ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Wednesday, June 29, 2011 5:28 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); CORNELL Veronica (EXTERNAL AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 201, FSAR Ch. 3, Supplement 3
Attachments: RAI 201 Supplement 3 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 7 questions of RAI No. 201 on May 6, 2009. On August 14, 2009, AREVA NP submitted Supplement 1 to provide technically correct and complete responses to 4 questions, as committed.

As a result of a U.S. EPR design change to embedded NI common basemat structures, the previously submitted final response to Question 03.07.02-35 has been revised. On May 24, 2011, AREVA NP submitted Supplement 2 to provide a revised schedule for Question 03.07.02-35. The response to Question 03.07.01-19 is superseded by the response to RAI 320 Question 03.07.02-63.

The attached file, "RAI 201 Supplement 3 Response US EPR DC.pdf" provides a technically correct and complete revised final response to Question 03.07.01-19 and a final response to Question 03.07.02-35.

The following table indicates the respective pages in the response document, "RAI 201 Supplement 3 Response US EPR DC.pdf," that contain AREVA NP's revised response to the subject question.

Question #	Start Page	End Page
RAI 201 — 03.07.01-19	2	2
RAI 201 — 03.07.02-35	3	17

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

From: WILLIFORD Dennis (RS/NB)
Sent: Tuesday, May 24, 2011 12:17 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); CORNELL Veronica (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 201, FSAR Ch. 3, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 7 questions of RAI No. 201 on May 6, 2009. On August 14, 2009, AREVA NP submitted Supplement 1 to provide technically correct and complete responses to 4 questions, as committed.

The final response to Question 03.07.02-35 was submitted in Supplement 1. As a result of a U.S. EPR design change to embedded NI common basemat structures, the previously submitted final response to Question 03.07.02-35 will be revised.

The schedule for the technically correct and complete revised response to question 03.07.02-35 is provided below.

Question #	Response Date
RAI 201 — 03.07.02-35	**July 8, 2011**

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

From: Pederson Ronda M (AREVA NP INC)
Sent: Friday, August 14, 2009 5:23 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 201, FSAR Ch. 3, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 7 questions of RAI No. 201 on May 6, 2009. The attached file, “RAI 201 Supplement 1 Response US EPR DC.pdf” provides technically correct and complete responses to 4 of the remaining 4 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 201 Question 03.07.02-37.

The following table indicates the respective pages in the response document, “RAI 201 Supplement 1 Response US EPR DC.pdf” that contain AREVA NP’s response to the subject questions.

Question #	**Start Page**	**End Page**
RAI 03.07.01-19	2	2
RAI 03.07.02-35	3	14
RAI 03.07.02-36	15	15
RAI 03.07.02-37	16	17

This concludes the formal AREVA NP response to RAI 201 and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
AREVA NP Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
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From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, May 06, 2009 3:16 PM
To: 'Getachew Tesfaye'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT); WELLS Russell D (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 201, FSAR Ch. 3

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 201 Response US EPR DC.pdf" provides technically correct and complete responses to 3 of the 7 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 201 Question 03.02.01-10.

The following table indicates the respective pages in the response document, "RAI 201 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 201 — 03.02.01-8	2	3
RAI 201 — 03.02.01-9	4	5
RAI 201 — 03.02.01-10	6	6
RAI 201 — 03.07.01-19	7	7
RAI 201 — 03.07.02-35	8	8
RAI 201 — 03.07.02-36	9	9
RAI 201 — 03.07.02-37	10	10

A complete answer is not provided for 4 of the 7 questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 201 — 03.07.01-19	August 17, 2009
RAI 201 — 03.07.02-35	August 17, 2009
RAI 201 — 03.07.02-36	August 17, 2009
RAI 201 — 03.07.02-37	August 17, 2009

Sincerely,

Ronda Pederson
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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, April 08, 2009 1:13 PM
To: ZZ-DL-A-USEPR-DL
Cc: Yuken Wong; Jennifer Dixon-Herrity; Manas Chakravorty; Jim Xu; Michael Miernicki; Joseph Colaccino; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 201 (2123, 2206,2207), FSAR Ch. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on March 12, 2009, and discussed with your staff on April 1, 2009. No changes were made to the Draft RAI Questions as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 3172

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D47AF3A1)

Subject: Response to U.S. EPR Design Certification Application RAI No. 201, FSAR Ch. 3, Supplement 3
Sent Date: 6/29/2011 5:27:31 PM
Received Date: 6/29/2011 5:27:39 PM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

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"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
Tracking Status: None
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"RYAN Tom (AREVA)" <Tom.Ryan@areva.com>
Tracking Status: None
"CORNELL Veronica (EXTERNAL AREVA)" <Veronica.Cornell.ext@areva.com>
Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: auscharmx02.adom.ad.corp

