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W3F1-2010-0011

February 22, 2010

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: License Amendment Request
Technical Specification Change Regarding Steam Generator Program
Waterford Steam Electric Station, Unit 3
Docket No. 50-382
License No. NPF-38

Dear Sir or Madam:

Pursuant to 10CFR50.90, Entergy Operations, Inc. (Entergy) hereby requests a license amendment to the Waterford Steam Electric Station, Unit 3 (Waterford 3) Technical Specifications (TS). The proposed amendment will modify TS 6.5.9, "Steam Generator (SG) Program," and TS 6.9.1.5, "Steam Generator Tube Inspection Report" to eliminate currently allowed SG tube alternate repair criteria and to modify the SG tube inservice inspection frequency.

Entergy will be replacing the two Waterford 3 steam generators (SGs) during the 17th refueling outage which will commence in the spring of 2011. The existing Waterford 3 SG Program under TS 6.5.9 contains an alternate repair criterion for SG tube inspections that is no longer applicable to the replacement SGs. The replacement SGs will contain new thermally treated Alloy 690 tubing material which will have no tube inspection limitations that will require additional revision to the Waterford 3 Steam Generator Program. Additionally, with the new Alloy 690 thermally treated SG tubing, inservice inspection frequencies may be extended beyond that currently allowed. Therefore, this request is only to eliminate the alternate SG tubing repair criterion that is not applicable to the replacement SGs and to incorporate SG tube inspection frequencies consistent with TSTF-449-A.

A description of the proposed change is provided in Attachment 1. A markup of the affected TS pages is contained in Attachment 2. Associated changes to the TS Bases being controlled under the Waterford 3 TS Bases Control Program are provided for information in Attachment 3.

The proposed change has been evaluated in accordance with 10CFR50.91(a)(1) using criteria in 10CFR50.92(c) and it has been determined that the changes involve no significant hazards consideration.

The proposed change involves no new commitments.

A001
NRR

Entergy requests approval of the proposed amendment by February 19, 2011. Once approved, the amendment shall be implemented prior to the first SG tube inservice inspection for the replacement SGs.

Please contact Robert Murillo, Manager, Licensing at 504-739-6715 if there are any comments regarding this submittal.

I declare under penalty of perjury that the foregoing is true and correct. Executed on February 22, 2010.

Sincerely,

JAK/sab

Attachments:
1. Analysis of Proposed Technical Specification Change
2. Proposed Technical Specification Changes (mark-up)
3. Proposed Technical Specification Bases Changes (mark-up for information only)

cc: Mr. Elmo E. Collins, Jr.
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Attachment 1 to

W3F1-2010-0011

Analysis of Proposed Technical Specification Change

1.0 DESCRIPTION

This letter is a request to amend Operating License NPF-38 for the Waterford Steam Electric Station, Unit 3 (Waterford 3). Entergy will be replacing the two Waterford 3 steam generators (SGs) during the 17th refueling outage which will contain SG tubes having Alloy 690 Thermally Treated (TT) material. The Waterford 3 Technical Specifications (TS) 6.5.9, "Steam Generator (SG) Program," and TS 6.9.1.5, "Steam Generator Tube Inspection Report" contain a SG tube alternate repair criterion that is only applicable to original SGs. Therefore, this amendment request will propose the removal of the alternate repair criterion which will not be applicable to the replacement SGs. Additionally with the replacement of the SGs with new Alloy 690 TT material, the SG tube inspection frequency is being extended after the initial inspection post-SG replacement. No other changes to the Waterford Steam Generator Program TSs are being requested as a result of the replacement SGs.

2.0 PROPOSED CHANGE

The proposed modification to TS 6.5.9 and 6.9.1.5 will remove currently approved alternate repair criteria applicable to the original SGs and modify the SG tube inspection frequencies in the Waterford 3 Steam Generator Program for the new SG tube material. These changes will be consistent with Technical Specification Task Force (TSTF)-449-A, Revision 4 (Reference 1). The Waterford 3 SG Program contains one alternate repair criterion. This criterion excludes inspection and repair of the bottom portion of the SG tube within the hot leg tubesheet region to only require inspections of the upper portion of the tube within the hot-leg tubesheet region. The following proposed TS changes will remove inspection, flaw acceptance, and reporting requirements associated with this alternate repair criterion. These changes are contained in Attachment 2 of this submittal.

