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F. Stanley Echols
Winston & Strawn
(202) 371-5777

STAGED LICENSING: AN ESSENTIAL ELEMENT OF THE NRC'S REVISED REGULATIONS

I. INTRODUCTION

Over the past several years, Congress has directed the Department of Energy (DOE), the Nuclear Regulatory Commission (NRC), and the Environmental Protection Agency (EPA) to abandon their efforts to assess an array of potential candidate geologic repository sites for the permanent disposal of spent nuclear reactor fuel and high-level radioactive waste, to develop generally applicable requirements for licensing geologic repositories, and to develop generally applicable radiation protection standards for geologic repositories, and instead to focus their efforts to determine whether a single site located at Yucca Mountain, Nevada can be developed as a geologic repository while providing reasonable assurance that public health and safety and the environment will be adequately protected.

From a technical perspective, these efforts are well under way. DOE is conducting comprehensive analyses of the geologic setting and engineered barrier systems, and assessments of the long-term performance of the natural and engineered features as a system for the Yucca Mountain site; the NRC is in the process of developing revised technical criteria, where needed, to better assess the Yucca Mountain site; and the EPA is developing a revised radiation protection standard specific to a geologic repository located at the Yucca Mountain site.

However, one aspect of repository development likely will not, and indeed should not, change. Under the existing NRC regulatory framework which has been in place for over a decade, and which is based in part on decades of experience in licensing nuclear power reactors, DOE must receive authorization from the NRC to proceed in discrete stages to construct, operate, and permanently close a repository. If the Yucca Mountain site is found to be suitable for development as a geologic repository, then at each stage of development DOE will have to provide the NRC with progressively more detailed information regarding repository design and long-term performance. NRC regulations reflect the fact that it will not be until the repository has been operating for a number of years that the NRC will be able to make a final determination as to long-term repository performance. Nevertheless, the NRC will be able to allow DOE to construct and operate a repository, provided that the NRC believes that the documented results of existing studies, together with the anticipated results from continuing and future studies, will enable the NRC to to make a final determination that it has reasonable assurance that the repository system's long-term (post-closure) performance will not cause undue risk to the public. Thus, in its efforts to revise its current regulations to assure that the technical criteria are specifically applicable to the Yucca Mountain site, the NRC should also make sure that it preserves and clarifies the concept of staged repository development requiring progressively greater levels of detail of information at each stage.

DISCLAIMER

II. DISCUSSION

A. Congressional Actions to Focus the Repository Program on Yucca Mountain

Under the original terms of the Nuclear Waste Policy Act (NWPA) [1], which was enacted over fifteen years ago, Congress provided a federal program for the permanent disposal of spent nuclear reactor fuel and high-level nuclear waste in deep geologic repositories in a manner that would provide reasonable assurance that public health and safety and the environment would be adequately protected from the hazards of such wastes. Under the NWPA, Congress provided that the Environmental Protection Agency (EPA) would develop radiation protection standards that would be generally applicable to any repository or to multiple repositories. In addition, the Nuclear Regulatory Commission (NRC) would develop generally applicable regulations addressing the technical requirements and criteria that it would apply in determining whether to grant permission to the Department of Energy (DOE) to construct, operate, and permanently close one or more geologic repositories.

DOE was designated as the federal agency responsible for screening multiple potential repository sites using, in part, generally applicable siting guidelines to assist it in narrowing the selection of sites. After conducting a number of studies to characterize a limited number of potential repository sites, DOE would then recommend to the President that it be allowed to apply to the NRC for permission to develop one particular site as a geologic repository. NRC regulations generally provide that such permission to develop a nuclear facility, such as a nuclear power plant or a repository, would be granted by issuing a license to the entity seeking to develop the facility.

Although the primary roles of the DOE, NRC and EPA have not changed, over the past several years there has been a significant narrowing in focus of the United States' program to develop deep geologic repositories for the permanent disposal of spent nuclear reactor fuel and high-level radioactive wastes. About ten years ago, in an effort to keep the repository program on track, Congress enacted the Nuclear Waste Policy Amendments Act [2], in which Congress directed DOE to end its studies of all potential repository sites, except for the one site located at Yucca Mountain, Nevada. In addition, Congress directed DOE not to conduct any site-specific activities regarding a second repository unless specifically authorized by Congress at a future date.

