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June 24, 2003  
L-03-100

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555-0001

**Subject: Beaver Valley Power Station, Unit No. 1  
Docket No. 50-334, License No. DPR-66  
License Amendment Request No. 311  
Steam Generator Tube Inspection Clarifications**

Pursuant to 10 CFR 50.90, FirstEnergy Nuclear Operating Company (FENOC) requests an amendment to the above license for Beaver Valley Power Station (BVPS) Unit No. 1 in the form of changes to the Technical Specifications. The proposed amendments will clarify the steam generator tube inspection definition and the steam generator tube repair criteria.

The FENOC evaluation of the proposed changes are presented in the Enclosure. The proposed Technical Specification changes are presented in Attachment A. Attachment B provides the proposed information-only changes to the Technical Specification Bases that reflect the proposed license amendment. Attachment C indicates that there are no new commitments made in this submittal.

The Beaver Valley review committees have reviewed the changes. The changes were determined to be safe and do not involve a significant hazard consideration as defined in 10 CFR 50.92 based on the attached safety evaluation and no significant hazard evaluation.

FENOC requests approval of the proposed amendment by June 2004. Once approved, the amendment shall be implemented within 60 days.

If there are any questions concerning this matter, please contact Mr. Larry R. Freeland, Manager, Regulatory Affairs/Performance Improvement at 724-682-5284.

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I declare under penalty of perjury that the foregoing is true and correct. Executed on June 24, 2003.

Sincerely,



L. William Pearce

Enclosure: FENOC Evaluation of the Proposed Change.

Attachments:

- A. Proposed Technical Specification Changes (mark-ups)
- B. Proposed Changes to Technical Specification Bases (Information only)
- C. List of Regulatory Commitments

- c: Mr. T. G. Colburn, NRR Senior Project Manager  
Mr. D. M. Kern, NRC Sr. Resident Inspector  
Mr. H. J. Miller, NRC Region I Administrator  
Mr. D. A. Allard, Director BRP/DEP  
Mr. L. E. Ryan (BRP/DEP)

**ENCLOSURE**

**Beaver Valley Power Station, Unit No. 1  
License Amendment Request No. 311**

**FENOC Evaluation of the Proposed Change**

**Subject:** Application for amendment of Technical Specification Surveillance Requirement 4.4.5.4.a.6 and 4.4.5.4.a.8, Tube Inspection Definition.

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<u>Number</u>	<u>Title</u>
A	Proposed Technical Specification Changes
B	Proposed Technical Specification Bases Changes
C	Commitment Summary

## 1.0 DESCRIPTION

FirstEnergy Nuclear Operating Company (FENOC) requests to amend Operating Licenses DPR-66 for Beaver Valley Power Station (BVPS) Unit No. 1.

The proposed change will revise the Unit No. 1 Technical Specification definition for steam generator tube inspection included in BVPS Technical Specification (TS) Surveillance Requirement (SR) 4.4.5.4.a.8 to clarify the definition to exclude the portion of the tube within the tubesheet below the  $W^*$  distance ( $W^*$  is defined in WCAP-14797 and in this document on page 3). The proposed change will also revise SR 4.4.5.4.a.6, steam generator tube repair criteria. FENOC's proposed change requires that any tube identified with service induced degradation in the  $W^*$  distance be repaired.

## 2.0 PROPOSED CHANGE

The proposed Technical Specification change, which is submitted for Nuclear Regulatory Commission (NRC) review and approval, is provided in Attachment A. The changes proposed to the Technical Specification Bases are provided in Attachments B. The proposed Technical Specification Bases changes do not require NRC approval. The Beaver Valley Power Station (BVPS) Technical Specification Bases Control Program controls the review, approval and implementation of Technical Specification Bases changes. The Technical Specification Bases changes are provided for information only. Attachment C provides a list of commitments associated with this License Amendment Request (LAR).

The proposed change to the Technical Specifications and Technical Specification Bases have been prepared electronically. Deletions are shown with a strike-through and insertions are shown double-underlined. This presentation allows the reviewer to readily identify the information that has been deleted and added.

To meet format requirements the Index, Technical Specifications and Bases pages will be revised and repaginated as necessary to reflect the changes being proposed by this LAR.

