MODEL SAFETY EVALUATION FOR PLANT-SPECIFIC ADOPTION OF TECHNICAL SPECIFICATIONS TASK FORCE TRAVELER TSTF-510, REVISION 2, "REVISION TO STEAM GENERATOR PROGRAM INSPECTION FREQUENCIES AND TUBE SAMPLE SELECTION," USING THE CONSOLIDATED LINE ITEM IMPROVEMENT PROCESS

1.0 INTRODUCTION

By letter dated [DATE], [LICENSEE] (the licensee) proposed changes to the Technical Specifications (TSs) for [PLANT] to adopt U.S. Nuclear Regulatory Commission (NRC)-approved Revision 2 to Technical Specifications Task Force (TSTF) Standard Technical Specifications (STS) Change Traveler TSTF-510, "Revision to Steam Generator [(SG)] Program Inspection Frequencies and Tube Sample Selection" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML110610350). The proposed changes revise Limiting Condition for Operation (LCO) [3.4.17], "Steam Generator (SG) Tube Integrity," Specification 5.5.9, "Steam Generator (SG) Program," and Specification 5.6.7, "Steam Generator Tube Inspection Report," and include TS Bases changes that summarize and clarify the purpose of the TS. The specific changes concern SG inspection periods, and address applicable administrative changes and clarifications.

The licensee stated that the license amendment request (LAR) is consistent with the Notice of Availability of TSTF-510, Revision 2, announced in the *Federal Register* on [DATE] ([ ] FR [ ]) as part of the consolidated line item improvement process.

The current STS requirements in the above specifications were established in May 2005 with the NRC staff's approval of TSTF-449, Revision 4, "Steam Generator Tube Integrity" (NRC *Federal Register* Notice of Availability (70 FR 24126)). The TSTF-449 changes to the STS incorporated a new, largely performance-based approach for ensuring the integrity of the SG tubes is maintained. The performance-based requirements were supplemented by prescriptive requirements relating to tube inspections and tube repair limits to ensure that conditions adverse to quality are detected and corrected on a timely basis. As of September 2007, the TSTF-449, Revision 4, changes were adopted in the plant TS for all pressurized water reactors (PWRs).

The proposed changes in TSTF-510, Revision 2, reflect licensees' early implementation experience with respect to the TSTF-449, Revision 4. TSTF-510 characterizes the changes as editorial corrections, changes, and clarifications intended to improve internal consistency, consistency with implementing industry documents, and usability without changing the intent of the requirements. The proposed changes are an improvement to the existing SG inspection requirements and continue to provide assurance that the plant licensing basis will be maintained between SG inspections.

2.0 REGULATORY EVALUATION

The SG tubes in PWRs have a number of important safety functions. These tubes are an integral part of the reactor coolant pressure boundary (RCPB) and, as such, are relied upon to maintain primary system pressure and inventory. As part of the RCPB, the SG tubes are unique in that they are also relied upon as a heat transfer surface between the primary and secondary systems such that residual heat can be removed from the primary system and are relied upon to isolate the radioactive fission products in the primary coolant from the secondary system. In

addition, the SG tubes are relied upon to maintain their integrity to be consistent with the containment objectives of preventing uncontrolled fission product release under conditions resulting from core damage during severe accidents.

The regulation at Title 10 of the *Code of Federal Regulations* (10 CFR) establishes the requirements with respect to the integrity of the SG tubing. Specifically, the General Design Criteria (GDC) in Appendix A to 10 CFR Part 50 state that the RCPB shall have "an extremely low probability of abnormal leakage...and of gross rupture" (GDC 14), "shall be designed with sufficient margin" (GDC 15 and 31), shall be of "the highest quality standards practical" (GDC 30), and shall be designed to permit "periodic inspection and testing...to assess...structural and leaktight integrity" (GDC 32). {NOTE: For plants constructed before the promulgation of the GDC, include a discussion on Final Safety Analysis Report statements regarding preliminary design criteria.} To this end, 10 CFR 50.55a specifies that components which are part of the RCPB must meet the requirements for Class 1 components in Section III of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code). Section 50.55a further requires, in part, that throughout the service life of a PWR facility, ASME Code Class 1 components meet the requirements, except design and access provisions and pre-service examination requirements, in Section XI, "Rules for Inservice Inspection [(ISI)] of Nuclear Power Plant Components," of the ASME Code, to the extent practical. This requirement includes the inspection and repair criteria of Section XI of the ASME Code.

