



March 26, 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 04, 2017
 3. NuScale Power, LLC Supplemental Response to "NRC Request for Additional Information No. 151 (eRAI No. 8974)" dated April 9, 2018
 4. NuScale Power, LLC Supplemental Response to "NRC Request for Additional Information No. 151 (eRAI No. 8974)" dated September 21, 2018
 5. NuScale Power, LLC Supplemental Response to "NRC Request for Additional Information No. 151 (eRAI No. 8974)" dated January 11, 2019

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



RAIO-0319-64970

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



Enclosure 1:

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

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
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NuScale Response:

As discussed, during a public meeting on February 26, 2019, the following supplemental response to RAI 8974 03.08.04-23 is provided:

NRC Feedback

Consistent with the description for COL item 3.8-2, please include the ISRS for the skirt supports, lug restraints, and RFT base in the ISRS list for the RXB (i.e. the ISRS list related to COL item 3.8-2). Also, please include the ISRS for the bioshield.

Response

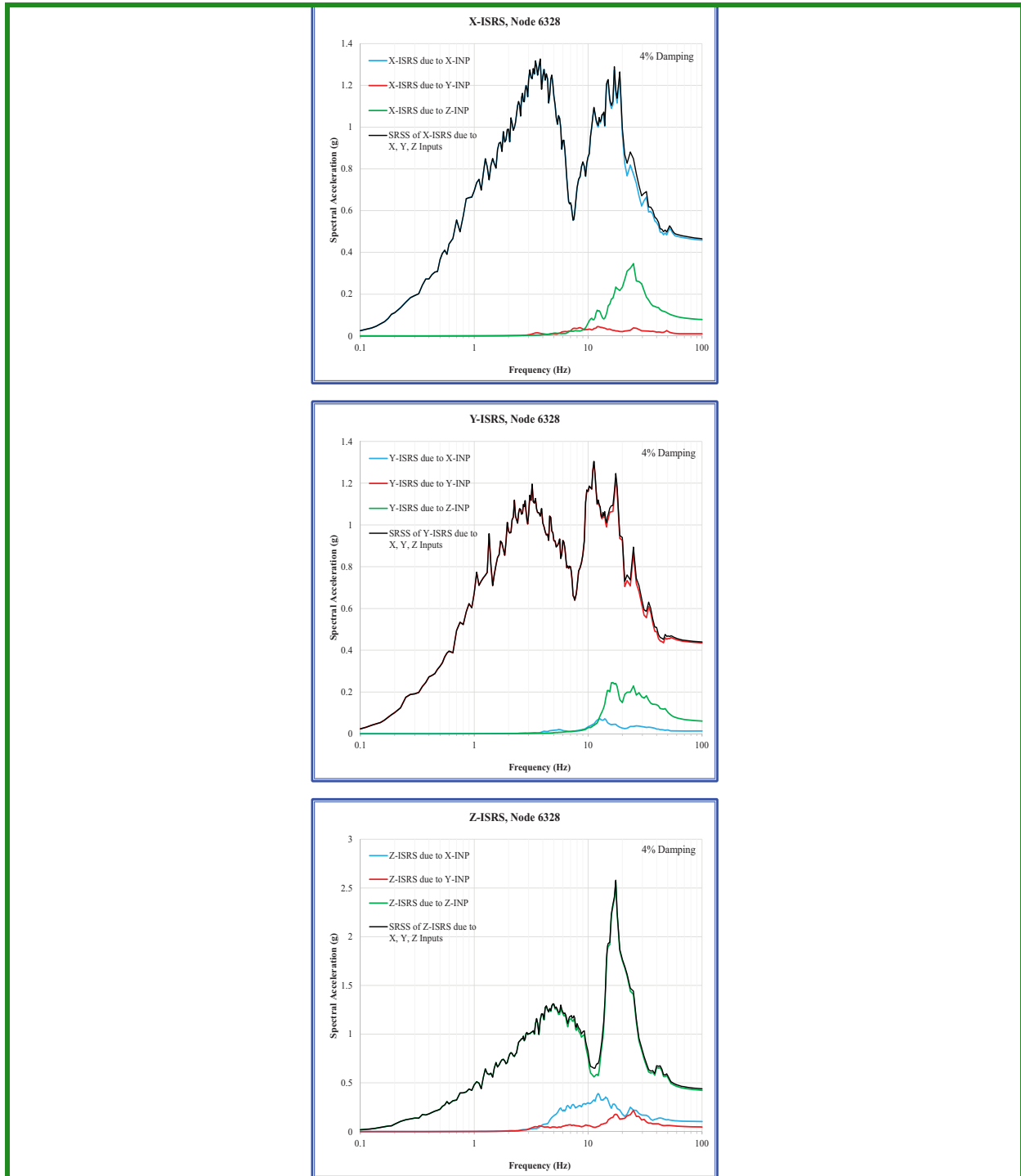
FSAR Tier 2, Section 3.8.4.8 has been revised to include, within the list of RXB design parameters/results, the ISRS at the skirt supports, lug restraints, RFT base and the bioshields.

Impact on DCA:

FSAR Tier 2, Section 3.8.4.8 has been revised as described in the response above and as shown in the markup provided in this response.

