CHARLES H. CRUSE
Vice President
Nuclear Energy

Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, Maryland 20657
410 495-4455

BGE

June 27, 1997

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Response to Request for Additional Information Regarding License Amendment Request: Sleeving Option for Steam Generator Tube Repair (TAC Nos. M94205 & M94206)

By letter dated November 30, 1995 (Reference a), the Baltimore Gas and Electric Company (BGE) requested an Amendment to Operating License Nos. DPR-53 and DPR-69 to allow the installation of tube sleeves as an alternative to plugging to repair defective steam generator tubes. Specifically, Reference (a) requested approval of sleeving repair techniques developed by Westinghouse Electric Corporation and Asea Brown Boveri-Combustion Engineering, Inc. (ABB-CE) for Calvert Cliffs application. The Westinghouse portion of the amendment request was approved on March 22, 1996 (Reference b), while the NRC continued to review the ABB-CE sleeve portion of the application, pending the resolution of generic issues raised by industry experience related to the use of ABB-CE sleeves. By letter dated March 6, 1997 (Reference c), we responded to the additional information requested by the NRC staff to address these generic issues (Reference d). This letter responds to the additional information you requested following your review of our March 6, 1997 response (Reference e). Your requests, followed by our responses, are detailed below:

REQUEST #1:

It appears that the sleeve plugging limit, discussed on page 8-9 of CEN 630-P should be 48.7% minus an allowance for NDE [non-destructive examination] *uncertainty and flaw growth instead of the presently [proposed] TS* [Technical Specification] *wording of 40%. Please clarify what the correct value should be for ABB/CE sleeves and provide appropriate TS wording changes if needed.*

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RESPONSE:

The presently proposed Technical Specification wording of 40% is based on the sleeve plugging limit of 48.7%, discussed on Page 8-9 of CEN 630-P, minus a 9% allowance for NDE uncertainty and flaw growth, discussed on Page 5-6 of CEN 630-P. However, based on the discussion we had with the NRC staff, we will use a conservative value of 20% allowance for NDE uncertainty and flaw growth. The 20% allowance, which accounts for 10% uncertainty value for NDE measurement and 10% allowance for continued degradation, is consistent with the value used for the Westinghouse sleeves (Reference a). The revised Technical Specification marked-up pages are provided in Attachments (1) and (2).

REQUEST #2:

The staff notes the generic topical provides for post-weld heat treatment (PWHT) as an optional item. The staff position is that PWHT enhances service life of the repair by lowering residual stress. This should result in increased time to crack initiation and possibly lower crack growth rates. What is the licensee's intention with respect to PWHT and basis for acceptability if the PWHT is not performed? Please provide data as necessary to support your bases.

RESPONSE:

Baltimore Gas and Electric Company will perform post-weld heat treatment during the installation of the ABB-CE leak tight sleeves in accordance with the staff position. In addition, per discussion we had with the staff, the requirement for the post-weld heat treatment will now be included in the Technical Specification. The revised Technical Specification marked-up pages are provided in Attachments (1) and (2).

REQUEST #3:

The staff believes that the inspection and expansion criteria in the EPRI [Electric Power Research Institute] *steam generator tube examination guidelines should be satisfied, as a minimum, for all sleeved tubes. Please provide appropriate wording in the TS reflecting this criteria. For reference, a previously adopted table incorporated in the TS of another licensee is attached.*

RESPONSE:

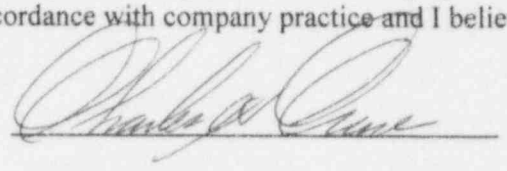
As stated in Reference (b), in response to the NRC Generic Letter 95-03, "Circumferential Cracking of Steam Generator Tubes," BGE has committed to perform steam generator inspections in conformance with Electric Power Research Institute guidelines. In accordance with the staff's suggestion, the repaired tube inspection and expansion criteria will be reflected in the Technical Specification. The revised Technical Specification marked-up pages are provided in Attachments (1) and (2).

