October 5, 2004

Mr. L. William Pearce
Vice President
FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Post Office Box 4
Shippingport, PA 15077

SUBJECT: BEAVER VALLEY POWER STATION, UNIT NO. 1 (BVPS-1)- ISSUANCE OF AMENDMENT RE: ONE-CYCLE USE OF WESTINGHOUSE LEAK-LIMITING ALLOY 800 STEAM GENERATOR (SG) TUBE SLEEVES FOR SG TUBE REPAIR (TAC NO. MC1857)

Dear Mr. Pearce:

The Commission has issued the enclosed Amendment No. 260 to Facility Operating License No. DPR-66 for the Beaver Valley Power Station, Unit No. 1. This amendment consists of changes to the Technical Specifications (TSs) in response to your application dated January 27, 2004, as supplemented May 27, 2004.

The amendment revises TS 3.4.5 to allow a one-cycle use of Westinghouse leak-limiting Alloy 800 SG tube sleeves as an acceptable SG tube repair. Specifically, surveillance requirements 4.4.5.4.a.6 and 4.4.5.4.a.9 are being revised to list the Westinghouse leak-limiting Alloy 800 sleeves as an acceptable SG tube sleeving method in addition to the currently approved Westinghouse laser welded sleeves and the former ABB Combustion Engineering tungsten inert gas welded sleeves.

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

Sincerely,

/RA/

Timothy G. Colburn, Senior Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-334

Enclosures: 1. Amendment No. 260 to DPR-66
2. Safety Evaluation

cc w/encls: See next page

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TSs:
Package Number: ML042400151
Accession Number: ML042400116 *SE input provided. No substantive changes made.

OFFICE	PDI-1/PM	PDI-2/LA	IROB/SC	EMCB/SC	OGC	PDI-1/SC
NAME	TColburn	MO'Brien	TBoyce	LLund*	HMcGurren	RLaufer
DATE	9/16/04	9/16/04	9/20/04	08/10/2004	9/24/04	10/1/04

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Beaver Valley Power Station, Unit Nos. 1 and 2

cc:

Mary O'Reilly, Attorney
FirstEnergy Nuclear Operating Company
FirstEnergy Corporation
76 South Main Street
Akron, OH 44308

FirstEnergy Nuclear Operating Company
Regulatory Affairs/Performance
Improvement
Larry R. Freeland, Manager
Beaver Valley Power Station
Post Office Box 4, BV-A
Shippingport, PA 15077

Commissioner James R. Lewis
West Virginia Division of Labor
749-B, Building No. 6
Capitol Complex
Charleston, WV 25305

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

Director, Pennsylvania Emergency
Management Agency
2605 Interstate Dr.
Harrisburg, PA 17110-9364

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

J. H. Lash, Plant Manager (BV-IPAB)
FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Post Office Box 4
Shippingport, PA 15077

Rich Janati, Chief
Division of Nuclear Safety
Bureau of Radiation Protection
Department of Environmental Protection
Rachel Carson State Office Building
P.O. Box 8469
Harrisburg, PA 17105-8469

Mayor of the Borough of Shippingport
P O 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

FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
ATTN: R. G. Mende, Director
Work Management (BV-IPAB)
Post Office Box 4
Shippingport, PA 15077

FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Mr. B. F. Sepelak
Post Office Box 4, BV-A
Shippingport, PA 15077

PENNSYLVANIA POWER COMPANY

OHIO EDISON COMPANY

FIRSTENERGY NUCLEAR OPERATING COMPANY

DOCKET NO. 50-334

BEAVER VALLEY POWER STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 260
License No. DPR-66

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

   A. The application for amendment by FirstEnergy Nuclear Operating Company, et al. (the licensee), dated January 27, 2004, as supplemented May 27, 2004, 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.

