Entergy

Entergy Operations, Inc.
17265 River Road
Killona, LA 70057-3093
Tel 504-739-6715
Fax 504-739-6698
jkowale@entergy.com

Joseph A. Kowalewski
Vice President, Operations
Waterford 3

W3F1-2011-0040

July 20, 2011

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

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

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, 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 3/4.4.4, "Steam Generator (SG)Tube Integrity," TS 6.5.9, "Steam Generator (SG) Program," and TS 6.9.1.5, "Steam Generator Tube Inspection Report."

Entergy will be replacing the two Waterford 3 steam generators (SGs) during the 18th refueling outage which will commence in the fall of 2012. 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existing Waterford 3 SG Program under TS 6.5.9 contains an alternate repair criterion for SG tube inspections that is no longer applicable to the replacement SGs. Additionally, the replacement SGs will contain improved Alloy 690 thermally treated (TT) tubing material. Therefore, the SG tubing inservice inspection frequencies may be extended beyond that currently allowed by the Waterford TSs. Entergy proposes to apply the guidance of Technical Specification Task Force (TSTF)-510, Revision 2 for this change. TSTF-510 is currently being proposed as a Consolidated Line Item Improvement Process (CLIIP); however TSTF-510 has not been approved by the NRC at this time. Due to other proposed changes to the Waterford 3 TSs for the upcoming Replacement SG outage and the near term need to process these changes ahead of NRC approval of TSTF-510, Entergy is requesting adoption of these improvements as a plant specific change for Waterford 3 instead of a CLIIP change.

A description of the proposed change is provided in Attachment 1. A markup of the affected TS pages is contained in Attachment 2. Proposed changes to the TS Bases which are being controlled under the Waterford 3 TS Bases Control Program are provided in Attachment 3, for information only. A clean copy of the proposed TS pages is contained in Attachment 4.

The proposed change has been evaluated in accordance with 10 CFR 50.91(a)(1) using criteria in 10 CFR 50.92(c) and it has been determined that the changes involve no significant hazards consideration.

A001
NRR

The proposed change involves no new commitments.

Entergy requests approval of the proposed amendment by August 1, 2012. Once approved, the amendment shall be implemented prior to the first SG tube inservice inspection for the replacement SGs.

Please contact William J. Steelman at 504-739-6685 if there are any questions regarding this amendment request.

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 20, 2011.

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)
4. Proposed Technical Specification Changes (clean copy)

cc: Mr. Elmo E. Collins, Jr.
Regional Administrator
U. S. Nuclear Regulatory Com mission
Region IV
612 E. Lamar Blvd., Suite 400
Arlington, TX 76011-4125
RidsRgn4MailCenter@nrc.gov

NRC Senior Resident Inspector
Waterford Steam Electric Station Unit 3
P.O. Box 822
Killona, LA 70066-0751
marlone.davis@nrc.gov'
Dean.Overland@nrc.gov

U. S. Nuclear Regulatory Com mission
Attn: Mr. N. Kalyanam
Mail Stop O-07D1
Washington, DC 20555-0001
Kaly.Kalyanam@nrc.gov

Attachment 1 to

W3F1-2011-0040

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 18th refueling outage which will commence in the fall of 2012. 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 the original SGs. Therefore, this amendment request will propose the removal of this alternate repair criterion. Additionally, the replacement SG (RSG) tubes will contain Alloy 690 Thermally Treated (TT) material. Based on this improved tubing material, the SG tube inspection frequency periods are also being requested for extension after the initial inspection post-SG replacement. Entergy proposes to apply the guidance of Revision 2 to Technical Specification Task Force (TSTF)-510 (Reference 1) for the change in inservice inspection frequency. Other changes consistent with TSTF 510 are also being proposed including changes to TS 3/4.4.4,"Steam Generator Tube Integrity."

2.0 PROPOSED CHANGE

The proposed modification to TSs 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 TSTF-510, Revision 2. The Waterford 3 SG Program currently contains one alternate repair criterion. This criterion excludes inspection and repair of the SG tube below a specified location in the hot leg tubesheet region. The following proposed TS changes will remove inspection, flaw acceptance, and reporting requirements associated with this alternate repair criterion. In addition, TSTF-510 also contains modified SG Program language that is being proposed for the Waterford 3 TSs. These TS page are discussed below and markups for the proposed changes are contained in Attachment 2 of this submittal.