Files	Size	Date & Time
MESSAGE	7420	6/29/2011 5:27:39 PM
RAI 201 Supplement 3 Response US EPR DC.pdf	726881	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Response to

Request for Additional Information No. 201, Supplement 3

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.07.01 - Seismic Design Parameters
SRP Section: 03.07.02 - Seismic System Analysis
Application FSAR Ch.: 3

QUESTIONS for Structural Engineering Branch 2 (ESBWR/ABWR Projects) (SEB2)

Question 03.07.01-19

(Audit follow-up) In Section 3.7.1.1.1 (Design Ground Motion Response Spectra) it indicates that the SSI model of the NI Common Basemat Structure is considered as a surface founded model in the SASSI calculations even though it is embedded to a depth of 41.3 feet. The acceptance criteria of SRP 3.7.2 states that the effect of embedment of the structure should be accounted for in the SSI analysis. Please provide justification for neglecting the depth of embedment on SSI results and quantify the impact on structural design loads as well as on the computation of in-structure response spectra.

Response to 03.07.01-19:

The response to this question is superseded by the Response to RAI 320, Question 03.07.02-63.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 03.07.02-35

(Audit follow-up) Within the U.S. EPR standard design organization, one group is responsible for the seismic analysis of the NI common basemat structures and another group is responsible for the seismic analysis of the reactor coolant system (RCS). The NI seismic model contains a simplified model of the RCS provided by the group responsible for RCS seismic analysis. In a similar way, the seismic analysis of the RCS includes, in addition to a detailed model of the RCS, a seismic model of the Reactor Containment Building internal structure which supports the RCS. The seismic input for this coupled model consists of the time histories at the foundation mat determined from the NI seismic analysis. What are the methods used to verify that similar results are obtained in each of these analyses so as to verify that the interface forces are correct and that the coupled seismic model used in the analysis of the RCS is providing results consistent with the results obtained in the analysis of the NI common basemat structure? Include in your response a comparison of displacements and forces at key interface points of the RCS and internal structure from each of the models that document the adequacy of the results and methodology.

Response to Question 03.07.02-35:

A simplified model of the reactor coolant system (RCS) is added to the reactor building internal structures (RBIS) finite element model (FEM) to capture the effect of the RCS on the RBIS building response in the soil-structure interaction (SSI) analysis. To capture the building motion in the RCS, an RBIS stick model is tuned to the RBIS FEM model and coupled with the detailed RCS model. The RBIS SSI analysis uses the MTR/SASSI (SASSI) computer program, and the RCS seismic analysis uses the BWSPAN computer program.

The enveloped acceleration response spectra generated from the RBIS SSI and RCS analyses of the seismic cases in U.S. EPR FSAR Tier 2, Table 3.7.1-6, including the high frequency (HF) cases are compared. Figures 3.7.2-35-1 to 3.7.2-35-9 show comparisons for the reactor coolant pump (RCP) and the lower steam generator supports (elevation 1.5 m), the reactor pressure vessel supports (elevation 5.15 m), and the upper steam generator supports (elevation 19.5 m). Comparisons of the acceleration response spectra generated from each analysis at the RCS support locations show that the responses of the two models are similar, except between 20-50 Hz. The relationship of these support locations to the RCS model is shown in Figure 3.7.2-35-10.

Figures 3.7.2-35-1 through 3.7.2-35-9 show that as a result of the HF case, the BWSPAN spectra exceed the SASSI spectra between 20-50 Hz. The differences in the in-structure response spectra (ISRS) at the locations shown are a result of:

- Differences in analysis techniques for the RBIS SSI analysis and the RCS seismic analysis of the RCS. The FEM model SSI analysis is performed in the frequency domain using MTR/SASSI. The RCS seismic analysis is performed with a BWSPAN time history analysis using modal superposition.
- Modeling limitations inherent in the creation of the simplified RBIS stick and RCS models, with the differences being amplified in the high frequency zone.

Below 20 Hz, the peaks result from fundamental modes of the structure-soil system. The magnitudes and frequencies are expected to be different as a result of the simplifications in both models. The BWSPAN spectra for wall locations are prepared for comparison purposes only.

BWSPAN spectra at locations on the RCS are used for the loading and stress evaluation of components and piping attached to the RCS. The SASSI model spectra are published as ISRS at various floor elevations for the seismic analysis of other sub-systems.

In addition to the response spectra comparisons, the RCS support reactions are also reviewed. Table 3.7.2-35-1a and Table 3.7.2-35-1b summarize the reactions from each analysis model for case 5ae. Case 5ae produces the highest loads for most locations. For the components on the RBIS wall, Table 3.7.2-35-1a compares total reactions between the BWSPAN and SASSI analyses. As a representative case, Table 3.7.2-35-1b compares individual support loads for Loop 1 steam generator (SG) and reactor coolant (RC) pump supports between the BWSPAN and SASSI analyses. There is reasonably good agreement between the two models, with loads from the RCS model being higher in cases where disagreement is greater than 15 percent.

