NRC Feedback on "KHNP's Draft Revised Response to RAI 200-8225, Question 03.08.02-2"
(Draft Response Provided 4/6/16)

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The staff reviewed the draft response to Question 03.08.02-2 and noticed that Section 3.8.2.4.2 of the markup for DCD Tier 2, provided in the response has several items that should be addressed:

1. To avoid confusion and to be consistent with the terminology in ASME Section III, Subsection NE, and consistent with SRP 3.8.2, the loading conditions should be identified as Testing; Design; and Service Levels A, B, C, and D; rather than test, normal, upset, emergency, and faulted.

   KHNP's Response: DCD is revised to refer the loading conditions to be identified in accordance with SRP 3.8.2. Refer to revised DCD Table 3.8-3(page 8/10, 9/10 of Attachment of revised response) and DCD markup (page 3/10, 4/10, 5/10 of Attachment of revised response).

2. On page 4 of 6 of the attachment (Insert B), it is stated that "For the ASME Class MC Components, the applicable loads for each condition and load combination are as listed below and those presented in Table 3.8-3." The staff notes that DCD Table 3.8-3 does not identify all applicable loads in some of the load combinations. For example, the seismic load E_s is not included in load combination no. 6. Also, hydrodynamic loads such as POSRV and hydraulic transient loads (mentioned in Item b-2 of the markup) are not identified. The need to consider POSRV is also being reviewed as part of RAI 129-8085, Question 03.08.01-1, which has not yet been resolved.

   KHNP's Response: The loads and loading combinations considered in the design of steel containments are listed in revised DCD Table 3.8-3. The DCD Table 3.8-3 identified all applicable loads including seismic load(E') for level D Service limit and all pressure loads, thermal loads, and pipe reaction loads that are generated by the actuation of SRV discharge, including pool swell and subsequent hydrodynamic loads (P_s, T_s, R_s) for level A, B, C, and D service limits

3. Page 4 of 6 of the attachment refers to loads and load combinations defined in DCD Table 3.8-3, and also lists them in items a) through g) of the response. However it appears that some of the applicable loads are missing from the load combinations listed in Items a) through g). For example, live load (L) is missing in most load combinations; T_a, P_a, and R_a is missing from Service levels A, B, C, and D load combinations. Also, identification of some loads should be made clear; for example, explain what are "design pressures and temperatures" and if they correspond to P_a and T_a, respectively, then these should be used or stated. Also explain why they are plural; which suggests there may be more than one design pressure and one design temperature. Based on the above discussion, a review by KHNP of the information in Insert B should be made to ensure it matches DCD Table 3.8-3, and that both of these are consistent with the load combinations in SRP 3.8.2, or explain any deviation.

KHNP's Response: Load combinations are applied in accordance with SRP 3.8.2 as shown in DCD Table 3.8-3. DCD Markup is modified to have a consistency with the revised DCD Table 3.8-3.

4. Explain why DCD Table 3.8-3 identifies the Post-LOCA flood load combination and Insert B does not.

   KHNP's Response: DCD Table 3.8-3 is modified to identify the post-flooding condition.

5. On page 4 of 6 of the attachment, Item f indicates that the fatigue evaluation considers the combination of loads listed in Item b. Explain why some of the other loads (e.g., mechanical loads) are not included for fatigue evaluation. Also, identify what portion of ASME Section III, Subsection NE is used to design for fatigue.

   KHNP's Response: Fatigue evaluation for MC component is performed in accordance with Subarticle NE-3221.5 of ASME Section III, Division 1. Service Loadings such as pressure and mechanical loads involving cyclic application of loads and thermal conditions shall be determined for the fatigue evaluation. DCD markup includes the mechanical loads to be considered in the fatigue evaluation.

6. Page 5 of 6 of the attachment identifies that loads such as condensation oscillation and chugging are also considered. Explain what these loads are and where they are placed in the load combinations, and also describe them in the DCD text and include them in DCD Table 3.8-3.

