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.:	**255-8285**
SRP Section:	**03.08.05 – Foundations**
Application Section:	**03.08.05**
Date of RAI Issue:	**10/19/2015**

Question No. 03.08.05-13

10 CFR 50.55a and Appendix A to 10 CFR Part 50, General Design Criteria 1, 2, 4, 16 and 50, provide the regulatory requirements for the design of the containment internal structures. Standard Review Plan (SRP) 3.8.5, Section II specifies analysis and design procedures applicable to the foundation of seismic Category I structures.

Technical Report (TR) APR1400-E-S-NR-14006-P, Rev 1, “Stability Check for NI Common Basemat,” Section 3.2.6, “Load Combinations,” states that, “The division of the basemat by code jurisdiction at the thickness transition is a logical choice, and the boundary of the code jurisdiction is conservatively designed using the greater forces from the analysis results of ASME and ACI codes.” It is not clear to the staff as to how the applicant consider the loads and load combinations for the basemat of the containment and the Auxiliary building (AB), and how the applicant design the transition region. For example, it is not clear whether the division of the basemat code jurisdiction at the thickness transition is in accordance with the ASME Code Interpretation: 111-2-83-01, which covers this design configuration and how do they define the transition region. Per 10 CFR 50.55a; Appendix A to 10 CFR Part 50, General Design Criteria 1, 2, 4, 16 and 50; and SRP 3.8.5, the applicant is requested to describe in more detail how the loads and load combinations for the basemat of the containment and the AB, were considered in the analysis and how the transition region is design.

Response – (Rev. 2)

Load combinations and load factors for the RCB and the AB basemats are selected based on their relevant design codes, ASME and ACI respectively. The boundary of code jurisdiction between the ASME code and the ACI code is shown in Figure 1. The details of the code jurisdiction boundary are presented in the response to RAI 199-8223, Question 03.08.01-11.

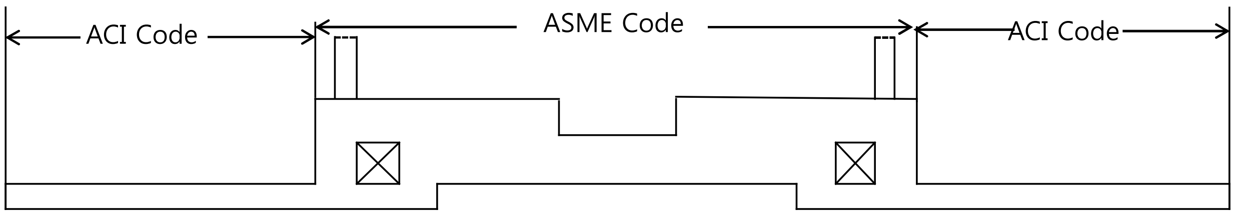
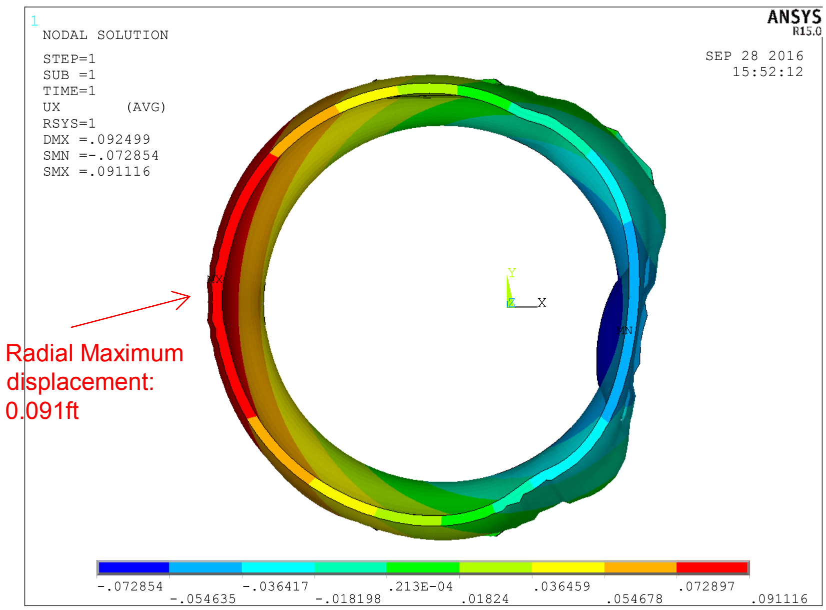


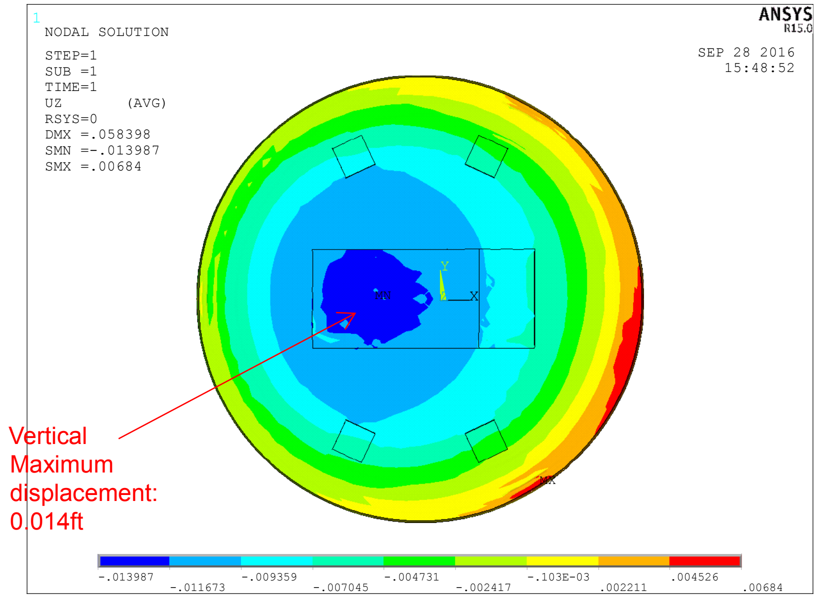
Figure 1 Jurisdictional Boundary for Design of Common Basemat

For the RCB basemat, the 5 loading combinations (test, normal, severe, abnormal, and abnormal/extreme environmental) are selected as the critical loading combinations in the analysis of the NI basemat. Table1 shows the selected load combinations and applicable load factors for analysis.

