage installations.

The amendments to Part 51 published here include § 51.23 (a), (b) and (c) as well as conforming amendments in §§ 51.30(b), 51.53 (a) and (b), 51.61, 51.69, 51.95 and 51.97. Paragraph 51.23(a) is a restatement of a final generic Commission determination (elsewhere in this issue) based on the Waste Confidence rulemaking proceeding, while § 51.23 (b) and (c) establish the procedures for implementing that generic determination in individual licensing cases.

Amendment to Part 50

The Commission is also adopting an amendment to 10 CFR Part 50 as set forth here, concerning the management of spent fuel from nuclear power reactors whose operating licenses may expire prior to the availability of a repository. The procedures established by this amendment are intended to confirm that there will be adequate lead time for whatever actions may be needed at individual reactor sites to assure that the management of spent fuel following the expiration of the reactor operating license will be accomplished in a safe and environmentally acceptable manner.

The Commission amends § 50.54 to establish requirements that the licensee for an operating nuclear power plant reactor shall no later than 5 years prior to expiration of the reactor operating license submit plans for NRC review and approval of the actions which the licensee proposes for management of all irradiated fuel at the reactor upon expiration of its operating license. No specific course of action is required of the licensee by the NRC. Licensee actions could include, but are not necessarily limited to, continued storage of spent fuel in the reactor spent fuel storage basin, storage in an independent spent fuel storage installation (refer to 10 CFR 72.3(m)) located at the reactor site or at another site; transshipment to and storage of the fuel at another operating reactor site in that reactor's basin; reprocessing of the fuel if it appears that licensed reprocessing facilities will be available; or disposal of the fuel in a repository. The proposed licensee actions must be consistent with NRC requirements for licensed possession of irradiated or spent fuel (as defined in § 72.3(v)) and must be capable of being authorized by the NRC and implemented by the licensee on a timely basis. The licensee's plans must specify how the financial costs of extended storage or other disposition of spent fuel will be funded. Further, the

licensee's plans must describe the proposed disposition of all irradiated fuel from the reactor. The licensee shall notify the NRC of any significant changes to these plans; changes are not precluded provided that the licensee maintains the capability to manage the spent fuel safely.

The Commission notes that extended storage of spent fuel at a reactor beyond the expiration date of the operating license will require an amendment to the Part 50 license to cover possession only of the reactor and spent fuel under the requisite provisions of Parts 30, 50 and 70, or an authorization pursuant to Part 72, "Licensing Requirements for the Storage of Spent Fuel in an Independent Spent Fuel Storage Installation" (ISFSI). This rulemaking does not alter the requirements and provisions of Parts 51 and 72 with respect to the performance of environmental reviews of the impacts of spent fuel storage in an independent spent fuel storage installation or extended storage in a reactor spent fuel pool. This means that the NRC staff will continue to perform environmental reviews before issuing a license under 10 CFR Part 72 or an amendment for extended storage under 10 CFR Part 50. Notice of the receipt of a license application for storage of spent fuel pursuant to Part 72 will be published in the Federal Register.

Related Commission Actions

On March 13, 1978, the NRC published an Advance Notice of Proposed Rulemaking indicating that the NRC was reevaluating its decommissioning policy and considering amending its regulations to provide more specific guidance on decommissioning of nuclear facilities (43 FR 10370). In January 1981, NRC published a "Draft Generic Environmental Impact Statement on Decommissioning Nuclear Facilities" (NUREG-0586). Proposed amendments to 10 CFR Parts 30, 40, 50, 51, 70, and 72 are being prepared by the NRC staff for Commission consideration. The proposed amendments for decommissioning would allow unrestricted use of a reactor or independent spent fuel storage installation site and would permit termination of the license. However, the storage of irradiated fuel either in a reactor basin or in an independent spent fuel storage installation would require restricted access and management of the storage facility to protect public health and safety. Thus, any continued storage of spent fuel beyond expiration of an operating license would be licensed under either Parts 50 or 72 and could

preclude final decommissioning of the site.

Analysis of Public Comment

1. Introduction

Proposed amendments to 10 CFR Parts 50 and 51, related to the Commission's Waste Confidence decision, were published in the Federal Register (48 FR 22730) for public comment on May 20, 1983. Section 50.54(aa) (formerly identified as § 50.54(x)) proposed to require licensees to submit no later than 5 years before expiration of reactor operating licenses a plan for post-operation management of spent fuel which is onsite at the time of license expiration. Section 51.23(a) (formerly identified as § 51.5(e)(1)) proposed a restatement of the Commission's generic determination in the Waste Confidence decision that no significant environmental impacts will result from onsite or offsite storage of spent fuel up to 30 years after reactor operating license expiration, that there is reasonable assurance that a repository will be available by 2007-2009, and that sufficient repository capacity will be available within 30 years beyond license expiration to dispose of reactor waste and spent fuel. Section 51.23(b) (formerly identified as § 51.5(e)(2)) proposed that the environmental impacts of potential extended spent fuel storage (i.e., storage beyond the period of an existing or initial license) need not be addressed in connection with a reactor operating license or the license for an independent spent fuel storage installation.

Comments were received from 21 respondents to the May 20, 1983 request. In addition to substantive comments discussed below, some commenters questioned: (1) The adequacy of the opportunity to comment on the Commission's fourth finding and supporting documentation; (2) the Commission's compliance with NEPA. In response, the Commission reopened the comment period (48 FR 50746, November 3, 1983). These later comments represent expanded discussions of procedural and environmental issues raised in the May 20, 1983 comment period and the Commission's responses to them are set out in the companion Waste Confidence decision published concurrently with this document. For the reasons discussed there, the Commission found no basis to modify its fourth finding or the related supporting documentation. The participants are identified by the abbreviated citations defined in Section 5 below.

2. Proposed Provisions of 10 CFR 50.54(bb)

a. Timely Submission of Spent Fuel Management Plans

(1) *Summary of Comments.* The proposed rule would require each reactor licensee to submit, no later than 5 years before expiration of the operating license, written notification to the Commission describing the licensee's program for post-operational management of all irradiated fuel which is at the reactor at the time of expiration of the operating license, pending ultimate disposal of the irradiated fuel in a repository.

Some respondents agreed with the proposed notification date (Tol. Ed., UNWVG-EEI p. 3; MP&L). Others believed that the submittal of notification only 5 years before expiration of the reactor operating license was too late; rather, they would require utilities with operating reactors to submit spent fuel management plans within six months of issuance of this rule. For new reactors, these latter respondents advocated submission of plans prior to issuance of an operating license (UCS p. 2; NECNP p. 1; Hiatt) or even sooner (CNPP p. 1). Still others agreed that early planning was essential but did not recommend specific timing for submittal of plans (Wis. p. 2; ISAS p. 1; WED, EPI pp. 1, 2).

Among the reasons advanced for recommending an earlier planning requirement were the following: Industry's alleged record of reluctance to accept its responsibilities for spent fuel storage (Hiatt; ISAS p. 1; EPI p. 1); five years before license expiration the utility's primary concerns would be the massive inventory of spent fuel on hand, possible financial constraints as a result of reduction in the rate base, and the need to concentrate on newer and more long-term generating facilities (UCS, p. 2). UCS remarked that the requirement to submit a management plan near the end of the license term implied NRC might be willing to permit development of onsite semi-permanent storage facilities (UCS p. 2). Other respondents pointed out that earlier planning for spent fuel management is needed because the reactor may be shut down prior to the license expiration date; some plants may be shut down prematurely as a result of accidents or inability to meet newer regulatory requirements, and others may be shut down because of premature aging, steam generator or primary system degradation, or unacceptable severe accident risks (ISAS p. 1; EPI pp. 1, 2). One respondent recommended that the NRC require utilities to prepare spent

fuel management plans every 5 years (EPI p. 3).

The Utility Decommissioning Group stated that consideration of premature shutdown due to accidents or other conditions was speculative and irrelevant to the Commission's proposed rule (UDG p. 7). An industry representative commented that the requirement to verify submittals for NRC authorizations was inappropriate since some authorizations would not be needed as early as five years before operating license expiration; an alternative schedule for seeking such authorizations was suggested (AIF, p. 7). Finally, one respondent stated that licensee plans should only address spent fuel management up to the time when the material and title are delivered to DOE for disposal (SE2 p. 4).

(2) *NRC Response.* The Commission believes that the choice of five years prior to operating license expiration represents a reasonable timeframe for licensees to submit their spent fuel management plans.

Delaying a request for such plans until the license expiration is imminent would not permit the timely implementation of alternative actions in the event deficiencies in the plans are identified by the Commission. Time is needed to ensure that the proposed plans are consistent with the licensee's long range plans, such as decommissioning, and that the plans meet whatever requirements are involved in the transfer of title to spent fuel to the Secretary of Energy for disposal in a repository.

On the other hand, the Commission believes that a requirement for a licensee to develop spent fuel management plans a decade or two before license expiration would be unnecessarily restrictive and could even be counterproductive. Such premature plans would be likely to undergo several revisions to accommodate to changing circumstances and their usefulness would be questionable.

Premature shutdown or termination of a reactor's license which results in an unanticipated need for interim storage or disposal arrangements is not expected to be a generic problem. The Commission will consider the consequences of premature termination of operation, should such an event occur, on a case-by-case basis. Even if a reactor shuts down prematurely, it will still be required to comply with license requirements.

Premature shutdown of a reactor could not pose a problem for storage of spent fuel, because intermediate or long-term demands on the spent fuel storage

facilities at a shutdown reactor (whether shut down prematurely or because of operating license expiration) will be limited by termination of spent fuel production. Any short-term need for storage would be related to the desirability of maintaining a full core reserve, which is not a safety issue.

AIF's concern that it may be inappropriate for a licensee to apply for all necessary NRC authorizations five years before license expiration has been taken into account by changing the third sentence of the proposed § 50.54(bb) to read "Where implementation of such actions require NRC authorizations, the licensee shall verify in the notification that submittals for such actions have been or will be made to NRC and shall identify them." (Emphasis added.)

Under the terms of the Nuclear Waste Policy Act of 1982, the Secretary of Energy will take title to spent fuel at a licensee's facility and transport the spent fuel to a repository for ultimate disposal. Because of this, each licensee's spent fuel management plans need only consider actions to be taken until the time of spent fuel transfer to the Secretary of Energy, rather than until the time of ultimate disposal. The final words of the first sentence of the proposed § 50.54(bb) have been revised to read "until title to the irradiated fuel and possession of the fuel is transferred to the Secretary of Energy for its ultimate disposal in a repository." (Emphasis added.)

b. Plans for Funding Spent Fuel Management

(1) *Summary of Comments.* The proposed rule would require a licensee's notification to include plans for financing the management of all irradiated fuel upon expiration of the reactor operating license until the ultimate disposal of the fuel in a repository.

Some respondents believed that the funding for spent fuel management should be considered together with funding for decommissioning (e.g., UDG pp. 5-7; UNWGMG-EEL p. 5; Tol Ed; AIF p. 6). They contended that, if funding for spent fuel management were to be addressed separately from decommissioning, the Commission should recognize that utilities generally would be permitted by the rate-making authorities to recover costs associated with extended fuel storage (UDG p. 6; AIF pp. 7, 8). Moreover, since each utility will have to demonstrate to NRC its ability to finance decommissioning—which will involve far greater costs than the maintenance and monitoring of spent fuel storage—the funding required for post-operating license spent fuel

management will be assured (UDG pp. 5-7; AIF pp. 7, 8). Others believe that the funding required for post-OL management of spent fuel would be assured because the utilities are financially responsible (UDG pp. 5-7; AIF pp. 7, 8); still others contended that if a utility operates a reactor, it should be required to have adequate funding set aside now to manage the spent fuel (UCS p. 3). On the other hand, some respondents expressed the view that, when the notification of plans is due, a utility might not wish to spend or even retain the funds required for spent fuel management (CNPP p. 1), e.g., Turkey Point, (FUSE p. 2).

(2) *NRC Response.* Following termination of reactor operation, actions to manage irradiated fuel stored on the plant site or to provide for its removal would include activities taken prior to and subsequent to decommissioning. In all cases after operating license termination, continued spent fuel storage at the nuclear power plant site would be subject to licensing under 10 CFR Part 50 or 72.

The suggestion that funding for decommissioning and spent fuel management be considered together would appear to offer no significant advantage. The costs of each are readily separable. Moreover, it is possible that rate-making authorities will treat cost recovery for decommissioning differently from costs of extended spent fuel storage, in which case separation of costs would be necessary. In addition, the scheduling of spent fuel storage and disposal is likely to depend primarily on factors not directly related to decommissioning such as irradiated fuel age, status of disposal facilities and availability of spent fuel transport casks. The Commission also notes that all reactor licensees have contracted with DOE for disposal of their spent fuel; further, any new reactor operating license will require that the licensee have a contract in place with DOE for disposal of all spent fuel generated.

c. Meaning of "Approval" of Plans for Spent Fuel Management

(1) *Summary of Comments.* The proposed 10 CFR 50.54(bb) provides for Commission "review and approval" of the licensee's spent fuel management plans. One respondent noted that there is no indication whether the NRC "approval" would take the form of an order or a license amendment and recommended that the concept of "approval" be eliminated from the rule (AIF pp. 6, 7). Others characterized formal approval as unnecessary (UDG p. 7) and burdensome (UNWGMG-EEL, pp. 3-5; Tol. Ed.), or as creating "a new

layer of approvals" (SE2 p. 3). It was suggested that the NRC staff review the plans, alert licensees to any deficiencies, and undertake formal approval only when action is taken to implement the plan through license amendments or other regulatory actions (AIF pp. 6, 7; UNWGMG-EEL p. 4).

(2) *NRC Response.* The Commission's review of each licensee's plans for management and ultimate disposal of all irradiated fuel at the reactor following operating license expiration is intended to assure that each licensee has made adequate advance preparations, including allowance for contingencies, for managing spent fuel in a manner which provides adequate protection of the public health and safety and the environment until it is transferred to the Secretary of Energy for disposal. Because the plans would be developed at least five years prior to operating license expiration, they would be based on the utility's forecast of its future situation. Some utilities may have sufficient uncertainty in their forecasts to preclude an early firm commitment to details of a program for management of spent fuel after operating license expiration. Accordingly, the Commission will consider the notification to be submitted under § 50.54(bb) as a formal expression of intent. The notification is part of an information gathering process which is more specific, but similar in nature to the provisions of § 50.54(f), which states:

The licensee will at any time before expiration of the license, upon request of the Commission submit written statements, signed under oath or affirmation, to enable the Commission to determine whether or not the license should be modified, suspended or revoked.

The provisions of § 50.54(bb) may be used by the Commission in determining if it needs to take any further action. The Commission's review will focus on the identification of discrepancies or omissions and its "approval" will signify that, based on the information available at the time of filing the notification, the licensee's plans are sound and will provide adequate protection of the public health and safety and the environment. Between the time the Commission indicates its preliminary approval of the plans and the date of expiration of the operating license, the licensee may propose for Commission consideration modifications or supplementation of its plans. In this way, prior to license expiration, the licensee will have developed a course of action which the Commission has approved as satisfying the regulatory requirements for safety and

environmental protection. The plan would then, at license expiration and termination of reactor operation, become part of the conditions of an amended Part 50 license for a shut down reactor facility, or a Part 72 license for storage of spent nuclear fuel following termination of reactor operation.

In order to clarify the Commission's intent that the Commission's approval of the licensee's plans for spent fuel management is not a final approval, the word "preliminary" has been inserted before "approval" in the first sentence of the proposed § 50.54(bb) and the following sentence is inserted after the first sentence: "Final Commission review will be undertaken as part of the proceeding for continued licensing under Part 50 or Part 72."

d. Relationship of Extended Spent Fuel Storage to Decommissioning

(1) *Summary of Comments.* In view of the potential juxtaposition of actions to implement spent fuel management plans addressed in § 50.54(bb) and decommissioning plans, some respondents urged that promulgation of the former be considered in the decommissioning rulemaking (UDG pp. 3-6) or coordinated with the decommissioning requirements (UDG pp. 5-7; UNWGM-EEI p. 5; EPI p. 2; AIF pp. 5, 6; Pilalis p. 2; MSS p. 2). The concerns were that the two rules (§ 50.54(bb) and decommissioning) might be conflicting or duplicative with respect to site access, preferred decommissioning mode, and financing (Pilalis p. 1; AIF pp. 5, 6). The record of the decommissioning rulemaking was cited as providing support for the Commission's determination that the environmental and safety implications of extended storage of spent fuel need not be considered in licensing proceedings (AIF pp. 3, 4; UDG p. 5).

(2) *NRC Response.* Here again, the Commission considers the decommissioning process as a set of actions separate from those discussed in § 50.54(bb). To delay issuance of a rule for extended spent fuel storage in order to combine it with the decommissioning rule which is being developed would serve no useful purpose. The safety and environmental implications of the two processes differ significantly. Specifically, decommissioning involves many more complex considerations than post-OL spent fuel management plans. Although the two activities may overlap in time, they are so different that combining the associated regulatory requirements into a single rulemaking would have no apparent advantage.

Although there is a potential for overlap between the plans submitted in

the § 50.54(bb) notification and the decommissioning plans, the overlap is most likely to be limited to scheduling aspects, e.g., situations where the presence of spent fuel in the reactor storage pool must be taken into account when considering decommissioning options. The Commission does not consider the potential for conflict from such overlapping activities to be sufficient to delay the present rulemaking until decommissioning regulations are in place. Clearly the utility must decide which decommissioning option it wishes to choose before operating license expiration. The utility's spent fuel management plans submitted in response to § 50.54(bb) and its choice of decommissioning options, should be consistent. Such consistency may be achieved by modifying either the decommissioning plan, the spent fuel management plan, or both.

3. Miscellaneous Comments

a. Recognition of Yakima Indian Rights

(1) *Summary of Comments.* The Yakimas stated that their sovereign rights cannot be properly protected by generalized rulemaking and that Federal rules must be based upon recognition of their treaty rights (YIN p. 2). They also contended that environmental impact analyses for siting nuclear waste storage and disposal facilities are based on value systems not related to those of affected Indian tribes (YIN, Enclosure 2). The Yakimas believe that environmental impact studies have consistently failed to look beyond the Judeo-Christian socio-economic heritage and as a result there have been repeated nuisance violations of the sovereign rights guaranteed to the Yakimas by the Treaty of 1855 (YIN p. 2 of Attachment 2).

(2) *NRC Response.* This final rule does not concern repository siting, or the extended storage of spent fuel at any reactor located within the tribal lands. Siting will be considered under procedures laid out by the Nuclear Waste Policy Act (NWPA), DOE siting guidelines, and NRC regulations for high-level waste disposal (10 CFR Part 60). All of these recognize Indian rights in the siting of waste repositories and provide for participation by affected Indian tribes.

b. Extended Length of Time for Storage

(1) *Summary of Comments.* The Environmental Policy Institute states that the Commission may not assume that plants will be able to dispose of fuel in a repository on a schedule reflecting OL termination because the NWPA

carries a presumption that significant repository capacity will be taken up by defense waste; moreover, section 135(e) of the NWPA requires that spent fuel in interim Federal storage must be moved within three years of the availability of permanent disposal of storage facilities. Furthermore, EPI notes that DOE proposes in its contracts to give priority to the oldest fuel (EPI pp. 2, 3). Pilalis adds that the contracts give priority to fuel from permanently shutdown reactors.

(2) *NRC Response.* The Commission notes that the various categories (e.g., wastes from commercial or defense activities) of high-level waste and spent fuel are addressed in the NWPA in a manner which assures that they will be dealt with or managed and disposed of with appropriate priorities. The NWPA mandates a Mission Plan from the Secretary of DOE (section 301(a)), which includes:

an estimate of (A) the total repository capacity required to safely accommodate the disposal of all high-level radioactive waste and spent nuclear fuel expected to be generated through December 31, 2020, in the event that no commercial reprocessing of spent nuclear fuel occurs, as well as the repository capacity that will be required if such reprocessing does occur, (B) the number and type of repositories required to be constructed to provide such disposal capacity; (C) a schedule for the construction of such repositories; and (D) an estimate of the period during which each repository listed in such schedule will be accepting high-level radioactive waste or spent nuclear fuel for disposal; (section 301(a)(9)).

Thus the intention of the NWPA is to provide adequate repository capacity on a timely basis for all high-level radioactive waste and spent fuel and to take into account the various priorities for disposal established by the Act itself. The Commission notes in its Waste Confidence decision (elsewhere in this issue) that:

sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of commercial high-level radioactive waste and spent fuel generated up to that time. The Nuclear Waste Policy Act of 1982 establishes Federal responsibility and a clearly defined Federal policy for the disposal of such waste and spent fuel and creates a Nuclear Waste Fund to implement Federal policy. The Act establishes as a matter of national policy that this responsibility is a continuing one, and provides means for the Secretary of Energy to examine periodically the adequacy of resources to accomplish this end (Appendix to the Commission's decision [section 2.2B4]).

In any event, the Commission does not assume, as EPI contends, that plants will be able to dispose of spent fuel in a

repository on a schedule corresponding to OL termination. The Commission's second finding states (in part) that sufficient repository capacity will be available within 30 years beyond OL termination. The priority that DOE proposes to follow in its contracts for acceptance of the oldest spent fuel does not affect this situation.

4. Non-Substantive Revisions in the Amendment to 10 CFR Part 51.

Non-substantive revisions were made in the amendment to Part 51 for clarification and to conform to the recently published (49 FR 9352, March 12, 1984, effective June 7, 1984, 49 FR 24512, June 14, 1984) general revision of 10 CFR Part 51 and related conforming amendments implementing CEQ NEPA regulations.

5. Listing of Participants

Respondents to the May 20, 1983 Invitation for Public Comment (48 FR 22730) on the Proposed Amendments to 10 CFR Parts 50 and 51, "Requirements for Licensee Actions Regarding the Disposition of Spent Fuel Upon Expiration of the Reactor's Operating License

1. New York Attorney General (NY Atty. Gen.)
2. Floridians United for Safe Energy (FUSE)
3. Toledo Edison Company (Tol. Ed.)
4. Environmental Policy Institute (EPI)
5. Utility Decommissioning Group (UDG)
6. Atomic Industrial Forum, Inc. (AIF)
7. Utility Nuclear Waste Management Group and the Edison Electric Institute (UNWMC—EEI)
8. Wisconsin (Wis.)
9. Middle South Services, Inc. (MSS)
10. Coalition for Nuclear Power Postponement (CNPP)
11. Union of Concerned Scientists (UCS)
12. Indiana Sassafras Audubon Society (ISAS)
13. Yakima Indian Nation (YIN)
14. Wisconsin Environmental Decade (WED)
15. Labros E. Pilalis (Pilalis)
16. New-England Coalition on Nuclear Pollution, Inc. (NECNP)
17. Scientists and Engineers for Secure Energy, Inc. (SE2)
18. Susan L. Hiatt (Hiatt)
19. Mississippi Power and Light Co. (MP&L)
20. Department of Energy (DOE)
21. Consolidated Public Interest Representative (CPIR)

Respondents to the Commission's November 3, 1983 Order (40 FR 50746) To Reopen the Period for Limited Comment on the Environmental Aspects of the Commission's Fourth Finding in the Waste Confidence Proceeding

1. Attorney General of the State of New York (N.Y.)
2. Marvin Lewis (Lewis)
3. Sierra Club Radioactive Waste Campaign (Sierra)
4. Scientists and Engineers for Secure Energy, Inc. (SE2)
5. Safe Haven, Ltd. (S.H.)
6. American Institute of Chemical Engineers (AIChE)
7. Atomic Industrial Forum, Inc. (AIF)
8. Utility Nuclear Waste Management Group—Edison Electric Institute (UNWMC—EEI)
9. Natural Resources Defense Council, Inc. (NRDC)
10. Attorney General of the State of Wisconsin (Wis.)
11. U.S. Department of Energy (DOE)
12. American Nuclear Society (ANS)
13. Attorney General of the State of Minnesota (Minn.)

Environmental Impact

This final rule amends 10 CFR Part 51 of the Commission's regulations to incorporate the generic determination made by the Commission at the conclusion of the Waste Confidence rulemaking proceeding that for at least 30 years beyond the expiration of reactor operating licenses no significant environmental impacts will result from the storage of spent fuel in reactor facility storage pools or independent spent fuel storage installations located at reactor or away-from-reactor sites. The detailed environmental analysis on which the generic determination was based can be found in the record at that proceeding published elsewhere in this issue. This rulemaking action formally incorporating the generic determination in the Commission's regulations has no separate independent environmental impact.

The other amendments to Parts 50 and 51 of the Commission's regulations set out in the final rule contain procedures which relate to the submission and review of applications for licenses, license amendments and other forms of permission. The final rule specifies notification procedures applicable to licensee proposals for the management of irradiated fuel following expiration of a reactor operating license and the types of environmental information required to be submitted or addressed in connection with an application for a

license or license amendment to store spent fuel at a nuclear power reactor or at an independent spent fuel storage installation after the reactor operating license has expired. Accordingly, these amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(3). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of these amendments.

Paperwork Reduction Act Statement

This final rule amends information collection requirements that are subject to the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 et seq.). These requirements were approved by the Office of Management and Budget (approval numbers 3150-0011 and 3150-0021).

Regulatory Flexibility Certification

As required by the Regulatory Flexibility Act, 5 U.S.C. 605(b), the Commission certifies that this rule does not have a significant economic impact on a substantial number of small entities. This rule affects only the licensing and operation of nuclear power plants. The companies that own these plants are dominant in their service areas and do not fall within the scope of the definition of "small entities" set forth in the Regulatory Flexibility Act or the Small Business Size Standards set out in regulations issued by the Small Business Administration at 13 CFR Part 121.

List of Subjects

10 CFR Part 50

Antitrust, Classified information, Fire prevention, incorporation by reference, Intergovernmental relations, Nuclear power plants and reactors, Penalty, Radiation protection, Reactor siting criteria, Reporting and record keeping requirements.

10 CFR Part 51

Administrative practice and procedure, Environmental impact statement, Nuclear materials, Nuclear power plants and reactors, Reporting and record keeping requirements.

For the reasons set out in the Preamble and under the authority of the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, and 5 U.S.C. 553, the NRC is adopting the following amendments to 10 CFR Parts 50 and 51.

PART 50—DOMESTIC LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

1. The authority citation for Part 50 continues to read as follows:

Authority: Secs. 103, 104, 161, 182, 183, 186, 189, 68 Stat. 936, 937, 948, 953, 954, 955, 956, as amended, sec. 234, 83 Stat. 1244, as amended (42 U.S.C. 2133, 2134, 2201, 2232, 2233, 2236, 2238, 2282); secs. 201, 202, 206, 88 Stat. 1242, 1244, 1246, as amended (42 U.S.C. 5841, 5842, 5846), unless otherwise noted.

Section 50.7 also issued under Pub. L. 96-601, sec. 10, 92 Stat. 2951 (42 U.S.C. 5851). Sections 50.57(d), 50.58, 50.91, and 50.92 also issued under Pub. L. 97-415, 96 Stat. 2071, 2073 (42 U.S.C. 2133, 2239). Section 50.78 also issued under sec. 122, 68 Stat. 939 (42 U.S.C. 2152). Sections 50.80-50.81 also issued under sec. 184, 68 Stat. 954, as amended (42 U.S.C. 2234). Sections 50.100-50.102 also issued under sec. 188, 68 Stat. 955 (42 U.S.C. 2236).

For the purposes of sec. 223, 68 Stat. 958, as amended (42 U.S.C. 2273), §§ 50.10 (a), (b), and (c), 50.44, 50.48, 50.48, 50.54, and 50.80(a) are issued under sec. 161b, 68 Stat. 948, as amended (42 U.S.C. 2201(b)); §§ 50.10 (b) and (c) and 50.54 are issued under sec. 161f, 68 Stat. 949, as amended (42 U.S.C. 2201(i)); and §§ 50.55(e), 50.59(b), 50.70, 50.71, 50.72, 50.73, and 50.78 are issued under sec. 161o, 68 Stat. 950, as amended (42 U.S.C. 2201(o)).

2. In § 50.54, a new paragraph (bb) is added to read as follows:

§ 50.54 Conditions of licenses.

Whether stated therein or not, the following shall be deemed conditions in every license issued.

(bb) For operating nuclear power reactors, the licensee shall, no later than 5 years before expiration of the reactor operating license, submit written notification to the Commission for its review and preliminary approval of the program by which the licensee intends to manage and provide funding for the management of all irradiated fuel at the reactor upon expiration of the reactor operating license until title to the irradiated fuel and possession of the fuel is transferred to the Secretary of Energy for its ultimate disposal in a repository. Final Commission review will be undertaken as part of any proceeding for continued licensing under Part 50 or Part 72. The licensee must demonstrate to NRC that the elected actions will be consistent with NRC requirements for licensed possession of irradiated nuclear fuel and that the actions will be implemented on a timely basis. Where implementation of such actions require NRC authorizations, the licensee shall verify in the notification that submittals for such actions have been or will be made to NRC and shall identify them. A copy of the notification shall be retained by the licensee as a record until

expiration of the reactor operating license. The licensee shall notify the NRC of any significant changes in the proposed waste management program as described in the initial notification.

PART 51—ENVIRONMENTAL PROTECTION REGULATIONS FOR DOMESTIC LICENSING AND RELATED REGULATORY FUNCTIONS

3. The authority citation for Part 51 continues to read as follows:

Authority: Sec. 161, 68 Stat. 948, as amended (42 U.S.C. 2201), secs. 201, as amended, 202, 88 Stat. 1242, as amended, 1244 (42 U.S.C. 5841, 5842).

Subpart A also issued under National Environmental Policy Act of 1969, secs. 102, 104, 105, 83 Stat. 853-854, as amended (42 U.S.C. 4332, 4334, 4335); and Pub. L. 95-604, Title II, 92 Stat. 3033-3041. Section 51.22 also issued under sec. 274, 73 Stat. 688, as amended by 92 Stat. 3036-3038 (42 U.S.C. 2021).

4. A new § 51.23 is added to read as follows:

§ 51.23 Temporary storage of spent fuel after cessation of reactor operation—Generic determination of no significant environmental impact.

(a) The Commission has made a generic determination that for at least 30 years beyond the expiration of reactor operating licenses no significant environmental impacts will result from the storage of spent fuel in reactor facility storage pools or independent spent fuel storage installations located at reactor or away-from-reactor sites. Further, the Commission believes there is reasonable assurance that one or more mined geologic repositories for commercial high-level radioactive waste and spent fuel will be available by the year 2007-2009, and that sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time.

(b) Accordingly, as provided in §§ 51.30(b), 51.53, 51.61, 51.80(b), 51.95 and 51.97(a), and within the scope of the generic determination in paragraph (a) of this section, no discussion of any environmental impact of spent fuel storage in reactor facility storage pools or independent spent fuel storage installations (ISFSI) for the period following the term of the reactor operating license or amendment or initial ISFSI license or amendment for which application is made, is required in any environmental report, environmental impact statement, environmental assessment or other analysis prepared in connection with the

issuance or amendment of an operating license for a nuclear reactor or in connection with the issuance of an initial license for storage of spent fuel at an ISFSI, or any amendment thereto.

(c) This section does not alter any requirements to consider the environmental impacts of spent fuel storage during the term of a reactor operating license or a license for an ISFSI in a licensing proceeding.

5. In § 51.30, a new paragraph (b) is added to read as follows:

§ 51.30 Environmental assessment.

(b) Unless otherwise determined by the Commission, an environmental assessment will not include discussion of any aspect of the storage of spent fuel within the scope of the generic determination in § 51.23(a) and in accordance with the provisions of § 51.23(b).

6. Section 51.53 is revised to read as follows:

§ 51.53 Supplement to Environmental Report.

(a) *Operating license stage.* Each applicant for a license or for renewal of a license to operate a production or utilization facility covered by § 51.20 shall submit with its application the number of copies, as specified in § 51.55, of a separate document, entitled "Supplement to Applicant's Environmental Report—Operating License Stage," which will update "Applicant's Environmental Report—Construction Permit Stage." Unless the applicant requests the renewal of an operating license or unless otherwise required by the Commission, the applicant for an operating license for a nuclear power reactor shall submit this report only in connection with the first licensing action authorizing full power operation. In this report, the applicant shall discuss the same matters described in §§ 51.45, 51.51 and 51.52, but only to the extent that they differ from those discussed or reflect new information in addition to that discussed in the final environmental impact statement prepared by the Commission in connection with the construction permit. Unless otherwise required by the Commission, no discussion of need for power or alternative energy sources or alternative sites for the facility or of any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) and in accordance with § 51.23(b) is required in this report. The "Supplement to Applicant's Environment Report—Operating License Stage" may

incorporate by reference any information contained in the "Applicant's Environmental Report—Construction Permit Stage," final environmental-impact statement or record of decision previously prepared in connection with the construction permit.

(b) *Post operating license stage.* Each applicant for a license or license amendment to store spent fuel at a nuclear power reactor after expiration of the operating license for the nuclear power reactor shall submit with its application the number of copies, as specified in § 51.55, of a separate document, entitled "Supplement to Applicant's Environmental Report—Post Operating License Stage." Unless otherwise required by the Commission, in accordance with the generic determination in § 51.23(a) and the provisions in § 51.23(b), the applicant shall only address the environmental impact of spent fuel storage for the term of the license applied for. The "Supplement to Applicant's Environmental Report—Post Operating License Stage" may incorporate by reference any information contained in "Applicant's Environmental Report—Construction Permit Stage," "Supplement to Applicant's Environmental Report—Operating License Stage," final environmental impact statement, supplement to final environmental impact statement or records of decision previously prepared in connection with the construction permit or operating license.

7 Section 51.61 is revised to read as follows:

§ 51.61 Environmental report—Independent spent fuel storage installation (ISFSI) license.

Each applicant for issuance of a license for storage of spent fuel in an independent spent fuel storage installation (ISFSI) pursuant to Part 72 of this chapter shall submit with its application to the Director of Nuclear Material Safety and Safeguards the number of copies, as specified in § 51.66 of a separate document, entitled "Applicant's Environmental Report—ISFSI License." The environmental report shall contain the information specified in § 51.45 and shall address the siting evaluation factors contained in Subpart E of Part 72 of this chapter. Unless otherwise required by the Commission, in accordance with the generic determination in § 51.23(a) and

the provisions of § 51.23(b), no discussion of the environmental impact of the storage of spent fuel at an ISFSI beyond the term of the license or amendment applied for is required in an environmental report submitted by an applicant for an initial license for storage of spent fuel in an ISFSI, or any amendment thereto.

8. Section 51.80 is revised to read as follows:

§ 51.80 Draft environmental impact statement—Material license.

(a) The NRC staff will either prepare a draft environmental impact statement or as provided in § 51.92, a supplement to a final environmental impact statement for each type of action identified in § 51.20(b) (7)–(12). Except as the context may otherwise require, procedures and measures similar to those described in §§ 51.70, 51.71, 51.72 and 51.73 will be followed.

(b) *Independent spent fuel storage installation (ISFSI).* Unless otherwise determined by the Commission, and in accordance with the generic determination in § 51.23(a) and the provisions of § 51.23(b), a draft environmental impact statement on the issuance of an initial license for storage of spent fuel at an independent spent fuel storage installation (ISFSI) or any amendment thereto, will address environmental impacts of spent fuel storage only for the term of the license or amendment applied for.

9. Section 51.95 is revised to read as follows:

§ 51.95 Supplement to final environmental impact statement.

(a) *Operating license stage.* In connection with the issuance of an operating license for a production or utilization facility, the NRC staff will prepare a supplement to the final environmental impact statement on the construction permit for that facility, which will update the prior environmental review. The supplement may incorporate by reference any information contained in the final environmental impact statement or in the record of decision prepared in connection with the construction permit for that facility. The supplement will include a request for comments as provided in § 51.73. The supplement will only cover matters which differ from, or which reflect significant new information concerning matters discussed in the final environmental

impact statement. Unless otherwise determined by the Commission, a supplement on the operation of a nuclear power reactor will not include discussion of need for power or alternative energy sources or alternative sites or of any aspect of the storage of spent fuel for the nuclear power reactor within the scope of the generic determination in § 51.23(a) and in accordance with § 51.23(b), and will only be prepared in connection with the first licensing action authorizing full power operation.

(b) *Post operating license stage.* In connection with the issuance, amendment or renewal of a license to store spent fuel at a nuclear power reactor after expiration of the operating license for the nuclear power reactor, the NRC staff will prepare a supplemental environmental impact statement for the post operating license stage or an environmental assessment, as appropriate, which will update the prior environmental review. The supplement or assessment may incorporate by reference any information contained in the final environmental impact statement, the supplement to the final environmental impact statement—operating license stage, or in the records of decision prepared in connection with the construction permit or the operating license for that facility. The supplement will include a request for comments as provided in § 51.73. Unless otherwise required by the Commission, in accordance with the generic determination in § 51.23(a) and the provisions of § 51.23(b), a supplemental environmental impact statement for the post operating license stage or an environmental assessment as appropriate, will address the environmental impacts of spent fuel storage only for the term of the license, license amendment or license renewal applied for.

10. A new § 51.97 is added to read as follows:

§ 51.97 Final environmental impact statement—Materials license.

(a) *Independent spent fuel storage installation (ISFSI).* Unless otherwise determined by the Commission, and in accordance with the generic determination in § 51.23(a) and the

provisions of § 51.23(b), a final environmental impact statement on the issuance of an initial license for the storage of spent fuel at an independent spent fuel storage installation (ISFSI) or any amendment thereto, will address environmental impacts of spent fuel storage only for the term of the license or amendment applied for.

(b) [Reserved]

Dated at Washington, D.C. this 22nd day of August, 1984.

For the Nuclear Regulatory Commission,
Samuel J. Chilk,
Secretary of the Commission.

[FR Doc. 84-23183 Filed 8-30-84; 8:45 am]

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**NUCLEAR REGULATORY
COMMISSION**

10 CFR Part 51

RIN 3150-AD28

**Consideration of Environmental
Impacts of Temporary Storage of
Spent Fuel After Cessation of Reactor
Operation****AGENCY:** Nuclear Regulatory
Commission.**ACTION:** Final rule.

SUMMARY: The Nuclear Regulatory Commission is revising its generic determinations on the timing of availability of a geologic repository for commercial high-level radioactive waste and spent fuel and the environmental impacts of storage of spent fuel at reactor sites after the expiration of reactor operating licenses. These revisions reflect findings of the Commission reached in a five-year update and supplement to its 1984 "Waste Confidence" rulemaking proceeding, which are published elsewhere in this issue of the *Federal Register*. The Commission now finds that spent fuel generated in any reactor can be stored safely and without significant environmental impacts in reactor facility storage pools or independent spent fuel storage installations located at reactor or away-from-reactor sites for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license). Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time.

EFFECTIVE DATE: October 18, 1990.

FOR FURTHER INFORMATION CONTACT: John P. Roberts, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555, telephone: (301) 492-0608.

SUPPLEMENTARY INFORMATION:**Background**

In 1984, the Commission concluded a generic rulemaking proceeding, the "Waste Confidence" proceeding, to reassess its degree of confidence that radioactive wastes produced by nuclear facilities will be safely disposed of, to

determine when any such disposal would be available, and whether such wastes can be safely stored until they are safely disposed of. The Commission found that there was reasonable assurance that one or more mined geologic repositories for commercial high-level radioactive waste and spent fuel will be available by 2007-2009. However, some reactor operating licenses might expire without being renewed or some reactors might be permanently shut down prior to this period. Since independent spent fuel storage installations had not yet been extensively developed, there was a probability that some onsite spent fuel storage after license expiration might be necessary or appropriate. In addition, the possibility existed that spent fuel might be stored in existing or new storage facilities for some period beyond 2007-2009. The Commission also found that the licensed storage of spent fuel for at least 30 years beyond the reactor operating license expiration either at or away from the reactor site was feasible, safe, and would not result in a significant impact on the environment.

Consequently, the Commission adopted a rule, codified in 10 CFR 51.23, providing that the environmental impacts of at-reactor storage after the termination of reactor operating licenses need not be considered in Commission proceedings related to issuance or amendment of a reactor operating license. The same safety and environmental considerations applied to fuel storage installations licensed under part 72 as for storage in reactor basins. Accordingly, the rule also provided that the environmental impacts of spent fuel storage at independent spent fuel storage installations for the period following expiration of the installation storage license or amendment need not be considered in proceedings related to issuance or amendment of a storage installation license.

Amendment to Part 51

At the time of issuance of its Waste Confidence decision and the adoption of 10 CFR 51.23, the Commission also announced that while it believed that it could, with reasonable assurance, reach favorable conclusions of confidence, it also recognized that significant unexpected events might affect its decision.

Consequently, the Commission stated that it would "review its conclusions on waste confidence should significant and pertinent unexpected events occur, or at least every 5 years until a repository for high-level radioactive waste and spent fuel is available." The Commission has now completed a five-year review of its

earlier findings. A description of this review and the supplement and update to the earlier findings is announced elsewhere in this issue. As a result of this review, the Commission is modifying two of its earlier findings as follows:

The Commission finds reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time; and The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

In this proceeding, the Commission is revising 10 CFR 51.23(a) to be consistent with these revisions to the Waste Confidence decision.

