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UNITED STATES

NUCLEAR REGULATORY COMMISSION

June 1, 1977

SECY-77-48B

CONSENT CALENDAR ITEM

For: The Commissioners

From: Howard K. Shapar
Executive Legal Director

Thru: *RAM*
for Lee V. Gossick
Executive Director for Operations

Subject: NRDC PETITION FOR RULEMAKING ON WASTE MANAGEMENT

Purpose: Commission approval of a notice of denial of the petition.

Discussion: In a memorandum to Mr. Gossick, dated April 20, 1977, the Commission requested that certain revisions be made to the draft notice of denial in SECY-77-48A, and that certain changes be made to the related "Basis for Confidence" document. Both documents have been revised accordingly, and are attached hereto for the Commission's consideration. The revised notice of denial was prepared by OELD, and the revised "Basis for Confidence" document was prepared by ONMSS.

The Commission should note that the "Basis for Confidence" document places substantial emphasis on discussion of the question "will we dispose of the high level wastes." ONMSS feels strongly that this question--which is to be distinguished from the technical question can we--is a critical one. Unfortunately, this question is difficult to answer, because it raises a host of questions regarding the momentum of the current waste management program, and the depth and continuity of the national commitment to proceed with demonstration of an actual repository in the face of what will almost certainly be substantial controversy.

While the notice of denial and "Basis for Confidence" document carefully avoid tying the Commission's basis for confidence that high level waste can and will be disposed of safely to a specific waste

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management program time table, the "Basis for Confidence" document does tie the Commission to the general direction of the present program.

The clear implication is that if the direction of the present program should change significantly, the Commission as a matter of sound policy may no longer be in a position to continue licensing reactors. This has the advantage of insuring that the Commission can strongly influence the direction of the waste management program. On the other hand, it has the disadvantage of placing continued licensing of reactors on an uncertain footing, and placing the legal argument that no safety finding is required in an unfavorable context if the direction of the present program changes:

I would prefer that the "Basis for Confidence" document place less emphasis on the tie-in between the direction of the present program and the basis for confidence. However, ONMSS does not agree and prefers the present wording.

Recommendation:

That the attached Notice of Denial be issued.

Coordination:

ONMSS concurs in both the notice and "Basis for Confidence" document. Both documents have been reviewed and approved by the Office of Policy Evaluation and the Office of the General Counsel.

Sunshine Act:

Affirmation at an Open Meeting.

Anticipated
Scheduling:

Week of June 20, 1977.



Howard K. Shapar
Executive Legal Director

Attachments:

1. Draft notice of denial.
2. Basis for Confidence document.

Commissioners' comments or consent should be provided directly to the Office of the Secretary by close of business Tuesday, June 14, 1977.

Commission staff office comments, if any, should be submitted to the Commissioners NLT June 8, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires additional time for analytical review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

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NUCLEAR REGULATORY COMMISSION

Docket No. PRM-50-18

Natural Resources Defense Council

Notice of 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, N.W., 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, N.W., 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

nd 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 deduced that the NRC must make a finding, prior to issuing an operating license for a reactor, that permanent disposal of high-level radioactive wastes ^{1/} 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

^{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 C.F.R. Part 50, App. F, spent fuel rods, and transuranic-contaminated wastes. (Petition, at 2).

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 the finding that NRDC requests, namely, a "definitive" finding that 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 find that the facility in question will provide 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 presently being accomplished, and there is no indication that permanent disposal will be needed before these facilities are developed and in place. 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 such 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 seems 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 no 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

^{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 material defined in §11aa of the Act (42 U.S.C. §2014aa) and covered in §§51-58 of the Act (42 U.S.C. §§2071-2078), source material which is defined in §11z of the Act (42 U.S.C. §2014z) and covered in §§61-69 of the Act (42 U.S.C. §§2091-2099), and byproduct material which is defined in §11e of the Act (42 U.S.C. §2014e) and covered in §§81-82 of the Act (42 U.S.C. §§2111-2112).

a license to operate a 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 solely to the facility and applicant to be licensed is especially significant. No such information is required regarding high-level waste disposal facilities, though such information would surely be helpful if not absolutely necessary were the Commission required 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 C.F.R. 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 C.F.R. §50.57(a)(3) and (a)(6)). These findings have not included findings with regard to safe permanent disposal of high-level radioactive wastes ^{4/} 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 was well known to Congress, as was the extent of the development of systems for high-level radioactive waste disposal. Yet, Congress has continued to permit the Commission to license reactors and to exercise broad discretion in developing criteria for licensees. Such

