NRC Feedback on "KHNP's Draft Revised Response to RAI 129-8085, Question 3.8.1-1" (Draft Response Provide 2/19/16)

The staff evaluated the draft response to Question 3.8.1-1 and noted the following:

a. Acceptable – Confirmatory Item (CI)

b. Defer to the resolution of RAI 252-8299, Question 03.07.02-7

KHNP INPUT

The response will be revised after the RAI 252-8299, Question 03.07.02-7 will be resolved.

c. Staff is coordinating the appropriate Chapter reviewer to evaluate the methodology for calculating the hydrogen generation pressure load.

d. Acceptable - CI

e. The first paragraph of the RAI response states "Thus, there is no connection to transfer POSRV actuation loads to the containment wall. Therefore, POSRV actuation loads are not applied to the containment basemat through the containment wall." Since the POSRV loads also apply a pressure load on the IRWST floor slab which is on top of the RCB basemat, then POSRV loads can affect the RCB basemat directly (i.e., not through the containment wall) and also may have an effect on the dynamic overall building response in terms of member forces and building response spectra. The basis for not considering these effects should be provided or an evaluation should be performed to consider these loads.

The remaining paragraphs of the response, including the response to Question 03.08.03-1 of RAI No. 208-8245, do not adequately demonstrate that there will be no overall building response in terms of member forces and building response spectra. The RAI response indicates that the hydrodynamic pressure load is a short transient pressure time history, the period of the POSRV discharge load is very short, and the load rapidly decreases in magnitude. This type of hydrodynamic pressure time history is similar to safety relief valve transients in other nuclear power plants which have shown in some cases to cause significant loading on the overall building response and response spectra. Therefore, the applicant is requested to provide further justification to address this item.

KHNP INPUT

As mentioned in RAI response to Question 03.08.03-1, the hydrodynamic pressure load is generated from two spargers located at Az. 90° and Az. 180°. Therefore, this pressure load is locally applied to the IRWST wall and bottom slab and will not directly affect the "global behavior" of the containment basemat because the IRWST concrete slab having a thickness of 3 ft is sitting on the basemat. In addition, the results from the hydrodynamic load are already reflected in the

design of the IRWST wall and bottom slab together with the seismic load. It means that the rebars together with concrete share the stress or deformation of IRWST bottom slab caused by hydrodynamic load.

The RAI response to Question 03.08.03-1 of RAI No. 208-8245 is related to dynamic load factor which transforms a dynamic peak load into a static load with the same effect on the structure, not related to overall building response. This is based on the concept described in Chapter 2 of "Introduction to Structural Dynamics" written by John M. Biggs. which is commonly applied in the industry.

With regard to the dynamic overall building response caused by POSRV loads, the additional hydrodynamic load analysis, which is time history analysis (refer to Table 1 of Question 03.08.01-15 of RAI No. 249-8323), has been carried out. In this analysis, the transient displacements of primary and secondary shield wall (PSW and SSW), which will be directly influenced on POSRV load because of entire structure (PSW, SSW, IRWST), were calculated. The locations for transient displacement were selected within the influence region of POSRV loading as shown in Figure 1. The maximum transient displacements of PSW and SSW are also described in Table 1. As shown in Table 1, on every direction, the maximum transient displacement is less than 0.0036 inch (0.091 mm). Figure 2 shows the Floor Response Spectrum (FRS) of PSW (EL. 100'-0", EW) by POSRV load. And the comparison of spectral acceleration between POSRV and seismic (SSE) loads (EL. 100'-0") is shown in Table 2. The spectral acceleration by POSRV is less than 9 percent of that by seismic load. Therefore, it can be judgeable that the structure response caused by POSRV load is negligible to overall building except for local design of IRWST wall for POSRV pressure load.

