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Statement

of

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before the

SUBCOMMITTEE ON ENERGY, NUCLEAR  
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## I. INTRODUCTION

My name is Thomas B. Cochran. I have a Ph.D. in physics, and I am presently a Senior Staff Scientist at Natural Resources Defense Council (NRDC) on whose behalf I am testifying. NRDC is a national non-profit environmental organization with a membership of approximately 45,000. We have been concerned with the nuclear waste issue for a number of years and welcome this opportunity to appear before this Subcommittee.

My testimony will focus on the recently released Report to the President of the Interagency Review Group on Nuclear Waste Management (IRG Report) and some preliminary results of work on the waste issue that NRDC has been doing under a small Department of Energy (DoE) contract (See Enclosures 1 and 2).

In his letter of invitation the Chairman requested that I address six topics specifically. It would perhaps be most useful, therefore, to begin with these.

## II. SPECIFIC TOPICS

1. Our views on the technical, scientific and program strategy aspects of the IRG Report.

To place the question of strategy and the IRG review in context, I want to begin with an observation I made last year.

Let us set aside all subsidiary considerations and simply address the question: what is the most rational way to attack the radioactive waste disposal problem? In answer to this, we would propose the following four stage approach.

- First, the waste problem must be carefully defined.  
The focus here would be on the quality and quantity of the wastes. The former to define the biological hazard of the wastes and the latter to define the present and future logistic problems.
- Second, a definitive set of overall waste disposal criteria must be established. The overriding objective in establishing these criteria should be the protection of the present and future generations from the adverse effects of exposure to the ionizing radiation associated with the wastes.
- Third, an R & D program would have to be established in order to identify those disposal approaches which would meet the above criteria. As part of this R & D program, procedures and instrumentation would have to be developed and implemented to determine that the ultimate disposal approaches and sites will meet the criteria.
- Fourth, based upon the above R & D program, sites would be selected and the waste disposal demonstration aspect would begin. By demonstration is meant proof that the selected sites will satisfy the criteria.

If the waste problem is to be solved properly, we would suggest that the above approach must be followed. This is not the case for the approach taken by the present Government pro-

gram. In fact, the Government appears to be proceeding backwards through the above stages.

Initially, the geologic medium (salt) and the site were chosen. The first site was Lyons, Kansas, and now it's Carlsbad, New Mexico; then came the R&D program, characterized by the IRG as an "inadequate perception of the additional technological and scientific capabilities needed to develop an acceptable disposal capability" (IRG Report, p. 2). Only now are the EPA and NRC getting around to writing criteria (See IRG Report, pp. 23-29); and we have yet to fully define the problem, for example, in terms of the biological hazards of low level radiation, and the institutional issues - particularly important resource and logistical issues (See IRG Report, pp. 87-88).

In the midst of this chaos the IRG has been charged to review the waste management program and to make recommendations. We must recognize at the onset limitations of the IRG that have severely restricted the quality of its review and findings. These are:

- o The IRG is incapable of stopping the present program momentum, the backward process, and recommending that we start anew with a more logical approach as outlined above.
- o The DoE is marching to a different drummer. Its highest priority is to insure the survivability of the nuclear option, rather than insuring the health and safety of future generations. This has infected virtually every important waste management policy decision of this Administration.

- o The IRG is dominated by representatives of the Executive Branch, and is thus ill-equipped to criticize waste policies already adopted by President Carter - namely, the spent fuel policy of October 1977. By the same token, the IRG is incapable of questioning the competence of a department (i.e., DoE) or agency (i.e., EPA) to perform its function.

Because of these shortcomings, the IRG has not focused on the underlying problems. It is attacking the symptoms of the disease rather than the disease itself. The important institutional issues, the resolution of which the IRG admits are equally important as the resolution of outstanding, technical issues (IRG Report, p. 87), are not seriously addressed, much less resolved. Most of the remaining interesting issues, because of DoE's misguided priorities, are unresolved by the IRG and will be decided on an "interim strategic planning basis" by the President based on recommendations in some future secret Presidential Decision Memorandum. While this "interim strategic planning basis" is meant to be a temporary posture, with choices on technical strategies awaiting the completion of the NEPA process (IRG Report, p. 21), because the DoE makes such a mockery of the NEPA process, there is nothing "interim" about the "interim planning basis." And finally, the IRG report does not meet its own stated criteria for neutrality to the future of nuclear power (See IRG Report, p. 8).

Once you appreciate these deficiencies, what remains is not all that bad. As with the earlier draft, the IRG Report is a positive and welcome change from the tired rhetoric of waste management reports of previous Administrations. It's an honest appraisal of some of the significant technical and institutional problems associated with long term management of nuclear wastes, and little attempt has been made to mask differences of opinion within the Administration over how to proceed.

