THE U.S. NUCLEAR REGULATORY COMMISSION OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS REVIEW OF THE U.S. DEPARTMENT OF ENERGY'S KEY TECHNICAL ISSUE AGREEMENT RESPONSE RELATED TO THE POTENTIAL GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN, NEVADA: GENERAL AGREEMENT 1.01

1.0 INTRODUCTION

By letter dated August 31, 2004, the U.S. Department of Energy (DOE) submitted (Ziegler, 2004a) a report titled "Key Technical Issue Letter Report (Response to GEN.1.01), Revision 1," to satisfy the informational needs of Agreement General (GEN) 1.01. DOE indicated (Ziegler, 2004a) that the letter transmitted the final response to Key Technical Issue (KTI) Agreement GEN.1.01. However, DOE's August submission (Ziegler, 2004a) did not include the necessary details to understand where the information requested in 12 of the 49 comments of Agreement GEN.1.01 had been provided. Subsequently by letter dated September 30, 2004, DOE submitted (Ziegler, 2004b) a revised report titled "Key Technical Issue Letter Report (Response to GEN.1.01), Revision 2," to satisfy the informational needs of agreement GEN.1.01. The GEN.1.01 agreement addresses 49 separate U.S. Nuclear Regulatory Commission (NRC) comments on many different issues in the DOE's Supplemental Science and Performance Analyses (Bechtel SAIC Company, LLC, 2001a; Bechtel SAIC Company, LLC, 2001b). The information was requested by NRC during a technical exchange in September 2001 (Reamer, 2001). DOE's initial response to these comments, provided at the September 2001 technical exchange (Reamer, 2001), related the specific GEN.1.01 comments to other KTI agreements. DOE has responded to the majority of comments in GEN.1.01 in DOE responses to other KTI agreements, either in individual KTI letter reports or in technical basis documents. DOE's specific response to the Agreement GEN.1.01 (Ziegler, 2004b) identifies in Table 1 either where the information requested in each of the GEN.1.01 comments had been provided to NRC or when the NRC's review of the information provided by DOE in each of the GEN.1.01 comments had been closed. The status of the NRC staff review of GEN.1.01 Comments 3, 8, 12, 15, 18, 41, 42, 50, 56, 75, 78, 83, 93, 96, 97, 98, 102, 103, 109, 110, 113, 116, 118, 120, 122, 123, 124, and 126 was previously provided to DOE (Kokajko, 2005a). That letter indicated that those comments were considered closed.

Specific comments of Agreement GEN.1.01 addressed in this NRC review of the information provided by DOE (Ziegler, 2004b) include Comments 5, 9, 10, 13, 16, 21, 24, 27, 36, 37, 45, 46, 64, 69, 81, 82, 95, 104, 106, 111, and 119. This review summarizes where NRC has provided reviews of DOE's response to the remaining individual GEN.1.01 comments and reviews some of DOE's responses to specific GEN.1.01 comments (Ziegler, 2004b) where NRC has not previously provided to DOE the results of the NRC review. This review addresses all of the GEN.1.01 comments associated with other KTI low- and medium-risk significant agreements.

2.0 AGREEMENTS

Wording of the agreement is provided next.

GEN.1.01[1]

"For NRC comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 37, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126, DOE will address the concern in the documentation for the specific KTI agreement identified in the DOE response (Attachment 2). The schedule and document source will be the same as the specific KTI agreement."

3.0 RELEVANCE TO OVERALL PERFORMANCE

NRC synthesized existing information to categorize the KTI resolution agreements according to the risk significance of the agreement (NRC, 2003). In classifying agreements into the three categories (i.e., low-, medium-, and high-risk significant), risk information (i.e., risk insights) was drawn and synthesized using many types of existing quantitative analyses. Complementing the risk insights is the concept of multiple barriers (i.e., both engineered and natural barriers) in geologic disposal of high-level radioactive wastes (NRC, 2003). Multiple barriers, as an element of a defense-in-depth approach, results in a robust repository system that is more tolerant of failures and external challenges (e.g., poor or highly degraded performance is necessary in multiple areas to have a significant effect on risk). The baseline of risk insights (NRC, 2003) also addressed the risk significance of general post-closure performance assessment review items (i.e., system description and demonstration of multiple barriers; scenario analysis and event probability; model abstraction; and demonstration of compliance with the post-closure public health and environmental standards). These review topics relate to post-closure performance objectives and to items needed to support confidence in the total system performance assessment risk calculations. For these topics, the risk ranking also considered the significance of the information to build confidence in the calculations and the safety attributes of the repository system (NRC, 2003). The specific comments of GEN.1.01 are related to other KTI agreements, whose risk significance varies from low-risk to high-risk significance. The individual comments within GEN.1.01 were not separately categorized within the significance framework.