Should you have further questions regarding this matter, we would be pleased to discuss them with you.

Very truly yours,

STATE OF MARYLAND :
: **TO WIT:**
COUNTY OF CALVERT :

I, Charles H. Cruse, being duly sworn, state that I am Vice President, Nuclear Energy Division, Baltimore Gas and Electric Company (BGE), and that I am duly authorized to execute and file this License Amendment Request on behalf of BGE. To the best of my knowledge and belief, the statements contained in this docume[illegible]re true and correct. To the extent that these statements are not based on my personal knowledge, the[illegible] are based upon information provided by other BGE employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.



Subscribed and sworn before me, a Notary Public in and for the State of Maryland and County of Calvert, this 27th day of June, 1997.

WITNESS my Hand and Notarial Seal:

Denise D. Sanders
Notary Public

My Commission Expires:

3/2/98
Date

CHC/GT/dlm

Attachments: (1) Unit 1 Marked-Up Technical Specification Pages
(2) Unit 2 Marked-Up Technical Specification Pages

cc: A. W. Dromerick, NRC

(Without Attachments)

cc: R. S. Fleishman, Esquire
J. E. Silberg, Esquire
Director, Project Directorate I-1, NRC
H. J. Miller, NRC
Resident Inspector, NRC
R. I. McLean, DNR
J. H. Walter, PSC

REFERENCES:

(a) Letter from Mr. R. E. Denton (BGE) to NRC Document Control Desk, dated November 30, 1995, "License Amendment Request: Sleeving Option for Steam Generator Tube Repair"

(b) Letter from Mr. D. G. McDonald, Jr. (NRC) to Mr. C. H. Cruse (BGE), dated March 22, 1996, "Issuance of Amendments for Calvert Cliffs Nuclear Plant, Unit No. 1 (TAC No. M94205) and Unit No. 2 (TAC No. M94206)"

(c) Letter from C. H. Cruse (BGE) to NRC Document Control Desk, dated March 6, 1997, "Response to Request for Additional Information Regarding License Amendment Request: Sleeving Option for Steam Generator Tube Repair (TAC Nos. M94205 & M94206) "

(d) Letter from Mr. D. G. McDonald, Jr. (NRC) to Mr. C. H. Cruse (BGE), dated February 26, 1996, "Request for Additional Information Regarding ABB-CE Steam Generator Tube Sleeving Process - Calvert Cliffs Nuclear Plant, Unit Nos. 1 and 2 (TAC Nos. M94205 and M94206)"

(e) Letter from A. W. Dromerick (NRC) to Mr. C. H. Cruse (BGE), dated April 1, 1997, "Request for Additional Information Regarding License Amendment Request-Sleeving Option for Steam Generator Tube Repair (TAC Nos. M94205 and M94206)"

ATTACHMENT (1)

UNIT 1 MARKED-UP TECHNICAL SPECIFICATION PAGES

REVISED PAGES:

3/4 4-10

3/4 4-12

3/4 4-13

3/4 4-14

B 3/4 4-4

Baltimore Gas & Electric Company
Docket Nos. 50-317 and 50-318
June 27, 1997

3/4.4 REACTOR COOLANT SYSTEM

3/4.4.5 STEAM GENERATORS

LIMITING CONDITION FOR OPERATION

3.4.5 Each steam generator shall be **OPERABLE.**

APPLICABILITY: **MODES** 1, 2, 3 and 4.

ACTION: With one or more steam generators inoperable, restore the inoperable generator(s) to **OPERABLE** status prior to increasing T_{avg} above 200°F.

SURVEILLANCE REQUIREMENTS

4.4.5.0 Each steam generator shall be demonstrated **OPERABLE** by performance of the following augmented inservice inspection program and the requirements of Specification 4.0.5.

