RAIO-0119-64084

January 11, 2019

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 151 (eRAI No. 8974) on the NuScale Design Certification Application

REFERENCES:

1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 151 (eRAI No. 8974)," dated August 05, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 151 (eRAI No.8974)," dated October 03, 2017
3. NuScale Power, LLC Supplemental Response to NRC "Request for Additional Information No. 151 (eRAI No. 8974)," dated April 09, 2018
4. NuScale Power, LLC Supplemental Response to NRC "Request for Additional Information No. 151 (eRAI No. 8974)," dated September 17, 2018

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) supplemental response to the referenced NRC Request for Additional Information (RAI).

The Enclosure to this letter contains NuScale's supplemental response to the following RAI Question from NRC eRAI No. 8974:

- 03.08.04-23

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Marty Bryan at 541-452-7172 or at mbryan@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8974

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Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8974

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Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 8974
Date of RAI Issue: 08/05/2017

NRC Question No.: 03.08.04-23

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Sections 3.7.1 and 3.8.4 provide review guidance pertaining to seismic parameters and design of seismic Category I structures. Consistent with the guidance in DSRS 3.7.1.II.4.A.viii, the staff reviews comparison criteria for the acceptability of a standard design for a potential site.

COL item 3.8-2 in Section 3.8.4.8 directs the COL applicant to confirm that the site independent RXB and CRB are acceptable for use at the designated site. Further, Section 3.8.4.8 identifies locations within the building and respective ISRS which are to be used by the COL applicant to compare with their respective site-specific ISRS for purposes of confirming the acceptability of the site independent structures for the designated site. The applicant is requested to correct inconsistencies between the ISRS Figures referred to in FSAR Section 3.8.4.8 and the respective Figures in FSAR Section 3.7. Further, clarify whether the ISRS in these figures are based on the envelope of all or a partial envelope of the SSI and SSSI analysis cases.

Further, the staff request the applicant to address the following in the FSAR.

1. propose locations for the comparison of building member forces and deformations, with the identification of the respective FSAR Tables and Figures

2. clarify whether the current locations for ISRS comparison include responses at peripheral locations to detect rocking and torsion or propose additional locations as necessary

3. augment the list of locations for ISRS comparison in the RXB to address the fuel racks

4. include responses to check overturning, torsional, and sliding stability of the structures

NuScale Response:

The following supplemental responses are provided, as discussed during a meeting with the staff on October 30, 2018:

1. **Question:** Consistent with the information provided for other in-structure response spectra (ISRS) locations, please provide FSAR markups to identify the nodes and respective location (e.g. tables and or figures) related to the ISRS in the following Figures:

- Figure 3.7.2-114: ISRS at Reactor Building Crane Wheels at El. 145’ 6”
- Figure 3.7.2-119: Control Building ISRS at Floor at El. 76’ 6”
- Figure 3.7.2-120: Control Building ISRS at Floor at El. 100’ 0”
- Figure 3.7.2-121: Control Building ISRS at Floor at El. 120’ 0”

Response: FSAR Tier 2, Tables 3.7.2-56 and 3.7.2-57 are added to provide the respective location related to the ISRS of the above mentioned figures.

2. **Question**: Clarify if the node numbers in Table 3.7.2-55 are also applicable to the ISRS in Figure 3.7.2-116. If not, please provide FSAR markups to identify the nodes and respective location (e.g. tables and or figures) for the ISRS in 3.7.2-116. Further, please provide the coordinates and or figures showing the location for the nodes listed in Tables 3.7.2-54 and 3.7.2-55.

Response: Node numbers in Table 3.7.2-55 are not applicable to ISRS in Fig. 3.7.2-116. Figures 3.7.2-115 and 3.7.2-116 are removed from the FSAR as they do not constitute the standard design basis. Design-basis ISRS at the skirt and lug locations of NPM1 and NPM6 are shown in FSAR Figures 3.7.2-156 through 3.7.2-163.

FSAR Tier 2 Tables 3.7.2-54 and 3.7.2-55 are updated, as shown in the attached mark-up.

3. **Question:** Additionally, please provide FSAR markups to include an ISRS at the RFT location that is consistent with the input used for the seismic analysis of the lower RPV at the RFT location. Also please, provide markups to identify the nodes and respective location (e.g. tables and or figures)

Response: The ISRS at the RFT location are added as FSAR Figures 3.7.2-164 through 3.7.2-171 and the coordinates of the selected RFT nodes are provided in FSAR Table 3.7.2-58, as shown in the attached FSAR mark-up.

4. **Question:** For item 2 in COL Item 3.7-10, clarify whether the max forces in the NuScale Power Module lug restraints and skirts, refers to the standard design basis seismic demands and clarify whether the markups identifying the Tables and or FSAR Section (s) containing the magnitude of such standard design basis demands will be provided in the response to Question 03.07.02-25 or in a supplemental response to Q 03.08.04-23. The staff's expectation is that the site-specific verification is to be made against the standard design basis seismic demands. If the max forces indicated in COL Item 3.7-10 refer to forces other than the standard design basis seismic demands, please provide FSAR markups to identify the Table(s) and or FSAR Section(s) containing the magnitude for both the max forces and the standard design basis seismic demands and clarify the use of the max forces.

Response: Item 2 of COL Item 3.7-10 is revised to provide a reference to FSAR Table 3B-28, which includes the standard design-basis seismic demands for the NuScale Power Module lug restraints and skirt.

5. **Question:** For item 4 in COL Item 3.7-10, clarify whether the forces and moments in Table 3.7.2-32 are the standard design basis demands for the east and west wing walls and pool walls. If so, please identify the specific case that constitutes the standard design basis seismic demands. If not the standard design basis seismic demands, please provide FSAR markups to identify the standard basis seismic demands for those locations and respective FSAR Table(s) or Section(s).

Response: Item 4 of COL Item 3.7-10 is revised to reference FSAR Tables 3B-22b and Table 3B-23b, which contain the magnitude of design-basis demands for the west wing wall and pool wall. These tables were added to the FSAR in response to eRAI 8971 Question 03.08.04-11.

6. **Question:** Consistent with the site-specific approach for the seismic analysis and design of the fuel rack, please remove item 5 from COL Item 3.7-10.

Response: Item 5 of COL Item 3.7-10 has been removed, as shown in the attached mark-up.

Impact on DCA:

FSAR Tier 2, Sections 3.7.2.5.5, 3.7.2.5.6, 3.7.2.5.7, 3.7.2.9.1.5, and 3.8.4.8 and FSAR Tier 2, Tables 1.8-2, 3.7.2-54 through 3.7.2-58, and 3B-28 and FSAR Tier 2, Figures 3.7.2-96, 3.7.2-97, 3.7.2-115, 3.7.2-116, and 3.7.2-156 through 3.7.2-171 have been revised as described in the response above and as shown in the markup provided in this response.

RAI 01-61, RAI 02.04.13-1, RAI 03.04.01-4, RAI 03.04.02-1, RAI 03.04.02-2, RAI 03.04.02-3, RAI 03.05.01.03-1, RAI 03.05.01.04-1, RAI 03.05.02-2, RAI 03.05.03-4, RAI 03.06.02-6, RAI 03.06.02-15, RAI 03.06.03-11, RAI 03.07.01-2, RAI 03.07.01-3, RAI 03.07.02-6S1, RAI 03.07.02-6S2, RAI 03.07.02-8, RAI 03.07.02-12, RAI 03.07.02-15S5, RAI 03.07.02-23S1, RAI 03.07.02-26, RAI 03.08.04-3S2, RAI 03.08.04-23S1, RAI 03.08.04-23S2, RAI 03.08.04-23S3, RAI 03.08.05-14S1, RAI 03.09.02-15, RAI 03.09.02-48, RAI 03.09.02-67, RAI 03.09.02-69, RAI 03.09.03-12, RAI 03.09.06-5, RAI 03.09.06-6, RAI 03.09.06-16, RAI 03.09.06-16S1, RAI 03.09.06-27, RAI 03.11-8, RAI 03.11-14, RAI 03.11-14S1, RAI 03.11-18, RAI 03.13-3, RAI 04.02-1S2, RAI 05.02.03-19, RAI 05.02.05-8, RAI 05.04.02.01-13, RAI 05.04.02.01-14, RAI 05.04.02.01-19, RAI 06.02.01.01.A-18, RAI 06.02.01.01.A-19, RAI 06.02.06-22, RAI 06.02.06-23, RAI 06.04-1, RAI 09.01.01-20, RAI 09.01.02-4, RAI 09.01.05-3, RAI 09.01.05-6, RAI 09.03.02-3, RAI 09.03.02-4, RAI 09.03.02-5, RAI 09.03.02-6, RAI 09.03.02-8, RAI 10.02-1, RAI 10.02-2, RAI 10.02-3, RAI 10.02.03-1, RAI 10.02.03-2, RAI 10.03.06-1, RAI 10.03.06-5, RAI 10.04.06-1, RAI 10.04.06-2, RAI 10.04.06-3, RAI 10.04.10-2, RAI 11.01-2, RAI 12.03-55S1, RAI 13.01.01-1, RAI 13.01.01-1S1, RAI 13.02.02-1, RAI 13.03-4, RAI 13.05.02.01-2, RAI 13.05.02.01-2S1, RAI 13.05.02.01-3, RAI 13.05.02.01-3S1, RAI 13.05.02.01-4, RAI 13.05.02.01-4S1, RAI 14.02-7, RAI 19-31, RAI 19-31S1, RAI 19-38, RAI 20.01-13

Table 1.8-2: Combined License Information Items

Item No.	Description of COL Information Item	Section
COL Item 1.1-1:	A COL applicant that references the NuScale Power Plant design certification will identify the site-specific plant location.	1.1
COL Item 1.1-2:	A COL applicant that references the NuScale Power Plant design certification will provide the schedules for completion of construction and commercial operation of each power module.	1.1
COL Item 1.4-1:	A COL applicant that references the NuScale Power Plant design certification will identify the prime agents or contractors for the construction and operation of the nuclear power plant.	1.4
COL Item 1.7-1:	A COL applicant that references the NuScale Power Plant design certification will provide site-specific diagrams and legends, as applicable.	1.7
COL Item 1.7-2:	A COL applicant that references the NuScale Power Plant design certification will list additional site-specific piping and instrumentation diagrams and legends as applicable.	1.7
COL Item 1.8-1:	A COL applicant that references the NuScale Power Plant design certification will provide a list of departures from the certified design.	1.8
COL Item 1.9-1:	A COL applicant that references the NuScale Power Plant design certification will review and address the conformance with regulatory criteria in effect six months before the docket date of the COL application for the site-specific portions and operational aspects of the facility design.	1.9
COL Item 1.10-1:	A COL applicant that references the NuScale Power Plant design certification will evaluate the potential hazards resulting from construction activities of the new NuScale facility to the safety-related and risk significant structures, systems, and components of existing operating unit(s) and newly constructed operating unit(s) at the co-located site per 10 CFR 52.79(a)(31). The evaluation will include identification of management and administrative controls necessary to eliminate or mitigate the consequences of potential hazards and demonstration that the limiting conditions for operation of an operating unit would not be exceeded. This COL item is not applicable for construction activities (build-out of the facility) at an individual NuScale Power Plant with operating NuScale Power Modules.	1.10
COL Item 2.0-1:	A COL applicant that references the NuScale Power Plant design certification will demonstrate that site-specific characteristics are bounded by the design parameters specified in Table 2.0-1. If site-specific values are not bounded by the values in Table 2.0-1, the COL applicant will demonstrate the acceptability of the site-specific values in the appropriate sections of its combined license application.	2.0
COL Item 2.1-1:	A COL applicant that references the NuScale Power Plant design certification will describe the site geographic and demographic characteristics.	2.1
COL Item 2.2-1:	A COL applicant that references the NuScale Power Plant design certification will describe nearby industrial, transportation, and military facilities. The COL applicant will demonstrate that the design is acceptable for each potential accident, or provide site-specific design alternatives.	2.2
COL Item 2.3-1:	A COL applicant that references the NuScale Power Plant design certification will describe the site-specific meteorological characteristics for Section 2.3.1 through Section 2.3.5, as applicable.	2.3
COL Item 2.4-1:	A COL applicant that references the NuScale Power Plant design certification will investigate and describe the site-specific hydrologic characteristics for Section 2.4.1 through Section 2.4.14, except Section 2.4.8 and Section 2.4.10.	2.4

Table 1.8-2: Combined License Information Items (Continued)

