Commonwealth Edison Company
1400 Opus Place
Downers Grove, IL 60515

ComEd

May 17, 1995

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Application for Amendment to Facility Operating Licenses:

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

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

"ABB Combustion Engineering Steam Generator Tube Sleeving Methodology"

Reference: 1. Letter, Ramin R. Assa (NRC) to D. L. Farrar (ComEd), Issuance of Amendments (TAC Nos. M87227, M87228, M87229, M87230), dated March 4, 1994

Gentlemen:

Pursuant to Title 10, Code of Federal Regulations, Part 50, Section 90 (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 would modify Technical Specification Section 3/4.4.5 to:

1. Allow steam generator tubes to be repaired using the tungsten inert gas (TIG) welded sleeve process as described in ABB Combustion Engineering, Inc. (ABB/CE) Licensing Report CEN-621-P, Revision 00, "Commonwealth Edison Byron and Braidwood Unit 1 & 2 Steam Generator Tube Repair Using Leak Tight Sleeves, FINAL REPORT," April 1995 (Attachment E),

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Change: NRC RDR 4 Encl. 1 INP

2. Delete the ability to repair steam generator tubes using the Babcock & Wilcox Nuclear Technologies (BWNT) kinetically welded sleeve process previously approved by the United States Nuclear Regulatory Commission (NRC) in Reference 1, and

3. Increasing the requirement to inspect the number of sleeved tubes from 3% of the total number of sleeved tubes in all four steam generators or all sleeved tubes in one steam generator to 20% of each sleeve design installed by deleting Technical Specification 4.4.5.2.b.3, making Technical Specification 4.4.5.2.e applicable to ABB/CE TIG welded sleeves, and making Technical Specification 4.4.5.2.e a permanent requirement.

The proposed amendment would also modify Facility Operating License NPF-37 Condition 2.C.16, Facility Operating License NPF-66 Condition 2.C.5, Facility Operating License NPF-72 Condition 2.C.6, and Facility Operating License NPF-77 Condition 2.C.5 to delete the requirement to conduct additional corrosion testing to establish the design life for the BWNT kinetically welded sleeve in the presence of a crevice.

The amendment package consists of the following:

Attachment A:	Description and Safety Analysis of Proposed Changes
Attachment B:	Proposed Changes to Facility Operating Licenses and Technical Specifications
Attachment C:	Evaluation of Significant Hazards Considerations
Attachment D:	Evaluation of Environmental Assessment
Attachment E:	ABB Combustion Engineering, Inc. Licensing Report CEN-621-P, Revision 00, "Commonwealth Edison Byron and Braidwood Unit 1 & 2 Steam Generator Tube Repair Using Leak Tight Sleeves, FINAL REPORT, " April 1995 and Related Affidavit

Subsequent to issuance of CEN-621-P, Revision 00 to ComEd, ABB Combustion Engineering, Inc. issued errata for pages 5-1 and 5-5. These errata pages have been incorporated into Attachment E.

As CEN-621-P, Revision 00 contains information proprietary to ABB Combustion Engineering, Inc., it is supported by an affidavit signed by ABB Combustion Engineering, Inc., the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.790 of the Commission's regulations. Accordingly, it is respectfully requested that the information which is proprietary to ABB Combustion Engineering, Inc. be withheld from public disclosure in accordance with 10 CFR 2.790 of the Commission's regulations.

Correspondence with respect to the proprietary aspects of the items listed above or the supporting ABB Combustion Engineering, Inc. Affidavit should reference CEN-621-P and should be addressed to S. E. Ritterbusch, Manager of Standard Plant Licensing, ABB Combustion Engineering, Inc., 1000 Prospect Hill Road, P. O. Box 500, Windsor, Connecticut, 06095-0500.

The proposed amendment has been reviewed and approved by the On-site and Off-site Review Committees in accordance with ComEd procedures. ComEd has reviewed this proposed amendment in accordance with 10 CFR 50.92(c) and has determined that no significant hazards consideration exists.

ComEd is notifying the State of Illinois of our application for this proposed amendment by transmitting a copy of this letter and the associated attachments to the designated state official.

ComEd requests that NRC review and approval of this proposed amendment be completed no later than February 1, 1996. Approval by this date is required to ensure sufficient time to mobilize the proper contractor resources necessary to support the Byron Unit 1 Cycle 7 Refuel Outage currently scheduled to begin March 29, 1996.

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 comments or questions regarding this matter to this office.

