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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.: 288-8328  
SRP Section: 10.02.03 – Turbine Rotor Integrity  
Application Section: 10.02.03  
Date of RAI Issued: 11/03/2015

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### **Question No. 10.02.03-1**

APR 1400 FSAR Tier 2, Section 10.2.3.5 states that the COL applicant shall provide the site-specific turbine rotor inservice inspection program and inspection interval consistent with the manufacturer's turbine missile analysis. However, there is no COL Information Item for providing this inservice inspection program or the turbine valve inservice test program. Therefore, the staff requests that an applicable COL Information Item be added to FSAR Section 10.2.5 and Table 1.8-2 which specifies that the COL applicant shall provide the site-specific turbine rotor inservice inspection program and inspection interval, consistent with the manufacturer's turbine missile analysis, including the turbine valve test program and test frequency to be consistent with FSAR Section 10.2.3.5, and as specified by SRP Section 10.2.3.

### **Response**

As noted in the RAI, FSAR Section 10.2.3.5 discusses in-service test and inspections. Also, 10.2.3.6 requires the turbine missile probability analysis address preservice test and inspection procedures and criteria (item g) and in-service inspection and testing of valves (item j).

COL 10.2(3) was intended to ensure the COL applicant addressed all relevant criteria, including pre-service and in-service inspections. It currently states "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." To address the concern identified by the RAI, in-service tests and inspections will be added after "preservice inspections"

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**Impact on DCD**

DCD Subsection 10.2.3, Subsection 10.2.5 Combined License Information item (3) and Table 1.8-2 will be revised as shown in the attached markup.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical/Environmental Report**

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

**Impact on Technical Specifications**

There is no impact on the Technical Specifications.

**APR1400 DCD TIER 2**10.2.3 Turbine Rotor Integrity

Turbine rotor integrity is provided by the integrated combination of material selection, rotor design, fracture toughness requirements, tests, and preservice and inservice inspection. This combination results in a low probability of a condition that would cause a rotor failure.

The COL applicant shall identify the turbine vendor and model. Also, 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 10.2(3)).

, in-service tests and inspections

The as-built turbine material properties, turbine rotor and blade forgings, preservice inspection and testing results and in-service testing and inspection requirements shall be verified by ITAAC to meet the requirements defined in the turbine missile probability analysis.

10.2.3.1 Material Selection

Turbine rotor forgings are made from vacuum treated or remelted Ni-Cr-Mo-V alloy steel components using processes that minimize flaw occurrence, provide reasonable assurance of uniform strength, and provide adequate fracture toughness. Undesirable elements, such as sulfur and phosphorus, are controlled to the lowest practicable concentrations consistent with good feedstock selection and melting practice, and consistent with obtaining adequate initial and long-life fracture toughness for the environment in which the parts operate. The turbine rotor material conforms with the chemical property limits of ASTM A470 (Reference 3). The chemical composition of manufacturer's material for the rotor steel has lower or equal limitations than indicated in the ASTM standard for phosphorous, sulphur, and antimony as described in Table 10.2.3-1. The rotor forgings are heat treated and tested prior to the final machining process.

Turbine designs utilize rotors produced from large integral forgings or from multiple wrought components. Acceptable material properties will be consistent with component size and fabrication method. Material testing has shown that fracture appearance transition temperature (FATT) increases (and Charpy V-notch energy decreases) from the

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Appropriate radiological controls can be applied to steam systems in the event that such leakage occurs. Discussions of the radiological aspects of primary-to-secondary leakage are presented in Chapter 11.

**10.2.5 Combined License Information**

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.

, in-service tests  
and inspections

**10.2.6 References**

1. ASME Section VIII, Division 1, "Rules for Construction of Pressure Vessels," the American Society of Mechanical Engineers, the 2013 Edition.
2. IEEE Standard C50.13-2014, "IEEE Standard for Cylindrical - Rotor, 50 Hz and 60 Hz Synchronous Generators Rated 10 MVA and Above," Institute of Electrical and Electronics Engineers, 2014.
3. ASTM A470, "Standard Specification for Vacuum-Treated Carbon and Alloy Steel Forgings for Turbine Rotors and Shafts," American Society for Testing and Materials, 2010.
4. ASTM A370, "Standard Test Methods and Definitions for Mechanical Testing of Steel Products," American Society for Testing and Materials, 2014.

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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.

, in-service tests  
and inspections