ENTERGY

Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72801
Tel 501 858-5000

July 3, 1996

1CAN079601

U. S. Nuclear Regulatory Commission
Document Control Desk
Mail Station P1-137
Washington, DC 20555

Subject: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Request For Relief From ASME Sections III
and XI Due to Flaws in Service Water Piping

Gentlemen:

In accordance with 10CFR50.55a and the guidance provided in Generic Letters 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1,2, and 3 Piping," and 91-18, "Information to Licensees Regarding Two NRC Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and on Operability," Entergy Operations hereby requests relief from the requirements of the ASME Boiler and Pressure Vessel Code, Sections III and XI. On June 5, 1996, during the performance of an automated ultrasonic inspection of 42 locations of the service water system piping, three locations on the loop 2 supply pipe were identified as having less than minimum wall thickness (t_{min}) as required by the ASME code. Additionally, based on estimated corrosion rate values, three additional pipe locations are projected to be at or below their minimum allowable wall thickness before their currently scheduled replacement dates.

The piping is not leaking at any of the above identified locations, but it contains pits which exceed, or are projected to exceed, code acceptance limits; therefore, the guidance provided in Generic Letters 90-05 and 91-18 was determined to apply. Plans are to perform code repairs on these identified locations of the piping before, or during, the next refueling outage (1R13) scheduled to begin in September 1996. However, should a leak develop prior to the repair, plans are to install a simple rubber patch with band clamps to serve as a "stop gap" measure to limit leakage for housekeeping purposes. Attachment 1 contains the technical justification for a temporary repair in accordance with Generic Letter 90-05.

Should you have questions or comments, please contact me.

A047

Very truly yours,

Dwight C. Mims
Director, Nuclear Safety

DCM/dwb

Attachments

cc: Mr. Leonard J. Callan
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

NRC Senior Resident Inspector
Arkansas Nuclear One
P.O. Box 310
London, AR 72847

Mr. George Kalman
NRR Project Manager Region IV/ANO-1 & 2
U. S. Nuclear Regulatory Commission
NRR Mail Stop 13-H-3
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Attachment 1
Technical Justification for a Temporary Repair In Accordance with Generic Letter 90-05

1.0 Flaw Detection and System Description

On June 5, 1996, during the performance of an automated ultrasonic inspection of 42 locations of the service water system piping, three locations on the loop 2 supply pipe were identified as having less than minimum wall thickness (t_{min}) as required by the ASME code. These pit locations exhibited a wall thickness of 0.050", 0.026", and 0.050", respectively. Based on an engineering calculation and a conservatively assumed system pressure of 120 psig, the minimum allowable wall thickness for this pipe is 0.056". This section of the loop 2 service water supply piping is not isolable and therefore, is pressurized at the normal supply header pressure (current service water pump discharge pressure ≈78 psig). Manual ultrasonic inspections were performed to validate these findings; however, due to the geometry of the pits, the exact readings could not be repeated using an independent inspection method. The manual readings were greater than the minimum recorded automated readings. These three degraded areas are located in the reactor auxiliary building on the main loop 2 service water system supply piping, HBD-20-14". Specifically, the locations are: (1) 4½ feet downstream of the HBD-4-8" branch to the emergency feedwater supply line; (2) between the HCD-117-3" branch for the emergency control room chiller VCH-4A and vent valve SW-634; and (3) between system vent valve SW-634 and the HBD-45-10" branch for the reactor building coolers VCC-2C/D.

The automated ultrasonic inspection data collected indicated that the average wall corrosion rates are approximately 0.003"/year and the pit corrosion rate is approximately 0.008"/year. Using these estimated corrosion rate values, three additional pipe locations are projected to be at or below their minimum allowable wall thickness before their currently schedule replacement dates. Specifically, the locations are: (1) loop 2 supply header HBD-20-14" between vent valve SW-634 and the HBD-45-10" branch for the reactor building coolers (VCC-2C/D) in the reactor auxiliary building ; (2) loop 2 supply header HBD-20-18" approximately six feet downstream of FE-3901 in the turbine building pipe chase; and (3) loop 1 supply header HBD-14-18" approximately 6½ feet downstream of FE-3902 in the turbine building pipe chase. A visual inspection was performed at these six locations. It was verified that the service water piping was not leaking and the external appearance of the areas of concern was not degraded. The loop 1 pipe is currently scheduled to be replaced during 1R13 and the loop 2 pipe during 1R14.

The ultrasonic inspections were performed in accordance with procedure OP1415.023 Rev 4, "*Ultrasonic Thickness Measurements.*" This automated process utilizes a computerized projection image scanning (P SCAN) ultrasonic testing system. The P SCAN method provides average piping wall thickness and pit depth data for each location, resulting in a 9" by 360° representation of the pipe wall condition. The location selection for the inspections and the data evaluation were performed in accordance with procedure OP1309.014 Rev 3, "*Service Water Piping Thickness Evaluation.*" There were twelve loop 1 locations, fifteen loop 2 locations, five

locations in the common supply header in the intake structure, and ten locations in the return lines inspected.

