Commonwealth Edison
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December 3, 1992

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: Document Control Desk

SUBJECT: Dresden Station Units 2 and 3
Quad Cities Station Units 1 and 2
Commonwealth Edison RWCU Outboard Piping Inspection Plan for Dresden and Quad Cities Stations
NRC Docket Nos. 50-237/249 and 50-254/265

REFERENCES:
(a) J.L. Schrage to T.E. Murley letter dated July 24, 1992.

(b) Meeting between CECo (J. Schrage et al) and NRR (L. Olshan et al) on September 23, 1992; "RWCU Outboard Piping Program for Dresden and Quad Cities Stations".

(c) Meeting between CECo (J. Schrage) and NRR (B. Siegel and W. Koo) on November 5, 1992; "Commonwealth Edison Proposed Alternate RWCU Pipe Inspection Plan".

(d) Teleconference between CECo (J. Schrage et al) and NRR (B. Siegel et al) on November 19, 1992.

Dr. Murley,

In Reference (a), Commonwealth Edison (CECo) presented the basis for a request to rescind CECo's commitment to replace the Reactor Water Cleanup (RWCU) system outboard piping at Dresden and Quad Cities Stations. This commitment was made in response to Generic Letter 88-01, "NRC Position on Integranular Stress Corrosion Cracking (IGSCC) in BWR Austenitic Stainless Steel Piping". The basis was discussed with the NRC during the Reference (b) meeting. During that meeting, CECo committed to revise the proposed RWCU Pipe Inspection Plan to incorporate NRC comments. CECo presented a revised plan to the NRC during the Reference (c) meeting and Reference (d) teleconference.

The purpose of this letter is to document the proposed revision to the CECo RWCU Pipe Inspection Plan which was originally submitted in Reference (a). The revised plan is described in the Attachment to this letter. CECo requests approval of this plan by December 18, 1992, as discussed during the Reference (d) teleconference.

A001

If there are any questions or comments, please direct them to John L. Schrage at 708-515-7283.

Sincerely,

John L. Schrage
Nuclear Licensing Administrator

JLS/lak

Attachment

cc: A. Bert Davis, Regional Administrator-RIII
C. Patel, Project Manager-NRR
B. Siegel, Project Manager-NRR
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ZNLD/2275-4

ATTACHMENT
RWCU Outboard Piping Inspection Plan for Dresden and Quad Cities Station

OVERVIEW

The Commonwealth Edison (CECo) RWCU Outboard Piping Inspection Plan described in this attachment was developed to address the RWCU outboard piping at Dresden and Quad Cities Stations for Generic Letter 88-01 (and Supplement 1). The proposed inspection plan is structured to: 1) ensure that the NRC is informed of outboard RWCU weld inspection results as well as long term actions and plans for the outboard piping; 2) ensure that any pipe replacement activities are based upon inspection results; and, 3) minimize outage extensions by establishing a fixed inspection sample size. The plan consists of inspections of supply side and return side welds on each unit at Dresden and Quad Cities Stations during the upcoming refuel outages. Based upon the results of these inspections, CECo will utilize the approach outlined in this attachment, and shown on the attached flowchart, to determine the appropriate action. The plan has currently been developed for three cycles of inspections for each unit, at which time CECo will discuss future inspection, repair, and/or replacement activities with the NRC.

RWCU SYSTEM ISOLATION CAPABILITY

In response to Generic Letter 89-10 Supplement 3, CECo has implemented upgrades/enhancements to the RWCU isolation valves at each station during recent outages (refueling and forced). These upgrades/enhancements primarily included the adjustment of torque switch settings and the bypassing of close torque switches (to 95% of valve travel). The upgrades /enhancements were implemented to ensure that the valves would produce sufficient thrust to perform their design basis function, which is the isolation of containment in the event of a pipe break downstream of the valves. As a result of these efforts, CECo has determined that only one isolation valve at each station is considered "deficient" with respect to Generic Letter 89-10 Supplement 3 (Quad Cities Unit 1 outboard isolation valve, Dresden Unit 2 inboard isolation valve). Additionally, CECo plans to implement long-term upgrades/enhancements on the isolation valves during the upcoming refuel outage for each unit (see following schedule). These upgrades/enhancements, which primarily involve hardware modifications (ie: valve replacements, installation of larger valve actuators, gear replacements in existing actuators, installation of larger power cables), will increase design margins and ensure isolation capability (for the two previously discussed valves).