Very truly yours,

Harold D. Pontious, Jr.
Nuclear Licensing Administrator

Attachments

cc: J. B. Martin, Regional Administrator - RIII
G. F. Dick Jr., Byron Project Manager - NRR
R. R. Assa, Braidwood Project Manager - NRR
H. Peterson, Senior Resident Inspector - Byron
S. G. DuPont, Senior Resident Inspector - Braidwood
Office of Nuclear Facility Safety - IDNS

Signed before me

on this 17th day of May, 1995

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

by Mary Jo Yack.
Notary Public

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ATTACHMENT A

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

Description of the Proposed Changes:

Commonwealth Edison Company (ComEd) proposes to amend Technical Specification (TS) 3.4.5 to allow steam generator (SG) tubes that exceed the repair limit to remain in service by installation of a tungsten inert gas (TIG) welded sleeve developed by ABB Combustion Engineering, Inc. (ABB/CE). The ABB/CE sleeving process will be an additional option to the currently approved sleeving processes developed by Westinghouse and Babcock & Wilcox Nuclear Technologies (BWNT) for use at Byron and Braidwood Units 1 and 2.

ComEd is requesting approval to delete the kinetic sleeving process from TS 4.4.5, "Steam Generators" and associated bases as an allowable option for the repair of a defective SG tube. Additionally, ComEd proposes to delete the requirement for completion of the corrosion testing of the kinetic sleeve from Operating Licenses NPF-37, NPF-66, NPF-72, and NPF-77. BWNT does not currently recommend using the kinetic sleeving methodology previously approved for Byron or Braidwood.

The requirement to inspect 3% of the total number of sleeved tubes in all four steam generators or all sleeved tubes in one steam generator will be removed from TS 4.4.5.2.b.3 and included in the sample size selected at the end of each cycle in TS 4.4.5.2.e. This sample size will be maintained at 20% for each sleeve design installed.

Copies of the actual Technical Specification and Operating License pages with the changes indicated are included in Attachment B of this submittal.

Description of Current Requirements:

The existing Technical Specification 3/4.4.5, "Steam Generators," provides the surveillance requirements for sample selection, inspection, inspection frequency, acceptance criteria, tube repair and the reporting requirements to maintain the steam generator tube integrity and operability. The Specification allows tube repair processes to reestablish tube serviceability in lieu of tube plugging. Acceptable tube repair processes include tube sleeving using the Westinghouse Laser Welded Sleeving and the BWNT Kinetic Sleeving processes. Sleeve inspection, acceptance criteria, repair, and reporting requirements are also stipulated.

Additional corrosion testing was needed for the Westinghouse and the BWNT sleeving processes to establish the design life for the sleeved tubes in the presence of the crevice created at the joint between the sleeve and the tube. The test data is to determine the effects that material microstructure, chemistry, and joint crevices will have on primary water stress corrosion cracking initiation and growth. This testing program should be conducted for the sleeving processes installed for Byron and Braidwood and accepted by the NRC prior to the Beginning-of-Cycle (BOC) 9 for Byron Unit 1, prior to the BOC 8 for Byron Unit 2, and prior to the BOC 7 for Braidwood Units 1 and 2. This additional corrosion testing requirement is stated in the Operating Licenses for Byron and Braidwood Units 1 and 2.

Bases for the Current Requirements:

The TS Surveillance Requirements (TSSRs) for inspection and repair of the SG tubes and sleeves ensure that the structural integrity of this portion of the Reactor Coolant System will be maintained. Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," August 1976, serves as the basis for determining structural integrity requirements and safety margins. The program for inservice inspection of the tubes and sleeves is based on a modification of RG 1.83, Revision 1, July 1975. Inservice inspection of SG tubing and sleeving is essential in order to maintain surveillance of the condition of the tubing in the event there is evidence of progressive degradation of the pressure boundary. Inservice inspection of the tubing and sleeving provides a means to identify the nature and cause of any degradation so corrective measures can be taken.

The laser and kinetic welded sleeving processes reestablish the primary to secondary pressure retaining boundary of a tube that contains degradation exceeding the repair limit. Installation of a sleeve provides a leak tight boundary that spans a defective area and restores the structural integrity of the tubing to satisfy the RG 1.121 requirements. The sleeves are designed to allow inservice inspection of the pressure boundary of the sleeve and the tubing behind the sleeve. The plugging limit for the sleeve is derived from RG 1.121 analysis and utilizes an allowance for eddy current uncertainty and additional degradation growth.

Additional corrosion testing is being conducted to establish the design life for the kinetically welded and laser welded sleeve assemblies in the presence of a crevice. This corrosion testing is to demonstrate the corrosion resistance for kinetically and laser welded joints in the tubes that bound the material parameters in the steam generator. The corrosion testing results, required in the Operating Licenses, will confirm that tube structural integrity is maintained.

