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November 26, 1979
AEP:NRC:00305

Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74

Mr. J. G. Keppler, Regional Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Region III
799 Roosevelt Avenue
Glen Ellyn Illinois 60137

Dear Mr. Keppler:

This letter and its attachments submit to the Commission additional information with regard to the analysis, inspection, and modification of the main feedwater system at the Cook Plant.

Attachment No. 1 to this letter contains the fourth progress report on the Feedwater Line Data Collection Program in Unit No.2. Previous progress reports on this program were transmitted to you via our AEP:NRC:00221A (August 3, 1979), AEP:NRC:00221B (September 5, 1979), and AEP:NRC:00221C (October 12, 1979) submittals. This progress report, submitted in accordance with the commitment made in our AEP:NRC:00221 submittal dated June 15, 1979,addresses IE Bulletin No. 79-13, Revision 2 which we received on October 24, 1979 and also contains the information requested by members of the Washington NRC Staff during telephone conversations held on November 1, and November 6, 1979.

Attachment No. 2 to this letter contains a description of the thermal sleeve which is being installed in the feedwater elbow to the No. 4 steam generator in Unit No. 2. This information was also requested during the aforementioned telephone discussions.

ATTACHMENT NO. 1 TO AEP:NRC:00305

FOURTH PROGRESS REPORT ON THE FEEDWATER LINE DATA COLLECTION PROGRAM

DONALD C. COOK UNIT NO. 2

ATTACHMENT 1
AEP:NRC:00305
PROGRESS REPORT IV
FEEDWATER LINE DATA COLLECTION

Introduction

This is the fourth progress report on the investigation of the feedwater line elbow cracking problem at Donald C. Cook Plant Units Nos. 1 and 2. Unit 2 is presently in a refueling outage; during which we performed surveillance of the nozzle-to feedwater elbow welds in accordance with the commitment made in our AEP:NRC:00221 submittal dated June 15, 1979 and in IE Report No. 50-316/79-16. In addition to those modifications already made, we plan to implement new design modifications to the feedwater system during this outage.

Surveillance

All four steam generator nozzle to elbow weld areas were radiographed. No cracks or linear indications were evident. Elbow 2 - 4 was removed, and the inside surfaces at the nozzle and elbow counterbore areas were examined by fluorescent magnetic particles. No relevant indications were found. Ultrasonic examination from the outside surfaces of the elbow and nozzle of the weld and adjacent area were performed on 2-1, 2-2 and 2-3. No indications other than those previously identified in the baseline were found.

As required by IE Report No. 50-316/79-16 all four elbow to reducer welds were also radiographed. In addition to confirming the indication on 2-3 that we were committed to repair, additional indications of slag and entrapped oxide were revealed in 2-1 and 2-2 welds due to improved radiography. None of the indications were service induced. Repairs are being made to those welds.

Design Modifications

The results of this surveillance indicates that the modifications made on Unit 2 in June of this year as described in our letter of June 7, 1979 (AEP:NRC:00216) were effective in that no cracks were shown to initiate. Therefore, these modifications, (replacing the elbows with new elbows that have a greater wall thickness in the affected area, thereby reducing stress levels; modifying the counterbore area to greatly reduce the local stress riser; and improving the control of feedwater dissolved oxygen concentration) provide assurance for the continued safe operation of the Cook units.

Continued

However, because of the severe economic consequences of having the units unavailable due to potential cracking problems we have undertaken additional design modifications to reduce the number and magnitude of the cyclic stresses caused by the thermal transients and stratified feedwater conditions.

As previously reported, the design modification to give us the capability of using heated feedwater, rather than cold auxiliary feedwater, during unit start-up and during extended hot-standby when the secondary side is available, is in progress. The design phase is now completed and we are attempting to install this modification on Unit 2 during the present refueling outage.

The arrangement (see Figure 1-1) for heating the feedwater during start-up of a unit, involves using main steam from that unit in the two highest stage heaters. Steam from the unit's auxiliary steam header will be used to drive the feedpump turbine and to pull vacuum. The heater drains go to the condenser and are returned as feedwater.

