



Westinghouse Electric Company
Nuclear Power Plants
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, D.C. 20555

Direct tel: 412-374-6206
Direct fax: 724-940-8505
e-mail: sisk1rb@westinghouse.com

Your ref: Docket No. 52-006
Our ref: DCP_NRC_002957

July 9, 2010

Subject: AP1000 Response to Request for Additional Information (SRP TR44)

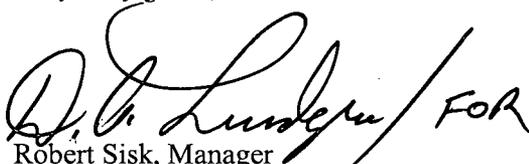
Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section TR44. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following RAI(s):

RAI-TR44-011 R2

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,


Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Strategy

/Enclosure

1. Response to Request for Additional Information on SRP Section TR44

DD 63
NRD

cc:	D. Jaffe	- U.S. NRC	1E
	E. McKenna	- U.S. NRC	1E
	P. Buckberg	- U.S. NRC	1E
	T. Spink	- TVA	1E
	P. Hastings	- Duke Power	1E
	R. Kitchen	- Progress Energy	1E
	A. Monroe	- SCANA	1E
	P. Jacobs	- Florida Power & Light	1E
	C. Pierce	- Southern Company	1E
	E. Schmiech	- Westinghouse	1E
	G. Zinke	- NuStart/Entergy	1E
	R. Grumbir	- NuStart	1E
	S. Altmayer	- Westinghouse	1E

ENCLOSURE 1

Response to Request for Additional Information on SRP Section TR44

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR44-011
Revision: 2

Question: (Revision 0)

Insufficient data is provided regarding the input loads used for the seismic analysis of the new fuel rack. The following information is requested:

- (a) Floor response spectra (X, Y, and Z - vertical directions) at or the near the elevation of the top of the fuel rack and near the bottom of the fuel rack or vault floor corresponding to the damping value used for the analysis.
- (b) Explain why the envelope of these two sets of spectra was not used.
- (c) The current DCD is applicable for the hard rock site. Therefore, provide further explanation for the range of soil and rock properties used in enveloping the seismic floor spectra. Where are these ranges of soil/rock properties specified for confirmation by future COL applicant?
- (d) For the synthetic time histories, provide plots of the three time histories, the cross correlation coefficients, the comparisons of the spectra from the synthetic time histories to the enveloped target response spectra, and the comparisons of the power spectral density plots to the target power spectral density function associated with the target response spectra.
- (e) Which time history was used (displacement, velocity, or acceleration)? Were all three directions input simultaneously? Was gravity included in the time history analysis?

Question: (Revision 1)

Staff Assessment: Response similar to response for spent fuel racks. See RAI-TR54-17.

New Question: (Revision 2)

Leading into the June 2010 audit, NRC requested feedback on updated seismic spectra inputs. Please provide the information for the updated seismic input equivalent that which was previously requested in the initial question of this RAI. Also, please summarize responses to the following three questions:

- (1) present comparisons of the old design-basis spectra to the new design-basis spectra, at the bottom of the New Fuel Pit;
- (2) explain why the spectra have changed or why they have not changed; and

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

(3) compare the old loads to the new loads used in the HOLTEC new fuel rack analysis.

Westinghouse Response:

(Revision 0)

- a) Floor response spectra (X, Y, and Z - vertical directions) near the elevation of the bottom of the new fuel storage vault corresponding to the damping value used for the analysis are provided in the PDF attachment RAI TR44-11a. No floor response spectra are provided near or at the elevation of the top of the new fuel rack (See response to TR44-11b).

The ASB99 floor response spectra (FRS) represents the enveloping response spectra for the auxiliary and shield building (ASB) at elevation 99 feet for a range of soil/rock condition. FRS of various soil/rock analyses were first enveloped for various locations of the ASB. All of the ASB locations at elevation 99 were then grouped and enveloped to develop the ASB99 floor response spectra.

- b) It is probable that the floor response spectra will be revised for various reasons and that a revision to the new fuel storage rack structural/seismic analysis will be required. The methodology of developing the spectra is described in RAI-TR-44-011 a, d and e responses.
- c) The range of soil and rock conditions for which the seismic floor spectra applies is described in Westinghouse Technical Report 03, APP-GW- S2R-010 Revision 0, "Extension of NI Structures Seismic Analysis to Soil Sites."
- d) The synthetic time histories, the response spectrum curves, and the power spectral density plots for the Auxiliary and Shielding Building (ASB) at Elevation 99 feet are provided in Figures TR44-11.1 through TR44-11.9. The cross correlation coefficients for the three orthogonal components (East-West, North-South, and Vertical) of the ASB99 synthetic time histories are summarized in the table below:

Description	Cross Correlation Coefficient
East-West to North-South	-0.0414
East-West to Vertical	0.0088
North-South to Vertical	0.0536

