



Crystal River Nuclear Plant
Docket No. 50-302
Operating License No. DPR-72

Ref: 10 CFR 50.90

December 21, 2006
3F1206-02

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

Subject: Crystal River Unit 3 – License Amendment Request #264, Revision 1:
Application to Modify Improved Technical Specifications Regarding Steam
Generator Tube Integrity and Response to Request for Additional Information

References: 1. NRC Generic Letter 2006-01 dated January 20, 2006, “Steam Generator Tube
Integrity and Associated Technical Specifications”
2. Crystal River Unit 3 to NRC Letter dated February 13, 2006, “Crystal River
Unit 3 – 30-Day Response to NRC Generic Letter 2006-01, “Steam Generator
Tube Integrity and Associated Technical Specifications”
3. Crystal River Unit 3 to NRC Letter dated May 25, 2006, “Crystal River Unit 3
– License Amendment Request #264, Revision 0, Application to Modify
Improved Technical Specifications Regarding Steam Generator Tube
Integrity”

Dear Sir:

In accordance with the provisions of 10 CFR 50.90, Florida Power Corporation (FPC), doing business as Progress Energy Florida, Inc., hereby provides Revision 1 to License Amendment Request #264 and the response to a Request for Additional Information. The proposed amendment would revise the Crystal River Unit 3 (CR-3) Improved Technical Specification (ITS) requirements related to steam generator tube integrity. This submittal is consistent with NRC-approved Revision 4 to Technical Specification Task Force (TSTF) Standard Technical Specification Change Traveler TSTF-449, “Steam Generator Tube Integrity.” The availability of this ITS improvement was announced in the Federal Register on May 6, 2005 (70 FR 24126) as part of the consolidated line item improvement process (CLIP). This submittal replaces Reference 3, License Amendment Request #264, Revision 0, in its entirety.

Attachment A provides the Request for Additional Information response from a discussion with NRC Staff that occurred on September 19, 2006. Attachment B provides a description of the proposed change and confirmation of applicability. Attachment C provides the existing ITS pages marked-up to show the proposed change, and Attachment D provides those same changes presented more formally with revision bars. Attachments E and F provide similar formats for the related Bases sections.

FPC requests approval of the proposed license amendment by February 28, 2007, with the amendment to be implemented within ninety days of issuance.

In accordance with 10 CFR 50.91, a copy of this application with enclosures is being provided to the designated Florida State Official.

This letter establishes no new regulatory commitments.

The CR-3 Plant Nuclear Safety Committee has reviewed this request and recommended it for approval.

If you have any questions regarding this submittal, please contact Mr. Paul Infanger, Supervisor, Licensing and Regulatory Programs at (352) 563-4796.

Sincerely,



Daniel L. Roderick
Director Site Operations
Crystal River Nuclear Plant

DLR/dar

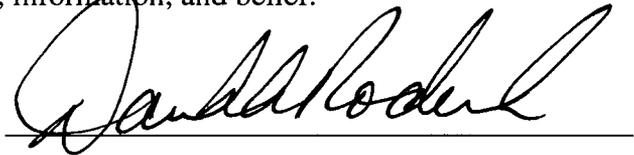
- Attachments:
- A. Request for Additional Information Response
 - B. Description and Assessment
 - C. Proposed Improved Technical Specification Changes (Mark-up)
 - D. Proposed Improved Technical Specification Changes (Revision Bar Format)
 - E. Proposed Improved Technical Specification Bases Pages (Mark-up)
 - F. Proposed Improved Technical Specification Bases Pages (Revision Bar Format)

xc: NRR Project Manager
Regional Administrator, Region II
Senior Resident Inspector
State Contact

STATE OF FLORIDA

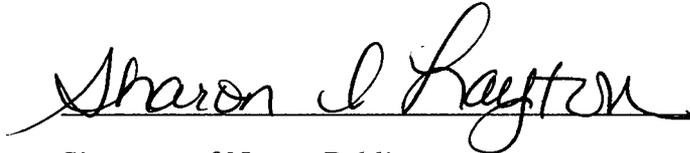
COUNTY OF CITRUS

Daniel L. Roderick states that he is the Director Site Operations, Crystal River Nuclear Plant for Florida Power Corporation, doing business as Progress Energy Florida, Inc.; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission the information attached hereto; and that all such statements made and matters set forth therein are true and correct to the best of his knowledge, information, and belief.



Daniel L. Roderick
Director Site Operations
Crystal River Nuclear Plant

The foregoing document was acknowledged before me this 21st day of December, 2006, by Daniel L. Roderick.



Signature of Notary Public
State of Florida



(Print, type, or stamp Commissioned
Name of Notary Public)

Personally Known ✓ -OR- Produced Identification

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

LICENSE AMENDMENT REQUEST #264, REVISION 1

**Application to Modify Improved Technical Specifications
Regarding Steam Generator Tube Integrity**

ATTACHMENT A

Request for Additional Information Response

Request for Additional Information Response

On September 19, 2006, Florida Power Corporation (FPC) and NRC Staff held a phone call to discuss the content of Revision 0 of License Amendment Request (LAR) #264 for Crystal River Unit 3 (CR-3) and ten questions sent by email on September 11, 2006. The following is submitted to respond to the NRC questions on Revision 0 of this LAR (Reference 3). Many of the responses to these questions altered the wording of the proposed Improved Technical Specification (ITS) resulting in Revision 1 to LAR #264 which follows in Attachments B through F.

NRC Request

1. In proposed technical specification (TS) 5.6.2.10.b.2, you indicate that leakage is not to exceed 1 gallon per minute (gpm) “except for specific types of degradation at specific locations as described in paragraph c of the Steam Generator Program.” Since TS 5.6.2.10.c addresses all degradation, please discuss your plans to modify this statement to clarify the degradation mechanisms to which the exception applies. For example, “Leakage from all sources, excluding the leakage attributed to the degradation described in TS Section [insert appropriate Section(s)] is not to exceed 1 gpm per SG.”

Florida Power Corporation (FPC) Response

1. *The final sentence has been changed as shown below by deleting the last part of the last sentence. The additional qualification for types of leakage as suggested above was unnecessary to reflect current CR-3 licensing basis. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. Paragraph 5.6.2.10.b.2 has been changed to read:*

“Accident induced leakage performance criterion: The primary to secondary accident induced leakage rate for any design basis accident, other than an OTSG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all OTSGs and leakage rate for an individual OTSG. Leakage is not to exceed one gallon per minute per OTSG, ~~except for specific types of degradation at specific locations as described in paragraph c of the Steam Generator Program.~~”

NRC Request

2. In your proposed TS (and Technical Specification Task Force-449), a steam generator (SG) tube is defined as the entire length of the tube including the tube wall and any repairs made to it, between the tube-to-tubesheet weld at the tube inlet and the tube-to-tubesheet weld at the tube outlet. Given this definition, the proposed repair criteria in TS 5.6.2.10.c may not be complete.

It is also not clear that proposed TS 5.6.2.10.c appropriately lists the repair criteria for sleeves. As currently written, the repair criteria for sleeves is 40% of the tube wall. In addition, it is not clear that your proposed TS contains the appropriate repair limit for the parent tube at the locations of the sleeve-to-tube joint.

Please discuss your plans to modify your TS to address these issues. For example, the TS may be modified by using something similar to the following:

The non-sleeved region of a tube found by inservice inspection to contain flaws with a depth equal to or exceeding 40% of the nominal tube wall thickness shall be plugged or repaired except if the flaws are permitted to remain in service through application of an alternate tube repair criteria discussed below. Tubes shall be plugged if the sleeved region of a tube is found by inservice inspection to contain flaws in the (a) sleeve or (b) the pressure boundary portion of the original tube wall in the sleeve/tube assembly (i.e., the sleeve-to-tube joint).

FPC Response

2. *The text shown above, with the exception of the final parenthetical statement, replaces existing text in 5.6.2.10.c. The changes are made to provide clarification and description of the affected portion of the tube and to provide more specific repair criteria for the sleeves. The parenthetical was omitted since it may imply the repair is limited to the sleeves. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. Paragraph 5.6.2.10.c has been changed to read:*

~~“Provisions for OTSG 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 or repaired. The non-sleeved region of a tube found by inservice inspection to contain flaws with a depth equal to or exceeding 40% of the nominal tube wall thickness shall be plugged or repaired except if the flaws are permitted to remain in service through application of an alternate tube repair criteria discussed below.~~

“Tubes shall be plugged if the sleeved region of a tube is found by inservice inspection to contain flaws in the (a) sleeve or (b) the pressure boundary portion of the original tube wall in the sleeve/tube assembly.”

NRC Request

3. Regarding proposed TS 5.6.2.10.c.1, please address the following:
- Please discuss your plans to move the first sentence to TS 5.6.2.10.d.x, since this sentence provides inspection requirements rather than repair criteria.
 - Please discuss your plans to delete the second and fourth sentences since there are no minimum sample size requirements for the random inspection and there are no inspection categories for the results of the inspection.
 - Please discuss your plans to remove the third sentence since it is consistent with the standard 40% depth-based repair criteria.

FPC Response

3a-c. *The first sentence in 5.6.2.10.c.1 was moved to ITS 5.6.2.10.d.4 to relocate inspection requirements to the same area. The abbreviation “IGA” has already been defined in earlier ITS text as “intergranular attack,” so that clarification is removed. The second, third and fourth sentences have been deleted because the information is either no longer a requirement or redundant to text elsewhere in the amendment request. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The new ITS 5.6.2.10.d.4 reads as follows:*

“Inservice tubes with pit-like ~~intergranular attack (IGA)~~ indications in the first span of the B OTSG, identified in the OTSG Inservice Inspection Surveillance Procedure must be inspected with bobbin and Motorized Rotating Pancake Coil (MRPC) eddy current techniques from the lower tube sheet secondary face to the bottom of the first tube support plate during each inservice inspection of the B OTSG. ~~No credit is to be taken for this inspection in meeting minimum sample size requirements for the random inspection. Defective tubes found during this inspection are to be plugged or sleeved. Degraded or defective tubes found during this inspection are not to be considered in determining the inspection results category for the random inspection, unless the degradation mechanism identified is a mechanism other than pit-like IGA.~~”

This change relocated the entire revised text of ITS 5.6.2.10.c.1. New text will be placed in this paragraph in response to Request 8.

NRC Request

Regarding proposed TS 5.6.2.10.c.2, please address the following:

4a. The first paragraph deals mainly with inspection issues. Please discuss your plans to move these requirements to TS 5.6.2.10.d.x. In addition, discuss your plans to remove the last sentence since there are no random sample inspection requirements. In addition, discuss your plans to clarify that the inspections will be performed at a specific interval rather than during each subsequent inspection since an inspection may be performed for reasons other than tube end cracking. For example, “The portion of the tube with an axially oriented tube end crack (TEC) must be inspected using the motorized rotating coil eddy current technique every 24 effective full power months or one refueling outage (whichever is less).”

FPC Response

4a. *The first paragraph has been moved to 5.6.2.10.d.5 to relocate inspection requirements to the same area, the text regarding the random sample inspection requirements has been removed since this will no longer be a requirement, and the suggested text above has been added to clarify that inspections will be performed at a specific interval rather than during each subsequent inspection. The parentheses around the term “whichever is less” were removed. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The new 5.6.2.10.d.5 reads as follows:*

“Tubes in-service with axially oriented tube end cracks (TEC) are identified in the OTSG Inservice Inspection Surveillance Procedure. The portion of the tube with the axial TEC must be inspected using the motorized rotating coil eddy current technique during each subsequent inspection. No credit is to be taken for this inspection for meeting the minimum sample size requirement for random sample inspection. every 24 effective full power months or one refueling outage, whichever is less.”

NRC Request

4b. Regarding the second paragraph, it is not clear that it is needed since all tubes with TECs must be reinspected per paragraph one and there is no longer a requirement to categorize the inspection results. Please discuss your plans to remove this paragraph.

FPC Response

4b. *The first sentence of this paragraph remains a requirement so it has been retained. The second sentence can be deleted since it will no longer be necessary to calculate inspection categories. The first sentence is added to the single sentence in the next paragraph to form a two-sentence paragraph, and then moved one paragraph lower on the page to become the second paragraph of 5.6.2.10.c.2. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The revised second paragraph of 5.6.2.10.c.2 will be as follows:*

“Tubes identified with TEC that meet the alternate repair criteria will be added to the existing list of tubes in the OTSG Inservice Inspection Surveillance Procedure. ~~Tubes identified with TEC during the previous inspection which meet the criteria to remain in service will not be included when calculating the inspection category of the OTSG.~~ The inspection data for tubes with axially oriented TEC indications shall be compared to the previous inspection data to monitor the indications for growth.

NRC Request

4c. Regarding the fourth paragraph, it is not clear that the reference to the accident-induced leakage limits (i.e., the values cited) are still needed. Please confirm that these values are consistent with your design and licensing basis. If they are consistent with your design and licensing basis, discuss your plans to remove them from this paragraph since these are already requirements of proposed TS 5.6.2.10.b.2.

FPC Response

4c. *This paragraph contains information that is still consistent with the CR-3 design and licensing basis. As such, it is being retained and moved to the first paragraph of 5.6.2.10.c.2 for clarity. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. This first paragraph of 5.6.2.10.c.2 is combined with text discussed in Request 8 to read as follows (the bolded text is the subject of this request, 4c):*

“Tube End Cracks (TEC) are those crack-like eddy current indications, circumferentially and/or axially oriented, that are within the Inconel clad region of the primary face of the upper and lower tubesheets, but do not extend into the carbon steel-to Inconel clad interface. Tubes with axially oriented TEC may be left in-service using the method described in Topical Report BAW-2346P, Revision 0, provided the combined projected leakage from all primary-to-secondary leakage, including axial TEC indications left in-service, does not exceed the Main Steam Line Break (MSLB) accident leakage limit of one gallon per minute, minus 150 gallons per day, per OTSG. The contribution to MSLB leakage rates from TEC indications shall be determined utilizing the methodology in Addendum B dated August 10, 2005 to Topical Report BAW-2346P, Revision 0. The projection of TEC leakage that may develop during the next operating cycle shall be determined using the methodology in Addendum C dated August 30, 2005 to Topical Report BAW-2346P, Revision 0.”

NRC Request

- 4d. Regarding the fifth paragraph, discuss your plans to move these inspection requirements to TS 5.6.2.10.d.x. In addition, please discuss your plans to replace the term “defective” with a more descriptive term (since defective is no longer defined in the TS). For example, replace “are defective” with “exceed the tube repair criteria.”