Table 3.7.2-35-2 shows that the HF case loads are significantly smaller than the loads from case 5ae, which demonstrates that the response spectrum differences have a negligible effect on the design of RCS components and piping.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Table 3.7.2-35-1a—Comparison of BWSPAN and SASSI Reactions

Location (Mass Point)	Forces (kips)	Differences in Force (Delta in %) SASSI vs. BWSPAN
RPV:		
Horizontal		
BWSPAN	3214	+14
SASSI	3658	
Vertical		
BWSPAN	1373	-3
SASSI	1326	
SG Upper Support:		
Horizontal		
BWSPAN	23849	-20
SASSI	19016	
SG Lower:		
Horizontal		
BWSPAN	4443	-40
SASSI	2688	
Vertical		
BWSPAN	6793	-4
SASSI	6553	
RC Pump:		
Horizontal		
BWSPAN	2065	-38
SASSI	1283	
Vertical		
BWSPAN	853	-20
SASSI	686	

Table 3.7.2-35-1b—Comparison of BWSPAN and SASSI Reactions (Individual Support Reactions – Loop 1)

Location (Mass Point)	Forces (kips)
SG Upper Support (Loop 1):	
Horizontal Snubbers	
BWSPAN	1218
	1205
SASSI	1208
	1192
Link Bars	
BWSPAN	1566
	1593
SASSI	1027
	1088
SG Lower Support (Loop 1):	
Horizontal	
BWSPAN	1079
SASSI	633
Vertical	
BWSPAN	1644
SASSI	1435
RC Pump (Loop 1):	
Horizontal Snubbers	
BWSPAN	264
	418
SASSI	208
	202
Vertical	
BWSPAN	217
SASSI	158

Table 3.7.2-35-2—Comparison of BWSPAN Bell Bend and Case 5ae Reactions

Location (Mass Point)	Forces (kips)	Differences in Force (Delta in %)
RPV:		
Horizontal		
BWSPAN Bell Bend	1482	-54
BWSPAN 5ae	3214	
Vertical		
BWSPAN Bell Bend	1382	+1
BWSPAN 5ae	1373	
SG Upper Support:		
Horizontal		
BWSPAN Bell Bend	5209	-78
BWSPAN 5ae	23849	
SG Lower:		
Horizontal		
BWSPAN Bell Bend	1511	-66
BWSPAN 5ae	4443	
Vertical		
BWSPAN Bell Bend	2535	-63
BWSPAN 5ae	6793	
RC Pump:		
Horizontal		
BWSPAN Bell Bend	693	-66
BWSPAN 5ae	2065	
Vertical		
BWSPAN Bell Bend	577	-32
BWSPAN 5ae	853	

Figure 3.7.2-35-1—ISRS Comparison between SASSI and BWSPAN, Reactor Building Internals, 5% Damping, 1.5m, X = Y* (N-S) Dir, Envelope of Seismic Soil Cases