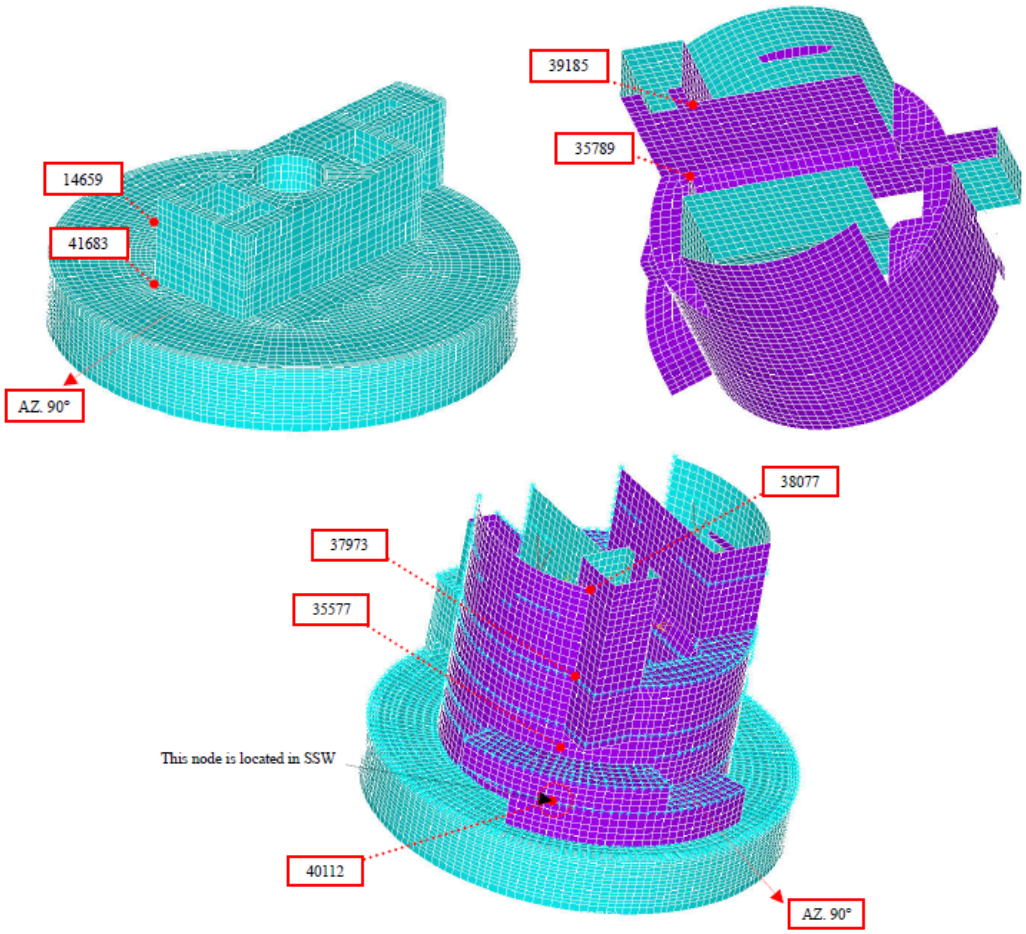

Figure 1. Locations for Transient Displacement (Hydrodynamic Load, Time History Analysis)

Table 1. Maximum Transient Displacement

[unit: inch]

Primary Shield Wall (PSW)									
Elevation	Load Case	Displacements			Elevation	Load Case	Displacements		
		EW (X)	NS (Y)	VT (Z)			EW (X)	NS (Y)	VT (Z)
EL.100	4 Hz	0.0003485	0.0001982	0.0000999	EL.130	4 Hz	0.0004582	0.0003907	0.0003149
	5 Hz	0.0003871	0.0002314	0.0001078		5 Hz	0.0006004	0.0004252	0.0003192
	6 Hz	0.0004026	0.0002923	0.0001075		6 Hz	0.0004734	0.0004521	0.0003344
	7 Hz	0.0003746	0.0002636	0.0001062		7 Hz	0.0004658	0.0004790	0.0003707
	8 Hz	0.0004427	0.0002840	0.0001600		8 Hz	0.0006496	0.0006408	0.0004886
	9 Hz	0.0005273	0.0003406	0.0001759		9 Hz	0.0007987	0.0006009	0.0004902
	10 Hz	0.0005158	0.0003679	0.0001736		10 Hz	0.0008464	0.0007836	0.0006287
	11 Hz	0.0004056	0.0004594	0.0001806		11 Hz	0.0009094	0.0010084	0.0006484
	12 Hz	0.0005240	0.0004470	0.0001865		12 Hz	0.0008849	0.0007891	0.0006718
	13 Hz	0.0004759	0.0005284	0.0001621		13 Hz	0.0008477	0.0007834	0.0006200
	14 Hz	0.0004625	0.0005304	0.0001478		14 Hz	0.0006863	0.0006954	0.0005446
	Max.	**0.0005273**	**0.0005304**	**0.0001865**		**Max.**	**0.0009094**	**0.0010084**	**0.0006718**
Elevation	Load Case	Displacements			Elevation	Load Case	Displacements		
		EW (X)	NS (Y)	VT (Z)			EW (X)	NS (Y)	VT (Z)
EL.156	4 Hz	0.0006091	0.0006041	0.0003696	EL.191	4 Hz	0.0008838	0.0015422	0.0004009
	5 Hz	0.0007076	0.0006481	0.0004277		5 Hz	0.0010249	0.0015860	0.0005029
	6 Hz	0.0006991	0.0007173	0.0004067		6 Hz	0.0010542	0.0015226	0.0004444
	7 Hz	0.0007571	0.0007398	0.0004293		7 Hz	0.0013119	0.0019909	0.0005238
	8 Hz	0.0009343	0.0009708	0.0005503		8 Hz	0.0014236	0.0031154	0.0006463
	9 Hz	0.0011160	0.0011321	0.0005778		9 Hz	0.0017642	0.0035094	0.0005852
	10 Hz	0.0011312	0.0011344	0.0008460		10 Hz	0.0021027	0.0027021	0.0009065
	11 Hz	0.0011792	0.0014412	0.0008450		11 Hz	0.0021468	0.0024751	0.0010094
	12 Hz	0.0011477	0.0009765	0.0007988		12 Hz	0.0017990	0.0025221	0.0009738
	13 Hz	0.0010220	0.0011044	0.0008018		13 Hz	0.0014867	0.0029380	0.0008732
	14 Hz	0.0009983	0.0009975	0.0007013		14 Hz	0.0015599	0.0028628	0.0008274
	Max.	**0.0011792**	**0.0014412**	**0.0008460**		**Max.**	**0.0021468**	**0.0035094**	**0.0010094**