The Unit 1 service water system was constructed in accordance with ANSI B31.1, but was reclassified as ASME Class 3 for the purpose of in-service inspection specified in ASME Section XI. The loop 2 supply pipe, HBD-20-14", is a 14" carbon steel, STD schedule (nominal wall thickness of 0.375"), "moderate energy" pipe. The HBD-14-18" and the HBD-20-18" pipes are 18" carbon steel, STD schedule (nominal wall thickness of 0.375"), "moderate energy" pipes.

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. 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 Cause and Effect Evaluation

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

Three localized pits were found on loop 2 of the Unit 1 service water system. The actual minimum wall thickness recorded, using an automated ultrasonic inspection technique, were less than t_{min}. These three locations were found in scan numbers SW-128, SW-220 and SW-309C and the minimum wall thickness reported were 0.050", 0.026" and 0.050", respectively. Additionally, based on the results of Design Engineering evaluation number 91-E-0125-06, Revision 0, that reviewed all of the ultrasonic inspection data recorded during this inspection period, three other locations were identified to have a pit where the minimum wall thickness was projected to go below t_{min}, prior to 1R14. These other three locations are SW-128B, SW-134A and SW-136A. SW-128B and SW-136A are also on loop 2 of the Unit 1 service water system. SW-134A is on loop 1 of the Unit 1 service water system. All of the above thinned areas were evaluated using the guidance provided in NRC Generic Letter 90-05 and have been found to be acceptable for continued operation until 1R13. The automated ultrasonic inspection data was utilized to characterize each of the thinned areas. The data revealed that the pipe wall thinning originated from corrosion pitting on the interior surface of the pipe. The pipe contained pits of varying degrees around the circumference of the pipe. However, significant average overall pipe wall thicknesses remained in each of the scanned locations. All other locally thinned areas were found

to be above t_{min} required for pressure, and are projected to remain above t_{min} until at least 1R14. The following contains a detailed discussion of each of these thinned areas.

Table 1 provides a summary of the flaw parameters, flaw characteristics, and a summary of the evaluation per NRC Generic Letter 90-05 through-wall approach. Use of the through-wall flaw technique is conservative since none of the scanned areas were through-wall, and no visual leakage had been noted at these locations. The table entries are as follows:

- Scan Location
- Pipe Size and Material
- Avg. Thick - Average measured wall thickness
- Min. Required - Minimum required wall thickness to meet all ASME Section III Class III Code equations (Equations 8, 9B, 9D, and 11)
- T_{pit} - The minimum pit wall thickness measured using ultrasonic scan data
- t_{min} - Calculated thickness required to meet ASME Section III Class III Code equation 3
- F_{meas} - Measured Flaw Size
- F_{thick} - Thickness used in determining flaw size
- F_{allow} - Maximum allowed flaw size
- $F_{th\text{-}allowed}$ - Minimum allowed flaw thickness
- Allowed Wear till 1R13
- Projected Wear till 1R13

Table 1

Scan Location	Pipe Size & Material	Avg. Thick (in.)	Min. Req'd (in.)	T_{pit} (in.)	t_{min} (in.)	F_{meas} (in.)	F_{thick} (in.)	F_{allow} (in.)	$F_{th\ allowed}$ (in.)	Allowed Wear till 1R13 (in.)	Project Wear till 1R13 (in.)
SW-128	14", sch. 30, C.S.	0.257	0.100	0.050	0.056	0.720	0.112	0.740	0.100	0.012	0.002
SW-128B	14", sch. 30, C.S.	0.249	0.100	0.062	0.056	0.800	0.116	0.810	0.108	0.008	0.002
SW-134A	18", std wt, C.S.	0.318	0.145	0.072	0.072	0.800	0.175	1.020	0.165	0.010	0.002
SW-136A	18", std wt, C.S.	0.301	0.146	0.076	0.072	0.500	0.155	0.790	0.145	0.010	0.002
SW-220	14", sch. 30, C.S.	0.254	0.080	0.026	0.056	0.800	0.125	0.870	0.115	0.010	0.002
SW-309C	14", sch. 30, C.S.	0.287	0.080	0.050	0.056	0.600	0.125	0.740	0.115	0.010	0.002

From the table, all measured flaw sizes were determined to be less than the allowed flaw size. The measured flaw thickness is greater than the minimum allowed flaw thickness, and the allowed wear until 1R13 is greater than the projected wear through 1R13, as detailed in Arkansas Nuclear One (ANO)-Calculation 91-E-0125-06, Rev. 0. Therefore, all scanned locations meet the intent of NRC Generic Letter 90-05.