In the 1970s, ASME Code Section XI requirements pertaining to ISI of SG tubing were augmented by additional SG tube surveillance requirements (SRs) in the TS. The regulation at 10 CFR 50.55a paragraph (b)(2)(iii), states "if the [TSs] … include [SRs] for [SGs] different than those in Article IWB- 2000, the [ISI] program for [SG] tubing is governed by the requirements in the [TSs]."

The regulation at 10 CFR 50.36, "Technical specifications," establishes the requirements related to the content of the TS. Pursuant to 10 CFR 50.36, TSs are required to include items in the following five categories related to station operation: (1) safety limits, limiting safety system settings, and limiting control settings; (2) LCOs; (3) SRs; (4) design features; and (5) administrative controls. LCOs and accompanying action statements and SRs in the STS relevant to SG tube integrity are in Specification 3.4.13, "RCS [reactor coolant system] Operational Leakage," and Specification [3.4.17], "Steam Generator (SG) Tube Integrity." The SRs in the "Steam Generator (SG) Tube Integrity" specification reference the SG Program which is defined in the STS administrative controls.

The regulation at 10 CFR 50.36(c)(5) defines administrative controls as "the provisions relating to organization and management, procedures, recordkeeping, review and audit, and reporting necessary to assure the operation of the facility in a safe manner." Programs established by the licensee to operate the facility in a safe manner, including the SG Program, are listed in the administrative controls section of the TS. The SG Program is defined in Specification 5.5.9, while the reporting requirements relating to implementation of the SG Program are in Specification 5.6.7.

Specification 5.5.9 requires that an SG Program be established and implemented to ensure that SG tube integrity is maintained. SG tube integrity is maintained by meeting the performance

criteria specified in TS 5.5.9.b for structural and leakage integrity, consistent with the plant design and licensing basis. Specification 5.5.9.a requires that a condition monitoring assessment be performed during each outage in which the SG tubes are inspected, to confirm that the performance criteria are being met. Specification 5.5.9.d includes provisions regarding the scope, frequency, and methods of SG tube inspections. These provisions require that the inspections be performed with the objective of detecting flaws of any type that (1) may be present along the length of a tube, from the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet, and (2) may satisfy the applicable tube repair criteria. The applicable tube repair criteria, specified in TS 5.5.9.c., are that tubes found during ISI to contain flaws with a depth equal to or exceeding 40 percent of the nominal wall thickness shall be plugged, unless the tubes are permitted to remain in service through application of the alternate repair criteria provided in TS 5.5.9.c.1.

3.0 TECHNICAL EVALUATION

Each proposed change to the TS is described individually below, followed by the NRC staff's assessment of the change.

3.1 Specification 5.5.9, "Steam Generator (SG) Program"

Proposed Change: The last sentence of the introductory paragraph currently states: "In addition, the Steam Generator Program shall include the following provisions:" The change would delete the word "provisions" such that the sentence would state: "In addition, the Steam Generator Program shall include the following:" The basis for this change is that subsequent paragraphs in Specification 5.5.9 start with "Provisions for …" and the word "provisions" in the introductory paragraph is duplicative.

Assessment: The NRC staff has reviewed Specification 5.5.9 and agrees that the word, "provisions," in the introductory paragraph is duplicative. The NRC staff agrees that the change is administrative in nature, and therefore is acceptable.

3.2 Paragraph 5.5.9.b.1, "Structural integrity performance criterion"

The first sentence currently states:

> 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.

Proposed Change: Revise the sentence as follows:

> All in-service steam generator tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cool down), all anticipated transients included in the design specification, and design-basis accidents.

The basis for the change is that this sentence inappropriately includes anticipated transients in the description of normal operating conditions.

Assessment: The NRC staff agrees the current wording is incorrect and that anticipated transients should be differentiated from normal operating conditions. Therefore, the NRC staff finds the change acceptable.