FPC Response

- 4d. *These inspection requirements have been moved to 5.6.2.10.d.6 to relocate inspection requirements to the same area. The words “are defective” have been replaced with “satisfy the tube repair criteria” for clarity. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The new 5.6.2.10.d.6 paragraph reads as follows:*

“If the plant is required to shut down due to primary-to-secondary leakage and the cause is determined to be degradation of the TEC portion of the tubes, 100% of the tubes with TEC in that OTSG shall be examined in the location of the TEC. If more than 1% of the examined tubes satisfy the tube repair criteria, 100% of the tubes with TEC in the other OTSG shall be examined in the location of the TEC.”

NRC Request

- 4e. Regarding the fifth paragraph, please discuss your plans to more specifically state what constitutes an “appropriate approved method.” Presumably, the tubes shall be repaired using the appropriate method from TS 5.6.2.10.f or removed from service by plugging the tube.

FPC Response

- 4e. *This comment is actually about the sixth paragraph. The suggested information is added to for purposes of clarity. That is, removal from service is clarified to mean it is done by plugging the tube. The appropriate repair method is given a reference to ITS 5.6.2.10.f. Generally, the other change to this section is a revision of the words that retains the same meaning. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The third paragraph of 5.6.2.10.c.2 has been revised to read:*

“Tubes with crack-like indications within the carbon steel portion of the tubesheet, circumferentially oriented TEC, or volumetric indications within the Inconel clad region of the tubesheet shall be repaired ~~or removed from service~~ using the appropriate method. from 5.6.2.10.f ~~Tubes with circumferentially oriented TEC or volumetric indications within the Inconel clad region of the tubesheet shall be repaired or removed from service by plugging the tube.~~”

NRC Request

5. Depending on your response to the other questions, please discuss your plans to add reference to the additional “d.x” items added above to the existing string of “d.1., d.2, and d.3.”

FPC Response

5. *Because of the additional items moved to 5.6.2.10.d, the text in that section was changed from “In addition to meeting the requirement of d.1, d.2, and d.3 below...” to “In addition to meeting the requirements of d.1 through d.8 below...” This text can be seen in the response to NRC Request 6, below (the sentence following the bolded one). This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request.*

NRC Request

6. As currently written, your proposed technical specification would require an inspection of the parent tube repaired with a sleeve. Please discuss your plans to modify TS 5.6.2.10.d to indicate: “In tubes repaired by sleeving, the portion of the original tube wall between the sleeve’s joints is not an area requiring re-inspection.”

FPC Response

6. *Paragraph 5.6.2.10.d has been modified to exclude a portion of sleeve repaired tubes from re-inspection. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The bolded text represents the additional sentence below:*

*“Provisions for OTSG tube inspections. Periodic OTSG 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 repair criteria. The tube-to-tubesheet weld is not part of the tube. **In tubes repaired by sleeving, the portion of the original tube wall between the sleeve’s joints is not an area requiring re-inspection.** In addition to meeting the requirements of d.1 through d.8 below, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that OTSG tube integrity is maintained until the next OTSG 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.”*

NRC Request

Regarding proposed TS 5.6.2.10.f.2, please address the following:

7a. Please discuss your plans for removing reference to “eddy-current methods” since the new proposed technical specifications already require that techniques capable of detecting flaws of any type that may be present must be used during the inspections.

FPC Response

7a. *Paragraph 5.6.2.10.f.2 remains as originally submitted since the Amendment 158 Safety Evaluation from the NRC for rerolls (Reference 4) specifically identifies eddy-current as the inspection method for rerolls.*

NRC Request

7b. Please discuss your plans to replace “imperfections and degradation” with more appropriate terminology since these terms are no longer defined in your proposed TS. For example, “The repair roll must be free of fabrication or service-induced flaws for the repair to be considered acceptable. If the repair roll is unacceptable, the tube must be repaired or plugged.”

FPC Response

7b. *The definitions for imperfection and degradation are being deleted in this license amendment request. Instead of using these terms or the suggested “fabrication or service-induced flaws,” the more simple term, “flaws,” is used to describe unacceptable defects in the repair roll. Additionally, the last sentence is added for clarification purposes. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The revised paragraph 5.6.2.10.f.2 is as follows:*

“Installation of repair rolls in the upper and lower tubesheets in accordance with BAW-2303P, Revision 4. The repair process (single, overlapping, or multiple roll) may be performed in each tube. The repair roll area will be examined using eddy-current methods following installation. The repair roll must be free of ~~imperfections and degradation~~ flaws for the repair to be considered acceptable. If the repair roll is unacceptable, the tube must be repaired or plugged.”

NRC Request

7c. Please discuss your plans to move the last paragraph to the inspection section (i.e., 5.6.2.10.d.x) since it contains inspection requirements. In addition, discuss your plans to replace “during each subsequent inservice inspection” with the appropriate interval (i.e., every 24 effective full power months or one refueling outage (whichever is less)) for the reason cited above.

FPC Response

7c. *The last paragraph has been moved to 5.6.2.10.d.7 to keep all inspection requirements in the same section. Additionally, the inspection interval is clarified to be consistent with the text change made in FPC Response 4a. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The new ITS 5.6.2.10.d.7 is as follows:*

“The repair roll in each tube will be inspected ~~during each subsequent inservice inspection~~ every 24 effective full power months or one refueling outage (whichever is less) while the tube with a repair roll is in service.”

NRC Request

8. There were several sections of your current TS that were not moved into your proposed TS. Specifically, TS 5.6.2.10.4.a.7, the last paragraph of TS 5.6.2.10.4.a.11.b, TS 5.6.2.10.4.a.12, and TS 5.6.2.10.4.c. were not carried over into your proposed new TS. Please discuss your plans to move the appropriate requirements from these specifications (in light of the questions above) into the appropriate section of your proposed TS.

FPC Response

8. *Current ITS 5.6.2.10.4.a.7 has been moved to 5.6.2.10.c.1 of LAR #264, Revision 1 and is shown as bolded text below. The additional text is provided to clarify repair criteria for IGA. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The new 5.6.2.10.c.1 is as follows:*

“Pit-like Intergranular Attack (IGA) indication means a bobbin coil indication confirmed by Motorized Rotating Pancake Coil (MRPC) or other qualified inspection techniques to have a volumetric, pit-like morphology characteristic of IGA. Inservice tubes with pit-like IGA indications in the first span of the B OTSG, identified in the OTSG Inservice Inspection Surveillance Procedure are acceptable to remain in service provided the indication is less than 40% of the nominal tube wall thickness.”

The first sentence of the last paragraph of current ITS 5.6.2.10.4.a.11.b has been moved to 5.6.2.10.d.8 of LAR #264, Revision 1 to relocate all inspection requirements to the same area. The second sentence refers to inspection categories which have been deleted in the amendment, so this sentence is also deleted. The first sentence has been reworded to be consistent with paragraph 5.6.2.10.d.6. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The new paragraph 5.6.2.10.d.8 is as follows:

5.6.2.10.d.8. “If the plant is required to shut down due to primary-to-secondary leakage and the cause is determined to be degradation of a repair roll, 100% of the repair rolls in that OTSG shall be examined. ~~If that inspection results in entering Category C-2 or C-3 for specific limited area inspection, as detailed in Table 5.6.2-3, 100% of the repair rolls shall be examined in the other OTSG.”~~

Current ITS 5.6.2.10.4.a.12 has been moved to 5.6.2.10.c.2 of LAR #264, Revision 1 to keep similar subject matter together. It is shown as the non-bolded text shown in the response to NRC Request 4c., above. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request.

Current ITS 5.6.2.10.4.c has been moved to the second paragraph of 5.6.2.10.d.4 of LAR #264, Revision 1 to keep inspection requirements for inservice tubes with pit-like IGA together. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The second paragraph of 5.6.2.10.d.4 is as follows:

“Inservice tubes with pit-like IGA indications in the “B” OTSG first span shall be monitored for growth of these indications by using a test probe equivalent to the high frequency bobbin probe used in the 1997 inspection. The indicated percentage through-wall value from the current inspection shall be compared to the indicated percentage through-wall value from the 1997 inspection.”

NRC Request

9. It does not appear that your current reporting requirements in TS 5.7.2.c.2 and TS 5.7.2.c.4 were moved to your new proposed TS. Please discuss your plans to incorporate the existing TS requirements in 5.7.2.c.2 into proposed TS 5.7.2.10. Similarly, discuss your plans to incorporate the existing TS requirements in 5.7.2.c.4 into proposed TS 5.7.2.11.

FPC Response

9. A reporting requirement from current ITS 5.7.2.c.2 is added to 5.7.2.10 of LAR #264, Revision 1. The requirement in 5.7.2.c.2 to report on crack-like indications already exists in 5.7.2.11 so this was not added. The remaining requirement from the current ITS 5.7.2.c.2 was added since it was not explicitly stated in 5.7.2.10 or 5.7.2.11 of LAR #264, Revision 0. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. As such, the new 5.7.2.10 is shown as follows with the newly added text in bold:

*“Location, bobbin coil amplitude, and axial and circumferential extent (if determined) for each first span IGA indication, **and an assessment of growth for indications in the first span of OTSG B, and**”*

Reporting requirements from current ITS 5.7.2.c.4 are added to 5.7.2.11 of LAR #264, Revision 1. The requirement in 5.7.2.c.4 to report on the number of tubes and axially oriented TEC indications left in-service already exists in 5.7.2.11 so this was not added. The remaining requirement from the current ITS 5.7.2.c.4 was added since this was not explicitly stated in 5.7.2.10 or 5.7.2.11 of LAR #264, Revision 0. This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request. The new 5.7.2.11, with the new text bolded, is as follows:

*“Number of as-found and as-left tubes with TEC indications, number of as-found and as-left TEC indications, the number of as-found and as-left TEC indications as a function of tubesheet radius, the as-found, as-left, probability of detection and new TEC leakage for upper and lower tubesheet indications. **The projected accident leakage and an assessment of growth for TEC indications will be provided.** An assessment of the adequacy of the predictive methodology in Addendum C to Topical Report BAW-2346P, Revision 0, including assessing the distribution of indications found in each OTSG to ensure the assumption regarding the similarity of the*

distribution of indications remain consistent from one cycle to the next and that the assumption of a linear increase in leak rate remain valid. Corrective actions in the event that the assessment indicates the assumptions can not be fully supported.”

NRC Request

10. There appears to be a couple of typographical errors in your TS Bases. On page B 3.4-76, 10 CFR 50.36I(2)(ii) should be 10 CFR 50.36(c)(2)(ii). In the last sentence on page B 3.4-81, it would appear that “steam generator repairs” should be “steam generator tube repairs.” Please discuss your plans to correct these apparent typographical errors.

FPC Response

10. FPC has reviewed Title 10 of the Code of Federal Regulations and determined that 10CFR50.36(c)(2)(ii) is the appropriate reference. The Bases has been corrected to reflect this change. FPC has reviewed previous ITS Bases 3.4-81 and concluded that the word “tube” was inadvertently omitted. The ITS Bases page 3.4-81 has been corrected to read, “Steam generator tube repairs.” This change is technically consistent with TSTF-449, Revision 4 and therefore does not change the description or the assessment presented in Attachment B to this amendment request.

While discussing the above responses with the NRC staff, the subject of primary-to-secondary leakage and the relationship between operating leakage, accident leakage and accident-induced leakage was discussed. Steam generator performance issues and the role these parameters play in the accident analysis have recently gained industry-wide visibility. Currently, efforts are being made by the Nuclear Energy Institute and the Electric Power Research Institute to resolve concerns in these matters with the NRC. Rather than attempt to settle these issues for CR-3 prematurely, FPC prefers to allow the industry and NRC to arrive at a consensus before determining if a change to the CR-3 ITS is necessary. As such, the content of Revision 1 to this license amendment request only reflects the intent of NRC Technical Specification Task Force (TSTF) Standard Technical Specification Change Traveler, TSTF-449, “Steam Generator Tube Integrity,” Revision 4 and the NRC requested changes already discussed. There is no change in the amendment request to address the on-going industry discussions on operational and accident primary-to-secondary leakage.

In the interest of completeness, FPC is providing the following description of the CR-3 licensing basis for operational and accident leakage. This information supports approval of the proposed LAR 264, Revision 1, without additional changes.

The existing CR-3 accident analyses assume a maximum accident primary-to-secondary leakage of one gallon per minute (gpm) total from both Once-Through Steam Generators (OTSG) in a Loss of Coolant Accident, one gpm from the unaffected OTSG in a Steam Generator Tube Rupture, and one gpm from the affected OTSG in a Steam Line Break accident. The present (and proposed) CR-3 ITS limits primary-to-secondary leakage during normal operation to 150 gallons per day (gpd). The current approved licensing basis for these parameters is not changed by this amendment request.

Generic Letter (GL) 95-05 (Reference 1) provided guidance on preparing a Technical Specifications change request to implement alternate steam generator tube repair criteria for Westinghouse-designed steam generators. It introduced provisions for augmented inspections and more restrictive operational leakage limits. In part, the GL suggested reducing the restriction

on primary-to-secondary leakage during normal operation from one gpm to 150 gpd through each steam generator. As stated in the GL, the identified provisions (e.g., reducing this leakage restriction to 150 gpm) were to ensure that structural and leakage integrity continue to be maintained with an acceptable level of margin during normal, operating, transient, and postulated accident conditions. At the time the GL was issued, the CR-3 ITS primary-to-secondary leakage limit during normal operation was one gpm. To improve leakage integrity, CR-3 reduced this to 150 gpd per OTSG consistent with the GL. This limit was introduced as a temporary (one cycle) revision to the CR-3 ITS in Amendment 154 (Reference 5), and made permanent in Amendment 158 (Reference 2). In Amendment 158, the change to the Bases described this primary-to-secondary leakage through all OTSGs as follows:

“This LEAKAGE limit is established to ensure that tubes initially leaking during normal operation do not contribute excessively to total leakage during postulated accident conditions. The 150 gpd limit is a conservative limit which is consistent with the operational leakage limit specified in NRC Generic Letter 95-05 for plants implementing Alternate Repair Criteria. CR-3 has elected to voluntarily adopt this conservative limit to ensure plant shutdown in a timely manner in response to detection of primary to secondary LEAKAGE.”

The 150 gpd per OTSG is a limit placed on primary-to-secondary leakage during normal operation. Under accident conditions, total primary-to-secondary leakage is assumed to increase to no more than one gpm. This one gpm accident leakage is not mechanistically modeled in the accident analysis based on an initial operating leakage of 150 gpd per OTSG. It is not mathematically derived from the allowed operating leakage. The value assumed for primary-to-secondary leakage during accident conditions is an analytical assumption, unrelated to the value defined in the CR-3 ITS for allowed operating leakage. Both values are currently part of the approved licensing basis for CR-3. As stated earlier, these remain unchanged by this amendment request, consistent with TSTF-449, Revision 4.

