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## 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.: 452-8545  
SRP Section: 10.03.06 – Steam and Feedwater System Materials  
Application Section: 10.3.6  
Date of RAI Issue: 03/28/2016

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### **Question No. 10.03.06-19**

In response to RAI 314-8378, Question 28615 (Question 10.03.06-5) the applicant deleted information from the FSAR. The deleted information described the material specifications for components between 1) the high pressure turbine and the moisture separator reheater and 2) the moisture separator reheater and the low pressure turbine.

The rationale provided by the applicant was that the systems were not safety related and therefore should be deleted from the FSAR.

GL 89-08 does not differentiate between safety related and non-safety related components; it applies to both systems. 10 CFR 50.65 requires licensees to implement maintenance programs that account for operating experience. FAC has and continues to cause failure of moisture separator reheaters (LER 2015-02 from Davis-Besse <http://pbadupws.nrc.gov/docs/ML1519/ML15194A013.pdf> ).

The FSAR no longer contains sufficient information for staff review.

The applicant should revoke the response to RAI 314-8378 Question 28615 and provide the staff with an answer to Question 28615.

Additionally, the applicant should evaluate the current response to RAI 314-8378, Question 28621 (10.03.06-7).

### **Response**

T/G design has not been selected in APR1400 DCD. The COL applicant will select the optimum design from a plant safety and reliability perspective. Material A588 Gr.C is used by one specific T/G manufacturer. Since a T/G vendor has not been picked there is no material specification for the components between 1) the high pressure turbine and the moisture separator reheater and 2) the moisture separator reheater and the low pressure turbine in the DCD.

The material specification will be described by COL applicant when the T/G design is selected.

Therefore, a COL item will be added that states, "The COL applicant is to provide the material specifications for the components between 1) the high pressure turbine and the moisture separator reheater and 2) the moisture separator reheater and the low pressure turbine when the T/G design is selected. The COL applicant is also to specify that the pipe thickness is adequate for the plant design life in terms of FAC in place of the components between 1) the high pressure turbine and the moisture separator reheater and 2) the moisture separator reheater and the low pressure turbine when the T/G design is selected"

The response for RAI 314-8378, Question 28615 (10.03.06-5) is superseded by the response provided here for RAI 452-8545, Question 10.03.06-19. There was an editorial error in class of the pipe chase to the AF pump turbine including the fittings. Therefore, those typos are corrected in this response with Class 3 being assigned.

There is no impact on the response to RAI 314-8378, Question 28621 (10.03.06-7). The items related to TG vendor have been deleted in Table 10.3.2-3 in the response to Question 28621 (10.03.06-7)

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### **Impact on DCD**

DCD Tier 2, Table 1.8-2 (16 of 29), 10.3.2-3, Subsection 10.3.6.3, 10.3.7 will be revised as indicated on the attached markup.

### **Impact on PRA**

There is no impact on the PRA.

### **Impact on Technical Specifications**

There is no impact on the Technical Specifications.

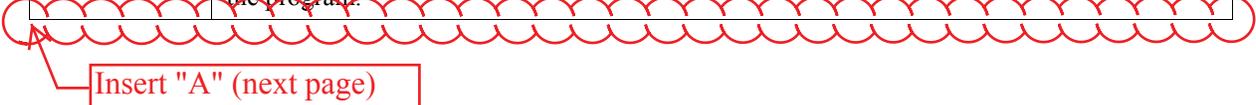
### **Impact on Technical/Topical/Environmental Reports**

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

## APR1400 DCD TIER 2

Table 1.8-2 (16 of 29)

Item No.	Description
COL 9.5(7)	The COL applicant is to provide the fire brigade radio systems.
COL 9.5(8)	The COL applicant is to provide the LAN and VPN system.
COL 9.5(9)	The COL applicant is to provide the emergency offsite communication system including dedication hotline, local law enforcement radio equipment, and wireless communication system.
COL 9.5(10)	The COL applicant is to specify that adequate and acceptable sources of fuel oil are available, including the means of transporting and recharging the fuel storage tank, following a design basis accident.
COL 9.5(11)	The COL applicant is to provide a description of the offsite communication system that interfaces with the onsite communication system, including type of connectivity, radio frequency, normal and backup power supplies, and plant security system interface.
COL 9.5(12)	The COL applicant is to provide the security radio system that consists of a base unit, mobile units, and portable units.
COL 9.5(13)	The COL applicant is to provide the local law enforcement communications including dedicated conventional telephone and radio-transmitted two-way communication system.
COL 9.5(14)	The COL applicant is to provide electric power for the security lighting system.
COL 9.5(15)	The COL applicant is to provide the system design information of AAC GTG building HVAC system including flow diagram, if the AAC GTG building requires the HVAC system.
COL 10.2(1)	The COL applicant is to identify the turbine vendor and model.
COL 10.2(2)	The COL applicant is to identify how the functional requirements for the overspeed protection system are met and provide a schematic of the TGCS and protection systems from sensors through valve actuators.
COL 10.2(3)	The COL applicant is to provide a description of how the turbine missile probability analysis conforms with Subsection 10.2.3.6 to ensure that requirements for protection against turbine missiles (e.g., applicable material properties, method of calculating the fracture toughness properties per SRP Section 10.2.3 Acceptance Criteria, preservice inspections) will be met.
COL 10.3(1)	The COL applicant is to provide operating and maintenance procedures including adequate precautions to prevent water (steam) hammer and relief valve discharge loads and water entrainment effects in accordance with NUREG-0927 and a milestone schedule for implementation of the procedure.
COL 10.3(2)	The COL applicant is to establish operational procedures and maintenance programs as related to leak detection and contamination control.
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.