Dresden Unit 2: D2R13 refuel outage (starting January 1993)

Dresden Unit 3: D3R13 refuel outage (starting January 1994)

Quad Cities Unit 1: Q1R12 refuel outage (currently in progress - ending December 1992)

Quad Cities Unit 2: Q2R12 refuel outage (starting March 1993)

INITIAL RWCU OUTBOARD PIPING INSPECTIONS

During the next refuel outage on each unit at Dresden and Quad Cities Stations (beginning with D2R13 - January 1993 and Q2R12 - March 1993), Commonwealth Edison (CECo) will perform circumferential weld inspections (ultrasonic examinations) on eight welds. The selection of the initial eight welds was based upon the potential susceptibility of the outboard RWCU piping to IGSCC and the accessibility of the individual welds. As part of the selection process, CECo identified the RWCU outboard piping with the greatest potential for developing IGSCC, based upon operating temperature and conductivity. Within the specific sections of piping which have the greatest susceptibility to IGSCC, CECo selected individual welds based upon accessibility (with respect to ease of inspection and estimated radiation exposure). CECo did not distinguish between shop and field welds, since neither group of welds received post-weld heat treatment.

The use of operating temperature and conductivity as criteria to evaluate potential IGSCC susceptibility is based upon the direct relationship between IGSCC and both operating temperature and conductivity. The RWCU systems at Dresden and Quad Cities stations exhibit significant differences in both temperature and conductivity for various sections of RWCU piping. Based upon these differences, CECo has determined that the supply side piping which runs from the outboard containment isolation valves to the regenerative heat exchangers has the greatest potential for the initiation of IGSCC. This section of piping has the highest operating temperature (approximately

540° F) and the highest conductivity. Six out of the eight welds will be selected from this section of pipe. The two remaining welds will be selected from the return side piping downstream of the regenerative heat exchangers. This section of return side piping (downstream of the regenerative heat exchangers) has an operating temperature of approximately 435° F. However, since the conductivity of the return side piping is approximately one order of magnitude lower than the supply side piping, only two welds will be selected from the return piping.

The six supply side welds represent approximately 10% of the total supply side outboard piping welds with operating temperatures greater than 300° F, and 13% of the welds on the most susceptible section of RWCU piping (supply side piping with operating temperature greater than 500° F).

PROPOSED ACTIONS: INDICATIONS DURING INITIAL WELD INSPECTIONS

Initial Evaluation and CECo Actions

If the results of the initial weld inspections on a particular unit indicate the presence of cracks, CECo will implement the following: 1) repair the indications/replace localized sections of piping during the current outage; or 2) seek NRC concurrence for one cycle of continued operation without repair. The justification for continued operation without repair will be based upon: isolation capability; crack growth projections based upon CECo calculations (see "Crack Growth Determination" section of this attachment); and, interim compensatory measures (e.g., augmented temperature monitoring, periodic walkdowns, etc.).

If the NRC does not concur with an additional cycle of operation without repair, CECo will repair the indications or replace localized sections of piping during the current outage. However, if the NRC concurs with the request for an additional cycle of operation without repair/localized replacement, CECo will reinspect those welds during the next (second) refuel outage and notify the NRC of the results as well as the proposed actions (see "***Actions During Future Outages***" in this section of the Attachment).

As a secondary evaluation during the initial inspection period, if the total number of supply side indications exceed 40% of the number of inspected supply side welds, CECo will replace the supply side piping (through the regenerative heat exchangers) during the following refuel outage at Quad Cities Station, given procurement constraints; and during the following two refuel outages at Dresden Station.

The two refuel outage schedule at Dresden Station is based upon current plans for the potential implementation of the activities associated with the RWCU outboard supply piping replacement. The RWCU outboard supply piping replacement would modify the system from a two-train design to a single-train design. Since the outboard supply line for Dresden Station is configured with a common section of piping through a pipeway prior to entering the two heat exchanger rooms (each containing one train of the two-train system), replacement of the outboard piping during a single outage would necessitate an unnecessary outage extension. Current plans during the first outage would be to: 1) replace the common supply side piping; 2) replace the piping associated with Auxiliary Cleanup Pump; and 3) physically isolate one train of the system (in preparation for replacement). The planned replacement and isolation activities encompass approximately 59% of the supply side welds with operating temperatures greater than 300°F. During the following operating cycle, replacement activities on the isolated train could be performed, while the other train remains in service. During the second outage, the replaced train (with the non-susceptible supply piping) will be permanently connected to the common supply piping to complete the single-train design. At this point, the remaining train (with susceptible piping) will be physically isolated to support removal at a later time. At Quad Cities Station, the RWCU outboard supply piping enters a single heat exchanger room (which contains both trains) when leaving containment, resulting in a shorter length of supply piping. This configuration, coupled with a smaller pipe size at Quad Cities Station, allows for replacement of the supply side piping in a single refuel outage.