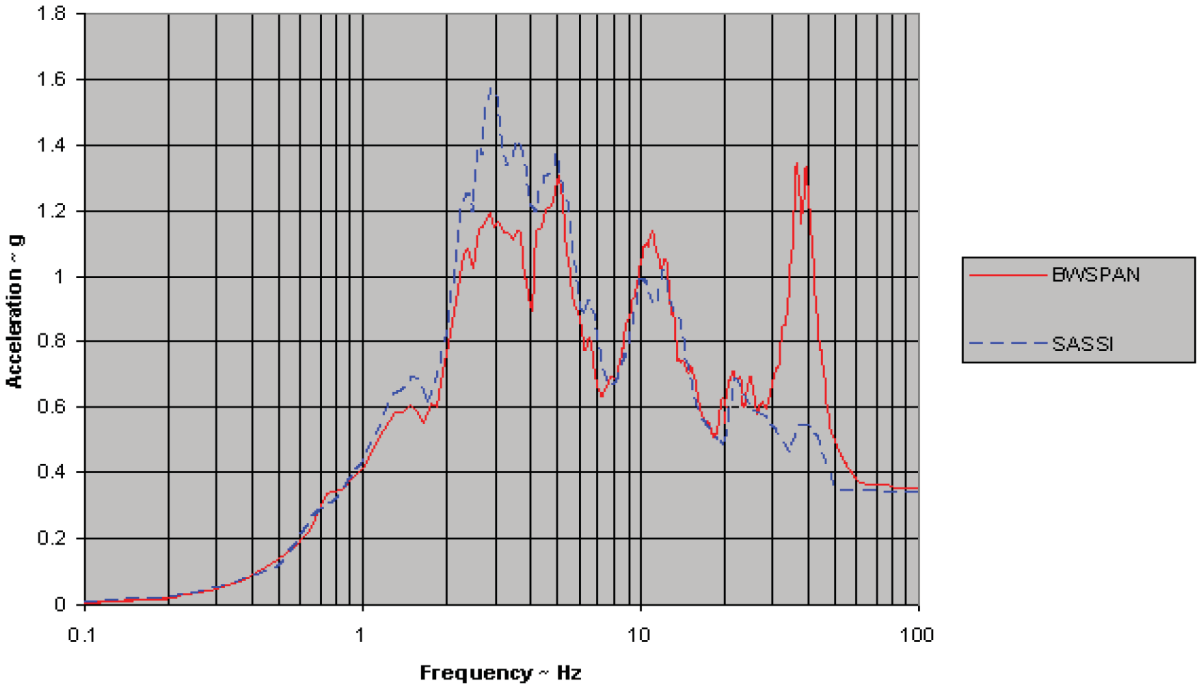

Figure 3.7.2-35-2—ISRS Comparison, between SASSI and BWSPAN, Reactor Building Internals, 5% Damping, 1.5m, X = Y* (N-S) Dir, Envelope of Seismic Soil Cases

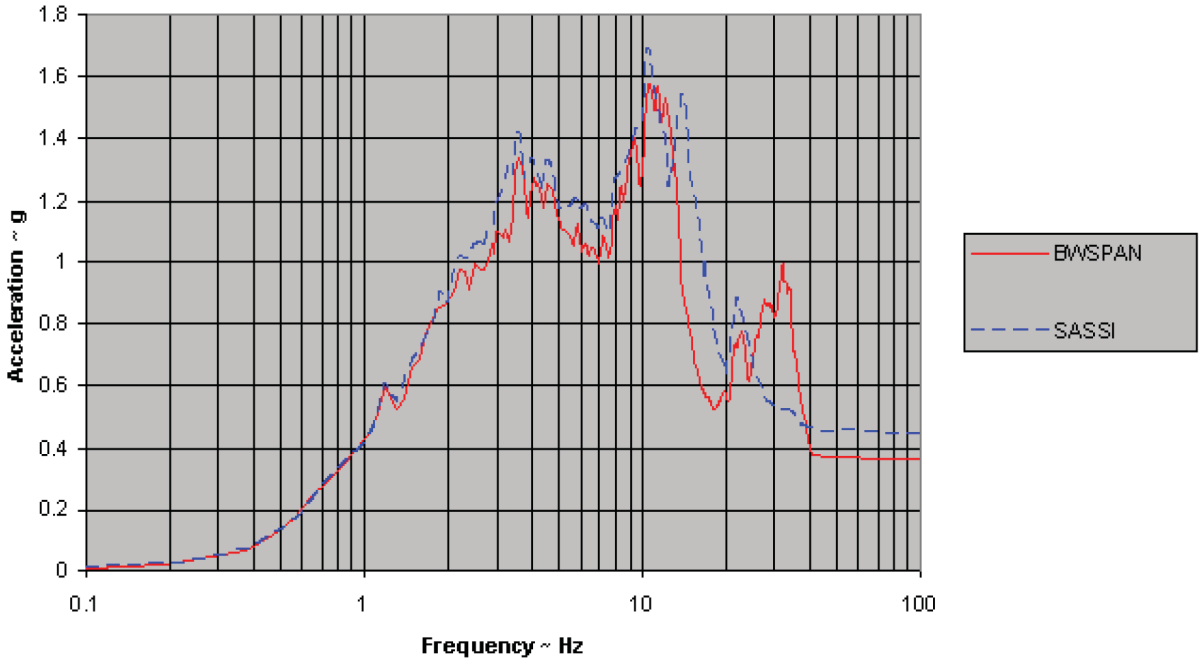

Figure 3.7.2-35-3—ISRS Comparison between SASSI and BWSPAN, Reactor Building Internals, 5% Damping, 1.5m, Z = X* (E-W) Dir, Envelope of Seismic Soil Cases

