Omaha Public Power District
444 South 16th Street Mall
Omaha, Nebraska 68102-2247

February 14, 2001
LIC-01-0011

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Mail Station PI-137
Washington, DC 20555

References: 1. Docket No. 50-285
2. Letter from the Omaha Public Power District (OPPD) (R. L. Phelps) to NRC (Document Control Desk) (LIC-00-0107, "Request For Use Of A Mechanical Nozzle Seal Assembly As An Alternate Method Of Repair," dated December 20, 2000)

SUBJECT: Additional Information Supporting the Fort Calhoun Station's Request for Use of a Mechanical Nozzle Seal Assembly as an Alternate Method of Repair

In Reference 2, the Omaha Public Power District submitted a request for use of a Mechanical Nozzle Seal Assembly (MNSA). Subsequent to that submittal, on January 4, 2001, a phone conversation was held between the NRC-NRR, Baltimore Gas and Electric Company, OPPD and Westinghouse that discussed NRR generic concerns with MNSA industry operating experience and waiver requests. On January 31, 2001, another phone conversation was held between the NRC-NRR and OPPD staff regarding specific NRR comments on Reference 2. In response to these two conversations, OPPD is providing additional information as requested by NRR to update Reference 2.

Attachment 1, "Improvements in the FCS MNSA Design and Installation Process," addresses actions taken to enhance the Fort Calhoun Station (FCS) MNSA utilizing the lessons learned from recent industry operating experience with MNSA applications.

Attachment 2, "Response to the Request for Additional Technical Information," provides the requested technical and code specific information to supplement Reference 2.

A001

Further, because OPPD understands that the NRC requires that relief requests for a non-code repair installed on a non-leaking penetration be of limited duration, the previous request (Reference 2) for use of the presently installed preventative TE-107 MNSA through 2005 is being revised. At this time, repair relief is requested through the cooldown to Mode 5 at the beginning of the 2002 refueling and maintenance outage, presently planned for the Fall of 2002.

FCS intends to remove the TE-107 MNSA as soon as the 2002 outage. To support the intention of a 2002 outage removal, an inspection of the MNSA and TE-107 nozzle will be planned. As a contingency, should removal or repair in the 2002 outage not be possible, a relief request will be submitted in the Spring of 2002 for use of the TE-107 MNSA beyond the Fall 2002 refueling and maintenance outage. The contingency request will provide justification for continued use of the MNSA. The justification may include: a) industry MNSA experience gained in the interim, and b) results of a MNSA inspection, planned during the Fall 2002 outage, which includes removal of the MNSA with inspection of the TE-107 pressurizer nozzle for leakage, and the MNSA for materiel condition.

If the Fall 2002 outage inspections determine that the TE-107 sleeve is leaking, or, J-weld inspection data indicates Inconel-600 cracking is in progress, one of three options will be utilized: 1) The sleeve will be weld repaired if allowed by logistical constraints, i.e., dose, craft availability, outage scheduling conditions, or other technical causes; 2) The significance of the inspection indications will be evaluated for allowing continued service without a MNSA, or; 3) The MNSA will be re-installed in accordance with the contingency MNSA repair request.

The MNSA would be permanently removed if no leakage is detected and the TE-107 J-weld inspection assures weld integrity, i.e., no Inconel-600 cracking is in progress.

The Fort Calhoun Station has participated in industry activities related to development of the MNSA concept. The Fort Calhoun Station will continue to work with the Combustion Engineering Owners Group (CEOG) and other plants to support NRC approval of the MNSA as an alternative to weld repair of components susceptible to age related leakage.

If you have any questions, please call me.