Item No.	Description of COL Information Item	Section
COL Item 3.7-10:	A COL applicant that references the NuScale Power Plant design certification will perform a site-specific configuration analysis that includes the Reactor Building with applicable configuration layout of the desired NuScale Power Modules. The COL applicant will confirm the following are bounded by the corresponding design certified seismic demands: 1) The in-structure response spectra of the standard design at the foundation and roof. See FSAR Figure 3.7.2-107 and Figure 3.7.2-108 for foundation in-structure response spectra and Figure 3.7.2-113 for roof in-structure response spectra. 2) The maximum forces in the NuScale Power Module lug restraints and skirts. See Table 3B-28. 3) The site-specific in-structure response spectra for the NuScale Power Module at the skirt support will be shown to be bounded by the in-structure response spectra in Figure 3.7.2-156 and Figure 3.7.2-157. The site-specific in-structure response spectra for the NuScale Power Module at the lug restraints will be shown to be bounded by the in-structure response spectra in Figure 3.7.2-158 through Figure 3.7.2-163. 4) The maximum forces and moments in the ~~east and~~ west wing wall~~s~~ and pool wall~~s~~. See ~~FSAR Table 3.7.2-32~~Table 3B-22b and Table 3B-23b. 5) Not Used.~~The site-specific in-structure response spectra for the fuel storage racks will be shown to be bounded by the in-structure response spectra in Figure 3-6 through Figure 3-14 of TR-0816-49833.~~ 6) The site-specific in-structure response spectra shown immediately below will be shown to be bounded by their corresponding certified in-structure response spectra: • Reactor Building north exterior wall at EL 75′-0″: bounded by in-structure response spectra in Figure 3.7.2-110 • Reactor Building west exterior wall at EL 126′-0″: bounded by in-structure response spectra in Figure 3.7.2-112 • Reactor Building crane wheels at EL 145′-6″: bounded by in-structure response spectra in Figure 3.7.2-114 • Control Building east wall at EL 76′-6″: bounded by in-structure response spectra in Figure 3.7.2-119a and Figure 3.7.2-119b • Control Building south wall at EL 120′-0″: bounded by in-structure response spectra in Figure 3.7.2-121a and Figure 3.7.2-121b If not, the standard design will be shown to have appropriate margin or should be appropriately modified to accommodate the site-specific demands.	3.7
COL Item 3.7-11:	A COL applicant that references the NuScale Power Plant design certification will perform a site-specific analysis that~~, if applicable,~~ assesses the effects of soil separation. The COL applicant will confirm that the in-structure response spectra in the soil separation cases are bounded by the in-structure response spectra shown in FSAR Figure 3.7.2-107 through Figure 3.7.2-122.	3.7
COL Item 3.7-12:	A COL applicant that references the NuScale Power Plant design certification will perform an analysis that uses site-specific soil and time histories to confirm the adequacy of the fluid-structure interaction correction factor.	3.7
COL Item 3.7-13:	A COL applicant that references the NuScale Power Plant design certification will perform a site-specific analysis that assesses the effects of non-vertically propagating seismic waves on the free-field ground motions and seismic responses of seismic Category I structures, systems, and components.	3.7
COL Item 3.8-1:	A COL applicant that references the NuScale Power Plant design certification will describe the site-specific program for monitoring and maintenance of the Seismic Category I structures in accordance with the requirements of 10 CFR 50.65 as discussed in Regulatory Guide 1.160. Monitoring is to include below grade walls, groundwater chemistry if needed, base settlements and differential displacements.	3.8
COL Item 3.8-2:	A COL applicant that references the NuScale Power Plant design certification will confirm that the site- independent Reactor Building and Control Building are acceptable for use at the designated site.	3.8
COL Item 3.8-3:	A COL applicant that references the NuScale Power Plant design certification will identify local stiff and soft spots in the foundation soil and address these in the design, as necessary.	3.8

Floor	Figure
126'-0"	Figure 3.7.2-112
181'-0"	Figure 3.7.2-113

3.7.2.5.4 Reactor Building Crane In-Structure Response Spectra

RAI 03.08.04-23S3

The seismic analysis of the RBC uses ISRS for input. ISRS are generated at four selected individual crane wheel locations. These locations are on the reactor pool wall at the crane rail slab at elevation 145' 6", see Table 3.7.2-56. The enveloping ISRS for these four locations are provide in Figure 3.7.2-114. The seismic analysis of the RBC is completed per ASME NOG-1 (Reference 3.7.2-4).

RAI 03.08.04-23S3

3.7.2.5.5 ~~NuScale Power Module Bay Wall In-Structure Response Spectra~~Not Used

RAI 03.08.04-23S3

~~The NPM lug restraints transfer the horizontal forces between the NPMs and the walls of the bay. These restraints ensure that the NPM will not fall as a result of a seismic event. Because of the significance of the restraints, bounding ISRS are provided. These ISRS are not used for the design of any of the restraints, nor any specific components. However they are used in Section 3.8.4.8 to confirm acceptability of the site independent Reactor Building for use at specific sites.~~

RAI 03.08.04-23S3

~~Figure 3.7.2-96 provides node locations that were used to develop the ISRS for the NPM bay walls at the pool floor. The enveloping ISRS for these locations are provided in Figure 3.7.2-115.~~

RAI 03.08.04-23S3

~~Figure 3.7.2-97 provides node locations that were used to develop the ISRS for the NPM bay walls at the lug restraints. The enveloping ISRS for these locations are provided in Figure 3.7.2-116.~~

RAI 03.08.04-23S2, RAI 03.08.04-23S3

3.7.2.5.6 NuScale Power Module Skirt, ~~and~~ Lug Supports, and Reactor Flange Tool Base ~~ISRS~~In-Structure Response Spectra

RAI 03.08.04-23S2, RAI 03.08.04-23S3

At the CNV skirts of NPM1 and NPM6, response spectra are generated for the time histories at ~~the eight spider~~ nodes, directly beneath each corresponding NPM~~to the eight spider elements~~. The SASSI ~~node numbers~~coordinates of these ISRS locations are listed in Table 3.7.2-54.

RAI 03.08.04-23S2, RAI 03.08.04-23S3

The resulting spider node spectra are then averaged for each module. This results in nine averaged skirt response spectra for each module, based on the three seismic cases provided (Soil Type 7, Capitola time history, cracked concrete nominal stiffness, cracked concrete reduced stiffness, uncracked concrete nominal stiffness), each with three components (X,Y, and Z). The ISRS of the nine averaged skirt response spectra are~~is~~ then enveloped for NPM1 and NPM6 in the X, Y, and Z directions. The six resulting enveloping ISRS (two modules x one skirt support x three directions) for the NPM1 and NPM6 CNV skirts are shown in Figure 3.7.2-156 and Figure 3.7.2-157.

RAI 03.08.04-23S2

At the CNV lugs of NPM1 and NPM6, response spectra are generated for the time histories at the nodes listed in Table 3.7.2-55. The spectra are then enveloped at each of the lugs on NPM1 and NPM6, resulting in 18 total enveloping spectra (two modules x three lugs x three directions). These spectra are shown in Figure 3.7.2-158 through Figure 3.7.2-163.

RAI 03.08.04-23S3

Response spectra are generated for time histories at four reactor flange tool (RFT) base locations. The coordinates of these ISRS locations are listed in Table 3.7.2-58. For each case, there are 12 (3 directions x 4 locations) ISRS generated. For the two analysis cases (cracked and uncracked concrete), the total number of ISRS is 24 (12 x 2 cases). The plots of the ISRS are presented in Figure 3.7.2-164 through Figure 3.7.2-171.

3.7.2.5.7 Control Building In-Structure Response Spectra

RAI 03.08.04-23, RAI 03.08.04-23S3

The ISRS corresponding to each main floor of the CRB identified below are provided ~~o~~in the listed figures. The governing ISRS envelop the ISRS taken from node locations on the corners of the buildings to capture the torsional and rocking components. Coordinates selected for floor ISRS generation in the CRB are listed in Table 3.7.2-57.

RAI 03.07.02-26

Floor	Figure
50’-0”	~~Figure 3.7.2-117~~Figure 3.7.2-117a and Figure 3.7.2-117b
63’-3”	~~Figure 3.7.2-118~~Figure 3.7.2-118a and Figure 3.7.2-118b
76’-6”	~~Figure 3.7.2-119~~Figure 3.7.2-119a and Figure 3.7.2-119b
100’-0”	~~Figure 3.7.2-120~~Figure 3.7.2-120a and Figure 3.7.2-120b

RAI 03.07.02-8, RAI 03.08.04-23S2

1) The in-structure response spectra of the standard design at the foundation and roof. See FSAR Figure 3.7.2-107 and Figure 3.7.2-108 for foundation in-structure response spectra and Figure 3.7.2-113 for roof in-structure response spectra.

RAI 03.07.02-8, RAI 03.08.04-23S2, RAI 03.08.04-23S3

2) The maximum forces in the NuScale Power Module lug restraints and skirts. See Table 3B-28.

RAI 03.08.04-23S1, RAI 03.08.04-23S2

3) The site-specific in-structure response spectra for the NuScale Power Module at the skirt support will be shown to be bounded by the in-structure response spectra in Figure 3.7.2-156 and Figure 3.7.2-157. The site-specific in-structure response spectra for the NuScale Power Module at the lug restraints will be shown to be bounded by the in-structure response spectra in Figure 3.7.2-158 through Figure 3.7.2-163.

RAI 03.07.02-8, RAI 03.08.04-23S2, RAI 03.08.04-23S3

4) The maximum forces and moments in the ~~east and~~ west wing wall~~s~~ and pool wall~~s~~. See ~~FSAR~~ Table 3B-22b and Table 3B-23b~~Table 3.7.2-32~~.

RAI 03.08.04-23S1, RAI 03.08.04-23S2, RAI 03.08.04-23S3

5) Not Used.~~The site-specific in-structure response spectra for the fuel storage racks will be shown to be bounded by the in-structure response spectra in Figure 3-6 through Figure 3-14 of TR-0816-49833.~~

RAI 03.08.04-23S1, RAI 03.08.04-23S2

6) The site-specific in-structure response spectra shown immediately below will be shown to be bounded by their corresponding certified in-structure response spectra:

RAI 03.08.04-23S1, RAI 03.08.04-23S2

- Reactor Building north exterior wall at EL 75′-0″: bounded by in-structure response spectra in Figure 3.7.2-110

RAI 03.08.04-23S1, RAI 03.08.04-23S2

- Reactor Building west exterior wall at EL 126′-0″: bounded by in-structure response spectra in Figure 3.7.2-112

RAI 03.08.04-23S1, RAI 03.08.04-23S2

- Reactor Building crane wheels at EL 145′-6″: bounded by in-structure response spectra in Figure 3.7.2-114

RAI 03.07.02-26, RAI 03.08.04-23S1, RAI 03.08.04-23S2

- Control Building east wall at EL 76′-6″: bounded by in-structure response spectra in ~~Figure 3.7.2-119~~Figure 3.7.2-119a and Figure 3.7.2-119b

RAI 03.07.02-26, RAI 03.08.04-23S1, RAI 03.08.04-23S2

- Control Building south wall at EL 120′-0″: bounded by in-structure response spectra in ~~Figure 3.7.2-121~~Figure 3.7.2-121a and Figure 3.7.2-121b

RAI 03.07.02-8

If not, the standard design will be shown to have appropriate margin or should be appropriately modified to accommodate the site-specific demands.

RAI 03.08.04-23S2, RAI 03.08.04-23S3

Table 3.7.2-54: SASSI ~~CNV~~Containment Vessel Skirt Coordinates~~Nodes~~

	X (in.)	Y (in.)~~NPM1~~	Z (in.)~~NPM6~~
RXM 1	2019.5	305.5~~6027~~	132~~6287~~
RXM 6	3509.5	305.5~~6028~~	132~~6288~~
		~~6029~~	~~6289~~
		~~6039~~	~~6299~~
		~~6042~~	~~6302~~
		~~6053~~	~~6307~~
		~~6054~~	~~6308~~
		~~6055~~	~~6309~~

RAI 03.08.04-23S2, RAI 03.08.04-23S3

Table 3.7.2-55: SASSI ~~CNV~~Containment Vessel Lug Coordinates~~Nodes~~

		X (in.)~~NPM1~~	Y (in.)~~NPM6~~	Z (in.)
RXM 1	West Lug	1915.88~~6477~~	305.5~~31081~~	673.73
	North Lug	2019.5~~6483~~	409.12~~31087~~	673.73
	East Lug	2123.12~~6486~~	305.5~~31090~~	673.73
RXM 6	West Lug	3405.88	305.5	673.73
	North Lug	3509.5	409.12	673.73
	East Lug	3613.12	305.5	673.73

RAI 03.08.04-23S3

Table 3.7.2-56: Selected Crane Wheel Locations for In-Structure Response Spectra Presentation

Location No.	Coordinates (inches)			Location Description
	X (E-W)	Y (N-S)	Z (VT)	
1	2215	-453	1548	SW Crane Wheel
2	2215	453	1548	NW Crane Wheel
3	3067.25	-453	1548	SE Crane Wheel
4	3067.25	453	1548	NE Crane Wheel

RAI 03.08.04-23S3

Table 3.7.2-57: Coordinates of Standalone and Triple Building Models for Control Building Floor In-Structure Response Spectra Generation

Count No.	Standalone CRB Model			Triple Building Model		
	X (in.)	Y (in.)	Z (in.)	X (in.)	Y (in.)	Z (in.)
1	4500	-700	405	4470	-705	405
2	4500	-8	405	4470	-8	405
3	4500	700	405	4470	705	405
4	4968	-8	405	4938	-8	405
5	5154	58.5	405	5124	58.5	405
6	5436	-700	405	5406	-705	405
7	5436	-8	405	5406	-8	405
8	5436	700	405	5406	705	405
9	4500	-270	570	4470	-270	570
10	4500	700	570	4470	705	570
11	4693	-491.5	570	4663	-491.5	570
12	4751.33	-270	570	4721.33	-270	570
13	4751.33	-8	570	4721.33	-8	570
14	5436	-700	570	5406	-705	570
15	4389	-270	720	4359	-270	720
16	4500	-8	720	4470	-8	720
17	4500	700	720	4470	705	720
18	4693	-491.5	720	4663	-491.5	720
19	4809.67	-8	720	4779.67	-8	720
20	4809.67	58.5	720	4779.67	58.5	720
21	4809.67	353.5	720	4779.67	353.5	720
22	5436	-700	720	5406	-705	720
23	4389	-270	1020	4359	-270	1020
24	4500	-8	1020	4470	-8	1020
25	4500	58.5	1020	4470	58.5	1020
26	4500	700	1020	4470	705	1020
27	4693	-491.5	1020	4663	-491.5	1020
28	4809.67	-8	1020	4779.67	-8	1020
29	4809.67	58.5	1020	4779.67	58.5	1020
30	4809.67	284	1020	4779.67	284	1020
31	5304	-324.5	1020	5274	-324.5	1020
32	5304	-8	1020	5274	-8	1020
33	5304	284	1020	5274	284	1020
34	5436	-700	1020	5406	-705	1020
35	4500	700	1260	4470	700	1260
36	4693	-491.5	1260	4663	-491.5	1260
37	4809.67	-8	1260	4779.67	-8	1260
38	4809.67	58.5	1260	4779.67	58.5	1260
39	4809.67	423	1260	4779.67	423	1260
40	5436	-700	1260	5406	-700	1260
41	4500	700	1518	4470	700	1518
42	5436	-700	1518	5406	-700	1518