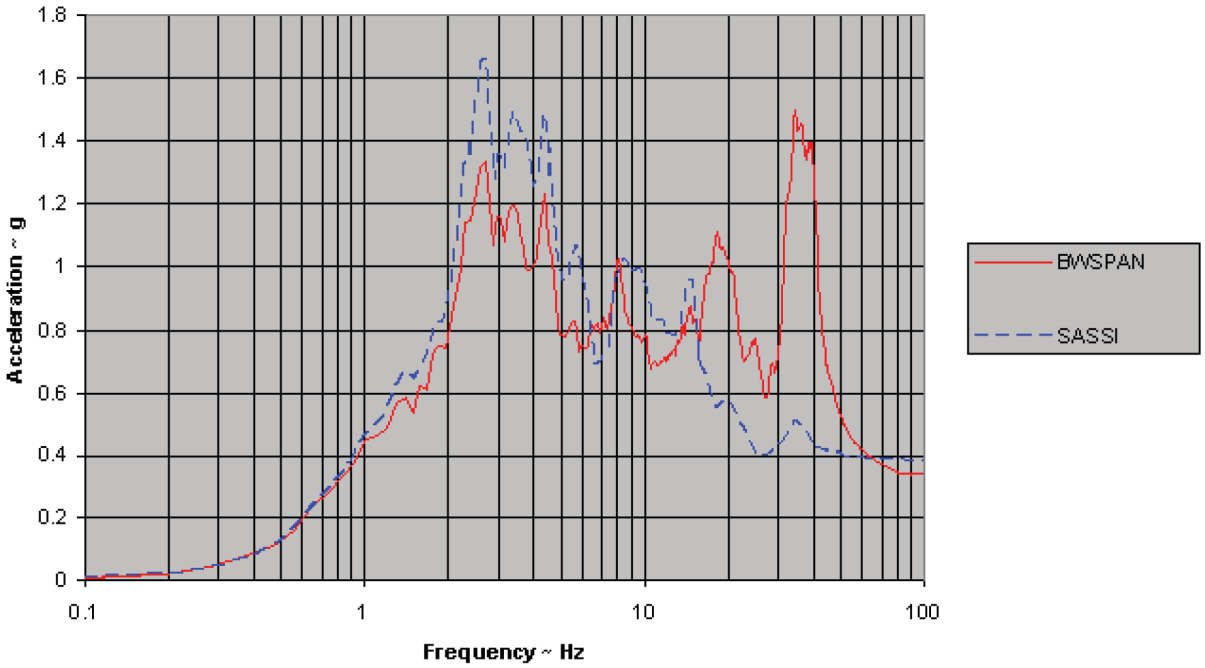

Figure 3.7.2-35-4—ISRS Comparison between SASSI and BWSPAN, Reactor Building Internals, 5% Damping, 5.15m, X = Y* (N-S) Dir, Envelope of Seismic Soil Cases

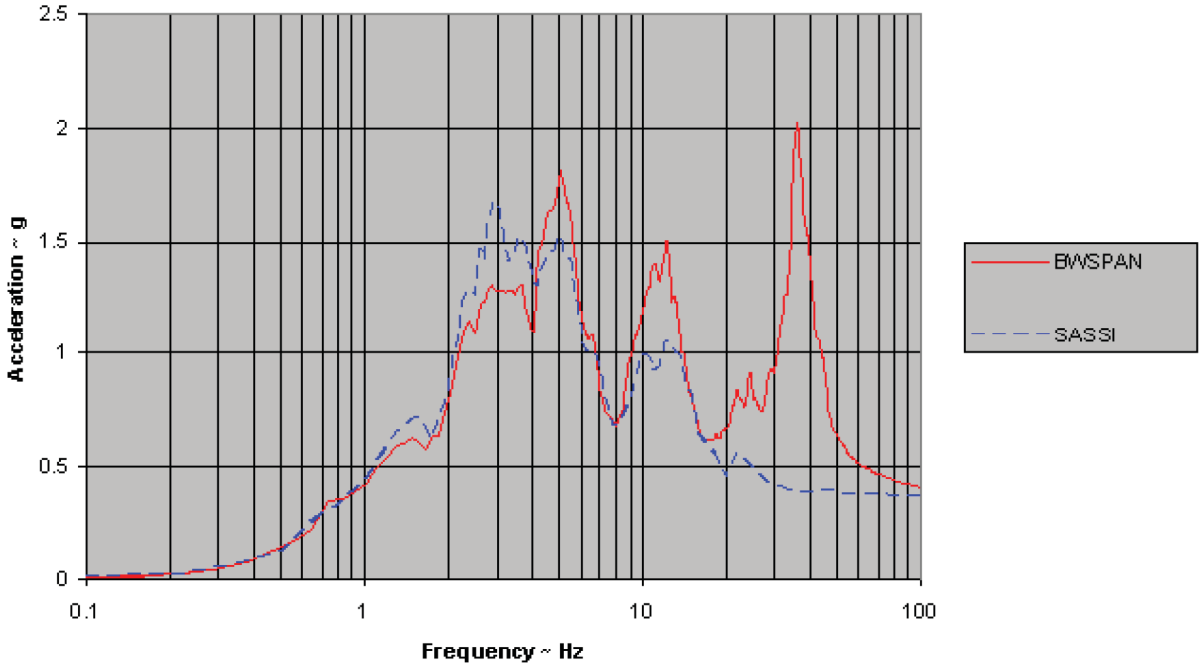

Figure 3.7.2-35-5—ISRS Comparison between SASSI and BWSPAN, Reactor Building Internals, 5% Damping, 5.15m, Y = Z* (Vert) Dir, Envelope of Seismic Soil Cases