The scientific and technical analysis in the IRG Report and its supporting documents are basically sound, although, here, we agree with the view of some members of the IRG that "insufficient attention is given in this [the final IRG] report to significant gaps and uncertainties in our current technical understanding" (IRG Report, p. 42).

2. The degree of consensus within the scientific and technical community that the safe permanent disposal of nuclear wastes in mined geologic repositories is feasible. Identify the recognized authorities supporting various positions on this matter.

To place this in proper context, let's begin with a few observations.

First, no laws of physics must be defied to safely and permanently dispose of nuclear waste in mined geologic repositories. In theory, it can be done - it is feasible.

Second, there are numerous identifiable geologic formations that have been stable for hundreds of millions of years, hence

we have available media which have been stable in terms of geologic epochs and geologic times. A subset of these formations have been dry and isolated from the biosphere over these long periods.

Third, in the absence of water, one can construct very stable waste forms. Witness the artifacts from the tomb of Tutankhamen. Within limits one can dilute the waste to obviate problems deriving from the heat produced as a consequence of radioactive decay of the waste.

Given these facts, it is easy to understand why the technical literature is replete with statements to the effect that safe permanent disposal of nuclear waste in mined geologic repositories is feasible. In theory, it is capable of being done.

On the other hand, if by feasible, we mean to imply "probable, or likely", these theoretical points have little relevance. References 1-11 of Enclosure 2 identify a myriad of unresolved technical issues related to disposal of radioactive waste in mined geologic repositories. Failure to properly deal with these technical uncertainties can easily lead to implementation of unsafe or risky disposal schemes. Institutional failures can force technical failures. The history of the Government's radioactive waste management program is one long series of technical blunders that can be attributed to institutional failures. We have had the leaking tank farm; the Lyons, Kansas fiasco; the ill-conceived Retrievable Surface Storage Facility; the rejection of the first site in the Carlsbad, New Mexico area; the mess at West Valley, New York; the mismanagement of the mill tailings; and Maxey Flats.



Thanks to DoE, we are about to embark on a new round of fiascoes called WIPP, basalt at Hanford and the Gulf coast salt domes. It is highly likely that we will implement unsafe disposal schemes. The IRG report quite properly observes that "The resolution of institutional issues is equally important as the resolution of outstanding technical issues and problems" (IRG Report, p. 87). None of the reports often cited as evidence that recognized authorities or informed technical experts believe safe disposal of nuclear waste is feasible, address the institutional question. These reports should be interpreted as statements that in theory safe disposal is capable of being done. One could even question the competence of these "recognized authorities" of the technical community to pass judgment on the success of the institutions to resolve the institutional issues.

In this regard, IRG is careful to make no claim that what is in theory possible will actually come to pass. Rather, the IRG Report says only that "Successful isolation of radioactive waste from the biosphere appears technically feasible for periods of thousands of years provided that the systems view is utilized rigorously to evaluate the suitability of sites and designs, to minimize the influence of future human activities and to select a waste form that is compatible with its host rock." (IRG Report, p. 38, emphasis supplied.) The IRG then backs off from even this position by making what is in effect a negative declaration, "No scientific or technical reason is known that would prevent identifying a site that is suitable for a repository provided . . ."

and "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 of particular sites." (IRG Report, p. 42) It should be emphasized that the present Government program is incompatible with each of the caveats following the word "provided" in the underlined portion of the quote above.

One final observation on this matter, to the extent we are questioning whether safe disposal is feasible, it depends first on defining a comprehensive set of criteria that must be met before the disposal plan is considered safe, and second, on the process by which the plan is judged against these criteria. Today we have defined neither the criteria nor the process. As discussed below, the two enclosed NRDC reports are an attempt to address these two unresolved issues, the criteria and the process. We have found that it is a simple matter to specify criteria and processes which screen waste management plans according to one's tastes. Although it is a straightforward process to write criteria designed at producing safe and conservative waste disposal plans, it is just as easy to write criteria which, despite being superficially impressive, allow foolish and unsafe waste management plans to proceed.

Under the backwards approach to waste management (as discussed previously) it is likely that the EPA and NRC, "in consultation with DoE" will write criteria allowing any DoE proposed plan to be licensed. This may be a cynical view, but it is supported by the history of the development of radiation protection standards

(See Enclosure 1, pp. 16-27) and the development of the commercial nuclear reactor industry.

3. The specific areas of scientific and technical uncertainty which must be clarified with respect to the permanent disposal of wastes and importantly, the significance of these areas of uncertainty to the overall safety achievable in permanent nuclear waste disposal programs.

