March 7, 1979

UNITED STATES
NUCLEAR REGULATORY COMMISSION

SECY-79-163

CONSENT CALENDAR ITEM

For: The Commission

Thru: Executive Director for Operations

From: Daniel J. Donoghue, Director
Office of Administration

Subject: REVISION OF 10 CFR 2.802, PETITION FOR RULE MAKING

Purpose: To obtain Commission approval of the publication in effective form of 10 CFR 2.802, Petition for rule making.

Category: This paper covers a routine matter requiring Commission consideration.

Discussion: On April 28, 1978, the Commission published in the Federal Register proposed amendments to its "Rules of Practice" regarding the filing and processing of petitions for rule making. The amendments would require the petitioner to include a statement in support of the petition which shall set forth the specific issues involved, the petitioner's views or arguments with respect to those issues, relevant technical, scientific, or other data involved which is reasonably available to the petitioner, and such information as the petitioner deems necessary to support the action sought. Other independent regulatory agencies (CAB, FTC, FPC, FCC, SEC, FAA) require petitioners for rule making to provide similar information.

The proposed rule also added language stating (a) that a prospective petitioner is encouraged to confer with the staff prior to the filing of a petition for rule making and (b) that questions regarding applicable NRC regulations sought to be amended, procedures for filing a petition for rule making, or requests for a meeting with the appropriate NRC staff to discuss a petition for rule making should be addressed to the Division of Rules and Records, Office of Administration.

Four letters of comment were received on the proposed rule. Three of the commenters supported the proposed amendments. A fourth commenter, Public Citizen Litigation Group (Public Citizen) agreed that petitions are more useful and likely to be adopted if they are well supported and well presented.

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492-7086

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Public Citizen, however, expressed some reservations about the proposed rule and offered a number of changes to the proposed rule which are discussed in the statement of considerations of the attached rule.

The thrust of several of Public Citizen's comments was a concern that the staff, in rendering assistance on the filing of petitions, might abuse its discretion by encouraging undesired modifications of the substance of a petition and that such assistance combined with the power to reject a petition as inadequately presented, could have the effect of deterring prospective petitioners.

The staff does not consider this general concern to be a valid comment on the proposed procedures set out in the proposed revision of § 2.802. The staff will assist a petitioner with respect to the procedural requirements of § 2.802, if the petitioner requests such assistance. This assistance will be rendered in an objective manner. The staff will not require modifications of the substance of a petition.

The staff recognizes that the new procedure must be administered in a manner that does not detract from the right accorded interested persons by the Administrative Procedure Act to petition for the issuance, amendment, or repeal of a rule. In addition to following the procedures for improving the processing of petitions, as set out in SECY-77-526, the staff intends to exercise its "completeness review" in a liberal manner and will not arbitrarily reject a petition as inadequately presented. In those cases where information is not "reasonably available" to the petitioner, substantial expenditure of staff resources may still be required to dispose of the petition.

Public Citizen also is concerned that the Commission may require a petitioner not only to highlight the existence of a problem, but also to propose a definite solution. The staff agrees with the commenter that a petitioner should not be required to furnish detailed provisions, numerical standards, or a precise rule, designed to solve the problems which a petitioner has documented. A sentence is included in the statement of considerations of the rule that "Although a petitioner may highlight the existence of a problem and suggest the general direction of a possible solution, the Commission's staff will be responsible for the development of a proposed rule if the staff study indicates a need for amendment of NRC regulations."

Public Citizen also questioned the proposed provision of § 2.802. (c)(2) that each petition shall state clearly and concisely the petitioner's grounds or interest in the action requested. Public Citizen states that it would be dismayed if the NRC intended to impose judicial standards of standing to filing a petition for rule making as it has chosen to do for intervention in nuclear export licensing proceedings.

Pursuant to the Administrative Procedure Act, as amended, the right to petition must be accorded to any "interested persons." The Commission has always construed these terms broadly in accepting petitions for rule making, and has no intention of rejecting a petition for rule making solely on the ground that a petitioner has not alleged an injury in fact of the same character that would be necessary for standing in a licensing proceeding.