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

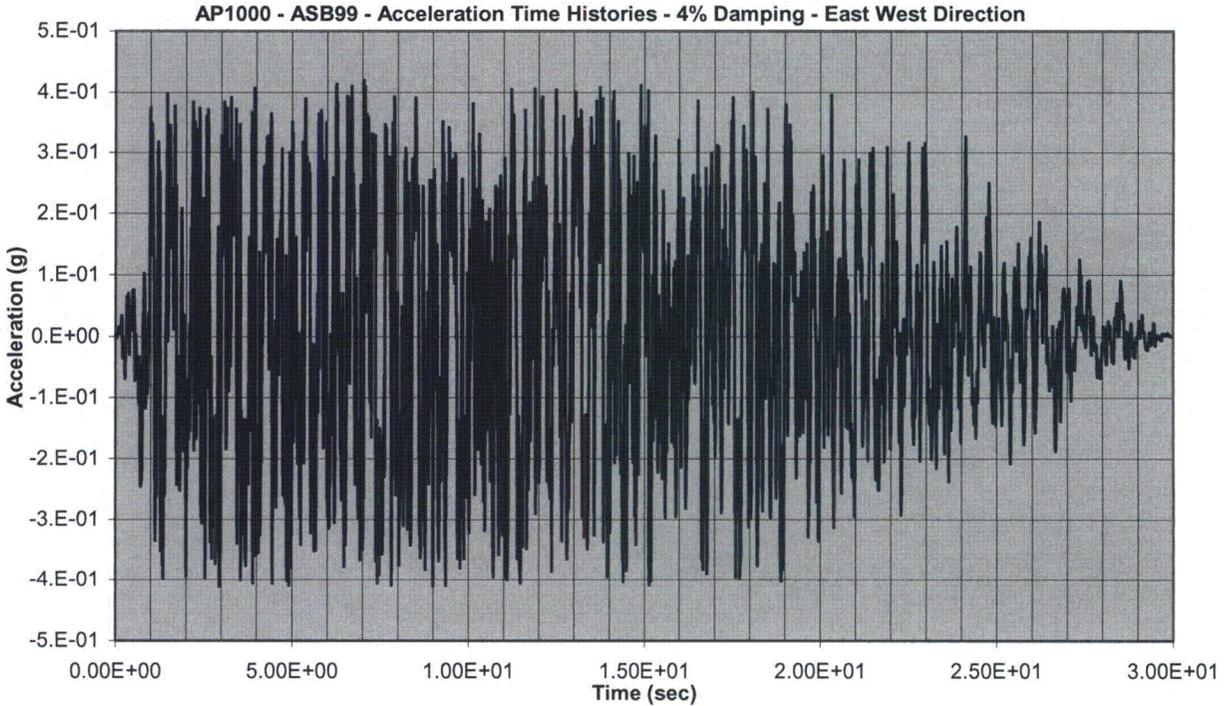


Figure TR44-11.1

ASB99 Acceleration Time History for EW Direction

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

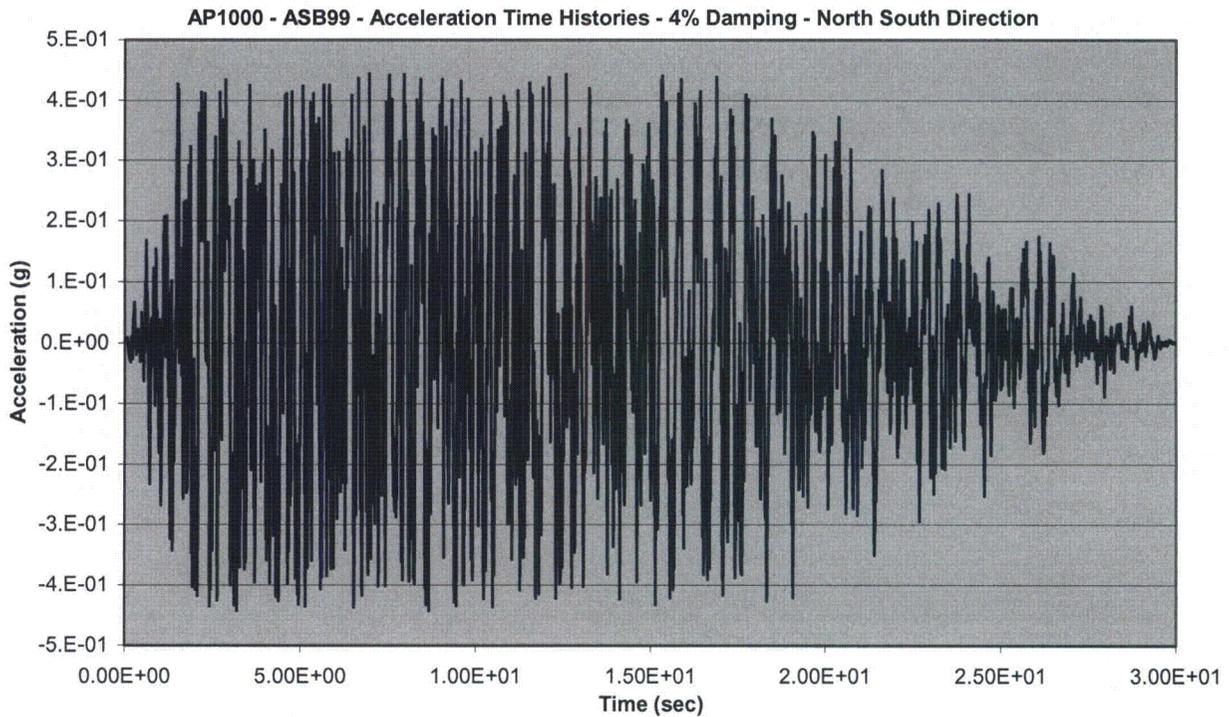


Figure TR44-11.2

ASB99 Acceleration Time History for NS Direction

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

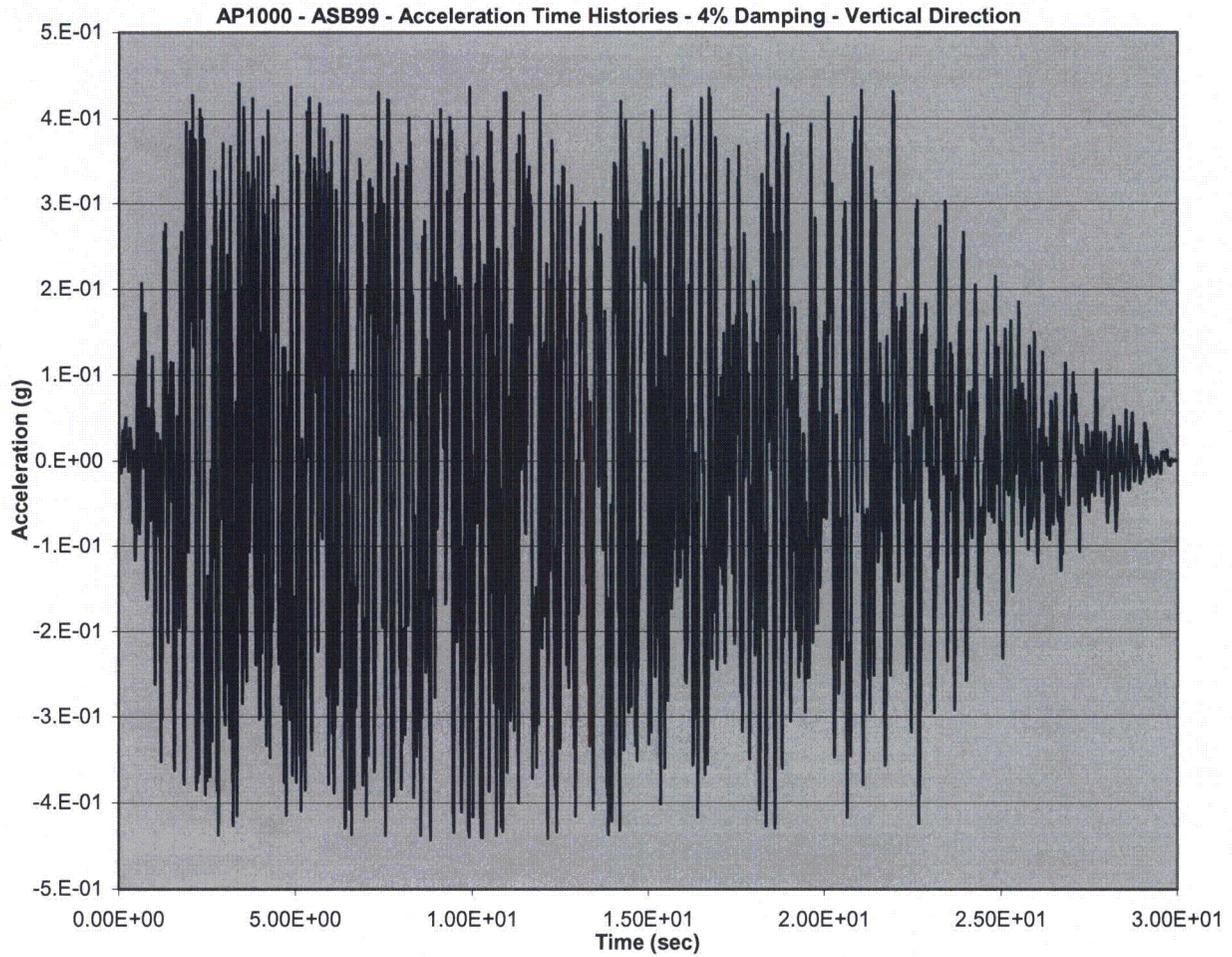


Figure TR44-11.3

ASB99 Acceleration Time History for VT Direction

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

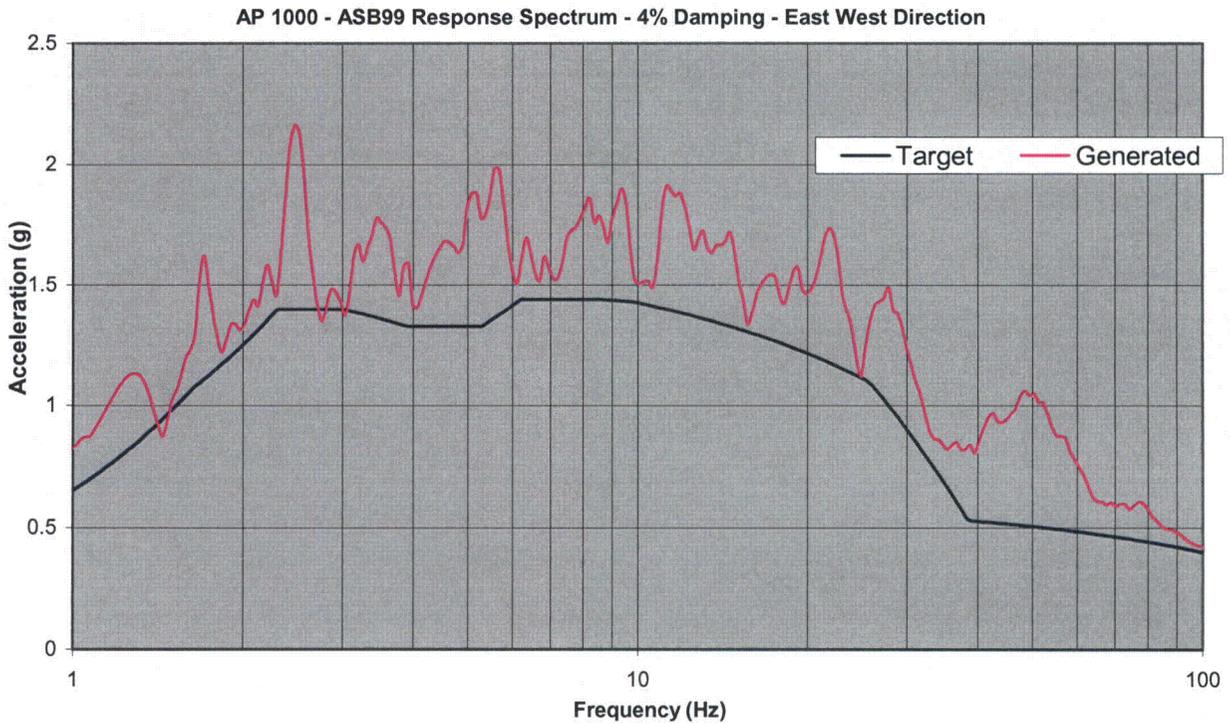


Figure TR44-11.4

ASB99 Response Spectrum for EW Direction

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

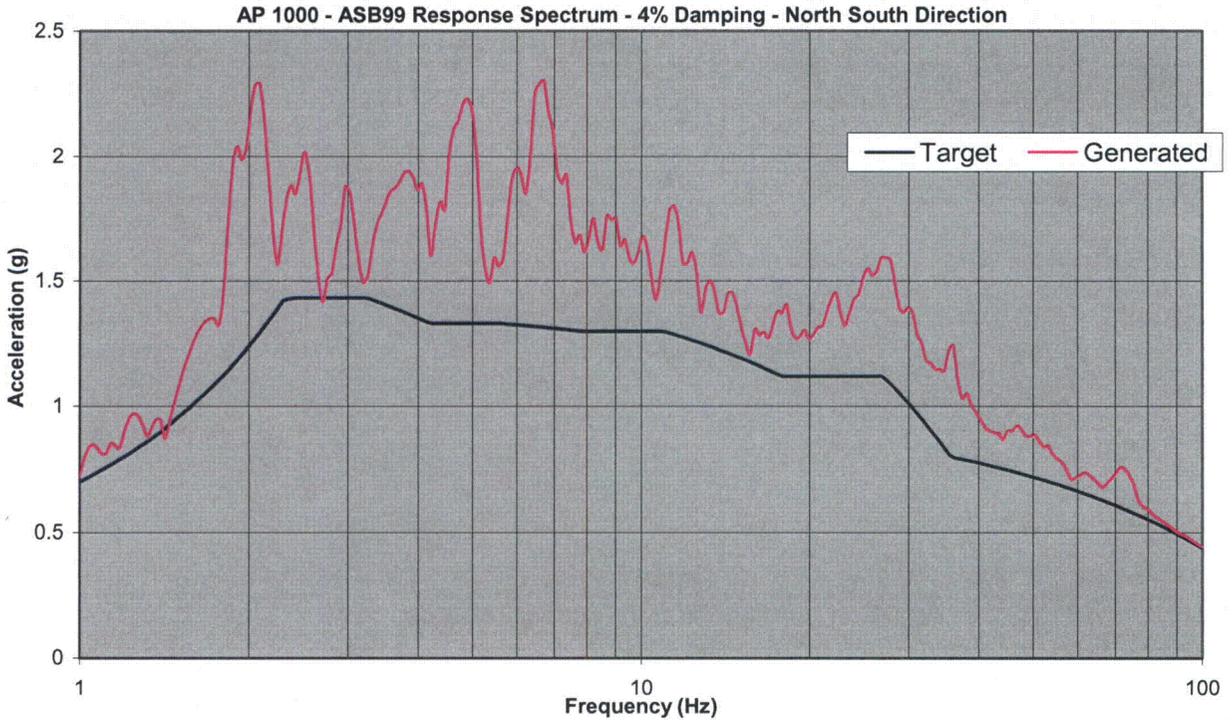


Figure TR44-11.5

ASB99 Response Spectrum for NS Direction

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

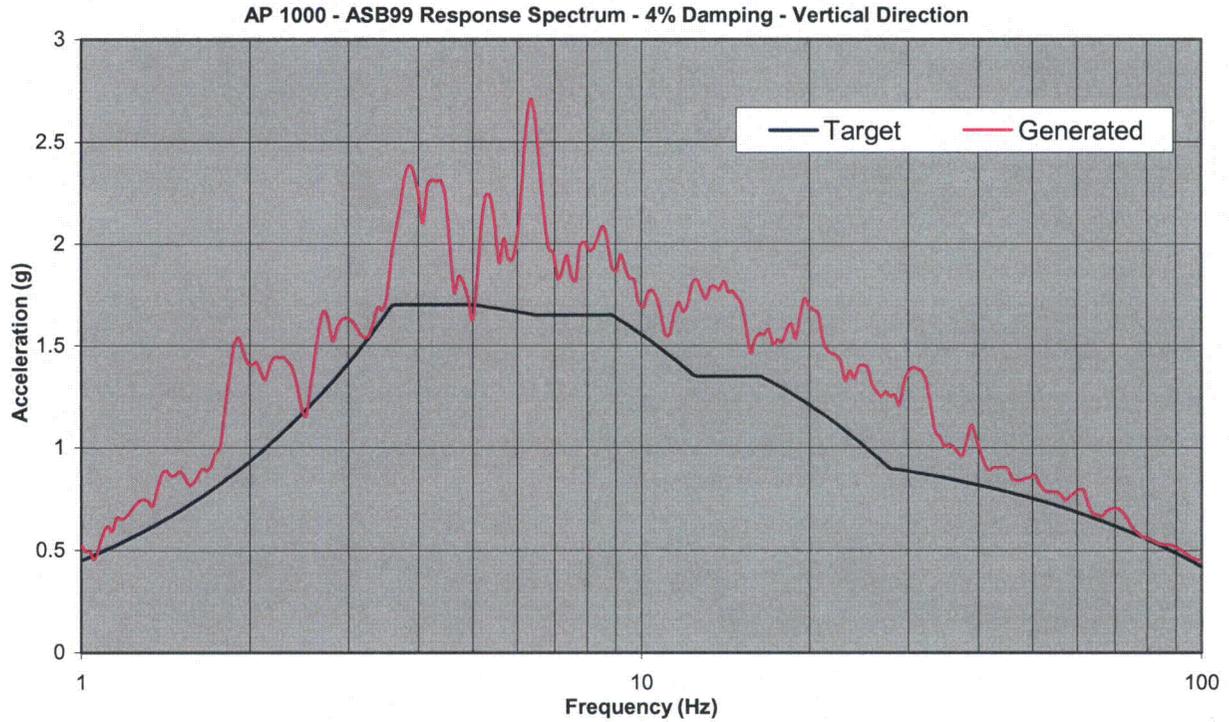


Figure TR44-11.6

ASB99 Response Spectrum for VT Direction

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

