New TS Bases B 3.4.18

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.18 Steam Generator (SG) Tube Integrity

BASES

BACKGROUND

SG tubes are small diameter, thin walled tubes that carry primary coolant through the primary to secondary heat exchangers in pressurized water reactors (PWRs). In the context of this Specification, tubing is defined as:

"Steam generator tubing refers to 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."

Insert: B thru H are located at end of this markup

The SG tubes have a number of important safety functions. SG tubes are an integral part of the reactor coolant pressure boundary (RCPB) and, as such, are relied upon to maintain the primary system's pressure and inventory. The SG tubes isolate the radioactive fission products in the primary coolant from the secondary system. In addition, 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. This Specification addresses only the RCPB integrity function of the SG. The SG heat removal function is addressed by LCO 3.4.4, "RCS Loops – MODES 1 and 2," LCO 3.4.5, "RCS Loops – MODE 3," LCO 3.4.6, "RCS Loops – MODE 4," and LCO 3.4.7, "RCS Loops – MODE 5, Loops Filled."

Insert A → (from next page)

Concerns relating to the integrity of SG tubing stem from the fact that the tubing is subject to a variety of degradation mechanisms. Throughout the industry, SG tubes have experienced 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. ~~A means of determining and managing degradation is needed. SG performance criteria were developed for this purpose.~~

Insert B →

The SG performance criteria identify the standards against which performance is to be measured. Meeting the performance criteria

BASES

BACKGROUND (continued)

provides reasonable assurance that the SG tubing remains capable of fulfilling its specific safety function of maintaining RCPB integrity. The SG performance criteria and the processes required to meet them are defined by the NEI Steam Generator Program Guidelines (Ref. 1).

There are three SG performance criteria: accident induced leakage, structural integrity, and operational LEAKAGE. They act together to provide reasonable assurance of tube integrity at normal and accident conditions. SG tube integrity means that the tubes are capable of performing their intended safety functions consistent with their licensing basis, including applicable regulatory requirements.

combine paragraphs

→ A

The purpose of this LCO is to require compliance with the SG performance criteria. The accident induced leakage and structural integrity performance criteria apply to SG tubes and associated appurtenances considered part of the SG primary to secondary pressure boundary (e.g., plugs, sleeves, and other repairs). The accident induced leakage and structural integrity performance criteria are documented in Specification 5.5.9.

The third performance criterion, operational LEAKAGE, is addressed by LCO 3.4.13, "RCS Operational LEAKAGE."

APPLICABLE SAFETY ANALYSES

Satisfying the SG structural integrity performance criterion provides reasonable assurance against tube burst and the resulting primary to secondary LEAKAGE that might occur at normal and accident conditions.

Satisfying the accident induced leakage performance criterion provides reasonable assurance of acceptable primary to secondary LEAKAGE that might occur as a result of design basis accident conditions other than a SG tube rupture. The consequences of design basis accidents that include primary to secondary LEAKAGE depend, in part, on the accident induced leakage and the radioactive source term in the primary coolant.

The design basis accidents for which the primary to secondary LEAKAGE is a pathway for release of activity to the environment include the main steam line break, SG tube rupture, reactor coolant pump locked rotor accident, single rod withdrawal accident, and rod ejection accident. The analysis of radiological consequences of these design basis accidents, except for a SG tube rupture, assumes that the total primary to secondary

feedline break ?

BASES

APPLICABLE SAFETY ANALYSES (continued)

LEAKAGE from each SG initially is 150 gallons per day. Transient thermal hydraulic analyses of these design basis accidents determine the primary to secondary LEAKAGE changes (decreases or increases) that result from changing pressures and temperatures. These calculated values are used in the analyses of radiological consequences of these design basis accidents.

The source term in the primary coolant for some design basis accidents (e.g., reactor coolant pump locked rotor accident and rod ejection accident) is associated primarily with fuel rods calculated to be breached. For other design basis accidents (e.g., main steam line break and SG tube rupture), the source term in the primary coolant consists primarily of the levels of Dose Equivalent I^{131} radioactivity levels calculated for the design basis accident. This, in turn, is based on the limiting values in the Technical Specifications and postulated iodine spikes.

