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OPPD
Omaha Public Power District

444 South 16th Street Mall
Omaha NE 68102-2247

July 25, 2003
LIC-03-0099

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

References: 1. Docket No. 50-285
2. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, 1989 Edition

SUBJECT: Relief Request for Previous Repair of Pressurizer Nozzle

Pursuant to the provision stated in 10 CFR 50.55a (3) (ii), the Omaha Public Power District requests relief from certain requirements of the ASME Boiler and Pressure Vessel Code, Section XI, with regard to flaw acceptance in pressure boundary materials. This relief request applies to the temperature element, TE-108, pressurizer nozzle, which was repaired in October, 2000. The need for relief from Section XI was recently identified.

No commitments are made to the NRC in this letter. If you have any questions or require additional information, please contact Dr. R. L. Jaworski at (402) 533-6833.

Sincerely,

D. J. Bannister
Manager – Fort Calhoun Station

DJB/rlj

Attachment: Relief Request for Previous Repair of Pressurizer Nozzle

c: T. P. Gwynn, Acting Regional Administrator, NRC Region IV
A. B. Wang, NRC Project Manager
J. G. Kramer, NRC Senior Resident Inspector

A047

Relief Request
for
Previous Repair of Pressurizer Nozzle

1. ASME Code Component Affected

One 1" pipe size pressurizer nozzle (instrument tag number TE-108) on the side of the pressurizer near the bottom. Figure 1 shows the repaired configuration of the TE-108 nozzle.

Nozzle details: OPPD Drawing file numbers 01479, 20196, 49870

2. Applicable Code Edition and Addenda

Design Code is ASME III 1965 with Addenda through Summer 1966.

3. Applicable Code Requirement

Pursuant to 10 CFR 50.55a (a)(3)(ii), the Omaha Public Power District requests an alternative to the requirements of the ASME Section XI Code, paragraph IWB-3132.2

> "Components whose volumetric or surface examination reveal flaws that exceed the acceptance standards listed in Table IWB-3410-1 shall be unacceptable for continued service until the additional examination requirements of IWB-2430 are satisfied, and the flaw shall either be removed by mechanical methods or the component repaired to the extent necessary to meet the acceptance standards of IWB-3000."

Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

4. Reason for Request

In contrast to the requirements of ASME Section XI Code, paragraph IWB-3132.2, a nozzle leak at the TE-108 location on the pressurizer was successfully repaired in October of 2000 without removing the flaw which caused the failure (leakage). Due to the design of the repair which eliminated the pressure boundary function of the element containing the flaw, the following examinations were not performed: 1) NDE to confirm the location of the flaw, 2) Re-

examinations of the subject flaw per IWB-3132.4 (b), and 3) Additional examination locations as described in IWB-2430.

Industry experience has shown that cracks may develop in the Inconel 600 (nozzle) base metal or in the weld metal joining the nozzles to the vessels creating leakage paths for reactor coolant. The cracks are believed to be caused by primary water stress corrosion cracking (PWSCC). The exact leak path, through the weld or through the base metal or through both, frequently cannot be readily determined. To remove all possible leak paths for TE-108 would require access to the interior of the pressurizer and machining or grinding out the attachment weld. Because of the nozzle's location near the bottom of the pressurizer, removal of some or all of the bottom-insertion heater elements would be required for interior access. A repair activity which would remove the flaw would have resulted in a much higher radiation exposure to the personnel involved than the repair performed. Working inside the pressurizer vessel also creates significant personnel safety concerns.

OPPD considers the repair performed to be equal in quality and safety to one which would have removed the flaw.

5. Proposed Alternative and Basis for Use

ALTERNATIVE

The ASME Code Section XI, paragraph IWB-3132.4 states, "Acceptance by Analytical Evaluation" paragraph (a) "Components whose volumetric or surface examination reveals flaws which exceed the acceptance standards listed in table IWB-3410-1 shall be acceptable for continued service without the flaw removal, repair, or replacement if an analytical evaluation, as described in IWB-3600, meets the acceptance criteria in IWB-3600".

The ASME Code, Section XI paragraph IWB-3134(b) also states "Analytical evaluation of examination results as required by IWB-3132.4 shall be submitted to the regulatory authority having jurisdiction at the plant site."

