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Subject: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Non-Code Repair Of Service Water Piping

Gentlemen:

During routine operator rounds on January 2, 1996, a 0.0005 gpm leak from the Loop 1 service water supply line to the "B" emergency feedwater pump was observed. Based on visual inspection, it was determined that the source of the leak was a through-wall defect in the service water piping. The operability of the service water 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 pinhole leak is insignificant and will not cause the service water loop, nor individual system components, to be degraded. Additionally, 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 ASME Code are impractical during plant operation, Entergy Operations requests granting of 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. Entergy Operations is evaluating the most suitable permanent repair method and will complete the code repair when practicable. The next scheduled outage of adequate duration of 30 days, or more, is Unit 1's 1R13 refueling outage that is currently scheduled to begin September 17, 1996. The permanent code repair is scheduled to be performed this outage.

Current plans are to install a simple rubber patch attached to the pipe by band clamps to serve as a "stop gap" measure to limit leakage for housekeeping purposes. The installed patch will not alter the structural integrity of the piping and will be reversible, if necessary. It is planned to maintain this patch or a similar configuration as the temporary repair.

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. Further, 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 regarding this submittal, please contact me.

Very truly yours,

Dwight C. Mims

Dwight C. Mims
Director, Nuclear Safety

DCM/dwb

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 January 2, 1996 at 0215 hours, during routine Unit 1 operator rounds, a leak from the Loop 1 service water supply line to the "B" emergency feedwater (EFW) pump was observed. Based on visual inspection, it was determined that the source of the leak was a through-wall defect in the service water piping. The leak rate was initially estimated to be about 12 drops per minute and later measured to be 0.0005 gpm.

The specific location of the pinhole leak is approximately ¼" upstream of service water (SW) to EFW supply valve CV-3850 on line HBD-4-6". The upstream side of CV-3850 is not isolable from the Loop 1 service water supply piping; therefore, is pressurized at the normal supply header pressure (current SW pump discharge pressure ≈78 psig), but normally stagnant. This line is aligned to the "B" EFW pump and directs service water to the emergency feedwater system as the assured emergency source of feedwater. This valve is normally closed and receives a remote manual 'open' signal from the control room.

The Unit 1 service water system was constructed in accordance with ANSI B31.1, but is treated as ASME Class 3 for the purpose of in-service inspection specified in ASME Section XI. This piping is a 6" carbon steel, schedule 40 (nominal wall thickness of 0.280"), "moderate energy" pipe.

Unit 1 Technical Specification 3.4.3 requires that:

1. Motor driven Emergency Feedwater Pump, P-7B, and its flow path be operable when the Reactor Coolant System is above Cold Shutdown and a Steam Generator is being utilized for heat removal.
2. Turbine driven Emergency Feedwater Pump, P-7A, and its flow path be operable when the Reactor Coolant System is at or above 280°F.

Although the opposite service water loop (Loop 2) may be used to supply either EFW pump, the system design intent to have two full capacity independent EFW loops can only be satisfied if both service water loops are operable. With one EFW pump and its flow path inoperable, the inoperable train is required to be restored within 72 hours or the unit must be placed in Hot Shutdown within 6 hours. In the event that an entire loop of service water is declared inoperable, cascading technical specifications cause the associated trains of emergency diesel generator, high pressure injection, low pressure injection, reactor building spray, and reactor building cooling to be inoperable. As a result, a condition that would cause one loop of service water to be inoperable requires that the plant be placed in hot shutdown within 36 hours per Technical Specification 3.3.6.

2.0 Root Cause Determination

The operability of the service water system in the "as-found" condition was assessed. Based on this assessment, the service water piping, system, and associated equipment remains operable and available. The issues considered were:

- structural integrity
- flooding concerns
- effect of leakage spray on area components
- reduction in flow to service water supplied components
- emergency cooling pond inventory concerns

Structural integrity

The through-wall defect is in a horizontal run of a 6" carbon steel line, located at the bottom of the pipe in the heat affected zone of a carbon steel to stainless steel weld. 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 line; however, the average overall pipe wall thickness was determined to be greater than 0.18". The thinnest recorded wall thickness, except at the leak location, was 0.09".