For accidents in which the source term in the primary coolant consists of the Dose Equivalent I^{131} activity levels, the SG tube rupture yields the limiting values for radiation doses at offsite locations. In the calculation of radiation doses following this event, the rate of primary to secondary LEAKAGE in the intact SGs is set equal to the operational LEAKAGE rate limits in LCO 3.4.13. For the ruptured SG, a double ended rupture of a single tube is assumed. Following the initiating event, contaminants in flashed and atomized break flow (the latter computed for time spans during which the tubes are calculated to be uncovered), as well as secondary coolant, may be released to the atmosphere. Before reactor trip, the accident analysis for the SG tube rupture assumes that these contaminants are released to the condenser and from there to the environment with credit taken for scrubbing of iodine contaminants in the condenser. Following reactor trip (and loss of offsite power), the accident analysis assumes that these contaminants are released to the environment through the SG power operated relief valves and the main steam code safety valves until such time as the closure of these valves can be credited.

For other design basis accidents such as main steam line break, rod ejection accident, reactor coolant pump locked rotor accident, and uncontrolled rod withdrawal accident, the tubes are assumed to retain their structural integrity (i.e., they are assumed not to rupture). The LEAKAGE is assumed to be initially at the limit given in LCO 3.4.13. This is consistent with the accident induced leakage performance criterion.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The three SG performance criteria and the limits included in the plant Technical Specifications for Dose Equivalent I^{131} in primary coolant and secondary coolant ensure the plant is operated within its analyzed condition. The dose consequences resulting from the most limiting design basis accident are within the limits defined in GDC 19 (Ref. 2), 10 CFR 100 (Ref. 3), or the NRC approved licensing basis (e.g., a small fraction of these limits or 10 CFR 50.67 (Ref. 4)).

SG Tube Integrity satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

Insert C

LCO

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

During a SG 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 threshold but was not plugged or repaired, the tube may still have tube integrity.

~~SG tube integrity is defined by the performance criteria. The performance criteria include design basis parameters that define acceptable SG performance. The Steam Generator Program provides the evaluation process for determining conformance with the performance criteria.~~

~~Compliance with the LCO during MODES 1 through 4 is determined by verifying:~~

- ~~satisfactory completion of an integrity assessment in accordance with Steam Generator Program requirements as part of each SG inspection, and~~
- ~~plant operation within the operating cycle defined by the operational assessment.~~

~~Performance Criteria~~ No Yield Criterion

Accident induced leakage and structural integrity are two of the three performance criteria defined by the Steam Generator Program. These two, along with the third performance criterion, operational LEAKAGE, act together to provide reasonable assurance of tube integrity at normal and accident conditions.

BASES

LCO (continued)

The structural integrity and accident induced leakage performance criteria are documented in Specification 5.5.9. The operational LEAKAGE performance criterion is included in LCO 3.4.13, "RCS Operational LEAKAGE." All three performance criteria are described below:

(i) Structural Integrity Criterion

The structural integrity criterion is:

"SG tubing shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cooldown, and all anticipated transients included in the accident analysis 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 largest primary to secondary pressure differential associated with ASME Section III, Level D service. Additional conditions identified in the design and licensing basis shall be evaluated to determine if the associated loads do not contribute to burst.

Contributing loads that do affect burst shall be assessed with a safety factor of 1.0 and combined with the appropriate load due to the defined pressure differential."

The structural integrity criterion can be broken into two separate considerations:

- Providing a margin of safety against tube burst under normal and accident conditions, and

- Ensuring structural integrity of the SG tubes under all anticipated transients included in the design specification.

Tube Burst

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."

BASES

LCO (continued)

The structural integrity criterion provides reasonable assurance that a SG tube will not burst during normal or accident conditions. The structural integrity criterion requires that the tubes not burst when subjected to differential pressures equal to 3.0 times those experienced during normal steady state full power operation and 1.4 times ASME Section III, Level D accident pressure differentials. Other loadings required by the design and licensing basis shall be combined with the design basis accident loads without application of the 1.4 safety factor. The safety factors of 3.0 and 1.4 and the requirement to include applicable design basis loads are based on ASME Code Section III Subsection NB (Ref. 5) requirements and Draft Regulatory Guide 1.121 (Ref. 6) guidance.

In the context of the structural integrity criterion, normal steady state full power operation is defined as:

"The conditions existing during MODE 1 operation at the maximum steady state reactor power as defined in the design or equipment specification. Changes in design parameters such as plugging or sleeving levels, primary or secondary modifications, or T_{hot} should be assessed and their effects on differential pressure should be included if significant."

