Mr. J. E. Cross
President-Generation Group
Duquesne Light Company
Post Office Box 4
Shippingport, PA 15077

March 26, 1999

SUBJECT: BEAVER VALLEY POWER STATION, UNIT NO. 2 (TAC NO. M98137)

Dear Mr. Cross:

The Commission has issued the enclosed Amendment No. 98 to Facility Operating License No. NPF-73 for the Beaver Valley Power Station, Unit 2 (BVPS-2). This amendment consists of changes to the Technical Specifications (TSs) in response to your application dated March 10, 1997, as supplemented July 28, 1997, September 17, 1997, April 30, 1998, January 29, 1999, and February 26, 1999, which submitted Proposed Operating License Change Request Nos. 237 and 111. Proposed Operating License Change Request No. 237, applicable to Beaver Valley Power Station, Unit No. 1, was previously issued as Amendment No. 208 to the Unit 1 operating license.

This amendment modifies TS 3/4.4.5, "Steam Generators," and its associated Bases and adds a new license condition to Appendix D to allow repair of steam generator tubes by installation of sleeves developed by ABB Combustion Engineering. In addition, the amendment deletes the option for using the kinetic sleeving methodology previously approved for use at BVPS-2.

A copy of our safety evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly Federal Register notice.

Sincerely,
ORIGINAL SIGNED BY:

Daniel S. Collins, Project Manager
Project Directorate I-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-412

Enclosures: 1. Amendment No. 98 to NPF-73
2. Safety Evaluation

cc w/encls: See next page

NRC FILE CENTER COPY

DISTRIBUTION:

Docket File	MO'Brien	ACRS
PUBLIC	DCollins	PEselgroth, RGN-I
PDI-1 Reading	OGC	PRush
JZwolinski	GHill(2)	RNorsworthy (E-Mail SE)
SBajwa	WBeckner	PEselgroth, RGN-I

OFFICE	PDI-1/PM	PDI-2/LA	EMCB	OGC	PDI-1/D
NAME	DCollins:lcc	MO'Brien	SE dtd		SBajwa
DATE	3/15/99	3/9/99	2/2/99	3/25/99	3/26/99

OFFICIAL RECORD COPY
DOCUMENT NAME: G:\BEAVER\AMD98137.WPD

9904050016 990326
PDR ADOCK 05000412
P PDR

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 26, 1999

Mr. J. E. Cross
President-Generation Group
Duquesne Light Company
Post Office Box 4
Shippingport, PA 15077

SUBJECT: BEAVER VALLEY POWER STATION, UNIT NO. 2 (TAC NO. M98137)

Dear Mr. Cross:

The Commission has issued the enclosed Amendment No. 98 to Facility Operating License No. NPF-73 for the Beaver Valley Power Station, Unit 2 (BVPS-2). This amendment consists of changes to the Technical Specifications (TSs) in response to your application dated March 10, 1997, as supplemented July 28, 1997, September 17, 1997, April 30, 1998, January 29, 1999, and February 26, 1999, which submitted Proposed Operating License Change Request Nos. 237 and 111. Proposed Operating License Change Request No. 237, applicable to Beaver Valley Power Station, Unit No. 1, was previously issued as Amendment No. 208 to the Unit 1 operating license.

This amendment modifies TS 3/4.4.5, "Steam Generators," and its associated Bases and adds a new license condition to Appendix D to allow repair of steam generator tubes by installation of sleeves developed by ABB Combustion Engineering. In addition, the amendment deletes the option for using the kinetic sleeving methodology previously approved for use at BVPS-2.

A copy of our safety evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly Federal Register notice.

Sincerely,

Daniel S. Collins

Daniel S. Collins, Project Manager
Project Directorate I-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-412

Enclosures: 1. Amendment No. 98 to NPF-73
2. Safety Evaluation

cc w/encls: See next page

cc:

Jay E. Silberg, Esquire
Shaw, Pittman, Potts & Trowbridge
2300 N Street, NW.
Washington, DC 20037

Director-Safety and Licensing
Department (BV-A)
Duquesne Light Company
Beaver Valley Power Station
PO Box 4
Shippingport, PA 15077

Commissioner Roy M. Smith
West Virginia Department of Labor
Building 3, Room 319
Capitol Complex
Charleston, WV 25305

Director, Utilities Department
Public Utilities Commission
180 East Broad Street
Columbus, OH 43266-0573

Director, Pennsylvania Emergency
Management Agency
Post Office Box 3321
Harrisburg, PA 17105-3321