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Table 3.7.2-58: Coordinates of Selected Reactor Flange Tool Nodes

Joint No.	X (in.)	Y (in.)	Z (in.)
6328	1191	-228	132.1
6329	1255	-88.5	132.1
6330	1383	-88.5	132.1
6331	1447	-228	132.1

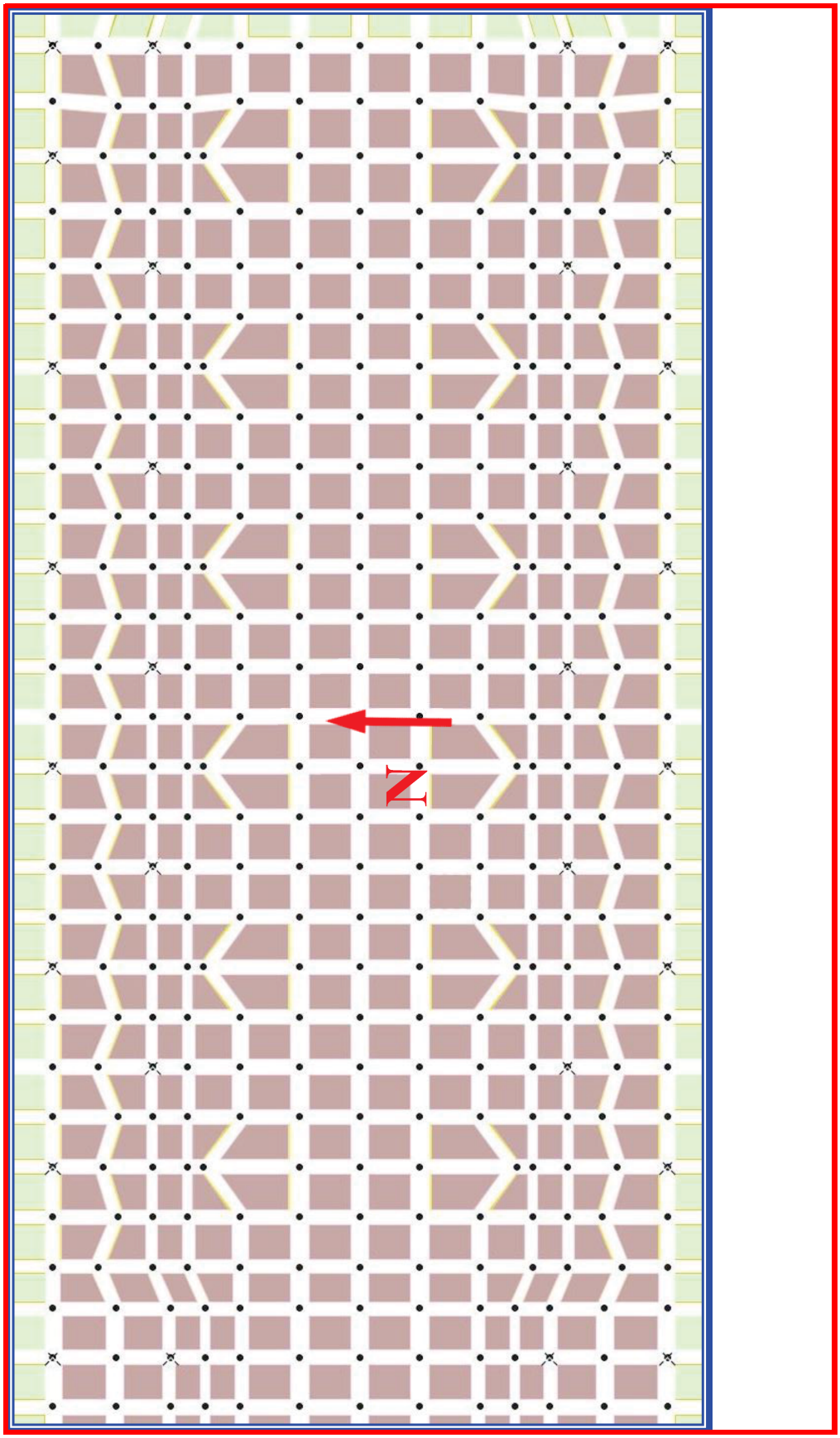


Figure 3.7.2-96: ~~Nodes Used for ISRS for NPM Bay Walls at the Pool Floor (EL. 25′-0″)~~Not Used

RAI 03.08.04-23S3

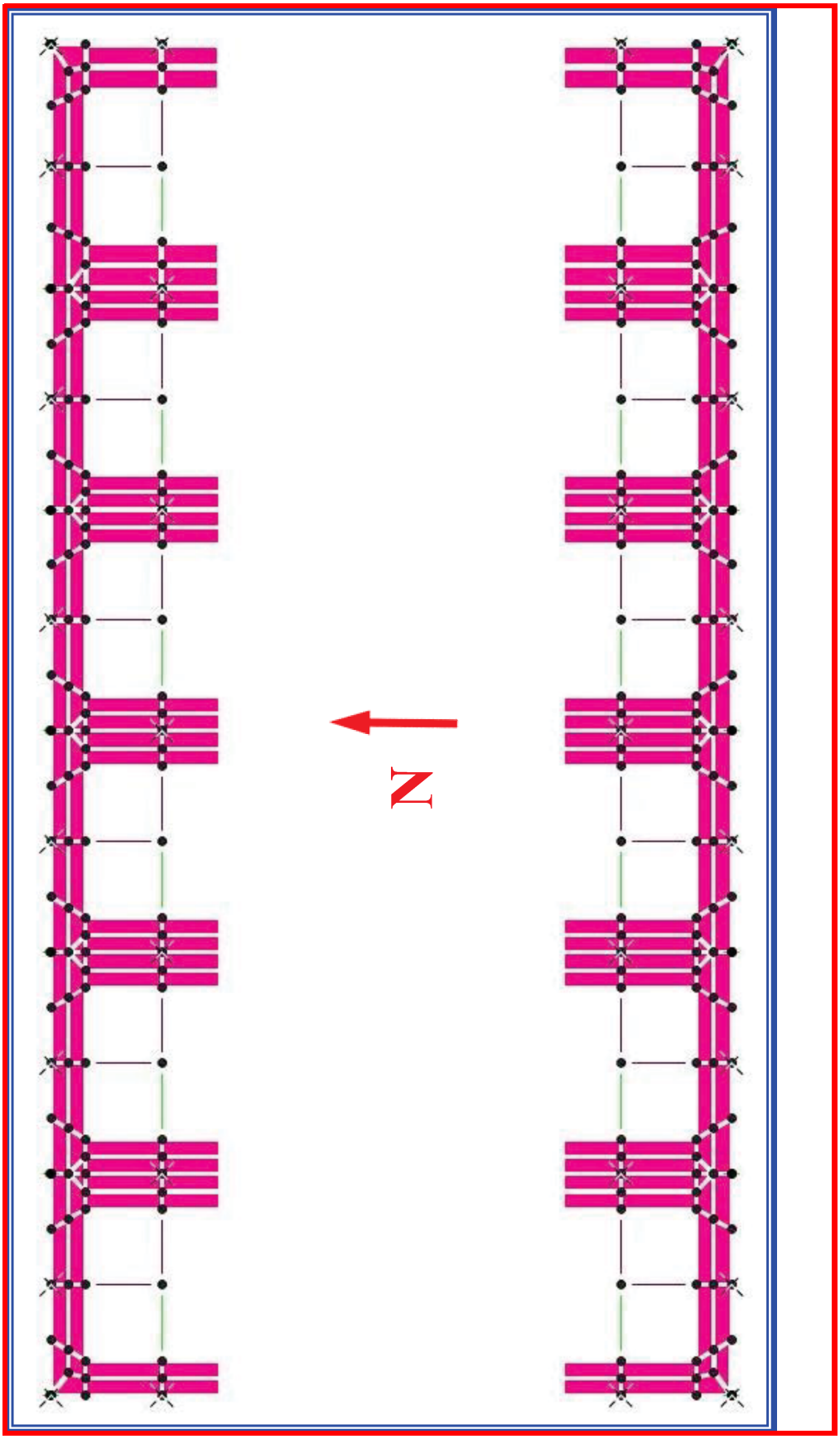
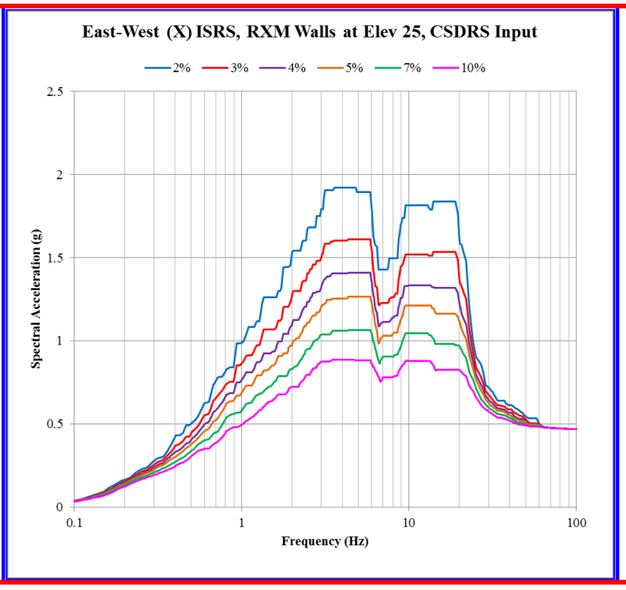


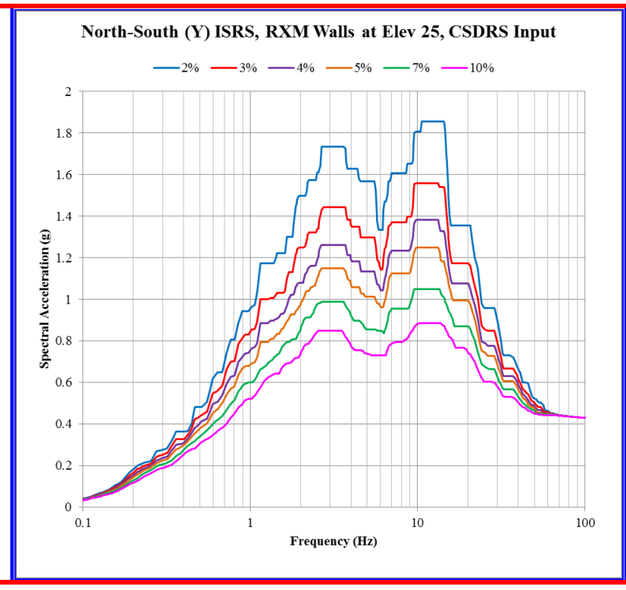
Figure 3.7.2-97: ~~NPM Lug Restraint Node Locations (EL. 71'-7")~~Not Used