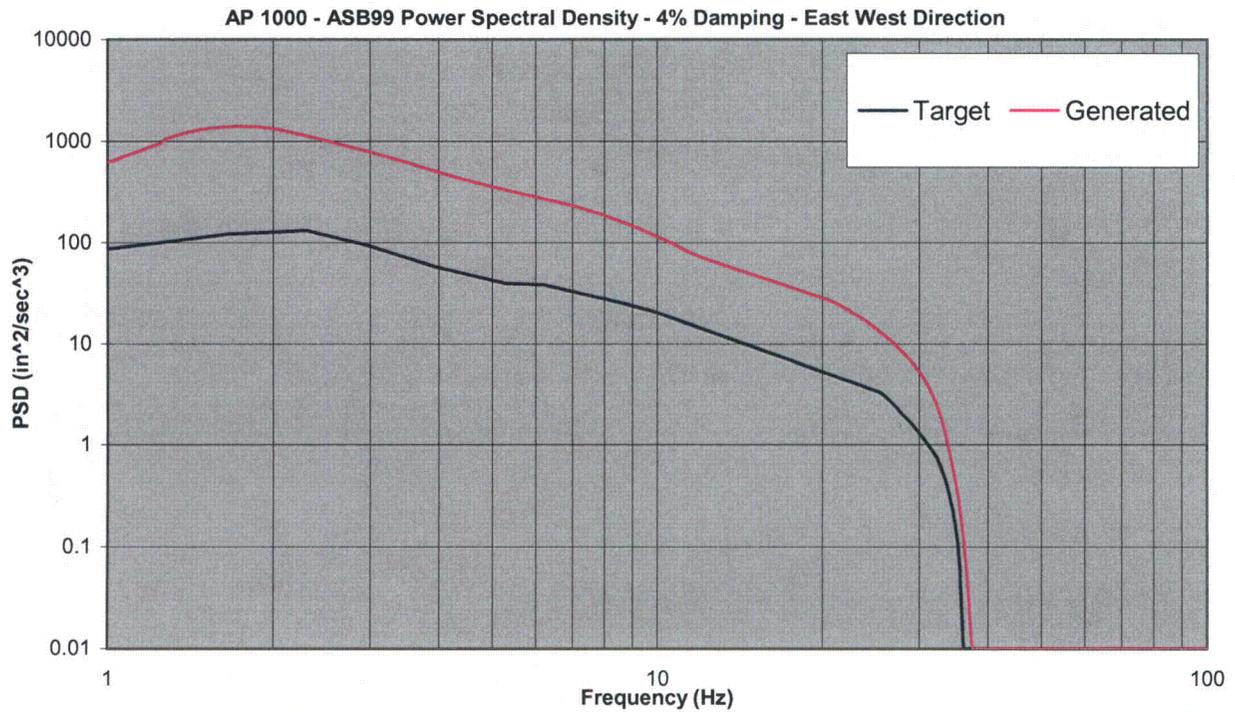


Figure TR44-11.7 ASB99 Power Spectral Density for EW Direction

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

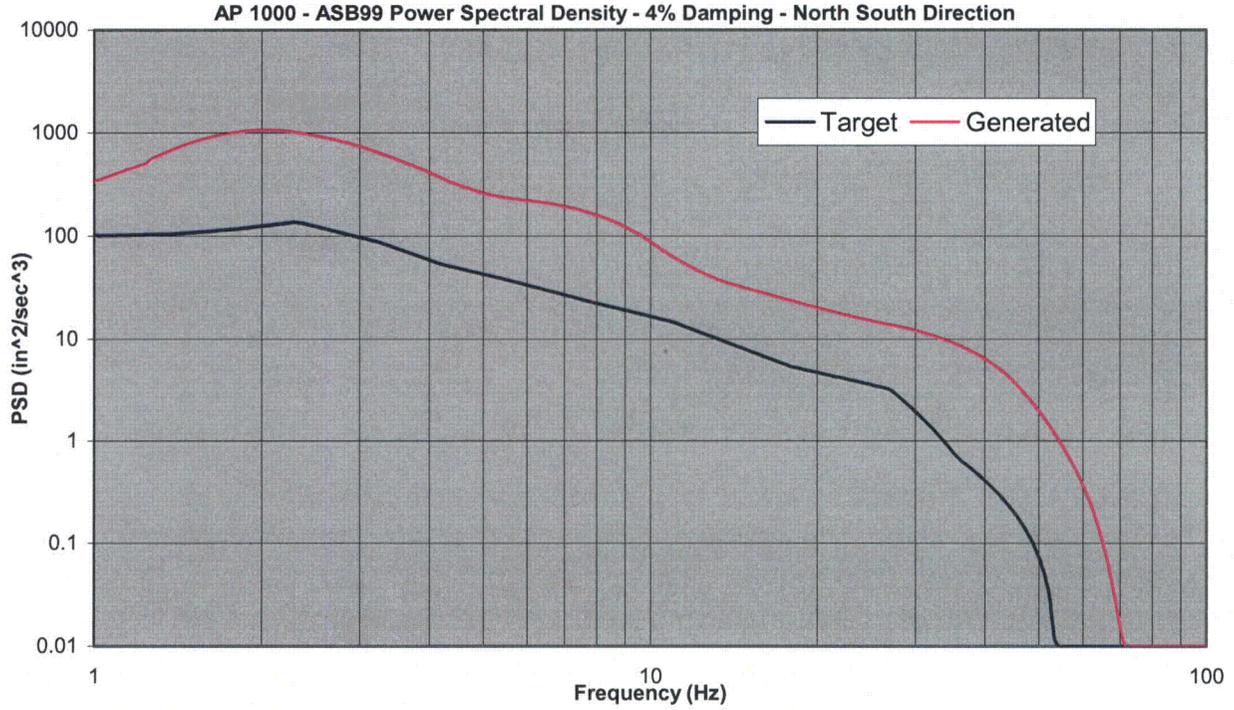


Figure TR44-11.8

ASB99 Power Spectral Density for NS Direction

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

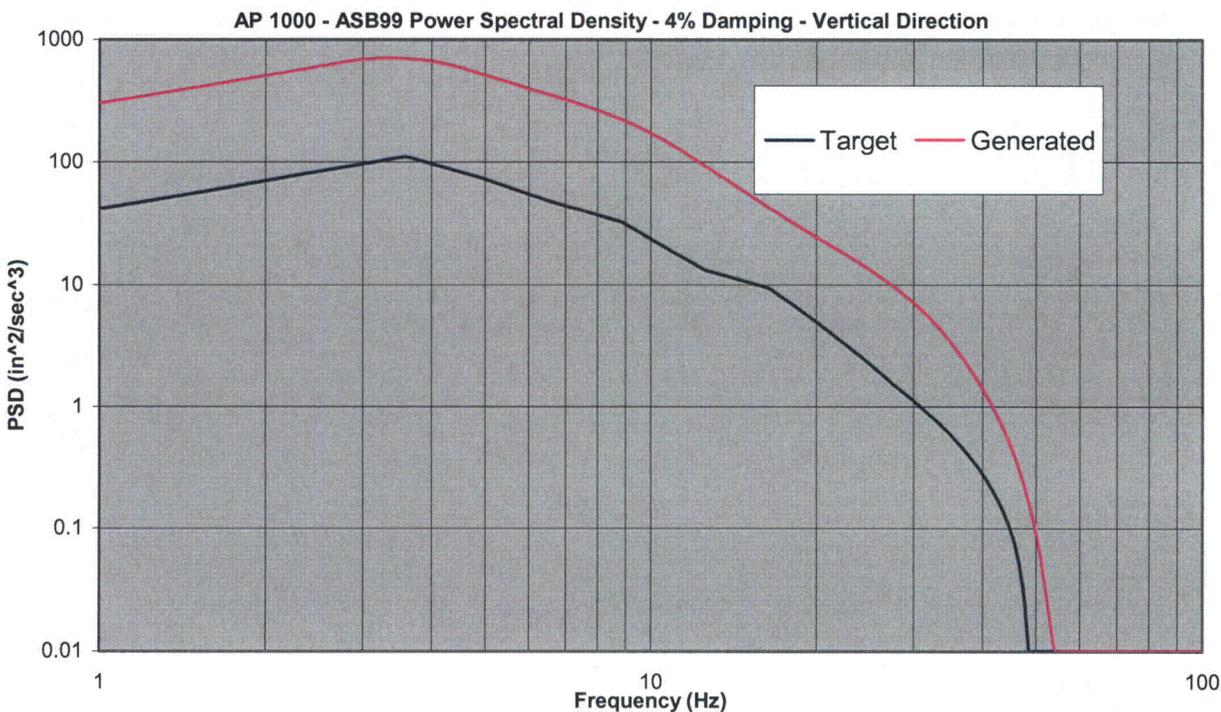


Figure TR44-11.9

ASB99 Power Spectral Density for VT Direction

e) Acceleration time histories are used as the input motion for the seismic analysis of the spent fuel racks. The acceleration input is defined by three orthogonal components, which are input and solved simultaneously. Gravity is also included in the time history analysis.

Westinghouse Supplemental Response following May 21 and 22, 2008 Technical Review: (Revision 1)

For the similar spent fuel racks RAI-TR54-017, items A, B, and D were considered technically acceptable following the April 16-19, 2007 audit. Item C had a typographical error that was corrected in Revision 1 