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 Engineering Calculation CALC-96-E-0001-01 Revision 0. The evaluation concluded that the flawed piping satisfied the "through-wall flaw" stability criteria of the generic letter. The qualifying pipe stress calculation (CALC-91-E-0016-063 Revision 1) was reviewed to determine the maximum pipe stress levels in the area immediately upstream of valve CV-3850. The existing ANSI B31.1 code allowable pipe stress levels were determined to be under 15% with no pipe wall thinning accounted for. With the pipe wall thickness conservatively assumed to be 0.09" for the full circumference, the maximum pipe stress was assessed to be approximately 35% of the code allowable stress levels. Therefore, even with the entire pipe wall circumference conservatively assumed to be thinned to 0.09", the pipe would be within code allowable strength requirements. 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 drop below 0.09" in an area greater than that which would be enclosed by a 0.75" diameter circle.

Flooding concerns

The leakage at present (0.0005 gpm) is insignificant and does not present a flooding concern. A floor drain is located approximately four feet from CV-3850 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 System Engineering survey of the immediate area determined that there are no components which would be affected by spray from this pinhole leak. The leak is located on the bottom of the piping and would spray directly on the floor. The local floor drain would accommodate the leakage.

Reduction in flow to service water supplied components

Based on the 1R12 As-Left Service Water Flow Test per Procedure 1309.013, the total Loop 1 service water flow was 5,083 gpm, with the system in an Engineered Safeguards alignment. Based on previous evaluations (Condition Report CR-1-95-479), it has been determined that a Loop 1 leak rate of 491.5 gpm could be tolerated before any associated components would reach low flow conditions. The reduction in flow to the associated Loop 1 components due to this pinhole leak is insignificant and will not cause the service water loop nor individual system components to be degraded.

Emergency cooling pond (ECP) inventory concerns

This pinhole leakage would also provide an additional drain path from the emergency cooling pond. The overall leakage from the emergency cooling pond is routinely accounted for by totaling the sluice gate and system boundary valve leakage from both Unit 1 and Unit 2 (because the ECP is a shared emergency source of service water). The 1R12 as-left sluice gate and system boundary valve leakage tests determined that the total leakage from Unit 1 was 6.4 gpm compared to an allowable 39.74 gpm, which indicates a margin of 33.34 gpm. The current pinhole leak rate of 0.0005 gpm is bounded by the allowable system leak rate of 33.34 gpm.

Root cause determination

Based on the UT data, the flaw was characterized as a highly localized through-wall pit typical of corrosion degradation in service water piping. Previous evaluations of the large bore service water pipe condition, as part of ANO's Service Water Integrity Program, has determined that similar pitted areas are most likely due to microbiologically induced corrosion 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.

3.0 Augmented Inspection

Six additional locations, representative of the environment seen by the defect, were selected for the augmented inspection via UT. These locations included downstream of valve CV-3850, downstream of the similar Loop 2 service water valve CV-3851 (upstream portion was replaced during refueling outage 1R12), and four discretional pipe locations upstream of the leak. The data collected indicated negligible corrosion or pit propagation at these locations. The piping inspected as a result of this event validated that the leak was the only location that violated the minimum required wall thickness.

Due to the fact that this flaw is already through-wall, and based on previous System Engineering experience of similar flaws, consideration of flaw growth is not a significant concern. Therefore, it has been concluded that the overall condition of the system, during the short time until the next Unit 1 refueling outage (1R13) is acceptable.

4.0 Impracticality of Repair Determination

It was determined that conducting a code qualified repair during power operation will not be feasible since one EFW pump would have to be declared inoperable. With one EFW pump and its flow path inoperable, the inoperable train is required to be restored within 72 hours or the unit must be placed in Hot Shutdown within 6 hours per Technical Specification 3.3.6. Based on the insignificance of the leak, it would be inappropriate to challenge the operation of the plant in this high risk configuration during the repair.

It is planned to install a simple rubber patch attached to the pipe by band clamps to serve as a "stop gap" measure to limit leakage for housekeeping purposes. The installed patch will not alter the structural integrity of the piping and will be reversible, if necessary. It is planned to maintain this patch, or a similar configuration, as the temporary repair. In addition, if the temporary repair were to fail, there is no equipment in close proximity to the leak location that would be affected by water spray, and the leak rate would be so small that local floor drains are expected to 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 service water system. Because failure of the temporary repair would have no adverse safety impact, the structural condition of the rubber patch and clamp do not require a rigorous structural analysis. No credit is being taken for the additional structural strength contribution from the patch and band clamps.