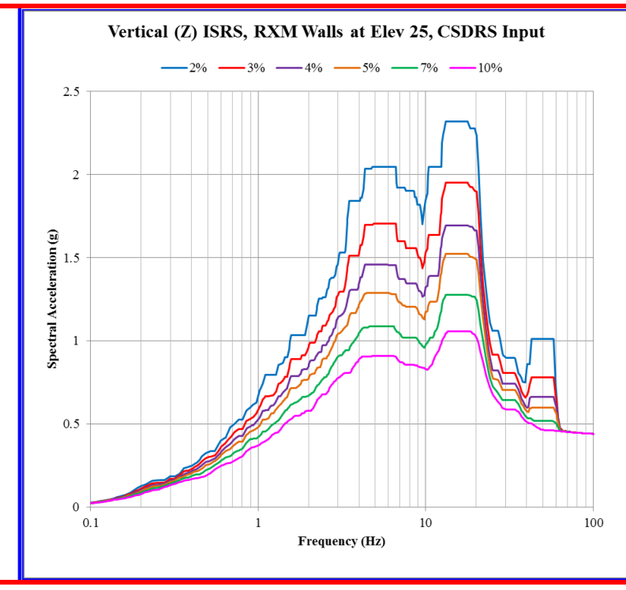
RAI 03.08.04-23S3

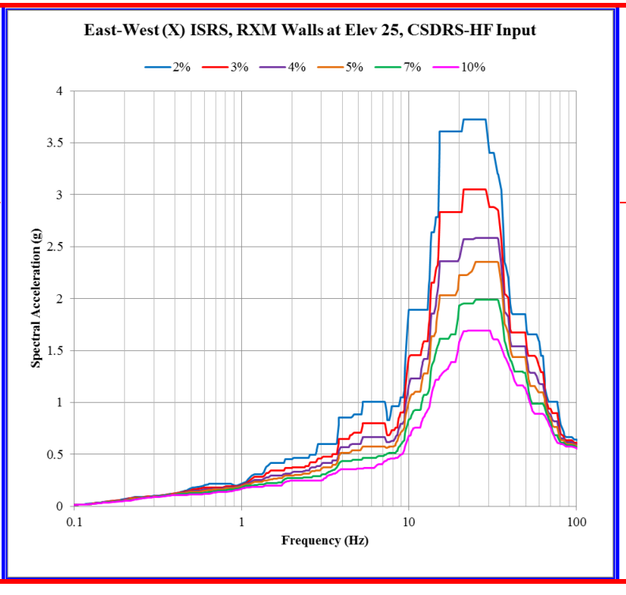
RAI 03.08.04-23S3

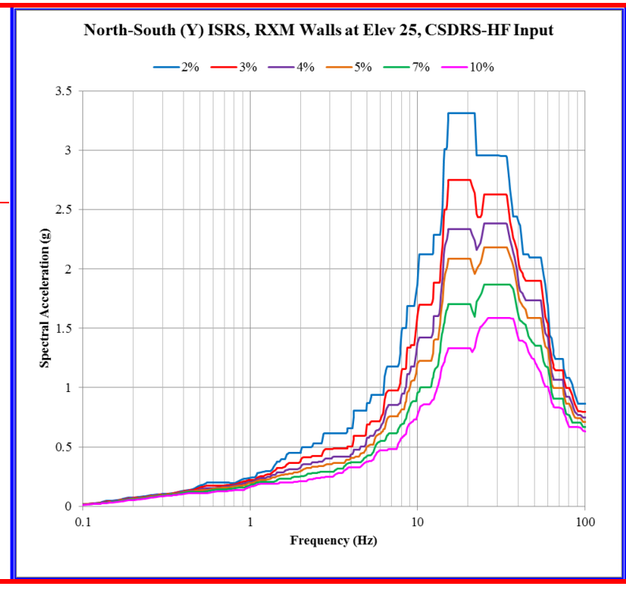
Figure 3.7.2-115: ~~ISRS at NPM Bay Wall at the Pool Floor~~Not Used

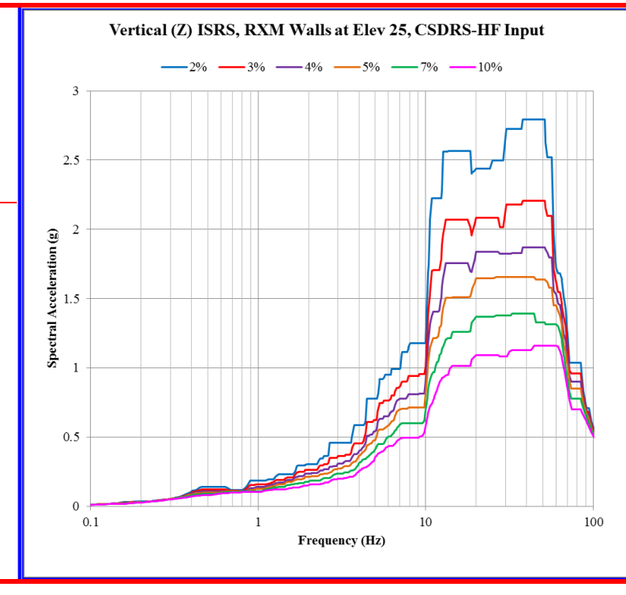






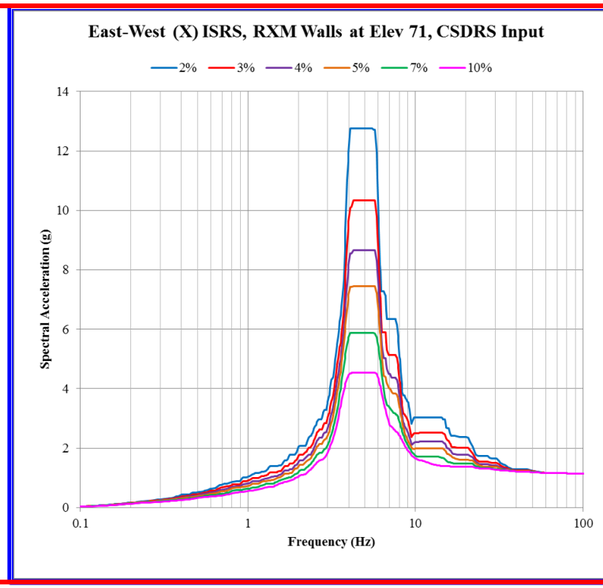


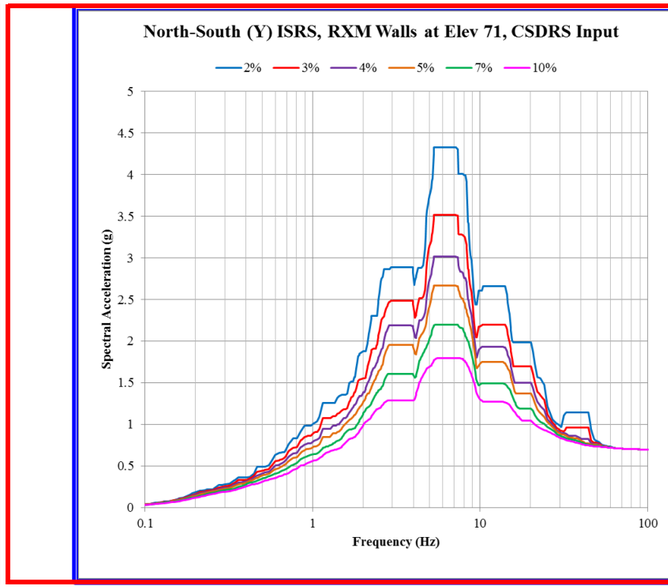


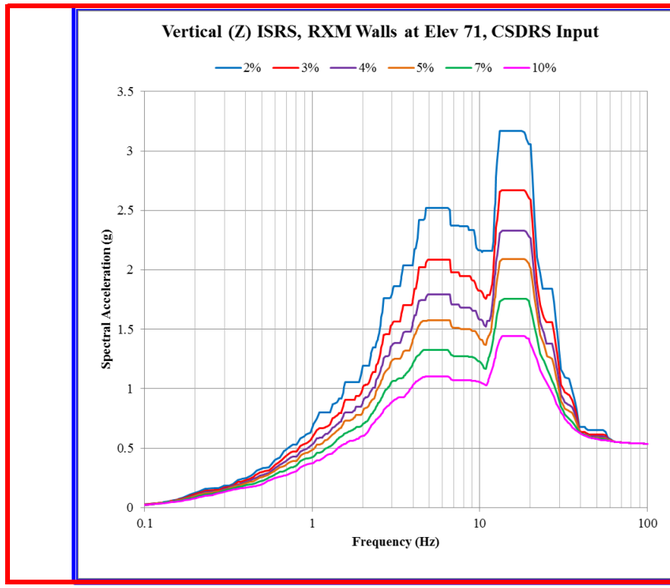


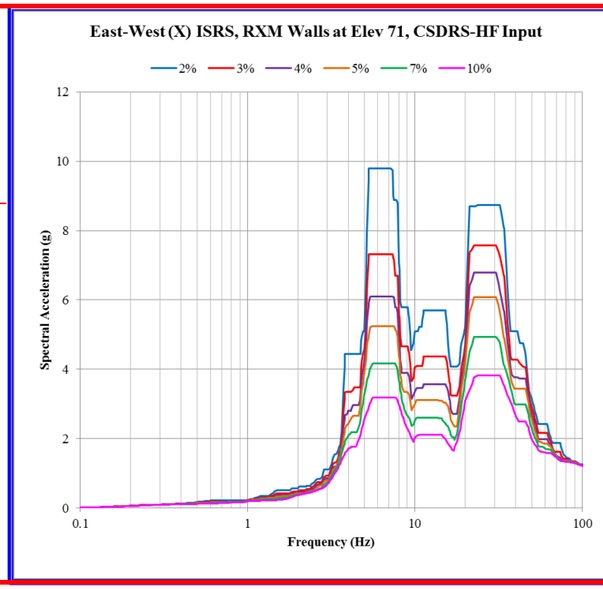
RAI 03.08.04-23S3

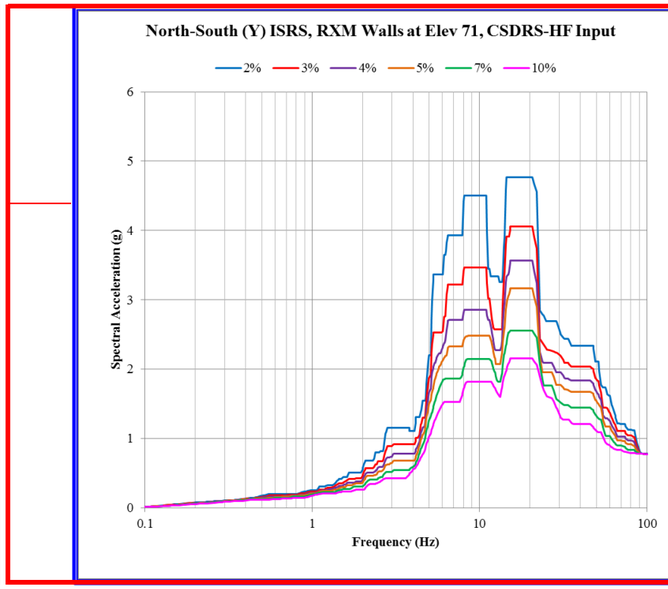
Figure 3.7.2-116: ~~ISRS at NPM Lug Restraints~~Not Used

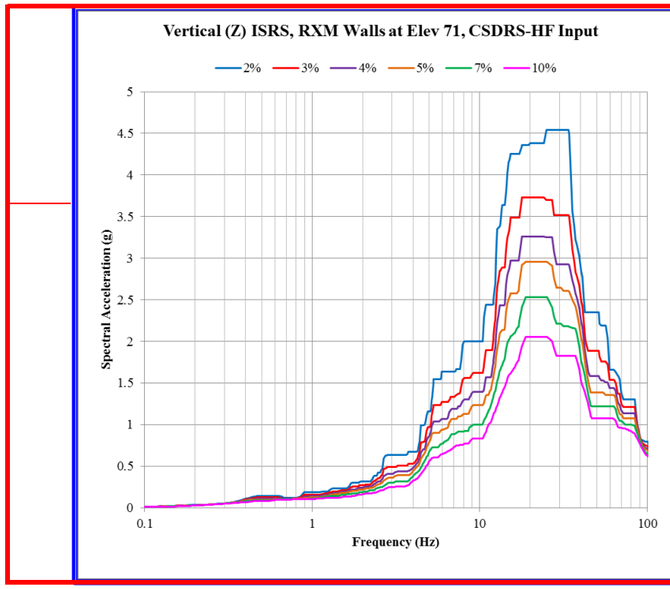






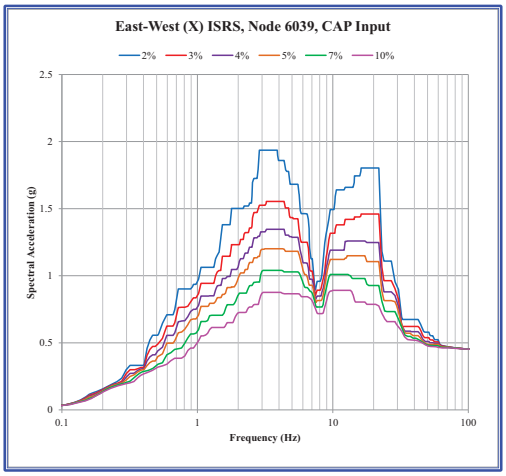


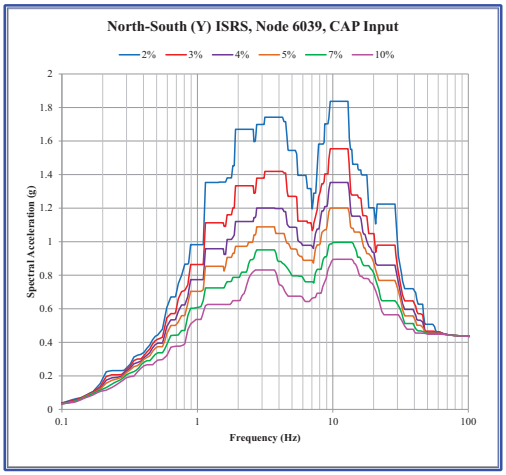


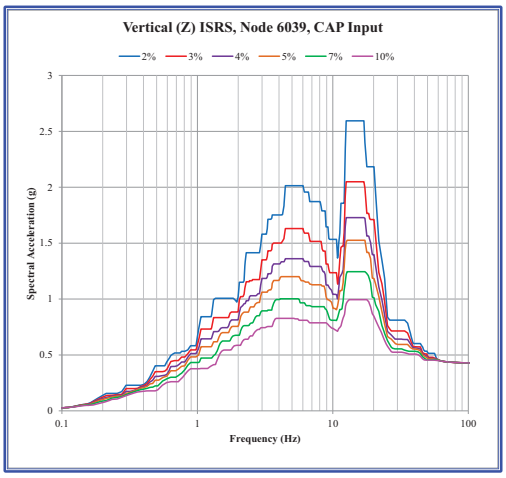


RAI 03.08.04-23S2, RAI 03.08.04-23S3

Figure 3.7.2-156: ~~Enveloping ISRS~~In-Structure Response Spectra ~~of Cases 1, 2, and 3~~ at the ~~CNV~~Containment Vessel Skirt of ~~NPM~~NuScale Power Module 1, Capitola Input