3.3 Paragraph 5.5.9.b.2, "Accident induced leakage performance criterion"

Proposed Change: Add a missing closing bracket to the end of Specification 5.5.9.b.2.

Assessment: The NRC staff agrees with the editorial correction and is therefore acceptable.

3.4. Paragraph 5.5.9.c, "Provisions for SG tube repair criteria," Paragraph 5.5.9.d, "Provisions for SG tube inspections," LCO [3.4.17], "Steam Generator (SG) Tube Integrity"

Proposed Change: Change all references to "tube repair criteria" to "tube plugging [or repair] criteria." This change is intended to be consistent with the treatment of SG tube repair throughout Specification 5.5.9.

Assessment: The NRC staff finds that the proposed change provides a more accurate label of the criteria and, therefore, adds clarity to the specification. This is because one of two actions must be taken when the criteria are exceeded. One action is to remove the tube from service by plugging the tube at both tube ends. The alternative action is to repair the tube, but only if such a repair is permitted by paragraphs 5.5.9.c and 5.5.9.f. Therefore, the NRC staff finds the change acceptable.

3.5 Paragraph 5.5.9.d, "Provisions for SG tube inspection"

Proposed Change: Change the term "assessment of degradation" to "degradation assessment" to be consistent with the terminology used in industry program documents.

Assessment: The NRC staff agrees that the terminology should be consistent and finds the change acceptable.

3.6 Paragraph 5.5.9.d.1

Proposed change: The paragraph currently states: "Inspect 100% of the tubes in each SG during the first refueling outage following SG replacement." The change would replace "SG

replacement" with "SG installation." The basis for the change is that it will allow the SG Program to apply to both existing plants and new plants.

Assessment: The NRC staff agrees the SG Program can apply to both existing and new plants. Therefore, the NRC staff finds the change acceptable.

3.7 Paragraph 5.5.9.d.2 for plants with SGs with alloy 600 mill annealed (MA) tubes:

The paragraph currently states:

> 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 SGs. No SG shall operate for more than 24 effective full power months or one refueling outage (whichever is less) without being inspected.

Proposed change:

(a) Revise these sentences for purposes of improved clarity, as follows:

> After the first refueling outage following SG installation, inspect each steam generator at least every 24 effective full power months or at least every refueling outage (whichever results in more frequent inspections). In addition, inspect 100% of the tubes at sequential periods of 60 effective full power months beginning after the first refueling outage inspection following SG installation.

(b) Add a third sentence to paragraph 5.5.9.d.2 to provide additional flexibility to licensees in scheduling inspections to meet the endpoint requirement, as follows:

> Each 60 effective full power month inspection period may be extended up to 3 effective full power months to include a SG inspection outage in an inspection period and the subsequent inspection period begins at the conclusion of the included SG inspection outage.

(c) Also, add a fourth and fifth sentence to paragraph 5.5.9.d.2 to clarify sampling requirements when a new sampling plan is added to the inspection scope after the start of an inspection period, as follows:

> If a degradation assessment indicates the potential for a type of degradation to occur at a location not previously inspected with a technique capable of detecting this type of degradation at this location and that may satisfy the applicable tube repair criteria, the minimum number of locations inspected with such a capable inspection technique during the remainder of the inspection period may be prorated. The fraction of locations to be inspected for this potential type of degradation at this location at the end of the inspection period shall be no less than the ratio of the number of times the SG is scheduled to be inspected in the inspection period after the determination that a new form of degradation could potentially be occurring at this location divided by the total number of times the SG is scheduled to be inspected in the inspection period.

Assessment:

(a) The NRC staff concurs that the proposed changes to the existing sentences of paragraph 5.5.9.d.2 (Alloy 600 MA tubes) are of a clarifying nature and do not change the intent. Therefore, the NRC staff finds the changes acceptable.

(b) The proposed third sentence to allow extension of the 60 effective full power month (EFPM) period by up to an additional 3 EFPM potentially impacts the average tube inspection sample size to be implemented during a given inspection in that period. For example, if three SG inspections are scheduled to occur within the nominal 60 EFPM period, the minimum sample size for each of the three inspections could average as little as 33.3 percent of the tube population. If a fourth inspection can be included within the period by extending the period by 3 EFPM, then the minimum sample size for each of the four inspections could average as little as 25 percent of the tube population. The proposed third sentence does not impact the required frequency of SG inspection.