of RAI-TR54-017, and following the May 21 and 22, 2008 technical review, item C was considered technically acceptable. That typo did not occur in this RAI for the new fuel rack; therefore Westinghouse considers item C of this RAI to be technically resolved for the new fuel rack as well. For spent fuel rack RAI-TR54-017, item E was considered technically acceptable, and it was requested that the words in the response be included in a revision to TR54. Similar words to those used to resolve this item for the spent fuel racks will be included in a revision to TR44, see the Technical Report Revision section below for a mark-up of TR44.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Therefore Westinghouse considers all of the responses submitted in Rev. 0 of this RAI for the new fuel rack to be technically acceptable as well; however, the input floor response spectra was revised since Rev. 0 was submitted. Following are updated responses to account for those changes.

- a) The "New Fuel" floor response spectra (FRS) represents the enveloping response spectra for the new fuel storage vault inside the Auxiliary and Shield Building (ASB) at an elevation close to the bottom of the new fuel vault floor for a range of soil/rock condition.

- d) The synthetic time histories, the response spectrum curves, and the power spectral density plots for the new fuel storage vault inside the Auxiliary and Shielding Building (ASB) at Elevation 116' - 6" (the bottom of the new fuel vault is at Elevation 118' - 2.5") are provided in Figures TR44-11.1 through TR44-11.9. The cross correlation coefficients for the three orthogonal components (East-West, North-South, and Vertical) of the "New Fuel" synthetic time histories are summarized in the table below.

Description	Cross Correlation Coefficient
East-West to North-South	0.0152
East-West to Vertical	-0.0537
North-South to Vertical	0.0031

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

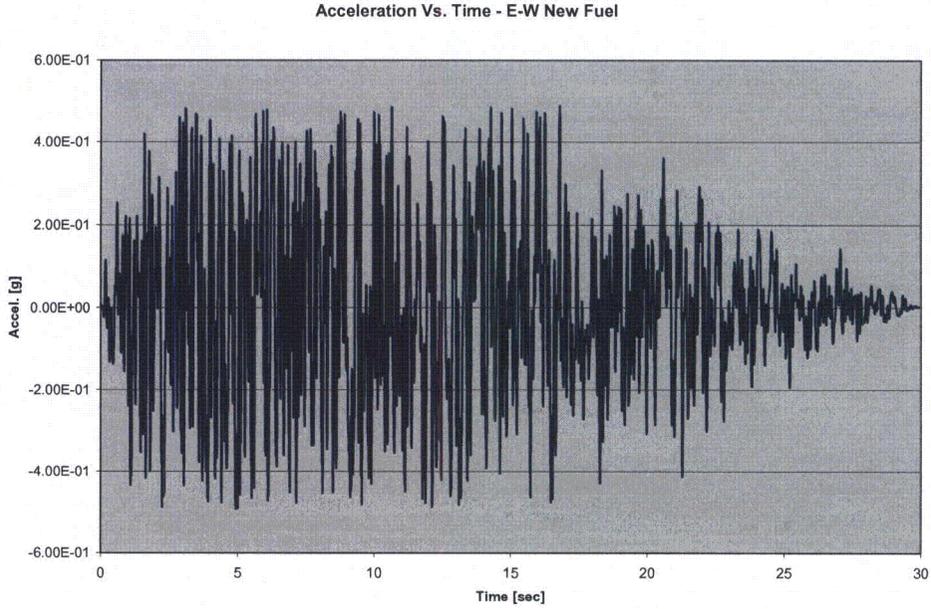
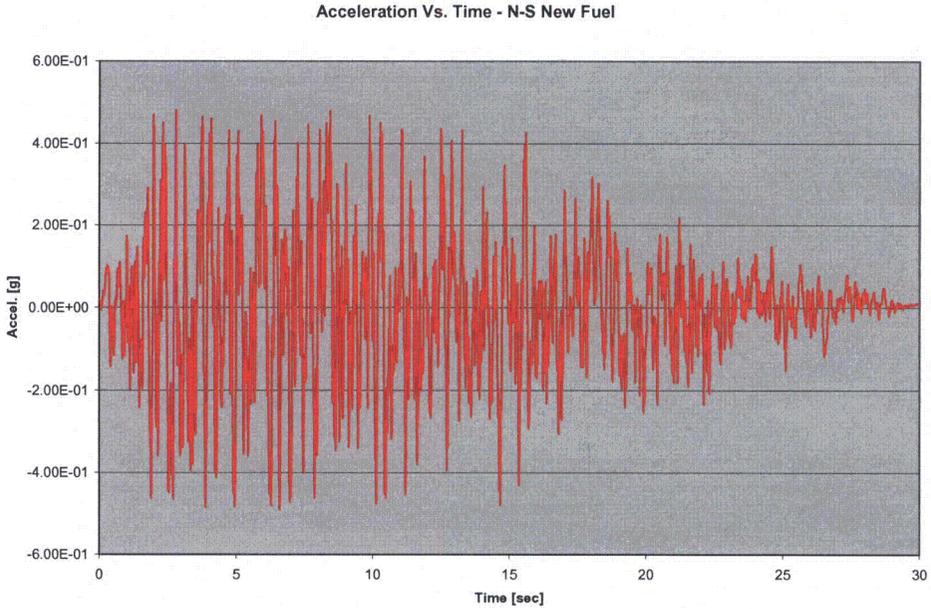


