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Fred Dacimo
Site Vice President
Administration

August 30, 2006

Re: Indian Point Units 2 and 3
Dockets 50-247 and 50-286
NL-06-089

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

SUBJECT: **Reply to Request for Additional Information Regarding Proposed License Amendment for Adoption of TSTF 449 (TAC MD2178 / 2179)**

REFERENCES:

1. NRC letter to Entergy dated July 12, 2006; "Request for Additional Information Regarding Amendment Application to Revise Technical Specifications".
2. Entergy letter NL-06-063 to NRC dated May 31, 2006; "License Amendment Request for Adoption of TSTF 449 Regarding Steam Generator Tube Integrity".

Dear Sir or Madam:

Entergy Nuclear Operations, Inc (Entergy) is providing, in Attachment One, a response to the request for additional information (Reference 1) regarding a proposed license amendment (Reference 2) for the adoption of TSTF 449, "Steam Generator Tube Integrity".

Responses to the request for additional information are provided in Attachment One and revised markups for the affected Technical Specification and Bases pages are provided in Attachment Two. The information provided in this response does not change the conclusions of the No Significant Hazards Evaluation previously provided by Entergy in Reference 2.

There are no new commitments identified in this submittal. If you have any questions or

A001

require additional information, please contact Mr. Patric W. Conroy, IPEC Licensing Manager at (914) 734-6668.

Sincerely,

Fred R. Dacimo
Site Vice President
Indian Point Energy Center

cc:

Mr. John P. Boska, Senior Project Manager, NRC NRR DORL
Mr. Samuel J. Collins, Regional Administrator, NRC Region I
NRC Resident Inspector's Office, Indian Point 2
NRC Resident Inspector's Office, Indian Point 3
Mr. Peter R. Smith, NYSERDA
Mr. Paul Eddy, NYS Department of Public Service

ATTACHMENT ONE TO NL-06-089

REPLY TO REQUEST FOR ADDITIONAL INFORMATION

REGARDING PROPOSED LICENSE AMENDMENT

FOR ADOPTION OF TSTF 449

(STEAM GENERATOR TUBE INTEGRITY)

ENTERGY NUCLEAR OPERATIONS, INC
INDIAN POINT NUCLEAR GENERATING UNITS NO. 2 and 3
DOCKETS 50-247 and 50-286

Question 1:

In proposed TS 5.5.7.a for Unit 2 and TS 5.5.8.a for Unit 3, you indicated that condition monitoring will be performed when steam generator tubes "are inspected, plugged, to confirm" that the performance criteria are being met. Please discuss your plans to correct this apparent typographical error. The phrase should read: "are inspected or plugged."

Entergy Reply:

Entergy has corrected the affected pages (IP2 Insert 5.5.7 and IP3 Insert 5.5.8) to read "are inspected **or** plugged" (IP2 Insert 5.5.7 and IP3 Insert 5.5.8) and replacement markups are provided in Attachment Two.

Question 2:

In proposed TS 3.4.17 for Unit 2 and 3, the second limiting condition for operation contains the phrase "[or repaired]" whereas all other references to tube repair have been crossed out. Since repair is not authorized for Unit 2 or 3, please discuss your plans for removing this phrase.

Entergy Reply:

Entergy has corrected the affected pages (IP2 3.4.17-1 and IP3 3.4.17-1) by removing the phrase "[or repaired]" and replacement markups are provided in Attachment Two.

Question 3:

In proposed TS 3.4.13, the added text for Action B is not clear. Please confirm that the proposed addition is "OR Primary to secondary leakage not within limit."

Entergy Reply:

This is to confirm that the proposed addition is as stated in the Question. A clearer markup page (IP3 3.4.13-1) is provided in Attachment Two.

Question 4:

The proposed wording for the last sentence in TS 5.5.8.b.2 for Unit 3 is not clear. It currently reads: "Leakage is not to exceed 0.3 gpm [gallons per minute] per SG not to exceed 1 gpm total leakage." Please discuss your plans to clarify this sentence in both your proposed TS and in your Bases (page B 3.4.17-3). For example, "Leakage is not to exceed 0.3 gpm per SG and 1 gpm through all SGs."