- Revise TS 6.5.9.c to remove the sentence which states: "The following alternate tube repair criteria may be applied as an alternative to the 40% depth based criteria".
- Delete TS 6.5.9.c.1 in its entirety which allows flaws located greater than 10.6 inches below the bottom of the hot leg expansion transition to remain in service.
- Revise TS 6.5.9.d to remove discussion regarding the alternate repair criterion. The wording in this section is being revised to be consistent with TSTF-449-A.
- Revise TS 6.5.9.d.2 to replace the current sequential SG tube inspection period frequency for Alloy 600 mill annealed tubing to that for new Alloy 690 TT material.
- Revise TS 6.9.1.5.g to remove "...assessment of accident induced leakage from all tubesheet indications..." since this was added to address the alternate repair criterion.

The following changes are being proposed to the TS Bases as reflected in Attachment 3. Since TS Bases changes are controlled by the Waterford 3 TS Bases Control Program, they are provided for information only.

- Revise TS Bases 3/4.4.4 under Limiting Conditions for Operation, to remove the discussion regarding tubesheet inspection depth as part of the definition of a SG tube. The wording in this section is being revised to be consistent with TSTF-449-A.

- Delete Reference 7 of TS Bases 3/4.4.4 which is associated with WCAP-16208-P that was the basis for the tubesheet inspection depth alternate repair criterion.

3.0 BACKGROUND

In response to Generic Letter 2004-01 (Reference 2), Entergy determined that the Waterford 3 SG tube inspection scope was not consistent with the NRC position for performing tube inspections within the tubesheet region of the SG. As a result, Entergy committed to modify the Waterford-3 TSs to include a specific limitation for tubesheet depth inspection associated with the existing SGs. In letter dated March 15, 2005 (Reference 3), Entergy sought a license amendment for Waterford 3 that proposed an alternate repair criterion that would allow the tube inspection depth to be based on a joint industry testing program which was reported in WCAP-16208-P (Reference 4). This report concluded that flaws below a defined inspection distance below the tubesheet expansion transition region do not pose a safety concern. Based on the results of WCAP-16208-P, Entergy determined that Waterford 3 could exclude inspections of the tube portion from 10.6 inches below the top of the tubesheet and would not affect SG operational safety. Any tube with degradation within the tubesheet above this inspection distance would be plugged upon detection. The NRC approved this license amendment request including supplements in Waterford 3 License Amendment 207 dated August 26, 2006 (Reference 5).

Under a separate license amendment request by Entergy, the NRC approved Waterford 3 License Amendment 204 (Reference 6) which changed the SG tube surveillance program to be consistent with the approach and format approved by the NRC in TSTF-449-A. At the time of implementation of this change, the subsequent inspection frequency for SG tube inspections was based on having mill annealed Alloy 600 tubing (Alloy 600 MA). This amendment provided the current Waterford 3 SG Tube Integrity requirements in TS 3/4.4.4 and SG Program requirements in TS 6.5.9.

4.0 TECHNICAL ANALYSIS

The Alloy 600 MA tubing material in the original SGs has shown to be susceptible to primary water stress corrosion cracking (PWSCC). The Waterford 3 replacement SGs have been designed using Alloy 690 TT tubing. Based on extensive industry-wide testing, Alloy 690 TT materials have been determined to be the material of choice for reactor coolant system applications including SG tubing. Alloy 690 TT has been proven through both laboratory testing and operational experience to provide increased corrosion resistance compared to Alloy 600 MA. No steam generator tube degradation due to PWSCC has occurred in Westinghouse steam generators using Alloy 690 TT tube material. Each of the original Waterford 3 SGs contain 9350 vertical U-tubes having an outside diameter (OD) of 0.750 inches and a tube wall thickness of 0.048 inches. Each replacement SG will contain 8968 tubes having a tube OD of 0.750 inches and a tube wall thickness of 0.044 inches (rows 1 and 2) or 0.043 inches (rows 3 through 138).

Steam generator tube wear is considered to be the only degradation mechanism that has the potential to reduce tube life and tube integrity. The tube wear is typically caused by fretting between a tube and a neighboring object. Based on the replacement SG design, unacceptable tube wear is not expected. The replacement SGs include a number of features that minimize the potential for tube wear at the tube supports and the anti-vibration bars

(AVBs). Provisions to minimize the potential for wear include the spacing between the tube supports, the configuration of the broached hole through the support plate, the surface finish of the broached hole in the tube support plate, the clearance between the tube and the hole in the tube support plate, tube support plate material selection, and the configuration of the AVB assemblies. Based on the above design changes for the replacement SGs, Entergy believes that significant wear will be limited over the remaining life of the plant.

