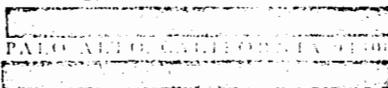


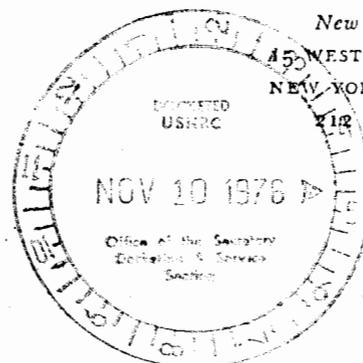
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Comments
Of The
Natural Resources Defense Council
On The
Nuclear Regulatory Commission's
General Statement of Policy on
Proceedings Concerning The Environmental Effects
Of The Nuclear Fuel Cycle

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I. THE RULEMAKING PROCEEDING MUST FULLY ANALYZE POTENTIAL ENVIRONMENTAL IMPACTS FROM WASTE DISPOSAL AND FULLY DISCLOSE THE BASIS FOR ALL ESTIMATES

The opinion of the Court of Appeals charges the Commission with many substantive obligations. The Commission must fully disclose the environmental effects of nuclear waste disposal and reprocessing. The Commission must "confront and explore fully the depth and consequences of . . . uncertainties" and conduct "a thorough exploration of the problems involved in waste disposal, including past mistakes, and a forthright assessment of the uncertainties and differences in expert opinion" concerning environmental impact. Slip Opinion, at 38-39. If the rulemaking is to produce an adequate generic discussion of fuel cycle impacts to be relied upon in individual licensing proceedings to satisfy NEPA's requirements, the rulemaking and the record produced must satisfy NEPA's requirements. The alternative to not satisfying the requirements of NEPA in the generic rulemaking is to confront the NEPA issues during the licensing of individual nuclear power plants.

The Court of Appeals' opinion and NEPA case law establish that the Commission's rulemaking must satisfy the following criteria.

- A. The Commission Must Analyze All Aspects of the Environmental Impacts of "Radioactive Waste Disposal" and "Reprocessing."

The rulemaking proceeding must address itself broadly to "waste storage and management," involving the "containment of wastes during the long period necessary for them to decay naturally into non-toxic substances." Slip Opinion, at 24-25 n. 41. At a minimum, therefore, the proceedings must consider potential environmental impacts from the management, both interim and permanent, of spent fuel, liquid high-level wastes, solidified high-level wastes, transuranic wastes, low-level wastes, decommissioning wastes (whether left in place or shipped to a repository) and captured gases. In addition, the proceedings should consider all other wastes that need to be contained for long periods, such as mill tailing piles that require steps to "stabilize" the release of radioactive gases.

The Commission can usefully rely on a recent publication of the Energy Research and Development Administration to define the appropriate scope of its consideration of "waste storage and management." In preparation for writing an environmental impact statement on the disposal of radioactive wastes, ERDA prepared a document entitled Alternatives for Managing Wastes From Reactors and Post-Fission Operations in the LWR Fuel Cycle, ERDA-76-43 [hereinafter "Technical Alternatives Document"]. ERDA identified the wastes to be managed as those coming from reactors, from spent fuel storage facilities, from fuel reprocessing plants, from mixed-oxide fuel fabrication plants, and from decommissioning of fuel cycle facilities.

ERDA pointed out that the management and storage of these wastes involved four activities: treatment, interim storage, transportation and final isolation or disposal. Technical Alternatives Document, at 8. In addition, ERDA noted that the scope and nature of waste management operations will vary significantly depending on which of three basic alternative configurations of the LWR fuel cycle is ultimately selected. These alternatives are (1) no recycle of uranium or plutonium; (2) uranium recycle only (plutonium is stored); (3) recycle of uranium and plutonium. Id.

NRC must take these alternative possibilities fully into account. Each scenario will have to be carefully analyzed to determine the potential environmental impacts from reprocessing and waste management. If the Commission seeks to adopt a "bracketing" approach -- essentially making "worst case" estimates -- it will have to determine which scenario presents the "worst case." For example, the potential impacts posed by uranium recycle only -- involving interim storage or ultimate disposal of large amounts of purified plutonium -- would have to be compared with long-term criticality problems posed by disposal of fuel rods assuming no recycle of plutonium or uranium.

In short, the analysis of potential impacts of all waste management options must be done three ways -- assuming plutonium recycle, assuming uranium recycle only, and assuming no recycle of uranium or plutonium -- to ascertain which

assumption represents the "worst case." Within each fuel cycle scenario, the Commission must analyze the potential for environmental releases from treatment, interim storage, transportation, and final disposal of all wastes produced in the course of that cycle.

