

## 5.2 Multiple Barriers

*Issue 1:* Will the Yucca Mountain Review Plan consider limitations of each barrier's capability?

*Comments.* Commenters argued that numerous unresolved questions remain with respect to the engineered and natural barriers (e.g., durability of the waste package, amount of water flowing into repository drifts) that raise concerns regarding how the Yucca Mountain Review Plan considers the limitations in barrier capabilities. Commenters asked a number of questions regarding how specific systems, subsystems, and components of the repository would perform.

*Response.* In accordance with 10 CFR 63.115, NRC staff's review of the capability of each barrier relied upon by DOE will include consideration of uncertainty in the behavior of the barriers. Additionally, the barrier capability is to be described in terms of the approaches used in the performance assessment, which include potential limitations in barrier capabilities, through consideration of uncertainty in parameters; alternative conceptual models; and degradation, deterioration, and alteration processes of the engineered barriers. Each of the model abstractions (i.e., degradation of engineered barriers, flow paths in the saturated zone) in the Yucca Mountain Review Plan includes consideration of potential limitations in the representation of the repository barriers. The Yucca Mountain Review Plan supports a detailed review of repository barriers and provides understanding of the intended function of each of the barriers and of the potential limitations regarding individual barrier performance. The concerns noted in the comment must be adequately addressed in a DOE license application for a high-level waste repository at Yucca Mountain.

Section 4.2.1.1, "System Description and Demonstration of Multiple Barriers," of the draft Yucca Mountain Review Plan indicates that: (i) There are no quantitative limits placed on individual barriers or categories of barriers; and (ii) the intent of the review is to understand the capability of each barrier to perform its intended function and the relationship of that barrier's role to limiting radiological exposure in the context of the overall performance assessment.

*Issue 2:* Does the Yucca Mountain Review Plan appropriately describe potential barrier functions?

*Comment.* The commenter recommended that the exact wording from the definition of barrier in 10 CFR

part 63 (that is, prevents or substantially reduces the rate of movement of water or radionuclides from the Yucca Mountain repository to the accessible environment, or prevents the release or substantially reduces the release rate of radionuclides from the waste) be used to describe the potential functions of the barriers in Sections 4.2.1.1.1, "System Description and Demonstration of Multiple Barriers," of the draft Yucca Mountain Review Plan.

*Response.* Use of the exact wording from the definition of barrier in 10 CFR 63.2 to describe the potential functions of the barriers in the Yucca Mountain Review Plan is appropriate and the Yucca Mountain Review Plan has been modified accordingly.

*Issue 3:* Should the Yucca Mountain Review Plan specify that a specific natural or engineered barrier be the primary barrier for the repository?

*Comment.* Some commenters were concerned that current expectations for the waste package to be corrosion-resistant for more than 10,000 years reduce the requirement that the repository include natural or geologic barriers. One commenter requested that the repository be required to be substantially geologic. Another commenter asked that Section 4.2.1.1, "System Description and Demonstration of Multiple Barriers," of the draft Yucca Mountain Review Plan clarify that neither natural nor engineered barriers need be the primary barriers for containing radionuclides, reflecting that overall performance of the repository is important, rather than subsystem requirements.

*Response.* The regulations at 10 CFR 63.115 require DOE to identify the barriers of the repository system, describe the capabilities of the barriers, and provide the technical basis for each barrier's capability. The Yucca Mountain Review Plan addresses this requirement.

No changes have been made to the Yucca Mountain Review Plan in response to this comment.

## 5.3 Screening Features, Events, and Processes

*Issue 1:* How will NRC determine whether the appropriate features, events, and processes have been included in a postclosure performance assessment?

*Comment.* Several commenters expressed concern whether DOE would provide a complete evaluation of features, events, and processes, in developing its postclosure performance assessment (similar in concept to the Category 1 and 2 initiating events in the preclosure section of the Yucca

Mountain Review Plan). One commenter proposed establishing a Category 3 that would encompass natural and man-made events and stated that the total system performance assessment should include an analysis of climate changes over 10,000 years. Additional comments on specific potential disruptive scenarios included were provided.

Several commenters cited the current DOE design plans calling for titanium drip shields as evidence that the Yucca Mountain environment contains significant amounts of water, and expressed concern that this water and the geochemically oxidizing environment for the proposed repository would lead to corrosion of the waste packages. Commenters also expressed concern about the performance of Alloy C-22 and cladding, and requested specific technical information on engineered materials performance.

Another commenter expressed concern that if the consequence of an event were high, it must be considered in the performance assessment, regardless of the probability of its occurrence. The same commenter took exception to the use of the term "credible natural events," arguing that this was an artificial means of removing disruptive events from further consideration for mitigation. One commenter asked whether microbial influenced events were being evaluated.

*Response.* Consideration of features, events, and processes, especially those with potentially adverse effects, is a key part of the performance assessment process. A number of features, events, and processes have been or are being considered relevant to the performance of the proposed repository at Yucca Mountain. DOE has the responsibility to prepare the postclosure performance assessment and demonstrate compliance with the postclosure performance objectives of 10 CFR 63.113. In meeting the performance objectives, the regulations in 10 CFR 63.114 require DOE to consider pertinent features, events, and processes. As described in Section 4.2.1.2, "Scenario Analysis and Event Probability," of the draft Yucca Mountain Review Plan, it is anticipated that DOE would screen an initial list of features, events, and processes that include the issues raised by the commenters. The purpose of the screening is for DOE to develop a final list that will be considered in detail in its postclosure performance assessment. DOE must provide a technical basis for the inclusion or exclusion of features, events, and processes from the performance assessment. As defined in 10 CFR 63.114(d), one of the screening