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**"A"**

COL 10.3(6)

The COL applicant is to provide the description about the material specifications for components between 1) the high pressure turbine and the moisture separator reheater and 2) the moisture separator reheater and the low pressure turbine when the T/G design is selected. The COL applicant is also to specify that the pipe thickness is adequate for the plant design life in terms of FAC in place of the components between 1) the high pressure turbine and the moisture separator reheater and 2) the moisture separator reheater and the low pressure turbine when the T/G design is selected.

**APR1400 DCD TIER 2**

- d. Condensate piping from the deaerator inlet control valves to the deaerator is made of chrome-moly materials. Other condensate piping is made of carbon steel with a 1.524 mm (0.06 in) additional margin in the design.
- e. As shown in Table 10.3.2-2 and Table 10.3.2-3, the entire portion of MSS piping is made of carbon steel with a 0.889 mm (0.035 in) additional margin in design.
- f. The entire portion of extraction steam piping is made of chrome-moly materials
- g. Most feedwater heater drain piping is made of carbon steel with 1.524 mm (0.06 in) additional margin in design. FAC-susceptible portions such as downstream components of control valves are made of high-content chrome-moly materials.

For safety/non-safety carbon steel piping with relatively mild potential for FAC degradation, the required design wall thickness is based on piping design pressure, design temperature, and allowable stress in accordance with ASME Section III NC/ND-3640 or ASME B31.1 Paragraph 104. The specified wall thickness (prior to fabrication) is a standardized wall thickness stipulated in ASME B36.10M (Reference 20). It is determined to exceed the required design wall thickness with consideration of minus tolerances of the thicknesses by the appropriate amount to account for the expected wall thickness loss during fabrication. The piping layout includes a consideration of several features for the various piping systems to minimize the incidence of FAC and erosion/corrosion in piping as follows:

- a. Elimination of high-turbulence points wherever possible (e.g., increasing the pipe length downstream of flow orifice, control valve)
- b. Application of a suitable flow orifice to minimize cavitation possibilities (e.g., using the multi-plate orifice and multi-hole orifice)
- c. Application of long-radius elbows
- d. Application of smooth transition at shop or field welds
- e. Selection of pipe diameter to have velocities within industry-recommended values

The COL applicant is to provide the description about the material specifications for components between 1) the high pressure turbine and the moisture separator reheater and 2) the moisture separator reheater and the low pressure turbine when the T/G design is selected. The COL applicant is also to specify that the pipe thickness is adequate for the plant design life in terms of FAC in place of the components between 1) the high pressure turbine and the moisture separator reheater and 2) the moisture separator reheater and the low pressure turbine when the T/G design is selected. (COL 10.3(6))

**APR1400 DCD TIER 2**

For the safety/non-safety carbon steel piping with relatively mild FAC degradation, the FAC monitoring program is prepared and implemented using knowledge acquired from experience in pipe wall thinning management of the operating nuclear power plants in Korea. The FAC monitoring program includes preservice thickness measurements of as-built piping considered susceptible to FAC and erosion/corrosion. By performing this preservice measurement, the piping thickness margin that is used as a wall thinning margin is known. By combining the measurement with regular inspections, the frequency of the pipe replacement can be predicted. Reasonable assurance of the integrity and safety of plants is provided by conducting inspection and maintenance during the service life of the plant and replacing piping if necessary. The type of fluid, flow rates, fluid temperatures, and pressure of ASME Class 2 and 3 piping for steam and feedwater system are given in Table 10.3.2-5.

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 (COL 10.3(3)).