Therefore, Entergy is eliminating the current alternate repair criterion that is only applicable to the original SGs and is not proposing any additions for new or different alternate repair criteria. Even though not final, Entergy believes that the Regulatory Guide 1.121 (Reference 7) analyses will validate the current 40% tube repair limit. The SG Program requirements for the structural integrity, accident induced leakage, and operational leakage performance criteria will be confirmed by design analyses which will be performed under the requirements of 10CFR50.59. Entergy also does not anticipate any other changes to the Waterford 3 Steam Generator Program technical specifications associated with the replacement SGs.

The current SG tube inspection frequency contained under TS 6.5.9.d.2 for subsequent tube inspections is based on having Alloy 600 MA tubing material. Since this material is more susceptible to stress corrosion cracking, the inspection frequency is based on a 60 effective full power month period. However, with the improved material design of the replacement SG tubing, the frequency of subsequent SG tube is justified. TSTF-449-A provides various SG tube inspection frequency options based on tubing material. Since the replacement SGs use the latest improved Alloy 690 TT materials, the inspection frequency can be extended. As a result, Entergy will be revising TS 6.5.9.d.2 to extend the inspection of 100% of the tubes to sequential periods of 144, 108, 72, and, thereafter, 60 effective full power months. The first sequential period shall be considered to begin after the first inservice inspection of the SGs. In addition, inspect 50% of the tubes by the refueling outage nearest the midpoint of the period and the remaining 50% by the refueling outage nearest the end of the period. No SG shall operate for more than 72 effective full power months or three refueling outages (whichever is less) without being inspected.

Therefore, the scope of the proposed changes to the Waterford 3 Steam Generator Tube Integrity and Steam Generator Program contained in the technical specifications will eliminate the existing alternate repair criterion that is not applicable to the replacement SGs and will extend the subsequent SG tube inspection period to conform with the SG Program requirements for the new tube materials under TSTF-449-A.

5.0 REGULATORY ANALYSIS

5.1 Applicable Regulatory Requirements/Criteria

Entergy Operations, Inc. (Entergy) proposes to remove the steam generator (SG) tube alternate repair criteria that are contained in Waterford Steam Electric Station, Unit 3 (Waterford 3) Technical Specification (TS) 6.5.9, "Steam Generator (SG) Program," and TS 6.5.1.5, "Steam Generator Tube Inspection Report." The Waterford 3 TSs contain one alternate repair criterion which is only applicable to the original SGs. The original SGs are scheduled to be replaced in the spring 2011 refueling outage. Additionally, the allowed subsequent sequential SG tube inspection period after initial inspection is being extended based on replacement SGs that contain Alloy 690 Thermally Treated (TT) material. No other

changes to the Waterford 3 SG Program contained in the TSs are being proposed as a result of the replacement SGs. The proposed changes will revise the Waterford 3 TSs to the discussion contained in NRC approved Technical Specification Task Force (TSTF)-449-A, Revision 4 having no alternate repair criteria.

In conclusion, Entergy has determined that the proposed change does not require any exemptions or relief from regulatory requirements, other than the TS, and does not affect systems, structures, and components described in the Waterford 3 Final Safety Analysis Report (FSAR).

5.2 No Significant Hazards Consideration

Entergy Operations, Inc. has evaluated whether or not a significant hazards consideration is involved with the proposed amendment 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?

   Response: No.

   The proposed change continues to implement the Waterford 3 Steam Generator Program performance criteria for tube structural integrity, accident induced leakage, and operational leakage for the replacement SGs. Meeting the performance criteria provides reasonable assurance that the replacement SG tubing will remain capable of fulfilling its specific safety function of maintaining reactor coolant system (RCS) pressure boundary integrity throughout each operating cycle and in the unlikely event of a design basis accident.

   The Steam Generator Tube Rupture (SGTR) is the primary accident analysis associated with SG tube integrity. The replacement SG tubing contains improved materials that will reduce the likelihood of tubing flaws. The proposed change to remove alternate repair criteria from the SG inspection program does not affect the design of the replacement SGs, their method of operation, operational leakage limits, or primary coolant chemistry controls. Therefore, the proposed change does not affect the probability of a SGTR accident. The SGs will be designed with substantial margin to burst. The SG tube inspection repair limit will also identify potential flaws before they become a safety concern. The extension of the SG tube inspection frequency after initial inspection is based on the low likelihood of having potential tube flaws and is considered to be an acceptable inspection period to preserve pressure boundary integrity. As a result, there will be no affect on the previous dose analysis reported in the FSAR and the consequences of any accident are unchanged.