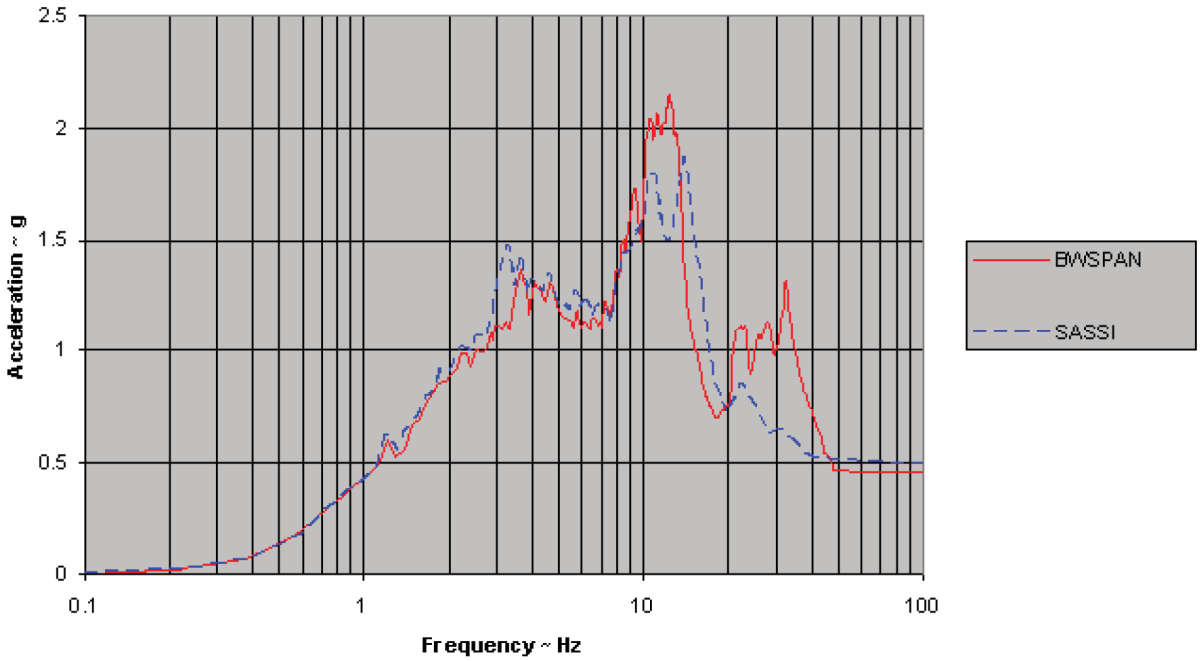

Figure 3.7.2-35-6—ISRS Comparison between SASSI and BWSPAN, Reactor Building Internals, 5% Damping, 5.15m, Z = X* (E-W) Dir, Envelope of Seismic Soil Cases

