

KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Tuesday, July 26, 2016 2:35 PM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Junggho Kim (jhokim082@gmail.com); Andy Jiyong Oh; Christopher Tyree
Cc: Yeshnik, Andrew; Mitchell, Matthew; Wunder, George; Williams, Donna
Subject: APR1400 Design Certification Application RAI 506-8649 (10.03.06 - Steam and Feedwater System Materials)
Attachments: APR1400 DC RAI 506 MCB 8649.pdf

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, KHNP requests, and we grant, the following RAI question response times. We may adjust the schedule accordingly.

10.03.06-24: 30 days
10.03.06-25: 30 days
10.03.06-26: 60 days
10.03.06-27: 60 days

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

Jeff Ciocco
New Nuclear Reactor Licensing
301.415.6391
jeff.ciocco@nrc.gov



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From: Ciocco, Jeff

Created By: Jeff.Ciocco@nrc.gov

Recipients:

"Yeshnik, Andrew" <Andrew.Yeshnik@nrc.gov>
Tracking Status: None
"Mitchell, Matthew" <Matthew.Mitchell@nrc.gov>
Tracking Status: None
"Wunder, George" <George.Wunder@nrc.gov>
Tracking Status: None
"Williams, Donna " <Donna.Williams@nrc.gov>
Tracking Status: None
"apr1400rai@khnp.co.kr" <apr1400rai@khnp.co.kr>
Tracking Status: None
"KHNPDCDRAIsPEM Resource" <KHNPDCDRAIsPEM.Resource@nrc.gov>
Tracking Status: None
"Junggho Kim (jhokim082@gmail.com)" <jhokim082@gmail.com>
Tracking Status: None
"Andy Jiyong Oh" <jiyong.oh5@gmail.com>
Tracking Status: None
"Christopher Tyree" <Christopher.tyree@aecom.com>
Tracking Status: None

Post Office: HQPWMSMRS08.nrc.gov

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REQUEST FOR ADDITIONAL INFORMATION 506-8649

Issue Date: 07/26/2016
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 10.03.06 - Steam and Feedwater System Materials
Application Section: 10.3.6

QUESTIONS

10.03.06-24

Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix A, General Design Criteria 1 and 10 CFR Part 50.55a contains provisions regarding quality standards for Systems, Structures and Components. These provisions are met by compliance with the ASME Boiler and Pressure Vessel Code (ASME Code) and by acceptable application of ASME Code Cases as described in Regulatory Guide (RG) 1.147 "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1."

ASME Code Case N-597-2 is a fundamental aspect of the EPRI NSAC-202L program. It ensures there is sufficient safety margin and provides a methodology of justifying operability when the component wall thickness is less than $0.875 t_{nom}$.

10 CFR 50.55a(b)(5) limits the use of ASME Code Cases as provided in RG 1.147. RG 1.147 places six conditions on the use of ASME Code Case N-597-2; one of which is a requirement for a licensee to submit a request for alternative under 10 CFR 50.55(z) when components are below the ASME Code Case N-597-2 limits.

The staff reviewed DCD Tier 2, FSAR Chapter 10 and found that this topic was not directly covered in FSAR Section 10.3.6.2 when it states: "The APR1400 meets the regulatory requirements of 10 CFR 50.55a."

The staff finds that a clear statement should be added to the FSAR to ensure that the regulatory limitations and conservatism are incorporated into the FAC program.

The staff requests that that applicant add the following statement to DCD Tier 2, FSAR Section 10.3.6.3 or add to the end of COL item 10.3(3):

"The FAC monitoring program shall incorporate the conditions of 10 CFR 50.55a(b)(5) on ASME Code Case N-597-2."

10.03.06-25

Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix A, General Design Criteria 4 requires that SSCs important to safety shall accommodate the effects of environmental conditions during normal, off normal, and accident conditions. Safety-related components in the main steam and feedwater lines shall be designed with consideration for FAC.

Title 10 of the Code of Federal Regulations (10 CFR) Part 50.65 requires monitoring of the condition and operation of Structures, Systems, and Components (SSCs) to ensure that they are capable of maintaining their intended function. The functions are established from design goals which are based on operating experience. The requirements of 10 CFR 50.65 are applicable to non-safety systems "whose failure could cause a reactor scram or actuation of a safety-related system;" a main steam-line or feed-line break would result in an Engineered Safety Feature (ESF) actuation. Generic Letter (GL) 89-08. "Erosion/Corrosion-Induced Pipe Wall Thinning," defined a Flow Accelerated Corrosion (FAC) program that would meet the requirements of 10 CFR 50.65 for secondary, non-safety related systems.

DCD Tier 2, FSAR Section 10.3.7 has the following COL item:

"COL 10.3(3)

The COL applicant is to provide a description of the FAC monitoring program for carbon steel portions of the steam and power conversion systems that contain water or wet steam and are susceptible to erosion-corrosion damage. The description is to address consistency with GL 89-08 and NSAC-202L-R3 and provide a milestone schedule for implementation of the program."

All lines (not just the carbon steel portions) lines in the steam and power conversion systems should be addressed in the FAC monitoring program. The FAC monitoring program may exclude lines based upon the EPRI guidance but the identification of lines

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and exclusion principals should be documented in the Susceptibility Analysis (which is part of the FAC monitoring program). This logic is presented in EPRI NSAC-202L-R3, Section 4.2:

"Care should be taken to ensure that all susceptible lines, including lines not on the plant line list (including vendor lines such as gland steam), are included in the FAC program. Additionally, this evaluation should be periodically reviewed to ensure that it is kept current with plant design changes and ways that systems are being operated (see Subsection 3.3)."