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. DPR-66 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 260, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days including the licensee's commitments contained in the licensee's letters of January 27 and May 27, 2004. The commitments shall remain in effect for the authorized period of sleeving with Westinghouse Alloy 800 sleeves, i.e., Cycle 17.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Richard J. Laufer, Chief, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: October 5, 2004

ATTACHMENT TO LICENSE AMENDMENT NO. 260

FACILITY OPERATING LICENSE NO. DPR-66

DOCKET NO. 50-334

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
3/4 4-9	3/4 4-9
3/4 4-10b	3/4 4-10b
3/4 4-10c	3/4 4-10c

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 260 TO FACILITY OPERATING LICENSE NO. DPR-66

PENNSYLVANIA POWER COMPANY

OHIO EDISON COMPANY

FIRSTENERGY NUCLEAR OPERATING COMPANY

BEAVER VALLEY POWER STATION, UNIT NO. 1 (BVPS-1)

DOCKET NO. 50-334

1.0 INTRODUCTION

By application dated January 27, 2004, as supplemented by letter dated May 27, 2004, FirstEnergy Nuclear Operating Company (FENOC, the licensee), requested changes to the Technical Specifications (TSs) for BVPS-1. The supplement dated May 27, 2004, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the Nuclear Regulatory Commission (NRC) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on March 16, 2004 (69 FR 12369).

The proposed changes would revise TS 3.4.5 to allow a one-cycle use of Westinghouse leak-limiting Alloy 800 steam generator (SG) tube sleeves as an acceptable SG tube repair. Specifically, surveillance requirements 4.4.5.4.a.6 and 4.4.5.4.a.9 would be revised to list the Westinghouse leak-limiting Alloy 800 sleeves as an acceptable SG tube sleeving method in addition to the currently approved Westinghouse laser welded sleeves and the former ABB Combustion Engineering tungsten inert gas (TIG) welded sleeves.

2.0 REGULATORY EVALUATION

The applicable NRC regulations and guidance for review of the proposed sleeve repair method are as follows:

General Design Criterion (GDC) 14 of Appendix A to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, requires that the reactor coolant pressure boundary be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. SG tubes represent the majority of the reactor coolant pressure boundary. When a tube is defective, the tube is either repaired using a sleeve or removed from service by plugging. To repair a part of the existing reactor coolant pressure boundary, the sleeve should be qualified for service in accordance with the specifications in Section XI of the American Society for Mechanical Engineers (ASME)

Boiler and Pressure Vessel Code (Code), which refers back to Section III of the ASME Code. The sleeve is analyzed with appropriate ASME Code equations considering design, operating, and accident loading conditions. The resulting sleeve stresses should satisfy corresponding ASME Code limits. In addition, the sleeve wall thickness needs to satisfy the minimum wall thickness requirement of the ASME Code.

Appendix B to 10 CFR, Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," requires a quality assurance program for the design, fabrication, construction, and operation of structures, systems, and components in nuclear plants. The pertinent requirements of Appendix B apply to all activities affecting the safety-related functions of those structures, systems, and components. These activities include designing, purchasing, fabricating, handling, shipping, storing, cleaning, installing, inspecting, testing, operating, maintaining, repairing, refueling, and modifying.

Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded PWR [pressurized water reactor] Steam Generator Tubes," provides guidance for determining the minimum wall thickness beyond which the degraded tube should be plugged (i.e., plugging limits). RG 1.121 also provides performance criteria that recommend that the margin of safety against tube rupture under normal operating conditions should not be less than 3 at any tube location where defects have been detected. The margin of safety against tube failure under postulated accidents, such as a loss-of-coolant accident (LOCA), main steam line break (MSLB), or feedwater line break concurrent with the safe shutdown earthquake, should be consistent with the margin of safety determined by the stress limits specified in Section III of the ASME Code.

3.0 TECHNICAL EVALUATION

BVPS-1 contains three Westinghouse Model 51 SGs. There are 3388 mill-annealed Alloy 600 tubes per SG. The tubes have an outside diameter of seven-eighths of an inch, a wall thickness of 0.050-inch, and are supported by carbon steel tube support plates. The tube support plates are of a drilled hole design. BVPS-1 SG tubes were expanded full length into the tubesheet using an explosive expansion (WEXTEX) process.