Further, the proceeding must fully analyze the environmental impact of the reprocessing phase of the fuel cycle, including the impacts from fuel storage facilities, chemical separations facilities, waste solidification facilities, plutonium conversion facilities, and mixed-oxide fuel fabrication plants -- all of which are part of the "phase of the fuel cycle in which reusable portions of spent fuel are extracted for recycling and the remaining radioactive residues are concentrated." Slip Opinion at 24, n. 41.

B. The Commission Must Fully Analyze the Cumulative Impacts Involved in Reprocessing and Waste Management.

The invalidated Table S-3 considered environmental impacts on the basis of one year's operation of a single one-thousand megawatt (electrical) light water reactor. The Court's opinion, as well as NEPA case law, makes clear that such disclosure is thoroughly inadequate. First, the Court's opinion establishes that the Commission must analyze the environmental impacts of the wastes that will be generated by each reactor during its expected 40-year operating

life. Second, the court also noted explicitly that it was "misleading to focus solely on the incremental impact of the waste generated by an additional reactor." Slip Opinion, at 9 n. 12 (emphasis in original) (citations omitted). Thus, the Commission must make "reasonable forecasts" as to the number of reactors that will be operating and analyze the environmental impacts of the wastes that will be generated by these reactors over their operating lifetimes. And third, the environmental effects to be analyzed must include those impacts expected over the full toxic lifetimes of the wastes under discussion. Slip Opinion, at 8 n. 12. Indeed, it is axiomatic in NEPA case law that cumulative effects must be fully considered. See, e.g. Natural Resources Defense Council v. Calloway, 524 F. 2d 79, 89 (2d Cir. 1975); Jones v. Lynn, 477 F. 2d 885,891 (1st Cir. 1973).

The D. C. Circuit's opinion flatly labels any other approach as "misleading." Therefore, the Commission must consider the total cumulative impacts of reprocessing and disposing of wastes from a mature nuclear power industry. An initial step will be forecasting the maximum credible number of nuclear power plants over some reasonably long time frame, e.g., 50 years, and calculating the total amounts of wastes that would be generated during the 40-year operating lifetimes of the plants brought on-line during that period. Then the total radioactive releases during the reprocessing and disposing of these wastes, integrated over

the "full detoxification period" of the wastes, Slip Opinion, at n. 12, must be estimated. These procedures will develop the "source terms" for calculations of health and environmental impacts.

Furthermore, the analysis of this impact must be in terms of person-rems and predicted health effects during the toxic lifetimes of the materials. Disclosure in terms of curies as Table S-3 presently does, is virtually meaningless and inadequate. The ill-health effects are best calculated using the Environmental Radiation Dose Commitment concept utilized by the U. S. Environmental Protection Agency.^{2/} This procedure relates the amount of ill-health caused by radioactive releases from a particular activity to the total associated population exposure in person-rems. An EPA official recently described the usefulness of this concept as follows:

"The environmental dose commitment is of direct use in estimating the projected impact of specific activities releasing radioactivity. It is an essential tool in both cost/benefit and cost-effectiveness of risk reduction (e.g., "as low as practicable") analyses. Thus it finds application in the preparation of the environmental impact statements required by NEPA. . .As man's uses of radioactive materials have increased, and as man-made radioactive contamination of the biosphere

^{2/} See, EPA, Environmental Radiation Dose Commitment: An Application To The Nuclear Power Industry, EPA-520/4-73-002, February 1974.

has become ubiquitous, the calculation of . . . population dose commitments has become vital for radiation protection assessments for most major uses of radioactivity." 3/

The major uncertainties in calculating dose commitments are due to the lack of knowledge about the long-term environmental behavior of long-lived radionuclides. In evaluating the environmental movement of long-lived radionuclides the Commission must be particularly careful to obtain the "full range of responsible opinion." Slip Opinion, at 21. For instance, simple arguments about the sorption of plutonium to soil particles resulting in its immobilization must be contrasted with other scientists' concern that plutonium released in and to the environment may be bio-concentrated and enter man's food chain, causing significant radiation exposure. 4/

3/ Richardson, "The Historical Development of Concepts of Radiation Dose Commitment" in Population Exposures, Proceedings of the Eighth Midyear Topical Symposium of the Health Physics Society, CONF-741018, Knoxville, Tennessee, October 21-24, 1974, at 6.

4/ See, "Transuranic Elements" in Assessing Potential Ocean Pollutants, A Report of the Study Panel on Assessing Potential Ocean Pollutants to the Ocean Affairs Board, Commission on Natural Resources, National Research Council, National Academy of Sciences, 1975. See also attached Appendix A, at 19-26.