Figure TR44-11.1 New Fuel Acceleration Time History for EW Direction



AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Figure TR44-11.2 New Fuel Acceleration Time History for NS Direction

Acceleration Vs. Time - Vertical New Fuel

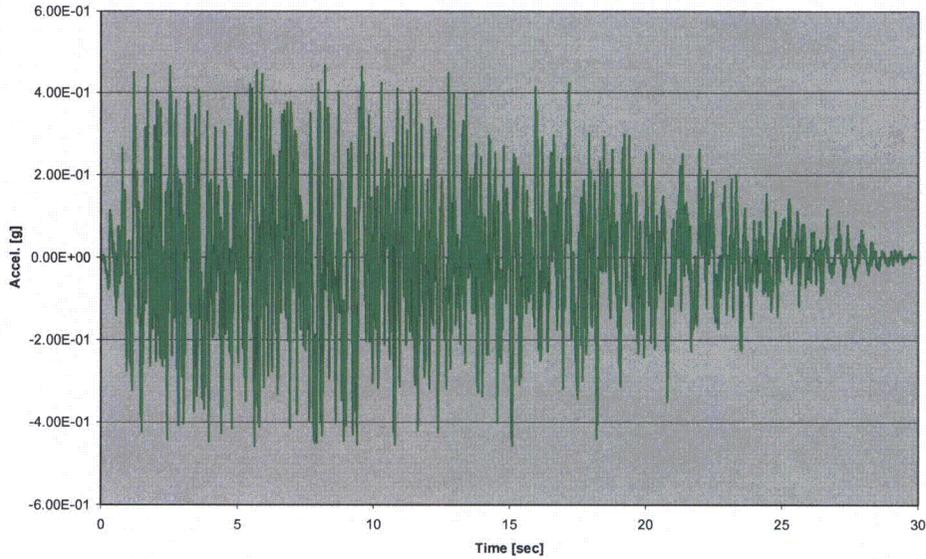
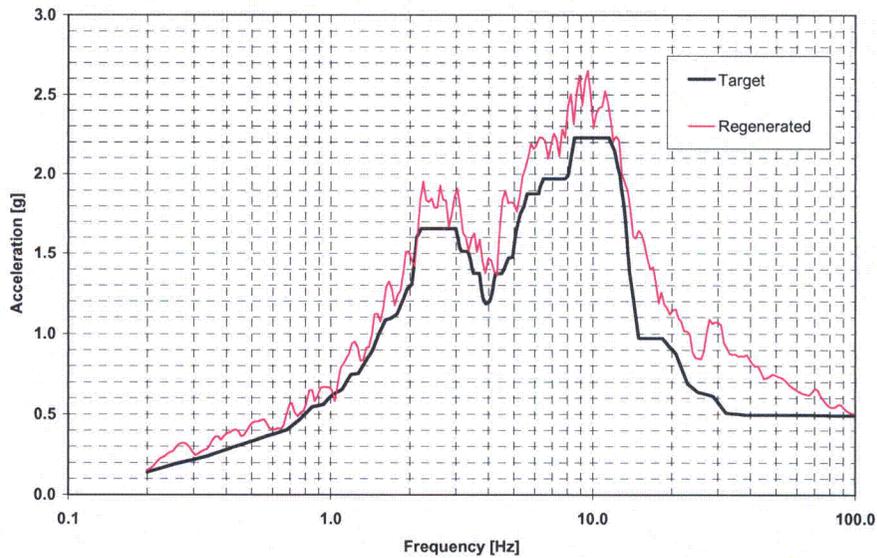


Figure TR44-11.3 New Fuel Acceleration Time History for VT Direction

Acceleration (Log) vs Frequency Curve - E-W New Fuel



AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Figure TR44-11.4 New Fuel Response Spectrum for EW Direction

Acceleration (Log) vs Frequency Curve - N-S New Fuel

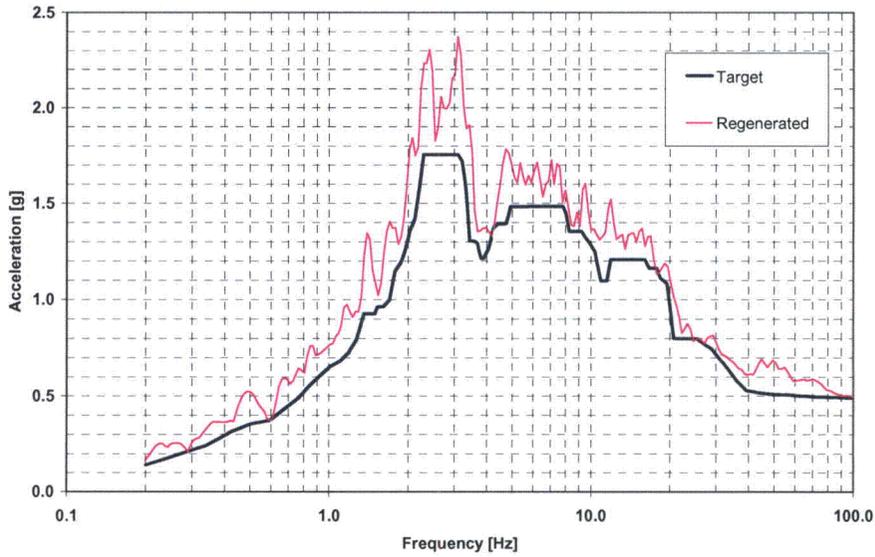
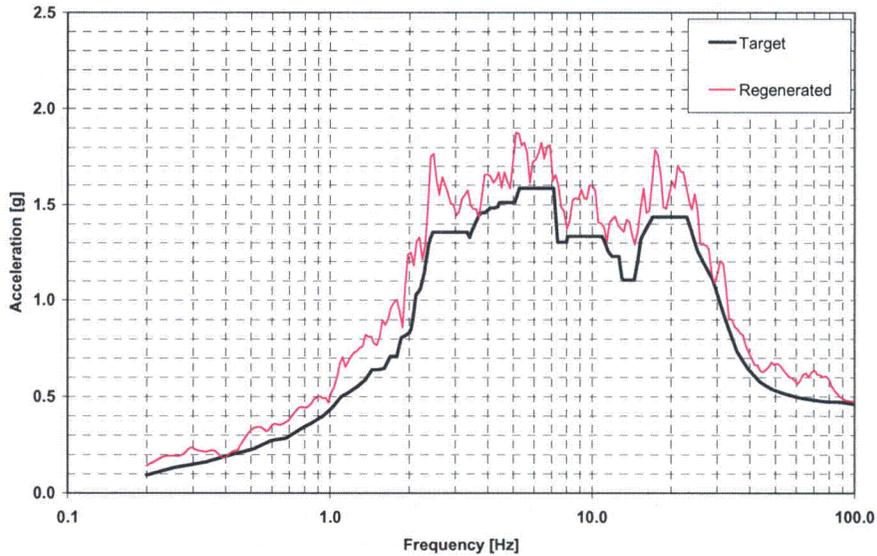


