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U. S. Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6
Non-Code Repair of Service Water Piping
and Request for Generic Relief

Gentlemen:

During routine operator rounds on October 4, 1996, a 3 drop per minute leak from the Arkansas Nuclear One, Unit 2 (ANO-2) 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."

Attachment 1 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 2's 2R12 refueling outage that is currently scheduled to begin April 10, 1997. The permanent code repair is scheduled to be performed this outage.

For housekeeping purposes a soft rubber clamp device has been installed as a "stop gap" measure to limit leakage. The installed clamp does not alter the structural integrity of the piping. It is planned to maintain this clamp or a similar configuration as the temporary repair upon NRC approval.

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.

REQUEST FOR FUTURE GENERIC RELIEF

ANO has replaced the majority of small bore piping in both the ANO-1 and ANO-2 service water systems. Currently, significant portions of the large bore piping are being replaced each refueling outage. Prior to completion of this effort, it is expected that additional piping flaws resulting from microbiologically induced corrosion (MIC) will be identified as having less than minimum wall thickness as required by the ASME Code. As the service water piping is replaced and chemistry improvements are implemented, we expect the occurrences of flaws due to MIC to decrease.

In an effort to reduce the administrative burden on ANO and the NRC, ANO requests generic relief from the ASME code repair requirements to allow for temporary, non-code repairs of the service water piping only in the specific instances described below. In these instances, ANO will perform the required evaluations in accordance with GL 90-05 and adhere to the guidance of the generic letter except for submitting a request for relief to the NRC. Additionally, each occurrence will be documented in ANO's corrective action system. This documentation will be available for NRC review.

Conditions that must be satisfied in order to invoke the generic relief:

- the flaws will be evaluated per GL 90-05 and the structural integrity of the pipe walls will be determined to be acceptable per the GL 90-05 criteria,

- the generic relief will only apply to the ASME Code Class 3 or ASME B31.1 treated as ASME CODE Class 3 service water system piping on both units,

- the initiating flaw mechanism must be determined to be microbiologically induced corrosion; flaws resulting from any other initiating mechanism will be submitted to the NRC for relief,

- the flaw will be repaired at the next outage exceeding 30 days, but no later than the next scheduled refueling outage (if the flaw is detected during a scheduled shutdown, a code repair will be effected before plant restart),

- the GL 90-05 guidance for weekly inspections and quarterly assessments will be conducted (with the exception of the requirement to submit a relief request to the NRC), and

- the non-code repairs must be consistent with those previously used at ANO, i.e., clamps with rubber gaskets or similar repairs that are removable and which facilitate access to the piping for periodic inspection.

Additional details of the request for generic relief are provided in Attachment 2. The relief proposed does not reduce any actions required by ASME Code or Generic Letter 90-05. It only asks that the requirement to submit a formal relief request to the NRC for each occurrence be waived as long as the criteria in Attachment 2 are satisfied.

Please note that the request for generic relief may be reviewed and considered separately from the relief request for the leak which was discovered on October 4, 1996. 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

Attachments

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ATTACHMENT 1

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

1.0 Flaw Detection and System Description

On October 4, 1996 at 1400 hours, during an investigation of water leaking out of piping insulation, a leak from the Arkansas Nuclear One, Unit 2 (ANO-2) 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 3 drops per minute and later measured to be 0.0001 gpm.

The specific location of the pinhole leak is approximately 5 feet downstream of the Loop 1 header connection of service water (SW) to EFW supply line 2HBC-85-6". This portion of the line is upstream of the first isolation valve (2SW-39A) and is not isolable from the Loop 1 service water supply piping. It is therefore 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.

The Unit 2 service water system was constructed in accordance with ASME Section III Class 3. This piping is a 6" carbon steel, schedule 40 (nominal wall thickness of 0.280"), "moderate energy" pipe.

Unit 2 Technical Specification 3.7.1.2 requires that:

In Modes 1, 2, and 3 two emergency feedwater pumps and associated flow paths shall be operable with:

1. One motor driven pump capable of being powered from an operable emergency bus and
2. One turbine driven pump capable of being powered from an operable steam supply system.

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 12 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 for more

than 72 hours requires that the plant be placed in hot shutdown within 6 hours per technical specification 3.7.3.1.

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 approximately 30° off bottom dead center of the pipe. 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 thinned regions.

