

No. S-10-94
Tel. 301-504-2240

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Is Geologic Disposal Still The Way To Go?:
A Regulator's Perspective

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Presented at the
International High-Level Radioactive Waste
Management Conference
Las Vegas, Nevada
May 23, 1994

Good Morning. I am very pleased to be here this morning at the opening of the fifth annual International High-Level Radioactive Waste Management Conference. The Nuclear Regulatory Commission has a statutory responsibility to ensure that radioactive wastes generated by its licensees, both high-level and low-level wastes, are safely managed and safely disposed of. In particular, it is our responsibility to implement the regulatory framework and provide the regulatory oversight necessary to fulfill our nation's commitment to safe geologic disposal of high-level nuclear wastes. The Commission takes this responsibility very seriously, and we view the safe management of all radioactive wastes to be an important issue confronting our society today.

I am well aware of the recent questioning of this national commitment to geologic disposal, and of suggestions by those who would abandon or set aside the course set forth in the Nuclear Waste Policy Act of 1982 and its amendments. Some of these concerns may have their origin in a mistaken notion that the decision to pursue geologic disposal of long-lived radioactive waste was a decision taken in haste, without due consideration, in order to bring about an expedient resolution to a difficult problem. Nothing could be further from the truth. Still others may wrongly interpret the fact that Congress has mandated a National Academy of Sciences' (NAS) review of the standards that will be used to determine acceptability of a particular design and site as signaling a lack of faith in the feasibility of geologic disposal. We at the Commission do not share these views, and, as I will discuss more in a moment, we welcome the Academy review as a significant undertaking. We anticipate that the findings of the Academy Committee will contribute substantially to the evolution of

our understanding of what constitutes scientifically supportable measures of acceptability for a first-of-a-kind technical challenge.

As early as 1954, the Atomic Energy Commission, predecessor to both the Department of Energy and the NRC, sought guidance from the National Academy on the technical feasibility of the disposal of nuclear wastes in geologic formations. In 1957, the Academy endorsed deep geologic disposal for high-level wastes. As some of you may recollect, the DOE published in 1980 an Environmental Impact Statement proposing the development of mined geologic repositories for the disposal of commercially-generated high-level wastes. In the EIS, DOE evaluated the advantages and disadvantages of alternatives to geologic disposal. Among these alternatives were: subseabed emplacement, transport into space, emplacement in ice sheets, and indefinite storage. DOE concluded then that geologic disposal was superior to the available alternatives and was environmentally, legally and technically the preferred option. Two years later, in 1982, the Congress effectively endorsed the pursuit of geologic disposal by enacting the Nuclear Waste Policy Act (NWPA). This act laid out a process, funded by the waste generators, whereby specific sites could be characterized, and, assuming one or more were found suitable, repositories could be constructed and licensed consistent with environmental and safety standards of the EPA and NRC.

Even prior to the enactment of the NWPA, the Nuclear Regulatory Commission, in response to questions raised regarding the future availability of disposal capacity, embarked on a generic proceeding to ascertain the degree of assurance that high-level radioactive wastes could be disposed of safely, to determine when such disposal would be available, and to assess whether spent fuel can be stored safely at commercial reactor sites beyond the expiration of the reactors' operating licenses. The enactment of the NWPA during the development of this proceeding was welcomed by the Commission because the NWPA appeared to provide a means for resolving some of the more vexing technical, institutional and funding issues associated with geologic disposal. This proceeding culminated in the Waste Confidence Decision of 1984. The Commission expressed its confidence that:

- (1) safe disposal of HLW and spent fuel in a mined geologic repository is technically feasible;
- (2) one or more repositories would be available by 2007-2009 which would provide sufficient capacity within 30 years beyond the expiration of any reactor operating license;
- (3) HLW and spent fuel will be managed safely until a repository is available;

- (4) spent fuel can be stored safely without significant environmental impacts for a minimum of 30 years beyond the expiration of a reactor's operating license; and
- (5) safe independent on- or off-site storage of spent fuel will be made available if such capacity is needed.

The Commission promised to revisit its findings every five years, or more frequently should significant events warrant. The Commission's confidence was founded on a number of key considerations. First, the Commission, then as now, could identify no technical problems that would make safe geologic disposal infeasible. Second, passage of the NWPA created a process whereby safe disposal could be ensured by the required site investigations, and engineering development required prior to construction of the repository. Third, the Commission recognized that there already exists sufficient technical and institutional experience with the management and storage of spent fuel such that safe storage can be accomplished in spent fuel pools or dry storage installations.

