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October 22, 1998

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U. S. Nuclear Regulatory Commission
Document Control Desk
Mail Station OP1-17
Washington, DC 20555

Subject: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Non-Code Piping Repair per Generic Letter 90-05

Gentlemen:

During routine operator rounds on September 24, 1998, a 40 drop per minute leak in a 12 inch Arkansas Nuclear One, Unit 2 (ANO-2) loop 1 service water (SW) return line from spent fuel pool cooling was observed. It was determined that the source of the leak was a through-wall defect in the line at a weld between an elbow and straight piping. The cause of the leak is believed to be due to microbiologically induced corrosion (MIC). The operability of the SW system in the "as found" condition was assessed and determined to be operable. The purpose of this letter is to request temporary relief to allow a non-code repair of the piping as required by Generic Letter 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping."

The attachment provides justification for a temporary repair of this piping in accordance with the guidance provided in Generic Letter 90-05. Using this guidance, the flaw and flaw area were evaluated to verify the structural integrity of the pipe. The evaluation concluded that the flawed piping satisfied the "through-wall-flaw" stability criteria of the generic letter.

Additionally, other system interactions were considered such as flooding, water spraying on plant equipment as a result of the leak, and loss of flow to service water-supplied components. The leakage is insignificant and does not present a flooding concern, nor are there any components in the vicinity of the leak that would be affected by spray from this leak should the leak worsen. The reduction in flow to the associated loop 1 components due to this leak is insignificant and will not cause the service water loop or individual system components to be degraded. Also, the leakage provides another drain path from the emergency cooling pond; however, the small amount of leakage is well within the allowable system leak rate of the emergency cooling pond.

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Since the flaw satisfies the criteria for a non-code repair as described in Generic Letter 90-05, and permanent repairs in accordance with the American Society of Mechanical Engineers (ASME) Code are impractical during plant operation, Entergy Operations requests relief permitting a temporary non-code repair of the affected service water piping as an alternative to the repair methods of the ASME Boiler and Pressure Vessel Code, Section XI. The permanent code repair is scheduled to be performed during the next Unit 2 refueling outage (2R13) which is currently scheduled to begin January 8, 1999.

The leakage is currently being contained by a temporary patch as a "stop gap" measure to limit leakage for housekeeping purposes. The installed clamp does not alter the structural integrity of the piping.

In accordance with Generic Letter 90-05 guidance, the integrity of the non-code repair will be assessed on a quarterly basis utilizing an ultrasonic testing examination method. Furthermore, a qualitative visual assessment of leakage through the temporary non-code repair and the affected piping will be performed on a weekly basis to determine any degradation of structural integrity. These inspections will continue until the code repair is completed. Should you have any questions, please contact me.

Very truly yours,

Jimmy D. Vandergrift
Director, Nuclear Safety

JDV/nbm
Attachment

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**Technical Justification for a Temporary Repair
In Accordance with Generic Letter 90-05**

1.0 Flaw Detection and System Description

On September 24, 1998, at 1011 hours during operator rounds in the ANO-2 auxiliary building, water was discovered leaking from insulation in the overhead. Further inspection found that the 12 inch loop 1 service water return line from spent fuel pool (SFP) cooling had a pin hole leak in the pipe. Based on visual inspection, it was determined that the source of the leak was a through-wall defect in the line at a weld between the flow orifice 2FO-1525 and the pipe tie-in to the loop 1 return header. The leak was small and was initially estimated to be approximately 40 drops per minute or approximately 0.005 gpm.