In the case of the combustible gas load combination, the load combination is focused on the liner strain, which complies with ASME CC-3720. As shown in Figure 2, due to the combustible gas load, the liner strain of the containment wall governs, not that of the basemat. The deformation of the basemat may be small enough to ignore compared with that of containment wall due to the very thick concrete. Therefore, the combustible gas load combination is not considered in the design of the basemat.



(a) Containment Wall Deformation Contour



(b) Basemat Deformation Contour

Figure 2 Deformation of Containment Wall and Basemat under Combustible Gas Load

As shown in Table 1, the loads, except for loads G, To, Ta, W, Ro, Ra, Yj, Ym and Pv, are considered in the basemat analysis.

- Valve actuation load (G), due to POSRV discharge, is a short transient pressure in expansion and collapse of the air bubble. The load from the spargers is locally applied in the IRWST. The load does not effect on the global behavior of the basemat. Based on the explanation above, this load was not considered in the basemat analysis.

- According to ACI 349, thermal gradients less than approximately 100°F need not be analyzed because such gradients will not cause significant stress in the reinforcement or strength deterioration. The effects of the temperature load in the basemat are negligible and not considered in the basemat analysis because the temperature gradient is approximately 50°F.

- Wind (W) and tornado (Wt) loads are not considered. From the loading conditions, wind and tornado loads are not considered simultaneously with the seismic load. A comparison of the loads shows the seismic load is larger than the wind and tornado loads.

- The reactions of piping, cable trays (Ro, Ra), jet impingement load (Yj), and missile impact load (Ym) are considered in local analyses.

- The external pressure load (Pv) in the normal loading condition is negligible compared with the accident pressure (Pa) in the abnormal loading condition. So, it does not effect on global behavior of the basemat.

- In Table 1, as mentioned in the response of RAI 129-8085, Question 03.08.01-1 Rev.1, the terminology of “Severe Accident” was changed to “Combustible Gas Control inside Containment” and this combustible gas load associated with hydrogen generation caused by the reaction between the fuel cladding and the water coolant is not considered for basemat analysis and design. Regulatory Guide 1.216 classify the combustible gas load as the internal pressure loading above design-basis pressure and required that the concrete containment should meet the Factored Load Category requirements of ASME Section III Div.2 CC-3720, which is related to allowable strain of liner plate, for integrity of containment. Therefore, the combustible gas load due to hydrogen generation is only considered in the structural integrity assessment based on deterministic design basis analysis, not considered in the determination of structural member forces for design. In addition, the evaluation of combustible gas load is executed under pressure boundary condition in accordance with ASME CC Code. Note that, in case of auxiliary building design which is not followed by ASME CC, this evaluation of combustible gas load is not necessary for auxiliary basemat which is classified as ACI Code boundary as shown in Figure 1 and, for this reason, not included in Table 2.

The polar crane load includes the self-weight and lifting loads in the basemat analysis. The crane lifting load is not considered under severe environmental, extreme environmental, abnormal, abnormal/severe environmental, and abnormal/extreme environmental loading conditions since the polar crane is not permitted to lift any loads during plant operation. The self-weight of the polar crane is applied to the parking position (location of polar crane: Az.280^{o}, trolley location: 12ft 7in away from end of east part), since the crane is placed in the parking position during plant operation. The COL applicant is to confirm that the parking position of the crane and trolley when the crane is not being used (location of polar crane: Az.280º, trolley location: 12ft 7in away from end of east part). The COL applicant it to confirm thatthis requirement is included in the technical specification of the COL application for use of the polar crane (COL 3.8(21)).

For the AB basemat, the 4 loading combinations (test, normal, abnormal, and abnormal/extreme environmental) are selected as the critical loading combinations in the analysis of the NI basemat. Table 2 shows the selected load and applicable load factors for the analysis. For detailed description related to the construction sequence load combination, refer to the RAI 255-8285 Question 03.08.05-7.

As shown in Table 2, the loads (except for loads Ra, To, Po, Mo, Pa, Ta and Ma which do not have an effect on the global behavior of the basemat) are considered in the basemat analysis. For the crane and trolley loads, the self-weight of the fuel handling overhead crane is considered in the basemat analysis. Tables 1 and 2 will be added and the load combination Table used for NI common basemat analysis will be revised to Technical Report APR1400-E-S-NR-14006-P/NP as shown in Attachment 1.

For the design of the basemat, at the interface between the ASME and ACI codes, the lager amount of reinforcement required by either code was used.