Additional margin between operational and accident leakage is provided by procedural implementation of NEI 97-06, “Steam Generator Program Guidelines.” CR-3 plant procedures ensure enhanced monitoring is established when primary-to-secondary leakage is detected greater than 5 gpd. Monitoring is escalated if the leak grows above 30 gpd and the procedure begins an orderly plant shutdown for leakage above 75 gpd. These limits are the combined leakage from both OTSGs. These procedural controls provide addition margin between operational leakage and the assumed accident leakage value of one gpm.

References:

1. NRC Generic Letter 95-05 dated August 3, 1995, “Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking”
2. NRC to Crystal River Unit 3 Letter dated October 28, 1997, “Crystal River Unit 3 – Staff Evaluation and Issuance of Amendment Re: Steam Generator Tube Intergranular Attack Degradation [TAC No. M98262]
3. Crystal River Unit 3 to NRC Letter dated May 25, 2006, “Crystal River Unit 3 – License Amendment #264, Revision 0, Applicability to Modify Improved Technical Specifications Regarding Steam Generator Tube Integrity”

4. NRC to Crystal River Unit 3 Letter dated September 10, 2001, "Crystal River Unit 3 – Issuance of Amendment Regarding Reroll Repair for Once-Through Steam Generator Tubing (TAC No. MB1519)"
5. NRC to Crystal River Unit 3 Letter dated April 30, 1996, "Crystal River Nuclear Generating Plant Unit 3 - Issuance of Amendment Re: Alternate Repair Criteria for Steam Generator Tubing (Tac No. M92548)"

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

LICENSE AMENDMENT REQUEST #264, REVISION 1

**Application to Modify Improved Technical Specifications
Regarding Steam Generator Tube Integrity**

ATTACHMENT B

Description and Assessment

Description and Assessment

1.0 INTRODUCTION

The proposed license amendment revises the requirements in the Crystal River Unit 3 (CR-3) Improved Technical Specification (ITS) related to steam generator tube integrity. The changes are consistent with NRC approved Technical Specification Task Force (TSTF) Standard Technical Specification Change Traveler, TSTF-449, "Steam Generator Tube Integrity," Revision 4. The availability of this technical specification improvement was announced in the Federal Register on May 6, 2005 as part of the consolidated line item improvement process (CLIIP). This request replaces License Amendment Request #264, Revision 0, submitted May 25, 2006, in its entirety.

2.0 DESCRIPTION OF PROPOSED AMENDMENT

Consistent with the NRC-approved Revision 4 of TSTF-449, the proposed ITS changes include:

- Revised ITS definition of LEAKAGE
- Revised ITS 3.4.12, RCS [Reactor Coolant System] Operational Leakage
- New ITS 3.4.16, Steam Generator (OTSG) Tube Integrity
- Revised ITS 5.6.2.10, Steam Generator (OTSG) Program
- Revised ITS 5.7.2.c, d, and e, Steam Generator Tube Inspection Report(s)

Proposed revisions to the ITS Bases are also included in this application. As discussed in the NRC's model safety evaluation, adoption of the revised ITS Bases associated with TSTF-449, Revision 4 is an integral part of implementing this ITS improvement. The changes to the affected ITS Bases pages will be incorporated in accordance with the ITS Bases Control Program.

3.0 BACKGROUND

The background for this application is adequately addressed by the NRC Notice of Availability published on May 6, 2005 (70 FR 24126), the NRC Notice for Comment published on March 2, 2005 (70 FR 10298), and TSTF-449, Revision 4.

4.0 REGULATORY REQUIREMENTS AND GUIDANCE

The applicable regulatory requirements and guidance associated with this application are adequately addressed by the NRC Notice of Availability published on May 6, 2005 (70 FR 24126) the NRC Notice for Comment published on March 2, 2005 (70 FR 10298), and TSTF-449, Revision 4.

5.0 TECHNICAL ANALYSIS

Florida Power Corporation (FPC) has reviewed the safety evaluation (SE) published on March 2, 2005 (70 FR 10298) as part of the CLIIP Notice for Comment. This included the NRC staff's SE, the supporting information provided to support TSTF-449, and the changes associated with Revision 4 to TSTF-449. FPC has concluded that the

justifications presented in the TSTF proposal and the SE prepared by the NRC staff are applicable to CR-3 and justify this amendment for the incorporation of the changes to the CR-3 ITS.

6.0 REGULATORY ANALYSIS

A description of this proposed change and its relationship to applicable regulatory requirements and guidance was provided in the NRC Notice of Availability published on May 6, 2005 (70 FR 24126), the NRC Notice for Comment published on March 2, 2005 (70 FR 10298), and TSTF-449, Revision 4.

6.1 Verification and Commitments

The following information is provided to support the NRC staff's review of this amendment application:

Plant Name, Unit No.	<i>Crystal River Unit 3</i>	
Steam Generator Model(s):	<i>177FA</i>	
Effective Full Power Years (EFPY) of service for currently installed OTSGs	<i>Approximately 19.2 as of Refuel 14 (Nov. 05, 2005)</i>	
Tubing Material	<i>Alloy 600 Stress Relieved</i>	
Number of tubes per OTSG	<i>15,531</i>	
Number and percentage of tubes plugged in each OTSG	<u><i>OTSG A</i></u> <i>351 (2.3%)</i>	<u><i>OTSG B</i></u> <i>862 (5.6%)</i>
Number of Tubes repaired in each OTSG	<u><i>OTSG A</i></u>	<u><i>OTSG B</i></u>
<i>Tubes w/ sleeves (Inservice)</i>	<i>159</i>	<i>156</i>
<i>Tubes w/ repair rolls (Inservice)</i>	<i>948</i>	<i>1401</i>
Degradation mechanism(s) identified	<ul style="list-style-type: none"> - <i>Primary Water Stress Corrosion Cracking (PWSCC)</i> - <i>Outside Diameter Intergranular Attack/Stress Corrosion Cracking (OD IGA/SCC)</i> - <i>Wear / Fretting / Thinning</i> 	
Current primary-to-secondary leakage limits:	<p>Per SG: <i>150 gallons per day (gpd) per LCO 3.4.12.d</i></p> <p>Total: <i>No total limit specified in ITS</i></p> <p>Temperature condition leakage is evaluated at: <i>room temperature</i></p>	

<p>Approved Alternate Tube Repair Criteria (ARC):</p> <p>1. <i>First Span IGA</i></p> <hr/> <p>2. <i>Tube End Cracks (TECs)</i></p>	<ul style="list-style-type: none"> - Approved by: <i>Amendment 158 dated 10/28/97</i> - Applicability: <i>Inservice tubes with pit-like IGA indications in the first span of OTSG B</i> - Any special limits on allowable accident leakage: <i>None</i> - Any exceptions or clarifications to the structural performance criteria that apply to the ARC: <i>None</i> <hr/> <ul style="list-style-type: none"> - Approved by: <i>Amendments 188 dated 10/01/99 and 222 dated 10/31/05</i> - Applicability: <i>Inservice tubes with axially-oriented TECs in either OTSG</i> - Any special limits on allowable accident leakage: <i>1 gallon per minute (gpm) minus 150 gpd for TECs combined with all other postulated accident leakage</i> - Any exceptions or clarifications to the structural performance criteria that apply to the ARC: <i>None</i>
<p>Approved OTSG Tube Repair Methods</p> <p>1. <i>Sleeves</i></p> <hr/> <p>2. <i>Repair Rolls</i></p>	<ul style="list-style-type: none"> - Approved by: <i>Amendment 136 dated 09/11/91</i> - Applicability limits, if any: <i>(ITS 5.6.2.10.4.a.11.a) No more than five thousand sleeves may be installed in each OTSG.</i> - Repair criteria: <i>40% of the sleeve wall thickness</i> <hr/> <ul style="list-style-type: none"> - Approved by: <i>Amendment 198 dated 09/10/01</i> - Applicability limits, if any: <i>None.</i> - Repair criteria: <i>40% of the initial wall thickness</i>
<p>Performance criteria for accident leakage</p>	<ul style="list-style-type: none"> - Primary to secondary leak rate values assumed in licensing basis accident analysis, including assumed temperature conditions: <i>1 gpm at room temperature assumed in the CR-3 Final Safety Analysis Report</i>

7.0 NO SIGNIFICANT HAZARDS CONSIDERATION

FPC has reviewed the proposed no significant hazards consideration determination published on March 2, 2005 (70 FR 10298) as part of the CLIIP. FPC has concluded that the proposed determination presented in the notice is applicable to CR-3 and the determination is hereby incorporated by reference to satisfy the requirements of 10 CFR 50.91(a).

8.0 ENVIRONMENTAL EVALUATION

FPC has reviewed the environmental evaluation included in the model SE published on March 2, 2005 (70 FR 10298) as part of the CLIIP. FPC has concluded that the staff's findings presented in that evaluation are applicable to CR-3 and the evaluation is hereby incorporated by reference for this application.

9.0 PRECEDENT

This application is being made in accordance with the CLIIP. FPC is not proposing variations or deviations from the ITS changes described in TSTF-449, Revision 4, or the NRC staff's model SE published on March 2, 2005 (70 FR 10298). Several clarifications have been requested by the NRC Staff as described in Attachment A. These proposed changes are consistent with the CLIIP model application.

10.0 REFERENCES

Federal Register Notices:

Notice for Comment published on March 2, 2005 (70 FR 10298)

Notice of Availability published on May 6, 2005 (70 FR 24126)

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

LICENSE AMENDMENT REQUEST #264, REVISION 1

**Application to Modify Improved Technical Specifications
Regarding Steam Generator Tube Integrity**

ATTACHMENT C

Proposed Improved Technical Specification Changes (Mark-up)

~~Strikeout text~~ indicates deleted text.

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(continued)

1.1 Definitions

LEAKAGE (continued)	<p>3. Reactor Coolant System (RCS) LEAKAGE through a steam generator (OTSG) tube to the secondary system (primary to secondary LEAKAGE).</p> <p>b. <u>Unidentified LEAKAGE</u> All LEAKAGE that is not identified LEAKAGE.</p> <p>c. <u>Pressure Boundary LEAKAGE</u> LEAKAGE (except OTSG tube leakage <u>primary to secondary LEAKAGE</u>) through a non-isolable fault in an RCS component body, pipe wall, or vessel wall.</p>
MODE	A MODE shall correspond to any one inclusive combination of core reactivity condition, power level, average reactor coolant temperature, and reactor vessel head closure bolt tensioning specified in Table 1.1-1.
NUCLEAR HEAT FLUX HOT CHANNEL FACTOR ($F_q(Z)$)	$F_q(Z)$ shall be the maximum local linear power density in the core divided by the core average fuel rod linear power density, assuming nominal fuel pellet and fuel rod dimensions.
NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR ($F_{\Delta H}^N$)	$F_{\Delta H}^N$ shall be the ratio of the integral of linear power along the fuel rod on which minimum departure from nucleate boiling ratio occurs to the average fuel rod power.
OPERABLE-OPERABILITY	A system, subsystem, train, component, or device shall be OPERABLE when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication and other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its specified safety function(s) are also capable of performing their related support function(s).
PHYSICS TESTS	PHYSICS TESTS shall be those tests performed to measure the fundamental nuclear characteristics of the reactor core and related instrumentation.

(continued)

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12 RCS Operational LEAKAGE

LCO 3.4.12 RCS operational LEAKAGE shall be limited to:

- a. No pressure boundary LEAKAGE;
- b. 1 gpm unidentified LEAKAGE;
- c. 10 gpm identified LEAKAGE; and
- d. 150 gpd of primary to secondary LEAKAGE through any one steam generator (OTSG).

~~Two OTSGs shall be OPERABLE.~~

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RCS <u>operational</u> LEAKAGE not within limits for reasons other than pressure boundary LEAKAGE or <u>primary to secondary LEAKAGE</u> .	A.1 Reduce LEAKAGE to within limits.	4 hours
B. Required Action and associated Completion Time not met. <u>OR</u> Pressure boundary LEAKAGE exists. <u>OR</u> <u>Primary to secondary LEAKAGE not within limit.</u>	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.4.12.1 -----NOTES-----</p> <p>1. Not required to be performed in MODE 4. Not required in MODE 3 until 12 hours of steady state operation.</p> <p>2. Not applicable to primary to secondary LEAKAGE.</p> <p>-----</p> <p>Verify RCS operational LEAKAGE is within limits by performance of Perform RCS water inventory balance during steady state operation.</p>	<p>72 hours</p>
<p>SR 3.4.12.2 -----NOTE-----</p> <p>Not required to be performed until 12 hours after establishment of steady state operation.</p> <p>-----</p> <p>Verify steam generator tube integrity is in accordance with the Steam Generator Tube Surveillance Program. Verify primary to secondary LEAKAGE is \leq 150 gallons per day through any one steam generator.</p>	<p>In accordance with the Steam Generator Tube Surveillance Program.</p> <p>72 hours</p>

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.16 Steam Generator (OTSG) Tube Integrity

LCO 3.4.16 OTSG tube integrity shall be maintained.

AND

All OTSG tubes satisfying the tube repair criteria shall be plugged or repaired in accordance with the Steam Generator Program.

