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ACCESSION NBR:8102100010 DOC.DATE: 81/02/04 NOTARIZED: YES DOCKET #
FACIL:50-331 Duane Arnold Energy Center, Iowa Electric Light & Pow 05000331
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DENTON,H.R. Office of Nuclear Reactor Regulation, Director

SUBJECT: Forwards proposal & schedule for implementation of requirements in NUREG-0619, "BWR Feedwater Nozzle & Control Rod Drive Return Line Nozzle Cracking." Response was delayed due to late receipt of NRC 801210 request.

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Iowa Electric Light and Power Company

February 4, 1981
LDR-81-42

LARRY D. ROOT
ASSISTANT VICE PRESIDENT
OF NUCLEAR DIVISION

Mr. Harold Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

Enclosed herewith is our proposal and schedule for implementation of requirements set forth in NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking."

This submittal is in response to the November 13, 1980 letter of Mr. Darrell Eisenhut. However, since Mr. Eisenhut's letter was not received until December 10, 1980, it was necessary to delay this response as discussed with the NRC Project Manager. The proposed modifications are deemed fully adequate to comply with the requirements set forth in NUREG-0619.

Three signed and 37 additional copies of this letter are transmitted herewith. The foregoing letter and attachment are true and accurate to the best of my knowledge and belief.

IOWA ELECTRIC LIGHT AND POWER COMPANY

BY Larry D. Root
Larry D. Root
Assistant Vice President

Subscribed and Sworn to Before Me on this 4th day of February 19 81.

Mary E Benfield
Notary Public In and For the State of Iowa

NOTARIAL SEAL IOWA
MARY E. BENFIELD
My Commission Expires
SEPTEMBER 30, 1983

LDR/BWR/ld
Attachment
cc: B. Reid
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S. Tuthill
D. McGaughy
K. Meyer
D. Mineck
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Duane Arnold Energy Center
Proposed Implementation
of Requirements Set Forth in
NUREG-0619
"BWR Feedwater Nozzle and
Control Rod Return Line Nozzle Cracking"

Presented below is a description of the modifications and implementation schedule proposed by the Iowa Electric Light and Power Company to bring the DAEC into compliance with the requirements set forth in NUREG-0619. The responses include Part I, Feedwater Nozzles, and Part II, Control Rod Drive Return Line Nozzles.

Part I - Feedwater Nozzles

During the 1981 outage, the internals of the feedwater regulating valves will be replaced. This will allow a steady, continuous flow to the reactor vessel under low flow conditions. No modification of the low-flow controller will be required to meet Section 4.2 of NUREG-0619.

During the 1977 outage General Electric performed extensive tests on the feedwater nozzles and spargers to determine the thermal cycling at various power levels. Because of the unique thermal sleeve design at the DAEC, thermal cycling does not occur to the same extent as other BWR's and feedwater nozzle cracking due to fatigue was not predicted to occur within the life of the plant. The results of the test were included in the GE document NEDC-23677, dated September, 1977, copies of which were submitted to the NRC on November 14, 1979 as attachments to a letter from Larry D. Root to Mr. Thomas A. Ippolito, our number LDR-79-292. A summary of the report is included as Attachment A.

In regard to rerouting the RWCU system, present DAEC design returns RWCU flow through two feedwater nozzles. As indicated in Attachment A, large thermal cycles do not occur at Duane Arnold at low feedwater temperatures. Therefore, there is no benefit to be gained by rerouting the RWCU flow as discussed in Section 2.4 of NUREG-0619, and the RWCU will not be rerouted to all four feedwater nozzles.

The inspection requirements of Table 2 are addressed by the GE report. As described in Table 2, ultrasonic (UT) examinations will remain as part of the ISI program on the feedwater nozzle assemblies. Every two years, during the outage, the nozzle inner radius and bore, the safe-end, the safe-end to nozzle weld and the thermal sleeve to safe-end weld will be UT examined. Visual inspection of the spargers and nozzle area will also be done at two year intervals.

Table 2 requires a routine dye-penetrant (PT) examination of accessible areas on an interval of every 4 refueling cycles. Due to the limited areas accessible for PT examination, and as recommended by the GE report, a PT examination will not be performed unless the ultrasonic examination detects cracking.

The feasibility of installing an on-line monitoring system to detect leakage past the thermal sleeve is being considered.

Part II - CRD Return Line Nozzle

A schedule has been set which will allow the DAEC to conform to all modifications which we feel will improve the safety and operation of the plant. The following timetable describes each modification to be done to the CRD hydraulic system and when each is presently planned.