Required tube inspection sample sizes are also subject to the performance-based requirement in paragraph 5.5.9.d, which states, in part, that in addition to meeting the requirements of paragraph 5.5.9.d.2, "the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that SG tube integrity is maintained until the next scheduled SG inspection." This requirement remains unchanged under the proposal. The NRC staff concludes the proposed third sentence involves only a relatively minor relaxation to the existing sampling requirements in paragraph 5.5.9.d.2. However, the performance-based requirements in 5.5.9.d ensure that adequate inspection sampling will be performed to ensure tube integrity is maintained. The NRC staff concludes that adding the proposed third sentence to paragraph 5.5.9.d.2 is acceptable.

(c) The proposed fourth and fifth sentences to paragraph 5.5.9.d.2 address the possibility that a degradation assessment in accordance with paragraph 5.5.9.d indicates the tubing may be susceptible to a type of degradation at a location not previously inspected with a technique capable of detecting that type of degradation at that location. For example, new information from another similar plant becomes available indicating the potential for circumferential cracking at a specific location on the tube. Previous degradation assessments had not identified the potential for this type of degradation at this location. Thus, previous inspections of this location had not been performed with a technique capable of detecting circumferential cracks. However, now that the potential for circumferential cracking has been identified at this location, paragraph 5.5.9.d requires a method of inspection to be performed with the objective of detecting circumferential cracks which may be present at this location and that may satisfy the applicable tube repair criteria. Suppose this inspection is performed for the first time during the third of four SG inspections scheduled for the subject 60 EFPM inspection period. Paragraph 5.5.9.d.2 currently does not specifically specify whether this location needs to be 100 percent inspected by the end of the 60-month inspection period, or whether a prorated approach may be taken. The NRC staff addressed this question in Issue 1 of NRC Regulatory Information Summary (RIS) 2009-04, "Steam Generator

Tube Inspection Requirements," dated April 3, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML083470557), as follows:

> **Issue 1**: *A licensee may identify a new potential degradation mechanism after the first inspection in a sequential period. If this occurs, what are the expectations concerning the scope of examinations for this new potential degradation mechanism for the remainder of the period (e.g., do 100 percent of the tubes have to be inspected by the end of the period or can the sample be prorated for the remaining part of the period)?*
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> [NRC Staff Position:] The TS contain requirements that are a mixture of prescriptive and performance-based elements. Paragraph "d" of these requirements indicates that the inspection scope, inspection methods, and inspection intervals shall be sufficient to ensure that SG tube integrity is maintained until the next SG inspection. Paragraph "d" is a performance-based element because it describes the goal of the inspections but does not specify how to achieve the goal. However, paragraph "d.2" is a prescriptive element because it specifies that the licensee must inspect 100 percent of the tubes at specified periods.
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> If an assessment of degradation performed after the first inspection in a sequential period results in a licensee concluding that a new degradation mechanism (not anticipated during the prior inspections in that period) may potentially occur, the scope of inspections in the remaining portion of the period should be sufficient to ensure SG tube integrity for the period between inspections.
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> In addition, to satisfy the prescriptive requirements of paragraph "d.2" that the licensee must inspect 100 percent of the tubes within a specified period, a prorated sample for the remaining portion of the period is appropriate for this potentially new degradation mechanism. This prorated sample should be such that if the licensee had implemented it at the beginning of the period, the TS requirement for the 100 percent inspection in the entire period (for this degradation mechanism) would have been met. A prorated sample is appropriate because (1) the licensee would have performed the prior inspections in this sequential period consistently with the requirements, and (2) the scope of inspections must be sufficient to ensure that the licensee maintains SG tube integrity for the period between inspections.

The NRC staff finds that proposed Sentences 4 and 5 clarify the existing requirement consistent with the NRC staff's position from RIS 2009-04 quoted above and are, therefore, acceptable.