Public Citizen proposes a number of formal procedural steps for the processing of petitions, including time limitations for the determination of petitions. The staff has concluded that it is impracticable to incorporate such procedures into the text of § 2.802. In many respects the procedure would be wasteful of the Commission's time. Internal procedures have been established whereby the staff initially reviews petitions, establishes priorities in processing petitions, and initiates necessary studies. In addition, the time required to process a petition is dependent upon staff availability and the priority of other work assignments. The Commission is informed on a semi-annual basis of the status of each petition. Many petitions are complex from a technical or legal view, and it is more efficient for the staff to make the initial evaluation and to recommend a course of action rather than for the Commission to process petitions initially and direct the staff with respect to disposition of the petition. The fact that the staff processes the petition initially does not mean that the Commission isn't ultimately responsible for action on the petition. The text of the rule set forth in Enclosure "A" is identical with the text of the proposed amendments published on April 28, 1978.

Recommendation: The Commission:

Approve the notice of rule making set forth in Enclosure "A" which amends 10 CFR 2.802.

Note the amendments in Enclosure "A" become effective 30 days after publication in the Federal Register.

Note the House Committee on Interior and Insular Affairs, the Senate Committee on Environment and Public Works, and the House Committee on Interstate and Foreign Commerce will be notified.

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Coordination: The Offices of Standards Development and Policy Evaluation concur in the recommendation of this paper. The Office of Executive Legal Director and the Office of the General Counsel have no legal objection. The Office of Public Affairs concurs that a public announcement will not be issued.

Sunshine Act: Recommend affirmation at an open meeting.

Daniel J. Donoghue, Director
Office of Administration

Enclosure:
"A" - Notice of Rule Making

NOTE: Commission comments or consent should be provided directly to the Office of the Secretary by c.o.b. Tuesday, March 20, 1979.

Commission staff office comments, if any, should be submitted to the Commissioners NLT March 14, 1979, 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.

This paper is tentatively scheduled for affirmation at an Open Meeting during the Week of March 26, 1979. Please refer to the appropriate Weekly Commission Schedule, when published, for a specific date and time.

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Title 10 - Energy

CHAPTER I - NUCLEAR REGULATORY COMMISSION

PART 2 - RULES OF PRACTICE FOR DOMESTIC LICENSING PROCEEDINGS

Petitions for Rule Making

AGENCY: U. S. Nuclear Regulatory Commission

ACTION: Final Rule

SUMMARY: The Nuclear Regulatory Commission is issuing amendments to its "Rules of Practice" regarding the filing and processing of petitions for rule making. The amendments require the petitioner to include a statement in support of the petition setting forth the specific issues involved, the petitioner's views regarding those issues, and relevant technical, scientific, or other data involved which is reasonably available to the petitioner. The amendments will facilitate the processing of petitions for rule making.

EFFECTIVE DATE: These amendments become effective on

FOR FURTHER INFORMATION CONTACT:

Gerald L. Hutton
Division of Rules and Records
Office of Administration
U. S. Nuclear Regulatory Commission
Washington, DC 20555
TEL: (301-492-7086)

SUPPLEMENTARY INFORMATION: The Nuclear Regulatory Commission published a notice of proposed rule making in the FEDERAL REGISTER on April 28, 1978 (43 FR 18195) to amend 10 CFR Part 2.

The proposed amendment of § 2.802 set out in the April 28, 1978 notice would require a person filing a petition for rule making to state clearly and concisely the petitioner's grounds or interest in the action requested and to include a statement in support of the petition setting forth

the specific issues involved, the petitioner's views or arguments with respect to those issues, relevant technical, scientific, or other data involved which is reasonably available to the petitioner, and such information as the petitioner deems necessary to support the action sought.

It was proposed also to add language stating (a) that a prospective petitioner is encouraged to confer with the staff prior to the filing of a petition for rule making, and (b) that questions regarding applicable NRC regulations sought to be amended, procedures for filing a petition for rule making, or requests for a meeting with the appropriate NRC staff to discuss a petition for rule making should be addressed to the Division of Rules and Records, Office of Administration.