Table 1 Selected Loading Conditions of Containment for RCB Basemat Analysis

Loading Condition	D(⑫)	L	F	Pt	G	Pa	Tt	To	Ta	Es	W	Wt	Ro	Ra	Yr	Yj	Ym	Yf	H	Hs	Pv	Ha	Ps	Analysis
Test	1.0	1.0	1.0	1.0	-	-	(1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	yes
Construction	1.0	1.0	1.0	-	-	-	-	1.0	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	no(①)
Normal	1.0	1.0(⑬)	1.0	-	(1.0)	-	-	(1.0)	-	-	-	-	(1.0)	-	-	-	-	-	-	-	(1.0)	-	-	yes
Severe Environmental	1.0	1.3	1.0	-	(1.0)	-	-	(1.0)	-	-	(1.5)	-	(1.0)	-	-	-	-	-	-	-	(1.0)	-	-	yes
	1.0	1.3	1.0	-	1.0	-	-	1.0	-	-	-	-	1.0	-	-	-	-	-	1.5	-	1.0	-	-	no(②)
Extreme Environmental	1.0	1.0	1.0	-	1.0	-	-	1.0	-	1.0	-	-	1.0	-	-	-	-	-	-	-	1.0	-	-	no(③)
	1.0	1.0	1.0	-	1.0	-	-	1.0	-	-	-	1.0	1.0	-	-	-	-	-	-	-	1.0	-	-	no(④)
	1.0	1.0	1.0	-	1.0	-	-	1.0	-	-	-	-	1.0	-	-	-	-	-	-	1.0	1.0	-	-	no(⑤)
Abnormal	1.0	1.0	1.0	-	(1.0)	1.5	-	-	(1.0)	-	-	-	-	(1.0)	-	-	-	-	-	-	-	-	-	yes
	1.0	1.0	1.0	-	1.0	1.0	-	-	1.0	-	-	-	-	1.25	-	-	-	-	-	-	-	-	-	no(⑥)
	1.0	1.0	1.0	-	1.25	1.25	-	-	1.0	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	no(⑦)
Abnormal/Severe Environmental	1.0	1.0	1.0	-	1.0	1.25	-	-	1.0	-	1.25	-	-	1.0	-	-	-	-	-	-	-	-	-	no(⑧)
	1.0	1.0	1.0	-	1.0	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	no(⑨)
	1.0	1.0	1.0	-	1.0	-	-	1.0	-	-	1.0	-	-	-	-	-	-	-	-	-	-	1.0	-	no(⑩)
Abnormal/Extreme Environmental	1.0	1.0	1.0	-	(1.0)	1.0	-	-	(1.0)	1.0	-	-	-	(1.0)	1.0	(1.0)	(1.0)	-	-	-	-	-	-	yes
Combustible Gas Control inside Containment	1.0	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	no(⑪)

* ( ) : loads not considered in basemat analysis. * yellow row : load combinations for basemat analysis.

① - Effect on the basemat due to wind is less than that of Pt, and To is negligible

② - H is not considered to be critical for the basemat (Containment building roof could not contain any rainwater.)

③, ④, ⑤ - Abnormal/ Extreme Environmental combination is more limiting than these combinations.

⑥ - 0.25 x Ra is less critical than 0.5 x Pa for the basemat

⑦, ⑧ - 0.25 x G and 1.25W are less critical than 0.25 x Pa for the basemat

⑨, ⑩ - 1.0 x W is less critical than 1.5 x Pa for the basemat (Abnormal/severe environmental load condition with wind load is the governing case compared to same loading condition, excluding wind load)

⑪ - Combustible gas load due to hydrogen generation is classified as the internal pressure loading above design-basis pressure in accordance with RG 1.216 and is only considered in the structural integrity assessment based on the deterministic design basis analysis, not considered in the determination of structural member forces for design.

⑫ Self-weight of polar crane is included.

⑬ Lifting load of polar crane is included.

Table 2 Selected Loading Conditions of AB and CIS for AB Basemat Analysis

Loading Condition	Normal									Severe		Abnormal					Extreme			Analysis
	D	D_d	L	L_h	T_o	R_o	C	P_o	M_o	W	H	P_a	T_a	R_a	Y	M_a	E_s	W_t	H_s	
Construction	1.1	-	1.3	1.1	-	1.1	1.3	-	1.3	1.6	-	-	-	-	-	-	-	-	-	no(①)
	-	0.9	-	1.1	-	-	1.3	-	1.3	1.6	-	-	-	-	-	-	-	-	-	no(②)
Test	1.1	-	1.3	1.1	(1.3)	(1.1)	1.3	(1.3)	(1.3)	-	-	-	-	-	-	-	-	-	-	yes
Normal	1.4	-	1.7	1.4	(1.3)	(1.4)	1.7	(1.7)	(1.7)	-	-	-	-	-	-	-	-	-	-	yes
Severe Environmental	1.4	-	1.7	1.4	1.3	1.4	1.7	1.7	1.7	1.7	-	-	-	-	-	-	-	-	-	no(③)
	1.2	-	-	1.4	1.3	1.2	1.7	1.7	1.7	1.7	-	-	-	-	-	-	-	-	-	no(④)
	1.4	-	1.7	1.4	1.3	1.4	1.7	1.7	1.7	-	1.7	-	-	-	-	-	-	-	-	no(⑤)
	1.2	-	-	1.4	1.3	1.2	1.7	1.7	1.7	-	1.7	-	-	-	-	-	-	-	-	no(⑥)
Abnormal	1.0	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	1.0	-	-	-	no(⑦)
	1.0	-	1.0	1.0	-	-	1.0	-	(1.0)	-	-	(1.4)	(1.0)	(1.0)	-	-	-	-	-	yes
Extreme Environmental	1.0	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	-	1.0	-	-	no(⑧)
	1.0	-	1.0	1.0	1.0	1.0	-	1.0	1.0	-	-	-	-	-	-	-	-	1.0	-	no(⑨)
	1.0	-	1.0	1.0	1.0	1.0	-	1.0	1.0	-	-	-	-	-	-	-	-	-	1.0	no(⑩)
Abnormal / Extreme Environmental	1.0	-	1.0	1.0	-	-	1.0	-	(1.0)	-	-	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	1.0	-	-	Yes

* ( ) : loads not considered in basemat analysis. * yellow row : load combinations for basemat analysis.