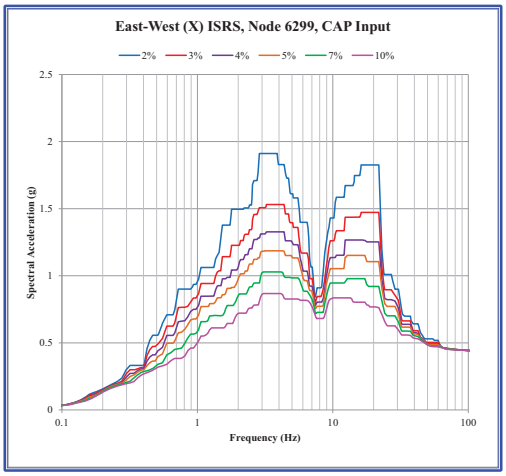


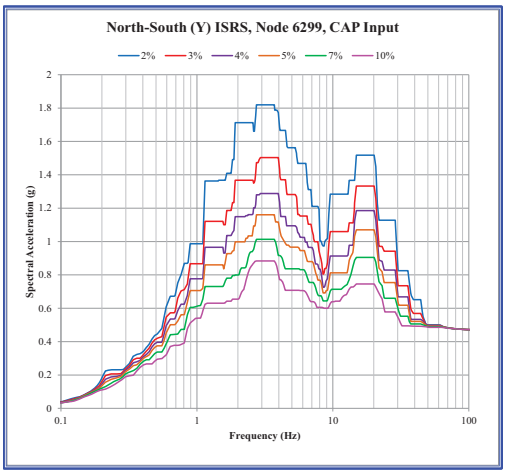


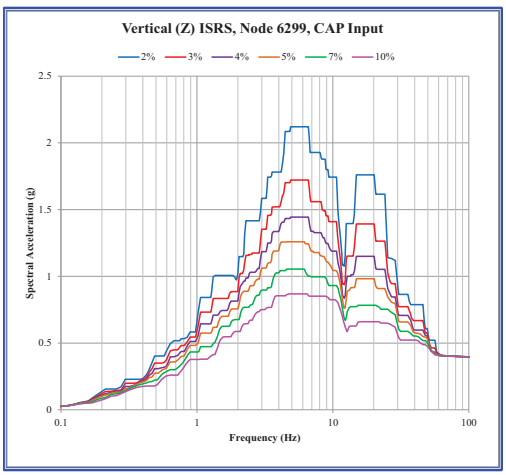


RAI 03.08.04-23S2, RAI 03.08.04-23S3

Figure 3.7.2-157: ~~Enveloping ISRS~~In-Structure Response Spectra ~~of Cases 1, 2, and 3~~ at the ~~CNV~~Containment Vessel Skirt of ~~NPM~~NuScale Power Module 6, Capitola Input

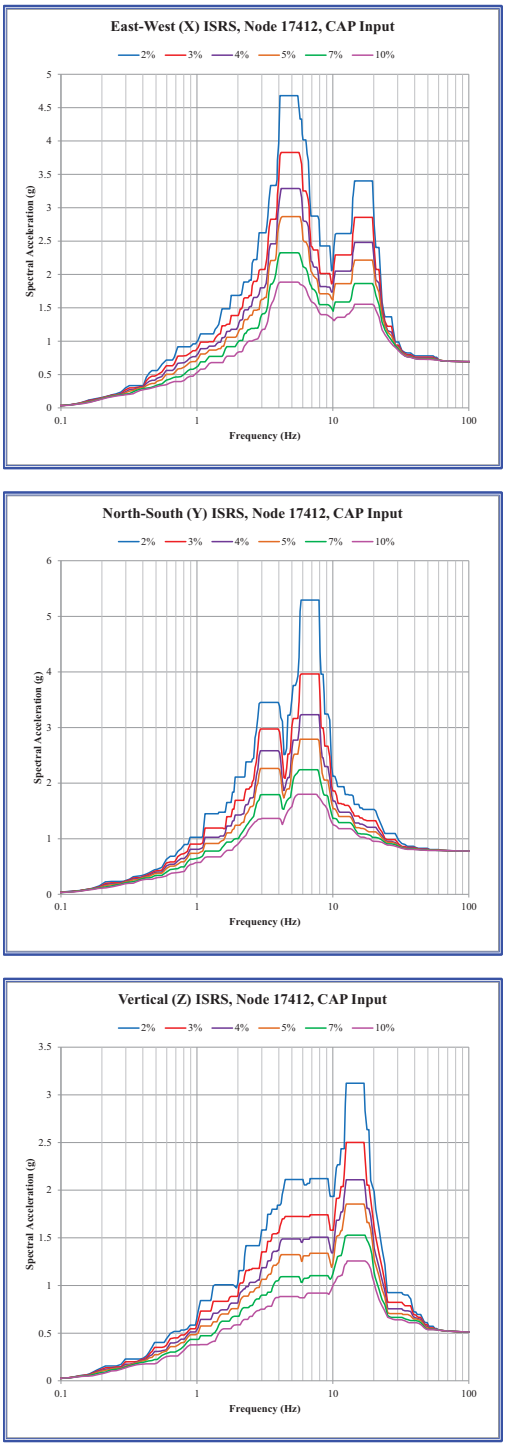






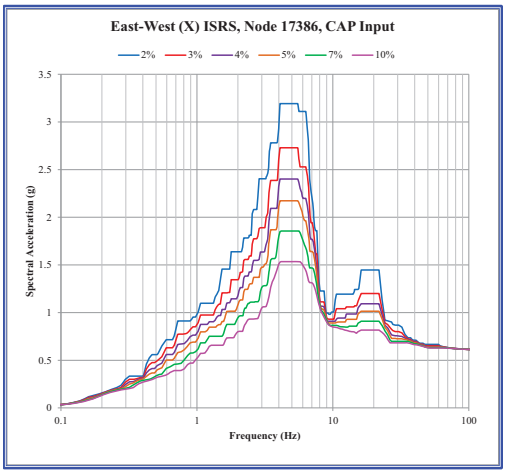
RAI 03.08.04-23S2, RAI 03.08.04-23S3

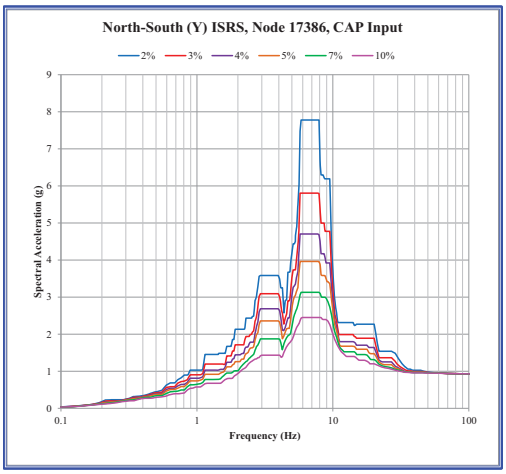
Figure 3.7.2-158: ~~Enveloping ISRS~~In-Structure Response Spectra ~~of Cases 1, 2, and 3~~ at the East Lug of ~~NPM~~NuScale Power Module 1, Capitola Input

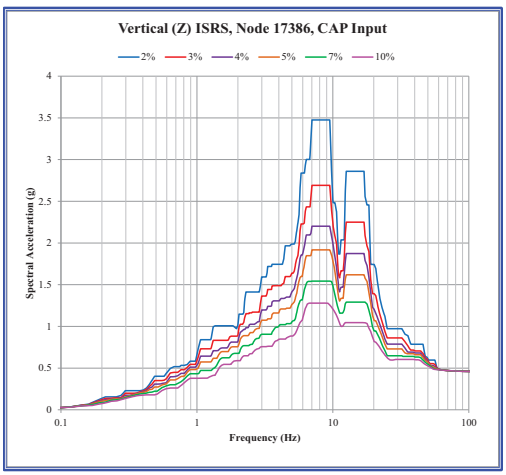


RAI 03.08.04-23S2, RAI 03.08.04-23S3

Figure 3.7.2-159: ~~Enveloping ISRS~~In-Structure Response Spectra ~~of Cases 1, 2, and 3~~ at the North Lug of ~~NPM~~NuScale Power Module 1, Capitola Input

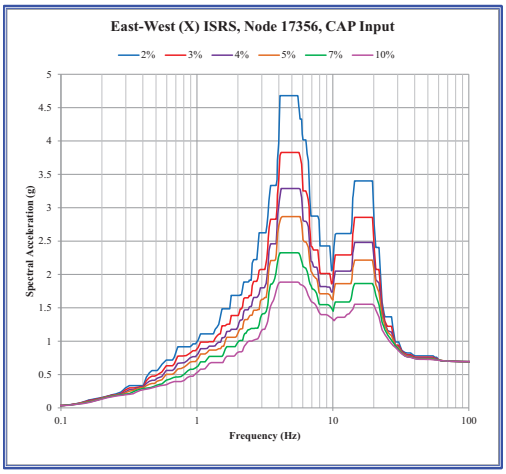


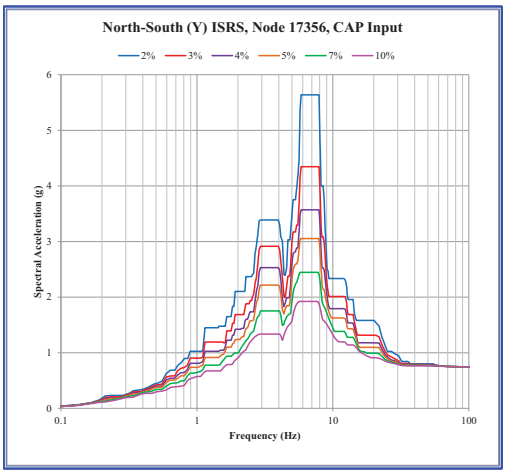


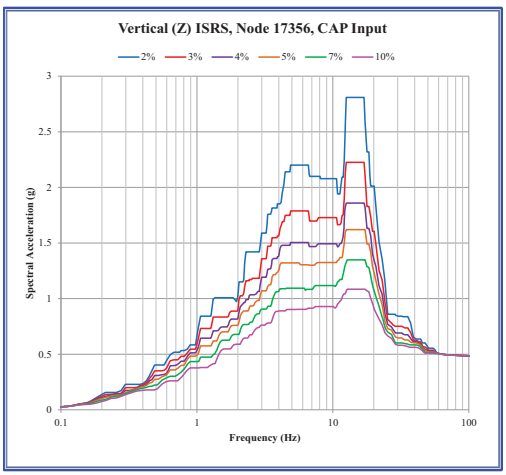


RAI 03.08.04-23S2, RAI 03.08.04-23S3

Figure 3.7.2-160: ~~Enveloping ISRS~~In-Structure Response Spectra ~~of Cases 1, 2, and 3~~ at the West Lug of ~~NPM~~NuScale Power Module 1, Capitola Input

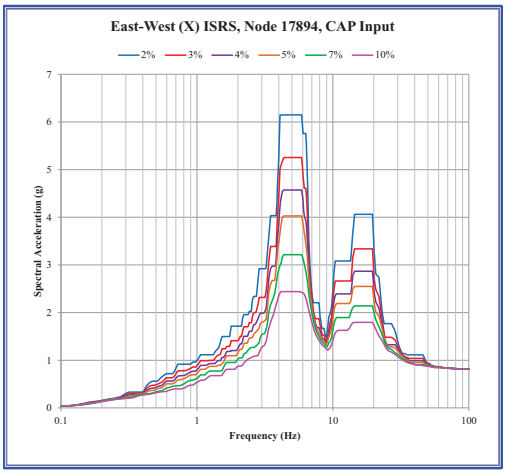


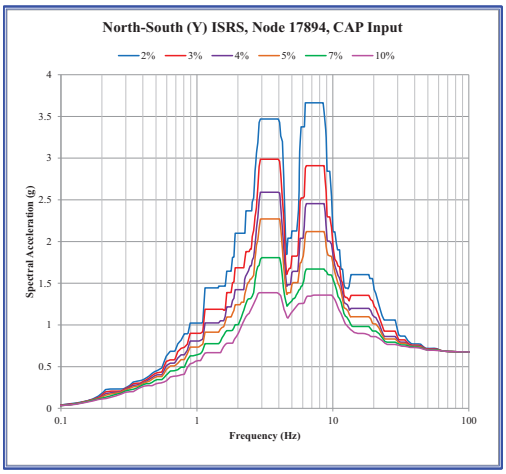


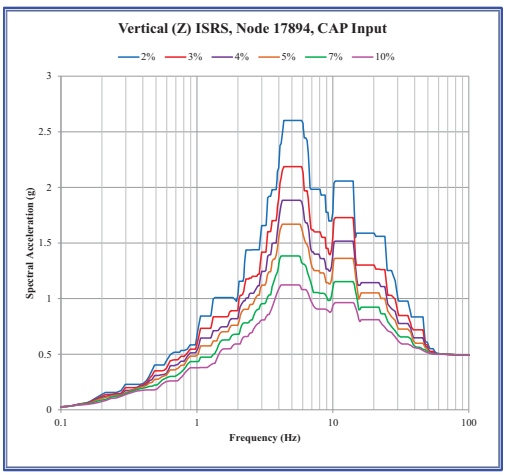


RAI 03.08.04-23S2, RAI 03.08.04-23S3

Figure 3.7.2-161: ~~Enveloping ISRS~~In-Structure Response Spectra ~~of Cases 1, 2, and 3~~ at the East Lug of ~~NPM~~NuScale Power Module 6, Capitola Input