4.4.5.1 Steam Generator Sample Selection and Inspection - Each steam generator shall be determined **OPERABLE** during shutdown by selecting and inspecting at least the minimum number of steam generators specified in Table 4.4-1.

4.4.5.2 Steam Generator Tube Sample Selection and Inspection - The steam generator tube minimum sample size, inspection result classification, and the corresponding action required shall be as specified in Table 4.4-2. The inservice inspection of steam generator tubes shall be performed at the frequencies specified in Specification 4.4.5.3 and the inspected tubes shall be verified acceptable per the acceptance criteria of Specification 4.4.5.4. When applying the exceptions of 4.4.5.2.a through 4.4.5.2.c, previous defects or imperfections in the area repaired by sleeving are not considered an area requiring reinspection. The tubes selected for each inservice inspection shall include at least 3% of the total number of tubes in all steam generators; the tubes selected for these inspections shall be selected on a random basis except:

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a. Where experience in similar plants with similar water chemistry indicates critical areas to be inspected, then at least 50% of the tubes inspected shall be from these critical areas.

b. The first inservice inspection (subsequent to the preservice inspection) of each steam generator shall include:

   1. All nonplugged tubes that previously had detectable wall penetrations (> 20%), and

SURVEILLANCE REQUIREMENTS (Continued)

outage if the results of the two previous inspections were not in the C-3 Category. However, if the results of either of the previous two inspections were in the C-2 Category, an engineering assessment shall be performed before operation beyond 24 months and shall provide assurance that all tubes will retain adequate structural margins against burst throughout normal operating, transient, and accident conditions until the end of the fuel cycle or 30 months, whichever occurs first. If two consecutive inspections following service under AVT conditions, not including the preservice inspection, result in all inspection results falling into the C-1 category or if two consecutive inspections demonstrate that previously observed degradation has not continued and no additional degradation has occurred, theinspection interval may be extended to a maximum of once per 40 months.

b. If the inservice inspection of a steam generator conducted in accordance with Table 4.4-2 at 40-month intervals fall in Category C-3, the inspection frequency shall be increased to at least once per 20 months. The increase in inspection frequency shall apply until the subsequent inspections satisfy the criteria of Specification 4.4.5.3.a; the interval may then be extended to a maximum of once per 30 or 40 months, as applicable.

c. Additional, unscheduled inservice inspections shall be performed on each steam generator in accordance with the first sample inspection specified in Table 4.4-2 during the shutdown subsequent to any of the following conditions:

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

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

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

   4. A main steam line or feedwater line break.

d. The provisions of Specification 4.0.2 do not apply for extending the frequency for performing inservice inspections as specified in Specifications 4.4.5.3.a and b.

SURVEILLANCE REQUIREMENTS (Continued)

4.4.5.4 Acceptance Criteria

a. As used in this Specification:

1. Tubing or Tube means that portion of the tube or sleeve which forms the primary system to secondary system pressure boundary.

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

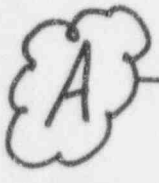
3. Degradation means a service-induced cracking, wastage, wear or general corrosion occurring on either inside or outside of a tube.

4. Degraded Tube means a tube containing imperfections $\geq$ 20% of the nominal wall thickness caused by degradation.

5. % Degradation means the percentage of the tube wall thickness affected or removed by degradation.

6. 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.

7. 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. Westinghouse laser welded sleeve wall.....40%

8. 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 steam line or feedwater line break as specified in 4.4.5.3.c, above.

9. 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 of the cold leg.

SURVEILLANCE REQUIREMENTS (Continued)

10. Tube Repair refers to a process that reestablishes tube serviceability. Acceptable tube repairs will be performed by the following process: (B5)

    a) Westinghouse Laser Welded Sleeving as described in the proprietary Westinghouse Reports WCAP-13698, Revision 2, "Laser Welded Sleeves for 3/4 Inch Diameter Tube Feedring-Type and Westinghouse Preheater Steam Generators, Generic Sleeving Report," April 1995; and WCAP-14469, "Specific Application of Laser Welded Sleeving for the Calvert Cliffs Power Plant Steam Generators," November 1995.