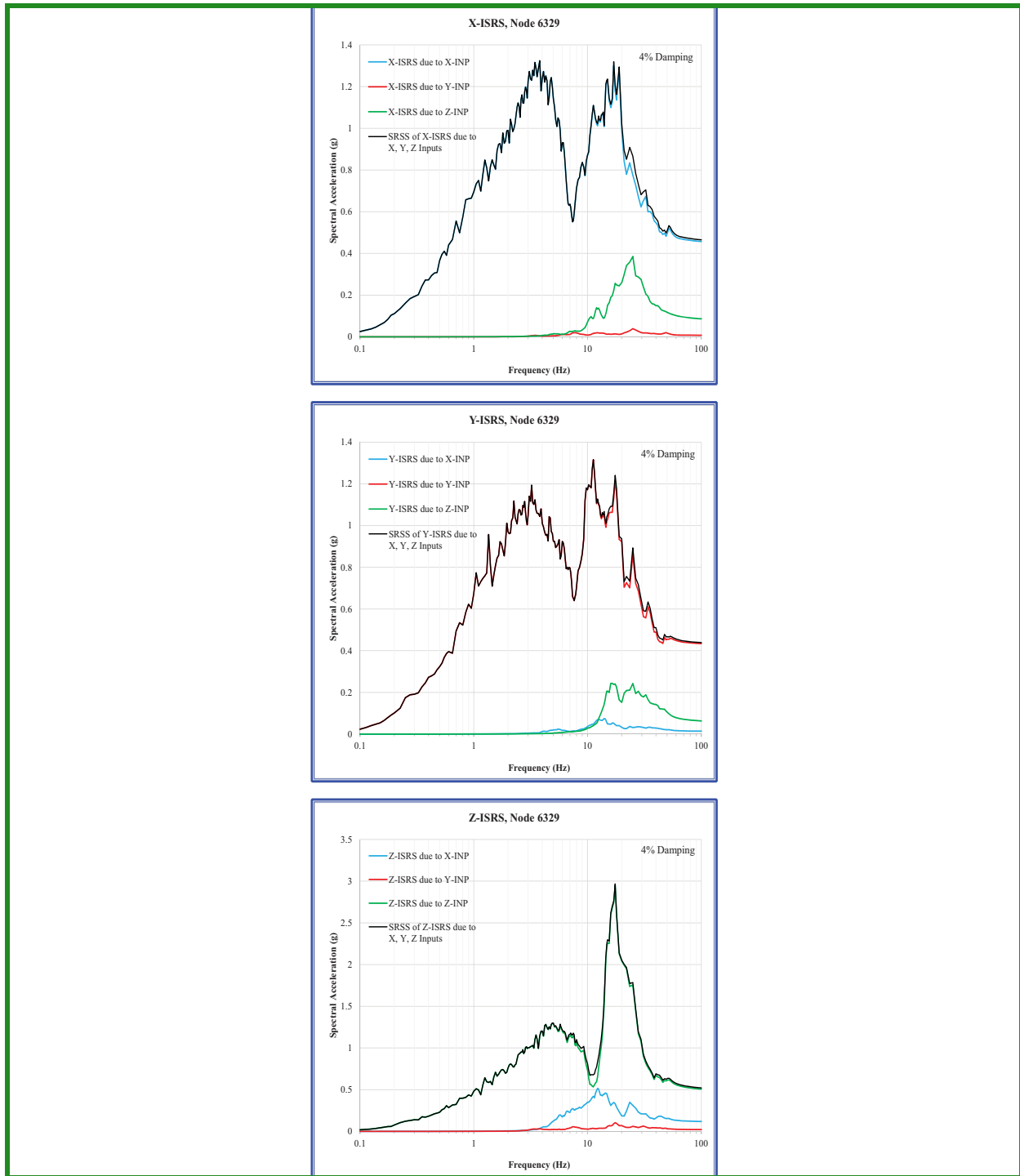
RAI 03.08.04-23S3, RAI 03.08.04-23S4

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



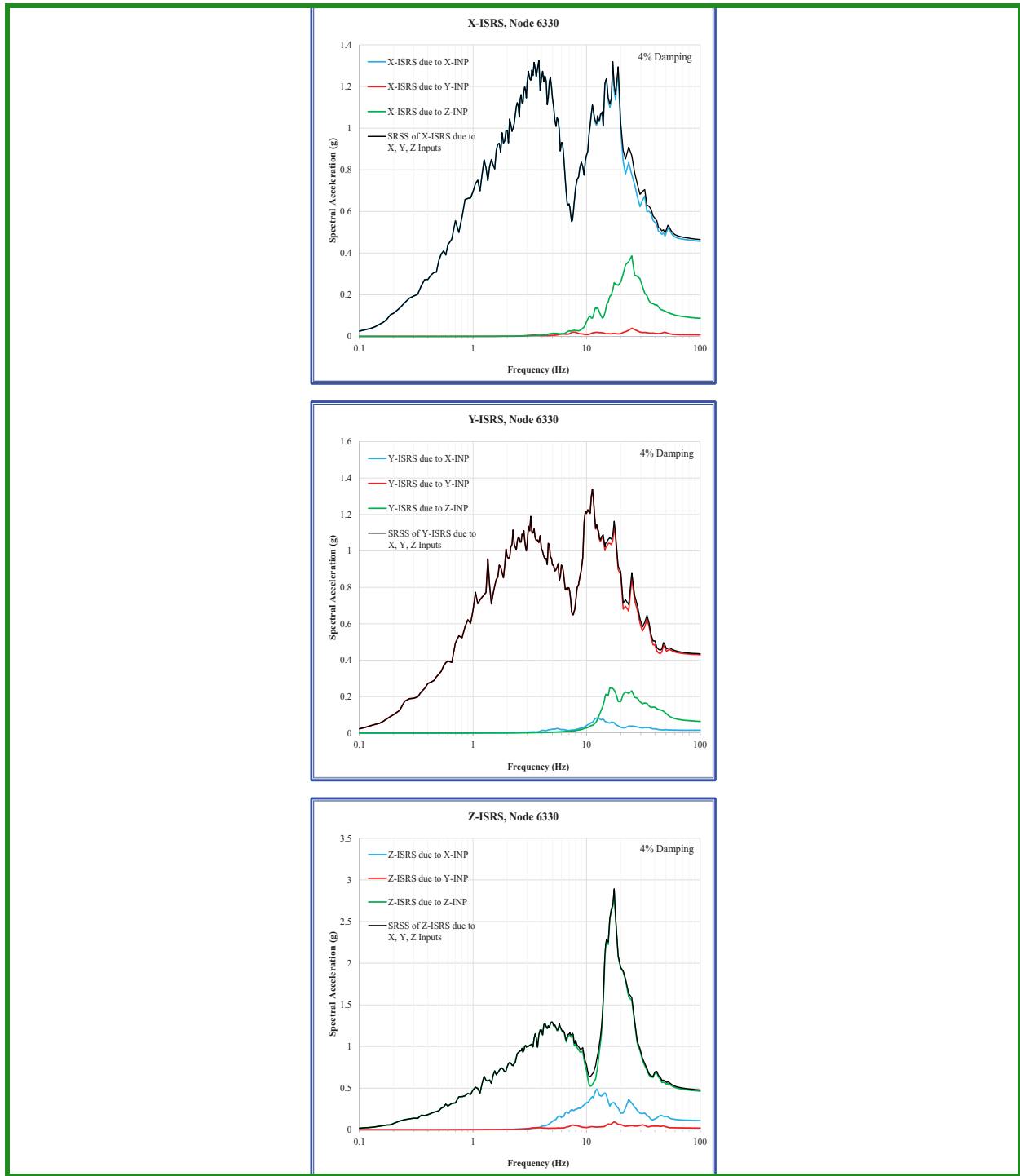
RAI 03.08.04-23S3, RAI 03.08.04-23S4

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



