RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**494-8620**
SRP Section:	**05.04.02.02 – Steam Generator Program**
Application Section:	**SRP 05.04.02.02**
Date of RAI Issue:	**06/08/2016**

Question No. 05.04.02.02-6

The March 2, 2016 response (ADAMS Accession No. ML16062A276) to RAI 299-8310, Question 05.04.02.02-3, Parts (h) and (i), proposes changes to leakage values on Attachment pages 10-13. It is not clear to the staff that the proposed values are consistent with the accident
analyses. Please address the following issues and identify any FSAR changes needed to address them. In addition, identify any other FSAR changes that may be necessary for consistency. This information is needed to determine consistency with the Standard Technical Specifications, which provide for the establishment and implementation of a steam generator program to ensure that tube integrity is maintained, which is part of meeting General Design Criteria 32.

a. Provide a justification for proposing to delete the first phrase in the first paragraph on page 10 of the March 2, 2016 attachment (Technical Specifications Bases page B 3.4.12-2), or leave this phrase in the Bases as originally proposed. The phrase being deleted is, “Except for primary to secondary LEAKAGE,…” The staff’s understanding is that this phrase should be included in the Bases because it is part of the Standard Technical Specifications Bases and consistent with the proposed definitions of LEAKAGE in the APR1400 (as modified by the response to Action Item 5-6.27, Enclosure 9 to KHNP Letter MKD/NW-15-0061L, ML15216A447).

b. Clarify the last sentence in the first paragraph of page 10 of the March 2, 2016 attachment (page B 3.4.12-2 of FSAR Rev.0), which states that an event resulting in steam discharge to the atmosphere assumes 1.13 L/min (0.3 gpm) primary to secondary leakage as the initial condition. This appears to be inconsistent with a proposed revision to the same page that states, “The safety analysis for the SLB accident assumes the entire 2.27 L/min (0.6 gpm) primary to secondary LEAKAGE is through the affected generator as an initial condition.” Similarly, FSAR Section 15.1 describes the initial conditions for the analysis of a main steam line break as 2.27 L/min (0.6 gpm). Clarifying whether the assumed leakage is for one or two SGs and why.

c. The proposed revision to page 11 of the March 2, 2016 attachment (Bases page B 3.4.17-2) reads, “In these analyses, the steam discharge to the atmosphere is based on the total primary to secondary leakage from all SGs of 1.14 L/min (0.3 gpm) or is assumed to increase to 1.14 L/min (0.3 gpm) as a result of accident induced conditions.” It is the staff’s understanding from part (h) of the response, from FSAR Chapter 15, and from the response to RAI 108-7973, Question 15.00.03-2 (dated 5/9/2016, ML16130A547) that a steam line break (SLB) is the limiting accident and assumes a total leakage from the steam generators of 2.27 L/min (0.6 gpm). Please clarify how the proposed value of 1.14 L/min is consistent with the APR1400 accident analyses or discuss your plans to revise the TS Bases for consistency with the accident analyses.

Response

a. The first phrase in the first paragraph on page B3.4.12-2 of Ch.16 (TS) was deleted based on the action items produced in the face-to-face meeting between NRC and KHNP dated June 30 2015. KHNP understood that deleting this phrase is not consistent with the Standard Technical Specification. Therefore KHNP will cancel the deletion of this phrase and include it in the first paragraph on page B3.4.12-2 of Ch.16 (TS) as shown on page 1 of the Attachment.

b. The 0.3 gpm and 0.6 gpm are the primary to secondary leakage per one SG and two SGs, respectively. Therefore the last sentence in the first paragraph of page B 3.4.12-2 of FSAR Rev.0 should be modified as that “an event resulting in steam discharge to the atmosphere assumes 2.27 L/min (0.6 gpm) primary to secondary leakage as the initial condition” as shown on page 1 of the Attachment. Therefore, 0.6 gpm leakage is the assumed leakage from two SGs throughout event in SLB safety analysis for conservatism.

c. As described in the accident analyses in the FSAR Ch.15, all the accident analyses relevant to the primary-to-secondary leakage assumed the 0.3 gpm leakage for any one SG and 0.6 gpm for all SGs. As stated in the response of above subquestion ‘b’, the SLB accident assumed 0.6 gpm leakage from total SGs. KHNP will change the 0.3 gpm to 0.6 gpm for consistency with Ch.15 accident analyses as shown on page 2 of the Attachment.