Description of the Need for Amending the Technical Specifications:

The NRC approved the sleeving processes developed by Westinghouse and BWNT for use at Byron and Braidwood with the issuance of amendments 58 and 46, respectively. The amendments allowed the repair of a defective SG tube by either plugging or sleeving the tube. The large number of indications identified during the past refueling outages for the Unit 1 Westinghouse Model D-4 Steam Generators makes sleeving SG tubes a viable method for the repair of tubes that would otherwise require plugging. BWNT does not currently recommend the kinetic sleeving methodology for use at Byron or Braidwood. With the removal of the kinetic sleeve from the available options to repair a defective tube, the proven methodology of the ABB/CE TIG welded sleeve is being requested for steam generator tube repair at Byron and Braidwood.

Elimination of the BWNT kinetic sleeve as a repair option for Byron and Braidwood now makes the need to conduct additional corrosion testing on the kinetic sleeving materials unnecessary. Also, with no kinetic sleeving material installed at Byron and Braidwood, the need to establish the design life for the kinetically welded sleeved tubes is no longer required.

Description of the Proposed Changes:

Specification 4.4.5.2, Steam Generator Tube Sample Selection and Inspection

TS 4.4.5.2.b.3 will be removed and the requirement to inspect 3% of the total number of sleeved tubes in all four steam generators or all sleeved tubes in one steam generator will be increased to 20% for each sleeve design installed and included in TS 4.4.5.2.e. Also, subsections 4 and 5 (only subsection 4 for Braidwood) will be renumbered to reflect the deletion of subsection 3.

The inservice inspection requirement to select a sample size of 20% of the total number of sleeves installed under TS 4.4.5.2.e for laser welded sleeves will be applied to the TIG welded sleeves. Requiring a 20% sample at the end of each cycle is more conservative than the 3% sample selection deleted from TS 4.4.5.2.b.3 and continues to ensure sleeve and tube structural integrity is monitored. The inservice inspection will be revised to include the tube to sleeve joints. The last two sentences of this section will be deleted since the requested revision will always require a 20% sample size be selected for the inservice inspection.

The second sentence of TS 4.4.5.2.e requires additional sleeves to be inspected should an imperfection of greater than or equal to 40% through wall be detected. The 40% through wall criteria is the repair or plugging limit for the tubing and laser welded sleeves. The plugging limit for the ABB/CE TIG welded sleeve is 32% through wall. ComEd requests revising this inspection requirement to "exceeding the repair limit", in lieu of specifying a percent through wall value. Insert "D" includes the revised inspection requirements and will read as follows:

> "A random sample of at least 20% of the total number of laser welded sleeves and at least 20% of the total number of TIG welded sleeves installed shall be inspected for axial and circumferential indications at the end of each cycle. In the event that an imperfection exceeding the repair limit is detected, an additional 20% of the unsampled sleeves shall be inspected, and if an imperfection exceeding the repair limit is detected in the second sample, all remaining sleeves shall be inspected. These inservice inspections will include the entire sleeve, the tube at the heat treated area, and the tube to sleeve joints. The inservice inspection for the sleeves is required on all types of sleeves installed in the Byron and Braidwood Steam Generators to demonstrate acceptable structural integrity."

Specification 4.4.5.4, Acceptance Criteria

Insert "A" provides clarification to TS 4.4.5.4.a.6 pertaining to the plugging or repair limit for the tubing, laser welded sleeving, and TIG welded sleeving. With the sleeving methodologies identifying different repair limits, the last sentence of subsection 6 will be revised to clarify the specific type of sleeve. The plugging limit for the TIG welded sleeving is 32% of the nominal sleeve thickness as identified in the ABB/CE Technical Report which includes a 20% allowance for eddy current uncertainty and continued degradation. The plugging or repair limit for the tubing and laser welded sleeving is 40% of the nominal wall thickness. Insert "A" reads as follows:

> "The plugging or repair limit imperfection depth for the tubing and laser welded sleeves is equal to 40% of the nominal wall thickness. The plugging limit imperfection depth for TIG welded sleeves is equal to 32% of the nominal wall thickness."

Insert "B" revises part b of TS 4.4.5.4.a.10 by eliminating the kinetic welded sleeving process and replaces the section with the identification of the ABB Combustion Engineering Inc. TIG welded sleeving process as an acceptable tube repair method.

Insert "B" reads as follows:

> "TIG welded sleeving as described in a ABB Combustion Engineering Inc. Technical Report currently approved by the NRC, subject to the limitations and restrictions as noted by the NRC Staff."