Ohio EPA-DERR
ATTN: Zack A. Clayton
Post Office Box 1049
Columbus, OH 43266-0149

Dr. Judith Johnsrud
National Energy Committee
Sierra Club
433 Orlando Avenue
State College, PA 16803

Duquesne Light Company
Beaver Valley Power Station
PO Box 4
Shippingport, PA 15077
ATTN: Kevin L. Ostrowski, Division Vice
President, Nuclear Operations Group
and Plant Manager (BV-SOSB-7)

Bureau of Radiation Protection
Pennsylvania Department of
Environmental Resources
ATTN: Michael P. Murphy
Post Office Box 2063
Harrisburg, PA 17120

Mayor of the Borough of
Shippingport
Post Office Box 3
Shippingport, PA 15077

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Resident Inspector
U.S. Nuclear Regulatory Commission
Post Office Box 298
Shippingport, PA 15077

Duquesne Light Company
Beaver Valley Power Station
PO Box 4
Shippingport, PA 15077
ATTN: S. C. Jain, Senior Vice President
Nuclear Services (BV-A)

Mr. J. A. Hultz, Manager
Projects & Support Services
First Energy
76 South Main Street
Akron, OH 44308

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

DUQUESNE LIGHT COMPANY

OHIO EDISON COMPANY

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

THE TOLEDO EDISON COMPANY

DOCKET NO. 50-412

BEAVER VALLEY POWER STATION, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 98
License No. NPF-73

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Duquesne Light Company, et al. (the licensee) dated March 10, 1997, as supplemented July 28, 1997, September 17, 1997, April 30, 1998, January 29, 1999, and February 26, 1999, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

9904050018 990326
PDR ADOCK 05000412
P PDR

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. NPF-73 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 98 , and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated in the license. DLCO shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

   In addition, the license is amended by changes to paragraph 2.C.(11) to the Facility Operating License No. NPF-73 as follows:

   (11) Additional Conditions

   The Additional Conditions contained in Appendix D, as revised through Amendment No. 98 , are hereby incorporated into this license. Duquesne Light Company shall operate the facility in accordance with the Additional Conditions.

3. This license amendment is effective as of the date of its issuance, to be implemented within 60 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Singh S. Bajwa, Director
Project Directorate I-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: 1. Page 1 of Appendix D of License* NPF-73.
2. Changes to the Technical Specifications

Date of Issuance: March 26, 1999

* Page 1 of Appendix D is attached, for convenience, for the composite license to reflect this change.

ATTACHMENT TO LICENSE AMENDMENT NO. 98

FACILITY OPERATING LICENSE NO. NPF-73

DOCKET NO. 50-412

1. Revise Appendix D of the License as follows:

Remove Page	Insert Page
1	1

2. Replace the following pages of the Appendix A Technical Specifications with the enclosed pages as indicated. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

Remove	Insert
3/4 4-14	3/4 4-14
3/4 4-14a	3/4 4-14a
B 3/4 4-3	B 3/4 4-3

APPENDIX D

ADDITIONAL CONDITIONS
OPERATING LICENSE NO. NPF-73

Duquesne Light Company, Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company shall comply with the following conditions on the schedules noted below:

Amendment Number	Additional Condition	Implementation Date
83	The licensee is authorized to relocate certain Technical Specification requirements to licensee-controlled documents. Implementation of this amendment shall include the relocation of these technical specification requirements to the appropriate documents, as described in the licensee's application dated September 9, 1996, and evaluated in the staff's safety evaluation attached to this amendment.	This amendment shall be implemented within 60 days from April 14, 1997
87	The licensee is authorized to relocate certain Technical specification requirements to licensee-controlled documents. Implementation of this amendment shall include the relocation of these technical specification requirements to the appropriate documents, as described in the licensee's application dated March 14, 1997, as supplemented July 29 and August 13, 1997, and evaluated in the staff's safety evaluation attached to this amendment.	The amendment shall be implemented within 60 days from December 10, 1997
88	The licensee is authorized to relocate certain Technical Specification requirements to licensee-controlled documents. Implementation of this amendment shall include the relocation of these technical specification requirements to the appropriate documents, as described in the licensee's application dated September 11, 1997, and evaluated in the staff's safety evaluation attached to this amendment.	The amendment shall be implemented within 30 days from January 20, 1998
98	The licensee commits to perform visual acceptance examinations of sleeve welds; post weld heat treatment of sleeve welds; and the NRC-recommended inspections of repaired tubes as described in the licensee's application dated March 10, 1997, as supplemented July 28, 1997, September 17, 1997, April 30, 1998, and January 29, 1999, and evaluated in the staff's safety evaluation attached to this amendment.	The amendment shall be implemented within 60 days from March 26, 1999

SURVEILLANCE REQUIREMENTS (Continued)

3. A loss-of-coolant accident requiring actuation of the engineered safeguards, or

4. A main steamline or feedwater line break.

4.4.5.4 Acceptance Criteria

a. As used in this Specification:

1. Imperfection means an exception to the dimensions, finish or contour of a tube or sleeve from that required by fabrication drawings or specifications. Eddy-current testing indications below 20 percent of the nominal tube wall thickness, if detectable, may be considered as imperfections.