^{4/} See General Design Criteria for Nuclear Power Plants, Appendix A, 10 C.F.R. Part 50. See also comments by LeBoeuf, Lamb, Leiby, and MacRae, at 10-12; and Shaw, Pittman, Potts, and Trowbridge, at 7-9.

conduct constitutes implicit ratification of the Commission's handling of the high-level waste disposal question. ^{5/}

As early as 1959, Congress held hearings on waste disposal problems. ^{6/} 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, the solution to the problem was further from achievement 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. ^{7/} 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." ^{8/}

^{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 JCAE 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.

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. ^{9/}

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. ^{10/} One witness cited the 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

^{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 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.

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 finding or conclusion that high-level wastes can be safely disposed of--was also presented to the Congress. Congress was aware of the high-level waste disposal problem, aware of its logical connection to reactor operation, and aware that the Commission did not plan to defer licensing until the problem was resolved.

The question of continued licensing in the face of continued uncertainty respecting ultimate disposal technology is certainly a legitimate one to present

^{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 336-47.

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 though 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 as it has in the past. The Commission has confidence, given the on-going federal programs, that the problem of permanent disposal will be solved before the public health and safety requires permanent disposal to be implemented. The significant fact for the present discussion is that even as the Congress passed major legislation dividing the Atomic Energy Commission into separate agencies and provided for licensing of ERDA waste management facilities, it did not order a moratorium on 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 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/

14/ 367 U.S. 396, 409 (1961).

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

^{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).

for its conclusion that this finding must extend to safe permanent disposal of high-level wastes, an 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 overall 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, it is clear that 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 Sec. 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 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 safe disposal system can be demonstrated, the Commission sees in the waste disposal question 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. Most importantly, ERDA has dramatically expanded the U.S. program for development of a permanent high-level waste repository. ERDA issued a report on technology for high-level waste repositories last year (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 extensive programs to develop methods of stabilizing (e.g., solidifying) high-level wastes to provide for optimum safety during transportation, storage and disposal and to develop 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. This survey served as the basis for an interim rule (hereinafter "S-3") promulgated on March 14, 1977 (42 F.R. 13803) which quantified the environmental impacts from spent fuel reprocessing and radioactive waste management. 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"). These proceedings have furnished the Commission with information on waste management and reprocessing 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 and reprocessing 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 comprehensive 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 _____ day of _____, 1977.

FOR THE NUCLEAR REGULATORY COMMISSION

Samuel J. Chilk
Secretary of the Commission

ONMSS ANALYSIS OF THE COMMISSION'S BASIS
FOR CONFIDENCE THAT HIGH LEVEL WASTES
CAN BE DISPOSED OF SAFELY

INTRODUCTION AND SUMMARY

The purpose of this paper is to identify the extent of the staff's confidence that high level radioactive wastes can be disposed of safely and to evaluate those factors which should be considered in order to make such a judgment. This paper is in response to the Commission's request made during Policy Session 77-13.

After reviewing available information, the staff has concluded that the Commission may base its confidence on the following:

- the technology for high level waste disposal is reasonably available,
- existing studies though not fully conclusive, support the feasibility and safety of geologic disposal,
- there is now a definitive, coordinated Federal program to develop and demonstrate a disposal system for high level radioactive wastes.

INFORMATIONAL ANALYSIS

To determine the basis for the Commission's confidence, two separate but key questions were posed: (1) can the wastes be disposed of safely, and (2) will the wastes be disposed of safely? The answer to the first rested heavily upon the technical considerations and to some extent on past performance, while the answer to the second rested more on the traditionally non-technical concerns (social, ethical, economic, institutional, etc.) that must be resolved.

The basis for a statement regarding the degree of confidence in safe disposal of nuclear wastes lies in an explanation of (1) the factors which might lead to a lack of confidence, (2) the factors which provide reason for confidence, and (3) a judgment regarding the threshold for confidence on each such factor.