   KHNP's Response: An In-containment Refueling Water Storage Tank (IRWST) is used as a passive safety feature for the APR1400. When the Safety Depressurization & Vent System (SDVS) is actuated, the reactor is rapidly depressurized and the reactor coolant is discharged into the IRWST. The IRWST water temperature rises as depressurization occurs. As steam is discharged, the condensation oscillation occurs in the IRWST, which causes pressure oscillation to intensify as the water temperature rises to a certain level and then rapidly declines thereafter. If a discharge device is not properly designed, the structural integrity of a tank may be impaired when severe oscillation loads are imposed on its boundary. Appropriate design guidelines for a multi-hole sparger and tank are needed to avoid structural failures. These phenomena is called chugging or condensation oscillation depending upon the magnitude of steam mass flux. These loads, as mentioned in Section I.3.G, are included in the DCD Table 3.8-3 as P_a, T_a, and R_a that are generated by the pool swell and subsequent hydrodynamic loads.

7. The applicant stated in its response that, "The equipment hatch, personnel airlocks, and electrical penetrations mentioned in DCD Tier 2, Subsection 3.8.2.4.1 are vendor designed components. The COL applicant is to provide detailed analysis and design procedure for the equipment hatch, personnel airlocks, and electrical penetrations. The key design aspects and criteria for the equipment hatch and personnel airlocks will be described in DCD Tier 2 Subsection 3.8.2.4.1." The staff considers this statement to be acceptable, but requires incorporating markup into the DCD.

   KHNP's Response: DCD Markup incorporating the statement in the response is included in Attachment of revised response (page 1/10, 2/10)

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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.:	**200-8225**
SRP Section:	**03.08.02 - Steel Containment**
Application Section:	**03.08.02**
Date of RAI Issue:	**09/08/2015**

Question No. 03.08.02-2

Appendix A to 10 CFR Part 50, General Design Criteria (GDC) 1, 2, 4, 16 and 50, provide the regulatory requirements for the design of the containment penetrations. Standard Review Plan (SRP) 3.8.2, Section II specifies the procedures used for the analysis and design of the containment penetrations with emphasis on the extent of compliance with Article CC-3300 of Section III, Division 1, of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, with additional guidance provided in Regulatory Guide 1.57, “Design Limits and Loading Combinations for Metal Primary Reactor Containment System Components.”

DCD Tier 2, Section 3.8.2.4, “Design and Analysis Procedures,” describes the design and analysis procedures for the equipment hatch, personnel airlocks, electrical penetrations, and process piping penetrations. The staff noted that Section 3.8.2.4 did not adequately describe the design and analysis approach for the various penetrations. Per Appendix A to 10 CFR Part 50, GDC 1, 2, 4, 16 and 50; and SRP 3.8.2, the applicant is requested to describe to the extent possible, the design methodology for these penetrations in the application, including the models, boundary conditions, how loadings are applied, the analysis approach for the various loadings, and how stresses are determined including the approach to check for buckling. The description for the analysis of the various loads should include loads from internal and external pressures; applied end loads from attached process piping or attachment to adjacent structures for the fuel transfer tube; and containment interface displacements and seismic inertial loadings at the attachment points to the containment.

For penetrations that are considered to be a vendor designed component, a description should still be provided of the criteria to be used for the analysis and design of the penetrations. This description should summarize, to the extent possible, the key analysis and design aspects discussed above, consistent with ASME Code Section III, Division 1, Subsection NE, provisions applicable to containment penetrations and the existing criteria in the DCD. It should be noted that even if the design of the containment penetrations are not completed or finalized at this time, SRP 3.8.1 and 3.8.2 indicates that the ultimate pressure capacity of the containment,

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including its penetrations, need to be determined. Therefore, some analysis of the critical containment penetrations (e.g., equipment hatch and/or personnel airlocks) would be needed to address the ultimate pressure capacity evaluation of the containment and Section 19 PRA/accident evaluations.

Response

DCD Tier 2, Section 3.8.2.4.2 will be revised to describe the design methodology, including the models, boundary conditions, how loadings are applied, the analysis approach for the various loadings, and how stresses are determined, for process piping penetrations, as indicated in the attachment associated with this response.

