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February 13, 1995

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

Subject: Application for Amendment to Facility Operating Licenses:

Byron Nuclear Power Station, Units 1 and 2
NPF-37/66; NRC Docket Nos. 50-454/455

Braidwood Nuclear Power Station, Units 1 and 2
NPF-72/77; NRC Docket Nos. 50-456/457

"Steam Generators"

References:

1) D. Saccomando letter to Nuclear Regulatory Commission dated February 6, 1995, transmitting Final WCAP and "Probability of Detection by Bobbin Inspection" Reports

2) D. Saccomando letter to Nuclear Regulatory Commission dated January 28, 1995, transmitting Technical Report Regarding the Application for Increase in Interim Plugging Criteria for Byron and Braidwood Unit 1

Pursuant to 10 CFR 50.90, Commonwealth Edison Company (ComEd) proposes to amend Appendix A, Technical Specifications of Facility Operating Licenses NPF-37, NPF-66, NPF-72 and NPF-77. The proposed amendment request addresses Technical Specification changes necessary to increase the Interim Plugging Criteria (IPC) value for Braidwood and Byron Station Unit 1 Steam Generators. Please note that the proposed Technical Specification amendment is applicable to Byron and Braidwood Unit 1 only, but because common Technical Specification pages are used for both units, this request is being docketed for Byron Units 1 and 2 and Braidwood Units 1 and 2.

Information contained in this amendment request justifies an increase in the IPC for the hot leg tube intersections with outside diameter stress corrosion cracking (ODSCC) from 1.0 volt to 3.0 volts. While the current 1.0 volt IPC criteria is partially based on a structural limit derived from freespan tube burst conditions, the 3.0 volt IPC criteria is based on the

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constraining effects of the tube support plates (TSPs) to reduce burst probability to negligible levels. ComEd proposes to accomplish this by limiting the TSP motion during postulated steam line break events. Selected hot leg tubes will be hydraulically expanded to serve as anchors to limit TSP motion during a postulated steam line break event. With TSP motion limited, the length of a crack confined within the TSP that would be subjected to freespan conditions due to TSP movement would be greatly reduced, thus reducing tube burst probabilities during accident conditions. Additionally, ComEd is proposing an alternate probability of detection (POD) in accordance with the Draft Generic Letter 94-xx.

Please note that the technical bases for this proposed amendment request, WCAP-14273, "Technical Support for Alternate Plugging Criteria with Tube Expansion at Tube Support Plate Intersections for Braidwood 1 and Byron 1 Model D4 Steam Generators," and EPRI Project 6424/RP-3580, "Probability of Detection by Bobbin Inspection," have been previously transmitted in References 1 and 2. Attached is WCAP-14274, the non-proprietary version of WCAP-14273.

The amendment package consists of the following:

Attachment A:	Description and Safety Analysis of Proposed Changes to Appendix A
Attachment B:	Byron/Braidwood Unit 1 Steam Generator Interim Plugging Criteria Methodology
Attachment C-1:	Proposed Changes to the Technical Specification Pages for Braidwood Station
Attachment C-2:	Proposed Changes to the Technical Specification Pages for Byron Station
Attachment D:	Evaluation of Significant Hazards Consideration
Attachment E:	Environmental Assessment
Attachment F:	WCAP-14274 "Technical Support for Alternate Plugging Criteria with Tube Expansion at Tube Support Plate Intersections for Braidwood 1 and Byron 1 Model D4 Steam Generators" (Non-Proprietary)

WCAP-14273 contains information justifying application of IPC to the flow distribution baffles. Byron and Braidwood Stations are not requesting application of IPC to these baffles in this proposed amendment.

On February 2, 1995, ComEd transmitted a proposed Technical Specification amendment regarding the incorporation of the F* criteria for Byron and Braidwood steam generator tubes. The proposed F* amendment and this IPC amendment affect the same Technical Specification pages. Depending on the order of issuance of these amendments, ComEd and the Staff may need additional conversation regarding the numbering of the sections of the pages.

This amendment request is considered a cost beneficial licensing action. Application of a 3.0 volt IPC would reduce the number of tubes needing plugging or repair during Braidwood's refueling outage and Byron's mid-cycle outage. The projected dollar savings is between $3.4 and $7.1 million for Byron and between $2.3 and 6.4 million for Braidwood, depending upon the repair strategy selected. This dollar savings is based only upon repair costs and does not include additional costs associated with plant output derating, extension of outage time and person-rem. ComEd requests approval of this proposed amendment by July 30, 1995. Approval by this date is requested in order to ensure that all necessary repair equipment is mobilized prior to the steam generator tube inspections.

To the best of my knowledge and belief, the statements contained in this document are true and correct. In some respects these statements are not based on my personal knowledge, but on information furnished by other ComEd employees, contractor employees, and/or consultants. Such information has been reviewed in accordance with company practice, and I believe it to be reliable.

Please address any further comments or questions regarding this mater to this office.

OFFICIAL SEAL
MARY JO YACK
NOTARY PUBLIC STATE OF ILLINOIS
MY COMMISSION EXPIRES 11/29/97

Sincerely,

Denise M. Saccomando
Nuclear Licensing Administrator

Mary Jo Yack 2/13/95

Attachments

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ATTACHMENT A

DESCRIPTION AND SAFETY ANALYSIS OF
PROPOSED CHANGES TO APPENDIX A
TECHNICAL SPECIFICATIONS OF
FACILITY OPERATING LICENSES
NPF-37, NPF-66, NPF-72, AND NPF-77

A. DESCRIPTION OF THE PROPOSED CHANGE

Commonwealth Edison (ComEd) proposes to amend Byron and Braidwood Technical Specification (TS) 3.4.5, "Steam Generators," the bases for TS 3.4.5, and Braidwood TS 3.4.8, "Specific Activity".

The changes proposed to TS 3.4.5 will increase the bobbin coil probe, voltage based, Steam Generator (SG) Tube Support Plate (TSP) Interim Plugging Criteria (IPC) limit for Outside Diameter Stress Corrosion Cracking (ODSCC)indications at the hot leg TSP intersections. These changes will apply to Braidwood Unit 1, Cycle 6, and Byron Unit 1, for the remainder of Cycle 7.

The footnote to Braidwood TS 3.4.8.a concerning Unit 1 Cycle 5 Reactor Coolant System dose equivalent Iodine-131 (I-131) concentration will be deleted.

For Braidwood, additional changes are proposed to make the Braidwood TS more consistent with Draft Generic Letter 94-XX, "Voltage Based Repair Criteria for the Repair of Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking" (Draft Generic Letter), dated August 12, 1994. These changes are not needed for Byron since Draft Generic Letter guidance has already been incorporated in the Byron TS.

Specific changes are discussed in detail in Section E of this attachment. Affected TS pages showing the actual changes are included in Attachments C-1 and C-2.