A few years later, Congress revisited the repository program once again. This time, pursuant to Title VIII of the Energy Policy Act of 1992 [3], Congress directed the EPA to abandon its initial efforts regarding the development of generally acceptable radiation protection standards and instead to develop a site-specific radiation protection standard for the Yucca Mountain site. Under Congressional direction, the EPA need not, and indeed should not, attempt to develop the new standard to be consistent with its earlier standard. Instead, the EPA was to follow specific Congressional directions, together with additional guidance that was to be provided by the National Academy of Sciences (NAS). The NAS provided its guidance, in the form of a report, in 1995. [4]

Thus since 1992, Congress has directed the DOE, NRC and EPA to narrow their focus to an assessment of whether the Yucca Mountain site should be developed as a geologic repository. To that end, DOE is engaged in a number of continuing studies at Yucca Mountain to characterize the geologic setting and assess various engineered barriers, which together comprise the repository system that is intended to isolate radioactive waste. NRC regulations define the geologic setting as the geologic, hydrologic and geochemical systems of the region in which a geologic repository may be located. [5] The engineered barrier system includes the waste packages and the underground portion of the repository.

B. NRC Revisions to its Technical Criteria to Assess Yucca Mountain

During the past several years, there has also been an evolution in the way in which the DOE and NRC conduct their respective assessments of a geologic repository. The NRC has gradually increased its emphasis on the use of Probabilistic Risk Assessments (PRAs) as a tool in assessing whether various facilities, including a geologic repository, will be able to provide adequate protection of public health and safety. According to the NRC's Final Policy Statement on the Use of Probabilistic Risk Assessment in Nuclear Regulatory Activities, PRA will complement, rather than replace, its other, more traditional, assessment tools such as the use of "defense-in-depth" in assuring facility designs can prevent and mitigate the effects of radioactive releases into the biosphere.[6] The NRC is engaged in an ongoing process to identify those portions of its existing regulations that should be revised to reflect this increased emphasis on PRA. In the geologic repository program, both the NRC and DOE use the term "performance assessment" (PA), as opposed to PRA, to describe the probabilistic assessments of various technical parameters important to long-term isolation of radioactive waste. Consistent with the NRC's increased emphasis on the use of performance assessments in the repository program, DOE also is engaged in significant PA activities as part of its assessment of the repository system which, as noted above, is comprised of both the geologic setting and engineered barriers to isolate nuclear waste.

The NRC has also begun the process of revising its regulations, codified at Part 60 of Title 10 of the Code of Federal Regulations (10 C.F.R. Part 60),to assure that its repository technical performance objectives and site and design criteria will be appropriate for assessing the Yucca Mountain site, and to more accurately reflect the current emphasis on the use of PA by both agencies, which is in addition to the use of the more traditional "deterministic" approach in assessing the Yucca Mountain site as a potential geologic repository. As the NRC proceeds in its review of the various technical criteria to determine which are more or less relevant to an assessment of the Yucca Mountain site, it is equally important that the new or revised site-specific regulations underscore the NRC's current regulatory philosophy regarding the multi-staged licensing process, and the level to which long-term (post-closure) repository performance must be addressed at each licensing stage.

C. The Need to Preserve the Concept of Staged Licensing and Identify the Level of Detail of Information Needed at Each Stage

At the time the NWPA was enacted, Congress addressed the appropriateness of a staged process of repository development and noted that only after perhaps 30 years of repository operation would there be sufficient information to adequately predict the repository's long-term performance and ability to protect public health and safety.[7] Because of this, Congress required the repository design to remain sufficiently flexible to accommodate any changes that might be required as a result of new information acquired during the period of operation. The legislative history of the NWPA indicates that Congress did not expect DOE to have sufficiently complete information regarding definitive repository performance and design at the time of repository operation, much less at repository construction, and did not expect the NRC to be able to make a final determination as to repository performance at such early stages of repository development.