The specific location of the pinhole leak is on the 12" SW loop 1 return header (2HBC-81-12") from the SFP heat exchanger 2E-27. It is approximately 20" downstream of flow orifice 2FO-1525 on the weld that connects the straight pipe to the 45° elbow just upstream of the connection to the return header. The leak is near the top of the piping. This portion of the return line is downstream of the last isolation valve (2SW-44A) and is not isolable from the loop 1 SW return piping; therefore, it is pressurized at the normal return header pressure (approximately 30 psig). The SFP heat exchanger can be supplied by either loop of SW and can return this flow through either of two return loops. Both of the SW loop return lines normally have flow through them since loop separation is maintained by check valves. The line that the leak is on is pressurized and is normally in service with water flowing through it. The ANO-2 SW system was constructed in accordance with ASME Section III Class 3. This piping is a 12" carbon steel, standard schedule (nominal wall thickness of 0.375"), class HBC "moderate energy" pipe.

2.0 Operability Assessment

The operability of the SW system in the "as-found" condition was assessed. Based on this assessment, the SW piping, system, and associated equipment remain operable and available. The issues considered were structural integrity, flooding concerns, effect of leakage spray on area components, reduction in flow to SW supplied components, and emergency cooling pond (ECP) inventory concerns.

<u>Structural integrity</u>

The through-wall defect is on the weld between a 45 degree elbow and straight carbon steel pipe, located just downstream of flow orifice 2FO-1525. In order to evaluate the piping in the region of the leak, ultrasonic thickness (UT) measurements were taken on a 360° band around the circumference of the pipe. A more detailed ultrasonic thickness mapping was conducted immediately around the leak. This thickness mapping provided the means of characterizing the flaw at the leak location and verification that the flaw could be treated as a single flaw with respect to the proximity of other flaws.

The data revealed that the through-wall flaw originated from corrosion pitting on the interior surface of the pipe and included localized wall thinning in the immediate area. The pipe contained pits of varying degrees around the circumference of the pipe. The average overall pipe wall thickness was determined to be greater than 0.26". The thinnest recorded wall thickness at the leak location was 0.100".

Using the guidance of Generic Letter 90-05, the flaw and flaw area were evaluated to verify the structural integrity of the pipe and documented by Design Engineering Calculation 98-E-0048-01, Revision 0. The evaluation concluded that the flawed piping satisfied the "through-wall flaw" stability criteria of the generic letter. The qualifying stress calculation (6600-2-903, Revision 6) was reviewed to determine the maximum pipe stress levels in the area immediately downstream of flow orifice 2FO-1525. The existing ASME Section III Class 3 code allowable pipe stress levels were determined to be less than 22% excluding pipe wall thinning. With the pipe wall thickness conservatively assumed as 0.100" for the full circumference, the maximum pipe stress was assessed to be approximately 81% of the allowable stress levels for operability. Therefore, even with the entire pipe wall circumference conservatively assumed to be thinned to 0.100", the pipe would remain within operability limits. Additionally, the through-wall flaw has been shown to be stable for expected plant loading conditions, provided that the wall thickness of the pipe does not decrease below 0.100" in an area greater than that which would be enclosed by a 0.375" diameter circle.

Flooding concerns

The leakage at present (approximately 0.005 gpm) is insignificant and does not present a flooding concern. A floor drain is located approximately six feet from the leak and is sized to remove normal leakage from this area of the plant. Any significant unobserved increase in leak rate would be identified by an increase in the auxiliary building sump level. However, based on the structural assessment and engineering experience with respect to flaw growth, no significant leak rate increase is expected to occur.

Effect of leakage spray on area components

A survey of the immediate area determined that there are no components which would be adversely affected by spray from this pinhole leak. The leak is located on the south side of the piping near the top and is approximately two feet from the west wall and seven feet from the floor. There is one motor operated valve in the vicinity of the leak that could potentially be affected by spray from the leak. The valve (2CV-1406-2) is used for isolation of the service water supply to loop 2 engineered safeguards equipment. This valve is five feet south and three feet below the leak and is normally maintained open which is its safety position. It would not be directly impacted by significant spray from the leak area. The valve operator is environmentally qualified and would not be adversely affected from any spray. Additionally, actions would be taken to contain and stop any excessive leakage or spray in a short period of time that would prevent any adverse long term impacts to the valve. The local floor drain would also accommodate the leakage.

