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SUBJECT: Requests relief from requirements of ASME Section XI in order to allow non-code repair of minor leak in body of main feedwater isolation valve 2-FMO-203.Background info & justification for ASME Section XI relief request encl.

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January 31, 1995

AEP:NRC:0969AD

Docket No.: 50-316

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

Gentlemen:

Donald C. Cook Nuclear Plant Unit 2
ASME SECTION XI RELIEF FOR WELD PATCH PLATE
REPAIR OF FEEDWATER ISOLATION VALVE 2-FMO-203

The purpose of this letter, submitted pursuant to 10 CFR 50.55a(g)(6)(i), is to request relief from the requirements of ASME Section XI in order to allow a non-code repair of a minor leak in the body of main feed water isolation valve 2-FMO-203.

The cause of the leak has been characterized as a pin-hole flaw located just upstream of the seat and in the lower quadrant of the valve body. Presently, the leak site surface has been peened and flow from the flaw site has stopped. Further, the valve is being monitored periodically for signs of leakage. Request for relief from the ASME Section XI requirements to allow continued operation with the flaw was submitted in our letter AEP:NRC:0969AB on January 5, 1995. As noted in that letter, we would plan to operate with the valve in its present condition, while investigating the following options:

1. non-code interim repair,

2. code repair, and

3. replacement.

Although the valve is presently not leaking, we have developed a non-code repair plan as a contingency, should the leak recur, and are requesting NRC approval of the repair plan. The relief is requested on a temporary basis. The valve will be either replaced or have a code repair performed by the end of the next (Cycle 10-11) refueling outage, projected for May 1996.

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The attachment to this letter contains justification for the relief request, including rationale as to why application of the ASME Section XI requirements regarding repair of the leak is considered impractical.

For the reasons discussed in the attachment to this letter, we believe that granting relief from ASME Section XI requirements for the temporary non-code repair of valve 2-FMO-203 will not endanger life or property or the common defense and security.

Sincerely,

for E. E. Fitzpatrick
Vice President

eh

Attachment

cc: A. A. Blind
G. Charnoff
J. B. Martin
NFEM Section Chief
NRC Resident Inspector - Bridgman
J. R. Padgett

Attachment to AEP:NRC:0969AD

BACKGROUND INFORMATION AND JUSTIFICATION FOR ASME SECTION XI RELIEF FOR REPAIR OF VALVE 2-FMO-203

This attachment provides background information and justification for relief from the repair requirements of the ASME Section XI Code. The proposed relief would allow for a non-code interim repair to the body of main feedwater isolation valve 2-FMO-203. This relief is requested as a contingency should the leak recur.

BACKGROUND

On December 29, 1994, a small, pinhole leak was detected at the bottom of the subject valve body at roughly the 4 to 5 o'clock position, located on the upstream side of the disc. The steam plume was characterized as an eight inch long wisp. Peening was performed to stop the active leak and informational UT thickness measurements were taken on the as-cast surface. These UT results indicated no substantial loss of wall thickness.

On December 30, 1994, the as-cast surface was buffed to improve UT entry surface transmission. This substantially improved the signal/noise ratio. Calibration was performed on a step wedge and checked on a flange of known thickness at full system temperature. A one-half inch diameter transducer was used for measurements, which were taken on one-half inch centers for two-inch lengths in eight radial directions around the flaw, as well as at a mirror image location on the other side of the valve. These readings showed two- to three-inch thickness throughout, consistent backwall reflection, and no intermediate indications such as voids. Design minimum wall thickness per ANSI B16.5-68 is 1 3/8 inches, so there is substantial reinforcement in the area of the leak. The vendor, Anchor/Darling, was contacted on December 30, 1994. The vendor's service manager was informed of our UT results and preliminary assessment of cause and flaw type. The service manager concurred with the acceptability of continued monitoring of the condition.

During surface preparation for UT the leak path was reopened, resulting in a four-to six-inch steam wisp. The leak site surface was repeened and has exhibited no active leakage since that time (December 30, 1994). The condition is currently being periodically monitored.

PROPOSED MODIFICATION

Our letter AEP:NRC:0969AB dated January 5, 1995, requested relief from the ASME Section XI code to allow us to continue operation with the valve in its present condition. Our plan remains to continue operating in this manner. However, as a contingency should the valve leak recur, we have developed an interim, non-code repair on which we are requesting NRC approval.