- C. Given The Uncertainties Surrounding Which Waste Disposal Alternative Will Be Selected, the Commission Must Analyze All Reasonable Alternatives Sufficiently to Insure That Its Disclosure of Environmental Impact is "Sufficiently Conservative and Credible."

The rulemaking must provide an adequate basis on which to consider the environmental effects of waste disposal when the Commission licenses individual reactors. To do this plainly requires full disclosure and analysis of potential environmental impacts. However, the Commission faces a difficult task in this regard since neither ERDA nor NRC has authoritatively identified the precise technologies that will be used at various stages of reprocessing and waste disposal. Thus, several alternatives are available at each of the four basic waste management steps involving treatment, interim storage, transportation, and final isolation or disposal for each of the different types of waste that must be isolated from the environment.

It is true that the Commission is not obligated in the present proceedings to determine which alternative technology is most desirable on the basis of a full evaluation of every alternative available for waste management and reprocessing. However, the Court of Appeals asserted that the Commission need not provide such "plenary consideration of alternatives" only if "a sufficiently conservative and credible assessment of a particular waste disposal method

is used." Slip Opinion, at 40 n. 58.

The Commission must, of course, justify its conclusion that it is providing such "a sufficiently conservative and credible assessment." To provide this justification, the Commission will have to engage in substantial analysis to identify the alternative that provides a "conservative" assessment of potential environmental impacts. For example, the Commission must determine which disposal alternative for decommissioning wastes is "conservative." Does entombment of highly radioactive structures at scattered sites around the country provide greater risk of environmental contamination and human radiation exposure than efforts to dismantle highly radioactive facilities which risk release of radioactive dusts and aerosols?^{5/} Similarly, the Commission must analyze potential environmental impacts of different methods of managing radioactive gases from reprocessing plants. Does release to the atmosphere pose greater hazards than an attempt to capture gases and store them in concentrated form in a repository, which may risk release of concentrated radioactive gas?

Unless the Commission is prepared to identify the precise alternative which it will permit sole use of in the

^{5/} See, Technical Alternatives Document, supra page 8, at 15.17.

future, the Commission must undertake an analysis of all potentially available and acceptable alternatives in order to identify that alternative which provides a "conservative" estimate of environmental impacts relative to other potential alternatives. Plainly, it would not be acceptable for the Commission to base its analysis on the optimistic assumption that the most desirable alternative will turn out to be available and will in fact be implemented. Nor can the Commission simply assert without supporting analysis that the alternative it has selected represents a "conservative" estimate. Rather, the Court has mandated the Commission to provide a "conservative" assessment and the Commission must undertake the "in-depth" analysis necessary to demonstrate that it is providing such an assessment.

D. The Identification of a Particular Waste Disposal Method or Reprocessing Technology as the Basis for Calculating Environmental Impact Must Be Carefully Justified.

1. Reliance on any technology that has not been utilized to date must be justified as reasonable, the current practice must be fully presented, and the grounds for believing that a change will occur must be set forth.

Analysis of the potential environmental impact of any particular phase of waste disposal or reprocessing must begin with a "thorough exploration of the problems involved. . . ,

including past mistakes, and a forthright assessment of the uncertainties." Slip Opinion at 39. At a minimum, this requires the Commission to analyze current practice, to identify the consequences of continuing that practice into the future, and to indicate the basis for its conclusion that a new or different technology will be adopted. The Court of Appeals addressed this question suggesting:

"Where important changes in the state of the art or other major uncertainties are in the offing, meaningful assessments of future environmental impacts might be facilitated by making two alternative estimates: one based only on existing technology and another which takes into account developments which may reasonably be anticipated." Slip Opinion at 10 n. 13.

Thus, disposal of high-level radioactive wastes from reprocessing must begin with an in-depth analysis of ERDA's high-level waste storage program and the Nuclear Fuel Service's waste storage program to date -- alkaline slurries in carbon steel tanks. If cost constraints in these situations prevented the adoption of better storage modes, the Commission must indicate the basis for its conclusion that better access to adequate funds will occur in the future. If this conclusion rests on assumptions about regulatory actions, the Commission should identify specifically what actions it intends to take.