4.0 RESULTS OF THE NRC REVIEW

The disposition for agreement GEN.1.01 Comments 5, 9, 10, 13, 16, 21, 24, 27, 36, 37, 45, 46, 64, 69, 81, 82, 95, 104, 106, 111, and 119 is provided in Table 1 below. DOE provided specific responses to Comments 9 and 10 (Bechtel SAIC Company, LLC, 2003a) and reviews of DOE's response to Comments 9, and 10 are provided in Sections 4.1 and 4.2, respectively.

[1]In the agreement below, the phrase Attachment 2 refers to Attachment 2 of the enclosure of Reamer (2001).

Table 1. Disposition of GEN.1.01 Comments.

Comment	Status	NRC Review of DOE Response to Comment, Including ADAMS Accession Number
5	Closed	Kokajko L. E., 2005b, ML050960478
9	Closed	Addressed in Section 4.1
10	Closed	Addressed in Section 4.2
11[2]	Closed	Kokajko L. E., 2004a, ML043420398
13	Closed	Kokajko L. E., 2005c, ML050540056
16	Closed	Kokajko L. E., 2005b, ML050960478
21	Closed	Kokajko L. E., 2005d, ML050530415
24	Closed	Kokajko L. E., 2005e, ML050040251
27	Closed	Kokajko L. E., 2005f, ML051020515
36	Closed	Kokajko L. E., 2005g, ML050670323
37	Open	Kokajko L. E., 2005g, ML050670323
43[3]	Closed	Reamer C.W., 2004a, ML043360345
45	Closed	Kokajko L. E., 2005h, ML050330111
46	Closed	Reamer C.W., 2004a, ML043360345
64	Closed	Kokajko L. E., 2005d, ML050530415
69	Closed	Kokajko L. E., 2005e, ML050040251
81	Closed	Kokajko L. E., 2005i, ML050670015
82	Closed	Kokajko L. E., 2005j, ML050400241
95	Closed	Kokajko L. E., 2005c, ML050540056
104	Closed	Kokajko L. E., 2005i, ML050670015
106	Closed	Kokajko L. E., 2005e, ML050040251

[2]Although both DOE provided a response to this comment (Bechtel SAIC Company, LLC, 2004a) and NRC reviewed DOE's response, Comment 11 is not part of the GEN.1.01 agreement.

[3]Although both DOE provided a response to this comment (Bechtel SAIC Company, LLC, 2003b) and NRC reviewed DOE's response, Comment 43 is not part of the GEN.1.01 agreement.

Comment	Status	NRC Review of DOE Response to Comment, Including ADAMS Accession Number
111[4]	Closed	Kokajko L. E., 2005k, ML043650122
119	Closed	Kokajko L. E., 2005l, ML050100312

4.1 GEN.1.01 Comment 9

Wording of the GEN.1.01 Comment 9:

"Data supporting the residual stress calculations as a result of welding, after laser peening and after induction annealing are not provided.

Basis: The distribution of residual stresses in the waste package final closure welds is based on Finite element modeling. Details of the Model are provided in the *Stress Corrosion Cracking of the Drip Shield, the Waste Package Outer Barrier, and the Stainless Steel Structural Material AMR* [Analysis and Model Report]. The effects of induction annealing on the residual stresses in the final closure are detailed in the *Residual Stress Minimization of Waste Packages from Induction Annealing AMR*. Several assumptions are made in the models that are not supported by data. These include the assumed temperature profile during welding, the cooling rates during welding and the residual stress during induction annealing. The distribution of residual stress in the inner closure weld after laser peening is estimated in the SSPA [Supplemental Science and Performance Analyses] using a shot-peened Incoloy 908 specimen. The technical basis for using a shot-peened specimen is not provided. Differences in the residual stress mitigation methods (i.e., mechanical shot-peening vs. laser peening) may result in significantly different stress distributions."