We are proposing to temporarily repair the valve by welding a small patch plate onto the valve body. A 2" diameter by 1/2" minimum thickness patch plate will be fabricated from ASME SA-106 Grade B or ASME SA-105 plate material. The initial thickness of either material will be approximately 1" to allow the material to be machined and/or ground to fit the contour of the outer housing of the valve and achieve a final thickness of 1/2" minimum. The patch plate will be welded to the valve housing with a 1/4" partial penetration groove weld and a 3/8" backup fillet weld. Welds will be made using the Shielded Metal Arc Welding (SMAW) process and all materials, including weld rod, will be nuclear grade.

The valve body will need to be peened once again to stop the leak in order to allow the installation of the patch plate to occur. A fit-up inspection will then be performed. Once the inspection is complete and the fit-up tolerances are in accordance with American Welding Society (AWS) D1.1, the patch plate will be tack welded in place on the valve housing and then heated to the temperature of the valve housing, either manually or by heat transfer from the housing itself. Once the patch plate temperature has increased to approximately the temperature of the valve housing, the patch plate will be welded to the valve housing using the SMAW process and ASME (Section II, Part D) welding material type E7018 weld rod. The final weld will be magnetic particle tested in accordance with plant procedures for ASME Class 2 components.

This temporary repair design description was reviewed by Anchor/Darling and was concluded to be acceptable in a letter dated January 6, 1995.

JUSTIFICATION

1. *VALVE TYPE*

Valve 2-FMO-203 is a normally open, fourteen inch, Class 900 psi Lunkenheimer gate valve with an ASTM A216 grade WCB cast steel body and is used for backup feedwater isolation. The valve does not have a flow regulation or control function. It is classified as a non-safety related valve, but is in our IST and Generic Letter 89-10 programs. It is installed in piping designed to non-safety related Seismic Class III criteria.

ASTM A216 grade WCB is a 70 ksi minimum tensile steel with 22% elongation and is furnished in the annealed or normalized condition. It is readily weldable and is specifically designed for high temperature service. This material is expected to behave in a ductile manner and rapid propagation or catastrophic failure is extremely unlikely.

2. *FLOW ACCELERATED CORROSION CONSIDERATIONS*

As part of the Cook Nuclear Plant Flow Accelerated Corrosion (FAC) Program, we have conducted ultrasonic wall thickness measurements on over 200 components in the feedwater system. We have removed, measured, and visually inspected several pipe segments, and found no evidence of flow accelerated corrosion in this portion of the system. The vendor has reviewed the valve design and confirmed that, based on orientation of this flaw relative to flow and the seat, there should not be any localized eddys or cavitation mechanisms present. Under normal operation this segment of pipe experiences very consistent steady state conditions and is not subject to any upset or transient conditions.

3. *FLAW CHARACTERIZATION AND ORIENTATION*

Our experience at Cook Nuclear Plant and at AEP fossil plants indicates that this type of pinhole leak is typically due to a gradual link-up over time of casting discontinuities such as sand, porosity, or shrink. An internal stress riser or weld discontinuity associated with the seat ring might have served as an initiating site on the ID surface. Our fossil plant experience and the vendor both indicate that while this is not a frequent occurrence, it does happen over time and is not unusual for a commercial-quality valve in service for fifteen years. These flaws are typically tight, have no substantial volume, propagate over a tortuous path, and do not have a planar, crack-like morphology. The fact that peening has arrested the leak supports this conclusion.

Further, the orientation of the flaw is such that increased leakage will tend to be directed towards nearby concrete walls and floors, with no intervening equipment. As indicated above and concurred by the vendor, rapid propagation or catastrophic failure is considered extremely unlikely. It is therefore considered reasonable to monitor the valve and to perform the non-code interim repair only in the event that the leakage recurs.

4. *PATCH PLATE AND WELD STRESS CONSIDERATIONS*

In order to determine the viability of the proposed repair, an evaluation of the possible stresses in the patch plate and its welds was conducted.

DESIGN CONSIDERATIONS

The pipe material specification for the main feedwater system and its components states an operating temperature and pressure of approximately 430°F and 1070 psig, respectively, while the design temperature and pressure are designated as approximately

450°F and 1300 psig, also respectively. According to ANSI standard B16.34, the design pressure for the material of the valve, ASTM A-216 Grade WCB, at 450°F is 1850 psig. For this reason, the patch plate analysis conservatively used a pressure of 1850 psig. The yield strength and weld allowables were chosen for a design temperature of 450°F and a pressure of 1850 psig (conservative) was distributed over the entire surface of the 2" diameter patch plate.