The factors considered are:

1. The nature of wastes and the risks associated with their disposal,
2. Past performance and/or practices in waste disposal,
3. Actions by other jurisdictions regarding the need for demonstrated methods of waste disposal,

4. Recent analyses of the technologies for waste disposal and their safety and environmental impacts, and
5. Ongoing programs in the Federal agencies with regard to waste disposal.

This information is analyzed in summary form below and the extent of the staff's confidence is indicated. The references which were utilized in preparing this analysis are specified.

I. Nature of Wastes and Associated Risks

- A. Quantity: There have been numerous projections of waste volumes by type for several scenarios of nuclear growth. Tables IV H-1, IV H-21 in GESMO and Table 3.4 (p. 3-16) in NUREG-0116 provide such information.(1-2) When measured by activity level, or curies, the amount of waste in temporary storage today as spent fuel and high level reprocessing wastes is substantial and growing rapidly. Measured on this basis, the current inventory will double in two to three years. The relevant consideration here is that the size of the current and anticipated inventory precludes its disposition into the biosphere and therefore permanent isolation is mandatory. Although current storage facilities are "acceptable as a temporary measure ... nuclear wastes remain a very serious potential health problem until isolated from the environment."(3)

- B. Expected Radionuclide Releases from Disposal Operations: The quantitative prediction of effluents from the operational phase of proposed disposal systems is within present calculational capabilities. These capabilities have been developed for existing fuel cycle facilities and can be applied to the operations of future facilities as well. Limits on these effluents and their associated doses are specified by NRC regulations and would also be specified by forthcoming EPA standards. Effluents have been calculated in NUREG-0116 and found to be acceptable and well within present safety limits.
- C. Long Term Risk From Radioactive Waste Disposal: The long-term risk (expressed as a time-dependent probability versus consequences) due to radioactive waste is a result of the possibility of a release of some fraction of the contained wastes to the human environment. The level of this risk, and its time-dependence, has not been completely assessed. A complete assessment would have to include creditable estimates of all mechanisms (man-made, natural and repository/waste induced) for breaching the waste repository. The estimates must be in terms of time-dependent probabilities for a particular degree of breachment. After breaching of the repository, the movement of waste materials through the geosphere to the biosphere must

be calculated. When the waste material reaches the biosphere, their ultimate fate (accumulation in environmental receptors, environmental sink, recycling, etc.) must be calculated.

A complete, comprehensive analysis including all of the above considerations has not yet been performed. Nevertheless, there are a number of studies and partial analyses.(4-21) These probably show the upper bounds of risk that would be obtained from a more complete analysis. Present, ongoing analyses have not identified any new concerns that would alter the levels of risk discussed below.

There are a number of potentially important phenomena that might affect the integrity of the repository and, once waste material is released, influence the level of consequences. Some of these phenomena have been, or can be, investigated to the extent that reasonably precise analytical models with supporting data bases can be developed and utilized. Other phenomena, such as climatic and demographic changes, and human actions, cannot be specified with any precision. Even with a great deal of investigation, we will not be able to specify these phenomena to any reasonable precision. Therefore, there will always be uncertainties associated with any risk estimate

of waste disposal. Decisions affecting long-term disposal of the waste will have to be made with full awareness of these uncertainties.

In the following, the results of some of the partial analyses mentioned above are discussed. These analyses are separated into the areas of repository breaching and geospheric and environmental transport.

Repository Breaching: The most difficult part of a risk analysis is the estimation of the likelihood and degree of repository breaching. Several researchers have avoided these difficulties by showing the relative hazards of the waste in the repository should it be breached. This has been done by calculating a "hazard index" for the wastes. The hazard index is defined as the quantity of water required to dilute the wastes, assuming them to be totally soluble, to maximum permissible concentration in drinking water.(6, 14-18) These analyses show that the waste repository possesses a significantly larger hazard than uranium ores during the first few thousand years after closure of the repository. Thereafter the hazard is less than that of uranium ores.

The hazard index is only a measure of potential hazard due to the existence of the waste and it does not take into account important phenomena such as different relative rates of migration of various radionuclides through soils and biospheric pathways.