A sleeve is a tube segment with a diameter smaller than that of the parent tube. The sleeve is inserted into and expanded inside the parent tube to form a structural joint. FENOC proposes a tube repair method that uses Westinghouse leak-limiting sleeves made of Alloy 800 material. The leak-limiting sleeve is not required to be leak tight. The design, installation, analysis, and qualification tests of the sleeve are documented in the Westinghouse Topical Report, "Steam Generator Tube Repair for Westinghouse Designed Plants with 7/8 Inch Inconel 600 Tubes Using Leak Limiting Alloy 800 Sleeves," WCAP-15919-P, Revision 00, dated August 2003 (proprietary). Thousands of leak-limiting Alloy 800 sleeves have been installed in several international nuclear plants and have been approved for use in the SGs at Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (original SGs), Watts Bar Nuclear Plant, Unit 1, and Comanche Peak Steam Electric Station, Unit 1. FENOC also stated that the leak-limiting Alloy 800 sleeves will not be in operation for more than one cycle due to the planned replacement of the BVPS-1 SGs after Cycle 17.

The NRC staff reviewed the following areas of the tube repair method: design, installation, materials selection, qualification testing, inspection, structural analyses, and leakage integrity of the Westinghouse leak-limiting Alloy 800 sleeve. The NRC staff also reviewed the proposed

changes to BVPS-1 TS 3.4.5 to determine the acceptability of the proposed changes. These topics are discussed below:

Design

Two leak-limiting Alloy 800 sleeve designs were proposed for use in repairing a tube. A transition zone sleeve (TZS) is designed to repair tube degradation in the vicinity of the top of the tubesheet. A tube support sleeve (TSS) is designed to repair tube degradation at the tube support plate intersections or in the freespan region. The length of the TZS and TSS are sized to encompass the degraded regions of the tube. To attach the sleeve to the parent tube, the TZS uses several hydraulic expansion joints in the upper region of the sleeve and a hard roll joint in the lower region of the sleeve that is located inside the tubesheet. The TSS uses several hydraulic expansion joints in the upper and lower regions of the sleeve.

Installation

FENOC stated that the leak-limiting Alloy 800 sleeves will be installed in accordance with the processes provided by the vendor and described in the associated reports, which address sleeve design, qualification, installation methods, non-destructive examination and as low as reasonably achievable (ALARA) radiation dose considerations. The Westinghouse leak-limiting Alloy 800 sleeving process is described in Westinghouse WCAP-15919-P, Revision 00. The nonproprietary version of the report is WCAP-15919-NP, Revision 00.

Prior to sleeve installation, the inside surface of the candidate tube is mechanically conditioned with a high-speed buffing tool. Buffing removes raised material and some of the oxide, and prepares the sealing surface of the tube. It was noted in the WCAP report that the buffing process may be eliminated in the future when a sufficient confidence level is developed. An expansion device is inserted into the sleeve to expand the sleeve to make the required number of hydraulic expansion joints with the parent tube. The expansion device is controlled and monitored to ensure consistent diametral expansion. The hydraulic expansion joints support the required structural and leakage integrity while limiting the residual stresses in the parent tube. The hard roll in the lower end of TZS is performed by a roll expander. The torque of the roll expander is also monitored and controlled. After the installation, all sleeve/tube joints undergo an initial acceptance and baseline inspection using an eddy current technique.

In response to the NRC staff's request for additional information (RAI), dated May 11, 2004, regarding actions to be taken upon the improper installation of a sleeve, FENOC stated that certain sleeve installation conditions, if present, would be cause to take a sleeved tube out of service by plugging. These conditions are: (1) an unacceptable set of expansions, (2) improper torque value for the rolled joint, (3) improperly positioned expanded joints, and (4) any type of unacceptable indication in the sleeve/tube pressure boundary found during baseline eddy current testing. FENOC also stated that the maximum number of rolling operations that can be performed on a sleeve joint is 6, of which 2 must meet the torque value requirements.

Materials Selection

The sleeve material, Alloy 800, is a nickel-iron-chromium alloy. Westinghouse selected Alloy 800 for its favorable mechanical properties and corrosion resistance in both the primary and secondary side water chemistry. It is procured in accordance with the requirements of ASME Code, Section II, Part B, SB-163, NiFeCr Alloy, Unified Numbering System (UNS) N08800, and Section III, Subsection NB-2000. Alloy 800 is incorporated in ASME Code Case N-20 and is considered acceptable for use by Regulatory Guide 1.85, "Materials Code Case Acceptability ASME Section III, Division 1," Revision 24, dated July 1986 (this RG was withdrawn in June 2003 and its guidance was incorporated into RG 1.84, "Design and Fabrication and Materials Code Case Acceptability, ASME Section III," Revision 32, dated June 2003). Westinghouse also requires additional restriction on contents of various chemical elements and specifies a specific annealing temperature and yield strength for the Alloy 800 sleeve.

