RETHINKING THE MRS: PUBLIC POLICY ISSUES SURROUNDING MONITORED RETRIEVABLE STORAGE OF SPENT NUCLEAR FUEL

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ABSTRACT

Various options for utilizing monitored retrievable storage of civilian spent fuel were compared using the criteria of maximizing the likelihood of implementing successfully a comprehensive U.S. nuclear waste management system (taking into account scientific and institutional uncertainties) and minimizing the costs, risks, and other impacts. The option that appears to be most robust for dealing with the key uncertainties has two components: (i) an integrated management system that maximizes dry-storage at reactors using dual purpose casks and shipment via dedicated trains and (ii) a more experimental approach to the development of the repository at Yucca Mountain and authorization of an unconstrained MRS facility on the Nevada Test Site.

INTRODUCTION

This paper presents the tentative conclusions of a study that I conducted under contract for the State of Tennessee. The title of the study is "Rethinking the MRS: Public Policy Issues Surrounding Monitored Retrievable Storage of Spent Nuclear Fuel." A companion study, entitled "A Systems Evaluation of DOE's Proposed Integral-MRS System and an At-Reactor Storage Alternative Based on Systems Integration of Dual Purpose Casks," has been conducted by Ray Hoskins, a private consultant, for the University of Tennessee as part of the same contract with the State. These studies represent the independent work of the two respective authors and do not necessarily represent the opinions of either the University of Tennessee or the State of Tennessee.

PURPOSE OF STUDY

The purpose of the study that I conducted was to state clearly the goals and objectives of various MRS options, to evaluate them by well-defined and reasonable criteria, and to assess their robustness under different scenarios about the future. Because of the large uncertainties that exist in making predictions about future events, especially in the realm dealing with human behavior and nuclear waste management, I believe that robustness of policy options -- that is, the ability to deal with a range of future scenarios -- is a key factor in selecting the best option.

When conducting a technical study on a controversial public policy issue like the MRS, I believe that it is important to lay out the technical parameters for each policy option in the most objective manner possible so as not to constrain artificially choices for the public and elected officials. All too often the values of those conducting the technical studies intrude and distort the menu of choices through claims of technical constraints, which upon further investigation prove to be not totally accurate. When value or other subjective judgements are made in the conduct of a study, they should be explicit. I attempted to do so in this study. I also think that it is important to bend over backwards to maintain credibility with the public in any assessment of controversial policy options. At a minimum this requires listening to and seriously considering diverse points of view. One of the biggest problems in the nuclear waste management field, in my opinion, has been the lack of public trust and credibility in studies conducted by the government. I would like to commend the members and staff of the MRS Review Commission for doing an exemplary job to date in maintaining public trust; in the conduct of its hearings the Commission has been scrupulously independent, open-minded, thoughtful, and fair to all participants.

MENU OF MRS CONCEPTS, OBJECTIVES, AND CRITERIA FOR EVALUATION

A number of MRS concepts were considered in the conduct of the study. An attempt was made to state clearly and explicitly the goals of each; protagonists in the MRS debate have often talked past each other because they see different goals and purposes for the MRS. The six generic MRS options that I considered were: the Backup MRS (an alternative or backup to the repository, as envisioned in the Nuclear Waste Policy Act of 1982), the Integral MRS (as proposed by DOE in 1985), the Constrained MRS (as authorized in the Nuclear Waste Policy Amendments Act of 1987, with linkages to the repository schedule), a Co-located MRS (located on the Nevada Test Site, currently forbidden by law), Regional MRS's (several storage-only facilities located on government property around the country), and the Decentralized MRS (storage at reactors with shipment directly to the repository, when the latter is ready, which is sometimes called the Integral-No-MRS option).

A key objective of the Backup MRS is to provide an alternative for government acceptance of spent nuclear fuel from utilities in case the repository program encounters difficulties or delays. Key objectives of the Integral-MRS are to integrate the MRS into the repository system, thereby achieving some benefits (according to DOE) in terms of reduced transportation impacts and earlier spent fuel acceptance, while permitting a major portion of the federal waste management system to be built in the near term. The Constrained MRS is a compromise; the linkages to the repository schedule in the 1987 NWPAA were placed to assure MRS-opponents that the facility could not become an alternative to the repository. The Co-located MRS has the potential advantage of allowing early federal acceptance

of spent fuel from utilities while affecting only one state. Regional MRS's for storage at federal facilities have the potential advantage of early spent fuel acceptance and greater geographic equity. Storage at reactors has the advantage of keeping pressure on the repository program, as well as being the option least likely to provoke public opposition.