Breaching of the repository by faulting, meteorite impact, and volcanism have been estimated.(4,7) There is agreement that the probability of these breaching mechanisms can be controlled by proper repository site selection and that it is not likely that the probability of breaching by these mechanisms would be larger than roughly 10^{-10} per repository per year. This point was made explicitly by the Advisory Committee on Reactor Safeguards, "The Committee has been unable to develop or postulate any event in such a facility that would be comparable to a Class 9 accident."(22)

Other less dramatic breaching events likely have higher probabilities of occurrence but result in a smaller quantity of waste being released from the repository. These events are subsidence, erosion, unplugged boreholes, etc.

Geospheric and Environmental Transport: The most likely consequence of breaching of the repository is the penetration

of water into the repository and slow dissolution of the wastes. Given the penetration of water into the repository, analyses of the likely consequences have been performed.(5,7) These analyses have considered water penetration occurring at any time after repository closure and with a variable transport path length to a point of discharge to surface waters. As might be expected, the shorter the path length and time of initial dissolution of the waste, the larger the consequences (maximum radiation dose to an individual). This assumes that the presence of the waste materials in the water is not detected. The general conclusion from the analyses is that waste concentrations in the water, because of slow dissolution rates and long holdup times in the soil due to ion-exchange, would not be extremely large. The radiation doses to population that might arise would be fractions of natural background, or at most a few multiples of background for some individuals in unlikely cases.

II. Past Performance and/or Practices in Waste Disposal

In tracing the experience regarding the disposal of high level waste, a few historical events stand out. These have been described in several documents and an outline will suffice here.(23)

- The basic conceptual framework for management of civilian HLW emerged from a report by the National Academy of Science's Committee on Waste Management in 1957. The Committee noted that "the most promising method of disposal of high-level waste at the present time seems to be in salt deposits."(24)

- Since large scale reprocessing of commercial fuel was not anticipated for many years, no sense of urgency was instilled into the disposal effort during the 1960's. However laboratory and field experiments were carried out relative to disposal in bedded salt (the medium of choice).(25)

- In 1970 and 1971 the nature of the AEC field experiment in Lyons, Kansas, changed twice--first from experiment to designated site, then from designated site to abandoned plans (too many technical difficulties with the site became apparent in the final stages of study and review).(26-28)

- During 1972 to 1975 an interim solution (the Retrievable Surface Storage Facility) was the core of the AEC program, and work on disposal almost ceased.

- In 1974 the environmental statement on the RSSF received such strong objections for its lack of attention to disposal that

it was withdrawn in 1975 and the (ERDA) program was again directed toward primary emphasis on geologic disposal.

- In July 1976, an AEC (NRC) rule specifying uranium fuel cycle environmental impacts to be considered in the licensing of power reactors was remanded by the U. S. Court of Appeals, D.C. Circuit, because of deficiencies in the record regarding reprocessing and waste management. (Vermont Yankee)*
- In October 1976, the President's Statement on Nuclear Energy called for an expanded effort in waste management that would result in having a HLW repository available by 1985.
- In December 1976, ERDA announced a massive program for an extensive nationwide search to identify several candidate sites for geologic disposal.

Today, geologic disposal is the major alternative being considered by the U.S. Government and has its counterpart in most other countries. Alternatives to geologic disposal exist in principle, including

*Public hearings on the Interim Rule resulting from the staff's reevaluation of the impacts from this portion of the fuel cycle will be scheduled in the near future.

space disposal and transmutation. Almost all agree that these technologies are beyond present capabilities, and many are not at all convinced that they can provide any incentives with regard to safety or environmental effects. While geologic media of great interest exist below the oceans and (perhaps) beneath the ice caps, logistics of working in these areas and a lack of detailed information make these beyond immediate use.

In the past, assurance that commercial high level wastes could be safely disposed of was based on expert engineering judgment which has been a part of the record in testimonies for many years. Meanwhile spent fuel has been stored safely on an interim basis for a number of years. The need for additional storage capacity for spent fuel as a result of the decision to delay reprocessing does not present any foreseeable health and safety and environmental impacts over the next few decades.

Perhaps because there have been no measurable or anticipated adverse public health effects from interim storage, there was also little sense of urgency in resolving the problem of permanent disposal. However, in the past year, public attention to the unfinished business of waste disposal has increased dramatically and the lack

of a demonstrated waste disposal system has to some become a critical drawback to the continued use of nuclear power. This lack of a demonstrated system in the face of years of insistence by scientific experts that it could be done, has resulted in public concern that perhaps there is no safe solution to the problem.