①, ② - Governed by the severe environmental load combination

③ - It is the same as Normal loading condition except wind load which is not critical in basemat design.

④ - Governed by the severe environmental load combination

⑤, ⑥ - H is not considered critical for the basemat

⑦, ⑧, ⑨, ⑩ - Abnormal/Extreme Environmental combination is more critical than these combinations

Impact on DCD

DCD Tier 2, Rev.1, Section 3.8.1.3.2, 3.8.4.3.1, 3.8.6, and Table 1.8-2 will be revised, as indicated in Attachment 2 to 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

Technical report APR1400-E-S-NR-14006-P/NP, Rev. 3 Tables 3-5, 3-6, and 3-7 will be revised or added, as indicated in Attachment 1 to this response.

RAI 255-8285 Question 03.08.05-13_R1

RAI 255-8285 Question 03.08.05-13_R2

Table ~~1.~~ 3-6 Selected Loading Conditions of ~~Superstructure~~ Containment ~~for~~ RCB Basemat analysis ~~(RCB)~~

Loading Condition	D (⑫)	L (⑬)	F	Pt	G	Pa	Tt	To	Ta	Es	W	Wt	Ro	Ra	Yr	Yj	Ym	Yf	H	Hs	Pv	Ha	Ps	Analysis
Test	1.0	1.0	1.0	1.0	-	-	(1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	yes
Construction	1.0	1.0	1.0	-	-	-	-	1.0	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	no(①)
Normal	1.0	1.0	1.0	-	(1.0)	-	-	(1.0)	-	-	-	-	(1.0)	-	-	-	-	-	-	-	(1.0)	-	-	yes
Severe Environmental	1.0	1.3	1.0	-	(1.0)	-	-	(1.0)	-	-	(1.5)	-	(1.0)	-	-	-	-	-	-	-	(1.0)	-	-	yes
	1.0	1.3	1.0	-	1.0	-	-	1.0	-	-	-	-	1.0	-	-	-	-	-	1.5	-	1.0	-	-	no(②)
Extreme Environmental	1.0	1.0	1.0	-	1.0	-	-	1.0	-	1.0	-	-	1.0	-	-	-	-	-	-	-	1.0	-	-	no(③)
	1.0	1.0	1.0	-	1.0	-	-	1.0	-	-	-	1.0	1.0	-	-	-	-	-	-	-	1.0	-	-	no(④)
	1.0	1.0	1.0	-	1.0	-	-	1.0	-	-	-	-	1.0	-	-	-	-	-	-	1.0	1.0	-	-	no(⑤)
Abnormal	1.0	1.0	1.0	-	(1.0)	1.5	-	-	(1.0)	-	-	-	-	(1.0)	-	-	-	-	-	-	-	-	-	yes
	1.0	1.0	1.0	-	1.0	1.0	-	-	1.0	-	-	-	-	1.25	-	-	-	-	-	-	-	-	-	no(⑥)
	1.0	1.0	1.0	-	1.25	1.25	-	-	1.0	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	no(⑦)
Abnormal/Severe Environmental	1.0	1.0	1.0	-	1.0	1.25	-	-	1.0	-	1.25	-	-	1.0	-	-	-	-	-	-	-	-	-	no(⑧)
	1.0	1.0	1.0	-	1.0	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	no(⑨)
	1.0	1.0	1.0	-	1.0	-	-	1.0	-	-	1.0	-	-	-	-	-	-	-	-	-	-	1.0	-	no(⑩)
Abnormal/Extreme Environmental	1.0	1.0	1.0	-	(1.0)	1.0	-	-	(1.0)	1.0	-	-	-	(1.0)	1.0	(1.0)	(1.0)	-	-	-	-	-	-	yes
Combustible Gas Control inside Containment	1.0	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	no(⑪)

* ( ) : ~~load~~ loads not considered in basemat analysis. * yellow ~~column~~ row : ~~considered load combination in basemat analysis.~~ load combinations for basemat analysis

① - Effect on the basemat due to wind is less than that of Pt, and To is negligible

② - H is not considered to be critical for the basemat (Containment building roof could not contain any rainwater.)

③, ④, ⑤ - Abnormal/ Extreme Environmental combination is more limiting than these combinations.

⑥ - 0.25 x Ra is less critical than 0.5 x Pa for the basemat

⑦, ⑧ - 0.25 x G and 1.25W are less critical than 0.25 x Pa for the basemat

⑨, ⑩ - 1.0 x W is less critical than 1.5 x Pa for the basemat

(Abnormal/severe environmental load condition with wind load governs compared to same loading condition excluding wind load)

⑪ - ~~Beyond design load combination~~ : Combustible gas load due to hydrogen generation is classified as the internal pressure loading above design-basis pressure in accordance with RG 1.216 and is only considered in the structural integrity assessment based on the deterministic design basis analysis, not considered in the determination of structural member forces for design.

⑫ Self-weight of polar crane is included.

⑬ Lifting load of polar crane is included.