2. Any needed institutional support -- particularly over the long-term -- must be carefully identified and justified.

Chairman Rowden in his testimony before the Joint Committee on Atomic Energy on May 12, 1976, pointed out:

"Among the ingredients for the safe management of nuclear wastes two that stand out are a trustworthy technology and a process for the timely implementation of that technology. . . . Having the technology on the shelf is not enough. . . . Organizations must carry out the tasks." 6/

Thus, the Commission must carefully identify any assumptions it makes that a particular technology can or will be implemented in a timely fashion and specify the institutional and organizational mechanism on which it bases that assumption. Specifically, for example, any assumption concerning long-term surveillance must include a description of the institutions that will be needed to carry out that surveillance and an explanation for any assumption that such institutions will in fact implement such surveillance. Thus, the Court of Appeals explicitly faulted the Commission's earlier rulemaking for asserting "without further explanation" that a future geologic repository would be established for high-level wastes and that the federal

6/ Testimony of Marcus A. Rowden, Chairman, Nuclear Regulatory Commission, Before the Joint Committee on Atomic Energy, at 5 (May 12, 1976).

government would maintain the site in perpetuity. Slip Opinion, at 26. The Court further emphasized that the Commission's earlier proceeding provided "no discussion of how 'adequate human surveillance and maintenance' can be assured for the periods involved, nor what the long-term costs of such a commitment are, nor of the dangers if surveillance is not maintained." Slip Opinion, at 33.

3. The potential for unplanned releases and accidental events must be taken into account in analyzing the potential environmental impacts of any disposal method or reprocessing technology.

Credible accidents, sabotage, natural catastrophes, and other unplanned events may involve the potential for significant environmental impact. The Commission must consistently include the possible contribution of such events within its analysis of the potential environmental impacts of reprocessing and of the various waste management steps of treatment, interim storage, transportation and final disposal. Such analysis must include a description of potential unplanned release mechanisms, an estimate of their likelihood, and a description of "how serious a radioactivity hazard would be presented" if they occurred. Slip Opinion, at 29.

E. The Analysis Must Represent the Commission's Independent Judgment and Analysis.

NEPA, of course, requires not only that the environmental analysis be "detailed" but also that it be prepared "by the responsible official." 42 U.S.C. § 4332(C). The Commission must, according to the Guidelines issued by the Council on Environmental Quality, "make its own evaluation of the environmental issues and take responsibility for the" accurate disclosure of environmental effects. 38 Fed. Reg. 20553 (1973). Thus, in the present case, it is insufficient for the Commission to perform merely a literature search and identify documents that contain estimates of environmental impacts. Rather, the Commission must make its own assessment of the accuracy of estimates of potential environmental impacts. The Commission must identify uncertainties and exercise its independent, regulatory judgment in assessing and describing environmental impacts.

Most critically, in many cases, detailed analysis of potential environmental impacts does not yet exist and will have to be carried out by the Commission. For example, ERDA's recently issued Technical Alternatives Document describes for the first time various technical alternatives for managing radioactive wastes from the back end of the commercial light water reactor fuel cycle. However, ERDA has stressed that "the document does not . . . address environmental impact

issues, . . . estimate and compare costs, . . . [or] estimate and compare safety and risks." Technical Alternatives Document, at 7. Furthermore, the ERDA document does not seriously consider the geological disposal of irradiated fuel or the disposal of decommissioned wastes -- major issues that must be addressed by the Commission. Thus, for many of the alternatives identified, NRC will have to make its own assessment of environmental impact and safety and risks.

The Court of Appeals has cautioned the Commission that,

"An agency may abuse its discretion by proceeding to a decision which the record before it will not sustain." Slip Opinion, at 23.

A failure to develop needed, relevant information on environmental effects would result in a record that could not sustain Commission licensing decisions.

F. The Commission Must Analyze the Impacts in Detail.

The National Environmental Policy Act requires a "detailed" evaluation of the environmental impacts of proposed actions. Superficial or generalized analyses of environmental effects will not satisfy the mandate of NEPA to disclose "meaningful information" concerning the effects of waste reprocessing and disposal. See Scientists' Institute for Public Information, Inc. v. AEC, 481 F.2d 1079 (1973). Indeed,

the Court of Appeals' opinion emphasizes the Commission's "affirmative obligation to explore the issues in depth." Slip Opinion, at 21 n. 34 (emphasis added). Thus, the Court calls for the Commission to "explore fully" uncertainties and to engage in a "thorough exploration" of all aspects of the problem. Slip Opinion, at 38-39.

G. In All the Discussions, the Commission Must Present the Full Range of Responsible Opinion and Highlight Uncertainties and Disagreements Related to Environmental Impact.

Throughout its discussions, the Commission must give prominent attention to NEPA's requirement "that the Agency acknowledge and consider 'responsible scientific opinion concerning possible adverse environmental effects' which is contrary to the official agency position." Slip Opinion, at 21. The agency must indicate "the full range of responsible opinion on the environmental effects" to be anticipated. Id. More importantly, the Commission must seek out "a fair representation of scientific opinion" in order to make a full and complete record. The Court of Appeals emphasized that the Commission must "identify and address information contrary to its own position." Slip Opinion, at 42. Without relying on intervenors, the Commission must not only disclose all existing responsible opinions concerning potential environmental impacts, but it must seek out and

develop a full range of opinion on the critical areas of its analysis.