The proposed changes to the Unit 1 Technical Specification (TS) will clarify the definition of steam generator tube inspection to exclude the portion of the tube within the tubesheet below the  $W^*$  distance. This will ensure that inspections may continue to be utilized to ensure the safe operation of the plant while limiting unnecessary radiation exposure to plant personnel.

FirstEnergy Nuclear Operating Company (FENOC) is proposing to modify the Beaver Valley Power Station (BVPS) Unit 1 Technical Specification (TS) to revise

Surveillance Requirement (SR) 4.4.5.4.a.8 and SR 4.4.5.4.a.6. SR 4.4.5.4.a.8 defines steam generator (SG) tube inspection scope. FENOC's proposed change clarifies the tube inspection to exclude the portion of the tube within the tubesheet below the W\* distance. The W\* distance is the distance from the top of the tubesheet to the bottom of the W\* length (The maximum length of tubing below the bottom of the WEXTEX transition {BWT} which must be demonstrated to be non-degraded and is defined as 7.0 inches below the bottom of the WEXTEX transition on the hot leg side) plus the distance to the BWT and uncertainties. SR 4.4.5.4.a.6 provides steam generator tube repair criteria. FENOC's proposed change requires that any service induced degradation identified in the W\* distance be repaired.

### 3.0 BACKGROUND

The steam generators (SGs) at BVPS Unit 1 are Westinghouse Model 51 with a U-tube configuration. Each tube is secured in the tubesheet above the lower plenum of the SG by an explosive expansion process (WEXTEX). The WEXTEX process expands each tube over its entire length of the tubesheet and forms an interference fit between the tube and tubesheet. This interference fit forms the interface which provides the structural and part of the leaktight boundary between the primary and secondary systems at each end of a SG tube. Located near the top of the tubesheet is a region where the tube transitions from the tubesheet hole diameter to that of the original tube. This region is referred to as the WEXTEX transition region.

An alternate tube repair criteria (referred to as W\*) was developed by Westinghouse Electric Company (Westinghouse) to permit tubes with predominantly axially oriented primary water stress corrosion cracking (PWSCC) in the WEXTEX tubesheet expansions to remain in service. The W\* analysis defines a W\* length that would permit flaws to remain in service and assure adequate strength is available to resist the axial pullout loads experienced within the tubesheet. This proposed change is for the purpose of clarifying the inspection scope only, i.e., to allow Technical Specification required SG tube inspections to exclude the length of tubing below the W\* length on the hot leg side and is not requesting an alternate repair criteria as intended by WCAP-14797, Revision 1.

#### Definitions:

W\* length - The maximum length of tubing below the bottom of the WEXTEX transition (BWT) which must be demonstrated to be non-degraded and is defined in WCAP-14797, Revision 1, Section 4 as 7.0 inches below the bottom of the WEXTEX transition on the hot leg side and 7.5 inches below the bottom of the WEXTEX transition on the cold leg side.

**BWT** - Bottom of the WEXTEX transition and is defined in WCAP 14797, Revision 1, as approximately 0.25 inch from the top of the tubesheet.

**W\*** distance - The distance from the top of the tubesheet to the bottom of the W\* length including the distance to the BWT and uncertainties. Uncertainties are defined in Section 8 of WCAP-14797, Revision 1, as 0.12 inch. Therefore, the W\* distance is 7.12 inches on the hot leg side plus the distance to BWT and 7.62 inches on the cold leg side plus the distance to BWT.

#### 4.0 TECHNICAL ANALYSIS

FENOC is proposing to modify the BVPS Unit 1 TSs to revise Surveillance Requirement (SR) 4.4.5.4.a.6 and 4.4.5.4.a.8. SR 4.4.5.4.a.8 defines steam generator (SG) tube inspection scope. FENOC's proposed change clarifies the tube inspection to exclude the portion of the tube within the tubesheet below the W\* distance. SR 4.4.5.4.a.6 provides steam generator tube repair criteria. FENOC's proposed change requires that any service induced degradation identified in the W\* distance requires repair. The amendment is based on the Westinghouse Electric Company WCAP-14797, Revision 1 entitled, "Generic W\* Tube Plugging Criteria For 51 Series Steam Generator Tubesheet Region Wextex Expansions." The WCAP was developed for Westinghouse fabricated steam generators that utilized the WEXTEX tube expansion process for application of W\* alternate repair criteria. The W\* analysis accounts for the reinforcing effect that the tubesheet has on the external surface of the SG tube within the tubesheet region. The W\* analysis shows that tube integrity and leakage below the W\* distance remain within the existing design limits. WCAP-14797 Revision 1 has been previously approved by the Nuclear Regulatory Commission for Diablo Canyon Units 1 and 2 in license amendments 129 and 127, respectively.