   Therefore, this change 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?

   Response: No.

   Steam generator tube rupture events have already been postulated and analyzed in the Waterford 3 FSAR. The proposed change does not affect the design of the SGs, their method of operation, or primary or secondary coolant chemistry controls. Additionally, the proposed amendment does not impact any other plant systems or components. The TSs have established SG tube inspection requirements which assure that potential tubing flaws will be detected prior to affecting tube integrity and the RCS pressure boundary. Therefore, the proposed change does not create the possibility of a new or different type of accident from any accident previously evaluated.

   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?

   Response: No.

   The structural integrity, accident induced leakage, and operational leakage performance criteria required by the Waterford 3 TSs provide substantial design margin for assuring SG tube integrity against the possibility of a SG tube pressure boundary failure. The proposed change removes an existing alternate repair criterion that is not applicable to the replacement SGs and establishes appropriate SG tube subsequent inspection periods consistent with the new SG tubing design. The replacement SGs will continue to meet their required performance criteria. The Waterford 3 SG tube inspection program will assure that this margin is maintained through the operational life of the plant.

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

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

5.3 Environmental Considerations

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.

6.0 PRECEDENCE

Similar changes to remove alternate repair criteria as part of SG replacements have been previously sought and approved by other licensees. A recent example was that performed for Progress Energy's Crystal River Nuclear Plant which the NRC approved on May 29, 2009 (Reference 8).

7.0 REFERENCES

1. Technical Specification Task Force (TSTF)-449-A, "Steam Generator Tube Integrity", Revision 4, May 5, 2006.
2. NRC Generic Letter 2004-01, "Requirements for Steam Generator Tube Inspections", August 30, 2004.
3. Proposed Technical Specification Change Regarding Tubesheet Inspection Depth for Steam Generator Tube Inspections, March 15, 2005 (W3FI-2005-0009). [ML050770200]
4. WCAP-16208-P, "NDE Inspection Length for CE Steam Generator Tubesheet Region Explosive Expansions", Revision 0, October 2004.
5. NRC Amendment 207 issued to Entergy Operations on August 29, 2006, "Waterford Steam Electric Station, Unit 3 - Issuance of Amendment Re: Steam Generator Tube Inspections and Repair Criteria within the Hot-Leg Tubesheet Region" (TAC No. MC6421). [ML062220137]
6. NRC Amendment 204 issued to Entergy Operations on July 31, 2006, "Waterford Steam Electric Station, Unit 3 - Issuance of Amendment Re: Steam Generator Tube Integrity" (TAC NO. MC7973). [ML062000169]
7. U. S. Nuclear Regulatory Commission Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes", August 1976.
8. NRC Amendment 234 issued to Progress Energy on May 29, 2009, "Crystal River Unit 3 -Issuance of Amendment Regarding the Revision of the Steam Generator Portion of the Technical Specifications to Reflect the Replacement of the Steam Generators" (TAC No. MD9547). [ML091100056]

Attachment 2 to

W3F1-2010-0011

Proposed Technical Specification Changes (mark-up)

ADMINISTRATIVE CONTROLS

STEAM GENERATOR (SG) PROGRAM (Continued)

b. Performance criteria for SG tube integrity. SG tube integrity shall be maintained by meeting the performance criteria for tube structural integrity, accident induced leakage, and operational leakage.

1. Structural integrity performance criterion: All in-service steam generator tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cool down and all anticipated transients included in the design specification) and design basis accidents. This includes retaining a safety factor of 3.0 against burst under normal steady state full power operation primary to secondary pressure differential and a safety factor of 1.4 against burst applied to the design basis accident primary to secondary pressure differentials. Apart from the above requirements, additional loading conditions associated with the design basis accidents, or combination of accidents in accordance with the design and licensing basis, shall also be evaluated to determine if the associated loads contribute significantly to burst or collapse. In the assessment of tube integrity, those loads that do significantly affect burst or collapse shall be determined and assessed in combination with the loads due to pressure with a safety factor of 1.2 on the combined primary loads and 1.0 on axial secondary loads.