Bases 3/4.4.5, Steam Generators

The description of the technical bases for the sleeving methodologies used at Byron and Braidwood are identified in each vendors' sleeving technical report as discussed in the last sentence of the second paragraph. ComEd requests removal of the reference to the BWNT kinetic welded sleeve and the adding of ABB/CE to this discussion. This would change the last sentence to read as follows:

> "The technical bases for sleeving are described in the current Westinghouse and ABB Combustion Engineering, Inc. Technical Reports."

An editorial correction for Byron only, is requested to the final word of the fifth sentence of the second paragraph correcting the spelling of "ejecters" to read "ejectors."

In the third paragraph of the bases section of TS 3/4.4.5 for "Steam Generators," Insert "C" provides clarification to the plugging or repair limit for the tubing, laser welded, and TIG welded sleeving stated in the fourth sentence. The plugging limit for the TIG welded sleeving is 32% of the nominal sleeve thickness, whereas, the plugging or repair limit for the tubing and laser welded sleeving is 40% of the nominal wall thickness. Insert "C" reads as follows:

> "A laser welded sleeved tube must be plugged if a through wall penetration is detected in the sleeve that is equal to or greater than 40% of the nominal sleeve thickness. TIG welded sleeved tubes must be plugged if a through wall penetration is detected in the sleeve that is equal to or greater than 32% of the nominal sleeve thickness."

In the fifth sentence of the same paragraph, delete the "40%" plugging limit reference and make it generic when describing how the sleeve repair limit is derived from the RG 1.121 analysis.

The reference to "Babcock & Wilcox Nuclear Technologies" later in the same paragraph will be replaced with "ABB Combustion Engineering, Inc." as one of the applicable technical reports used to describe the sleeve inspection techniques.

With the inspection techniques improving and the ability to detect degradation being revised with each new technique used by the industry, ComEd requests deleting the reference to 20% through wall detectability in the next to the last sentence of the same paragraph. ComEd will validate the adequacy of the methods used to detect a degradation and will upgrade the testing methods as appropriate to ensure the best possible results of the sleeving inspection.

Facility Operating License No. NPF-37 Part 2.C

Remove reference to the kinetically welded sleeves in paragraph 2.C.16 of Facility Operating License No. NPF-37.

Facility Operating License No. NPF-66 Part 2.C

Remove reference to the kinetically welded sleeves in paragraph 2.C.5 of Facility Operating License No. NPF-66

Facility Operating License No. NPF-72 Part 2.C

Remove reference to the kinetically welded sleeves in paragraph 2.C.6 of Facility Operating License No. NPF-72.

Facility Operating License No. NPF-77 Part 2.C

Remove reference to the kinetically welded sleeves in paragraph 2.C.5 of Facility Operating License No. NPF-77.

Bases of the Proposed Changes:

The proposed TS amendment will allow the ABB/CE TIG welded sleeve to repair defects in steam generator tubing. The sleeve spans the defective area of the tube and provides a leak tight replacement pressure boundary that reestablishes the structural integrity of the tube.

The TIG welded sleeve has two designs, depending on the location to be used. The roll transition zone (RTZ) sleeve is used to repair tubes with defects in the tubesheet. This sleeve type contains a TIG welded upper joint above the tubesheet and a mechanically rolled lower joint located within the tubesheet. The other design is the tube support plate (TSP) sleeve used to repair defects at a tube support plate intersection, flow distribution baffle, or in the free span of the tube. The TSP sleeve contains a TIG welded upper and lower joint. The material of each sleeve design is thermally treated Inconel 690, which provides increased corrosion resistance. The technical bases and qualification of both sleeve designs are described in ABB/CE Technical Report CEN-621-P, Revision 00.

Structural and mechanical tests and analyses have been performed on the sleeve-tube assembly to establish integrity under normal and accident conditions with appropriate margins of safety. The sleeves were designed to conform to the stress limits and margins of safety specified in Section III of the ASME Boiler and Pressure Vessel Code. Additionally, the safety factors of Regulatory Guide 1.121 were applied for normal operating and faulted conditions. Based on the results of the analytical and test programs described in the Technical Report, both the RTZ and TSP sleeve types provide leak tight structural members that meet or exceed all established design criteria and margins of safety. The plugging limit for the TIG welded sleeving is 52% of the nominal sleeve thickness as identified in the ABB/CE Technical Report. ComEd will utilize a 20% allowance for eddy current uncertainty and additional degradation growth in addition to the ABB/CE repair limit to reduce the plugging limit imperfection depth to 32% of the nominal sleeve thickness.