NRC Review:

The DOE response (Ziegler, 2004b) indicates the residual stress profiles for the post-induction annealing conditions are based on ANSYS calculations using the induction annealing temperatures, temperature distributions and the cooling rates. Stress profiles for the laser-peened samples are based on actual measurements and shot peening data on Incoloy 908 was only to get uncertainty distribution for the process. In addition, in response to GEN.1.01 Comment 8 (Ziegler, 2004b) and CLST 1.16 (Bechtel SAIC Company, LLC, 2003a), DOE has indicated that induction annealing will not be used to mitigate residual stresses in the waste package closure welds. Laser peening or controlled plasticity burnishing will be used to impart compressive stresses to the closure welds. Analyses of the residual stress profiles for laser peened and controlled plasticity burnished Alloy 22 welds are provided in DOE's response to CLST 1.13 (Bechtel SAIC Company, LLC, 2003a). The information provided by DOE suggests that sufficient information will be available at the time of the license application. The information provided by DOE satisfactorily addresses GEN.1.01 Comment 9.

[4]Although the status of this comment was already identified as complete in Table 1 of Kokajko (2005a), the transmittal letter did not indicate that the comment was complete.

4.2 GEN.1.01 Comment 10

Wording of the GEN.1.01 Comment 10:

"The modified stress corrosion cracking parameters are based in recent tests that may not consider the range of possible environments and the effects of fabrication processes.

Basis: The SSPA [Supplemental Science and Performance Analyses] uses modified parameters for the stress corrosion cracking including the repassivation rate for the slip dissolution model and the minimum threshold stress for stress corrosion cracking. The SSPA indicates that these new parameters are based on recent data. The particular importance is the change in the minimum threshold stress which has been increased from 20-30 to 80-90 percent of the yield strength. The value of this parameter which is used in the model abstraction as the critical parameter for the occurrence of SCC [stress corrosion cracking] is likely to be dependent on several factors that have not been investigated such as chemical composition of the environment and the effects of fabrication processes (only a limited number of cold worked and welded specimens has been evaluated)."

NRC Review:

The DOE response (Ziegler, 2004b) indicates that DOE addressed Comment 10 in "Technical Basis Document No. 6: Waste Package and Drip Shield Corrosion" (Bechtel SAIC Company, LLC, 2003a). That document indicates additional data has been obtained in simulated groundwater and concentrated chloride solutions to support the parameters used in the stress corrosion cracking abstraction (Bechtel SAIC Company, LLC 2003c). Additional tests are planned on specimens fabricated from laser peened and controlled plasticity burnished plate. The information provided by DOE suggests that sufficient information will be available at the time of the license application and DOE has satisfactorily addressed GEN.1.01 Comment 10.

5.0 SUMMARY

NRC reviewed DOE's KTI agreement response within "Key Technical Issue Letter Report (Response to GEN.1.01), Revision 2" (Ziegler, 2004b) and "Technical Basis Document No. 6: Waste Package and Drip Shield Corrosion" (Bechtel SAIC Company, LLC, 2003a) to determine whether any important aspect of Comments 9 and 10 of Agreement GEN.1.01 was excluded from the response. In addition, NRC performed an independent assessment to determine whether the information provided would support submission of a potential License Application for a geologic repository. The NRC staff have identified where NRC has previously responded to DOE on many GEN.1.01 comments (see Table 1 and Kokajko, 2005a). Notwithstanding new information that could raise new questions or comments concerning this agreement, the information provided satisfies the intent of Comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126 of Agreement GEN.1.01. On the basis of this review, the information assembled in response to Comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126 of Agreement GEN.1.01 is adequate to support the submission of a License Application for the potential repository at Yucca Mountain. However, as described in Kokajko (2005g), the

information provided did not satisfy the intent of Comment 37 and the information assembled in response to Comment 37 of Agreement GEN.1.01 is not adequate to support the submission of a license application for the potential repository at Yucca Mountain.

6.0 STATUS OF THE AGREEMENTS

Based on the preceding review, the information provided with respect to Comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126 of Agreement GEN.1.01 is adequate to support submission of the License Application. Therefore, NRC considers Comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126 of Agreement GEN.1.01 to be closed. As described in Kokajko (2005g), Comment 37 of Agreement GEN.1.01 needs additional information.

7.0 REFERENCES

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Kokajko, L. E. "Pre-Licensing Evaluation of Key Technical Issue Agreements: Radionuclide Transport 1.02 and 3.10; General 1.01 Comment 27." Letter (April 15, 2005) to J. D. Ziegler DOE. Washington, DC: NRC. 2005f.

Kokajko, L. E. "Pre-Licensing Evaluation Of Key Technical Issue Agreements: Evolution Of The Near-Field Environment 1.06, 4.03, 4.04, And 4.06; Total System Performance Assessment And Integration 3.17, 3.30, And 3.42; And General 1.01, Comments 35, 36, 37, And 38" Letter (April 15, 2005) to J. D. Ziegler DOE. Washington, DC: NRC. 2005g.

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