Summary of Comments

The Commission received 11 comments on its proposed revision to 10 CFR 51.23(a) from the following entities listed in the order of receipt of comments:

Duke Power Company
Public Citizen
Edison Electric Institute
Malachy Murphy (State of Nevada)
Yankee Atomic Electric Company
Department of Energy (DOE)
Philadelphia Electric Company
Commonwealth Edison
Virginia Electric and Power Company
Marvin I. Lewis, Registered Professional Engineer
Florida Power & Light

The revision to this rule was supported by Duke Power Company, Edison Electric Institute, Yankee Atomic Electric Company, Department of Energy, Philadelphia Electric Company, and Virginia Electric and Power Company and generally supported by Commonwealth Edison.

Malachy Murphy, for the State of Nevada, suggests that 10 CFR 51.23(a) be amended to reflect reasonable assurance that spent fuel can be stored safely and without significant environmental risk in dry casks at reactor sites for up to one hundred years. The Commission, in the notice of proposed rulemaking, discussed its conclusion that even if storage of spent fuel were necessary for at least thirty

years beyond the licensed life for operation of reactors, which for a reactor whose license is renewed for thirty years would mean a period of at least 100 years, such storage is feasible, safe and would not result in a significant impact on the environment. The Commission's conclusion on this issue considers both wet and dry storage. Although the Commission does not dispute the statement that dry spent fuel storage is safe and environmentally acceptable for a period of 100 years, the Commission does not find it necessary to make that specific finding in this proceeding.

Marvin I. Lewis avers that 100 years is an excessive amount of time to predict that at-reactor storage will be available and safe. The commenter suggests that our institutions may not survive in a form that will provide safe onsite storage 100 years in the future. The commenter requests that the Commission reverse its finding that storage will be available and safe for 100 years. The Commission does not agree with the commenter that this finding should be reversed. The Commission believes that adequate regulatory authority exists and will remain available to require any measures necessary to assure safe storage of spent fuel.

Conclusions

The Commission is adopting the proposed revision with one small clarifying change. The proposed revision to 10 CFR 51.23(a) (and the proposed revision to the Waste Confidence decision) stated that spent fuel can be stored safely for at least 30 years beyond the licensed life for operation of any reactor which may include the term of a "revised license." As the discussion in the notice made explicit, the term "revised" license was intended to embrace a "renewed" license. To reflect more accurately the inclusion of the term of a renewed license, the parenthetical phrase which refers to this subject is being revised to read: "which may include the term of a revised or renewed license."

The necessity for the proposed revisions to the Waste Confidence decision and to 10 CFR 51.23(a) is based on the timing of repository availability, and premised on the following factors: The potential for delays in DOE's program; the mandate of the Nuclear Waste Policy Act Amendments of 1987 to characterize only the Yucca Mountain site which means that if that site is found unsuitable, characterization will have to begin at another site or suite of sites with consequent delay in repository availability; the regulatory

need to avoid premature commitment to the Yucca Mountain site; and the questionable value of making predictions about completion of a project as complex and unique as the repository in terms of years when decades would be more realistic. But even with this change the Commission has concluded that it has reasonable assurance that on such a schedule for repository availability, sufficient repository capacity will be available within 30 years beyond the licensed life for operation of reactors. Adequate regulatory authority is available to require any measures necessary to assure safe storage of the spent fuel until a repository is available. In addition, the Commission has concluded that even if storage of spent fuel were necessary for at least 30 years beyond the licensed life of reactors, which in the case of a reactor whose operating license is renewed for 30 years would mean for a period of at least 100 years, such storage is feasible, safe and would not result in a significant impact on the environment.

The Commission's conclusions with respect to safety and environmental impacts of extended storage are supported by NRC's Environmental Assessment (EA) for the 10 CFR part 72 rulemaking "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste" (53 FR 31651, August 19, 1988). Ongoing licensing and operational experience as well as studies of extended pool storage continue to demonstrate that such storage is a benign environment for spent fuel which does not lead to significant degradation of spent fuel integrity. Significant advances in the processes of dry storage of spent fuel continue to demonstrate that dry storage systems are simple, passive and easily maintained. NRC staff safety reviews of topical reports on dry storage system designs and dry storage installations at two reactor sites, as well as the EA for part 72, support the finding that storage of spent fuel in such installations for a period of 70 years does not significantly impact the environment. No significant additional non-radiological consequences which could adversely effect the environment for extended storage at reactors and independent spent fuel storage installations have been identified. In sum, the long-term material and system degradation effects are well understood and known to be minor, the ability to maintain a spent fuel storage system is assured, and the Commission maintains regulatory

authority over any spent fuel storage installation.

Environmental Impact

This final rule amends 10 CFR part 51 of the Commission's regulations to modify the generic determination currently codified in part 51 which was made by the Commission in the Waste Confidence rulemaking proceeding. That generic determination was that for at least 30 years beyond the expiration of a reactor's operating license no significant environmental impacts will result from the storage of spent fuel in reactor facility storage pool or independent spent fuel storage installations located at reactor or away-from-reactor sites. The modification provides that, if necessary, spent fuel generated in a reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation of any reactor. The licensed life for operation of a reactor may include the term of a revised or renewed license. The environmental analysis on which the revised generic determination is based can be found in the revision and supplement to the Waste Confidence findings published elsewhere in this issue. This final rulemaking action formally incorporating the revised generic determination in the Commission's regulations does not have separate independent environmental impact. The supplemental assessment and revisions to the Waste Confidence findings are available for inspection at the NRC Public Document Room, 2120 L Street, NW. (Lower Level), Washington, DC.

Paperwork Reduction Act Statement

This final rule does not contain a new or amended information collection requirement subject to the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 *et seq.*). Existing requirements were approved by the Office of Management and Budget approval number 3150-0021.

Regulatory Flexibility Certification

As required by the Regulatory Flexibility Act of 1980, 5 U.S.C. 605(b), the Commission certifies that this rule will not have a significant economic impact on a substantial number of small entities. The rule describes a revised basis for continuing in effect the current provisions of 10 CFR 51.23(b) which provides that no discussion of any environmental impact of spent fuel storage in reactor facility storage pools or independent spent fuel storage installations [ISFSI] for the period following the term of the reactor operating license or amendment or

initial ISFSI license or amendment for which application is made is required in any environmental report, environmental impact statement, environmental assessment or other analysis prepared in connection with certain actions. This rule affects only the licensing and operation of nuclear power plants. Entities seeking or holding Commission licenses for such facilities do not fall within the scope of the definition of small businesses found in section 34 of the Small Business Act, 15 U.S.C. 632, in the Small Business Size Standards set out in regulations issued by the Small Business Administration at 13 CFR part 121, or in the NRC's size standards published December 9, 1985 (50 FR 50241).

Backfit Analysis

This final rule does not modify or add to systems, structures, components or design of a facility; the design approval or manufacturing license for a facility; or the procedures or organization required to design, construct or operate a facility. Accordingly, no backfit analysis pursuant to 10 CFR 50.109(c) is required for this final rule.

List of Subjects in 10 CFR Part 51

Administration practice and procedure, Environmental impact statement, Nuclear materials, Nuclear power plants and reactors, Reporting and recordkeeping requirements.

For the reasons set out in the preamble and under the authority of the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, and 5 U.S.C. 552 and 553, the NRC is adopting the following amendment to 10 CFR part 51.

PART 51—ENVIRONMENTAL PROTECTION REGULATIONS FOR DOMESTIC LICENSING AND RELATED REGULATORY FUNCTIONS

1. The authority citation for part 51 continues to read as follows:

Authority: Sec. 161, 68 Stat. 948, as amended (42 U.S.C. 2201); secs. 201, as amended, 202, 68 Stat. 1242, as amended, 1244 (42 U.S.C. 5841, 5842).

Subpart A also issued under National Environmental Policy Act of 1969, secs. 102, 104, 105, 63 Stat. 853-854, as amended (42 U.S.C. 4332, 4334, 4335); and Pub. L. 95-604, Title II, 92 Stat. 3033-3041. Sections 51.20, 51.30, 51.60, 51.61, 51.60, and 51.97 also issued under secs. 135, 141, Pub. L. 97-425, 96 Stat. 2232, 2241, and sec. 148, Pub. L. 100-203, 101 Stat. 1330-223 (42 U.S.C. 10155, 10161, 10166). Section 51.22 also issued under sec. 274, 73 Stat. 688, as amended by 92 Stat. 3036-3038 (42 U.S.C. 2021) and under Nuclear Waste Policy Act of 1982, sec. 121, 96 Stat. 2228 (42 U.S.C. 10141), Sections 51.43, 51.67, and 51.109

also issued under Nuclear Waste Policy Act of 1982, sec. 114(f), 96 Stat. 2216, as amended (42 U.S.C. 10134(f)).

2. Section 51.23, paragraph (a) is revised to read as follows:

§ 51.23 Temporary storage of spent fuel after cessation of reactor operation—generic determination of no significant environmental impact.

(a) The Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time.

Dated at Rockville, Maryland this 11th day of September, 1990.

For the Nuclear Regulatory Commission,
Samuel J. Chilk,
Secretary of the Commission.
[FR Doc. 90-21869 Filed 9-17-90; 8:45 a.m.]
BILLING CODE 7590-01-0

10 CFR Part 51

Waste Confidence Decision Review

AGENCY: Nuclear Regulatory Commission.

ACTION: Review and Final Revision of Waste Confidence Decision.

SUMMARY: On August 31, 1984, the Nuclear Regulatory Commission (NRC) issued a final decision on what has come to be known as its "Waste Confidence Proceeding." The purpose of that proceeding was "...to assess generically the degree of assurance now available that radioactive waste can be safely disposed of, to determine when such disposal or offsite storage will be available and to determine whether radioactive waste can be safely stored onsite past the expiration of existing facility licenses until offsite disposal or storage is available." (49 FR 34658). The Commission noted in 1984 that its Waste Confidence Decision was unavoidably in the nature of a prediction, and

committed to review its conclusions "...should significant and pertinent unexpected events occur or at least every five years until a repository is available." The purpose of this notice is to present the findings of the Commission's first review of that Decision.

The Commission has reviewed its five findings and the rationale for them in light of developments since 1984. This revised Waste Confidence Decision supplements those 1984 findings and the environmental analysis supporting them. The Commission is revising the second and fourth findings in the Waste Confidence Decision as follows:

Finding 2: The Commission finds reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and that sufficient repository capacity will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time.

Finding 4: The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

The Commission is reaffirming the remaining findings. Each finding, any revisions, and the reasons for revising or reaffirming them are set forth in the body of the review below.

The Commission also issued two companion rulemaking amendments at the time it issued the 1984 Waste Confidence Decision. The Commission's reactor licensing rule, 10 CFR part 50, was amended to require each licensed reactor operator to submit, no later than five years before expiration of the operating license, plans for managing spent fuel at the reactor site until the spent fuel is transferred to the Department of Energy (DOE) for disposal under the Nuclear Waste Policy Act of 1982 (NWPA). 10 CFR part 51, the rule defining NRC's responsibilities under the National Environmental Policy Act (NEPA), was amended to provide that, in connection with the issuance or amendment of a reactor operating license or initial license for an independent spent fuel storage installation, no discussion of any

environmental impact of spent fuel storage is required for the period following expiration of the license or amendment applied for.

In keeping with the revised Findings 2 and 4, the Commission is providing elsewhere in this issue of the Federal Register conforming amendments to its 10 CFR part 51 rule providing procedures for considering in licensing proceedings the environmental effects of extended onsite storage of spent fuel.

Finally, the Commission is extending the cycle of its Waste Confidence reviews from every five years to every ten until a repository becomes available. In its 1984 Decision, the Commission said that because its conclusions were "...unavoidably in the nature of a prediction," it would review them "...should significant and pertinent unexpected events occur, or at least every five years until a repository...is available." As noted below, the Commission now believes that predictions of repository availability are best expressed in terms of decades rather than years. To specify a year for the expected availability of a repository decades hence would misleadingly imply a degree of precision now unattainable. Accordingly, the Commission is changing its original commitment in order to review its Waste Confidence Decision at least every ten years. This would not, however, disturb the Commission's original commitment to review its Decision whenever significant and pertinent unexpected events occur. The Commission anticipates that such events as a major shift in national policy, a major unexpected institutional development, and/or new technical information might cause the Commission to consider reevaluating its Waste Confidence Findings sooner than the scheduled ten-year review.

FOR FURTHER INFORMATION CONTACT: John Roberts, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555, telephone (202) 492-0608.

SUPPLEMENTARY INFORMATION:

Analysis of Public Comments on the Proposed Waste Confidence Decision Review.

1.0 Introduction

Comments were received from a Federal agency, the public interest sector, the nuclear industry, and one State as listed below in order of their receipt:

Duke Power Company
Public Citizen
Edison Electric Institute
Malachy Murphy (State of Nevada)

Yankee Atomic Electric Company
Department of Energy
Philadelphia Electric Company
Commonwealth Edison
Virginia Electric and Power Company
Marvin I. Lewis, Registered
Professional Engineer

Florida Power & Light Company
The majority of the commenters were supportive of the Commission's proposed decision and rule. The comments were consolidated into a total of 19 issues to be addressed. Each of these issues is discussed under the Commission finding to which it relates. Two additional issues, not raised by commenters, are treated under the heading "Other Relevant Issues." The "Other Relevant Issues" section includes consideration of the petition by the State of Vermont to intervene in the consideration of the extension of the operating license for Vermont Yankee and the potential for non-payment of the one-time fee for spent nuclear fuel generated prior to April 1983 into the Nuclear Waste Fund.

2.0 Analysis of Issues Related to Commission Findings

2.1 The Commission's First Finding

The Commission finds reasonable assurance that safe disposal of high-level radioactive waste and spent fuel in a mined geologic repository is technically feasible.

Issue No. 1: Technical Feasibility of Safe Disposal in a Mined Geologic Repository

Comment

The commenter representing Public Citizen (PC) stated that there is still not adequate assurance that permanent, safe disposal of high-level radioactive waste in a mined geologic repository is technically feasible. In support of this, the commenter indicated that a number of major scientific panels have pointed out that there is no technical or scientific basis for knowing for sure that geologic disposal is possible. As an example, PC stated that President Carter's Office of Science and Technology Policy (OSTP) found in 1979 a rather general consensus among scientists that a technology base "sufficient to permit complete confidence in the safety of any particular repository design or the suitability of any particular site" was still lacking. PC further stated that more recently, a Waste Isolation Systems Panel of the National Academy of Sciences pointed out many areas of the geologic disposal problem where technical uncertainties exist, and where "more information is needed." PC also stated that the technical difficulties presented by a million-year disposal

problem are unprecedented and enormous, and that there have been no major findings since (the above studies) that have resolved the uncertainties to the point where it is possible to be *assured* that geologic disposal is technically feasible.

NRC Response

The issue of the technical feasibility of the safe disposal of spent nuclear fuel and radioactive waste has been addressed at length in the Commission's 1989 Proposed Waste Confidence Decision Review (54 FR 39767; September 28, 1989) as well as in the original 1984 Waste Confidence Decision (49 FR 34658; August 31, 1984). While those discussions addressed the concerns raised by the comment, it is useful to provide additional specific responses to them. The comment that major scientific panels have pointed out that there is no technical or scientific basis for knowing for sure that geologic disposal is possible makes reference to President Carter's OSTP statement in 1979. Contrary to the comment, the OSTP statement does not support the contention that there is no technical or scientific basis for knowing for sure that geologic disposal is possible. Rather, it remarks on the lack of a technology base sufficient to permit complete confidence in the safety of any particular repository design or the suitability of any particular site. The information base necessary to license a repository is still being developed. This includes information on site characterization, repository design, waste package design, and the performance assessment of the entire disposal system. The complete body of such necessary information is expected to be in hand only at the completion of the developmental studies and characterization work being undertaken by the DOE. It is at this point that the DOE will be in a position to apply for a license from the NRC and seek NRC's approval of the safety of its proposed site and repository design.

The Commission also notes that the OSTP statement was made over a decade ago, prior to the completion of a substantial amount of work which has addressed many of the issues related to disposal technology. While the Commission recognizes that more information is needed and that the technical difficulties are challenging, there is no basis to believe that safe disposal in a repository is impossible, or even that it is not likely. No major breakthrough in technology is required to develop a mined geologic repository. Rather, there is a need to add to the current extensive body of technical

information already available and apply it to an evaluation of specific sites and engineering designs.

Regarding the commenter's emphasis on the need for resolution of uncertainties to assure the technical feasibility of geologic disposal, we would respond that the Commission did not state that the feasibility of a mined geologic repository was assured, in the absolute sense, but that it had found reasonable assurance in the feasibility of mined geologic disposal on the basis of a thorough review of the technologies needed to achieve this disposal.

Issue No. 2: Difficulty in Evaluating Compliance with Repository Safety Standards Over Long Time Periods

Comment

The PC commenter also raised the issue of what he termed the "inability to predict with a reasonable degree of certainty that, once buried, the waste will remain contained [in the geologic repository] for the required time period." The commenter noted uncertainties related to geologic stability, engineered barriers, rock-waste interactions, and groundwater hydrology which contribute to the difficulty of evaluating compliance with safety standards over the long time periods involved in radioactive waste isolation. The commenter concluded that although these problems may be able to be resolved, there is not a basis for assurance that this will be the case.

NRC Response

The NRC believes that existing safety assessment techniques have the potential to provide a basis for deciding whether proposed radioactive waste disposal systems are acceptable. We recognize the difficulty of predicting with a high degree of accuracy the maximum impacts a repository would have on human health and the environment, especially in the very far future. It will likely not be possible to test empirically the ability of models to predict long-term repository performance to the same extent as models for short-term performance. However, we believe existing technology can provide a sufficient level of safety for present and future generations under certain conditions. These conditions include addressing the uncertainties inherent in projecting far into the future and in modelling complex heterogeneous natural systems, and acquiring and evaluating data on specific sites.

We also note that the language of the original Environmental Protection Agency's (EPA) Environmental Radiation Standards for Management and Disposal of Spent Nuclear Fuel,

High-Level and Transuranic Wastes (40 CFR part 191) does not require absolute assurance that containment requirements will be met. Rather, it recognizes the uncertainties involved in projecting repository performance far into the future, and states "Instead, what is required is a reasonable expectation, on the basis of the record before the implementing agency, that compliance with Sec.191.13(a) will be achieved."

Issue No. 3: Unanticipated Difficulties in Developing the WIPP Facility

Comment

PC also indicated that the Waste Isolation Pilot Plant (WIPP) has not opened because of numerous unanticipated difficulties, including leakage of salt water into the site. PC states that this leakage, which was not anticipated prior to the beginning of construction in the early 1980s, shows that even on a scale of a few years, geologic events in a repository are unpredictable--to say nothing of events on a time scale of hundreds of thousands of years.

NRC Response

Although the NRC does not have oversight responsibility for the WIPP project, NRC does monitor DOE progress on WIPP insofar as it may offer valuable insight into efforts to license a repository for commercial high-level waste and spent fuel. For example, DOE must demonstrate compliance with the EPA standard in order to operate the WIPP facility. NRC cognizance of DOE efforts to implement the EPA Standard at WIPP could help provide information and consensus-building in the implementation of the EPA Standard for the commercial high-level waste repository.

The NRC does not consider the occurrence of brine pockets at the WIPP site as a factor that might diminish its confidence in the technical feasibility of a mined geologic repository. The Commission does not expect that site characterization of a candidate site will proceed free from all difficulty. We have urged DOE to establish a planning mechanism for timely development and implementation of contingency plans at Yucca Mountain to address problems during site characterization as they arise. DOE has announced a new focus on surface-based testing for the Yucca Mountain site in its Reassessment Report to Congress. Under this program, the primary goal of testing is to identify features of the site which would render it unsuitable for a repository. If such features are identified, DOE would notify Congress and the State of Nevada, and terminate site specific

activities. A finding that the Yucca Mountain site is unsuitable would likely lead to delays in repository availability while another candidate site is identified and characterized, however it would not diminish confidence in the technical feasibility of geologic disposal.

Issue No. 4: Impact of the BEIR V Report on the Commission's Decision

Comment

Marvin Lewis drew attention to the recent findings of the Committee on the Biological Effects of Ionizing Radiation (BEIR V) in their report on the Health Effects of Exposure to Low Levels of Ionizing Radiation. The commenter stated that the BEIR V study indicated that the danger from radioactivity is four or more times higher than previously known. The commenter further stated that the BEIR V findings will require that the NRC change many of its radiation protection guidelines and rules. He also requested that the NRC stop all action on the Waste Confidence Decision Review until the Commission can determine the effect of the BEIR V report on the Decision.

NRC Response

The Commission has been aware for some time of the scientific data underpinning the estimate of risk from radiation exposure contained in the BEIR V report. Much of this information has been incorporated in the Commission's forthcoming revisions to its radiation protection requirements (10 CFR part 20). For reasons stated below, however, the Commission does not foresee any impact of the BEIR V report on the Waste Confidence Decision.

The BEIR V report is the latest in a series of reports dealing principally with the effects of low-LET radiation in humans, e.g., radiation such as beta particles and gamma photons. The report covers radiation carcinogenesis, genetic effects, and effects on the developing embryo/fetus. The report also includes new information related to the dosimetry of the Japanese atomic bomb survivors, and new epidemiological information. The NRC staff, other Federal agencies, and national and international organizations are currently reviewing both the BEIR V report and the report issued in 1988 by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR).

The estimates of risk due to low-LET radiation in the BEIR V report are based principally upon effects observed in populations exposed to high doses and at high dose rates. These effects are then extrapolated using statistical modeling to predict effects at low doses

and dose rates. The extrapolations to low dose and dose rate lead to significant uncertainties in the estimates of risk in the BEIR V report. The estimates of risk for fatal cancer induction in the BEIR V report are from three to four times larger than the estimate from the preferred model of the BEIR III report in 1980. However, the new BEIR V estimate is within the overall range of risk estimates and uncertainties from the different models presented in BEIR III.

It is important to note that the BEIR V report only addresses the issue of risk estimates for radiation effects. The BEIR committee did not make any recommendations on acceptable risk or on the potential impacts of the risk estimates to dose limits or standards for radiation protection. Efforts are underway by the International Commission on Radiological Protection (ICRP), National Council on Radiation Protection and Measurements (NCRP), and the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) of the Executive Office of the President to reach some measure of consensus on the impacts of the revised risk estimates to radiation protection standards.

Under section 121(a) of the Nuclear Waste Policy Act (NWPA), NRC is required to issue technical requirements and criteria that it will apply in approving or disapproving a repository. These requirements and criteria must be consistent with the high-level waste disposal standards promulgated by the Environmental Protection Agency. Demonstration of compliance with the EPA standard was discussed under the rationale for Finding 1 in the Commission's Proposed Waste Confidence Decision Review.

The NRC does not believe that numerical criteria for individual protection requirements are at issue in its Waste Confidence Proceeding. The broader issue of demonstrating compliance with EPA release limits using probabilistic analyses was a concern of the NRC staff and the NRC's Advisory Committee on Nuclear Waste in preparing the Proposed Waste Confidence Decision Review. As stated in the Proposed Waste Confidence Decision Review, the NRC staff is closely monitoring EPA's progress on issuing its revised standards to assure that EPA methodologies for demonstrating compliance with them can be applied by NRC to evaluate DOE's demonstration of compliance. NRC will also monitor DOE efforts to demonstrate compliance with the EPA

standard at the Waste Isolation Pilot Plant facility for transuranic wastes.

2.2 The Commission's Second Finding

The Commission finds reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and that sufficient repository capacity will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time.

Issue No. 5: Expected Date for Repository Availability

Comment

Malachy Murphy (State of Nevada) and Public Citizen expressed a lack of support for the Commission's proposed second finding. These commenters argue that the finding should be revised to reflect the 2010 date for repository availability announced in DOE's November 1989 Reassessment Report to Congress. They believe that the NRC's "confidence" date of 2025 for repository availability may be exceeded if the Yucca Mountain site is found to be unsuitable sometime after the year 2000 because there might not be enough time to locate, characterize, license and construct a repository at another site by 2025. The commenter from Public Citizen also finds that even if the Yucca Mountain site were found to be suitable, a repository there might not be available until after 2025. This commenter concluded that it would be more conservative to assume that four candidate sites would be found to be unsuitable during the course of site characterization and that there is no basis for assurance that a repository would be available before 2055.

NRC Response

The NRC does not believe it is necessary to change the proposed second finding to reflect DOE's revised date for repository availability of 2010. NRC anticipated an extension of several years in DOE's schedule when it issued its proposed revised second finding. NRC took the position that if the Yucca Mountain site were found to be unsuitable on or before the year 2000, it was reasonable to expect that an alternative site could be identified and developed in time for repository availability by 2025.

NRC continues to believe that if DOE determines that the Yucca Mountain site is unsuitable, it will make this determination by about the year 2000. DOE's program is now focused on surface-based testing designed to identify features of the site which would

render it unsuitable for a repository. The only significant barriers to DOE proceeding with site characterization at Yucca Mountain are the development of a quality assurance (QA) program acceptable to NRC, completion of study plans for site characterization activities they wish to begin, and resolution of the impasse between DOE and the State of Nevada regarding permits for drilling. DOE has made significant progress in the development of a QA program for its site characterization activities. It is possible that this work will be completed and accepted by late 1990 or early 1991. Regarding the impasse with the State of Nevada, both DOE and the State of Nevada have filed lawsuits in Federal Court in an effort to resolve the question of site access. While any litigation of this matter has the possibility of an unfavorable outcome for DOE, the Commission believes that Congress has aggressively demonstrated in both the Nuclear Waste Policy Act of 1982 and the Nuclear Waste Policy Amendments Act of 1987 that it is committed to an orderly progression of the repository program and a resolution of the radioactive waste disposal problem. Accordingly, NRC believes that it is reasonable to assume that Congress will not allow the uncertainties related to the start of site characterization to continue for many more years.

For these reasons, NRC believes that the coming decade will be ample time for the DOE to determine whether or not Yucca Mountain is unsuitable and to begin work on an alternate site, if necessary. We believe that Congress is committed to a resolution of the waste problem and will take measures to bring this issue to a close.

We would also point out here that the Court decision that led to the Waste Confidence Proceeding did not require NRC to determine when a repository would be available. The Court remanded to NRC the question of "...whether there is reasonable assurance that an offsite storage solution will be available by the years 2007-2009, the expiration of [Prairie Island and Vermont Yankee's] operating licenses, and if not, whether there is reasonable assurance that the fuel can be safely stored at the reactor sites beyond those dates." NRC chose as a matter of policy not to confine itself to the storage-related questions in the Court's remand, but to address the broader issues of whether radioactive wastes could be safely disposed of, when such disposal would be available, and whether such wastes can be safely stored until they are disposed of. NRC

was not requested to determine nor has it made a determination that a repository must be available by 2025 in order to protect public health and safety.

NRC does not find a reasonable basis for the argument that even if the Yucca Mountain site were found to be suitable, it might not be available by the year 2025. Surface-based and in-situ testing are expected to take approximately ten years. The NWPA provides that NRC's review of DOE's license application is to be completed in three years (with the possibility of an additional year). Construction is scheduled to take another six years. Even if each of these activities were to take several years longer than planned, a repository at Yucca Mountain could be available well before the year 2025. The limiting condition appears to be the timing of DOE's access to the site to begin testing.

Finally, we do not believe it is realistic to assume for conservatism that four candidate sites will be found unsuitable before an acceptable site is characterized, licensed and built. To date, no candidate site for a repository has been found to be unsuitable for technical reasons. However, if the Yucca Mountain site is found to be unsuitable, an alternative site would have to undergo a similar process of site-screening and characterization to determine its suitability. We believe it is reasonable to expect that experience gained in the Yucca Mountain site characterization effort would provide a better basis for choosing an alternative site. Furthermore, it may be possible to complete site suitability testing at another site at a faster pace than at Yucca Mountain given the benefits of lessons-learned at that site.

Issue No. 6: Clarification of the NRC's Role in the Licensing Support System (LSS)

Comment

The DOE commented that it was not clear what NRC meant by the words "implementing it" in the statement "DOE has the responsibility for designing the LSS and bearing the costs associated with it and NRC will be responsible for implementing it."

NRC Response

In its Proposed Waste Confidence Decision Review, NRC included a description of the Licensing Support System (LSS) under its discussion of "Measures for dealing with Federal-State-Local concerns." The LSS is intended to provide participants in the repository licensing proceeding early access to documents relevant to the licensing decision.

To eliminate any confusion regarding NRC's responsibilities for the LSS, the

above sentence in the Proposed Decision Review will be eliminated and the following description will be inserted in its place: "DOE is responsible for the design, development, procurement and testing of the LSS. LSS design and development must be consistent with objectives and requirements of the Commission's LSS rulemaking and must be carried out in consultation with the LSS Administrator and with the advice of the Licensing Support System Advisory Review Panel. NRC (LSS Administrator) is responsible for the management and operation of the LSS after completion of the DOE design and development process."

Issue No. 7: Suggestion for Reducing Licensing Uncertainties Related to Spent Fuel Transshipments

Comment

Commonwealth Edison commented that in order to enhance the viability of the option of transferring spent fuel from retired reactors to others under active management, the NRC should reduce, to the maximum extent possible, licensing uncertainties related to such fuel transfers. The commenter also stated that by predetermining that spent fuel pool densification and alternative on-site spent fuel storage methods do not raise any significant hazards considerations, the NRC's final decision would be strengthened.

NRC Response

The Commission evaluates applications for modification of spent fuel storage at licensee's facilities or for transshipment from one site to another on an individual basis. Such a case-by-case consideration of the merits of each application ensures that all significant safety issues are addressed in a thorough manner and provides a conservative approach for arriving at a decision on the merits of the license application.

Issue No. 8: Appropriate Use of Nuclear Waste Fund Monies

Comment

Commonwealth Edison Company (CECo) refers to the NRC's statement that DOE could accept responsibility for management of spent fuel until a repository is available in the event that a licensee becomes insolvent prior to the time a geologic repository is ready to accept spent fuel. Funds from either the Nuclear Waste Fund (NWF) or from the utility itself could be used (54 FR 39767, at 39786 and 39790). CECo comments that the use of the NWF monies for this purpose would involve the solvent utilities funding the storage of spent fuel generated by the bankrupt licensees. CECo believes that it is not clear

whether the Nuclear Waste Policy Act would allow NWF monies to be used for this purpose and suggests that NRC should seek and analyze comments on this issue. Until further evaluation and analysis has taken place, CECo believes NRC should delete this as a basis for confidence.

NRC Response

The Commission believes that there are two related issues presented in the above comment. The first is whether DOE can accept responsibility for spent fuel if a utility is insolvent or otherwise no longer capable of managing it. A second related issue is, given DOE's acceptance of responsibility for the spent fuel, where would DOE obtain the funds needed to pay the costs of this responsibility? The NRC continues to believe that DOE would accept responsibility for spent fuel management in the event that a licensee is unable to exercise its own responsibility. Further, the NRC believes that DOE would have sufficient resources to carry out any safety-related measures.

As indicated in the discussion under Issue 21, because DOE is not precluded from accepting responsibility for the waste in those situations, default is an issue of equity rather than public health and safety. As such, the Commission does not believe that a licensee's potential default has a direct bearing on the Commission's Waste Confidence Decision.

Nevertheless, because the source of funds, but not DOE's ultimate responsibility is ambiguous, the NRC has decided to change the references that CECo cites with the bracketed words to be deleted in the Final Waste Confidence Decision Review:

If for any reason not now foreseen, this spent fuel can no longer be managed by the owners of these reactors, and DOE must assume responsibility for its management earlier than currently planned, this quantity of spent fuel is well within the capability of DOE to manage onsite or offsite with available technology [financed by the utility either directly or through the Nuclear Waste Fund]. (p.39786, col.1)

Even if a licensed utility were to become insolvent, and responsibility for spent fuel management were transferred to DOE earlier than is currently planned, the Commission has no reason to believe that DOE would [have insufficient Nuclear Waste Fund resources or otherwise] be unable to carry out any safety-related measures NRC considers necessary. (p.39390, col.1)

Issue No. 9: Costs Incurred Due to Delayed Acceptance of Spent Fuel at Repository

Comment

Commonwealth Edison Company (CECo) observed that additional costs will be incurred by licensees as a result of delayed acceptance of spent fuel at the repository. CECo believes that consideration should be given as to whether these costs will be covered by the Nuclear Waste Fund or whether the costs will be incurred directly by the licensee.

NRC Response

The Commission believes that this is a matter which will have to be resolved in another forum in the context of the contracts between DOE and the utilities/owners of spent fuel. The individual contracts currently specify the dates by which DOE has agreed to accept responsibility for the disposal of spent fuel. If DOE must delay its acceptance of spent fuel, the responsibility for the financial consequences of that default would have to be determined at that time by reference to and interpretation of the pertinent contracts. The ultimate answer to this question will not affect the findings of the Waste Confidence Decision.

Issue No. 10: Clarification of Discussion of Period of Safe Spent Fuel Storage at Dresden 1

Comment

Commonwealth Edison Company (CECo) comments that the discussion in the Proposed Decision Review of the possible extended storage of spent fuel from Dresden 1 is not clear and should be clarified. On the basis of assumptions discussed in the Proposed Decision Review, CECo concludes that three different dates could be derived to indicate the maximum time for onsite spent fuel storage. For Dresden 1, which was licensed to operate in 1959 and permanently shut down in 1978, 30 years after shutdown would yield a maximum date of 2008; 30 years after a full 40-year license term yields a maximum date of 2029; and 30 years after a full 40-year license term plus a 30-year extension of the operating license would yield a date of 2059.

NRC Response

The NRC believes that CECo has misinterpreted the discussion pertaining to the maximum term of onsite spent fuel storage in the Waste Confidence Decision and the bases and assumptions underlying that discussion as they pertain to the specific circumstances of Dresden 1. The generic discussion of the derivation of the maximum safe storage term for the purposes of the Waste Confidence Decision is contained in pp.39785-90 and pp.39783-96. The Commission concluded on a generic basis that "spent fuel generated in any

reactor can be stored safely and without significant environmental impacts in reactor facility storage pools or independent spent fuel storage installations located at-reactor or away-from-reactor sites for at least 30 years beyond the licensed life for operation (which may include the term of a revised license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations" (proposed 10 CFR 51.23(a) at p. 39968 (Finding 4) (emphasis added)). The discussion and findings were based on technical and institutional considerations that, for the sake of completeness, considered situations like those at Dresden 1 that differ from those with most reactors that are expected to operate to full term plus a possible extended license term. For Dresden 1, based on proposed § 51.23(a), the applicable storage period would be 30 years beyond the licensed life of operation, or until 2029.

2.3 The Commission's Third Finding

The Commission finds reasonable assurance that high-level radioactive waste and spent fuel will be managed in a safe manner until sufficient repository capacity is available to assure the safe disposal of all high-level waste and spent fuel.

Issue No. 11: Resolution of Contractual Conflicts Between DOE and Licensees

Comment

Commonwealth Edison Company (CECo) comments that the NRC has unnecessarily interjected itself into issues involved in the contracts between the DOE and licensees by NRC's statement that it would have more confidence if the DOE and licensees could resolve any uncertainties by reaching an early and amicable resolution as to how and when the DOE will accept responsibility for spent fuel. CECo believes that the implication in this statement is that licensees should amend their contracts with DOE to allow DOE additional time to perform under the contracts or that licensees should refrain taking action against DOE if it defaults under the contracts. CECo notes that NRC has stated that its confidence in safe storage is unaffected by potential contractual disputes between DOE and the spent fuel owners (54 FR 39792), therefore CECo believes that it would be appropriate for NRC to strike the statement and express no opinion regarding possible future disputes between DOE and licensees.

NRC Response

The Commission did not intend the implication that CECo perceives regarding any particular preferred outcome or suggested resolution of

future potential contract disputes between DOE and contract holders. The Commission has stated that its confidence in safe storage is unaffected by any potential contractual dispute between DOE and spent fuel generators and owners as to responsibility for spent fuel storage. The Commission's further statement that it would be helpful if any future potential contract disputes could be resolved amicably merely expressed a concern that the waste management system operates smoothly and efficiently. The statement did not imply any additional impact on or repercussion from the Waste Confidence Decision upon the resolution of future potential contract disputes between DOE and contract holders.

The Commission believes that it has made its position clear that its confidence is not diminished by any potential contractual disputes between DOE and spent fuel owners. However, in order to avoid any further misunderstanding in this regard, the Commission has decided to delete the following statements in its Proposed Waste Confidence Decision Review from its Final Waste Confidence Decision Review:

To resolve any continuing uncertainties, however, it would be helpful if DOE and utilities and other spent fuel generators and owners could reach an early and amicable resolution to the question of how and when DOE will accept responsibility for spent fuel. This would facilitate cooperative action to provide for a smoothly operating system for the ultimate disposition of spent fuel. (54 FR 39792) and

If DOE and the utilities can amicably resolve their respective responsibilities for spent fuel storage in the interest of efficient and effective administration of the overall waste management system, including the Nuclear Waste Fund, NRC would gain added confidence in the institutional arrangements for spent fuel management. (54 FR 39797)

Issue No. 12: NRC Responsibility to Identify Need for Utilities to Provide Interim Storage and to Notify Congress of This Requirement

Comment

Malachy Murphy (State of Nevada) comments that, in light of DOE's Reassessment Report to Congress, the NRC should explicitly state that utilities will need to have interim spent fuel storage available well into the next century. The commenter also states that NRC should explicitly request that Congress take note of this requirement. The commenter believes that such action would be in keeping with NRC's responsibilities to the public and to nuclear utilities.

NRC Response

The standard contracts between DOE and generators of spent nuclear fuel or persons holding title to spent fuel currently provide that in return for payment to the Nuclear Waste Fund, DOE will dispose of high-level waste and spent fuel beginning no later than January 31, 1998. The Commission believes it would be inappropriate for NRC to take any position on the need for generators and those holding title to such material to provide interim storage for it beyond 1998. This is a matter that will have to be resolved between the parties to the standard contracts. NRC, in its original Waste Confidence Decision and in the Proposed Waste Confidence Decision Review, addressed the issue of storage of spent fuel until a repository becomes available and has expressed its confidence that spent fuel will be safely managed until a repository is available. Furthermore, in its original Waste Confidence Proceeding, NRC amended its reactor licensing rule, 10 CFR part 50 to require each licensed reactor operator to submit, no later than five years before expiration of the operating license, plans for managing spent fuel at the reactor site until the spent fuel is transferred to DOE for disposal.

In the Nuclear Waste Policy Act (NWPA), Congress placed primary responsibility for interim storage of spent fuel on the nuclear utilities until disposal becomes available. Section 132 of the NWPA requires that DOE, NRC, and other authorized Federal officials take such actions as they believe are necessary to encourage and expedite the effective use of available storage, and necessary additional storage, at the site of each civilian nuclear power reactor.

Sections 218(a) and 133 of the NWPA also provide that NRC by rule establish procedures for the licensing of any technology approved by NRC for use at the site of any civilian nuclear power reactor. NRC may by rule approve one or more dry spent fuel storage technologies for use at the sites of civilian power reactors without, to the maximum extent practicable, the need for additional site-specific approvals. Congress is eminently aware of the likely need for at-reactor storage of spent fuel and has taken legislative action with respect to this matter. Therefore, the NRC believes it is not necessary to inform Congress of this need. However, the NRC will continue to exercise its responsibility to assure that spent fuel is managed safely until a repository is available and will notify Congress of any actions it believes are necessary to provide this assurance.

2.4 The Commission's Fourth Finding

The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

Issue No. 13: Consideration of the Cumulative Impacts on Waste Management in the NRC's NEPA Documentation

Comment

DOE commented that the cumulative impacts on waste management of potential reactor operating license extensions should be considered in the NRC's National Environmental Policy Act (NEPA) documentation for license renewals.

NRC Response

DOE has observed that renewal of operating licenses would increase the total amount of spent fuel requiring disposal or interim storage which would be taken into account in DOE program planning and should be considered in NRC's NEPA documentation for license renewals. This is generally consistent with the discussion in the Commission's proposed decision, especially 54 FR 39795 (third column). The greater amount of spent fuel which must be stored as a result of license renewal does not affect the Commission's overall finding of no significant environmental impacts.

Issue No. 14: Need for NRC to Facilitate ISFSI License Extensions to Reflect the Commission's Revised Fourth Finding

Comment

The Virginia Electric & Power Company (VEPCo) states that the current license on the Independent Spent Fuel Storage Installation (ISFSI) for its Surry nuclear power plant expires on July 31, 2006. VEPCo states that the NRC should initiate actions to facilitate ISFSI license extensions to reflect the proposed revised Fourth Finding that spent fuel generated in any reactor can be safely stored for at least 30 years beyond the licensed life for operation of that reactor either onsite or offsite.

NRC Response

The Commission's Waste Confidence finding on the duration of safe storage of spent fuel is generic in nature. Site-specific licensing procedures remain effective. Pursuant to § 72.42, an ISFSI license is issued for a period of 20 years but may be renewed upon application by the licensee. Part 72 in no way precludes licensees from requesting

additional extensions of license terms for ISFSIs. The licensee thus has the option of requesting an ISFSI license renewal to coincide with whatever operating term and post-operation spent fuel storage period is in effect for a particular reactor. For example, a single renewal could extend the Surry ISFSI license expiration date to the year 2026. The NRC does not believe that further revisions to § 72.42 to facilitate these license extensions are warranted at this time.