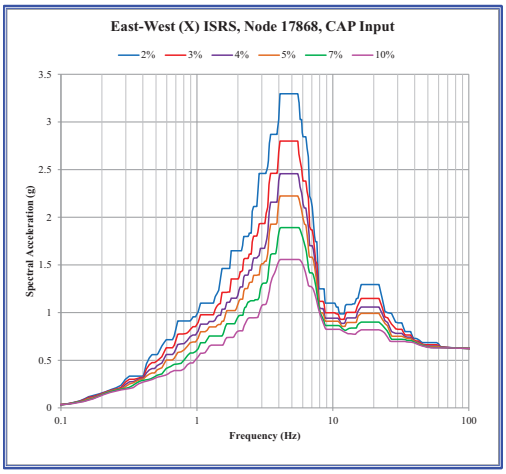


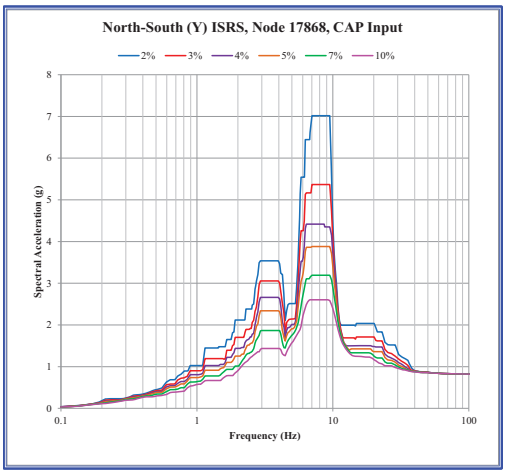


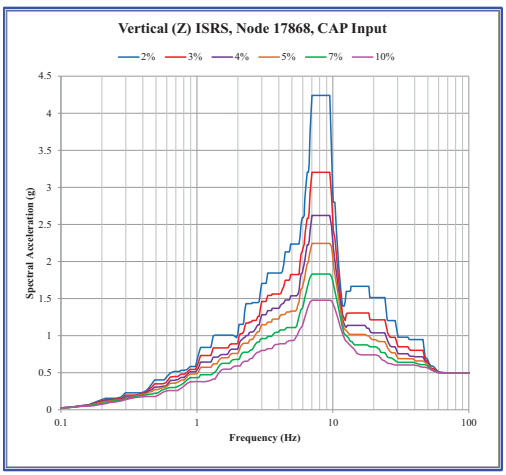


RAI 03.08.04-23S2, RAI 03.08.04-23S3

Figure 3.7.2-162: ~~Enveloping ISRS~~In-Structure Response Spectra ~~of Cases 1, 2, and 3~~ at the North Lug of ~~NPM~~NuScale Power Module 6, Capitola Input

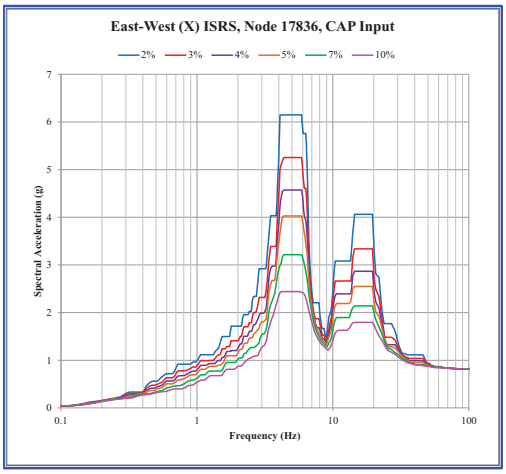


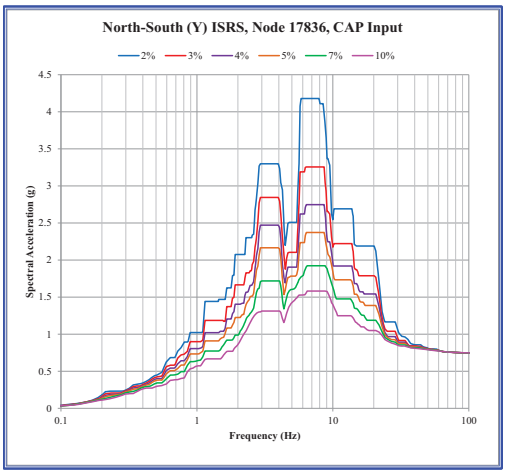


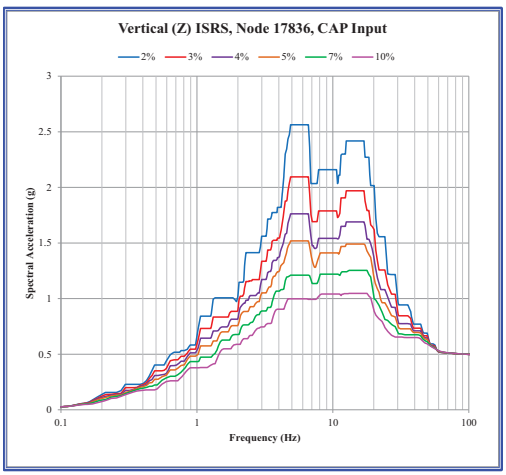


RAI 03.08.04-23S2, RAI 03.08.04-23S3

Figure 3.7.2-163: ~~Enveloping ISRS~~In-Structure Response Spectra ~~of Cases 1, 2, and 3~~ at the West Lug of ~~NPM~~NuScale Power Module 6, Capitola Input

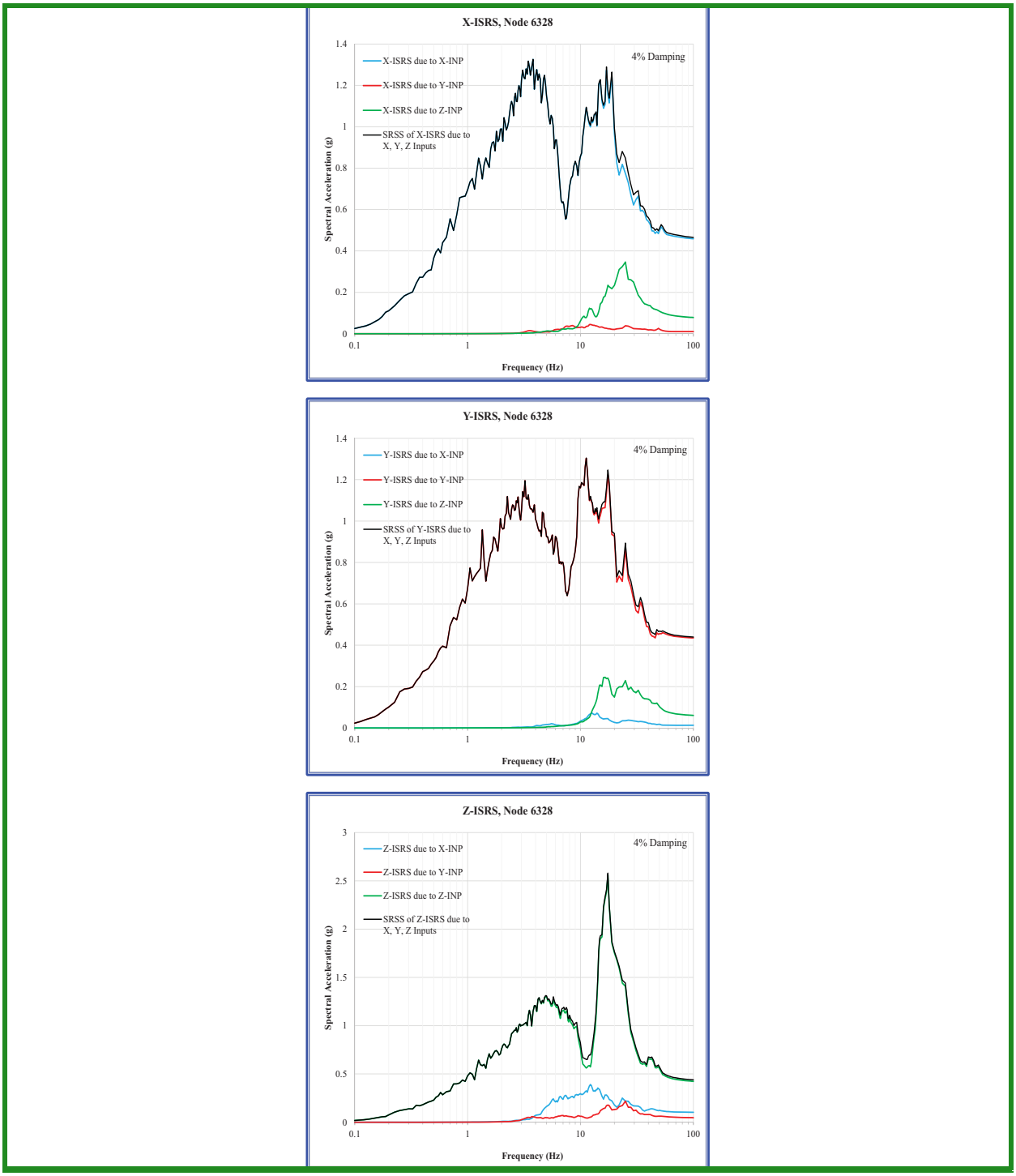






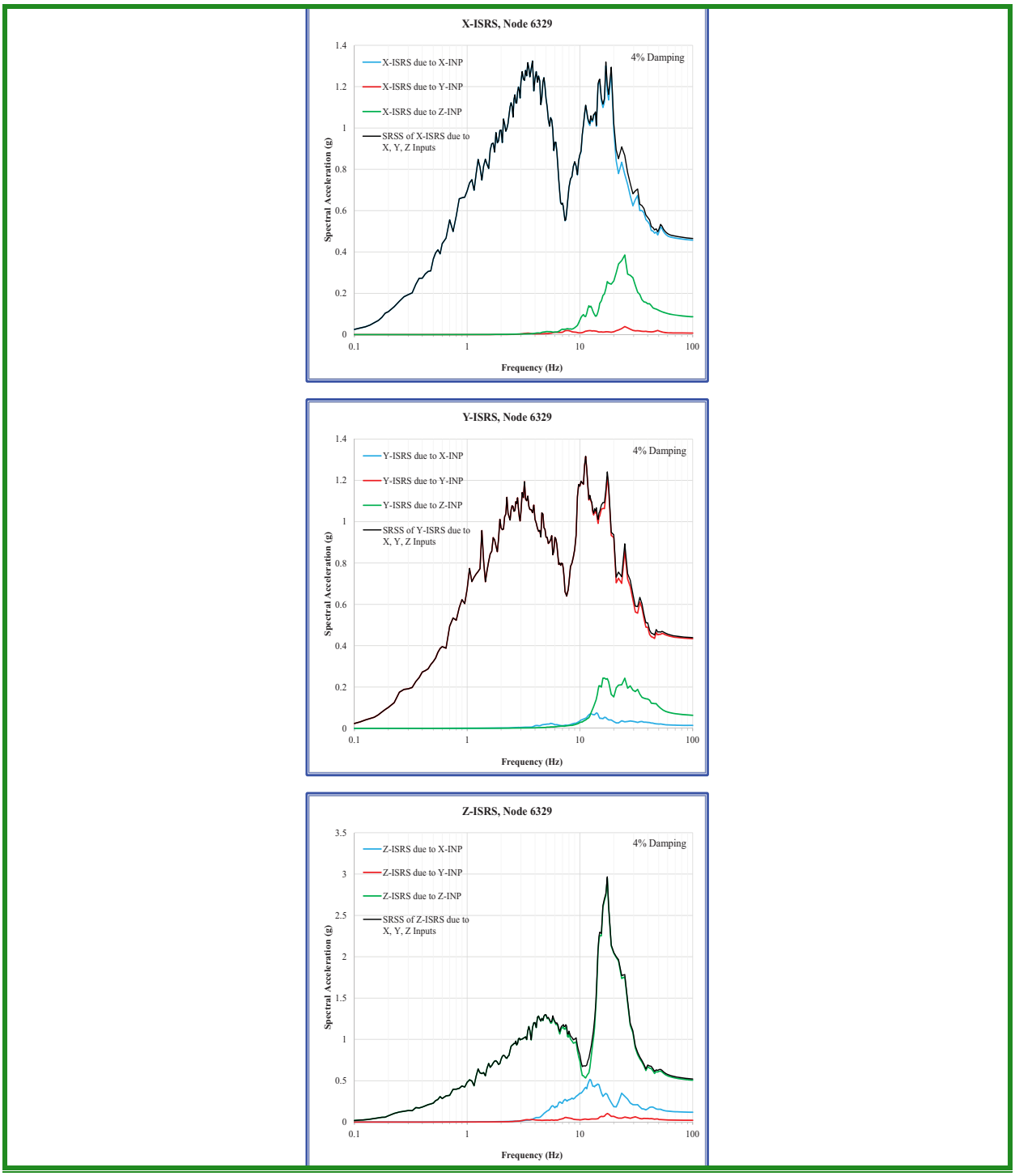
RAI 03.08.04-23S3

Figure 3.7.2-164: In-Structure Response Spectra at Node 6328 due to X, Y, and Z Inputs of Capitola Excitation for Soil Type 7, Uncracked Condition



