

## MEB-CQ-201505 5.4.2.2 Responses

### **Issue #1**

(Editorial) The staff notes that Final Safety Analysis Report (FSAR) Table 1.9-2 (Page 9 of 33) lists FSAR Subsection 5.4.2.6 as the applicable FSAR section addressing NRC Standard Review Plan (SRP) Section 5.4.2.2. This table entry should be changed from 5.4.2.6 to 5.4.2.2 to be consistent with the FSAR.

### **Response**

KHNP will change the typo in Table 1.9-2 from 5.4.2.6 to 5.4.2.2.

### **Issue #2**

In accordance with NEI 97-06, "Steam Generator Program Guidelines," implementation of an acceptable steam generator program requires that all tubes be accessible from the primary side, that every tube can be inspected over its full length, and that every tube can be removed from service and stabilized if necessary. This is part of meeting GDC 32, since steam generator tubes are part of the reactor coolant pressure boundary and have a potential for degradation over their full length.

Revise FSAR Subsection 5.4.2.2 to state that these criteria are met for the APR1400 steam generators.

### **Response**

KHNP will add following sentence in the section 5.4.2.2.1 Design Description:

"The steam generator tubes of the APR1400 can be accessed from the primary side of the steam generator for full length inspection."

### **Issue #3**

FSAR Subsection 5.4.2.2 refers to steam generator tube repair in several places. The first is in FSAR Subsection 5.4.2.2.2.1, which lists sleeves as a feature of reactor coolant pressure boundary (RCPB) integrity related to degradation assessments.

As stated in NEI 97-06, repair methods (e.g., sleeving) shall be reviewed by the NRC prior to implementation. Since the APR1400 does not propose sleeving as a tube repair method, revise FSAR Section 5.4.2.2 to delete all statements about sleeves and tube repairs (e.g., from FSAR Subsections 5.4.2.2.2.1, 5.4.2.2.2.4, 5.4.2.2.2.12, etc.). The staff notes that the references to tube repairs in FSAR Subsection 5.4.2.2.2.12 ("Reporting") make that information inconsistent with Section 5.6.7 of the proposed APR1400 Technical Specifications.

### **Response**

KHNP will delete repair methods such as sleeving and plugging in sections 5.4.2.2.2.1, 5.4.2.2.2.4, and 5.4.2.2.2.12.

### **Issue #4**

The second paragraph of FSAR Subsection 5.4.2.2.2.1 implies that the degradation assessment focuses only on cracking. Since the purpose of the Steam Generator Program is to maintain tube integrity, the degradation assessment must consider all potential forms of degradation.

Revise FSAR Subsection 5.4.2.2.2.1 by deleting the second paragraph to make it clear that steam generator tube degradation assessment is not limited to cracking.

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### Response

KHNP will delete the 2<sup>nd</sup> paragraph of section 5.4.2.2.1.

### Issue #5

FSAR Subsections 5.4.2.2.7 and 5.4.2.2.8, respectively, describe the secondary-side and primary-side water chemistry programs to limit corrosion-related degradation. These programs are described and reviewed primarily in other sections of the FSAR (9.3.4, 10.3.5, Technical Specifications 5.5.10).

Revise FSAR Subsection 5.4.2.2 to identify the subsections where these programs are more fully described.

### Response

KHNP will add following sentence in 5.4.2.2.7:

“More details are described in Section 10.3.5 and Technical Specification 5.5.10 of APR1400 DCD.”

KHNP will add following sentence in 5.4.2.2.8:

“More details are described in Section 9.3.4.2.7 of APR1400 DCD.”

### Issue #6

FSAR Subsection 5.4.2.2.12 (“Reporting”) contains three paragraphs at the end that are not related to reporting. These paragraphs include a description of the tube surveillance program, preservice inspection (PSI), and differences between the Technical Specifications and the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code).

Revise FSAR Subsection 5.4.2.2.12 to delete the third of these paragraphs and relocate the information in the first two of these paragraphs to more appropriately titled parts of Subsection 5.4.2.2.