The generic W\* analysis detailed in WCAP-14797, Revision 1 is applicable to the BVPS SGs and defines the maximum hot leg W\* lengths for pullout resistance as 7.0 inches below the bottom of the WEXTEX transition. These distances are increased by an allowance for Non-Destructive Examination (NDE) uncertainties in measuring the W\* length. The maximum NDE uncertainty on the W\* length in WCAP-14797, Revision 1 is 0.12 inch. The required Technical Specification inspection distances below the top of the tubesheet is then 7.12" for the hot leg side plus an allowance for the distance of the "bottom of WEXTEX transition" (BWT) to the top-of-tubesheet. The W\* analysis provides the basis for tubes with any form of degradation below the W\* length to remain in service. The presence of the surrounding tubesheet prevents tube rupture and provides resistance against axial pullout loads during normal and accident conditions. In addition, any primary-to-secondary leakage from tube degradation below

the  $W^*$  length contributes less than 5 percent of the total leakage assumed for a steamline break (SLB) accident and may be considered negligible. Consequently, any tube degradation that may go undetected in this area would not affect structural or leakage margins.

BVPS SG inspection fulfills TS 4.4.5.4.a.8 requirements for inspecting SG tubing by performing 100 percent full-length inspection of each tube using a bobbin coil probe. To reduce the probability and consequences of SG tube rupture or tube failure, BV performs rotating pancake coil (RPC) probe examinations in critical regions for crack-like indications that would not be easily identified with the bobbin coil probe. These critical regions are based on a degradation assessment where potential and active degradation is expected in SG tubes that could challenge structural and/or leakage integrity if the tubes are not taken out of service by repair.

The critical region of the tubes in the tube-to-tubesheet expansion in Westinghouse Model 51 SGs with WEXTEX explosive expansions is defined as the  $W^*$  length. The  $W^*$  length is defined for BVPS Unit 1 in WCAP-14797, Revision 1, considering the most stringent loads associated with plant operation, including transients, and accident conditions. Below the  $W^*$  distance, any degradation or combination thereof is acceptable.

BVPS Unit 1 does not use WCAP-14797, Revision 1 to leave degraded tubes in service via an alternate repair criteria. FENOC's proposed change requires that any service induced degradation identified in the  $W^*$  distance be repaired. The WCAP is only used to define the length of tubing that should be inspected with an RPC probe to remove degraded tubes from service by plugging.

Tube burst is precluded for cracks within the tubesheet by the constraint provided by the tubesheet. Thus, structural criterion is satisfied by the tubesheet constraint. However, a 360-degree circumferential crack or many axially oriented cracks could permit severing of the tube and tube pullout from the tubesheet under the axial forces on the tube from primary to secondary pressure differentials. Section 4 of WCAP-14797, Revision 1 describes the testing that was performed to define the length of non-degraded tubing that is sufficient to compensate for the axial forces on the tube and thus prevent pullout. The operating conditions utilized in WCAP-14797, Revision 1 bound the operating conditions for BVPS Unit 1.

Operating experience has demonstrated negligible normal operating leakage from primary water stress corrosion cracking (PWSCC) even under free span conditions in roll transitions. PWSCC in WEXTEX expansion in the tubesheet region would be even further leakage limited by the tight tube-to-tubesheet crevice and the limited crack

opening permitted by the tubesheet constraint. The steamline break (SLB) conditions provide the most stringent radiological hazards for postulated accidents involving loss of pressure or fluid in the secondary system. WCAP-14797, Revision 1, describes the methodology for calculating leakage for all cracks left in service and the justification to neglect the total SLB leak rate contributed by cracks below the W\* distance. Nonetheless, BVPS does not allow cracks to remain in service. Therefore, RPC probe inspection in the area below the W\* distance is not necessary to preclude normal operating or accident induced leakage.