B. DESCRIPTION OF THE CURRENT REQUIREMENT

For both Byron and Braidwood, the Technical Specification Surveillance Requirements (TSSR) for TS 3.4.5 require, in part, that axial flaws indicative of ODSCC confined within the thickness of the TSP may remain inservice provided that the following requirements are met:

- If the flaw-like bobbin coil signal amplitude is less than or equal to 1.0 volt, or

- If the flaw-like bobbin coil signal amplitude is greater than 1.0 volt but less than or equal to 2.7 volts and the signal is not confirmed with Rotating Pancake Coil (RPC) examination, and

- The flaw-like signal is not in a location that is susceptible to collapse or deformation during a postulated Loss Of Coolant Accident (LOCA) + Safe Shutdown Earthquake (SSE) event.

- Tubes containing flaw-like bobbin coil signal amplitudes greater than 2.7 volts must be plugged or repaired, regardless of RPC confirmation.

For Byron only, if as a result of leakage due to a mechanism other than ODSCC at the TSP intersection, or some other cause, an unscheduled inspection is performed, bobbin coil voltage limits are determined in accordance with an equation that takes into account the time remaining in the cycle, the structural limit voltage, and the bobbin voltage at the Beginning Of Cycle (BOC).

For Braidwood only, the TSSRs discuss eddy current inspection guidelines and contain a requirement that the projected End of Cycle (EOC) distribution of crack indications must result in a total primary to secondary leakage of less than 9.1 gallons per minute (gpm). This leakage includes operational and accident leakage.

For Braidwood only, TS 3.4.8.a references a footnote which requires that for Unit 1 Cycle 5, RCS dose equivalent I-131 will be limited to 0.35 microCuries per gram (μci/gm).

C. BASES FOR THE CURRENT REQUIREMENT

The surveillance requirements for inspection of SG tubes ensure that the structural integrity of this portion of the Reactor Coolant System (RCS) will be maintained. For tubes left in service due to application of IPC, analyses are performed to demonstrate acceptable probability of tube burst, and that Main Steam Line Break (MSLB) leakage is within site specific limits. Inservice inspection of SG tubing is essential in order to maintain surveillance of the conditions of the tubes in the event that there is evidence of mechanical damage or progressive degradation due to design, manufacturing errors, or inservice conditions that lead to corrosion. Inservice inspection of SG tubing also provides a means of characterizing the nature and cause of any tube degradation so that corrective measures can be taken.

For Byron only, the unplanned inspection voltage equation takes into account indication growth that occurs during the cycle. It conservatively establishes a voltage limit for each previously identified indication above which the tube must be plugged.

The inspection guidelines identified in the Braidwood Specifications ensure that the maximum number of indications are detected and ensure reliable, consistent acquisition and analysis of data.

With respect to Braidwood TS 3.4.8, the limitations on the specific activity of the reactor coolant ensure that the resulting 2-hour doses at the Site Boundary will not exceed an appropriately small fraction of Title 10 Code of Federal Regulations Part 100 (10 CFR 100) dose guideline values following a SG tube rupture accident in conjunction with an assumed steady state reactor-to-secondary SG leakage rate of 1 gpm.

The current Braidwood Unit 1 Cycle 5 limit of 0.35 µci/gm referenced in the footnote to TS 3.4.8.a is based on ensuring the resulting 2 hour doses at the Site Boundary will not exceed an appropriately small fraction of 10 CFR 100 dose guideline values following a SG tube rupture accident in conjunction with the predicted MSLB leakage calculated as part of Braidwood Station's April 30, 1994, D. Saccomando to W. Russell letter.

For Braidwood, the leakage limits specified in the TS ensure that current offsite dose limits are maintained.

D. NEED FOR REVISION OF THE REQUIREMENT

At both Byron and Braidwood, Unit 1 has four Westinghouse Model D-4 SGs and Unit 2 has four Westinghouse Model D-5 SGs. These models differ significantly in tube and TSP materials and design. The D-4 SGs have 0.75 inch thick carbon steel TSPs with drilled hole tube supports. The D-5 SGs have 1.125 inch thick stainless steel TSPs with Quatrefoil tube supports. The D-4 SG tubes are mill annealed Inconel 600 which were hard rolled into the tubesheet during initial assembly. Subsequently, the D-4 tubes were shot peened in the tubesheet area and stress relieved in the U-bend area. The D-5 tubes are heat treated Inconel 600 which were hydraulically expanded into the tube sheet during initial assembly. Over the past several refueling outages, the number of Unit 1 SG tubes plugged per outage has been increasing. Unit 1 has had more defective tubes than Unit 2 primarily due to the design differences between the D-4 and D-5 SGs as described above.

Current repair projections for the Braidwood Unit 1 Cycle 5 Refueling Outage indicate that, using the current 1.0 volt IPC, as many as 975 SG tubes may need to be plugged or repaired by sleeving due to ODSCC. If all these tubes were plugged, this would result in a total of 2686 plugged tubes in the Braidwood Unit 1 SGs based on a current projection of 850 tubes being plugged in Braidwood's upcoming Mid-Cycle outage. Projections for Byron Station's Unit 1 Mid-Cycle outage indicate that, using the current 1.0 volt IPC, as many as 1100 SG tubes may need to be plugged or repaired by sleeving due to ODSCC. If all these tubes were plugged, this would result in a total of 2852 plugged tubes in the Byron Unit 1 SGs. Plugging levels this high exceed currently analyzed maximum levels and could result in significantly reduced RCS flow rates, plant output deratings, excessive outage repair costs, and severely restricted SG life. Sleeving a sufficient number of tubes to reduce plugging to acceptable levels would result in a significant increase in outage cost, outage length, and radiation exposure.

Application of a 3.0 volt IPC for ODSCC indications at the hot leg TSPs would reduce the projected maximum number of tubes needing plugging or repair due to ODSCC to 80 for Byron, 62 for Braidwood. This represents a "savings" of 1020 tubes at Byron and 913 tubes at Braidwood that would have had to be plugged or repaired using the previous IPC criteria. This represents a dollar savings of $3.4 Million at Byron and $2.3 Million at Braidwood assuming all these tubes were plugged. However, since plugging levels this high exceed currently analyzed maximums, sleeving these tubes could add as much as $7.1 Million at Byron and $6.4 Million at Braidwood in outage inspection and repair costs.

Braidwood's original IPC amendment request neglected to include the allowable 0.1 gpm operational primary-to-secondary leakage from the three intact SGs in the allowable leakage limit. Therefore, for Braidwood only, the allowable leakage limit of 9.1 gpm is being raised to 9.4 gpm. This is consistent with WCAP 14046, "Braidwood Unit 1 Technical Support for Cycle 5 Steam Generator Interim Plugging Criteria."