RAI 255-8285 Question 03.08.05-13_R1

RAI 255-8285 Question 03.08.05-13_R2

3-7 AB and CIS AB

Table ~~2~~ Selected Loading Conditions of ~~Superstructures for~~ Basemat ~~Analsysi (RCB)~~ Analysis

Loading Condition	Normal									Severe		Abnormal					Extreme			Analysis
	D	D_d	L	L_h	T_o	R_o	C	P_o	M_o	W	H	P_a	T_a	R_a	Y	M_a	E_s	W_t	H_s	
Construction	1.1	-	1.3	1.1	-	1.1	1.3	-	1.3	1.6	-	-	-	-	-	-	-	-	-	no(①)
	-	0.9	-	1.1	-	-	1.3	-	1.3	1.6	-	-	-	-	-	-	-	-	-	no(②)
Test	1.1	-	1.3	1.1	(1.3)	(1.1)	1.3	(1.3)	(1.3)	-	-	-	-	-	-	-	-	-	-	yes
Normal	1.4	-	1.7	1.4	(1.3)	(1.4)	1.7	(1.7)	(1.7)	-	-	-	-	-	-	-	-	-	-	yes
Severe Environmental	1.4	-	1.7	1.4	1.3	1.4	1.7	1.7	1.7	1.7	-	-	-	-	-	-	-	-	-	no(③)
	1.2	-	-	1.4	1.3	1.2	1.7	1.7	1.7	1.7	-	-	-	-	-	-	-	-	-	no(④)
	1.4	-	1.7	1.4	1.3	1.4	1.7	1.7	1.7	-	1.7	-	-	-	-	-	-	-	-	no(⑤)
	1.2	-	-	1.4	1.3	1.2	1.7	1.7	1.7	-	1.7	-	-	-	-	-	-	-	-	no(⑥)
Abnormal	1.0	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	1.0	-	-	-	no(⑦)
	1.0	-	1.0	1.0	-	-	1.0	-	(1.0)	-	-	(1.4)	(1.0)	(1.0)	-	-	-	-	-	yes
Extreme Environmental	1.0	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	-	1.0	-	-	no(⑧)
	1.0	-	1.0	1.0	1.0	1.0	-	1.0	1.0	-	-	-	-	-	-	-	-	1.0	-	no(⑨)
	1.0	-	1.0	1.0	1.0	1.0	-	1.0	1.0	-	-	-	-	-	-	-	-	-	1.0	no(⑩)
Abnormal / Extreme Environmental	1.0	-	1.0	1.0	-	-	1.0	-	(1.0)	-	-	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	1.0	-	-	Yes

* ( ) : ~~load~~ loads not considered in basemat analysis. * yellow ~~column~~ row : ~~considered load combination in basemat analysis.~~

①, ② - Governed by the severe environmental load combination

③ - It is the same as Normal loading condition except wind load which is not critical in basemat design.

④ - Governed by the severe environmental load combination

⑤, ⑥ - H is not considered critical for the basemat

⑦, ⑧, ⑨, ⑩ - Abnormal/Extreme Environmental combination is more critical than these combinations

load combinations for basemat analysis

RAI 255-8285 Question 03.08.05-13_R1
RAI 255-8285 Question 03.08.05-13_R2

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Table 3 Load Combination for NI Common Basemat Analysis

Condition	Load Case	Load Combination	Remark	Reference
Test	LC01	$1.0D+1.0L+1.0L_1+1.0F+1.0P_t$	For RCB basemat design	DCD Table 3.8-2
Normal	LC02	$1.0D+1.0L+1.0L_1+1.0F$		
Severe	LC03	$1.0D+1.3L+1.3L_1+1.0F$		
Abnormal	LC04	1.0D+1.0L+1.0L1+1.0F+1.5Pa		
Test	LC05	$1.1D+1.3L+1.1L_1+1.0F+1.0P_t$	For AB basemat design	DCD Table 3.8-9A
Normal	LC06	$1.4D+1.7L+1.4L_1+1.0F$		
Abnormal	LC07	1.0D+1.0L+1.0L1+1.0F+1.4Pa		
Abnormal /Extreme	LC08	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es01+Lg_d	For RCB & AB Basemat design	DCD Table 3.8-2, 3.8-9A
	LC09	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es02+Lg_d		
	LC10	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es03+Lg_d		
	LC11	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es04+Lg_d		
	LC12	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es05+Lg_d		
	LC13	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es06+Lg_d		
	LC14	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es07+Lg_d		
	LC15	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es08+Lg_d		
	LC16	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es09+Lg_d		
	LC17	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es10+Lg_d		
	LC18	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es11+Lg_d		
	LC19	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es12+Lg_d		
	LC20	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es13+Lg_d		
	LC21	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es14+Lg_d		
	LC22	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es15+Lg_d		
	LC23	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es16+Lg_d		
	LC24	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es17+Lg_d		
	LC25	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es18+Lg_d		

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LC26	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es19+Lg\_d$
LC27	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es20+Lg\_d$
LC28	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es21+Lg\_d$
LC29	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es22+Lg\_d$
LC30	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es23+Lg\_d$
LC31	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es24+Lg\_d$
LC32	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es25+Lg\_d$
LC33	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es26+Lg\_d$
LC34	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es27+Lg\_d$
LC35	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es28+Lg\_d$
LC36	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es29+Lg\_d$
LC37	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es30+Lg\_d$
LC38	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es31+Lg\_d$
LC39	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es32+Lg\_d$
LC40	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es33+Lg\_d$
LC41	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es34+Lg\_d$
LC42	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es35+Lg\_d$
LC43	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es36+Lg\_d$
LC44	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es37+Lg\_d$
LC45	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es38+Lg\_d$
LC46	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es39+Lg\_d$
LC47	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es40+Lg\_d$
LC48	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es41+Lg\_d$
LC49	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es42+Lg\_d$
LC50	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es43+Lg\_d$
LC51	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es44+Lg\_d$
LC52	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es45+Lg\_d$