The equipment hatch, personnel airlocks, and electrical penetrations mentioned in DCD Tier 2, Subsection 3.8.2.4.1 are vendor designed components. The COL applicant is to provide detailed analysis and design procedure for the equipment hatch, personnel airlocks, and electrical penetrations. A new COL item (3.8(11)) has been added to the DCD to reflect this. The key design aspects and criteria for the equipment hatch and personnel airlocks will be described in DCD Tier 2 Subsection 3.8.2.4.1.

Impact on DCD

DCD Tier 2, Subsection 3.8.2.4.1, 3.8.2.4.2, 3.8.6 and Tables 1.8-2 and 3.8-3 will be revised as indicated in 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 Environmental Report.

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c. Severe accident load due to (as applicable):

1) Pressure load generated from 100 percent fuel clad metal-water reaction

2) Pressure loads generated by hydrogen burning

3.8.2.3.2 Load Combinations for Instrument and Process Piping Penetrations

The load combinations for instrument and process piping penetrations are given in Table 3.8-4.

3.8.2.4 Design and Analysis Procedures

3.8.2.4.1 Equipment Hatch, Personnel Airlocks, and Electrical Penetrations

The equipment hatch, personnel airlocks, and electrical penetrations are designed as pressure-retaining components. The portions of the sleeves not backed by concrete are analyzed and designed according to the provisions of ASME Section III, Division 1, Subsection NE 3000.

Insert A

3.8.2.4.2 Process Piping Penetrations

The entire penetration assembly including the sleeve, head fitting, and attached portion of pipe is designed for the loads described in Subsections 3.8.2.3.1 and 3.8.2.3.2 by the finite element computer program ANSYS. ~~The boundary conditions for the model are considered fixed against all degrees of freedom at the containment building wall. The computer program is also used to evaluate thermal gradient. The final stress analysis of the piping penetration assemblies including metal fatigue evaluation is performed by this computer program~~.

Insert B

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Insert A

The equipment hatch, personnel airlocks, and electrical penetrations are vendor designed components. The COL applicant is to provide detailed analysis and design procedure for the equipment hatch, personnel airlocks, and electrical penetrations (COL 3.8(11)). The major design aspects and criteria for the equipment hatch and personnel airlocks are as follows.

The equipment hatch design consists of a flanged cover bolted to a matching flanged cylindrical sleeve embedded into the reactor containment building. The equipment hatch closure head and sleeve shall be evaluated for design and service conditions in accordance with the requirements of NE 3000. The closure head spherical shell thickness shall be adequate for the design pressure in accordance with the rules of NE 3133.4. The head flange and sleeve flange shall meet the rules of NE 3326.2 and Appendix XI 3260. The swing bolts shall provide adequate bolt area for all preload, design and service conditions.

The personnel airlock design consists of a cylindrical shell having a bulkhead and pressure retaining door at each end. The personnel airlock pressure retaining components shall be evaluated for design and service conditions in accordance with the requirements of NE 3000. The airlock door plate thickness and stiffeners, and the bulkhead plate and stiffeners shall be adequate for the design condition in accordance with the stress limits of NE 3221. The airlock shell thickness shall meet the requirements of NE 3133 and NE 3324 for the external and internal pressure conditions.

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Insert B (1/3)

The penetration assemblies provide for process piping to pass through the containment structure or other building walls or floors.

Each penetration assembly may consist of the following components.

a. Portion of the process or instrument piping.
b. The penetration sleeve, which encloses the process piping and which is embedded and anchored in the wall or floor.
c. The head fitting (forged flued head or flat plate ring), which is welded to both the process pipe and the penetration sleeve. A typical piping penetration assembly configuration is shown in Figure 3.8-8.

Finite element analysis programs for the axisymmetric structural analysis for the stress analysis of the piping penetration assembly are used. The model will generate an automatic mesh, and imposed load and thermal condition are input to the model to perform FEM structural analysis. The pipe outside diameter, pipe wall thickness, sleeve outer diameter, sleeve wall thickness, head fitting thickness, and insulation thickness are considered in the analysis model.

