

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.: 403-8454
SRP Section: 6.1.1 – Engineered Safety Features Materials
Application Section: 6.1.1
Date of RAI Issue: 02/10/2016

Question No. 06.01.01-2

Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix A, General Design Criteria 4 requires SSCs to be designed and fabricated to accommodate the effects of environmental conditions during normal, off normal, and accident conditions.

On November 13, 2015, the applicant provided supplemental information (ML15321A271) which clarified information in the original application and responded to issues identified by the staff. Issue #9 (AI 6-14.9) had the following response from KHNP:

Valves and Piping in the CS, ECC, and IW systems and all components which come into contact with the reactor coolant are fabricated with austenitic stainless steel. There is no allowance for wall thinning considered in the design of these systems and components. “

If the staff were to certify the APR-1400 design and a plant was built the Combined Operating Licenses would have a term of 40 years.

Provide the staff with a justification on how erosion/corrosion/abrasion/other environmental effects for 40 operating years of the ESF system would not reduce the thickness of the ESF components thereby challenging the operability of the ESF system.

Response

General corrosion of stainless steels in normal nuclear power plant applications is so low that it is not a concern from a structural standpoint; thus, a corrosion allowance for stainless steels is unnecessary, except in very thin sections. Actual wall thicknesses of ESF components are designed to be more than required so there is no concern regarding operability. ESF systems are not operating in during normal plant operation so erosion/abrasion of materials will not have an affect on the long term operability of ESF systems.

Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environment Report.

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.: 403-8454
SRP Section: 6.1.1 – Engineered Safety Features Materials
Application Section: 6.1.1
Date of RAI Issue: 02/10/2016

Question No. 06.01.01-3

Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix A, General Design Criteria 4 requires SSCs to be designed and fabricated to accommodate the effects of environmental conditions during normal, off normal, and accident conditions.

On July 29th, 2015 the staff and KHNP had a public meeting to discuss areas of the APR-1400 FSAR which could be supplemented with more information to improve the quality of the initial staff SER. One FSAR section that was discussed was Section 5.2.3.

Staff Issue #14 requested information on a 0.065% carbon limit for austenitic stainless steels; this carbon limit is greater than the staff recommendations in Regulatory Guide 1.44 “Control of the Processing and Use of Stainless Steel.”

The applicant responded that the 0.065% carbon limit was sufficient because reactor coolant system has a dissolved oxygen limit of 0.10 ppm. This control is an acceptable method for preventing intergranular failure as it is described in RG 1.44.

On November 13, 2015, the applicant provided supplemental information (ML15321A271) which clarified information in the original application and responded to issues identified by the staff. The sensitization controls in FSAR Section 6.1.1 were removed and a reference to FSAR Section 5.2.3 was added. The result of this change was that the sensitization controls for ESF components would be the same as reactor coolant system components.

The water source for the ESF system is the IRWST. This water source is not isolated from the containment atmosphere which allows the dissolved oxygen content to be higher than the 0.10 ppm limit in the RCS. Additionally, the IRWST water is not monitored during operation.

Provide the staff with a justification of how the sensitization controls for ESF components are sufficient considering the dissolved oxygen content of the ESF system is not controlled in the same manner as the reactor coolant system.

Response

As described in Regulatory Guide 1.44, B. Discussion, 'Dissolved oxygen concentration should be maintained below the limiting value of 0.10 ppm during periods when the material is at elevated temperatures' and C. Position, 4.a, 'material exposed to pressurized water reactor coolant that has a controlled concentration of typically less than 0.020 ppm, with a limiting value of 0.10 ppm dissolved oxygen at all temperatures above 200 degrees F during normal operation', since the temperature of ESF system is below 200 degrees F during normal operation, therefore, sensitization controls for ESF components met Regulatory Position of Regulatory Guide 1.44.

Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environment Report.

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.: 403-8454
SRP Section: 6.6.1 – Engineered Safety Features Materials
Application Section: 6.6.1
Date of RAI Issue: 02/10/2016

Question No. 06.01.01-4

Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix A, General Design Criteria 4 requires SSCs to be designed and fabricated to accommodate the effects of environmental conditions during normal, off normal, and accident conditions.

FSAR Section 6.1.1 states that cold-worked stainless steel will be subjected to an augmented in-service inspection (ISI) program. FSAR Section 6.6 discusses the general in-service inspection program for Class 2 and 3 systems including the augmented ISI:

“An augmented in-service inspection is conducted to provide reasonable assurance of the structural integrity of cold- worked austenitic stainless steel components (refer to Subsection 6.1.1.1). The COL applicant is to identify the implementation milestone for the augmented in-service inspection program (COL 6.6(2)).”