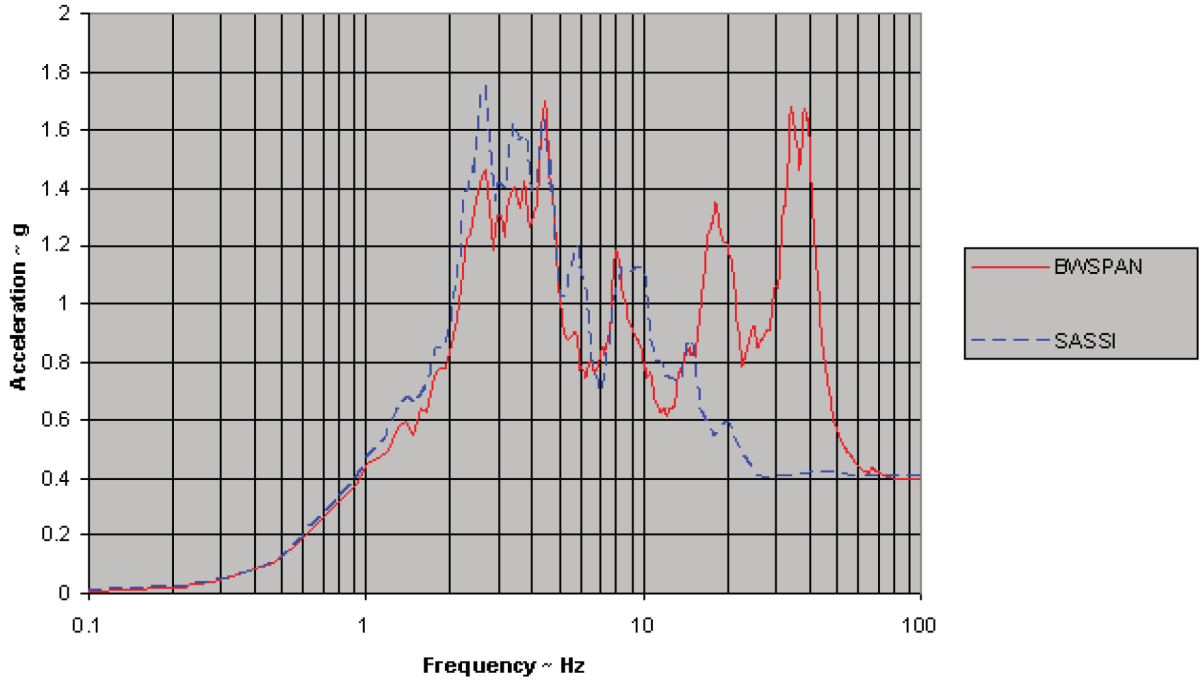

Figure 3.7.2-35-7—ISRS Comparison between SASSI and BWSPAN, Reactor Building Internals, 5% Damping, 19.5m, X = Y* (N-S) Dir, Envelope of Seismic Soil Cases

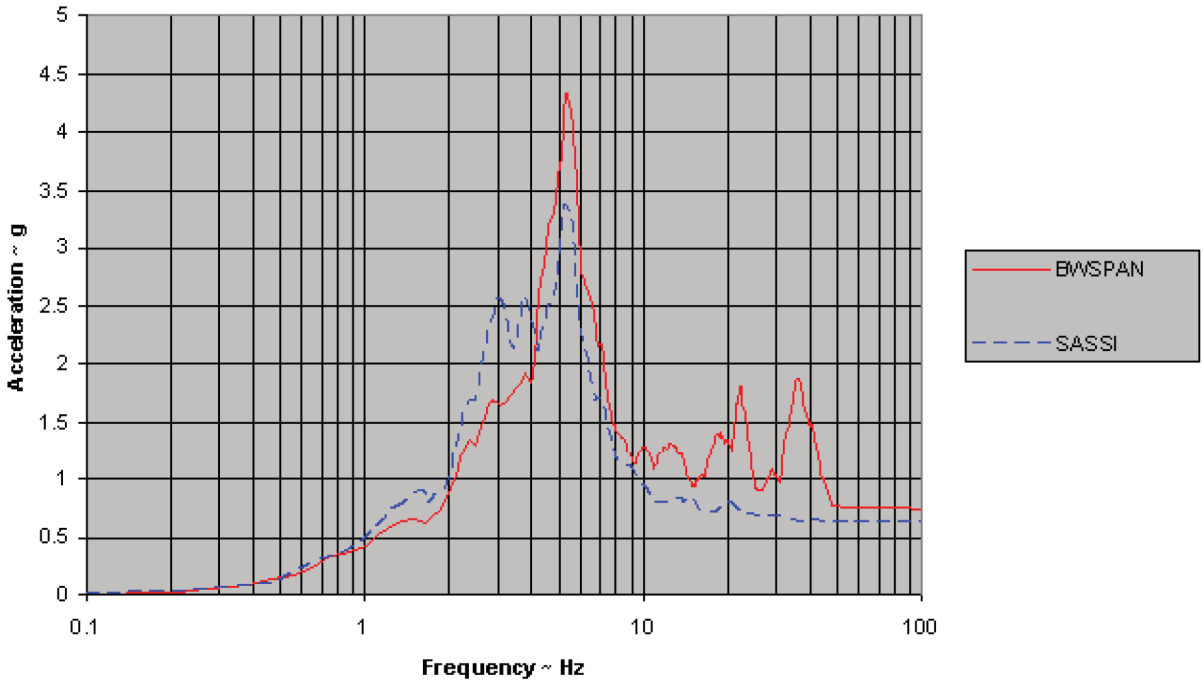

Figure 3.7.2-35-8—ISRS Comparison between SASSI and BWSPAN, Reactor Building Internals, 5% Damping, 19.5m, Y = Z* (Vert) Dir, Envelope of Seismic Soil Cases