Figure TR44-11.5 New Fuel Response Spectrum for NS Direction

Acceleration (Log) vs Frequency Curve - Vertical New Fuel



AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Figure TR44-11.6 New Fuel Response Spectrum for VT Direction

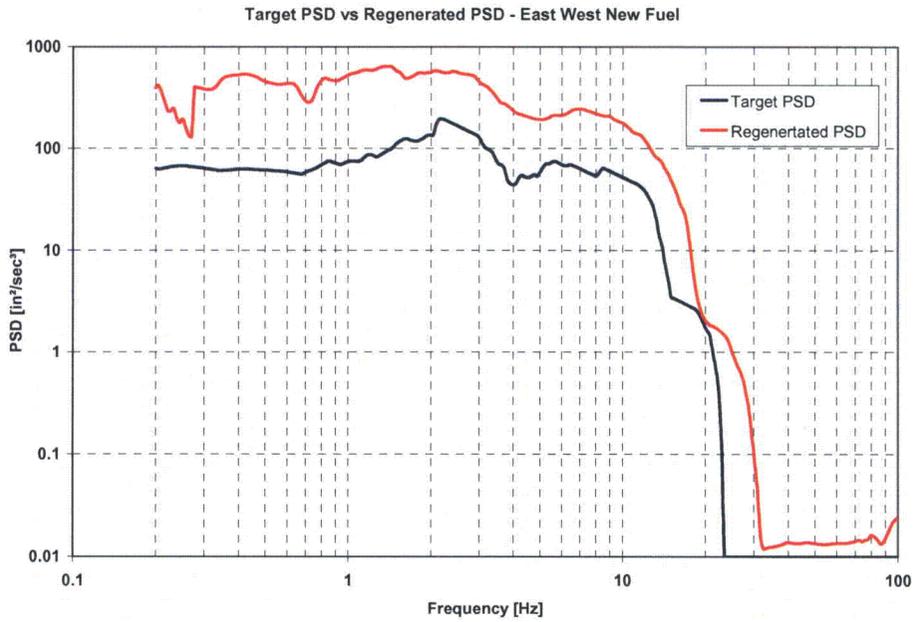
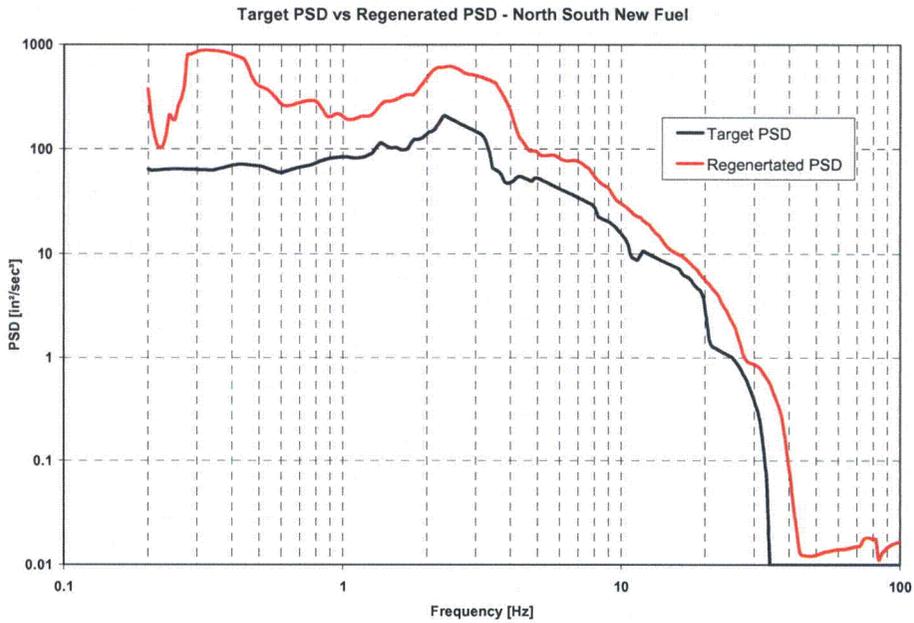


Figure TR44-11.7 New Fuel Power Spectral Density for EW Direction



AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Figure TR44-11.8 New Fuel Power Spectral Density for NS Direction

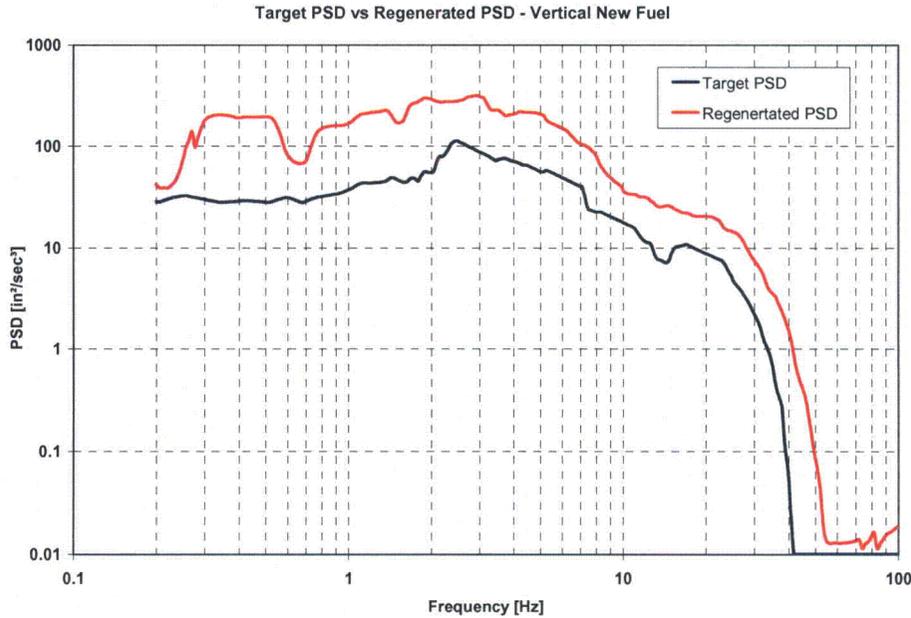


Figure TR44-11.9 New Fuel Power Spectral Density for VT Direction

e) Acceleration time histories are used as the input motion for the seismic analysis of the new fuel rack. The acceleration input is defined by three orthogonal components, which are input and solved simultaneously. Gravity is also included in the time history analysis.

Response: (Revision 2)

The technical information provided in the Revision 1 response to this RAI is still correct; however, in addition to the seismic input provided in the Revision 1 response, new seismic input was made available in May 2010 and has been evaluated in Revision 3 of TR44 (in addition to the seismic input provided in the Revision 1 RAI response).