III. Other Jurisdictions

As the Commission is aware, high level waste disposal has become a critical issue within the States.* A number of state ballot initiatives were tied to the issue of waste disposal. While these all lost at the polls, the issue has been raised in a manner precisely like that of the NRDC petition. California has passed laws requiring a finding on the part of their Energy, Conservation and Development Commission, that prior to siting further reactors in the State, the

*The staff also considered actions in other countries where the issue of curtailing the expansion of nuclear power in light of the lack of demonstrated safe disposal systems is being faced. The new government of Sweden has ordered the industry to find a viable and safe disposal system in one year or the licensing for operation of additional nuclear plants will cease. A British report (of the Royal Commission on Environmental Pollution) concluding that solution of the waste disposal question must precede further expansion of the nuclear option for energy has received widespread publicity here and abroad. Recently, a German Court reached a similar conclusion in a case regarding a controversial power plant (further licensing is being held up pending the selection of a repository site). Conversely, Japan has decided to proceed on the basis of confidence in the developing technology. A number of other countries seem to be tacitly proceeding along a similar line. While these decisions do not have a direct bearing on the Commission's level of confidence, they could affect the public acceptability of a proposed disposal operation which could prevent its implementation.

Federal agencies have "demonstrated"* and approved a safe disposal system. Recent court decisions have heightened public awareness of the issue. The decision in the Vermont Yankee case contributed to a perception that the high level waste question has been inadequately addressed. Since ERDA's announcement last December to expand its study of geologic formations for data on potential sites, bills have been introduced in a number of State legislatures (ten) banning high level disposal within the State. In Montana and Vermont the bills have been signed into law. In addition, a bill has been introduced in Congress (H.R. 5369) to provide for a referendum of the people on the question of locating a radioactive waste storage facility in a state.

The political force of these actions provides some measure of confidence that the Federal Government will continue on its present course for a solution. Counterbalancing this positive factor is the question of public acceptance of any specific disposal site as reflected in state laws banning high level waste disposal. The definition of an acceptable solution is dependent upon non-technological factors which have not been addressed in the traditional scientific-engineering approach. (29)

*Demonstrated does not necessarily mean in operation.

IV. Recent Analyses

Existing analyses from Federal agencies provide conclusions only regarding the availability of the technology and the expected (or reasonably anticipated) environmental impacts of the disposal system in normal operation.(30-33) Analyses are based on limited data and in at least one case (NUREG-0116) carefully note remaining uncertainties. Although existing analyses are inconclusive, they do tend toward confidence in the light of ongoing programs which should resolve remaining questions.

Two of the documents dealing with the technologies for waste management-- ERDA 76-43 and BNWL 1900--conclude that a number of alternatives are both technically feasible and ready for application. These documents do not, however, explicitly reach conclusions regarding the safety of such technologies.

Environmental analyses such as GESMO and NUREG-0116 predict little environmental impact (including radiological impacts) from waste disposal. However, either explicitly (in the case of NUREG-0116) or in the course of staff testimony in support of the document (in the case of GESMO), both have noted significant areas where analyses are still to be completed in order to reach conclusions based on detailed estimates of risk or impact. Still, it has been possible in both cases to reach a reasoned judgment that those analyses when

complete will show additional impacts or risks which would not add significantly to those already calculated.

Also, there have been two independent analyses by individuals unallied to any agency or specific interest group; which have attempted quantitative analyses of the consequences of geological disposal.(34,35) Informal staff review of the Cohen analysis has shown that inadequacies noted in the early draft versions seem to have been corrected. The Lapp analysis is based on analogy with naturally occurring substances and has not as yet been reviewed by the staff. Both conclude that geologic disposal is safe.