Qualification Testing

Westinghouse performed qualification tests in accordance with Appendix B to 10 CFR, Part 50. The testing program included mechanical load tests, leakage tests, and corrosion tests. The mechanical load tests included axial load, pressure, collapse, and load cycling. The tests were performed on sleeve/tube mock-ups that were constructed to the same dimensions as the installed sleeves in the field.

Westinghouse performed axial load tests to determine the structural integrity of the sleeve/tube joint under differential thermal expansion of a leak-limiting Alloy 800 sleeve and Alloy 600 tube. The test loads included the full range of loadings expected under startup, transient, normal power, shutdown, and accident conditions. The axial load tests showed that the leak-limiting Alloy 800 sleeve can support differential thermal conditions and accident loads even if the parent tube is severed.

Westinghouse performed pressure tests to determine the structural integrity of the sleeve/tube joint under primary-to-secondary pressure differentials during normal operating, transient and postulated accident conditions. The pressure tests showed that the sleeve/tube joint will maintain a margin of 3 with respect to the normal operating differential pressure load as specified in RG 1.121.

Westinghouse performed collapse tests to show that the sleeve would not collapse if water is trapped in the annulus region between the inside surface of the parent tube and the outside surface of the sleeve. The trapped water may be pressurized during operation and potentially cause the sleeve to collapse. The collapse tests showed that the sleeve would not collapse under the maximum secondary side pressure.

Westinghouse performed load-cycling tests to show that the structural and leakage integrity of the sleeve/tube joint will be maintained under cyclical differential thermal expansion and internal pressure in normal operating and transient conditions. The load-cycling tests included fatigue, thermal cycling, and mechanical load cycling. The load applied in the cycling tests was greater than 3 times the maximum differential pressure. These tests showed that under various temperatures, the sleeve/tube joint is not degraded by cyclic loads. The cycling tests confirm that slip during the initial heat-up is small, and the sleeve repositions itself inside of the parent tube to accommodate the thermal expansion without subsequent slip. As a part of the load

cycling tests, the specimens were also tested for leakage integrity. The leak tests showed that the seal in the hydraulically expanded joints improved after load cycling.

Westinghouse performed leak-rate tests on the sleeve/tube assembly for various temperatures and pressures under normal operating and MSLB conditions. The test results showed that the leakage from a single sleeve is extremely small relative to the operational primary-to-secondary leakage limit in the plant TSs and the allowable leakage under accident conditions (see discussion below). It would take thousands of leaking sleeves to reach either operational or accident condition leakage limits.

Sleeve/tube joints increase the residual stresses in the parent tube which, in turn, may cause the tube to be susceptible to stress corrosion cracking (SCC). Westinghouse stated that the leak-limiting Alloy 800 sleeve is designed to impart minimal residual stresses to the parent tube to avoid potential corrosion in the hydraulic expansion joints. Westinghouse has performed various corrosion tests and assessments of leak-limiting Alloy 800 sleeves with full length sleeved tube mock-ups. Sleeve/tube assemblies were pressurized with highly corrosive solutions. Westinghouse also performed the corrosion tests to assess the relative time to cracking of the sleeve/tube joint. Leak-limiting Alloy 800 sleeves did not develop any cracking in either the primary or secondary side tests. The leak-limiting Alloy 800 sleeve has demonstrated higher corrosion resistance than the Alloy 600 parent tube.

Westinghouse stated that the leak-limiting Alloy 800 sleeves have not experienced service-induced degradation or leakage in nuclear plants. Westinghouse also stated that besides leak-limiting Alloy 800 sleeves, Alloy 800 tubing has been used in PWR conditions in international nuclear plants without experiencing primary or secondary side SCC. This is based on experience of over 200,000 tubes in service. However, the NRC staff judges that the time for the initiation of corrosion in sleeve/tube assemblies is difficult to accurately quantify. Although vendors traditionally conduct accelerated corrosion tests of sleeve/tube assemblies to predict service life, the NRC staff finds this method is unreliable for deterministic predictions. The NRC staff does consider that the corrosion tests give a viable indicator of potential performance. Presently, the NRC staff can only assume a limited life expectancy for leak-limiting Alloy 800 sleeves. Considering the uncertainties in sleeve life expectancy, the NRC staff requires licensees to inspect a sample of sleeves at each refueling outage to ensure that any degradation in the sleeve/tube assembly is detected and addressed early.