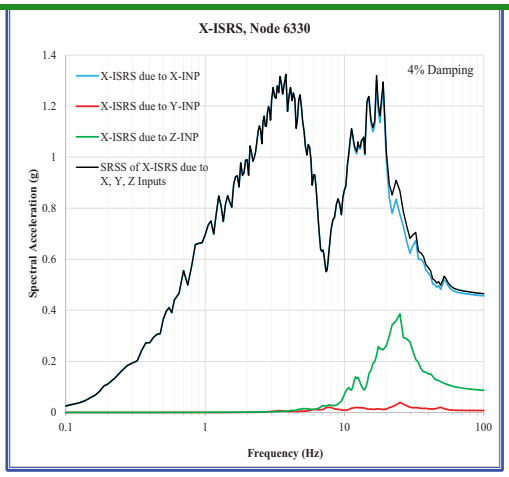
RAI 03.08.04-23S3

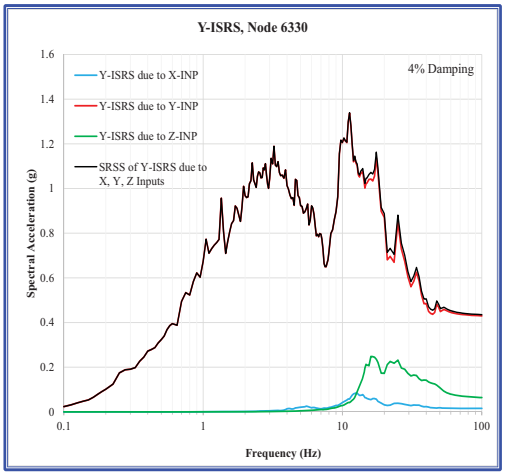
Figure 3.7.2-165: In-Structure Response Spectra at Node 6329 due to X, Y, and Z inputs of Capitola Excitation for Soil Type 7, Uncracked Condition

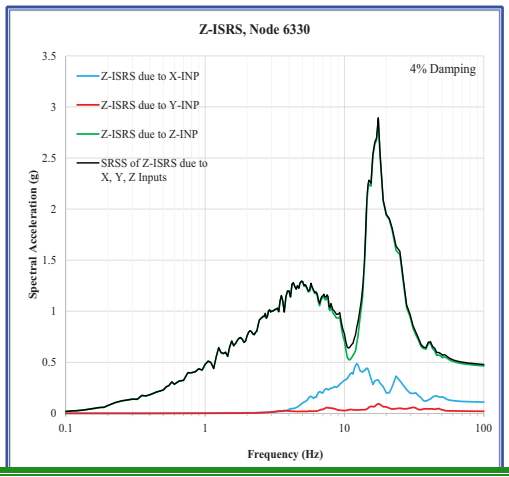


RAI 03.08.04-23S3

Figure 3.7.2-166: In-Structure Response Spectra at Node 6330 due to X, Y, and Z Inputs of Capitola Excitation for Soil Type 7, Uncracked Condition

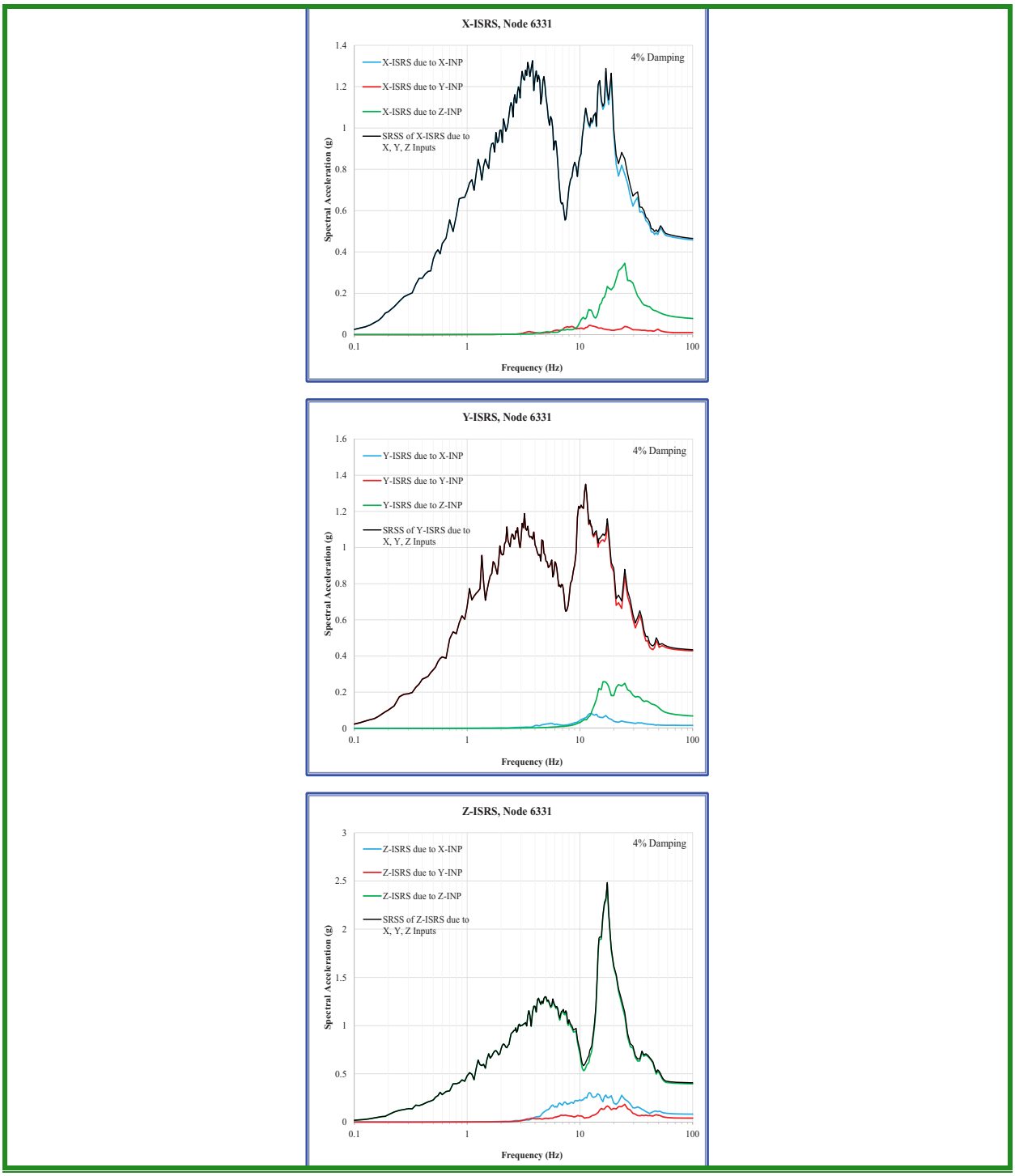






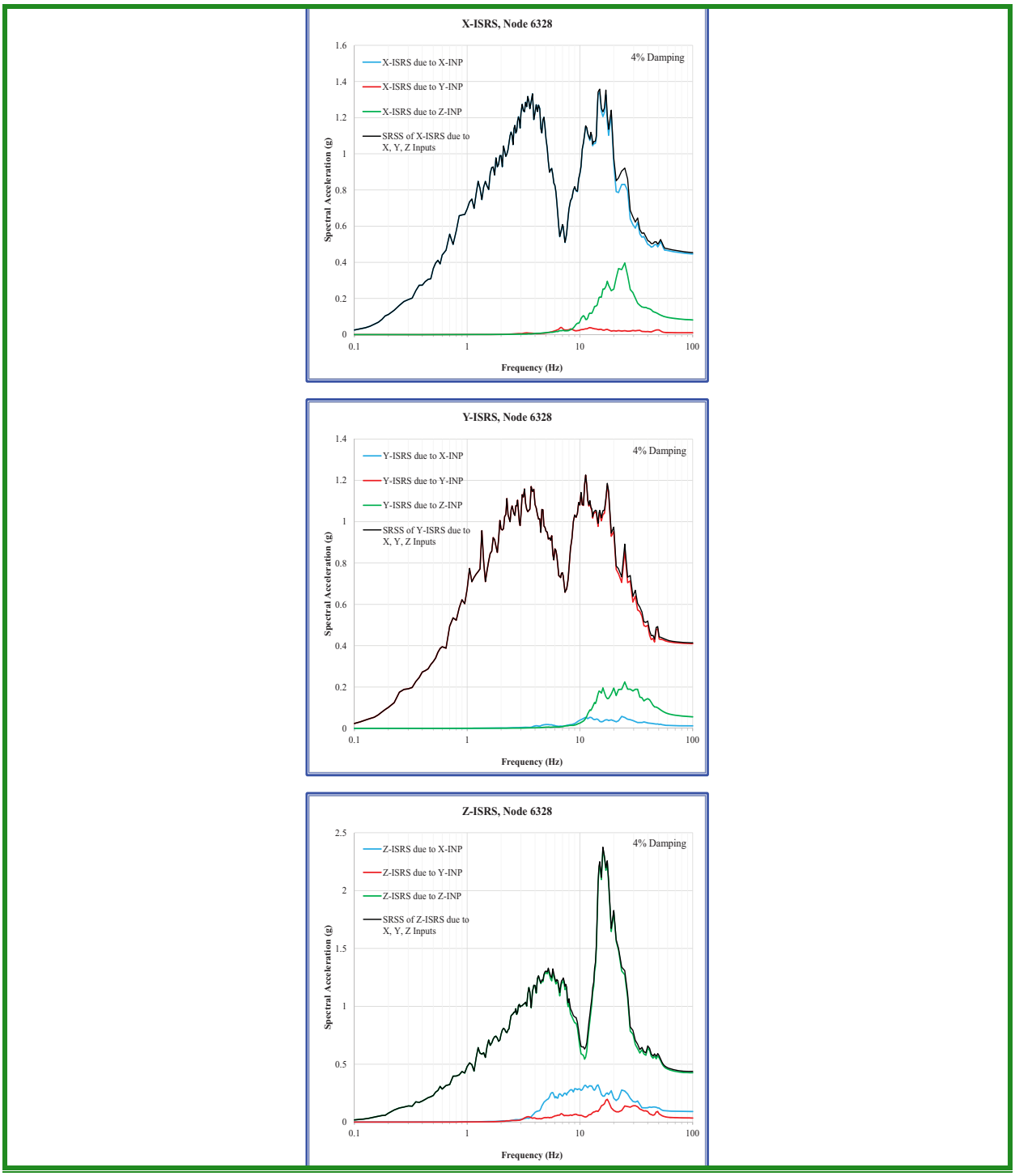
RAI 03.08.04-23S3

Figure 3.7.2-167: In-Structure Response Spectra at Node 6331 due to X, Y, and Z Inputs of Capitola Excitation for Soil Type 7, Uncracked Condition



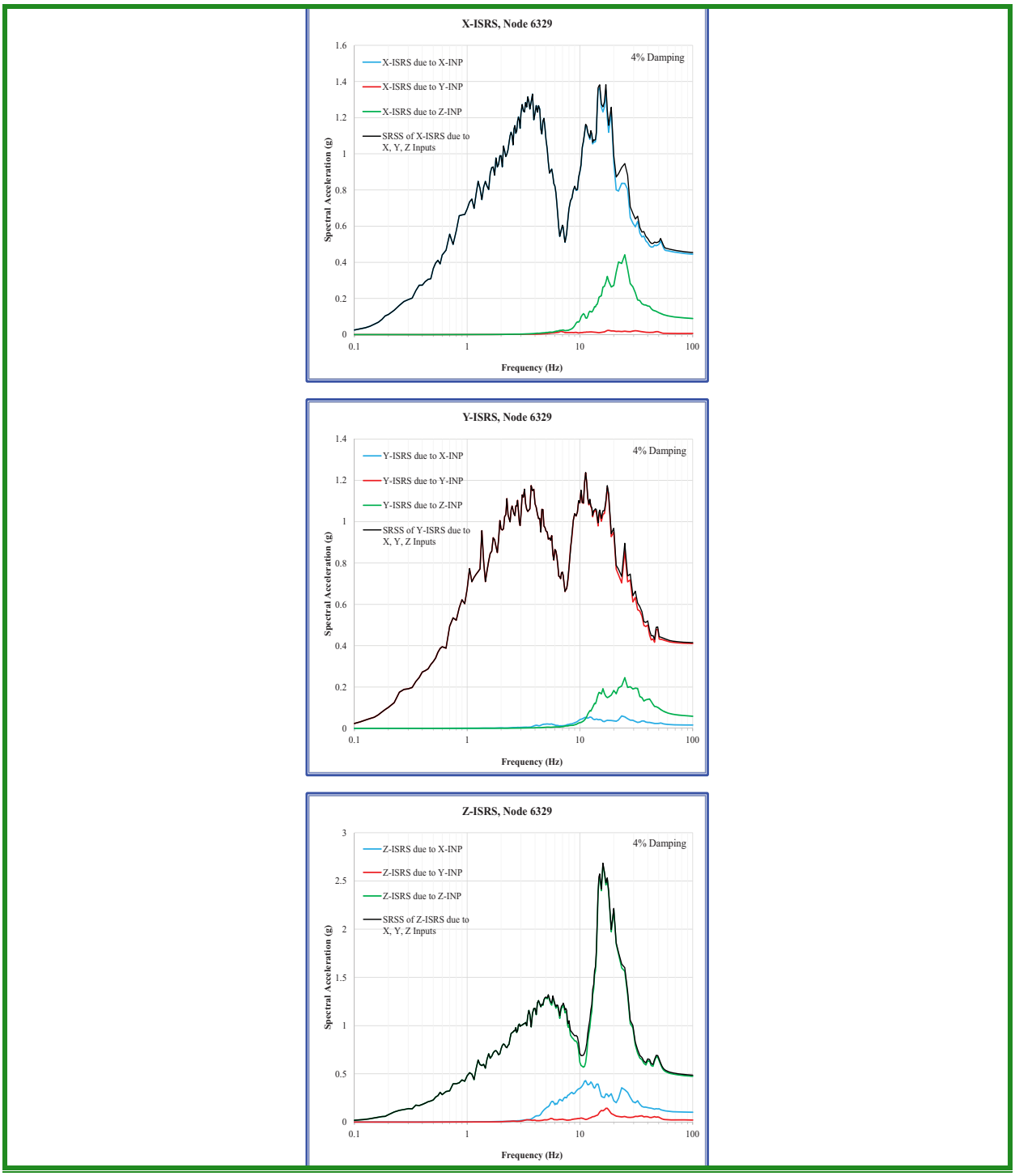
RAI 03.08.04-23S3

Figure 3.7.2-168: In-Structure Response Spectra at Node 6328 due to X, Y, and Z Inputs of Capitola Excitation for Soil Type 7, Cracked Condition