The main portion of the TE-108 nozzle, where it penetrates the vessel wall, is a straight 1" nominal pipe size. It is made of Inconel 600, and has a close tolerance fit into the drilled hole in the vessel wall. The original vessel-to-nozzle attachment weld is a partial penetration J-groove weld inside the vessel to the cladding. The cladding extended into the J-bevel prep area. Welded to the external end of the Inconel nozzle is a type 316 stainless Steel ("safe end") adapter which has a socket-weld end for attachment of a thermo-well for the temperature element.

The repair for the nozzle leakage consisted of first overlaying an Inconel 152 pad 0.50" to 0.62" thick to the outside surface of the vessel wall using the temper bead method. A weld prep was

made in the pad for a partial penetration groove for attaching the nozzle to the pad and was welded. This partial penetration weld, external to the vessel, became the pressure boundary. The original internal J-weld for the nozzle was left in place.

Welding of the nozzle was performed using procedures qualified in accordance with ASME Section IX and meeting the requirements of ASME Sections III and XI.

BASIS FOR USE

A) Prior to making the repair, an evaluation of the stresses resulting from leaving the original internal weld in place was made per the ASME Code (Reference 7.1) and found to be acceptable.

B) As a result of relocating the pressure boundary to the exterior of the vessel shell, the low alloy material of the vessel shell will be exposed to borated reactor coolant in the close tolerance annular area between the nozzle and the bored hole in the vessel wall. Low alloy and carbon steels used for reactor coolant systems components are clad with stainless steel to minimize corrosion resulting from exposure to borated primary coolant. Since the crevice region is not clad, the low alloy steel is exposed to borated water. The recent reactor head degradation discovered at the Davis-Besse unit demonstrated that significant corrosion of carbon and low alloy steels can occur under conditions where boric acid concentrates in an aerated environment. The corrosion rate was estimated to have progressed at up to 2 inches per year. The environment that supported the high corrosion rate was concentrated solutions or wet deposits of boric acid and leakage at a rate to cause local cooling of the reactor vessel head. As a result of the subject nozzle repair weld, there is no mechanism for concentrating boric acid in the annular crevice because there is no active external leakage, and the corrosion rates that will occur in the crevice region will be low. Several laboratory studies described in Reference 7.1 demonstrated that the high corrosion rates observed in concentrated solutions or wet deposits of boric acid will not occur under the operating conditions for the subject nozzle. Thus, the industry experience gained from Davis-Besse and similar events involving reactor coolant system components and fasteners are not applicable to this nozzle repair because of the significant difference in the environmental conditions. Although some minor corrosion may occur in the annular region of the repaired nozzle, the degradation will not proceed to the point where ASME Code requirements will be exceeded before the end of component life (Reference 7.1).

C) An evaluation of the stability of a postulated flaw was completed under Reference 7.2. The analysis postulates a double-sided crack that has propagated through the J-Weld (nozzle weld) and is beginning to encroach on the carbon steel material that comprises the pressure boundary. It concludes that any J-weld flaws left in place are acceptable for the currently licensed 40-year plant life (i.e., until August 2013). In Reference 7.6, OPPD provided a new Time Limited Aging Analysis commitment to evaluate the repaired nozzle for the proposed license renewal period of extended operation.

In summary, the ASME Section XI Code requires repair or replacement of material containing unacceptable flaws. The alternative described in this relief request demonstrates by analysis that the presence of a postulated flaw will not be detrimental to the pressure retaining function of the pressurizer. The above evaluations and analyses have shown that allowing the material containing a flaw to remain in place and in service would not result in a reduction of the level of quality or safety.

6. Duration of Proposed Alternative

The repair may remain in place for the duration of the operating license for Fort Calhoun Station.