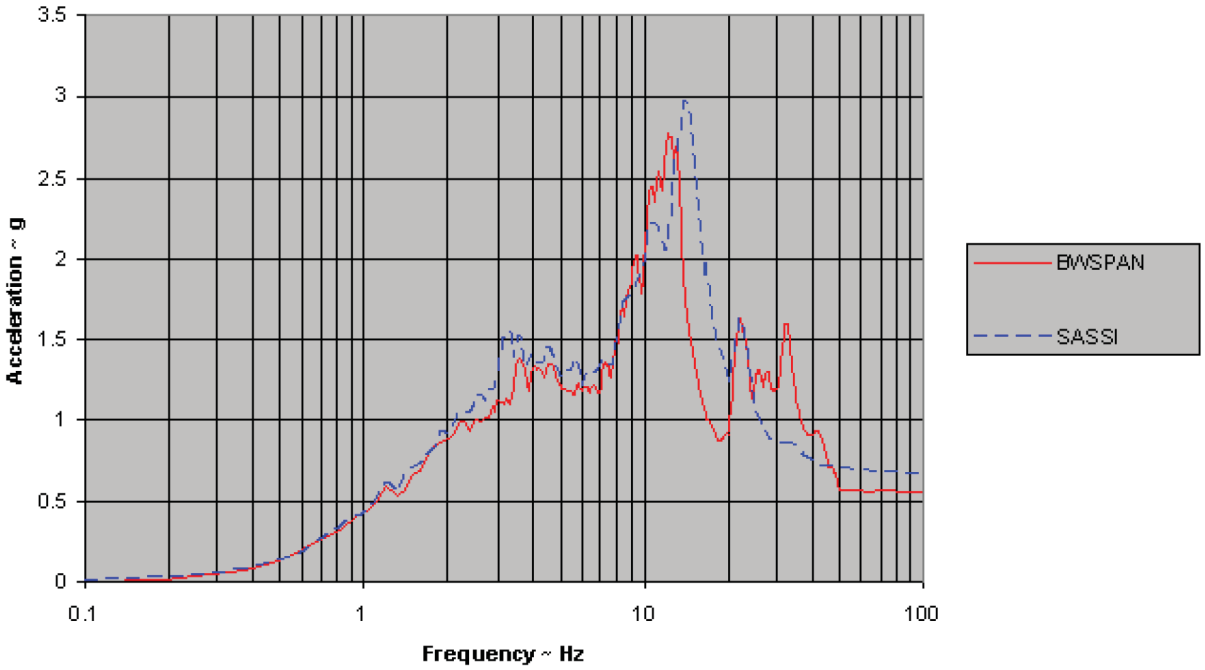

Figure 3.7.2-35-9—ISRS Comparison between SASSI and BWSPAN, Reactor Building Internals, 5% Damping, 19.5m, Z = X* (E-W) Dir, Envelope of Seismic Soil Cases

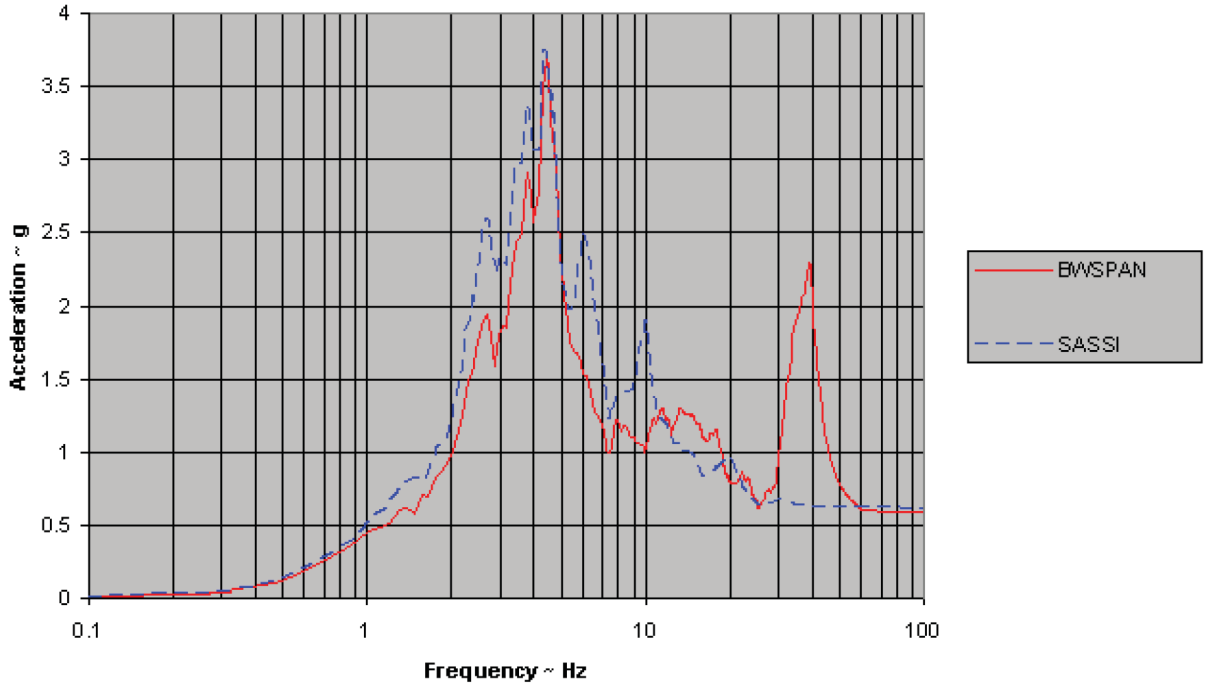

Figure 3.7.2-35-10—RCS Support Elevations