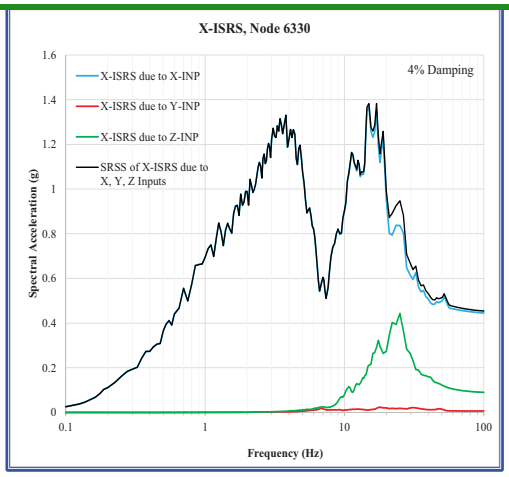
RAI 03.08.04-23S3

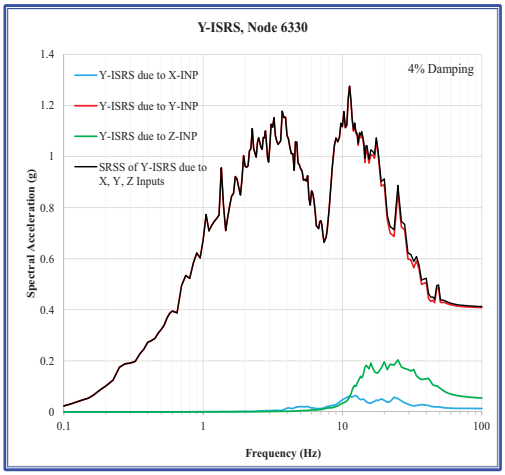
Figure 3.7.2-169: In-Structure Response Spectra at Node 6329 due to X, Y, and Z Inputs of Capitola Excitation for Soil Type 7, Cracked Condition

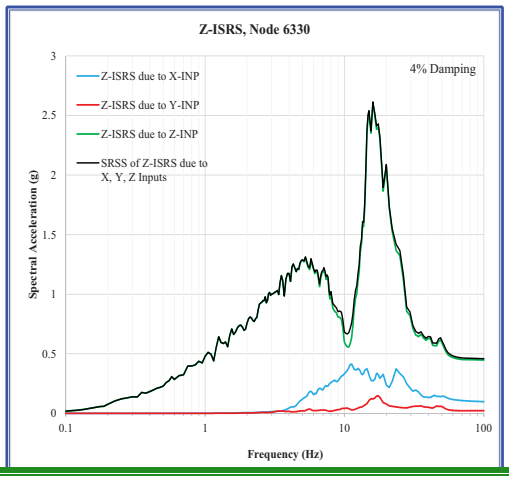


RAI 03.08.04-23S3

Figure 3.7.2-170: In-Structure Response Spectra at Node 6330 due to X, Y, and Z Inputs of Capitola Excitation for Soil Type 7, Cracked Condition

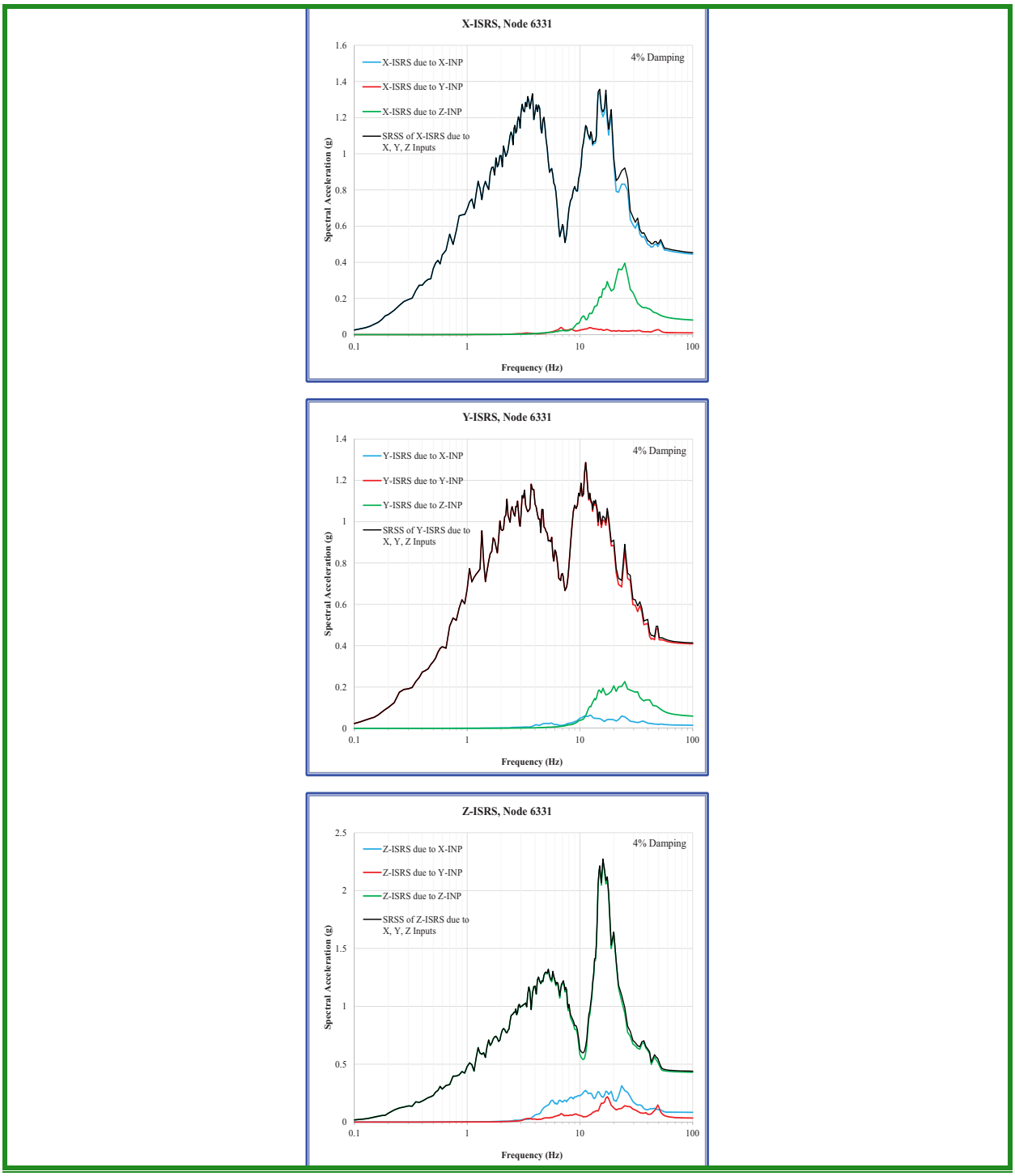






RAI 03.08.04-23S3

Figure 3.7.2-171: In-Structure Response Spectra at Node 6331 due to X, Y, and Z Inputs of Capitola Excitation for Soil Type 7, Cracked Condition



buildings. Typically this will be reinforcing beams underneath slabs. The uniform distributed dead load applied in the structural and seismic analyses encompasses the weight of this steel. The RFT stand and embedded plate will be fabricated using conventional fabrication processes.

3.8.4.7 Testing and Inservice Inspection Requirements

RAI 03.08.04-1

There is no testing or in-service surveillance beyond the quality control tests performed during construction, which is in accordance with ACI 349, and AISC N690 (Reference 3.8.4-6). The Seismic Category I RFT stand will be inspected prior to installation via NDE to qualify it in accordance with applicable requirements of ASME Boiler and Pressure Vessel code Section III, Division 1 (Reference 3.8.4-9).

COL Item 3.8-1: A COL applicant that references the NuScale Power Plant design certification will describe the site-specific program for monitoring and maintenance of the Seismic Category I structures in accordance with the requirements of 10 CFR 50.65 as discussed in Regulatory Guide 1.160. Monitoring is to include below grade walls, groundwater chemistry if needed, base settlements and differential displacements.

3.8.4.8 Evaluation of Design for Site Specific Acceptability

RAI 02.03.01-2, RAI 03.08.04-23S3

The RXB and CRB are designed to remain operable and to transmit forces, moments, and accelerations so that contained, safety-related SSC remain operable during and following an earthquake, with a spectra equal to the CSDRS or the CSDRS-HF. This is accomplished by confirming the buildings meet code-acceptance criteria if situated on a soft soil site, a hard soil/soft rock site, a rock site, and a hard rock site. However, each actual site will have unique soil conditions and a site-specific SSE. The entire analysis described in Section 3.8.4 does not need to be re-performed if it can be shown that non-seismic loads are less than those produced by the site parameters provided in Table 2.0-1 and that the forces experienced within the building from the site-specific earthquake are less than those produced from the CSDRS and CSDRS-HF.

RAI 03.08.04-23S3

COL Item 3.8-2: A COL applicant that references the NuScale Power Plant design certification will confirm that the site-independent Reactor Building and Control Building are acceptable for use at the designated site.

RAI 03.08.04-3S2, RAI 03.08.04-23S3

COL Item 3.8-4: A COL applicant that references the NuScale Power Plant design certification will evaluate and document construction aid elements such as steel beams, Q-decking, formwork, lugs, and other items that are left in place after construction, but that were not part of the certified design, to verify the construction aid elements do not have an appreciable adverse effect on overall mass, stiffness, and seismic demands of the certified building structure. The COL applicant will confirm that these

left-in-place construction aid elements will not have adverse effects on safety-related structures, systems, and components per Section 3.7.2.

RAI 03.08.04-23S3

The comparison of the non-seismic parameters is performed as described in COL Item 2.0-1, in Section 2.0. A direct comparison of seismic inputs cannot be made. Therefore, the results of the site-specific seismic analysis prepared in response to COL Item 3.7-5 and COL Item 3.7-6, in Section 3.7.2.16, are compared as described below.

RAI 03.08.04-23S3

The site-specific foundation input response spectra (FIRS) are compared to the CSDRS and CSDRS-HF (which were used as the FIRS for the site-independent analysis). This demonstrates that the site-specific seismic input is bounded by the input used for design.

RAI 03.08.04-23S3

In-structure response spectra at 5 percent damping are used for comparison within the buildings. The design ISRS may be used as a surrogate for the forces and moments. If the site-independent ISRS are larger than the site-specific ISRS, the forces and moments will also be bounded for the design. The ISRS comparisons are done specifically at the ~~reactor pool floor and the~~ NPM skirt supports, lug restraints, and RFT base to confirm that the forces and accelerations that ~~will be experienced by~~the NPMs experience are acceptable. In addition, the ISRS at the RBC wheels are~~is~~ checked. The RBC is the only other large, risk-significant SSC. As a general check of the buildings, the ISRS are compared at grade and at the roof of the RXB; and at the main control room, grade level, and the top of the Seismic Category I portion of the CRB. This will be accomplished by confirming the following site-specific characteristics/results are bounded by the DCD design parameters/results:

RAI 03.08.04-23, RAI 03.08.04-23S3

RXB

• FIRS	Compare to Figure 3.7.1-1 through Figure 3.7.1-4
• ISRS at the reactor pool floor	Compare to Figure 3.7.2-108
• ~~ISRS at the NPM lug restraints~~	~~Compare to Figure 3.7.2-116~~
• ISRS at the RBC wheels	Compare to Figure 3.7.2-114
• ISRS at grade	Compare to Figure 3.7.2-111
• ISRS at the roof	Compare to Figure 3.7.2-113

RAI 03.08.04-23

CRB

• FIRS	Compare to Figure 3.7.1-1 through Figure 3.7.1-4
• ISRS at the main control room	Compare to Figure 3.7.2-119
• ISRS at grade	Compare to Figure 3.7.2-120
• ISRS at Elevation 120'-0"	Compare to Figure 3.7.2-121

RAI 03.07.02-10S1, RAI 03.08.04-23S3

Table 3B-28: Enveloped NPM Lug Support and Skirt Support Reaction Forces Using Soil Type 7 (CSDRS) and Design Capacities (x10^3 kips)

Enveloped Input Case	SRSS Horizontal Skirt Reaction ~~(x10^3 kips)~~	Vertical Skirt Reaction* ~~(x10^3 kips)~~	East Wing Wall N-S Lug Reaction ~~(x10^3 kips)~~	Pool Wall E-W Lug Reaction ~~(x10^3 kips)~~	West Wing Wall N-S Lug Reaction ~~(x10^3 kips)~~	Skirt Support Plate Capacity	Lug Assembly Capacity
NPM Seismic Analysis	1.20	1.62	3.15	3.68	2.24	2.23	4.50
SASSI Building Seismic Analysis	1.59	1.86	2.18	2.82	2.30		

*Vertical skirt reactions are not resisted by the support plates, the NPM is free to move vertically