(B)

    Tube repair includes the removal of plugs that were previously installed as a corrective or preventive measure. A tube inspection per Specification 4.4.5.4.a.9 is required prior to returning previously plugged tubes to service.

b. The steam generator shall be determined **OPERABLE** after completing the corresponding actions (plug or repair all tubes exceeding the plugging or repair limit and all tubes containing through-wall cracks) required by Table 4.4-2 (E5) and 4.4-3.

4.4.5.5 Reports

a. Following each inservice inspection of steam generator tubes, the number of tubes plugged or repaired in each steam generator shall be reported to the Commission within 15 days pursuant to 10 CFR 50.4.

b. The complete results of the steam generator tube inservice inspection during the report period shall be submitted to the Commission prior to March 1 of each year pursuant to 10 CFR 50.4. This report shall include:

    1. Number and extent of tubes inspected.

    2. Location and percent of wall-thickness penetration for each indication of an imperfection.

    3. Identification of tubes plugged or repaired.

c. Results of steam generator tube inspections which fall into Category C-3 require verbal notification of the NRC Regional Administrator by telephone within 24 hours prior to resumption of plant operation. The written followup of this report shall provide a description of investigations conducted to determine cause of the tube degradation and corrective measures taken to prevent recurrence and shall be submitted within the next 30 days pursuant to 10 CFR 50.4.

TABLE 4.4-3

STEAM GENERATOR REPAIRED TUBE INSPECTION

1ST SAMPLE INSPECTION			2ND SAMPLE INSPECTION	
Sample Size	Result	Action Required	Result	Action Required
A minimum of 20% of repaired tubes(1)(2)	C-1	None	NA	NA
	C-2	Plug Defective repaired tubes and inspect 100% of the repaired tubes in this SG.	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 in this SG plug defective tubes and inspect 20% of the repaired tubes in the other SG. 24-hour verbal notification to NRC with written follow-up, pursuant 10 CFR 50.4.	Other SG is C-1	None
			Other SG is C-2	Perform action for C-2 result of first sample
			Other SG is C-3	Inspect all repaired tubes in each SG and plug defective tubes. 24-hour verbal notification to NRC with written follow-up, pursuant 10 CFR 50.4.

(1) Each repair method is considered a separate population for determination of scope expansion.
(2) The inspection of repaired tubes may be performed on tubes from either SG based on outage plans.

adequate structural margins against burst during all normal operating, transient, and accident conditions until the end of the fuel cycle. This evaluation would include the following elements:

1. An assessment of the flaws found during the previous inspections.

2. An assessment of the structural margins relative to the criteria of Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," that can be expected before the end of the fuel cycle or 30 months, whichever comes first.

3. An update of the assessment model, as appropriate, based on comparison of the predicted results of the steam generator tube integrity assessment with actual inspection results from previous inspections.

The plant is expected to be operated in a manner such that the secondary coolant will be maintained within those chemistry limits found to result in negligible corrosion of the steam generator tubes. If the secondary coolant chemistry is not maintained within these 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 = 1 gallon per minute, total). 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 1 gallon perminute 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. Defective tubes may be repaired by a Westinghouse Laser Welded Sleeve. The technical bases for Westinghouse Laser Welded Sleeve are described in the proprietary Westinghouse Reports WCAP-13698, Revision 2, "Laser Welded Sleeves for 3/4 Inch Diameter Tube Feedring-Type and Westinghouse Preheater Steam Generators, Generic Sleeving Report," April 1995; and WCAP-14469, "Specific Application of Laser Welded Sleeving for the Calvert Cliffs Power Plant Steam Generators," November 1995.