3.8 Paragraph 5.5.9.d.2 for plants with SGs with alloy 600 thermally treated (TT) tubes

The paragraph currently states:

> Inspect 100% of the tubes at sequential periods of 120, 90, and, thereafter, 60 effective full power months. The first sequential period shall be considered to begin after the first inservice inspection of the SGs. In addition, inspect 50% of the tubes by the refueling outage nearest the midpoint of the period and the remaining 50% by the refueling outage nearest the end of the period. No SG shall operate for more than 48 effective full power months or two refueling outages (whichever is less) without being inspected.

Proposed Change: Revise paragraph 5.5.9.d.2 as follows:

> After the first refueling outage following SG installation, inspect each SG at least every 48 effective full power months or at least every other refueling outage (whichever results in more frequent inspections). In addition, the minimum number of tubes inspected at each scheduled inspection shall be the number of tubes in all SGs divided by the number of SG inspection outages scheduled in each inspection period as defined in a, b, and c below. If a degradation assessment indicates the potential for a type of degradation to occur at a location not previously inspected with a technique capable of detecting this type of degradation at this location and that may satisfy the applicable tube repair criteria, the minimum number of locations inspected with such a capable inspection technique during the remainder of the inspection period may be prorated. The fraction of locations to be inspected for this potential type of degradation at this location at the end of the inspection period shall be no less than the ratio of the number of times the SG is scheduled to be inspected in the inspection period after the determination that a new form of degradation could potentially be occurring at this location divided by the total number of times the SG is scheduled to be inspected in the inspection period. Each inspection period defined below may be extended up to 3 effective full power months to include a SG inspection outage in an inspection period and the subsequent inspection period begins at the conclusion of the included SG inspection outage.
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> a) After the first refueling outage following SG installation, inspect 100% of the tubes during the next 120 effective full power months. This constitutes the first inspection period;
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> b) During the next 96 effective full power months, inspect 100% of the tubes. This constitutes the second inspection period; and
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> c) During the remaining life of the SGs, inspect 100% of the tubes every 72 effective full power months. This constitutes the third and subsequent inspection periods.

Assessment: Paragraph 5.5.9.d.2 in its current form and with the proposed changes is similar for each of the tube alloy types, but with differences that reflect the improved resistance of alloy 600 TT to stress corrosion cracking relative to alloy 600 MA and the improved resistance of alloy 690 TT relative to both alloy 600 MA and alloy 600 TT. These differences include progressively larger maximum inspection interval requirements and sequential inspection periods (during which 100% of the tubes must be inspected) for alloy 600 MA, 600 TT, and alloy 690 TT tubes, respectively. In addition, because of the longer maximum inspection intervals allowed for alloy 600 TT and 690 TT tubes, paragraph 5.5.9.d.2 includes a restriction on the distribution of sampling over each sequential inspection period for alloy 600 TT and 690 TT tubes that is not included for alloy 600 MA tubes.

For SGs with alloy 600 TT tubing, the licensee proposes to move the first two sentences of paragraph 5.5.9.d.2 to the end of the paragraph and make editorial changes to improve clarity. The NRC staff finds these changes to be of a clarifying nature, not changing the current intent of these two sentences. However, the LAR also includes two changes to when inspections are performed as follows:

- The second inspection period would be revised from 90 to 96 EFPM.
- The third and subsequent inspection periods would be revised from 60 to 72 EFPM.

The licensee characterizes these changes as marginal increases for consistency with typical fuel cycle lengths that better accommodate the scheduling of inspections. The NRC staff notes that plants with alloy 600 TT SG tubes typically inspect at 18- or 36-month intervals (one or two fuel cycles, respectively) depending on whether stress corrosion crack activity was observed during the most recent inspection. With these intervals, the last scheduled inspection during the first inspection period would occur at 108 months after the first refueling outage following SG installation. This is 12 months before the end of the first 120 EFPM inspection period. However, with the proposed changes to the length of the second and subsequent inspection periods, the NRC staff finds that the last scheduled inspections in the second and subsequent inspection periods will coincide exactly with the end of these periods.