Boundary conditions can be classified into three categories for the performance of the stress analysis of the piping penetration assembly; 1) stress boundary at the penetration assembly section connected to pipe where the stress distribution is applied corresponding to its location against imposed force, 2) inner surface of the pipe and sleeve where pressure is acting normal to the surface, and therefore stresses normal to the surfaces are applied as pressure for the boundary condition, and 3) fixed point at the concrete wall.

The forces and moments imposed at the penetration assembly boundaries are due to the following:

a. Internal and external operating and design pressures and temperature
b. Process pipe reactions due to (as applicable):
   1) Weight
   2) Safe shutdown earthquake (SSE)
   3) Thermal expansion and relative dynamic displacements
   4) Hydraulic transients and other non-seismic dynamic loads
   5) Pipe rupture and jet impingement
c. Maximum reactor containment building pressure during severe accidents

The penetration assemblies are required to meet the stress limits under the worst loading combinations for testing, design, and Service Conditions for Level A, B, C, and D service limit in accordance with the requirements and provisions of ASME Code Section III.

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Insert B -Continued (2/3)

Loading combinations are formulated in a way that will assure the highest resultant stress. For the sleeve anchors, the types of loads applicable for each condition will be as stated in Table CC-3230-1 of Section III, Division 2. (Table SNB 3230-1 of KEPIC SNB). For the ASME Class MC Components, the applicable loads for each condition are as listed below and Table 3.8-3

a. Testing Condition: Test pressure and temperature plus dead load and live load

b. Design Condition: These include all design loadings for which the containment vessel or portions thereof might be designed during the expected life of the plant. Such loads include design pressure, design temperature, and the design mechanical loads generated by the design-basis LOCA (as applicable).

c. Service Condition for Level A and B service limits: These service limits are applicable to the service loadings to which the containment is subjected, including the plant or system design basis accident conditions for which the containment function is required. The additional loads resulting from natural phenomena during which the plant must remain operational for Level B service limits.

   1) For Expansion Stress Evaluation: Loads due to operating temperature, thermal expansion and relative dynamic displacements

   2) For Primary-plus-Secondary Stress Evaluation: Pressure, temperature, and reaction load, plus mechanical loads due to: dead load, live load, thermal expansion and relative dynamic displacements, hydraulic transients such as actuation of SRV discharge and subsequent hydrodynamic reaction loads, OBE, and LOCA, as applicable

d. Service Condition for Level C service limits: These service limits include the loads subject to Level A service limits plus the additional loads resulting from natural phenomena for which safe shutdown of the plant is required.

   Pressure, temperature, and reaction load, plus loads due to: dead load, live load, thermal expansion, hydraulic transients such as actuation of SRV discharge and subsequent hydrodynamic reaction loads, SSE, and LOCA, pressure resulting from hydrogen release are applied as applicable.

e. Service Condition for Level D service limits: These service limits include other applicable service limits and loadings of a local dynamic nature for which the containment function is required.

   1) Pressure, temperature, and reaction load, plus loads due to: dead load, live load, thermal expansion, hydraulic transients such as actuation of SRV discharge and subsequent hydrodynamic reaction loads, SSE, and LOCA, pipe rupture and jet impingement are applied as applicable.

   2) Maximum operating pressure applied in the annulus between the process pipe and the penetration sleeve for process piping penetration assembly

f. Post-flooding Condition: This includes the post-LOCA flooding of the containment in combination with OBE-basis earthquake

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Insert B -Continued (3/3)

g. Fatigue evaluation: For the metal fatigue evaluation, pressure- and load-range combinations must be formed in a way that will assure cyclic stress optimization. For the formation of these load-range combinations the loads listed in Subsection above c) 2 will be used. Contribution from thermal transients will also be considered. With the exception of the pressure and temperature values, the numerical values of the load components for each penetration assembly are obtained from appropriate stress analysis reports for the corresponding piping systems. Fatigue evaluation for MC component is performed in accordance with Subarticle NE-3221.5 of the ASME Code, Section III, Division 1.