Issue No. 15: Insufficient Assurance on Duration of Safe Storage and Risk of Fire at a Spent Fuel Pool

Comment

Public Citizen stated that there is not adequate assurance that spent fuel will be stored safely at reactor sites for up to 30 years beyond the expiration of reactor operating licenses. This is even more the case if license extensions of up to 30 years are included. Public Citizen further stated that "the (Waste Confidence) policy statement fails to recognize that spent fuel buildup at reactor sites poses a growing safety hazard. The pools are not well protected from the environment (in many cases they are outside the reactor's containment structure) and have leaked in the past. For example, in December 1988 at the Hatch nuclear power plant in Baxley, Georgia, 141,000 gallons of radioactive water leaked out of the plant's fuel pool. More than 80,000 gallons of the water drained into a swamp and from there into the Altamaha River near the plant." Public Citizen added that "More recently, on August 16, 1988, a seal on a fuel pool pump failed at the Turkey Point nuclear plant near Miami, FL, causing some 3,000 gallons of radioactive water to leak into a nearby storm sewer. The shoes and clothing of approximately 15 workers were contaminated."

Public Citizen also stated that the danger posed by an accident in which enough pool water escaped to uncover the irradiated fuel assemblies would be greater than the operational incidents described above. According to the commenter, if a leak or pump failure caused the water level in a spent fuel pool to drop to a level which exposed the fuel assemblies, the remaining water might be insufficient to provide adequate cooling. The pool water could then heat to the boiling point, producing steam and causing more water to boil away. The danger then is that heat could continue to build up even further until the cladding which encloses the irradiated fuel pellets catches fire. The commenter continued saying that the

NRC itself, in the time since the original Waste Confidence Decision, has studied the issue of storage in reracked spent fuel pools and concluded in a 1987 report that the consequence of such a cladding fire could be a "significant" radiation release. The NRC report found:

(1) the natural air flow permitted by high-density storage racks is so restricted that potential for self-sustaining cladding fire exists; and

(2) with high-density racks providing "severely restricted air flow" the oxidation (burning) would be "very vigorous" and "failure of both the fuel rods and the fuel rod racks is expected."

Public Citizen states that nowhere in the Proposed Waste Confidence Decision Review does the NRC take into account the findings of this report, which should have been included.

NRC Response

The Commission has addressed the safety of extended post-operational spent fuel storage at considerable length in the discussion of its proposed revised Fourth Finding.

Operational occurrences cited in Public Citizen's comment have been addressed by the NRC staff at the plants listed. The NRC has taken inspection and enforcement actions to reduce the potential for such operational occurrences in the future. We would like to note, however, that the event at the Hatch plant occurred in a transfer canal between spent fuel pools during an operation that would not normally be performed following expiration of a reactor operating license. In the case of the event at Turkey Point, the water that flowed outside the building went back into the intake of the plant cooling canal. The canal is a large, closed loop onsite flow path. There was no radiation release offsite, and the safety significance of the event appears to have been very low.

Regarding the risk of fire at spent fuel pools, the NRC staff has spent several years studying in detail catastrophic loss of reactor spent fuel pool water possibly resulting in a fuel fire in a dry pool. The 1987 report, "Severe Accidents in Spent Fuel Pools in Support of Generic Safety Issue 82" (NUREG/CR-4982), referred to in Public Citizen's comment represents an early part of the NRC's study. Its findings were based on generic data on seismic hazards and response of spent fuel pools, which resulted in calculated risk numbers with wide ranges of uncertainty. (See p. xiii.) Subsequent study of the consequences and risks due to a loss of coolant water from spent fuel pools was conducted by the NRC, and the results were published in NUREG/CR-5176, "Seismic Failure and Cask Drop Analysis of the Spent

Fuel Pools at Two Representative Nuclear Power Plants," January 1989, and NUREG-1353, "Regulatory Analysis for the Resolution of Generic Issue 82, >Beyond Design Basis Accidents in Spent Fuel Pools," April 1989. These reports were cited in the Commission's Proposed Waste Confidence Decision Review (54 FR 39767-39797, at p.39795, September 28, 1989). Also issued in 1989, as part of the NRC staff's study, was "Value/Impact Analyses of Accident Preventive and Mitigative Options for Spent Fuel Pools" (NUREG/CR-5281).

The analyses reported in these studies indicate that the dominant accident sequence which contributes to risk in a spent fuel pool is gross structural failure of the pool due to seismic events. Risks due to other accident scenarios (such as pneumatic seal failures, inadvertent drainage, loss of cooling or make-up water, and structural failures due to missiles, aircraft crashes and heavy load drops) are at least an order of magnitude smaller. For this study, older nuclear power plants were selected, since the older plants are more vulnerable to seismic-induced failures.

It should be noted that for a zircaloy cladding fire in a spent fuel storage pool, an earthquake or other event causing a major loss of cooling water would have to occur within two years after operation of a PWR or six months after operation of a BWR. (See NUREG-1353, p. 4-11.) Thus, during the decades of post-operational storage, even a major loss of cooling water would not be sufficient to cause a cladding fire. During the time the pool would be most vulnerable to a fire, the most-recently discharged fuel assemblies would have to be adjacent to other recently discharged assemblies for a fire to propagate to the older fuel. Considering that a third of the reactor core is typically unloaded as spent fuel each year, the probability of a fire involving even the equivalent of a reactor core--a small portion of a pool's capacity--is quite remote.

It should also be noted that even if the timing of a spent fuel pool failure were conducive to fire, a fire could occur only with a relatively sudden and substantial loss of coolant--a loss great enough to uncover all or most of the fuel, damaging enough to admit enough air from outside the pool to keep a large fire going, and sudden enough to deny the operators time to restore the pool to a safe condition. Such a severe loss of cooling water is likely to result only from an earthquake well beyond the conservatively estimated earthquake for which reactors are designed. Earthquakes of that magnitude are extremely rare.

The plant-specific studies following the 1987 generic study found that, because of the large safety margins inherent in the design and construction of their spent fuel pools, even the more vulnerable older reactors could safely withstand earthquakes several times more severe than their design basis earthquake. Factoring in the annual probability of such beyond-design-basis earthquakes, the plant-specific and generic followup studies calculated that the average annual probability of a major spent fuel pool failure at an operating reactor was ten to thirty times lower than the average probabilities in the 1987 study. (See NUREG/CR-5176, p. xiii, and NUREG-1353, pp. ES-2-3.) For either BWR or PWR designs, this probability was calculated at two chances in a million per year of reactor operation. (See NUREG-1353, pp. ES-3-4.)

After evaluating several regulatory options for reducing the risk of spent fuel pool fires, the NRC regulatory analysis concluded that "[t]he risk[s] due to beyond design basis accidents in spent fuel pools, while not negligible, are sufficiently low that the added costs involved with further risk reductions are not warranted." (See NUREG-1353, pp. ES-6-8.)

Issue No. 18: Need for NRC Requirement for Dry Cask Storage Instead of Storage in Spent Fuel Pools

Comment

Public Citizen states that the use of dry cask storage for spent fuel would help address some of the concerns described above, but that NRC has no plans to require dry cask storage instead of storage in spent fuel pools. The commenter notes that NRC has explicitly stated in its Proposed Decision Review that storage in a reactor's "spent fuel storage basin" is considered safe, and (the commenter) apparently disagrees with this conclusion.

NRC Response

The record of operational experience with reactor spent fuel storage pools, as discussed in the Commission's Proposed Decision Review and in response to the preceding comments, strongly supports the conclusion that reactor spent fuel pool storage, which has continued for decades, is safe. Accordingly, the NRC has reached the conclusion that past experience and available information amply support the safety of spent fuel storage, both in pools and dry storage casks, for at least 30 years past the expiration of reactor operating licenses (including the term of a revised license).

Issue No. 17: Suggestion to Revise Proposed Fourth Finding to Reflect Reasonable Assurance That Spent Fuel Can Be Safely Stored in Dry Casks at Reactor Sites for Up to One Hundred Years

Comment

Malachy Murphy [State of Nevada] commented that NRC's Proposed Revised Fourth Finding did not go far enough with respect to the duration of safe storage in dry storage casks. The commenter suggested that both the proposed finding and the Proposed Amendment to 10 CFR 51.23 be amended to reflect reasonable assurance that spent fuel can be stored safely and without significant environmental risk in dry casks at reactor sites for up to one hundred (100) years.

NRC Response

The Commission does not dispute a conclusion that dry spent fuel storage is safe and environmentally acceptable for a period of 100 years. Evidence supports safe storage for this period. A European study published in 1988 states, "In conclusion, present-day technology allows wet or dry storage over very long periods, and up to 100 years without undue danger to workers and population." (See Fettel, W., Kaspar, G., and Gunther, H., "Long-Term Storage of Spent Fuel from Light-Water Reactors" (EUR 11866 EN), Executive Summary, p.v, 1988.)

Although spent fuel can probably be safely stored without significant environmental impact for longer periods, the Commission does not find it necessary to make a specific conclusion regarding dry cask storage in this proceeding, as suggested by the commenter, in part because the Commission's Proposed Fourth Finding states that the period of safe storage is "at least" 30 years after expiration of a reactor's operating license. The Commission supports timely disposal of spent fuel and high-level waste in a geologic repository, and by this Decision does not intend to support storage of spent fuel for an indefinitely long period.

Issue No. 18: Maintenance of Institutional Controls for One Hundred Years

Comment

Marvin Lewis commented that the Commission's Proposed Revised Decision and Amendment to 10 CFR part 51 both require that at-reactor storage be available and safe for at least 100 years, which is an excessive amount of time to depend on institutional memory. The commenter states that to look into the future and have confidence

that our institutions will survive in a form which will provide that safe onsite storage is available for at least 100 years into the future lacks any merit. The commenter asked that the Commission arrive at the opposite conclusion, namely that "Due to the Department of Energy's lack of quality control of data and analysis, inability to qualify acceptable sites, accusation against subcontractors when data contradicts DOE's preconceived assumptions, and general adherence to the political solution instead of scientific veracity, the NRC cannot find that temporary storage at reactors will ensure that geological storage for spent fuel will be available and safe when needed."

NRC Response

The Commission believes there is an adequate basis from the record of Federal regulations, historical experience and current practice to support the Commission's finding regarding institutional controls over spent fuel storage activities.

The Environmental Protection Agency's standards for high-level waste disposal provide that "active institutional controls over disposal sites should be maintained for as long a period of time as is practicable after disposal; however, performance assessments that assess isolation of the wastes from the accessible environment shall not consider any contributions from active institutional controls for more than 100 years after disposal" (40 CFR 191.14(a)). The finding that repository licensing performance assessments can take credit for active institutional controls for 100 years is not one of the issues involved in the judicial action which vacated the EPA standard, and it is not expected that this section will be disturbed when the standard is reissued. It should also be noted that this language does not suggest that active institutional controls are unlikely for a period greater than 100 years. In the summary of the Final Rule (50 FR 38086; September 19, 1985), EPA noted that many commenters on the Proposed Rule felt that "a few hundred years" which was the proposed period for reliance on active institutional controls was too long. EPA agreed to limit the period to 100 years, noting that "this was the time period [EPA] considered in criteria for radioactive waste disposal that were proposed for public comment in 1978 (43 FR 53262), a period that was generally supported by the commenters on that proposal" (50 FR 38086, at p. 38080).

NRC would add that there are abundant examples of institutions in human society which have maintained a continuity in institutional controls far

exceeding 100 years. The government of the United States, which is relatively young, is over 200 years old. The governments of some European countries have been in existence for time periods between 700 to 1000 years. While invading armies and civil wars have been disruptive, archival information of interest to the safety of the population can be expected to be preserved. In the United States today, real estate contracts are commonly executed to cover a period of 100 years, or a significant fraction thereof. One hundred-year land-lease agreements are common. Major civil construction projects such as harbors, bridges, flood control systems, and dams are often planned and executed—and investments made in them—with the view of recovering the benefits over a period of 100 years or more.

2.5 The Commission's Fifth Finding

The Commission finds reasonable assurance that safe independent onsite or offsite spent fuel storage will be made available if such storage capacity is needed.

Issue No. 19: Impact of Extension of Time for Repository Availability on the Increased Generation of Low-Level Radioactive Waste

Comment

Commonwealth Edison (CECO) commented that the Proposed Waste Confidence Review does not address low-level waste concerns resulting from delayed acceptance of spent fuel by the repository under DOE's extended schedule for repository availability. CECO commented that if they store spent fuel in pools and implement rod consolidation to conserve space during the extension, additional low-level waste may be generated. CECO believes that NRC should determine if this additional low-level waste should go to a Federal Repository or to a sited compact for disposal.

NRC Response

The disposition of high-level and low-level radioactive wastes has already been determined by Congress in the Nuclear Waste Policy Act of 1982 (NWPA) and in the Low-Level Radioactive Waste Policy Act (LLWPA). Congressional designation of the method of disposal of each type of waste was not dependent on the DOE's schedule for development of the repository; rather, Congress designated the method of disposal according to characteristics of the waste which are associated with its hazard (i.e., radioactive source strength, radioactive species of the emanating radiation, and half-life). It is not within the NRC's regulatory

jurisdiction to change the directives provided by Congress in the NWPA and the LLWPA.

3.0 Consideration of Other Events Relevant to the Commission's Decision

Issue No. 20: Petition by the State of Vermont to Intervene in the Consideration of the Extension of the Operating License for Vermont Yankee

In the Commission's Proposed Waste Confidence Decision Review, it was stated that the basis for the 2007-2009 timeframe in the Court remand leading to the Waste Confidence Proceeding had changed since the original Decision. This discussion was based on the fact that it appeared likely that these dates no longer represented the expected expiration dates for the operating licenses of the Vermont Yankee and Prairie Island nuclear plants. The NRC staff has been granting extensions of the dates of expiration of nuclear plant operating licenses to reflect a 40-year period from the date of issuance of the operating license rather than from the date of the construction permit. The dates of expiration of the Prairie Island Units 1 and 2 had already been extended from the year 2006 to the years 2013 and 2014. The NRC staff anticipated that on the basis of the date of issuance of its operating license, Vermont Yankee would be eligible for an extension of its operating license to March 2012.

In the time since the drafting of the Proposed Decision Review, several pertinent events have occurred. NRC published a notice of consideration of amendment to the Vermont Yankee Operating License, a proposed "no significant hazards" consideration determination, and opportunity for a hearing (54 FR 31120; July 26, 1989). On August 22, 1989, the State of Vermont filed a petition for leave to intervene. On October 30, 1989, Vermont filed a supplement to its petition to intervene proposing nine contentions for litigation on Vermont Yankee Nuclear Power Corporation's application to extend its operating license. On November 15, 1989, the NRC's Atomic Safety and Licensing Board (ASLB) heard oral argument by counsel for the licensee, the NRC staff, and the State of Vermont concerning the State's petition for leave to intervene and supplemental petition for leave to intervene. The ASLB granted the State of Vermont's petition for leave to intervene, admitted one contention (which did not concern waste disposal) as an issue in controversy for litigation, and granted the request for hearing. The ASLB's ruling was issued in a Prehearing Conference

Memorandum and Order dated January 26, 1990 (Docket No.50-271-OLA-4).

It is now apparent that the extension of Vermont Yankee's operating license expiration date will be dependent on the outcome of this contested hearing. There is the possibility that a shorter extension or that no extension will be granted. In view of the uncertain outcome, the Commission will delete all discussion of a possible revised date for the Vermont Yankee operating license expiration and the revised date for expiration of the Prairie Island operating license. This deletion, however, does not affect the Commission's Proposed Revised Second Finding in its Waste Confidence Decision Review. Assuming that no extension or a lesser extension is granted and Vermont Yankee's operating license expires in 2007, the basis for the Commission's finding that a repository will be available within the first quarter of the twenty-first century and that sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor, would be unaffected.

Issue No. 21: Potential Need for Additional Financial Security for the Nuclear Waste Fund

The NRC staff has been informed by DOE's Office of Civilian Radioactive Waste Management that a pending final report from DOE's Inspector General has indicated a potential problem for certain nuclear utility licensees to pay the one-time fee into the Nuclear Waste Fund (NWF) for spent fuel generated prior to April 1983. This issue arises because several utilities elected to defer payment into the fund and, instead, themselves hold the money that was collected from ratepayers for the one-time fee. DOE's Inspector General believes that some of those utilities may not be able to make their payments when due.

The NRC staff met with DOE's Office of Civilian Radioactive Waste Management (OCRWM) on December 13, 1989 to discuss this issue and determine the potential impact on both NRC's Decommissioning Rulemaking and on the Waste Confidence Decision, and, more generally, on protection of public health and safety. In addition, NRC discussed at that meeting and in follow-up telephone conversations potential actions that DOE might take. These actions could include modifying DOE's spent fuel contracts with electric utilities, seeking legislative amendments, and working with the National Association of Regulatory Utility Commissioners to increase assurance of one-time contributions into the NWF.

The NRC understands from OCRWM staff that, if a nuclear utility licensee were to default on its one-time contribution to the NWF, DOE is not precluded from accepting for disposal all spent fuel from that utility. Thus, the NRC does not view this issue as affecting its confidence that the spent fuel will be disposed of. Rather, the issue is one of equity--that is, will a utility and its customers and investors or U.S. taxpayers and/or other utilities ultimately pay for disposal of spent fuel generated prior to April 1983.

Background

In November 1976, the Natural Resources Defense Council (NRDC) petitioned NRC for a rulemaking to determine whether radioactive wastes generated in nuclear power reactors can be subsequently disposed of without undue risk to the public health and safety. The NRDC also requested that NRC not grant pending or future requests for operating licenses until the petitioned finding of safety was made.

On June 27, 1977, NRC denied the NRDC petition. The Commission said that in issuing operating licenses, NRC must have assurance that wastes can be safely handled and stored as they are generated. It also said that it is not necessary for permanent disposal to be available if NRC could be confident that permanent disposal could be accomplished when necessary. NRC added that Congress was aware of the relationship between nuclear reactor operations and the radioactive waste disposal problem, and that NRC would not refrain from issuing reactor operating licenses until the disposal problem was resolved. The Commission also stated that it "...would not continue to license reactors if it did not have reasonable confidence that the wastes can and will in due course be disposed of safely."

Also in November 1976, two utility companies requested amendments to their operating licenses to permit expansion in the capacity of their spent nuclear fuel storage pools: Vermont Yankee Nuclear Power Corporation for the Vermont Yankee plant; and Northern States Power Company for its Prairie Island facility. In both cases, the utilities planned to increase storage capacity through closer spacing of spent fuel assemblies in existing spent fuel pools. The New England Coalition on Nuclear Power and the Minnesota Pollution Control Agency intervened. The NRC staff evaluated the requests and found that the modifications would not endanger public health and safety. The staff did not consider any potential

environmental effects of storage of spent fuel at the reactors beyond the dates of expiration of their operating licenses. NRC's Atomic Safety and Licensing Board Panel (ASLBP) adopted the staff's safety and environmental findings and approved the license amendments for the two plants. It too did not consider the effects of at-reactor storage beyond the expiration of the facility operating license.

The Board's decision was appealed to the Atomic Safety and Licensing Appeal Board (ASLAB). The ASLAB affirmed the Licensing Board's decision, citing the Commission's "...reasonable confidence that wastes can and will in due course be disposed of safely..." in the Commission's denial of the NRDC petition. The decision of the ASLAB was appealed to the U.S. Circuit Court of Appeals. On May 23, 1979 the Court declined to stay or vacate the license amendments, but remanded to NRC the question of "...whether there is reasonable assurance that an offsite storage solution will be available by the years 2007-2009, the expiration of the plants' operating licenses, and if not, whether there is reasonable assurance that the fuel can be safely stored at the reactor sites beyond those dates." In its decision to remand to NRC, for consideration in either a generic rulemaking or an adjudicatory proceeding, the Court observed that the issues of storage and disposal of nuclear waste were being considered by the Commission in an ongoing generic proceeding known as the "S-3 Proceeding" on the environmental impacts of uranium fuel cycle activities to support the operation of a light water reactor, and that it was appropriate to remand in light of a pending decision on that proceeding and analysis.

On October 18, 1979, NRC announced that it was initiating a rulemaking proceeding in response to the Appeals Court remand and as a continuation of the NRDC proceeding. Specifically, the purpose of the proceeding was for the Commission "...to reassess its degree of confidence that radioactive wastes produced by nuclear facilities will be safely disposed of, to determine when any such disposal will be available, and whether such wastes can be safely stored until they are disposed of."

The Commission recognized that the scope of this proceeding would be broader than the Court's instruction, which required the Commission to address only storage-related questions. The Commission believed, however, that the primary public concern was the safety of waste disposal rather than the availability of an off-site solution to the

storage problem. The Commission also committed itself to reassess its basis for confidence that methods of safe permanent disposal for high-level waste would be available when needed. Thus, the Commission chose as a matter of policy not to confine itself exclusively to the narrower issues in the court remand.

In the Notice of Proposed Rulemaking, the Commission also stated that if the proceeding led to a finding that safe off-site storage or disposal would be available before expiration of facility operating licenses, NRC would promulgate a rule providing that the impact of onsite storage of spent fuel after expiration of facility operating licenses need not be considered in individual licensing proceedings.

The Waste Confidence Decision was issued on August 31, 1984 (49 FR 34858). In the Decision, the Commission made five findings. It found reasonable assurance that:

(1) Safe disposal of high-level radioactive waste and spent fuel in a mined geologic repository is technically feasible.

(2) One or more mined geologic repositories for commercial high-level radioactive waste and spent fuel will be available by the years 2007-2009, and sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of existing commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time.

(3) High-level radioactive waste and spent fuel will be managed in a safe manner until sufficient repository capacity is available to assure the safe disposal of all high-level radioactive waste and spent fuel.

(4) If necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of that reactor's operating license at that reactor's spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

(5) Safe independent onsite or offsite spent fuel storage will be made available if such storage capacity is needed.

On the day the Decision was issued, the Commission also promulgated two rulemaking amendments: (1) an amendment to 10 CFR part 50, which required that no later than five years before expiration of reactor operating licenses, the licensee must provide NRC with a written plan for management of spent fuel onsite, until title for the spent fuel is transferred to the DOE; and (2) an

amendment to 10 CFR part 51 which provided that environmental consequences of spent fuel storage after expiration of facility licenses need not be addressed in connection with issuance of or amendment to a reactor operating license.

In issuing the part 51 amendment, the Commission stated that although it had reasonable assurance that one or more repositories would be available by 2007-2009, it was possible that some spent fuel would have to be stored beyond those dates. The part 51 amendment was based on the Commission's finding in the Waste Confidence Proceeding that it had reasonable assurance that no significant environmental impacts will result from storage of spent fuel for at least 30 years beyond expiration of reactor operating licenses.

Enactment of the NWPA contributed significantly to the basis for the Commission's 1984 Decision and companion rulemakings. The Act established a funding source and process with milestones and schedules for, among other things, the development of a monitored retrievable storage (MRS) facility and two repositories, one by early 1998 and a second, if authorized by Congress, at a later date, initially planned by DOE for 2006. For each repository, the Act required DOE to conduct *in-situ* investigations of three sites and recommend one from among them to the President and Congress for repository development. The NWPA also required DOE to recommend, from among alternative sites and designs, a site and design for an MRS for spent fuel and high-level waste management before disposal. The Commission's licensing and regulatory authority over both storage and disposal facilities was preserved by the Act.

In the four years after enactment of the NWPA, DOE met a number of the Act's early program requirements, but also encountered significant difficulties. It published a final Mission Plan for the overall NWPA program, and followed with a Project Decision Schedule for DOE and other Federal agency actions. It promulgated, with Commission concurrence, a set of guidelines for repository siting and development. It published draft and final environmental assessments for nine candidate repository sites, and recommended three for characterization. It completed and submitted to Congress an environmental assessment, a program plan, and a proposal with a site and design for an MRS. All these actions followed extensive interactions with interested Federal agencies, State, Indian tribal, and local governments, and other

organizations. In the course of these activities, however, DOE also slipped its schedule for operation of the first repository by five years, indefinitely postponed efforts toward a second repository, and had to halt further MRS siting and development activities pending Congressional authorization.

In December, 1987, Congress enacted the Nuclear Waste Policy Amendments Act (NWPAA). The NWPAA redirected the high-level waste program by suspending site characterization activities for the first repository at sites other than the Yucca Mountain site, and by suspending all site-specific activities with respect to a second repository. The Amendments Act also authorized and set schedule and capacity limits on the MRS. The purpose of these limitations, according to sponsors of the legislation, was to assure that an MRS would not become a substitute for a geologic repository.

Consistent with its commitment to revisit its Waste Confidence conclusions at least every five years, the Commission has undertaken the current review to assess the effect of these and other developments since 1984 on the basis for each of its five findings. The Commission issued its proposed Waste Confidence Decision Review and proposed revised findings for public comment on September 28, 1989. The comment period expired December 27, 1989. A total of eleven comments were received.

In this document, the Commission supplements the basis for its earlier findings and the environmental analysis of the 1984 Decision. The Commission is amending its second finding, concerning the timing of initial availability and sufficient capacity of a repository, and its fourth finding, concerning the duration of safe spent fuel storage. These revisions are based on the following considerations:

(1) the five-year slippage, from 1998 to 2003, in the DOE schedule for repository availability prior to issuance of its November, 1989 "Report to Congress on Reassessment of the Civilian Radioactive Waste Management Program" and its new target date of 2010 for repository availability announced in that report;

(2) the additional slip of four and one-half years since the January 1987 Draft Mission Plan Amendment in the DOE schedule for the excavation of the exploratory shaft;

(3) the need to continue accounting for the possibility that the Yucca Mountain site might be found unsuitable and that DOE would have to initiate efforts to identify and characterize another site for the first repository;

(4) the statutory suspension of site-specific activities for the second repository;

(5) DOE's estimate that site screening for a second repository should start about 25 years before the start of waste acceptance; and

(6) increased confidence in the safety of extended spent fuel storage, either at the reactor or at independent spent fuel storage installations.

The Commission is also issuing an amendment to 10 CFR 51.23(a) to conform with the revisions to Findings 2 and 4 elsewhere in this issue of the Federal Register.

Organization and Table of Contents

In conducting this review, the Commission has addressed, for each of its 1984 Findings, two categories of issues. The first category consists of the issues the Commission considered in making each Finding at the time of the initial Waste Confidence Decision. For these issues, the Commission is interested in whether its conclusions, or the Finding these conclusions support, should be changed to address new or foreseeable developments that have arisen since the first Waste Confidence Decision. The second category of issues consists of those the Commission believes should be added to the 1984 issues in light of subsequent developments. (To enable the reader to follow more easily, the lengthy discussions of Findings 1 and 2 have been organized to address each original and new issue under subheadings.)

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Reaffirmed Finding 1: The Commission finds reasonable assurance that safe disposal of high-level radioactive waste and spent fuel in a mined geologic repository is technically feasible.

I.A. Issues Considered in Commission's 1984 Decision on Finding 1

I.A.1. The identification of acceptable sites

Under the Nuclear Waste Policy Act of 1982 (NWPAA), the Department of Energy (DOE) had responsibility for identifying candidate sites for a geologic repository and for repository development. The first requirement leading to recommendation of candidate

sites was formal notification of States with one or more potentially acceptable sites for a repository within 90 days of enactment of the NWPAA. In February 1983, the DOE identified nine potentially acceptable sites for the first repository. Four of the sites were in bedded-salt formations, three were in salt domes, one in volcanic tuff, and one in basalt.

The NWPAA required that each site nomination be accompanied by an environmental assessment (EA). In December 1984, DOE published Draft EAs (DEAs) for each of the nine sites identified as potentially acceptable and proposed the following sites for nomination: the reference repository location at Hanford, WA; Yucca Mountain, NV; Deaf Smith County, TX; Davis Canyon, UT; and Richton Dome, MS. In May 1986, DOE released Final EAs (FEAs) for the five sites nominated. At that time, DOE recommended that the Yucca Mountain, Hanford, and Deaf Smith County sites undergo site characterization. The President approved the recommendation.

The NRC staff provided extensive comments on both the DEAs and the FEAs. NRC concerns on the FEAs related primarily to DOE's failure to recognize uncertainty inherent in the existing limited data bases for the recommended sites, and the tendency of DOE to present overly favorable or optimistic conclusions. The primary intent of the comments was to assist DOE in preparing high-quality Site Characterization Plans (SCPs) for each site, as required under the NWPAA, before excavation of exploratory shafts. NRC concerns can only be addressed adequately through the site characterization process, because one of the purposes of this process is to develop the data to evaluate the significance of concerns relative to site suitability.

NRC did not identify any fundamental technical flaw or disqualifying factor which it believed would render any of the sites unsuitable for characterization. Further, NRC did not take a position on the ranking of the sites in order of preference, because this could be viewed as a prejudgment of licensing issues. NRC was not aware of any reason that would indicate that any of the candidate sites was unlicenseable. Nor has NRC made any such finding to date with respect to any site identified as potentially acceptable.

In March 1987, Congress began drafting legislation to amend the repository program. NRC provided comments on a number of these draft amendments. In December 1987, the NWPAA was enacted. In a major departure from the initial intent of the

NWPAA, the new law required that DOE suspend site-characterization activities at sites other than the Yucca Mountain site. This decision was not based on a technical evaluation of the three recommended sites or a conclusion that the Hanford and Deaf Smith sites were not technically acceptable. According to sponsors of the legislation, the principal purpose of the requirement to suspend characterization at these sites was to reduce costs. In effect, the NWPAA directed DOE to characterize candidate sites sequentially, if necessary, rather than simultaneously. If DOE determines at any time that the Yucca Mountain site is unsuitable, DOE is to terminate all site characterization activities and report to Congress its recommendations for further actions.

The NRC staff has identified numerous issues regarding the Yucca Mountain site that may have a bearing on the licenseability of that site. These issues will have to be resolved during site characterization. An example of a site issue that may bear on the question of suitability is tectonic activity, the folding or faulting of the earth's crust. In the 1984 Waste Confidence Decision, NRC noted that "...the potential sites being investigated by DOE are in regions of relative tectonic stability." The authority for this statement came from the Position Statement of the US Geological Survey (USGS). NRC has raised concerns regarding tectonic activity at the Yucca Mountain site in the comments on the draft and final EAs, in the draft and final Point Papers on the Consultation Draft Site Characterization Plan, and in the Site Characterization Analysis for the Yucca Mountain site. If it appears during site characterization that the Yucca Mountain site will be unable to meet NRC requirements regarding isolation of waste, DOE will have to suspend characterization at that site and report to Congress.

DOE's program of site screening in different geologic media was consistent with section 112(a) of the NWPAA, which required that DOE recommend sites in different geologic media to the extent practicable. This strategy was to ensure that if any one site were found unsuitable for reasons that would render other sites in the same geologic medium unacceptable, alternate sites in different host rock types would be available. NRC referred to this policy in its 1984 Waste Confidence Decision, when it said, in support of its argument on technical feasibility, that "...DOE's program is providing information on site characteristics at a sufficiently large number and variety of sites and geologic

media to support the expectation that one or more technically acceptable sites will be identified."

NRC recognizes that simultaneous site characterization is not necessary to identify a repository site that would meet NRC's technical criteria for isolating wastes. Sequential site characterization does not necessarily preclude or hinder identification of an acceptable site for a repository. NRC did express concern to Congress, on several occasions during deliberations over the proposed legislation, that sequential site characterization could delay considerably the schedule for opening a repository if the site undergoing characterization were found to be unlicenseable. NRC also indicated that this potential for delay would have to be considered by NRC in reevaluating the findings in its Waste Confidence Decision. The impact of this redirection of the high-level waste program on the Commission's Waste Confidence findings is not on the ability to identify technically acceptable sites, but on the timing of availability of technically acceptable sites. Because characterization of multiple sites appears to be more directly related to the timing of repository availability than to the feasibility of geologic disposal, consideration of the above statement in light of the NWPA program redirection will be discussed under Finding 2.

Another question bearing on whether technically acceptable sites can be found is whether compliance with Environmental Protection Agency (EPA) environmental standards for disposal of spent fuel and high-level waste can be demonstrated. These standards, originally promulgated in final form in September 1985, were vacated in July, 1987, by the U.S. Court of Appeals, and remanded to EPA for further consideration (see *NRDC v. EPA*, 824 F. 2d 1256). As originally promulgated, the standards set limits on releases of radioactive materials from the site into the accessible environment over a 10,000 year period following disposal. They also required that there be less than one chance in ten that the release limits will be exceeded in 10,000 years, and less than one chance in 1,000 that releases will exceed ten times the limits over 10,000 years.

In past comments on draft and proposed EPA standards, and in related NRC rulemaking efforts, NRC has expressed concern that probabilistic analyses should not be exclusively relied on to demonstrate compliance with EPA release limits. NRC's comments said in part that "...[t]he numerical probabilities in [the

standards] would require a degree of precision which is unlikely to be achievable in evaluating a real waste disposal system." The comments went on to explain that "...identification of the relevant processes and events affecting a particular site will require considerable judgment and will not be amenable to accurate quantification, by statistical analysis, of their probability of occurrence." NRC believed then, and continues to believe, that it must make qualitative judgments about the data and methodologies on which the numerical probabilities were based.

In response to NRC concerns, EPA incorporated language into its 1985 standards that appeared to allow flexibility to combine qualitative judgments with numerical probability estimates in a way that might have made implementation of the EPA standards practicable. The text of those standards recognized that "proof of the future performance of a disposal system is not to be had in the ordinary sense of the word" with the substantial uncertainties and very long performance period involved. The 1985 standards emphasized that a "reasonable expectation"—rather than absolute proof—is to be the test of compliance. "What is required," the text of the standards said, "is a reasonable expectation, on the basis of the record... that compliance... will be achieved." In an additional attempt to provide flexibility for implementation of the standards, EPA also provided that numerical analyses of releases from a repository were to be incorporated into an overall probability distribution only "to the extent practicable." This phrase appeared to allow some discretion for NRC to incorporate qualitative considerations into its license decision-making, rather than having to rely solely on numerical projections of repository performance. On the strength of these and other EPA assurances, the Commission did not object when the final standards were published in 1985.

The Commission also notes that the EPA standards, as promulgated in 1985, contained a provision for development of alternative standards by EPA. The Federal Register text (50 FR 38074, September 19, 1985) describing this alternative standards provision stated:

There are several areas of uncertainty the Agency [EPA] is aware of that might cause suggested modifications of the standards in the future. One of these concerns is implementation of the containment requirements for mined geologic repositories. This will require collection of a great deal of data during site characterization, resolution of the inevitable uncertainties in such information, and adaptation of this information into probabilistic risk

assessments. Although the Agency is currently confident that this will be successfully accomplished, such projections over thousands of years to determine compliance with an environmental regulation are unprecedented. If—after substantial experience with these analyses is acquired—disposal systems that clearly provide good isolation cannot reasonably be shown to comply with the containment requirements, the Agency would consider whether modifications to [the standards] were appropriate.

This statement suggests to the Commission that EPA would be willing to consider modifications to the standard's containment requirements in the event that their probabilistic formulation is found to hamper or preclude an adequate evaluation of a proposed repository's capability to isolate radioactive waste.

Pursuant to the remand by the Federal court in 1987, EPA is currently revising its standards for disposal of spent fuel and high-level waste. The court's decision directed that the remand focus on the ground water and individual protection requirements of the standards. Although the EPA standards are still undergoing development at this time, the Commission does not currently see a sufficient basis to withdraw its confidence in the feasibility of evaluating compliance with such standards. NRC staff will closely monitor the development of the repromulgated standards.

In sum, considering both past and current programs for characterizing sites, the Commission concludes that technically acceptable sites for a repository can be found. The Commission is confident that, given adequate time and resources, such sites can be identified, evaluated, and accepted or rejected on their merits, even if no more than one site is undergoing site characterization. This judgment does not rest on the acceptability of the Yucca Mountain site or any one future candidate site.

1.A.2. The development of effective waste packages.

1.A.2.a. Considerations in developing waste packages.

The NWPA required NRC to promulgate technical requirements and criteria to be applied in licensing a repository for high-level radioactive waste. Under Section 121 of the Act, these technical criteria must provide for use of a system of multiple barriers in the design of the repository and such restrictions on the retrievability of waste as NRC deems appropriate. The system of multiple barriers includes both engineered and natural barriers.

The waste package is the first engineered barrier in the system of multiple barriers to radionuclide escape. The waste package is defined as the "waste form and any containers, shielding, packing and other absorbent materials immediately surrounding an individual waste container." Before sinking an exploratory shaft for site characterization, DOE is required to prepare an SCP including a description of the waste form or packaging proposed for use at the repository, and an explanation of the relationship between such waste form or packaging and the geologic medium of the site.

The multiple barrier approach to radioactive waste isolation in a geologic repository is implemented in NRC requirements by a number of performance objectives and by detailed siting and design criteria. The NRC performance objective for the waste package requires substantially complete containment for a period of not less than 300 years nor more than 1000 years after permanent closure of the repository. The technical design criteria for the waste package require that interaction of the waste package with the environment not compromise performance of the package, the underground facility, or the geologic setting. Therefore, the waste package design must take into account the complex site-specific interactions between host rock, waste package, and ground water that will affect waste package and overall repository performance.

Under the NWPAA, DOE was required to suspend site characterization activities at sites other than the Yucca Mountain, NV site. Consequently, DOE has narrowed the range of waste package designs to a design tailored for unsaturated tuff at the Yucca Mountain site. This aspect of the high-level waste program redirection may facilitate and expedite the waste package design process insofar as it enables DOE to concentrate its efforts on developing a single design for a single site instead of three designs for sites in bedded salt, basalt, and unsaturated tuff.

Currently, DOE is evaluating uncertainties in waste package design related to waste form, container type, and environment. The current conceptual design for the waste package is based on several assumptions. The waste form is presumed to be ten-year-old spent fuel or high-level waste in the form of borosilicate glass in stainless-steel canisters. (In addition to spent fuel and high-level waste, the waste form may include greater-than-Class C (GTCC) low-level waste. This waste is

not routinely acceptable for near-surface disposal under NRC regulations for disposal of low-level wastes, but is acceptable for disposal in a repository licensed for disposal of spent fuel and high-level wastes. This waste might include such materials as sealed sources and activated metals from the decommissioning of reactors and production facilities.)

Six materials are being considered for fabrication of containers, including austenitic steel (316L), nickel-based alloys (Alloy 825), pure copper (CDA 102), copper-based alloys (aluminum-bronze, CDA-813, and 70-30 Cu-Ni, CDA-715), and a container with a metal outer shell and ceramic liner. The reference container for the spent fuel and high-level waste is a 1.0-cm thick cylinder to be made of American Iron and Steel Institute (AISI) 304L stainless steel. This will be DOE's benchmark material, against which other materials are to be compared. DOE currently intends for spent fuel containers to be filled with an inert gas, such as argon, before being welded closed. In addition to these six materials, DOE also plans to assess the merits of alternative waste package materials and designs.

The reference repository location is in the unsaturated tuff of the Topopah Spring Formation underlying Yucca Mountain. According to DOE, little free-flowing water is thought to be present there to contribute to corrosion of the waste containers, although the degree of saturation in this tuff is estimated to be 65 (plus or minus) 19 percent of the available void space in the rock. DOE has acknowledged, however, that the greatest uncertainties in assessing waste package performance at Yucca Mountain stem from difficulty in characterizing and modeling the coupled geochemical-hydrologic processes that represent the interactions between the host rock, waste package, and ground water. The final waste package design will depend on the results of site characterization and laboratory testing to reduce uncertainty in predicting these interactions in the reference repository horizon. The final design will also be shaped by research in understanding the degradation of candidate container materials, and the characteristics of the likely reference waste forms.

Regarding the state of technology for developing long-lived waste package containers, the Swedish Nuclear Fuel and Waste Management Company (SKB), the organization responsible for radioactive waste disposal in Sweden, has described a container for spent fuel rods that consists of a 0.1-m thick copper canister surrounded by a

bentonite overpack. The design calls for pouring copper powder into the void spaces in the canisters, compacting the powder using hot-isostatic pressing with an inert gas, and sealing the canisters. SKB estimates that the copper canister waste package has a million-year lifetime. (See also LB.3. below.)

As noted in NRC's Final Point Papers on the Consultation Draft Site Characterization Plan, the Commission does not expect absolute proof that 100 percent of the waste packages will have 100 percent containment for 300 to 1000 years. Since that time, the NRC staff has completed its review of the December 1988 Site Characterization Plan for Yucca Mountain. Although the Commission continues to have concerns about DOE's waste package program, nothing has occurred to diminish the Commission's confidence that as long as DOE establishes conservative objectives to guide a testing and design program, in tuff or in other geologic media if necessary, it is technically feasible to develop a waste package that meets the performance objective for substantially complete containment.

I.A.2.b. Effect of reprocessing on waste form and waste package.

The Draft 1988 Mission Plan Amendment estimates that about 77,800 metric tons of heavy metal (MTHM) of spent nuclear fuel will be available for disposal by the year 2020. (This estimate is based on a "no new orders" assumption for commercial nuclear reactors and a 40-year reactor lifetime.) Also, approximately 9400 MTHM of reprocessed defense waste and a small amount of commercial reprocessed waste from the West Valley Demonstration Project is estimated to be available for disposal by 2020. The decision to locate the defense high-level waste in the repository for wastes from commercial power reactors resulted from the requirement in Section 8 of the NWA that the President evaluate the possibility of developing a defense-waste-only repository. In February 1985, DOE submitted a report to the President recommending a combined commercial and defense repository. In April 1985, the President agreed that no basis appeared to exist for a defense-only repository and directed DOE to dispose of defense waste in the commercial repository.