### 10.3.7 Combined License Information

COL 10.3(1) The COL applicant is to provide operating and maintenance procedures including adequate precautions to prevent water (steam) hammer and relief valve discharge loads and water entrainment effects in accordance with NUREG-0927 and a milestone schedule for implementation of the procedure.

COL 10.3(2) The COL applicant is to establish operational procedures and maintenance programs as related to leak detection and contamination control.

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.

APR1400 DCD TIER 2

RAI 314-8378\_Question 10.03.06-3  
 RAI 314-8378\_Question 10.03.06-5  
 RAI 314-8378\_Question 10.03.06-7

RAI 452-8545\_Question 10.03.06-19

Table 10.3.2-3

Main Steam Branch Piping Design Data (2.5 Inches and Larger)

Segment	Material Specification	Nominal OD (mm (in))	ASME Class
Main steam piping to MSADV	SA106 Gr. C (seamless)	500 (20)	Section III, Class 2
MSADV discharge piping to silencer	A106 Gr. B (seamless)	400 (16)	B31.1
Main steam piping to MSSV	SA-105	200 (8)	Section III, Class 2
MSSV discharge piping to vent stack	A106 Gr. B (seamless)	250 (10), 650 (26)	B31.1
Main steam piping to pipe chase	SA-333 Gr. 6 (seamless)	200 (8)	Section III, Class 2
Pipe chase to AF pump turbine steam isolation valve	SA-106 Gr. B (seamless)	200 (8)	Section III, Class 3
Fittings	ASTM (S)A-234 WPB	65 (2.5) and larger	Section III, Class 2
Flanges	SA-350 LF2, ASTM A-105	65 (2.5) ~ 600 (24)	Section III, Class 2
Valves (globe, gate, check)	ASTM (S)A-216, WCB or WCC, A352 LCB	65 (2.5) and larger	Section III, Class 2
Main steam piping to moisture separator reheater	A106 Gr. B (seamless)	250 (10), 300 (12)	B31.1
Fittings	ASTM A-234, WPB	250 (10), 300 (12)	
Flanges	ASTM A-105	80 (3) and larger	
Valves (globe, gate, check)	ASTM A-216, WCB or WCC	65 (2.5) ~ 650 (26)	
HP turbine to moisture separator reheater	A588 Gr. C (welded)	1,050 (42)	B31.1
Moisture separator reheater to LP turbine	A588 Gr. C (welded)	1,050 (42)	B31.1
Fittings	ASTM A-234, WPB	1,050 (42)	

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RAI 314-8378\_ Question 10.03.06-3  
 RAI 314-8378\_ Question 10.03.06-5  
 RAI 314-8378\_ Question 10.03.06-7

RAI 452-8545 Question 10.03.06-19

Table 10.3.2-3

Main Steam Branch Piping Design Data (2.5 Inches and Larger)

Segment	Material Specification	Nominal OD (mm (in))	ASME Class
Main steam piping to MSADV	SA-106 Gr.C (seamless)	500 (20)	Section III, Class 2
MSADB discharge piping to silencer	A-106 Gr.B (seamless)	400 (16)	B31.1
Main steam piping to MSSV	SA-105	150 (6)	Section III, Class 2
MSSV discharge piping to vent stack	A-106 Gr.B (seamless)	250 (10) 650 (26)	B31.1
Main steam piping to pipe chase	SA-333 Gr.6 (seamless)	200 (8)	Section III, Class 2
Pipe chase to AF pump turbine steam isolation valve	SA-106 Gr.B (seamless)	200 (8)	Section III, Class 2
Fittings	ASTM(S)A-234 WPB	65 (2.5) and larger	Section III, Class 2

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RAI 452-8545 Question 10.03.06-19

Table 10.3.2-3

B

Main Steam Branch Piping Design Data (2.5 Inches and Larger)

Segment	Material Specification	NPS	DN	Outside Diameter (in)	Remark	ASME Class
Main steam piping to MSADV	SA-106 Gr.C (seamless)	20	500	20.000	-	Section III, Class 2
MSADV discharge piping to silencer	A-106 Gr.B (seamless)	16	400	16.000	-	B31.1
Main steam piping to MSSV	SA-105	6	150	6.625	-	Section III, Class 2
MSSV discharge piping to vent stack	A-106 Gr.B (seamless)	10 26	250 650	10.750 26.000	-	B31.1
Main steam piping to pipe chase	SA-333 Gr.6 (seamless)	8	200	8.625	-	Section III, Class2
Pipe chase to AF pump turbine steam isolation valve	SA-106 Gr.B (seamless)	8	200	8.625	-	Section III, Class 3
Fittings	ASTM(S)A-234 WPB	2.5 and larger	65 and larger	2.875 and larger	-	Section III, Class 3