Inspection

FENOC stated that a preservice exam would be performed on the full length of 100% of the leak-limiting Alloy 800 sleeve/tube assemblies using the +Point™ eddy current probe. This examination would establish inservice inspection baseline data and initial installation acceptance data on the primary pressure boundary of the sleeve/tube assembly repair.

In response to the NRC staff's RAI regarding the use of eddy current equipment and examination techniques to detect degradation, FENOC stated that inspections of the leak-limiting Alloy 800 sleeves will be accomplished with eddy current inspections and equipment capable of detecting all flaw types which may potentially be present in the pressure boundary of the sleeve/tube assembly. The licensee stated that Westinghouse indicated that the specified eddy current technique, using the +Point™ probe, has been qualified in accordance with Appendix H of EPRI's [Electric Power Research Institute] Report, "PWR Steam Generator

Examination Guidelines," Revision 5, September 1997. Westinghouse qualified the sleeve inspection technique on actual sleeve/tube assemblies in accordance with 10 CFR, Part 50, Appendix B. The sleeve/tube qualification samples were fabricated with axially and/or circumferentially oriented notches representing flaws at each of the transitions and expansion zones. In addition, sleeve and tube flaws in the pressure boundary away from the expansion regions were included in the sample set. The flaws included electro-discharge machined (EDM) notches and a limited number of samples with cracking in the parent tube.

The NRC staff expressed a concern over the wording in the proposed TS change regarding the plugging criteria for the sleeve/tube assemblies. Existing TS 4.4.5.4.a.1 states, "...Eddy current testing indications below 20% of the nominal tube wall thickness, if detectable, may be considered as imperfections." Since the proposed TS does not specifically state that all eddy current testing indications below 20% of the nominal wall thickness in the sleeve and/or pressure boundary portion of the original tube wall in the sleeve/tube assembly will be considered as imperfections, it is possible that sleeves with indications up to 20% through-wall may not be classified as imperfections and, therefore, left in service. In response to the NRC staff's RAI regarding this statement, FENOC maintained that they will plug on detection any service-induced imperfection, degradation, or defect in the sleeve and/or pressure boundary portion of the original tube wall in the sleeve/tube assembly. Degradation is defined as ...a service-induced cracking, wastage, wear or general corrosion occurring on either the inside or outside of a tube or sleeve...without regard to the percent of tube wall thickness. Therefore, the term *any degradation* would mean that any service-induced indications of the type described above would require plugging upon detection. FENOC further stated that this would assure that any type of defect, regardless of percent through-wall degradation, would be removed from service upon detection in the areas being examined. Because the licensee's proposed TS change to "...Plug on detection of any service induced imperfection, degradation or defect in the (a) sleeve and/or (b) pressure boundary portion of the original tube wall in the sleeve/tube assembly..." ensures that regardless of the amount of service-induced cracking, wastage, wear or general corrosion occurring either on the inside or outside of the tube or sleeve, that it will be plugged, the NRC staff finds the proposed TS change acceptable.

In response to the staff's RAI regarding the structural limit for sleeve wall thinning, FENOC stated that thinning was not postulated to be a credible degradation mechanism due to the current operating chemistry regime. However, thinning would be expected to produce a greater probability of detection than cracking, based on the affected material volume. FENOC stated that wear scars of approximately 5% were readily detectable with the +Point™ coil. The NRC staff notes that FENOC did not provide the structural limit for sleeve wall thinning. However, the NRC staff concluded that, since FENOC plans to operate the current BVPS-1 SGs for only one additional cycle, Cycle 17, and since the prospect of wall thinning in the sleeves during this time period is considered negligible, this does not pose a significant concern to the integrity of the sleeved tubes during Cycle 17.