2. Degradation means a service-induced cracking, wastage, wear or general corrosion occurring on either inside or outside of a tube or sleeve.

3. Degraded Tube means a tube or sleeve containing imperfections greater than or equal to 20 percent of the nominal wall thickness caused by degradation.

4. Percent Degradation means the percentage of the tube or sleeve wall thickness affected or removed by degradation.

5. Defect means an imperfection of such severity that it exceeds the plugging or repair limit. A tube containing a defect is defective. Any tube which does not permit the passage of the eddy-current inspection probe shall be deemed a defective tube.

6. Plugging or Repair Limit means the imperfection depth at or beyond which the tube shall be removed from service by plugging or repaired by sleeving in the affected area because it may become unserviceable prior to the next inspection. The plugging or repair limit imperfection depths are specified in percentage of nominal wall thickness as follows:

a.	Original tube wall	40%
b.	ABB Combustion Engineering TIG welded sleeve wall	32%
c.	Westinghouse laser welded sleeve wall	25%

SURVEILLANCE REQUIREMENTS (Continued)

7. Unserviceable describes the condition of a tube if it leaks or contains a defect large enough to affect its structural integrity in the event of an Operating Basis Earthquake, a loss-of-coolant accident, or a steamline or feedwater line break as specified in 4.4.5.3.c, above.

8. Tube Inspection means an inspection of the steam generator tube from the point of entry (hot leg side) completely around the U-bend to the top support to the cold leg.

9. Tube Repair refers to sleeving which is used to maintain a tube in-service or return a tube to service. This includes the removal of plugs that were installed as a corrective or preventive measure. The following sleeve designs have been found acceptable:

   a) ABB Combustion Engineering TIG welded sleeves, CEN-629-P, Revision 02 and CEN-629-P Addendum 1.

   b) Westinghouse laser welded sleeves, WCAP-13483, Revision 1.

b. The steam generator shall be determined OPERABLE after completing the corresponding actions (plug or repair all tubes exceeding the plugging or repair limit) required by Table 4.4-2.

4.4.5.5 Reports

a. Within 15 days following the completion of each inservice inspection of steam generator tubes, the number of tubes plugged or repaired in each steam generator shall be submitted in a Special Report in accordance with 10 CFR 50.4.

b. The complete results of the steam generator tube and sleeve inservice inspection shall be submitted in a Special Report in accordance with 10 CFR 50.4 within 12 months following the completion of the inspection. This Special Report shall include:

   1. Number and extent of tubes and sleeves inspected.

3/4.4.5 STEAM GENERATORS (Continued)

decay heat removal capabilities for RCS temperatures greater than 350°F if one steam generator becomes inoperable due to single failure considerations. Below 350°F, decay heat is removed by the RHR system.

The Surveillance Requirements for inspection of the steam generator tubes ensure that the structural integrity of this portion of the RCS will be maintained. The program for inservice inspection of steam generator tubes is based on a modification of Regulatory Guide 1.83, Revision 1. Inservice inspection of steam generator 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 steam generator tubing also provides a means of characterizing the nature and cause of any tube degradation so that corrective measures can be taken.

The plant is expected to be operated in a manner such that the secondary coolant will be maintained within those parameter limits found to result in negligible corrosion of the steam generator tubes. If the secondary coolant chemistry is not maintained within these parameter limits, localized corrosion may likely result in stress corrosion cracking. The extent of cracking during plant operation would be limited by the limitation of steam generator tube leakage between the primary coolant system and the secondary coolant system (primary to secondary LEAKAGE = 500 gallons per day per steam generator). Cracks having a primary to secondary LEAKAGE less than this limit during operation will have an adequate margin of safety to withstand the loads imposed during normal operation and by postulated accidents. Operating plants have demonstrated that primary to secondary LEAKAGE of 500 gallons per day per steam generator can readily be detected by radiation monitors of steam generator blowdown. Leakage in excess of this limit will require plant shutdown and an unscheduled inspection, during which the leaking tubes will be located and plugged or repaired by sleeving. The technical bases for sleeving are described in the approved vendor reports listed in Surveillance Requirement 4.4.5.4.a.9.