Four letters of comment were received on the proposed rule. Three of the commenters supported the proposed amendments.

One commenter, the Power Authority of the State of New York, stated that the proposed amendments would be beneficial to all parties affected by a petition for rule making in that the issues involved would be clearly delineated and the consequent greater understanding of the concerns of the petitione would lead to a more efficient and expeditious resolution of those concerns.

A second petitioner, Consumers Power Company, stated that the provisions of this change requiring petitioners to clearly state specific interests and issues supported by relevant technical and scientific data should aid in screening superfluous petitions, and that encouraging pre-petition conferences with the staff should aid the petitioner and help streamline the process through early resolution of misunderstandings and procedural problems.

A third commenter, Dow Chemical, U.S.A., favored the proposed rule, but recommended that the following statement, or its equivalent, be added to the proposed § 2.802(c)(3):

> The petitioner must submit information showing why current regulations and licensing practices are not adequate and how a new rule would alleviate this situation.

It is the Commission's view that the language set out in the proposed rule adequately covers the type of information to be submitted in support of a petition. Further, a petitioner may describe an inadequacy, but be unable to show how a new rule would alleviate the situation. Accordingly, this suggestion has not been adopted.

A fourth commenter, Public Citizen Litigation Group (Public Citizen) made the following general statement:

> Public Citizen is concerned that the proposed amendment to 10 CFR 2.802, governing petitions for rule making to the Nuclear Regulatory Commission (NRC) may result in staff rejection of valuable and important citizens' petitions. Furthermore, because of the vagueness of the standards in the proposed regulations, there is danger of staff abuse of its discretion. The hurdle represented by these newly imposed requirements enforced by staff rejection of "deficient" petitions may deter citizens from petitioning the NRC . . . Public Citizen agrees with the premise of the proposed rule, that petitions to the NRC are more useful and likely to be adopted if they are well supported and well presented.

The Commission does not believe that the proposed amendments will result in staff rejection of worthwhile, well-presented petitions.

Public Citizen also offered several specific comments as follows:

> Section 2.802(b) encourages consultation with the NRC staff on a prospective petition. Section (f) permits rejection of a petition by the staff, after an opportunity for revision, for failure to meet the standards of section (c). Consultation with the NRC staff could make available to a petitioner a valuable resource, resulting in greater efficiency and quality for all concerned. The officially encouraged consultation has the potential drawback of having a citizen's concerns steered in ways the NRC staff considers more desirable and realistic.

It is the intent of the Commission that its staff be available to assist petitioners in filing a petition if the petitioner requests such assistance. Consultation with the NRC staff is not required. The Commission intends that such consultation, if requested, will be of assistance to the petitioner and will be rendered in an objective manner. The NRC staff will not require modifications of the substance of a petition. This should result in petitions which satisfy the procedural requirements of § 2.802 and are in a proper form for consideration on the merits.

Public Citizen also states that:

> Who makes the rejection determination of section (f)? It apparently is someone in the Division of Rules and Records. This procedure is defective in providing for low

> level, low visibility rejection of petitions without any attention by the Commission. Rather than allowing staff rejection, the Commission should take final responsibility for decisions on petitions.

The Commission considers that it is appropriate for the staff to make the determination as to whether a petition meets the procedural requirements of § 2.802, because the determination relates to non-policy procedure and format matters. However, the Commission always retains its inherent supervisory authority over staff actions.

Public Citizen states further that:

> The trouble with requiring presentation of the desired product of the proposed rulemaking is that some problems are too complex or unexplored for a petitioner to propose a definite solution. For example, the PIRG decommissioning petition proposed imposition of financial guarantees of eventual decommissioning. However, the petitioners, who are reasonably well informed, could not say what would be a realistic estimate of the needed funds or what financial guarantee arrangements would be available. The situation is similar with respect to the analogous petition of the Natural Resources Defense Council (NRDC) on financial guarantees of safe windup of uranium mills. . . It should suffice for a petition to document the existence of a problem, suggest the direction of a solution, without detailed provisions or numerical standards, and to ask the NRC to apply its expert knowledge to study and solve the problem.