In addition to above questions, NRC staff asked KHNP to change the RAI number and correct an inconsistency between TS bases and the accident analysis in Ch. 15 with a follow-up email dated on July 13, 2016. KHNP will change the RAI number from 05.04.02.02-5 to 05.04.02.02-6 and correct the inconsistency as shown on page 1 of the Attachment.

Impact on DCD

FSAR Subsection described in “Impact on Technical Specifications” will be revised.

Impact on PRA

There is no impact on the PRA.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical or Environmental Reports.

Impact on Technical Specifications

TS Bases 3.4.12 and 3.4.17 will be revised.

AI 5-6.27_5.4.2.2

RAI 494-8620 - Q 05.04.02.02-6

RAI 299-8310 - Q 05.04.02.02-3

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 an event resulting in steam discharge to the atmosphere assumes a ~~1.13 L/min (0.3 gpm)~~ primary to secondary LEAKAGE as the initial condition.

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.

The DCD Tier 2 (Reference 3) analysis for SGTR assumes the contaminated secondary fluid is only briefly released via safety valves and the majority is steamed to condenser. The ~~1.13 L/min (0.3 gpm)~~ primary to secondary LEAKAGE is relatively inconsequential.

The SLB is more limiting for site radiation releases. The safety analysis for the SLB accident assumes the entire ~~1.13 L/min (0.3 gpm)~~ primary to secondary LEAKAGE is through the affected generator as an initial condition. The dose consequences resulting from the SLB are well within the limits defined in 10 CFR 50.34.

RCS operational LEAKAGE satisfies ~~LCO SELECTION CRITERION 2~~.

LCO

RCS operational LEAKAGE shall be limited to:

a. Pressure boundary LEAKAGE

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

dleted

restore the origin

The

2.27 L/min (0.6 gpm)

2.27 L/min (0.6 gpm)

0.3 gpm through each steam generator for the first 30 minutes, and then

2.27 L/min (0.6 gpm)

Criterion 2 of 10 CFR 50.36(c)(2)(ii)

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 3.4.12, "RCS Operational Leakage," plus the leakage rate associated with a double-ended rupture of a single tube. The accident analysis for a SGTR assumes the contaminated secondary fluid is only briefly released to the atmosphere via safety valves ~~and relief valves~~.

2.27 L/min (0.6 gpm)

the majority is discharged to the main condenser.

The analysis for design basis accidents and transients other than a SGTR assume the SG tubes retain their structural integrity (i.e., do not rupture.) In these analyses, the steam discharge to the atmosphere is based on the total primary to se 1.14 L/min (0.3 gpm) Gs of ~~1.13 L/min (0.3 gpm)~~. 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 LC ~~3.785 L/min (1.0 gpm)~~ or is assumed to increase to ~~3.785 L/min (1.0 gpm)~~ as a result of accident induced conditions. or accidents that assume fu function of the amount of activ lose consequences of these events are within the limits of GDC 19 (Reference 2), 10 CFR Part 100 (Refere 1.14 L/min (0.3 gpm) d licensing basis (e.g., a small fraction of these limits).

2.27 L/min (0.6 gpm)

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 in accordance with the Steam Generator Program.

plugging

During an SG inspection, any inspected tube that satisfies the Steam Generator Program ~~repair~~ criteria is removed from service by plugging. If a tube was determined to satisfy the ~~repair~~ criteria but was not plugged, 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, 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, "Steam Generator Program," and describe acceptable SG tube performance.