Wastage-type defects are unlikely with the all volatile treatment (AVT) of secondary coolant. However, even if a defect of similar type should develop in service, it will be found during scheduled inservice steam generator tube examinations. Plugging or repair will be required of all tubes with imperfections exceeding the plugging or repair limit. Degraded steam generator tubes may be

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 98 TO FACILITY OPERATING LICENSE NO. NPF-73

DUQUESNE LIGHT COMPANY

OHIO EDISON COMPANY

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

THE TOLEDO EDISON COMPANY

BEAVER VALLEY POWER STATION, UNIT 2

DOCKET NO. 50-412

1.0 INTRODUCTION

By letter dated March 10, 1997, as supplemented by letters dated July 28, 1997, September 17, 1997, April 30, 1998, January 29, 1999, and February 26, 1999, Duquesne Light Company (the licensee) submitted a proposed license amendment which includes an amendment to the Technical Specifications (TSs) and new license conditions for Beaver Valley Power Station, Units 1 and 2 (BVPS-1 and BVPS-2). The proposed changes would allow sleeving of steam generator tubes at Beaver Valley Power Station with sleeves designed by the vendor, ABB Combustion Engineering (CE). Additionally, the proposed amendment would establish a repair limit of 32-percent for the pressure boundary of any CE sleeve and delete a reference to a previously used sleeving technique referenced in the TSs. The licensee has also committed to perform inservice inspections of installed CE welded sleeves, complete a post weld heat treatment (PWHT) of CE sleeve welds, and visually inspect sleeve welds after installation. These commitments are included in license conditions described in Section 5 of this safety evaluation (SE). The following safety evaluation considers the proposed changes to the license for Beaver Valley Unit 2. The staff previously reviewed and approved similar changes for BVPS-1 as documented in Amendment No. 208 to Facility Operating License No. DPR-66 dated November 25, 1997. The July 28, 1997, September 17, 1997, April 30, 1998, January 29, 1999, and February 26, 1999, letters did not change the no significant hazards consideration or expand the amendment beyond the scope of the initial notice.

Three types of ABB/CE leak tight sleeves are proposed for use at Beaver Valley. Two of the three designs are termed Full Depth Tubesheet (FDTS) sleeves. One FDTS sleeve is welded to the tube near both the upper and lower ends of the sleeve. The second type is welded to the tube near the upper end and a hard roll expansion in the lower tubesheet area secures the tube within the steam generator tubesheet. The third sleeve design spans degraded areas of the steam generator tube at tube support plates or in a free span section of the tube. This Tube Support sleeve is welded at both ends.

9904050021 990326
PDR ADOCK 05000412
P PDR

The revised TS would reference the current generic topical report for CE welded sleeves, CEN-629-P, Revision 02, "Repair of Westinghouse Series 44 and 51 Steam Generator Tubes Using Leak Tight Sleeves," and CEN-629-P Addendum 1, of the same title, both dated January 1997. Because the bulk of the technical and regulatory issues for the present request are identical to those reviewed in the previous SEs for CE sleeves, this SE discusses only those issues warranting revision, amplification or inclusion based on recent experience.

Details of prior staff evaluations of CE sleeves may also be found in the SEs for Waterford Steam Electric Station, Unit 3, Docket No. 50-382, dated December 14, 1995; Byron Nuclear Power Station, Units 1 and 2, and Braidwood Nuclear Power Station, Units 1 and 2, Docket Nos. 50-454, 50-455, 50-456, and 50-457, dated April 12, 1996; Zion Nuclear Power Station, Units 1 and 2, Docket Nos. 50-295 and 50-304, dated October 29, 1996; and Kewaunee Nuclear Power Plant, Docket No. 50-305. The staff's conclusions in these evaluations apply to the proposed BVPS-2 license amendment unless superseded by an evaluation discussed herein.

2.0 SUMMARY OF PREVIOUS REVIEWS

Previous staff evaluations of CE sleeves addressed the technical adequacy of the sleeves in the four principal areas of pressure retaining component design: structural requirements, material of construction, welding, and non-destructive examination. The staff found the analyses and tests that were submitted to address these areas of component design to be acceptable.

The function of sleeves is to restore the structural and leakage integrity of the tube pressure boundary. Consequently, structural analyses were performed for a variety of loadings including design pressure, operating transients, and other parameters selected to envelope loads imposed during normal operating, upset, and accident conditions. Stress analyses of sleeved tube assemblies were performed in accordance with the requirements of the ASME Boiler and Pressure Vessel Code (ASME Code), Section III. These analyses, along with the results of qualification testing and previous plant operating experience were cited to demonstrate that the sleeved tube assembly is capable of restoring steam generator tube integrity.