About 8750 MTHM of reprocessed high-level waste from defense facilities at Savannah River, SC, Hanford, WA, and Idaho Falls, ID will be available by 2020 for disposal in the repository, according to the Draft 1988 Mission Plan Amendment. This waste will likely be solidified into a borosilicate glass

matrix. About 640 MTHM of reprocessed high-level waste will come from the West Valley Demonstration Project, a facility for wastes from discontinued commercial reprocessing of spent fuel at that site. This reprocessed waste also will be solidified, probably in a borosilicate glass waste form.

Waste-form testing for the Yucca Mountain site is focusing on both spent fuel and reprocessed high-level waste. The performance of the waste form in providing the first barrier to radionuclide migration is being evaluated on the basis of the physical and chemical environment of the waste form after disposal, the performance of the waste container, and the emplacement configuration.

A major limitation on glass waste-form testing is that the actual waste glasses to be disposed of are not available, and their exact composition will not be established until after further testing. Reference waste-glass compositions are being used for studies on the effect of variation in glass composition on performance. (These glass compositions are designed by Savannah River Laboratory (SRL) for defense high-level waste, and by Pacific Northwest Laboratory (PNL) for the commercial high-level wastes to be vitrified under the West Valley Demonstration Project Act.) The reference compositions will be revised when better analyses of the composition of the wastes at SRL and West Valley are available. The test program will seek to establish upper bounds on leaching of important radionuclides, and the extent to which glass fracturing increases leach rate. Other factors influencing leach rate are temperature, pH of the leaching solution, formation of solid layers on the surface of the waste glass, irradiation, water volume, and chemistry.

It is possible that renewed reprocessing of spent fuel from nuclear power reactors may result in a greater proportion of reprocessed waste to spent fuel than is currently anticipated. Although such a departure from the current plan to dispose of mostly unreprocessed spent fuel in the repository does not appear likely at this time, the Commission believes it is important to recognize the possibility that this situation could change.

The possibility of disposal of reprocessed waste as an alternative waste form to spent fuel assemblies was recognized by the Commission in the 1984 Waste Confidence Decision. The Commission noted that the disposal of waste from reprocessing had been studied for a longer time than the disposal of spent fuel, and that the

possibility of reprocessing does not alter the technical feasibility of developing a suitable waste package. The Commission went on to say that there is evidence that the disposal of reprocessed high-level waste may pose fewer technical challenges than the disposal of spent fuel. As long as DOE uses conservative assumptions and test conditions for evaluating the performance of different waste forms against NRC licensing requirements, the Commission has no basis to change its finding that there is reasonable assurance that reprocessing does not reduce confidence in the technical feasibility of designing and building a waste package that will meet NRC licensing requirements in a variety of geologic media.

I.A.3. The development of effective engineered barriers for isolating wastes from the biosphere

I.A.3.a. backfill materials.

At the time of the 1984 Waste Confidence Decision, DOE was developing conceptual designs for backfill in several geologic media. Most candidate sites at that time were in saturated rock, and the conceptual designs included backfilling or packing around waste containers to prevent or delay ground water flow which could enhance corrosion and radionuclide transport near the waste containers. The conceptual design for the engineered barrier system at the Yucca Mountain site has different parameters because the site is unsaturated; instead of backfill or packing around the waste container, there is to be an air gap between sides of the waste canister and the host rock.

Backfill material around the container is not required under NRC regulations for the waste package. NRC regulations require that "...containment of high-level waste within the waste packages [which includes the container] will be substantially complete for a period to be determined by the Commission...provided, that such period shall not be less than 300 years nor more than 1000 years after permanent closure of the repository" [10 CFR subsection 60.113(a)(1)(ii)(B)], and that the entire engineered barrier system meet the release rate performance objective of 1 part in 100,000 per year.

Backfill is also a component of the borehole, shaft, and ramp seals, which are not part of the engineered barrier system or the underground facility. Boreholes, shafts, and ramps must be sealed when the repository is permanently closed. This aspect of backfilling is discussed below under "Development of Sealants." Backfill

may also include crushed rock used to fill openings such as drifts in the underground facility. At the Yucca Mountain candidate site, DOE currently plans to fill openings in the underground facility at closure of the repository. Backfilling is not planned before repository closure because it is not needed for structural support for the openings, and it would make waste retrieval more difficult. At closure of the facility, however, openings will be backfilled with coarse tuff excavated for the facility. In the conceptual design provided in the SCP, the selection of coarse tuff as backfill material is based on numerical simulations performed by DOE which suggest that coarse tuff would be a more effective barrier to capillary flow in the backfill matrix than fine materials.

DOE's design for the engineered barrier system submitted with the license application will have to contain information sufficient for NRC to reach a favorable conclusion regarding the overall system performance objective. Backfill or packing around waste containers is not required by NRC regulations if DOE can demonstrate that applicable performance objectives can be met without it. If, on the basis of testing and experiments during site characterization, DOE decided that backfill would enhance engineered barrier system performance, the design would have to reflect this conclusion. DOE has already conducted research on a wide variety of candidate materials for backfill around waste packages in a variety of geologic media. The Commission continues to have confidence that backfill or packing materials can be developed as needed for the underground facility and waste package to meet applicable NRC licensing criteria and performance objectives.

I.A.3.b. Borehole and shaft seals.

The engineered barrier system described above is limited to the waste package and the underground facility as defined in 10 CFR part 60. The underground facility refers to the underground structure, including openings and backfill materials, but excluding shafts, boreholes, and their seals. Containment and release-rate requirements are specified for the engineered barrier system, but not for the borehole and shaft seals. Seals are covered under 10 CFR section 60.112, the overall post-closure system performance objective for the repository. Among other things, this provision requires that shafts, boreholes and their seals be designed to assure that releases of radioactive materials to the accessible

environment following permanent closure conform to EPA's generally applicable standards for radioactivity. Although the criteria for seals given in 10 CFR part 60 do not specifically mention seals in ramps and the underground facility, it is reasonable to consider them together with borehole and shaft sealants, because the seals and drainage design in ramps and the underground facility could also affect the overall system performance of the geologic repository.

Construction of the exploratory shaft facility (ESF) will be the first major site characterization activity at the repository horizon. Currently, DOE is reviewing its plans for construction of exploratory shafts. According to the 1989 "Reassessment Report," DOE is reevaluating the "locations chosen for the two exploratory shafts, the method chosen (drilling and blasting) for the construction of the shafts, the means of access (ramps or shafts) to the repository horizon, the need for additional exploratory drifts, and the design of the shafts and other components of the exploratory shaft facility." This reevaluation of plans for the shaft facility is in response to concerns from the NRC staff and the Nuclear Waste Technical Review Board (NWTB).

When the repository is decommissioned, NRC expects that most, if not all, shafts, ramps, and boreholes will probably have to be sealed to reduce the possibility that they could provide preferential pathways for radionuclide migration from the underground facility to the accessible environment. DOE estimates that as many as 350 shallow and 70 deep exploratory boreholes may be emplaced by the time site characterization has been completed at the Yucca Mountain site. Decommissioning may not occur for up to 100 years after commencement of repository operations. Because the final design for seals will likely have been modified from the initial license application design (LAD), DOE is viewing the seal LAD as serving two primary functions. As set forth in DOE's SCP for the Yucca Mountain candidate site, the seal LAD is to establish that: (1) "...technology for constructing seals is reasonably available;" and (2) "...there is reasonable assurance that seals have been designed so that, following permanent closure, they do not become pathways that compromise the geologic repository's ability to meet the post-closure performance objectives."

To establish the availability of technology for seal construction, DOE has identified at least 31 site properties

that need to be characterized in determining necessary seal characteristics. These properties include saturated hydraulic conductivity of alluvium near shafts, the quantity of water reaching the seals due to surface-flooding events, and erosion potential in the shaft vicinity. The SCP also discusses material properties that need to be identified to determine sealing components such as initial and altered hydrologic properties of materials.

The SCP indicates that DOE is planning to use crushed tuff and cements in the sealing program at the Yucca Mountain candidate site. The stated advantages of using tuff include minimizing degradation of seal material and avoiding disruption of ambient ground-water chemistry.

DOE's current design concept for meeting the overall performance objectives includes a combination of sealing and drainage. Seal requirements may be reduced in part by: (1) limiting the amount of surface water that may enter boreholes, shafts, and ramps; (2) selecting borehole, shaft, and ramp locations and orientations that provide long flow paths from the emplaced waste to the accessible environment above the repository; and (3) maintaining a sufficient rate of drainage below the repository horizon level so that water can be shunted past the waste packages without contacting them.

Although DOE's program is focusing on seals for the Yucca Mountain candidate site, the Commission finds no basis for diminished confidence that an acceptable seal can be developed for candidate sites in different geologic media. The Commission finds no evidence to suggest that it can not continue to have reasonable assurance that borehole, shaft, ramp, and repository seals can be developed to meet 10 CFR part 60 performance objectives.

I.B. Relevant Issues That Have Arisen Since the Commission's Original Decision

I.B.1. In support of its argument on technical feasibility, the Commission stated in its 1984 Waste Confidence Decision that "...DOE's program is

providing information on site characteristics at a sufficiently large number and variety of sites and geologic media to support the expectation that one or more technically acceptable sites will be identified." The NWPAA required, however, that DOE suspend site-specific site characterization activities under the Nuclear Waste Policy Act of 1982 at all sites other than the Yucca Mountain, NV, site.

Under the NWPAA, the DOE program has been redirected to characterize candidate repository sites in sequence rather than simultaneously. If the Yucca Mountain site is found to be unsuitable, DOE must terminate site characterization activities there and provide Congress with a recommendation for further action, such as the characterization of another site. Because characterization of multiple sites now appears to be more directly related to the timing of repository availability than to the technical feasibility of geologic disposal as a concept, consideration of the Commission's aforementioned 1984 statement in light of the NWPAA will be discussed under Finding 2.

I.B.2. What is the relationship, if any, of the "S-3 Proceeding" to the current review of the Commission's 1984 Waste Confidence Findings? Would the planned revision of the S-3 rulemaking be affected if the Commission had to qualify its current confidence in the technical feasibility of safe disposal?

In its decision to remand to NRC the questions of whether safe offsite storage would be available by 2007-2009, or, if not, whether spent fuel could be safely stored onsite past those dates, the U.S. Circuit Court of Appeals observed that the issues of storage and disposal of nuclear waste were being considered by the Commission in an ongoing generic proceeding known as the "S-3" Proceeding.

The S-3 Proceeding was the outgrowth of efforts to address generically the NEPA requirement for an evaluation of the environmental impact of operation of a light water reactor (LWR). Table S-3 assigned numerical values for environmental costs resulting from uranium fuel cycle activities to support one year of LWR operation. NRC promulgated the S-3 rule in April 1974. In July 1976, the U.S. Circuit Court of Appeals found that Table S-3 was inadequately supported by the record regarding reprocessing of spent fuel and radioactive waste management, in part because the Commission, in reaching its assessment, had relied heavily on

testimony of NRC staff that the problem of waste disposal would be resolved.

When the U.S. Circuit Court of Appeals issued the remand on what were to become the "Waste Confidence" issues in May 1979, NRC had pending before it the final amended S-3 rule. The Court regarded the resolution of the issue of waste disposal in the S-3 proceeding as being related to the issue raised by the petitioners in the appeals of the NRC decisions on the expansion of spent fuel storage capacity. The Court said that the "...disposition of the S-3 proceeding, though it has a somewhat different focus, may have a bearing on the pending cases."

The Commission approved the final S-3 rule in July 1979. In October 1979, the Commission issued a Notice of Proposed Rulemaking (NPR) on the Waste Confidence issues in response to the remand by the Court of Appeals. In the NPR, the Commission stated that the proceeding would "...draw upon the record compiled in the Commission's recently concluded rulemaking on the environmental impacts of the nuclear fuel cycle, and that the record compiled herein will be available for use in the general fuel cycle rule update discussed in that rulemaking."

In the final Table S-3 rule issued in 1979, the Commission had said that "...bedded salt sites can be found which will provide effective isolation of radioactive waste from the biosphere." When the Commission issued the 1984 Waste Confidence Decision, part of the basis for the discussion of waste management and disposal in the August 1979 final S-3 rule had changed. For example, in 1984 the repository program was proceeding under the NWP, which required that DOE recommend three sites for site characterization.

NRC is preparing to amend 10 CFR 51.51, adding new estimates for releases of Tc-99 and Rn-222, and a revised narrative explanation describing the basis for values contained in Table S-3. The amendment would also explain the environmental effects of potential releases from the light water reactor (LWR) fuel cycle, and postulate the potential radiation doses, health effects, and environmental impacts of these releases. It is unlikely that the revision will have any impact on the Commission's generic findings in the Waste Confidence proceeding. Nor is it likely that this reexamination of the Waste Confidence findings will affect the S-3 rule; the Waste Confidence Proceeding is not intended to make quantitative judgments about the environmental costs of waste disposal. Unless the Commission, in a future review of the Waste Confidence

decision, finds that it no longer has confidence in the technical feasibility of disposal in a mined geologic repository, the Commission will not consider it necessary to review the S-3 rule when it reexamines its Waste Confidence findings in the future.

I.B.3. To what extent do developments in spent fuel disposal technology outside of the United States (e.g., Swedish waste package designs) enhance NRC's confidence in the technical feasibility of disposal of high-level waste and spent fuel?

Spent fuel disposal technology is the subject of extensive research investigation in both Europe and North America. Advances in this technology are being communicated to the NRC staff both through bilateral agreements and the presentation of research results at international meetings.

Outside the U.S., studies of spent fuel as a waste form are now being conducted primarily in Canada and Sweden, although both France and West Germany have small programs in this area. The Swedish studies have been mainly concerned with boiling water reactor (BWR) spent fuel, whereas the Canadian studies focus on spent fuel from that country's CANDU reactors, which use unenriched uranium in a core immersed in "heavy" water made from deuterium. BWR and CANDU fuel, like pressurized water reactor (PWR) fuel, are uranium dioxide fuels clad in zircaloy. However, the burnup rates for these three fuel types vary considerably. Ongoing research studies on spent fuel include: work on the characterization of spent fuel as a waste form; the corrosion of spent fuel and its dissolution under oxidizing and reducing conditions; the radiolysis of ground water in the near vicinity of the spent fuel, and its effects on the dissolution of the fuel; and the development of models to predict the leaching of spent fuel over long time periods. The results of this work are steadily increasing our understanding of spent fuel as a waste form.

High-level radioactive waste, whether it is spent reactor fuel or waste from reprocessing, must be enclosed in an outer canister as part of the waste package. The canister surrounding the waste is expected to prevent the release of radioactivity during its handling at the repository site before emplacement. After emplacement in the repository, it is expected to prevent the release of radioactivity for a specified period of time after the repository is closed, by providing a barrier to protect the waste from coming into contact with ground water.

For practical reasons, canister materials may be divided into the following classes: (1) completely or partially thermodynamically stable materials such as copper; (2) passive materials such as stainless steel, titanium, Hastelloy, Inconel, and aluminum; (3) corroding or sacrificial materials such as lead and steel; and (4) non-metallic materials such as alumina and titanium dioxide ceramics and cement.

Sweden has been conducting an extensive canister research program over the past several years. The main canister material of interest is copper, but titanium, carbon steel, and alumina and titanium dioxide are also being studied as reasonable alternatives, should unexpected problems be discovered with using pure copper.

One of the Swedish canister designs is a 0.1-m thick copper container (as described previously in section I.A.2.a.), which is claimed to provide containment, in conjunction with an appropriate backfill material, for a period on the order of one million years. The critical factors for the isolation period for copper canisters are: (1) the presence of corrosive substances such as sulphide ions in the ground water; (2) the possibility of these substances reaching the canister surface; and (3) the degree of inhomogeneity, or pitting, of the resulting corrosion. Studies are continuing to obtain more information on pitting corrosion of copper and on techniques for welding thick-walled copper containers.

Several conceptual designs for canisters for the safe disposal of unprocessed spent fuel have also been developed in Canada. One canister design option is the supported-shell, metal-matrix concept, which involves packing the spent fuel bundles into a thin corrosion-resistant shell and casting the remaining space with a low melting point metal or alloy. Structural support for the shell would be provided by the resulting metal matrix. Lead is a possible matrix material because of its favorable casting properties, cost, and low melting point.

Other supported shell canister concepts include the packed-particulate and structurally-supported designs. In these designs, a thin outer shell is supported by a particulate material packed around a steel internal structure that contains the spent fuel bundles. Several materials have been identified for the fabrication of the corrosion resistant outer shell, including commercially pure and low-alloy titanium, high nickel-based alloys such as Inconel 625, and pure copper.

Detailed designs have been produced for all three types of supported shell canisters incorporating either a titanium or nickel alloy shell less than 6-mm thick. A conceptual design has also been produced for a copper-shell structurally-supported canister and a metal-matrix container with a relatively thick (25-mm) copper shell and a lead matrix material. This last canister is intended to contain 72 used CANDU fuel bundles in four layers of 18 bundles each.

Both the Canadian and Swedish conceptual designs for the disposal of spent fuel in canisters provide for surrounding the canister with backfill material as part of the waste package when it is emplaced in the repository. This backfill material would be packed around the canister to retard the movement of ground water and radionuclides. Investigations of backfill material at the Stripa mine in Sweden have shown that bentonite and silica sand can be employed successfully as backfill, both around the canister and in repository tunnels. A bentonite-silica mixture is the recommended backfill material on the basis of its thermal and mechanical properties. Bentonite backfills have been shown to produce hydraulic conductivities that are very similar to the surrounding granite at Stripa. Problems concerning the variability of bentonite samples from different geographic locations can be eliminated if material from a single source is used. The presence of sulfur and some organic material, including bacteria, in many bentonites poses some problems related to microbially-accelerated corrosion. Treatment with hydrogen peroxide may be used to oxidize these organics. Heating the bentonite to 400 degrees C can also be effective, although this may alter the crystal structure of the bentonite.

Many countries intend to dispose of their high-level radioactive waste by first converting the wastes into a solid, vitrified form after reprocessing. Since the leaching of the waste form by circulating ground water after disposal is the most likely mechanism by which the radionuclides might be returned to the biosphere, the waste form must be composed of a highly stable material with an extremely low solubility in ground water. Thus, the waste form itself should function as an immobilization agent to prevent any significant release of radionuclides to the biosphere over very long time periods. The two primary materials currently being considered for use as solidified waste forms are borosilicate glass and SYNROC, a man-made titanate ceramic material.

SYNROC was initially developed in Australia as an alternative material to borosilicate glass. It is composed primarily of three minerals (hollandite, zirconolite, and perovskite) which collectively have the capacity to accept the great majority of radioactive high-level waste constituents into their crystal lattice structure. These three minerals, or closely related forms, occur naturally, and have been shown to have survived for many millions of years in a wide range of natural environments. SYNROC has the property of being extremely resistant to leaching by ground water, particularly at temperatures above 100 degrees C. In addition, the capacity of SYNROC to immobilize high-level wastes is not markedly impaired by high levels of radiation damage.

The high leach-resistance of SYNROC at elevated temperatures increases the range of geologic environments in which it may be used, such as deep geologic repositories in both continental and marine environments.

Research and development work on improving SYNROC production technology is currently being done jointly in Australia and Japan. New methods of using metal alkoxides in the fabrication of SYNROC to obtain high homogeneity and lowered leachability have recently been developed in Australia. The Japanese have recently developed a new method that uses titanium hydroxide, as a reducing agent to produce SYNROC with a high density and low leach rate. A pilot facility for the production of non-radioactive SYNROC is now in operation in Australia, and a small pilot facility for producing SYNROC with radioactive constituents is being completed in Japan.

On the basis of current information from the foreign studies just described on canisters, spent fuel as a waste form, backfill materials, and alternatives to borosilicate glass waste forms, the Commission concludes that there is no basis for diminished confidence that an acceptable waste package can be developed for safe disposal of high-level waste and spent fuel.

I.C. Conclusion on Finding 1

The Commission has reexamined the basis for its First Finding in the 1984 Waste Confidence Decision in light of subsequent program developments, and concludes that Finding 1 should be reaffirmed.

The technical feasibility of a repository rests initially on identification of acceptable sites. At this time, the Commission is not aware of any evidence indicating that Yucca

Mountain is not acceptable for site characterization. There are many outstanding questions regarding the licenseability of the site, however, and they must be answered satisfactorily in order for NRC to issue a construction authorization for that site. If data obtained during site characterization indicate that the Yucca Mountain site is not suitable for a repository, DOE is required by the NWPA to terminate site characterization activities and report to Congress. Within six months of that determination, DOE must make a recommendation to Congress for further action to assure the safe, permanent disposal of spent fuel and high-level waste. DOE could recommend, for example, that Congress authorize site characterization at other sites. Considering DOE's investigations of other potentially acceptable sites before its exclusive focus on Yucca Mountain, the Commission has no reason to believe that, given adequate time and program resources, a technically acceptable site can not be found.

The technical feasibility of geologic disposal also depends on the ability to develop effective engineered barriers, such as waste packages. DOE is currently evaluating six candidate materials for waste containers, including austenitic steel and copper- and nickel-based alloys, and is planning waste-form testing based on both spent fuel and high-level waste in borosilicate glass. On the basis of DOE's program, and results from Swedish investigations of a copper waste container, the Commission is confident that, given a range of waste forms and conservative test conditions, the technology is available to design acceptable waste packages.

In addition to the materials testing for the waste container and waste form, there may be additional measures that can be taken to improve the effectiveness of the engineered barriers. It is known, for example, that the heat-loading characteristics of the wastes diminish with time. Also, the longer wastes are stored before disposal, the smaller will be the quantities of radionuclides available for transport to the accessible environment.

It is also technically feasible to separate from radioactive wastes the radionuclides that constitute the principal source of heat from the nuclides of greatest long-term concern. The former radionuclides, mainly fission products such as cesium-137 and strontium-90, could then be stored for a period of years while the fission products decay to the point where they could be disposed of either in a manner

that does not require the degree of confinement provided by a geologic repository, or in a repository with less concern for thermal disturbance of the host rock's expected waste isolation properties. Meantime, the longer-lived remaining radionuclides, such as transuranic wastes with elements heavier than uranium, could be disposed of in a repository away from the fission products and without the high thermal loadings that would otherwise have to be considered in predicting the long-term waste isolation performance of the geologic setting. France, Great Britain, and Japan are currently pursuing this waste management strategy or a variant of it.

The Commission emphasizes here that it does not believe that recycling technologies are required for the safety or feasibility of deep geologic disposal in the United States. Other countries, such as Canada, the Federal Republic of Germany, and Sweden are pursuing disposal strategies based on a similar view. Reprocessing, if employed in its current stage of development, would result in additional exposures to radiation and volumes of radioactive wastes to be disposed of. For the purpose of finding reasonable assurance in the technical feasibility of geologic disposal, however, it is worth noting that technology is currently available to permit additional engineering control of waste forms if, for reasons not now foreseen, such control were deemed desirable at some future time. Meanwhile, the Commission continues to have confidence that safe geologic disposal is technically feasible for both spent fuel and high-level waste.

DOE's reference design for the waste package in the December 1988 Site Characterization Plan does not include backfill or packing around waste containers in the emplacement boreholes. Neither is required under NRC rules so long as DOE can show that applicable regulatory criteria and objectives will be met. An air gap between the container and the host rock is currently one of the barriers in DOE's design for meeting the performance objective. DOE has conducted investigations on a variety of candidate materials for backfill in a variety of geologic media, and the Commission finds no basis to qualify its past confidence that backfill materials can be developed, if needed, to meet applicable NRC requirements.

The December 1988 reference design for sealing boreholes, shafts, ramps and the underground facility at the Yucca Mountain candidate site employs crushed tuff and cement. Regardless of

the geologic medium of the candidate site, DOE will have to show that the license application design meets NRC post-closure performance objectives. The Commission continues to have reasonable assurance that DOE's program will lead to identification of acceptable sealant materials for meeting these objectives.

No major breakthrough in technology is required to develop a mined geologic repository. NRC will not be able to license a repository at a particular site, however, until there is sufficient information available for that site. The information needed to license a site includes site characterization data, data on repository design, and waste package design sufficient for performance assessment of the entire waste disposal system. Further, the Commission recognizes the challenge posed by the need to predict impacts of a repository on human health and the environment over very long periods of time. It will not be possible to test the accuracy of long-term repository performance assessment models in an absolute sense. The NRC does believe that existing performance assessment models have the potential to provide a basis for deciding whether a system for geologic disposal of high-level waste is acceptable, and can provide a sufficient level of safety for present and future generations under certain conditions. These conditions include addressing uncertainties, and gathering data from specific sites.

Overall, from its reexamination of issues related to the technical feasibility of geologic disposal, the Commission concludes that there is reasonable assurance that safe disposal of high-level waste and spent fuel in a mined geologic repository is technically feasible.

Original Finding 2: The Commission finds reasonable assurance that one or more mined geologic repositories for commercial high-level waste and spent fuel will be available by the years 2007-2009, and that sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of existing commercial high-level radioactive waste and spent fuel originating in that reactor and generated up to that time.

Revised Finding 2: The Commission finds reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and that sufficient repository capacity will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial

high-level radioactive waste and spent fuel originating in such reactor and generated up to that time.

II.A. Issues Considered in Commission's 1984 Decision on Finding 2

II.A.1. Finding Technically Acceptable Sites in a Timely Fashion

In order for the Commission to find that any candidate site for a repository is technically acceptable (that is, in compliance with NRC licensing requirements), the site must undergo comprehensive site characterization to assess its hydrologic, geologic, geochemical, and rock mechanics properties. It is possible that a site may be found unacceptable on the basis of surface-based testing, early in-situ testing or other site characterization activities. It will not be possible, however, for the NRC staff to take a position before a licensing board that a site will meet NRC requirements for construction authorization until the results of all site characterization activities are available. Even then, the staff may conclude that the evidence from site characterization does not constitute reasonable assurance that NRC performance objectives will be met. Also, the results of the licensing hearings on construction authorization cannot be predicted. If construction is authorized and when it is substantially complete, DOE is required to obtain, in addition to the construction authorization permit, a license to receive and possess waste at the geologic repository operations area in order to commence repository operations. These considerations argue for maintaining the ready availability of alternative sites if, after several years, site characterization or licensing activities bring to light difficulties at the leading candidate site.

In support of its argument on technical feasibility, the Commission stated in its 1984 Waste Confidence Decision that "...DOE's program is providing information on site characteristics at a sufficiently large number and variety of sites and geologic media to support the expectation that one or more technically acceptable sites will be identified." At the time, DOE was required under the NWPA to characterize three candidate repository sites.

The NWPA had a major impact on DOE's repository program, however. Under the NWPA, DOE was required to suspend site-specific activities at the Hanford, WA and Deaf Smith County, TX sites, which had been approved by the President for site characterization for the first repository. Redirection of the repository program to single-site

characterization (or, if necessary, sequential site characterization if the Yucca Mountain site is found to be unsuitable) will permit DOE to concentrate its efforts and resources on information gathering at a single site, as opposed to spreading out its efforts over a range of sites. The possible schedular benefits to single-site characterization, however, must be weighed for the purposes of this Finding against the potential for additional delays in repository availability if the Yucca Mountain site is found to be unsuitable. By focusing DOE site characterization activities on Yucca Mountain, the NWPAA has essentially made it necessary for that site to be found suitable if the 2007-2009 timeframe for repository availability in the Commission's 1984 Decision is to be met. Clearly, the Commission cannot be certain at this time that the Yucca Mountain site will be acceptable.

Although the Commission has no reason to believe that another technically acceptable site can not be found if the Yucca Mountain site proves unsuitable, several factors raise reasonable doubts as to the availability of even one repository by 2007-2009. These include: (1) the current reliance on a single site with no concurrently available alternatives; (2) the probability that site characterization activities will not proceed entirely without problems; and (3) the history of schedular slippages since passage of the NWPA. For example, DOE's schedule for the first repository slipped five years (from 1998 to 2003) between January 1983, when the NWPA was enacted, and January 1987, when the first Draft Mission Plan Amendment was issued. The schedule for excavation of the exploratory shaft for the Yucca Mountain site has slipped by more than five years since the issuance of the PDS in March 1986. In the past several years, DOE has cited numerous reasons for program slippages, including the need for a consultation process with States and Tribes, Congressional actions (e.g., the barring of funds in the 1987 budget appropriation for drilling exploratory shafts), and DOE's recognition that the EIS and license application would require more technical information than previously planned.

In the November 1989 "Report to Congress on Reassessment of the Civilian Radioactive Waste Management Program," DOE announced a further extension of three years until 1992 for sinking the exploratory shaft, and extensions until 2001 for submittal of the license application and 2010 for repository availability. DOE attributes

the causes for these delays to prolonging the schedule for site characterization and repository development activities, and to the unwillingness, to date, of the State of Nevada to issue the permits required for DOE to begin testing. In the "Reassessment Report," DOE proposes to focus the repository program on the evaluation of features of the site that can be studied through surface-based testing, beginning in January 1991. The aim of this surface-based testing program is to make an early determination as to whether there are any features of the site that would render it unsuitable for development as a repository. Of course, the site may be found unsuitable or unlicenseable at any time during the site characterization or licensing process. The NRC supports DOE's efforts to reach an early determination that this may be the case. If the Yucca Mountain site is unsuitable, it will be necessary to begin work to identify and characterize another candidate site for a repository. The sooner this determination is made, the sooner DOE will have an alternative site available for disposal of high-level waste.

The NRC had anticipated additional delays in repository program milestones when it issued its Proposed Waste Confidence Decision Review (54 FR 39767). One of the key issues in the repository program to date has been the need for DOE to develop a qualified quality assurance (QA) program. For example, DOE has taken the position, with which NRC agrees, that sinking of exploratory shafts should not occur before it has a qualified quality assurance (QA) program in place. The Commission believes that DOE's aggressive, success-oriented schedule for this milestone did not allow for unexpected developments. Indeed, the effort to develop an acceptable QA program has, in itself, identified problems in design control and other processes that must be resolved in order to establish a qualified program that addresses all applicable NRC licensing requirements. DOE has made progress in development of its QA program with seven contractor plans accepted in October and November 1989. NRC expects that DOE should be able to have the study plans and technical procedures which implement the contractor plans ready in time for surface-based testing at the Yucca Mountain site to begin by January 1991, consistent with the schedule for starting surface-based testing in the Reassessment Report.

DOE's current schedule appears to be more realistic than previous schedules.

Yet even this schedule could prove unattainable due to difficulties of a non-technical nature that are outside of DOE's control, for example litigation over gaining access to the Yucca Mountain site. Although the NWPAA is a clear and strong reaffirmation of Congressional support for the timely development of a repository, the Commission in this Waste Confidence review cannot ignore the potential for delay in repository availability if the Yucca Mountain site, or any other single site designated for site characterization, is found to be unsuitable. Without alternative sites undergoing simultaneous characterization or even surface-based testing, DOE will have to begin characterizing another site if the site currently selected for characterization proves unsuitable. The earlier a determination of unsuitability can be made, the smaller the impact of such a finding would be on the overall timing of repository availability.

DOE has estimated conservatively that it would require approximately 25 years to begin site screening for a second repository, perform site characterization, submit an EIS and license applications, and await authorizations before the repository could be ready to receive waste. In its June 1987 Mission Plan amendment, DOE stated "It ... seems prudent to plan that site-specific screening leading to the identification of potentially acceptable sites should start about 25 years before the start of waste acceptance for disposal." DOE went on to say that it considered this estimate to be conservative because it does not account for expected schedular benefits from the first repository program, including improvements in such areas as site screening, site characterization, and performance assessment techniques.

Although DOE's estimate was premised on the successful completion of a program for the first of two repositories, schedular benefits from improvements in the understanding of waste isolation processes would still be available. The glass waste form from the Defense Waste Processing Facility now under construction at Savannah River, SC, for example, will be available for testing under simulated repository conditions well before the turn of the century under current DOE schedules, and improvements in the modelling of spent fuel behavior within waste canisters can be applied in performance assessments largely irrespective of the geology of a site. It may also be pertinent that when DOE made its 25-year estimate for the second repository program in mid-1987, the law at the time

required the simultaneous characterization of three sites, so that DOE could not proceed to develop one site for a repository until the completion of characterization at the site that required the most time.

In view of DOE's new schedule, it no longer appears feasible for repository operation to commence prior to 2010. As stated in the Proposed Decision Review, the Commission does not believe it would be prudent to reaffirm the Agency's 1984 finding of reasonable assurance that the 2007-2009 timetable will be met. As the Court of Appeals noted in remanding this issue to NRC, the ultimate determination of whether a disposal facility will be available when needed "...can never rise above a prediction." The Commission is in the position of having to reach a definitive finding on events which are approximately two decades away. We believe that the institutional timescale for this question can more realistically be framed in decades than in years. As the program proceeds into the next century, it will become easier for NRC to make more definitive assessments, if necessary, of the time a repository will be available.

In light of all these considerations, the Commission believes it can have reasonable assurance that at least one repository will be available within the first quarter of the twenty-first century. This estimate is based on the time it would take for DOE to proceed from site screening to repository operation at a site other than Yucca Mountain, if this should prove necessary. Assuming for the sake of conservatism that Yucca Mountain would not be found suitable for repository development, it is reasonable to expect that DOE would be able to reach this conclusion by the year 2000. This would leave 25 years for the attainment of repository operations at another site.

NRC will reassess progress towards attaining repository operation by 2025 prior to 2000 during its next scheduled review of its Waste Confidence Findings, if not sooner. DOE's current focus on surface-based testing as an early indicator of repository suitability should help provide a strong basis for evaluating the likelihood of meeting the 2025 estimate of repository availability.

II.A.2. Timely Development of Waste Packages and Engineered Barriers.

The November 1989 Reassessment Report announced that "major activities related to the design of a repository at the Yucca Mountain site and waste package are being deferred. They will be resumed when more information is available concerning the suitability of

the site. This approach will conserve resources and allow the DOE to concentrate efforts on scientific investigations." Prior to the Reassessment Report, DOE's most recent conceptual design for the waste package was discussed in the Site Characterization Plan (SCP) for the Yucca Mountain site. As information is obtained from site characterization activities and laboratory studies, the conceptual design will evolve in successive stages into the Advanced Conceptual Design (ACD), the LAD, and the final procurement and construction design. DOE has identified four areas of investigation related to the waste package LAD: (1) waste package environment; (2) waste form and materials testing; (3) design, analysis, fabrication, and prototype testing; and (4) performance assessment. Numerous uncertainties exist in each of these areas. DOE's testing program will attempt to reduce uncertainties in these areas where possible. For example, *in-situ* testing is expected to decrease significantly uncertainties regarding the repository host rock mass in which the waste packages will be emplaced. In the area of performance assessment, however, where results of relatively short-term testing of complex rock-waste-ground water interactions must be extrapolated over as many as 10,000 years, it may be necessary to rely more heavily on the use of simplifying assumptions and bounding conditions than in other areas of investigation.

As discussed under Finding 1, the Commission continues to have reasonable assurance that waste packages and engineered barriers can be developed which will contribute to meeting NRC performance objectives for the repository. Development of acceptable waste packages and engineered barriers for a repository in the 2010 timeframe will depend on the overall acceptability of the Yucca Mountain site. If the site is found to be unsuitable, waste package and engineered barrier development will have to begin for a different site, because under the NWPAA, DOE may not carry out site characterization and waste package development work at sites other than the Yucca Mountain site.

Although much of the work related to waste form, materials, and performance assessment for the waste package can proceed independently of *in-situ* testing, the investigations related to waste package environment depend on the schedule for this testing. The schedule for *in-situ* testing depends on when DOE is able to resolve outstanding issues which have impeded shaft sinking and

in-situ testing, and on DOE's being granted access to the site to begin surface-based testing.

In sum, the Commission is not aware of any scientific or technical problems so difficult as to preclude development of a waste package and engineered barrier for a repository at Yucca Mountain to be available within the first quarter of the twenty-first century. Moreover, even given the uncertainty regarding the ultimate finding of site acceptability, and the uncertainty concerning the range of site-related parameters for which the engineered facility and waste package will have to be designed, the Commission finds reasonable assurance that waste package and engineered barrier development can be completed on a schedule that would permit repository operation within the first quarter of the twenty-first century. If necessary (that is, if Yucca Mountain were found unsuitable by the turn of the century), DOE could initiate site characterization and develop waste packages and engineered barriers at another site or sites and still commence operation before the end of the first quarter of that century.

II.A.3. Institutional Uncertainties.

II.A.3.a. Measures for dealing with Federal-State-local concerns.

In its 1984 Waste Confidence Decision, the Commission found that the NWPA should help to minimize the potential that differences between the Federal Government and States and Indian tribes will substantially disrupt or delay the repository program. The Commission noted that the NWPA reduced uncertainties regarding the role of affected States and tribes in repository site selection and evaluation. The Commission also said that the decision-making process set up by the NWPA provides a detailed, step-by-step approach that builds in regulatory involvement, which should also provide confidence to States and tribes that the program will proceed on a technically sound and acceptable basis. Despite the expected and continuing State opposition to DOE siting activities, the Commission has found no institutional developments since that time that would fundamentally disturb its 1984 conclusions on this point.

NRC regulatory involvement, for example, has indeed been built into the process. DOE has continued its interactions with NRC regarding repository program activities since the Commission's 1984 Waste Confidence decision was issued. NRC provided comments to DOE on major program

documents such as the Siting Guidelines and the PDS as required by the NWPA, and NRC concurred on those documents. NRC also reviewed and provided comments to DOE on the DEAs and FEAs. In the December 22, 1986 letter to DOE on the FEAs, the NRC staff noted that "...significant efforts were made by DOE to respond to each of the NRC staff major comments on the DEAs, and in fact, many of these comments have been resolved." NRC provided comments to DOE on the 1987 Draft Mission Plan Amendment, and DOE responded to most of these comments in the Final Mission Plan Amendment provided to Congress on June 9, 1987.

Since enactment of the NWPA in December 1987, DOE-NRC interactions have focused on the Yucca Mountain site. In January 1988, DOE issued the Consultation Draft Site Characterization Plan (CDSCP) for the Yucca Mountain site. The NRC staff provided comments in the form of draft and final "point papers" on the CDSCP. The NRC comments included several objections related to: (1) the failure to recognize the range of alternative conceptual models of the Yucca Mountain site; (2) the status of the quality assurance (QA) plans for site characterization activities; and (3) concerns related to the exploratory shaft facility. Although the December 1988 SCP shows improvement over the CDSCP, NRC continues to have an objection involving the need for implementing a baselined QA program before beginning site characterization and an objection involving the need for DOE to demonstrate the adequacy of both the ESF design and the design control process. Prior to the November 1989 Reassessment Report, DOE had committed to having a qualified QA program in place before sinking the exploratory shaft at the Yucca Mountain site.

This commitment has not changed. However, in view of the extension in the schedule for shaft sinking from November 1989 to November 1992, qualified QA plans are needed in the near term for meeting the January 1991 schedule for surface-based testing. In addition to having a qualified QA program in place, DOE must also have issued the pertinent study plans for site characterization activities they wish to begin.

DOE has taken measures to clarify and institutionalize the roles of other Federal agencies in addition to NRC. In the Draft 1988 Mission Plan Amendment, DOE described interactions with these agencies. DOE has a Memorandum of Understanding (MOU) with the Mine Safety and Health Administration of the

Department of Labor for technical support and oversight for shaft construction and other site characterization activities, and with the Department of Transportation to define the respective responsibilities of the two agencies in the waste disposal program. DOE also has interagency agreements with the Bureau of Mines and the U.S. Geological Survey of the Department of the Interior.

DOE's efforts to address the concerns of States, local governments, and Indian tribes have met with mixed results. For example, DOE has not succeeded in finalizing any consultation and cooperation (C&C) agreements as required under section 117(c) of the NWPA, as amended. These agreements were to help resolve State and Tribal concerns about public health and safety, environmental, and economic impacts of a repository. Publication of the Siting Guidelines under section 112(a) of the NWPA resulted in numerous lawsuits challenging the validity of the Guidelines. Similarly, the FEAs were challenged in the Ninth Circuit by affected States and tribes.

The NWPA did not curtail financial assistance to affected States and tribes, except to redefine and redistribute it if DOE and a State or tribe enter into a benefits agreement. The State of Nevada and affected local governments are eligible to receive financial assistance. DOE has attempted to negotiate an agreement with the State of Nevada for monetary benefits under Section 170 of the NWPA. This Section would provide for payments of \$10 million per year before receipt of spent fuel, and \$20 million per year after receipt of spent fuel until closure of the repository. These payments would be in addition to certain monetary benefits for which the State is eligible under the NWPA, as amended. Also under a benefits agreement, a Review Panel would be constituted for the purpose of advising DOE on matters related to the repository, and for assisting in the presentation of State, tribal, and local perspectives to DOE. The beneficiary to a benefits agreement must waive its right to disapprove the recommendation of the site for a repository and its rights to certain impact assistance under Sections 116 and 118 of the NWPA, as amended. To date, the State of Nevada has declined DOE's offer to negotiate a benefits agreement. In 1989, the State of Nevada requested \$23 million for work on Yucca Mountain. Congress appropriated \$5 million and authorized DOE to release an additional \$8 million at the discretion of the Secretary on the basis of good faith efforts of the State to

allow technical investigations to begin at the site.

The NWPA introduced several new organizational entities to the repository program with responsibilities that may contribute to resolving concerns of Federal, State, and local governments involved in the program. Under section 503 of the NWPA, the Nuclear Waste Technical Review Board (NWTB) is to evaluate the technical and scientific validity of DOE activities under the NWPA, including site characterization and activities related to packaging or transportation of spent fuel. The NWPA also established the Office of Nuclear Waste Negotiator, who is to seek to negotiate terms under which a State or Indian tribe would be willing to host a repository or MRS facility at a technically qualified site. Among the duties of the Negotiator is consultation with Federal agencies such as NRC on the suitability of any potential site for site characterization.