Entergy Reply:

Entergy has revised the affected pages (IP3 Insert 5.5.8 and B 3.4.17-3) to read "Leakage is not to exceed 0.3 gpm per SG and 1 gpm through all SGs." and replacement markups are provided in Attachment Two.

Question 5:

In your proposed Bases, the reference numbers do not appear correct. Please discuss your plans to correct the reference numbers in the Bases. For example:

Insert B 3.4.13 B for Unit 2: Reference 4 in the first paragraph should be Reference 5.

Insert B 3.4.13 D (WOG) for Unit 2: Reference 5 in the first and third paragraph should be Reference 6.

Insert B 3.4.13 B for Unit 3: Reference 4 in the first paragraph should be Reference 3.

Insert B 3.4.13 D (WOG) for Unit 3: Reference 5 in the first and third paragraph should be Reference 4.

Entergy Reply:

Entergy has reviewed the reference numbering used in the original markup package and corrected pages are provided in Attachment Two (IP2 Bases 3.4.13 Insert Pages 1 and 2; IP3 Bases 3.4.13 Insert Pages 1 and 2).

Question 6:

In the second paragraph on proposed TS Bases page B 3.4.17-2 for Unit 2, there is reference to General Design Criterion (GDC) 19 and Title 10 of the *Code of Federal Regulations* (10 CFR) Part 100. However, on page B 3.4.13-2, there is reference to a Westinghouse report and NRC Regulatory Guide 1.183. Please confirm that 10 CFR 50.67 is not applicable to your current Unit 2 licensing basis dose assessments.

Similarly, on proposed TS Bases page B 3.4.13-2 for Unit 3, the dose consequences were indicated to be within the limits of 10 CFR 50.67 and the NRC staff approved licensing bases whereas on page B 3.4.17-2, the dose consequences are indicated to be within the limits of GDC19 and 10 CFR 100, or the NRC-approved licensing basis. Please clarify this apparent discrepancy.

Entergy Reply:

10 CFR 50.67 and Regulatory Guide 1.183 are part of the licensing basis of both Indian Point Unit 2 (License Amendments 211 and 241) and Indian Point Unit 3 (License Amendment 224). Entergy has corrected the affected pages (IP2 B 3.4.17-2 and -7; IP3 B 3.4.17-2 and -7) and replacement markups are provided in Attachment Two.

Question 7:

In your current Unit 3 safety analyses for reactor coolant system operational leakage (refer to page B 3.4.13-2), there is a statement that the 1 gallon per minute (gpm) primary to secondary leakage is relatively inconsequential. You have proposed to change the 1 gpm to 0.9 gpm. Please discuss the basis for revising this limit. In addition, confirm that the 0.9 gpm is consistent with your current licensing basis for Unit 3.

Entergy Reply:

The proposed change from 1 gpm to 0.9 gpm was not intended to be a change in the existing 1 gpm limit. The safety analysis, for SGTR discussed on Indian Point Unit 3 Bases page B.3.4.13-2 assumes 0.9 gpm primary to secondary leakage in the intact steam generators. The 0.1 gpm leakage remaining in the 1.0 gpm limit is assumed for the faulted steam generator but excluded from the model as insignificant compared to the leakage from the ruptured tube as allowed by Regulatory Guide 1.183. Entergy has deleted the proposed change regarding 0.9 gpm and the affected replacement page (IP3 B 3.4.13-2) is provided in Attachment Two.

Question 8:

On page B 3.4.13-2 of the Unit 3 TS Bases, there is a statement that the safety analysis for the steam line break accident assumes 432 gallons per day primary to secondary leakage through the affected steam generator. This statement appears to be incomplete. Please confirm that your current licensing basis steam line break accident analysis not only assumes 432 gallons per day leakage but also that the total leakage from all steam generators is limited to 1 gpm. If so, discuss your plans to modify your TS Bases. If this is not the case, please confirm the adequacy of insert B 3.4.13A for Unit 3, which indicates that leakage is limited to 1 gpm from all steam generators.

Entergy Reply:

The current licensing basis steam line break accident analysis limit assumes 432 gallons per day leakage through the affected steam generator and that the total leakage from all steam generators is limited to 1 gpm. The 432 gallons per day leakage is equivalent to 0.3 gpm. Entergy has revised the affected page (B.3.4.13-2) and the replacement markup is provided in Attachment Two.