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

ACTIONS

NOTE
Separate Condition entry is allowed for each OTSG tube.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more OTSG tubes satisfying the tube repair criteria and not plugged or repaired in accordance with the Steam Generator Program.	A.1 Verify tube integrity of the affected tube(s) is maintained until the next refueling outage or OTSG tube inspection. AND A.2 Plug or repair the affected tube(s) in accordance with the Steam Generator Program.	7 days Prior to entering MODE 4 following the next refueling outage or OTSG tube inspection
B. Required Action and associated Completion Time of Condition A not met. OR OTSG tube integrity not maintained.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.16.1 Verify OTSG tube integrity in accordance with the Steam Generator Program.	In accordance with the Steam Generator Program
SR 3.4.16.2 Verify that each inspected OTSG tube that satisfies the tube repair criteria is plugged or repaired in accordance with the Steam Generator Program.	Prior to entering MODE 4 following a OTSG tube inspection

~~5.6 Procedures, Programs and Manuals (continued)~~

~~5.6.2.10 Steam Generator (OTSG) Tube Surveillance Program~~

~~Each OTSG shall be demonstrated OPERABLE by performance of the following augmented inservice inspection program:~~

- ~~1. Each OTSG shall be determined OPERABLE during shutdown by selecting and inspecting at least the minimum number of OTSGs specified in Table 5.6.2-1.~~
- ~~2. The OTSG tube minimum sample size, inspection result classification, and the corresponding action required shall be as specified in Table 5.6.2-2. The inservice inspection of OTSG tubes shall be performed at the frequencies specified in Specification 5.6.2.10.3 and the inspected tubes shall be verified acceptable per the acceptance criteria of Specification 5.6.2.10.4. The tubes selected for each inservice inspection shall include at least 3% of the total number of tubes in all OTSGs. The tubes selected for these inspections shall be selected on a random basis except:
 - ~~a. Where experience in similar plants with similar water chemistry indicates critical areas to be inspected, then at least 50% of the tubes inspected shall be from these critical areas.~~
 - ~~b. The first inservice inspection (subsequent to the preservice inspection) of each OTSG shall include:
 - ~~1. All nonplugged tubes that previously had detectable wall penetrations (>20%), and~~
 - ~~2. Tubes in those areas where experience has indicated potential problems.~~~~
 - ~~c. The second and third inservice inspections may be less than a full tube inspection by concentrating (selecting at least 50% of the tubes to be inspected) the inspection on those areas of the tube sheet array and on those portions of the tubes where tubes with imperfections were previously found.~~
 - ~~d. Tubes in specific limited areas which are distinguished by unique operating conditions or physical construction may be excluded from random samples if all such tubes~~~~

(continued)

~~5.6—Procedures, Programs and Manuals~~

~~5.6.2.10—OTSG Tube Surveillance Program (continued)~~

~~in the specific area of an OTSG are inspected with the inspection result classification and the corresponding action required as specified in Table 5.6.2-3. No credit will be taken for these tubes in meeting minimum sample size requirements. Degraded or defective tubes found in these areas will not be considered in determining the inspection results category as long as the mode of degradation is unique to that area and not random in nature.~~

~~e.—Inservice tubes with pit-like IGA indications in the first span of the B OTSG, identified in the OTSG Inservice Inspection Surveillance Procedure, must be inspected with bobbin and Motorized Rotating Pancake Coil (MRPC) eddy current techniques from the lower tube sheet secondary face to the bottom of the first tube support plate during each inservice inspection of the B OTSG. No credit is to be taken for this inspection in meeting minimum sample size requirements for the random inspection. Defective tubes found during this inspection are to be plugged or sleeved. Degraded or defective tubes found during this inspection are not to be considered in determining the inspection results category for the random inspection, unless the degradation mechanism identified is a mechanism other than pit-like IGA.~~

~~f.—Tubes in service with axially oriented tube end cracks (TEC) are identified in the OTSG Inservice Inspection Surveillance procedure. The portion of the tube with the axial TEC must be inspected using the motorized rotating coil eddy current technique during each subsequent inspection. No credit is to be taken for this inspection for meeting the minimum sample size requirement for random sample inspection.~~

~~Tubes identified with TEC that meet the alternate repair criteria will be added to the existing list of tubes in the OTSG Inservice Inspection Surveillance procedure. Tubes identified with TEC during the previous inspection which meet the criteria to remain in-service will not be included when calculating the inspection category of the OTSG.~~

(continued)

5.6—Procedures, Programs and Manuals

5.6.2.10 OTSG Tube Surveillance Program (continued)

The inspection data for tubes with axially oriented TEC indications shall be compared to the previous inspection data to monitor the indications for growth.

Tubes with axially oriented TEC may be left in-service using the method described in Topical Report BAW-2346P, Revision 0, provided the combined projected leakage from all primary to secondary leakage, including axial TEC indications left in-service, does not exceed the Main Steam Line Break (MSLB) accident leakage limit of one gallon per minute, minus 150 gallons per day, per OTSG. The contribution to MSLB leakage rates from TEC indications shall be determined utilizing the methodology in Addendum B dated August 10, 2005 to Topical Report BAW-2346P, Revision 0. The projection of TEC leakage that may develop during the next operating cycle shall be determined using the methodology in Addendum C dated August 30, 2005 to Topical Report BAW-2346P, Revision 0.

If the plant is required to shut down due to primary-to-secondary leakage and the cause is determined to be degradation of the TEC portion of the tubes, 100% of the tubes with TEC in that OTSG shall be examined in the location of the TEC. If more than 1% of the examined tubes are defective tubes, 100% of the tubes with TEC in the other OTSG shall be examined in the location of the TEC.

Tubes with crack-like indications within the carbon steel portion of the tubesheet shall be repaired or removed from service using the appropriate approved method. Tubes with circumferentially oriented TEC or volumetric indications within the Inconel clad region of the tubesheet shall be repaired or removed from service using the appropriate approved method.

The results of each bobbin coil sample inspection shall be classified into one of the following three categories:

NOTE

In all inspections, previously degraded tubes whose degradation has not been spanned by a sleeve must exhibit significant (>10%) further wall penetrations to be included in the below percentage calculations.

NOTE

For the inspection conducted in accordance with 5.6.2.10.2.f, only tubes with TEC indications identified after the 1997 inspection will be included in the below percentage calculations.

(continued)

~~5.6—Procedures, Programs and Manuals~~

~~5.6.2.10—OTSG Tube Surveillance Program (continued)~~

<u>Category</u>	<u>Inspection Results</u>
C-1	Less than 5% of the total tubes inspected are degraded tubes and none of the inspected tubes are defective.
C-2	One or more tubes, but not more than 1% of the total tubes inspected are defective, or between 5% and 10% of the total tubes inspected are degraded tubes.
C-3	More than 10% of the total tubes inspected are degraded tubes or more than 1% of the inspected tubes are defective.

- ~~3. The above required inservice inspections of OTSG tubes shall be performed at the following frequencies:~~
- ~~a. Inservice inspections shall be performed at intervals of not less than 12 nor more than 24 calendar months after the previous inspection. If two consecutive inspections following service under all volatile treatment (AVT) conditions, not including the preservice inspection, result in all inspection results falling into the C-1 category, or if two consecutive inspections demonstrate that previously observed degradation has not continued and no additional degradation has occurred, the inspection interval may be extended to a maximum of once per 40 months.~~
 - ~~b. If the inservice inspection of an OTSG, conducted in accordance with Table 5.6.2-2 or Table 5.6.2-3 requires a third sample inspection whose results fall in Category C-3, the inspection frequency shall be reduced to at least once per 20 months. The reduction in inspection frequency shall apply until a subsequent inspection demonstrates that a third sample inspection is not required. If the C-3 inspection results classification is due to including new tubes with TEC indications that meet the criteria to remain in-service, no reduction in inspection frequency is required.~~
 - ~~c. Additional unscheduled inservice inspections shall be performed on each OTSG in accordance with the first sample inspection specified in Table 5.6.2-2 or Table 5.6.2-3 during the shutdown subsequent to any of the following conditions:~~
 - ~~1. Primary-to-secondary tube leaks (not including leaks originating from tube-to-tube sheet welds) in excess of the limits of Specification 3.4.12;~~
 - ~~2. A seismic occurrence greater than the Operating Basis Earthquake;~~
 - ~~3. A loss-of-coolant accident requiring actuation of the engineered safeguards, or~~
 - ~~4. A main steam line or feedwater line break.~~

(continued)

~~5.6—Procedures, Programs and Manuals~~

~~5.6.2.10—OTSG Tube Surveillance Program—(continued)~~

~~4.—Acceptance criteria:~~

~~a.—Vocabulary as used in this Specification:~~

- ~~1.—Tubing or Tube means that portion of the tube or sleeve which forms the primary system to secondary system pressure boundary.~~
- ~~2.—Imperfection means an exception to the dimensions, finish or contour of a tube from that required by fabrication drawings or specifications. Eddy-current testing indications below 20% of the nominal tube wall thickness, if detectable, may be considered as imperfections.~~
- ~~3.—Degradation means a service-induced cracking, wastage, wear, or general corrosion occurring on either inside or outside of a tube.~~
- ~~4.—Degraded Tube means a tube containing degradation $\geq 20\%$ through-wall but $< 40\%$ through-wall in the pressure boundary.~~
- ~~5.—% Degradation/% Through-wall means the percentage of the tube (pressure boundary) wall thickness affected or removed by degradation.~~
- ~~6.—Defective Tube means a tube containing degradation $\geq 40\%$ through-wall in the pressure boundary. Any tube which does not permit the passage of the eddy-current inspection probe shall be deemed a defective tube.~~
- ~~7.—Pit-like Intergranular Attack (IGA) indication means a bobbin coil indication confirmed by Motorized Rotating Pancake Coil (MRPC) or other qualified inspection techniques to have a volumetric, pit-like morphology characteristic of IGA.~~

(continued)

~~5.6—Procedures, Programs and Manuals~~

~~5.6.2.10—OTSG Tube Surveillance Program—(continued)~~

- ~~8. Plugging/Repair Limit means the extent of pressure boundary degradation beyond which the tube shall either be removed from service by installation of plugs or the area of degradation shall be removed from service (a new pressure boundary established) using an Approved Repair Technique. The plugging/repair limit is 40% through-wall for all pressure boundary degradation.~~
- ~~9. Unserviceable describes the condition of a tube if it leaks or contains a defect large enough to affect its structural integrity in the event of an Operating Basis Earthquake, a loss of coolant accident, or a main steam line or feedwater line break, as specified in 5.6.2.10.3.c, above.~~
- ~~10. Tube Inspection means an inspection of the OTSG tube pressure boundary.~~
- ~~11. Approved Repair Technique means a technique, other than plugging, that has been accepted by the NRC as a methodology to remove or repair degraded or defective portions of the pressure boundary and to establish a new pressure boundary. Following are Approved Repair Techniques:
 - ~~a) Sleeve installation in accordance with the B&W process (or method) described in report BAW-2120P. No more than five thousand sleeves may be installed in each OTSG.~~
 - ~~b) Installation of repair rolls in the upper and lower tubesheets in accordance with BAW-2303P, Revision 4. The repair process (single, overlapping, or multiple roll) may be performed in each tube. The repair roll area will be examined using eddy-current methods following installation. The repair roll must be free of imperfections and degradation for the repair to be considered acceptable.~~~~

(continued)

~~5.6—Procedures, Programs and Manuals~~

~~5.6.2.10—OTSG Tube Surveillance Program—(continued)~~

~~The repair roll in each tube will be inspected during each subsequent inservice inspection while the tube with a repair roll is in service. The repair roll will be considered a specific limited area and will be excluded from the random sampling. No credit will be taken for meeting the minimum sample size.~~

~~If primary-to-secondary leakage results in a shutdown of the plant and the cause is determined to be degradation in a repair roll, 100% of the repair rolls in that OTSG shall be examined. If that inspection results in entering Category C-2 or C-3 for specific limited area inspection, as detailed in Table 5.6.2-3, 100% of the repair rolls shall be examined in the other OTSG.~~

~~12. Tube End Cracks (TEC) are those crack-like eddy current indications, circumferentially and/or axially oriented, that are within the Inconel clad region of the primary face of the upper and lower tubesheets, but do not extend into the carbon steel-to Inconel clad interface.~~

- ~~b. The OTSG shall be determined OPERABLE after completing the corresponding actions (plug or repair all tubes exceeding the plugging/repair limit) required by Table 5.6.2-2 (and Table 5.6.2-3 if the provisions of Specification 5.6.2.10.2.d are utilized).~~
- ~~c. Inservice tubes with pit-like IGA indications in the "B" OTSG first span shall be monitored for growth of these indications by using a test probe equivalent to the high frequency bobbin probe used in the 1997 inspection. The indicated percentage throughwall value from the current inspection shall be compared to the indicated percentage throughwall value from the 1997 inspection.~~

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 Steam Generator (OTSG) Program

A Steam Generator Program shall be established and implemented to ensure that OTSG 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 OTSG inspection outage, as determined from the inservice inspection results or by other means, prior to the plugging or repair of tubes. Condition monitoring assessments shall be conducted during each outage during which the OTSG tubes are inspected, plugged, or repaired to confirm that the performance criteria are being met.

b. Performance criteria for OTSG tube integrity. OTSG 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.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Program (continued)

2. Accident induced leakage performance criterion: The primary to secondary accident induced leakage rate for any design basis accident, other than an OTSG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all OTSGs and leakage rate for an individual OTSG. Leakage is not to exceed one gallon per minute per OTSG.

3. The operational LEAKAGE performance criterion is specified in LCO 3.4.12, "RCS Operational LEAKAGE."

c. Provisions for OTSG tube repair criteria. The non-sleeved region of a tube found by inservice inspection to contain flaws with a depth equal to or exceeding 40% of the nominal tube wall thickness shall be plugged or repaired except if the flaws are permitted to remain in service through application of an alternate tube repair criteria discussed below.

Tubes shall be plugged if the sleeved region of a tube is found by inservice inspection to contain flaws in the (a) sleeve or (b) the pressure boundary portion of the original tube wall in the sleeve/tube assembly.

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

1. Pit-like Intergranular Attack (IGA) indication means a bobbin coil indication confirmed by Motorized Rotating Pancake Coil (MRPC) or other qualified inspection techniques to have a volumetric, pit-like morphology characteristic of IGA. Inservice tubes with pit-like IGA indications in the first span of the B OTSG, identified in the OTSG Inservice Inspection Surveillance Procedure are acceptable to remain in service provided the indication is less than 40% of the nominal tube wall thickness.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Program (continued)

2. Tube End Cracks (TEC) are those crack-like eddy current indications, circumferentially and/or axially oriented, that are within the Inconel clad region of the primary face of the upper and lower tubesheets, but do not extend into the carbon steel-to Inconel clad interface. Tubes with axially oriented TEC may be left in-service using the method described in Topical Report BAW-2346P, Revision 0, provided the combined projected leakage from all primary-to-secondary leakage, including axial TEC indications left in-service, does not exceed the Main Steam Line Break (MSLB) accident leakage limit of one gallon per minute, minus 150 gallons per day, per OTSG. The contribution to MSLB leakage rates from TEC indications shall be determined utilizing the methodology in Addendum B dated August 10, 2005 to Topical Report BAW-2346P, Revision 0. The projection of TEC leakage that may develop during the next operating cycle shall be determined using the methodology in Addendum C dated August 30, 2005 to Topical Report BAW-2346P, Revision 0.

Tubes identified with TEC that meet the alternate repair criteria will be added to the existing list of tubes in the OTSG Inservice Inspection Surveillance Procedure. The inspection data for tubes with axially oriented TEC indications shall be compared to the previous inspection data to monitor the indications for growth.

Tubes with crack-like indications within the carbon steel portion of the tubesheet, circumferentially oriented TEC, or volumetric indications within the Inconel clad region of the tubesheet shall be repaired using the appropriate method from 5.6.2.10.f or removed from service by plugging the tube.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Program (continued)

d. Provisions for OTSG tube inspections. Periodic OTSG 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 repair criteria. The tube-to-tubesheet weld is not part of the tube. In tubes repaired by sleeving, the portion of the original tube wall between the sleeve's joints is not an area requiring re-inspection. In addition to meeting the requirements of d.1 through d.8 below, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that OTSG tube integrity is maintained until the next OTSG 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 OTSG during the first refueling outage following OTSG replacement.
2. Inspect 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 OTSGs. No OTSG 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 OTSG tube, then the next inspection for each OTSG 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.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Program (continued)

4. Inservice tubes with pit-like IGA indications in the first span of the B OTSG, identified in the OTSG Inservice Inspection Surveillance Procedure must be inspected with bobbin and Motorized Rotating Pancake Coil (MRPC) eddy current techniques from the lower tube sheet secondary face to the bottom of the first tube support plate during each inservice inspection of the B OTSG.