The proposed changes would generally increase the number of inspections in each of the second and subsequent inspection periods by up to one additional inspection. This could reduce the required average minimum sample size during these periods. However, inspection sample sizes will continue to be subject to paragraph 5.5.9.d which states that in addition to meeting the requirements of paragraphs 5.5.9.d.1, d.2, and d.3, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure SG tube integrity is maintained until the next scheduled inspection. Therefore, the NRC staff concludes that with the proposed changes to the length of the second and subsequent inspection periods, compliance with the SG program requirements in Specification 5.5.9 will continue to ensure both adequate inspection scopes and tube integrity.

{NOTE: The changes proposed in the TSTF-510 Traveler also included the addition of a Reviewer's Note to the STS that states," a licensee may elect to retain historical and existing inspection period lengths in order to not revise those inspection periods." For example, a 600 TT plant currently at the end of the second SG inspection period may elect to retain the 90 EFPM length of the second inspection period instead of the revised 96 EFPM length so that

the second period may be completed under the current inspection plan. The NRC staff finds this Reviewer's Note acceptable, since the currently specified inspection periods are acceptable.}

For each inspection period, paragraph 5.5.9.d.2 currently requires that at least 50 percent of the tubes be inspected by the refueling outage nearest to the mid-point of the inspection period and the remaining 50 percent by the refueling outage nearest the end of the inspection period. The NRC staff notes that if there are not an equal number of inspections in the first half and second half of the inspection period, the average minimum sampling requirement may be markedly different for inspections in the first half of the inspection period compared to those in the second half, even when there are uniform intervals between each inspection. For example, a plant in the first (120 EFPM) inspection period with a scheduled 36-month interval (two fuel cycles) between each inspection would currently be required to inspect 50 percent of the tubes by the refueling outage nearest the midpoint of the inspection which would be the third refueling outage in the period, six months before the mid-point. However, since no inspection is scheduled for that outage, then the full 50 percent sample must be performed during the inspection scheduled for the second refueling outage in the period. Two inspections would be scheduled to occur in the second half of the inspection period, at 72 and 108 months into the inspection period. Thus, the current sampling requirement could be satisfied by performing a 25 percent sample during each of these inspections or other combinations of sampling (e.g., 10 percent during one and 40 percent in the other) totaling 50 percent. The NRC staff finds there is no basis to require the minimum initial sample size to vary so much from inspection to inspection. The licensee proposes to revise this requirement such that the minimum sample size for a given inspection in a given inspection period is 100 percent divided by the number of scheduled inspections during that inspection period. For the above example, the proposed change would result in a uniform initial minimum sample size of 33.3 percent for each of the three scheduled inspections during the inspection period. The NRC staff concludes this proposed revision to be an improvement to the existing requirement since it provides a more consistent minimum initial sampling requirement.

The proposed changes to paragraph 5.5.9.d.2 include two new sentences addressing the prorating of required tube sample sizes if a degradation assessment indicates the potential for a type of degradation to occur at a location not previously inspected with a technique capable of detecting this type of degradation at this location and that may satisfy the applicable tube repair criteria. These new sentences are identical to those proposed for alloy 600 MA tubing (see Section 3.7 above). The NRC staff concludes these new sentences to be acceptable for the same reasons given in Section 3.7 for alloy 600 MA tubes.

Finally, the first sentence of the proposed revision to paragraph 5.5.9.d.2 replaces the last sentence of the current paragraph 5.5.9.d.2. This sentence establishes the minimum allowable SG inspection frequency as at least every 48 EFPM or at least every other refueling outage (whichever results in more frequent inspections). This minimum inspection frequency is unchanged from the current sentence. The NRC staff finds that the wording changes in the sentence are of a editorial and clarifying nature and are not material, such that the current intent of the requirement is unchanged. Thus, the NRC staff concludes the first sentence of proposed paragraph 5.5.9.d.2 is acceptable.

