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1400 Opus Place
Downers Grove, IL 60515

October 11, 1995

ComEd

Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: Document Control Desk

Subject: Teleconference between Commonwealth Edison Company and the Nuclear Regulatory Commission dated October 3 and 4, 1995, regarding the Increase in the Interim Plugging Criteria for Byron Unit 1 and Braidwood Unit 1 Steam Generators
NRC Docket Numbers:50-454 and 50-456

References: 1 D. Saccomando letter to the Nuclear Regulatory Commission dated October 7, 1995, transmitting Clarification to Teleconference dated October 3 and 4, 1995

2. Teleconference between the Nuclear Regulatory Commission and the Commonwealth Edison Company dated October 3 and 4, 1995

In the Reference teleconference the Nuclear Regulatory Commission (NRC) discussed several items with the Commonwealth Edison Company (ComEd) pertaining to the request to increase the interim plugging criteria for Braidwood Unit 1 and Byron Unit 1 steam generators. The conversation focused on clarification of items previously docketed. In Reference 2 ComEd transmitted clarification to 3 of the items discussed during the teleconference. Attached clarifies the remaining items.

Please address any comments to this office.

Sincerely,

Denise M. Saccomando
Senior Nuclear Licensing Administrator

Attachment

cc: D. Lynch, Senior Project Manager-NRR
R. Assa, Braidwood Project Manager-NRR
G. Dick, Byron Project Manager-NRR
S. Ray, Senior Resident Inspector-Braidwood
H. Peterson, Senior Resident Inspector-Byron
H. Miller, Regional Administrator-RIII
Office of Nuclear Safety-IDNS

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Attachment

Generic Letter 95-05 Differences

ComEd will implement all requirements of NRC Generic Letter 95-05 for hot leg and cold leg tube support plate intersections with ODSCC, with the following differences:

- The repair limit for hot leg intersections will be 3.0 volts. All indications above 3.0 volts will be repaired, regardless of RPC confirmation. To implement the 3.0 volt IPC, a selected number of tubes are required to be expanded to lock the tube support plates in order to limit tube to tube support plate displacement. The upper and lower repair limits for cold leg intersections are consistent with GL 95-05.

- Voltage-based repair criteria (1.0 volt or 3.0 volt) will not be applied to the hot leg or cold leg flow distribution baffle (FDB) plates. The repair criteria for defected tubes at the FDB is 40% throughwall.

- The main steam line break (MSLB) leak rate will be calculated by the methodology specified in GL 95-05, with the inclusion of leakage contributions from indications restricted from burst (IRB) at the hot leg intersections. Details of this methodology is contained in this attachment under the heading "Leak and Burst Methodology Clarification".

- Bobbin probe wear will be controlled to a sensitivity of +/- 15% of the initial voltage amplitude response. If the probe is found to be out of tolerance by X%, then all tubes that had indications within X% of the repair limit (3.0 volt for hot leg indications and 1.0 volt for cold leg indications) that were inspected since the last acceptable probe wear check shall be reinspected with a new, calibrated bobbin probe. As an example, if a probe was found to deviate from the initial voltage response by 17%, then all tubes with indications within 2% of the repair limit, inspected since the last probe wear check shall be reinspected with a new calibrated bobbin probe. This position was previously submitted to the Staff in the September 15, 1995, letter from H. Pontious to the Office of Nuclear Reactor Regulation.

- In addition to inspecting all intersections with dents greater than 5.0 volts by RPC, a 20% sample of dented intersections between 2.5-5.0 volts will be inspected by RPC. If PWSCC or circumferential cracking is detected, 100% of the dented support plates between 2.5-5.0 volts will be inspected by RPC.

- All hot leg intersections with indications greater than 3.0 volts will be RPC inspected.

- A 20% sample of hot leg TSP indications that are greater than 1.0 and less than or equal to 3.0 volts will be RPC inspected.

- In addition to the required information to be provided following each restart (GL 95-05 Section 6.b), ComEd will supply the following information:

    - Separate hot and cold leg tabulations will be provided for 1.0 and 3.0 volt IPC.
    - The complete results of the Steam Generator Structural Inspection performed to support 3.0 volt IPC.

- GL95-05 allows for an alternate plugging criteria, that can be applied for more than one cycle. ComEd's proposed 3 volt interim plugging criteria is being requested for Braidwood cycle 6 and through Byron cycle 8.

Additional inspection and reporting requirements beyond those specified in GL 95-05, were deemed necessary to support ComEd's request for a 3.0 volt IPC. These requirements are listed below:

- The presence o of the tube support plates will be verified through review of the bobbin coil data. Prompt NRC notification will be made should any plate signals be found missing.

- The data analysts will monitor for corrosion induced denting at tube support plates. Prompt NRC notification will be made should corrosion induced denting greater than 5.0 volts be found.

- If a hot leg intersection cannot pass a 0.610 inch diameter probe due to a dented support plate, then at that intersection IPC will not be applied. Adjacent intersections shall be repaired to the voltage-based repair criteria that applies to the cold leg. If a 0.610 inch diameter probe fails to pass through a tube adjacent to an expanded tube, then the NRC shall be notified.

- Enhanced eddy current inspections will be performed in tubes that are in the area of the three anti-rotation devices in each SG, in order to verify the integrity of the tube support plates in these regions.

- Visual and enhanced eddy current inspections will be performed in a sample of tubes adjacent to the patch plate at the top tube support plate in the 1A steam generator at Braidwood Station.

- Tube intersections that have been expanded to lock the tube support plates, will be inspected by an NDE technique that is capable of detecting circumferential and axial oriented indications in sleeved tubes.

To provide clarification on ComEd's method of calculating Probability of Detection (POD), the POD value stated in GL 95-05 (POD=0.6) will be used for all voltage ranges.

ComEd will be measuring voltages per IPC and GL 95-05 guidelines during the Braidwood Unit 1 and Byron Unit 1 inspections. This includes use of calibration standards cross calibrated to the reference laboratory standard.

Scope of TSP Eddy Current Inspection During Byron Refueling Outage

During the Byron Unit 1 refueling outage (Spring '96) the following eddy current inspections will be performed to assure TSP integrity.

- Verify the presence of eddy current signals for all hot leg TSP intersections.

- Eddy current of 50 TSP intersections in the area of the anti-rotation devices (3 per SG) will be inspected in each SG. For these tubes, the data will be collected full length. All data obtained on the hot leg TSP intersections, as part of this inspection, will be collected using techniques and analysis guidelines developed through the EPRI program.

Leak and Burst Methodology Clarification

The following discussion clarifies how the indications will be grouped for the application of the leak and burst methodologies.

Cold leg side indications:
- Those indications which will be treated in accordance with the free span methodology outlined in Generic Letter 95-05 and meet the 1 volt criteria.
- Those indications at wedge locations, in which an interim plugging criteria will not be applied.

Hot leg side indications fall into 3 categories:
- Indications which meet the requirement for the 3 volt criteria,
- Indications which do not meet the 3 volt criteria (limited to those tubes adjacent to tubes with significant corrosion induced denting (i.e. failed to pass a .610 probe). These indications will be treated in accordance with the free span methodology outlined in the Generic Letter and a 1 volt criteria will be applied, and
- Indications at wedge location, in which an interim plugging criteria will not be applied.

All RPC confirmed indications in the wedge locations will be repaired. Unconfirmed wedge location indications are added to the leakage calculation.

The indications will then be placed into the following 2 groups for the calculation of the burst and leak rates:

Group 1. Cold leg ODSCC TSP indications will be added to the hot leg indications in which the 1 volt criteria applies, and wedge locations on the cold leg side that are not required to be repaired.

Group 2. Hot leg indications in which the 3 volt criteria is applied will be added to the wedge location indications from the hot leg side that are not required to be repaired.

The leakage calculation will then be performed for each of these 2 groups. In Group 2 , the leakage calculation will include contributions from IRBs. The leakage from Group 1 is then added to Group 2 and compared to leak rate acceptance criteria. Burst will be calculated for Group 1 only. For Group 2 burst has been determined to be negligible; therefore, is not calculated.

<u>Growth Rate Methodology</u>

The following provides additional clarification on the methodology that will be used for the cold leg indications (Group 1) for which the 1 volt criteria applies. The growth rate methodology to be employed is a function of the number of cold leg indications as follows:

a) >200 cold leg indications
In this case, there are a sufficient number of cold leg indications to develop a cold leg growth rate distribution per GL 95-05 guidance. Separate growth rates would then be obtained for the hot and cold leg indications.

b) <200 cold leg indications
In this case, there is not a sufficient number of cold leg indications to develop a separate cold leg growth rate; therefore, the growth rate will be based upon the hot and cold leg indications. Prior Braidwood-1 and Byron-1 IPC analyses have shown that there is not a significant dependence of growth on TSP elevation. Therefore, the growth rate for all 1 volt indications will be applied to both hot and cold leg 1 volt indications.

Growth rates for the indications with 3.0 Volt IPC will be determined from the Group 2 database or all indications if no dependence on TSP elevation is again demonstrated for the growth data.

Leak Rate Methodology

The uncertainty analyses included in the Monte Carlo leakrate methodology are the same as those approved by the Staff in the 1994 Byron and Braidwood SERs, dated August 18, 1994 and October 24, 1994, respectively.

TSP Constraint Burst Test Data

The constrained axial burst data points are not included in the correlation because they are non-representative of circumferential burst. None of these specimens showed evidence of circumferential rupture at the time axial burst occurred. The residual cross sectional area (RCS) was calculated for these specimens as the ratio of the axial force at the burst pressure corrected for high temperature lower tolerance limit (LTL) material properties to the axial load capability of the tube nominal cross section at high temperature ultimate strength. The RCS was not determined by metallography for these specimens. Thus, these data represent a condition above which circumferential burst would have to occur and they represent a lower bound to the axial tensile tearing burst. Therefore, these data are inappropriate for inclusion in the correlation because they represent an entirely different failure mechanism.

Plant E-4 Residual Cross Sectional Area

The response to RAI 41e, transmitted to the NRC on 7/21/95, noted that the residual cross section of the Plant E-4 tubes is based on the following:

- For tubes identified in Table 41-1 as "Residual CSA Calculated from Force Data" in the "Comments" column, the RCS was determined based on the pull force for rupture and the measured tensile properties (i.e., rupture force divided by the ultimate tensile strength times the undegraded cross section).

- For tubes identified in Table 41-1 as "Residual CSA from Metallurgical Exam" in the "Comments" column, the RCS was determined during destructive examination by measuring the undegraded fraction of the tube cross section. It is known that metallographic examination was performed for these specimens; however, it is not known at this time what, if any, specific assumptions were made in determining the RCS from the metallographic data.

Clarification of Response to Question 41f (effects of lateral restraints)

The data used in the response to 41f are either axial tensile tearing data or are obtained from residual undegraded tube areas obtained from metallography measurements. The tensile rupture force is independent of lateral restraint.

Only pulled tubes with significant cellular corrosion are included in the residual tube cross section correlation of Figure 41-1. Tubes without cellular corrosion would have tensile rupture forces much higher than the data included in the correlation. The data shown on Figure 41-1 with upward pointing arrows are based on axial burst pressures for indications burst within the TSP as discussed above. These indications, up to about 40 volts, did not rupture in a circumferential mode which is as expected for cellular corrosion.

Lateral restraint for free span burst testing refers to the lateral (horizontal) restraint against bending provided by the TSPs (or tubesheet) above and below the crack location. The crack location is freespan and typically a few inches above the lateral restraint. Lateral restraint is universally (domestic and European tests) included in burst tests for circumferential cracks and is required by EPRI burst test guidelines for circumferential cracks. Westinghouse includes lateral restraint in burst tests of known cellular indications to assure that SG conditions are reflected in the burst results. The effects of lateral restraint are not significantly dependent on the TSP gap size simulated in the burst tests and the effects would be similar if the tube were permitted to contact an adjacent tube rather than a TSP. This has been demonstrated by burst tests of circumferential cracks with lateral restraint gaps up to at least 0.4" and the resulting burst pressures found to be independent of the lateral gap. Thus, lateral restraint is always present for SG tubes. Burst tests of circumferential indications without lateral restraint would be meaningless for SG applications.

Cellular corrosion has oblique crack angles with variable depth cracks. This type of crack ruptures by an axial burst or tensile loading for TSP constrained cracks rather than the bending instability that can occur for a circumferential throughwall crack. This has been demonstrated by the free span burst test results in the EPRI ODSCC database that includes cellular indications up to 22 volts for 3/4" tubing. All indications burst in a axial mode. It is not known whether or not the European data in this database included lateral restraint in the burst tests but this is not important since lateral restraint is always present as discussed above.

In summary, axial tensile rupture is the appropriate failure mode for cellular indications constrained by the TSP. The cellular indications would rupture by tensile loading rather than by a bending instability as shown by free span burst testing of cellular indications. Lateral restraint in SGs is provided by the TSPs or adjacent tubes if it is postulated that a section of the TSP might be missing.

WCAP 14273 Figure 41-1 Temperature Reduction and LTL

The temperature correction was made by multiplying the lower bound data fit by the ratio of flow stress at temperature to the flow stress at room temperature. Since the RCS was derived, in part, from room temperature tensile tests, the application of this ratio is appropriate to predict the high temperature results. The more conservative of the ratios for 3/4" diameter and 7/8" diameter tubing material properties was used in all cases. The required RCS at temperature was determined based on the LTL material properties for the 3 times normal operating pressure loads. Thus, Figure 41-1 is an appropriate and conservative representation of minimum section capability compared to maximum section requirements, at a consistent temperature.

WCAP 14273 Figure 41-1, Clarification of 5% Adder

The 5% adder is applied for the EPRI library IGA specimens by adding a constant 5% depth to the measured TW depth (shown on Table 41-1 in the "%TW" column). The resulting increased TW depth values are then used to calculate the RCS.

Clarification of Voltages used in WCAP 14273 Figure 41-1

The voltages obtained for the pulled tubes in Table 41-1 are based on calibration to the 20% ASME holes per IPC and GL 95-05 guidelines and include calibration standards cross calibrated to the reference laboratory standard. These data are used in the correlation of Figure 41-1. ComEd will be measuring voltages per IPC and GL 95-05 guidelines during the Braidwood Unit 1 and Byron Unit 1 inspections.

The IGA specimens of Table 41-1, which are not used in the correlation and are provided for relative information, are not entirely consistent with the IPC voltage normalization. These specimens include adjusted differential voltages and absolute voltages as described in Section 3.3 and Figure 3-9 of EPRI Report NP-7480-L, Volume 1, Revision 1.

90 Day Report Confirmatory Calculations

The information to be provided in the 90 day report will be consistent with that requested in Section 6.b, items b and c, of GL 95-05. This information will be provided for the hot leg indications meeting the requirement for application of the 3 volt repair limit and separate tabulations provided for cold/hot leg indications to which a 1 volt repair limit is applied, if such indications are found in the inspection.

Tie Rod Shear

As discussed in the response to the prior teleconference question on this issue, the lateral deflections of the TSPs are limited under accident conditions to approximately 0.2 inch by diametral gaps that may exist between the plates, wrapper and shell including pressurization and thermal expansion effects and by the in-plane TSP support system. This TSP displacement acts to deflect the tie rods laterally over the 29 to 42 inch spacing between hot leg plates. The resulting modest bending stress in the tie rods would not shear a tie rod.

Circumferential Burst Probabilities

The circumferential burst probabilities discussed in RAI response 54 part 7, were calculated using the deterministic estimation described in Section 5.2.2 of WCAP-14277. This method includes the effects of uncertainties in determining the regression coefficients. As discussed in the prior question response and Section 6.3 of the WCAP, this deterministic method tends to overestimate the burst probability compared to Monte Carlo simulations. At a burst probability magnitude of about 10^{-6}, as discussed in the question response, the deterministic methods tend to be about a decade higher than Monte Carlo simulations (See, for example, Figure 6-3 of WCAP-14046, Revision 2).

ODSCC Growth Rates for Braidwood Unit 1 and Byron Unit 1

Table 1 contains the cycle lengths in Effective Full Power Years (EFPY) and ODSCC growth rates for Braidwood Unit 1 and Byron Unit 1.

TABLE 1

BYRON/BRAIDWOOD UNIT 1
CYCLE LENGTHS AND GROWTH RATES

	Cycle	Outage	Cummulative EFPY	Cycle Length (EFPY)	Maximum Growth (Volts/EFPY)	Average Growth (Volts/EFPY)	Comment
Byron Unit 1	Cycle 5	B1R05	5.671	1.127	2.13	0.28	
	Cycle 6	B1R06	6.949	1.278	7.72	0.25	
	Cycle 7A	B1P02	7.816 est.	0.867 est.	*	*	10/20/95 Outage Start
	Cycle 7B	B1R07	8.134 est.	0.318est.	*	*	4/96 Outage Start
Braidwood Unit 1	Cycle 4	A1R04	4.302	1.147	8.51	0.23	
	Cycle 5A	A1M05	5.016	0.714	5.77	0.4	
	Cycle 5B	A1R05	5.522	0.506	*	*	9/29/95 Outage Start
	Cycle 6	A1R06	6.732 est.	1.21 est.	*	*	3/97 Outage Start

*FUTURE INSPECTION - DATA NOT AVAILABLE