Actions During Future Outages

Following the initial outage in which crack indications are found, CECo will implement weld inspections during the two subsequent refuel outages on each applicable unit. For the supply side piping, the inspections will be performed on 6 supply side welds which are exposed to temperatures in excess of 300°F. This number of welds will consist of: reinspection of welds with indications identified during the previous outage(s) which were not repaired; and, new supply side welds. For the return side piping, the inspections will be performed on two times the number of new indications identified during the previous outage, plus two. This total will include reinspection of previous indications which were not repaired.

If indications on new welds are found during the subsequent inspections, CECo will implement the following: 1) repair the indications/replace localized sections of piping during the current outage; or 2) provide justification to the NRC for an additional cycle of operation without repair (utilizing the same process employed for

the initial inspections). Those new indications found during the second refuel outage which are not repaired will be inspected during the third refuel outage.

Based upon the results of the inspections for the previously unrepaired welds, CECo will implement the following: 1) repair the indications/replace localized sections of piping during the current outage; or 2) provide justification to the NRC for an additional cycle of operation without repair. The justification will take into account the previous cycle's crack growth, coupled with the projected growth for the upcoming cycle, when compared to an allowable flaw size.

If, during the subsequent weld inspections, the total number of supply side indications exceeds 40% of the total number of inspected supply side welds, CECo will replace the supply side piping (through the regenerative heat exchangers) during the following refuel outage, given procurement constraints (note: Dresden units will require two refuel outages as indicated previously). If the total number of return side indications exceed 40% of the total number of return side welds (with a minimum sample size of 8 welds), CECo will replace the return side piping during the following refuel outage.

Final Resolution

After three cycles of inspections (initial inspection and two cycles of subsequent inspections), CECo will discuss the results of the RWCU outboard piping weld inspections with the NRC in order to determine future inspection, repair, and/or replacement activities.

PROPOSED ACTIONS: NO INDICATIONS DURING INITIAL WELD INSPECTIONS

Initial Evaluation and CECo Actions

If the results of the initial weld inspections on a particular unit do not indicate the presence of any cracks, CECo will implement weld inspections, with a smaller inspection sample, during the next refuel outage (second refuel outage) on the applicable unit. The welds will be chosen from the original sample of inspected welds.

Actions During Future Outages

CECo will inspect two supply side welds and one return side weld on the applicable unit during the second refuel outage. If the results do not indicate the presence of any cracks, CECo will inspect the same sample size (two supply side welds and one return side weld) during the third refuel outage. The welds will once again be selected from the original (initial) sample of inspected welds (rotating basis selection process). If the inspections during the second refuel outage indicate the presence of cracks, CECo will implement the previously described actions for new indications found during future outages (see previous section of this attachment). The implementation of these previously described actions will result in a larger sample inspection size during the third refuel outage.

Final Resolution

After three cycles of inspections (initial inspection and two cycles of subsequent inspections), CECo will discuss future inspection, repair, and/or replacement activities with the NRC.

CRACK GROWTH DETERMINATION

If IGSCC indications are discovered during ultrasonic examinations of the sample size, CECo will perform crack growth calculations to determine the feasibility of one cycle of operation without repair. CECo will utilize a crack growth model presented in References 1, 2, and 3 of this attachment. This model considers the environment as well as the material conditions. The crack growth correlation, based upon the slip dissolution/film rupture model is given as:

$$da/dt = 7.8E\text{-}3 * n^{3.6} * (6E\text{-}14 * K_I^4)^n \ cm/sec$$

where: K_I = stress intensity factor (ksi $in^{0.5}$)
n = crack growth parameter

In the above equation, the parameter n is a function of the corrosion potential at the exposed mouth of the crack (mVshe), the room temperature conductivity of the bulk solution ($\mu S\ cm^{-1}$) and the degree of grain boundary sensitization as measured by the electrochemical potentiokinetic reactivation (EPR) technique ($C\ cm^{-2}$).

The methodology for determining the corrosion potential, conductivity, grain boundary sensitization, and flaw size acceptance criteria will be submitted to the NRC in a separate document by December 4, 1992.

REFERENCES

1) F.P. Ford and P.L. Andersen, "The Theoretical Prediction of the Effect of System Variables on the Cracking of Stainless Steel and its Use in Design", Corrosion '87, Paper No. 83, March 9-13, 1987, Moscone Center, San Francisco, CA.

2) EPRI Document NP-5064M, "Corrosion-Assisted Cracking of Stainless and Low Alloy Steels in LWR Environments", February 1987.

3) EPRI Document NP-TR-100399, Volume 2, "Stress Corrosion Monitoring and Component Life Prediction in BWRs", March 1992.

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Outboard RWCU Pipe Inspection Plan