II. MAJOR TYPES OF WASTE FOR
WHICH THE COMMISSION MUST
ASSESS DISPOSAL METHODS

In Part I-A, supra, we pointed out that the Commission must analyze potential environmental impacts for all waste forms identified in ERDA's Technical Alternatives Document, and that this analysis should take account of the four basic waste management activities set out by ERDA. As further guidance to the Commission on the scope of the analysis it must undertake, we attach to these comments two documents prepared earlier by NRDC. As Appendix A, we attach relevant portions of a memorandum recently submitted

to the Commission in another context which highlights the uncertainties and deficiencies in the current program for disposing of low-level and transuranic wastes. As Appendix B, we attach comments submitted by NRDC to ERDA on WASH-1538, the now-withdrawn draft environmental impact statement on ERDA's research and development program for developing a disposal method for high-level and transuranic wastes. Both documents highlight waste management issues that should be considered by the Commission in assessing the potential impact from waste management and reprocessing.

To provide an even more specific indication of the type of assessment we believe the Commission must undertake, these Comments will outline briefly the analysis needed for seven major types of wastes. This discussion is not intended to be all inclusive, but rather is illustrative of what is needed.

A. Spent Fuel Rods

The chemical processing of irradiated fuel may never occur, or may be delayed for a number of years, based on a regulatory determination that plutonium cannot be adequately safeguarded or based on an industry determination that plutonium recycle is inadequately profitable. (See, Wohlstetter, et al., Moving Toward Life In A Nuclear Armed Crowd?, April 22, 1976). The unprocessed fuel would become either a temporary or permanent waste needing management comparable

to that required by high-level wastes. However, management and disposal of irradiated fuel may pose unique problems. The Commission must undertake careful analyses in order to evaluate the potential environmental impacts of storage and disposal.

The most serious problem posed by spent fuel storage and disposal may be the possible formation of a critical mass during the thousands of years required for the fissile materials to decay to insignificant levels. This potential hazard may be particularly severe for surface storage in engineered facilities and for disposal in a water soluble geological formation such as bedded salt. The Commission must analyze at least two possible "worst case" situations: society might cease the maintenance and surveillance of near-surface storage facilities containing irradiated fuel, and water might dissolve away over an extended period a salt formation holding such fuel. Given the large amounts of plutonium in such collections of spent fuel, the Commission must assess all events that might lead to the formation of a critical mass. It must analyze and disclose the likelihood of a criticality incident and the consequences if it occurred.

Another potential problem that needs detailed review is the release of gases over long periods of time and their build-up in an enclosed facility underground. The Commission must analyze the risk posed by any such build-up, including the mechanisms for possible sudden release of any such

accumulation. The analysis of potential criticality and off-gas release needs to be carried out in order to determine whether the potential environmental effects from this configuration of the LWR fuel cycle poses greater or lesser risks than a fuel cycle including reprocessing.

At least to some extent, the Commission must make these estimates on the basis of original calculations. The Atomic Energy Commission pointed out in the draft GESMO statement that,

"Little work has been done relative to the ultimate disposition of plutonium or of unreprocessed fuel."
AEC, Draft, Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuel in LWR's, ("GESMO") at XI-52 (WASH-1327) (1974).

And ERDA has announced that "no funding is provided in the [ERDA] FY 77 commercial waste budget for the throwaway fuel cycle option." U.S. ERDA, Program Implementation Document, ERDA's Program for Management of Radioactive Waste From Commercial Nuclear Power Reactors, at 8 (May 7, 1976).

The Commission must also assess the potential impact from the interim storage of large quantities of irradiated fuel prior to geologic disposal or reprocessing. Potential impacts from extended storage at reactor sites and regional storage depots must be assessed. Existing experimental information about the existing spent fuel storage pools at plant sites can be used in evaluating the risks and costs of the

interim storage of irradiated fuel. In the use of regional storage centers, where large numbers of fuel rods may be stored over an extended period of time, e.g., 20 years, the possibility and consequences of (a) losing human maintenance and surveillance, and (b) terrorist attacks or warlike acts against the facility must be analyzed.

B. Liquid And Solidified High-Level Wastes

The treatment, interim storage, transportation and final disposal of high-level wastes remains shrouded in uncertainty, if not mystery. To date, there has been little experience with the reprocessing of spent fuel rods irradiated in large, commercial nuclear power reactors. These rods will produce high-level wastes with substantially greater levels of radioactivity than the government has had to contend with from its own reprocessing plants which have handled fuel rods irradiated for the purpose of producing plutonium, not electric power. In presenting any data from past experience the Commission must, therefore, highlight the differences between the waste handled in the past and the waste to be generated at commercial reprocessing plants.