In response to the NRC staff's RAI regarding the chosen eddy current techniques used in the detection of cracks in the sleeve/tube configuration and the detectability of SCC flaws in sleeve/tube mockup samples, FENOC stated the capabilities of the eddy current technique were described in the Appendix H qualification document referenced in Section 5 of WCAP-15919-P, Rev. 00. FENOC also stated that the eddy current technique was qualified for a number of flaw types and locations, which it listed. In response to the NRC staff's RAI regarding the detection of flaws situated behind the nickel band in the sleeve/tube

configuration, FENOC stated that none of the qualification samples contained flaws behind the nickel band. However, calibration standards fabricated for the inspection of the TIG welded sleeve included axial EDM notches in the parent tube at the location of the nickel band as well as the microlok band immediately above (FENOC stated that the lower roll joint in the TIG sleeve is identical to that of the Alloy 800 sleeve). In the TIG sleeve, the notches were 100%, 70% and 50% deep. In the notches behind the nickel band, only the 100% notch was clearly detectable, whereas all three notches behind the microlok band were clearly detectable. FENOC stated that, since the parent tube would be inspected in the hardroll joint region prior to sleeve installation and that no parent tubes with detectable degradation in this region will be sleeved, the detection capabilities involving cracks behind the nickel band are not applicable. Subsequent inspection after operation, if required, would identify partial through-wall degradation of the parent tube above and below the nickel band. FENOC, furthermore, stated that axial degradation of the parent tube in the hardroll region coincident with the nickel band would not prevent the sleeve from performing its intended design function. The compressive nature of residual stresses below the expansion transition, coupled with the thermal expansion characteristics of the tubesheet, tube, and sleeve, and inherent residual preload associated with mechanical roll expansion are expected to result in a condition where the design function of the sleeve is not compromised for postulated axial degradation within the nickel band region. Given that the sleeves will only be in operation for one cycle of operation and the parent tube is inspected prior to sleeve installation, the NRC staff finds the limitations in the inspection capability are not a concern for BVPS-1, since this region of the tube will never need to be inspected.

With regard to FENOC's disposition of the Alloy 800 leak-limiting sleeves following Cycle 17 operation, FENOC added the footnote "Applicable only to Cycle 17" to proposed TS 4.4.5.4.a.6.d). This footnote was again used in conjunction with TS 4.4.5.4.a.9.c) in reference to the applicability of the Westinghouse WCAP-15919-P, Rev. 00, Report. FENOC also stated that BVPS-1 would not be legally allowed to operate using Alloy 800 leak-limiting tubes in Cycle 18 with the TSs written as proposed. The licensee plans to replace SGs prior to Cycle 18, however, in the unlikely event that the current SGs would be needed to operate beyond Cycle 17, the licensee stated that this would be addressed prior to Cycle 18 operation.

Therefore, the NRC staff concludes that the "Applicable only to Cycle 17" statement in the TSs is acceptable.

Structural Analysis

Westinghouse performed structural analyses in accordance with 10 CFR, Part 50, Appendix B, and Section III of the ASME Code. The structural analyses included applied loads from pressure, sleeved tube vibration, relative displacement, fatigue, axial, seismic, and thermal radial differential under normal and accident loading conditions. In the analyses, Westinghouse assumed two bounding tube configurations: (1) the tube is intact, and (2) the tube is severed at the flaw location. In addition, Westinghouse assumed two bounding tube support plate configurations: (1) the tube is free to move past the tube support plates, and (2) the tube is locked in the first tube support plate and is prevented from axial motion. The structural analyses showed that stresses and fatigue factor in the worst sleeve/tube configuration satisfy the allowables in Section III of the ASME Code.

Westinghouse's structural analysis also included calculations for a minimum required sleeve thickness based on ASME Code, Section III, Paragraph NB-3324.1. The calculations show that the actual sleeve wall thickness is greater than the minimum required thickness, and, therefore, is structurally acceptable. Westinghouse also calculated the percentage of sleeve wall thickness for allowable degradation considering axial or circumferential cracking as specified in RG 1.121. The calculated degradation limit was considered acceptable, since FENOC proposed a plug-on-detection approach which will limit the extent of any sleeve degradation.

Under severe accident conditions in which primary system temperature may reach 1200°F to 1500°F, the material properties of Alloy 800 are not significantly different from that of Alloy 600. As a result, the structural integrity of the leak-limiting Alloy 800 sleeve is commensurate with the integrity of the Alloy 600 parent tubing under severe accident conditions.

The NRC staff finds that FENOC's structural analysis is consistent with the ASME Code, and is, therefore, acceptable.