3.9 Paragraph 5.5.9.d.2 for plants with SGs with alloy 690 TT tubes

The paragraph currently states:

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

Proposed Change: Revise the paragraph as follows:

> After the first refueling outage following SG installation, inspect each SG at least every 72 effective full power months or at least every third refueling outage (whichever results in more frequent inspections). In addition, the minimum number of tubes inspected at each scheduled inspection shall be the number of tubes in all SGs divided by the number of SG inspection outages scheduled in each inspection period as defined in a, b, c, and d below. If a degradation assessment indicates the potential for a type of degradation to occur at a location not previously inspected with a technique capable of detecting this type of degradation at this location and that may satisfy the applicable tube repair criteria, the minimum number of locations inspected with such a capable inspection technique during the remainder of the inspection period may be prorated. The fraction of locations to be inspected for this potential type of degradation at this location at the end of the inspection period shall be no less than the ratio of the number of times the SG is scheduled to be inspected in the inspection period after the determination that a new form of degradation could potentially be occurring at this location divided by the total number of times the SG is scheduled to be inspected in the inspection period. Each inspection period defined below may be extended up to 3 effective full power months to include a SG inspection outage in an inspection period and the subsequent inspection period begins at the conclusion of the included SG inspection outage.
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> a) After the first refueling outage following SG installation, inspect 100% of the tubes during the next 144 effective full power months. This constitutes the first inspection period;
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> b) During the next 120 effective full power months, inspect 100% of the tubes. This constitutes the second inspection period;
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> c) During the next 96 effective full power months, inspect 100% of the tubes. This constitutes the third inspection period; and

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

Assessment: Paragraph 5.5.9.d.2 in its current form and with the proposed changes for alloy 690 TT is identical with alloy 600 TT except for (1) the specified minimum SG inspection frequency and (2) the length of the inspection periods over which 100 percent of the tubes must be inspected. Apart from these two parameters, all proposed changes to paragraph 5.5.9.d.2 for alloy 690 TT tubing are identical to the changes proposed for alloy 600 TT tubing which are evaluated in Section 3.8 of this safety evaluation. The NRC staff's evaluation of these identical changes in Section 3.8 applies equally to alloy 690 TT tubing. The following provides additional assessment on the proposed changes:

Under the proposed changes to paragraph 5.5.9.d.2, the required minimum inspection frequency for alloy 690 TT (every 72 EFPM or every third refueling outage (whichever is less)) would remain materially unchanged. Minor editorial changes and clarifications to the requirement are the same as those evaluated in Section 3.8 for alloy 600 TT tubing. The NRC staff finds these changes are acceptable for alloy 690 TT tubing for the same reasons discussed in Section 3.8 for alloy 600 TT tubing.

With respect to the proposed changes to the inspection periods in paragraph 5.5.9.d.2 for alloy 690 TT tubing, the first inspection period would remain unchanged at 144 EFPM. The second and third inspection periods would be revised from 108 and 72 EFPM, respectively, to 120 and 96 EFPM, respectively. The fourth and subsequent inspection periods would be revised from 60 EFPM to 72 EFPM. The licensee characterizes these changes as marginal increases for consistency with typical fuel cycle lengths that better accommodate the scheduling of inspections. {NOTE: Choose appropriate statement depending on plant-specific inspection intervals.} [The NRC staff observes that this is clearly the case for plants operating with [18][36]-month inspection interval ([one][two] fuel cycle[s]). With these intervals, the last scheduled inspection during the first inspection period would coincide with the end of the first, third, and subsequent inspection periods.] [The NRC staff finds that for plants operating with 54-month inspection intervals (three fuel cycles); the end of each inspection period will not generally coincide with a scheduled inspection outage.]

{NOTE: Choose appropriate statement depending on plant-specific inspection intervals.} [For plants operating with [18][36]-month inspection intervals, the proposed changes would generally increase the number of inspections in each of the third and subsequent inspection periods by up to one additional inspection. This could reduce the required average minimum sample size during these periods.] [For plants operating with 54-month inspection intervals, the proposed changes will usually have no effect on the required average minimum sample size during these periods. However, inspection sample sizes will continue to be subject to paragraph 5.5.9.d which states that in addition to meeting the requirements of paragraph 5.5.9.d.1, d.2, and d.3, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure SG tube integrity is maintained until the next scheduled inspection.] Therefore, the NRC staff concludes that with the proposed changes to the length of the second and subsequent inspection periods, compliance with the SG program requirements in Specification 5.5.9 will continue to ensure both adequate inspection scopes and tube integrity.

3.10 Paragraph 5.5.9.d.3 (for plants with SG tubing fabricated from alloy 600 TT or alloy 690 TT)

The first sentence of paragraph 5.5.9.d.3 currently states:

> If crack indications are found in any SG tube, then the next inspection for each SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full power months or one refueling outage (whichever is less).