### Response

The first two paragraphs will be moved to the end of the **general description portion before Subsection 5.4.2.2.1** and the third paragraph will be deleted.

### Issue #7

The next-to-last paragraph in FSAR Subsection 5.4.2.2.12 states that PSI of all tubes is performed in accordance with the EPRI guidelines, NEI 97-06, and Section XI of the ASME Code.

Revise FSAR Subsection 5.4.2.2.12 to clarify the requirements using language consistent with the Technical Specification (TS) requirements for inservice inspections. This is necessary because the PSI for steam generator tubing is not addressed by the TS, and the requirements are not clear in Section III of the ASME Code. Revising FSAR Subsection 5.4.2.2.12 can be accomplished with a statement such as:

“Preservice inspection is performed on the full length of 100% of the tubes in each steam generator using techniques capable of detecting degradation and fabrication abnormalities along the length of the tube, from the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet. The preservice inspection will be performed after field hydrostatic testing and before operation.”

### Response

The paragraph provided will be added to the **end of the general description portion of subsection 5.4.2.2.**

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### Issue #8

Paragraph b in Subsection 5.4.2.2 and the last paragraph in Subsection 5.4.2.2.12 have statements, such as the following, that address potential differences between the TS and Section XI of the ASME Code:

If the plant Technical Specifications include inspection requirements that differ from those in Article IWB-2000 of Section XI of the ASME Code, the Technical Specifications govern.

These statements are based on earlier versions of the regulations in 10 CFR 50.55a. That statement is no longer part of 10 CFR 50.55a.

Revise Paragraph b in Subsection 5.4.2.2 and the last paragraph in Subsection 5.4.2.2.12 to delete these statements from the FSAR. If the applicant is aware of any potential conflicts/differences between the ASME Code and the TS such that the requirements of both cannot be met, revise the FSAR to address those conflicts/differences.

### Response

The following sentence in paragraph b of section 5.4.2.2 will be deleted:

“In addition, 10 CFR 50.55a(b)(2)(iii) addresses SG tubes and states that if the plant Technical Specifications include inspection requirements that differ from those in Article IWB-2000 of Section XI of the ASME Code, the Technical Specifications govern.”

The last paragraph in section 5.4.2.2.12 will be deleted also.

### Issue #9

Several issues need to be addressed for the APR 1400 Technical Specifications because they are inconsistent with the latest Standard Technical Specifications. The STS provide for the establishment and implementation of steam generator program to ensure that tube integrity is maintained, which is part of meeting GDC 32. The relevant STS are comprised of Revision 4 of NUREG-1432 (for Combustion Engineering plants) plus the changes incorporated by Technical Specification Task Force Traveler 510 (“Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection,” Revision 2, ML110610350). Examples of the differences between the APR1400 TS and the STS are listed below and should be revised, or the applicant should provide justification for not using the STS.

- Revise the definition of Identified LEAKAGE (a.3.) in TS 1.1 to include “(primary to secondary LEAKAGE)”.

Response - KHNP will add the definition of “primary to secondary leakage” to TS 1.1.

- Revise the definition of Pressure Boundary Leakage (c) in TS 1.1 to change “except SG LEAKAGE” to “except primary to secondary leakage”.

Response - KHNP will revise “except SG leakage” to “except primary to secondary leakage.”

- Revise TS 3.4.17, “Steam Generator (SG) Tube Integrity,” in three places to be consistent with the STS. TSTF-510 changed the terminology from “tube repair criteria” to “tube plugging [or repair] criteria.” (Plants without an approved tube repair method (sleeving) exclude the bracketed part.)

Response - KHNP will change “tube repair criteria” to “tube plugging [or repair] criteria” in TS 3.4.17 in accordance with the STS.

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- Revise the terminology in the steam generator TS and Bases to replace “repair criteria” with “plugging criteria,” for consistency with TSTF-510. There are also corresponding changes in Subsection 5.4.2.2 of the FSAR.