In 1987, following the enactment of the Nuclear Waste Policy Amendments Act, site investigations at all sites other than Yucca Mountain were discontinued along with all activities related to a second repository. Significant limits were also placed on the development of a monitored retrievable storage facility in order to preclude its use as a substitute for permanent geologic disposal.

These amendments also created a very important body devoted to technical oversight of DOE's repository program, the Nuclear Waste Technical Review Board. I would note, in passing, that the Commission has a special appreciation for the importance and unique oversight responsibilities of this panel of distinguished experts. We meet periodically with them so that we may remain informed of their perspective on DOE's repository activities. We are fortunate to have also our own Advisory Committee on Nuclear Waste and a dedicated Center for Nuclear Waste Regulatory Analysis to provide us with competent advice and help.

In 1990, the Commission completed its first reexamination of its initial Waste Confidence findings and modified two of its findings related to the timing of the availability of disposal and to the length of time spent fuel can be stored safely at reactor sites. These modifications acknowledged the programmatic changes mandated by the Amendments Act and their impact on DOE's site characterization program, and reflected a growing appreciation for the difficulty of making scheduling predictions for such a complex, first-of-a-kind project. The Congressional decision to characterize only Yucca Mountain meant that should Yucca Mountain

be found unsuitable, significant additional time would be required to select and characterize another site or sites. Making more realistic allowances for delays, both expected and unanticipated, the Commission nonetheless continued to support geologic disposal as both safe and technically feasible.

The national commitment to geologic disposal reflects an underlying commitment to a principle of fairness and equity -- that we who benefit from electricity generated by nuclear fission should assume the burden of disposing of the resulting waste in a manner such that future generations will not experience hazards that we would find unacceptable today. And, although the Commission found in its second Waste Confidence Decision in 1990 that spent fuel may continue to be safely stored at reactor sites for as much as about 100 years, it would seem inconsistent with our prior commitment to national policy to condone storage of spent fuel indefinitely at reactor sites, of which there are more than seventy.

It is also true, however, that as we struggle to accomplish something that has never been attempted before, our collective thinking continues to evolve as to what constitutes appropriate measures of acceptability and licensability and how those measures should be applied to a specific site. The Energy Policy Act of 1992 directed the Environmental Protection Agency (EPA) to seek the guidance of the National Academy of Sciences on specific issues which bear on the selection of meaningful performance standards for a repository at Yucca Mountain. As will be discussed in more detail later in this conference, the NAS has formed a Committee to examine the technical bases of Yucca Mountain standards. I understand that the Committee expects to issue formal recommendations to EPA by the end of this year. The NRC staff has contributed to the deliberations of this Committee and has provided whatever documents and background information the Committee has requested to support its review. We believe that the NAS Committee has embarked on a constructive and worthwhile endeavor. We anticipate that the recommendations which will emerge from this process will be of great value both to the EPA and to the NRC.

Once the NAS issues its recommendations, the Energy Policy Act requires EPA to promulgate health-based standards for a repository at Yucca Mountain by the end of 1995. The Act requires that the standards be based upon and consistent with the recommendations of the Academy. The Commission will then be obligated to conform our regulations to final EPA standards. The NRC's technical criteria in 10 CFR Part 60, put in place more than a decade ago, are consistent with the statutory direction of the NWPA, in that the NRC's implementing regulations provide a system of multiple barriers and include restrictions on retrievability. The Part 60 technical criteria include three subsystem performance objectives for particular barriers. The objectives prescribe a minimum time period during which containment within the waste packages must be

substantially complete, an acceptable fractional release rate from the overall engineered barrier system, and a minimum for pre-emplacment groundwater travel time.

We at the NRC are well aware of the questions that have arisen with regard to the merit of these particular quantitative objectives, and the NRC staff is actively reexamining these criteria to ensure that they indeed represent appropriate measures of subsystem performance. That being said, however, the Commission's Part 60 also recognizes the need for flexibility in applying these criteria and therefore allows for Commission consideration of alternate waste package containment periods, release rates or travel times on a case-by-case basis. In establishing these criteria, the Commission sought to define simple, understandable measures of performance for key repository subsystems which, if met, would enhance confidence that the overall performance objective -- namely, the EPA standard -- would be accomplished.