- Revise TS 3/4.4.4 to apply a change in terminology from what was previously referenced as "tube repair criteria" to become "tube plugging criteria." This terminology is also revised in various locations of TS 6.5.9.

- Revise TS 6.5.9 to remove the word "provisions" at the end of the first paragraph since this is duplicative to the bulleted items. This is an editorial change and is not further discussed.

- Revise TS 6.5.9.b.1 to relocate the closure of the parenthetical statement after "and cooldown" which is consistent with TSTF-510. This inappropriately includes anticipated transients in the description of normal operating conditions. This change is considered an editorial change and is not further discussed.

- *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. This specification 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-510.

- Revise TS 6.5.9.d for the portion of the sentence where "An assessment of degradation..." is being changed to "A degradation assessment..."

- Revise TS 6.5.9.d.1 to change the reference of "SG replacement" to "SG installation." This wording change will allow the Steam Generator Program to apply to both existing plants and new plants. This change is considered editorial and is not further discussed.

- Revise TS 6.5.9.d.2 to replace the current sequential SG tube inspection period requirements for Alloy 600 mill annealed tubing to that for new Alloy 690 TT material consistent with the guidance of TSTF-510 (see revised SG tube inspection frequency in Attachment 2). Note: A new TS page 6-7d is created due to rollover of previous text.

- Revise the first sentence in TS 6.5.9.d.3 to read: "If crack indications are found in any SG tube, then the next inspection for each affected and potentially affected SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full power months or one refueling outage (whichever results in more frequent inspections)."

- Revise TS 6.9.1.5.b and 6.9.1.5.e to remove the word "Active" for reporting degradation mechanisms discovered.

- Revise TS 6.9.1.5.f to read: "The number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator." This change also replaces TS 6.9.1.5.h which is being deleted.

- 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 being provided for information only.

- Revise TS Bases 3/4.4.4 in several locations to apply a change in terminology for "tube plugging criteria."

- 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 current language of TSTF-510 where no alternate repair criteria are proposed.

- Add the following statement at the end of the fourth paragraph under Surveillance Requirements in TS Bases 3/4.4.4: "If crack indications are found in any SG tube, the maximum inspection interval for all affected and potentially affected SGs is restricted by Specification 6.5.9 until subsequent inspections support extending the inspection interval."

- Delete Reference 7 of TS Bases 3/4.4.4 which is associated with WCAP-16208-P that is only applicable to 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 unacceptable 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 (Reference 7). 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.

TSTF-510, Revision 2 provides industry recommended improvements for SG tube inspection frequencies for that previously provided in the guidance of TSTF-449-A, Revision 4 as well as enhancements to other SG Program sections. Entergy believes that the guidance of TSTF-510 provides a more appropriate approach for SG tube inspection frequency. Even though not approved, the NRC provided notice of opportunity for public comment on the model safety evaluation for TSTF-510 (Reference 8). However, due to the near term need to seek changes to the SG Program TSs in support of the upcoming Replacement SG outage, Entergy is requesting adoption of these improvements as a plant specific change for Waterford 3 instead of a Consolidated Line Item Improvement Process (CLIIP) change.

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 RSGs have been designed using Alloy 690 TT tubing. Alloy 690 TT tubing 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 RSG 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).

<u>Alternate Repair Criteria</u> - Steam generator tube wear is considered to be the only degradation mechanism that has the potential to reduce tube life and tube integrity for the

RSGs. The tube wear is typically caused by fretting between a tube and a neighboring object. Based on the RSG design, unacceptable tube wear is not expected. The RSGs 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 RSGs, 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.

SG Tube Structural Integrity Performance Criterion (SIPC) and Plugging Criteria - Waterford 3 TS 6.5.9.b.1 requires that the SIPC be met for in-service steam generator tubes over the full range of normal operating conditions 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 differential. In addition, loading conditions associated with the design basis accidents 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.