Guidance on accounting for changes in these parameters is provided in the EPRI Steam Generator Integrity Assessment Guidelines (Ref. 7).

In addition to the safety factors of 3.0 and 1.4, further adjustments may be required to ensure representative verification of tube burst integrity for various damage forms. For example, adjustments to include axial loading associated with locked tube supports in recirculating SG designs is addressed in Ref. 8 to ensure that the evaluated or tested conditions are at least as severe as those expected during operating and accident events. However, these loads are not subject to the safety factor applied to normal full power operation and accident pressure differentials.

Tube Structural Integrity

Pursuant to the structural integrity criterion, Ref. 1 requires that the primary membrane stress intensity in a tube not exceed the yield strength for all ASME Secton III, Level A (normal operating conditions) and Level B (upset or abnormal conditions) transients included in the design specification.

BASES

LCO (continued)

(ii) Accident Induced Leakage Criterion

The accident induced leakage criterion is:

"The primary to secondary accident induced leakage rate for any design basis accident, other than a SG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all SGs and leakage rate for an individual SG. Leakage is not to exceed 150 gallons per day through each SG for a total of 600 gallons per day through all SGs."

In the context of the accident induced leakage criterion, accident induced leakage rate is defined as:

"Accident induced leakage rate means the primary to secondary LEAKAGE occurring during accidents other than a SG tube rupture when tube structural integrity is assumed. This includes the primary to secondary LEAKAGE rate existing immediately prior to the accident plus additional primary to secondary LEAKAGE induced during the accident."

The accident induced leakage criterion can be broken into two separate considerations:

- Meeting design basis conditions, and
- Limiting accident induced leakage to 150 gallons per day through each SG under all circumstances.

Design Basis

Primary to secondary LEAKAGE is a factor in the activity releases outside containment resulting from a limiting design basis accident. The radiological dose consequences resulting from a potential primary to secondary leak during design basis accidents must not exceed the offsite dose limits required by Ref. 3, or the control room personnel dose limits required by Ref. 2, or the NRC approved licensing basis.

When calculating offsite doses, the safety analysis for the limiting design basis accident, other than a SG tube rupture, sets the initial primary to secondary LEAKAGE in each SG to 150 gallons per day.

BASES

LCO (continued)

Limiting Accident Induced Leakage to 150 Gallons per Day through Each SG

Recent experience with degradation mechanisms involving tube cracking has revealed that leakage under accident conditions can exceed the level of operating LEAKAGE by orders of magnitude. Therefore, a separate performance criterion for accident induced leakage was established. The numerical limit for the accident induced leakage criterion is established at the value for operational LEAKAGE (i.e., 150 gallons per day through each SG).

The NRC has concluded (Item Number 3.4 in Attachment 1 to Ref. 8) that additional research is needed to develop an adequate methodology for fully predicting the effects of LEAKAGE on the outcome of some accident sequences. As a result, LEAKAGE greater than the accident induced leakage criterion is not allowed.

(iii) Operational LEAKAGE Criterion

The operational LEAKAGE criterion and its associated Required Action and Surveillance Requirements are contained in LCO 3.4.13, "RCS Operational LEAKAGE." The operational LEAKAGE criterion is not included in the SG Tube Integrity Specification because it is one of the forms of RCS LEAKAGE that are addressed by the RCS Operational LEAKAGE Specification and because, unlike structural integrity and accident induced leakage, it is observable by the operator during MODES 1 through 4. The operational LEAKAGE criterion is presented below for completeness since all of the performance criteria act together to ensure tube integrity.

The operational LEAKAGE criterion is:

"The RCS operational primary to secondary LEAKAGE through any one SG shall be limited to 150 gallons per day."

An explanation of the operational LEAKAGE criterion is provided in the Bases for LCO 3.4.13, "RCS Operational LEAKAGE."

The Bases for SR 3.4.13.2 indicates that if this SR is not met, compliance with LCO 3.4.18 should be evaluated. If SR 3.4.13.2 is met, then compliance with LCO 3.4.18 need not be evaluated insofar as primary to secondary LEAKAGE is concerned. ← Insert D

operational

BASES

APPLICABILITY

SG tubes are designed to withstand the stresses due to differential pressures as large as 3.0 times those experienced under normal full power operations or 1.4 times the largest primary to secondary pressure differential for ASME Section III, Level D (faulted) accidents. This requirement is delineated in the structural integrity criterion. This magnitude of differential pressure or the possibility of an accident impacting tube integrity is only possible during MODES 1, 2, 3, and 4.