Inservice tubes with pit-like IGA indications in the "B" OTSG first span shall be monitored for growth of these indications by using a test probe equivalent to the high frequency bobbin probe used in the 1997 inspection. The indicated percentage through-wall value from the current inspection shall be compared to the indicated percentage through-wall value from the 1997 inspection.

5. Tubes in-service with axially oriented tube end cracks (TEC) are identified in the OTSG Inservice Inspection Surveillance Procedure. The portion of the tube with the axial TEC must be inspected using the motorized rotating coil eddy current technique every 24 effective full power months or one refueling outage, whichever is less.

6. If the plant is required to shut down due to primary-to-secondary leakage and the cause is determined to be degradation of the TEC portion of the tubes, 100% of the tubes with TEC in that OTSG shall be examined in the location of the TEC. If more than 1% of the examined tubes satisfy the tube repair criteria, 100% of the tubes with TEC in the other OTSG shall be examined in the location of the TEC.

7. The repair roll in each tube will be inspected every 24 effective full power months or one refueling outage (whichever is less) while the tube with a repair roll is in service.

8. If the plant is required to shut down due to primary-to-secondary leakage and the cause is determined to be degradation of a repair roll, 100% of the repair rolls in that OTSG shall be examined.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Program (continued)

- e. Provisions for monitoring operational primary to secondary LEAKAGE.
- f. Provisions for OTSG tube repair methods. Steam generator tube repair methods shall provide the means to reestablish the RCS pressure boundary integrity of OTSG tubes without removing the tube from service. For the purposes of these Specifications, tube plugging is not a repair. All acceptable tube repair methods are listed below.
 - 1. Sleeve installation in accordance with the B&W process (or method) described in report BAW-2120P. No more than five thousand sleeves may be installed in each OTSG.
 - 2. Installation of repair rolls in the upper and lower tubesheets in accordance with BAW-2303P, Revision 4. The repair process (single, overlapping, or multiple roll) may be performed in each tube. The repair roll area will be examined using eddy-current methods following installation. The repair roll must be free of flaws for the repair to be considered acceptable. If the repair roll is unacceptable, the tube must be repaired or plugged.

~~TABLE 5.6.2-1 (page 1 of 1)
MINIMUM NUMBER OF STEAM GENERATORS (OTSGs) TO BE INSPECTED
DURING INSERVICE INSPECTION~~

Preservice Inspection	Yes
Number of OTSGs	Two
First Inservice Inspection	One
Second and Subsequent Inservice Inspections	One[‡]

~~‡ The inservice inspection may be limited to one OTSG on a rotating schedule encompassing 6% of the tubes if the results of the first or previous inspections indicate that both OTSGs are performing in a like manner. Note that under some circumstances, the operating conditions in one OTSG may be found to be more severe than those in the other OTSG. Under such circumstances the sample sequence shall be modified to inspect the most severe conditions.~~

TABLE 5.6.2-2 (page 1 of 1)
OTSG TUBE INSPECTION

1st Sample Inspection			2nd Sample Inspection		3rd Sample Inspection	
Sample Size	Result	Action Required	Result	Action Required	Result	Action Required
A minimum of 5 tubes per OTSG	C-1	None	N/A	N/A	N/A	N/A
	C-2	Plug or repair defective tubes and inspect an additional 25 tubes in this OTSG.	C-1	None	N/A	N/A
			C-2	Plug or repair defective tubes and inspect additional 45 tubes in this OTSG.	C-1	None
					C-2	Plug or repair defective tubes.
					C-3	Perform action for C-3 result of first sample.
	C-3	Perform action for C-3 result of first sample.	N/A	N/A		
	C-3	Inspect all tubes in this OTSG, plug or repair defective tubes, inspect 25 tubes in each other OTSG, and notify NRC per 10CFR50.72	All other OTSGs are C-1	None	N/A	N/A
			Some OTSGs C-2 but no additional OTSGs are C-3	Perform action for C-2 result of second sample.	N/A	N/A
			Additional OTSG is C-3	Inspect all tubes in each OTSG, plug or repair defective tubes, and notify NRC per 10CFR50.72.	N/A	N/A

S = 3 N/n % Where N is the number of OTSGs in the unit and n is the number of OTSGs inspected during inspection period.

TABLE 5.6.2-3 (page 1 of 1)
SPECIFIC LIMITED AREA INSPECTION

1st Sample Inspection of a "Specific Limited Area"			2nd Sample Inspection of a "Specific Limited Area"	
Sample Size	Result	Action Required	Result	Action Required
100% of area in both OTSGs	C-1	None	N/A	N/A
	C-2	Plug or repair defective tubes.	N/A	N/A
	C-3	Plug or repair defective tubes.	N/A	N/A
100% of area in one OTSG	C-1	None	N/A	N/A
	C-2	Plug or repair defective tubes and inspect 100% of corresponding area in other OTSG	C-1	None
			C-2	Plug or repair defective tubes.
			C-3	Plug or repair defective tubes.
	C-3	Plug or repair defective tubes and inspect 100% of corresponding area in other OTSG.	C-1	None
			C-2	Plug or repair defective tubes.
			C-3	Plug or repair defective tubes.

5.7 Reporting Requirements

5.7.1.2 Not Used

5.7.2 Special Reports

Special Reports shall be submitted in accordance with 10 CFR 50.4 within the time period specified for each report.

The following Special Reports shall be submitted:

- a. When a Special Report is required by Condition B or F of LCO 3.3.17, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.
- b. Any abnormal degradation of the containment structure found during the inspection performed in accordance with ITS 5.6.2.8 shall be reported to the NRC within 30 days of the current surveillance completion. The abnormal degradation shall be defined as findings such as delamination of the dome concrete, widespread corrosion of the liner plate, corrosion of prestressing elements (wires, strands, bars) or anchorage components extending to more than two tendons and group tendons force trends not meeting the requirements of 10CFR50.55a(b)(2)(ix)(B). The report shall include the description of degradation, operability determination, root cause determination and the corrective actions.

c. A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.6.2.10, Steam Generator (OTSG) Program. The report shall include:

1. The scope of inspections performed on each OTSG,
2. Active degradation mechanisms found,
3. Nondestructive examination techniques utilized for each degradation mechanism,
4. Location, orientation (if linear), and measured sizes (if available) of service induced indications,

(continued)

5.7 Reporting Requirements

5.7.2 Special Reports (continued)

5. Number of tubes plugged or repaired during the inspection outage for each active degradation mechanism,
6. Total number and percentage of tubes plugged or repaired to date,
7. The results of condition monitoring, including the results of tube pulls and in-situ testing,
8. The effective plugging percentage for all plugging and tube repairs in each OTSG,
9. Repair method utilized and the number of tubes repaired by each repair method,

- ~~c. Following each inservice inspection of steam generator (OTSG) tubes, the NRC shall be notified of the following prior to ascension into MODE 4:~~
- ~~1. Number of tubes plugged and repaired;~~
 - ~~2. Crack-like indications and assessment of growth for indications in the first span;~~
 - ~~3. Results of in-situ pressure testing, if performed; and~~
 - ~~4. Number of tubes and axially oriented TEC indications left in-service, the projected accident leakage, and an assessment of growth for TEC indications.~~

(continued)

~~5.7 Reporting Requirements~~

~~5.7.2 Special Reports (continued)~~

- ~~d. Results of OTSG tube inspections that fall into Category C-3 shall be reported to the NRC in accordance with 10CFR50.72.~~
 - ~~e. The complete results of the OTSG tube inservice inspection shall be submitted to the NRC within 90 days after breaker closure following restart. The report shall include:~~
 - ~~1. Number and extent of tubes inspected,~~
 - ~~2. Location and percent of wall thickness penetration for each indication of an imperfection,~~
 - ~~3. 10. Location, bobbin coil amplitude, and axial and circumferential extent (if determined) for each first span IGA indication, and an assessment of growth for indications in the first span of OTSG B, and~~
 - ~~4. Identification of tubes plugged or repaired and specification of the repair methodology implemented for each tube.~~
 - ~~5. 11. Number of as-found and as-left tubes with TEC indications, number of as-found and as-left TEC indications, the number of as-found and as-left TEC indications as a function of tubesheet radius, the as-found, as-left, probability of detection and new TEC leakage for upper and lower tubesheet indications. The projected accident leakage and an assessment of growth for TEC indications will be provided. An assessment of the adequacy of the predictive methodology in Addendum C to Topical Report BAW-2346P, Revision 0, including assessing the distribution of indications found in each OTSG to ensure the assumption regarding the similarity of the distribution of indications remain consistent from one cycle to the next and that the assumption of a linear increase in leak rate remain valid. Corrective actions in the event that the assessment indicates the assumptions can not be fully supported.~~
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PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

LICENSE AMENDMENT REQUEST #264, REVISION 1

**Application to Modify Improved Technical Specifications
Regarding Steam Generator Tube Integrity**

ATTACHMENT D

**Proposed Improved Technical Specification Changes
(Revision Bar Format)**

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(continued)

1.1 Definitions

LEAKAGE (continued)	<p>3. Reactor Coolant System (RCS) LEAKAGE through a steam generator to the secondary system (primary to secondary LEAKAGE).</p> <p>b. <u>Unidentified LEAKAGE</u> All LEAKAGE that is not identified LEAKAGE.</p> <p>c. <u>Pressure Boundary LEAKAGE</u> LEAKAGE (except primary to secondary LEAKAGE) through a non-isolable fault in an RCS component body, pipe wall, or vessel wall.</p>
MODE	A MODE shall correspond to any one inclusive combination of core reactivity condition, power level, average reactor coolant temperature, and reactor vessel head closure bolt tensioning specified in Table 1.1-1.
NUCLEAR HEAT FLUX HOT CHANNEL FACTOR ($F_q(Z)$)	$F_q(Z)$ shall be the maximum local linear power density in the core divided by the core average fuel rod linear power density, assuming nominal fuel pellet and fuel rod dimensions.
NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR ($F_{\Delta H}^N$)	$F_{\Delta H}^N$ shall be the ratio of the integral of linear power along the fuel rod on which minimum departure from nucleate boiling ratio occurs to the average fuel rod power.
OPERABLE-OPERABILITY	A system, subsystem, train, component, or device shall be OPERABLE when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication and other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its specified safety function(s) are also capable of performing their related support function(s).
PHYSICS TESTS	PHYSICS TESTS shall be those tests performed to measure the fundamental nuclear characteristics of the reactor core and related instrumentation.

(continued)

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12 RCS Operational LEAKAGE

LCO 3.4.12 RCS operational LEAKAGE shall be limited to:

- a. No pressure boundary LEAKAGE;
- b. 1 gpm unidentified LEAKAGE;
- c. 10 gpm identified LEAKAGE; and
- d. 150 gpd of primary to secondary LEAKAGE through any one steam generator (OTSG).

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RCS operational LEAKAGE not within limits for reasons other than pressure boundary LEAKAGE or primary to secondary LEAKAGE.	A.1 Reduce LEAKAGE to within limits.	4 hours
B. Required Action and associated Completion Time not met. <u>OR</u> Pressure boundary LEAKAGE exists. <u>OR</u> Primary to secondary LEAKAGE not within limit.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.4.12.1 -----NOTES-----</p> <p>1. Not required to be performed in MODE 4. Not required in MODE 3 until 12 hours of steady state operation.</p> <p>2. Not applicable to primary to secondary LEAKAGE.</p> <p>-----</p> <p>Verify RCS operational LEAKAGE is within limits by performance of RCS water inventory balance.</p>	<p>72 hours</p>
<p>SR 3.4.12.2 -----NOTE-----</p> <p>Not required to be performed until 12 hours after establishment of steady state operation.</p> <p>-----</p> <p>Verify primary to secondary LEAKAGE is \leq 150 gallons per day through any one steam generator.</p>	<p>72 hours</p>

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.16 Steam Generator (OTSG) Tube Integrity

LCO 3.4.16 OTSG tube integrity shall be maintained.

AND

All OTSG tubes satisfying the tube repair criteria shall be plugged or repaired in accordance with the Steam Generator Program.

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

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each OTSG tube.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more OTSG tubes satisfying the tube repair criteria and not plugged or repaired in accordance with the Steam Generator Program.	A.1 Verify tube integrity of the affected tube(s) is maintained until the next refueling outage or OTSG tube inspection.	7 days
	<u>AND</u> A.2 Plug or repair the affected tube(s) in accordance with the Steam Generator Program.	Prior to entering MODE 4 following the next refueling outage or OTSG tube inspection
B. Required Action and associated Completion Time of Condition A not met. <u>OR</u> OTSG tube integrity not maintained.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.16.1 Verify OTSG tube integrity in accordance with the Steam Generator Program.	In accordance with the Steam Generator Program
SR 3.4.16.2 Verify that each inspected OTSG tube that satisfies the tube repair criteria is plugged or repaired in accordance with the Steam Generator Program.	Prior to entering MODE 4 following a OTSG tube inspection

5.6 Procedures, Programs and Manuals

5.6.2.10 Steam Generator (OTSG) Program

A Steam Generator Program shall be established and implemented to ensure that OTSG 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 OTSG inspection outage, as determined from the inservice inspection results or by other means, prior to the plugging or repair of tubes. Condition monitoring assessments shall be conducted during each outage during which the OTSG tubes are inspected, plugged, or repaired to confirm that the performance criteria are being met.
- b. Performance criteria for OTSG tube integrity. OTSG 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.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Program (continued)

2. Accident induced leakage performance criterion: The primary to secondary accident induced leakage rate for any design basis accident, other than an OTSG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all OTSGs and leakage rate for an individual OTSG. Leakage is not to exceed one gallon per minute per OTSG.
 3. The operational LEAKAGE performance criterion is specified in LCO 3.4.12, "RCS Operational LEAKAGE."
- c. Provisions for OTSG tube repair criteria. The non-sleeved region of a tube found by inservice inspection to contain flaws with a depth equal to or exceeding 40% of the nominal tube wall thickness shall be plugged or repaired except if the flaws are permitted to remain in service through application of an alternate tube repair criteria discussed below.

Tubes shall be plugged if the sleeved region of a tube is found by inservice inspection to contain flaws in the (a) sleeve or (b) the pressure boundary portion of the original tube wall in the sleeve/tube assembly.

