REVISED 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.:	**503-8641**
SRP Section:	**05.04.01.01 – Pump Flywheel Integrity (PWR)**
Application Section:	**5.4.1.1**
Date of RAI Issue:	**07/06/2016**

Question No. 05.04.01.01-9

In response to RAI 341-8410, question 05.04.01.01-3, your letter dated April 29, 2016, did not provide a sufficient basis for using the design acceptance criteria of one-third ultimate strength in lieu of one-third yield strength for the flywheel design stress limit. The use of one-third of the yield strength as a design acceptance criteria has been documented by the NRC in SRP 5.4.1.1 and RG 1.14 as providing an acceptable level of safety for this component. The use of one-third of the ultimate strength of the material as the basis for the flywheel design stress limit is unacceptable absent a technical basis demonstrating why the use of such a criteria will provide for an acceptable level of safety against flywheel failure. Revise the APR1400 Design Certification to apply a RCP flywheel stress limit of one-third of the yield strength of the material, or provide a technical justification regarding why the use of one-third of the ultimate strength as the design stress limit will provide an acceptable level of safety against potential failure of the flywheels.

Your response also stated that the “NRC staff used an approximate conversion factor of 1 MPa = 145 psi to arrive at the value of 800/3 MPa = 38,667 psi.” The NRC did not convert the units from metric to standard, but simply used the flywheel material ultimate strength (standard units) specified in the flywheel analysis report of 116,000 psi, and divided it by three to obtain 38,667 psi. Therefore, if the use of the one-third ultimate strength criteria is to be justified as noted above, the acceptance criteria should be revised to specify 38,667 psi in the technical report APR1400-A-M-NR-14001-P, “KHNP APR 1400 Flywheel Integrity Report,” Revision 0, dated November 24, 2014.

Response – (Rev. 2)

Technical Report APR1400-A-M-NR-14001-P has been revised to apply a RCP flywheel stress limit of one-third of the yield strength of the material. The minimum specified yield strength (Sy = 640 MPa (92,824) psi) is used instead of the preliminary measured Sy value reported in Revision 0 of this response.

The description of the deviation from SRP 5.4.1.1, Rev.3 in DCD Tier 2, Table 1.9-2 will be deleted.

Impact on DCD

DCD Table 1.9-2 and Subsection 5.4.18 will be revised as indicated in the attachment.

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

Technical Report APR1400-A-M-NR-14001-P has been revised as indicated in the attachment.

APR1400 DCD TIER 2

RAI 341-8410 - Question 05.04.01.01-3

RAI 503-8641 - Question 05.04.01.01-9_Rev.1

Table 1.9-2 (9 of 33)

SRP Section/Title	Revision / Issue Date	Conformance or Summary Description of Deviation	DCD Tier 2 Section
5.3.3 – Reactor Vessel Integrity	Rev. 2 03/2007	The APR1400 conforms with this SRP.	5.3.3
5.4 – Reactor Coolant System Component and Subsystem Design	Rev. 2 03/2007	The APR1400 conforms with this SRP.	5.4
5.4.1.1 – Pump Flywheel Integrity (PWR)	Rev. 3 05/2010	The APR1400 conforms with this SRP ~~with the following exception:~~ • ~~Design stress criteria.~~	5.4.1.1
5.4.2.1 – Steam Generator Materials	Rev. 3 03/2007	The APR1400 conforms with this SRP.	5.4.2.1
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~~• Design stress criteria~~

~~The acceptance criterion for total stress in the flywheel at standstill and normal operating speed is 1/3 ultimate tensile strength, instead of the SRP 5.4.1.1 suggested 1/3 yield strength.~~

~~The stresses in the flywheel are typically a function of the flywheel material, the shrink fit, and the rotational speed. The Siemens flywheel design considers all three attributes in the material selection and specific manufacturing processes for compliance with the regulatory guidance. The design also factors in field experience gained from successfully operating flywheels of similar design in Germany and South Korea for more than four decades.~~

~~The flywheel design specification requires that no flywheel separation at speeds less than 150% of normal operation would occur for the APR1400 flywheel assembly. In order to maintain a shrink-fit stress that would meet this requirement, the criterion on combined stresses at normal operation was chosen to limit the maximum stress to 1/3 minimum Su, instead of 1/3 minimum Sy. This exception, taken for the APR1400 flywheel design, still provides significant margin relative to the material yield strength, albeit not 33% as suggested by the SRP guidance.~~

COL 5.4(4) The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations of SCS.

COL 5.4(5) The COL applicant is to verify the as-built RV support material properties and 60-year neutron fluence.

COL 5.4(6) The COL applicant is to provide a procedure to protect the plant personnel from harsh environment and lengthen the work time within containment during hatch closure.

5.4.18 References

1. ASME Boiler and Pressure Vessel Code, Section III, "Rules for Construction of Nuclear Facility Components," The American Society of Mechanical Engineers, the 2007 Edition with the 2008 Addenda.

2. 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants." U.S. Nuclear Regulatory Commission.

3. Regulatory Guide 1.14, "Reactor Coolant Pump Flywheel Integrity," Rev. 1, U.S. Nuclear Regulatory Commission, August 1975.

4. APR1400-A-M-NR-14001-P, "KHNP APR1400 Flywheel Integrity Report," ~~KHNP, November 2014.~~ Rev. 3, KHNP, July 2017.

5. 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.

6. APR1400-A-M-NR-14002-P, "Extended Loss of AC Power Capability for APR1400 KSB RCP Seals," Rev. 1, KHNP, May 2016.

7. ASME PTC 8.2, "Centrifugal Pumps," The American Society of Mechanical Engineers, 1990.

8. NEMA MG-1, "Motors and Generators," National Electrical Manufacturers Association, 2009 (with 2010 Revision 1).