S. K. Gambhir
Division Manager
Nuclear Operations

SKG/RLJ/rlj

Attachments

c: E. W. Merschoff, NRC Regional Administrator, Region IV
L. R. Wharton, NRC Project Manager
W. C. Walker, NRC Senior Resident Inspector
Winston & Strawn

Improvements in the FCS MNSA Design and Installation Process

Background

Westinghouse (then Asea Brown Boveri (ABB)) installed three MNSAs on the hot leg nozzles in the Spring of 1999 at another Combustion Engineering Nuclear Steam Supply System (CE-NSSS) plant, Plant A. The nozzles were initially discovered to be leaking during a routine outage boric acid walkdown. The nozzles were a Resistance Temperature Detector (RTD) nozzle, a Pressure Differential Tap (PDT) nozzle and a sampling line nozzle.

When the plant was returning to power, boric acid was observed around the sampling line nozzle MNSA during a Mode 3 walkdown. The boric acid was cleaned off and the nozzle was left for approximately 3 hours. No adjustments were made to the installation. When the nozzle was re-inspected, there was no evidence of any further leakage and the plant continued to ramp up to power operation. A material ductile property of Grafoil is that it continues to "flow" under compression after initial torquing. The probable cause of the MNSA leakage was that as the plant was heating up a leak developed as the various parts of the MNSA and the nozzle connection were heating up and expanding. After the initial leak, the Grafoil flowed into the crevice and stopped the leak.

As a result of this experience, Westinghouse reviewed the design and installation procedure for the MNSAs that were being supplied to a second CE-NSSS plant, Plant B. One of the MNSAs that was originally supplied to Plant B was subsequently sent to Fort Calhoun and installed on TE-107. As a result of this review, changes were made to the installation procedure to ensure sufficient compression of the Grafoil seal. Therefore, the following changes were made for the Plant B and Fort Calhoun MNSAs.

1. The dimensions and the tolerance stackups were reviewed. Dimensions were changed slightly and tolerances were tightened to increase the Grafoil seal compression. The original range was 26-30 percent compression. After the changes, the range was 34-40 percent compression.

2. The initial torque values were changed in the installation procedure. Originally, the procedure required that the torque be increased in 5 ft-lbs increments up to 30 ft-lbs. If metal to metal contact was not achieved at or before 30 ft-lbs was reached, the torque could be increased up to 50 ft-lbs to achieve metal to metal contact. The torque was then backed off to 30 ft-lbs. The procedure was revised to have the initial torque values be 50 ft-lbs regardless of whether metal to metal contact was achieved before reaching that value. The torque was then backed off to 30 ft-lbs.

3. The thread lubricant in the procedure was changed to Fel-Pro 5000 or equivalent. The procedure originally also allowed Neolube to be used.

Subsequently, a third CE-NSSS plant, Plant C, shut down for a refueling outage, and the PDT nozzle with the MNSA installed exhibited significant leakage. This was not the MNSA that initially leaked during startup. That MNSA was on a sampling line and it went through the cycle without further leakage. Westinghouse is currently conducting a further review of the installation procedure to provide more detailed guidance on the torquing sequence and checks during torquing to ensure that the MNSA is being seated evenly.

During the installation of the MNSAs at Plant A and Plant C, some installation problems were encountered. The following is a summary of the problems and the actions that have been taken to mitigate the problems.

1. Problem

   The hot leg nozzle required machining of the taper to allow sufficient clearance for the compression collar.

   Mitigation

   The compression nozzle did not require any modifications during MNSA installation at Fort Calhoun. This could also occur at other plants. In the future, Westinghouse will be prepared to machine the nozzle if required.

2. Problem

   A valve was being used as a reaction point for the anti-ejection plate. Also, there was a gap between the anti-ejection plate and the reaction point on the valve to allow for thermal expansion. There was interference between a fillet weld on the valve and the hole in the anti-ejection plate so that the gap could not be set properly.

   Mitigation

   The Fort Calhoun design and other designs currently in use do not react off a surface that is adjacent to a fillet weld. The use of a grooved clamp on the nozzle as a reaction point provides a known surface that is independent of the nozzle to pipe or nozzle to valve joint. The grooved nozzle clamp also addresses other installation problems related to a reaction point for the anti-ejection plate.

   Soft Belleville washers are now used to account for thermal expansion rather than setting a gap.