Secretary of Energy James Watkins has emphasized the importance of the Negotiator to the success of the program. A Negotiator could contribute to the timely success of the repository program by providing an alternative site to the Yucca Mountain site that would still have to be technically acceptable, but that would enjoy the advantage of reduced institutional uncertainties resulting from opposition of State or affected Indian tribes. The President nominated and the Senate recently confirmed David Leroy to be the Negotiator.

An additional measure which may facilitate documentation and communication of concerns related to a repository is the Licensing Support System (LSS). The LSS is to provide full text search capability of and easy access to documents related to the licensing of the repository. Although the primary purpose of the LSS is to expedite NRC's review of the construction authorization application for a repository, it will be an effective mechanism by which all LSS participants, including the State and local governments, can acquire early access to documents relevant to a repository licensing decision. DOE is responsible for the design, development, procurement and testing of the LSS. LSS design and development must be consistent with objectives and requirements of the Commission's LSS rulemaking and must be carried out in consultation with the LSS Administrator and with the advice of the Licensing Support System Advisory Review Panel. NRC (LSS Administrator) is responsible for the management and operation of the

LSS after completion of the DOE design and development process.

Procedures for the use of the LSS are part of revisions to 10 CFR part 2. NRC's Rules of Practice for the adjudicatory proceeding on the application to receive and possess waste at a repository. These revisions were the result of a "negotiated rulemaking" process in which affected parties meet to reach consensus on the proposed rule. The members of the negotiating committee included: DOE; NRC; State of Nevada; coalition of Nevada local governments; coalition of industry groups; and a coalition of national environmental groups. The coalition of industry groups dissented on the final text of the proposed rule, but the negotiating process enabled NRC to produce a proposed rule reflecting the consensus of most of the interested parties on an important repository licensing issue.

NRC is committed to safe disposal of radioactive waste and the protection of public health and safety and the environment. Any State with a candidate site for a repository should be assured that a repository will not be licensed if it does not meet NRC criteria. NRC has its own program for interaction with the State of Nevada and affected units of local government, and will continue to provide information to Nevada and consider State concerns as requested.

Given the difficult nature of siting a repository, the Commission believes that the NWPA, as amended, has achieved the proper balance between providing for participation by affected parties and providing for the exercise of Congressional authority to carry out the national program for waste disposal. The NWPA provides adequate opportunity for interaction between DOE and other Federal agencies, States, tribes, and local governments such that concerns can be presented to DOE for appropriate action. Both the NRC and the State or tribe can exercise considerable prerogative regarding repository development. The State or tribe may disapprove the recommendation that the site undergo repository development. This disapproval can be overridden only by vote of both houses of Congress within 90 days of continuous session. If the State disapproval is overridden, DOE may submit an application for authorization to construct the repository, and, if approved, a subsequent application to receive and possess waste for emplacement. NRC will make decisions on the license applications according to the requirements of its statutory mission.

Despite the complexity of the overall process and the strong views of the participants in it, the Commission sees no compelling reason to conclude that current institutional arrangements are inadequate to the task of resolving State, Federal, and local concerns in time to permit a repository to be available within the first quarter of the twenty-first century.

II.A.3.b. Continuity of the management of the waste program

At the time the Commission issued its 1984 Waste Confidence Decision, the possibility that DOE functions would be transferred to another Federal agency was cited as the basis for concerns that the resolution of the radioactive waste disposal problem would likely undergo further delays. The Commission responded that in the years since the Administration had proposed to dismantle DOE in September 1981, Congress had not acted on the proposal. The Commission further stated that even if DOE were abolished, the nuclear waste program would simply be transferred to another agency. The Commission did not view the potential transfer in program management as resulting in a significant loss of momentum in the waste program. The Commission also concluded that the enactment of the NWPA, which gave DOE lead responsibility for repository development, further reduced uncertainties as to the continuity of management of the waste program.

Section 303 of the NWPA did, however, require the Secretary of Energy to "...undertake a study with respect to alternative approaches to managing the construction and operation of all civilian radioactive waste facilities, including the feasibility of establishing a private corporation for such purpose." To carry out this requirement, DOE established the Advisory Panel on Alternative Means of Financing and Managing Radioactive Waste Facilities, which came to be known as the "AMFM" Panel. The Panel's final report, issued in December 1984, concluded that several organizational forms are more suited than DOE for managing the waste program, including an independent Federal agency or commission, a public corporation, and a private corporation. The report identified a public corporation as the preferred alternative on the basis of criteria developed by the Panel for an acceptable waste management organization. In particular, the report indicated that a public corporation would be stable, highly mission-oriented, able to maintain credibility with stakeholders, and more

responsive to regulatory control than a Federal executive agency.

Commenting on the AMFM Panel's report in April 1985, DOE recommended retaining the present management structure of the waste program at least through the siting and licensing phase of the program. Congress did not take action to implement the Panel's recommendations, and DOE's management of the waste program has remained uninterrupted.

By enacting the NWPA, Congress effectively reaffirmed DOE's continued management of the waste program. Congress did not revise DOE's role as the lead agency responsible for development of a repository and an MRS. Congress did establish several new entities for the purpose of advising DOE on matters related to the waste program, such as the NWTRB and the Review Panel, to be established if DOE and a State or tribe enter into a benefits agreement under Section 170 of the NWPA. Congress provided further indication of its intent that DOE maintain management control of the waste program for the foreseeable future in requiring, under Section 161, that the Secretary of DOE "...report to the President and to Congress on or after January 1, 2007, but not later than January 1, 2010, on the need for a second repository."

This is not to say, however, that there have been no management problems in the DOE program. Since the enactment of the NWPA in 1983, only one of the five Directors of DOE's Office of Civilian Radioactive Waste Management (OCRWM) has held the position on a permanent basis. Inadequate progress toward an operating repository has concerned several Congressional observers, including Senator J. Bennett Johnston, Chairman of the Senate Energy and Natural Resources Committee. In February 1989 confirmation hearings for then-Secretary-of-Energy-designate James Watkins, Senator Johnston strongly criticized mounting cost projections and lack of progress in the program, and called for new and stronger management.

In the November 1989 Reassessment Report, DOE discussed several new initiatives for improving its management of the repository program. The initiatives include "direct-line" reporting from the Yucca Mountain Project Office to the Office of Civilian Radioactive Waste Management (OCRWM), and an independent contractor review of OCRWM management structures, systems and procedures to identify program redundancies, gaps, and

strengths. The OCRWM is also implementing improvements in the overall Program Management System, the QA program, and establishment of program cost and schedule baselines.

Whether the management structure of the repository development program should in fact be changed is a decision best left to others. The Commission believes that a finding on the likely availability of a repository should take management problems into account, but finds no basis to diminish the degree of assurance in its 1984 conclusion on this issue. Events since the submission of the AMFM Panel report do not indicate that there will be a fundamental change in the continuity of the management structure of the program any time soon. In addition, it cannot be assumed that the program would encounter significantly less difficulty with a new management structure than it would continuing under the present one. Under either scenario, however, the Commission believes it would be more prudent to expect repository operations after the 2010 timeframe than before it. Neither the problems of a new management structure nor those of the existing one are likely to prevent the achievement of repository operations within the first quarter of the next century, however.

II.A.3.c. Continued funding of the nuclear waste management program
Section 302 of the NWPA authorized DOE to enter into contracts with generators of electricity from nuclear reactors for payment of 1.0 mill (0.1 cent) per kilowatt-hour of net electricity generated in exchange for a Federal Government commitment to take title to the spent fuel from those reactors. In the 1984 Waste Confidence Decision, the Commission noted that all such contracts with utilities had been executed. After the 1984 Decision, then-President Reagan decided that defense high-level wastes are to be collocated with civilian wastes from commercial nuclear power reactors. DOE's Office of Defense Programs is to pay the full cost of disposal of defense waste in the repository.

DOE is required under Section 302(a)(4) of the NWPA, as amended, "...annually [to] review the amount of the fees...to evaluate whether collection of the fees will provide sufficient revenues to offset the costs...." In the June 1987 Nuclear Waste Fund Fee Adequacy Report, DOE recommended that the 1.0 mill per kilowatt-hour fee remain unchanged. This assessment was based on the assumption that an MRS facility would open in 1998, the first repository would open in 2003, and the second repository in 2023. These

assumptions do not reflect changes in the waste program brought about by the NWPA enacted in December 1987. Two such changes with significant potential impacts were the suspension of site-specific activities related to the second repository until at least 2007, and the linkage between MRS construction and operation and the granting of a repository construction authorization, which will probably occur no earlier than 1998.

DOE has not issued a fee adequacy report since the June 1987 report. When the updated report is released, it is expected to reflect overall program cost savings to the utilities resulting from: (1) limiting site characterization activities to a single site at Yucca Mountain, NV; and (2) the DOE Office of Defense Programs' sharing other program costs with generators of electricity "...on the basis of numbers of waste canisters handled, the portion of the repository used for civilian or defense wastes, and the use of various facilities at the repository," in addition to paying for activities solely for disposing of defense wastes. An additional factor which may eventually also contribute to the overall adequacy of Nuclear Waste Fund fees is the likelihood that a significant number of utilities will request renewals of reactor operating lifetimes beyond their current OL expiration dates. OL renewal would provide additional time during which Nuclear Waste Fund fees could be adjusted, if necessary, to cover any future increase in per-unit costs of waste management and disposal. It is expected that the new report may reflect a recent Court decision which found that fees paid into the Nuclear Waste Fund be adjusted to reflect transmission and distribution losses.

The Commission recognizes the potential for program cost increases over estimates in the 1987 Nuclear Waste Fund Fee Adequacy Report. If there is a significant delay in repository construction, for example, it is reasonable to assume that construction costs will escalate. There may also be additional costs associated with at-reactor dry cask storage of spent fuel, if DOE does not have a facility available to begin accepting spent fuel by the 1998 date specified in the NWPA. These costs would be further increased if one or more licensee was to become insolvent and DOE was required to assume responsibility for storage at affected reactors before 1998.

In the event of insolvency, DOE would still have sufficient funds to take over responsibility for managing spent fuel until a repository is available. Because spent fuel disposal costs are directly related to the amount of electricity

generated, with contributions to the NWF based on a kilowatt-hour surcharge that must be paid in short-term installments, utilities can be presumed to be mostly up-to-date with their contributions. It is highly unlikely that a utility would jeopardize its contract for spent fuel disposal with DOE by defaulting on a periodic payment to save a few million dollars. Even if a utility were to default, it would not be much in arrears for its spent fuel before it would trigger close DOE scrutiny and mitigative action.

Larger amounts in default could possibly occur with those relatively few utilities that have not paid their full share of pre-1983 collections. This issue arises because several utilities elected to defer payment for spent fuel generated prior to April 1983 into the fund and, instead, themselves hold the money that was collected from ratepayers for the one-time fee. DOE's Inspector General believes that some of those utilities may not be able to make their payments when due. The NRC understands from OCRWM staff that, if a nuclear utility licensee were to default on its one-time contribution to the NWF, DOE is not precluded from accepting for disposal all spent fuel from that utility. Thus, the NRC does not view this issue as affecting its confidence that the spent fuel will be disposed of. Rather, the issue is one of equity—that is, will a utility and its customers and investors or U.S. taxpayers and/or other utilities ultimately pay for disposal of spent fuel generated prior to April 1983. The Commission does not believe that a licensee's potential default has a direct bearing on the Commission's Waste Confidence Decision.

The full impact of the program redirection resulting from the NWPA and the outlook for the timing of repository availability will continue to be assessed annually. If it does appear that costs will exceed available funds, there is provision in the NWPA for DOE to request that Congress adjust the fee to ensure full-cost recovery. Thus, the Commission finds no reason for changing its basic conclusion that the long-term funding provisions of the Act should provide adequate financial support for the DOE program.

II.A.3.d. DOE's schedule for repository development

At the time that the 1984 Waste Confidence Decision was issued, the Nuclear Waste Policy Act of 1982, enacted in January 1983, had been in effect for less than 20 months. The NWPA had established numerous deadlines for various repository program milestones. Under section

112(b)(1)(B), the NWPA set the schedule for recommendation of sites for characterization no later than January 1, 1985. Section 114(a)(2) specified that no later than March 31, 1987, with provision for a 12-month extension of this deadline, the President was to recommend to Congress one of the three characterized sites qualified for an application for repository construction authorization. Under section 114(d), NRC was to issue its decision approving or disapproving the issuance of a construction authorization not later than January 1, 1989, or the expiration of three years after the date of submission of the application, whichever occurs later. Section 302(a)(5)(B) required that contracts between DOE and utilities for payments to the Waste Fund provide that DOE will begin disposing of spent fuel or high-level waste by January 31, 1998.

In little more than a year after enactment, the schedule established by the NWPA began proving to be optimistic. In the reference schedule for the repository presented in the April 1984 Draft Mission Plan, for example, DOE showed a slip from January 1989 to August 1993 for the decision on construction authorization.

In the 1984 Waste Confidence Decision, the Commission recognized the possibility of delay in repository availability beyond 1998, and did not define its task as finding confidence that a repository would be available by the 1998 milestone in the NWPA. The Commission focused instead on the question of whether a repository would be available by the years 2007-2009, the date cited in the court remand as the expiration of the OLS for the Vermont Yankee and Prairie Island reactors. The NRC believed that the NWPA increased the chances for repository availability within the first few years of the twenty-first century, by specifying the means for resolving the institutional and technical issues most likely to delay repository completion, by establishing the process for compliance with NEPA, and by setting requirements for Federal agencies to cooperate with DOE in meeting program milestones. Finding that no fundamental technical breakthroughs were necessary for the repository program, the Commission predicted that "...selection and characterization of suitable sites and construction of repositories will be accomplished within the general time frame established by the Act [1998] or within a few years thereafter."

In January 1987, DOE issued a Draft Mission Plan Amendment to apprise Congress of significant developments

and proposed changes in the repository program. In the Draft Amendment, DOE announced a five-year delay in its schedule for repository availability from the first quarter of 1998 to the first quarter of 2003. DOE's reasons for the delay included the need for more time for consultation and interaction with States and Tribes, the requirement in DOE's 1987 budget that funds not be used for drilling exploratory shafts in 1987, and the need for more information than previously planned for site selection and the license application. The 1987 Draft Mission Plan Amendment set the second quarter of 1988 as the new date for exploratory shaft construction at the Yucca Mountain site. When the final 1987 Mission Plan Amendment was submitted to Congress in June 1987, the schedule for shaft sinking at the Yucca Mountain site had slipped six months to the fourth quarter of 1988. Congress did not take action to approve the June 1987 Mission Plan Amendment as DOE had requested.

On December 22, 1987, the NWPAA was enacted. The NWPAA had its major impact on the repository program in suspending site characterization activities at the Hanford and Deaf Smith County sites and authorizing DOE to characterize the Yucca Mountain site for development of the first repository.

DOE subsequently issued the Draft 1988 Mission Plan Amendment in June 1988, to apprise Congress of its plans for implementing the provisions of the NWPAA. In the Draft 1988 Mission Plan Amendment, DOE's schedule for shaft sinking at Yucca Mountain had slipped another six months to the second quarter of 1989. Since the NRC published the Proposed Waste Confidence Review (54 FR 39767) for comment, the schedule for shaft sinking has been changed from November 1989 to November 1992. Issues requiring DOE attention before site characterization can begin have been identified, and it is possible that additional issues affecting DOE's readiness will come to light. However, DOE has made progress in completing QA plans since September 1989, and it is reasonable to expect that study plans and technical procedures needed for surface-based testing will be ready in time for testing to begin by January 1991.

Heretofore, the repository schedule has always been aggressive and highly success-oriented. In comments on the Draft 1988 Mission Plan Amendment, the Commission noted that the schedule has not allowed adequately for contingencies, and that, given the compression in the schedule for near-

term program milestones, DOE had not shown how it would be able to meet the 2003 milestone for repository operation. The revised schedule announced in the November 1989 Reassessment Report includes a new reference schedule for the restructured repository, MRS, and transportation programs. Under the restructured program, the schedule for submittal of a construction authorization application to NRC has been extended from 1995 to 2001, and the schedule for repository operation at Yucca Mountain, if that site is found to be suitable, is 2010. DOE believes that this reference schedule is the first repository program schedule since passage of the NWPA that is based on a "realistic assessment of activity duration and past experience." The new schedule allows more time for scientific investigations than earlier schedules. NRC believes that the restructured program has been responsive to NRC concerns that the quality and completeness of site investigations were being compromised in order to satisfy unrealistic schedule requirements.

Another potential source of delay in repository availability may arise from NRC regulations. Given the revised schedule, however, the NRC does not believe this is likely. The Commission believes that current NRC rules are fully adequate to permit DOE to proceed to develop and submit a repository license application, but further clarification of these rules is desirable to reduce the time needed to conduct the licensing proceeding itself. In order to meet the three-year schedule provided in the NWPA for a Commission decision on repository construction authorization, the NRC staff has undertaken to refine its regulatory framework on a schedule that would permit DOE to prepare and submit an application for repository construction authorization under its current schedule. The Commission fully intends to avoid delaying DOE's program, while working to reduce the uncertainties in NRC regulatory requirements that could become contentions in the licensing proceeding. Even if there are any delays resulting from a need for DOE to accommodate more specific regulatory requirements in its site characterization or waste package development programs, the Commission is confident that the time savings in the licensing proceeding will more than compensate for them.

In view of the delays in exploratory shaft excavation since the 2003 date for repository availability was set, the Commission believed it was optimistic to expect that Phase 1 of repository operations would be able to begin by

2003. As DOE's schedule for repository availability has slipped a year and a half since the date was changed from 1998 to 2003, the earliest date for repository availability would probably be closer to 2005. Given additional delays in shaft sinking and DOE's revised program schedule, NRC believes that 2010 is the earliest date for repository availability at Yucca Mountain. Yet, the Commission recognizes that DOE is committed to improving the schedule where possible without sacrificing quality and completeness of scientific investigations.

An institutional issue that may further affect DOE's schedule is the status of EPA standards for disposal of spent fuel and high-level waste. These standards are required under section 121(a) of the NWPA. Under 10 CFR section 60.112, NRC's overall postclosure system performance objective, the geologic setting shall be selected and the engineered barrier system, which includes the waste package, must be designed to assure that releases of radioactive materials to the accessible environment, following permanent closure, conform to EPA's standards. 40 CFR part 191, the EPA standards, first became effective in November 1985. In July 1987, the U.S. Court of Appeals for the First Circuit vacated and remanded to EPA for further proceedings subpart B of the high-level radioactive waste disposal standards. As noted under the aforementioned I.A.1., the standards have not been reissued.

A significant modification in the reissued EPA standard may affect the schedule for completing the design of the waste package and engineered barrier to the extent that design testing is planned to demonstrate compliance with the standards. DOE's current site characterization plans for demonstrating compliance with 40 CFR part 191 are based on the standards as promulgated in 1985. DOE is proceeding to carry out its testing program developed for the original EPA standards. DOE has stated that if the EPA standards are changed significantly when they are reissued, DOE will reevaluate the adequacy of its testing program.

The Commission believes that DOE's approach is reasonable. Much of the information required to demonstrate compliance with the EPA standards is expected to remain the same regardless of the numerical level at which each standard is set. Considering the importance of developing the repository for waste disposal as early as safely

practicable, it would be inappropriate for DOE to suspend work on development of engineered barriers pending reissuance of the standards, unless EPA had given clear indications of major changes in them.

Another possibility is that, regardless of any changes in the repromulgated EPA standards, they will be litigated in Federal court. Even if this proves to be the case, however, the Commission believes that any such litigation will still permit EPA to promulgate final standards well within the time needed to enable DOE to begin repository operations at any site within the first quarter of the twenty-first century.

Given the current DOE program schedule, and assuming that the QA program can be qualified and surface-based testing begun within the next year, the Commission finds that although it is not impossible that a repository at Yucca Mountain will be available by 2007-2009, it is more likely that the earliest date for a repository there is 2010. If DOE determines that the Yucca Mountain site is unsuitable, and if DOE makes this determination by the year 2000, the NRC believes that a repository at another site could be available within the first quarter of the next century. The Commission will reevaluate these dates during the next scheduled Waste Confidence Review in 1999.

II.B. Relevant Issues That Have Arisen since the Commission's Original Decision

II.B.1. NRC stated in 9-14-87 correspondence to Sen. Breaux on pending nuclear waste legislation that under a program of single site characterization, "...there may be a greater potential for delay of ultimate operation of a repository than there is under the current regime where three sites will undergo at-depth characterization before a site is selected." To what extent does the NWPA raise uncertainty about the identification of a technically acceptable site and potential delay in repository availability by limiting site characterization to a single candidate site (Yucca Mt.) and by raising the possibility that a negotiated agreement might influence repository site selection? Does this uncertainty affect confidence in the availability of a repository by 2007-2009?

In providing comments to Congress on proposed amendments to the NWPA, NRC took the position that simultaneous site characterization of three sites, as required by the NWPA, was not

necessary to protect public health and safety. NRC further stated that the adequacy of a site for construction authorization would ultimately be determined in a licensing proceeding, and that NRC would only license a site that satisfied NRC licensing requirements. As described next, the Commission believes that the NWPA contains numerous provisions to ensure that a technically acceptable site will be identified.

The NWPA does not reduce the scope of site characterization activities that DOE is authorized to undertake. The Amendments Act establishes a Nuclear Waste Technical Review Board composed of individuals recommended by the National Academy of Sciences and appointed by the President to evaluate the scientific validity of DOE activities, including site characterization activities, and to report its findings at least semiannually to Congress and DOE. The Amendments Act also provides funding for technical assistance to States, tribes, and affected units of local government. Finally, section 160(l) of the NWPA provides that "Nothing in this Act shall be construed to amend or otherwise detract from the licensing requirements of the NRC established in Title II of the Energy Reorganization Act of 1974 (42 U.S.C. 5841 et seq.)." In providing for these reviews and in reaffirming NRC's licensing authority, the NWPA ensures that a candidate site for a repository must satisfy all NRC requirements and criteria for disposal of high-level radioactive wastes in licensed geologic repositories.

Section 402 of the NWPA establishes the Office of the Nuclear Waste Negotiator. The duty of the Negotiator is to attempt to find a State or tribe willing to host a repository or MRS at a technically qualified site. The Negotiator may solicit comments from NRC, or any other Federal agency, on the suitability of any potential site for site characterization. Section 403(d)(4) strengthens the Commission's confidence that a technically acceptable site will be identified by providing that DOE may construct a repository at a negotiated site only if authorized by NRC. Given these safeguards on selection of a technically acceptable site, the Commission does not consider that the possibility of a negotiated agreement reduces the likelihood of finding a technically qualified site.

The Commission raised the concern as early as April 1987 that under a program of single-site characterization, there could be considerable delay while

characterization was completed at another site or slate of sites if the initially chosen site was found inadequate. By terminating site characterization activities at alternative sites to the Yucca Mountain site, the NWPAA has had the effect of increasing the potential for delay in repository availability if the Yucca Mountain site proves unsuitable. The provision in the NWPAA for a Negotiator could reduce the uncertainty and associated delay in restarting the repository program by offering an alternate to the Yucca Mountain site; but at the time of this writing, a Negotiator has not been appointed.

It should be noted here that the repository program redirection under the NWPAA does not, *per se*, have a significant impact on the Commission's assurance of repository availability by 2007-2009, the relevant dates in the original Waste Confidence Proceeding, or on availability by 2010, DOE's current date. The Commission's reservations about affirming this timeframe derive from other considerations, including delays in sinking shafts and the potential for other delays in meeting program milestones, that would have arisen without the NWPAA.

The Amendments Act does, however, effectively make it necessary that Yucca Mountain be found suitable if the 2007-2009 or 2010 timeframe is to be met: this target period would almost certainly be unachievable if DOE had to begin screening to characterize and license another site. Thus, confidence in repository availability in this period would imply confidence in the suitability of Yucca Mountain. The Commission does not want its findings here to constrain in any way its regulatory discretion in a licensing proceeding. Therefore, the Commission declines to reaffirm the 2007-2009 timeframe in the original decision or to affirm the current 2010 date for repository operation.

II.B.2. In the Draft 1988 Mission Plan Amendment, DOE stated that "...the

data indicate that the Yucca Mountain site has the potential capacity to accept at least 70,000 MTHM [metric tons heavy metal equivalent] of waste, but only after site characterization will it be possible to determine the total quantity of waste that could be accommodated at this site."

a. Do the issues of limited spent fuel capacity at Yucca Mountain, indefinite

suspension of the second repository program, and the likelihood that no more than one repository will be available by 2007-2009 undermine the NRC's 1984 assurance that "sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of existing commercial high level radioactive waste and spent fuel originating in such reactor and generated up to that time?"

b. Is there sufficient uncertainty in total spent fuel projections (e.g., from extension-of-life license amendments, renewal of operating licenses for an additional 20 to 30 years, or a new generation of reactor designs) that this Waste Confidence review should consider the institutional uncertainties arising from having to restart a second repository program?

II.B.2.a. Although it will not be possible to determine whether Yucca Mountain can accommodate 70,000 MTHM or more of spent fuel until after site characterization, the Commission does not believe that the question of repository capacity at the Yucca Mountain site should be a major factor in the analysis of Finding 2. This is because it cannot be assumed that Yucca Mountain will ultimately undergo development as a repository. The generic issue of repository capacity does add to the potential need for more than one repository, however.

As noted earlier, the NWPAA established deadlines for major milestones in the development of the first and the second repository programs. The Act also required NRC to issue a final decision on the construction authorization application by January 1, 1989 for the first repository, and January 1, 1992 for the second (or within three years of the date of submission of the applications, whichever occurred later). The July 1984 Draft DOE Mission Plan set January 1998 and October 2004 as the dates for commencement of waste emplacement in the first and second repositories, assuming that Congressional authorization was obtained to construct the second repository.

Thus, at the time the 1984 Waste Confidence Decision was issued, DOE was authorized and directed to carry out two repository programs under a schedule to make both facilities operational by 2007-2009. DOE and NRC were also working under the constraint, still in force under the NWPAA as amended, that no more than 70,000 MTHM may be emplaced in the first repository before the second is in

operation. Because DOE estimated at the time that commercial U.S. nuclear power plants with operating licenses or construction permits would discharge a total 160,000 MTHM of spent fuel, it appeared that at least two repositories would be needed.

In the 1984 Waste Confidence Decision, reactors were assumed to have a 40-year operating lifetime, and because the earliest licenses were issued in 1959 and the early 1960's, the oldest plants' licenses were due to expire as early as 1999 and 2000, as discussed in more detail below. Although it was expected that at least one repository would be available by this time, there was also a limit as to how quickly spent fuel could be accepted by the repository. DOE had estimated that waste acceptance rates of 3400 MTHM per year could be achieved after the completion of Phase 2 of the first repository. This rate could essentially double if two repositories were in operation. At 6000 MTHM/year, it was estimated that all the anticipated spent fuel could be emplaced in the two repositories by about the year 2026. This was the basis for the Commission's position that sufficient repository capacity would be available within 30 years beyond expiration of any reactor OL to dispose of existing commercial high level waste and spent fuel originating in such reactor and generated up to that time.

In May 1986, however, DOE announced an indefinite postponement of the second repository program. The reasons for the postponement included decreasing forecasts of spent fuel discharges, as well as estimates that a second repository would not be needed as soon as originally supposed. With enactment of the NWPAA in December 1987, DOE was required to terminate all site-specific activities with respect to a second repository unless such activities were specifically authorized and funded by Congress. The NWPAA required DOE to report to Congress on the need for a second repository on or after January 1, 2007, but not later than January 1, 2010.

Current DOE spent fuel projections, based on the assumption of no new reactor orders, call for 87,000 MTHM to have been generated by the year 2036, including approximately 9000 MTHM of defense high-level waste. With the likelihood that there will be reactor lifetime extensions and renewals, however, the no-new-orders case probably underestimates total spent fuel discharges. Also, the NWPAA did not change the requirement that no more

than 70,000 MTHM could be emplaced in the first repository before operation of the second. It therefore appears likely that two repositories will be needed to dispose of all the spent fuel and high-level waste from the current generation of reactors, unless Congress provides statutory relief from the 70,000 MTHM limit, and the first site has adequate capacity to hold all of the spent fuel and high-level waste generated. The Commission believes that if the need for an additional repository is established, Congress will provide the needed institutional support and funding, as it has for the first repository.

For all but a few licensed nuclear power reactors, OLs will not expire until some time in the first three decades of the twenty-first century. Several utilities are currently planning to have their OLs renewed for ten to 30 years beyond the original license expiration. At these reactors, currently available spent fuel storage alternatives effectively remove storage capacity as a potential restriction for safe operations. For these reasons, a repository is not needed by 2007-2009 to provide disposal capacity within 30 years beyond expiration of most OLs. If work is begun on the second repository program in 2010, the repository could be available by 2035, according to DOE's estimate of 25 years for the time it will take to carry out a program for the second repository. Two repositories available in approximately 2025 and 2035, each with acceptance rates of 3400 MTHM/year within several years after commencement of operations, would provide assurance that sufficient repository capacity will be available within 30 years of OL expiration for reactors to dispose of the spent fuel generated at their sites up to that time.

There are several reactors, however, whose OLs have already expired or are due to expire within the next few years, and which are now licensed or will be licensed only to possess their spent fuel. If a repository is not available until about 2025, these reactors may be exceptions to the second part of the Commission's 1984 Finding 2, which was that sufficient repository capacity will be available within 30 years beyond the expiration of any reactor OL to dispose of the commercial high-level waste and spent fuel originating in such reactor and generated up to that time.

The basis for this second part of Finding 2 has two components: (1) a technical or hardware component; and (2) an institutional component. The technical component relates to the reliability of storage hardware and engineered structures to provide for the

safe storage of spent fuel. An example would be the ability of spent fuel assemblies to withstand corrosion within spent fuel storage pools, or the ability of concrete structures to maintain their integrity over long periods. In the 1984 Decision, the Commission found confidence that available technology could in effect provide for safe storage of spent fuel for at least 70 years.

The Commission's use of the expression "30 years beyond expiration of any reactor operating license" in the 1984 Finding was based on the understanding that the license expiration date referred to the scheduled expiration date at the time the license was issued. It was also based on the understanding that, in order to refuel the reactor, some spent fuel would be discharged from the reactor within twelve to eighteen months after the start of full power operation.

Thus, the Commission understood that, depending on the date of the first reactor outage for refueling, some spent fuel would be stored at the reactor site for most of the 40-year term of the typical OL. In finding that spent fuel could be safely stored at any reactor site for at least 30 years after expiration of the OL for that reactor, the Commission indicated its expectation that the total duration of spent fuel storage at any reactor would be about 70 years.

Taking the earliest licensed power reactor, the Dresden 1 facility licensed in 1959, and adding the full 40-year operating license duration for a scheduled license expiration in the year 1999, the Commission's finding would therefore entail removal of all spent fuel from that reactor to a repository within the succeeding 30 years, or by 2029. Even if a repository were not available until the end of the first quarter of the twenty-first century, DOE would have at least four years to ship the reactor's 683 spent fuel assemblies, totalling 70 metric tons initial heavy metal (MTHM), from Dresden 1 without exceeding the Commission's 30-year estimate of the maximum time it would take to dispose of the spent fuel generated in that reactor up to the time its OL expired. (MTHM is a measure of the mass of the uranium in the fuel (or uranium and plutonium if it is a mixed oxide fuel) at the time the fuel is placed in the reactor for irradiation.)

Considering the experience from the 1984 and 1985 campaigns to return spent fuel from the defunct West Valley reprocessing facility to the reactors of origin, 70 metric tons of BWR spent fuel can easily be shipped within four years. The first campaign, involving truck

shipments of 20 metric tons from West Valley, NY, to Dresden 1 in Morris, IL, took eleven months. The second, involving truck shipments of 43 tons from West Valley to the Oyster Creek reactor in Toms River, NJ, took six months. (See *Case Histories of West Valley Spent Fuel Shipments*, Final Report, NUREG/CR-4847 WPR-86(6811), 1, p. 2-2.) This estimate assumes, moreover, that no new transportation casks, designed to ship larger quantities of older, cooler spent fuel, for example, would be available by 2025.

The institutional part of the question concerning the availability of sufficient repository capacity required the Commission to make a finding as to whether spent fuel in at-reactor storage would be safely maintained after the expiration of the facility OL. This question related to the financial and managerial capability for continued safe storage and monitoring of spent fuel, rather than to the capability of the hardware involved. The Commission determined, in Finding 3 of its 1984 Decision, that spent fuel will be managed in a safe manner until sufficient repository capacity is available to assure safe disposal, which was expected under Finding 2 to be about 30 years after the expiration of any reactor OL. (See discussion of Finding 3 below for additional discussion of the institutional aspects of spent fuel storage pending the availability of sufficient disposal capacity.)

The availability of a repository within the first quarter of the twenty-first century holds no significant adverse implications for the Commission's institutional concern that there be an organization with adequate will and wherewithal to provide continued long-term storage after reactor operation. This could be a concern if a significant number of reactors with significant quantities of spent fuel onsite were to discontinue operations indefinitely between now and 1995, and the utility-owners of these reactors did not appear to have the resources to manage them safely for up to 30 years pending the assumed availability of a repository in 2025.

No such development is likely. No licenses for currently operating commercial nuclear reactors are scheduled to expire until the year 2000, and most such licenses will expire during the first two decades after 2006. (See *Nuclear Regulatory Commission 1989 Information Digest*, NUREG-1350, Vol. 1, p. 33.) The availability of the first repository by 2025, and of a second repository within one or two decades

thereafter, would provide adequate disposal capacity for timely removal of the spent fuel generated at these reactors.

There are several licensees, however, whose authority to operate their commercial reactors has already been terminated. These are Indian Point 1, Dresden 1, Humboldt Bay, and Lacrosse. They are also the only licensed power reactors that are retired with spent fuel being stored onsite. Assuming conservatively that a repository does not become operational until 2025, it appears likely that spent fuel will remain at these sites for more than 30 years beyond the time their reactors were indefinitely shut down, at which point their operating licenses could be considered to have effectively expired, although they will continue to hold a possession license for the storage of the spent fuel.

In considering the means and motivation of the owner of an indefinitely retired reactor to provide safe long-term storage, the Commission believes it is useful to distinguish between the owner with only one reactor, and the owner of a reactor at a multi-unit site or an owner with operating reactors at other sites. In the case of a retired reactor at a multi-unit site, the owner would have a clear need to maintain the safety of storage at the retired reactor sufficiently to permit continued generation at the site. If the owner of the retired reactor also owned other reactors at other sites, the spent fuel at the retired reactor could be transferred, if necessary, to the storage facilities of other units still under active management. Of the four reactors just cited, Indian Point 1 and Dresden 1 fit this description, and the sibling reactors at their sites are operating under licenses that do not expire until well beyond the year 2000—that is, well within the post-OL period during which the Commission has found that spent fuel could be safely stored pending the availability of a repository.

For the Lacrosse and Humboldt Bay reactors, the Commission is confident that, even if a repository is not available within 30 years following their retirement, the overall safety and environmental acceptability of extended spent fuel storage will also be maintained for these exceptional cases. Because there will still be an NRC possession license for the spent fuel at these facilities, the Commission will retain ample regulatory authority to require any measures, such as removal of the spent fuel remaining in storage pools to passive dry storage casks, that might become necessary until the time

that DOE assumes title to the spent fuel under contracts pursuant to the NWPA. It should also be borne in mind that Humboldt Bay and Lacrosse are both small early reactors, and their combined spent fuel inventory totals 67 metric tons of initial heavy metal. (See *Spent Fuel Storage Requirements* (DOE/RL 88-34) October 1988, Table A.3b., pp. A.15-A.17.) If for any reason not now foreseen, this spent fuel can no longer be managed by the owners of these reactors, and DOE must assume responsibility for its management earlier than currently planned, this quantity of spent fuel is well within the capability of DOE to manage onsite or offsite with available technology.

Nor does the Commission see a significant safety or environmental problem with premature retirements of additional reactors. In the Commission's original Waste Confidence Decision, it found reasonable assurance that spent fuel would have to spend no more than 30 years in post-operational storage pending the availability of a repository. For a repository conservatively assumed to be available in 2025, this expected 30-year maximum storage duration remains valid for most reactors, and would be true for all reactors that were prematurely retired after 1995. Based on the past history of premature shutdowns, the Commission has reason to believe that their likely incidence during the next six years will be small as a proportion of total reactor-years of operation.

Historically, 14 of the 125 power reactors that have operated in the U.S. over the past 30 years have been retired before the expiration of their operating licenses. These early retirements included many low-power developmental reactors, which may make the ratio of 14 to 125 disproportionately high as a basis for projecting future premature shutdowns.

The Commission is aware of currently operating reactors that may be retired before the expiration of their OLS, including: the recently-licensed Shoreham reactor, which has generated very little spent fuel; the Fort St. Vrain high-temperature gas-cooled reactor, which its owner plans to decommission; and the Rancho Seco reactor, which has operated for the past 12 years and may or may not be retired. Assuming that these and perhaps a few more reactors do retire in the next several years, their total spent fuel storage requirements would not impose an unacceptable safety or environmental problem, even in the unlikely event that all these reactors' owners were rendered financially or otherwise unable to

provide adequate care, and DOE were required to assume custody earlier than currently envisioned under the NWPA.

Licensed non-power research reactors provide an even more manageable case. DOE owns the fuel for almost all of these reactors, many of which have been designed with lifetime cores that do not require periodic refueling. For those reactors that do discharge spent fuel, DOE accepts it for storage or reprocessing, and not more than an estimated 50 kilograms of such spent fuel are generated annually.

Thus, given these worst-case projections, which are not expectations but bounding estimates, the Commission finds that a delay in repository availability to 2025 will not result in significant safety or environmental impacts due to extended post-operational spent fuel storage. To put it another way, the Commission is confident that, even if a repository were not available within 30 years after the effective expiration of the OLS for both currently retired reactors and potential future reactor retirements through 1995, the overall safety and environmental impacts of extended spent fuel storage would be insignificant.

II.B.2.b. Although it is clear that there is uncertainty in projections of total future spent fuel discharges, it is not clear that the institutional uncertainties arising from having to restart a second repository program should be considered in detail in the current Waste Confidence Decision review.

License renewals would have the effect of increasing requirements for spent fuel storage. The Commission understands that some utilities are currently planning to seek renewals for 30 years. Assuming for the sake of establishing a conservative upper bound that the Commission does grant 30-year license renewals, the total operating life of some reactors would be 70 years, so that the spent fuel initially generated in them would have to be stored for about 100 years if a repository were not available until 30 years after the expiration of their last OLS.

Even under the conservative bounding assumption of 30-year license renewals for all reactors, however, if a repository were available within the first quarter of the twenty-first century, the oldest spent fuel could be shipped off the sites of all currently operating reactors well before the spent fuel initially generated in them reached the age of 100 years. Thus, a second repository, or additional capacity at the first, would be needed only to accommodate the additional quantity of spent fuel generated during the later years of these reactors'

operating lives. The availability of a second repository would permit spent fuel to be shipped offsite well within 30 years after expiration of these reactors' OLs. The same would be true of the spent fuel discharged from any new generation of reactor designs.

In sum, although some uncertainty in total spent fuel projections does arise from such developments as utilities' planning renewal of OLs for an additional 20 to 30 years, the Commission believes that this Waste Confidence review need not at this time consider the institutional uncertainties arising from having to restart a second repository program. Even if work on the second repository program is not begun until 2010 as contemplated under current law, there is sufficient assurance that a second repository will be available in a timeframe that would not constrain the removal of spent fuel from any reactor within 30 years of its licensed life for operation.

II.B.3. Are early slippages in the DOE repository program milestones

significant enough to affect the Commission's confidence that a repository will be available when needed for health and safety reasons?

The 2007-2009 timeframe imposed on the Commission by the May 23, 1979 remand by the Court of Appeals was based on the scheduled expiration of the OLs for the Vermont Yankee and Prairie Island nuclear reactors. The specific issues remanded to the Commission were: (1) whether there is reasonable assurance that an offsite storage solution will be available by the years 2007-2009 (the expiration of the plants' operating licenses); and, if not, (2) whether there is reasonable assurance that the fuel can be stored safely at the sites beyond those dates.

There was no finding by the Court that public health and safety required offsite storage or disposal by 2007-2009. In directing the Commission to address the safety of at-reactor storage beyond 2007-2009, the Court recognized the possibility that an offsite storage or disposal facility might not be available by then.

The Commission has not identified a date by which a repository must be available for health and safety reasons. Taking into account institutional requirements for spent fuel storage, the Commission found, under Finding 3 in the 1984 Waste Confidence Decision, that spent fuel would be safely managed until sufficient repository capacity is available. The Commission also found, however, that in effect, under the second part of Finding 2, safe management would not need to continue for more

than 30 years beyond expiration of any reactor's OL, because sufficient repository capacity was expected to become available within those 30 years. Considering that spent fuel would not have to be stored more than 30 years after any reactor's 40-year OL expiration, and taking into account the technical requirements for such storage, the Commission went on to determine under Finding 4 that, in effect, spent fuel could be safely stored for at least 70 years after discharge from a reactor. Thus, the Commission's 1984 Decision did not establish a time when sufficient repository capacity would be required; it established a minimum period during which storage would continue to be safe and environmentally acceptable pending the expected availability of sufficient repository capacity.

