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DUKE POWER

May 11, 1995

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

Subject: Catawba Nuclear Station, Units 1 and 2
Docket Nos. 50-413 and 50-414
Request for Relief Number 95-03
Leaks in Nuclear Service Water System Piping

Gentlemen:

The purpose of this letter is to request, in response to NRC Generic Letter 90-05, relief from ASME Boiler and Pressure Vessel Code Section XI requirements pursuant to 10CFR50.55a(g)(6)(i). Accordingly, please find attached Request for Relief Number 95-03. This relief request is being submitted as a result of pinhole leaks that have been detected in the Heat Affected Zone (HAZ) of certain stainless steel piping in the nuclear service water (RN) system. The leaks have been determined to have resulted from Microbiological Influenced Corrosion (MIC).

Duke Power Company is requesting that the NRC review and approve this relief request at your earliest convenience. If you have any questions pertaining to this relief request, please call L.J. Rudy at (803) 831-3084.

Very truly yours,

D.L. Rehn

LJR/s

Attachment

A045
A001

xc (with attachment):
S.D. Ebneter, Regional Administrator
Region II

R.J. Freudenberger, Senior Resident Inspector

R.E. Martin, Senior Project Manager
ONRR

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RELIEF REQUEST FROM ASME CODE SECTION XI REQUIREMENTS
REQUEST FOR RELIEF NUMBER 95-03

UNIT: Catawba Nuclear Station Unit 1 & 2 DATE: 5/11/95

1.0 ORIGINATOR

1.1 DESCRIPTION OF FLAW

Pinhole leaks in stainless steel nuclear service water (RN) system piping Heat Affected Zone (HAZ).

1.2 IMPRACTICALITY OF CODE REPAIR

Repair of the leaks will result in increased RN system unavailability. In addition, the welding process itself may have resulted in the leaks. Delaying the repair will allow it to be scheduled with pre-planned activities, increasing safety system availability and allowing for analysis and changes to the welding process to prevent possible reoccurrence.

1.3 DESCRIPTION OF PROPOSED TEMPORARY REPAIR

No temporary repair is proposed. The pinhole leaks will be allowed to continue until a Code repair is implemented during the Unit 2 end-of-cycle 7 refueling outage. Temporary repairs are not necessary at this time.

1.4 SAFETY SIGNIFICANCE: SYSTEM INTERACTION EVALUATION

Attachment 1 of calculations:
Flooding: reviewed
Jet Spray: reviewed
Loss of Flow: insignificant

1.5 ROOT CAUSE INVESTIGATION

Root Cause Description:
Based on Catawba's investigation and inspection to date, the pitting is limited to the HAZ. The pit initiation sites are interphase of interdendritic transition regions. The presence of delta-ferrite at the austenite phase boundary increases the critical pitting potential. The water quality plays a major role in the corrosion initiation in this area. Catawba is located on Lake Wylie, which contains high suspended solids. Water bacteria and/or welding increases the possibility of random Microbiological Influenced Corrosion (MIC) attack. Polishing the pipe surface prior to welding, using N_2 in the shield gas, and controlling the ferrite content in the weld decreases the possibility/extent of MIC attack. These are corrective actions suggested in literature searches conducted to date. The MIC is attaching to the pipe in the HAZ at Catawba. Inspections of non-welded stainless steel pipe showed no attachment or growth of MIC tubercles. The adhered MIC starts to grow in the area beneath where the tubercle covers the pipe. The tubercle entraps water underneath it, changing the chemistry in this area. The presence of ferrite, altered chemistry, and the depletion of O_2 under the tubercle does not allow the passive layer to reform. This passive layer provides

the key corrosion resistance. Therefore, continuous attack to the pipe wall occurs. The attack, and anodic reaction, forms a large cavernous subsurface pit in the pipe wall and propagates through it.