The Commission must, of course, analyze and disclose potential environmental effects from each stage in the handling of high-level wastes. It must analyze and disclose potential effects while the wastes are in liquid form in tanks near

the reprocessing plant. Such analysis must include potential impact of sabotage, accidents, and other unplanned events. In addition, the Commission must indicate its assessment of the likelihood of leaks from the storage tanks and indicate the period of time that these storage tanks will be in service. Thus, even if wastes are removed within five years to be solidified, the Commission must indicate whether the tanks will be refilled, how long they will be used, and how long they can be expected to last in a mode involving constant refilling which will subject them to much greater stresses (from constantly fresh wastes) than if a single batch of wastes remained in the tanks for that period of time.

The Commission must also consider the costs, hazards and risks posed by the formation of insoluble particulates during reprocessing that might accumulate on reprocessing equipment and build-up in the bottoms of storage tanks. At a recent conference sponsored by the Commission, researchers summarized existing information about these solids, but they stressed that "much more information is needed":

"All of the potential problems with actinides sorbed on solids and with 'inextractable' plutonium have not yet been defined. Laboratory-scale studies with nonradioactive, synthetic waste solutions and hot cell studies with 250-g amounts of high-burnup LWR fuel are in progress to identify areas of difficulty and to develop acceptable solutions. Results of these studies have shown that (1) small amounts of

solid residue remain after dissolution of high-burnup fuel; (2) Purex feed solution is metastable, and solids form under certain conditions; (3) considerable amounts of solids are likely to form when high-level waste solutions are evaporated and stored; and (4) a small amount of plutonium is 'in-extractable.'

"Thus far, it has not been determined that any of these results offer insurmountable problems, but much more information is needed. Laboratory-scale and hot cell studies should be continued, and attention should be given to the implication of larger-scale processing." * * *

"When Purex feed (prepared from high-burnup fuel) is stored at elevated temperatures, a highly crystalline solid composed primarily of molybdenum and zirconium at a 2.1 mole ratio is formed. This solid can carry up to 20 mg of plutonium per gram of solid. . . . However, the plutonium can be effectively leached from these solids to very low values with nitric acid. The information available relative to the conditions for formation of these solids also indicates that careful process control will be an effective deterrent to such formation of gross amounts of solids from Purex feed. It appears, however, that there will be some serious problems with formation of these solids during treatment and interim storage of high-level waste."

"Test runs have demonstrated that small plutonium losses occur when either highly purified Pu(IV) in 3 M HNO₃ or Purex feed prepared from highly irradiated LWR fuel is extracted with 30% TBP--dodecane. . . . This problem, although apparently not

insurmountable, is worrisome and needs additional attention." 7/

Next, the Commission must analyze potential impacts from the solidification process and analyze the consequences of an inability to solidify the wastes. Evidently, at least the nuclear power industry is uncertain about the feasibility and acceptability of existing solidification procedures, since they have requested ERDA to demonstrate that the processes are satisfactory before the industry commits large sums to constructing such facilities. Since there has been no adequate demonstration that solidification techniques can be successfully applied to commercially generated wastes, the Commission must at least analyze the possibility that the technology will not work.

The Commission must analyze and disclose potential environmental impacts from temporary storage of high-level wastes. This storage may be necessary in the event that a geologic repository is not ready in time to receive solidified wastes, or it may occur by virtue of the construction of a Retrievable Surface Storage Facility, which has not been ruled out completely as a possible interim measure by ERDA. Thus, the Commission must analyze and calculate potential

7/ Leuze and Bond, "Status of Reprocessing Methods for Actinide Partitioning" in Proceedings of Nuclear Regulatory Commission Works on the Management of Radioactive Waste: Waste Partitioning as an Alternative, NR-CONF-001, June 8-10, 1976 at Battelle-Seattle Research Center, Seattle, Washington, at 141-142.

effects from either of these two readily conceivable developments. In addition, the Commission must take into account potential effects from transportation of the wastes to interim facilities such as an RSSF and then subsequent transportation to a geologic facility. In analyzing potential effects, the Commission must, of course, analyze the potential for loss of surveillance or inadequate maintenance during such temporary storage periods as well as unplanned natural events or human actions leading to accidents or releases. In this regard, the explicit requests in the Court of Appeals' opinion for estimates concerning the probability and consequences of a "melt-down" in a temporary facility, Slip Opinion, at 29, require careful analysis. Finally, in light of the demonstrated difficulties the government has had in actually locating a site and successfully constructing a geologic repository, the Commission must analyze the consequences of a permanent failure to construct a geologic repository.