Spring 1981 Outage

1. The nozzle inner radius, bore, and the nozzle safe end will be UT inspected. If any signs of cracking are found, an in-vessel PT inspection will be done on the nozzle. Cracks will be evaluated and, if necessary, ground out.

2. The 2 1/2 ft. of 304 stainless steel line connected to the nozzle safe end will be ultrasonicly (UT) inspected for IGSCC. This pipe section will remain part of the yearly ISI program.

Spring 1982 Outage

1. The thermal sleeve will be removed from the CRD Return Line Nozzle.

2. The RPV Nozzle and the surrounding area will be dye-penetrant (PT) inspected.

3. If necessary, the nozzle will be repaired by grinding out all cracks found until subsequent inspections show no cracks are present.

4. The exhaust water header and the stabilizing line will be re-routed to the cooling water header to eliminate all the carbon steel line in the flow stabilizer loop.

5. A matched pair of equalizing valves will replace the orificed check valve in the exhaust water header.

The proposed modifications meet the requirements set forth in Section 8.1 (4) Acceptability of Alternatives Proposed by GE with the exception of the "cut and cap" of the CRD Return Line Nozzle.

The intent of the CRDRL system modification was to eliminate the thermal stress in the CRDRL nozzle area without introducing the new problem of intergranular stress corrosion cracking caused by stagnant water in the lines. The proposed modification accomplishes the primary intent of removing the thermal stress and offers what is deemed to be an acceptable alternative to the IGSCC problem without cutting and capping the CRDRL.

By valving out the CRDRL, the thermal fatigue mechanism during normal operation described in Section 5 would be eliminated, thereby, eliminating the primary stress causing crack propagation during startup/shutdown operations and during scrams.

At the same time, this option preserves the ability to restore increased flow to the vessel during emergencies. Based on system performance curves, the flow capability to the reactor vessel is 315 gpm but decreases significantly to 130 gpm with the line cut and capped. Under emergency conditions, the increased flow to the vessel is more desirable to maintain core coverage. Flow to the RPV may be initiated from the control room by opening a motor operated valve when conditions warrant its use. The hand switch used to control this valve will be key-locked closed. Operating procedures will be modified to include operation of this system under emergency conditions.

The only piping in the CRDRL system susceptible to IGSCC is 2 1/2 ft. of 304 stainless steel line connected to the nozzle safe end. Inspection of the 2 1/2 ft. section of pipe will be done with the current ISI program. It will take only a few extra minutes to inspect this piece, so the additional dose to workers would be small. If signs of IGSCC are ever found, this section will be replaced with 316L stainless steel to alleviate the cracking susceptibility.

Barring any unforeseen circumstances which may change our schedule, the modifications, as described in the above timetable, will be complete by June 30, 1982.

2.0 SUMMARY AND CONCLUSIONS

The Duane Arnold feedwater nozzle design was specifically exempted from the General Electric Feedwater Nozzle Interim Examination Recommendation (FNIER) contained in Service Information Letter (SIL) Number 207, because the feedwater nozzle thermal sleeve is welded to the nozzle safe end. Therefore, it was expected that the feedwater nozzles would experience less thermal cycling and thus significantly less cracking than other BWRs with a similar period of operation.

The feedwater nozzle temperature cycling recorded during the May 1977 startup was significantly less than that recorded for other BWRs which have a slip fit between the thermal sleeve and the safe end. Large thermal cycles do not occur at Duane Arnold at low feedwater temperatures. The peak-to-peak temperature cycling is between 59°F and 82°F for all conditions with the feedwater temperature greater than 200°F. At lower feedwater temperatures the cycling is reduced except during a turbine trip transient.

Iowa Electric supplied the basis for a time/temperature map for the feedwater system at Duane Arnold. Based on the time/temperature map and on the measured temperature cycling, a 40-year cumulative fatigue usage factor due to rapid thermal cycling of 0.20 was calculated. This value is low enough so that feedwater nozzle cracking due to fatigue is not predicted to occur. Should cracking due to another mechanism occur, then the cracks will propagate slower than at other BWRs because of the smaller thermal cycles experienced at Duane Arnold.

It is therefore recommended that Duane Arnold remain exempt from FNIER. Periodic ultrasonic examination of the feedwater nozzles is recommended to assure that significant cracking due to another mechanism has not occurred. Liquid penetrant examination of the feedwater nozzle and safe end is not required, unless the ultrasonic examination detects cracking. To assess the performance of the thermal sleeve with time, it is also recommended that periodic visual examination of the feedwater sparger and of the weld between the thermal sleeve and safe end be performed.