The structural integrity analysis for the RSG tubing was performed by Westinghouse Electric Company under WCAP-17263-P, Revision 0 (Reference 9). This analysis used the guidance of Regulatory Guide (RG) 1.121 (Reference 10) and NEI 97-06, Revision 2 (Reference 11). The primary purpose of this evaluation was to confirm the structural capability of the RSG tubing under normal and accident conditions and to show that the current 40% tube plugging criteria provided in TS 6.5.9.c is bounded by the RSG tube "structural limit" given anticipated tube wall degradation. The evaluation was performed for a 40 year replacement steam generator life assuming 10% tube plugging. The integrity of individual tubes considered both general and localized degradation based on tube loadings, tube stresses, and the minimum tube wall thickness given potential wear. For American Society of Mechanical Engineers (ASME) Code, Section III, Service Level A (normal plant operations), Level B (transients), and Level D (design basis accidents) conditions, limiting stresses were determined for primary membrane stresses due to the primary-to-secondary pressure differential across the tube wall (Service Level C conditions were enveloped by Level D conditions). Calculations were performed to establish the minimum wall requirements for uniform tube wear and for wear over limited axial extent at the tube support plate and AVB intersections. The RSG tube structural analyses were performed for a 55% structural limit which provides sufficient margin above the 40% tube plugging criteria to account for potential flaw growth between tube inservice inspections during plant operation and for eddy current measurement uncertainty.

The calculated minimum tube wall thickness (tmin) values were based on stress limit criteria consistent with Section III of the ASME Code (Reference 12). The

Waterford 3 analysis determined that the limiting t_{min} location was along the SG tube freespan region for the given heatup or cooldown transient. To bound the prescribed 55% structural limit, the analysis was restricted to a maximum reactor coolant system (RCS) pressure of 2000 psia below an RCS temperature of 450°F and 2250 psia between a temperature of 450°F and 470°F. Based on these heatup/cooldown pressure limits, the RSG tubes will continue to retain the structural margin against gross failure or burst under normal operating, transient, and post accident conditions. In addition, the margin against SG tube collapse was confirmed by showing that the SG tubes having uniform localized degradation retains sufficient strength over the secondary to primary differential pressure created from the limiting design basis Loss of Coolant Accident (LOCA). These heatup/cooldown RCS pressure and temperature restrictions are being controlled by Entergy for incorporation into the Waterford 3 operating procedures prior to implementation of the RSGs.

The analysis performed under WCAP-17263-P confirms that the SIPC is met and the 40% tube plugging criteria provided in TS 6.5.9.c remain valid for the Waterford 3 RSGs. Therefore, there are no technical specification changes required based on results of this analysis.

SG Tube Inservice Inspection Frequency - 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. Since the RSGs use the latest improved Alloy 690 TT materials, the inspection frequency can be appropriately extended. However, in lieu of TSTF-449-A, Entergy proposes to apply TSTF-510 which provides more appropriate SG tube inspection frequency options based on the type and conditioning of SG tubing material. Within each inspection period for Alloy 690TT tubing, the current guidance of TSTF-449-A establishes inspection requirements for the midpoint and end point of each period such that 50% of the tubes are inspected by the refueling outage nearest the midpoint, and the remaining 50% is inspected by the refueling outage nearest the end point. However, these inspection requirements can interfere with a plant's ability to operate for the maximum inspection interval allowed by the specification even when no degradation is present. Sampling requirements for the midpoint and end point of each inspection period, and requirements for addition of new sample plans after the start of an inspection period, are not well defined and can require a plant to adjust the size of the inspection sample to meet these requirements. As a result, Entergy is proposing to revise TS 6.5.9.d.2 to extend the inspection of 100% of the tubes to include four distinct SG tube inspection periods for Alloy 690TT tubing material after the first refueling outage following SG installation. These periods are based on the guidance of TSTF-510 (see Insert 1 of Attachment 2).

A provision is also included in TS 6.5.9.d.2 which prorates the inspections for new degradation types or locations. It requires that the fraction of locations to be inspected for new potential degradation types or locations at the end of the inspection period shall be no less than the ratio of the number of times the SG is scheduled to be inspected in the inspection period after the determination that a new form of degradation could potentially be occurring at this location divided by the total number of times the SG is scheduled to be inspected in the inspection period. This change provides improved inspection flexibility.