Using main steam from the unit starting up results in feedwater temperatures which tend to track the temperatures of the steam generators. Two factors prevent an exact match of temperatures. The first, is the transport time from the heaters to the steam generators, which is greatest at low flowrates. The second is that there is a limit of 300^{o}F total rise. This means that when the saturation temperature of the main steam reaches 300^{o}F above the hotwell temperature, the steam to the heaters will be throttled to limit the total rise. The maximum feedwater temperature will be on the order of 400^{o}F.

The proposed method of operation is as follows. During the heatup of the steam generators to a low positive pressure (less than 100 psig) vacuum will be established and preparations made to transfer from auxiliary feedwater to main feedwater. Steam will be admitted slowly to the heaters to start warming piping and heaters. Initially the heating will be done in the next-to-top heater. The heater pressure will rise with the steam generator until this heater approaches its limit of 150^{o}F rise. Then the steam to this heater will be throttled and steam pressure to the top heater will continue to rise with steam generator pressure until it too reaches its limit. Automatic pressure control is provided to do this.

Continued

On a unit trip, main feedwater is tripped and auxiliary feedwater is initiated automatically. This design feature will be maintained. However, if the unit is expected to be in a hot-standby condition for a significant time, main feedwater flow and heating can be established as it is for a start-up.

We are also installing for evaluation a thermal sleeve into the feedwater elbow of steam generator 2-4 during the present refueling outage. This sleeve is designed to extend through the entire elbow and into the existing nozzle thermal sleeve. Details of the sleeve are described in Attachment No. 2. This particular feedwater elbow was chosen because it had been removed for weld repair. In order to confirm the performance of the thermal sleeve, we will undertake an instrumentation program following this outage to measure temperatures and strain on the modified elbow.

In addition, we have added weld build-up material to the outside diameter of all four steam generator feedwater nozzles to further reduce the magnitude of any cyclic stresses. The nozzle O.D. was first magnetic particle examined and then preheated to 175°F minimum prior to welding. Two welders using E8018-C3 electrodes with the SMAW (Shielded Metal Arc Weld) process, worked at the same time on opposite sides of the nozzle so as to prevent distortion. Intermittant areas were covered to further avoid distortion of the nozzle due to weld shrinkage. The weld build-up was radiographed and surface examined. Post weld heat treatment will be done at 1100 - 1500°F. Weld surfaces were machined or ground to a surface suitable for making a UT examination.

Conclusions

The results of our field data and analytical modeling have led to AEPSC to conclude that the thermal transient and stratified feedwater conditions that were observed in the nozzle elbow region during hot-standby and unit start-up were, along with corrosion, the major contributing factors to the initiation and/or propagation of the observed cracks. As a result of our recent surveillance, we believe that our modifications to date are effective and the new modifications outlined in this progress report further reduce the thermally induced cyclic stresses that are limited to the nozzle to elbow weld regions.

Clarification RAI 4.3.1-0 (S2)

RAI 4.3.1-0 (S2):

No RAI submitted. Clarification is related to LRA Table 4.3-1 as described below.

Clarification Requested for RAI 4.3.1-0 (S2):

Provide clarification regarding the following transient listed in the UFSAR (Table 4.1-10) but not listed in Table 4.3-1 of the CNP LRA: 120 cycles of secondary to primary leak tests for the Model 51R replacement steam generator.

I&M's Clarification for RAI 4.3.1-0 (S2):

UFSAR Table 4.1-10 lists design thermal and loading cycles, whereas Table 4.1-13 identifies the design thermal and loading cycles that I&M tracks. The secondary-to-primary leak test listed in Table 4.1-10, which is applicable only to the CNP Unit 1 Model 51R replacement steam generators (original steam generators were replaced in 2000), is no longer performed; therefore, it is not listed in UFSAR Table 4.1-13.