Response - KHNP will change “repair criteria” to “plugging criteria” in the TS and Bases in accordance with TSTF-510.

- Revise the requirements in for the frequency of verifying tube integrity in TS 5.5.9, “Steam Generator (SG) Program.” These requirements were changed in TSTF-510 and are explained and shown in the TSTF-510 documentation (see ML110610350 or the “Consolidated Line Item Improvement Process” link on the NRC’s Technical Specifications web page).

Response - KHNP will change TS 5.5.9.d.2 as follows:

2. After the first refueling outage following SG installation, inspect each SG every 72 effective full power months or 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 the degradation assessment indicates potential degradation at the next scheduled inspection, the number of inspections for each degradation mechanism in that inspection period may be prorated such that the fraction of tubes/locations inspected at the end of the inspection period is at least equal to the ratio of the number of SG inspection outages performed subsequent to the determination that a new degradation mechanism may occur or that new locations may be susceptible to degradation mechanisms divided by the total number of SG inspection outages performed in that 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.
  - a) After the first refueling outage following SG installation, inspect 100% of the tubes during the next 144 effective full power months. This constitutes the first inspection period;
  - b) During the next 120 effective full power months, inspect 100% of the tubes. This constitutes the second inspection period;
  - c) During the next 96 effective full power months, inspect 100% of the tubes. This constitutes the third inspection period; and
  - d) During the remaining life of the SGs, inspect 100% of the tubes every 72 effective full power months. This constitutes the fourth and subsequent inspection periods.

- Revise the one instance of “tube repair” that was not changed (by mistake) in TSTF-510 to “tube plugging” (TS 5.5.9.d.2, 3<sup>rd</sup> sentence).

Response - KHNP will change TS 5.5.9.d.2 as shown above.

- Revise TS 5.6.7 (“Steam Generator Tube Inspection Report”) and Bases section B 3.4.18 for consistency with TSTF-510.

Response - KHNP will change TS 5.6.7 in accordance with TSTF-510.

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- In TS 5.5.9.a, in the last sentence, change “inspected, plugged” to “inspected or plugged” to clarify the meaning.

Response - KHNP will change “inspected, plugged” to “inspected or plugged” in TS 5.5.9.

- In the Background of the TS Bases, Section B 3.4.12, at the end of the fifth paragraph, “to not interfere with the function of RCS leakage detection system.” The corresponding phrase in the STS is, “to not interfere with RCS leakage detection.” Revise the wording for consistency with the STS.

Response - KHNP will revise the words “to not interfere with the function of RCS leakage detection system” to “to not interfere with RCS leakage detection.”

- At the end of the last sentence of Applicable Safety Analyses, Bases Section B.3.4.12, change “LCO SELECTION CRITERION 2” to “Criterion 2 of 10 CFR 50.36(c)(2)(ii),” for clarity and consistency with the STS.

Response - KHNP will revise the words “LCO SELECTION CRITERION 2” to “Criterion 2 of 10 CFR 50.36(c)(2)(ii).”

- In the ACTION Section A.1 of TS Bases Section B.3.4.12, delete primary-to-secondary LEAKAGE from the first sentence. Note 2 in the associated SURVEILLANCE REQUIREMENTS states that this is not applicable to primary-to-secondary LEAKAGE.

Response - KHNP will delete “Except for primary to secondary LEAKAGE” in the first sentence of the first paragraph of page B3.4-54.

- In the SURVEILLANCE REQUIREMENTS section in TS Bases Section B.3.4.12, at the end of the second paragraph under SR 3.4.12.2, for consistency with the STS, add the sentence, “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.”

Response - KHNP will add following sentence at the end of the second paragraph of SR 3.4.12.2:

“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.”