RCS conditions are far less challenging in MODES 5 and 6 than during MODES 1 through 4. When the plant is shut down, primary to secondary differential pressure is low, resulting in lower stresses and reduced potential for LEAKAGE. In addition, primary coolant activity is also low. Therefore, this LCO is applicable in MODES 1 through 4 only.

ACTIONS

The Actions Table is modified by a Note to clarify the application of the Completion Time rules. The Conditions of this Specification may be entered independently for each affected tube. This is acceptable because the Required Actions for each Condition provide appropriate compensatory actions for each affected SG tube. The Completion Times of each affected tube evaluation will be tracked separately, starting from the time the Condition was entered.

A.1 and A.2

contained flaws which exceeded

Condition A applies if it is discovered that one or more inspected SG tubes ~~satisfy~~ the tube repair criteria but were not plugged ~~or repaired~~ in accordance with the Steam Generator Program as required by SR 3.4.18.2. An evaluation of SG tube integrity must be made. SG tube integrity is based on meeting the structural integrity and accident induced leakage performance criteria. In general, an affected tube is one with an indication that ~~satisfies~~ the repair criteria. More information on repair limits is provided in Ref. 8.

contains flaws exceeding

If it is discovered that a required plugging or repair was not implemented during a previous inspection, the affected SG tube(s) may have SG tube integrity. In this situation, the SGs were returned to service after the last inspection with a tube ~~already~~ ~~satisfying~~ the repair criteria. The SG repair criteria define limits on SG tube degradation that allow for flaw growth between inspections and still provide assurance that the performance criteria will continue to be met. In order to determine SG tube integrity, an evaluation must be completed that demonstrates that

containing a flaw exceeding →

BASES

ACTIONS (continued)

the performance criteria will continue to be met at the time of the next SG inspection. The tube integrity determination is based on the estimated condition of the tube at the time the situation is discovered and estimated growth of the degradation prior to the next SG inspection. A Completion Time of 7 days allows sufficient time to complete the evaluation. If it is determined that tube integrity is not being maintained, Condition B must be entered.

If the evaluation determines that tube integrity is maintained for the affected tube(s), Required Action A.2 allows plant operation to continue until the next outage as long as 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 after the outage. This Completion Time is acceptable since the condition will be corrected no later than at the next inspection of the affected SG and the time to the next inspection is supported by the Steam Generator Program as part of the evaluation completed upon entering Condition A. The timing of the next inspection is based on continuing to meet the structural integrity and accident induced leakage performance criteria.

B.1 and B.2

If the Required Actions and associated Completion Times of Condition A are not met or if SG tube integrity is not being maintained, the reactor must be brought to MODE 3 within 6 hours and MODE 5 within 36 hours. This action reduces the factors that tend to challenge tube integrity.

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. In MODE 5, the pressure stresses acting on the RCPB are much lower and further deterioration is much less likely.

SURVEILLANCE REQUIREMENTS

SR 3.4.18.1

Insert E

During shutdown periods the SGs will be inspected as required by the Steam Generator Program. The Steam Generator Program is required by Specification 5.5.9. Ref. 1 and its referenced EPRI Guidelines establish the detailed content of the Steam Generator Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

Use of the Steam Generator Program ensures that the inspection is appropriate and consistent with accepted industry practices.

During SG inspections the licensee will perform a condition monitoring assessment of the SG tubes. The condition monitoring assessment determines the "as found" condition of the SG tubes following inspection with respect to the structural integrity and accident induced leakage performance criteria. The purpose of the condition monitoring assessment is to ensure that the performance criteria have been met for the previous operating period.

~~The Steam Generator Program determines the scope of the inspection and the methods used to determine compliance with the performance criteria.~~ ← Insert F

- The inspection scope defines which tubes or areas of tubing within the SG are to be inspected. Inspection scope is a function of existing and potential degradation locations ~~and safety/pressure boundary considerations.~~

- Inspection methods are those Non-Destructive Examination (NDE) techniques used to find potential degradation. Inspection methods are a function of degradation morphology, NDE technique capabilities, and inspection locations.