7. References

7.1) Westinghouse Letter CSE-2000-106 dated October 25, 2000 with attachment

7.2) Westinghouse Electric Company LLC Calculation Note Number CN-CI-02-74 Revision 0, "Evaluation of Fatigue Crack Growth of Postulated Flaw At Omaha Fort Calhoun Pressurizer Lower Shell Instrumentation Nozzle" dated January 8, 2003

7.3) CE Drawing E-232-536-5 file number 20196

7.4) CE drawing E-232-532 file number 01479

7.5) Westinghouse drawing B-4309 file number 49870

7.6) Letter from OPPD (R. L. Phelps) to NRC (Document Control Desk) dated July 7, 2003 (LIC-03-0089)

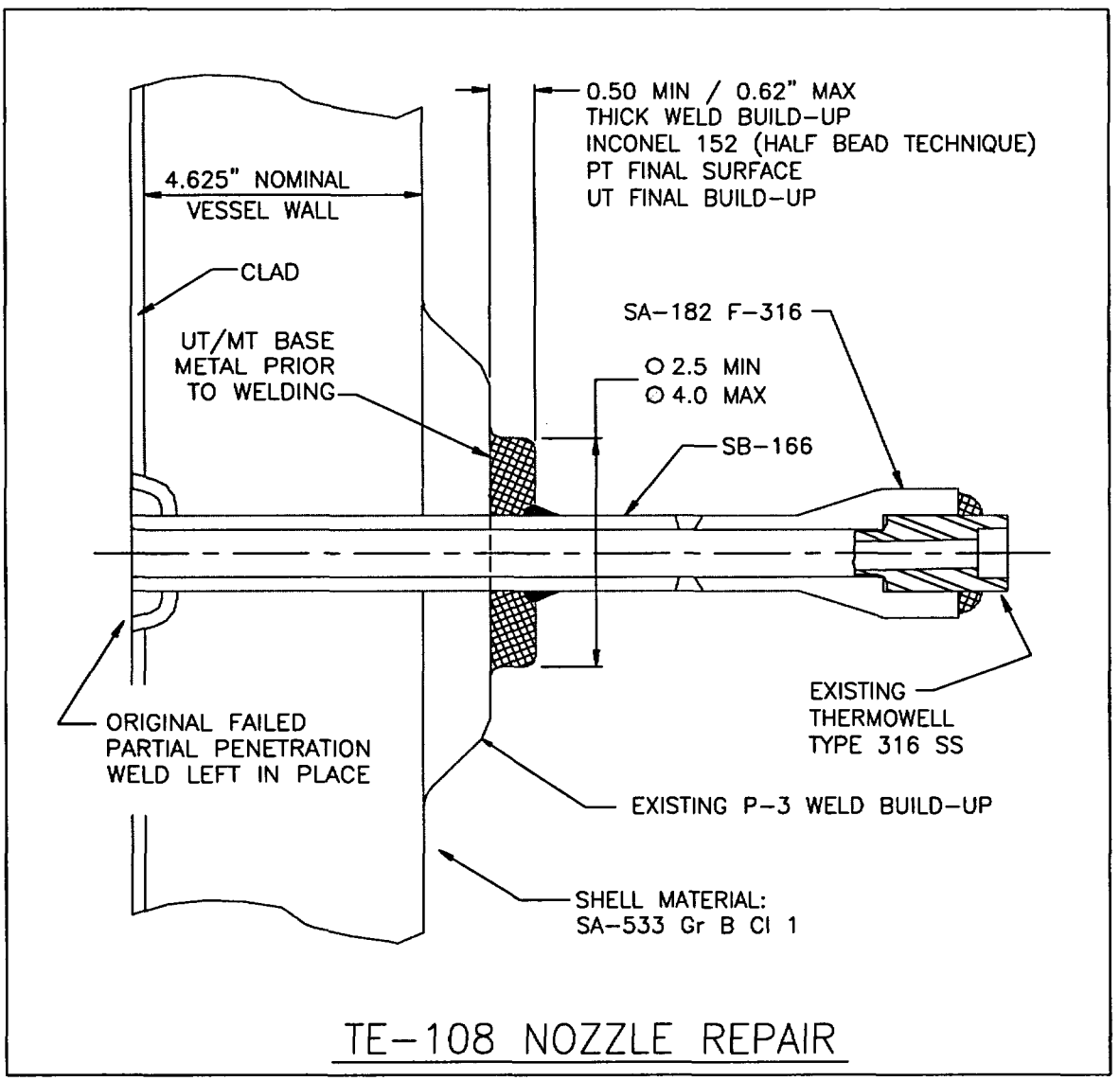

Figure 1: TE-108 – Repaired Nozzle Configuration