The material of construction of the sleeves is nickel Alloy 690, a Code-approved material (ASME SB-163), covered by ASME Code Case N-20. The staff has found that the use of Alloy 690 thermally treated (TT) sleeves is an improvement over the Alloy 600 material used in the original steam generator tubing. Corrosion tests conducted under Electric Power Research Institute (EPRI) sponsorship confirm test results regarding the improved corrosion resistance of Alloy 690 TT over that of Alloy 600. The NRC staff has concluded as a result of these laboratory corrosion tests that Alloy 690 is acceptable as meeting the guidelines in Regulatory Guide (RG) 1.85, "Materials Code Case Acceptability ASME Section III Division 1," Revision 24, dated July 1986. The NRC staff has approved use of Alloy 690 TT tubing in replacement steam generators as well as sleeving applications.

The welding process employed to join the sleeve to the parent tube is automatic autogenous gas-tungsten arc welding (GTAW). The application of this process to the CE sleeve design was qualified and demonstrated during laboratory tests employing full scale sleeve/tube

mock-ups. Qualification of the welding procedures and welding equipment operators was performed in accordance with the requirements of the ASME Code, Section IX (Welding).

The staff considers sleeves to be a long-term repair but not a repair with unlimited service life. The installation of CE Leak Tight Sleeves involves welding the sleeve to the tube which potentially creates new locations susceptible to stress corrosion cracking. The time for the initiation of service induced degradation in sleeve/tube assemblies is not quantified. Operating experience with tubes fabricated from Alloy 600 indicates that initiation times can vary significantly depending on residual stresses, variability in material properties, and the chemical environment adjacent to the tube material. Consequently, although vendors traditionally conduct accelerated corrosion tests of sleeve/tube assemblies for the purpose of making service life predictions, the staff finds this method too unreliable for deterministic predictions. However, the staff does consider the corrosion test results a good relative indicator of potential performance.

Considering the unreliability of sleeve life predictions, the staff has typically required licensees to inspect a sample of sleeves at each outage. Periodic inservice inspections will provide assurance that any service induced degradation in sleeves is detected and addressed appropriately. Inservice inspection requirements applicable to the licensee's proposed amendment request are discussed further in Section 3.3 of this SE.

3.0 DISCUSSION

Recent experience with the installation and inspection of steam generator tube sleeves has highlighted several areas that were either not relevant to previous sleeving amendments or addressed in detail in the staff's evaluations of the sleeving amendments previously referenced. These issues include: (1) the preparation of tube surfaces prior to sleeve welding, (2) the adequacy of inspection techniques used to accept sleeve welds, (3) inservice inspection requirements for sleeved tubes, and (4) the PWHT of sleeve welds. In addition to each of these topics, the licensee's proposal to establish a plugging limit for sleeve degradation is discussed in the following sections.

3.1 Weld Preparation

In order to form an adequate sleeve to tube weld, the surface of the metal(s) to be welded must be cleaned prior to performing any weld. For sleeve installation, the inner diameter of the parent tube must be cleaned of service induced oxides at the desired weld location. The presence of impurities during the welding process can lead to unacceptable weld indications. For the CE sleeving process, the tube inner surface is cleaned using motorized wire brushes.

Based on recent findings during the inspection of sleeves at other plants, the industry has identified the cleaning process as an essential step in the sleeve installation process. This conclusion is based on an ABB/CE root cause assessment which concluded that changes in the cleaning process, implemented in prior sleeve installations, resulted in the formation of weld zone indications. In order to minimize the potential for these indications, the vendor enhanced the tube cleaning process to ensure the optimum removal of service induced oxides prior to welding. In order to verify the removal of oxides, the vendor recommends a 100-percent visual examination of the cleaned area. At such time that process control is demonstrated to ensure cleaning efficiency, a sampling program may be used. The licensee

for BVPS-2 will confirm the effectiveness of the cleaning step in the sleeve installation by a visual examination of the tube inside diameter surface, as recommended by CE. If the visual inspections reveal that the cleaning process is effectively removing all tube oxide deposits, the licensee may relax the requirement to visually inspect tubes after cleaning.

3.2 Weld Acceptance Inspections

To verify the acceptability of sleeve welds, the licensee will complete an initial examination of sleeved steam generator tubes prior to returning a repaired tube to service. The acceptance examination includes an inspection using visual, ultrasonic, and eddy current techniques. The analysis of inspection data from three diverse methods of inspection improves the ability to detect fabrication induced defects. In addition, eddy current data are also used as a baseline for comparison with data obtained in future required periodic inspections.