In implementing the EPA standard through conforming NRC regulations consistent with the NAS recommendations, the NRC must thoroughly evaluate the overall performance of a geologic repository at Yucca Mountain, or at any site, before it can determine safety and licensability. In order to form a suitable basis for a licensing decision, the Commission requires, among other things, that DOE conduct a comprehensive and well-integrated performance assessment as part of its license application. Such an assessment itself requires a competent, comprehensive, and well-integrated site characterization program. Clearly, the theme of this year's conference, "Technology Integration: Above and Below" has a special significance to the NRC. During pre-licensing interactions with DOE, our staff has consistently emphasized the critical importance of coordinating and integrating all data gathering activities during site characterization at Yucca Mountain. In 1989 comments on the Department's Site Characterization Plan, the NRC staff identified the need for improved technical integration of DOE's overall site characterization program. We at the NRC are convinced that, long before any formal license application is submitted, iterative performance assessment must play a pivotal role in guiding site characterization and in directing our attention, as the regulator, to those aspects of repository performance that are of greatest safety significance. It is critical that DOE's site investigation activities be consistently designed and carried out with an eye to whether the data being collected will be of sufficient quality and quantity to determine whether the site will meet safety objectives.

In addition to reviewing DOE's performance assessments, the NRC is developing its own performance assessment capability so that we will be able to independently review DOE's projections of a repository's performance. Our staff expects to pay particular attention to the underlying assumptions that DOE is using to ensure

that appropriate alternatives have been considered in the selection of conceptual and process models as well as in the assignment of key parameters. The Commission is pleased to note that in recent presentations before the Nuclear Waste Technical Review Board, the Department has expressed its commitment to iterative performance assessment and has acknowledged the value of such assessments for setting priorities and evaluating DOE's testing program.

I would remind all of you that, should DOE succeed in obtaining a license to emplace waste, either at Yucca Mountain or at some other site, NRC regulations will require DOE to continue to collect data and assess the projected long-term performance of the repository system. NRC regulations explicitly require that a repository be designed to preserve the option of waste retrieval until the completion of a performance confirmation program, after which the Commission will review the data obtained. During this confirmation period -- which may last 50 years, or longer if the Commission finds it necessary -- measurements will be made of the actual performance of the repository system while it is subjected to the observed effects of emplaced wastes. These data are expected to provide additional assurance that the conceptual models which were relied upon during licensing appropriately bound the behavior of the repository system and corroborate projections made on the basis of short-term laboratory studies.

In a more general sense, we continue to believe that frequent, constructive, and open interactions between the NRC and DOE throughout site characterization are vital to ensuring that issues are raised and addressed early. Because of our statutory obligations to review and comment on DOE's site characterization plans and progress, and because of our abiding regulatory concern that data obtained during site characterization serve to support a high quality license application should the site be found suitable, the NRC staff, jointly with DOE, has developed and is implementing a procedural agreement to foster these interactions.

As a result of these continuing interactions, tangible progress has been made through improvements to DOE's characterization program. Most notable, perhaps, has been the development by DOE and its contractors of quality assurance programs that meet the requirements of Subpart G of the NRC's Part 60 regulations. As early as 1986 the NRC had expressed concerns that DOE did not have in place an effective QA program applicable to site characterization activities. These concerns rose to the level of a formal objection in NRC staff comments on DOE's site characterization plan in 1989. Since that time, the NRC has observed over 100 DOE audits and surveillances. The NRC has provided comments which have been implemented by DOE and have contributed to enhancing the DOE audit process. In addition to the NRC, the State of Nevada and affected units of local governments have also had the opportunity to observe these audits and to attend

meetings between NRC and DOE where QA problems of mutual interest are raised and addressed. A little more than two years ago, the NRC was able to remove its formal objection because all of DOE participating contractors had put in place acceptable individual QA programs, and key QA management positions within DOE had been filled with full-time personnel. Subsequently, DOE took the initiative of adopting a single, standardized QA program description applicable to all of its contractors, the NRC has accepted the program with only minor exceptions. The NRC staff is now of the view that, while problems are still being identified and will need to be addressed, DOE and its contractors have developed acceptable QA programs, which, if properly implemented, will address our QA concerns and inspire confidence that appropriate quality assurance is being successfully applied to site characterization activities.