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 generally along the longitudinal axis of the line. However, each pit found was determined to be within the Generic Letter 90-05 guidance which allowed each pit to be quantified as a singular flaw, not multiple flaws. The original nominal wall thickness was 0.280", and after almost 18 years of service the average overall pipe wall thickness circumferentially was determined to be greater than 0.240", based on current UT data contained in Engineering Calculation CALC-91-E-0125-07 Revision 0.

Using the guidance of Generic Letter 90-05, the flaw and flaw area were evaluated to verify the structural integrity of the pipe. This evaluation is documented in Engineering Calculation CALC-91-E-0125-07 Revision 0. The evaluation concluded that the flawed piping satisfied the "through-wall flaw" stability criteria of the generic letter for all expected plant loading conditions provided that the wall thickness of the pipe does not drop below 0.065" in an area greater than that which would be enclosed by a 1.00" diameter circle.

Flooding concerns

The leakage at present (0.0001 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 System Engineering 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 side of the piping and would spray directly on the north wall which has piping and public address speakers attached to it. The local floor drain would accommodate the leakage.

Reduction in flow to service water supplied components

Based on the 2R11 As-Left Service Water Flow Test per Procedure 2311.002, the total Loop 1 service water flow was 8500 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 will not cause the service water loop nor individual system components to be degraded.

Emergency cooling pond 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 emergency cooling pond is a shared emergency source of service water). The 2R11 as-left sluice gate and system boundary valve leakage tests determined that the total leakage from Unit 2 was 2.84 gpm compared to an allowable SAR 9.2.5.3 value of 75 gpm, which indicates a margin of 72.16 gpm. The current pinhole leak rate of 0.0001 gpm is bounded by the allowable system leak rate of 72.16 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

Five additional locations, representative of the environment seen by the defect, were selected for the augmented inspection via UT. These locations included two locations downstream of the similar Loop 2 service water pipe connection, which is upstream of the isolation valve, and three discretional pipe locations downstream of the leak. The data collected indicated negligible overall corrosion but did detect one pit approximately 12 inches downstream of the existing flaw that has a remaining wall thickness of 0.039 inches. This wall thickness does not violate t-minimum limits but has the potential to become a through wall leak before this piping is replaced. This flaw is also bounded by the previous evaluation of the actual through wall leak being reported in this letter. If this location should happen to develop a through wall leak, a temporary patch similar to the one requested in this request will be installed. The piping inspected as a result of this event validated that the actual leak location was the only location that violated the minimum required wall thickness for pressure.

Due to the fact that the original flaw is already through-wall, and based on previous System Engineering experience of similar flaws, consideration of flaw growth is not a significant concern since the projected wall thinning is only 0.008" per year based on established wall thinning rates at pit locations. Therefore, it has been concluded that the overall condition of the system, during the short time until the next Unit 2 refueling outage (2R12) is acceptable.

4.0 Impracticality of Repair Determination

It was determined that conducting a code qualified repair during power operation is not feasible since service water Loop 1 would have to be declared inoperable. With one service water loop inoperable, the inoperable loop is required to be restored within 72 hours or the unit must be placed in Hot Shutdown within 6 hours per technical specification 3.7.3.1. 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.

At the current time a clamp device has been installed over the defect area as a "stop gap" measure to limit leakage for housekeeping purposes. The installed clamp does not alter the structural integrity of the piping. It is planned to maintain this clamp, 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 adversely 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 clamp does not require a rigorous structural analysis. No credit is taken for the additional structural strength contribution from the clamp.

ATTACHMENT 2

Generic Relief Request for Future Occurrences of Flaws Resulting from Microbiologically Induced Corrosion

Components for Which Relief is Requested

ANO-1 ASME B31.1 service water system piping treated as ASME Code Class 3 piping.

ANO-2 ASME Code Class 3 service water piping.

ASME Code Section for Which Generic Relief is Requested

ANO-1 1980 Edition of the ASME Code, Section XI through and including winter 1981 addenda

ANO-2 1981 Edition of the ASME Code, Section XI, no addenda

ASME Section XI Code Requirement

The ASME Code Section XI requires that repairs or replacements of ASME Code Class components be performed in accordance with rules found in Articles IWA-4000 or IWA-7000, respectively. The intent of these rules serve to provide an acceptable means of restoring the structural integrity of degraded Code Class system back to the original design requirements.