In order to compare options in a simple manner, two criteria were selected. The first is to maximize the likelihood of successfully implementing in a timely manner a comprehensive U.S. nuclear waste management system -- one that gives confidence about our ability to manage the waste for the long term -- taking into account uncertainties and reasonable future scenarios. The second criterion is to minimize the costs, risks, and other impacts to people and the environment for this and future generations. Evaluating options based on these two criteria requires considerable subjective judgment.

KEY ISSUES AND DEBATES

There are a number of key issues whose exploration can help to illuminate some of conflicting objectives and opinions held by different stakeholders in the MRS debate. To me, the most relevant issues are: (i) the linkage of the future of nuclear power to the nuclear waste management system, (ii) the linkage of the MRS to the repository, (iii) the likelihood of licensing the repository with no more than a slight delay from the original schedule, (iv) the political problems in siting the MRS, (v) the definition, optimization, and integration of the overall nuclear waste management system, (vi) the flexibility of the system to deal with uncertainties and different future scenarios, (vii) the potential economic and equity impacts on host communities, (viii) the potential economic and equity impacts on utilities and ratepayers, and (ix) the role of compensation, incentives, and different management schemes to deal with perceived impacts. While I do not have space here to go into detail, I will attempt to make a few comments and to lay out some of the judgments that I have reached on these points.

Linkages

No matter what happens to nuclear power in the future, there will be lots of nuclear waste to take care of. Nevertheless, perception of a linkage between a permanent solution to the nuclear waste problem and the future of nuclear power has existed implicitly in the minds of many and explicitly in a California law (upheld by the Supreme Court) and the Waste Confidence Proceedings of the Nuclear Regulatory Commission. Some of the pressure for rapid development of geologic disposal comes from groups who believe that solving the nuclear waste problem in a demonstrable way is essential to convincing the public to accept nuclear power for the long run. Many of the pro-nuclear groups feel that the federal government, because of its past promotion of nuclear power, has a special responsibility to take spent fuel in a timely manner from utilities as well as to show the public that the radioactive waste problem is solvable. Some environmental stakeholders may use problems with nuclear waste management to increase public support for stopping nuclear power, but many of the environmental groups favor development of permanent geologic disposal in order to fulfill this generation's responsibility to fix a problem of its own making and to protect future generations.

The linkages of the MRS to the repository in the NWPAA of 1987 can be understood as a manifestation of the desires to prevent the MRS from becoming an alternative to the repository and, thereby, to maintain society's commitment to development of a permanent solution. While not in the majority, there are proponents of the Backup MRS who argue that this generation should not make irreversible decisions which may be costly to correct in the future. They argue that new technological developments may occur in the next century that could change our view of how to handle nuclear waste, that we currently know how to store safely in monitored engineered facilities where things can be corrected and repaired if something goes wrong, and that no reason exists to rush prematurely into developing an option of permanent disposal that has many scientific uncertainties and could lead to costly remedial action in the future. They argue that we should be more humble about our ability to project technological developments and human behavior over the next 10,000 years and that the fairest thing to do for future generations is to avoid costly mistakes and foreclosing options. Thus, some of the disputes surrounding the MRS have at their core deeply-held values and judgments, concerning how best to ensure future energy sources and to protect future generations.

Repository Uncertainties

From observing the repository program carefully over the past decade, I have concluded that considerable uncertainty exists concerning our ability to license the repository with no more than a slight delay from the original schedule. The U.S. has adopted a set of licensing criteria that requires considerable certainty about geohydrologic conditions at a site and release predictions based on modeling with a hypothetical set of long-term disruptive scenarios. The time frame for resolving these uncertainties with reasonable scientific assurance may be much longer than the time frame allowed in the licensing process, and may be impossible in the current regulatory framework. Proving with "reasonable expectation" that the EPA and NRC containment requirements and other licensing conditions will be met is an enormous and unprecedented challenge. The regulations themselves (or how they are interpreted) may have to evolve. As is often the case with frontier science, the more that is known may actually increase rather than decrease the uncertainties in the short run. It is very hard to speculate about a site until conditions are explored at repository depth, and there will always be credible scientists who will interpret the remaining uncertainties in ways different from DOE. My own view is that a considerable period of time will be necessary to evaluate a repository site, and that a more experimental, evolutionary, flexible, and cheaper approach to site investigation, with less pressure from a rigid schedule, would be beneficial and, perhaps, avoid a perceived failure of the program in the mid-1990s(2) Therefore, I conclude that it is important to develop a policy option that minimizes the risks from an inability to license a repository on our

current schedule. I want to make clear that I do favor a sound experimental program investigating the Yucca Mountain site at repository depth; the WIPP experience has taught us that things are not as simple underground as they seemed to be prior to sinking a shaft.