We are also encouraged by the significant progress DOE has made during the past year in commencing underground site characterization at Yucca Mountain. And while I would not wish to detract from the significance of this long-awaited milestone, I would stress that it is equally important to the Commission and to DOE's program that critical surface-based characterization efforts continue in concert with underground investigations. Again, the NRC staff will continue to monitor closely the coordination and extent of integration between surface and underground activities.

Another area of significant progress deserving of mention is DOE's accelerated effort to expand stakeholder involvement and to facilitate public involvement in the program's decision-making process. The Commission takes very seriously its obligation to carry out its regulatory responsibilities in a public and candid manner. Because of the close technical interactions the NRC staff must maintain with DOE throughout the pre-application consultation period, we are particularly sensitive to the need to conduct these interactions in a manner that in no way limits the Commission's ability to make independent judgments. Furthermore, it is equally important that NRC/DOE interactions inspire confidence in all affected and interested parties that any final judgment to construct and operate a repository will be based on the Commission's objective and unbiased evaluation of the available evidence. I am convinced that the very open arena in which we at the Commission have operated for many years is vital to building public confidence and trust that both the regulator and the regulated are fulfilling their responsibilities to protect the public health and safety. In this regard, then, I am heartened by DOE's continuing efforts at openness, above and beyond that which we at the NRC require.

As site characterization proceeds, DOE and all of the interested parties are preparing to review and interpret actual data that will enable DOE to determine if Yucca Mountain is suitable for

development as a geologic repository. At the same time, however, major new policy and programmatic changes are being discussed that could significantly alter the repository program as it is currently envisioned.

For example, program-wide use by DOE of Multipurpose Canisters (or MPC's) is a concept that certainly has merit and, if implemented, may afford considerably greater efficiency and flexibility for the receipt, handling and management of spent fuel pending availability of a repository. I would note that a special plenary session this afternoon, along with a number of technical sessions later in the conference, will be devoted to this topic. The NRC already has in place the mechanisms and requirements necessary to conduct the appropriate regulatory review for what are commonly referred to as dual purpose casks -- those to be used both for storage and for transportation of HLW and spent fuel. A DOE commitment to the use of a true multipurpose canister -- one in which the fuel or waste is placed only once and is then used for storage, transport and disposal -- will require a serious evaluation by the NRC staff of issues related to long-term disposal issues which heretofore have not been considered for dual purpose systems. The NRC's Part 60 regulations currently contain no provision for separate approval of waste package components prior to receipt of a license application; thus, currently any MPC design would have to be evaluated as part of the licensing process of the repository as a whole.

It has also been suggested that Yucca Mountain could be used as an underground monitored retrievable storage facility in parallel with site characterization efforts intended to evaluate objectively the suitability of the site as a repository. It is my understanding that such an approach would require considerable legislative and regulatory amendments. The Commission would need to evaluate whether it is possible to license the site as an MRS without affecting its future licensing as a disposal repository. Such an MRS would have to be very carefully designed and constructed to be in harmony with the planned design and construction of the repository. Otherwise, the subsequent use of the site as a repository would be jeopardized.

Any major redirection of the repository program should be weighed with extreme caution and its potential consequences should be carefully examined. As various programmatic options are considered and debated, I believe that site characterization efforts should continue so that any future decisions may benefit from the best scientific and technical information obtainable from the site at Yucca Mountain. As I indicated at the outset of my remarks, this nation's commitment to geologic disposal was a sober and well-considered decision. I continue to maintain that geologic disposal of high-level wastes can and will be realized. We have in place, today, a process that can bring this about if key technical, institutional, and regulatory steps are not circumvented. There

can be no short-cuts to excellence for such a first-of-a-kind endeavor of this magnitude.

In summary, the Commission and the NRC staff will continue to pursue constructive, open pre-application interactions with DOE. Throughout these interactions we will endeavor to respond as needed to programmatic changes, and to identify and address regulatory concerns as promptly as possible. Because our collective understanding of repository performance continues to evolve, it is necessary and appropriate that the knowledge gained from this evolution inform and reinforce our standards for that performance as well. The Commission and its staff will continue to participate actively in the development of an implementable regulatory framework consistent with the recommendations of the National Academy of Sciences, and consistent with our statutory obligations to protect the health and safety of the public. Thank you. I wish you a highly successful conference.