Past field experience has demonstrated that previous initial acceptance examinations based on visual and ultrasonic inspection techniques may not be sufficient to identify all fabrication induced defects. As a result, the weld acceptance nondestructive evaluation (NDE) was modified. The modifications include inspection using an ultrasonic tester with an enhanced digitized amplitude system. The enhanced ultrasonic inspection technique provides a greater number of signal properties to more fully characterize a weld. The modified procedure was extensively tested on laboratory produced welds containing a variety of inclusion and lack of fusion defects. Samples were destructively examined and the metallurgical sections compared with the inspection results. Comparison of results demonstrated the revised procedure was highly reliable, and that no significant defects should remain undetected when using the enhanced procedure.

In addition to ultrasonic testing, the sleeve weld acceptance criteria require a 100-percent eddy current inspection using a plus point probe. Field experience led CE to discover that weld suckback and circumferentially oriented oxide inclusions would not be detected by ultrasonic inspection techniques. CE has shown that the plus point probe reliably detects the various fabrication induced weld defects including blowholes, weld suckback and circumferentially oriented oxide inclusions. The vendor has also shown that eddy current methods can locate the position of a fabrication defect with respect to the weld centerline which is considered the pressure boundary. Thus, for an FDTS sleeve upper weld, indications located above the weld centerline that are acceptable with other inspection techniques may be left in service. However, any indication found below the weld centerline requires the tube to be plugged. For the lower welds on Tube Support sleeves, this criterion is appropriately modified so that indications below the weld centerline may be left in service.

During a recent installation of welded sleeves at Kewaunee Nuclear Power Plant, the licensee visually identified weld zone indications that were not identified with either eddy current or ultrasonic inspection techniques. This finding may indicate that all three inspection methods are needed to ensure acceptable sleeve welding. The licensee for BVPS-2 has indicated its intent to perform a 100-percent visual examination of all sleeve welds for the acceptance examinations. This commitment will be included in the license condition included in Section 5.2 of this SE.

3.3 Inservice Inspection Requirements

The licensee has proposed to complete a sample inspection of 20-percent of installed sleeves at each refueling outage. If degradation or defects are identified during the inspection of the sleeves, the scope of the inservice examination may be expanded to include additional inspections of repaired tubes. This proposal is consistent with current industry guidance for steam generator sleeve examinations. EPRI recommends a 20-percent sample inspection for sleeves. The licensee's commitment to inspect installed sleeves in each refueling outage is included in a license condition described in Section 5.1 of this SE.

3.4 Post-Weld Heat Treatment

One primary element in the development of service induced stress corrosion cracking in steam generator tubing is the residual stresses in the material. In unrepaired tubing, these stresses could originate from the original fabrication of the tubing or from deformation of the tube material at low temperatures (e.g., tubesheet expansion). The installation of sleeve welds will also introduce residual stresses from the welding process in both the sleeve and the tube. These stresses have the potential for increasing the susceptibility of the welded materials to stress corrosion cracking. A PWHT can reduce these stresses, and thus potentially increase the time for the initiation of cracking within a welded joint. For the installation of CE welded sleeves at BVPS-2, the licensee has committed to perform a PWHT of the sleeve welds. This commitment is included in a license condition discussed in Section 5.3 of this SE.

3.5 Sleeve Plugging Limits

The sleeve minimum acceptable wall thickness is determined using the criteria of RG 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," and ASME Code Section III allowable stress values and pressure stress equations. According to RG 1.121 criteria, an allowance for NDE uncertainty and postulated operational growth of tube wall degradation within the sleeve must be accounted for when using NDE to determine sleeve plugging limits. Therefore, a conservative tube wall combined allowance for postulated degradation growth and eddy current uncertainty of 20-percent through-wall per cycle was assumed for the purpose of determining the sleeve plugging limit. The sleeve structural limit, which was calculated based on the most limiting of normal, upset, or faulted conditions for 7/8-inch outside diameter steam generator tubes in Westinghouse Model 44 and 51 steam generators, was determined to be 52-percent of the sleeve nominal wall thickness based on ASME Code minimum material properties in accordance with staff positions. Removal of sleeved tubes from service when degradation in the sleeve pressure boundary reaches a depth of 32-percent provides assurance that the minimum acceptable wall thickness will not be violated during the next cycle of operation. This requirement is incorporated into TS 4.4.5.4.a.6.b.

4.0 PROPOSED TECHNICAL SPECIFICATION CHANGES

In order to incorporate the proposed changes to permit sleeving of the BVPS-2 steam generators using CE welded sleeves and to eliminate a reference to a sleeving methodology no longer used, the licensee has proposed the following changes to the TSs.