Leakage Integrity

Westinghouse has determined the sleeve joint leakage via laboratory testing to be small. For the leakage integrity assessment methodology, FENOC will conservatively assume all installed sleeves will leak under post-accident leakage conditions. The leak rate for each sleeve will be based on the upper 95% confidence limit on the mean value of leakage for appropriate temperature and pressure conditions. FENOC will combine the total sleeve leak rate with the total amount of leakage from all other sources (i.e., alternate repair criteria and non-alternate repair criteria indications) for comparison against the limit on accident-induced leakage as specified in the Updated Final Safety Analysis Report for the MSLB radiological consequences analysis. Based on a conservative sleeve leak rate determined from the sleeve leak rate tests and excluding calculated leakage from alternate plugging criteria in effect, a large number of TZSs or TSSs could be installed and still meet the BVPS-1 leakage limits. The plant-specific operational leakage limit for BVPS-1 is 150 gpd (gallons per day) primary-to-secondary leakage through any one SG as stated in TS 3.4.6.2, "RCS Operational Leakage." The BVPS-1 plant-specific accident-induced leakage limit for postulated MSLB conditions is 14.5 gpm (gallons per minute).

Based on the above, the NRC staff finds that FENOC's leakage integrity assessment methodology is acceptable.

Proposed Changes to Technical Specifications

FENOC proposed the following changes to Technical Specification 3.4.5. Proposed changes are underlined.

1. Technical Specification 4.4.5.2.b.3, page 3/4 4-9: Adds a statement concerning the Alloy 800 leak-limiting sleeve inspection sampling. The revised TS 4.4.5.2.b.3 reads as follows:

   > <u>Except for Alloy 800 leak limiting sleeves,</u> at least 3 percent of the total number of sleeved tubes in all three steam generators. A sample size less than 3 percent is acceptable provided all the sleeved tubes in the steam generator(s)

examined during the refueling outage are inspected. All inservice Alloy 800 leak limiting sleeves shall be inspected over the full length using a plus point coil or equivalent qualified technique during each refueling outage. These inspections will include both the tube and the sleeve, and

2. Technical Specification 4.4.5.4.a.6.d), page 3/4 4-10b: Is newly added and concerns the plugging or repair limit. The newly added TS 4.4.5.4.a.6.d) reads as follows:

> Westinghouse Alloy 800 leak limiting sleeve*: Plug on detection of any service induced imperfection, degradation or defect in the (a) sleeve and/or (b) pressure boundary portion of the original tube wall in the sleeve/tube assembly (i.e., the sleeve-to-tube joint).

In addition, the Note at the bottom of page 3/4 4-10b corresponds to the asterisk (*) in the newly added TS 4.4.5.4.a.6.d). The note reads as follows:

> * Applicable only to Cycle 17.

3. Technical Specification 4.4.5.4.a.9.c), page 3/4 4-10c: Is a newly added statement regarding sleeve designs acceptable for tube repair. The new TS 4.4.5.4.a.9.c) reads as follows:

> Westinghouse Alloy 800 leak limiting sleeves, WCAP-15919-P, Revision 00.*

In addition, a Note at bottom of page 3/4 4-10c corresponds to the asterisk (*) in the newly added TS 4.4.5.4.a.9.c). The note reads as follows:

> * Applicable only to Cycle 17.

As discussed previously, these proposed TS changes are acceptable to the NRC staff.

Conclusions

FENOC has performed structural analyses and tests for a variety of loadings that enveloped plant-specific design, operating, transient and accident loads. The analyses, testing, and operating experience demonstrate that the Westinghouse leak-limiting Alloy 800 sleeve is capable of restoring steam generator tube integrity. Therefore, the NRC staff concludes that the proposed changes to permit the installation of the Westinghouse leak-limiting Alloy 800 sleeves are acceptable.

4.0 REGULATORY COMMITMENTS

The licensee made several formal regulatory commitments in its letters of January 27 and May 27, 2004. The NRC staff has determined that the approval of the licensee's request should be conditional upon the licensee meeting these commitments; therefore, they have been incorporated into the amendment. The commitments shall remain in effect for the authorized period of sleeving with Westinghouse Alloy 800 sleeves, i.e., Cycle 17.

5.0 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.

6.0 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 (69 FR 12369). 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.

7.0 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: J. Terrell

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