MIC attack on the HAZ of the piping has been determined to be the cause of this pitting, rather than some other mechanism acting on the piping. An exhaustive study, using an in-situ test stand, was conducted at Catawba in 1989/1990 to determine the best alternative material to use in lieu of the RN system A-106 Grade B piping. Both piping and welded coupons were included for a variety of materials. Stainless steel suffered no degradation and no evidence of microbiological attack was evidenced in the study. This is an unanticipated attack mechanism on the material which was not identified in the study. No change in water chemistry or biology has yet been identifed since the study. Thus, the study is believed to have not accurately simulated the conditions which have resulted in the recent failures.

1.6 AUGMENTED INSPECTION

Leaks were first identified as three pinhole-sized leaks in stainless steel piping associated with the RN lube injection simplex strainers. The leaks are located within the heat affected zone of the welds of this 4-inch piping. Subsequent visual examination of other stainless steel piping and butt and socket-welded connections during a RN system walkdown has identified a total of 75 leak sites in both butt-welded and socket-welded connections of this stainless steel piping. The piping involved is that associated with the RN lube injection simplex strainers, the containment spray heat exchanger cooling water side process radiation monitors (EMFs), and two diesel generator starting air aftercoolers. The leak sites are very small and result in leak rates on the order of several drops per minute maximum. The leaks are primarily located on the bottom of the piping, but are not limited to horizontal piping. Some brown spots on the outside of the piping are evident which are leakage sites that have since plugged themselves with corrosion or silting deposits. Examination of the internal surface of the piping at the failure sites continues to show very low silting or corrosion deposit layers in the general piping area. The failure sites typically have a mound of material on the inside diameter of the piping over the failure site. This has been confirmed to be related to MIC, based upon Duke Metallurgical Laboratory analysis of samples cut from the system.

* A 100% walkdown of all stainless steel piping within the RN system has been completed. A total of 75 leak sites were identified in 4-inch butt-welded and various socket-welded piping.
* Characterization of samples from the identified leak sites has been completed by Duke's Metallurgical Laboratory.
* Structural assessment calculations per Generic Letter 90-05 for all leak sites have been completed and it was determined that all acceptance criteria were met.

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RELIEF REQUEST FROM ASME CODE SECTION XI REQUIREMENTS

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* Repair of socket-welded piping for 2EMF45's leak locations has been completed. Overall, 39 of the 75 leak sites have been repaired to date.
* It was determined that ultrasonic examination of the leak sites is not a viable method for characterizing the sites. Continued Metallurgical Laboratory work is being performed to support characterization of flaw sites as they are removed from the system. This will provide additional assurance that the structural evaluation is current and acceptable.

2.0 STRESS ANALYSIS UNIT

2.1 DESIGN DETAILS

ASME CLASS 3 PIPING, Duke Class C
CNC 1206.00-02-0007
CNC 1206.00-02-0008

2.2 FLAW CHARACTERIZATION

Refer to Attachment 2A of calculations.

2.3 PRELIMINARY FLAW EVALUATION SUMMARY

None: Initial flaws were isolated, removed, and flaw sized.

2.4 END OF CYCLE FLAW EVALUATION SUMMARY

Flaw size is not expected to exceed flaw limit size in greater than one year. Repair will be completed no later than by the end of the Unit 2 end-of-cycle 7 refueling outage which is scheduled to begin October 6, 1995.

2.5 FLAW MONITORING

A walkdown of the RN system stainless steel piping will be conducted at least once every six months.

2.6 ADDITIONAL COMMENTS

None.

2.7 EXCEPTIONS TO GL 90-05/DRAFT ASME CODE CASE

Calculations were performed in accordance with GL 90-05, through-wall flaw approach.

2.8 REFERENCES/INPUTS

Attachment 1: CNC 1206.00-02-0007
Attachment 2: CNC 1206.00-02-0008
Attachment 3: Metallurgical Laboratory Report 1812
PIP 0-C95-0527