The patch plate was considered simply supported at the edges of the plate for the plate stresses and weld stresses. The load included in the stress calculations is due to the distributed pressure load over the patch plate. The weight of the patch plate is approximately one pound and as such the dead load and seismic loads are judged to be insignificant. Lastly, the 3/8" backup fillet weld was not considered in the weld stress calculations.

RESULTS

The analysis indicated that the bending stress in the 1/2" patch plate would be approximately 45% of the allowable and the weld stress would be approximately 25% of the allowable for the 1/4" partial penetration groove weld. The allowables used in the calculation meet the requirements of the ASME Section III and/or the Manual of Steel Construction, 9th edition (1989, from the American Institute of Steel Construction).

5. *VALVE MATERIAL EVALUATION AT PATCH SITE*

As discussed above, non-destructive examinations (NDE) have confirmed that the valve housing thickness in the area of the flaw has not degraded. Past experience and discussion with the vendor indicate the flaw is a wormhole porosity casting defect rather than one from erosion/corrosion. Defects such as wormhole porosity in ductile cast steel material at this elevated temperature (approximately 430°F) are not susceptible to propagation when compared to planar cracks. Also, the stresses created by welding are low, because the base metal will be in excess of 400°F and the patch plate is circular. The welding will be performed approximately 3/4" away from the flaw location, and the flaw is not expected to be within the heat affected zone of the weld. The base material within the weld region is a minimum of 2" thick and the residual stresses from a 1/4" partial penetration groove weld with a 3/8" reinforcing fillet weld, we believe, will not have any adverse effects on the existing flaw. Therefore, we believe the integrity of the valve will not be compromised. External patch plates have been installed on similar materials in balance of plant applications in the past at Cook Nuclear Plant, with no significant flaw propagation occurring due to the installation of a patch plate.

6. *WELDING INDUCED TEMPERATURE DISTORTION CONSIDERATIONS*

Due to the fact that there is no post weld heat treatment or stress relief being performed, the seating surface region of the valve is not expected to see temperatures that would cause distortion since the material is a minimum of 2" thick in this location. The heat input due to welding of the patch plate is being applied to the lower quadrant of the valve, so even if warpage were to occur to the upstream valve seat (remote possibility), the large actuator would be expected to drive the valve closed in the normal time. Therefore, the temporary non-code repair would not affect the function of valve 2-FMO-203 and post-modification stroke testing per IWV-3200 would not be required.

7. *REASON WHY APPLICATION OF CODE REQUIREMENTS IS IMPRACTICAL*

Unit 2 of Cook Nuclear Plant is currently operating at full power. During power operation, the feedwater system is in service, providing flow to the steam generators. There are four main feedwater lines, each providing flow to one steam generator. Since flow is necessary to all steam generators during power operation, it is not possible to isolate a feedwater line. Performance of a code-acceptable repair would require excavation of the defect, which could not be performed with the feedwater line pressurized. Thus, it would be necessary to remove the unit from power operation in order to perform the repair, which would unnecessarily challenge and thermally cycle the unit, reduce system capacity, and provide minimal safety benefit. For this reason, we consider a code-type repair to be impractical.

ADDITIONAL EVALUATION

As recommended by the NRC staff during a teleconference on January 4, 1994, we performed a flaw evaluation using the "Through-Wall Flaw Approach" of Enclosure 1 of Generic Letter 90-05. The results met the acceptance criteria from Generic Letter 90-05. These results were communicated to the NRC during a January 9, 1995, teleconference.

COMPENSATORY MEASURES

In the event that the peen does not hold and the leak redevelops, then, and only then, the temporary non-code repair will be performed. Upon completion of the temporary non-code repair, routine surveillance will assure that there is no degradation of the repair patch plate, and no additional compensatory measures will be required.

CONCLUSION

Our evaluation of the condition of the leak in valve 2-FMO-203 has concluded that rapid propagation or catastrophic failure of the flaw is extremely unlikely and that the orientation of the flaw is such that increased leakage will tend to be directed towards nearby concrete walls and floors, with no intervening equipment. Additionally, the analysis of the stresses induced in the patch plate material and the patch plate welds indicates that the stresses are within relevant allowables. Also, there is no post-weld heat treatment being performed, so high temperature-induced warpage should not occur. Further, previous repairs of this nature have been performed with no significant flaw propagation. Based on this, we conclude that the requested relief will not endanger life or property or the common defense and security.