2. Accident induced leakage performance criterion: The primary to secondary accident induced leakage rate for any design basis accident, other than a SG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all SGs and leakage rate for an individual SG. Primary to secondary leakage is not to exceed 540 gpd through any one SG.

3. The operational leakage performance criterion is specified in LCO 3.4.5.2, "Reactor Coolant System Operational Leakage."

c. Provisions for SG tube repair criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding 40% of the nominal tube wall thickness shall be plugged.

~~The following alternate tube repair criteria may be applied as an alternative to the 40% depth based criteria:~~

~~1. Flaws located greater than 10.6 inches below the bottom of the hot leg expansion transition or top of the hot leg tubesheet, whichever is lower, may remain in service. Degradation detected between 10.6 inches below the bottom of the hot leg expansion transition or top of the hot leg tubesheet, whichever is lower, and the bottom of the hot leg expansion transition or top of the hot leg tubesheet, whichever is higher, shall be plugged on detection.~~

ADMINISTRATIVE CONTROLS

STEAM GENERATOR (SG) PROGRAM (Continued)

d. Provisions for SG tube inspections. Periodic SG tube inspections shall be performed. The number and portions of the tubes inspected and methods of inspection shall be performed with the objective of detecting flaws of any type (e.g., volumetric flaws, axial and circumferential cracks) that may be present along the length of the tube, from ~~the tube-to-tubesheet weld at the tube inlet~~ ~~10.6 inches below the bottom of the hot leg expansion transition or top of the hot leg tubesheet, whichever is lower, completely around the U-bend~~ to the tube-to-tubesheet weld at the tube outlet and that may satisfy the applicable tube repair criteria. The tube-to-tubesheet weld is not part of the tube. In addition to meeting the requirements of d.1, d.2, and d.3 below, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that SG tube integrity is maintained until the next SG inspection. An assessment of degradation shall be performed to determine the type and location of flaws to which the tubes may be susceptible and, based on this assessment, to determine which inspection methods need to be employed and at what locations.

1. Inspect 100% of the tubes in each SG during the first refueling outage following SG replacement.

2. ~~Inspection 100% of the tubes at sequential periods of 60 effective full power months. The first sequential period shall be considered to begin after the first inservice inspection of the SGs. No SG shall operate for more than 24 effective full power months or one refueling outage (whichever is less) without being inspected.~~

3. If crack indications are found in any SG tube, then the next inspection for each SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full power months or one refueling outage (whichever is less). If definitive information, such as from examination of a pulled tube, diagnostic non-destructive testing, or engineering evaluation indicates that a crack-like indication is not associated with a crack(s), then the indication need not be treated as a crack.

e. Provisions for monitoring operational primary to secondary leakage.

Inspect 100% of the tubes at sequential periods of 144, 108, 72, and, thereafter, 60 effective full power months. The first sequential period shall be considered to begin after the first inservice inspection of the SGs. In addition, inspect 50% of the tubes by the refueling outage nearest the midpoint of the period and the remaining 50% by the refueling outage nearest the end of the period. No SG shall operate for more than 72 effective full power months or three refueling outages (whichever is less) without being inspected.

ANNUAL REPORTS (Continued)

(1) Reactor power history starting 48 hours prior to the first sample in which the limit was exceeded;

(2) Results of the last isotopic analysis for radioiodine performed prior to exceeding the limit, results of analysis while limit was exceeded and results of one analysis after the radioiodine activity was reduced to less than limit. Each result should include date and time of sampling and the radioiodine concentrations;

(3) Clean-up system flow history starting 48 hours prior to the first sample in which the limit was exceeded;

(4) Graph of the I-131 concentration and one other radioiodine isotope concentration in microcuries per gram as a function of time for the duration of the specific activity above steady-state level; and

(5) The time duration when the specific activity of the primary coolant exceeded the radioiodine limit.

6.9.1.5 STEAM GENERATOR TUBE INSPECTION REPORT

A report shall be submitted within 180 days after the initial entry into HOT SHUTDOWN following completion of an inspection performed in accordance with the Specification 6.5.9, Steam Generator (SG) Program. The report shall include:

a. The scope of inspections performed on each SG,

b. Active degradation mechanisms found,

c. Nondestructive examination techniques utilized for each degradation mechanism,

d. Location, orientation (if linear), and measured sizes (if available) of service induced indications,

e. Number of tubes plugged during the inspection outage for each active degradation mechanism,

f. Total number and percentage of tubes plugged to date,

g. The results of condition monitoring, including the results of tube pulls, in-situ testing, and ~~assessment of accident-induced leakage from all tubesheet indications; and~~

h. The effective plugging percentage for all plugging in each SG.