Max. Value

Table 1. Maximum Transient Displacement (continued)

[unit: inch]

Secondary Shield Wall (SSW)									
Elevation	Load Case	Displacements			Elevation	Load Case	Displacements		
		EW (X)	NS (Y)	VT (Z)			EW (X)	NS (Y)	VT (Z)
EL.100	4 Hz	0.0004115	0.0003689	0.0002848	EL.130	4 Hz	0.0006849	0.0005226	0.0004250
	5 Hz	0.0004360	0.0004086	0.0003177		5 Hz	0.0006894	0.0005124	0.0005545
	6 Hz	0.0004356	0.0004325	0.0003446		6 Hz	0.0006611	0.0005689	0.0005600
	7 Hz	0.0004024	0.0003954	0.0003721		7 Hz	0.0006557	0.0005771	0.0006137
	8 Hz	0.0005449	0.0004817	0.0004534		8 Hz	0.0008865	0.0008691	0.0007151
	9 Hz	0.0006313	0.0004966	0.0004152		9 Hz	0.0011215	0.0007486	0.0007532
	10 Hz	0.0006358	0.0004463	0.0003689		10 Hz	0.0011703	0.0008886	0.0006395
	11 Hz	0.0004512	0.0005351	0.0003709		11 Hz	0.0011664	0.0010240	0.0007895
	12 Hz	0.0005320	0.0007124	0.0004410		12 Hz	0.0009405	0.0008925	0.0007012
	13 Hz	0.0004838	0.0007716	0.0004242		13 Hz	0.0008079	0.0007681	0.0006497
	14 Hz	0.0004111	0.0007162	0.0003671		14 Hz	0.0006778	0.0006095	0.0005848
	Max.	**0.0006358**	**0.0007716**	**0.0004534**		**Max.**	**0.0011703**	**0.0010240**	**0.0007895**
Elevation	Load Case	Displacements			Elevation	Load Case	Displacements		
		EW (X)	NS (Y)	VT (Z)			EW (X)	NS (Y)	VT (Z)
EL.156	4 Hz	0.0008715	0.0009086	0.0005820	EL.191	4 Hz	0.0010400	0.0016466	0.0006926
	5 Hz	0.0010395	0.0008716	0.0007222		5 Hz	0.0015426	0.0013733	0.0007993
	6 Hz	0.0011534	0.0009587	0.0006829		6 Hz	0.0014868	0.0016514	0.0007849
	7 Hz	0.0008549	0.0013698	0.0007984		7 Hz	0.0012729	0.0021199	0.0008185
	8 Hz	0.0010590	0.0016290	0.0009460		8 Hz	0.0016215	0.0031964	0.0010664
	9 Hz	0.0015705	0.0019596	0.0008874		9 Hz	0.0018884	0.0034063	0.0009695
	10 Hz	0.0018756	0.0019951	0.0010721		10 Hz	0.0025563	0.0026921	0.0012090
	11 Hz	0.0020092	0.0019729	0.0011097		11 Hz	0.0027734	0.0024877	0.0011745
	12 Hz	0.0019331	0.0018858	0.0009513		12 Hz	0.0027867	0.0027105	0.0011034
	13 Hz	0.0016577	0.0020059	0.0011469		13 Hz	0.0023522	0.0024438	0.0015217
	14 Hz	0.0011500	0.0018318	0.0012414		14 Hz	0.0021619	0.0019604	0.0016151
	Max.	**0.0020092**	**0.0020059**	**0.0012414**		**Max.**	**0.0027867**	**0.0034063**	**0.0016151**

Max. Value

Table 2. Comparison of Spectral Acceleration between POSRV and seismic (SSE) loads