The interval between inspections must be supported by an assessment that concludes tube integrity will be maintained for the period of planned operations. The assessment must be reviewed at each refueling outage regardless of whether a SG inspection is planned. If this assessment concludes that tube integrity cannot be ensured for the maximum interval between inspections, more frequent inspections are required. In addition, if crack-like indications are found in any SG, the interval to the next inspection is limited by TS 6.5.9.d.3 to 24 effective full power months or one refueling outage (whichever results in more frequent inspections). The specification would allow a SG which has tube cracking to return to a longer inspection frequency if cracking was not detected in a subsequent inspection provided it is supported with adequate justification in the degradation and operational assessments. The potential that the total number of SG inspections completed during a given inspection period may be less is offset by the addition of provisions to increase the minimum sample size at each inspection to ensure that 100% of tubes are inspected. This justification also supports the provision to allow a 3 effective full power month extension of the inspection period to include a SG inspection outage in an inspection period. Thus, the proposed increase in the total length of each inspection period for 690TT tubing does not reduce or adversely impact the integrity of SG tubing. Waterford 3 is on an 18 month refueling outage cycle whereby the maximum inspection interval within an inspection period will not exceed every third refueling outage.

Non-Technical Changes to the Waterford 3 SG Tube Inspection Program – The following provides a discussion of other changes to the Waterford TSs affecting SG tube inspections:

1. Terminology in TS 3/4.4.4 and TS 6.5.9 is being changed from what was previously referred to as "tube repair criteria" to "tube plugging criteria." Since Waterford 3 will no longer have an approved repair process for the RSGs, the term "tube plugging criteria" is more appropriate. This change does not affect the manner in which the SG Program is being implemented and is consistent with TSTF-510 guidance.

2. The change in TS 6.5.9.d from "An assessment of degradation" to "A degradation assessment" also represents an improvement in terminology. The reference to a degradation assessment is more appropriate since this is a formal assessment process that is consistent with industry SG tube inspection guidance. This change does not affect the manner in which the SG Program is being implemented and is consistent with TSTF-510 guidance.

3. TS 6.5.9.d.3 is being changed to read: "If crack indications are found in any SG tube, then the next inspection for each affected and potentially affected SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full power months or one refueling outage (whichever results in more frequent inspections)." This language provides clarity to the term "each SG". The intention is that those SGs that are affected or potentially affected must be inspected for the degradation mechanism that caused the crack indication. The current language could be misinterpreted that "each SG" requires only the SGs that are affected to be inspected for the degradation mechanism. This change is consistent with TSTF-510 guidance.

4. The revision to TS 6.9.1.5.b and 6.9.1.5.e which deletes the word "Active" for reporting degradation mechanisms discovered provides consistency with the remainder of the SG tube inspection program. The term "active" degradation mechanism is not defined or used elsewhere and should be referred to as just "degradation mechanism". This

change does not affect the manner in which the SG Program is being implemented and is consistent with TSTF-510 guidance.

5. The revision to TS 6.9.1.5.f to read: "The number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator" and the deletion of TS 6.9.1.5.h, provides a more appropriate reporting process. Paragraph 6.9.1.5.f is revised to require reporting the effective plugging percentage. Vendors of tube repair methods provide the equivalent RCS flow reduction to licensees for effective plugging percentage. In practice the plugging percentage and the effective plugging percentage are the same. This change does not affect the manner in which the SG Program is being implemented and is consistent with TSTF-510 guidance.

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 which is not applicable to the RSGs and will extend the subsequent SG tube inspection period to conform with the SG Program requirements for the new tube materials as recommended by TSTF-510. Other changes are either editorial or provide a more consistent approach for the implementation of the SG Program.

5.0 REGULATORY ANALYSIS

5.1 Applicable Regulatory Requirements/Criteria

Entergy Operations, Inc. (Entergy) proposes to modify the steam generator (SG) tube integrity requirements contained in Waterford Steam Electric Station, Unit 3 (Waterford 3) Technical Specification (TS) 3/4.4.4, "Steam Generator Tube Integrity," 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 fall 2012 refueling outage where this criterion will no longer be applicable. Additionally, the allowed subsequent sequential SG tube inspection periods after initial inspection are being extended based on RSGs that contain Alloy 690 Thermally Treated (TT) material. Other changes to the Waterford 3 TSs provide consistency and clarity to the SG Program. The SG Program structural integrity performance criterion and SG tube plugging criteria have also been confirmed for the RSG tubing. The proposed changes will revise the Waterford 3 TSs consistent with the discussion contained in the guidance in Technical Specification Task Force (TSTF) -510, Revision 2.