Wastage-type defects are unlikely with proper chemistry treatment of the secondary coolant. However, even if a defect should develop in service, it will be found during scheduled inservice steam generator tube examinations. Plugging or repair will be required for all tubes with imperfections at or exceeding the plugging or repair limit of 40% of the original tube nominal wall thickness. If a tube contains a Westinghouse Laser Welded Sleeve with imperfection exceeding 40% of nominal wall thickness, it must be plugged. The basis for the sleeve plugging limit is based on Regulatory Guide 1.121 analyses, and is described in the Westinghouse sleeving technical report mentioned above. Steam generator tube inspections of operating plants have demonstrated the capability to reliably detect degradation that has

OR an ABB-Combustion Engineering Leak Tight Sleeve

C

E

and ABB-Combustion Engineering

5

D

Insert A: c. ABB-Combustion Engineering Leak Tight Sleeve wall.....28%

Insert B: b. ABB-Combustion Engineering Leak Tight Sleeving as described in the proprietary ABB-Combustion Engineering Report CEN-630-P, Revision 01, "Repair of 3/4" O.D. Steam Generator Tubes Using Leak Tight Sleeves," August 1996. A post-weld heat treatment during installation will be performed.

Insert C: The technical bases for the Combustion Engineering Leak Tight Sleeve are described in the proprietary ABB-Combustion Engineering Report CEN-630-P, Revision 01, "Repair of 3/4" O.D. Steam Generator Tubes Using Leak Tight Sleeves," August 1996

Insert D: or an ABB-Combustion Engineering Leak Tight Sleeve exceeding 28%

Insert E: (Note: the sleeve plugging limit also includes 20% combined allowance for eddy current uncertainty and additional degradation growth.)

ATTACHMENT (2)

UNIT 2 MARKED-UP TECHNICAL SPECIFICATION PAGES

REVISED PAGES:

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Baltimore Gas & Electric Company
Docket Nos. 50-317 and 50-318
June 27, 1997

3/4.4 REACTOR COOLANT SYSTEM

3/4.4.5 STEAM GENERATORS

LIMITING CONDITION FOR OPERATION

3.4.5 Each steam generator shall be **OPERABLE.**

APPLICABILITY: **MODES** 1, 2, 3 and 4.

ACTION: With one or more steam generators inoperable, restore the inoperable generator(s) to **OPERABLE** status prior to increasing T_{avg} above 200°F.

SURVEILLANCE REQUIREMENTS

4.4.5.0 Each steam generator shall be demonstrated **OPERABLE** by performance of the following augmented inservice inspection program and the requirements of Specification 4.0.5.

4.4.5.1 Steam Generator Sample Selection and Inspection - Each steam generator shall be determined **OPERABLE** during shutdown by selecting and inspecting at least the minimum number of steam generators specified in Table 4.4-1.

4.4.5.2 Steam Generator Tube Sample Selection and Inspection - The steam generator tube minimum sample size, inspection result classification, and the corresponding action required shall be as specified in Table 4.4-2. The inservice inspection of steam generator tubes shall be performed at the frequencies specified in Specification 4.4.5.3 and the inspected tubes shall be verified acceptable per the acceptance criteria of Specification 4.4.5.4. When applying the exceptions of 4.4.5.2.a through 4.4.5.2.c, previous defects or imperfections in the area repaired by sleeving are not considered an area requiring reinspection. The tubes selected for each inservice inspection shall include at least 3% of the total number of tubes in all steam generators; the tubes selected for these inspections shall be selected on a random basis except:

Amd 4.4-3

a. Where experience in similar plants with similar water chemistry indicates critical areas to be inspected, then at least 50% of the tubes inspected shall be from these critical areas.

b. The first inservice inspection (subsequent to the preservice inspection) of each steam generator shall include:

   1. All nonplugged tubes that previously had detectable wall penetrations (>20%), and

SURVEILLANCE REQUIREMENTS (Continued)

were not in the C-3 Category. However, if the results of either of the previous two inspections were in the C-2 Category, an engineering assessment shall be performed before operation beyond 24 months and shall provide assurance that all tubes will retain adequate structural margins against burst throughout normal operating, transient, and accident conditions until the end of the fuel cycle or 30 months, whichever occurs first. If two consecutive inspections following service under AVT conditions, not including the preservice inspection, result in all inspection results falling into the C-1 category or if two consecutive inspections demonstrate that previously observed degradation has not continued and no additional degradation has occurred, the inspection interval may be extended to a maximum of once per 40 months.

b. If the inservice inspection of a steam generator conducted in accordance with Table 4.4-2 at 40-month intervals fall in Category C-3, the inspection frequency shall be increased to at least once per 20 months. The increase in inspection frequency shall apply until the subsequent inspections satisfy the criteria of Specification 4.4.5.3.a; the interval may then be extended to a maximum of once per 30 months or 40 months, as applicable.

c. Additional, unscheduled inservice inspections shall be performed on each steam generator in accordance with the first sample inspection specified in Table 4.4-2 during the shutdown subsequent to any of the following conditions:

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

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

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

   4. A main steam line or feedwater line break.

d. The provisions of Specificatin 4.0.2 do not apply for extending the frequency for performing inservice inspections as specified in Specifications 4.4.5.3.a and b.

SURVEILLANCE REQUIREMENTS (Continued)

4.4.5.4 Acceptance Criteria

a. As used in this Specification:

1. Tubing or Tube means that portion of the tube or sleeve which forms the primary system to secondary system pressure boundary.

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

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

4. Degraded Tube means a tube containing imperfections $\geq$ 20% of the nominal wall thickness caused by degradation.

5. % Degradation means the percentage of the tube wall thickness affected or removed by degradation.

6. 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.

7. 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. Westinghouse laser welded sleeve wall.....40%

8. 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 steam line or feedwater line break as specified in 4.4.5.3.c, above.

9. 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 of the cold leg.

SURVEILLANCE REQUIREMENTS (Continued)

10. Tube Repair refers to a process that reestablishes tube serviceability. Acceptable tube repairs will be performed by the following process: es

    a) Westinghouse Laser Welded Sleeving as described in the proprietary Westinghouse Reports WCAP-13698, Revision 2, "Laser Welded Sleeves for 3/4 Inch Diameter Tube Feedring-Type and Westinghouse Preheater Steam Generators, Generic Sleeving Report," April 1995; and WCAP-14469, "Specific Application of Laser Welded Sleeving for the Calvert Cliffs Power Plant Steam Generators," November 1995. B

    Tube repair includes the removal of plugs that were previously installed as a corrective or preventive measure. A tube inspection per Specification 4.4.5.4.a.9 is required prior to returning previously plugged tubes to service.

b. The steam generator shall be determined **OPERABLE** after completing the corresponding actions (plug or repair all tubes exceeding the plugging or repair limit and all tubes containing through-wall cracks) required by Table 4.4-2 and 4.4-3.

4.4.5.5 Reports S3

a. Following each inservice inspection of steam generator tubes, the number of tubes plugged or repaired in each steam generator shall be reported to the Commission within 15 days pursuant to 10 CFR 50.4.

b. The complete results of the steam generator tube inservice inspection during the report period shall be submitted to the Commission prior to March 1 of each year pursuant to 10 CFR 50.4. This report shall include:

    1. Number and extent of tubes inspected.

    2. Location and percent of wall-thickness penetration for each indication of an imperfection.

    3. Identification of tubes plugged or repaired.

c. Results of steam generator tube inspections which fall into Category C-3 require verbal notification of the NRC Regional Administrator by telephone within 24 hours prior to resumption of plant operation. The written followup of this report shall provide a description of investigations conducted to determine cause of the tube degradation and corrective measures taken to prevent recurrence and shall be submitted within the next 30 days pursuant to 10 CFR 50.4.