The Commission agrees with the commenter that a petitioner should not be expected to furnish detailed provisions or numerical standards or a precise rule, designed to solve the problem which the petitioner has documented. The Commission's staff will evaluate the merits of a petition, and develop an appropriate solution to such problems, including the preparation of proposed amendments of NRC regulations as may be indicated. Although a petitioner may highlight the existence of a problem and suggest the general direction of a possible solution, the Commission's staff will be responsible for the development of a proposed rule if the staff study indicates a need for amendment of NRC regulations.

Public Citizen questions the proposed provision § 2.802(c)(2) that each petition shall state clearly and concisely the petitioner's grounds or interest in the action requested. Public Citizen states that:

> Statement of petitioner's "interest" in the matter smacks of a standing requirement. Public Citizen would be dismayed if the NRC intended to impose judicial standards of standing to filing a petition for rulemaking as it has chosen to do for intervention in nuclear export license proceedings . . . Public Citizen does not suppose that a standing requirement is intended, but this should be clarified, along with clarification of what is intended and why.

Pursuant to the Administrative Procedure Act, as amended, the right to petition must be accorded to any "interested persons". The Commission has always construed these terms broadly in accepting petitions for rule making and has no intention of rejecting a petition for rule making solely on the ground that a petitioner has not alleged an injury in fact of the same character that would be necessary for standing in a licensing proceeding.

Public Citizen proposes a number of procedural steps for the processing of petitions, including time limitations for the determination of petitions. The Commission has concluded that it is impracticable to incorporate such procedures into the text of § 2.802. In many respects the proposed procedures would be administratively inefficient and wasteful of the Commission's time. Internal procedures have been established whereby the staff initially reviews petitions, establishes priorities in processing petitions and initiates necessary studies. The Commission is informed on a periodic basis of the status of each petition. Many petitions are complex from a technical or legal view and it is more efficient for the staff to make the initial evaluation and to recommend a course of action rather than for the Commission to process petitions initially and direct the staff with respect to disposition of the petition.

The text of the rule set forth below is identical with the text of the proposed amendments published on April 28, 1978.

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, and sections 552 and 553 of Title 5 of the United States Code, the following amendments to Title 10, Chapter I, Code of Federal Regulations, Part 2 are published as a document subject to codification.

1. Section 2.802 of 10 CFR Part 2 is revised to read as follows:

2.802 Petition for rule making

(a) Any interested person may petition the Commission to issue, amend or rescind any regulation. The petition should be addressed to the Secretary, U. S. Nuclear Regulatory Commission, Washington, DC 20555, Attention: Chief, Docketing and Service Branch.

(b) A prospective petitioner is encouraged to confer with the staff prior to the filing of a petition for rule making. Questions regarding applicable NRC regulations sought to be amended, the procedures for filing a petition for rule making, or requests for a meeting with the appropriate NRC staff to discuss a petition should be addressed to the Director, Division of Rules and Records, Office of Administration, U. S. Nuclear Regulatory Commission, Washington, DC 20555, Attention: Chief, Rules and Procedures Branch. A prospective petitioner may also telephone the Division of Rules and Records on (301) 492-7086 to obtain assistance.

(c) Each petition filed under this section shall:

(1) set forth the substance or text of any proposed regulation or amendment, or shall specify the regulation, the rescission or amendment of which is desired;

(2) state clearly and concisely the petitioner's grounds or interest in the action requested;

(3) include a statement in support of the petition which shall set forth the specific issues involved, the petitioner's views or arguments with respect to those issues, relevant technical, scientific or other data involved which is reasonably available to the petitioner,

and such other pertinent information as the petitioner deems necessary to support the action sought. In support of its petition, petitioner should note any specific cases of which petitioner is aware where the current rule is unduly burdensome, deficient, or needs to be strengthened with respect to nuclear safety, radiation safety, or safeguards.

(d) The petitioner may request the Commission to suspend all or any part of any licensing proceeding to which the petitioner is a party pending disposition of the petition for rule making.

