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RESOLUTION OF SITE CHARACTERIZATION ANALYSIS (SCA) QUESTION 35
(SCPB: N/A)

References: (1) Ltr, Shelor to Linehan, dtd 12/14/90
(2) Ltr, Bernero to Bartlett, dtd 7/31/91
(3) Ltr, Bell to Shelor, dtd 11/8/94

On December 14, 1990, the U. S. Department of Energy (DOE) transmitted its responses to objections, comments, and questions presented in the U.S. Nuclear Regulatory Commission's (NRC) SCA (Reference 1). The NRC staff evaluated these responses, closing some of the items and creating open items of the remainder (Reference 2). The open item identified above has been addressed through actions and progress in the program.

Question 35 asks if the acceptance criteria for a waste package helium leak test is consistent with the performance requirements of 10 Code of Federal Regulations (CFR) Part 60.113 for the engineered barrier system.

Assuming that all waste packages leak at the acceptance criterion, and all of the leakage is made up of carbon-14 as carbon dioxide, the release rate for small packages would be well below the $1x10^{-5}$/year limit in 10 CFR 60.113.

In the NRC's November 8, 1994, letter (Reference 3), the NRC stated DOE did not provide information that demonstrated the helium leak test acceptance criteria are consistent with the performance requirements of 10 CFR 60.113. DOE's supplemental response provides a preliminary quantitative evaluation of the leak acceptance criterion relative to the post-containment release rate limits in 10 CFR 60.113.

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DOE believes the additional information provided is sufficient to resolve SCA Question 35 and awaits NRC confirmation.

If you have any questions contact Thomas W. Bjerstedt at (702) 794-7590.

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AMSL:TWB-902

Enclosure:
Administrative Record for
SCA Question 35

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Enclosure 1

SCA Question 35 and Original DOE Response

NRC Evaluation of Original DOE Response

DOE Supplemental Response to NRC Question 35
(With additional information)

Section 8.3.4.2.G Waste package fabrication and handling before emplacement. Design goal for closure, p. 8.3.4.2-30 para. 6

SCA QUESTION 35

It is stated that the closure process will be capable of being performed and inspected under remote conditions with a reliability such that the containment would be capable of passing a standard helium leak test at the level of 1 x 10E-7 atm-cu cm/sec.

What is the basis for the helium leak test acceptance criteria?

EVALUATION OF DOE RESPONSE

- DOE cites ASME Section V, Article 10, Appendix IV, 1986 as the basis for the helium leak test acceptance criteria and indicates that the criteria will be assessed further during waste package design. However, DOE does not provide any assessment or information that demonstrates that the helium leak test acceptance criteria are consistent with the performance requirements of 10 CFR 60.113 for the engineered barrier system.

- The NRC staff considers this question closed as to the basis for the helium leak test acceptance criteria, but open as to whether the criteria are consistent with 10 CFR 60.113.

Section 8.3.4.2.G. Waste package fabrication and handling before emplacement. Design goal for closure, p. 8.3.4.2-30 para. 6.

QUESTION 35

It is stated that the closure process will be capable of being performed and inspected under remote conditions with a reliability such that the containment would be capable of passing a standard helium leak test at the level of 1 x 10^{-7} atm-cm^3/sec.

What is the basis for the helium leak tes' acceptance criteria?

BASIS

10 CFR Part 60.113 includes requirements for the performance of the engineered barrier system and it is not clear if the criteria are consistent with these requirements.

RECOMMENDATION

Provide the basis for the helium leak test acceptance criteria and demonstrate that the criteria are consistent with the performance requirements of 10 CFR Part 60.113 for the engineered barrier system.

RESPONSE

Design goal for closure. The closure process will be capable of reliable remote operation to seal the containers as required. A preliminary definition of sealed is passing a standard helium leak test (such as ASME Section V, Article 10, Appendix IV, 1986) to a level of $1x10^{7}$ atm-cm^3/s. This goal will be assessed further during waste package design.

The closure inspection process will be able to assure that the container is sealed and will have a high reliability for detecting design limit flaws. The preliminary reliability is set at 99% or greater. The design limit flaws have not been determined. These goals would be assessed further during waste package design.

DOE Supplemental Response to Question 35

The definition of "substantially complete containment" was addressed in the response to SCA Comment 80. In that response, the DOE stated that a new performance goal has been established which focuses on containment of radionuclides. The goal is to achieve mean waste package lifetimes well in excess of 1,000 years. This means that the number of failures at the initial tail of the failure distribution over time, i.e., during the containment period, will be very small. The DOE will achieve this performance goal through the use of multiple barriers with more than one failure mode. This permits the peak of the failure distribution of the combined waste package to be reduced and the distribution itself to be extended in time. Thus, the fraction failed at 1,000 years will be extremely small, on the order of 1%. This new approach, which focuses on containment, is consistent with the NRC's emphasis on containment rather than release during the containment period.

The potential for release from waste packages with undetected failures was evaluated with regard to meeting the post-containment controlled release requirement. It is assumed conservatively that all waste packages are leaking. The leak rate was assumed to be the same as that with which they would have passed through the inspection process undetected. For conservatism, it was assumed that this limit is the leak rate acceptance level of $1x10^{-7}$ atm-cm^3/sec. even though the actual detection limit is closer to $1x10^{-8}$ atm-cm^3/sec. It is further assumed that the leak rate is made up of only Carbon-14 as carbon dioxide. At a leakage rate of $1x10^{-7}$ atm-cm^3/s, the loss of C-14 gas would be $4.09x10^{-12}$ mol/s or $1.3x10^{-4}$ mol/yr. using the ideal gas law. For small waste packages that contain about 30 moles of gas, the release per package would be $4.3x10^{-6}$/yr, which is well below the release rate limit of $1x10^{-5}$/yr stated in 10 CFR 60.113 for the post-containment period.