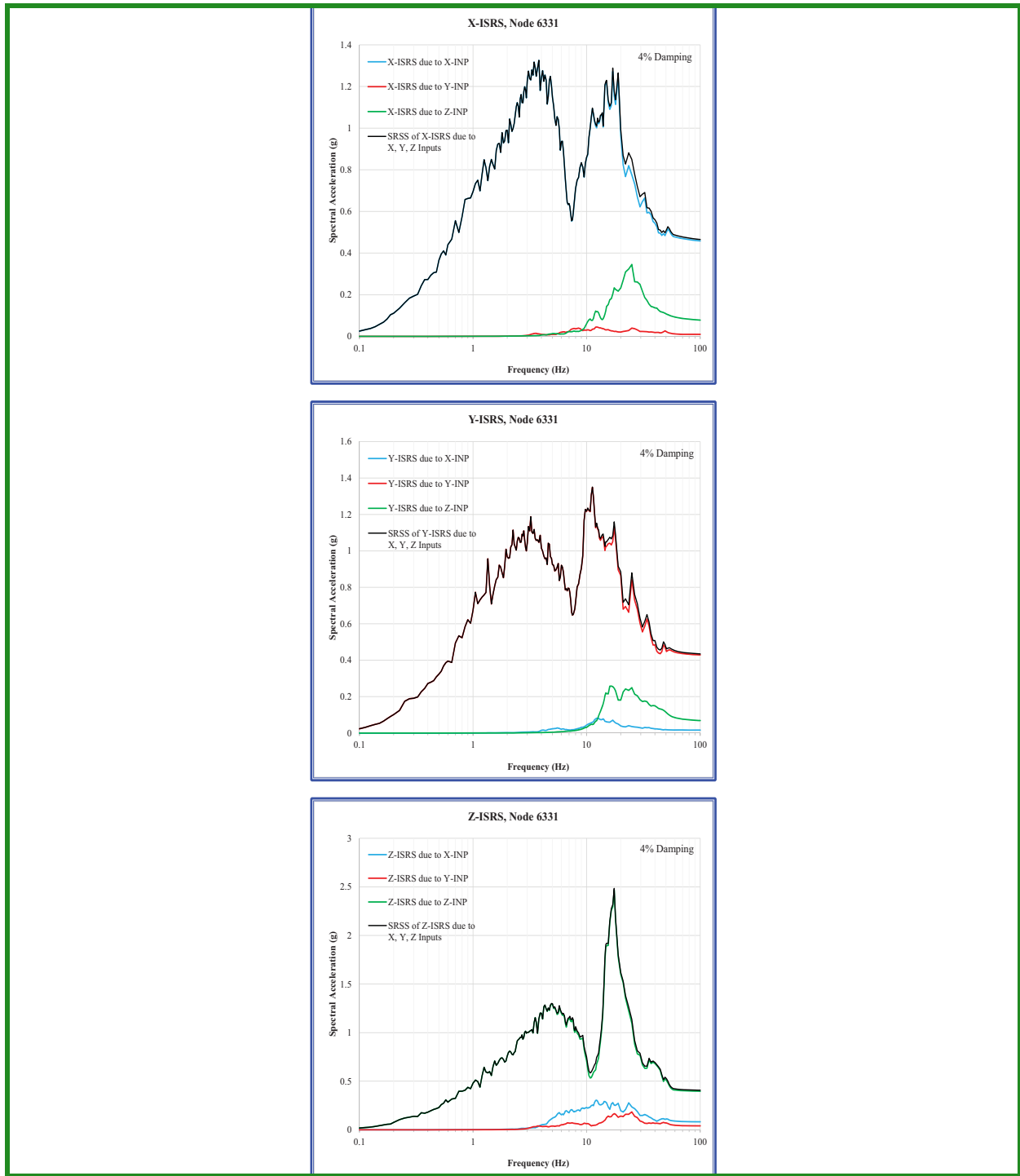
RAI 03.08.04-23S3, RAI 03.08.04-23S4

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



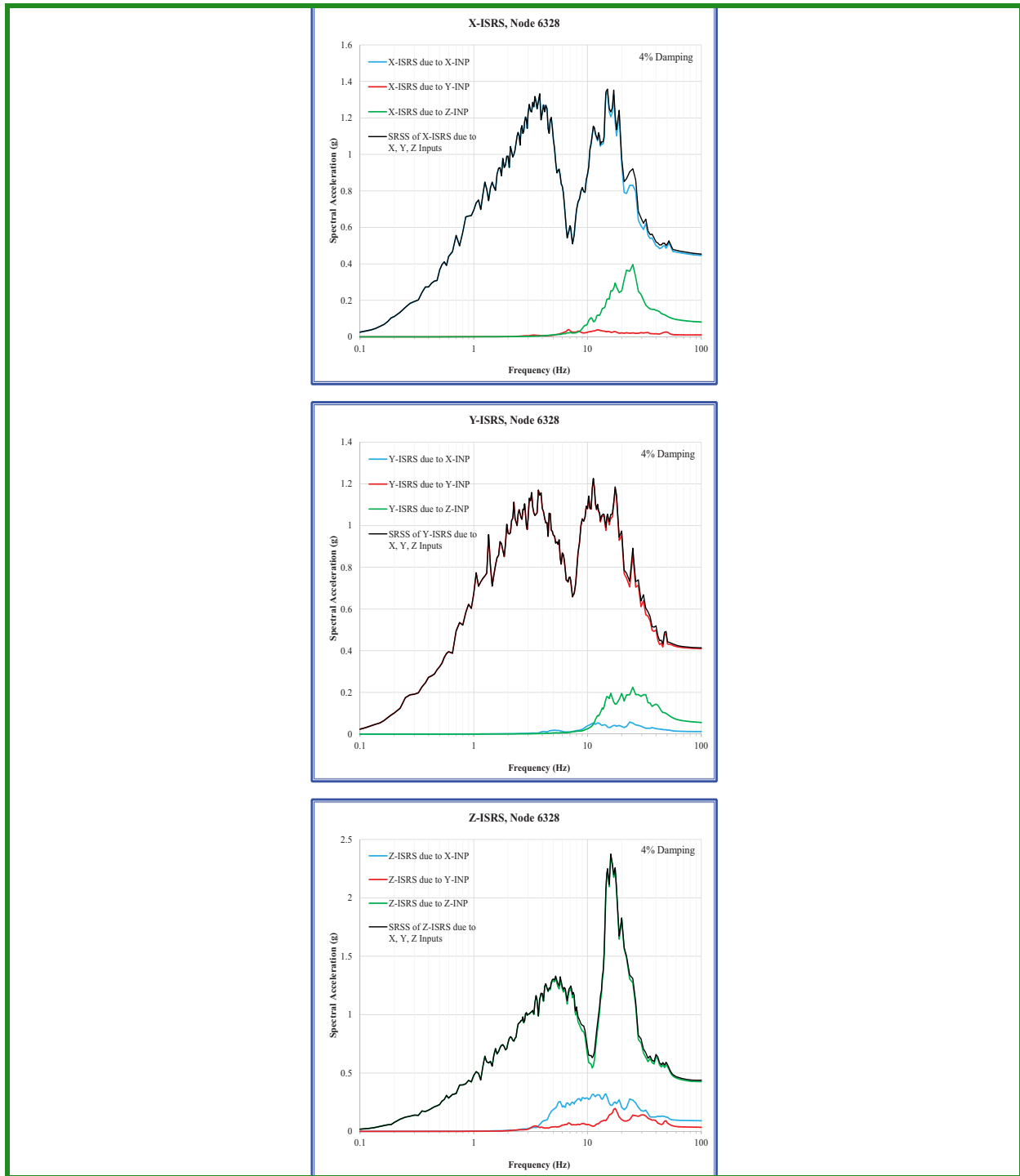
RAI 03.08.04-23S3, RAI 03.08.04-23S4