TABLE 4.4-3

STEAM GENERATOR REPAIRED TUBE INSPECTION

1ST SAMPLE INSPECTION			2ND SAMPLE INSPECTION	
Sample Size	Result	Action Required	Result	Action Required
A minimum of 20% of repaired tubes(1)(2)	C-1	None	NA	NA
	C-2	Plug Defective repaired tubes and inspect 100% of the repaired tubes in this SG.	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 in this SG plug defective tubes and inspect 20% of the repaired tubes in the other SG. 24-hour verbal notification to NRC with written follow-up, pursuant 10 CFR 50.4.	Other SG is C-1	None
			Other SG is C-2	Perform action for C-2 result of first sample
			Other SG is C-3	Inspect all repaired tubes in each SG and plug defective tubes. 24-hour verbal notification to NRC with written follow-up, pursuant 10 CFR 50.4.

(1) Each repair method is considered a separate population for determination of scope expansion.
(2) The inspection of repaired tubes may be performed on tubes from either SG based on outage plans.

adequate structural margins against burst during all normal operating, transient, and accident conditions until the end of the fuel cycle. This evaluation would include the following elements:

1. An assessment of the flaws found during the previous inspections.

2. An assessment of the structural margins relative to the criteria of Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," that can be expected before the end of the fuel cycle or 30 months, whichever comes first.

3. An update of the assessment model, as appropriate, based on comparison of the predicted results of the steam generator tube integrity assessment with actual inspection results from previous inspections.

The plant is expected to be operated in a manner such that the secondary coolant will be maintained within those chemistry limits found to result in negligible corrosion of the steam generator tubes. If the secondary coolant chemistry is not maintained within these 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 = 1 gallon per minute, total). 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 1 gallon per minute 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. Defective tubes may be repaired by a Westinghouse Laser Welded Sleeve. The technical bases for Westinghouse Laser Welded Sleeve are described in the proprietary Westinghouse Reports WCAP-13698, Revision 2, "Laser Welded Sleeves for 3/4 Inch Diameter Tube Feedring-Type and Westinghouse Preheater Steam Generators, Generic Sleeving Report," April 1995; and WCAP-14469, "Specific Application of Laser Welded Sleeving for the Calvert Cliffs Power Plant Steam Generators," November 1995.

Wastage-type defects are unlikely with proper chemistry treatment of the secondary coolant. However, even if a defect should develop in service, it will be found during scheduled inservice steam generator tube examinations. Plugging or repair will be required for all tubes with imperfections at or exceeding the plugging or repair limit of 40% of the tube original nominal wall thickness. If a tube contains a Westinghouse Laser Welded Sleeve with imperfection exceeding 40% nominal wall thickness, it must be plugged. The basis for the sleeve plugging limit is based on Regulatory Guide 1.121 analyses, and is described in the Westinghouse sleeving technical report mentioned above. Steam generator tube inspections of operating plants have demonstrated the capability to reliably detect degradation that has

OR an ABB-Combustion Engineering Leak Tight sleeve

C

E

and ABB-Combustion Engineering

D

Insert A: c. ABB-Combustion Engineering Leak Tight Sleeve wall.....28%

Insert B: b. ABB-Combustion Engineering Leak Tight Sleeving as described in the proprietary ABB-Combustion Engineering Report CEN-630-P, Revision 01, "Repair of 3/4" O.D. Steam Generator Tubes Using Leak Tight Sleeves," August 1996. A post-weld heat treatment during installation will be performed.

Insert C: The technical bases for the Combustion Engineering Leak Tight Sleeve are described in the proprietary ABB-Combustion Engineering Report CEN-630-P, Revision 01, "Repair of 3/4" O.D. Steam Generator Tubes Using Leak Tight Sleeves," August 1996

Insert D: or an ABB-Combustion Engineering Leak Tight Sleeve exceeding 28%

Insert E: (Note: the sleeve plugging limit also includes 20% combined allowance for eddy current uncertainty and additional degradation growth.)