MRS Siting Problems

No governor, state legislature, or Congressional delegation from a potential host state (with perhaps one brief exception) has up to the present been receptive to the idea of importing high level nuclear waste to either an MRS or repository in their state. Thus, one of the biggest downside problems for the MRS and the repository has been the likelihood that the siting decision would have to be imposed on the host state (even though there are communities that would be willing hosts). Congress was willing to do this in the case of the Yucca Mountain site in Nevada. Whether or not it would be willing to do so in the case of the MRS and a state stronger politically than Nevada is problematical. Nevertheless, the fact that political opposition to accepting nuclear waste is so strong convinces me that proponents of an MRS facility need to give careful thought to how it can be sited. While there is no guarantee of success, negotiated approaches (such as through the negotiator) are worthy of consideration -- negotiated approaches have had some success in the siting of other unwanted facilities. Nevertheless, I do not think it likely that a Governor can be convinced to sign a negotiated agreement to accept an MRS.

System Optimization

Ray Hoskins has done a careful comparison of the Integral MRS to an optimized Integral-No-MRS system that uses dual purpose casks.(3) As with our earlier studies for the State of Tennessee, it was found that transportation impacts can be as small or smaller with an optimized I-No-MRS system than with DOE's Integral MRS (regardless of assumptions made about rod consolidation at reactors). I conclude from these studies that minimizing transportation impacts from spent fuel shipments is worthwhile whether or not there is an MRS. To me, this implies maximizing cask capacities, using a family of standardized dual purpose casks, maximizing the use of rail (using in some cases barge or heavy haul vehicle to the nearest railhead), and using dedicated trains. Dedicated trains rather than individual shipments in general commerce will allow for guards and emergency response personnel to accompany each shipment.

Hoskins' economic comparisons are very important and worth careful attention. Using a fairly sophisticated probabilistic analysis and much of DOE's own cost data, he finds that the expected value for the I-MRS case, with the MRS opening in 1998 and the repository in 2008 (which would require relaxing the linkage between the MRS and the repository schedule), is $3.4 billion more than for the I-No-MRS case. If the MRS cannot open until 2008 along with the repository, then the expected value of the I-MRS case is $5.0 billion more than the I-No-MRS case. I conclude that a separately-located MRS, as proposed by DOE, adds considerable costs to the nuclear waste management system. The I-No-MRS case, using dual purpose casks, is technically feasible, cost effective, and minimizes transportation impacts.

Flexibility

In order to take credit for flexibility in justifying a particular policy option, one must be precise about the future scenarios and uncertainties that the option is meant to deal with. To me, the biggest uncertainties in the storage and disposal of nuclear waste are the ability of DOE and Congress to overcome political opposition to siting an MRS and the ability of DOE to receive a repository license on a rigid schedule. The I-No-MRS case is far more flexible than the I-MRS in dealing with the first uncertainty; neither case overcomes the latter problem.

Economic Impacts and Compensation

Whether or not it will materialize, real economic impact on the host state resulting from negative public perceptions about nuclear waste is a major concern for a state. This was the case with Tennessee and the MRS, and it is being seriously investigated by Nevada in its socioeconomic impact assessment of a geologic repository at Yucca Mountain. I believe that carefully tailored management strategies (particularly those that might increase public trust and credibility in the program) and compensation will be required to alleviate some of these concerns. Nevertheless, the perception of real economic impacts, as well as the feeling of being treated unfairly, are additional negative factors in trying to gain acceptance from a host state for the siting of either an MRS or repository.

The economic and equity impacts on utilities and ratepayers are also very important. I personally feel that too much money is wasted in the DOE program; it appears at times as if there are more managers than scientists in the program. There are too many other societal needs for us to assume that cost is no object in finding a permanent solution to the nuclear waste problem.

A major concern of utilities and their shareholders is the uncertainty from not knowing when the government will actually accept title and liability for spent fuel. Although utilities have contracts with DOE for spent fuel acceptance, there is no penalty for non-performance by DOE on the scheduled date. Any prudent utility is examining on-site storage options for the life of the plant. An equity concern for those utilities that are making investments now for on-site storage is having to pay as well for a federal MRS which they may not need.

