

in the design of the repository" (sec. 121(b)(1)(B));

(2) NRC's criteria "shall include such restrictions on the retrievability of the solidified [HLW] and spent fuel emplaced in the repository as the Commission deems appropriate" (sec. 121(b)(1)(B)); and

(3) NRC's criteria "shall not be inconsistent with any comparable standards promulgated by the Administrator under subsection (a)" (sec. 121(b)(1)(C)).

The first of these restrictions shows that although Congress did require NRC to provide for "multiple barriers" for waste isolation, it did not specify that geologic barriers must be primary or qualify the "multiple barriers" requirement in any other way.

Congress amended NWSA in 1987 to focus the national waste program exclusively on the characterization of the YM site as a potential geologic repository, but did not alter section 121 or otherwise place a requirement on NRC to make geologic barriers the primary means of waste isolation in its rules. Pub. L. 100-203 (101 Stat. 1330). Congress again revised the national waste program in the Energy Policy Act of 1992 (EnPA), Pub. L. 102-486, October 24, 1992. In the EnPA, Congress directed EPA to promulgate standards applicable solely to the Yucca Mountain site and directed NRC to modify its technical requirements and criteria under section 121(b) of NWSA, as necessary, to be consistent with EPA's standards. Section 801 of EnPA. EnPA did not direct either EPA or NRC to require that geologic barriers be the primary form of waste isolation.²

NRC initially established its procedural rules for a repository in 1981 in a new 10 CFR Part 60. (46 FR 13971; February 25, 1981). In 1983, NRC incorporated technical requirements into Part 60, as directed by NWSA. (48 FR 28194; June 21, 1983). The Commission explained that the purpose of the technical criteria was "to define more clearly the bases upon which licensing determinations will be made * * * ." (48 FR 28195). The Commission acknowledged that licensing decisions

would be complicated by the uncertainties that are associated with predicting the behavior of a geologic repository over thousands of years and stated that it intended to address this difficulty by requiring that a DOE proposal be based upon a multiple barrier approach:

An engineered barrier system is required to compensate for uncertainties in predicting the performance of the geologic setting, especially during the period of high radioactivity. Similarly, because the performance of the engineered barrier system is also subject to considerable uncertainty, the geologic setting must be able to contribute significantly to isolation.

Id. The Commission did not specify that either the engineered or the geologic barriers be primary. However, the Commission did elect to implement this approach by establishing a number of performance objectives and detailed siting and design criteria that it "deemed appropriate" for a multiple barrier system. *Id.*, fn 2. The Commission identified "two potentially viable approaches" to achieving the goal of waste isolation: (a) An approach "that would prescribe minimum performance standards for each of the major elements of the geologic repository, in addition to prescribing the EPA standard as a single overall performance standard;" and (b) an approach "that would specify the EPA standard as the sole measure of isolation performance." (48 FR 28196). In short, the Commission believed it was legally free to adopt either approach. The Commission adopted the first approach in order to convey "in [a] meaningful way the degree of confidence which it expects must be achieved in order for it to be able to make the required licensing decisions." *Id.* It, therefore, adopted a regulation setting sub-system performance standards, although with a provision allowing modifications on a case-by-case basis.³ See 10 CFR 60.113.

As explained above, EnPA required NRC to modify its technical requirements to assure consistency with EPA's standards for a repository at YM. In response to this mandate, NRC published a proposed rule to establish a new, separate part of its regulations at 10 CFR Part 63. (64 FR 8640; February 22, 1999). The proposed rule was designed to do more than simply conform NRC's technical requirements

to an EPA standard. The Commission recognized that in the 15 years since the Part 60 technical criteria had been put in place, there had been "considerable evolution in the capability of technical methods for assessing the performance of a geologic repository at Yucca Mountain [and that] * * * their implementation for Yucca Mountain [would] avoid the imposition of unnecessary, ambiguous, or potentially conflicting criteria that could result from the application of some of the Commission's generic requirements at 10 CFR Part 60." (64 FR 8641). In addition, the Commission recognized an opportunity to establish criteria compatible with the Commission's overall philosophy of risk-informed and performance-based regulation:

[T]he creation of a new part of its regulations to [achieve risk-informed, performance-based regulations] is preferable to modifying its generic requirements, given the fundamentally different approach laid out for Yucca Mountain by EnPA and NAS than was contemplated when the generic criteria were promulgated. More specifically, EnPA and NAS have specified an approach that would require the performance of a Yucca Mountain repository to comply with a health-based standard established in consideration of risk to a hypothetical critical group, and, further, that this would be the only quantitative standard for the post-closure performance of the repository. This approach is incompatible with the approach taken in the existing generic criteria which relies on quantitative, subsystem performance standards.

(64 FR 8643). The Commission decided to reexamine its implementation of a multiple barrier approach and propose a regulation which required a system of multiple barriers, but which did set numerical goals for the performance of individual barriers. See 64 FR 8647-50. Instead, DOE was required to demonstrate that the natural barriers and the engineered barrier system would work in combination to enhance overall performance of the geologic repository.⁴

⁴ In this reexamination, the Commission noted that the § 60.113 subsystem criteria "[had] not gained broad acceptance in the technical community" and had been "criticized as overly prescriptive, lacking in both a strong technical basis and a clear technical nexus to the overall performance objective * * * ." (64 FR 8649). Further, the Commission noted that NAS had found, in 1995, that "the physical and geologic processes relevant to a Yucca Mountain repository * * * are sufficiently quantifiable and the related uncertainties sufficiently boundable that the performance of a repository can be assessed over timeframes during which the geological system is relatively stable or varies in a boundable manner." *Id.* (quotations omitted). Moreover, "experience and improvements in the technology of performance assessment, acquired over more than 15 years, now provide significantly greater confidence in the technical ability to assess comprehensively overall

² Section 801(b)(2) of EnPA did place a further restriction on NRC's rules for a repository by requiring NRC to incorporate into its rules assumptions, consistent with the findings and recommendations of the National Academy of Sciences (NAS), pertaining to the sufficiency of engineered barriers and DOE's post-closure oversight to prevent human activity causing a breach of the repository and to prevent any increase in the exposure of individual members of the public to radiation beyond allowable limits. However, NAS concluded that these assumptions were not scientifically justified and Part 63 is not based on these assumptions.

³ Contrary to petitioner's assertions, the Commission did not view the sub-system requirements as the "essential prerequisites to establishing a safe repository." Petition at 22, but rather as a means of increasing confidence in its licensing decisions, given the uncertainties and technical methods for evaluating repository performance available in 1983.