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



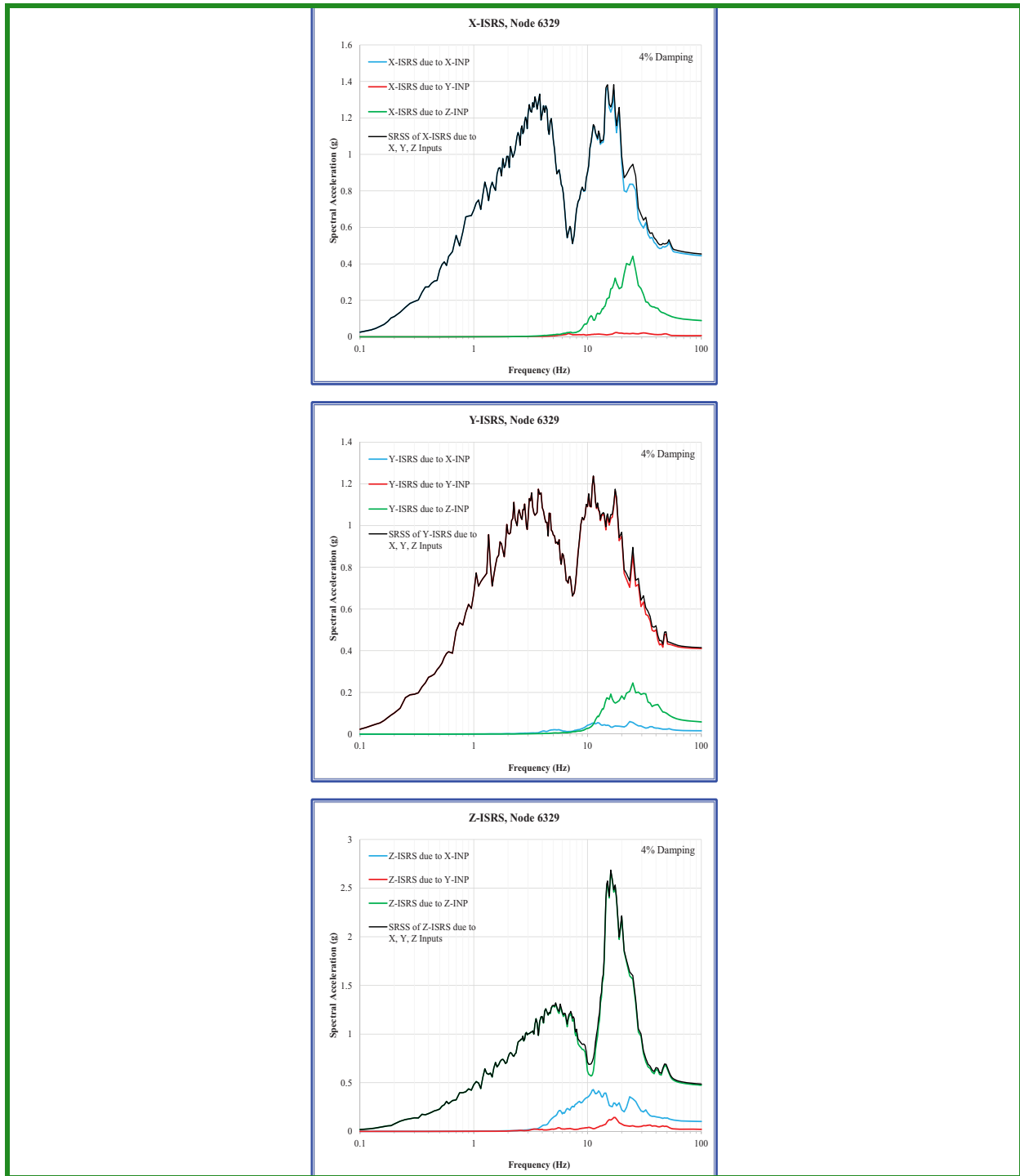
RAI 03.08.04-23S3, RAI 03.08.04-23S4

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



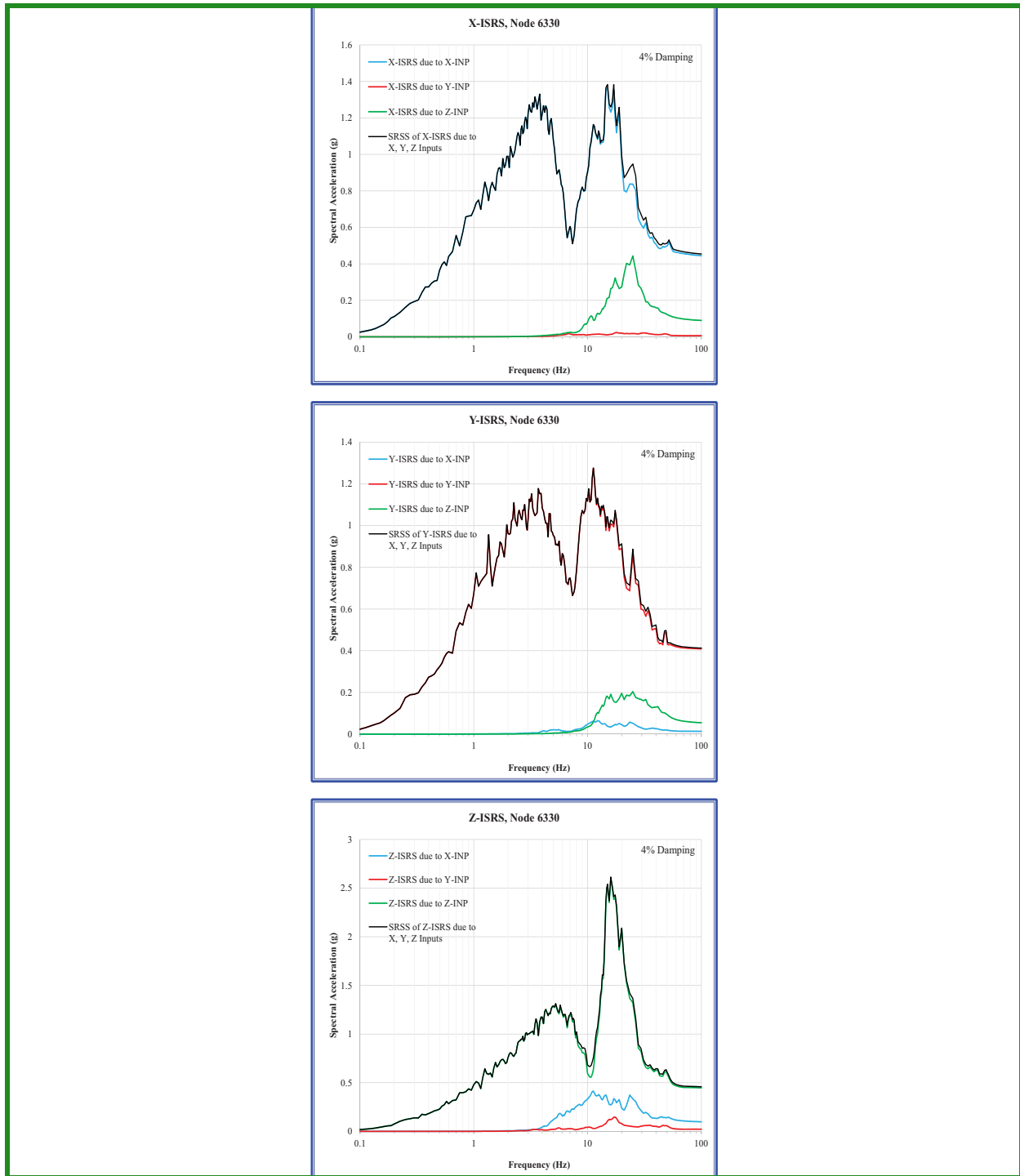