Reduction in flow to SW supplied components

Based on the most recent refueling outage (2R12) as-left SW flow test, the total loop 1 SW flow was 8975 gpm with the system in an engineered safeguards alignment. Adequate flow margin was available to all components. The reduction in flow to the associated loop 1 components due to this pinhole leak is insignificant and would not cause the SW loop nor individual system components to be degraded.

Emergency cooling pond inventory concerns

This pinhole leakage provides an additional drain path from the ECP. The overall leakage from the ECP is routinely accounted for by totaling the sluice gate and system boundary valve leakage from both ANO-1 and ANO-2 since the ECP is a shared emergency source of SW. The 2R12 as-left sluice gate and system boundary valve leakage tests determined that the total leakage from ANO-2 was 6.08 gpm compared to an allowable ANO-2 Safety Analysis Report Section 9.2.5.3 value of 75 gpm which indicates a margin of 68.92 gpm. The current pinhole leak rate of 0.005 gpm is bounded by the allowable system leak rate of 68.92 gpm.

3.0 Root Cause Determination

Based on the UT data, the flaw was characterized as a localized through-wall pit typical of corrosion degradation in SW piping. Previous evaluations of the large bore SW pipe condition, as part of ANO's Service Water Integrity Program, has determined that similar pitted areas are most likely due to MIC in the form of anaerobic sulfate reducing bacteria under deposits or tuberculation. A tubercle can form a protective barrier for these organisms which makes chemical treatment effectiveness vary from pipe location to pipe location. The pipe in which the leak is located is attached to a line with flow that allows the water in the drain pipe to be semi-stagnant which is an excellent environment for MIC to occur.

4.0 Augmented Inspection

Five additional locations, representative of the environment seen by the defect, were selected for the augmented inspection via UT. These locations included one location on the same line for the loop 2 SW return for SFP cooling, two locations on the loop 1 supply and return headers, and two locations on the loop 2 supply and return headers. The collected data indicated that overall corrosion was negligible; however, one pit on the loop 2 SW return for SFP cooling was detected. The pit has a remaining wall thickness of 0.084 inches. This does not violate minimum required wall thickness limits but has the potential to become a through-wall leak before the piping is replaced. This flaw is bounded by the evaluation of the through-wall leak being reported in this submittal. If this location should happen to develop a leak, a temporary patch similar to the one described in this submittal may be installed. The piping inspected as a result of this event indicated that the actual leak location was the only location that exceeded the minimum required wall thickness for pressure with the remaining surrounding area having sufficient thickness based on measured system corrosion rates.

Based on the fact that the original flaw is already through-wall and previous ANO experience of similar flaws, flaw growth is not a significant concern. This is because the projected wall thinning is approximately 0.008" per year based on ANO wall thinning rates at pit locations; therefore, the overall condition of the system is acceptable.

5.0 Impracticality of Repair Determination

Conducting a code-qualified repair during power operation is not feasible since loop 1 of SW would have to be removed from service. This loop of SW is necessary to support operation of one entire train of engineered safeguards features systems (e.g., emergency diesel generator, high pressure safety injection, and low pressure safety injection). Based on the insignificance of the leak, it would be inappropriate to challenge the operation of the plant in this high risk configuration for the repair.

The leakage is currently being contained by a temporary patch (rubber gasket material and hose clamp) as a "stop gap" measure to limit leakage for housekeeping purposes. This installed patch does not alter the structural integrity of the piping. It is planned to maintain this clamp as the temporary repair. Should this temporary repair fail, there is no equipment in close proximity to the leak location that would be adversely affected by water spray, and the leak rate would be so small that local floor drains would mitigate any potential for flooding. The loss of system flow through the leak would not reduce the ability to provide cooling water to critical equipment since the leak rate would be insignificant compared to the over all capacity margin of the SW system. Because failure of the temporary repair would have no adverse safety impact, the structural condition of the clamp does not require a rigorous structural analysis. No credit is taken for any structural strength contribution from the clamp.