...
"It is recommended that the Susceptibility Analysis identify the systems, or portions of systems excluded from the FAC program and the basis for their exclusion. This analysis should be appropriately documented and reviewed."

The staff requests that the applicant revise and simplify COL item COL10.3(3) as follows:

"COL 10.3(3)

The COL applicant is to provide a description of the FAC monitoring program. The description is to address consistency with GL 89- 08 and NSAC-202L-R3 and provide a milestone schedule for implementation of the program."

The staff notes that the applicant's Susceptibility Analysis provided during audit on May 10, 2016 identifies susceptible lines and the basis for exclusion. KHNP's Susceptibility Analysis is consistent with the statements above.

10.03.06-26

Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix A, General Design Criteria 4 requires that SSCs important to safety shall accommodate the effects of environmental conditions during normal, off normal, and accident conditions. Safety-related components in the main steam and feedwater lines shall be designed with consideration for FAC.

Title 10 of the Code of Federal Regulations (10 CFR) Part 50.65 requires monitoring of the condition and operation of Structures, Systems, and Components (SSCs) to ensure that they are capable of maintaining their intended function. The functions are established from design goals which are based on operating experience. The requirements of 10 CFR 50.65 are applicable to non-safety systems "whose failure could cause a reactor scram or actuation of a safety-related system;" a main steam-line or feed-line break would result in an Engineered Safety Feature (ESF) actuation. Generic Letter (GL) 89-08. "Erosion/Corrosion-Induced Pipe Wall Thinning," defined a Flow Accelerated Corrosion (FAC) program that would meet the requirements of 10 CFR 50.65 for secondary, non-safety related systems.

During the audit on May 10, 2016, the staff reviewed design documents for the feedwater system. While reviewing the design documents, the staff noted that a portion of downcommer feedwater line downstream of the downcommer flow control valve has a configuration of chrome-moly steel – carbon steel – chrome-moly steel. This configuration was not apparent to the staff prior to the audit.

DCD Tier 2, FSAR Table 10.3.2-4 lists material specifications for components in the feedwater system. This table does not have an entry for the carbon steel portion of the line between the chrome-moly portions of the downcommer feedwater line. The material specifications were not found in DCD Tier 2, FSAR Chapter 10 or Chapter 6. The carbon steel portion of the line contains the safety-related Main Feedwater Isolation Valves.

Operational experience has shown that components downstream of FAC resistant materials are more susceptible to FAC (EPRI NSAC-202L-R3, Section 4.4).

The staff asks the following:

- a. What material specifications are utilized for the carbon steel portion of the downcommer feedwater line between the chrome-moly portions of the same line (including the Main Feedwater Isolation Valves and connected safety-related piping)? This information should be added to DCD Tier 2, FSAR Chapter 10 or 6.
- b. Are the carbon steel portions of the downcommer feedwater line between the chrome-moly steel portions subject to augmented in-service inspection (ISI)? If augmented ISI will be performed on this section of piping, DCD Tier 2, FSAR Section 6.6 should be updated to state that these components are subject to augmented ISI and the augmented ISI should be described. If augmented ISI will not be performed, provide a justification on why additional ISI is not necessary considering that there may be an active degradation mechanism (FAC).

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10.03.06-27

Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix A, General Design Criteria 4 requires that SSCs important to safety shall accommodate the effects of environmental conditions during normal, off normal, and accident conditions. Safety-related components in the main steam and feedwater lines shall be designed with consideration for FAC.

Title 10 of the Code of Federal Regulations (10 CFR) Part 50.65 requires monitoring of the condition and operation of Structures, Systems, and Components (SSCs) to ensure that they are capable of maintaining their intended function. The functions are established from design goals which are based on operating experience. The requirements of 10 CFR 50.65 are applicable to non-safety systems "whose failure could cause a reactor scram or actuation of a safety-related system;" a main steam-line or feed-line break would result in an Engineered Safety Feature (ESF) actuation. Generic Letter (GL) 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning," defined a Flow Accelerated Corrosion (FAC) program that would meet the requirements of 10 CFR 50.65 for secondary, non-safety related systems.

The main feedwater system splits into two lines after the feedwater headers: the downcommer feedwater line and the economizer feedwater line. The downcommer feedwater line utilizes chrome-moly steel downstream of the flow control valves. The economizer feedwater line does not have chrome-moly steel in the same portion of the economizer line.

DCD Tier 2, FSAR Table 10.1-1 provides the flow rates of both lines. By using the pipe diameters specified in DCD Tier 2, FSAR Figure 10.4.7-1 and the flow data in Table 10.1-1, the staff calculates that the flow velocity in the economizer feedwater line should be comparable to, and possibly greater than, the flow velocity in the downcommer feedwater line. Considering that the economizer feedwater line has a greater flow rate than the downcommer feed water line, the consequences of a feedwater line break in the economizer line could be more severe than a feedwater break in the downcommer feedwater line. Yet, the downcommer feedwater line utilizes more FAC-resistant material than the economizer feedwater line.

Based on the observation above, explain why the use of FAC-susceptible carbon steel in the subject portion of the economizer feedwater line is adequate to ensure that FAC-related piping degradation does not occur in the economizer feedwater line.



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