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QA: N/A

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OVERNIGHT MAIL

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TRANSMITTAL OF KEY TECHNICAL ISSUE (KTI) AGREEMENT ITEM PRECLOSURE (PRE) 7.04

This letter provides the U.S. Department of Energy (DOE) response to the KTI Agreement Item PRE 7.04. This agreement is as follows:

> PRE 7.04: "Demonstrate that the non-destructive evaluation methods used to inspect the alloy 22 and 316 nuclear grade plate material and closure welds are sufficient and are capable of detecting all defects that may alter waste package mechanical properties.
> DOE will provide justification that the non-destructive evaluation methods used to inspect the alloy 22 and 316 nuclear grade plate material and welds are sufficient and are capable of detecting defects that may adversely affect waste package pre-closure structural performance. DOE agrees to provide the information in FY2003 and document the information in the Waste Package Operations Fabrication Process Report."

The response to KTI Agreement Item PRE 7.04 is provided in this letter and in the enclosed report. The report addresses nondestructive testing methods for the plate material and welds of the Alloy 22 component of the waste package. The response to KTI PRE 7.04 is provided in the enclosed report *Weld Flaw Evaluation and Nondestructive Examination Process Comparison Results for High-Level Radioactive Waste Package Manufacturing Program*, TDR-EBS-ND-000007, Revision 01. This report replaces the previously titled report *Waste Package Operations Fabrication Process Report*. The change to the report title was necessary to reflect work replanning.

During the past two years, the waste package closure design has evolved from a structurally welded inner cylinder of stainless steel 316 and a structurally welded outer cylinder of Alloy 22 to a spread ring closure for the stainless steel 316 cylinder and a structurally welded Alloy 22 cylinder. The stainless steel 316 cylinder provides the preclosure mechanical integrity for the waste package and the Alloy 22 cylinder functions primarily as the corrosion barrier for the waste package.

The study focused on the nondestructive examination of Alloy 22 base material and welded specimens. These specimens were joined using the Gas Tungsten Arc Welding method. The study confirmed that both ultrasonic testing (UT) and radiographic testing (RT) are capable of detecting volumetric flaws as small as one millimeter in size, with a strong correlation between the two methods. The nondestructive surface examination methods of eddy current and dye penetrant testing detected flaws with comparable results.

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Metallographic evaluation of the welded area indicated several small gas-induced spherical pores less than one millimeter in size (most of which were significantly smaller). These pores were attributed to the use of reagent grade gas in the welding process. Gas-induced pores can be reduced or eliminated by specifying an appropriate welding gas composition. The UT method did not detect the gas-induced pores. This was because the pores were smaller than the detection limits for UT. These pores were also not observed on the RT film. These pores were essentially spherical and are significantly smaller than the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME B&PV Code, Section III, Division 1) acceptance criteria, which assures structural adequacy of the material.

The report does not address the nondestructive examination aspects of the stainless steel 316 cylinder plate and closure welds. As described earlier, the spread ring design has eliminated the need for full penetration welds for the stainless steel 316 material closure. The spread ring is held in place with a seal weld that also provides containment of one atmospheric pressure of helium within the stainless steel 316 cylinder. Visual inspection and a helium leak test are planned for these seal welds. The function of the seal weld in the stainless steel 316 material closure is limited to leak tightness until the Alloy 22 lids are welded in place. The Yucca Mountain Project uses a "no breach" criteria for the waste package during preclosure. This criterion is met by the overall design of the waste package including the Alloy 22 material. Also, it should be noted that stainless steel 316 plate and fabrication welds have been used in the nuclear industry for over 35 years. During this period, extensive applications of nondestructive examination methods have been conducted for nuclear piping and components. A substantial body of knowledge exists which shows that nondestructive inspections can reliably detect and size small flaws in stainless steel 316 material components. The same ASME B&PV Code nondestructive examination methods and flaw acceptance criteria used for years in the nuclear industry for the fabrication of stainless steel 316 components will be used for the fabrication and acceptance of the waste package inner cylinder. Therefore, additional studies on nondestructive testing for stainless steel 316 material are not warranted and were not performed.

KTI Agreement Item PRE 7.04 was also linked with GENERAL 1.01 Items 8, 21, and 64. The enclosed report addresses the aspect of these items linked to KTI Agreement Item Pre 7.04.

Based on the information presented in this letter and enclosed report, and pending U.S. Nuclear Regulatory Commission (NRC) review and approval, the DOE recommends that KTI Agreement Item PRE 7.04 be closed.

This letter contains no new regulatory commitments. Please direct any questions concerning this transmittal to Timothy C. Gunter at (702) 794-1343 or Kirk D. Lachman at (702) 794-5096.

Joseph D. Ziegler, Acting Director
Office of License Application and Strategy

OLA&S:TCG-0867

Enclosure:
Weld Flaw Evaluation and Nondestructive Examination Process Comparison Results for High-Level Radioactive Waste Package Manufacturing Program, TDR-EBS-ND-000007, Revision 01

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