3. Problem

Orientation of valves on the steam generator at Plant A was rotated from what was shown on the drawing. As a result, the anti-ejection plate could not be installed. The valves had to be cut off and rewelded in the correct orientation.

Mitigation

The use of the grooved clamp would likely eliminate misaligned valves as a problem because they are no longer used as a reaction point for the anti-ejection plate. This problem did not occur at Fort Calhoun.

4. Problem

Alignment of the valve on the PDT line interfered with the tooling used to drill the holes in the hot leg.

Mitigation

The bolt circle was rotated to make the tooling setup easier. The analysis was modified to allow a range of positions for the bolt holes. This will provide flexibility in case a similar problem is encountered in the future. There were no interferences or problems with the installation at Fort Calhoun.

MNSAs have now been installed at four different sites. The above design and installation changes have effectively addressed the problems described, none of which occurred at Fort Calhoun because they did not apply or were addressed in the design and installation process.

Response to the Request for Additional Technical Information

1. Discuss the Code sections used for the joint design being approved. Is it NB-3200? What is the year and edition?

   Response

   The MNSA was proactively installed on the non-leaking TE-107 thermowell nozzle during the October 2000 forced outage under the replacement provisions of ASME Section XI 1989 edition. With this configuration, FCS is crediting the J-weld integrity based on the inservice inspection performed at the same time that TE-108 was found to be leaking.

   The MNSA joint design uses both ASME III 1965 with Addenda through Winter 1966 Article 4 "Design" and ASME III 1989 (No Addenda) Article NB-3000 "Design" as a basis.

   In order to perform an inservice visual inspection during startup from the 2001 refueling outage, the MNSA will either need to be removed and reinstalled or credited as the nozzle pressure boundary. As stated in the exemption request, Reference 2, the former will result in avoidable radiation exposure of approximately 200-400 mrem.

2. For what section(s) of the Code is relief being requested? Include year and edition.

   Response

   In order to credit the MNSA as the nozzle pressure boundary, an exemption to the design conditions of Article 4 "Design" of the ASME III Code "Nuclear Vessels" 1965 Edition with Addenda through Winter 1966 is being requested.

3. Discuss the details on extending the credited boundary from the existing J-weld to the MNSA seal.

   Response

   As stated above, the subject MNSA is installed on a non-leaking nozzle. In order to allow a visual inspection of the credited joint, the J-weld will be treated as cladding and the MNSA will be credited as the pressure-retaining joint. An evaluation performed by the Combustion Engineering Owners Group (CEOG) (CENPSD 1200) titled, "Long Term Use of Mechanical Nozzle Seal Assemblies (MNSA) for Repair of Leaking Nozzles in Reactor Coolant Systems," provides an

evaluation of long term corrosion issues associated with the installation of the MNSA on leaking nozzles. This evaluation concludes that corrosion within the annulus is not a concern due to stagnant conditions within. This document also considers stress corrosion cracking of the carbon steel shell, fatigue crack growth, boric acid corrosion, galvanic corrosion, and stress corrosion cracking of the MNSA fasteners. The risk associated with each of these failure mechanisms was determined to be minimal.

4. What design documentation performed by Westinghouse is credited in this application?

Response

The MNSA was designed and constructed by ABB-CE (now Westinghouse-CE Nuclear Power LLC) as a Class 1 component in accordance with ASME Boiler and Pressure Vessel Code, Section III 1989 edition. Design documentation includes a calculation in accordance with ASME code to demonstrate acceptability of the reinforcement requirements, stress intensities, fatigue evaluation, and maximum permissible shear loads in the area of the MNSA installation as well as stress analysis of the MNSA components.

5. Have the effects of the MNSA on the temperature measuring capability of the RTD been evaluated?

Response

Based on the small mass of the MNSA in comparison to the mass of the pressurizer, and the non-intrusive installation of the MNSA, a specific determination of the MNSA impact on the RTD itself was determined to be unnecessary. Post-installation testing was conducted that verified proper operation of the temperature indication following the MNSA installation.