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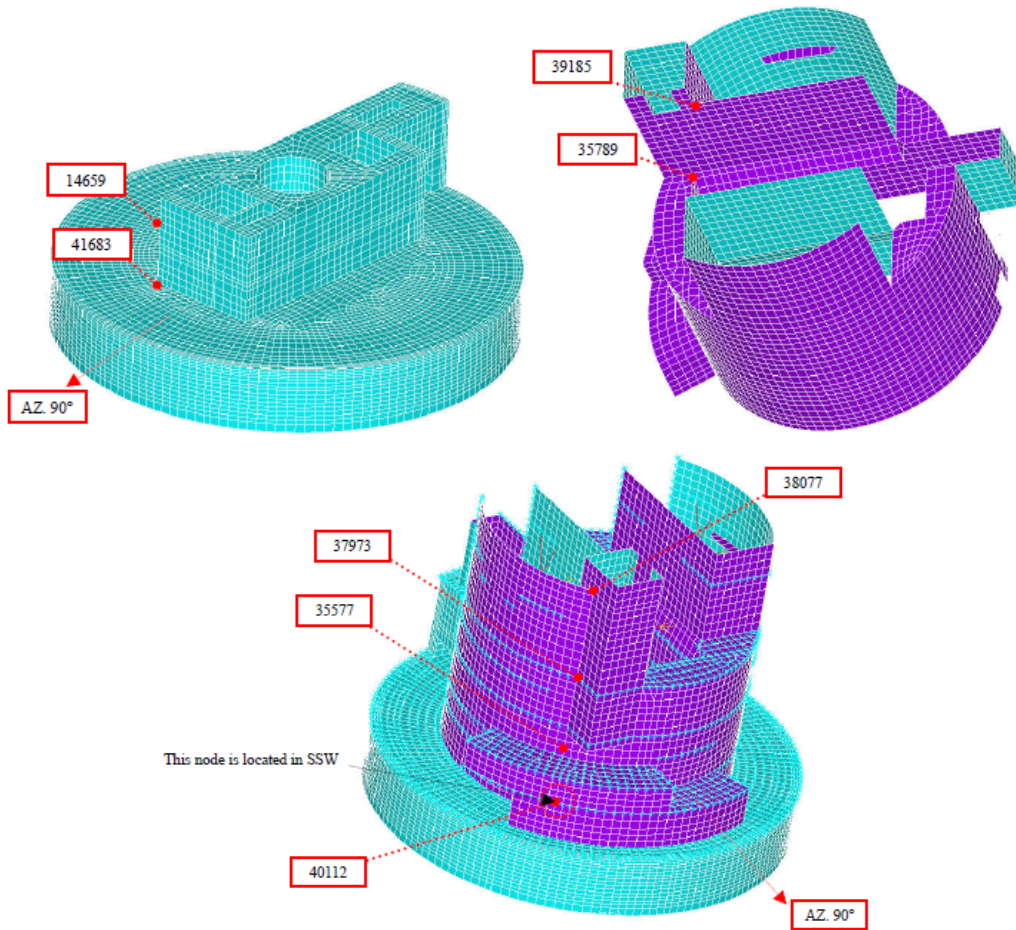
Figure 1. Locations for Transient Displacement (Hydrodynamic Load, Time History Analysis)

## 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 EW (X) | NS (Y) | VT (Z) | Elevation | Load Case | Displacements 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** |
| 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)
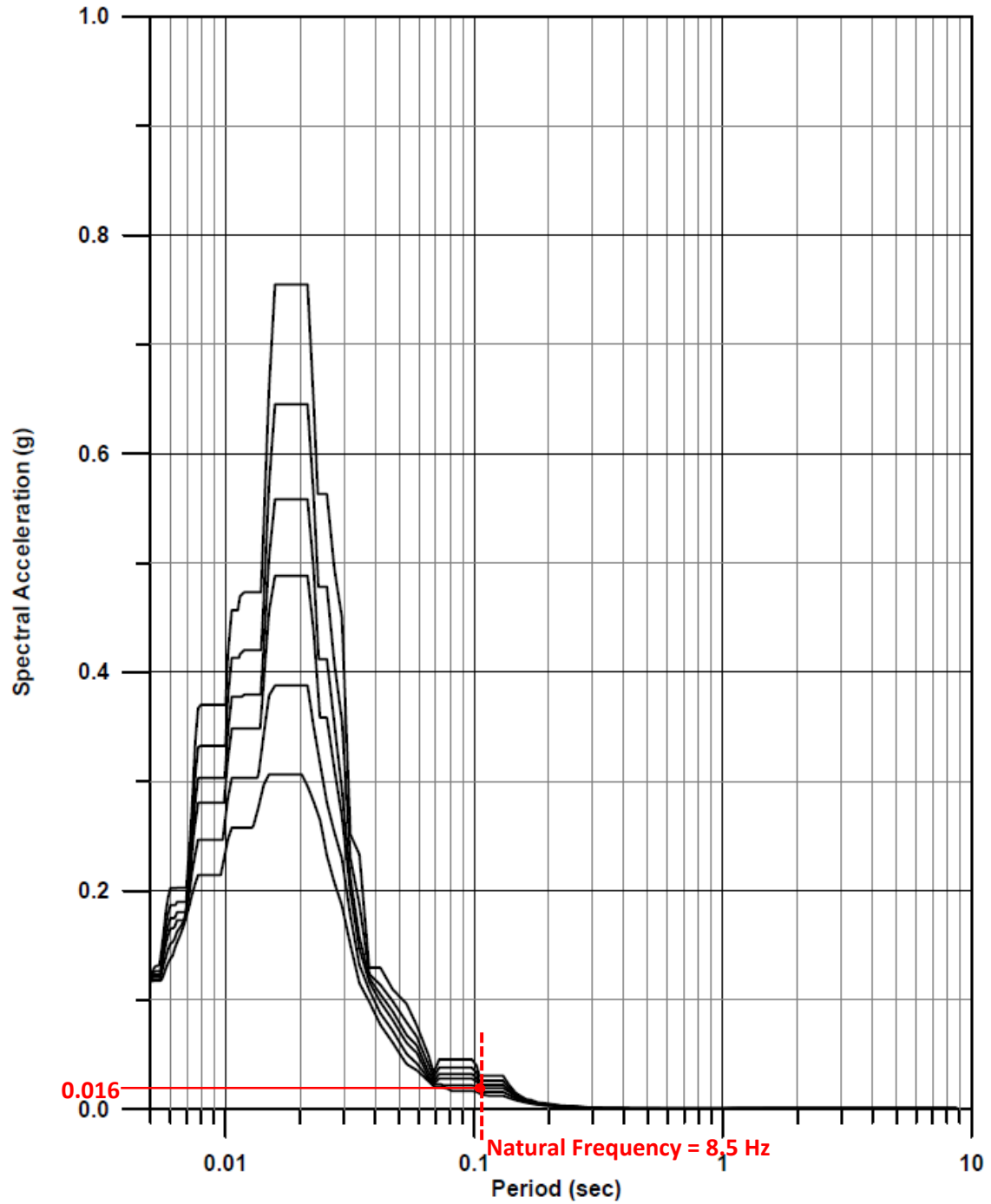
Figure 2. Floor Response Spectrum of PSW (EL. 100'-0", EW) (for example)