The two NRDC reports on Nuclear Waste Management (Enclosures 1 and 2) are responsive to this question. As noted previously, and in the Introduction to Enclosure 2, the implications of each of the myriad of unresolved technical issues depends first on defining the criteria and second on the process by which these are judged. The third report in this series, which is not yet complete, will address the nature of the R&D program required to resolve the technical uncertainties identified in the second of the two NRDC reports enclosed here. This third report should be completed within the month and will be made available to the Committee.

4. The "systems approach" referred to in the IRG Report for evaluating the effectiveness of alternative nuclear waste repository options, and, in particular, whether the use of this approach would reduce the need to maximize the effectiveness of individual system elements such as emplacement medium and waste form. In this regard, our views on the attractiveness bedded salt as an emplacement medium and the use of vitrification as a means for solidifying post reprocessing of high level waste.

Again, each of these issues is addressed in Enclosure 2, the second of the two NRDC reports on radioactive waste management.

Particular attention is directed to the discussion of the "systems approach" beginning on page 12 of Enclosure 2, which is summarized below.

The IRG correctly observes that the term "systems approach" is often misunderstood (IRG Report, p. 42), and we would add "abused". The term "systems approach" as used here grew out of concerns by geologists at the USGS that the historical approach of selecting first a waste form, e.g., glass, and a medium, e.g., salt, and then looking for a site, e.g., Lyons or Carlsbad, does not make a lot of sense given that some sites in salt are better - or worse - than some sites in other media, e.g., granite, and vice versa. Also, the waste form that should be used depends on the media and to some extent, the site. In choosing the best disposal plan, the USGS and the IRG suggested that it is necessary to look at the entire system as a whole and then to compare each system against the other alternative systems.

There are two ways in which this argument can be abused. First, the "systems approach" can be invoked to imply that the preferred approach to establishing criteria, and determining whether these criteria are met, is to exercise a large risk-consequence model, such as the A.D. Little models EPA is using to derive waste criteria. These models are analogous to the reactor safety modelling effort reported by Rasmussen. This interpretation of the systems approach is inappropriate. In a word, these models cannot be validated. A preferred process for judging the adequacy of waste disposal criteria is the defense-in-depth approach as discussed in Enclosure 2.

The second way the "systems approach" can be abused, and very likely will be, involves first an endorsement of the risk-consequence approach to licensing repositories. One then argues that "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 of particular sites," (IRG Report, p. 42). With this approach one can perpetuate unacceptable waste disposal proposals such as WIPP by arguing that we really will not be in a position to judge their adequacy until we have completed the site surveys, the R&D on the waste form, and gone through the entire licensing process. It will be argued that flaws in site can be compensated for by over-designing the waste form, or that a weakness in the waste form is of no matter because we can judiciously choose the site. Like the Clinch River Breeder Reactor, prior to completion of the licensing process, unacceptable proposals, like WIPP, can develop their own powerful constituencies bent on perpetuating circular rationalizations for their project's continued existence. As a consequence, they will be difficult, if not impossible, to abandon. We could thus be locked into a poor disposal system simply because we failed to pursue more reasonable alternatives before the inevitable day of reckoning.

Turning to the last question regarding the attractiveness of bedded salt and the vitrification process, as discussed in our second report (Enclosure 2) bedded salt does not meet our proposed criteria under the defense-in-depth licensing process

that we proposed. We have not yet rejected vitrification as a means for solidifying post-reprocessing high level waste. At the present time, an acceptable waste form, or forms, has not been determined. Considerable experimental study has been conducted on borosilicate glass but these studies are inadequate to determine its acceptability. Other candidate waste forms, such as ceramics, oxides and synthetic natural materials such as feldspar and "synrock" have been suggested, and some of these appear far preferable to borosilicate glass. Clearly much more R&D is required to find an acceptable waste form.

5. Our view of the preferred overall planning strategy to be followed in developing a permanent nuclear waste disposal facility with particular attention to the pace at which major program elements must be pursued. Specify the role envisioned for "intermediate scale facilities (ISF)" as this term is used in the IRG Report, with particular reference to the timing and the number of such facilities in relation to the construction of full-scale waste disposal facilities and the expected media in which such immediate scale facilities would be located.

As indicated previously, the present governmental program is proceeding backwards through the stages of a logically developed waste disposal program. The course for the Government to take at this time is to avoid any commitments to specific waste forms, or repository sites, until it has developed (1) a comprehensive set of criteria that must be met before a waste plan is considered acceptable, and (a) the licensing process by which the plan is judged against these criteria. At the same time, a coherent and credible technical R&D program must be established. Once the criteria are established the program should provide a systematic examination of areas of uncertainty geared to resolution of the

appropriate technical issues. For the time being, the R&D program should be on a slow track.