Bearing in mind that reactor facilities were originally designed and OLs issued for a licensed life for operation of 40 years, the Commission is proposing elsewhere in this Federal Register notice a clarifying revision of Finding 4 to say that spent fuel can be safely stored at a reactor for at least 30 years after the "licensed life for operation" of that reactor. Implicitly, the proposed use of the phrase "licensed life for operation" clarifies that the Commission found in 1984 that NRC licensing requirements for reactor facility design, construction, and operation provide reasonable assurance that spent fuel can be stored safely and without significant environmental impacts for at least the first 40 years of the reactor's life. The Commission's proposed finding also implies that, barring any significant and pertinent unexpected developments, neither technical nor institutional constraints would adversely affect this assurance for at least another 30 years after that first 40 years. Another implication of this revised finding is that, where a utility is able to meet NRC requirements to extend that reactor's operating lifetime by license renewal, spent fuel storage for at least 30 years beyond the end of the period of extended life will also be safe and without significant environmental impacts.

In assessing the effect of early slippages in DOE repository program milestones, therefore, the most important consideration is not the earliest date that an operating license actually expired, but the earliest date that an OL was issued. The earliest OL to be issued was for Dresden 1 in 1959, followed by a number of reactors licensed for operation in 1962. The OLs for all of the 111 power reactors now licensed to operate are currently scheduled to expire sometime within the

first three decades of the twenty-first century, which is also the period in which their currently licensed life for operation would end. (See *Nuclear Regulatory Commission 1989 Information Digest*, NUREG-1350, Vol. 1, p. 33.) Thus, conservatively assuming here that there will be no license renewals, the earliest timeframe when a repository might be needed to dispose of spent fuel from the majority of reactors is 2029-2050.

As proposed in the first part of Finding 2, the Commission has reasonable assurance that a repository will be available within the first quarter of the twenty-first century. Even if a repository were not available until 2025, this would be several years before the beginning of the earliest timeframe within which, based on an assumed 30-year storage after an assumed 40-year licensed life of reactor operation, a repository might be needed for spent fuel disposal. Thus, early slippages in DOE's program milestones do not affect the Commission's confidence that a repository will be available within that timeframe.

II.B.4. NRC has stated that the 3- to 4-year license application review schedule is optimistic, and that for NRC to meet this schedule, DOE must submit a complete and high-quality license application. In the September 16, 1988 NRC comments to DOE on the Draft 1988 Mission Plan Amendment, the Commission requested that DOE acknowledge its commitment to develop this complete and high-quality application, "even if this would result in longer times to collect the necessary information and subsequent delays in submitting the license application."

Will NRC's emphasis on the completeness and quality of the license application have a significant effect on the timing of the submittal of the license application and subsequent licensing proceeding to grant construction authorization in time for repository availability by 2007-2009?

As the NRC indicated to DOE in NRC's October 25, 1985 comments on the draft PDS, the three-year statutory schedule for the NRC licensing proceeding on the application for construction authorization is optimistic. The Commission has sought ways to improve the prospects for meeting this schedule, for example by developing the LSS for expedited document discovery during the licensing proceeding.

In the same correspondence on the PDS, NRC also stated that the adequacy of the three-year review period depends

on DOE's submittal of a complete and high-quality application. A license application supported by inadequate data may lead to findings during the licensing proceeding that the results of certain tests cannot be admitted as part of the license application. If it is not possible to repeat the tests in question, NRC may have no alternative but to deny the application--with a consequent loss of program momentum and considerable financial cost.

In the November 1989 Reassessment Report, DOE announced extensions in all major repository program milestones. The current target date for repository availability is 2010. In a speech before the 1989 Nuclear Energy Forum, W. Henson Moore, Deputy Secretary of Energy, stated that a permanent repository at Yucca Mountain could not be operational before 2010, under optimum circumstances. The 2010 at-the-earliest timeframe falls outside of the 2007-2009 timeframe for an "offsite storage solution" in the 1979 Court remand which precipitated the NRC's Waste Confidence Proceeding. In the Reassessment Report, DOE noted that in developing its current schedule, certain activities, one of which was NRC's review of the license application, were outside of DOE's control. However, DOE also stated that it would continue its ongoing interactions with NRC and EPA "to reduce the number of unresolved issues remaining at the time of licensing, which should enhance confidence that the license application can be reviewed in three years, as called for in the Nuclear Waste Policy Act." The NRC does not believe that it is likely that NRC's emphasis on completeness and quality of the license application will contribute to substantial delays in submitting the license application and in the licensing proceeding that would delay repository availability much beyond 2010 at the Yucca Mountain site.

In any case, the Commission remains convinced that the benefits to the repository program of submitting a high-quality license application would outweigh the cost of delay in preparing the application. NRC has always placed great emphasis on early resolution of potential licensing issues in the interest of expeditious review of the license application and timely repository availability. It is in the same spirit of timely repository operation that the Commission is urging greater attention to quality than to meeting the schedule for submittal of the license application. NRC believes that a complete and high-quality license application offers the best available assurance that timely

repository licensing and operation can be achieved.

In addition to expediting the review of the application, a high-quality license application and site characterization program should enhance overall confidence that any site granted a construction authorization will prove to be reliable during the period of performance confirmation. It will also increase public confidence that the program is being carried out in a thorough and technically sound manner.

II.C. Conclusion on Finding 2

In reexamining the technical and institutional uncertainties surrounding the timely development of a geologic repository since the 1984 Waste Confidence Decision, the Commission has been led to question the conservatism of its expectation that a repository would be available by 2007-2009.

At the time of the 1984 Decision, the Commission said that timely attainment of a repository did not require DOE to adhere strictly to the milestones set out in the NWPAA, and there would be delays in some milestones. It did not appear to the Commission at the time that delays of a year or so in meeting any of the milestones would delay the date of repository availability by more than a few years beyond the 1998 deadline specified in the Act.

Since then, however, several developments have made it apparent that delays of more than a few years are to be the norm rather than the exception in the early years of this program. There has been a twelve-year slip in DOE's estimate of repository availability from 1998 to 2010, and DOE has been unable to meet such near-term repository program milestones as excavation of the exploratory shaft and the start of in-situ testing. There remains the possibility that potential repository availability at the Yucca Mountain site will be further delayed due to unforeseen problems during site characterization.

In predicting the timing of repository availability, the suitability of Yucca Mountain should not be assumed. Yucca Mountain is now the only candidate site available; the NWPAA required that DOE terminate site characterization activities at all sites other than the Yucca Mountain site. In effect, the 2007-09 schedule for repository availability in the original Waste Confidence Decision could have been met only if Yucca Mountain survived the repository development process as a licensed site without major delays in site characterization and licensing. If this site were found to be unlicenseable or otherwise unsuitable, characterization

would have to begin at another site or suite of sites, with consequent further delay in repository availability. The final decision on the suitability of the site to proceed to licensing and repository development will rest with DOE, but the position of the NRC staff will figure in that decision. The staff will not be able to make a recommendation to a licensing board to authorize repository construction at Yucca Mountain until all site characterization activities have been completed. DOE might thus be unable for several more years to determine whether there will in fact have to be a delay to find and characterize another site.

Another reason the Commission is unwilling to assume the suitability of Yucca Mountain is that NRC must be mindful of preserving all its regulatory options--including a recommendation of license application denial--to assure adequate protection of public health and safety from radiological risk. In our view, it is essential to dispel the notion that for scheduler reasons there is no alternative to the currently preferred site. This view is consistent with past Commission statements that the quality of DOE's preparations for a license application should take precedence over timeliness where the two conflict. It is also consistent with the view that because we are making predictions about completion dates for a unique and complex enterprise at least some 20 years hence, it is more reasonable to express the timescale for completion in decades rather than years.

In order to obtain a conservative upper bound for the timing of repository availability, the Commission has made the assumption that the Yucca Mountain site will be found to be unsuitable. If DOE were authorized to initiate site screening for a repository at a different site in the year 2000, the Commission believes it reasonable to expect that a repository would be available by the year 2025. This estimate is based on the DOE position that site screening for a second repository should begin 25 years before the start of waste acceptance.

The consideration of technical and institutional issues presented here has found none that would preclude the availability of a repository within this timeframe. Given DOE's revised schedule, which provides 11 years for site characterization activities instead of six, it is possible that the Yucca Mountain site could be found unsuitable after the year 2000. In this case, DOE would have fewer than 25 years to initiate site screening and develop a repository for availability by 2025. The NRC will evaluate the likelihood of this

development during the next scheduled review of the Waste Confidence Decision in 1999.

For the second part of its 1984 finding on repository availability, the Commission found reasonable assurance that sufficient repository capacity will be available within 30 years beyond expiration of any reactor OL to dispose of existing commercial high level waste and spent fuel originating in that reactor and generated up to that time. The Commission believes that this finding should also be modified in light of developments since 1984.

When the Commission made this finding, it took into consideration both technical and institutional concerns. The technical concern centered on the ability of the spent fuel and the engineered at-reactor storage facilities to meet the requirements for extended post-operational storage before shipment for disposal. The institutional question concerned whether the utility currently responsible for post-operational at-reactor storage, or some substitute organization, would be able to assure the continued safety of this storage.

The principal new developments since 1984 that bear on these questions are: (1) that dry spent fuel storage technologies have become operational on a commercial scale; and (2) that several utilities are proceeding with plans to seek renewals of their OLs, with appropriate plant upgrading, for an additional period up to 30 years beyond the 40-year term of their current licenses. The accumulation of operating experience with dry-cask storage, a technology requiring little active long-term maintenance, provides additional assurance that both the technical and institutional requirements for extended post-operational spent fuel storage will be met. License renewals, however, would have the effect of increasing requirements for both the quantity and possibly the duration of storage. If the Commission were to grant 30-year license renewals, the total operating life of some reactors could be 70 years, so that the spent fuel initially generated in such reactors would have to be stored for about 100 years, if a repository were not available until 30 years after the expiration of their last OLs. This raises the question as to whether that spent fuel, and the hardware and civil engineering structures for storing it, can continue to meet NRC requirements for an additional 30 years beyond the period the Commission supported in 1984.

For all the reasons cited in the discussion of Finding 4, the Commission believes there is ample technical basis

for confidence that spent fuel can be stored safely and without significant environmental impact at these reactors for at least 100 years. If a repository were available within the first quarter of the twenty-first century, the oldest spent fuel could be shipped off the sites of all currently operating reactors well before the spent fuel initially generated in them reached the age of 100 years.

The need to consider the institutional aspects of storage beyond 30 years after OL expiration was not in evidence in 1984 because the Commission was confident that at least one repository would be available by 2007-2009. On that schedule, waste acceptance of spent fuel from the first reactor whose operating license had expired (Indian Point 1, terminated in 1980) could have begun within 30 years of expiration of that license. If a repository does not prove to be available until 2025, however, it would not be available within 30 years of the time that OLs could be considered effectively to have expired for Indian Point 1 and the three other plants with spent fuel onsite that were retired before the end of their licensed life for reactor operation. The same would be true of any additional reactors prematurely retired between now and 1995, when the 30-year clock starts for the availability of a repository by 2025. Premature shutdowns notwithstanding, the Commission has reasons to be assured that the spent fuel at all of these reactors will be stored safely and without significant environmental impact until sufficient repository capacity becomes available.

Considering first the technical reasons for this assurance, it is important to recognize that each of these reactors and its spent fuel storage installation were originally licensed in part on the strength of the applicant's showing that the systems and components of concern were designed and built to assure safe operation for 40 years under expected normal and transient severe conditions. All of the currently retired reactors have a significant portion of that 40-year expected life remaining, and all have only small quantities of spent fuel onsite in storage installations that were licensed to withstand considerably larger thermal and radiation loadings from much greater quantities of spent fuel. Of the four reactors currently retired with spent fuel onsite, the two with far the longest terms of operation, Lacrosse and Dresden, were operated for 19 and 18 years, respectively.

For the continued safe management of the spent fuel in storage installations at any existing or potential prematurely retired plant, the Commission believes it can reasonably rely on the continued

structural and functional integrity of the plant's engineered storage installations for at least the balance of its originally licensed life as if the OL were still in effect. This is to say that for the purposes of Finding 2, no foreseeable technical constraints have arisen to disturb the Commission's assurance that spent fuel storage at any reactor will remain safe and environmentally acceptable for at least 30 years after its licensed life for operation, regardless of whether its OL has been terminated at an earlier date.

The Commission also sees no insurmountable institutional obstacles to the continued safe management of spent fuel during the remainder of any shutdown reactor's initially licensed life for operation, or for at least 30 years thereafter. Because there will still be an NRC possession license for the spent fuel at any reactor that has indefinitely suspended operations, the Commission will retain ample regulatory authority to require any measures, such as removal of the spent fuel remaining in storage pools to passive dry storage casks, that might appear necessary after an OL expires. Even if a licensed utility were to become insolvent, and responsibility for spent fuel management were transferred to DOE earlier than is currently planned, the Commission has no reason to believe that DOE would be unable to carry out any safety-related measures NRC considers necessary. Thus, in the case of a premature reactor retirement, the Commission has an adequate basis, on both technical and institutional grounds, for reasonable assurance that spent fuel can be stored safely and without significant environmental impacts for at least 30 years beyond not only the actual end of that reactor's OL, but the end of its originally licensed life for operation.

In sum, considering developments since 1984 in the repository development program, in the operating performance of U.S. power reactors, and in spent fuel storage technology, the Commission finds that: (1) the overall public health, safety, and environmental impacts of the possible unavailability of a repository by 2007-2009 would be insignificant; and (2) neither 30-year renewals of reactor licenses nor a delay in repository availability to 2025 will result in significant safety or environmental impacts from extended post-operational spent fuel storage.

The Commission finds ample grounds for its proposed revised findings on the expected availability of a repository. The institutional support for the repository program is well-established. A mechanism for funding repository

program activities is in place, and there is a provision in the NWPAA for adjusting, if necessary, the fee paid by utilities into this fund. Congress has continued to provide support for the repository program in setting milestones, delineating responsibilities, establishing advisory bodies, and providing a mechanism for dealing with the concerns of States and affected Indian tribes.

Technical support for extended spent fuel storage has improved since 1984. Considering the growing availability, reasonable cost, and accumulated operating experience with new dry cask spent fuel storage technology since then, the Commission now has even greater assurance that spent fuel can be stored safely and without significant environmental impact for at least 30 years after the expected expiration of any reactor's OL. Where a reactor's OL has been terminated before the expected expiration date, the Commission has an adequate basis to reaffirm what was implicit in its initial concept, namely: that regardless of the actual date when the reactor's operating authority effectively ended, spent fuel can be stored safely and without significant environmental impacts for at least 30 years beyond that reactor's licensed life for operation.

There is thus no foreseeable health and safety or environmental requirement that a repository be made available within the 2007-2009 timeframe at issue in the Commission's original proceeding.

Indeed, the Commission sees important NRC mission-related grounds for avoiding any statement that repository operation by 2007-2009 is required. Geologic disposal of high-level radioactive wastes is an unprecedented endeavor. It requires reliable projections of the waste isolation performance of natural and engineered barriers over millennia. After the repository is sealed, retrieval of the emplaced wastes will no longer be practicable, and the commitment of wastes to that site will, by design, be irreversible. In DOE's testing, both in the laboratory and at the candidate repository site, in its development of facility and waste-package designs, and in all other work to demonstrate that NRC requirements will be met for a repository at Yucca Mountain, the Commission believes that the confidence of both NRC and the public depends less on meeting the schedule for repository operation than on meeting safety requirements and doing the job right the first time. Thus, given the Commission's assurance that spent fuel can safely be stored for at

least 100 years if necessary, it appears prudent for all concerned to prepare for the better-understood and more manageable problems of storage for a few more years in order to provide additional time to assure the success of permanent geologic disposal.

This is not to say that the Commission is unsympathetic to the need for timely progress toward an operational repository. It is precisely because NRC is so confident of the national commitment to achieve early repository operation that the Commission believes it no longer need add its weight to the considerable pressures already bearing on the DOE program. There is ample institutional impetus on the part of others, including Congress, the nuclear power industry, State utility rate regulatory bodies, and consumers of nuclear-generated power, toward DOE achievement of scheduled program milestones. With continuing confidence in the technical feasibility of geologic disposal, the Commission has no reason to doubt the institutional commitment to achieve it in a timeframe well before it might become necessary for safety or environmental reasons. Indeed, the Commission believes it advisable not to attempt in this review a more precise NRC estimate of the point at which a repository will be needed for radiological safety or environmental reasons, lest this estimate itself undermine the commitment to earlier achievement of repository operations.

To find reasonable assurance that a repository will be available by 2007-2009, however, is a different and more consequential proposition in the context of this review. In light of the delays the program has encountered since its inception, and the regulatory need to avoid a premature commitment to the Yucca Mountain site, the Commission could not prudently describe a basis for assurance that the previous DOE schedule for repository operation in 2003 would not slip another four to six years under any reasonably foreseeable circumstances. The NRC believes it is more realistic to expect that a repository at the Yucca Mountain site could be available by the year 2010 or a few years thereafter, if the Yucca Mountain site is found to be suitable. This revised estimate, however, could too easily be misinterpreted as an NRC estimate of the time at which continued spent fuel storage at these sites would be unsafe or environmentally significant. The Commission's enhanced confidence in the safety of extended spent fuel storage provides adequate grounds for the view that NRC need not at this time define more precisely the period when, for

reasons related to NRC's mission, a permanent alternative to post-operational spent fuel storage will be needed. The Commission therefore proposes the following revision of its original Finding on when sufficient repository capacity will be available:

The Commission finds reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license)⁴ of any reactor to dispose of the commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time.

Reaffirmed Finding 3: The Commission finds reasonable assurance that high-level radioactive waste and spent fuel will be managed, in a safe manner until sufficient repository capacity is available to assure the safe disposal of all high-level waste and spent fuel.

III.A. Issues Considered in Commission's 1984 Decision on Finding 3

In the Commission's discussion of Finding 3 in its Waste Confidence Decision (49 FR 34658, August 31, 1984), in Section 2.3 >Third Commission Finding,' the Commission stated,

Nuclear power plants whose operating licenses expire after the years 2007-09 will be subject to NRC regulation during the entire period between their initial operation and the availability of a waste repository. The Commission has reasonable assurance that the spent fuel generated by these licensed plants will be managed by the licensees in a safe manner. Compliance with the NRC regulations and any specific license conditions that may be imposed on the licensees will assure adequate protection of the public health and safety. Regulations primarily addressing spent fuel storage include 10 CFR Part 50 for storage at the reactor facility and 10 CFR Part 72 for storage in independent spent fuel storage installations (ISFSIs). Safety and environmental issues involving such storage are addressed in licensing reviews under both Parts 50 and 72, and continued storage operations are audited and inspected by NRC. NRC's experience in more than 80 individual evaluations of the safety of spent fuel storage shows that significant releases of radioactivity from spent fuel under licensed storage conditions are extremely remote.

Some nuclear power plant operating licenses expire before the years 2007-09. For technical, economic or other reasons, other plants may choose, or be forced to terminate operation prior to 2007-09 even though their

⁴The parenthetical phrase "which may include the term of a revised or renewed license" has been added to revised Finding 2 to make it consistent with revised Finding 4.

operating licenses have not expired. For example, the existence of a safety problem for a particular plant could prevent further operation of the plant or could require plant modifications that make continued plant operation uneconomic. The licensee, upon expiration or termination of its license, may be granted (under 10 CFR Part 50 or Part 72) a license to retain custody of the spent fuel for a specified term (until repository capacity is available and the spent fuel can be transferred to DOE under Sec. 123 of the Nuclear Waste Policy Act of 1982) subject to NRC regulations and license conditions needed to assure adequate protection of the public. Alternatively, the owner of the spent fuel, as a last resort, may apply for an interim storage contract with DOE, under Sec. 135(b) of the Act, until not later than 3 years after a repository or monitored retrievable storage facility is available for spent fuel. For the reasons discussed above, the Commission is confident that in every case the spent fuel generated by those plants will be managed safely during the period between license expiration or termination and the availability of a mined waste repository for disposal.

Even if a repository does not become available until 2025, nothing has occurred during the five years since its original Decision to diminish the Commission's confidence that high-level waste and spent fuel will be managed in a safe manner until a repository is available. The same logic just stated continues to apply through the first quarter of the twenty-first century. NRC regulations remain adequate to assure safe storage of spent fuel and radioactive high-level waste at reactors, at independent spent fuel storage installations (ISFSIs), and in an MRS until sufficient repository capacity is available.

10 CFR subsection 72.42(a) provides for renewal of licensed storage at ISFSIs for additional 20-year periods for interim storage, or for additional 40-year periods for monitored retrievable storage of spent fuel and solidified radioactive high-level waste if an MRS facility is constructed, licensed, and operated. This would ensure that spent fuel and solidified high-level waste, if any were to be delivered to an MRS facility, would remain in safe storage under NRC regulation throughout its storage. The Commission has also published for public comment a proposed amendment to part 72 to issue a general license to reactor licensees to use approved spent fuel storage casks at reactor sites. Currently, the Commission is considering the draft final amendment for this rulemaking action. If this amendment is promulgated, no specific part 72 license would be required. Operating license holders would register with NRC to use approved casks on their sites

Spent fuel may continue to be stored in the reactor spent fuel pool under a part 50 "possession only" license after the reactor has ceased operating. In addition, DOE's policy of disposing of the oldest fuel first, as set forth in its Annual Capacity Report, makes it unlikely that any significant fraction of total spent fuel generated will be stored for longer than the 30 years beyond the expiration of any operating reactor license. This expectation, established in the Commission's original proceeding, continues to be reasonable, even in the event that a repository is not available until some time during the first quarter of the twenty-first century. Even in the case of premature shutdowns, where spent fuel is most likely to remain at a site for 30 years or longer beyond OL expiration (see Finding 2, previously discussed), the Commission has confidence that spent fuel will be safely managed until safe disposal is available.

Until the reactor site has been fully decommissioned, and spent fuel has been transferred from the utility to DOE as required by NRC regulations, the licensee remains responsible to NRC. Furthermore, under 10 CFR subsection 50.54bb, originally issued in final form by the Commission with its 1984 Waste Confidence Decision, a reactor licensee must provide to NRC, five years before expiration of an OL, notice of plans for spent fuel disposition. Accordingly, the Commission concludes that nothing has changed since the enactment of the Nuclear Waste Policy Act of 1982 and the Waste Confidence Decision in August 1984 to diminish the Commission's "...reasonable assurance that high-level radioactive waste and spent fuel will be managed in a safe manner until sufficient repository capacity is available..."

Pursuant to the NWPA, the Commission issued in final form 10 CFR part 53, "Criteria and Procedures for Determining Adequacy of Available Spent Nuclear Fuel Storage Capacity," addressing the determination of need, if any, for DOE interim storage. No applications were received by the June 30, 1989 NWPA deadline incorporated into the Commission's rule, and it seems unlikely that any applications will be made to NRC for interim storage by DOE. Even if NRC had made an exception for a late application, a determination would have to have been made before January 1, 1990 to comply with the NWPA.

III.B. Relevant Issues That Have Arisen since the Commission's Original Decision on Finding 3

Although a DOE facility may not be available to enable the Department to

begin accepting spent fuel in 1998, as currently provided in the contracts under the NWPA, the Commission's confidence in safe storage is unaffected by any potential contractual dispute between DOE and spent fuel generators and owners as to responsibility for spent fuel storage. In the event that DOE does not take title to spent fuel by this date, a licensee under either 10 CFR part 50 or part 72 cannot abandon spent fuel in its possession.

The Commission recognizes that the NWPA limitation of 70,000 MTHM for the first repository will not provide adequate capacity for the total amount of spent fuel projected to be generated by all currently operating licensed reactors. The NWPA effectively places a moratorium on a second repository program until 2007-2010. Either the first repository must be authorized and able to provide expanded capacity sufficient to accommodate the spent fuel generated, or there must be more than one repository. Since Congress specifically provided in the NWPA for a first repository, and required DOE to return for legislative authorization for a second repository, the Commission believes that Congress will continue to provide institutional support for adequate repository capacity.

The Commission's confidence about the availability of repository capacity is not affected by the possibility that some existing reactor licenses might be renewed to permit continued generation of spent fuel at these sites. Because only two reactor licenses are scheduled to expire before 2003, the impact of license renewals (a matter not considered in the Commission's 1984 Decision) will have no significant effect within the first quarter of the twenty-first century on scheduling requirements for a second repository. Renewals may slightly alleviate the need for a second repository in the short term, because spent fuel storage capacity will be expanded for extended storage at these reactor sites. Over the longer term, renewals might increase spent fuel generation well into the latter half of the twenty-first century. Nonetheless, nothing in this situation diminishes the Commission's assurance that safe storage will be made available as needed.

In summary, the Commission finds no basis for changing the Third Finding in its Waste Confidence Decision. The Commission continues to find "...reasonable assurance that high-level radioactive waste and spent fuel will be managed in a safe manner until sufficient repository capacity is

available to assure the safe disposal of all high-level waste and spent fuel."

Original Finding 4: The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of that reactor's operating license at that reactor's spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

Revised Finding 4: The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

IV.A. Issues Considered in Commission's 1984 Decision on Finding 4

In the Commission's discussion of Finding 4 in its Waste Confidence Decision (49 FR 34658; August 31, 1984) section 2.4 "Fourth Commission Finding," the Commission said that:

Although the Commission has reasonable assurance that at least one mined geologic repository will be available by the years 2007-09, the Commission also realizes that for various reasons, including insufficient capacity to immediately dispose of all existing spent fuel, spent fuel may be stored in existing or new storage facilities for some periods beyond 2007-09. The Commission believes that this extended storage will not be necessary for any period longer than 30 years beyond the term of an operating license. For this reason, the Commission has addressed on a generic basis in this decision the safety and environmental impacts of extended spent fuel storage at reactor spent fuel basins or at either onsite or offsite spent fuel storage installations. The Commission finds that spent fuel can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of reactor operating licenses. To ensure that spent fuel which remains in storage will be managed properly until transferred to DOE for disposal, the Commission is proposing an amendment to its regulations (10 CFR Part 50). The amendment will require the licensee to notify the Commission, five years prior to expiration of its reactor operating license, how the spent fuel will be managed until disposal.

The Commission's finding is based on the record of this proceeding which indicates that significant releases of radioactivity from spent fuel under licensed storage conditions are highly unlikely. It is also supported by the Commission's experience in conducting more than 80 individual safety evaluations of storage facilities.

The safety of prolonged spent fuel storage can be considered in terms of four major issues: (a) The long-term integrity of spent fuel under water pool storage conditions, (b) structure and component safety for extended facility operation, (c) the safety of dry storage, and (d) potential risks of accidents and acts of sabotage at spent fuel storage facilities.

For reasons discussed above, the Commission arrived at a provisional figure of 70 years or more for storage (i.e., a 40-year reactor OL span, plus 30 years or more).

The 70-year-plus estimate is supported by oral testimony from the nuclear industry to the Commission in the Waste Confidence Proceeding. (See Transcript of Commission Meeting, "In the Matter of: Meeting on Waste Confidence Proceeding," January 11, 1982, Washington, DC, pp. 148-160). This testimony specifically addressed safety issues related to water pool storage of spent fuel and supported the position that spent fuel could be stored for an indefinite period, citing the industry's written submittal to the Commission in the proceeding. (See "The Capability for the Safe Interim Storage of Spent Fuel" (Document 4 of 4), Utility Nuclear Waste Management Group and Edison Electric Institute, July 1980). Some of this material alluded to in the oral testimony was subsequently referenced by the Commission in its discussion of water pool storage issues and its Fourth Finding of reasonable assurance that spent fuel and high level waste "...will be managed in a safe manner." (See 49 FR 34658 at pp. 34681-2, August 31, 1984).

If a reactor with a 40-year initial license were to have that license renewed for another 30 years, the Commission believes that the spent fuel generated at that reactor can be safely stored for at least several decades past the end of the 70-year operating period. Adding to these 70 years the expected 30-year post-OL period during which the Commission believes, under Finding 2, that sufficient repository capacity will be made available for any reactor's spent fuel, the total storage time would be about 100 years.

In making the original Fourth Finding, the Commission did not determine that for technical or regulatory reasons, storage would have to be limited to 70 years. This is apparent from the Commission's use of the words "...for at least 30 years beyond the expiration of that reactor's operating license...[emphasis added]." Similarly, in using the words "at least" in its revised Finding Four, the Commission is not suggesting 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) represents any technical limitation for

safe and environmentally benign storage. Degradation rates of spent fuel in storage, for example, are slow enough that it is hard to distinguish by degradation alone between spent fuel in storage for less than a decade and spent fuel stored for several decades.

The Commission's revised Finding here is meant to apply both to wet storage in reactor pools and dry storage in engineered facilities outside the reactor containment building. Both dry and wet storage will be discussed in detail next.

Since the original Waste Confidence Decision, which found that material degradation processes in dry storage were well-understood, and that dry-storage systems were simple, passive, and easily maintained, NRC and ISFSI operators have gained experience with dry storage which confirms the Commission's 1984 conclusions. NRC staff safety reviews of topical reports on storage-system designs, the licensing and inspection of storage at two reactor sites, and NRC promulgation of the part 72 amendment for MRS, have significantly increased the agency's understanding of and confidence in dry storage.

Under NWPA Section 218(a), DOE has carried out spent fuel storage research and development as well as demonstration of dry cask storage at its Idaho National Engineering Laboratory. Demonstration has been carried out for metal casks under review or previously reviewed by NRC staff. DOE has also provided support to utilities in dry storage licensing actions (see Godlewski, N.Z., "Spent Fuel Storage—An Update," *Nuclear News*, Vol. 30, No. 3, March 1987, pp.47-52).

Dry storage of spent fuel has become an available option for utilities, with at-reactor dry storage licensed and underway at three sites: the H. B. Robinson Steam Electric Plant, Unit 2, in South Carolina, and the Surry Nuclear Station in Virginia. A license was recently granted for a modular system at Duke Power Company's Oconee Nuclear Station site. New applications have been received in 1989 for CP&L's Brunswick site, for the Baltimore Gas and Electric Company's Calvert Cliffs site, and in 1990 for Consumer Power Company's Palisades site. Based on utility statements of intent, and projections of need for additional storage capacity at reactor sites, the NRC staff expects numerous applications from utilities over the next decade (see "Final Version Dry Cask Storage Study," DOE/RW-0220, February 1989).

Since the original Waste Confidence finding, the Commission has reexamined long-term spent fuel storage in issuing an amendment to 10 CFR part 72 to address the storage of spent fuel and high-level radioactive waste in an MRS, as envisioned by Congress in Section 141 of the NWP. Under this rule, storage in an MRS is to be licensed for a period of 40 years, with the possibility for renewal. The Commission determined not to prepare an environmental impact statement for the proposed amendments to 10 CFR part 72, however. (See 53 FR 31651, p. 31657; August 19, 1988.) An environmental assessment and finding of no significant impact were issued because the Commission found that the consequences of long-term storage are not significant. The environmental assessment for 10 CFR part 72, "Licensing Requirements for the Independent Storage of Spent Fuel and High-Level Radioactive Waste," NUREG-1092, assessed dry storage of spent fuel for a period of 70 years after receipt of spent fuel from a reactor:

The basis chosen for evaluating license requirements for the long-term storage of spent nuclear fuel and high-level radioactive waste in an MRS is an installation having a 70-year design lifetime and a 70,000 MTU storage capability. This assessment focuses on the potential environmental consequences for a long-term storage period, a period for which the Commission needs to assure itself of the continued safe storage of spent fuel and high-level radioactive waste and the performance of materials of construction. This means the reliability of systems important to safety needs to be established to ensure that long-term storage of spent fuel and HLW does not adversely impact the environment.

For example, the staff needs to establish that systems, such as concrete shielding, have been evaluated to determine how their physical properties withstand the consequences of irradiation and heat flux for about a 70-year period. The Commission addressed structure and component safety for extended operation for storage of spent fuel in reactor water pools in the matter of waste confidence rulemaking proceeding. The Commission's preliminary conclusion is that experience with spent fuel storage provides an adequate basis for confidence in the continued safe storage of spent fuel for at least 30 years after expiration of a plant's license. The Commission is therefore confident of the safe storage of spent fuel for at least 70 years in water pools at facilities designed for a 40-year lifetime. The Commission also stated that its authority to require continued safe management of spent fuel generated by licensed plants protects the public and assures them the risks remain acceptable. In consideration of the safety of dry storage of spent fuel, the Commission's preliminary conclusions were that [its] confidence in the extended dry storage of spent fuel is based on a reasonable

understanding of the material degradation processes, together with the recognition that dry storage systems are simpler and more readily maintained. In response to Nuclear Waste Policy Act of 1982 authorizations, the Commission noted: >...the Commission believes the information above [on dry spent fuel storage research and demonstration] is sufficient to reach a conclusion on the safety and environmental effects of extended dry storage. All areas of safety and environmental concern (e.g., maintenance of systems and components, prevention of material degradation, protection against accidents and sabotage) have been addressed and shown to present no more potential for adverse impact on the environmental and the public health and safety than storage of spent fuel in water pools. At this time, the Commission is confident it can evaluate the long-term integrity of material for constructing an installation and provide the needed assurance for safe storage of spent fuel and HLW to establish the licensibility of an MRS over extended periods of time. The MRS fuel storage concepts discussed here for revision of 10 CFR Part 72 covers only dry storage concepts. [References omitted]

The Commission believes that its 1984 Fourth Finding should be changed to reflect the environmental assessment in the 10 CFR part 72 MRS rulemaking and other evidence that spent fuel can be stored, safely and without significant environmental impact, for extended periods. Although the Commission does not believe storage in excess of a century to be likely, with or without an MRS, there is the potential for storage of spent fuel for times longer than 30 years beyond the expiration of an initial, extended, or renewed reactor OL, if a reactor operating under such a license were prematurely shut down. The Commission does not, however, see any significant safety or environmental problems associated with storage for at least 30 years after the licensed life for operation of any reactor, even if this effectively means storage for at least 100 years, in the case of a reactor with a 70-year licensed life for operation.

Under the environmental assessment for the MRS rule, the Commission has found confidence in the safety and environmental insignificance of dry storage of spent fuel for 70 years following a period of 70 years of storage in spent fuel storage pools. Thus, this environmental assessment supports the proposition that spent fuel may be stored safely and without significant environmental impact for a period of up to 140 years if storage in spent fuel pools occurs first and the period of dry storage does not exceed 70 years.

The Commission has also found that experience with water-pool storage of spent fuel continues to confirm that pool storage is a benign environment for spent fuel that does not lead to

significant degradation of spent fuel integrity. Since 1984, utilities have continued to provide safe additional reactor pool storage capacity through reracking, with over 110 such actions now completed. The safety of storage in pools is widely recognized among cognizant professionals. Specifically, the Commission notes one expert's view that:

During the last 40 years there has been very positive experience with the handling and storing of irradiated fuel in water; thus wet storage is now considered a proved technology. There is a substantial technical basis for allowing spent fuel to remain in wet storage for several decades. For the past two decades, irradiated Zircaloy-clad fuel has been handled and stored in water. There continues to be no evidence that Zircaloy-clad fuel degrades significantly during wet storage--this includes: fuel with burnups as high as 41,000 MWd/MTU; continuous storage of low-burnup fuel for as long as 25 years; and irradiation of fuel in reactors for periods up to 22 years. Cladding defects have had little impact during wet storage, even if the fuel is uncanned. [References omitted.] [See Bailey, W.J., and Johnston, Jr. A.B., et al., "Surveillance of LWR Spent Fuel in Wet Storage," NP-3765, Electric Power Research Institute (EPRI), October 1984, pp. 2-10.]

This last conclusion has been reaffirmed by the same authors, who recently wrote: "There continues to be no evidence that LWR spent fuel with Zircaloy or stainless steel cladding degrades significantly during wet storage [EPRI 1986; International Atomic Energy Agency (IAEA) 1982]." (See "Results of Studies on the Behavior of Spent Fuel in Storage," Journal of the Institute of Nuclear Materials Management, Vol. XVI, No. 3, April 1986, p. 27 IV A).

In addition to the confidence that the spent fuel assemblies themselves will not degrade significantly in wet storage, there is confidence that the water pools in which the assemblies are stored will remain safe for extended periods:

As noted in the recent IAEA world survey, the 40 years of positive experience with wet storage illustrates that it is a fully-developed technology with no associated major technological problems. Spent fuel storage pools are operated without substantial risk to the public or the plant personnel. There is substantial technical basis for allowing spent fuel to remain in wet storage for several decades. Minor, but repairable, problems have occurred with spent fuel storage pool components such as liners, racks, and piping. [See Bailey, W.J., and Johnson, Jr. A.B., et al., "Surveillance of LWR Spent Fuel in Wet Storage," EPRI NP-3765, prepared by Battelle Pacific Northwest Laboratories, Final Report, October 1984, p. 8-1.]

The studies just cited also support the view that rates of uniform corrosion of spent fuel cladding in storage pools are low over time. Localized corrosion on

cladding surfaces has also been gradual and can be expected to remain so. Cladding that has undergone damage while in the reactor core has not resulted in significant releases of radioactivity when stored in pools. Furthermore, the operational experience accumulated since the 1984 Waste Confidence Decision and NRC experience in licensing and inspection reinforce the conclusions in that Decision that wet storage involves a relatively benign environment. There are no driving mechanisms, such as temperature and pressure, to degrade storage structures or components or the fuel itself, or to spread contamination. Degradation mechanisms are gradual and well understood; they allow ample time for remedial action, including repair or replacement of any failing systems. This extensive experience adequately supports predictions of long-term integrity of storage basins.

The Commission also notes the endorsement of this basic confidence by cognizant professional organizations:

The American Nuclear Society issued a policy statement [ANS 1986] in 1986 regarding storage of spent nuclear fuel. The statement indicates that continued wet storage of spent fuel at nuclear power plant sites until the federal government accepts it under existing contracts with the utilities is safe, economical and environmentally acceptable. [See Gilbert, E.R., Bailey, W.J., and Johnson, A.B., "Results of Studies on the Behavior of Spent Fuel in Storage," Journal of the Institute of Nuclear Materials Management, Vol. XVI, No. 3, April 1988, p. 27.IV A.)]

The Commission is aware that in December 1986 at the Hatch nuclear power plant, radioactive water leaked out of a spent fuel transfer canal between spent fuel pools. Contaminated water drained into a swamp and from there into the Altamaha River. Also, more recently, on August 18, 1988, a spent fuel pool cooling pump failed at the Turkey Point nuclear power plant, causing about 3000 gallons of radioactive water to leak into the spent fuel pool heat exchanger room. Approximately 1500 gallons leaked from that room to adjacent areas. Approximately six to seven gallons entered the plant intake canal via storm drains. There was no radiation release offsite in this event. However, the shoes and clothing of approximately 15 workers were contaminated.

The occurrence of operational events like these have been addressed by the NRC staff at the plants listed. The staff has taken inspection and enforcement actions to reduce the potential for such operational occurrences in the future.

The NRC staff has spent several years studying in detail catastrophic loss of

reactor spent fuel pool water possibly resulting in a fuel fire in a dry pool, and recently participated in litigation over this issue relative to Vermont Yankee. The 1987 report, "Severe Accidents in Spent Fuel Pools in Support of Generic Safety Issue 82" (NUREG/CR-4982), referred to in Public Citizen's comment represents an early part of the NRC's study. Subsequent study of the consequences and risks due to a loss of coolant water from spent fuel pools was conducted by the NRC, and the results were published in NUREG/CR-5176, "Seismic Failure and Cask Drop Analysis of the Spent Fuel Pools at Two Representative Nuclear Power Plants," January 1989, and NUREG-1353, "Regulatory Analysis for the Resolution of Generic Issue 82, >Beyond Design Basis Accidents in Spent Fuel Pools," April 1989. These reports were cited in the Commission's Proposed Waste Confidence Decision Review (54 FR 39767-39797, at p.39795, September 28, 1989). Also issued in 1989, as part of the NRC staff's study, was "Value/Impact Analyses of Accident Preventive and Mitigative Options for Spent Fuel Pools" (NUREG/CR-5281).

The primary concern regarding accidents in spent fuel pools is the loss of water and its capability to cool the radioactive fuel. Without sufficient water cooling, some performance assessment models suggest that the fuel's zircaloy cladding may initiate and sustain rapid oxidation (fire) that may spread to adjacent fuel assemblies, with the potential of releasing large amounts of radioactivity.

The analyses reported in these NUREGs indicate that the dominant accident sequence which contributes to risk in a spent fuel pool is gross structural failure of the pool due to seismic events. Risks due to other accident scenarios (such as pneumatic seal failures, inadvertent drainage, loss of cooling or make-up water, and structural failures due to missiles, aircraft crashes and heavy load drops) are at least an order of magnitude smaller. For this study, older nuclear power plants were selected, since the older plants are more vulnerable to seismic-induced failures. The selected plants included the Vermont Yankee and the H.B. Robinson plants.

Although these studies conclude that most of the spent fuel pool risk is derived from beyond design basis earthquakes, this risk is no greater than the risk from core damage accidents due to seismic events beyond the safe-shutdown earthquake. Because of the large inherent safety margins in the design and construction of the spent fuel pool analyzed, it was determined that

no action was justified to further reduce the risk (NUREG-1353). As stated in the Preface to NUREG-1353:

This report presents the regulatory analysis, including decision rationale, for the resolution of Generic Issue 82, >Beyond Design Basis Accidents in Spent Fuel Pools. The object of this regulatory analysis is to determine whether the use of high density storage racks for the storage of spent fuel poses an unacceptable risk to the health and safety of the public. As part of this effort, the seismic hazards for two older spent fuel pools were evaluated. The risk change estimates, value/impact and cost-benefit analyses, and other insights gained during this effort, have shown that no new regulatory requirements are warranted in relation to this generic issue.