In conclusion, Entergy has determined that the proposed changes do not require any exemptions or relief from regulatory requirements and does not adversely affect systems, structures, and components described in the Waterford 3 Updated 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 10 CFR 50.92, "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 (SG) 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. Sufficient SG tube structural margin above the 40% SG tube plugging criteria is retained for the replacement SGs to ensure that the probability of an accident is unchanged. The replacement SGs are designed with substantial margin to burst. Therefore, the proposed change does not affect the probability of a SGTR accident. 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 Updated Final Safety Analysis Report (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 been postulated and analyzed in the Waterford 3 FSAR. The improved Alloy 690TT SG tubing material in the Waterford 3 replacement SG reduces the likelihood of creating new or different types of tubing flaws. The proposed changes do not reduce the design requirements of the SG tubes that would affect the current accident analysis. The proposed amendment does not impact any other plant systems or components. The SG tube inspection TS requirements 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 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 technical specifications provide substantial design margin for assuring SG tube integrity against the possibility of a SG tube pressure boundary failure. The analyzed 55% structural limit provides sufficient margin above the SG tube plugging criteria of 40% for consideration of eddy current measurement uncertainty and allowance for inspection cycle flaw growth. 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 10 CFR 50.92(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 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(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 for 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 13). Entergy is not aware of any requested or approved NRC license amendment applications based on the guidance of TSTF-510.

7.0 REFERENCES

1. Technical Specification Task Force (TSTF)-510, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection", Revision 2, transmitted to the NRC on March 1, 2011 under letter TSTF-11-02. [ML110610350]
2. NRC Generic Letter 2004-01, "Requirements for Steam Generator Tube Inspections", August 30, 2004 [ML042370768].
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 1, May 2005.
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. Technical Specification Task Force (TSTF)-449-A, "Steam Generator Tube Integrity", Revision 4, May 5, 2006.
8. Notice of Opportunity for Public Comment on the Proposed Model Safety Evaluation for Plant-Specific Adoption of Technical Specifications, Task Force Traveler TSTF–510, Revision 2, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection", Federal Register Vol. 76, No. 118 /Monday, June 20, 2011, Notices, pages 35923 and 35924.
9. WCAP-17263-P, "Regulatory Guide 1.121 Analysis and Structural Integrity Performance Criterion Application for the Waterford Unit 3 Model Delta 110 Replacement Steam Generators for a NSSS Power of 1869.6 MWt/SG" (Proprietary) Revision 0, November 2010 [Not a public record].
10. U. S. Nuclear Regulatory Commission Regulatory Guide 1.121, " Bases for Plugging Degraded PWR Steam Generator Tubes" (for comment), August 1976.
11. NEI 97-06, Revision 2, *Steam Generator Program Guidelines* (May 2005).
12 ASME Boiler and Pressure Vessel Code, 1998 Edition with Addenda through 2000 Addenda, Section III.
13. 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

W3F1-2011-0040

Proposed Technical Specification Changes (mark-up)

REACTOR COOLANT SYSTEM

3/4.4.4 STEAM GENERATOR (SG) TUBE INTEGRITY

LIMITING CONDITION FOR OPERATION
3.4.4

a. SG tube integrity shall be maintained, and

b. All SG tubes satisfying the tube ~~repair~~ plugging criteria shall be plugged in accordance with the Steam Generator Program.

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

ACTION:

NOTE: Separate ACTION entry is allowed for each SG tube.

a. With one or more SG tubes satisfying the tube ~~repair~~ plugging criteria and not plugged in accordance with the Steam Generator Program.

1. Within 7 days verify tube integrity of the affected tube(s) is maintained until the next refueling outage or SG tube inspection, and

2. Plug the affected tube(s) in accordance with the Steam Generator Program prior to entering HOT SHUTDOWN following the next refueling outage or SG tube inspection.

b. If the required ACTION and Allowed Outage Time of ACTION a above cannot be met or SG tube integrity cannot be maintained, be in HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.4.4.1 Verify SG tube integrity in accordance with the Steam Generator Program.

4.4.4.2 Verify that each inspected SG tube that satisfies the tube ~~repair~~ plugging criteria is plugged in accordance with the Steam Generator Program prior to entering HOT SHUTDOWN following a SG tube inspection.