		POSRV	SSE(1)	Remark
PSW(2)	EW	0.016 g	1.25 g	1.28 %
	NS	0.020 g	0.95 g	2.11 %
	VT	0.051 g	1.12 g	4.55 %
SSW(2)	EW	0.022 g	1.28 g	1.72 %
	NS	0.021 g	0.97 g	2.16 %
	VT	0.100 g	1.17 g	8.55 %

∗ Natural frequency of internal structure = 8.5 Hz (EW, NS), 23.4 Hz (VT)

(1) This values are from APR1400-E-S-NR-14003-P, Rev.0 “SSI Analysis of NI Buildings”

(2) EL. 100’-0”, 7% Damping Value (RC Structure)

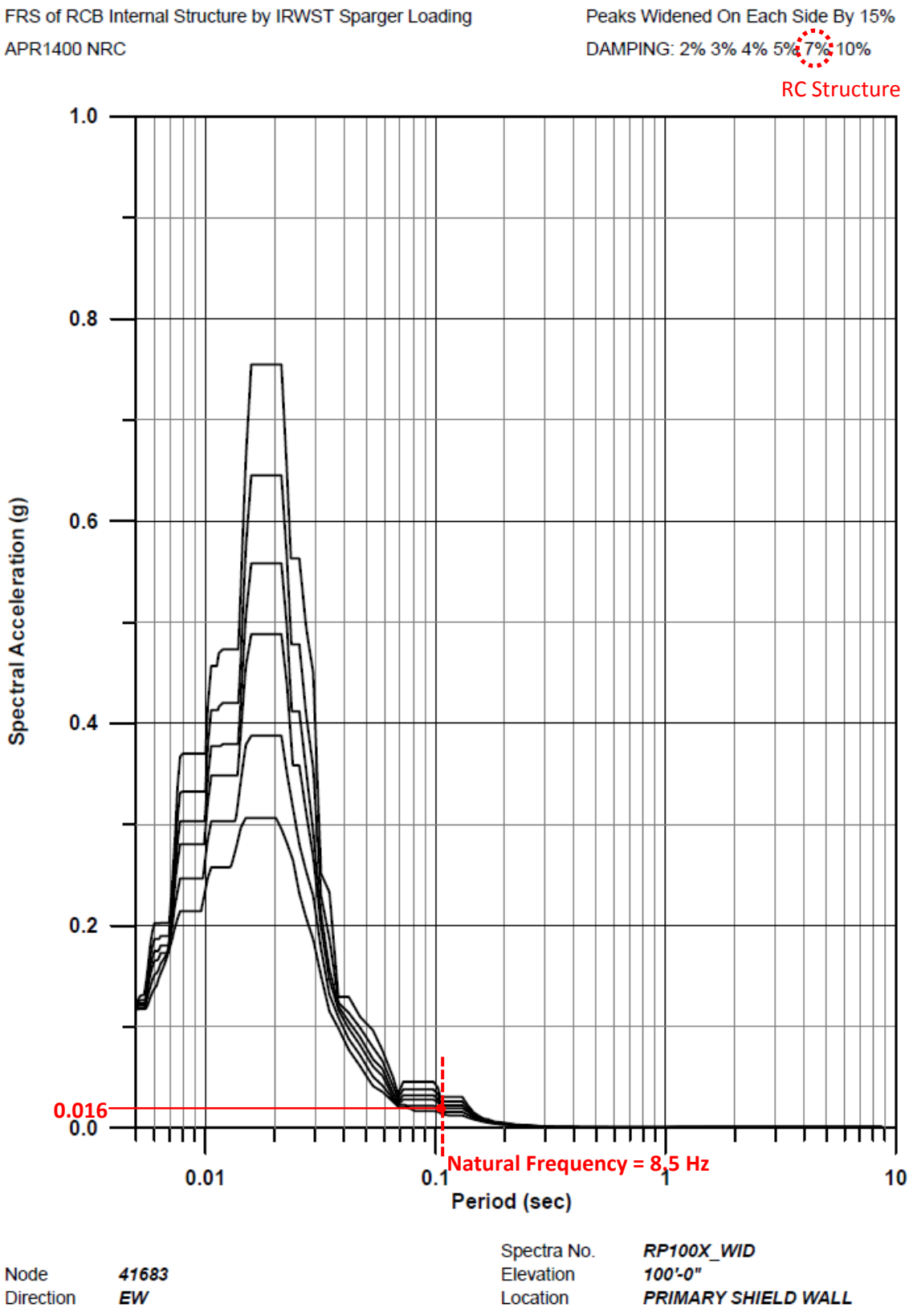

Figure 2. Floor Response Spectrum of PSW (EL. 100'-0", EW) (for example)