The mechanical forces and moments are applied to the penetration assembly at each boundary. In addition to the mechanical loads, loads due to the design and operating pressure within the pipe penetration annulus are applied. The loads and their combination methods are specified in the project unique penetration specification. These loads consist of the design and operating pressure, weight, earthquake, hydraulic transients, SRV, condensation oscillation, chugging, thermal expansion, and relative seismic displacements. Stress optimization is achieved by analyzing the penetration for the worst load combination for each loading condition (i.e., Design, Level A and B service limit, and Level C and D service limit).

It is required that the penetration assemblies be analyzed for the various design and operating component conditions, and that the resulting stresses be within the specified allowable limits. The allowable stress limits associated with each service load category are as stated below and Table 3.8-3.

a. Stress Limits for Process Piping: In accordance with the Piping System Design Specification
b. Stress Limits for Penetration Sleeve Anchors: In accordance with Division 2 of the ASME Code, Section III.
c. Stress Limits for Penetration Sleeves and Head Fittings: For MC penetration sleeves and head fittings the allowable stress limits shall be as specified in Subarticle NE-3200 of the ASME Code, Section III, Division 1, for Class MC components.

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COL 3.8(7) The COL applicant is to confirm that uneven settlement due to construction sequence of the NI basemat falls within the values specified in Table 2.0-1.

COL 3.8(8) The COL applicant is to provide the necessary measures for foundation settlement monitoring considering site-specific conditions.

COL 3.8(9) The COL applicant is to provide testing and inservice inspection program to examine inaccessible areas of the concrete structure for degradation and to monitor groundwater chemistry.

COL 3.8.(10) The COL applicant is to provide the following soil information for the APR1400 site: 1) elastic shear modulus and Poisson's ratio of the subsurface soil layers, 2) consolidation properties including data from one-dimensional consolidation tests (initial void ratio, Cc, Ccr, OCR, and complete e-log p curves) and time-versus-consolidation plots, 3) moisture content, Atterberg limits, grain size analyses, and soil classification, 4) construction sequence and loading history, and 5) excavation and dewatering programs.

COL 3.8(11) The COL applicant is to provide detailed analysis and design procedure for the equipment hatch, personnel airlocks, and electrical penetrations.

3.8.7 References

1. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," U.S. Nuclear Regulatory Commission.

2. ASME Section III, Subsection NE, "Class MC Components," The American Society of Mechanical Engineers, the 2007 Edition with the 2008 Addenda.

3. ASME Section III, Division 2, "Code for Concrete Containments," Subsection CC, American Society of Mechanical Engineers, 2001 Edition with 2003 Addenda.

4. Regulatory Guide 1.35, "Inservice Inspection of Ungrouted Tendons in Prestressed Concrete Containment," Rev. 3, U.S. Nuclear Regulatory Commission, July 1990.

5. Regulatory Guide 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," U.S. Nuclear Regulatory Commission, July 1990.

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Table 1.8-2 (5 of 29)

Item No.	Description
COL 3.8(7)	The COL applicant is to confirm that uneven settlement due to construction sequence of the NI basemat falls within the values specified in Table 2.0-1.
COL 3.8(8)	The COL applicant is to provide the necessary measures for foundation settlement monitoring considering site-specific conditions.
COL 3.8(9)	The COL applicant is to provide testing and inservice inspection program to examine inaccessible areas of the concrete structure for degradation and to monitor groundwater chemistry.
COL 3.8(10)	The COL application is to provide the following soil information for APR1400 site: 1) Elastic shear modulus and Poisson's ratio of the subsurface soil layers, 2) Consolidation properties including data from one-dimensional consolidation tests (initial void ratio, Cc, Ccr, OCR, and complete e-log p curves) and time-versus-consolidation plots, 3) Moisture content, Atterberg limits, grain size analyses, and soil classification, 4) Construction sequence and loading history, and 5) Excavation and dewatering programs.
COL 3.9(1)	The COL applicant is to provide the inspection results for the APR1400 reactor internals classified as non-prototype Category I in accordance with RG 1.20.
COL 3.9(2)	The COL applicant is to provide a summary of the maximum total stress, deformation, and cumulative usage factor values for each of the component operating conditions for ASME Code Class 1 components except for ASME Code Class 1 nine major components. For those values that differ from the allowable limits by less than 10 percent, the contribution of each loading category (e.g., seismic, deadweight, pressure, and thermal) to the total stress is provided for each maximum stress value identified in this range. The COL applicant is to also provide a summary of the maximum total stress and deformation values for each of the component operating conditions for Class 2 and 3 components required to shut down the reactor or mitigate consequences of a postulated piping failure without offsite power (with identification of those values that differ from the allowable limits by less than 10 percent).
COL 3.9(3)	The COL applicant is to identify the site-specific active pumps.
COL 3.9(4)	The COL applicant is to confirm the type of testing and frequency of site-specific pumps subject to IST in accordance with the ASME Code.
COL 3.9(5)	The COL applicant is to confirm the type of testing and frequency of site-specific valves subject to IST in accordance with the ASME Code.
COL 3.9(6)	The COL applicant is to provide a table listing all safety-related components that use snubbers in their support systems.