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

1. Pit-like Intergranular Attack (IGA) indication means a bobbin coil indication confirmed by Motorized Rotating Pancake Coil (MRPC) or other qualified inspection techniques to have a volumetric, pit-like morphology characteristic of IGA. Inservice tubes with pit-like IGA indications in the first span of the B OTSG, identified in the OTSG Inservice Inspection Surveillance Procedure are acceptable to remain in service provided the indication is less than 40% of the nominal tube wall thickness.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Program (continued)

2. Tube End Cracks (TEC) are those crack-like eddy current indications, circumferentially and/or axially oriented, that are within the Inconel clad region of the primary face of the upper and lower tubesheets, but do not extend into the carbon steel-to Inconel clad interface. Tubes with axially oriented TEC may be left in-service using the method described in Topical Report BAW-2346P, Revision 0, provided the combined projected leakage from all primary-to-secondary leakage, including axial TEC indications left in-service, does not exceed the Main Steam Line Break (MSLB) accident leakage limit of one gallon per minute, minus 150 gallons per day, per OTSG. The contribution to MSLB leakage rates from TEC indications shall be determined utilizing the methodology in Addendum B dated August 10, 2005 to Topical Report BAW-2346P, Revision 0. The projection of TEC leakage that may develop during the next operating cycle shall be determined using the methodology in Addendum C dated August 30, 2005 to Topical Report BAW-2346P, Revision 0.

Tubes identified with TEC that meet the alternate repair criteria will be added to the existing list of tubes in the OTSG Inservice Inspection Surveillance Procedure. The inspection data for tubes with axially oriented TEC indications shall be compared to the previous inspection data to monitor the indications for growth.

Tubes with crack-like indications within the carbon steel portion of the tubesheet, circumferentially oriented TEC, or volumetric indications within the Inconel clad region of the tubesheet shall be repaired using the appropriate method from 5.6.2.10.f or removed from service by plugging the tube.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Program (continued)

- d. Provisions for OTSG tube inspections. Periodic OTSG 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 repair criteria. The tube-to-tubesheet weld is not part of the tube. In tubes repaired by sleeving, the portion of the original tube wall between the sleeve's joints is not an area requiring re-inspection. In addition to meeting the requirements of d.1 through d.8 below, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that OTSG tube integrity is maintained until the next OTSG 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 OTSG during the first refueling outage following OTSG replacement.
 2. Inspect 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 OTSGs. No OTSG 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 OTSG tube, then the next inspection for each OTSG 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.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Program (continued)

4. Inservice tubes with pit-like IGA indications in the first span of the B OTSG, identified in the OTSG Inservice Inspection Surveillance Procedure must be inspected with bobbin and Motorized Rotating Pancake Coil (MRPC) eddy current techniques from the lower tube sheet secondary face to the bottom of the first tube support plate during each inservice inspection of the B OTSG.

Inservice tubes with pit-like IGA indications in the "B" OTSG first span shall be monitored for growth of these indications by using a test probe equivalent to the high frequency bobbin probe used in the 1997 inspection. The indicated percentage through-wall value from the current inspection shall be compared to the indicated percentage through-wall value from the 1997 inspection.

5. Tubes in-service with axially oriented tube end cracks (TEC) are identified in the OTSG Inservice Inspection Surveillance Procedure. The portion of the tube with the axial TEC must be inspected using the motorized rotating coil eddy current technique every 24 effective full power months or one refueling outage, whichever is less.
6. If the plant is required to shut down due to primary-to-secondary leakage and the cause is determined to be degradation of the TEC portion of the tubes, 100% of the tubes with TEC in that OTSG shall be examined in the location of the TEC. If more than 1% of the examined tubes satisfy the tube repair criteria, 100% of the tubes with TEC in the other OTSG shall be examined in the location of the TEC.
7. The repair roll in each tube will be inspected every 24 effective full power months or one refueling outage (whichever is less) while the tube with a repair roll is in service.
8. If the plant is required to shut down due to primary-to-secondary leakage and the cause is determined to be degradation of a repair roll, 100% of the repair rolls in that OTSG shall be examined.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.10 OTSG Program (continued)

- e. Provisions for monitoring operational primary to secondary LEAKAGE.
- f. Provisions for OTSG tube repair methods. Steam generator tube repair methods shall provide the means to reestablish the RCS pressure boundary integrity of OTSG tubes without removing the tube from service. For the purposes of these Specifications, tube plugging is not a repair. All acceptable tube repair methods are listed below.
 - 1. Sleeve installation in accordance with the B&W process (or method) described in report BAW-2120P. No more than five thousand sleeves may be installed in each OTSG.
 - 2. Installation of repair rolls in the upper and lower tubesheets in accordance with BAW-2303P, Revision 4. The repair process (single, overlapping, or multiple roll) may be performed in each tube. The repair roll area will be examined using eddy-current methods following installation. The repair roll must be free of flaws for the repair to be considered acceptable. If the repair roll is unacceptable, the tube must be repaired or plugged.

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5.7 Reporting Requirements

5.7.1.2 Not Used

5.7.2 Special Reports

Special Reports shall be submitted in accordance with 10 CFR 50.4 within the time period specified for each report.

The following Special Reports shall be submitted:

- a. When a Special Report is required by Condition B or F of LCO 3.3.17, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.
- b. Any abnormal degradation of the containment structure found during the inspection performed in accordance with ITS 5.6.2.8 shall be reported to the NRC within 30 days of the current surveillance completion. The abnormal degradation shall be defined as findings such as delamination of the dome concrete, widespread corrosion of the liner plate, corrosion of prestressing elements (wires, strands, bars) or anchorage components extending to more than two tendons and group tendons force trends not meeting the requirements of 10CFR50.55a(b)(2)(ix)(B). The report shall include the description of degradation, operability determination, root cause determination and the corrective actions.
- c. A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.6.2.10, Steam Generator (OTSG) Program. The report shall include:
 1. The scope of inspections performed on each OTSG,
 2. Active degradation mechanisms found,
 3. Nondestructive examination techniques utilized for each degradation mechanism,
 4. Location, orientation (if linear), and measured sizes (if available) of service induced indications,

(continued)

5.7 Reporting Requirements

5.7.2 Special Reports (continued)

5. Number of tubes plugged or repaired during the inspection outage for each active degradation mechanism,
 6. Total number and percentage of tubes plugged or repaired to date,
 7. The results of condition monitoring, including the results of tube pulls and in-situ testing,
 8. The effective plugging percentage for all plugging and tube repairs in each OTSG,
 9. Repair method utilized and the number of tubes repaired by each repair method,
 10. Location, bobbin coil amplitude, and axial and circumferential extent (if determined) for each first span IGA indication, and an assessment of growth for indications in the first span of OTSG B, and
 11. Number of as-found and as-left tubes with TEC indications, number of as-found and as-left TEC indications, the number of as-found and as-left TEC indications as a function of tubesheet radius, the as-found, as-left, probability of detection and new TEC leakage for upper and lower tubesheet indications. The projected accident leakage and an assessment of growth for TEC indications will be provided. An assessment of the adequacy of the predictive methodology in Addendum C to Topical Report BAW-2346P, Revision 0, including assessing the distribution of indications found in each OTSG to ensure the assumption regarding the similarity of the distribution of indications remain consistent from one cycle to the next and that the assumption of a linear increase in leak rate remain valid. Corrective actions in the event that the assessment indicates the assumptions can not be fully supported.
-

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

LICENSE AMENDMENT REQUEST #264, REVISION 1

**Application to Modify Improved Technical Specifications
Regarding Steam Generator Tube Integrity**

ATTACHMENT E

Proposed Improved Technical Specification Bases Pages (Mark-up)

~~Strikeout text~~ indicates deleted text.

Highlighted text indicates added text.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.12 RCS Operational LEAKAGE

BASES

BACKGROUND

During the life of the plant, the joint and valve interfaces contained in the RCS can produce varying amounts of reactor coolant LEAKAGE, through either normal operational wear or mechanical deterioration. The purpose of the RCS Operational LEAKAGE LCO is to limit system operation in the presence of LEAKAGE from these sources to amounts that do not compromise safety. This LCO specifies the types and amounts of LEAKAGE.

10 CFR 50, Appendix A, GDC 30 (Ref. 1), requires means for detecting and, to the extent practical, identifying the source of reactor coolant LEAKAGE. Regulatory Guide 1.45 (Ref. 2) describes acceptable methods for selecting leakage detection systems. OPERABILITY of the leakage detection systems is addressed in LCO 3.4.14, "RCS Leakage Detection Instrumentation."

The safety significance of RCS LEAKAGE varies widely depending on its source, rate, and duration. Therefore, detecting, monitoring, and quantifying reactor coolant LEAKAGE is critical. Quickly separating the identified LEAKAGE from the unidentified LEAKAGE is necessary to provide quantitative information to the operators, allowing them to take corrective action should a leak occur.

A limited amount of leakage inside containment is expected from auxiliary systems that cannot be made 100% leaktight. Leakage from these systems should be detected, located, and isolated from the containment atmosphere, if possible, to not interfere with RCS leakage detection.

APPLICABLE
SAFETY ANALYSES

Except for primary to secondary LEAKAGE, the safety analyses do not address operational LEAKAGE. However, other operational LEAKAGE is related to the safety analyses for a LOCA in that the amount of leakage can affect the probability of such an event. The safety analysis for an event resulting in steam discharge to the atmosphere assumes ~~1 gpm primary to secondary LEAKAGE as the initial condition.~~

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

that primary to secondary LEAKAGE from all steam generators (OTSGs) is one gallon per minute or increases to one gallon per minute as a result of accident induced conditions. The LCO requirement to limit primary to secondary LEAKAGE through any one OTSG to less than or equal to 150 gallons per day is significantly less than the conditions assumed in the safety analysis.

The FSAR (Ref. 3) analysis for steam generator tube rupture (SGTR) assumes the contaminated secondary fluid is only briefly released via safety valves and the majority is steamed to the condenser. The 1 gpm primary to secondary LEAKAGE safety analysis assumption is relatively inconsequential in terms of offsite dose.

The safety analysis for the Steam Line Break (SLB) accident assumes the entire 1 gpm primary to secondary LEAKAGE in one is through the affected generator as an initial condition (Ref. 4). The dose consequences resulting from the SLB accident meet the acceptance criteria defined in 10 CFR 50.67.

RCS operational LEAKAGE satisfies Criterion 2 of the NRC Policy Statement.

LCO

RCS operational LEAKAGE shall be limited to:

a. Pressure Boundary LEAKAGE

No pressure boundary LEAKAGE is allowed, being indicative of material deterioration. LEAKAGE of this type is unacceptable as the leak itself could cause further deterioration, resulting in higher LEAKAGE. Violation of this LCO could result in continued degradation of the reactor coolant pressure boundary (RCPB). LEAKAGE past seals and gaskets is not pressure boundary LEAKAGE.

b. Unidentified LEAKAGE

One gallon per minute (gpm) of unidentified LEAKAGE is allowed as a reasonable minimum detectable amount that the containment atmosphere and sump level monitoring equipment can detect within a reasonable time period. Violation of this LCO could result in continued degradation of the RCPB, if the LEAKAGE is from the pressure boundary.

(continued)

BASES

LCO

(continued)

c. Identified LEAKAGE

Up to 10 gpm of identified LEAKAGE is considered allowable because LEAKAGE is from known sources that do not interfere with the detection of unidentified LEAKAGE and is well within the capability of the RCS makeup system. Identified LEAKAGE includes LEAKAGE to the containment from specifically known and located sources, but does not include pressure boundary LEAKAGE or controlled reactor coolant pump (RCP) seal leakoff (a normal function not considered LEAKAGE). Violation of this LCO could result in continued degradation of a component or system.

~~d. Primary to Secondary LEAKAGE through Any One Steam Generator (OTSG)~~

~~This LEAKAGE limit is established to ensure that tubes initially leaking during normal operation do not contribute excessively to total leakage during postulated accident conditions. The 150 gpd limit is a conservative limit which is consistent with the operational leakage limit specified in NRC Generic Letter 95-05 for plants implementing Alternate Repair Criteria. CR-3 has elected to voluntarily adopt this conservative limit to ensure plant shutdown in a timely manner in response to detection of primary to secondary LEAKAGE. Primary to secondary LEAKAGE must be included in the total allowable limit for identified LEAKAGE.~~

~~Two OTSGs are also required to be OPERABLE. This requirement is met by satisfying the augmented inservice inspection requirements of the Steam Generator Tube Surveillance Program (Specification 5.6.2.10).~~

~~d. Primary to Secondary LEAKAGE through Any One OTSG~~

~~The limit of 150 gallons per day per OTSG is based on the operational LEAKAGE performance criterion in NEI 97-06, Steam Generator Program Guidelines (Ref. 5). The Steam Generator Program operational LEAKAGE performance criterion in NEI 97-06 states, "The RCS operational primary to secondary leakage through any one SG shall be limited to 150 gallons per day." The limit is based on operating experience with OTSG tube degradation mechanisms that result in tube leakage. The operational leakage rate criterion in conjunction with the implementation of the Steam Generator Program is an effective measure for minimizing the frequency of steam generator tube ruptures.~~

BASES

ACTIONS

A.1

If unidentified LEAKAGE, ~~or identified LEAKAGE, or primary to secondary LEAKAGE~~ are is in excess of the LCO limits, the LEAKAGE must be reduced to within limits within 4 hours. This Completion Time allows time to verify leakage rates and either identify unidentified LEAKAGE or reduce LEAKAGE to within limits before the reactor must be shut down. This action is necessary to prevent further deterioration of the RCPB.

B.1 and B.2

If any pressure boundary LEAKAGE exists or primary to secondary LEAKAGE is not within limits, ~~or if unidentified, or identified, or primary to secondary LEAKAGE~~ cannot be reduced to within limits within 4 hours, the reactor must be placed in a lower pressure condition to reduce the severity of the LEAKAGE and its potential consequences. The reactor must be placed in MODE 3 within 6 hours and MODE 5 within 36 hours. This action reduces the LEAKAGE and also reduces the stresses that tend to degrade the pressure boundary.

The Completion Times allowed are reasonable, based on operating experience, to reach the required conditions from full power conditions in an orderly manner and without challenging plant systems. In MODE 5, the pressure stresses acting on the RCPB are much lower and further deterioration is much less likely.