Question 9:

In the Unit 3 Bases for Surveillance Requirement (SR) 3.4.13.1 (page B 3.4.13-5), you indicated that the surveillance is modified by two notes. The next statement then starts with "Therefore, this SR....". TSTF-449 indicated that this should have been modified to indicate that "Note 1 states...". Please discuss your plans to modify the Bases to be consistent with TSTF-449.

Entergy Reply:

Entergy has corrected the affected page (IP3 3.4.13-5) to be consistent with TSTF 449, and the replacement markup is provided in Attachment Two.

Question 10:

Several of the marked-up TS pages you submitted do not match the previously NRC issued pages. For Unit 2, pages ii, iv, and 1.1-3 were issued by the NRC as Amendment No. 238. For Unit 3, page ii was issued by the NRC as Amendment No. 205, and page iv as Amendment No. 207. Please revise the marked-up pages to show the changes from the NRC issued pages.

Entergy Reply:

Attachment Two includes new markup pages for the IP2 and IP3 Table of Contents. In addition to the changes required to reflect TSTF 449, these markup pages incorporate changes from other license amendments previously approved by NRC, and reflect minor reformatting to improve layout and readability.

ATTACHMENT TWO TO NL-06-089

REPLACEMENT MARKUP PAGES FOR

PROPOSED LICENSE AMENDMENT

FOR ADOPTION OF TSTF 449

(STEAM GENERATOR TUBE INTEGRITY)

NOTE: The following 25 pages, which address this NRC RAI, replace corresponding pages previously provided in Entergy letter NL-06-063, dated May 31, 2006. The remaining markup pages from NL-06-063 are not affected by this RAI reply.

IP2		IP3		
Tech Spec	**Bases**	**Tech Spec**	**Bases**	**RAI**
T of C i - iv		T of C i - v		10
		3.4.13-1		3
3.4.17-1		3.4.17-1		2
Insert 5.5.7		Insert 5.5.8		1 and 4
			B 3.4.13-2	7 and 8
			B 3.4.13-5	9
	Insert B 3.4.13 Page 1 of 2		Insert B 3.4.13 Page 1 of 2	5
	Insert B 3.4.13 Page 2 of 2		Insert B 3.4.13 Page 2 of 2	5
	B 3.4.17-2		B 3.4.17-2	6
			B 3.4.17-3	4
	B 3.4.17-7		B 3.4.17-7	6

ENTERGY NUCLEAR OPERATIONS, INC
INDIAN POINT NUCLEAR GENERATING UNITS NO. 2 and 3
DOCKETS 50-247 and 50-286

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3.4.17 Steam Generator (SG) Tube Integrity

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page break

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Not used

3.4.17

3.4 REACTOR COOLANT SYSTEM (RCS)

~~3.4.20~~ Steam Generator (SG) Tube Integrity

~~3.4.20~~ → 3.4.17

LCO ~~3.4.20~~ SG tube integrity shall be maintained.

3.4.17 →

AND

All SG tubes satisfying the tube repair criteria shall be plugged ~~[or repaired]~~ in accordance with the Steam Generator Program.

RAI 2

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

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more SG 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 SG 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 SG tube inspection
B. Required Action and associated Completion Time of Condition A not met. OR SG tube integrity not maintained.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

for IP2

INSERT 5.5 [8] ← [7]

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

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

RAI

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

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

2. Accident induced leakage performance criterion: The primary to secondary accident induced leakage rate for any design basis accident, other than a SG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all SGs and leakage rate for an individual SG . Leakage is not to exceed [1 gpm] per SG [, except for specific types of degradation at specific locations as described in paragraph c of the Steam Generator Program]. (150 gpd)

3. The operational LEAKAGE performance criterion is specified in LCO 3.4.13, "RCS Operational LEAKAGE."

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

600 gallons per day

INSERT B 3.4.13 A

600 gallons per day

that primary to secondary LEAKAGE from all steam generators (SGs) 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 SG to less than or equal to 150 gallons per day is [significantly less than] the conditions assumed in the safety analysis.

equal to

INSERT B 3.4.13 B

d. Primary to Secondary LEAKAGE Through Any One SG

5

The limit of 150 gallons per day per SG is based on the operational LEAKAGE performance criterion in NEI 97-06, Steam Generator Program Guidelines (Ref. 4). 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 SG 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.