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	LC53	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es46+Lg_d		
	LC54	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es47+Lg_d		
	LC55	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es48+Lg_d		
	LC56	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es49+Lg_d		
	LC57	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es50+Lg_d		
	LC58	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es51+Lg_d		
	LC59	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es52+Lg_d		
	LC60	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es53+Lg_d		
	LC61	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es54+Lg_d		
	LC62	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es55+Lg_d		
	LC63	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es56+Lg_d		
	LC64	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es57+Lg_d		
	LC65	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es58+Lg_d		
	LC66	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es59+Lg_d		
	LC67	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es60+Lg_d		
	LC68	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es61+Lg_d		
	LC69	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es62+Lg_d		
	LC70	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es63+Lg_d		
	LC71	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es64+Lg_d		

Where:

D = Dead load (Including Hydrostatic load) from RCB and AB
L = Live load (Including Static Earth Pressure) from RCB and AB
F = Post-tension load of tendon embedded RCB shell and dome
Pa = Design internal pressure of RCB shell and dome
Pt = Internal pressure of RCB shell and dome at testing phase
Yr = Pipe break load
E_s = Seismic load (Including 5% Torision) from RCB and AB
L_{g_d} = Dynamic Earth Pressure
L_1 = Buoyance load

Table 3-5

Load Combinations for NI Common Basemat Analysis

Position	Condition	Load Case	Load Combination
RCB Basemat	Test	LC01	1.0D+1.0L+1.0Lh+1.0F+1.0Pt
	Normal	LC02	1.0D+1.0L+1.0Lh+1.0F
	Severe	LC03	1.0D+1.3L+1.3Lh+1.0F
	Abnormal	LC04	1.0D+1.0L+1.0Lh+1.0F+1.5Pa
AB Basemat	Test	LC05	1.1D+1.3L+1.1Lh+1.0F+1.0Pt
	Normal	LC06	1.4D+1.7L+1.4Lh+1.0F
	Abnormal	LC07	1.0D+1.0L+1.0Lh+1.0F+1.4Pa
RCB and AB Basemat	Abnormal /Extreme	LC08	1.0D+1.0L+1.0Lh+1.0F+1.0Pa+1.0Yr +1.0Es01
		LC09	1.0D+1.0L+1.0Lh+1.0F+1.0Pa+1.0Yr +1.0Es02
		LC10	1.0D+1.0L+1.0Lh+1.0F+1.0Pa+1.0Yr +1.0Es03
		LC11	1.0D+1.0L+1.0Lh+1.0F+1.0Pa+1.0Yr +1.0Es04
		LC12	1.0D+1.0L+1.0Lh+1.0F+1.0Pa+1.0Yr +1.0Es05
		LC13	1.0D+1.0L+1.0Lh+1.0F+1.0Pa+1.0Yr +1.0Es06
		LC14	1.0D+1.0L+1.0Lh+1.0F+1.0Pa+1.0Yr +1.0Es07
		LC15	1.0D+1.0L+1.0Lh+1.0F+1.0Pa+1.0Yr +1.0Es08

Where:

D = Dead load

L = Live load

F = Post-tension load of tendon embedded RCB shell and dome

Pa = Design internal pressure of RCB shell and dome

Pt = Internal pressure of RCB shell and dome at testing phase

Yr = Pipe break load

E_s = Seismic load

Replaced by pages 7 thru 11

Table 3-5

Load Combination for NI Common Basemat Analyses

Condition	Load Case	Load Combination	Remark	Reference
Test	LC01	$1.0D+1.0L+1.0L_1+1.0F+1.0P_t$	RCB load combinations for RCB basemat design	DCD Table 3.8-2
Normal	LC02	$1.0D+1.0L+1.0L_1+1.0F$		
Severe	LC03	$1.0D+1.3L+1.3L_1+1.0F$		
Abnormal	LC04	1.0D+1.0L+1.0L1+1.0F+1.5Pa		
Test	LC05	$1.1D+1.3L+1.1L_1+1.0F+1.0P_t$	AB load combinations for AB basemat design	DCD Table 3.8-7A
Normal	LC06	$1.4D+1.7L+1.4L_1+1.0F$		
Abnormal	LC07	1.0D+1.0L+1.0L1+1.0F+1.4Pa		
Abnormal /Extreme	LC08	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es01+Lg_d	For RCB & AB Basemat design	DCD Table 3.8-2, 3.8-7A
	LC09	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es02+Lg_d		
	LC10	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es03+Lg_d		
	LC11	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es04+Lg_d		
	LC12	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es05+Lg_d		
	LC13	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es06+Lg_d		
	LC14	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es07+Lg_d		
	LC15	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es08+Lg_d		
	LC16	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es09+Lg_d		
	LC17	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es10+Lg_d		
	LC18	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es11+Lg_d		
	LC19	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es12+Lg_d		
	LC20	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es13+Lg_d		
	LC21	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es14+Lg_d		
	LC22	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es15+Lg_d		
	LC23	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es16+Lg_d		
	LC24	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es17+Lg_d		

Condition	Load Case	Load Combination	Remark	Reference
	LC25	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es18+Lg\_d$		
	LC26	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es19+Lg\_d$		
	LC27	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es20+Lg\_d$		
	LC28	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es21+Lg\_d$		
	LC29	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es22+Lg\_d$		
	LC30	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es23+Lg\_d$		
	LC31	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es24+Lg\_d$		
	LC32	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es25+Lg\_d$		
	LC33	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es26+Lg\_d$		
	LC34	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es27+Lg\_d$		
	LC35	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es28+Lg\_d$		
	LC36	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es29+Lg\_d$		
	LC37	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es30+Lg\_d$		
	LC38	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es31+Lg\_d$		
	LC39	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es32+Lg\_d$		
	LC40	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es33+Lg\_d$		
	LC41	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es34+Lg\_d$		
	LC42	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es35+Lg\_d$		
	LC43	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es36+Lg\_d$		
	LC44	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es37+Lg\_d$		
	LC45	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es38+Lg\_d$		
	LC46	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es39+Lg\_d$		
	LC47	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es40+Lg\_d$		
	LC48	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es41+Lg\_d$		
	LC49	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es42+Lg\_d$		
	LC50	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es43+Lg\_d$		