SURVEILLANCE
REQUIREMENTS

SR 3.4.12.1

Verifying RCS LEAKAGE within the LCO limits ensures that the integrity of the RCPB is maintained. Pressure boundary LEAKAGE would at first appear as unidentified LEAKAGE and can only be positively identified by inspection. Unidentified LEAKAGE and identified LEAKAGE are determined by performance of an RCS water inventory balance. ~~Primary to secondary LEAKAGE is also measured by performance of an RCS water inventory balance in conjunction with effluent monitoring within the secondary steam and condensate systems.~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.12.1 (continued)

The RCS water inventory balance must be performed with the reactor at steady state operating conditions and with RCS temperature greater than 400°F. The test must be performed prior to entry into MODE 2 if it has not been performed within the past 72 hours near normal operating pressure. This surveillance is modified by two notes. Note 1 states that it is not required to be performed for entry into MODE 4 or ~~MODE 3~~ or for non-steady state conditions in MODE 3, but must be performed in MODE 3 above 400°F if 12 hours of steady state operation are achieved. If the test is not performed prior to all other requirements for entry into MODE 2 being satisfied, entry into MODE 2 must be delayed until steady state operation is established and the requirements of SR 3.0.4 are satisfied.

Steady state operation is required to perform a meaningful water inventory balance; calculations during maneuvering are not useful. For RCS operational LEAKAGE determination by water inventory balance, steady state is defined as stable RCS pressure, temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and RCP pump seal injection and return flows.

Note 2 states that this SR is not applicable to primary to secondary LEAKAGE because LEAKAGE of 150 gallons per day cannot be measured accurately by an RCS water inventory balance.

The 72 hour Frequency is reasonable to trend LEAKAGE and recognizes the importance of early leakage detection in the prevention of accidents.

SR 3.4.12.2

~~This SR provides the means necessary to determine OTSG OPERABILITY in an operational MODE. The requirement to demonstrate OTSG tube integrity in accordance with the Steam Generator Tube Surveillance Program emphasizes the importance of OTSG tube integrity, even though this surveillance cannot be performed at normal operating conditions.~~

(continued)

BASES

SURVEILLANCE SR 3.4.12.2 (continued)
REQUIREMENTS

This SR verifies that primary to secondary LEAKAGE is less than or equal to 150 gallons per day through any one OTSG. Satisfying the primary to secondary LEAKAGE limit ensures that the operational LEAKAGE performance criterion in the Steam Generator Program is met. If this SR is not met, compliance with LCO 3.4.16, "Steam Generator Tube Integrity," should be evaluated. The 150 gallons per day limit is measured at room temperature as described in Reference 6. The operational LEAKAGE rate limit applies to LEAKAGE through any one OTSG. If it is not practical to assign the LEAKAGE to an individual OTSG, all the primary to secondary LEAKAGE should be conservatively assumed to be from one OTSG.

The Surveillance is modified by a Note which states that the Surveillance is not required to be performed until 12 hours after establishment of steady state operation. For RCS primary to secondary LEAKAGE determination, steady state is defined as stable RCS pressure, temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flows.

The Surveillance Frequency of 72 hours is a reasonable interval to trend primary to secondary LEAKAGE and recognizes the importance of early leakage detection in the prevention of accidents. The primary to secondary LEAKAGE is determined using continuous process radiation monitors or radiochemical grab sampling in accordance with the EPRI guidelines (Ref. 6).

REFERENCES

1. 10 CFR 50, Appendix A, GDC 30.
2. Regulatory Guide 1.45, May 1973.
3. FSAR, Section 14.2.2.2.
4. FSAR, Section 14.2.2.1.
5. NEI 97-06, "Steam Generator Program Guidelines."
6. EPRI, "Pressurized Water Reactor Primary-to-Secondary Leak Guidelines."

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.16 Steam Generator (OTSG) Tube Integrity

BASES

BACKGROUND Steam generator (OTSG) tubes are small diameter, thin walled tubes that carry primary coolant through the primary to secondary heat exchanges. The OTSG tubes have a number of important safety functions. Steam generator tubes are an integral part of the reactor coolant pressure boundary (RCPB) and, as such, are relied on to maintain the primary system's pressure and inventory. The OTSG tubes isolate the radioactive fission products in the primary coolant from the secondary system. In addition, as part of the RCPB, the OTSG tubes are unique in that they act as the heat transfer surface between the primary and secondary systems to remove heat from the primary system. This Specification addresses only the RCPB integrity function of the OTSG. The OTSG heat removal function is addressed by LCO 3.4.4, "RCS Loops - MODE 3," LCO 3.4.5, "RCS Loops - MODE 4," LCO 3.4.6, "RCS Loops - MODE 5, Loops Filled," and is implicitly required in MODES 1 and 2 in order to prevent a Reactor Protection System actuation (LCO 3.3.1).

OTSG tube integrity means that the tubes are capable of performing their intended RCPB safety function consistent with the licensing basis, including applicable regulatory requirements.

Steam generator tubing is subject to a variety of degradation mechanisms. Steam generator tubes may experience tube degradation related to corrosion phenomena, such as wastage, pitting, intergranular attack, and stress corrosion cracking, along with other mechanically induced phenomena such as denting and wear. These degradation mechanisms can impair tube integrity if they are not managed effectively. The OTSG performance criteria are used to manage OTSG tube degradation.

Specification 5.6.2.10, "Steam Generator (OTSG) Program," requires that a program be established and implemented to ensure that OTSG tube integrity is maintained. Pursuant to Specification 5.6.2.10, tube integrity is maintained when the OTSG performance criteria are met. There are three OTSG performance criteria: structural integrity, accident induced leakage, and operational LEAKAGE. The OTSG

(continued)

BASES

BACKGROUND performance criteria are described in Specification
(continued) 5.6.2.10. Meeting the OTSG performance criteria provides reasonable assurance of maintaining tube integrity at normal and accident conditions.

The processes used to meet the OTSG performance criteria are defined by the Steam Generator Program Guidelines (Ref. 1).

APPLICABLE SAFETY ANALYSES The steam generator tube rupture (SGTR) accident is the limiting design basis event for OTSG tubes and avoiding an SGTR is the basis for this Specification. The analysis of a SGTR event assumes a bounding primary to secondary LEAKAGE rate equal to the operational LEAKAGE rate limits in LCO 3.4.12, "RCS Operational LEAKAGE," plus the leakage rate associated with a double-ended rupture of a single tube. The accident analysis for a SGTR assumes the contaminated secondary fluid is only briefly released to the atmosphere via safety valves and the majority is discharged to the main condenser.

The analysis for design basis accidents and transients other than a SGTR assume the OTSG tubes retain their structural integrity (i.e., they are assumed not to rupture). In these analyses, the steam discharge to the atmosphere is based on the total primary to secondary LEAKAGE from all OTSGs of one gallon per minute or is assumed to increase to one gallon per minute as a result of accident induced conditions. For accidents that do not involve fuel damage, the primary coolant activity level of DOSE EQUIVALENT I-131 is assumed to be equal to the LCO 3.4.15, "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 (Ref. 2), 10 CFR 50.67 (Ref. 3) or the NRC approved licensing bases (e.g., a small fraction of these limits).

Steam generator tube integrity satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO The LCO requires that OTSG tube integrity be maintained. The LCO also requires that all OTSG tubes that satisfy the repair criteria be plugged or repaired in accordance with the Steam Generator Program.

(continued)

BASES

<p>LCO (continued)</p>	<p>During an OTSG inspection, any inspected tube that satisfies the Steam Generator Program repair criteria is repaired or removed from service by plugging. If a tube was determined to satisfy the repair criteria but was not plugged or repaired, the tube may still have tube integrity.</p>
	<p>In the context of this Specification, an OTSG tube is defined as the entire length of the tube, including the tube wall and any repairs made to it, between the tube-to-tubesheet weld at the tube inlet and the tube-to-tubesheet weld at the tube outlet. The tube-to-tubesheet weld is not considered part of the tube.</p>
	<p>An OTSG tube has tube integrity when it satisfies the OTSG performance criteria. The OTSG performance criteria are defined in Specification 5.6.2.10, "Steam Generator Program," and describe acceptable OTSG tube performance. The Steam Generator Program also provides the evaluation process for determining conformance with the OTSG performance criteria.</p>
	<p>There are three OTSG 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.</p>
	<p>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 OTSG 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 have a significant effect on burst or collapse. In that context, the term "significant" is defined as "An accident loading condition other than differential pressure</p>

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BASES

LCO
(continued) 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 (Ref. 4) and Draft Regulatory Guide 1.121 (Ref. 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 one gallon per minute per OTSG, except for specific types of degradation at specific locations where the NRC has approved greater accident induced leakage. 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 OTSG tube conditions during plant operation. The limit on operational LEAKAGE is contained in LCO 3.4.12, "RCS Operational LEAKAGE," and limits primary to secondary LEAKAGE through any one OTSG to 150 gallons per day. This limit is based on the assumption 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.

BASES

APPLICABILITY Steam generator tube integrity is challenged when the pressure differential across the tubes is large. Large differential pressures across OTSG tubes can only be experienced in MODE 1, 2, 3, or 4.

RCS conditions are far less challenging in MODES 5 and 6 than during MODES 1, 2, 3, and 4. In MODES 5 and 6, primary to secondary differential pressure is low, resulting in lower stresses and reduced potential for LEAKAGE.

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

A.1 and A.2

Condition A applies if it is discovered that one or more OTSG tubes examined in an inservice inspection satisfy the tube repair criteria but were not plugged or repaired in accordance with the Steam Generator Program as required by SR 3.4.16.2. An evaluation of OTSG tube integrity of the affected tube(s) must be made. Steam generator tube integrity is based on meeting the OTSG performance criteria described in the Steam Generator Program. The OTSG repair criteria define limits on OTSG tube degradation that allow for flaw growth between inspections while still providing assurance that the OTSG performance criteria will continue to be met. In order to determine if an OTSG tube that should have been plugged or repaired has tube integrity, an evaluation must be completed that demonstrates that the OTSG performance criteria will continue to be met until the next refueling outage or OTSG 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 OTSG tube inspection. If it is determined that tube integrity is not being maintained, Condition B applies.

(continued)

BASES

ACTIONS A.1 and A.2 (continued)

A Completion Time of 7 days is sufficient to complete the evaluation while minimizing the risk of plant operation with an OTSG tube that may not have tube integrity.

If the evaluation determines that the affected tube(s) have tube integrity, Required Action A.2 allows plant operation to continue until the next refueling outage or OTSG 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 or repaired prior to entering MODE 4 following the next refueling outage or OTSG inspection. This Completion Time is acceptable since operation until the next inspection is supported by the operational assessment.

B.1 and B.2

If the Required Actions and associated Completion Times of Condition A are not met or if OTSG tube integrity is not being maintained, the reactor must be brought to MODE 3 within 6 hours and MODE 5 within 36 hours.

The allowed Completion 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 SR 3.4.16.1

During shutdown periods the OTSGs are inspected as required by this SR and the Steam Generator Program. NEI 97-06, Steam Generator Program Guidelines (Ref. 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 OTSG inspections a condition monitoring assessment of the OTSG tubes is performed. The condition monitoring assessment determines the "as found" condition of the OTSG tubes. The purpose of the condition monitoring assessment is to ensure that the OTSG performance criteria have been met for the previous operating period.

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BASES

SURVEILLANCE REQUIREMENTS SR 3.4.16.1 (continued)

The Steam Generator Program determines the scope of the inspection 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 OTSG 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 3.4.16.1. The Frequency is determined by the operational assessment and other limits in the OTSG examination guidelines (Ref. 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 OTSG performance criteria at the next scheduled inspection. In addition, Specification 5.6.2.10 contains prescriptive requirements concerning inspection intervals to provide added assurance that the OTSG performance criteria will be met between scheduled inspections.

SR 3.4.16.2

During an OTSG inspection, any inspected tube that satisfies the Steam Generator Program repair criteria is repaired or removed from service by plugging. The tube repair criteria delineated in Specification 5.6.2.10 are intended to ensure that tubes accepted for continued service satisfy the OTSG 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 OTSG 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 OTSG performance criteria.

Steam generator tube repairs are only performed using approved repair methods as described in the Steam Generator Program.

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BASES

SURVEILLANCE REQUIREMENTS SR 3.4.16.2 (continued)

The Frequency of prior to entering MODE 4 following a OTSG inspection ensures that the Surveillance has been completed and all tubes meeting the repair criteria are plugged or repaired prior to subjecting the OTSG 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."

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

LICENSE AMENDMENT REQUEST #264, REVISION 1

**Application to Modify Improved Technical Specifications
Regarding Steam Generator Tube Integrity**

ATTACHMENT F

**Proposed Improved Technical Specification Bases Pages
(Revision Bar Format)**

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.12 RCS Operational LEAKAGE

BASES

BACKGROUND

During the life of the plant, the joint and valve interfaces contained in the RCS can produce varying amounts of reactor coolant LEAKAGE, through either normal operational wear or mechanical deterioration. The purpose of the RCS Operational LEAKAGE LCO is to limit system operation in the presence of LEAKAGE from these sources to amounts that do not compromise safety. This LCO specifies the types and amounts of LEAKAGE.

10 CFR 50, Appendix A, GDC 30 (Ref. 1), requires means for detecting and, to the extent practical, identifying the source of reactor coolant LEAKAGE. Regulatory Guide 1.45 (Ref. 2) describes acceptable methods for selecting leakage detection systems. OPERABILITY of the leakage detection systems is addressed in LCO 3.4.14, "RCS Leakage Detection Instrumentation."

The safety significance of RCS LEAKAGE varies widely depending on its source, rate, and duration. Therefore, detecting, monitoring, and quantifying reactor coolant LEAKAGE is critical. Quickly separating the identified LEAKAGE from the unidentified LEAKAGE is necessary to provide quantitative information to the operators, allowing them to take corrective action should a leak occur.

A limited amount of leakage inside containment is expected from auxiliary systems that cannot be made 100% leaktight. Leakage from these systems should be detected, located, and isolated from the containment atmosphere, if possible, to not interfere with RCS leakage detection.

APPLICABLE
SAFETY ANALYSES

Except for primary to secondary LEAKAGE, the safety analyses do not address operational LEAKAGE. However, other operational LEAKAGE is related to the safety analyses for a LOCA in that the amount of leakage can affect the probability of such an event. The safety analysis for an event resulting in steam discharge to the atmosphere assumes

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

that primary to secondary LEAKAGE from all steam generators (OTSGs) is one gallon per minute or increases to one gallon per minute as a result of accident induced conditions. The LCO requirement to limit primary to secondary LEAKAGE through any one OTSG to less than or equal to 150 gallons per day is significantly less than the conditions assumed in the safety analysis.

The FSAR (Ref. 3) analysis for steam generator tube rupture (SGTR) assumes the contaminated secondary fluid is only briefly released via safety valves and the majority is steamed to the condenser. The 1 gpm primary to secondary LEAKAGE safety analysis assumption is relatively inconsequential in terms of offsite dose.

The safety analysis for the Steam Line Break (SLB) accident assumes the entire 1 gpm primary to secondary LEAKAGE is through the affected generator as an initial condition (Ref. 4). The dose consequences resulting from the SLB accident meet the acceptance criteria defined in 10 CFR 50.67.