RAI 5

INSERT B 3.4.13 C

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.

INSERT B 3.4.13 D (BWOG)

This SR verifies that primary to secondary LEAKAGE is less than or equal to 150 gallons per day through any one SG. 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 3.4.17, "Steam Generator Tube Integrity," should be evaluated. The 150 gallons per day limit is measured at room temperature as described in Reference 5. The operational LEAKAGE rate limit applies to LEAKAGE through any one SG. If it is not practical to assign the LEAKAGE to an individual SG, all the primary to secondary LEAKAGE should be conservatively assumed to be from one SG.

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).

3.4.17

INSERT B 3.4.13 D ~~(WOG)~~

This SR verifies that primary to secondary LEAKAGE is less or equal to 150 gallons per day through any one SG. 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 ~~3.4.20,~~ "Steam Generator Tube Integrity," should be evaluated. The 150 gallons per day limit is measured at room temperature as described in Reference 5. The operational LEAKAGE rate limit applies to LEAKAGE through any one SG. If it is not practical to assign the LEAKAGE to an individual SG, all the primary to secondary LEAKAGE should be conservatively assumed to be from one SG.

RAI 5

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. 5).

RAI 5

INSERT B 3.4.13 D (CEOG)

This SR verifies that primary to secondary LEAKAGE is less or equal to 150 gallons per day through any one SG. 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 3.4.18, "Steam Generator Tube Integrity," should be evaluated. The 150 gallons per day limit is measured at room temperature as described in Reference 5. The operational LEAKAGE rate limit applies to LEAKAGE through any one SG. If it is not practical to assign the LEAKAGE to an individual SG, all the primary to secondary LEAKAGE should be conservatively assumed to be from one SG.

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. 5).

INSERT B 3.4.13 E

5. → ~~4.~~ NEI 97-06, "Steam Generator Program Guidelines."

6. → ~~5.~~ EPRI, "Pressurized Water Reactor Primary-to-Secondary Leak Guidelines."

BASES

APPLICABLE SAFETY ANALYSES

The steam generator tube rupture (SGTR) accident is the limiting design basis event for SG 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 3.4.13, "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.~~ SG or atmospheric relief valves.

The analysis for design basis accidents and transients other than a SGTR assume the SG 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 SGs of ~~1 gallon per minute~~ or is assumed to increase to ~~1 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 3.4.16, "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 100 (Ref. 3) or the NRC approved licensing basis (e.g., a small fraction of these limits).

600 gallons per day

600 gallons per day

applicable limits of 10 CFR 50.67 (Ref 2) and Regulatory Guide 1.183 (Ref 3).

RAI 6

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

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 an 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 criteria but was not plugged ~~or repaired~~, the tube may still have tube integrity.

In the context of this Specification, a SG tube is defined as the entire length of the tube, including the tube wall ~~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.

A SG tube has tube integrity when it satisfies the SG performance criteria. The SG performance criteria are defined in Specification ~~5.5.9~~, 5.5.7 "Steam Generator Program," and describe acceptable SG tube performance. The Steam Generator Program also provides the evaluation process for determining conformance with the SG performance criteria.

REFERENCES

1. NEI 97-06, "Steam Generator Program Guidelines."
2. ~~10 CFR 50 Appendix A, GDC 19.~~ 10 CFR 50.67.
3. ~~10 CFR 100.~~
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."

Regulatory Guide 1.183, "Alternate Radiological Source Terms for Evaluating Design Basis Accidents in Nuclear Power Reactors", July 2000.

RAI 6

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page iv

Not Used

— Page V eliminated —

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.13 RCS Operational LEAKAGE

LCO 3.4.13 RCS operational LEAKAGE shall be limited to:

a. No pressure boundary LEAKAGE;

b. 1 gpm unidentified LEAKAGE;

c. 10 gpm identified LEAKAGE; and

~~d. 1 gpm total primary to secondary LEAKAGE through all steam generators (SGs); and~~

d. → ~~e.~~ ~~432~~ 150 gallons per day primary to secondary LEAKAGE through any one ← steam generator (SG)

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

operational

ACTIONS

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

OR

Primary to secondary leakage not within limit

RAI 3

3.4.17

3.4 REACTOR COOLANT SYSTEM (RCS)

~~3.4.20~~ Steam Generator (SG) Tube Integrity

LCO ~~3.4.20~~ SG tube integrity shall be maintained.