## 5.0 REGULATORY SAFETY ANALYSIS

FirstEnergy Nuclear Operating Company (FENOC) is proposing to modify the Beaver Valley Power Station (BVPS) Unit 1 Technical Specification (TS) to revise Surveillance Requirement (SR) 4.4.5.4.a.8 and SR 4.4.5.4.a.6. SR 4.4.5.4.a.8 defines steam generator (SG) tube inspection scope. FENOC's proposed change clarifies the tube inspection to exclude the portion of the tube within the tubesheet below the W\* distance. The W\* distance is defined in an analysis (WCAP-14797, Rev. 1) that accounts for the reinforcing effect that the tubesheet has on the external surface of the SG tube within the tubesheet region. This analysis shows that the tube integrity and leakage below the W\* distance remain within the existing design limits. SR 4.4.5.4.a.6 provides steam generator tube repair criteria. FENOC's proposed change requires that any service induced degradation identified in the W\* distance be repaired. These changes will ensure that inspections may continue to ensure the health and safety of the public and safe operation of the plant while limiting unnecessary radiation exposure to plant personnel. The proposed change is for the purpose of clarifying the inspection scope only and is not requesting an alternate repair criteria.

### 5.1 No Significant Hazards Consideration

FirstEnergy Nuclear Operating Company (FENOC) has evaluated whether or not a significant hazards consideration is involved with the proposed amendments by focusing on the three standards set forth in 10CFR50.92, "Issuance of amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

No. The proposed change modifies the BVPS Unit 1 TSs to incorporate SG tube inspection scope based on WCAP-14797, Revision 1. The proposed change only clarifies the current process which has been utilized in the past. The W\* analysis takes into account the reinforcing effect that the tubesheet has on the external

surface of an expanded SG tube. Tube-bundle integrity will not be adversely affected by the implementation of the W\* tube inspection scope. SG tube burst or collapse cannot occur within the confines of the tubesheet; therefore, the tube burst and collapse criteria of Regulatory Guide (RG) 1.121 are inherently met. Any degradation below the W\* distance is shown by analyses and test results to be acceptable, and therefore does not result in an increase in probability of a tube rupture or an increase in the consequences of a tube rupture.

Tube burst is precluded for cracks within the tubesheet by the constraint provided by the tubesheet. However, in the unlikely event of a complete circumferential separation of a tube occurring below the W\* distance, SG tube pullout is precluded, tube integrity maintained and leakage is predicted to be maintained within the Updated Final Safety Analysis Report limits during all plant conditions.

In conclusion, the incorporation of the W\* inspection scope into BVPS Unit 1 TS maintains existing design limits and does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

No. The proposed change modifies the BVPS Unit 1 TSs to incorporate SG tube inspection scope based on WCAP-14797, Revision 1. Tube-bundle integrity will be maintained during all plant conditions upon implementation of the proposed tube inspection scope. Use of this scope does not induce a new mechanism that would result in a different kind of accident from those previously analyzed. Even with the limiting circumstances of a complete circumferential separation of a tube occurring below the W\* distance, SG tube pullout is precluded and leakage is predicted to be maintained within the design limits during all plant conditions.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

No. WCAP-14797, Revision 1 describes the testing that was performed to define the length of non-degraded tubing that is sufficient to compensate for the axial forces on the tube and thus prevent pullout. The operating conditions utilized in WCAP-14797, Revision 1, bound BVPS Unit 1 operating conditions. Upon implementation of the W\* inspection scope, operation with potential cracking below the W\* distance in the WEXTEx expansion region of the SG tubing meets the

margin of safety as defined by RG 1.121 and RG 1.83 and the requirements of General Design Criteria 14, 15, 16, 31, and 32.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, FENOC concludes that the proposed amendments present no significant hazards consideration under the standards set forth in 10CFR50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

## 5.2 Applicable Regulatory Requirements/Criteria

A review of 10CFR50, Appendix A, "General Design Criteria (GDC) for Nuclear Power Plants" (Reference 1), was conducted to assess the potential impact associated with the proposed changes. The following table lists the criterion potentially impacted, and an assessment of the need for a modification to the UFSAR description of BVPS design conformance to the criterion.