Condition	Load Case	Load Combination	Remark	Reference
	LC51	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es44+Lg_d		
	LC52	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es45+Lg_d		
	LC53	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es46+Lg_d		
	LC54	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es47+Lg_d		
	LC55	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es48+Lg_d		
	LC56	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es49+Lg_d		
	LC57	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es50+Lg_d		
	LC58	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es51+Lg_d		
	LC59	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es52+Lg_d		
	LC60	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es53+Lg_d		
	LC61	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es54+Lg_d		
	LC62	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es55+Lg_d		
	LC63	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es56+Lg_d		
	LC64	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es57+Lg_d		
	LC65	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es58+Lg_d		
	LC66	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es59+Lg_d		
	LC67	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es60+Lg_d		
	LC68	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es61+Lg_d		
	LC69	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es62+Lg_d		
	LC70	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es63+Lg_d		
	LC71	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es64+Lg_d		
	LC72	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es65+Lg_d		
	LC73	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es66+Lg_d		
	LC74	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es67+Lg_d		
	LC75	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es68+Lg_d		
	LC76	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es69+Lg_d		

Condition	Load Case	Load Combination	Remark	Reference
	LC77	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es70+Lg_d		
	LC78	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es71+Lg_d		
	LC79	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es72+Lg_d		
	LC80	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es73+Lg_d		
	LC81	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es74+Lg_d		
	LC82	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es75+Lg_d		
	LC83	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es76+Lg_d		
	LC84	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es77+Lg_d		
	LC85	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es78+Lg_d		
	LC86	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es79+Lg_d		
	LC87	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es80+Lg_d		
	LC88	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es81+Lg_d		
	LC89	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es82+Lg_d		
	LC90	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es83+Lg_d		
	LC91	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es84+Lg_d		
	LC92	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es85+Lg_d		
	LC93	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es86+Lg_d		
	LC94	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es87+Lg_d		
	LC95	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es88+Lg_d		
	LC96	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es89+Lg_d		
	LC97	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es90+Lg_d		
	LC98	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es91+Lg_d		
	LC99	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es92+Lg_d		
	LC100	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es93+Lg_d		
	LC101	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es94+Lg_d		
	LC102	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ +1.0Es95+Lg_d		

Condition	Load Case	Load Combination	Remark	Reference
	LC103	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es96+Lg\_d$		
Abnormal /Extreme	LC104	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es97+Lg\_d$	For RCB & AB Basemat design	DCD Table 3.8-2, 3.8-7A
	LC105	$1.0D+1.0L+1.0L_1+1.0F+1.0P_a+1.0Y_r$ $+1.0Es98+Lg\_d$		

Where:

D = Dead load (Including Hydrostatic load) from RCB and AB
L = Live load (Including Static Earth Pressure) from RCB and AB
F = Post-tension load of tendon embedded RCB shell and dome
Pa = Design internal pressure of RCB shell and dome
Pt = Internal pressure of RCB shell and dome at testing phase
Yr = Pipe break load
E_s = Seismic load (Including 5% Torsion) from RCB and AB
(100-40-40 spatial combination: Es01 thru Es96, SRSS spatial combination: Es97 and Es98)
L_{g_d} = Dynamic Earth Pressure
L_1 = Buoyance load

2) Combustible gas load (P_s)

Combustible gas loads are pressure loads that result from a fuel-clad metal-water reaction (P_{g1}) followed by an uncontrolled hydrogen burn (P_{g2}) during a post-accident condition in the containment inerted by carbon dioxide. NRC RG 1.136, Regulatory Position C.5 provides the loads and load combinations acceptable for analysis and design of containment when exposed to the loading conditions associated with combustible gas. The loads and load combinations for combustible gas are provided in Subsection 3.8.1.3.

t. Missile loads other than hurricane generated or tornado-generated missiles

There are no missile loads on the containment resulting from activities of nearby military installations, turbine failures, or other causes.

u. Valve actuation load (G)

Loads resulting from relief valve or other high energy device actuation

v. Design flood/precipitation load (H)

Flood loads on seismic Category I structures are determined based on the maximum site flood levels specified in Chapter 2.

w. Probable maximum flood/precipitation (H_s)

H_s is the forces, due to the probable maximum precipitation as well as the maximum flood level, which includes the effects of seiches, surges, waves, and tsunamis.

x. Crane and trolley loads (C)

This load is the crane and trolley lifted load, including impact load, longitudinal load, and lateral load. All of these loads shall be considered as acting simultaneously. This load is detailed in Subsection 3.8.4.3.1.

In the case of the crane lifting load, it is not considered under severe environmental, extreme environmental, abnormal, abnormal/severe environmental, and abnormal/extreme environmental loading condition since the polar crane is not permitted to lift any loads during plant operation. When not in use, the polar crane is required to be in the parking position (location of polar crane: Az.280º, trolley location: 12 ft 7 in away from end of east part), since the crane is placed in the parking position during plant operation. The self-weight for all load conditions and live load (for construction and normal load condition) of polar crane are applied to the parking position (COL 3.8(21)).

For the test loading condition, this includes piping reactions due to test cleanup and blowdown conditions.

R_{op} – Effects of unbalanced pressure and thrust

e. Crane and trolley loads – (C)

C is crane and trolley lifted load, including impact load, longitudinal load and lateral load. All of these loads are considered as acting simultaneously.