ADMINISTRATIVE CONTROLS

6.5.8 INSERVICE TESTING PROGRAM

This program provides controls for inservice testing of ASME Code Class 1, 2, and 3 components. The program shall include the following:

a. Testing frequencies specified in Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as follows:

ASME Boiler and Pressure Vessel Code and applicable Addenda terminology for inservice testing activities	Required frequencies for performing inservice testing activities
Weekly	At least once per 7 days
Monthly	At least once per 31 days
Quarterly or every 3 months	At least once per 92 days
Semiannually or every 6 months	At least once per 184 days
Every 9 months	At least once per 276 days
Yearly or annually	At least once per 366 days
Biennially or every 2 years	At least once per 731 days

b. The provisions of Specification 4.0.2 are applicable to the above required frequencies for performing inservice testing activities.

c. The provisions of Specification 4.0.3 are applicable to inservice testing activities, and

d. Nothing in the ASME Boiler and Pressure Vessel Code shall be construed to supersede the requirements of any Technical Specification.

6.5.9 STEAM GENERATOR (SG) PROGRAM

A Steam Generator Program shall be established and implemented to ensure that SG tube integrity is maintained. In addition, the Steam Generator Program shall include the following ~~provisions~~:

a. Provisions for condition monitoring assessments. Condition monitoring assessment means an evaluation of the "as found" condition of the tubing with respect to the performance criteria for structural integrity and accident induced leakage. The "as found" condition refers to the condition of the tubing during an SG inspection outage, as determined from the inservice inspection results or by other means, prior to the plugging of tubes. Condition monitoring assessments shall be conducted during each outage during which the SG tubes are inspected or plugged to confirm that the performance criteria are being met.

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~~ plugging 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 ~~10.5 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~~ the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet and that may satisfy the applicable tube ~~repair~~ plugging 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~~ installation.

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.~~ Insert 1

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.

affected and potentially affected

results in more frequent inspections

Insert 1 (TS Section 6.5.9.d.2)

After the first refueling outage following SG installation, inspect each SG at least every 72 effective full power months or at least every third refueling outage (whichever results in more frequent inspections). In addition, the minimum number of tubes inspected at each scheduled inspection shall be the number of tubes in all SGs divided by the number of SG inspection outages scheduled in each inspection period as defined in a, b, c and d below. If a degradation assessment indicates the potential for a type of degradation to occur at a location not previously inspected with a technique capable of detecting this type of degradation at this location and that may satisfy the applicable tube repair criteria, the minimum number of locations inspected with such a capable inspection technique during the remainder of the inspection period may be prorated. The fraction of locations to be inspected for this potential type of degradation at this location at the end of the inspection period shall be no less than the ratio of the number of times the SG is scheduled to be inspected in the inspection period after the determination that a new form of degradation could potentially be occurring at this location divided by the total number of times the SG is scheduled to be inspected in the inspection period. Each inspection period defined below may be extended up to 3 effective full power months to include a SG inspection outage in an inspection period and the subsequent inspection period begins at the conclusion of the included SG inspection outage.

a) After the first refueling outage following SG installation, inspect 100% of the tubes during the next 144 effective full power months. This constitutes the first inspection period;

b) During the next 120 effective full power months, inspect 100% of the tubes. This constitutes the second inspection period;

c) During the next 96 effective full power months, inspect 100% of the tubes. This constitutes the third inspection period; and

d) During the remaining life of the SGs, inspect 100% of the tubes every 72 effective full power months. This constitutes the fourth and subsequent inspection periods.

ADMINISTRATIVE CONTROLS

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~~ The number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator,

g. The results of condition monitoring, including the results of tube pulls, and 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

W3F1-2011-0040

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).

Limiting Condition for Operation

→(CRN 06-897, Ch. 48)

The LCO requires plugging 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~~ plugging criteria is removed from service by plugging. If a tube was determined to satisfy the ~~repair~~ plugging 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 between the tube-to-tubesheet weld at the tube inlet and ~~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.

←(CRN 06-897, 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

design specification. This includes safety factors and applicable design basis loads based on ASME Code, Section III, Subsection NB (Reference 4) and Draft Regulatory Guide 1.121 (Reference 5).

- The accident induced leakage performance criterion ensures that the primary to secondary leakage caused by a design basis accident, other than a SGTR, is within the accident analysis assumptions. The accident analysis assumes that accident induced leakage does not exceed 540 gpd through any one SG. The accident induced leakage rate includes any primary to secondary leakage existing prior to the accident in addition to primary to secondary leakage induced during the accident.