Thus, supported by the consistency of NRC experience with that of others, the Commission has concluded that spent fuel can be stored safely and without significant environmental impact, in either wet storage or in wet storage followed by dry storage, for at least 100 years. The Commission considers it unlikely, however, that any fuel will actually remain in wet storage for 100 years or even for 70 years. We anticipate that, consistent with the currently developing trend, utilities will move fuel rods out of spent fuel pools and into dry storage to make room in pools for freshly-discharged spent fuel.

Although the Commission has concluded that reactor spent fuel pools can safely be used to store spent fuel for 100 years, there is no technically compelling reason to use them that long. If reactor licenses are renewed for as long as 30 years, making a total of 70 years of operation, it will be necessary to store the spent fuel discharged at the end of the reactor's operation in a spent fuel pool for several years to allow for radioactive decay and thermal cooling. After this period, the fuel could be placed in dry storage and the spent fuel pool decommissioned. Thus, for most reactors, the most likely maximum period of storage will be well within the extended 30-year post-operational period under the Commission's proposed revision to Finding 4. Moreover, considering that under certain conditions spent fuel can be stored safely and without significant environmental impacts for up to 140 years, the Commission believes there is ample basis for confidence in storage for at least 100 years.

In its 1984 Waste Confidence Decision, the Commission also concluded that "there are no significant additional non-radiological impacts which could adversely affect the environment if spent fuel is stored beyond the expiration of operating

licenses for reactors" (see 49 FR 34658 at p. 34686, August 31, 1984). The Commission did not find anything to contradict this conclusion in its 1988 rulemaking amending 10 CFR part 72 for long-term spent fuel and high-level waste storage at an MRS:

In August 1984, the NRC published an environmental assessment for this proposed revision of Part 72 NUREC-1092.

> Environmental Assessment for 10 CFR Part 72, Licensing Requirements for the Independent Storage of Spent Fuel and High-Level Radioactive Waste. NUREG-1092 discusses the major issues of the rule and the potential impact on the environment. The findings of the environmental assessment are >(1) past experience with water pool storage of spent fuel establishes the technology for long-term storage of spent fuel without affecting the health and safety of the public, (2) the proposed rulemaking to include the criteria of 10 CFR Part 72 for storing spent nuclear fuel and high-level radioactive waste does not significantly affect the environment, (3) solid high-level waste is comparable to spent fuel in its heat generation and in its radioactive material content on a per metric ton basis, and (4) knowledge of material degradation mechanisms under dry storage conditions and the ability to institute repairs in a reasonable manner without endangering the health (and safety) of the public shows dry storage technology options do not significantly impact the environment. The assessment concludes that, among other things, there are no significant environmental impacts as a result of promulgation of these revisions of 10 CFR Part 72.

Based on the above assessment, the Commission concludes that the rulemaking action will not have a significant incremental environmental impact on the quality of the human environment. (53 FR 31651 at pp. 31657-31658; August 19, 1988.)

Thus, the 1988 amendments to 10 CFR part 72 provide the basis for the Commission to conclude that the environmental consequences of long-term spent fuel storage, including non-radiological impacts, are not significant.

Finally, no considerations have arisen to affect the Commission's confidence since 1984 that the possibility of a major accident or sabotage with offsite radiological impacts at a spent-fuel storage facility is extremely remote. NRC has recently reexamined reactor pool storage safety in two studies, "Seismic Failure and Cask Drop Analyses of the Spent Fuel Pools at Two Representative Nuclear Power Plants" (NUREG/CR-5176) and "Beyond Design Basis Accidents in Spent Fuel Pools" (NUREG-1353). These studies reaffirmed that there are no safety considerations that justify changes in regulatory requirements for pool storage. Both wet- and dry-storage activities have continued to be licensed by the Commission. In its recent rulemaking amending 10 CFR part 72 to establish

licensing requirements for an MRS, the Commission did choose to eliminate an exemption regarding tornado missile impact "...to assure designs continue to address maintaining confinement of particulate material." (53 FR 31651, p. 31655, August 19, 1988). However, NRC staff had previously considered tornado missile impacts in safety reviews of design topical reports and in licensing reviews under 10 CFR part 72.

IV.D. Relevant Issues That Have Arisen since the Commission's Original Decision on Finding 4

In its original Finding 4, the Commission found reasonable assurance of safe storage without significant environmental impacts for at least 30 years beyond reactor OL expiration. Delays and uncertainties in the schedule for repository availability since the 1984 Decision have convinced the Commission to allow some margin beyond the scheduled date for repository opening currently cited by DOE. As noted in Finding 2, the Commission has reasonable assurance that at least one repository will be available within the first quarter of the twenty-first century. For all currently operating reactors, this would still be within the period of 30 years from expiration of their OLS, which the Commission previously found to be the minimum period for which spent fuel storage could be considered safe and without significant environmental impact.

Under the NWSA as amended, DOE is authorized to dispose of up to 70,000 MTHM in the first repository before granting a construction authorization for a second. Under existing licenses, projected spent fuel generation could exceed 70,000 MTHM as early as the year 2010. Possible extensions or renewals of OLS also need to be considered in assessing the need for and scheduling the second repository. It now appears that unless Congress lifts the capacity limit on the first repository—and unless this repository has the physical capacity to dispose of all spent fuel generated under both the original and extended or renewed licenses—it will be necessary to have at least one additional repository. Assuming here that the first repository is available by 2025 and has a capacity on the order of 70,000 MTHM, additional disposal capacity would probably not be needed before about the year 2040 to avoid storing spent fuel at a reactor for more than 30 years after expiration of reactor OLS.

Although action on a second repository before the year 2007 would require Congressional approval, the

Commission believes that Congress will take the necessary action if it becomes clear that the first repository site will not have the capacity likely to be needed. If DOE were able to address the need for a second repository earlier, for example by initiating a survey for a second repository site by the year 2000, DOE might be able to reduce the potential requirement for extended spent fuel storage in the twenty-first century. The Commission does not, however, find such action necessary to conclude that spent fuel can be stored safely and without significant environmental impact for extended periods.

The potential for generation and onsite storage of a greater amount of spent fuel as a result of the renewal of existing OLS does not affect the Commission's findings on environmental impacts. In Finding 4, the Commission did not base its determination on a specific number of reactors and amount of spent fuel generated. Rather, the Commission took note of the safety of spent fuel storage and lack of environmental impacts overall, noting that individual actions involving such storage would be reviewed. In the event there were applications for renewal of existing reactor OLS, each of these actions would be subject to safety and environmental reviews, with subsequent issuance of an environmental assessment or environmental impact statement, which would cover storage of spent fuel at each reactor site during the period of the renewed license.

The Commission also notes that the amount of spent fuel expected to be discharged by reactors has continued to decline significantly, a trend already noted in the Commission's discussion of its Finding 5 (49 FR 34658 at p. 34887, August 31, 1984). At the time of the Commission's decision, "...the cumulative amount of spent fuel to be disposed of in the year 2000 [was] expected to be 58,000 metric tons of uranium" (see "Spent Fuel Storage Requirements" (Update of DOE/RL-82-17) DOE/RL-83-1, January, 1983). Today, that figure has declined to 40,200 metric tons, the lower reference case which represents the conservative upper bound of commercial nuclear power growth (see "Integrated Data Base for 1989: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics," DOE/RW-0006, Rev. 5, November 1989). The amount of spent fuel considered likely to be discharged by the year 2000 in the Commission's 1984 decision will not be attained until the end of calendar year 2010, if then.

The Commission believes that its 1984 Finding 4 should be revised to acknowledge the possibility and assess the safety and environmental impacts of extended storage for periods longer than 70 years. The principal reasons for this proposed revision are that: (1) the long-term material and system degradation effects are well understood and known to be minor; (2) the ability to maintain the system is assured; and (3) the Commission maintains regulatory authority over any spent fuel storage installation.

On the basis of experience with wet and dry spent fuel storage and related rulemaking and licensing actions, the Commission concludes that spent fuel can be safely stored without significant environmental impact for at least 100 years, if necessary. Therefore, the Commission is revising its original Fourth Finding thus: "The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations."

Reaffirmed Finding 5: The Commission finds reasonable assurance that safe independent onsite spent fuel storage or offsite spent fuel storage will be made available if such storage capacity is needed.

V.A. Issues Considered in Commission's 1984 Decision on Finding 5

In its discussion of Finding 5 of its Waste Confidence Decision (49 FR 34658; August 31, 1984), the Commission said that:

The technology for independent spent fuel storage installations, as discussed under the fourth Commission Finding, is available and demonstrated. The regulations and licensing procedures are in place. Such installations can be constructed and licensed within a five-year time interval. Before passage of the Nuclear Waste Policy Act of 1982 the Commission was concerned about who, if anyone, would take responsibility for providing such installations on a timely basis. While the industry was hoping for a government commitment, the Administration had discontinued efforts to provide those storage facilities.... The Nuclear Waste Policy Act of 1982 establishes a national policy for providing storage facilities and thus helps to resolve this issue and assure that storage capacity will be available.

Prior to March 1981, the DOE was pursuing a program to provide temporary storage in off-site, or away-from-reactor (AFR), storage installations. The intent of the program was to provide flexibility in the national waste

disposal program and an alternative for those utilities unable to expand their own storage capacities.

Consequently, the participants in this proceeding assumed that, prior to the availability of a repository, the Federal government would provide for storage of spent fuel in excess of that which could be stored at reactor sites. Thus, it is not surprising that the record of this proceeding prior to the DOE policy change did not indicate any direct commitment by the utilities to provide AFR storage. On March 27, 1981, DOE placed in the record a letter to the Commission stating its decision to discontinue its efforts to provide Federal government-owned or controlled away-from-reactor storage facilities. The primary reasons for the change in policy were cited as new and lower projections of storage requirements and lack of Congressional authority to fully implement the original policy.

The record of this proceeding indicates a general commitment on the part of industry to do whatever is necessary to avoid shutting down reactors or derating them because of filled spent fuel storage pools. While industry's incentive for keeping a reactor in operation no longer applies after expiration of its operating license, utilities possessing spent fuel are required to be licensed and to maintain the fuel in safe storage until removed from the site. Industry's response to the change in DOE's policy on federally-sponsored away-from-reactor (AFR) storage was basically a commitment to do what is required of it, with a plea for a clear unequivocal Federal policy.... The Nuclear Waste Policy Act of 1982 has now provided that policy.

The Nuclear Waste Policy Act defines public and private responsibilities for spent fuel storage and provides for a limited amount of federally-supported interim storage capacity. The Act also includes provisions for monitored retrievable storage facilities and for a research development and demonstration program for dry storage. The Commission believes that these provisions provide added assurance that safe independent onsite or offsite spent fuel storage will be available if needed. [References omitted]

The policy set forth in the NWPA regarding interim storage remains in place. Therefore, the Commission's confidence remains unchanged. The only policy change affecting storage involves long-term storage in an MRS. The NWPAA sets schedule restrictions on an MRS by tying it to the repository siting and licensing schedule. These restrictions effectively delay implementation of an MRS. Consequently, its usefulness in providing storage capacity relief to utilities is likely to be lost.

The NWPAA established a Monitored Retrievable Storage Review Commission tasked with preparing a report on the need for an MRS facility as part of the national nuclear waste management system (section 143(a)). In its November

1989 report "Nuclear Waste: Is There a Need for Federal Interim Storage?", the MRS Commission reached the following conclusion:

An MRS linked as provided in current law would not be justified, especially in light of uncertainties in the completion time for the repository. Consequently, the Commission does not recommend a linked MRS as required by current law and as proposed by DOE.

In the November 1989 Reassessment Report, DOE stated that current linkages between the repository and MRS program make it impossible for the DOE to accept waste at an MRS facility on a schedule that is independent from that of the repository. Therefore, the DOE plans to work with the Congress to modify the current linkages between the repository and the MRS facility and to embark on an aggressive program to develop an integrated MRS facility for spent fuel. The DOE believes that if the linkages are modified, it is likely that waste acceptance at an MRS facility could begin by 1998 or soon thereafter.

Although the Commission's confidence in its 1984 Decision did not depend on the availability of an MRS facility, the possibility of such a facility, as provided for in the NWPA, was one way in which needed storage could be made available. The NWPAA makes an MRS facility less likely by linking it to repository development, unless Congress is willing to modify these linkages. The potential impact of the uncertainty surrounding an MRS on the Commission's confidence is, however, more than compensated for by operational and planned spent fuel pool expansions and dry-storage investments by utilities themselves—developments that had not been made operational at the time of the original Waste Confidence Decision. Consequently, the current statutory restrictions that may make an MRS ineffective for timely storage capacity relief are of no consequence for the Commission's finding of confidence that adequate storage capacity will be made available if needed.

Although the NWPAA limits the usefulness of an MRS by linking its availability to repository development, the Act does provide authorization for an MRS facility. The Commission has remained neutral since its 1984 Waste Confidence Decision with respect to the need for authorization of an MRS facility. The Commission does not consider the MRS essential to protect public health and safety. If any offsite storage capacity is required, utilities may make application for a license to store spent fuel at a new site. Consequently, while the NWPAA provision does affect MRS development and therefore can be said to be limiting,

the Commission believes this should not affect its confidence in the availability of safe storage capacity.

V.B. Relevant Issues That Have Arisen since the Commission's Original Decision on Finding 5

DOE will probably not be able to begin operation of a repository before 2010 under current plans, and operation might begin somewhat later. Given progress to date on an MRS, the link between MRS facility construction and repository construction authorization established by the NWPAA, and the absence of other concrete DOE plans to store the spent fuel, it seems unlikely that DOE will meet the 1998 deadline for taking title to spent fuel, unless DOE is successful in its efforts to work with Congress to modify the linkages. (Under section 302(a)(5)(B) of the NWPAA, "...the Secretary, beginning not later than January 31, 1998, will dispose of the high-level radioactive waste or spent nuclear fuel [subject to disposal contracts].") This potential problem does not, however, affect the Commission's confidence that storage capacity will be made available as needed.

The possibility of a dispute between DOE and utilities over the responsibility for providing spent fuel storage will not affect the public health and safety or the environment. Uncertainty as to contractual responsibilities raises questions concerning: (1) who will be responsible; (2) at what point in time responsibility for the spent fuel will be transferred; (3) how the fuel will be managed; (4) how the transfer of management responsibility from the utilities to DOE will take place; and (5) how the cost of DOE storage might differ, if at all, from utility storage. Utilities possessing spent fuel in storage under NRC licenses cannot abrogate their safety responsibilities, however. Until DOE can safely accept spent fuel, utilities or some other licensed entity will remain responsible for it.

Estimates of the amount of spent fuel generated have continued to decline. At the time of the Commission's Decision, the Commission cited in Finding 5 the cumulative figure of 58,000 metric tons uranium of spent fuel generated in the year 2000 (See 49 FR 34658, p. 34697, August 31, 1984.) More recently, DOE

estimated 40,200 metric tons the lower reference case which represents the conservative upper bound of commercial nuclear power growth (see "Integrated Data Base for 1989: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics," DOE/RW-0006, Rev. 5, November 1989). Although estimates may show an increase at some date well into the twenty-first century if licenses of some reactors are renewed or extended, this possibility does not affect the Commission's confidence in the availability of safe storage capacity until a repository is operational. The industry has made a general commitment to provide storage capacity, which could include away-from-reactor (AFR) storage capacity. To date, however, utilities have sought to meet storage capacity needs at their respective reactor sites. Thus, a new industry application for AFR storage remains only a potential option, which currently seems unnecessary and unlikely.

Utilities have continued to add storage capacity by reracking spent fuel pools, and NRC expects continued reracking where it is physically possible and represents the least costly alternative. Advances in dry-storage technologies and utility plans both have a positive effect on NRC's confidence. At the time the Commission reached its original findings, dry storage of LWR spent fuel was, as yet, unlicensed under 10 CFR part 72, and DOE's dry-storage demonstrations in support of dry-cask storage were in progress at the Idaho National Engineering Laboratory (INEL).

Today, DOE's demonstration efforts have been successful (See Godlewski, N. Z., "Spent Fuel Storage-An Update," *Nuclear News*, Vol. 30, No. 3, March 1987, pp. 47-52, at p. 47.) Dry storage has been licensed at three reactor sites, and three new applications are under review. Dry cask storage is licensed at Virginia Electric Power Company's Surry Power Station site (see License, SNM 2501 under Docket No. 72-2), and dry-concrete module and stainless-steel canister storage is licensed at Carolina Power and Light Company's (CP&L's) H. B. Robinson, Unit 2, site (see License SNM 2502, under Docket No. 72-3). A license was recently granted for a similar modular system at Duke Power

Company's Oconee Nuclear Station site. New applications have been received in 1989 for CP&L's Brunswick site, the Baltimore Gas and Electric Company's Calvert Cliffs site, and in 1990 for Consumer Power Company's Palisades site. Applications are also expected for CP&L's Robinson 2 site (at another onsite location to allow for greater storage capacity) and Wisconsin Electric Power Company's Point Beach site. The Tennessee Valley Authority has indicated that it will apply for a licensed dry storage installation at its Sequoyah plant site.

Thus, the successful demonstration by DOE of dry cask technology for various cask types at INEL, utilities' actions to forestall spent fuel storage capacity shortfalls, and the continuing sufficiency of the licensing record for the Commission to authorize increases in at-reactor storage capacity all strengthen the Commission's confidence in the availability of safe and environmentally sound spent fuel storage capacity.

Renewal of reactor OLS will involve consideration of how additional spent fuel generated during the extended term of the license will be stored onsite or offsite. There will be sufficient time for construction and licensing of any additional storage capacity needed.

In summary, the Commission finds no basis to change the Fifth Finding in its Waste Confidence Decision. Changes by the NWPAA, which may lessen the likelihood of an MRS facility, and the potential for some slippage in repository availability to the first quarter of the twenty-first century (see our discussion of Finding 2) are more than offset by the continued success of utilities in providing safe at-reactor-site storage capacity in reactor pools and their progress in providing independent onsite storage. Therefore, the Commission continues to find "...reasonable assurance that safe independent onsite spent fuel storage or offsite spent fuel storage will be made available if such storage is needed."

Dated at Rockville, Maryland, this 11th day of September 1990.

For the Nuclear Regulatory Commission,
Samuel J. Chilk,

Secretary of the Commission.

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NUCLEAR REGULATORY COMMISSION

10 CFR Part 51

RIN 3150-AD63

Environmental Review for Renewal of Nuclear Power Plant Operating Licenses

AGENCY: Nuclear Regulatory Commission.

ACTION: Final rule.

SUMMARY: The Nuclear Regulatory Commission (NRC) is amending its regulations regarding environmental protection regulations for domestic licensing and related regulatory functions to establish new requirements for the environmental review of applications to renew the operating licenses of nuclear power plants. The amendment defines those environmental impacts for which a generic analysis has been performed that will be adopted in plant-specific reviews for license renewal and those environmental impacts for which plant-specific analyses are to be performed.

The amendment improves regulatory efficiency in environmental reviews for license renewal by drawing on the considerable experience of operating nuclear power reactors to generically assess many of the environmental impacts that are likely to be associated with license renewal. The amendment also eliminates consideration of the need for generating capacity and of utility economics from the environmental reviews because these matters are under the regulatory jurisdiction of the States and are not necessary for the NRC's understanding of the environmental consequences of a license renewal decision.

The increased regulatory efficiency will result in lower costs to both the applicant in preparing a renewal application and to the NRC for

reviewing plant-specific applications and better focus of review resources on significant case specific concerns. The results should be a more focused and therefore a more effective NEPA review for each license renewal. The amendment will also provide the NRC with the flexibility to address unreviewed impacts at the site-specific stage of review and allow full consideration of the environmental impacts of license renewal.

The NRC is soliciting public comment on this rule for a period of 30 days. In developing any comment specific attention should be given to the treatment of low-level waste storage and disposal impacts, the cumulative radiological effects from the uranium fuel cycle, and the effects from the disposal of high-level waste and spent fuel.

DATES: Absent a determination by the NRC that the rule should be modified, based on comments received, the final rule shall be effective on August 5, 1996. The comment period expires on July 5, 1996.

ADDRESSES: Send comments to: The Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, Attention: Docketing and Services Branch, or hand deliver comments to the Office of the Secretary, One White Flint North, 11555 Rockville Pike, Rockville, Maryland between 7:30 a.m. and 4:15 p.m. on Federal workdays. Copies of comments received and all documents cited in the supplementary information may be examined at the NRC Public Document Room, 2120 L Street NW. (Lower Level), Washington, DC between the hours of 7:45 a.m. and 4:15 p.m. on Federal workdays.

FOR FURTHER INFORMATION CONTACT: Donald P. Cleary, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, telephone: (301) 415-6263; e-mail DPC@nrc.gov.

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I. Introduction

The Commission has amended its environmental protection regulations in 10 CFR part 51 to improve the efficiency of the process of environmental review for applicants seeking to renew an operating license for up to an additional 20 years. The amendments are based on the analyses conducted for and reported in NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (May 1996). The Commission's initial decision to undertake a generic assessment of the environmental impacts associated with the renewal of a nuclear power plant operating license was motivated by its beliefs that:

- (1) License renewal will involve nuclear power plants for which the

environmental impacts of operation are well understood as a result of data evaluated from operating experience to date;

(2) Activities associated with license renewal are expected to be within this range of operating experience, thus environmental impacts can be reasonably predicted; and

(3) Changes in the environment around nuclear power plants are gradual and predictable with respect to characteristics important to environmental impact analyses.

Although this amendment is consistent with the generic approach and scope of the proposed amendment published on September 17, 1991 (56 FR 47016), several significant modifications have been made in response to the public comments received. The proposed amendment would have codified the findings reached in the draft generic environmental impact statement (GEIS) as well as certain procedural requirements. The draft GEIS established the bounds and significance of potential environmental impacts at 118 light-water nuclear power reactors that, as of 1991, were licensed to operate or were expected to be licensed in the future.

All potential environmental impacts and other matters treated by the NRC in an environmental review of nuclear power plants were identified and combined into 104 discrete issues. For each issue, the NRC staff established generic findings encompassing as many nuclear power plants as possible. These findings would have been codified by the proposed amendment. Of the 104 issues reviewed for the proposed rule, the staff determined that 80 issues could be adequately addressed generically and would not have been reviewed in plant-specific license renewal reviews. For 22 of the issues, it was found that the issue was adequately addressed for some but not all plants. Therefore, a plant-specific review would be required to determine whether the plant is covered by the generic review or whether the issue must be assessed for that plant. The proposed amendment provided guidance on the application of these findings at the site-specific license renewal stage. For the two remaining issues, it was found that the issue was not generically addressed for any plant, and thus a plant-specific review would have been required for all plants.

Other major features of the proposed amendment included a conditional finding of a favorable cost-benefit balance for license renewal and a provision for the use of an environmental assessment that would address only those issues requiring

plant-specific review. A finding of no significant impact would have resulted in a favorable cost-benefit balance for that plant. If a finding of no significant impact could not be made for the plant, there would have to have been a determination as to whether the impacts found in the environmental assessment were sufficient to overturn the conditional cost-benefit balance found in the rule.

Although the final amendments to 10 CFR part 51 maintain the same generic approach used in the proposed rule, there are several modifications. The final amendments to 10 CFR part 51 now contain 92 issues. The reduction of the number of issues from 104 in the proposed rule to 92 in the final rule is due to (1) the elimination from the review of the consideration of the need for electric power and associated generating capacity and of the direct economic benefits and costs associated with electric power, (2) removing alternatives as an issue from Table B-1 and addressing review requirements only in the text of the rule, (3) combining the five severe accident issues used in the proposed rule into one issue, (4) eliminating several regional economic issues under socioeconomics that are not directly related to environmental impacts, (5) making minor changes to the grouping of issues under aquatic ecology and groundwater, (6) identifying collective offsite radiological impacts associated with the fuel cycle and all impacts of high level waste and spent fuel disposal as separate issues, and (7) adding environmental justice as an issue for consideration.

Of the 92 issues in the final rule, 68 issues were found to be adequately addressed in the GEIS, and therefore, additional assessment will not be required in a plant-specific review. Twenty-four issues were found to require additional assessment for at least some plants at the time of the license renewal review. In the final rule, the 2 issues in the proposed rule that would have required review for all plants are now included in the set of 24 issues of the final rule.

Public comments on the adequacy of the analysis for each issue were considered by the NRC staff. Any changes to the analyses and findings that were determined to be warranted were made in the final GEIS and incorporated in the rule. Several changes were made to the procedural features of the proposed rule in response to comments by the Council on Environmental Quality, the Environmental Protection Agency, and a number of State agencies. First, the NRC

will prepare a supplemental site-specific environmental impact statement (SEIS), rather than an environmental assessment (as initially proposed), for each license renewal application. The SEIS will be issued for public comment as part of the individual plant review process. The NRC will delay any conclusions regarding the acceptability of the overall impacts of the license renewal until completion of the site-specific review. In addition, the SEIS will be prepared in accordance with existing public scoping requirements. The NRC will also review and consider any new and significant information presented during the review of individual license renewal applications. In addition, any person may challenge the validity of the conclusions codified in the rule by filing a petition for rulemaking pursuant to 10 CFR 2.802. Finally, the NRC will review the rule and the GEIS on a schedule that allows revisions, if required, every 10 years. This review will be initiated approximately 7 years after the completion of the previous revision cycle.

In addition to the changes involving public participation, this final rule also contains several changes regarding the scope of analysis and conclusions in the rule and GEIS. The conditional cost-benefit balance has been removed from the GEIS and the rule. In place of the cost-benefit balancing, the NRC will use a new standard that will require a determination of whether or not the adverse environmental impacts of license renewal are so great, compared with the set of alternatives, that preserving the option of license renewal for future decisionmakers would be unreasonable. The final amendment also eliminates NRC's consideration of the need for generating capacity and the preparation of power demand forecasts for license renewal applications. The NRC acknowledges the primacy of State regulators and utility officials in defining energy requirements and determining the energy mix within their jurisdictions. Therefore, the issue of need for power and generating capacity will no longer be considered in NRC's license renewal decisions. The final GEIS has been revised to include an explicit statement of purpose and need for license renewal consistent with this acknowledgment. Lastly, the final rule has eliminated the consideration of utility economics from license renewal reviews under the National Environmental Policy Act (NEPA) except when such benefits and costs are either essential for a determination regarding the inclusion of an alternative

in the range of alternatives considered or relevant to mitigation. These and other features of the final rule are explained in detail below.

The NRC is soliciting public comment on this rule for a period of 30 days. In developing any comment specific attention should be given to the treatment of low-level waste storage and disposal impacts, the cumulative radiological effects from the uranium fuel cycle, and the effects from the disposal of high-level waste and spent fuel. Absent a determination by the NRC that the rule should be modified, based on comments received, the final rule shall be effective on August 5, 1996.

II. Rulemaking History

In 1986, the NRC initiated a program to develop license renewal regulations and associated regulatory guidance in anticipation of applications for the renewal of nuclear power plant operating licenses. A solicitation for comments on the development of a policy statement was published in the **Federal Register** on November 6, 1986 (51 FR 40334). However, the Commission decided to forgo the development of a policy statement and to proceed directly to rulemaking. An advance notice of proposed rulemaking was published on August 29, 1988 (53 FR 32919). Subsequently, the NRC determined that, in addition to the development of license renewal regulations focused on the protection of health and safety, an amendment to its environmental protection regulations in 10 CFR part 51 was warranted.

On October 13, 1989 (54 FR 41980), the NRC published a notice of its intent to hold a public workshop on license renewal on November 13 and 14, 1989. One of the workshop sessions was devoted to the environmental issues associated with license renewal and the possible merit of amending 10 CFR part 51. The workshop is summarized in NUREG/CP-0108, "Proceedings of the Public Workshop on Nuclear Power Plant License Renewal" (April 1990). Responses to the public comments submitted after the workshop are summarized in NUREG-1411, "Response to Public Comments Resulting from the Public Workshop on Nuclear Power Plant License Renewal" (July 1990).

On July 23, 1990, the NRC published an advance notice of proposed rulemaking (55 FR 29964) and a notice of intent to prepare a generic environmental impact statement (55 FR 29967). The proposed rule was published on September 17, 1991 (56 FR 47016). The same **Federal Register** notice described the supporting

documents that were available and announced a public workshop to be held on November 4-5, 1991. The supporting documents for the proposed rule included:

(1) NUREG-1437, "Draft Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (August 1991);

(2) NUREG-1440, "Regulatory Analysis of Proposed Amendments to Regulations Concerning the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses: Draft Report for Comment" (August 1991);

(3) Draft Regulatory Guide DG-4002, Proposed Supplement 1 to Regulatory Guide 4.2, "Guidance for the Preparation of Supplemental Environmental Reports in Support of an Application To Renew a Nuclear Power Station Operating License" (August 1991); and

(4) NUREG-1429, "Environmental Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants: Draft Report for Comment" (August 1991).

After the comment period, the NRC exchanged letters with the Council on Environmental Quality (CEQ) and the Environmental Protection Agency (EPA) to address their concerns about procedural aspects of the proposed rule. The Commission also decided that the staff should discuss with the States the concerns raised in comments by a number of States that certain features of the proposed rule conflicted with State regulatory authority over the need for power and utility economics. To facilitate these discussions, the NRC staff developed an options paper entitled "Addressing the Concerns of States and Others Regarding the Role of Need for Generating Capacity, Alternative Energy Sources, Utility Costs, and Cost-Benefit Analysis in NRC Environmental Reviews for Relicensing Nuclear Power Plants: An NRC Staff Discussion Paper." A **Federal Register** notice published on January 18, 1994 (59 FR 2542) announced the scheduling of three regional workshops during February 1994 and the availability of the options paper. A fourth public meeting on the State concerns was held in May 1994 in order for the NRC staff to better understand written proposals that had been submitted by two industry organizations after the regional workshops. After considering the comments from the workshops and the written comments, the NRC staff issued a proposed supplement to the proposed rule published on July 25, 1994 (59 FR 37724), that it believed would resolve the States' concerns regarding the

Commission's consideration of need for power and utility economics. Comments were requested on this proposal. The discussion below contains an analysis of these comments and other comments submitted in response to the proposed rule.

III. Analysis of Public Comments

The analysis of public comments and the NRC's responses to these comments are documented in NUREG-1529, "Public Comments on the Proposed 10 CFR part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response" (May 1996). The extent of comments received during the various stages of the rulemaking process and the principal concerns raised by the commenters, along with the corresponding NRC responses to these concerns, are discussed below.

A. Commenters

In response to the **Federal Register** notice on the proposed rule published on September 17, 1991 (56 FR 47016), 68 organizations and 49 private citizens submitted written comments. The 68 organizations included 5 Federal agencies; 26 State, regional, and local agencies; 19 nuclear industry organizations and engineering firms; 3 law firms; and 15 public interest groups. Before the close of the initial comment period, the NRC conducted a 2-day workshop on November 4-5, 1991, in Arlington, Virginia, to discuss the proposed rule. Representatives from Federal agencies, State agencies, utilities, engineering firms, law firms, and public interest groups attended the workshop. Workshop panelists included the NRC staff as well as representatives from the Department of Energy (DOE), Department of Interior (DOI), Environmental Protection Agency (EPA), Council on Environmental Quality (CEQ), several State agencies, the nuclear industry, and public interest groups.

In February 1994, the NRC conducted three public meetings to solicit views on the NRC staff's options for addressing the need for generating capacity, alternative energy sources, economic costs, and cost-benefit analysis in the proposed rule. The intent to hold public meetings and the availability of the options paper was noticed in the **Federal Register** on January 12, 1994 (59 FR 2542). Written comments were also solicited on the options paper. The public meetings were held in Rockville, Maryland; Rosemont, Illinois; and Chicopee, Massachusetts.

Representatives from several States, the National Association of Regulatory Utility Commissioners (NARUC), the nuclear industry, and public interest groups actively participated. Nineteen separate written comments were also submitted, primarily by the States and the nuclear industry. In their submittals, the Nuclear Energy Institute (NEI), formerly known as the Nuclear Management and Resources Council (NUMARC), and Yankee Atomic Electric Company (YAEC) each proposed an approach to handling the issues of need for generating capacity and alternative energy sources in the rule. For the NRC staff to better understand these proposals, an additional public meeting was held with NEI and YAEC on May 16, 1994, in Rockville, Maryland.

After considering the public comments on the NRC staff's options paper, the NRC issued a proposed supplement to the proposed rule; it was published in the *Federal Register* on July 25, 1994 (59 FR 37724). The proposed supplement set forth the NRC staff's approach to the treatment of need for generating capacity and alternative energy sources, as well as the staff's revision to the purpose of and need for the proposed action (i.e., license renewal), which was intended to satisfy the States' concerns and to meet NEPA requirements. Twenty separate written comments were received in response to this solicitation from Federal and State agencies, the nuclear industry, a public interest group, and two private citizens.

B. Procedural Concerns

The commenters on the proposed rule raised significant concerns regarding the following procedural aspects of the rule:

(1) State and public participation in the license renewal process and the periodic assessment of the GEIS findings;

(2) The use of economic costs and cost-benefit balancing; and

(3) Consideration of the need for generating capacity and alternative energy sources in the environmental review of license renewal applications.

Each of these concerns and the NRC response is discussed below.

1. Public Participation and the Periodic Assessment of the Rule and the GEIS

Concern. Many commenters criticized the draft GEIS finding that 80 of 104 environmental issues could be generically applied to all plants and, therefore, would not be subject to plant-specific review at the time of license renewal. As a consequence, these commenters believe they are being denied the opportunity to participate in the license renewal process. Moreover,

they pointed out that the site-specific nature of many important environmental issues does not justify a generic finding, particularly when the finding would have been made 20 years in advance of the decision to renew an operating license. The commenters believe that only a site-specific EIS to support a license renewal decision would satisfy NEPA requirements.

Federal and State agencies questioned how new scientific information could be folded into the GEIS findings because the GEIS would have been performed so far in advance of the actual renewal of an operating license. There were differing views on exactly how the NRC should address this question. A group of commenters, including CEQ and EPA, noted that the rigidity of the proposed rule hampers the NRC's ability to respond to new information or to different environmental issues not listed in the proposed rule. They believe that incorporation of new information can only be achieved through the process of amending the rules. One commenter recommended that, if the NRC decides to pursue the approach of making generic findings based on the GEIS, the frequency of review and update should be specifically stated in the rule. Recommendations on the frequency of the review ranged from 2 years to 5 years.

Response. In SECY-93-032, February 9, 1993, the NRC staff reported to the Commission their discussions with CEQ and EPA regarding the concerns these agencies raised, which were also raised by other commenters, about limiting public comment and the consideration of significant new information in individual license renewal environmental reviews. The focus of the commenters concerns is the limited nature of the site-specific reviews contemplated under the proposed rule. In response, the NRC has reviewed the generic conclusions in the draft rule, expanded the opportunity for site-specific review, and confirmed that what remains as generic is so. Also, the framework for consideration of significant new information has been revised and expanded.

The major changes adopted as a result of these discussions are as follows:

1. The NRC will prepare a supplemental site-specific EIS, rather than an environmental assessment (as initially proposed), for each license renewal application. This SEIS will be a supplement to the GEIS. Additionally, the NRC will review comments on the draft SEIS and determine whether such comments introduce new and significant information not considered in the GEIS analysis. All comments on

the applicability of the analyses of impacts codified in the rule and the analysis contained in the draft supplemental EIS will be addressed by NRC in the final supplemental EIS in accordance with 40 CFR 1503.4, regardless of whether the comment is directed to impacts in Category 1 or 2. Such comments will be addressed in the following manner:

a. NRC's response to a comment regarding the applicability of the analysis of an impact codified in the rule to the plant in question may be a statement and explanation of its view that the analysis is adequate including, if applicable, consideration of the significance of new information. A commenter dissatisfied with such a response may file a petition for rulemaking under 10 CFR 2.802. If the commenter is successful in persuading the Commission that the new information does indicate that the analysis of an impact codified in the rule is incorrect in significant respects (either in general or with respect to the particular plant), a rulemaking proceeding will be initiated.

b. If a commenter provides new information which is relevant to the plant and is also relevant to other plants (i.e., generic information) and that information demonstrates that the analysis of an impact codified in the final rule is incorrect, the NRC staff will seek Commission approval to either suspend the application of the rule on a generic basis with respect to the analysis or delay granting the renewal application (and possibly other renewal applications) until the analysis in the GEIS is updated and the rule amended. If the rule is suspended for the analysis, each supplemental EIS would reflect the corrected analysis until such time as the rule is amended.

c. If a commenter provides new, site-specific information which demonstrates that the analysis of an impact codified in the rule is incorrect with respect to the particular plant, the NRC staff will seek Commission approval to waive the application of the rule with respect to that analysis in that specific renewal proceeding. The supplemental EIS would reflect the corrected analysis as appropriate.

2. The final rule and the GEIS will not include conditional cost-benefit conclusions or conclusions about alternatives. Conclusions relative to the overall environmental impacts including cumulative impacts will be left entirely to each site-specific SEIS.

3. After consideration of the changes from the proposed rule to the final rule and further review of the environmental issues, the NRC has concluded that it is

adequate to formally review the rule and the GEIS on a schedule that allows revisions, if required, every 10 years. The NRC believes that 10 years is a suitable period considering the extent of the review and the limited environmental impacts observed thus far, and given that the changes in the environment around nuclear power plants are gradual and predictable with respect to characteristics important to environmental impact analyses. This review will be initiated approximately 7 years after completion of the last cycle. The NRC will conduct this review to determine what, if anything, in the rule requires revision.

Concern. As part of their comments on the July 1994 **Federal Register** notice, NEI, several utilities, and the DOE asked that the NRC reconsider its understanding with CEQ and EPA regarding the preparation of a site-specific supplemental EIS for each license renewal action. These commenters supported an approach that would allow the preparation of an environmental assessment for reviewing the environmental impacts of license renewal.

Response. The NRC does not agree with this position. The NRC believes that it is reasonable to expect that an assessment of the full set of environmental impacts associated with an additional 20 years of operation of any plant would not result in a "finding of no significant impact." Therefore, the review for any plant would involve an environmental impact statement.

2. Economic Costs and Cost-Benefit Balancing

Concern. State, Federal, and utility representatives expressed concern about the use of economic costs and cost-benefit balancing in the proposed rule and the draft GEIS. Commenters criticized the NRC's heavy emphasis on economic analysis and the use of economic decision criteria. They argued that the regulatory authority over utility economics falls within the States' jurisdiction and to some extent within the jurisdiction of the Federal Energy Regulatory Commission. Commenters also believe that the cost-benefit balancing used in the proposed rule and the draft GEIS went beyond NEPA requirements and CEQ regulations (40 CFR Parts 1500 to 1508). They noted that CEQ regulations interpret NEPA to require only an assessment of the cumulative effects of a proposed Federal action on the natural and man-made environment.

Response. In response to these concerns, the NRC has eliminated the use of cost-benefit analysis and

consideration of utility economics in its NEPA review of a license renewal application except when such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. As discussed in more detail in the following section, the NRC recognizes that the determination of the economic viability of continuing the operation of a nuclear power plant is an issue that should be left to appropriate State regulatory and utility officials.

3. Need for Generating Capacity and Alternative Energy Sources

Concern. In their comments on the proposed rule and the draft GEIS, several States expressed concern that the NRC's analysis of need for generating capacity would preempt or prejudice State energy planning decisions. They argued that the determination of need for generating capacity has always been the States' responsibility. Recommendations on how to address this issue ranged from withdrawing the proposed rule to changing the categorization of the issue so that a site-specific review can be performed, thus allowing for meaningful State and public participation. Almost all the concerned States called on the NRC to modify the rule to state explicitly that NRC's analysis does not preempt a State's jurisdiction over the determination of need for generating capacity.

Regarding the issue of alternative energy sources, several commenters contended that the site-specific nature of the alternatives to license renewal did not justify the generic finding in the GEIS. One significant concern about this finding is the States' perception that a generic finding, in effect, preempts the States' responsibility to decide on the appropriate mix of energy alternatives in their respective jurisdictions.

Three regional public meetings were held during the February 1994 to discuss the concerns of the States. At these meetings, and later in written comments, the State of New York proposed an approach to resolve the problem. The approach was endorsed by several other States. This approach had three major conditions:

(1) A statement in the rule that the NRC's findings on need and alternatives are only intended to satisfy the NEPA requirements and do not preclude the States from making their own determination with respect to these issues;

(2) The designation of the need for generating capacity and alternative

energy sources as Category 3 (i.e., requiring site-specific evaluation); and

(3) A requirement that all site-specific EISs and relicensing decisions reference State determinations of need for generating capacity and alternative energy sources, and that they defer to those State determinations to the maximum extent possible.

Response. After consideration, the NRC staff did not accept all elements of the States' approach because the approach would have continued to require the NRC to consider the need for generating capacity and utility economics as part of its environmental analysis. In addition, the approach would have required the NRC to develop guidelines for determining the acceptability of State economic analyses, which some States may have viewed as an intrusion on their planning process.