We cannot overemphasize the urgent need for Congressional oversight over the development of the waste disposal criteria. If the criteria are comprehensive and adequate, many of the present problems will take care of themselves. If the criteria are inadequate, we are in for a repetition of mistakes of the past related to nuclear reactor safety; backfitting repositories will be at best extremely expensive, and at worst, impossible.

The concept of an ISF and the linkage of ISF's for spent fuel and the establishment of a TRU waste repository occur largely as rationalizations for continuing the WIPP project. To the extent ISF was interpreted to mean "permanent disposal of nuclear waste should proceed on a stepwise basis in a technically conservative manner," (IRG Report, p. 61), the ISF approach made good sense. Because of confusion on this point, the IRG now proposes to use the term ISF only for stand-alone facilities or those collocated with a TRU repository (IRG Report, p. 57); unfortunately, because of WIPP, the IRG (actually DoE) has made the wrong linkage. Instead of collocating the ISF and TRU facilities, the ISF should be linked to availability of a site suitable for a high level waste (HLW) repository, and TRU disposal should await the availability of a HLW repository as well.

According to the Report of Task Force for Review of Nuclear Waste Management (The Deutch Report of Feb. 1978), the controlling factor governing the capacity of a HLW repository is the thermal loading constraint and therefore the projected heat generation from the HLW. The TRU can readily be accommodated in the back

fill space of the HLW repository. Thus, it doesn't make much sense building a special repository solely for TRU.

Also, it doesn't make much sense to locate an ISF on a site that is not suitable for a HLW repository. The expense of site surveys and sinking of a shaft (estimated in the neighborhood of \$400 million) will provide enormous pressure to go ahead and use the ISF as a HLW repository. Given that we may need anywhere from three to as many as 15, or so, HLW repositories to accommodate the waste generated by all the reactors operating up to the turn of the century, no one but a fool would not believe that every ISF will be a HLW repository in any case. The public, and we are presently witnessing this in New Mexico, is not going to believe an ISF can be limited to 1000 spent fuel assemblies, or less.

In sum, ISF's simply must take into account the high likelihood that they will become full scale HLW repositories. Consequently, any policy that links TRU and ISF's should be rejected, and no decision on the siting of an ISF should be made until the criteria and licensing process are established and a variety of alternative sites have been characterized and are fully considered.

6. The advisability of proceeding with development of the WIPP, or any other ISF, in the absence of the environmental or other regulatory criteria to be issued by the EPA and the NRC.

As previously indicated, WIPP should be abandoned for a wide variety of compelling reasons:



- o WIPP does not meet NRDC's Criterion 2 (Enclosure 1, p. 30) designed to protect against inadvertent future human intrusion. The WIPP site contains valuable resources, such as potash, oil and gas, that are being sought today.
- o We are opposed to disposal of high level waste in salt in that salt does not pass muster under the defense-in-depth licensing process as outlined in Enclosure 2 (See pp. 22-23 of Enclosure 2).
- o WIPP is widely viewed as a program for the eighties based on what is now known to be bad science of the fifties. WIPP is widely viewed as the first step towards an early decision for salt as a geologic disposal medium.
- o The scope of the WIPP project has changed significantly several times since its inception. For reasons discussed above, it is highly unlikely that its present scope can be contained to TRU and up to 1000 spent fuel assemblies.
- o Alternative sites have not been considered, which is in violation of NEPA.
- o WIPP cannot pass muster under section 204(c) of the Federal Land Policy and Management Act, which requires that the Secretary of Interior conduct a full and independent review of the suitability of the site for any waste disposal or research activities. This review requires, among other things, consideration of

...an evaluation of the current natural resource uses and values of the site and adjacent public and nonpublic land and how it appears they will be affected by the proposed use, including particularly aspects of use that might cause degradation of the environment.

...the manner in which existing and potential resource uses are incompatible with or in conflict with the proposed use, together with a statement of the provisions to be made for continuation or termination of existing uses, including an economic analysis of such continuation or termination;

...whether any suitable alternative sites are available (including cost estimates) for the proposed use or for uses such a withdrawal would displace;

o The contractor chosen to develop the WIPP site is Westinghouse Electric Corporation. This is perhaps the worst case of conflict of interest in nuclear waste management, with the possible exception of having DoE as the lead agency in charge of the Federal Government's nuclear waste program.

o Perhaps most importantly, the continuance of the existing WIPP program, for all the reasons above, will have a devastating impact on the public credibility of the Government's entire waste management program.