ERDA told the Congress in May that it was considering "three general conceptual alternatives" for disposal of wastes: "1. Geologic isolation on land; 2. Geologic isolation beneath the floor of the sea; 3. Elimination from existence on earth by extraterrestrial disposal or transmutation." Technical Alternatives Document, at 4. The maximum credible accidents and potential mechanisms that might release radioactivity vary greatly for each of these alterna-

tives. Without substantial environmental and safety analyses of each alternative, which were not provided in ERDA's document, NRC cannot hope to provide a well-grounded environmental and safety analysis of waste disposal. Even if the Commission seeks to perform a "bracketing" analysis based on "worst case" assumptions, the Commission must undertake a careful assessment of potential environmental impacts of each alternative in order to determine which is the "worst case." Without this analysis, there is no way for the Commission to demonstrate that its estimate is sufficiently "conservative."

Potential releases from a geologic repository over the period of time the wastes will remain toxic must also be carefully analyzed. The Commission must analyze the possibility that the repository will be located in a geologic formation unsuited to ultimate disposal, (e.g., one with fissures or significant access to water) due to political and economic pressures. Past experience with low-level waste burial sites demonstrates that this eventuality is at least possible, if not probable. See attached Appendix A, at 32-45. In addition, the Commission must indicate the period of time it anticipates surveillance of the ultimate disposal facility will be required and what the consequences would be if surveillance were lost. It must identify the institutions which will provide the surveillance for the period of time required. Finally, it must assess the probability of escape or release of radioactivity from a geologic repository.

Moreover, the Commission's entire analysis of high-level waste disposal must be presented against the background of past experience. To date, the federal government almost exclusively has had the relevant experience in irradiated fuel reprocessing, high-level waste storage, and management of transuranic wastes. In order to form a base line for conservatively predicting the potential environmental impacts of handling these wastes from the commercial nuclear power industry, the governmental experiences with them must be fully described. As the Court stated, "NEPA's requirement for forecasting environmental consequences far into the future implies the need for predictions based on existing technology and those developments which can be extrapolated from it." Slip Opinion, at 10. To the extent that the Commission believes the commercial experience will deviate in particular ways from the government's experience, the detailed reasoning supporting that expectation must be presented.

The Commission cannot dismiss out of hand the governmental experience simply by asserting that the commercial technology will be entirely different than that utilized by the government. First, the government's programs represent the largest, most complete experience to date. They provide virtually the only basis for evaluating the practical aspects of reprocessing and waste management.

Second, the small amount of commercial experience has

closely paralleled the government's. The one commercial reprocessing plant (Nuclear Fuel Services) that has operated used the Purex process which was developed and is still in use by the government. Another commercial plant under construction (Barnwell) also is based on the Purex process. The existing commercial high-level waste is stored principally as a neutralized liquid in a near-surface, carbon steel tank, similar to the ones in use at Hanford and the Savannah River Plant.

To the extent that there are relevant experiences with commercial waste management these must also be fully considered. Certainly there should be a thorough review of reprocessing and waste storage practices at the Nuclear Fuel Services' facility in West Valley, New York. Detailed disclosure should be provided of occupational exposures which were reportedly high at the NFS plant. Among the other issues that need to be addressed in detail are the risks and impacts associated with (a) leaving the existing neutralized and acidic high-level wastes in existing tanks, (b) periodically transferring them to new tanks, (c) retrieving and solidifying them for transport and disposal at another (specified) location, and (d) decontamination and decommissioning the facility. The institutional problems associated with these activities need to be disclosed. For instance, the question of which organization, NFS, ERDA, or the State of New York, will pay the potentially very large sums (up to \$500 million) required

to retrieve, solidify and transport the NFS high-level wastes must be fully considered.—^{8/} The Commission needs to explain why such problems will not occur again in the future and assess the potential consequences if similar problems were to develop.

C. Transuranic Wastes

During the past few years, the hazards posed by transuranic-contaminated (TRU) wastes have come to be recognized as much greater than had previously been thought. With recognition of the dangers has come virtual paralysis on the part of the government in formulating policy for managing these wastes.

At the most basic level, the government has yet to determine authoritatively the amount of transuranic waste that will be generated. The Commission must obviously confront this confusion in order to estimate the amount of transuranic waste that will be generated and the amount of transuranics that will be contained in that waste. NRDC has submitted to the Commission a lengthy analysis of the problems involved in the present disposal program for transuranic and low-level wastes. Discussion of the difficulties encountered in that program, which are relevant to the Commission's investigation here, are attached as Appendix A. As reflected there,

^{8/} See Battelle Pacific Northwest Laboratory, Alternative Processes For Managing Existing Commercial High-Level Radioactive Wastes, NUREG-0043, April 1976.

the estimates of the amount of transuranic waste to be generated by the year 2000 vary from a low NRC estimate of 5.4 million cubic feet to a high EPA estimate of 65 million feet. Plainly, the Commission must attempt to resolve this discrepancy in order to obtain an adequate source term for projecting potential impacts.