~~The Steam Generator Program defines the Frequency of SR 3.4.18.1. The Frequency is determined by the operational assessment and other limitations in the PWR Steam Generator Examination Guidelines (Ref. 9). The limitations in Ref. 9 and the operational assessment determine the length of the surveillance period by using information on existing degradations and growth rates to define a cycle length that provides reasonable assurance that the tubing will meet the performance criteria at the next scheduled inspection.~~

Insert G ←

~~The maximum interval between SG inspections is limited. Catawba will perform required SG inspections of tubing and/or sleeves at intervals no greater than those documented in Specification 5.5.9.~~

SR 3.4.18.2

contains flaws exceeding the

During a SG inspection, any inspected tube that ~~satisfies~~ Steam Generator Program repair criteria is ~~repaired or~~ removed from

BASES

SURVEILLANCE REQUIREMENTS (continued)

service by plugging. Repair criteria are defined as:

"Repair criteria are those NDE measured parameters at or beyond which a tube must be repaired using an approved repair method or removed from service by plugging."

The tube repair criteria establish limits for tube degradation that provide reasonable assurance that all tubes left in service (e.g., with degradation not satisfying the repair criteria) will meet the performance criteria at the next scheduled inspection by allowing for anticipated growth during the intervening time interval.

Insert H

Tube repair criteria are either the standard through wall (TW) depth based criterion (e.g., 40% TW for Catawba), or TW depth based criteria for repair techniques approved by the NRC, or other Alternate Repair Criteria (ARC) approved by the NRC such as a voltage based repair limit per Generic Letter 95-05 (Ref. 10).

The depth based criterion, approved for use at all plants by the NRC, was established when the most frequent form of degradation was general wastage corrosion. This type of degradation structurally bounds other forms of degradation and is characterized by a volumetric loss of the tube wall. This criterion was established to allow for NDE uncertainties and growth and still provide a reasonable assurance that all tubes with degradation not exceeding the criterion will exhibit acceptable structural integrity and accident induced leakage. Additional basis information is provided in Ref. 8.

Since not all forms of tube degradation can be accurately measured for flaw depth in terms of percentage of tube wall thickness, some tubes are "plugged or repaired on detection" to ensure that detected flaws that exceed the depth based criterion are not left in service.

Unnecessary

In addition, since the probability of detecting a flaw is not a certainty for a given eddy current technique, it is probable that some flaws will not be detected during an inspection. This condition does not mean that "plug on detection" has not been followed or that the depth based criterion has been violated.

In recent years, improved inspection techniques, knowledge of corrosion mechanisms, and experience have revealed additional types of tube degradation in the form of cracks in the tube wall. In some instances, a reliable method of characterizing specific types of cracks at defined locations within certain SG designs has been

Unnecessary

BASES

SURVEILLANCE REQUIREMENTS (continued)

developed. In these cases, the industry has developed, and the NRC has approved ARC to permit leaving a tube in service (as opposed to plugging) when the tube has indications that fall within the limits established by the ARC. "Plug or repair on detection" is not an ARC.

Unnecessary

The NRC must approve all repair criteria prior to use. The repair criteria approved for use at Catawba are listed in Specification 5.5.9.

Due to technique and analyst uncertainties, sampling plans, and probability of detection, there is a possibility that tube(s) satisfying the repair criteria will not be detected during a particular SG inspection. If the flaw(s) is detected during a subsequent inspection, the condition is not considered a reportable event unless it is determined that the performance criteria are not met.

SG tube repairs are only performed using approved repair methods. Repair methods are defined as:

"Repair methods are those means used to reestablish the RCS pressure boundary integrity of SG tubes without removing the tube from service. Plugging a SG tube is not a repair."

Repair methods are approved by the NRC either by license amendment or as part of the NRC's approval of applicable ASME Code requirements. The repair methods approved by license amendment (if any) are listed in Specification 5.5.9. The repair methods approved by the NRC through the ASME Code are those specifically listed in ASME Section XI, IWA-4720 (Ref. 11) of Code editions and addenda listed in 10 CFR 50.55a (Ref. 12). New repair methods designed in accordance with general Code requirements (as opposed to being specifically listed in the Code article cited above) may not be implemented without prior NRC approval.

There are no repair methods presently approved by license amendment for use at Catawba.