(e) If it is determined that the petition includes the information required by paragraph (c) of this section and is complete, the Director, Division of Rules and Records, or his designee, will assign a docket number to the petition, will cause the petition to be formally docketed, will deposit a copy of the docketed petition in the Commission's Public Document room, and cause a notice of the docketing of the petition to be published in the FEDERAL REGISTER, inviting public comment thereon. Publication will be limited by the requirements of section 181 of the Atomic Energy Act of 1954, as amended, and may be limited by order of the Commission.

(f) If it is determined that the petition does not include the information required by paragraph (c) of this section and is incomplete, the petitioner will be notified of that determination and the respects in which the petition is deficient and will be accorded an opportunity to submit additional data. Ordinarily this determination will be made

within 30 days from the date of receipt of the petition by the Secretary of the Commission. If the petitioner does not submit additional data to correct the deficiency within 90 days from the date of notification to the petitioner that the petition is incomplete, the petition may be returned to the petitioner without prejudice to the right of the petitioner to file a new petition.

(g) The Director, Division of Rules and Records, Office of Administration, or his designee, will prepare on a quarterly basis a summary of petitions for rule making pending before the Commission including the status thereof. A copy of the report will be available for public inspection and copying in the Commission's Public Document Room, 1717 H Street, N.W. Washington, DC.

(Sec. 161, Pub. L. 83-703, 68 Stat. 948 (42 U.S.C. 2201); Sec 201, Pub. L. 93-438, 88 Stat. 1243 (42 U.S.C. 5841)).

Dated at_____this _____day of_____ 1979

For the Nuclear Regulatory Commission

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Samuel J. Chilk
Secretary of the Commission

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: July 30, 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 enviromental 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 Fed. Reg. 13803) to be effective for 18 months and was extended several times, the final extension being to July 30, 1979. 44 Fed. Reg. 31939 (June 4, 1979).

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 Fed. Reg. 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 activities[1/] to the environmental costs of licensing the reactor in question. The exceptions are radon releases, presently omitted from the interim rule (see 43 Fed. Reg.

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

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. These matters remain open for litigation in individual proceedings. The present rulemaking settles only the question of fuel cycle release values, with the 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

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

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 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,

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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).

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 Fed. Reg. 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

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[4/] A revised version of this Environmental Survey was published in April 1974 as WASH-1248.

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 a three-person hearing board, following legislative-type procedures announced by the Commission in a supplemental notice (38 Fed. Reg. 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 Fed. Reg. 14188),

5/ The tabulated impacts in Table S-3 included acres of land committed to fuel cycle activities, amount of water discharged by such activities, fossil fuel consumption, and chemical and radiological effluents, the latter in curies, all normalized to the annual fuel requirement for a model 1000 MWe light-water reactor. Notations accompanying the tabulated values included a few radiological doses in man-rem, but no estimates are given of human health effects caused by fuel cycle radiological effluents. The Environmental Survey did not give quantitative estimates of health effects.

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

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6/ The Commission announced on April 14, 1978 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. 15613. 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 rule-making, 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.

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 an effective

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7/ The 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 Vermont Yankee Nuclear Power Corp., 4 AEC 930 (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.

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.[8/] 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

8/ 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.

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 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 Fed. Reg. 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 Fed. Reg. 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 Fed. Reg. 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 licensees 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

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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.

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 Fed. Reg. 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 Fed. Reg. 43806.

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 Fed. Reg. 26987 (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

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 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.

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

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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.

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; 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

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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).

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 26, 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

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.

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. These 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 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

16/ Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuels in Light Water Cooled Reactors, NUREG-0002, August 1976.

17/ Also, 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.

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, 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

18/ The 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.

of by burial in a bedded salt geologic repository.[19/] The 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

19/ The 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-0116, 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 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.

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 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]

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[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.

[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.

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 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/]

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.

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

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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.

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 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. 25a/

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

25/ 42 Fed. Reg. 34391, July 5, 1977. See also Natural Resources Defense Council v. NRC, 582 F.2d 166 (2d Cir. 1978).

25a/ 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.

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 isolation of radioactive waste from the biosphere.[26/]

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.

26/ 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 23 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."

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 accidential 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 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.[27/] In considering this alternative, the Commission expresses no view on the likelihood that such reprocessing will take place.[28/] 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

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27/ 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).