Proposed Change: Revise this sentence as follows:

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

The proposed change is replacing the words “for each SG” with the words “for each affected and potentially affected SG.” The licensee states that the existing wording can be misinterpreted. The licensee further states that the intention is that those SGs that are affected and those SGs that are potentially affected must be inspected for the degradation mechanism that caused the crack indication. However, some licensees have questioned whether the current reference to "each SG" requires only the SGs that are affected to be inspected for the degradation mechanism. The proposed revision is intended to clarify the intent of the requirement.

{NOTE: Paragraph 5.5.9.d.3 is not used in TS for plants with SG tubes fabricated from alloy 600 MA, since paragraph 5.5.9.d.2 already requires that SGs with alloy 600 MA tubes be inspected at least every 24 EFPM or one refueling outage (whichever is less).}

Assessment: Paragraph 5.5.9.d.2 permits SG inspection intervals to extend over multiple fuel cycles for SGs with alloy 600 TT and 690 TT tubing, assuming that such intervals can be implemented while ensuring tube integrity is maintained in accordance with paragraph 5.5.9.d. However, stress corrosion cracks may not become detectable by inspection until the crack depth approaches the tube repair limit. In addition, stress corrosion cracks may exhibit high growth rates. For these reasons, once cracks have been found in any SG tube, paragraph 5.5.9.d.3 restricts the allowable interval to the next scheduled inspection to 24 EFPM or one refueling outage (whichever is less). The intent of this requirement is that it applies to the affected SG and to any other SG which may be potentially affected by the degradation mechanism that caused the known crack(s). For example, a root cause analysis in response to the initial finding of one or more cracks might reveal that the crack(s) are associated with a manufacturing anomaly which causes locally high residual stress which in turn caused the early initiation of cracks at the affected locations. If it can be established that the extent of condition of the manufacturing anomaly applies only to one SG and not the others, then the NRC staff agrees that only the affected SG needs to be inspected within 24 EFPM or one refueling cycle in accordance with paragraph 5.5.9.d.2. The next scheduled inspections of the other SGs will continue to be subject to all other provisions of paragraph 5.5.9.d. The NRC staff finds the

proposed change to paragraph 5.5.9.d.3 acceptable, because it clarifies the intent the paragraph.

3.11 Specification 5.6.7, “Steam Generator Inspection Report”

This specification lists items a. through h. to be included in a report which shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.5.9, "Steam Generator (SG) Program."

Proposed Change: Item b. currently reads: “Active degradation mechanisms found…” to be revised to read: “Degradation mechanisms found...”

Item e. currently reads: “Number of tubes plugged [or repaired] during the inspection outage for each active degradation mechanism…” to be revised to read: “Number of tubes plugged [or repaired] during the inspection outage for each degradation mechanism...”

Item f. currently reads, “Total number and percentage of tubes plugged [or repaired] to date…” to be revised to read: “The number and percentage of tubes plugged [or repaired] to date, and the effective plugging percentage in each steam generator...”

Item h. currently reads: “The effective plugging percentage for all plugging [and tube repairs] in each SG, and,” which will be deleted.

Assessment: This proposal would delete the word “Active” in items b. and e above. Thus, all degradation mechanisms found, whether deemed to be active or not, would now be reportable. The NRC staff finds the proposed change acceptable. The proposal to combine items f. and h. is an editorial change that does not materially change the reporting requirements. The NRC staff finds this change acceptable.

4.0 STATE CONSULTATION

{NOTE: Per LIC-101, the PM is responsible for contacting the state official and verifying that this statement is correct.}

In accordance with the Commission's regulations, the [Name of State] State official was notified of the proposed issuance of the amendment. The State official had [no] comments. [If comments were provided, they should be addressed here].

5.0 ENVIRONMENTAL CONSIDERATION

{NOTE: Caution per LIC-101: The environmental consideration discussed below is written for a categorical exclusion based on 10 CFR 51.22(c)(9). The PM is responsible to ensure that this is accurate for the specific amendment being issued.}

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no

significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding ([ ] FR [ ]). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: E. Murphy

Date: