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.:	**81-8000**
SRP Section:	**3.9.3 - ASME CODE CLASS 1, 2, AND 3 COMPONENTS AND COMPONENT SUPPORTS,AND CORE SUPPORT STRUCTURES**
Application Section:	**3.9.3**
Date of RAI Issued:	**07/16/2015**

Question No. 03.10-6

In Table 3.9-6, “Stress Criteria for ASME Section III Class 2 and 3 Inactive Pumps,” in DCD Tier 2 provides a list of stress limits for various plant conditions to be applied to ASME Boiler and Pressure Vessel Code, Section III, Class 2 and 3 “inactive” pumps.

The NRC staff requests that the applicant revise Section 3.9, “Mechanical Systems and Components” in DCD Tier 2 to clarify its definition of “inactive” components and to identify any “inactive pumps” for the APR1400 design in the DCD.

Response – (Rev. 1)

Section 3.9.3.3 of the DCD will be revised to clarify the application of “active” components and to change the term “inactive” to “non-active” in DCD Table 3.9-6 for the APR1400 design.

As identified, the term “inactive” in the title of Table 3.9-6 is not a defined term in the DCD; although, inactive and non-active were meant to be the same. Therefore, in order to be consistent with the other design documents (e.g., Design Specifications) and industry nomenclature, the term will be changed from “inactive” to “non-active” and defined as those components whose operability is not relied upon to perform a safety related function for the various transients and plant conditions. ASME Section III Class 2 and 3 non-active pumps include the charging pumps, auxiliary charging pump, boric acid makeup pumps, holdup pumps, and reactor drain pumps.

Stress limits for non-active pumps and active pumps are shown in Table 3.9-6 and Table 3.9-7, respectively.

Impact on DCD

DCD Section 3.9.3.3 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

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

Non-active

The design and analysis requirements for the MSSVs, MSADVs, and discharge piping for the steam line are described in Subsection 10.3.2.

A relief valve on each of the SCS suction lines provides LTOP for RCS in a failure that initiates the pressure transient while in shutdown cooling and also can prevent overpressurization of the SCS. These relief valves are addressed in Subsection 5.4.7.

3.9.3.2.3 Pressure Relief Devices for Class 3 Systems and Components

Pressure-relieving devices for ASME Section III Class 3 systems include relief valves and safety valves on heat exchangers, tanks, and piping lines to prevent overpressurization of the components and systems. The thrust load due to the valve opening is usually calculated using static analysis, and the load from static analysis is considered as input to the piping analysis with a dynamic load factor of 2.0. In case the static analysis produces undesirably conservative results, the valve thrust load is accomplished using dynamic analysis.

3.9.3.2.4 Pressure Relief Device Discharge System Design and Analysis

ASME Section III, Appendix O describes two types of discharge systems for pressure relief devices: open-discharge systems and closed-discharge systems. An open-discharge system discharges fluid directly to the atmosphere or to a vent pipe that is open to the atmosphere. A closed-discharge system is hard-piped to a distant location or closed tank. ASME Section III, Appendix O also describes the layout considerations and limits for both types of systems, as well as design equations and considerations for analysis of these systems. The APR1400 design conforms with these requirements.

3.9.3.3 Pump and Valve Operability Assurance

3.9.3.3.1 Operability Assurance Program

Non-active components are those whose operability is not relied upon to perform a safety related function for the various transients and plant conditions.

components

Active ~~pumps and valves~~ are defined as pumps and valves and those components that perform a mechanical motion in order to shut down the plant, maintain the plant in a safe shutdown condition, or mitigate the consequences of a postulated event. The functional design and qualification of safety-related ~~pumps and valves~~ are performed in accordance

active components

3.9.3.3.2 Pump Operability

ASME Class 2 and 3 safety-related active pumps are listed in Table 3.9-18. The following criteria are employed in a qualification program to ensure operability of the pumps required to function during and following design basis events.

a. Analysis, test, or a combination of test and analysis are used in accordance with ASME QME-1-2007 as endorsed by NRC RG 1.100 to confirm the adequacy of the pumps to function over the expected range of service conditions specified, including design basis event and post-design-basis event conditions, as well as inservice testing (IST) conditions.

b. The loads imposed by the attached piping along with the sustained dynamic and seismic loads are taken into account. The design specification includes applicable loading combinations and design stress limits for the pumps. In order to provide reasonable assurance of operability under combined loadings, the stresses resulting from the applied test loads envelop the specified service stress limit for which the pump's operability is intended. Design stress limits applied in evaluating loading combinations are described in Subsection 3.9.3.1.3.

3.9.3.3.3 Valve Operability

Safety-related active valves are listed in Table 3.9-4. ASME Class 1, 2, and 3 valves are designed and analyzed according to the requirements of ASME Section III, subarticles

~~Inactive pumps are those whose operability is not relied upon to perform a safety related function for the various transients and plant conditions.~~ ASME Section III Class 2 and 3 non-active pumps include~~:~~ the charging pumps, auxiliary charging pump, boric acid makeup pumps, holdup pumps, and reactor drain pumps. Stress limits for non-active and active pumps are shown in Table 3.9-6 and Table 3.9-7, respectively.

a. Analysis, test, or a combination of test and analysis are used in accordance with ASME QME-1-2007 as endorsed by NRC RG 1.100 to confirm the adequacy of the valves to function over the expected range of service conditions specified, including design basis event and post-design-basis event conditions, as well as IST conditions.

b. The loads imposed by the attached piping along with the sustained dynamic and seismic loads are taken into account. The design specification includes applicable loading combinations, and design stress limits for the valves. In order to provide reasonable assurance of operability under combined loadings, the stresses resulting from the applied test loads envelop the specified service stress limit for which the valve's operability is intended. Design stress limits applied in evaluating loading combinations are described in Subsection 3.9.3.1.

The safety-related valves are subjected to a series of tests prior to service and during the plant life. Prior to installation, the following tests are performed:

a. Shell hydrostatic test to ASME Section III requirements

b. Backseat and main seat leakage tests

c. Disc hydrostatic test

d. Functional tests to verify that valve opens and closes as required when subjected to the design differential pressure and flow

Cold hydro qualification tests, hot functional qualification tests, and periodic in-service operational tests are performed in situ to verify and provide reasonable assurance of the functional ability of the valves. These tests provide reasonable assurance of the reliability of the valve for the design life of the plant.

3.9.3.3.4 Non-NSSS Active ASME Code Class 2 and 3 Pumps and Class 1, 2, and 3 Valves

Stress limits for active and non-active valves are shown in Table 3.9-9 and Table 3.9-8, respectively.

ASME Class 2 and 3 safety-related active pumps are listed in Table 3.9-18. The following criteria are employed in a qualification program to provide reasonable assurance of operability of the pumps required to function during and following design basis events.

Table 3.9-6

Non-active

Stress Criteria for ASME Section III Class 2 and Class 3 ~~Inactive~~ Pumps

Plant Condition	Service Limits(1)	Loads	Stress Limits(2)	P_{max}(3)	Subsections(5)
Design	Design	Sustained loads: pressure, weight, other mechanical loads	$\sigma_m \leq 1.0$ S $(\sigma_m$ or $\sigma_L) + \sigma_b \leq 1.5$ S	-	ASME Section III NC/ND-3400
Normal	Level A	Sustained loads: pressure, weight, other mechanical loads	$\sigma_m \leq 1.0$ S $(\sigma_m$ or $\sigma_L) + \sigma_b \leq 1.5$ S	1.0	ASME Section III NC/ND-3400
Upset	Level B	Occupational loads: pressure, weight, thermal effects, dynamic fluid loads,(4) wind(6)	$\sigma_m \leq 1.1$ S $(\sigma_m$ or $\sigma_L) + \sigma_b \leq 1.65$ S	1.1	ASME Section III NC/ND-3400
Emergency	Level C	Occupational loads: pressure, weight, thermal effects, dynamic system loads,(7) tornado(6)	$\sigma_m \leq 1.5$ S $(\sigma_m$ or $\sigma_L) + \sigma_b \leq 1.8$ S	1.2	ASME Section III NC/ND-3400
Faulted	Level D	Occupational loads: pressure, weight, thermal effects, dynamic fluid loads,(4) SSE inertia, pipe break	$\sigma_m \leq 2.0$ S $(\sigma_m$ or $\sigma_L) + \sigma_b \leq 2.4$ S	1.5	ASME Section III NC/ND-3400

(1) Service limits are taken from ASME Section III, NCA-2142.4.

(2) Stress limits are taken from ASME Section III, Subsections NC and ND, Table NC/ND-3416-1.

(3) The maximum pressure does not exceed the tabulated factors listed under Pmax times the design pressure.

(4) Dynamic fluid loads (DFL) are occasional loads such as safety and relief valve thrust, steam hammer, water hammer, or other loads associated with plant upset or faulted condition as applicable. Dynamic loads are combined by the SRSS method.

(5) SECY-93-087, Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs, Paragraph 9, "Elimination of Operating Basis Earthquake," Nuclear Regulatory Commission, July 21, 1993.

(6) Wind and tornado loads are not combined with earthquake loading.

(7) Dynamic system loadings associated with the emergency condition.