1. Proposed Changes to TS 4.4.5.4.a.6.b, "Plugging or Repair Limit"

   The definition of Repair Limit is modified to specify that the repair limit for ABB/CE tungsten inert gas (TIG) welded sleeves is 32-percent of the nominal sleeve wall thickness.

2. Proposed Changes to TS 4.4.5.4.a.9.a, "Tube Repair"

   A reference to allow the installation of Babcock and Wilcox kinetic welded sleeves is deleted and replaced by a reference to the ABB/CE topical reports, CEN-629-P, Revision 02, and CEN-629-P Addendum 1, for the TIG welded sleeves.

3. Proposed Changes to B 4.12, "Bases"

   The Bases Section is modified to indicate that the technical bases for sleeving are described in the CE topical report referenced in Surveillance Requirement 4.4.5.4.a.9.

5.0 LICENSEE'S COMMITMENT IN SUPPORT OF AMENDMENT REQUEST

As part of the proposed amendment request, the licensee has committed to perform an inservice inspection of CE welded sleeves in accordance with a license condition which establishes the sampling and expansion scope for examining CE welded sleeves. The licensee has committed to complete a visual inspection of sleeve welds in addition to eddy current and ultrasonic test examinations at the time of sleeve installation. The licensee also committed to perform a PWHT of sleeve welds. These commitments are reflected in a new license condition that is being proposed for inclusion in Appendix D to BVPS-2, Facility Operating License No. NPF-73.

5.1 Inservice Inspection of CE Welded Sleeves

The following are imposed to require an inspection of sleeves during each inservice inspection.

1. The initial inspection sample at each scheduled inservice inspection shall be a minimum of 20% of each repair method/design installed.

2. The repaired tubes selected as the second sample (if required by Table 1) during each scheduled inservice inspection shall include tubes containing similar repair design(s).

3. If the inservice inspection of a steam generator conducted in accordance with Table 1 requires a sample inspection whose results fall in Category C-3, the inspection frequency shall be at least once per 20 months. This inspection frequency shall apply until a subsequent inspection demonstrates that a third sample inspection is not required.

4. Additional, unscheduled inservice inspections shall be performed on each steam generator in accordance with the first sample inspection specified in Table 1 during the shutdown subsequent to any of the following conditions:

a. Primary-to-secondary tube leaks (not including leaks originating from tube-to-tube sheet welds) in excess of the limits of TS 3.4.6.2,

b. A seismic occurrence greater than the Operating Basis Earthquake,

c. A loss-of-coolant accident requiring actuation of the engineered safeguards, or

d. A main steam line or feedwater line break.

5. The steam generator shall be determined operable after completing the corresponding actions (plug or repair all tubes exceeding the plugging or repair limit) required by TS 3/4.4.5 (Tables 4.4-1 & 4.4-2) and Table 1 contained herein.

TABLE 1: STEAM GENERATOR REPAIRED TUBE INSPECTION (4)(5)

1ST SAMPLE INSPECTION (1)(2)			2ND SAMPLE INSPECTION (2)(3)	
SAMPLE SIZE	RESULT	ACTION REQUIRED	RESULT	ACTION REQUIRED
A minimum of 20% of repaired tubes	C-1	None	N.A	N.A
	C-2	Plug defective repaired tubes and inspect 100% of the same repair design in this S.G.	C-1	NONE
			C-2	Plug defective repaired tubes
			C-3	Perform action for C-3 result of first sample
	C-3	Inspect all repaired tubes of the same repair design in this S.G., plug defective tubes and inspect 20% of the same repair design in each other S.G.	All other S.G.s are C-1	NONE
			Some S.G.s C-2 but no additional S.G.s are C-3	Perform action for C-2 result of first sample
			Additional S.G. is C-3	Inspect all repaired tubes of the same repair design in each S.G. and plug defective tubes. Notification to NRC pursuant to 10 CFR 50.72(b)(2).

(1) The initial inspection sample at each scheduled inservice inspection shall be a minimum of 20% of each repair method/design installed.

(2) The inspection of repaired tubes may be performed on tubes from 1 to 3 steam generators based on outage plans.

(3) Each repair method/design is considered a separate population for determination of scope expansion.

(4) The categories above (C-1, C-2 and C-3) are those described in TS 3.4.5

(5) Repaired tube examinations shall be comprised of a volumetric examination of 100% of the repair pressure boundary.