The reference to the inservice inspection requirement of 20% of the total number of sleeves installed under TS 4.4.5.4.e at the end of each cycle is more conservative than the 3% sample selection deleted from TS 4.4.5.2.b.3 and continues to ensure sleeve and tube structural integrity is monitored. The last two sentences of TS 4.4.5.4.e will be deleted since the requested revision will maintain the sample size at a minimum of 20%. The sleeved tube will be removed from service if the acceptance criteria of TS 4.4.5.4 is exceeded.

Corrosion testing of typical sleeve-tube configurations were performed to evaluate local stresses, sleeve life and resistance to primary and secondary side corrosion. The tests were performed on stress relieved and as-welded (non-stress relieved) sleeve-tube joints. Using the corrosion test data in conjunction with finite element analyses of the local stress, the stress relieved joint life was determined to be in excess of 40 years. The ABB/CE TIG welded sleeve operating experience in the industry has shown no sleeve failures due to service induced degradation in sleeves that were installed with acceptable inspection results. This experience includes the stress relieved and as-welded sleeve configurations. ComEd will stress relieve all sleeves at Byron and Braidwood as specified in the Technical Report.

The sleeves are designed to allow inservice inspection of the pressure retaining portions of the sleeve and parent tube. Inservice inspection is performed on all sleeves following installation to ensure each sleeve has been properly installed and is structurally sound. Periodic inspections are performed in subsequent refuel outages to monitor sleeve degradation on a sample basis. The eddy current technique used for inspection will be capable of detecting both axial and circumferential flaws. A 20% sample of the sleeves are inspected each refuel outage. In the event an imperfection exceeding the repair limit is detected, an additional 20% of the sleeves will be inspected. The inspection scope is expanded to 100% of the sleeves should a repairable defect be found in the second sample. Tubes that contain defects in a sleeve, which exceeds the repair limit, will be removed from service. This ensures that sleeve and tube structural integrity is maintained.

The BWNT sleeving process was an approved repair method for use at Byron and Braidwood. However, BWNT no longer recommends using the current kinetic sleeving methodology at Byron or Braidwood. With the removal of the kinetic sleeve from the available options to repair a defective tube, the proven methodology of the ABB/CE TIG welded sleeve is being requested for steam generator tube repair at Byron and Braidwood. Consequently, the BWNT kinetic sleeve, which has not been used, is being eliminated as a sleeving option and the referral to any BWNT kinetic sleeving methodology will be deleted from the Technical Specifications.

Impact of the Proposed Changes:

The proposed TS change to support the installation of TIG welded sleeves does not adversely impact any previously evaluated design basis accident. The results of the analyses and testing, as well as industry operating experience, demonstrate that the sleeve assembly is an acceptable means of maintaining tube integrity.

The implementation of the proposed tube repair method does not introduce significant or adverse changes to the plant design basis. Stress and fatigue analysis of the repair processes has shown the ASME Code and RG 1.121 allowable values are met. Implementation of TIG welded sleeves maintains overall tube bundle structural and leakage integrity at a level consistent with that of the originally supplied tubing during all plant conditions. Leak and mechanical testing of the sleeves supports the conclusions that the sleeve retains both structural and leakage integrity during all conditions. Repair of a tube with a sleeve does not provide a mechanism to cause an accident outside of the area affected by the sleeve. Any hypothetical accident as a result of potential tube or sleeve degradation in the repaired portion of the tube is bounded by the existing steam generator tube rupture accident analysis. The sleeve design does not affect any other component or location of the tube outside of the immediate area repaired.

The effect of sleeve installation on the performance of the SG was analyzed for heat transfer, flow restriction, and steam generation capacity. The installation of sleeves can result in a hydraulic flow restriction that has less impact on the reactor coolant flow than plugging a tube. This is a preferable alternative when considering core safety margins based on minimum reactor coolant system flow rates. Evaluation of the installation of sleeves was based on the determination that loss of coolant accidents (LOCA) evaluations for the licensed minimum reactor coolant flow bound the combined effect of tube plugging and sleeving up to the actual equivalent plugging limit. The sleeving installation will result in a resistance to primary coolant flow through the tube for other evaluated accidents. The results of the analyses and testing, as well as industry operating experience, demonstrate that the sleeve assembly is an acceptable means of maintaining tube integrity.

Based on the above, the proposed amendment request has no significant negative impact on any system or operating mode.

Schedular Requirements:

ComEd requests that NRC review and approval of this proposed amendment be completed no later than February 1, 1996. Approval by this date is required to ensure sufficient time to mobilize the proper contractor resources necessary to support the Byron Unit 1 Cycle 7 Refuel Outage currently scheduled to begin April 1, 1996.