RAI 03.08.04-23S3, RAI 03.08.04-23S4

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



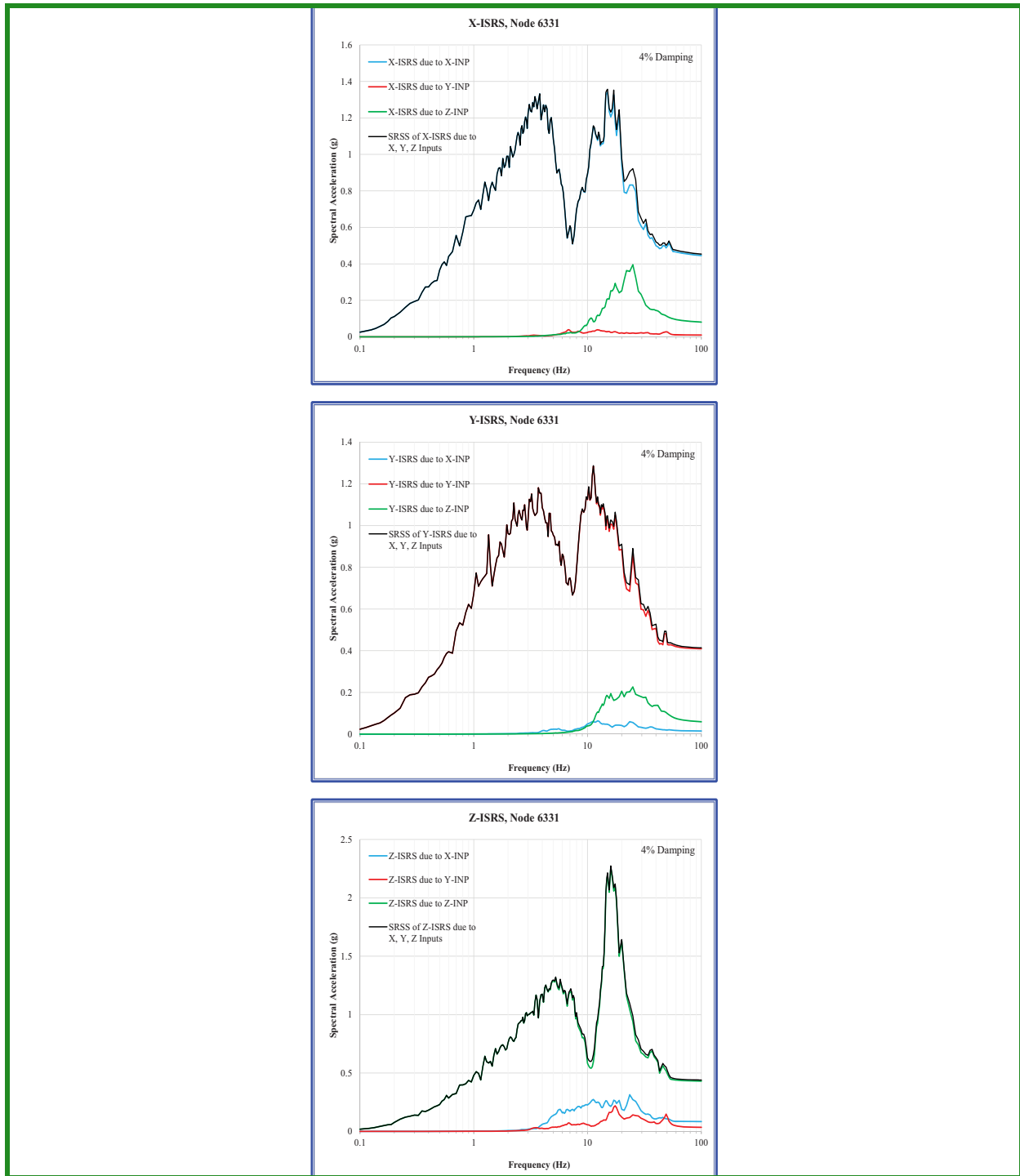
RAI 03.08.04-23S3, RAI 03.08.04-23S4

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



RAI 03.08.04-23S3, RAI 03.08.04-23S4

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



RAI 03.08.04-2354, RAI 03.11-19

Figure 3.7.3-4a: In-Structure Response Spectra at the Bioshield in X-Direction for Nodes 25826 and 26345 and the Enveloped ISRS using 4% Damping