3.4.17

AND

All SG tubes satisfying the tube repair criteria shall be plugged [~~or repaired~~] in accordance with the Steam Generator Program.

RAI 2

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

ACTIONS

NOTE

Separate Condition entry is allowed for each SG tube.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more SG 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 SG 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 SG tube inspection
B. Required Action and associated Completion Time of Condition A not met. OR SG tube integrity not maintained.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

INSERT 5.5 8

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

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

RAI 1

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

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

RAI 4

0.3 gpm per SG and 1 gpm through all SGs

2. Accident induced leakage performance criterion: The primary to secondary accident induced leakage rate for any design basis accident, other than a SG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all SGs and leakage rate for an individual SG. Leakage is not to exceed ~~[1 gpm]~~ per SG ~~[, except for specific types of degradation at specific locations as described in paragraph c of the Steam Generator Program]~~.

~~0.3 gpm per SG not to exceed 1 gpm total leakage.~~

3. The operational LEAKAGE performance criterion is specified in LCO 3.4.13, "RCS Operational LEAKAGE."

c. Provisions for SG tube repair criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding ~~[40%]~~ 8 of the nominal tube wall thickness shall be plugged ~~[or repaired]~~.

BASES

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 LOCA; the amount of leakage can affect the probability of such an event. The safety analysis for events resulting in steam discharge to the atmosphere assumes a range of primary to secondary LEAKAGE from 0.1 gpm to 10 gpm as the initial condition.

Insert B 3.4.13 A

Primary to secondary LEAKAGE is a factor in the dose releases outside containment resulting from a steam line break (SLB) accident. To a lesser extent, other accidents or transients involve secondary steam release to the atmosphere, such as a steam generator tube rupture (SGTR). The leakage contaminates the secondary fluid.

Safety analysis assumption

The FSAR (Ref. 2) analysis for SGTR assumes the contaminated secondary fluid is released via safety valves and atmospheric dump valves. The 1 gpm primary to secondary LEAKAGE is relatively inconsequential.

0.3 gpm

The SLB is more limiting for site radiation releases. The safety analysis for the SLB accident assumes ~~a range of~~ primary to secondary LEAKAGE as an initial condition. The dose consequences resulting from the SLB accident are well within the limits defined in 10 CFR 50.67 and the staff approved licensing basis (i.e., a small fraction of these limits).

is through the affected SG and 1 gpm through all SGs.

The RCS operational LEAKAGE satisfies Criterion 2 of 10 CFR 50.36.

RAI s 148

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

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

reduced to within limits within 4 hours, the reactor must be brought to lower pressure conditions to reduce the severity of the LEAKAGE and its potential consequences. It should be noted that LEAKAGE past seals and gaskets is not pressure boundary LEAKAGE. The reactor must be brought to MODE 3 within 6 hours and MODE 5 within 36 hours. This action reduces the LEAKAGE and also reduces the factors that tend to degrade the pressure boundary.

The allowed Completion Times are reasonable, based on operating experience, to reach the required 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 3.4.13.1

Verifying RCS LEAKAGE to be within the LCO limits ensures 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. It should be noted that LEAKAGE past seals and gaskets is not pressure boundary LEAKAGE. 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 blowdown systems.

The RCS water inventory balance must be met with the reactor at steady state operating conditions and near operating pressure. ~~Therefore,~~ this SR is not required to be performed in MODES 3 and 4 until 12 hours of steady state operation near operating pressure have been established.

The surveillance is modified by two Notes. Note 1 states that

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(continued)

INSERT B 3.4.13 A

that primary to secondary LEAKAGE from all steam generators (SGs) 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 SG to less than or equal to 150 gallons per day is significantly less than the conditions assumed in the safety analysis.

INSERT B 3.4.13 B

d. Primary to Secondary LEAKAGE Through Any One SG

The limit of 150 gallons per day per SG is based on the operational LEAKAGE performance criterion in NEI 97-06, Steam Generator Program Guidelines (Ref. 3). 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 SG 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.