Flooding concerns

As stated previously, the piping is not leaking. However, should leaks occur, no flooding concerns would result. Floor drains are located in the general areas and are sized to remove minor leakage from the areas of concern. For the degraded areas in the reactor auxiliary building, any significant change in leakage would be identified by an increase in the auxiliary building sump level or during operator tours. For the degraded areas in the turbine building pipe chase, the floor drains go directly to the main discharge flume. Any significant change in leakage in any of the areas of concern could be identified by a change in the monitored service water pump discharge pressure. However, based on the structural assessment, known corrosion rate, and engineering experience, no leakage 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 if the degraded areas begin to leak. The local floor drains could accommodate the leakage.

Reduction in flow to service water supplied components

Based on the refueling outage 1R12 as-left service water flow test with the system in an engineered safeguards alignment, the total measured loop 2 service water flow was 4,912 gpm. As determined by an evaluation performed in response to condition report action item CR-1-96-0203-02, it has been determined that a loop 2 leak rate of 314.4 gpm could be tolerated before any of the associated components would reach unacceptable low flow conditions. The reduction in flow to the associated loop 2 components due to any leaks occurring in the system would be insignificant and will not cause the service water loop, nor individual system components, to be degraded.

Emergency cooling pond (ECP) inventory concerns

Leakage from the service water system 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. Based on past experience, if a leak did develop at these locations, the leak rate would be considerably less than the 33.34 gpm margin.

Root cause determination

Based on the ultrasonic data, the flaws are characterized as highly localized pits typical of corrosion degradation in service water system piping. Previous evaluations of the large bore service water pipe condition, as part of ANO's service water integrity program, have 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.

3.0 Augmented Inspection

The automated ultrasonic inspection plan selected locations that provided a comprehensive representation of the pipe condition in the service water system. For this inspection, there were 42 locations selected, twelve loop 1 locations, fifteen loop 2 locations, five locations in the common supply header, and ten locations in the return lines. These locations include multiple flow regimes and similar water and piping conditions for both loops of the service water system piping. Thirty-four of these locations were inspected in previous years. This provides a composite representation of the system condition.

The data collected indicated negligible corrosion or pit propagation. Comparing the new inspection data with previous inspections revealed that the average wall corrosion rates are approximately 0.003"/year, which compares favorably with the 0.004"/year corrosion rates measured on corrosion coupons used to monitor the service water system chemical control program efficiency. The measured pit corrosion rate is approximately 0.008"/year.

Based on previous experience of similar flaws, consideration of flaw growth is not a significant concern. The piping inspection showed that the three areas were the only locations that were less than the minimum required wall thickness and the additional three areas were the only locations that were predicted to become less than the minimum required wall thickness before their scheduled replacement. Based on this and previous extensive inspections performed, it was determined that no additional inspections were needed to assess the overall condition of the system piping. Therefore, it has been concluded that the overall condition of the system is acceptable with respect to Generic Letter 90-05 until the next Unit 1 refueling outage (1R13).

4.0 Impracticality of Repair Determination

It was determined that conducting a code-qualified pipe replacement during power operation is not feasible since one entire loop of service water and its associated trains of emergency diesel generator, high pressure injection, low pressure injection, reactor building spray, and reactor building cooling would have to be rendered inoperable. 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. A code-

qualified pipe repair method is currently being developed that should allow installation during power operation. Upon completion of the required engineering and supporting documentation, installation is expected to be completed prior to the next Unit 1 refueling outage (1R13).

Because the pipe flaws are not through-wall and are not expected to leak, no immediate temporary repairs are deemed necessary. However, if a leak does occur before code repair, 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. This patch or a similar configuration would be maintained as the temporary repair until code repairs could be made. In addition, if the temporary repair were to fail, there is no equipment in close proximity to the probable leak locations that would be affected by water spray, and the leak rate would be small enough 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 overall capacity margin of the service water system. Because a failure of the temporary repair would have no adverse safety impact, the structural condition of the rubber patch and clamp would not require a rigorous structural analysis. No credit would be taken for the additional structural strength contribution from the patch and band clamps.

5.0 Code Repair Schedule

Since the pits meet the criteria covered by Generic Letter 90-05, and the documentation to support the permanent repairs in accordance with the ASME Code are not complete, Entergy Operations requests relief for continued operation and permitting a temporary non-code repair of the affected service water piping (if necessary) as an alternative to the requirements 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 as soon as practicable. The next scheduled outage of adequate duration is Unit 1's 1R13 refueling outage which is currently scheduled to begin in September 1996. The permanent code repair is scheduled to be performed prior to, or during, this outage.

In accordance with GL 90-05 guidance, the integrity of a non-code repair will be assessed on a quarterly basis utilizing an ultrasonic testing examination method. Furthermore, a qualitative visual assessment for leakage of 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.