Beyond the question of volume of waste, the government has so far given only a few faltering nods to the dangers posed by TRU wastes. The Atomic Energy Commission, before its dissolution, proposed a regulation requiring that transuranic wastes contaminated to a level greater than 10 nanocuries per gram be consigned to a federal repository. 39 Fed. Reg. 32921 (1974). The Environmental Protection Agency in testimony before the Joint Committee on Atomic Energy, in May 1976 explicitly noted the "increased awareness that low-level transuranic waste should be treated as a separate problem because of its long life time." ^{9/}

The Nuclear Regulatory Commission has not, since its creation, adopted regulations which prescribe special disposal procedures for transuranic wastes. Chairman Rowden in testimony to the Joint Committee on Atomic Energy stated that the formulation of NRC policy with regard to these wastes would

^{9/} Statement of Roger Strelow, Assistant Administrator for Air and Waste Management, Environmental Protection Agency, before the Subcommittee on ERDA, Environment and Safety, of the Joint Committee on Atomic Energy, at 2 (May 12, 1976).

await the results of an ERDA study currently in progress.^{10/}
The ERDA study will attempt to assess quantitatively the risks posed by various modes of disposal of transuranic wastes.

An analysis similar to that apparently being carried out by ERDA is, of course, required in order for the Commission to prepare its analysis of the impact of waste management required by the Court of Appeals' remand. Given the new awareness of the risks posed by releasing large amounts of plutonium into the environment, NRC must assess and disclose the potential environmental impacts that might result from continued land burial of transuranic wastes. It must do this analysis and disclosure since these wastes continue to be disposed of by this method and because NRC regulations permit such disposal nationwide. Moreover, it is plainly not acceptable to assume that no releases will occur from burial sites since two sites have already experienced off-site migration. The Commission's investigation must include explicit assumptions about the amounts of transuranics that will migrate from land burial sites. In this regard, NRC must fully analyze the data from the Maxey Flats site and the conclusions drawn by the EPA study of that site which suggest that plutonium may be migrating both overground and under-

^{10/} Statement by Marcus A. Rowden, Chairman, U.S. Nuclear Regulatory Commission, before the Joint Committee on Atomic Energy, at 14 (May 12, 1976).

ground away from the burial trenches. To provide "conservative" estimates, the Commission should calculate the consequences of continued reliance on poor burial practices at burial sites.

An analysis of the consequences of continued land burial of TRU waste is further required even if NRC anticipates that some TRU waste will go to a repository because no criterion in terms of nanocuries per gram has been chosen to determine which TRU waste would go to a repository. The Commission must, at a minimum, analyze the potential environmental effects that would result from adopting various cutoff points. For each cutoff point, the Commission must disclose the volume of TRU wastes that would continue to be buried at land burial sites and reveal potential environmental impacts associated with such burial.

Furthermore, the Commission must state whether or not it will permit ocean dumping of transuranic wastes in the future. Transuranic wastes are dumped by western European countries and was allowed previously in the United States. If the Commission cannot definitively state that ocean dumping always will be prohibited, then the amounts and impacts of future possible dumping must be estimated.

The Commission must also estimate the consequence of disposing of transuranic wastes by deep geologic disposal. This analysis must take account of any criticality problems that might arise, particularly if various volume reduction techniques are utilized. The Commission must also analyze any surveillance requirements, accident potential, and natural effects in the event of unplanned occurrences.

In addition, the Commission must also assess the

potential releases and environmental impacts from other steps in the disposal process, namely treatment, (e.g., incineration) and transportation.

The Commission must also address the important question of interim storage of transuranic wastes. Even if ultimate geologic disposal is planned, no repository currently exists for commercial transuranic contaminated wastes. Therefore, there will plainly be a stage during which substantial amounts of transuranic wastes will be generated and stored retrievably on a temporary basis. This temporary period, however, may extend into decades. The Commission must, therefore, analyze the potential for environmental impacts during this interim period when the waste is stored on the surface of the earth. This analysis must, of course, take into account the potential of natural catastrophes, human intrusion, sabotage, and other unplanned events.

D. Low-Level Wastes

Both the Nuclear Regulatory Commission and the Environmental Protection Agency have estimated that approximately 330 to 350 million cubic feet of low-level radioactive wastes will be generated by the year 2000 by the commercial nuclear power industry. These wastes will contain significant amounts of radioactive materials and pose substantial potential for the release of radioactivity into the environment.