Even though it is technically feasible and cost effective to store on-site at reactors for the foreseeable future, as assumed in the I-No-MRS case, I believe that pressure for government acceptance of utility spent fuel will increase in the 1990s, especially if the repository program begins to falter. This pressure for early federal spent fuel acceptance is one of the reasons for the rigid repository development

schedule. How to deal with this pressure is, for me, one of the major problems with the I-No-MRS option.

CONCLUSIONS

Rather than trying to list the pros and cons of each MRS option and to make a detailed comparison, I shall end by giving you my tentative conclusions from this study. They are as follows:

1. All of the MRS options are technically feasible, but the non-technical issues are the most important considerations for judging different options.
2. The option that appears to be most robust for dealing with the key uncertainties is a combination of the Integral-No-MRS system and the Co-located MRS. This combined system would have the following components:

(i) An Integrated System Maximizing Dry-Storage At Reactors Using Dual Purpose Casks - Because spent fuel is going to be stored at reactors for a long time, the highest priority for the federal government is to do more to help utilities to plan for life-of-plant storage. The most effective integrated system that maximizes at-reactor storage uses dual-purpose casks and plans for eventual shipment via dedicated trains. Each utility would be responsible for paying its own storage costs, but the federal government would purchase and lease dual-purpose casks for use by the utilities. If federal acceptance of spent fuel is significantly delayed, this system can ensure that spent fuel is managed safely for as long as necessary.

(ii) A More Experimental Approach to the Repository and a Co-located MRS - The government needs to plan for a more experimental and evolutionary approach with a relaxed schedule and lower cost for site characterization at Yucca Mountain, and careful consideration needs to be given to the option of an unconstrained MRS at the Nevada Test Site (i.e., no linkages to the repository development schedule). The government could provide additional rights, compensation, and oversight powers for the state of Nevada, including perhaps final authority over repository closure. Designating an unconstrained MRS at the Nevada Test Site would require changing the law and probably overriding once again the wishes of the state (which I would regret having to do). The advantages of this option include: (i) removing pressure being exerted by utilities and Congress for a rigid repository development schedule, which might avoid a perceived failure of the repository program in the 1990s, (ii) allowing for firm transportation planning now, (iii) avoiding the political fight from trying to site an MRS in another state, (iv) avoiding additional sites being concerned about special economic impacts since the current public perception is that Nevada will get the nation's nuclear waste, (v) avoiding significant increased costs from an MRS located elsewhere, (vi) gaining the flexibility to make decisions about rod consolidation at some later time, and (vii) changing the debate from where nuclear waste will reside to which technical option (storage or disposal) is the more prudent decision for this generation. It may turn out that Yucca Mountain proves unacceptable for a repository license. In that case, a new siting effort and many years will be required before the U.S. has a permanent disposal solution, but monitored engineered storage at the Nevada Test Site can continue as long as necessary. The biggest challenge for this option is convincing the public that this is a prudent course, one that gives confidence in our ability to manage nuclear waste safely for the long term and maintains our commitment to develop a permanent solution in a scientifically-sound manner. I would also hope that the federal government could bend over backwards in trying to accommodate the wishes of the State of Nevada after the MRS siting decision has been made.

3. If the Congress considers allowing the option of an unconstrained MRS in another state, it should do so if and only if the negotiator can find a state willing to volunteer through offers of incentives and compensation (thereby avoiding the political costs of forced siting) and the users are willing to pay for the significant increased costs to the overall system. My own view is that it is unlikely to find a host state willing to accept an MRS or users willing to pay the increased costs by themselves, but I am open to being convinced otherwise. The constrained MRS as defined in the NWPAA has almost no utility.

I look forward to the report of the MRS Review Commission next November. The country needs to hear the considered judgment of an independent group on this contentious and important issue.

REFERENCES

1. This paper is a revised version of the oral and written testimony presented to the MRS Review Commission on February 16, 1989. The complete study will be available from the author in April, 1989.
2. This approach has also been suggested by Luther Carter in a paper presented at the meeting of the American Association for the Advancement of Science in San Francisco on January 17, 1989, which will be published by the Forum for Applied Research and Public Policy, and by Chris Whipple in a paper presented at the Waste Management '89 Conference on February 27, 1989, which will be published in the proceedings.
3. Ray Hoskins, "A Systems Evaluation of DOE's Proposed Integral-MRS System and an At-Reactor Storage Alternative Based on Systems Integration of Dual Purpose Casks," prepared under contract for the Energy, Environment, and Resources Center of the University of Tennessee, February, 1989.