5.2 Visual Acceptance Examination of Sleeve Welds

The following is imposed to support the licensee's commitment to visually examine sleeve welds to identify weld zone indications that may not be detected using eddy current or ultrasonic inspection techniques:

> Welds associated with steam generator tube sleeves shall be subjected to a visual examination (VT-1) at the time of installation in addition to eddy current (ET) and ultrasonic (UT) test techniques. Discrepancies between the visual, eddy current and ultrasonic examination results shall be reconciled.

5.3 PWHT of CE Sleeve Welds

The following is imposed to support the licensee's commitment to perform a PWHT of ABB-CE TIG welded sleeve welds.

> The installation process for ABB-CE TIG welded sleeves per CEN-629-P, Revision 2, will include a heat treatment of sleeve welds.

6.0 STAFF EVALUATION

The staff concludes that the proposed sleeving repairs as described in the topical report, "Combustion Engineering Leak Tight Sleeves," (CEN-629-P, Revision 2) can be accomplished to produce sleeved tubes of acceptable metallurgical properties, corrosion resistance, and structural and leakage integrity. As indicated previously, recent experience has indicated the need to evaluate additional areas that were not applicable to previous CE sleeving amendments or were not addressed in detail in previously approved CE sleeving amendments. The staff evaluation of these issues is discussed below.

The licensee's commitment to visually inspect sleeve welds after installation addresses potential concerns resulting from experience at another plant where indications were identified only by visual inspection methods. At this time, industry experience with these indications is limited. The licensee has proposed a reasonable approach to identify indications that could potentially affect the structural and leakage integrity of CE welded sleeves.

The Beaver Valley Steam Generator Tube Surveillance Requirements currently require an examination of at least three percent of the inservice steam generator tubes. As discussed in Section 5.1 of this SE, the licensee has committed to inspect a 20-percent sample of sleeves at each refueling outage. Since the proposed scope for the inservice inspection of sleeves increases the probability that any sleeve/tube degradation is identified during the course of inspections, the staff concludes that the licensee's proposal for examining the sleeves at each inservice inspection is acceptable.

A PWHT of sleeve welds may reduce the residual stresses in the vicinity of the sleeve/tube weld, and thus decrease the susceptibility of the assembly to stress corrosion cracking. Given that stress corrosion cracking is a significant degradation mechanism affecting steam generator tubing, the licensee's intent to complete a PWHT of sleeve welds in accordance with the CE topical report should extend the useful life of sleeved tubes.

The structural analysis of sleeve/tube assemblies in CEN-629-P, Revision 02, assumes a material ultimate tensile strength of 90 ksi for Alloy 690 sleeves. According to the topical report, this value was determined based on actual test data. The sleeve design description in the report specifies that the Alloy 690 tubing "is procured to the requirements of the ASME Boiler and Pressure Vessel Code, Section II SB-163, Code Case N-20." In addition, Section 2 of the topical report states that the sleeve dimensions, materials, and joints were designed to the applicable ASME Boiler and Pressure Vessel Code. The staff notes that ASME Code Case N-20-3 states, "nickel-chromium-iron Alloys 600 and 690...may be used in the construction of Class 1 components in accordance with Section III, Division 1, provided the tensile, yield strength, and design stress intensity values as listed in Tables 1, 2, and 4, respectively are used." Table 1 in Code Case N-20-3 lists the ultimate strength of Alloy 600 and 690 as 80 ksi. Therefore, the staff has concluded that the use of 90 ksi in the calculations to evaluate sleeve margins of safety is inconsistent with the design requirements stated in CEN-629-P, Revision 2. However, the staff notes that the use of a 90 ksi tensile strength does not affect the conclusion that the sleeve design will provide adequate structural and leakage integrity for repaired steam generator tubes. In addition, the proposed sleeve repair limit is also unaffected by the use of an incorrect value for material tensile strength.

7.0 SUMMARY

The licensee has proposed changes to amend the license for BVPS-2 to permit the installation of CE Leak Tight Sleeves per topical report CEN-629-P, Revision 2. The changes include a licensee commitment to perform visual acceptance examinations of sleeve welds, perform a PWHT of CE sleeve welds during the installation process, and complete additional examinations of sleeve/tube assemblies during inservice inspections. The NRC staff has concluded, based on previous evaluations of CE sleeve repairs and the discussion included in Section 6 of this SE, that the amendment to the BVPS-2 TSs to allow the installation of CE sleeves is acceptable. Although some of the calculations in the referenced topical report are in error due to the use of invalid material properties, the staff notes that the overall results obtained from the analysis are correct. Therefore, the conclusion of acceptability of the proposed changes remains unchanged.

8.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendment. The State official had no comments.

9.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (62 FR 19829). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

10.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: P. Rush

Date: March 26, 1999