Inspected SG tubes that ~~satisfy~~ the repair criteria are ~~repaired or~~ removed from service by plugging prior to entry into MODE 4. This is necessary in order to provide reasonable assurance that tube integrity will be maintained until the next scheduled inspection.

contain flaws that exceed

BASES

REFERENCES

1. NEI 97-06, "Steam Generator Program Guidelines."
2. 10 CFR 50 Appendix A, GDC 19, "Control Room."
3. 10 CFR 100, "Reactor Site Criteria."
4. 10 CFR 50.67, "Accident Source Term."
5. ASME Boiler and Pressure Vessel Code, Section III, Subsection NB, "Rules for Construction of Nuclear Facility Components, Class 1 Components."
6. Draft Regulatory Guide 1.121, "Basis for Plugging Degraded Steam Generator Tubes," August 1976.
7. EPRI Steam Generator Integrity Assessment Guidelines.
8. S.C. Collins memo to W.D. Travers, "Steam Generator Action Plan Revision to Address Differing Professional Opinion on Steam Generator Tube Integrity," dated May 11, 2001.
9. EPRI PWR Steam Generator Examination Guidelines.
10. Generic Letter 95-05, "Voltage Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," August 3, 1995.
11. ASME Section XI, IWA-4720, "Sleeving."
12. 10 CFR 50.55a, "Codes and Standards."

Insert B

Specification 5.5.9 requires that a steam generator program be established and implemented to ensure that steam generator tube integrity is maintained. Pursuant to specification 5.5.9, tube integrity is maintained when the tube integrity performance criteria are met.

Insert C

Specification 5.5.9 requires that a steam generator program be established and implemented to ensure that steam generator tube integrity is maintained. Pursuant to specification 5.5.9, tube integrity is maintained when the tube integrity performance criteria are met.

Specification 5.5.9 defines the minimum regulatory requirements for establishing an implementing the SG Program. These minimum requirements are generally performance based, with some prescriptive requirements to ensure that the performance criteria are met. NEI 97-06, "Steam Generator Program Guidelines," provides guidelines for programmatic elements of the SG Program for ensuring the tube integrity performance criteria are met and references additional industry guidelines concerning details of these programmatic elements.

Compliance with the LCO during MODES 1 through 4 is determined by verifying that SG tube integrity is maintained in accordance with the SG Program. As part of the SG Program, specification 5.5.9 requires that the condition of the tubes be assessed during each outage during which the steam generators tubes are inspected or plugged to confirm that the performance criteria were met during the previous period of operation. In addition, an operational assessment is performed consistent with guidance in NEI 97-06 to ensure that the performance criteria will continue to be met until the next scheduled inspection.

Insert D

The integrity of tubes found to be leaking during SG tube inspections need to be evaluated as part of condition monitoring against the tube structural integrity and accident leakage performance criteria in accordance with the SG program, even if the operational leakage criterion was satisfied immediately prior to plant shutdown.

Insert E

Specification 5.5.9 defines the minimum regulatory requirements for establishing and implementing the SG Program. These minimum requirements are generally performance based with the objective of ensuring that SG tube integrity is maintained. This specification does contain some prescriptive requirements, including specified maximum tube inspection intervals and specified tube repair criteria, to ensure prompt detection of conditions not satisfying tube integrity performance criteria with no significant increase in risk.

Insert F

In accordance with specification 5.5.9, the inspection scope (i.e., number and portions of the tubes inspected) and method 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 and the tube-to-

tubesheet weld at the tube outlet, and that may exceed the applicable tube repair criteria. In addition, the scope, method, and frequency of inspection are such as to ensure that steam generator tube integrity is maintained.

Insert G

Reference 1and its referenced EPRI guidelines provide detailed guidelines for defining inspection scope, methods, and frequency consistent with the objectives in specification 5.5.9. Consistent with these guidelines, the licensee will perform operational assessments to establish that the program it has implemented reliably ensures that the performance criteria will continue to be met prior to the next scheduled inspection. In addition specification 5.5.9 contains a number of prescriptive restrictions on inspection frequency to provide added assurance that the tube integrity performance criteria will be met between scheduled inspections.

Insert H

The tube repair criteria specified in specification 5.5.9 are intended to ensure that tubes accepted for continued service satisfy the tube integrity 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 SG Program must ensure that the tube integrity performance criteria will continue to be met until the next inspection of the subject tube(s). Reference 1 and the referenced EPRI guidelines provide guidelines for performing operational assessments to verify that the tubes remaining in service will continue to meet the performance criteria.