For Braidwood only, this amendment request also proposes to delete the footnote to TS 3.4.8.a which limits Unit 1 Cycle 5 RCS dose equivalent I-131 to 0.35 µci/gm. This limit applies to Unit 1 Cycle 5 only, and analyses described in WCAP 14046, and WCAP 14273, "Technical Support for Alternative Plugging Criteria with Tube Expansion at Tube Support Plate Intersections for Braidwood-1 and Byron-1 Model D4 Steam Generators," have shown that the resulting 2 hour doses at the Braidwood site boundary will not exceed an appropriately small fraction of 10 CFR 100 dose guideline values following a SG tube rupture accident in conjunction with the predicted MSLB leakage calculated in accordance with this submittal. Thus the 0.35 µci/gm limit is no longer needed.

Bases changes are being made to both Braidwood and Byron TS in order to accurately reflect the changes made to the individual specifications.

Finally, additional changes are being made to make Braidwood TS consistent with the Draft Generic Letter. These changes are not needed for Byron since Draft Generic Letter guidance has already been incorporated in the Byron TS.

E. DESCRIPTION OF THE REVISED REQUIREMENT

For both Byron Unit 1 and Braidwood Unit 1, ComEd is requesting an increase in the IPC voltage from 1.0 volt to 3.0 volts for ODSCC indications at hot leg TSP intersections. The RPC confirmation limit for ODSCC at hot leg TSP intersections will increase from 2.7 volts to 10.0 volts.

For Byron, the structural limit voltage used in the equation for determining voltage acceptance criteria for an unplanned outage is increased from 4.5 volts to 20 volts for hot leg intersections, and 4.75 volts for cold leg intersections. For Braidwood, the equation for mid-cycle unplanned outage voltage acceptance criteria is added to the specification for conformance with the Draft Generic Letter.

For Braidwood, the allowable SG MSLB leakage limit is increased from 9.1 gpm to 9.4 gpm to correct an oversight in the original IPC submittal.

Braidwood's probability of tube burst limit is decreased from $2.5x10^{-2}$ to $1.0x10^{-2}$ consistent with the Draft Generic Letter. The footnote to Braidwood TS 3.4.8.a which limits Unit 1 Cycle 5 RCS dose equivalent I-131 to 0.35 µci/gm is being deleted. Other changes are being made to Braidwood TS to make them more consistent with the requirements of the Draft Generic Letter.

The specific TS modifications necessary to accomplish the changes discussed above are described below.

TSSR 4.4.5.2,Steam Generator Tube Sample Selection and Inspection

Changes to this section apply to Braidwood only. These items have previously been incorporated in the Byron TS. These changes to the surveillance requirements will specify that all tubes remaining in service due to application of IPC be included among the tubes to be inspected as part of, or in addition to, the sample selection made in accordance with the criteria of Table 4.4-2 of TSSR 4.4.5.2. The surveillance requirements will specify the minimum tube length inspection scope necessary to implement IPC. These changes are consistent with the direction given in the Draft Ceneric Letter.

Item 5 will be added to TSSR 4.4.5.2.b. This item reads as follows:

"5) For Unit 1, tubes left in service as a result of application of the tube support plate plugging criteria shall be inspected by bobbin coil probe during all future outages."

TSSR 4.4.5.2.d will be revised to read as follows:

"d. For Unit 1 Cycle 6, implementation of the tube support plate interim plugging criteria limit requires a 100% bobbin coil probe inspection for all hot leg tube support plate intersections and all cold leg intersections down to the lowest cold leg tube support plate with outer diameter stress corrosion cracking (ODSCC) indications. The determination of tube support plate intersections having ODSCC indications shall be based on the performance of at least a 20% random sampling of tubes inspected over their full length."

TSSR 4.4.5.4, Acceptance Criteria

For Braidwood only, TSSR 4.4.5.4.a.6 will be changed to be consistent with the guidance provided in the Draft Generic Letter, and to reflect Cycle 6 applicability. This change is not required for Byron since the Draft Generic Letter has been previously incorporated and the Cycle for applicability does not change with this submittal. The modified section of TSSR 4.4.5.4.a.6 will read:

"...For Unit 1 Cycle 6, this definition does not apply to tube support plate intersections for which the voltage based plugging criteria are being applied. Refer to 4.4.5.4.a.11 for the repair limit applicable to these intersections;"

For both Byron and Braidwood, TSSR 4.4.5.4.a.11 will be replaced with the plant specific Insert D identified in Attachments C-1 and C-2. Insert D defines the repair limit requirements for IPC implementation and incorporates the 3.0 volt hot leg IPC limits and the cold leg IPC limits. The guidance of the Draft Generic Letter is also incorporated for Braidwood. This guidance was previously incorporated for Byron. For Braidwood, Insert D reads as follows:

"11) For Unit 1 Cycle 6, the Tube Support Plate Interim Plugging Criteria Limit is used for the disposition of a steam generator tube for continued service that is experiencing outer diameter stress corrosion cracking confined within the thickness of the tube support plates. At tube support plate intersections, the repair limit is based on maintaining steam generator tube serviceability as described below:

a) Degradation attributed to outside diameter stress corrosion cracking within the bounds of the hot leg tube support plate with bobbin voltage less than or equal to 3.0 volts will be allowed to remain in service.

b) Degradation attributed to outside diameter stress corrosion cracking within the bounds of the cold leg tube support plate with bobbin voltage less than or equal to 1.0 volt will be allowed to remain in service.

c) Degradation attributed to outside diameter stress corrosion cracking within the bounds of the hot leg tube support plate with bobbin voltage greater than 3.0 volts will be repaired or plugged except as noted in 4.4.5.4.a.11)e) below.

d) Degradation attributed to outside diameter stress corrosion cracking within the bounds of the cold leg tube support plate, with bobbin voltage greater than 1.0 volt will be repaired or plugged except as noted in 4.4.5.4.a.11)f) below.

e) Indications of potential degradation attributed to outside diameter stress corrosion cracking within the bounds of the hot leg tube support plate with a bobbin voltage greater than 3.0 volts but less than or equal to 10.0 volts may remain in service if a rotating pancake coil inspection does not detect degradation. Indications of outside diameter stress corrosion cracking degradation with bobbin voltage greater than 10.0 volts at the hot leg tube support plates will be plugged or repaired.

f) Indications of potential degradation attributed to outside diameter stress corrosion cracking within the bounds of the cold leg tube support plate with a bobbin voltage greater than 1.0 volt but less than or equal to 2.7 volts may remain in service if a rotating pancake coil inspection does not detect degradation. Indications of outside diameter stress corrosion cracking degradation with bobbin voltage greater than 2.7 volts at the cold leg tube support plates will be plugged or repaired.

g) Certain intersections as identified in WCAP-14046, Section 4.7, will be excluded from application of the voltage-based repair criteria as it is determined that these intersections may collapse or deform following a postulated LOCA+SSE event.

h) If, as a result of leakage due to a mechanism other than ODSCC at the tube support plate intersection, or some other cause, an unscheduled mid-cycle inspection is performed, the following repair criteria apply instead of 4.4.5.4.11)e)for indications at the hot leg tube support plate intersections, or 4.4.5.4.11)f) for indications at the cold leg tube support plate intersections. If bobbin voltage is within expected limits, the indication can remain in service. The expected bobbin voltage limits are determined from the following equation:

$$V < \frac{\frac{\Delta t}{CL}(V_{SL} - V_{BOC}) + V_{BOC}}{1 + (0.2)(\frac{\Delta t}{CL})}$$

where:
V = measured voltage
V_{BOC}= voltage at BOC
Δt = time period of operation to unscheduled outage
CL = cycle length (full operating cycle length where operating cycle is the time between two scheduled steam generator inspections)
V_{SL} = 20 volts for the hot leg tube support plate intersections; 4.75 volts for the cold leg tube support plate intersections.

For Byron, Insert D reads as above with the exception that it is applicable to Cycle 7. This is reflected in the markup in Attachment C-2.

TSSR 4.4.5.5, Reports

For Braidwood only, TSSR 4.4.5.5.d will be replaced with Insert E. This change is consistent with the guidance on reports given in the Draft Generic Letter. This guidance was previously incorporated for Byron. Insert E reads as follows:

"d. For Unit 1 Cycle 6, implementation of the voltage-based repair criteria to tube support plate intersections, reports to the Staff shall be made as follows:

1) Notify the Staff prior to returning the steam generators to service should any of the following conditions arise:

a) If estimated leakage based on the actual measured end-of-cycle voltage distribution would have exceeded the leak limit (for postulated main steam line break utilizing licensing basis assumptions) during the previous operation cycle.

b) If circumferential crack-like indications are detected at the tube support plate intersections.

c) If indications are identified that extend beyond the confines of the tube support plate.

d) If the calculated conditional burst probability exceeds 1×10^{-2}, notify the NRC and provide an assessment of the safety significance of the occurrence.

2) The final results of the inspection and the tube integrity evaluation shall be reported to the Staff pursuant to Specification 6.9.2 within 90 days following restart."

TS 3.4.8

This change applies to Braidwood only. The footnote referenced in TS 3.4.8.a which limited Unit 1, Cycle 5 RCS dose equivalent I-131 to 0.35 µci/gm will be deleted.

BASES 3/4.4.5, Steam Generators

The discussion in the Bases section of TS dealing with the dispositioning of SG tubes experiencing ODSCC cracking within the thickness of the TSPs will be revised. For Braidwood, the revised discussion will correct the maximum primary-to-secondary leakage limit from 9.1 gpm to 9.4 gpm per WCAP-14046. This value was incorrectly specified as 9.1 gpm in the current Specification. Also for Braidwood, the bases will include a discussion on adjustment of the operating period to meet projected MSLB leakage limitations. For both Byron and Braidwood, the bases will be revised to include a discussion of the tube expansion process required for application of the 3.0 volt IPC for hot leg TSPs.

The revised discussion reads as follows for Braidwood:

"For Unit 1 Cycle 6, tubes experiencing outer diameter stress corrosion cracking within the thickness of the tube support plates will be dispositioned in accordance with Specification 4.4.5.4.a.11.

Application of the 3.0 volts hot leg Interim Plugging Criteria (IPC) requires that selected SG tubes be expanded at the Tube Support Plate (TSP) intersections in accordance with WCAP-14273, "Technical Support for Alternative Plugging Criteria with Tube Expansion at Tube Support Plate Intersections for Braidwood-1 and Byron-1 Model D4 Steam Generators." These expansions limit the motion of the TSP on a main steam line break, thus reducing the probability of burst for SG tubes left in service in accordance with IPC to negligible levels.

The operating period may be adjusted to less than the full operating cycle to meet the maximum site allowable primary-to-secondary leakage limit for End of Cycle Main Steam Line Break conditions. The leakage limit, 9.4 gpm, includes the accident leakage from a faulted steam generator and the operational leakage of the three remaining intact steam generators equal to the Specification 3.4.6.c leakage limit."

For Byron, the Bases discussion is as above with the exceptions for specifying applicability as Cycle 7 and the site specific leakage value of 12.8 gpm.

F. BASES FOR THE REVISED REQUIREMENT

The technical bases for the changes proposed in this amendment request are contained in the following documents:

- WCAP 14273, "Technical Support for Alternative Plugging Criteria with Tube Expansion at Tube Support Plate Intersections for Braidwood-1 and Byron-1 Model D4 Steam Generators," February 1995.

- WCAP 14046, "Braidwood Unit 1 Technical Support for Cycle 5 Steam Generator Interim Plugging Criteria," Revision 1, August 1994,

- Electric Power Research Institute (EPRI)Report NP-7480-L, "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates - Database for Alternate Repair Criteria, 3/4 Inch tubing," Volume 2, October 1993,

- Westinghouse Document SG-95-01-003, "Byron Unit 1 End-of-Cycle 6 Interim Plugging Criteria Report," January 17, 1995.

- WCAP 14277, "SLB Leak Rate and Tube Burst Probability Analysis Methods for ODSCC at TSP Intersections," January 1995

- NRC Draft Generic Letter, "Voltage-Based Repair Criteria for the Repair of Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," August 12, 1994.

- EPRI Project 6426/RP-3580, "Probability of Detection by Bobbin Inspection," February 6, 1995

In the D. Saccomando letter to the Office of Nuclear Reactor Regulation (NRR) dated November 23, 1994, Braidwood station presented a comprehensive plan that identifies the inspection scope and analysis methodologies that will be used in the upcoming Braidwood Unit 1 mid-cycle outage. This plan included a plant specific comparison of the IPC Draft Generic Letter requirements with the currently approved Braidwood IPC. As part of this comparison, a number of differences were identified that are included in this amendment proposal. These differences are identified in Section E of this document. These changes are primarily editorial in nature and provide clarification and conformance to the Draft Generic Letter.

In addition to updating Braidwood Station's TS for conformance with the Draft Generic Letter, this amendment request proposes to increase the IPC voltage repair limit for hot leg tube intersections with ODSCC from 1.0 volt to 3.0 volts for both Byron and Braidwood. While the 1.0 volt IPC criteria is based on a structural limit derived from freespan tube burst conditions, the 3.0 volt IPC criteria is based on the constraining effects of the TSP to reduce burst probability to negligible levels. Selected hot leg tubes will be hydraulically expanded to serve as anchors to limit tube support plate motion during a postulated steam line break event. With TSP motion limited, the length of a crack confined within the TSP that would be subjected to freespan conditions due to TSP movement would be greatly reduced, thus reducing tube burst probabilities during accident conditions.

Approach

The approach applied to developing the 3.0 volt IPC methodology for hot leg tube support plate intersections is based on developing the minimum requirements, establishing design objectives more limiting than the minimum requirements, and evaluating the overall performance based on supporting analyses for the tube expansion process. The general approach can be described as follows:

- Define acceptable TSP displacements to reduce the tube burst probability to negligible levels based on the conservative assumption that all hot leg TSP intersections have throughwall indications equal to the limited TSP displacement resulting from tube expansion.

- Identify the tubes and locations that require expansion to limit TSP movement during MSLB events to displacements that result in negligible tube burst probabilities.

- Identify additional tubes and locations for expansion to provide sufficient redundancy in the unlikely event that one or two expansions fail due to degradation.

- Define tube expansion functional requirements and process qualifications to ensure that design requirements are met.

- Calculate a tube structural voltage limit based on limited TSP displacement due to tube expansion.

- Develop the methodology for calculating MSLB leakage and tube burst probabilities that accounts for the effects of limited TSP displacement due to tube expansion, and uses a variable POD such that the results can be compared to appropriate limits.

- Maintain current leakage limits and operational measures to monitor, trend, and respond to SG tube leakage as specified in the original IPC submittal.

- Maintain current eddy current inspection guidelines to increase detectability and reduce voltage variability.

Attachment B provides a detailed description of the methodology used for evaluation of the increased IPC limit for hot leg intersections and a discussion of the operational measures in place at both Byron and Braidwood relative to IPC implementation.

Finally, Braidwood will be deleting the footnote referenced in Braidwood TS 3.4.8.a and raising the allowable MSLB leakage limit from 9.1 gpm to 9.4 gpm. Deleting the footnote referenced in TS 3.4.8.a returns the Braidwood Unit 1 RCS dose equivalent I-131 concentration to 1.0 µci/gm from 0.35 µci/gm. Analyses described in WCAP 14046 and WCAP 14273 show that the resulting 2 hour doses at the Braidwood site boundary will not exceed an appropriately small fraction of 10 CFR 100 dose guideline values following a SG tube rupture accident in conjunction with the predicted MSLB leakage calculated in accordance with this submittal. Thus the 0.35 µci/gm limit is no longer needed. Raising the Braidwood allowable MSLB leakage limit from 9.1 gpm to 9.4 gpm corrects an oversight in Braidwood's original IPC submittal. The original submittal neglected to include the 0.1 gpm operational leakage from the three intact SGs per TS 3.4.6.2.c.

G. IMPACT OF THE PROPOSED CHANGE

With the implementation of this license amendment request, the Braidwood and Byron Unit 1 SGs will continue to satisfy the requirements of RG 1.121. For the hot leg TSP intersections, the use of tube expansion and stabilization limits the tube/TSP relative displacements that occur during a postulated MSLB such that the tube burst margins for EOC-6 operation of Braidwood Unit 1, and EOC 7 operation at Byron Unit 1 are reduced to negligible levels.

For Braidwood, the increase in allowable leakage from 9.1 gpm to 9.4 gpm corrects an oversight in Braidwood's initial IPC amendment request and includes the allowable operational leakage in the three remaining unfaulted SGs during a MSLB event.

Deleting the footnote referenced in TS 3.4.8.a returns the Braidwood Unit 1 RCS dose equivalent I-131 concentration to 1.0 µci/gm from 0.35 µci/gm. Analyses described in WCAP 14046 and WCAP 14273 show that the resulting 2 hour doses at the Braidwood site boundary will not exceed an appropriately small fraction of 10 CFR 100 dose guideline values following a SG tube rupture accident in conjunction with the predicted MSLB leakage calculated in accordance with this submittal.

Implementation of this amendment request could result in as many as 1020 SG tubes at Byron, and 913 SG tubes at Braidwood remaining in service that would have otherwise been removed from service by plugging or repaired by sleeving due to ODSCC at the TSPs. This represents a dollar savings of $3.4 Million at Byron and $2.3 Million at Braidwood assuming all these tubes were plugged. However, since plugging levels this high exceed currently analyzed maximums, sleeving these tubes could add as much as $7.1 Million at Byron and $6.4 Million at Braidwood in outage inspection and repair costs. This will also minimize the RCS loop flow asymmetries and allow the unit to return to rated thermal power.

H. SCHEDULE REQUIREMENTS

ComEd requests that this amendment request be approved prior to July 30, 1995 to allow application of the provisions of this amendment request in Byron Station's Unit 1 Mid-Cycle Outage, and Braidwood Station's Unit 1 Refuel Outage.

ATTACHMENT B

BYRON/BRAIDWOOD UNIT 1 STEAM GENERATOR INTERIM PLUGGING CRITERIA METHODOLOGY

Introduction

This amendment request proposes to increase the Interim Plugging Criteria (IPC) voltage repair limit for hot leg tube intersections with Outside Diameter Stress Corrosion Cracking (ODSCC) from 1.0 volt to 3.0 volts for both the Byron and Braidwood Unit 1 steam generators (SG). While the 1.0 volt IPC criteria is based on a structural limit derived from freespan tube burst conditions, the 3.0 volt IPC criteria is based on the constraining effects of the Tube Support Plate (TSP) to reduce burst probability to negligible levels. Selected hot leg tubes will be hydraulically expanded to serve as anchors to limit tube support plate motion during transient conditions. These tubes essentially become additional stayrods that restrict potential displacements. With TSP motion limited, the length of a crack confined within the TSP that would be subjected to freespan conditions due to TSP movement would be greatly reduced, thus reducing tube burst probabilities during accident conditions.

The general approach for supporting a 3.0 volt IPC at the hot leg TSP intersections can be described as follows:

- Define acceptable TSP displacements to reduce the tube burst probability to negligible levels based on the conservative assumption that all hot leg TSP intersections have throughwall indications equal to the limited TSP displacement resulting from tube expansion.

- Identify the tubes and locations that require expansion to limit TSP movement during Main Steam Line Break (MSLB) events that result in negligible tube burst probabilities.

- Identify additional tubes and locations for expansion to provide sufficient redundancy in the unlikely event that one or more expansions fail due to degradation.

- Define tube expansion functional requirements and process qualifications to ensure that design requirements are met.

- Calculate a tube structural voltage limit based on limited TSP displacement due to tube expansion.

- Develop the methodology for calculating MSLB leakage and tube burst probabilities that accounts for the effects of limited TSP displacement due to tube expansion, such that the results can be compared to appropriate limits.

- Develop an alternate Probability of Detection (POD) function that is bobbin coil voltage amplitude dependant.

- Maintain current leakage limits and operational measures to monitor, trend, and respond to SG tube leakage as specified in the original IPC submittal.

- Maintain existing eddy current inspection guidelines to increase detectability and reduce voltage variability.

The cold leg IPC repair limit will remain at 1.0 volt as approved in the current Technical Specifications (TS). The structural voltage limit based on freespan considerations is increased from 4.54 volts to 4.75 volts, due to the inclusion of the latest Byron and Braidwood tube pull results into the industry database. The full Alternate Plugging Criteria (APC) repair limit or the limit at which a Rotating Pancake Coil (RPC) non-confirmed indication can remain in service remains at 2.7 volts, in accordance with the guidance provided in Draft Generic Letter 94-XX, "Voltage Based Repair Criteria for the Repair of Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking" (Draft Generic Letter), dated August 12, 1994.

Discussed below, is a summary of the analyses and methodologies used to support and apply a 3.0 volt IPC at the hot leg intersections and a 1.0 volt IPC at the cold leg intersections.

TSP Displacement and Tube Burst Considerations

During a postulated MSLB event, rapid depressurization of the secondary side results in fluid blowdown, water flashing, and hydraulic loading on the TSPs. This hydraulic loading can cause TSP deflections and relative tube to TSP displacements. For application of the Byron and Braidwood Unit 1 IPC, as proposed in this amendment, the relative tube to TSP displacements during postulated MSLB events are evaluated and limited through tube expansion to result in negligible tube burst probabilities.

Several modeling techniques are employed to determine hydraulic loading on the TSPs and to determine displacements. A thermal hydraulic model was developed to predict critical SG parameters during a postulated MSLB, such as mass flowrate, pressure drop, fluid temperature, steam quality and void fraction.

The model was run for several different plant operating conditions to determine the most conservative loads resulting from a MSLB. The hot standby condition with a MSLB at the SG nozzle yields the more limiting hydraulic loads and was used in evaluation for limiting tube displacements. A safety factor of 2 was applied to the hydraulic loads for additional conservatism.

A structural model was developed to determine relative tube to TSP motions under MSLB loads that were determined with the thermal hydraulic model discussed above. The structural model utilizes a general purpose finite element code that accounts for the physical SG structures and materials, as well as MSLB hydraulic loading. Locations of tube expansions that restrict TSP motion can also be evaluated with the model.

The analyses contained in these models also evaluated acoustic pressure waves caused by the steam line break, and found acoustic effects to have negligible impact on TSP hydraulic loads.

To support a 3.0 volt IPC the TSP motion is limited during MSLB events to displacements that result in negligible tube burst probabilities. The modeling techniques described above are used to determine relative tube to TSP motions. These techniques determine the length of a crack within a TSP that could be uncovered due to the relative tube to TSP displacement. From this freespan exposed crack length, a tube burst probability is derived from a correlation that relates crack length to tube burst pressure.

The evaluation conservatively assumes that every hot leg tube intersection (32,046 intersections) contains a through-wall crack length equal to the displacement and is located at the edge of the TSP. Alternatively, it is assumed that every hot leg tube intersection contains a through-wall crack length approximately equal to the thickness of a TSP. For all the postulated 32,046 through-wall cracked intersections a total tube burst probability of $1x10^{-5}$ was selected as the target for negligible burst probability. This is a factor of 1000 lower than the Draft Generic Letter limit of $1x10^{-2}$. The $1x10^{-5}$ tube burst probability corresponds to a maximum through-wall crack freespan length of 0.31" for the postulated 32,046 indications. Therefore, a maximum displacement of 0.31" is the tube expansion design criteria used for limiting TSP motion. However, a 0.1" maximum displacement was selected to be the functional design goal for tube expansion. This provides added conservatism and ability to perform in situ pressure testing of indications for increasing the leak rate database for constrained tubes. With a 0.1" displacement for all hot leg intersections, the total burst probability for through wall indications at all hot leg intersections is reduced from $1x10^{-5}$ to $1x10^{-10}$.

A number of tubes were selected for tube expansion to limit the displacement to less than 0.1". Additional tubes were selected to be expanded to serve as redundant or back-up tubes in the unlikely event that a tube expansion fails due to degradation. The redundant tubes ensure that a maximum displacement of 0.31" and a burst probability of $1x10^{-5}$ is achieved when one or more expansions fail. An additional two tubes are required to be expanded to limit a bending stress in the top support plate.

Tube Expansion

As previously discussed, tube expansion will be used on selected tubes to limit relative tube to TSP motion during postulated MSLB events to result in negligible tube burst probabilities. The tube expansion process will essentially convert the selected tubes into stayrods to restrict potential TSP displacements. This is accomplished by hydraulically expanding the tube into the TSP and also creating a bulge larger than the TSP drill hole above and below the TSP to lock the tube into the TSP to limit motion in both directions. The expanded tubes will be stabilized and removed from service.

The tube expansion process and stabilization is accomplished with a sleeve stabilizer. A sleeve is hydraulically expanded into the parent tube to create the necessary expansion and bulge for tube to TSP locking. The sleeve serves two purposes, 1) provides stabilization if the tube fails at the expansion, and 2) provides additional stiffness to the expanded joint. The sleeve stabilizer is designed to prevent damage to adjacent tubes in the unlikely event that the parent tube is severed at the expansion joint. The added stiffness of the expanded joint due to the sleeve provides additional resistance to TSP displacement. The expansion process is a qualified process to ensure that the expansion design functional requirements are met for each application. The expanded tubes will be inspected following the expansion process to ensure that the desired expansion parameters have been achieved.

Degradation of the parent tube expansion or sleeve is not an expected phenomena. Tube degradation is affected by temperature and stresses in the tube. The operating temperature of the expanded tube is greatly reduced since the tube is removed from service. The temperature of the expanded tube will be the temperature of the secondary side of the SG, which typically ranges from about 520° F to 544° F, as compared to an inservice tube that experiences temperatures of about 610° F. Laboratory tests have indicated that reducing the temperature from an inservice tube to that of a plugged tube results in a reduction in the stress corrosion cracking initiation by a factor of 16 for similarly stressed tubing.

Corrosion tests have been performed for varying expansion diameters up to and above those required for TSP locking. These tests have concluded that for the expansion process described the stress corrosion cracking potential is not expected to exceed that for hydraulic or hardroll tubesheet expansions. An inspection of three expanded tubes will be performed at a frequency of every three fuel cycles to ensure that degradation of the expansions is not occurring. To perform these inspections, each tube must be de-plugged, inspected, and re-plugged. If circumferential degradation is detected at an expansion, then the inspection will be expanded to other expansions in the SG based on the severity of the indications found in the base inspection.

Industry experience has shown that in severely dented SGs, tube support plates have been observed to be cracked. Evaluations were performed to assess this concern pertaining particularly to the application of tube expansion to support the 3.0 volt IPC. A finite element analysis was performed and established that the dent size necessary to cause a stress intensity that exceeds the yield strength of the TSP was a 65 mil diametral dent. Therefore, dents of a smaller size are not expected to produce stress levels that would be a cracking concern. Byron and Braidwood Unit 1 SGs have not experienced corrosion assisted denting at the TSP to date. To establish that denting does not produce a TSP cracking concern in the future at Byron and Braidwood, the bobbin coil probe will be used as a go-no-go gauge to assess dent sizes. The criteria used to ensure that dents are below the size necessary to cause excessive TSP stress levels is the passage of a 0.570" diameter bobbin probe through the tube. If the tube does not allow passage of a 0.570" probe due to a dent at a TSP, then a tube exclusion zone is to be established to prevent a 3.0 volt IPC from being applied to those areas that contain stressed TSPs.

Structural Voltage Limit and Leakage Considerations

The purpose of the TS repair limit is to ensure that tubes accepted for continued service will retain adequate structural and leakage integrity during normal, transient, and postulated accident conditions, consistent with General Design Criteria (GDC) 14, 15, 31, and 32 of Title 10 Code of Federal Regulations Part 50 (10 CFR 50), Appendix A. Structural integrity is defined as maintaining adequate margins against gross failure, rupture, and collapse of the SG tubing. Regulatory Guide (RG) 1.121, "Basis for Plugging Degraded PWR Steam Generator Tubes," requires a structural safety margin of 1.43 against tube failure under postulated accident conditions and a safety margin of 3.0 against burst during normal operation.

The proposed IPC meets the requirements of RG 1.121 and demonstrates that tube leakage is acceptably low and that tube burst is a highly improbable event during normal operation and postulated MSLB events. Implementation of this IPC results in offsite doses that are a small fraction of 10 CFR 100 limits.

For axial ODSCC located at cold leg intersections, the current 1.0 volt IPC criteria is still applicable. This criteria is derived from freespan burst considerations and is consistent with Draft Generic Letter requirements. The structural voltage limit is based on the log-linear relationship between tube burst and bobbin coil voltage. The database used for the calculation of the Byron and Braidwood structural limit is consistent with that described in the Draft Generic Letter, with the inclusion of the recent Byron and Braidwood tube pull results. Since tube burst is precluded during normal operating conditions due to the constraining effects of the TSP, a safety margin of 1.43 is used to derive the lower 95% confidence level voltage under MSLB conditions. This structural voltage limit is 4.75 volts. With allowances for voltage growth and Non-Destructive Examination (NDE) uncertainty, the voltage limit for allowing non-confirmed RPC indications to remain in service is 2.7 volts as recommended in the Draft Generic Letter.

For axial ODSCC located at hot leg intersections, tube burst probabilities are reduced to negligible levels during normal, transient, and postulated MLSB conditions due to limited TSP displacements from tube expansion. Therefore, MSLB leakage criteria dictates the structural and repair limits. Since axial ODSCC does not significantly impact the axial tensile loading of the tube, the more limiting degradation modes are cellular corrosion and Inter-Granular Attack (IGA). Significant IGA depths have not been experienced at the Byron or Braidwood units or in the industry. Thus, cellular corrosion is the expected crack morphology at TSPs to affect tensile load limits.

From available data (refer to Section 9.0 of WCAP-14273), the pressure that would be required to cause axial separation of a tube with cellular corrosion is well above the 3 times normal operating pressure differential at a bobbin voltage of 37 volts, with a lower bound 95% confidence level applied. Due to the limited size of the database, an additional safety factor is applied to conservatively establish a lower bound structural limit of 20 volts. Accounting for voltage growth and NDE uncertainty, the full APC limit exceeds 10 volts. For application of the Byron/Braidwood Unit 1 IPC, the upper limit for allowing non-RPC confirmed indications to remain inservice is conservatively chosen to be 10 volts.

Although the probability of burst is greatly reduced at hot leg tube intersections due to the constraining effects of the TSP, the probability of a higher MSLB leak rate is increased. A finite probability exists that a crack may open to the limits of the tube to TSP gap and cause increased leakage. This probability is equivalent to the probability of free span burst. The MSLB leakage analyses for Braidwood and Byron Unit 1 application accounts for the probability of higher leak rates for hot leg tube intersections and is discussed in Section 12.5 of WCAP-14273.

The total primary-secondary tube leakage at MSLB conditions due to IPC application and any other approved alternate repair criteria is not to exceed the site allowable leak rate of 9.4 gpm for Braidwood 1 and 12.8 gpm for Byron 1. This leak rate limit includes the total accident leakage of the faulted SG and the operational limit of 0.1 gpm (150 gallons per day) in each of the three intact SGs.

Probability of Detection

Probability of Detection of eddy current indications is an important consideration in the development and implementation of IPC. The POD is used to adjust the Beginning Of Cycle (BOC) voltage distribution to account for indications not detected during the inspection. The voltage distribution of detected indications is scaled up by a factor of 1/POD and tubes repaired are then subtracted to form the assumed population and voltage distribution for the next operating cycle. The adjusted BOC voltage distribution is used in tube leak and burst assessments in support of the IPC. Since the leakage and burst evaluations can be affected significantly by the assumed voltage distribution, the POD value is critical.

The Draft Generic Letter Section 2.b.1 requires the use of a POD of 0.6 unless an alternate POD function becomes available and is approved by the NRC. In an effort to develop an alternate POD, Commonwealth Edison (ComEd) in conjunction with Duke Power and the Electric Power Research Institute (EPRI) commissioned a study to correlate POD to indication voltage. This POD study involved a statistically significant body of field data which was used to compare an extensive collection of signals from 3/4" tubes with varying extents of outside diameter stress corrosion cracking at TSPs. The bobbin database was obtained from recent steam generator inspection campaigns at Braidwood Unit 1, Byron Unit 1 and Catawba Unit 1. All these units contain 3/4' tubing and have secondary systems which are essentially copper-free.

The POD Study evaluated field data from 818 tubes, which included 5726 tube support plate intersections. Within this data base, 50 tubes had No Detectable Degradation (NDD). The database included 872 indications which were confirmed by RPC, 222 indications identified in the field but were classified NDD by RPC and 251 indications which were identified during the study and judged to be valid by an expert panel, "peer review group" consisting of 5 Qualified Data Analysts. The peer review group worked as a team to determine which calls were "valid" and determine proper IPC voltage measurement.

The POD study database was analyzed by a total of 12 data analysts working independently using IPC analysis guidelines. These data analysts represented 5 different inspection companies with varying levels of experience and background. The results were then tabulated and compared to the peer review group results to determine a representative POD.

The complete report describing the POD study and methodologies used to develop an alternate POD correlation is given in Attachment G. In summary, the study shows that POD is voltage dependent and increases as the voltage of a given indication increases. ComEd employs the practice of using two totally independent analysts (dual-analysts) to review the data from each tube during steam generator inspection. This study also shows the benefit derived from this practice to further enhance POD. The final resultant voltage dependent POD curve which was arrived at through this study is included with this attachment (Figure 5-20, "Logistic Model of Dual-Analyst Bobbin POD"). A lower bound 95% confidence limit is applied to this curve for use in IPC application. Figure 5-20 shows that the probability of calling an indication which exceeds 1.0 volt is >83% and approaches 100% for indications which exceed 2.0 volts.

ComEd intends on using this voltage dependent POD curve to adjust the BOC and End Of Cycle (EOC) voltage distributions for the Braidwood Unit 1 fall 1995 refuel outage and the Byron Fall 1995 mid-cycle inspection.

MSLB Leakage and Burst Probability Analysis Methods

The analysis methodologies to support the current 1.0 volt IPC and proposed 3.0 volt IPC are consistent with the requirements of the Draft Generic Letter and the analysis methods described in the October 24, 1994, Byron Unit 1 Safety Evaluation Report (SER). For the proposed 3.0 volt IPC at hot leg intersections, the effects of limited TSP displacement are incorporated into the analyses, however the analysis methodologies remain generally the same, with additional guidance for potentially overpressurized indications.

The MSLB leakage analyses continue to be based on the EPRI Probability of Leakage (POL) model and the conditional leak rate correlation. The leakage assessment consists of predicting a freespan leak rate as a function of bobbin coil voltage, assuming that a leak occurs. The POL model uses the Nuclear Regulatory Commission (NRC) accepted single log-logistic function form. The conditional leak rate correlation (leak rate to bobbin voltage correlation) is a linear regression fit of the logarithms with an upper bound 95% confidence level. This correlation is deemed to be valid when a p-value test result of less than 5% is demonstrated. As previously discussed, the MSLB leakage analysis also accounts for the possibility of leakage due to overpressurized tubes as a result of limited TSP displacement.

For the cold leg indications, MSLB tube burst analyses continue to be based on EPRI tube burst correlations that demonstrate a log-linear relationship between tube burst pressure and bobbin coil voltage. The correlation used to define the structural voltage limit uses a lower 95% confidence level to correlate burst pressure to bobbin voltage. The tube burst analysis calculates the total probability of burst for a given voltage distribution. This total burst probability includes the summation of the probabilities of burst due to 1 tube bursting, 2 tubes bursting, etc.

A Monte Carlo simulation is applied to the POD adjusted BOC voltage distribution to estimate the MSLB leak rate and burst probabilities at the EOC condition. This approach applies considerations for NDE uncertainty and voltage growth. A full Monte Carlo technique is used to account for regression parameter uncertainty.

The database for the leak and burst correlations is consistent with the database used to support the Byron Unit 1 Cycle 7 IPC as described in the October 24, 1994, SER and the Byron Unit 1 90 day IPC report for Cycle 7 dated January 30, 1995. The results of the Braidwood Unit 1 and Byron Unit 1 tube pull results were added to the industry database. This database will be used until additional information becomes available or until otherwise directed by the NRC and/or the Final Generic Letter.

Those tubes which will be excluded from application of IPC as a result of the possibility of collapse during a Loss Of Coolant Accident (LOCA) with Safe Shutdown Earthquake (SSE) event will be identified in the revision to WCAP 14046 which will be submitted in the mid-February time frame.

Inspection Requirements

Technical Specification Surveillance Requirement (TSSR) 4.4.5.2 requires bobbin coil inspection to be performed on 100% of the hot leg tubes down to the lowest cold leg TSP elevation having PWSCC. A minimum of a 20% random sample is also to be inspected over the full length of the tube. RPC inspections are to be performed on the following indications:

- All hot leg TSP indications greater than 3.0 volts.
- All cold leg TSP indications greater than 1.0 volt.
- A minimum of 100 TSP intersections below 3.0 volts.
- All TSP intersections that contain dents greater than 5.0 volts.
- A 20% sample of TSP intersections with dents that are between 2.5 volts and 5.0 volts. This scope will be expanded to 100% if Primary Water Stress Corrosion Cracking (PWSCC) is confirmed.
- Intersections with artifact indications, i.e., indications with unusual phase angles or intersections with large interference signals that could mask a 3.0 volt defect.

The bobbin and RPC examinations will be performed using enhanced inspection guidelines that are intended to increase detectability and reduce voltage variability in support of IPC implementation. The IPC guidelines that will be used in the Braidwood Unit 1 and Byron Unit 1 Fall 1995 inspections are the same guidelines used to support the Byron Unit 1 Fall 1994 IPC inspection.

Operational Measures

Braidwood Station's April 25, 1994, and Byron Station's August 1, 1994, request for a 1.0 volt IPC contained a description of enhanced operational and procedural measures that Braidwood and Byron Station had taken to ensure a defense-in-depth approach against SG tube failures and detection of flaws that would exceed steam line break leakage limits. The measures remain in place at both Braidwood and Byron, and are summarized below.

- Actions have been taken to mitigate the corrosive environment in the TSP crevices and to increase the likelihood that future growth rates and crack morphologies will be within expected bounds.

- The alert and alarm setpoints on the main steam line and steam jet air ejector radiation monitors have been lowered to ensure early positive indication of primary to secondary leakage.

- Chemistry procedures have been revised to facilitate "quick counts" of chemistry samples to give rapid confirmation of SG leakage.

- SG chemistry sampling frequencies have been increased to hourly when primary-to-secondary leakage is detected, and then reduced to not less frequently than once per day once leakage stabilizes.

- In order to quickly determine if SG leakage is increasing during a tube leak event, Braidwood Operating Abnormal Procedure (BwOA) SEC-8, Byron Operating Abnormal Procedure (BOA SEC-8), have been revised to require that radiation monitors be checked at an increased frequency when SG leakage is detected.

- Tube rupture, tube leakage, and main steam line break scenarios are conducted frequently in the simulator. These scenarios include varying radiation monitor responses as appropriate.

- Byron and Braidwood Emergency Procedures require continuous monitoring for SG tube leakage. BwOA SEC-8, and BOA SEC-8 require continued monitoring of leakage during a shutdown to ensure detection of increasing leakage.

- Control Room daily surveillances have been revised to require that hourly trend readings of steam jet air ejector radiation monitor activity levels be reviewed on a daily basis.

- For both Braidwood and Byron, TS 3.4.6.2.c has been changed to limit primary-to-secondary leakage to 600 gallons per day total reactor-to-secondary leakage through all SGs not isolated from the RCS, and 150 gallons per day through any one SG.