The Combined License item for augmented ISI is:

COL 6.6(2) The COL applicant is to identify the implementation milestone for the augmented in-service inspection program.

The FSAR does not provide a description of the augmented ISI that will be conducted on the cold-worked austenitic stainless steel. Add information to the FSAR on the inspections to be conducted or add a COL item to instruct a COL applicant to provide a description on the augmented ISI program for cold-worked austenitic stainless steel.

Response

DCD Tier 2, Section 6.6.8 and Table 1.8-2 will be revised to require the COL applicant to provide a description of the augmented in-service inspection which is to be conducted to provide reasonable assurance of the structural integrity of cold-worked austenitic stainless steel

components, as indicated in the attachment associated with this response.

Impact on DCD

DCD Tier 2, Section 6.6.8 and Table 1.8-2 will be revised, as indicated on the Attachment associated with this response.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environment Report.

APR1400 DCD TIER 2

- b. For those portions of high-energy fluid system piping between the containment penetration wall and auxiliary building anchor wall beyond isolation valve, the extent of in-service examination completed during each inspection interval provides 100 percent volumetric examination of circumferential and longitudinal pipe welds within the boundary of these portions of piping.
- c. The areas subject to examination are defined in accordance with examination categories C-F-1 and C-F-2 for Class 2 piping welds in ASME Section XI, Article IWC-2000.

Information concerning areas subject to examination, method of examination and frequency of examination is contained in the in-service inspection program. The program includes the high-energy fluid piping systems described in Subsection 3.6.1 and 3.6.2.

An augmented in-service inspection is conducted to provide reasonable assurance of the structural integrity of cold-worked austenitic stainless steel components (refer to Subsection 6.1.1.1). The COL applicant is to identify the implementation milestone for the augmented in-service inspection program (COL 6.6(2)).

6.6.9 Combined License Information

- COL 6.6(1) The COL applicant is to identify the implementation milestones for ASME Section XI in-service inspection program for ASME Section III Class 2 and 3 components.
- COL 6.6(2) The COL applicant is to identify the implementation milestone for the augmented in-service inspection program.

and describe

6.6.10 References

1. 10 CFR 50.55a (g), "Inservice Inspection Requirements," U.S. Nuclear Regulatory Commission.
2. ASME Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," The American Society of Mechanical Engineers, the 2007 Edition with the 2008 Addenda.

APR1400 DCD TIER 2

Table 1.8-2 (9 of 29)

| Item No. | Description |
|------------|---|
| COL 6.1(1) | The COL applicant is to identify the implementation milestones for the coatings program. |
| COL 6.2(1) | The COL applicant is to identify the implementation milestone for the CILRT program. |
| COL 6.3(1) | The COL applicant is to prepare operational procedures and maintenance programs as related to leak detection and contamination control. |
| COL 6.3(2) | The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations. |
| COL 6.4(1) | The COL applicant is to provide automatic and manual operating procedures for the control room HVAC system, which are required in the event of a postulated toxic gas release. |
| COL 6.4(2) | The COL applicant is to provide the details of specific toxic chemicals of mobile and stationary sources and evaluate the MCR habitability based on the recommendations in NRC RG 1.78 to meet the requirements of TMI Action Plan Item III.D.3.4 and GDC 19. |
| COL 6.4(3) | The COL applicant is to identify and develop toxic gas detection requirements to protect the operators and provide reasonable assurance of the MCR habitability. The number, locations, sensitivity, range, type, and design of the toxic gas detectors are to be developed by the COL applicant. |
| COL 6.5(1) | The COL applicant is to provide the operational procedures and maintenance program as related to leak detection and contamination control. |
| COL 6.5(2) | The COL applicant is to maintain the complete documentation of system design, construction, design modifications, field changes, and operations. |
| COL 6.6(1) | The COL applicant is to identify the implementation milestones for ASME Section XI inservice inspection program for ASME Code Section III Class 2 and 3 components. |
| COL 6.6(2) | The COL applicant is to identify the implementation milestone for the augmented inservice inspection program. |
| COL 6.8(1) | The COL applicant is to provide the operational procedures and maintenance program for leak detection and contamination control. |
| COL 6.8(2) | The COL applicant is to provide the preparation of cleanliness, housekeeping, and foreign materials exclusion program. |
| COL 6.8(3) | The COL applicant is to maintain the complete documentation of system design, construction, design modifications, field changes, and operations. |
| COL 6.8(4) | The COL applicant is responsible for the establishment and implementation of the Maintenance Rule program in accordance with 10 CFR 50.65. |
| COL 7.5(1) | The COL applicant is to provide a description of the site-specific AMI variables such as wind speed, and atmosphere stability temperature difference. |
| COL 7.5(2) | The COL applicant is to provide a description of the site-specific EOF. |