Attachment 3 to

W3F1-2010-0011

Proposed Technical Specification Bases Changes

(Mark-up provided for information only)

For accidents that do not involve fuel damage, the primary coolant activity level is assumed to be equal to the LCO 3.4.7 *RCS Specific Activity* limits. For accidents that assume fuel damage, the primary coolant activity is a function of the amount of activity released from the damaged fuel. The dose consequences of these events are within the limits of GDC 19 (Reference 2) and 10 CFR 50.67 (Reference 3). Steam generator tube integrity satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

between the tube-to-tubesheet weld at the tube inlet and

Limiting Condition for Operation

• (ORN 06-997, Ch. 49)

The LCO requires that SG tube integrity be maintained. The LCO also requires that all SG tubes that satisfy the repair criteria be plugged in accordance with the *Steam Generator Program*. During a SG inspection, any inspected tube that satisfies the *Steam Generator Program* repair criteria is removed from service by plugging. If a tube was determined to satisfy the repair criteria but was not plugged, the tube may still have tube integrity. In the context of this Specification, a SG tube is defined as the entire length of the tube, including the tube wall, ~~from 10.6 inches below the bottom of the hot leg expansion transition or top of the hot leg tubesheet, whichever is lower, completely around the U-bend to~~ the tube-to-tubesheet weld at the tube outlet. The tube-to-tubesheet weld is not considered part of the tube.

• (ORN 06-997, Ch. 49)

A SG tube has tube integrity when it satisfies the SG performance criteria. The SG performance criteria are defined in Specification 6.5.9, *Steam Generator Program*, and describe acceptable SG tube performance. The Steam Generator Program also provides the evaluation process for determining conformance with the SG performance criteria.

There are three SG performance criteria: structural integrity, accident induced leakage, and operational leakage. Failure to meet any one of these criteria is considered failure to meet the LCO.

- The structural integrity performance criterion provides a margin of safety against tube burst or collapse under normal and accident conditions, and ensures structural integrity of the SG tubes under all anticipated transients included in the design specification. Tube burst is defined as, "The gross structural failure of the tube wall. The condition typically corresponds to an unstable opening displacement (e.g., opening area increased in response to constant pressure) accompanied by ductile (plastic) tearing of the tube material at the ends of the degradation." Tube collapse is defined as, "For the load displacement curve for a given structure, collapse occurs at the top of the load versus displacement curve where the slope of the curve becomes zero." The structural integrity performance criterion provides guidance on assessing loads that significantly affect burst or collapse. In that context, the term "significantly" is defined as "An accident loading condition other than differential pressure is considered significant when the addition of such loads in the assessment of the structural integrity performance criterion could cause a lower structural limit or limiting burst/collapse condition to be established." For tube integrity evaluations, except for circumferential degradation, axial thermal loads are classified as secondary loads. For circumferential degradation, the classification of axial thermal loads as primary or secondary loads will be evaluated on a case-by-case basis. The division between primary and secondary classifications will be based on detailed analysis and/or testing.

  Structural integrity requires that the primary membrane stress intensity in a tube not exceed the yield strength for all ASME Code, Section III, Service Level A (normal operating conditions) and Service Level B (upset or abnormal conditions) transients included in the

The frequency of prior to entering HOT SHUTDOWN following a SG inspection ensures that the Surveillance has been completed and all tubes meeting the repair criteria are plugged prior to subjecting the SG tubes to significant primary to secondary pressure differential.

REFERENCES

1. NEI 97-06, *Steam Generator Program Guidelines.*

2. 10 CFR 50 Appendix A, GDC 19.

3. 10 CFR 50.67.

4. ASME Boiler and Pressure Vessel Code, Section III, Subsection NB.

5. Draft Regulatory Guide 1.121, *Basis for Plugging Degraded Steam Generator Tubes,* August 1976.

6. EPRI, *Pressurized Water Reactor Steam Generator Examination Guidelines.*

←(DRN 06-916, Ch. 48)
→(DRN 06-997, Ch. 49)
~~7. Westinghouse WCAP-16208-P, Revision 1, "NDE Inspection Length for CE Steam Generator Tubesheet Region Explosive Expansions," May 2005~~
←(DRN 06-997, Ch. 49)