

clarify that analog information should be used to the extent appropriate.

5.4 Model Abstraction

Issue 1: What site characterization information would be included in the postclosure performance assessment?

Comment. A number of commenters provided examples of features, events, and processes that they contended should be included in the postclosure performance assessment. These included general lists of information on characteristics of the geologic and hydrologic setting, an inventory of potential corrosives from waste canisters, and climatologic information. One commenter stated that the performance assessment should include types of indirect information that may indicate the occurrence of past natural disruptive events. The same commenter noted that the general description should include trends in seismic and volcanic activity, as well as a study of volcanically active regions in the Cascade Mountains, and should evaluate the possibilities of similar activity at Yucca Mountain.

Response. DOE has the responsibility to prepare the postclosure performance assessment and demonstrate compliance with the performance objectives of 10 CFR 63.113. 10 CFR 63.114 requires DOE to provide a technical basis for the inclusion or exclusion of features, events, and processes in the performance assessment. This technical basis would include site characterization information.

No changes were made to the Yucca Mountain Review Plan as a result of this comment.

Issue 2: How would uncertainty be addressed in the model abstractions used in the postclosure performance assessment?

Comment. A number of comments were provided on uncertainties related to the engineered barriers and natural system, and how these uncertainties would be addressed in the review of a postclosure performance assessment. One commenter expressed concern that there were inconsistencies in how the alternative conceptual models are to be used in evaluating uncertainty in the postclosure performance assessment. Another commenter asked how NRC would consider uncertainties in reviewing DOE's performance assessment and requested more detail on the role uncertainty would play in establishing priorities for the licensing decision. Another commenter noted concerns about the basis for performance assessment model abstractions expressed in letters from the Advisory Committee on Nuclear

Waste to NRC Chairman Richard Meserve (September 28, 2001; and January 17, 2002).

Response. Accounting for uncertainty in estimating repository performance is an important factor in the evaluation of DOE's license application. The regulations at 10 CFR 63.114 and 63.304 require the performance assessment to provide for the full range of defensible and reasonable parameters and models, and account for uncertainty. NRC staff review will evaluate the nature and magnitude of the uncertainties and the impact of uncertainty on repository performance. Consideration of alternative models is one means of evaluating the conceptual model uncertainty in performance assessment. The postclosure performance assessment requirements in 10 CFR 63.114(c) require DOE to consider alternative conceptual models of features and processes that are consistent with available data and current scientific understanding and to evaluate the effects that alternative conceptual models have on the performance of the geologic repository. The Yucca Mountain Review Plan provides guidance regarding review of these requirements and that DOE has the flexibility to demonstrate compliance, consistent with a risk-informed, performance-based licensing approach.

As discussed in the "Statement of Considerations" for 10 CFR part 63 (66 FR pp. 55747–55748, November 2, 2001), the Commission recognizes " * * * the uncertainties inherent in evaluating a first-of-a-kind facility like the repository and in estimating system performance over very long time periods (*i.e.*, 10,000 years)." In response to these uncertainties, NRC modified 10 CFR part 63 to require that DOE include uncertainty in its postclosure performance assessment and provides sufficient information to allow NRC to evaluate DOE's uncertainty analysis. For example, 10 CFR 63.114(b) requires DOE to account for uncertainties and parameter variability, and to provide the technical bases for its treatment of uncertainty in the postclosure performance assessment. In addition, DOE is required by 10 CFR 63.114(c) to provide additional assurances that uncertainty in the information (*e.g.*, evaluation of site characterization data) used to develop the performance assessment has been evaluated by consideration of alternative conceptual models of features and processes that are consistent with available data and current scientific understanding. The regulation at 10 CFR 63.113(g) provides that DOE conduct corroborative testing

of its performance assessment to the extent feasible, and for DOE to use additional bases beyond performance assessment to compensate for uncertainty and to provide confidence that the postclosure performance objectives of 10 CFR 63.113 are met. For example, 10 CFR part 63, subpart F, requires that a performance confirmation program confirm that the behavior of the barriers of the repository system is consistent with assumptions in the performance assessment. Further, 10 CFR 63.113 and 10 CFR part 63, subpart G, require use of multiple barriers and a quality assurance program.

As described in the "Statement of Considerations" for 10 CFR part 63 (66 FR 55747–55748, November 2, 2001):

The Commission will consider all these requirements in determining whether it has sufficient confidence (*i.e.*, reasonable expectation) that DOE has demonstrated or has not demonstrated the safety of the repository. Specification of an acceptable level of uncertainty is neither practical nor appropriate due to the limited knowledge currently available to support any such specification and the range of uncertainties that would need to be addressed. The Commission believes the approach to performance assessment in the proposed rule, which includes the treatment of uncertainty, is appropriate and has retained this approach in the final rule.

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If NRC were to specify an acceptable level of uncertainty, the specified value would be somewhat arbitrary because: (1) Understanding of the site is evolving as site studies continue; (2) repository design options are still being evaluated; and (3) differences in the types of uncertainties (*e.g.*, variability in measured parameters, modeling assumptions, expert judgment, *etc.*) complicate the specification.

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Although the Commission does not require an "accurate" prediction of the future, uncertainty in performance estimates cannot be so large that the Commission cannot find a reasonable expectation that the postclosure performance objectives will be met (*see* discussion under "Reasonable Expectation") [Section 1.4, 66 FR 55739–55740]. At this time, the Commission is not aware of any information that suggests the uncertainties are so large that NRC will be unable to make a regulatory decision regarding the safety of a potential repository at Yucca Mountain.

Each of the performance assessment model abstractions, provided in Section 4.2.1.3, "Model Abstraction," of the draft Yucca Mountain Review Plan, provides specific review methods and acceptance criteria that address both data uncertainty (parameter variability) and model uncertainty (whether the model is adequate and appropriate). Therefore, the review methods and