- The operational leakage performance criterion provides an observable indication of SG tube conditions during plant operation. The limit on operational leakage is contained in LCO 3.4.5.2, *Reactor Coolant System Operational Leakage*, and limits primary to secondary leakage through any one SG to ≤ 75 gallons per day. This limit is based on assumptions in radiological analyses. This limit is less than the 150 gallons per day through any one SG limit of NEI 97-06, which assumes that a single crack leaking this amount would not propagate to a SGTR under the stress conditions of a LOCA or a Main Steam Line Break. If this amount of leakage is due to more than one crack, the cracks are very small, and the above assumption is conservative.

Actions

The ACTIONS are modified by a Note clarifying that the ACTIONS may be entered independently for each SG tube. This is acceptable because the ACTIONS provide appropriate compensatory actions for each affected SG tube. Complying with the ACTIONS may allow for continued operations, and subsequent affected SG tubes are governed by subsequent application of associated ACTIONS.

ACTION "a" applies if it is discovered that one or more SG tubes examined in an inservice inspection satisfy the tube ~~repair~~ plugging criteria but were not plugged in accordance with the *Steam Generator Program* as required by SR 4.4.4.2. An evaluation of SG tube integrity of the affected tube(s) must be made. Steam generator tube integrity is based on meeting the SG performance criteria described in the *Steam Generator Program*. The SG ~~repair~~ plugging criteria define limits on SG tube degradation that allow for flaw growth between inspections while still providing assurance that the SG performance criteria will continue to be met. In order to determine if a SG tube that should have been plugged has tube integrity, an evaluation must be completed that demonstrates that the SG performance criteria will continue to be met until the next refueling outage or SG tube inspection. The tube integrity determination is based on the estimated condition of the tube at the time the situation is discovered and the estimated growth of the degradation prior to the next SG tube inspection. If it is determined that tube integrity is not being maintained, ACTION "b" applies.

An allowed outage time of 7 days is sufficient to complete the evaluation while minimizing the risk of plant operation with a SG tube that may not have tube integrity. If the evaluation determines that the affected tube(s) have tube integrity, ACTION "a.2" allows plant operation to continue until the next refueling outage or SG inspection provided the inspection interval continues to be supported by an operational assessment that reflects the affected tubes. However, the affected tube(s) must be plugged prior to entering HOT SHUTDOWN

following the next refueling outage or SG inspection. This time period is acceptable since operation until the next inspection is supported by the operational assessment.

ACTION "b" applies if the ACTIONS and associated allowed outage time of ACTION "a" are not met or if SG tube integrity is not being maintained, the reactor must be brought to HOT STANDBY within the next 6 hours and COLD SHUTDOWN within the following 30 hours. The allowed outage times are reasonable, based on operating experience, to reach the desired plant conditions from full power conditions in an orderly manner and without challenging plant systems.

Surveillance Requirements

During shutdown periods the SGs are inspected as required by SR 4.4.4.1 and the Steam Generator Program. NEI 97-06, *Steam Generator Program Guidelines* (Reference 1), and its referenced EPRI Guidelines, establish the content of the *Steam Generator Program*. Use of the *Steam Generator Program* ensures that the inspection is appropriate and consistent with accepted industry practices.

During SG inspections a condition monitoring assessment of the SG tubes is performed. The condition monitoring assessment determines the "as found" condition of the SG tubes. The purpose of the condition monitoring assessment is to ensure that the SG performance criteria have been met for the previous operating period.

The *Steam Generator Program* determines the scope of the inspection, plugging and the methods used to determine whether the tubes contain flaws satisfying the tube ~~repair~~ criteria. Inspection scope (i.e., which tubes or areas of tubing within the SG are to be inspected) is a function of existing and potential degradation locations. The *Steam Generator Program* also specifies the inspection methods to be used to find potential degradation. Inspection methods are a function of degradation morphology, non-destructive examination (NDE) technique capabilities, and inspection locations.

The *Steam Generator Program* defines the frequency of SR 4.4.4.1. The frequency is determined by the operational assessment and other limits in the SG examination guidelines (Reference 6). The *Steam Generator Program* uses information on existing degradations and growth rates to determine an inspection frequency that provides reasonable assurance that the tubing will meet the SG performance criteria at the next scheduled inspection. In addition, Specification 6.5.9 contains prescriptive requirements concerning inspection intervals to provide added assurance that the SG performance criteria will be met between scheduled inspections.

If crack indications are found in any SG tube, the maximum inspection interval for all affected and potentially affected SGs is restricted by Specification 6.5.9 until subsequent inspections support extending the inspection interval.