RCS operational LEAKAGE satisfies Criterion 2 of the NRC Policy Statement.

LCO

RCS operational LEAKAGE shall be limited to:

a. Pressure Boundary LEAKAGE

No pressure boundary LEAKAGE is allowed, being indicative of material deterioration. LEAKAGE of this type is unacceptable as the leak itself could cause further deterioration, resulting in higher LEAKAGE. Violation of this LCO could result in continued degradation of the reactor coolant pressure boundary (RCPB). LEAKAGE past seals and gaskets is not pressure boundary LEAKAGE.

b. Unidentified LEAKAGE

One gallon per minute (gpm) of unidentified LEAKAGE is allowed as a reasonable minimum detectable amount that the containment atmosphere and sump level monitoring equipment can detect within a reasonable time period. Violation of this LCO could result in continued degradation of the RCPB, if the LEAKAGE is from the pressure boundary.

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BASES

LCO
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c. Identified LEAKAGE

Up to 10 gpm of identified LEAKAGE is considered allowable because LEAKAGE is from known sources that do not interfere with the detection of unidentified LEAKAGE and is well within the capability of the RCS makeup system. Identified LEAKAGE includes LEAKAGE to the containment from specifically known and located sources, but does not include pressure boundary LEAKAGE or controlled reactor coolant pump (RCP) seal leakoff (a normal function not considered LEAKAGE). Violation of this LCO could result in continued degradation of a component or system.

d. Primary to Secondary LEAKAGE through Any One OTSG

The limit of 150 gallons per day per OTSG is based on the operational LEAKAGE performance criterion in NEI 97-06, Steam Generator Program Guidelines (Ref. 5). The Steam Generator Program operational LEAKAGE performance criterion in NEI 97-06 states, "The RCS operational primary to secondary leakage through any one SG shall be limited to 150 gallons per day." The limit is based on operating experience with OTSG tube degradation mechanisms that result in tube leakage. The operational leakage rate criterion in conjunction with the implementation of the Steam Generator Program is an effective measure for minimizing the frequency of steam generator tube ruptures.

BASES

ACTIONS

A.1

If unidentified LEAKAGE or identified LEAKAGE is in excess of the LCO limits, the LEAKAGE must be reduced to within limits within 4 hours. This Completion Time allows time to verify leakage rates and either identify unidentified LEAKAGE or reduce LEAKAGE to within limits before the reactor must be shut down. This action is necessary to prevent further deterioration of the RCPB.

B.1 and B.2

If any pressure boundary LEAKAGE exists or primary to secondary LEAKAGE is not within limits, or if unidentified or identified LEAKAGE cannot be reduced to within limits within 4 hours, the reactor must be placed in a lower pressure condition to reduce the severity of the LEAKAGE and its potential consequences. The reactor must be placed in MODE 3 within 6 hours and MODE 5 within 36 hours. This action reduces the LEAKAGE and also reduces the stresses that tend to degrade the pressure boundary.

The Completion Times allowed are reasonable, based on operating experience, to reach the required conditions from full power conditions in an orderly manner and without challenging plant systems. In MODE 5, the pressure stresses acting on the RCPB are much lower and further deterioration is much less likely.

SURVEILLANCE
REQUIREMENTS

SR 3.4.12.1

Verifying RCS LEAKAGE within the LCO limits ensures that the integrity of the RCPB is maintained. Pressure boundary LEAKAGE would at first appear as unidentified LEAKAGE and can only be positively identified by inspection. Unidentified LEAKAGE and identified LEAKAGE are determined by performance of an RCS water inventory balance.

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BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.12.1 (continued)

The RCS water inventory balance must be performed with the reactor at steady state operating conditions and with RCS temperature greater than 400°F. The test must be performed prior to entry into MODE 2 if it has not been performed within the past 72 hours near normal operating pressure. This surveillance is modified by two notes. Note 1 states that it is not required to be performed for entry into MODE 4 or for non-steady state conditions in MODE 3, but must be performed in MODE 3 above 400°F if 12 hours of steady state operation are achieved. If the test is not performed prior to all other requirements for entry into MODE 2 being satisfied, entry into MODE 2 must be delayed until steady state operation is established and the requirements of SR 3.0.4 are satisfied.

Steady state operation is required to perform a meaningful water inventory balance; calculations during maneuvering are not useful. For RCS operational LEAKAGE determination by water inventory balance, steady state is defined as stable RCS pressure, temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and RCP pump seal injection and return flows.

Note 2 states that this SR is not applicable to primary to secondary LEAKAGE because LEAKAGE of 150 gallons per day cannot be measured accurately by an RCS water inventory balance.

The 72 hour Frequency is reasonable to trend LEAKAGE and recognizes the importance of early leakage detection in the prevention of accidents.

SR 3.4.12.2

This SR verifies that primary to secondary LEAKAGE is less than or equal to 150 gallons per day through any one OTSG. Satisfying the primary to secondary LEAKAGE limit ensures that the operational LEAKAGE performance criterion in the Steam Generator Program is met. If this SR is not met, compliance with LCO 3.4.16, "Steam Generator Tube Integrity," should be evaluated. The 150 gallons per day limit is measured at room temperature as described in Reference 6. The operational LEAKAGE rate limit applies to

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BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.12.2 (continued)

LEAKAGE through any one OTSG. If it is not practical to assign the LEAKAGE to an individual OTSG, all the primary to secondary LEAKAGE should be conservatively assumed to be from one OTSG.

The Surveillance is modified by a Note which states that the Surveillance is not required to be performed until 12 hours after establishment of steady state operation. For RCS primary to secondary LEAKAGE determination, steady state is defined as stable RCS pressure, temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flows.

The Surveillance Frequency of 72 hours is a reasonable interval to trend primary to secondary LEAKAGE and recognizes the importance of early leakage detection in the prevention of accidents. The primary to secondary LEAKAGE is determined using continuous process radiation monitors or radiochemical grab sampling in accordance with the EPRI guidelines (Ref. 6).

REFERENCES

1. 10 CFR 50, Appendix A, GDC 30.
 2. Regulatory Guide 1.45, May 1973.
 3. FSAR, Section 14.2.2.2.
 4. FSAR, Section 14.2.2.1.
 5. NEI 97-06, "Steam Generator Program Guidelines."
 6. EPRI, "Pressurized Water Reactor Primary-to-Secondary Leak Guidelines."
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.16 Steam Generator (OTSG) Tube Integrity

BASES

BACKGROUND

Steam generator (OTSG) tubes are small diameter, thin walled tubes that carry primary coolant through the primary to secondary heat exchanges. The OTSG tubes have a number of important safety functions. Steam generator tubes are an integral part of the reactor coolant pressure boundary (RCPB) and, as such, are relied on to maintain the primary system's pressure and inventory. The OTSG tubes isolate the radioactive fission products in the primary coolant from the secondary system. In addition, as part of the RCPB, the OTSG tubes are unique in that they act as the heat transfer surface between the primary and secondary systems to remove heat from the primary system. This Specification addresses only the RCPB integrity function of the OTSG. The OTSG heat removal function is addressed by LCO 3.4.4, "RCS Loops - MODE 3," LCO 3.4.5, "RCS Loops - MODE 4," LCO 3.4.6, "RCS Loops - MODE 5, Loops Filled," and is implicitly required in MODES 1 and 2 in order to prevent a Reactor Protection System actuation (LCO 3.3.1).

OTSG tube integrity means that the tubes are capable of performing their intended RCPB safety function consistent with the licensing basis, including applicable regulatory requirements.

Steam generator tubing is subject to a variety of degradation mechanisms. Steam generator tubes may experience tube degradation related to corrosion phenomena, such as wastage, pitting, intergranular attack, and stress corrosion cracking, along with other mechanically induced phenomena such as denting and wear. These degradation mechanisms can impair tube integrity if they are not managed effectively. The OTSG performance criteria are used to manage OTSG tube degradation.

Specification 5.6.2.10, "Steam Generator (OTSG) Program," requires that a program be established and implemented to ensure that OTSG tube integrity is maintained. Pursuant to Specification 5.6.2.10, tube integrity is maintained when the OTSG performance criteria are met. There are three OTSG performance criteria: structural integrity, accident induced leakage, and operational LEAKAGE. The OTSG

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BASES

BACKGROUND
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performance criteria are described in Specification 5.6.2.10. Meeting the OTSG performance criteria provides reasonable assurance of maintaining tube integrity at normal and accident conditions.

The processes used to meet the OTSG performance criteria are defined by the Steam Generator Program Guidelines (Ref. 1).

APPLICABLE
SAFETY
ANALYSES

The steam generator tube rupture (SGTR) accident is the limiting design basis event for OTSG tubes and avoiding an SGTR is the basis for this Specification. The analysis of a SGTR event assumes a bounding primary to secondary LEAKAGE rate equal to the operational LEAKAGE rate limits in LCO 3.4.12, "RCS Operational LEAKAGE," plus the leakage rate associated with a double-ended rupture of a single tube. The accident analysis for a SGTR assumes the contaminated secondary fluid is only briefly released to the atmosphere via safety valves and the majority is discharged to the main condenser.

The analysis for design basis accidents and transients other than a SGTR assume the OTSG tubes retain their structural integrity (i.e., they are assumed not to rupture). In these analyses, the steam discharge to the atmosphere is based on the total primary to secondary LEAKAGE from all OTSGs of one gallon per minute or is assumed to increase to one gallon per minute as a result of accident induced conditions. For accidents that do not involve fuel damage, the primary coolant activity level of DOSE EQUIVALENT I-131 is assumed to be equal to the LCO 3.4.15, "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 (Ref. 2), 10 CFR 50.67 (Ref. 3) or the NRC approved licensing bases (e.g., a small fraction of these limits).

Steam generator tube integrity satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The LCO requires that OTSG tube integrity be maintained. The LCO also requires that all OTSG tubes that satisfy the repair criteria be plugged or repaired in accordance with the Steam Generator Program.

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BASES

LCO
(continued)

During an OTSG inspection, any inspected tube that satisfies the Steam Generator Program repair criteria is repaired or removed from service by plugging. If a tube was determined to satisfy the repair criteria but was not plugged or repaired, the tube may still have tube integrity.

In the context of this Specification, an OTSG tube is defined as the entire length of the tube, including the tube wall and any repairs made to it, between the tube-to-tubesheet weld at the tube inlet and the tube-to-tubesheet weld at the tube outlet. The tube-to-tubesheet weld is not considered part of the tube.

An OTSG tube has tube integrity when it satisfies the OTSG performance criteria. The OTSG performance criteria are defined in Specification 5.6.2.10, "Steam Generator Program," and describe acceptable OTSG tube performance. The Steam Generator Program also provides the evaluation process for determining conformance with the OTSG performance criteria.

There are three OTSG 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 OTSG 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 have a significant effect on burst or collapse. In that context, the term "significant" is defined as "An accident loading condition other than differential pressure

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BASES

LCO
(continued)

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 (Ref. 4) and Draft Regulatory Guide 1.121 (Ref. 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 one gallon per minute per OTSG, except for specific types of degradation at specific locations where the NRC has approved greater accident induced leakage. 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 OTSG tube conditions during plant operation. The limit on operational LEAKAGE is contained in LCO 3.4.12, "RCS Operational LEAKAGE," and limits primary to secondary LEAKAGE through any one OTSG to 150 gallons per day. This limit is based on the assumption 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.

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BASES

APPLICABILITY Steam generator tube integrity is challenged when the pressure differential across the tubes is large. Large differential pressures across OTSG tubes can only be experienced in MODE 1, 2, 3, or 4.

RCS conditions are far less challenging in MODES 5 and 6 than during MODES 1, 2, 3, and 4. In MODES 5 and 6, primary to secondary differential pressure is low, resulting in lower stresses and reduced potential for LEAKAGE.

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

A.1 and A.2

Condition A applies if it is discovered that one or more OTSG tubes examined in an inservice inspection satisfy the tube repair criteria but were not plugged or repaired in accordance with the Steam Generator Program as required by SR 3.4.16.2. An evaluation of OTSG tube integrity of the affected tube(s) must be made. Steam generator tube integrity is based on meeting the OTSG performance criteria described in the Steam Generator Program. The OTSG repair criteria define limits on OTSG tube degradation that allow for flaw growth between inspections while still providing assurance that the OTSG performance criteria will continue to be met. In order to determine if an OTSG tube that should have been plugged or repaired has tube integrity, an evaluation must be completed that demonstrates that the OTSG performance criteria will continue to be met until the next refueling outage or OTSG 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 OTSG tube inspection. If it is determined that tube integrity is not being maintained, Condition B applies.

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

A Completion Time of 7 days is sufficient to complete the evaluation while minimizing the risk of plant operation with an OTSG tube that may not have tube integrity.

If the evaluation determines that the affected tube(s) have tube integrity, Required Action A.2 allows plant operation to continue until the next refueling outage or OTSG 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 or repaired prior to entering MODE 4 following the next refueling outage or OTSG inspection. This Completion Time is acceptable since operation until the next inspection is supported by the operational assessment.

B.1 and B.2

If the Required Actions and associated Completion Times of Condition A are not met or if OTSG tube integrity is not being maintained, the reactor must be brought to MODE 3 within 6 hours and MODE 5 within 36 hours.

The allowed Completion 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

SR 3.4.16.1

During shutdown periods the OTSGs are inspected as required by this SR and the Steam Generator Program. NEI 97-06, Steam Generator Program Guidelines (Ref. 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 OTSG inspections a condition monitoring assessment of the OTSG tubes is performed. The condition monitoring assessment determines the "as found" condition of the OTSG tubes. The purpose of the condition monitoring assessment is to ensure that the OTSG performance criteria have been met for the previous operating period.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.16.1 (continued)

The Steam Generator Program determines the scope of the inspection 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 OTSG 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 3.4.16.1. The Frequency is determined by the operational assessment and other limits in the OTSG examination guidelines (Ref. 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 OTSG performance criteria at the next scheduled inspection. In addition, Specification 5.6.2.10 contains prescriptive requirements concerning inspection intervals to provide added assurance that the OTSG performance criteria will be met between scheduled inspections.

SR 3.4.16.2

During an OTSG inspection, any inspected tube that satisfies the Steam Generator Program repair criteria is repaired or removed from service by plugging. The tube repair criteria delineated in Specification 5.6.2.10 are intended to ensure that tubes accepted for continued service satisfy the OTSG 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 OTSG 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 OTSG performance criteria.

Steam generator tube repairs are only performed using approved repair methods as described in the Steam Generator Program.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.16.2 (continued)

The Frequency of prior to entering MODE 4 following a OTSG inspection ensures that the Surveillance has been completed and all tubes meeting the repair criteria are plugged or repaired prior to subjecting the OTSG 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."
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