COL 3.8(11)	The COL applicant is to provide detailed analysis and design procedure for the equipment hatch, personnel airlocks, and electrical penetrations.

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Table 3.8-3

Load Definitions and Load Combinations for ASME Class MC Containment Components [1]

See Appendix 3.8A for definitions of the terms in this table.

No.	Load Factors														Service Load Category	Limitation of Stress Intensity
	Normal						Severe Environmental	Extreme Abnormal						Extreme Environmental		
	D	L	R_o	T_o	P_v	P_t	R_r [2]	T_a	P_a	R_a	Y_f	P_{g1}	P_{g2}	E_s		
1	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	-	-	-	A	Table NE 3221-1
2	1.0	1.0	-	-	-	-	-	1.0	1.0	1.0	-	-	-	-	A	Table NE 3221-1
3	1.0	1.0	-	-	-	-	-	1.0	1.0	1.0	-	-	-	-	B	Table NE 3221-1
4	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	-	-	1.0	C	Table NE 3221-1
5	1.0	1.0	-	-	-	-	-	1.0	1.0	1.0	-	-	-	1.0	C	Table NE 3221-1
6	1.0	1.0	-	-	-	-	1.0	1.0	1.0	1.0	-	-	-	-	D	Table NE 3221-1
7	1.0	1.0	-	1.0 [3]	-	1.0	-	-	-	-	-	-	-	-	Test Condition	NE 3226
8	1.0	1.0	-	-	-	-	-	-	-	-	1.0	-	-	-	Post-LOCA Flood	Table NE 3221-1
9	1.0	-	-	-	-	-	-	-	-	-	-	1.0	1.0	-	C	Table NE 3221-1

(1) Not applicable to process piping penetrations
(2) $R_r = Y_r + Y_j + Y_m$
(3) Temperature at time of test

Change to next pages

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Table 3.8-3 (1 of 2)

