TRANSNUCLEAR
AN AREVA COMPANY

February 27, 2013
E-34603

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Subject: ASME Code Alternative Request
Docket No. 72-1027

Reference: Letter from B. Jennifer Davis (NRC) to Donis Shaw (TN), "Request for Additional Information for Review of ASME Code Alternative Request for Certificate of Compliance No. 1027 (TAC No. L24714)," February 13, 2013

This submittal provides a response to the request for additional information (RAI) forwarded by the letter referenced above. Enclosure 1 herein provides the RAI item followed by TN's response.

Should the NRC staff require additional information to support review of this application, please do not hesitate to contact Mr. Don Shaw at 410-910-6878 or me at 410-910-6933.

Sincerely,

Clark Vanderniet
Director, Regulatory Affairs

cc: B. Jennifer Davis (NRC SFST)
10814 file

Enclosure:

1. RAI and Response

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RAI 1: Provide a justification that although an eight millimeter section of the circumferential TN-68 canister weld was not radiographically inspected after post weld heat treatment (PWHT), the canister's effectiveness will not be significantly reduced. The justification may include, but is not limited to: applicable ASME Code Cases, and/or a flaw-size analysis.

Radiographic examination of repaired welds should follow any PWHT in accordance with NB-5120(a).

This information is required to demonstrate compliance with 10 CFR 72.236(j) and (l)

TN Response to RAI 1:

Transnuclear's (TN's) authorization request identified that TN-68 unit 63A, fabricated by ENSA for Peach Bottom Atomic Power Station, had a small weld segment on the weld seam between the inner shell and the flange that was radiographed prior to post weld heat treatment (PWHT) but not radiographed after PWHT. The small weld segment was 8 mm (0.32 in.) long and 7 mm (0.28 in.) deep. As described in TN's request, all excavated areas were examined by liquid penetrant with acceptable results and all weld repair surfaces were subjected to visual and magnetic particle examination before and after PWHT with acceptable results. Therefore, it is evident that the surface of the small weld segment of concern is free of unacceptable defects.

In addition, TN performed a fracture toughness evaluation for both normal and accident conditions using fracture toughness criteria and primary stress criteria to determine the maximum allowable sub-surface flaw sizes for the weld between the inner shell and the flange. Because the surface of the small weld segment on TN-68 unit 63A was examined after PWHT, the evaluated allowable surface defects are not discussed here.

The allowable stress intensity, $K_{allowable}$, is calculated based on ASME Code, Section XI, IWB-3613 [Reference 2] as follows:

$$K_{allowable} \le K_{ia} / 10^{1/2} \text{ (normal condition)}$$
$$K_{allowable} \le K_{ia} / 2^{1/2} \text{ (accident condition)}$$

The lower bound fracture toughness, K_{ia} = 78 ksi$\sqrt{in.}$, of SA-350 Class LF3 and SA-203 Gr. E is used.

The following equation is used to calculate the maximum allowable flaw size for a sub-surface flaw [Reference 1]:

$$K_I = \left[1 - 0.025\left(\frac{a}{b}\right)^2 + 0.06\left(\frac{a}{b}\right)^4\right]\sqrt{\sec\left(\frac{\pi a}{2b}\right)}\sigma\sqrt{\pi a}$$

Where:

a = half of flaw depth,
σ = maximum applied stress (normal condition: 2.0 ksi, accident condition: 23.0 ksi, at the location of the weld), and
b = ½t (t is thickness, 1.5 in.).

Using the above equation, the maximum allowable sub-surface flaw size is 1.16 in. and is calculated based on the maximum applied stress of 23.0 ksi at the weld location due to the tip-over accident load. This 1.16 in. maximum allowable sub-surface flaw size bounds the flaw size calculated by normal condition loads.

In addition, per ASME Code, Section XI, IWB-3610 [Reference 2], the primary stress limits of ASME Code, Section III, need to be met for the flawed components. The following equation is used to calculate the allowable sub-surface flaw depths:

$$a_{all} = t[1- (S/S_{all})]$$

Where:

t = original local thickness, 1.5 in.
S = maximum calculated local stress intensity 23 ksi, and
S_{all} = allowable stress intensity per ASME Code, Section III, for SA-203 Gr. E and SA-350 Cl. LF3 at 400 °F = 70 ksi.

A maximum allowable flaw size of 1.00 in. is calculated for the primary stress criteria. Therefore, the limiting flaw size in the inner shell and flange weld is 1.00 in.

Conclusion:

Based on the surface examinations performed on the small weld segment, the weld surface is free of unacceptable defects. Additionally, the small weld segment with a maximum depth of 7 mm (0.28 in.) that was not radiographed after PWHT is bounded by the sub-surface flaw size evaluation, should the weld segment contain a defect or crack extending 7 mm (0.28 in.) in depth.

Therefore, although an 8 mm (0.32 in.) section of the circumferential TN-68 cask weld was not radiographically examined after PWHT, the cask's effectiveness is not significantly reduced.

References:

1. Hiroshi Tada, "The Stress Analysis of Cracks Handbook," Del Research Corporation, St. Louis, Missouri.
2. ASME Boiler and Pressure Vessel Code, Section XI, Division I, Article IWB-3000, 1989 Edition.