Insert A

1) Bridge crane

A bridge crane is a crane that has a bridge girder that moves longitudinally on two parallel beams, and a trolley hoist that moves laterally along the bridge girder. It can either ride on a rail on top of the two parallel beams or hang from their bottom flanges.

The lifted load is the rated capacity of the main hook. The manufacturer usually provides the maximum wheel load to be applied to the support steel.

The vertical impact load is considered to be 25 percent of the maximum wheel loads.

The longitudinal load is considered as 10 percent of the maximum wheel loads of the crane applied at the supporting beam flange.

The lateral load on crane runways for bridge cranes (to provide for the effect of the moving crane trolleys) is considered as 20 percent of the sum of the lifted load and the crane trolley. The load is applied to each side at the supporting beam flange (top or bottom depending on the support arrangement) acting in either direction normal to the support beams, and is distributed based on lateral stiffness of the structure supporting the bridge crane.

2) Trolley

A trolley is a hoist that can move longitudinally but not laterally and is hung from the bottom flange of the support beam (trolley beam). It can rotate laterally. Trolleys may be motorized or hand-operated.

A

For the crane and trolley loads of the fuel handling overhead crane, the self-weight, lifting load, and vertical load due to vertical seismic acceleration are considered in the structural analysis of auxiliary building and NI common basemat at the worst location through 3 cases analyses. The lateral load due to seismic is not considered in the analysis due to the pendent effect.

Table 1.8-2 (9 of 38)

Added in COL 3.8(21)in page 6

Item No.	Description
COL 3.8(20)	The COL applicant shall perform site-specific evaluations if the shear wave velocity is less than 1,000 ft/s. The site-specific evaluations (differential settlement, soil bearing pressure, and sliding evaluation [if needed]) and 3D FEM global analysis for basemat design of seismic Category I structures shall be performed using the site-specific measured Estatic and the methodology described in Subsection 3.8.5 and Technical report APR1400-E-S-NR-14006-P, Subsection 4.
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 identify the site-specific active pumps.
COL 3.9(3)	The COL applicant is to provide a full description of the IST program (including PST and MOV testing) for pumps, valves and dynamic restraints that will be administratively controlled such that the applicable requirements of the ASME OM Code edition and addenda are incorporated in the IST program.
COL 3.9(4)	The COL applicant is to provide an IST program including the type of testing and frequency of site-specific pumps subject to IST in accordance with the ASME OM Code and Table 3.9-13
COL 3.9(5)	The COL applicant is to provide an IST program including the type of testing and frequency of any site-specific valves subject to IST in accordance with the ASME OM Code and Table 3.9-13
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 3.10(1)	The COL applicant is to provide documentation that the designs of seismic Category I SSCs are analyzed for OBE, if OBE is higher than 1/3 SSE.
COL 3.10(2)	The COL applicant is to investigate if site-specific spectra generated for the COLA exceed the APR1400 design spectra in the high-frequency range. Accordingly, the COL applicant is to provide reasonable assurance of the functional performance of vibration-sensitive components in the high-frequency range.
COL 3.10(3)	The COL applicant is to develop the equipment seismic qualification files that summarize the component's qualification, including a list of equipment classified as seismic Category I in Table 3.2-1 and seismic qualification summary data sheets (SQSDS) for each piece of seismic Category I equipment.
COL 3.10(4)	The COL applicant is to perform equipment seismic qualification for seismic Category I equipment and provide milestones and completion dates of equipment seismic qualification program.
COL 3.11(1)	The COL applicant is to identify and qualify the site-specific mechanical, electrical, I&C, and accident monitoring equipment specified in RG 1.97.
COL 3.11(2)	The COL applicant is to identify the nonmetallic parts of mechanical equipment in procurement process.
COL 3.11(3)	The COL applicant is to operational address aspects for maintaining the environmental qualification status of components after initial qualification.
COL 3.11(4)	The COL applicant is to provide a full description of the environmental qualification of mechanical and electrical equipment program.

mudmat, and non-uniformity of soil layers, are identified. Then, a site-specific evaluation will be performed.

3) The time (short term vs long term), instantaneous settlement and time-consolidation effect, shall be considered in accordance with surveyed soil profiles. And the differential settlement of the basemat and bearing stress shall be checked to demonstrate acceptability.

4) COL applicant will build the seismic Category I structure according to the construction sequence used in construction sequence analysis.

5) If site-specific evaluation is required, the COL applicant performs construction sequence analysis based on the site-specific parameters. And if the settlement including results of construction sequence analysis exceeds the acceptance criteria in the DCD Table 2.0-1, the construction sequence will be modified to meet the acceptance criteria in the DCD Table 2.0-1 by COL applicant

6) The effect of the design for seismic Category I structures due to construction sequence analysis shall be accounted by COL applicant.

COL 3.8(20) The COL applicant shall perform site-specific evaluations if the shear wave velocity is less than 1,000 ft/s. The site-specific evaluations (differential settlement, soil bearing pressure, and sliding evaluation [if needed]) and 3D FEM global analysis for basemat design of seismic Category I structures shall be performed using the site-specific measured Estatic and the methodology described in DCD Tier 2, Subsection 3.8.5 and Technical report APR1400-E-S-NR-14006-P, Subsection 4.

Added in COL 3.8(21)in page 6

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.

COL 3.8(21)	The COL applicant is to confirm that the parking position of the crane and trolley when the crane is not being used is: location of polar crane: Az.280º, trolley location: 12ft 7in away from end of east part. The COL appicant is to confirm that this requirement is included in the technical specification of the COL application for the use of the polar crane.