Perhaps most convincingly, independent analyses by outside review groups indicate confidence that the technology for permanent disposal is reasonably available. This confidence can be demonstrated by the following statements:

"It appears reasonable that one or more of the methods proposed for disposal of such wastes would be adequate to provide protection for the public and the environment from any potential long-range hazards."(22)

"We are convinced that nuclear wastes and plutonium can be disposed of permanently in a safe manner. If properly buried deep underground in geologically stable formations, there is little chance that these materials will reenter the environment in dangerous quantities. Even if material were somehow to escape eventually in larger quantities than seems possible, it would not constitute a major catastrophe, or even a major health risk, for future civilizations."(1, p. 19)

"We expect that a repository site in bedded salt with suitable hydrogeology can be found, although an adequate data base does not yet exist to permit completion of the recommended analysis of groundwater flow and mass transport. We foresee no difficulty in obtaining the required data for a specific site and in completing such an analysis within the next few years."(36)

"We foresee no important technical barrier to the demonstration by 1985 of the technology for the solidification, encapsulation, transport and emplacement of commercial HLW into mined salt caverns. Retrieval would require improved design of protective sheathing and emplacement details to protect the canisters from corrosive attack by occluded brine in the salt and mechanical entrapment by creep deformation of the salt."(36)

"There are already substantial quantities of radioactive waste requiring secure disposal, but we are sufficiently hopeful that an acceptable solution will be found to this problem that we do not advocate halting the processes giving rise to the waste. Indeed, to do so might remove the sense of urgency that we believe to be required in seeking a solution."(37)

Analyses have shown us that technically there do not appear to be any serious reservations as to the feasibility of at least one waste disposal technology. The crucial remaining challenge that must be successfully confronted is to demonstrate this feasibility. For an assessment of the probability of achieving successful demonstration, the ongoing Federal program for waste management must be examined.

V. Current Federal Program

Recent changes in perception of the need for a solution to the waste management problem have been accompanied by a change in Federal commitment. There is now a definitive and coordinated Federal program to develop a disposal system for high level

radioactive wastes. Central to this program is a vastly expanded ERDA effort to develop and implement a waste disposal system for commercial high level wastes. The ERDA budget for this effort increased from \$10 million in FY 1976 to \$69 million in FY 1977. Potential disposal methods have been investigated, at least to the extent where they could be accepted or rejected for technical reasons. The safety and environmental effects of these technologies will be addressed in a generic Environmental Impact Statement to be published by ERDA in late 1977 in draft form.

Through the National Waste Terminal Storage (NWTs) program, ERDA is expanding its study of deep underground formations within the United States to gather preliminary data on the suitability of geologic disposal for safe terminal storage of commercial nuclear wastes. Geologic formations which are of high integrity, located in a seismically stable area and free of circulating groundwater will provide the barriers to assure that nuclear waste will not reach the biosphere in quantities that are harmful. Three generic categories of geologic formations are the basis of the studies: salt, argillaceous and crystalline rock formations.

Forty-five of the forty-eight mainland states are associated with major formations of the above generic categories. During the current fiscal year, the NWTs program will review the geologic

records and conduct field investigations in thirteen of these states and conduct less intensive investigations in twenty-three other states. Given the large geographical area, the diverse rock types and the varying hydrological regimes, there is reason to believe that suitable sites can be identified. To date no site has been selected nor been judged suitable by either ERDA or the NRC.

The objective of the NWTS program is to select sites for six nuclear waste repositories in different geologic formations by 1986. The first two sites will be identified and selected by the end of 1978. While no specific decision has been made as to the geologic formation or location, it is estimated that the first two repositories will be in salt because more information is currently available on salt than any other rock type.

The program that is being developed would result in a design of a repository capable of receiving either processed waste or spent fuel elements. Site specific Environmental Impact Statements for each repository will be prepared.

On the basis of a number of reports (e.g., ERDA 76-43), all of the technology needed for geologic emplacement can be judged to be available. Conventional mining techniques are either directly

adaptable to the present job, or can be slightly modified for the specific needs. Nothing new is anticipated in this regard. Handling of large radioactive objects (e.g., HLW canisters or spent fuel bundles) has become routine in nuclear industry. Only the specific designs for the mine environment are required.

Preliminary conceptual designs (artists renderings plus basic dimensions) for a bedded salt repository have existed for several years. While actual detailed designs must await the development of site-specific properties of the disposal media and the overlying rock formations, world wide experience in mining salt gives confidence that no special problems will be inherent in designing a mine in salt to the specific requirements of the local geology.

The abolishment of the AEC and the formation of two separate agencies (ERDA and NRC) have also produced a significant change in the character of the Federal program for management of high level radioactive wastes. Prior to the reorganization, the AEC had programmatic responsibility for developing, constructing and operating a Federal repository for the disposal of high level radioactive wastes. Since the AEC was exempt from its own licensing requirements, no provisions were made for independent licensing review of these operations. However, under the Energy Reorganization Act which

created ERDA and NRC, NRC was given regulatory responsibility over ERDA facilities designed for "long-term storage" of high level radioactive wastes. This provides for the first time a full independent regulatory assessment for high level waste disposal and a mechanism for public participation in the decision making process.