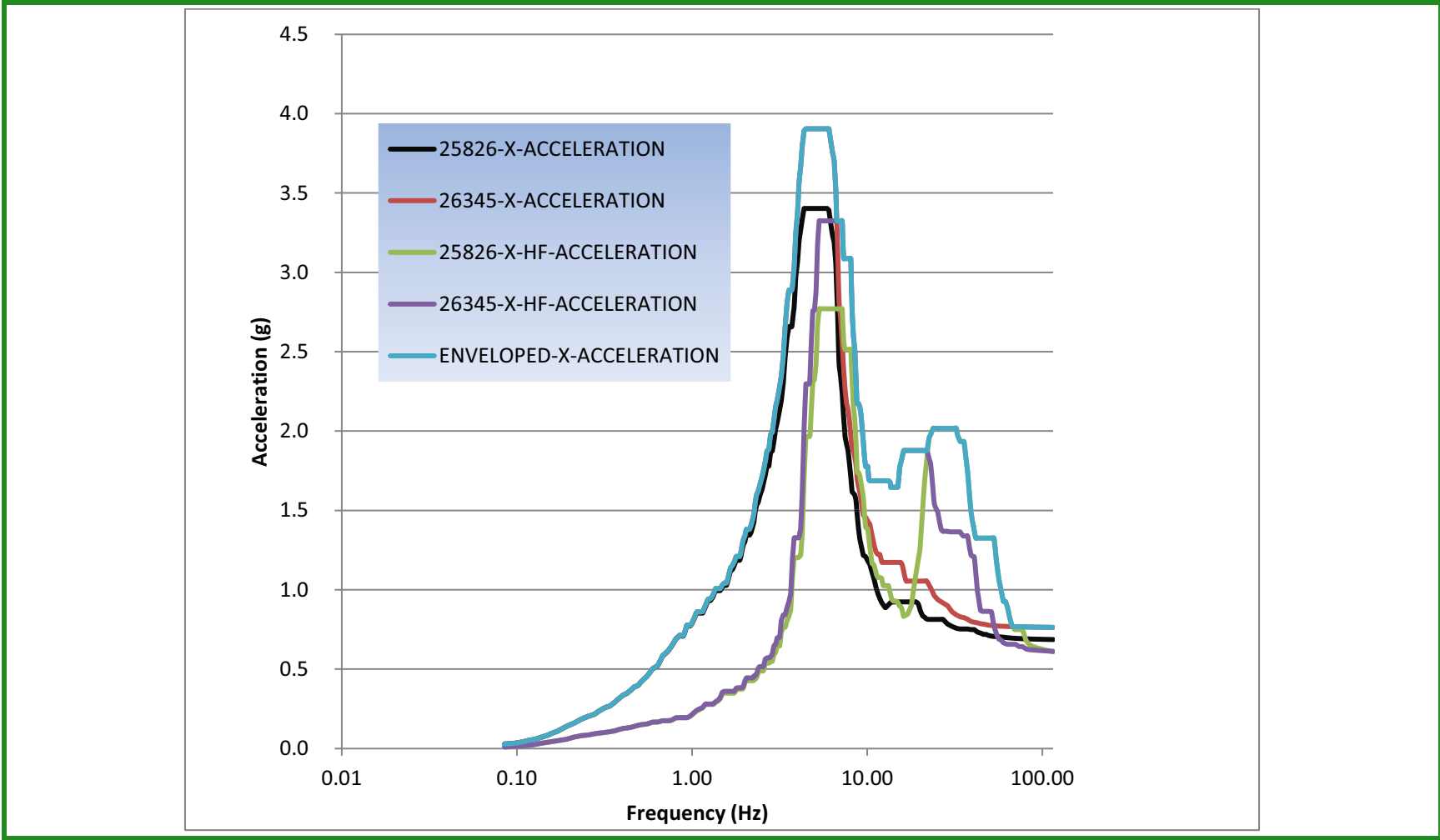


Figure 3.7.3-4b: In-Structure Response Spectra at the Bioshield in Y-Direction for Nodes 25826 and 26345 and the Enveloped ISRS using 4% Damping