General Design Criteria		Impact
14	Reactor coolant pressure boundary	None
15	Reactor coolant system design	None
16	Reactor containment design	None
31	Fracture prevention of reactor coolant pressure boundary	None
32	Inspection of reactor coolant pressure boundary	None

The reactor coolant pressure boundary, containment boundary and tube-bundle integrity will not be adversely affected by the implementation of the W\* tube inspection scope. SG tube burst or collapse cannot occur within the confines of the tubesheet; therefore, the tube burst and collapse criteria of Regulatory Guide (RG) 1.121 are inherently met. Any degradation below the W\* distance is shown by analyses and test results to be acceptable, thereby precluding an event with consequences similar to a postulated tube rupture event. Steam generator tube surveillance requirements continue to ensure that degraded tubes will be removed from service. Therefore, conformance with all applicable GDCs remain valid.

In conclusion, based on the considerations discussed above, (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.

## 6.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10CFR20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10CFR51.22(c)(9). Therefore, pursuant to 10CFR51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

## 7.0 REFERENCES

1. 10CFR50, Appendix A, "General Design Criteria for Nuclear Power Plants."
2. Beaver Valley Power Station Unit No. 1 Updated Final Safety Analysis Report
3. Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes", August, 1976
4. Westinghouse Electric Company WCAP-14797, Revision 1, "Generic W\* Tube Plugging Criteria For 51 Series Steam Generator Tubesheet Region Wextex Expansions"

**ATTACHMENT A**

**Beaver Valley Power Station, Unit No. 1  
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**Proposed Technical Specification Changes**

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The following is the only affected page:

3/4 4-10b

SURVEILLANCE REQUIREMENTS (Continued)

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%
- 1.0) This definition does not apply to tube support plate intersections for which the voltage-based repair criteria are being applied. Refer to 4.4.5.4.a.10 for the repair limit applicable to these intersections.
- 2.0) This definition does not apply to service induced degradation identified in the W\* distance. Service induced degradation identified in the W\* distance shall be repaired on detection. The W\* distance is defined in WCAP-14797, Revision 1.
- b) ABB Combustion Engineering TIG welded sleeve wall 32%
  - c) Westinghouse laser welded sleeve wall 25%
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 of the cold-leg, excluding the portion of the tube within the tubesheet below the W\* distance, as defined in WCAP-14797, Revision 1.
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.

**Attachment B**

**Beaver Valley Power Station, Unit No. 1  
License Amendment Request No. 311**

**Proposed Technical Specification Bases Changes**

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**Technical Specification Bases changes are provided for information only.**

**The following is the only affected page:**

**B 3/4 4-2**

BASES

3/4.4.3 SAFETY VALVES (Continued)

Demonstration of the safety valves' lift settings will occur only during shutdown and will be performed in accordance with the provisions of Section XI of the ASME Boiler and Pressure Code.

3/4.4.4 PRESSURIZER

The requirement that (150)kw of pressurizer heaters and their associated controls be capable of being supplied electrical power from an emergency bus provides assurance that these heaters can be energized during a loss of offsite power condition to maintain natural circulation at HOT STANDBY.

3/4.4.5 STEAM GENERATORS

One OPERABLE steam generator in a non-isolated reactor coolant loop provides sufficient heat removal capability to remove decay heat after a reactor shutdown. The requirement for two OPERABLE steam generators, combined with other requirements of the Limiting Conditions for Operation ensures adequate 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 and leakage 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. However, WCAP-14797, Revision 1, provides the basis for excluding that portion of the tube within the tubesheet that does not contribute to structural and leakage integrity from periodic nondestructive examination requirements. 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

## **Attachment C**

### **Beaver Valley Power Station, Unit No. 1 License Amendment Request No. 311**

#### **Commitment Summary**

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**There are no actions committed to by FirstEnergy Nuclear Operating Company (FENOC) for Beaver Valley Power Station (BVPS), Unit No. 1 in this document. Any other actions discussed in the submittal represent intended or planned actions by Beaver Valley. These other actions are described only as information and are not regulatory commitments. Please notify Mr. Larry R. Freeland, Manager, Regulatory Affairs/Performance Improvement, at Beaver Valley on (724) 682-5284 of any questions regarding this document or associated regulatory commitments.**