In mid-1975 the NRC established a separate waste management unit to coordinate all NRC waste management activities. Principal initial efforts have been to (1) establish objective performance goals for management of nuclear wastes (2) develop a regulatory framework (regulation, standards and guides) which reflects these goals and (3) prepare licensing procedures (and assessment methodologies) needed to evaluate proposed waste management programs and strategies in light of this regulatory framework. Initial studies have been completed, tentative regulatory needs have been established and a program which will allow NRC to make timely licensing decisions is underway. The principal thrust of the program has been in the area of high level waste management with emphasis on having appropriate standards and regulations in place in time to provide guidance to ERDA in developing its HLW repository program. Efforts are also underway in the areas of low level waste, uranium mill tailings, radioactive gases and decommissioning of nuclear facilities.

Significantly, there is one aspect of nuclear waste management that is operationally unique for the Commission. Simply stated, that

aspect is that the NRC cannot forever discharge its health and safety responsibilities through the refusal of a license for the disposition of the wastes. For a reactor or other fuel cycle facility, the NRC discharges its health and safety responsibilities through the review process and can ultimately refuse a license if NRC criteria are not likely to be met. For a waste disposal system, a refusal merely postpones the ultimate discharge of these responsibilities.

The relevant issues at this point are (1) whether the recent momentum which has been generated in the Federal program can be maintained, and (2) whether this program will be accompanied by the strong national commitment that is likely to be necessary for successful implementation. Confidence generated by the momentum and thrust of the ERDA program must now be considered in the context of the recently changed policy regarding reprocessing and the extended storage of spent fuel. The Executive Branch must continue to provide assurance that this change in policy will not alter the goal of having a high level waste repository available for demonstration and that this will be reflected in the priorities placed on the program's structure, direction and budget within the proposed Department of Energy. Such assurance has been provided recently by the Acting Assistant Administrator for Nuclear Energy in ERDA, "...we still believe that this objective [operation of two repositories by 1985] must be met to demonstrate a permanent solution to waste management..."(38)

The staff has also considered those actions that could influence the level of commitment needed for the obtainment of goals. Examples of these actions are the increasing number of State and Federal hearings devoted to waste management, the GAO review of Federal waste management programs and the interest of the Executive Branch as seen in the commissioning of a review by the Science Advisor to the President and the decision by the President to conduct a thorough review of ERDA's waste management program.

These activities, of course, go beyond merely indicating that there is interest and concern at all levels for finding a solution to the waste management problem. The reviews completed to date stress confidence in technical feasibility while acknowledging there could be serious institutional and social obstacles to timely and acceptable implementation. Hopefully, the concerns raised as the result of these reviews will be faced and remedied.

CONCLUSION

On the basis of technical considerations which indicate that the technology is reasonably available for the geologic disposal of high level waste, the Commission can respond positively (albeit cautiously) to the question, "Can the wastes be disposed of safely?"

However, the degree of confidence the Commission can have regarding whether or not the wastes will be disposed of safely is more limited. Regardless of the technical feasibility of disposal, selection of disposal sites will be highly controversial and there will almost certainly be a problem with public acceptance. In addition, the current interest in an interim storage concept for spent fuel and postponement of reprocessing and the breeder could result in a decreased sense of urgency in demonstrating a system for final disposal at the same time that quantities of waste nuclides are rapidly increasing. Thus far, indications are that the present high priority of the program will continue.

On balance, therefore, the staff believes that:

1. Because the quantities of wastes being generated in the commercial industry are such that they cannot be released to the biosphere, it is necessary that a safe and environmentally acceptable facility be available for disposal of high level radioactive wastes. The available information regarding high level waste disposal suggests optimism in its technical feasibility and the existence of geologically acceptable sites. Pending detailed review, it is likely that the wastes can be disposed of in a safe manner.
2. Pending this review, our confidence in the ultimate safety of permanent disposal is based on existing knowledge of the current technology and associated risks and the momentum and size of the Federal program.

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