- In the APPLICABLE SAFETY ANALYSES section of TS Bases Section b.3.4.17, in the first paragraph on page B 3.4.17-2, the APR 1400 bases read, “... released to the atmosphere via safety valves and relief valves.” Corresponding wording in the STS is, “... released to the atmosphere via safety valves and the majority is discharged to the main condenser.” Revise the APR1400 bases for consistency with the STS.

Response - KHNP will revise the words, “... released to the atmosphere via safety valves and relief valves” to “... released to the atmosphere via safety valves and the majority is discharged to the main condenser.”

- In the APPLICABLE SAFETY ANALYSES section of TS Bases Section b.3.4.17, in the second sentence of the second paragraph on page B 3.4.17-2, the APR 1400 bases omit the phrase, “or is assumed to increase to [1.13 L/min (0.3 gpm)] as a result of accident induced conditions.” (The brackets indicate this is a plant-specific leak rate). Revise the APR 1400 bases for consistency with the STS.

Response - KHNP will add following the following phrase in the second sentence of the second paragraph on page B 3.4.17-2:

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“or is assumed to increase to [2.27 L/min (0.6 gpm)] as a result of accident induced conditions.”

- Delete the two paragraphs at the top of page B 3.4.17-3 because they are duplicates from the bottom of the previous page.

Response - KHNP will delete the two paragraphs at the top of page B 3.4.17-3.

- Since the APR 1400 design certification is not requesting approval of tube repair methods (e.g., sleeving), delete the three references to tube repairs from the TS Bases Section SR 3.4.17.2. The three references are, “[repaired or], [or repaired], and the sentence, “Steam generator tube repairs are only performed using approved repair methods as described in the Steam Generator Program.”

Response - KHNP will delete the three references from the TS Bases Section SR 3.4.17.2.

- Change the first reference for TS Bases Section 3.4.17 from IEEE Standard 603 to NEI 97-06.

Response - KHNP will change the first reference “IEEE Standard 603” in the TS Bases Section 3.4.17 to “NEI 97-06.”

- Revise TS Bases Section 3.4.17 as needed for consistency with TSTF-510 Bases Section 3.4.18.

Response - KHNP will revise TS Bases Section 3.4.17 by using the following terminologies, plugging [or repair], degradation, growth etc.

### **Issue #10**

In 2013, the U.S. NRC issued Information Notice (IN) 2013-20, “Steam Generator Channel Head and Tubesheet Degradation.” IN 2013-20 describes operating experience with exposure of the carbon steel base material in the steam generator channel head and primary side of the tubesheet. The base material in those cases was originally protected by corrosion-resistant weld material (stainless steel or nickel-base alloy).

Revise FSAR Subsection 5.4.2.2 to describe:

- The controls in place to prevent damage to cladding during fabrication and maintenance activities that could expose the underlying carbon steel to primary coolant
- The inspections that will be performed to evaluate the integrity of corrosion-resistant cladding and monitor the integrity of locations where exposure of the base metal has occurred.

### **Response**

KHNP will revise Section 5.4.2.2 to provide more description on the controls to prevent cladding damage during fabrication and maintenance and the inspections that will be performed to evaluate and monitor cladding integrity and provide the appropriate markups.

### **Issue #11**

Steam generator ISI and PSI are required by 10 CFR 50.55a and are identified in SECY-05-0197 as Operational Programs to be implemented by licensees. However, since steam generators have distinct ISI and PSI requirements, it is appropriate to list the requirements and milestones separately in the COLA Table of Operational Programs under ISI and PSI.

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Revise FSAR Subsections 5.4.2.2, 5.4.16, and 1.8 to add a Combined License item to show the implementation milestones for Steam Generator inservice inspection (ISI) and preservice inspection (PSI) in the table of Operational Programs (Chapter 13) for APR1400 Combined License Applications.

### Response

The sentence of “PSI and ISI of the SG tubes are performed in accordance with SGMP PWR Examination Guideline” will be added in 5.4.2.3 (Tests and Inspections).

Also, a COL item for SGMP will be described in the section 5.4.16, 1.8, and 13.4.1 (Combined License Information).