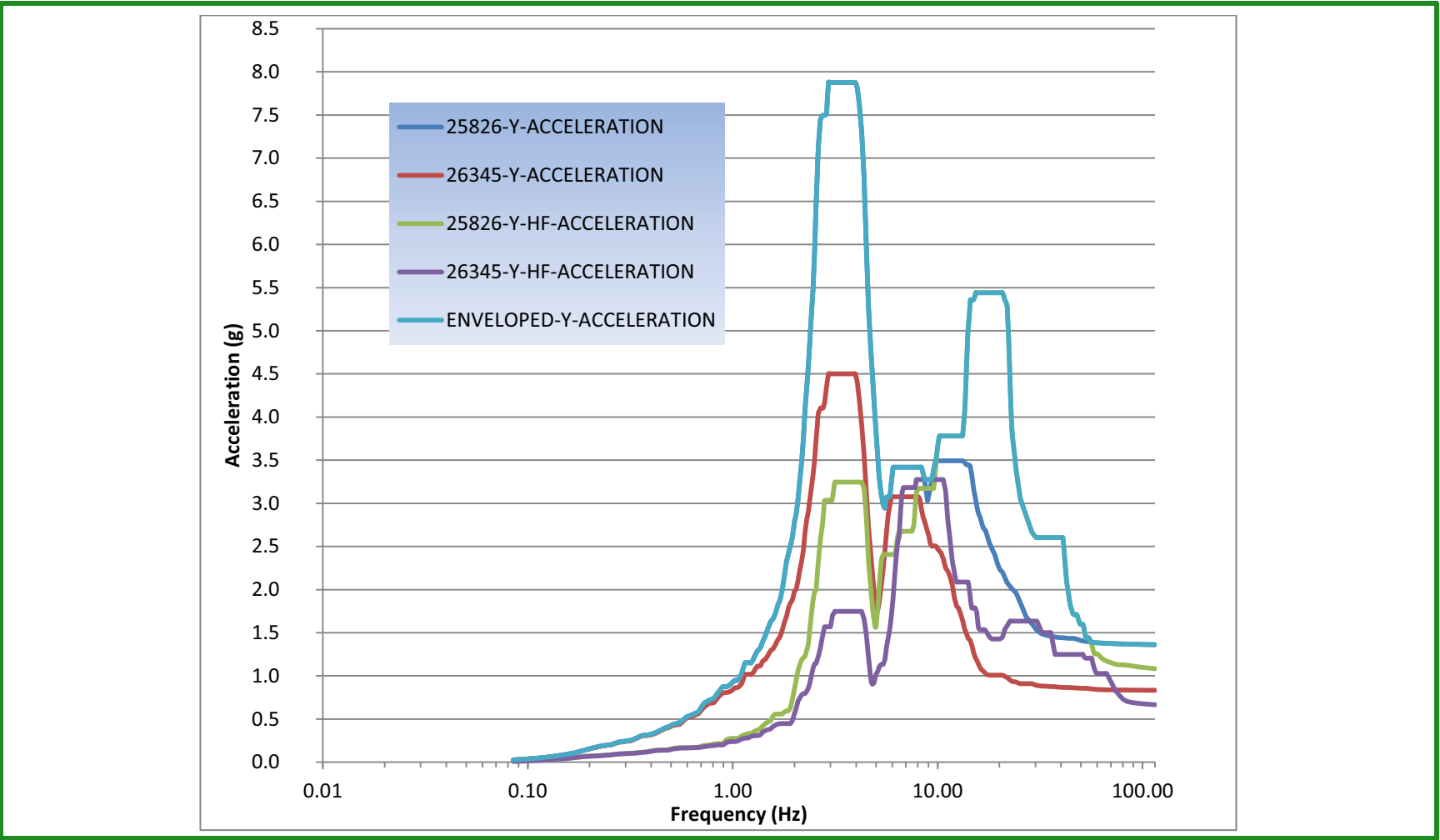
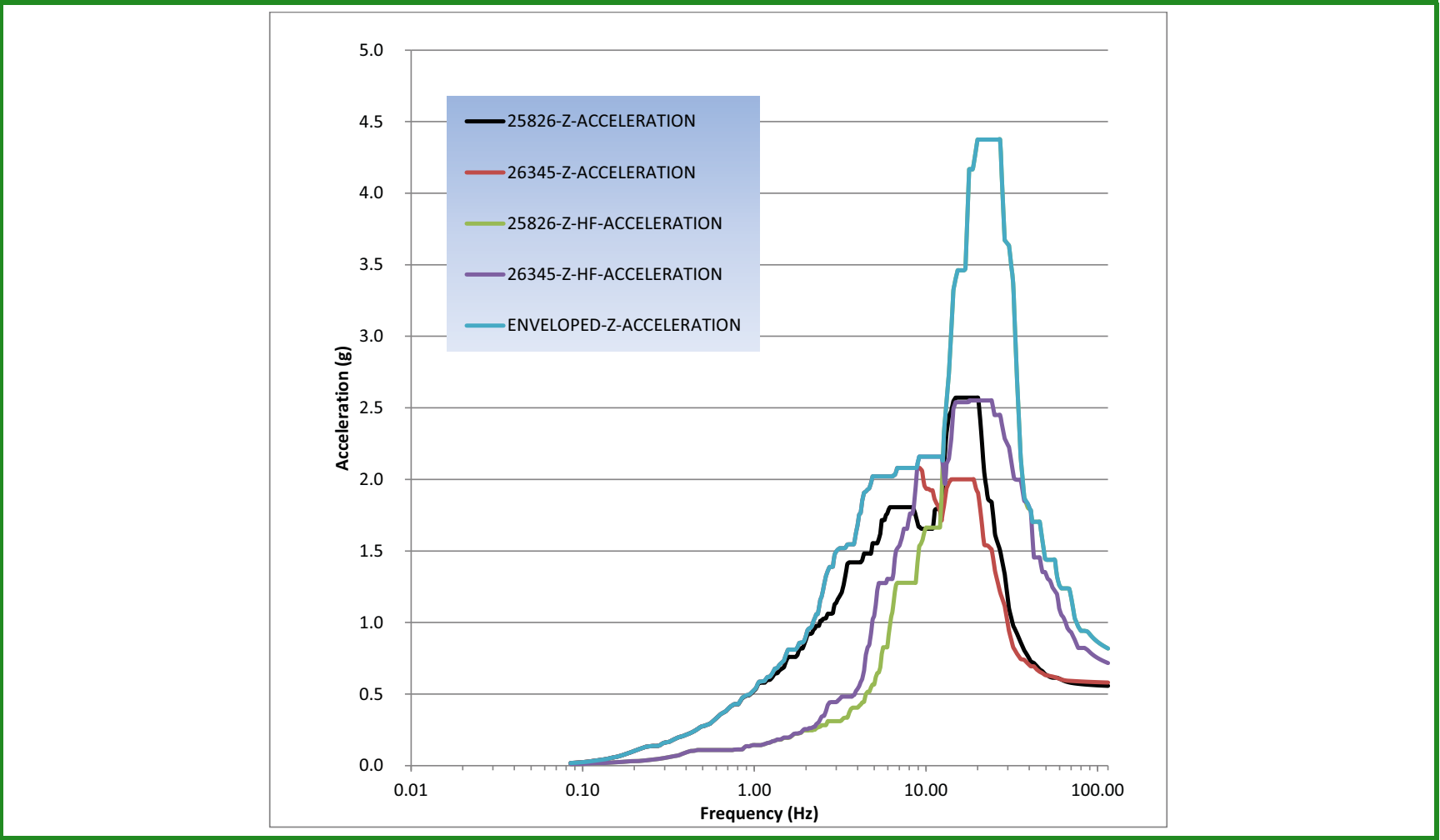


Figure 3.7.3-4c: In-Structure Response Spectra at the Bioshield in Z-Direction for Nodes 25826 and 26345 and the Enveloped ISRS using 4% Damping



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, RAI 03.08.04-23S4

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, and COL Item 3.8-2 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, RAI 03.08.04-23S4

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 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, bioshields, 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, RAI 03.08.04-23S4

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
- ISRS at the NPM skirt supports Compare to Figure 3.7.2-156 and Figure 3.7.2-157
- ISRS at the NPM lug restraints Compare to Figure 3.7.2-158 through Figure 3.7.2-163
- ISRS at the RFT base Compare to Figure 3.7.2-164 through Figure 3.7.2-171
- ISRS at the bioshields Compare to Figure 3.7.3-4a through Figure 3.7.3-4c

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

3.8.4.9

References

3.8.4-1 SAP2000 Advanced (Version 17.1.1) [Computer Program]. (2015). Walnut Creek, CA: Computers and Structures, Inc.

3.8.4-2 SASSI2010 (Version 1.0) [Computer Program]. (2012). Berkeley, CA.