As required by SR 4.4.4.2, any inspected plugging tube that satisfies the plugging *Steam Generator Program* ~~repair~~ criteria is removed from service by plugging. The tube ~~repair~~ criteria delineated in Specification 6.5.9 are intended to ensure that tubes accepted for continued service satisfy the SG performance criteria with allowance for error in the flaw size measurement and for future flaw growth. In addition, the tube ~~repair~~ criteria, in conjunction with other elements of the *Steam Generator Program*, ensure that the SG performance criteria will continue to be met until the next inspection of the subject tube(s). Reference 1 provides guidance for performing operational assessments to verify that the tubes remaining in service will continue to meet the SG performance criteria.

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.

plugging

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 08-918, 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)

Attachment 4 to

W3F1-2011-0040

Proposed Technical Specification Changes (Clean Pages)
(contains 6 pages)

3/4.4.4 STEAM GENERATOR (SG) TUBE INTEGRITY

LIMITING CONDITION FOR OPERATION

a. SG tube integrity shall be maintained, and

b. All SG tubes satisfying the tube plugging criteria shall be plugged in accordance with the Steam Generator Program.

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

ACTION:

NOTE: Separate ACTION entry is allowed for each SG tube.

a. With one or more SG tubes satisfying the tube plugging criteria and not plugged in accordance with the Steam Generator Program.

   1. Within 7 days verify tube integrity of the affected tube(s) is maintained until the next refueling outage or SG tube inspection, and

   2. Plug the affected tube(s) in accordance with the Steam Generator Program prior to entering HOT SHUTDOWN following the next refueling outage or SG tube inspection.

b. If the required ACTION and Allowed Outage Time of ACTION a above cannot be met or SG tube integrity cannot be maintained, be in HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.4.4.1 Verify SG tube integrity in accordance with the Steam Generator Program.

4.4.4.2 Verify that each inspected SG tube that satisfies the tube plugging criteria is plugged in accordance with the Steam Generator Program prior to entering HOT SHUTDOWN following a SG tube inspection.

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. 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 degradation mechanism,

f. The number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator, and

g. The results of condition monitoring, including the results of tube pulls, in-situ testing.

STEAM GENERATOR (SG) PROGRAM (Continued)

a. 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), 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 plugging 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.

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 to the tube-to-tubesheet weld at the tube outlet and that may satisfy the applicable tube plugging 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. A degradation assessment 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 installation.

2. After the first refueling outage following SG installation, inspect each SG at least every 72 effective full power months or at least every third refueling outage (whichever results in more frequent inspections). In addition, the minimum number of tubes inspected at each scheduled inspection shall be the number of tubes in all SGs divided by the number of SG inspection outages scheduled in each inspection period as defined in a, b, c and d below. If a degradation assessment indicates the potential for a type of degradation to occur at a location not previously inspected with a technique capable of detecting this type of degradation at this location and that may satisfy the applicable tube repair criteria, the minimum number of locations inspected with such a capable inspection technique during the remainder of the inspection period may be prorated. The fraction of locations to be inspected for this potential type of degradation at this location at the end of the inspection period shall be no less than the ratio of the number of times the SG is scheduled to be inspected in the inspection period after the determination that a new form of degradation could potentially be occurring at this location divided by the total number of times the SG is scheduled to be inspected in the inspection period. Each inspection period defined below may be extended up to 3 effective full power months to include a SG inspection outage in an inspection period and the subsequent inspection period begins at the conclusion of the included SG inspection outage.

a) After the first refueling outage following SG installation, inspect 100% of the tubes during the next 144 effective full power months. This constitutes the first inspection period;

b) During the next 120 effective full power months, inspect 100% of the tubes. This constitutes the second inspection period;

STEAM GENERATOR (SG) PROGRAM (Continued)

c) During the next 96 effective full power months, inspect 100% of the tubes. This constitutes the third inspection period; and

d) During the remaining life of the SGs, inspect 100% of the tubes every 72 effective full power months. This constitutes the fourth and subsequent inspection periods.

3. If crack indications are found in any SG tube, then the next inspection for each affected and potentially affected SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full power months or one refueling outage (whichever results in more frequent inspections). 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.

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. 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 degradation mechanism,

f. The number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator,

g. The results of condition monitoring, including the results of tube pulls and in-situ testing.