Consistent with Congressional findings noted above, the NRC recognized in its Part 60 rulemaking that the level of detail and reliability of data in support of proceeding with each licensing stage would increase as the repository program progressed through construction and operation. Although under Part 60 the same objectives and similar criteria are to be taken into account by the NRC at each stage in assessing the various features of the repository, the NRC noted that "with each [licensing] stage there is a progressive increase in knowledge regarding these features and a corresponding increase in confidence in a decision whether HLW [high-level waste] can be disposed of at a repository at the site."[8] The NRC also noted that because it believed that its knowledge of expected repository performance could be substantially increased through a carefully planned program of testing during the period of repository operation, it wished to base its decision to permanently close the repository on such information.[9] Indeed, Part 60 itself acknowledges that the NRC anticipates that there will be gaps and uncertainties in the information provided by DOE to the NRC in its application to construct the repository, including gaps in the information about the contribution of the engineered and natural (geologic) barriers to long-term repository performance. However, Part 60 also requires that DOE present the NRC with an acceptable plan and schedule to acquire the additional information in time to be evaluated by the NRC at the next licensing stage. In the interim, DOE will have the burden of adequately documenting the results of available geologic and engineering studies and its rationale for using bounding conditions, "expert judgment," natural analogs, and the like in making its case to the NRC that repository development should proceed.

In developing the staged approach to repository licensing, the NRC not only reflected the Congressional findings noted above, but also indicated that it was drawing upon decades of experience of licensing nuclear reactors in discrete stages under its Part 50 regulations (at section 50.35(a)) that provide that reactor construction may proceed even though design information is insufficient to complete a safety analysis of the reactor, and further research may be needed for safety-related systems.

III. CONCLUSION

Despite the fact that both Congress and the NRC have been remarkably clear in their intent that repository development should proceed in a series of stages (generally referred to as construction, operation (or waste emplacement), and permanent closure) with greater detailed information about repository design and long-term performance becoming available at each succeeding licensing stage, there has nevertheless been evidence that some have interpreted Part 60 as requiring that virtually all design and long-term repository performance issues must be resolved, as opposed to addressed, at the initial licensing stage to construct the repository. Therefore, as it goes about its process of revising Part 60 to more precisely assess the ability of the Yucca Mountain site to be developed as a geologic repository, the NRC should also once again underscore its rationale for adopting a staged licensing approach to repository development.

In doing so, the NRC should draw from its earlier repository rulemaking activities spanning 15 years, and consolidate its earlier and quite comprehensive discussions regarding the NRC approach to evaluating adequacy of information to be contained in the DOE's license application to begin construction of a geologic repository. The rulemaking should include a discussion of the appropriateness of staged licensing, the level of detail of information needed for each licensing stage, and the requirement for reasonable, as opposed to complete, assurance of repository performance for each stage. In addition, there should be an explicit statement, consistent with its earlier rulemaking and Congressional findings, that in order for DOE to be able to begin construction, it is not expected to have resolved all design and long-term repository performance issues at this initial licensing stage. However, DOE would be responsible for developing a sufficiently robust and well-documented license application that would enable the NRC to independently determine whether DOE can develop a geologic repository at Yucca Mountain, Nevada, without undue risk to public health and safety. Finally, the language of the revised rule itself should emphasize these points to the greatest extent possible to avoid any future confusion or debates as to the intent of the rule, and to facilitate any judicial review of later administrative decisions based on the rule.

REFERENCES:

1. Nuclear Waste Policy Act of 1982, Pub. L. 97-425, 96 Stat. 2201, codified at 42 U.S.C. Sections 10101 et seq.

2. Nuclear Waste Policy Amendments Act of 1987, Pub. L. 100-203, 101 Stat. 1330, codified at 42 U.S.C. Sections 10101 et seq.

3 Energy Policy Act of 1992, Pub. L. 102-486, 106 Stat. 2921-2923, codified at 42 U.S.C. 13201 et seq.

4. "Technical Basis for Yucca Mountain Standards," Board on Radioactive Waste Management, National Research Council, National Academy Press (1995).

5. 10 C.F.R. Part 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories" (1997).

6. Final Policy Statement: Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities, 60 Fed. Reg. 42,622 (1995).

7. House Report No. 97-491, reported in 1982 U.S. Code Cong. and Admin. News, Vol. 4.

8. Proposed Rule: Disposal of High-Level Radioactive Wastes in Geologic Repositories; Proposed Licensing Procedures, 44 Fed. Reg. 70,408 (1979).

9. Final Rule: Disposal of High-Level Radioactive Wastes in Geologic Repositories; Technical Criteria, 48 Fed. Reg. 28,194 (1983).

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