28/ 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."

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. 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.[29/] 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.[30/]

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

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

30/ These include ruthenium-106, strontium-90, cesium-137, plutonium and other transuranic nuclides. The staff assumed decontamination factors on the order of 10^8. Decontamination factors of about 10^5 were measured at NFS for ruthenium, strontium, and cesium. See Recommendations at 22.

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.[31/]

31/ 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.

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.[32/]

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

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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.

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.33/

33/ 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 638, 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.

Accordingly, the Commisssion concludes, as in the matter of waste disposal uncertainties, that uncertainties in reprocessing impacts should be 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 socio-economic 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,[34/] 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.

34/ 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. NRDC, 435 U.S. 519, 551 (1978); NRDC v. Morton, 458 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.

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 July 30, 1979.

10 CFR Part 51 is amended by revising Sections 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 reacto s 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, 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 July 30, 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.**/ 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 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

**/ Values for releases of Rn-222 and Tc-99 are not given in the Table. The amount and significance of Rn-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.

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.

TABLE S-3

Table of Uranium Fuel Cycle Environmental Data[1]

(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.

Table S-3 (Continued)

ENVIRONMENTAL CONSIDERATIONS	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
EFFLUENTS - CHEMICAL (MT):		
Gases (including entrainment):[3]		
SO_x	4,400	
NO_x[4]	1,190	Equivalent to emissions from 45 MWe coal-fired plant for a year.
Hydrocarbons	14	
CO	29.6	
Particulates	1,154	
Other gases:		
F	.67	Principally from UF_6 production, enrichment, and reprocessing. Concentration within range of state standards - below level that has effects on human health.
HCl	.014	
Liquids:		
$SO_4^=$	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: NH_3 - 600 cfs. NO_3 - 20 cfs. Fluoride - 70 cfs.
NO_3^-	25.8	
Fluoride	12.9	
Ca^{++}	5.4	
Cl^-	8.5	
Na^+	12.1	
NH_3	10.0	
Fe	.4	
Tailings solutions (thousands of MT)	240	From mills only - no significant effluents to environment.
Solids	91,000	Principally from mills - no significant effluents to environment.

ENVIRONMENTAL CONSIDERATIONS	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
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	Principally 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	Principally from milling - included tailings liquor and returned to ground - no effluents; therefore, no effect on environment.
Ra-226	.0034	From UF_6 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 - included in tailings returned to ground

Table S-3 (Continued)

ENVIRONMENTAL CONSIDERATIONS	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
EFFLUENTS - RADIOLOGICAL (curies) (cont'd)		
Solids (buried on site) (cont'd):		
TRU and HLW (deep)	1.1×10^7	Buried at Federal Repository.
Effluents - thermal (billions of British thermal units)	4,063	< 5 percent of model 1,000 MWe LWR.
Transportation (person-rem):		
Exposure of workers and general public	2.5	
Occupational exposure (person-rem)	22.6	From reprocessing and waste management

[1] In 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 "Discussion of Comments Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle," NUREG-0216 (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.

[2] The 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.

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

[4] 1.2 percent from natural gas use and process.

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 new health effects, there is not much a licensing board can do with the table. The new table is in fact almost identical to the table in use now. The major effect of adopting a final rule now without an explanatory narrative is to relieve pressure for its 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. I still believe that to be the correct course.

There is, however, another reason for my disagreement with the Commission's action in approving the final rule. I would not adopt 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. I am even more concerned about what this misplaced confidence implies for the Commission's positic and programs on the regulation of high-level waste respositories.

I am aware that the Commission's finding for the purposes of the environmental review is a weaker one legally than would be required for a safety approval. Nevertheless this step takes the Commission a good way beyond the more general statement made in June, 1977, in which I joined, that the Commission had "reasonable confidence that the wastes can and will in due course be disposed of safely."1/ The new table puts the Commissioners, who are expected to review with a critical eye any application for a waste repository, on record as believing in the likelihood of its absolutely perfect operation.