RAI 5

INSERT B 3.4.13 C

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.

INSERT B 3.4.13 D (BWOG)

This SR verifies that primary to secondary LEAKAGE is less than or equal to 150 gallons per day through any one SG. 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 3.4.17, "Steam Generator Tube Integrity," should be evaluated. The 150 gallons per day limit is measured at room temperature as described in Reference 5. The operational LEAKAGE rate limit applies to LEAKAGE through any one SG. If it is not practical to assign the LEAKAGE to an individual SG, all the primary to secondary LEAKAGE should be conservatively assumed to be from one SG.

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).

3.4.17 for IP3

INSERT B 3.4.13 D ~~(WOG)~~

This SR verifies that primary to secondary LEAKAGE is less or equal to 150 gallons per day through any one SG. 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 ~~3.4.20,~~ "Steam Generator Tube Integrity," should be evaluated. The 150 gallons per day limit is measured at room temperature as described in Reference ~~5~~ 4. The operational LEAKAGE rate limit applies to LEAKAGE through any one SG. If it is not practical to assign the LEAKAGE to an individual SG, all the primary to secondary LEAKAGE should be conservatively assumed to be from one SG.

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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. 5).

4 → 5

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INSERT B 3.4.13 D (CEOG)

This SR verifies that primary to secondary LEAKAGE is less or equal to 150 gallons per day through any one SG. 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 3.4.18, "Steam Generator Tube Integrity," should be evaluated. The 150 gallons per day limit is measured at room temperature as described in Reference 5. The operational LEAKAGE rate limit applies to LEAKAGE through any one SG. If it is not practical to assign the LEAKAGE to an individual SG, all the primary to secondary LEAKAGE should be conservatively assumed to be from one SG.

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. 5).

INSERT B 3.4.13 E

3 → 4

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NEI 97-06, "Steam Generator Program Guidelines."

EPRI, "Pressurized Water Reactor Primary-to-Secondary Leak Guidelines."

BASES

APPLICABLE SAFETY ANALYSES

The steam generator tube rupture (SGTR) accident is the limiting design basis event for SG 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 3.4.13, "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.~~ SG or atmospheric relief valves.

The analysis for design basis accidents and transients other than a SGTR assume the SG 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 SGs of ~~1~~ gallon per minute ~~or is assumed to increase to 1 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 3.4.16, "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 100 (Ref. 3) or the NRC approved licensing basis (e.g., a small fraction of these limits).

applicable limits of 10 CFR 50.67 (Ref 2) and Regulatory Guide 1.183 (Ref 3).

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

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 an 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 criteria but was not plugged ~~or repaired~~, the tube may still have tube integrity.

In the context of this Specification, a SG tube is defined as the entire length of the tube, including the tube wall ~~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.

5.5.8,

A SG tube has tube integrity when it satisfies the SG performance criteria. The SG performance criteria are defined in Specification ~~5.5.9~~, "Steam Generator Program," and describe acceptable SG tube performance. The Steam Generator Program also provides the evaluation process for determining conformance with the SG performance criteria.

BASES

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

The structural integrity performance criterion provides a margin of safety against tube burst or collapse under normal and accident conditions, and ensures structural integrity of the SG tubes under all anticipated transients included in the design specification. Tube burst is defined as, "The gross structural failure of the tube wall. The condition typically corresponds to an unstable opening displacement (e.g., opening area increased in response to constant pressure) accompanied by ductile (plastic) tearing of the tube material at the ends of the degradation." Tube collapse is defined as, "For the load displacement curve for a given structure, collapse occurs at the top of the load versus displacement curve where the slope of the curve becomes zero." The structural integrity performance criterion provides guidance on assessing loads that 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 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 [1 gpm per SG, 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.

0.3 gpm per SG and 1 gpm through all SGs.

RAI 4

REFERENCES

1. NEI 97-06, "Steam Generator Program Guidelines."
2. ~~10 CFR 50 Appendix A, GDC 19.~~ ← 10 CFR 50.67
3. ~~10 CFR 100.~~
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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Regulatory Guide 1.183, "Alternate Radiological Source Terms for Evaluating Design Basis Accidents in Nuclear Power Reactors", July 2000