Load Definition and Load Combinations for ASME Class MC Containment Components

No	Load Condition	D	L	T_o	R_o	P_o	T_t	P_t	T_s	R_s	P_s	T_a	R_a	P_a	E	E'	P_{g1}	P_{g2}	P_{g3}	Y_r	Y_j	Y_m	F_L	Stress Intensity Limits[2]
1	**Testing Condition**	1.0	1.0				1.0	1.0																Table NE-3221-1
2	**Design Condition**	1.0	1.0									1.0	1.0	1.0										Table NE-3221-1
3	**Service Condition[1]**																							Table NE-3221-1
4	**Level A Service Limit**																							Table NE-3221-1
5	1) Normal operating plant condition	1.0	1.0	1.0	1.0	1.0																		Table NE-3221-1
6	2) Operating plant condition in conjunction with the actuation of multiple SRVs	1.0	1.0						1.0	1.0	1.0													Table NE-3221-1
7	3) Design-basis LOCA	1.0	1.0									1.0	1.0	1.0										Table NE-3221-1
8	4) Multiple SRV actuations in conjunction with small or intermediate break accident	1.0	1.0						1.0	1.0	1.0	1.0	1.0	1.0										Table NE-3221-1
9	**Level B Service Limit**																							Table NE-3221-1
10	1) Design-basis LOCA in combination with OBE	1.0	1.0									1.0	1.0	1.0	1.0									Table NE-3221-1
11	2) Operating plant condition in combination with OBE	1.0	1.0	1.0	1.0	1.0									1.0									Table NE-3221-1
12	3) Operating plant condition in combination with OBE and multiple SRV actuations	1.0	1.0						1.0	1.0	1.0				1.0									Table NE-3221-1
13	4) Design-basis LOCA in combination with a single active component failure causing one SRV discharge	1.0	1.0						1.0	1.0	1.0	1.0	1.0	1.0										Table NE-3221-1
14	**Level C Service Limit**																							Table NE-3221-1
15	1) Design-basis LOCA in combination with SSE	1.0	1.0									1.0	1.0	1.0		1.0								Table NE-3221-1
16	2) Operating plant condition in combination with SSE	1.0	1.0	1.0	1.0	1.0										1.0								Table NE-3221-1
17	3) Multiple SRV actuations in combination with small- or intermediate-break accident and SSE	1.0	1.0						1.0	1.0	1.0	1.0	1.0	1.0		1.0								Table NE-3221-1
18	4) Dead load plus pressure resulting from an accident that releases hydrogen	1.0															1.0	1.0						Table NE-3221-1
19	**Level D Service Limit**																							Table NE-3221-1
20	1) Design-basis LOCA in combination with SSE and local dynamic loadings	1.0	1.0									1.0	1.0	1.0		1.0				1.0	1.0	1.0		Table NE-3221-1
21	2) Multiple SRV actuations in combination with small- or intermediate-break accident, SSE, and local dynamic loadings	1.0	1.0						1.0	1.0	1.0	1.0	1.0	1.0		1.0				1.0	1.0	1.0		Table NE-3221-1
22	**Post-Flooding Condition**	1.0	1.0												1.0								1.0	Table NE-3221-1

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Table 3.8-3 (2 of 2)

Notes

(1) The loads may be combined by their actual time history of occurrence taking into consideration their dynamic effect upon the structure.
(2) Acceptance criteria are taken from the referenced section in Section III of the ASME Code
(3) Definitions of the terms in this table are as follows;

D: Dead loads
L: Live loads, including all loads resulting from platform flexibility and deformation and from crane loading, if applicable
P_t: Test pressure
T_t: Test temperature
T_o: Thermal effects and loads during startup, normal operating, or shutdown conditions, based on the most critical transient or steady-state condition
R_o: Pipe reactions during startup, normal operating, or shutdown conditions, based on the most critical transient or steady-state condition
P_o: External pressure loads resulting from pressure variation either inside or outside containment
E: Loads generated by the OBE, including sloshing effects, if applicable
E': Loads generated by the SSE, including sloshing effects, if applicable
P_a: Pressure load generated by the postulated pipe break accident (including pressure generated by postulated small-break or intermediate-break pipe ruptures), pool swell, and subsequent hydrodynamic loads
T_a: Thermal loads under thermal conditions generated by the postulated pipe break accident, pool swell, and subsequent hydrodynamic reaction loads
R_a: Pipe reactions under thermal conditions generated by the postulated pipe break accident, pool swell, and subsequent hydrodynamic reaction loads
P_s: All pressure loads that are caused by the actuation of SRV discharge, including pool swell and subsequent hydrodynamic loads, if applicable
T_s: All thermal loads that are generated by the actuation of SRV discharge, including pool swell and subsequent hydrodynamic thermal loads, if applicable
R_s: All pipe reaction loads that are generated by the actuation of SRV discharge, including pool swell and subsequent hydrodynamic reaction loads, if applicable
Y_r: Equivalent static load on the structure generated by the reaction on the broken pipe during the design-basis accident
Y_j: Jet impingement equivalent static load on the structure generated by the broken pipe during the design-basis accident
Y_m: Missile impact equivalent static load on the structure generated by or during the design-basis accident, such as pipe whipping
F_L: Load generated by the post-LOCA flooding of the containment, if applicable
P_{g1}: Pressure load generated from 100-percent fuel clad metal-water reaction
P_{g2}: Pressure loads generated by hydrogen burning, if applicable

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