Content of the Generic Relief Request

Relief is sought from performing a repair or replacement of the service water piping per the requirements of Article IWA-4000 or IWA-7000, respectively. The majority of small bore piping has been replaced in both units at ANO. Currently, significant portions of the large bore piping is being replaced each refueling outage. The large bore piping replacement is approximately 60% complete for ANO-1 and approximately 15% complete for ANO-2 (both estimates exclude the underground piping). During the recently completed ANO-1 refueling outage 1R13, approximately 100 feet of large bore piping was replaced. Approximately 290 feet were replaced during 1R12. The April 1997 ANO-2 refueling outage 2R12 includes plans to replace 150 feet of large bore piping. Approximately 180 feet were replaced during 2R11. The piping replacements are part of an ongoing effort. The piping is prioritized and replaced based on ultrasonic testing mapping results.

Prior to completion of the service water piping replacement project, it is expected that additional piping flaws resulting from microbiologically induced corrosion (MIC) will be identified as having less than minimum wall thickness as required by the ASME Code. As the service water piping is replaced and chemistry improvements are implemented, we expect the occurrences of flaws due to MIC to decrease significantly. Since it is likely that additional flaws will be detected, generic relief for very specific occurrences is being sought in an effort to reduce the administrative burden on both ANO and the NRC.

Basis for Relief

10CFR50.55(a)(3)(i) allows licensees to propose alternatives to Code requirements if the proposed alternative would provide an acceptable level of quality and safety. Each subsequent flaw will be evaluated in accordance with the guidance provided in Generic Letter 90-05. In order to invoke this generic relief for each subsequent flaw, ANO will establish that the flaw satisfies the criteria for non-code repair as described in the generic letter and that performing permanent repairs in accordance with the ASME Code would be impracticable during plant operation. The requested relief is for specific instances only. The conditions that must be satisfied in order to invoke the generic relief are:

- the flaws will be evaluated per GL 90-05 and the structural integrity of the pipe walls will be determined to be acceptable per the GL 90-05 criteria,

- the generic relief will only apply to the ASME Code Class 3 or ASME B31.1 treated as ASME CODE Class 3 service water system piping on both units,

- the initiating flaw mechanism must be determined to be microbiologically induced corrosion; flaws resulting from any other initiating mechanism will be submitted to the NRC for relief,

- the flaw will be repaired at the next outage exceeding 30 days, but no later than the next scheduled refueling outage (if the flaw is detected during a scheduled shutdown, a code repair will be effected before plant restart),

- the GL 90-05 guidance for weekly inspections and quarterly assessments will be conducted (with the exception of the requirement to submit a relief request to the NRC), and

- the non-code repairs must be consistent with those previously used at ANO, i.e., clamps with rubber gaskets or similar repairs that are removable and which facilitate access to the piping for periodic inspection.

The Generic Letter 90-05 guidance will be adhered to up to the point of actually submitting a request to the NRC. Each occurrence will be documented in ANO's corrective action system. This documentation will be available for NRC review.

Previous Requests for Relief

Previous requests for relief have been submitted on the following three occasions within the past few years. Each occurrence involved the service water system for ANO-1.

1) August 20, 1993 (1CAN089305) - 1 gpm leak in the ANO-1 service water common return header. The resident inspector statused the leak in inspection report 50-313/93-07; 50-368/93-07 dated September 10, 1993, and 50-313/93-08; 50-368/93-08 dated November 9, 1993. In a letter to the NRC dated October 29, 1993 (1CAN109307), ANO withdrew the request for relief following the installation of a Code-qualified modification to the return header.

2) January 25, 1996 (1CAN019603) - 0.0005 gpm leak from the ANO-1 Loop 1 service water supply line to the "B" emergency feedwater pump. The NRC granted relief in a safety evaluation report dated March 26, 1996 (1CNA039602).

3) July 3, 1996 (1CAN079601) - three locations on the ANO-1 Loop 2 service water supply piping were identified as having less than minimum wall thickness as required by the ASME code (piping was not leaking). A response has yet to be received from the NRC.

Alternative Program

Future non-Code repairs will be consistent with those previously used at ANO, i.e., simple rubber patch attached to the pipe by band clamps (or similar type repair) which is removable and which facilitate access to the piping for periodic inspection. The rubber patch, or similar type repair) will not alter the structural integrity of the piping and will be reversible, if necessary. The rubber patch, or similar configuration, will be maintained as a temporary repair.