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

The Commission got itself into this position because of the perceived need to protect reactor licensing decisions against certain legal challenges -- to remedy a procedural deficiency

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1/ Denial of NRDC Petition for Rule-Making, 42 FR 34391 (July 5, 1977).

found by the Court of Appeals in a decision subsequently overturned by the Supreme Court. 2/

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 power plant 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. 3/ As a practical matter, such a finding, reaching the very core of NRC decision making could -- and should — only come 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

2/ Aeschliman v NRC, 547F2d622 (1976), reversed sub nom. Vermont Yankee Nuclear Power Corporation v National Resources Defense Council, 435 U.S. 519(1978).

3/ 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.

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.

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. As Commissioner Bradford notes the Commission's attempt to save time by committing decisions on whether to allow cross-examination to the sole discretion of the Board has resulted in a situation (for example concerning the effect of technetium) which will likely prove more time-consuming and less satisfactory than a Commission decision to permit cross-examination would have done.

May 11, 1979

SEPARATE VIEWS OF COMMISSIONER BRADFORD ON S-3

I

I am concurring in the latest version of the S-3 table with the understanding that it is to be extensively supplemented. The best that can be said for today's decision is that it improves somewhat on the present interim version. It is 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 judgement, the reprocessing scenario, and the procedural underpinning, and the absence of a clear statement of the health effects and time commitments involved.

I can concur in the "zero release" number only because it is better founded than the equivalent 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.

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 "judgement." 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 make a bedded salt repository a responsible working assumption

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1/ See for example, Transcript, p. 729. The Commission improves upon the Board's understatement in its Footnote 24, p. 39. 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."

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 that is cited in 42 Fed. Reg. 34391. To term the denial of a requested rulemaking an expression of a Commission view on the safety of a waste repository proceeding is procedural farce of a low order, and it should not be done here. In July 1977, the Commission reached sweeping conclusions 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. As the basis for that 1977 expression of confidence has been called into question, the Commission's expression of confidence has, if anything, increased. I am tempted to conclude that the Commission's new confidence is flowing from the fact that today's studies are perceptive enough to doubt the basis upon which its 1977 confidence was based. Perhaps none of this is illegal, especially following Vermont Yankee, but that doesn't make it wise.

As to reprocessing, I have concluded that Commissioner Gilinsky was in many respects correct in his dissenting views from our January 26, 1978 order 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.

2/ Transcript, p. 534, 575.

II

By memorandum of January 26, 1977, to the Fuel Cycle Rulemaking Hearing Board, the Commission ordered that the Board entertain requests for cross-examination of particular witnesses 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.

Regrettably, 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, stating that 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 S-3, however, reject 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 in sufficiently 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's refusal to allow cross-examination regarding bedded salt is particularly unfortunate since it came immediately after the DOE Task Force on Nuclear Waste Management, as noted by the petitioner for cross-examination, 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)).

The NRDC demonstrated a need to cross-examine the staff as to the validity of its "zero release" conclusion in light of contrary indications in some of the very documents on which the staff was relying for its position. Through the extraordinary dubious procedural device of its "irrevocable delegation," the Commission has 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 on this point.

Ironically, one of the issues NRDC wished to cross-examine on was the staff's lack of analysis of media other than salt. Yet, even without this inquiry, the Commission now makes a "judgement" that an "equivalent" to a bedded salt repository will be found. The support for this statement is not the testimony presented before the Board, but some statements from the IRG Report.

In refusing to permit cross-examination on waste disposal, the Board has kept perfect the 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 be found which will have a zero release after it is sealed, the Commission has yet to allow a proceeding to take place where witnesses supporting these views could be cross-examined.

III

Since NEPA is intended to assure that decisionmakers have a maximum of information on the environmental impacts of their decisions, pro-

cedures that restrict that information seem to me to be unsound policy even if they are legally tolerable. The restrictions placed on cross-examination are one such limitation. Another, which the Commission has committed itself to remedying, is the confining of health impact calculations to artificially short time periods and the failure to state adverse health impacts in terms of cancer deaths and genetic mutations. It is good to have this problem recognized in the Statement of Considerations, but I will not personally feel that the S-3 Table is much of an aid to decisionmaking until the table itself is our best effort to reflect the reality of what we do.