The NRC staff developed and recommended another approach, which was published on July 25, 1994 (59 FR 37724), after consideration of information gathered at the regional meetings and from the written comments. This approach, which borrows some elements from NEI and YAEC proposals, has five major features:

(1) Neither the rule nor the GEIS would contain a consideration of the need for generating capacity or other issues involving the economic costs and benefits of license renewal and of the associated alternatives;

(2) The purpose and need for the proposed action (i.e., license renewal) would be defined as preserving the continued operation of a nuclear power plant as a safe option that State regulators and utility officials may consider in their future planning actions;

(3) The only alternative to the proposed action would be the "no-action" alternative, and the environmental consequences of this alternative are the impacts of a range of energy sources that might be used if a nuclear power plant operating license were not renewed;

(4) The environmental review for license renewal would include a comparison of the environmental impacts of license renewal with impacts of the range of energy sources that may be chosen in the case of "no action"; and

(5) The NRC's NEPA decision standard for license renewal would require the NRC to determine whether the environmental impacts of license renewal are so great that preserving the option of license renewal for future decisionmakers would be unreasonable.

The statement that the use of economic costs will be eliminated in this approach refers to the ultimate NEPA decision regarding the comparison of alternatives and the proposed action. This approach does not preclude a consideration of economic costs if these costs are essential to a determination regarding the inclusion of an alternative in the range of alternatives considered (i.e., an alternative's exorbitant cost could render it nonviable and unworthy of further consideration) or relevant to mitigation of environmental impacts. Also, the two local tax issues and the two economic structure issues under socioeconomics in the table would be removed from consideration when applying the decision standard.

Concern. Comments received from several States on the NRC staff's July 1994 recommended approach ranged from rejection to endorsement. Some States supported the three conditions proposed by the State of New York. Several States were still concerned about whether a meaningful analysis of need for generating capacity and alternative energy sources could be undertaken 20 years ahead of time. One State asked that the proposed rule be withdrawn. Another State wanted the proposed rule to be reissued for public comment. CEQ supported the approach proposed by the State of New York. CEQ believed that the NRC's recommended approach was in conflict with the NEPA process because the proposed statement of purpose and need for the proposed action was too narrow and did not provide for an appropriate range of alternatives to the underlying need for the proposed action. CEQ wanted the NRC to address other energy sources as separate alternatives, rather than as consequences of the no-action alternative. Moreover, CEQ stated that the proposed decision standard places a "weighty and improper burden of proof" on consideration of the alternative. The EPA endorsed CEQ's comments. In general, the nuclear industry was supportive of the recommended approach. However, NEI and the utilities strongly expressed the opinion that, with the redefined statement of purpose and need, alternative energy sources would no longer be alternatives to the proposed action and, therefore, need not be considered.

Response. After consideration of the comments received on the Commission's July 1994 proposal, the Commission has modified and clarified its approach in order to address the concerns of CEQ relative to consideration of appropriate alternatives

and the narrow definition of purpose and need. These modifications and clarifications addressed the States' concerns relative to treatment of need for generating capacity and alternatives. Specifically, the Commission has clarified the purpose and need for license renewal in the GEIS as follows:

The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decisionmakers.

Using this definition of the purpose of and need for the proposed action, which stresses options for the generation of power, the environmental review will include a characterization of alternative energy sources as being the alternatives to license renewal and not merely the consequences of the no-action alternative and, thus, it addresses CEQ's concern that the scope of the alternatives analysis is unacceptably restricted.

With respect to the States' concerns regarding need for generating capacity analysis, the NRC will neither perform analyses of the need for power nor draw any conclusions about the need for generating capacity in a license renewal review. This definition of purpose and need reflects the Commission's recognition that, absent findings in the safety review required by the Atomic Energy Act of 1954, as amended, or in the NEPA environmental analysis that would lead the NRC to reject a license renewal application, the NRC has no role in the energy planning decisions of State regulators and utility officials. From the perspective of the licensee and the State regulatory authority, the purpose of renewing an operating license is to maintain the availability of the nuclear plant to meet system energy requirements beyond the term of the plant's current license. The underlying need that will be met by the continued availability of the nuclear plant is defined by various operational and investment objectives of the licensee. Each of these objectives may be dictated by State regulatory requirements or strongly influenced by State energy policy and programs. In cases of interstate generation or other special circumstances, Federal agencies such as the Federal Energy Regulatory Commission (FERC) or the Tennessee Valley Authority (TVA) may be involved in making these decisions. The objectives of the various entities involved may include lower energy cost, increased efficiency of energy

production and use, reliability in the generation and distribution of electric power, improved fuel diversity within the State, and environmental objectives such as improved air quality and minimized land use.

The consideration of alternatives has been shifted to the site-specific review. The rule contains no information or conclusions regarding the environmental impacts of alternative energy sources, it only indicates that the environmental impact of alternatives will be considered during the individual plant review. However, the GEIS contains a discussion of the environmental impacts of alternative energy sources based on currently available information. The information in the GEIS is available for use by the NRC and the licensee in performing the site-specific analysis of alternatives and will be updated as appropriate. For individual plant reviews, information codified in the rule, information developed in the GEIS, and any significant new information introduced during the plant-specific review, including any information received from the State, will be considered in reaching conclusions in the supplemental EIS. The NRC's site-specific comparison of the impacts of license renewal with impacts of alternative energy sources will involve consideration of information provided by State agencies and other members of the public. This approach should satisfy the States' concerns relative to a meaningful analysis of alternative energy sources.

The Commission disagrees with CEQ's assertion that the new decision standard is inappropriate. Under this decision standard, the NRC must determine if the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable. The Commission expects that license renewal would be denied only if the expected environmental effects of license renewal significantly exceed all or almost all alternatives. The Commission believes that this is a reasonable approach to addressing the issue of environmental impacts of license renewal, given NRC's limited role in the area of energy systems planning. The operation of a nuclear power plant beyond its initial license term involves separate regulatory actions, one taken by the utility and the NRC, and the other taken by the utility and the State regulatory authorities. The decision standard would be used by NRC to determine whether, from an environmental perspective, it is

reasonable to renew the operating license and allow State and utility decisionmakers the option of considering a currently operating nuclear power plant as an alternative for meeting future energy needs. The test of reasonableness focuses on an analysis of whether the environmental impacts anticipated for continued operation during the term of the renewed license reasonably compare with the impacts that are expected from the set of alternatives considered for meeting generating requirements. The NRC would reject a license renewal application if the analysis demonstrated that the adverse environmental impacts of the individual license renewal were so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

After the NRC makes its decision based on the safety and environmental considerations, the final decision on whether or not to continue operating the nuclear plant will be made by the utility, State, and Federal (non-NRC) decisionmakers. This final decision will be based on economics, energy reliability goals, and other objectives over which the other entities may have jurisdiction. The NRC has no authority or regulatory control over the ultimate selection of future energy alternatives. Likewise, the NRC has no regulatory power to ensure that environmentally superior energy alternatives are used in the future. Given the absence of the NRC's authority in the general area of energy planning, the NRC's rejection of a license renewal application based on the existence of a single superior alternative does not guarantee that such an alternative will be used. In fact, it is conceivable that the rejection of a license renewal application by the NRC in favor of an individual alternative may lead to the implementation of another alternative that has even greater environmental impacts than the proposed action, license renewal.

Given the uncertainties involved and the lack of control that the NRC has in the future, the Commission believes that it is reasonable to exercise its NEPA authority to reject license renewal applications only when it has determined that the impacts of license renewal sufficiently exceed the impacts of all or almost all of the alternatives that preserving the option of license renewal for future decision makers would be unreasonable. Because the objectives of the utility and State decisionmakers will ultimately be the determining factors in whether a nuclear power plant will continue to operate, NRC's proposed decision

standard is appropriate. The decision standard will not affect the scope or rigor of NRC's analyses, including the consideration of the environmental impacts relevant to the license renewal decision and associated alternatives. The NRC staff believes that, under the circumstances, the decision standard does not place "a weighty and improper burden of proof" on other alternatives as CEQ claims.

With respect to the industry's desire to eliminate consideration of alternative energy sources, the Commission does not agree. The Commission does not support the views of NEI and others that alternative energy sources need not be considered in the environmental review for license renewal. The Commission is not prepared to state that no nuclear power plant will fall well outside the range of other reasonably available alternatives far in advance of an actual relicensing decision. Following NEI's suggestion would not lead to a meaningful set of alternatives with which to compare a proposed action. The Commission has always held the view that alternative sources of energy should be compared with license renewal and continued operation of a nuclear power plant.

Lastly, the Commission does not believe it is necessary to reissue this rule for public comment as a State commenter requested. The Commission has taken many measures to involve the public concerning the resolution of public comments on the proposed rule. The Commission has conducted a number of public meetings and published for public comment its recommended procedural revisions to the proposed rule. The Commission believes that modifications made to the proposed rule reflect the logical outgrowth of the proposed rule based on the public comments received by the Commission.

C. Technical Concerns

1. Category and Impact Magnitude Definitions

Concerns. Many commenters expressed concern that the category definitions and the impact-significance definitions were ambiguous and appeared somewhat interconnected. The EPA expressed concern that mitigation of adverse impacts was not addressed adequately.

Commenters expressed a number of concerns about the use of the applicability categories and the magnitude-level categories. With respect to the applicability categories, concerns ranged from a general concern that Category 1 precludes or hinders public

involvement in an issue at the time of the plant-specific review to specific concerns about the technical adequacy of the analysis supporting a Category 1 finding for an issue. Several commenters believed that the definitions create confusion, especially as to whether the finding of small impact and Category 1 are interdependent. The GEIS appears to use Category 1 and "small" interchangeably. Concern was also expressed that the requirement to consider mitigative actions was inadequately addressed in the draft GEIS and proposed rule.

Response. To reduce potential confusion over the definitions, the use of the categories, and the treatment of mitigation within the context of the categorization scheme, the NRC has revised the definitions to eliminate any ambiguity as to how they are used. Further, the GEIS has been modified to clearly state the reasons behind the category and magnitude findings.

In order to facilitate understanding of the modifications to the GEIS, the previous approach is discussed as follows. In the proposed rule and the draft GEIS, findings about the environmental impact associated with each issue were divided into three categories of applicability to individual plant reviews. These categories were:

- Category 1: A generic conclusion on the impact has been reached for all affected nuclear power plants.
- Category 2: A generic conclusion on the impact has been reached for affected nuclear power plants that fall within defined bounds.
- Category 3: A generic conclusion on the impact was not reached for any affected nuclear power plants.

The significance of the magnitude of the impact for each issue was expressed as one of the three following levels.

- *Small* impacts are so minor that they warrant neither detailed investigation nor consideration of mitigative actions when such impacts are negative.
- *Moderate* impacts are likely to be clearly evident and usually warrant consideration of mitigation alternatives when such impacts are negative.
- *Large* impacts involve either a severe penalty or a major benefit, and mitigation alternatives are always considered when such impacts are negative.

With respect to the categories of applicability, under the proposed rule applicants would have:

- (1) Not provided additional analyses of Category 1 issues;
- (2) Not provided additional analyses if their plant falls within the bounds

defined in the rule for a Category 2 issue;

(3) Provided additional plant-specific analyses if their plant does not fall within the bounds defined in the rule for a Category 2 issue; and

(4) Provided plant-specific analyses of Category 3 issues.

In order to address the comments on these magnitude and category definitions, the GEIS has been modified to clearly state the reasons behind the category and magnitude findings.

The revised definitions are listed below.

- **Category 1:** For the issue, the analysis reported in the Generic Environmental Impact Statement has shown:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic;

(2) A single significance level (i.e., small, moderate, or large) has been assigned to the impacts (except for collective off site radiological impacts from the fuel cycle and from high level waste and spent fuel disposal); and

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

The generic analysis of the issue may be adopted in each plant-specific review. Issues for which the impact was found to be favorable were also defined to be Category 1 issues.

- **Category 2:** For the issue, the analysis reported in the GEIS has shown that one or more of the criteria of Category 1 cannot be met and, therefore, additional plant-specific review is required.

If, for an environmental issue, the three Category 1 criteria apply to all plants, that issue is Category 1 and the generic analysis should be used in a license renewal review for all plant applications. If the three Category 1 criteria apply to a subset of plants that are readily defined by a common plant characteristic, notably the type of cooling system, the population of plants is partitioned into the set of plants with the characteristic and the set without the characteristic. For the set of plants with the characteristic, the issue is Category 1 and the generic analysis should be used in the license renewal review for those plants. For the set of plants without the characteristic, the issue is Category 2 and a site-specific analysis for that issue will be performed

as part of the license renewal review.

The review of a Category 2 issue may focus on the particular aspect of the issue that causes the Category 1 criteria not to be met. For example, severe accident mitigation under the issue "severe accidents" is the focus for a plant-specific review because the other aspects of the issue, specifically the offsite consequences, have been adequately addressed in the GEIS. With the revised definitions, the two issues previously designated as Category 3 are now designated Category 2. For an issue to be a Category 1, current mitigation practices and the nature of the impact were considered and a determination was made that it is unlikely that additional measures will be sufficiently beneficial. In the GEIS, in discussing the impacts for each issue, consideration was given to what is known about current mitigation practices.

The definitions of the significance level of an environmental impact have been revised to make the consideration of the potential for mitigating an impact separate from the analysis leading to a conclusion about the significance level of the impact. Further, the significance level of an impact is now more clearly tied to sustaining specific attributes of the affected resource that are important to its viability, health or usefulness. General definitions of small, moderate and large significance levels are given below. These definitions are adapted to accommodate the resource attributes of importance for each of the environmental issues in the GEIS. The definition of "small" clarifies the meaning of the term as it applies to radiological impacts. The definition of "small" in the proposed rule did not logically apply to such impacts.

The general definitions of significance level are:

- **Small:** For the issue, environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

- **Moderate:** For the issue, environmental effects are sufficient to alter noticeably but not to destabilize important attributes of the resource.

- **Large:** For the issue, environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The discussion of each environmental issue in the GEIS includes an explanation of how the significance category was determined. For issues in

which probability of occurrence is a key consideration (i.e., accident consequences), the probability of occurrence has been factored into the determination of significance. The determination of the significance category was made independently of the consideration of the potential benefit of additional mitigation.

The major concerns (organized by topical areas) about the environmental issues examined in the draft GEIS and the NRC staff's response to those concerns are summarized next.

2. Surface Water Quality

Concern. Several commenters expressed concerns related to the National Pollutant Discharge Elimination System (NPDES) permitting process for surface water discharge. They believe that the NRC may have overlooked its legal obligation to comply with Section 401 of the Clean Water Act (CWA). Their recommendations included withholding approval for license renewal until a facility has complied with Section 401 and treating license renewal as an opportunity for a new NEPA review. On the other hand, other commenters recommended decoupling the NRC relicensing process from the NPDES permitting process.

Response. In issuing individual license renewals, the Commission will comply, as has been its practice, with the provisions of Section 401 of the Federal Water Pollution Control Act (see 10 CFR 51.45(d) and 51.71(c)). In addition, pursuant to Section 511(c) of the Federal Water Pollution Control Act of 1972, the Commission cannot question or reexamine the effluent limitations or other requirements in permits issued by the relevant permitting authorities. Nevertheless, compliance with the environmental quality standards and requirements of these permits does not negate the requirement for the Commission to consider all environmental effects of the proposed action. Accordingly, the Commission has not only taken existing permits into account in its analysis of the water quality impacts of license renewal but has also considered information on actual operating impacts collected from individual plants, State and Federal regulatory agencies, and published literature. As a result of this analysis, the Commission has concluded that the environmental impacts on surface water quality are small for those effluents subject to existing permit or certification requirements. A total decoupling of the license renewal process and the NPDES permitting process is not appropriate because, for

issues with incomplete Clean Water Act determinations, the NRC cannot complete its weighing and balancing of impacts without independently addressing the issues.

Concern. Several commenters raised concerns that various issues within the Surface Water Quality topic should be Category 2 or 3 issues. These included water use conflicts as experienced in Arizona and the Midwest, thermal stratification and salinity gradients associated with once-through cooling systems, and the toxicity of biofouling compounds.

Response. Regarding the water use conflicts, the NRC has considered the impacts of water use during the renewal period and has concluded that these impacts are small for plants with a once-through cooling system and that this is a Category 1 issue for those plants. However, this issue is designated Category 2 for plants with cooling towers and cooling ponds because, for those plants, the impacts might be moderate (they could also be small). In either case, pursuant to 10 CFR 51.45(d), an applicant for license renewal must identify and indicate in its environmental report the status of State and local approvals regarding water use issues. For those reactor sites where thermal stratification or salinity gradient was found to be the most pronounced, the issues were reviewed during preparation of the GEIS and found to be acceptable by the States within the NPDES process. No change in the categorization in the GEIS would be required. Similarly, the NPDES permit for a facility establishes allowable discharges, including biocides. The NRC has no indication that residual environmental impacts would occur as a result of license renewal activities at any nuclear plant site other than perhaps water use conflicts arising at plants with cooling ponds or cooling towers using make-up water from a small river with low flow. For those plants, this issue is Category 2.

3. Aquatic Ecology

Concern. A number of comments regarding the ecological impact of cooling water withdrawal from aquatic bodies were received. Specific concerns included fish kills associated with the entrainment and impingement of fish within once-through and cooling pond cooling systems, the use of chlorine and molluscicides to control mussel and clam growth, and the long-term effects of heavy metal discharges from plants with copper-nickel condenser tubes. Another commenter noted that license extension affords the opportunity to review the intake and discharge

configuration of plant cooling water systems, since the best available technology that is economically available may be different given the additional 20 years of plant operating life.

Response. The Commission has considered the impacts of license renewal on aquatic ecology and, in doing so, has reviewed existing NPDES permits and other information. Based on this analysis, the Commission has concluded that these impacts are small with the exception that plants with once-through cooling and cooling ponds may have larger effects associated with entrainment of fish and shellfish in early life stages, impingement, and heat shock. Agencies responsible for existing permits are not constrained from reexamining the permit issues if they have reason to believe that the basis for their issuance is no longer valid. The Commission does not have authority under NEPA to impose an effluent limitation other than those established in permits issued pursuant to the Clean Water Act. The problem of the long-term effects of heavy metal discharges from plants with copper-nickel condenser tubes has been found at only one plant. The affected condenser tubes have been replaced with tubing of a more corrosion-resistant material.

Concern. A commenter pointed out that the issue of riparian zones should be addressed in the GEIS because the vegetation region along a water course can be affected by water withdrawal and is important in maintaining the habitat.

Response. The NRC agrees with the importance of addressing the impacts of license renewal on the riparian habitat. The final GEIS provides a discussion of the riparian habitat as an important resource and the potential effects of consumptive water use on riparian zones.

4. Groundwater Use and Quality

Concern. Several commenters indicated that groundwater issues should be reviewed on a site-specific basis because of groundwater use conflicts (in particular, the effect on aquifer recharge of using surface water for cooling water), opportunities for saltwater intrusion, and concerns over tritium found in wells at one site. On the other hand, a commenter requested that the issue of groundwater use for cooling tower makeup water be changed from Category 2 to Category 1 because the issue is based solely on data from Ranney wells at the Grand Gulf Nuclear Station, where tests have shown that the elevation of the water plain around Grand Gulf is not dropping.

Response. Based on consideration of comments, the issue of groundwater use conflicts resulting from surface water withdrawals for cooling tower makeup water or cooling ponds is now Category 2 for plants withdrawing surface water from small water bodies during low flow conditions. The GEIS has identified a potential reduction in aquifer recharge as a result of competing water use. These conflicts are already a concern at two closed-cycle nuclear power plants. The NRC does not agree that saltwater intrusion should be considered a Category 2 issue. When saltwater intrusion has been a problem, the major cause has been the large consumption of groundwater by agricultural and municipal users. Groundwater consumption by nuclear power plants is small by comparison and does not contribute significantly to the saltwater intrusion problem. With regard to traces of tritium found in the groundwater at one nuclear power plant, the tritium was attributed to a modification in the plant's inlet and discharge canal that did not take into consideration a unique situation in topology and groundwater flow. The releases were minor and the situation has been corrected.

Regarding the issue of the use of groundwater for cooling water makeup, the NRC has designated this issue as Category 2 even though only the Grand Gulf Nuclear Station is currently using Ranney wells to withdraw groundwater. This water intake does not conflict with other groundwater uses in the area. It is not possible to predict whether or not water use conflicts will occur at the Grand Gulf facility in the future. It is also not possible to determine the significance of the environmental impacts associated with Ranney well use at other nuclear plants that may choose to adopt this method in the future.

5. Terrestrial Ecology

Concern. Several commenters recommended that the issue of bird mortality resulting from collisions with transmission lines, towers, or cooling towers be characterized as a Category 2 issue. Such a characterization would provide for a review of mitigation at those plants with cooling towers that do not have illumination and for power plant transmission lines that transect major flyways or that cross wetlands used by large concentrations of birds.

Response. The NRC does not agree with this recommendation. The GEIS cites several studies that conclude that bird mortalities resulting from collision with transmission lines, towers, or cooling towers are not significantly

reducing bird populations. Mitigation measures in place, such as safety lights, were found adequate and additional measures were not warranted. Therefore, the issue remains a Category 1 issue because refurbishment will not involve construction of any additional transmission lines or natural draft cooling towers.

Concern. One commenter expressed concern that the GEIS analysis of land use did not adequately encompass the impact of onsite spent fuel storage on land use and that the Category 1 finding is questionable. A specific concern was the potential need for the construction of additional spent fuel storage facilities associated with the license renewal term, along with their associated impacts on the terrestrial environment.

Response. The NRC does not agree that there is a need to change the Category 1 determination for onsite land use. Waste management operations could require the construction of additional storage facilities and thus adversely affect land use and terrestrial ecology. However, experience has shown that the land requirements would be relatively small (less than 9 acres), impacts to land use and terrestrial ecology would also be relatively small, and the land that may be used is already possessed by the applicant; thus, its basic use would not be altered. Onsite land use is Category 1. Terrestrial ecology with disturbance of sensitive habitat is treated as a separate issue and is Category 2.

6. Human Health

Concern. In the human health section of the GEIS, the radiological impacts of plant refurbishment and continued operations during the license renewal term to workers and the general public were examined. Several commenters indicated that it was inappropriate to compare the radiation exposures associated with license renewal to natural background levels. These commenters believed that the appropriate argument should be that the risks associated with the additional exposures are so small that no additional mitigative measures are required.

Response. The NRC agrees that the assessment of radiation exposure should not be simply a comparison with background radiation. In response to comments on the draft generic environmental impact statement and the proposed rule, the standard defining a small radiological impact has changed from a comparison with background radiation to sustained compliance with the dose and release limits applicable to the various stages of the fuel cycle. This

change is appropriate and strengthens the criterion used to define a small environmental impact for the reasons that follow. The Atomic Energy Act requires the Nuclear Regulatory Commission to promulgate, inspect and enforce standards that provide an adequate level of protection of the public health and safety and the environment. The implementation of these regulatory programs provides a margin of safety. A review of the regulatory requirements and the performance of facilities provides the bases to project continuation of performance within regulatory standards. For the purposes of assessing radiological impacts, the Commission has concluded that impacts are of small significance if doses to individuals and releases do not exceed the permissible levels in the Commission's regulations.

With respect to whether additional mitigative measures are required, it should be noted that in 10 CFR parts 20 and 50 there are provisions that radiological impacts associated with plant operation be reduced to levels as low as reasonably achievable (ALARA).

Concern. Several commenters indicated that the GEIS needs a broader treatment of uncertainty as it relates to human health issues.

Response. The NRC agrees that there is considerable uncertainty associated with health effects, especially at low occupational and public dose levels, and particularly with respect to electromagnetic fields. Health effect estimates from radiation exposures are based on the best scientific evidence available and are considered to be conservative estimates. Several sections of the GEIS have been expanded to more thoroughly explain how predicted impacts could be affected by changes in scientific information or standards.

Concern. One commenter indicated that, in the GEIS and the proposed rule, risk coefficients should have been used for chemicals and radiation to obtain upper bound risk estimates of cancer incidence.

Response. The NRC does not agree with this comment. In making comparisons of alternatives, comparisons of the central or best estimates of impacts are consistent with NEPA requirements because they provide the fairest determination. The GEIS is written using current, Commission-approved risk estimators.

Concern. Two commenters expressed concern regarding the GEIS conclusion that the impact of radiation exposure to the public is small, citing a study done by the Massachusetts Department of Public Health (MDPH). This study concluded that adults who live within

10 miles of the Pilgrim Nuclear Power Plant have a risk of contracting leukemia four times greater than other individuals.

Response. The NRC staff reviewed the MDHP study and compared it with various other studies. The results of the study have been contradicted by a National Cancer Institute (NCI) study entitled "Cancer in Populations Living Near Nuclear Facilities" (July 1990). The NCI study, which included the Pilgrim plant in its analysis, found no reason to suggest that nuclear facilities may be linked causally with excess deaths from leukemia or from other cancers. The findings of the NCI study are consistent with the findings of several similar epidemiological studies in foreign countries and with the latest conclusions of expert bodies such as the National Research Council's Committee on the Biological Effects of Ionizing Radiation. The NRC continues to base its assessment of the health effects of ionizing radiation on the overall body of scientific knowledge and on the recommendations of expert groups.

7. Socioeconomics

Concern. A commenter concerned with historic preservation pointed out that this issue must be addressed through compliance with the National Historic Preservation Act (NHPA) and cannot be resolved generically.

Response. The NRC agrees with this comment. Historical and archaeological impacts have been changed from a Category 1 to a Category 2 issue (that is, it must be evaluated site-specifically). Consultation with State historical preservation offices and other Government agencies, as required by NHPA, must be undertaken to determine whether protected historical or archaeological resources are in areas that might be disturbed during refurbishment activities and operation during the renewal period.

Concern. Several commenters indicated that transportation issues associated with refurbishment activities should be changed from Category 3 to Category 2 because the impacts will be insignificant in the majority of cases. One recommendation was to use a level of service (LOS) determination for specific plants as the bounding criterion. The analysis would require that LOS be determined for that part of the refurbishment period during which traffic not related to the plant is expected to be the heaviest. Another recommendation was to establish bounding criteria based on past major routine outages.

Response. The NRC agrees that use of the LOS approach may prove to be

Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*), the information collection or recordkeeping requirements included in this rule have been approved by the Office of Management and Budget (OMB) under OMB control number 0579-0129.

List of Subjects in 7 CFR Part 319

Bees, Coffee, Cotton, Fruits, Honey, Imports, Logs, Nursery Stock, Plant diseases and pests, Quarantine, Reporting and recordkeeping requirements, Rice, Vegetables.

Accordingly, we are amending 7 CFR part 319 as follows:

PART 319—FOREIGN QUARANTINE NOTICES

1. The authority citation for part 319 continues to read as follows:

Authority: 7 U.S.C. 150dd, 150ee, 150ff, 151-167, 450, 2803, and 2809; 21 U.S.C. 136 and 136a; 7 CFR 2.22, 2.80, and 371.2(c).

2. In § 319.56-2ff, new paragraphs (j) and (k) are added to read as follows:

§ 319.56-2ff Administrative instructions governing movement of Hass avocados from Mexico to the Northeastern United States.

* * * * *

(j) *Repackaging.* If any avocados are removed from their original shipping boxes and repackaged, the stickers required by paragraph (c)(3)(vi) of this section may not be removed or obscured and the new boxes must be clearly marked with all the information required by paragraph (c)(3)(vii) of this section.

(k) *Compliance agreements.* (1) Any person, other than the permittee, who moves or distributes the avocados following their importation into the United States (i.e., a second-party or subsequent handler) must enter into a compliance agreement with APHIS. In the compliance agreement, the person must acknowledge, and agree to observe, the requirements of paragraph (a) and paragraphs (f) through (k) of this section. Compliance agreement forms are available, free of charge, from local offices of Plant Protection and Quarantine, which are listed in local telephone directories. A compliance agreement will not be required for an individual place of business that only offers the avocados for sale directly to consumers.

(2) Before transferring the avocados to any person (i.e., a second-party handler) for movement or distribution, the permittee must confirm that the second-party handler has entered into a

compliance agreement with APHIS as required by paragraph (k)(1) of this section. If the permittee transfers the avocados to a second-party handler who has not entered into a compliance agreement, APHIS may revoke the permittee's import permit for the remainder of the current shipping season.

(3) Any second-party or subsequent handler who transfers the avocados to another person for movement or distribution must confirm that the person receiving the avocados has entered into a compliance agreement with APHIS as required by paragraph (k)(1) of this section. If the second-party or subsequent handler transfers the avocados to a person who has not entered into a compliance agreement, APHIS may revoke the handler's compliance agreement for the remainder of the current shipping season.

(4) *Action on repeat violators.* APHIS may deny an application for an import permit from, or refuse to enter into a compliance agreement with, any person who has had his or her import permit or compliance agreement revoked under paragraph (k)(2) or (k)(3) of this section twice within any 5-year period.

(Approved by the Office of Management and Budget under control number 0579-0129.)

Done in Washington, DC, this 30th day of November 1999.

Craig A. Reed,
Administrator, Animal and Plant Health Inspection Service.

[FR Doc. 99-31513 Filed 12-3-99; 8:45 am]

BILLING CODE 3410-34-U

NUCLEAR REGULATORY COMMISSION

10 CFR Part 51

Waste Confidence Decision Review: Status

AGENCY: Nuclear Regulatory Commission.

ACTION: Status report on the review of the Waste Confidence Decision.

SUMMARY: On September 18, 1990 (55 FR 38474), the Nuclear Regulatory Commission (NRC) issued the results of the first review of its Waste Confidence Decision, originally issued on August 31, 1984 (49 FR 34658). The purpose of the original Waste Confidence Decision was "to assess the degree of assurance now available that radioactive waste can be safely disposed of, to determine when such disposal or offsite storage will be available and to determine whether radioactive waste can be safely stored onsite past the expiration of

existing facility licenses until offsite disposal or storage is available." (49 FR 34658). In 1984, the Commission concluded that there was reasonable assurance that safe disposal in a geologic repository is technically feasible, one or more repositories would be available by the years 2007-2009, and spent fuel will be managed in a safe manner until sufficient repository capacity is available. The 1990 review of this decision basically affirmed the findings of the original decision and further determined that spent fuel could be safely stored and managed under existing processes through the first quarter of the 21st century and 30 years beyond the licensed life for power reactor operation. In its 1990 review, the Commission stated that its next review of the waste confidence issues would occur in ten years. As the ten year period for review approaches, the Commission is issuing this notice on its intent with regard to further Waste Confidence reviews. The Commission is of the view that experience and developments since 1990 confirm the Commission's 1990 Waste Confidence findings. Thus, the Commission has decided that a comprehensive evaluation of the Waste Confidence Decision at this time is not necessary. The Commission would consider undertaking a comprehensive evaluation when the impending repository development and regulatory activities have run their course or if significant and pertinent unexpected events occur, raising substantial doubt about the continuing validity of the 1990 Waste Confidence findings.

FOR FURTHER INFORMATION CONTACT: Janet Kotra, Office of Nuclear Materials Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington DC 20555, telephone (301) 415-6674.

SUPPLEMENTARY INFORMATION:

- I. Background
- II. Ongoing Repository Development and Spent Fuel Storage Activities
- III. The Next Review

I. Background

In 1977, the Commission denied a petition for rulemaking wherein the U.S. Nuclear Regulatory Commission (NRC) was asked to determine whether radioactive wastes generated in nuclear power reactors can be disposed of without undue risk to public health and safety and to refrain from granting pending or future requests for reactor operating licenses until such finding of disposal safety was made. The Commission noted in its denial that it " * * * would not continue to license reactors if it did not have reasonable

confidence that the wastes can and will in due course be disposed of safely.”

At about the same time, the Commission granted license amendments permitting expansion of the capacity of spent fuel storage pools at two nuclear power plants, finding that the actions would not endanger public health and safety. The Commission did not address the potential environmental consequences of such storage beyond the expiration of the reactors' operating licenses. Upon appeal of the license amendment decisions, the US Court of Appeals declined to stay or vacate the license amendments but remanded to NRC the question of whether reasonable assurance exists that an offsite storage solution will be available by the years 2007–2009, the expiration dates of the plants' operating licenses, and, if not, whether there is reasonable assurance that spent fuel can be stored safely at the reactor sites beyond those dates.

In response to the Court's remand, NRC conducted a generic rulemaking to assess the degree of assurance that radioactive wastes can be disposed of safely, to determine when disposal or offsite storage will be available, and to determine whether the wastes can be stored safely at reactor sites beyond the expiration of existing facility licenses until offsite disposal or storage is available. This rulemaking came to be known as the “Waste Confidence” proceeding. On August 31, 1984 (49 FR 34658; 49 FR 34688), the Commission issued five findings, accompanied by a final rule, codified at 10 CFR 51.23, incorporating the findings as the basis for excluding case-by-case consideration of environmental effects of extended onsite storage of spent fuel in reactor and spent fuel storage facility licensing proceedings. The Commission's basic conclusions were that there was reasonable assurance that safe disposal in a geologic repository is technically feasible, that one or more repositories would be available by the years 2007–2009, and that spent fuel will be managed in a safe manner until sufficient repository capacity is available.

In the 1984 Decision, the Commission noted that its decision with respect to the availability of a repository for disposal was unavoidably in the nature of a prediction, and indicated that it would review its conclusions should significant and pertinent unexpected events occur or at least every five years until a repository is available. The first review was completed in 1990 (55 FR 38474; September 18, 1990). The conclusions reached and the findings made in the Commission's 1990 review

of the original Waste Confidence Decision were:

1. The Commission finds reasonable assurance that safe disposal of radioactive waste and spent fuel in a mined geologic repository is technically feasible. (This finding is identical to the finding in the original Waste Confidence Decision in 1984).

2. The Commission finds reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and that sufficient repository capacity will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial high-level radioactive waste and spent fuel originating in such reactor and generated up until that time. (This finding revised the finding in the original decision that a mined geologic repository would be available by the years 2007 to 2009.)

3. The Commission finds reasonable assurance that high-level radioactive waste and spent fuel will be managed in a safe manner until sufficient repository capacity is available to assure the safe disposal of all high-level waste and spent fuel. (This finding is identical to the finding in the original Waste Confidence Decision in 1984).

4. The Commission finds reasonable assurance that, if necessary, spent fuel can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations. (This finding is basically identical to that in the original Waste Confidence Decision with the addition of the consideration of license renewal and spent fuel storage 30 years beyond the licensed life for operation of a reactor).

5. The Commission finds reasonable assurance that safe independent onsite or offsite spent fuel storage will be made available if such storage capacity is needed. (This finding is identical to the finding in the original Waste Confidence Decision in 1984).

In issuing the 1990 review of the Waste Confidence Decision, the Commission extended the cycle for future reviews from every five years to every ten years. The rationale for this extension was that predictions of repository availability are best expressed in terms of decades rather than years. The Commission also affirmed its original statement that it

would reevaluate its Decision at any time whenever significant and pertinent unexpected events occur, such as major shifts in national policy or a major unexpected institutional development, or new technical information.

II. Ongoing Repository Development and Spent Fuel Storage Activities

We are now nearing the end of the ten year period since the last review of the Waste Confidence Decision. Since the 1990 revisions of the Waste Confidence findings, the U.S. Department of Energy's (DOE) program for characterizing a single site at Yucca Mountain, Nevada, as a potential geologic repository has progressed and is nearing completion. DOE published a viability assessment on the proposed repository in December of 1998 and a draft environmental impact statement (EIS) in August of 1999. It is expected that DOE will complete a final EIS in 2000, such that a recommendation with regard to suitability of the Yucca Mountain site, pursuant to the Nuclear Waste Policy Act of 1982, as amended (NWPA), can be made in 2001. If DOE is able to advise the President that the Yucca Mountain site is suitable for development as a repository, and the President accepts the Secretary of Energy's recommendation, DOE intends to submit a license application to NRC in 2002. In addition, NRC has proposed 10 CFR Part 63 which would establish a framework for licensing consideration of the repository. Similarly, the Environmental Protection Agency (EPA) has published its proposed standards for repository licensing. Thus, there has been substantial progress toward consideration and possible licensing of a repository.

As to spent fuel storage capabilities and capacity, the NRC has continued to review commercial dual-purpose spent fuel dry cask storage and transportation system designs and site-specific license applications for onsite dry storage of spent fuel to meet the interim storage needs of reactor licensees. In addition, the NRC is reviewing an application for an away-from-reactor Independent Spent Fuel Storage Installation (ISFSI), and a second application is expected in fiscal year 2000. The NRC staff has noted substantial advances in spent fuel storage—the certifications of a number of new spent fuel storage cask designs; additional interim dry cask storage capacity at power reactor sites; the NRC's establishment of a Spent Fuel Project Office to more effectively focus on interim spent fuel storage and management—since waste confidence findings were last reviewed in 1990.

These considerations confirm and strengthen the Commission's 1990 findings and lead the Commission to conclude that no significant and unexpected events have occurred—no major shifts in national policy, no major unexpected institutional developments, no unexpected technical information—that would cast doubt on the Commission's Waste Confidence findings or warrant a detailed reevaluation at this time. As a result, a formal review of these activities now would not call into serious question the Commission's Waste Confidence findings, as updated in 1990. The Commission, therefore, is not undertaking any modification to the findings codified in 10 CFR 51.23. However, when the nearer term activities on repository development and licensing are concluded, there may be implications for the Waste Confidence findings. If warranted, the Commission will consider undertaking a comprehensive review at that time.

III. The Next Review

The appropriate trigger for the next review could be a combination of events or it could be a single event. For example, any significant delays in DOE's repository development schedule or a decision by the Secretary of Energy to not recommend Yucca Mountain as a candidate site might necessitate a reevaluation of the Commission's Waste Confidence Decision. Thus, the Commission would consider undertaking a comprehensive reevaluation of the Waste Confidence findings when the impending repository development and regulatory activities run their course or if significant and pertinent unexpected events occur, raising substantial doubt about the continuing validity of the Waste Confidence findings.

Dated at Rockville, Maryland, this 30th day of November, 1999.

For the Nuclear Regulatory Commission,
Annette Vietti-Cook,
Secretary of the Commission.

[FR Doc. 99-31506 Filed 12-3-99; 8:45 am]

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 71

[Airspace Docket No. 99-ACE-39]

Amendment to Class E Airspace; Emmetsburg, IA

AGENCY: Federal Aviation Administration, DOT.

ACTION: Direct final rule; confirmation of effective date.

SUMMARY: This document confirms the effective date of a direct final rule which revises Class E airspace at Emmetsburg, IA.

DATES: The direct final rule published at 64 FR 48088 is effective on 0901 UTC, December 30, 1999.

FOR FURTHER INFORMATION CONTACT: Kathy Randolph, Air Traffic Division, Airspace Branch, ACE-520C, DOT Regional Headquarters Building, Federal Aviation Administration, 901 Locust, Kansas City, MO 64106; telephone: (816) 329-2525.

SUPPLEMENTARY INFORMATION: The FAA published this direct final rule with a request for comments in the **Federal Register** on September 2, 1999 (64 FR 48088). The FAA uses the direct final rulemaking procedure for a non-controversial rule where the FAA believes that there will be no adverse public comment. This direct final rule advised the public that no adverse comments were anticipated, and that unless a written adverse comment, or a written notice of intent to submit such comment period, the regulation would become effective on December 30, 1999. No adverse comments were received, and thus this notice confirms that this direct final rule will become effective on that date.

Issued in Kansas City, MO on November 18, 1999.

Richard L. Day,
Acting Manager, Air Traffic Division, Central Region.

[FR Doc. 99-31520 Filed 12-3-99; 8:45 am]

BILLING CODE 4910-13-M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 71

[Airspace Docket No. 99-ACE-42]

Amendment to Class E Airspace; Malden, MO

AGENCY: Federal Aviation Administration, DOT.

ACTION: Direct final rule; confirmation of effective date.

SUMMARY: This document confirms the effective date of a direct final rule which revises Class E airspace at Malden, MO.

DATES: The direct final rule published at 64 FR 49374 is effective on 0901 UTC, December 30, 1999.

FOR FURTHER INFORMATION CONTACT: Kathy Randolph, Air Traffic Division, Airspace Branch, ACE-520C, DOT Regional Headquarters Building, Federal Aviation Administration, 901 Locust, Kansas City, MO 64106; telephone: (816) 329-2525.

SUPPLEMENTARY INFORMATION: The FAA published this direct final rule with a request for comments in the **Federal Register** on September 13, 1999 (64 FR 49374). The FAA uses the direct final rulemaking procedure for a non-controversial rule where the FAA believes that there will be no adverse public comment. This direct final rule advised the public that no adverse comments were anticipated, and that unless a written adverse comment, or a written notice of intent to submit such an adverse comment, were received within the comment period, the regulation would become effective on December 30, 1999. No adverse comments were received, and thus this notice confirms that this direct final rule will become effective on that date.

Issued in Kansas City, MO on November 18, 1999.

Richard L. Day,
Acting Manager, Air Traffic Division, Central Region.

[FR Doc. 99-31522 Filed 12-3-99; 8:45 am]

BILLING CODE 4910-13-M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 71

[Airspace Docket No. 99-ACE-43]

Amendment to Class E Airspace; Sikeston, MO

AGENCY: Federal Aviation Administration, DOT.

ACTION: Direct final rule, confirmation of effective date.

SUMMARY: This document confirms the effective date of a direct final rule which revises Class E airspace at Sikeston, MO.

DATES: The direct final rule published at 64 FR 49373 is effective on 0901 UTC, December 30, 1999.

FOR FURTHER INFORMATION CONTACT: Kathy Randolph, Air Traffic Division,