 and describe

APR1400 DCD TIER 2

- b. For those portions of high-energy fluid system piping between the containment penetration wall and auxiliary building anchor wall beyond isolation valve, the extent of in-service examination completed during each inspection interval provides 100 percent volumetric examination of circumferential and longitudinal pipe welds within the boundary of these portions of piping.
- c. The areas subject to examination are defined in accordance with examination categories C-F-1 and C-F-2 for Class 2 piping welds in ASME Section XI, Article IWC-2000.

Information concerning areas subject to examination, method of examination and frequency of examination is contained in the in-service inspection program. The program includes the high-energy fluid piping systems described in Subsection 3.6.1 and 3.6.2.

An augmented in-service inspection is conducted to provide reasonable assurance of the structural integrity of cold-worked austenitic stainless steel components (refer to Subsection 6.1.1.1). The COL applicant is to identify the implementation milestone for the augmented in-service inspection program (COL 6.6(2)).

6.6.9 Combined License Information

- COL 6.6(1) The COL applicant is to identify the implementation milestones for ASME Section XI in-service inspection program for ASME Section III Class 2 and 3 components.
- COL 6.6(2) The COL applicant is to identify the implementation milestone for the augmented in-service inspection program.

and describe

6.6.10 References

1. 10 CFR 50.55a (g), "Inservice Inspection Requirements," U.S. Nuclear Regulatory Commission.
2. ASME Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," The American Society of Mechanical Engineers, the 2007 Edition with the 2008 Addenda.

APR1400 DCD TIER 2

Table 1.8-2 (9 of 29)

| Item No. | Description |
|------------|---|
| COL 6.1(1) | The COL applicant is to identify the implementation milestones for the coatings program. |
| COL 6.2(1) | The COL applicant is to identify the implementation milestone for the CILRT program. |
| COL 6.3(1) | The COL applicant is to prepare operational procedures and maintenance programs as related to leak detection and contamination control. |
| COL 6.3(2) | The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations. |
| COL 6.4(1) | The COL applicant is to provide automatic and manual operating procedures for the control room HVAC system, which are required in the event of a postulated toxic gas release. |
| COL 6.4(2) | The COL applicant is to provide the details of specific toxic chemicals of mobile and stationary sources and evaluate the MCR habitability based on the recommendations in NRC RG 1.78 to meet the requirements of TMI Action Plan Item III.D.3.4 and GDC 19. |
| COL 6.4(3) | The COL applicant is to identify and develop toxic gas detection requirements to protect the operators and provide reasonable assurance of the MCR habitability. The number, locations, sensitivity, range, type, and design of the toxic gas detectors are to be developed by the COL applicant. |
| COL 6.5(1) | The COL applicant is to provide the operational procedures and maintenance program as related to leak detection and contamination control. |
| COL 6.5(2) | The COL applicant is to maintain the complete documentation of system design, construction, design modifications, field changes, and operations. |
| COL 6.6(1) | The COL applicant is to identify the implementation milestones for ASME Section XI inservice inspection program for ASME Code Section III Class 2 and 3 components. |
| COL 6.6(2) | The COL applicant is to identify the implementation milestone for the augmented inservice inspection program. |
| COL 6.8(1) | The COL applicant is to provide the operational procedures and maintenance program for leak detection and contamination control. |
| COL 6.8(2) | The COL applicant is to provide the preparation of cleanliness, housekeeping, and foreign materials exclusion program. |
| COL 6.8(3) | The COL applicant is to maintain the complete documentation of system design, construction, design modifications, field changes, and operations. |
| COL 6.8(4) | The COL applicant is responsible for the establishment and implementation of the Maintenance Rule program in accordance with 10 CFR 50.65. |
| COL 7.5(1) | The COL applicant is to provide a description of the site-specific AMI variables such as wind speed, and atmosphere stability temperature difference. |
| COL 7.5(2) | The COL applicant is to provide a description of the site-specific EOF. |


 and describe