The technical input for the new seismic input is as follows:

Description	Cross Correlation Coefficient (@ 0 lag)
East-West to North-South	0.056
East-West to Vertical	0.036
North-South to Vertical	0.135

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

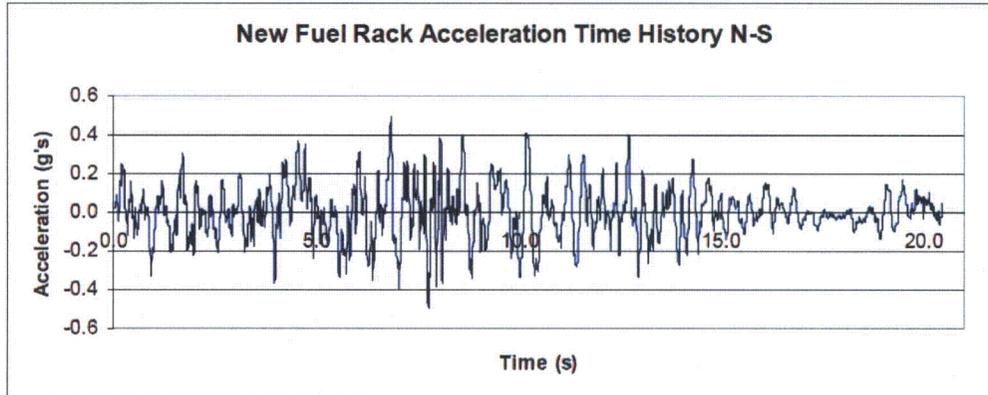


Figure 2-1: New Fuel Storage Rack Artificial Acceleration Time History North-South Direction

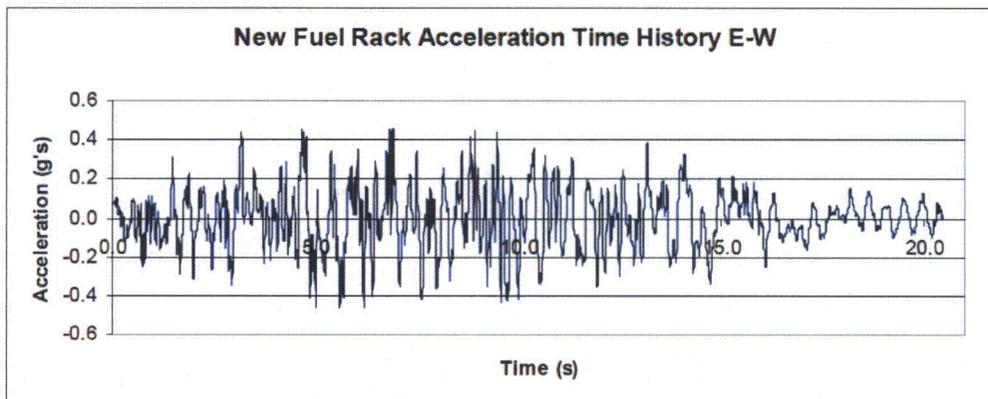


Figure 2-2: New Fuel Storage Rack Artificial Acceleration Time History East-West Direction

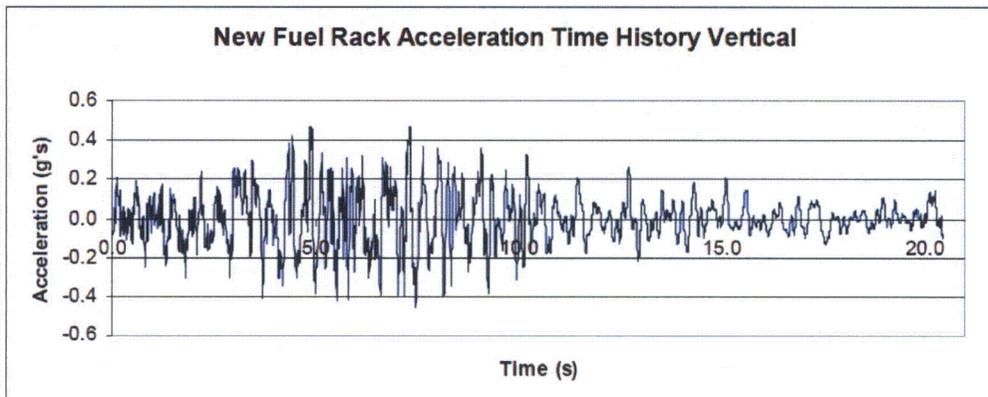
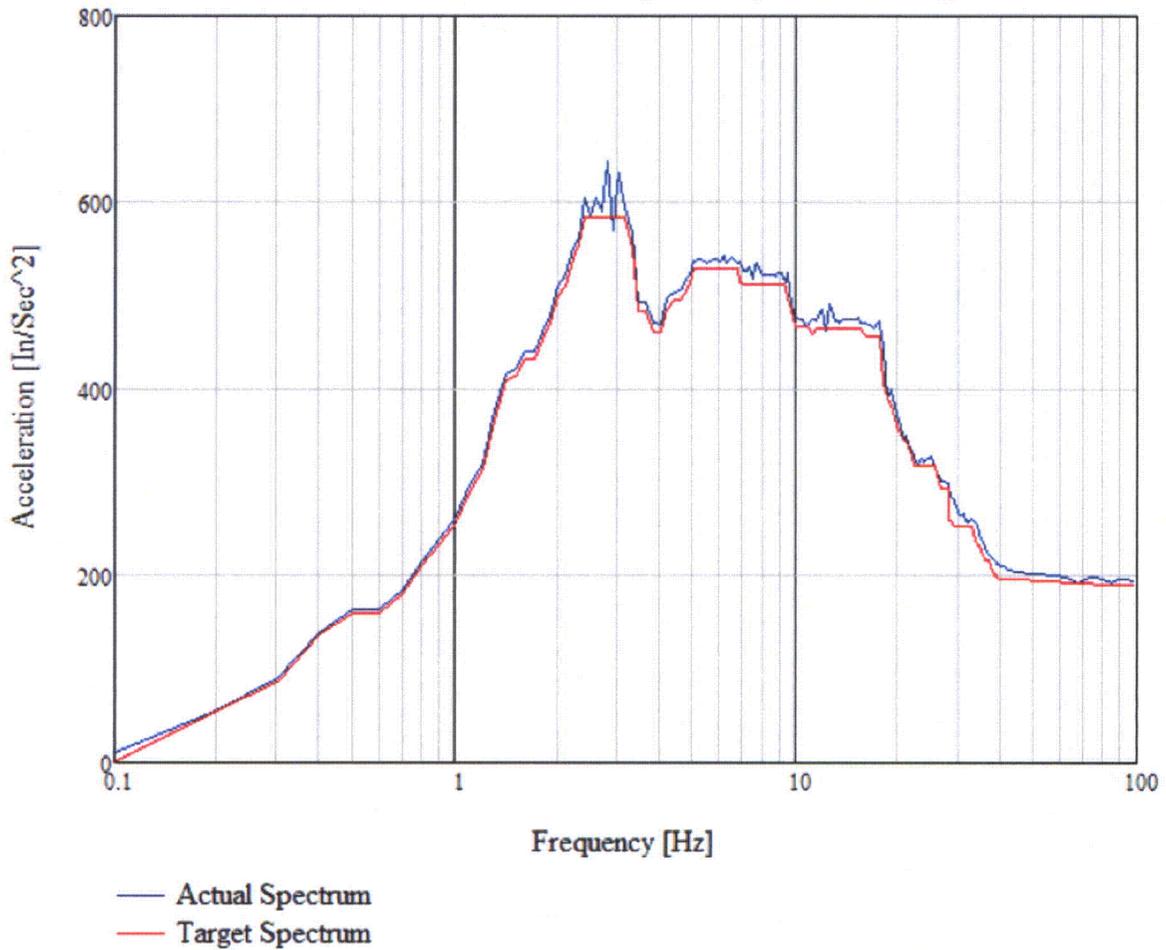


Figure 2-3: New Fuel Storage Rack Artificial Acceleration Time History Vertical Direction

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Final Factored Acceleration Response Spectrum Comparison

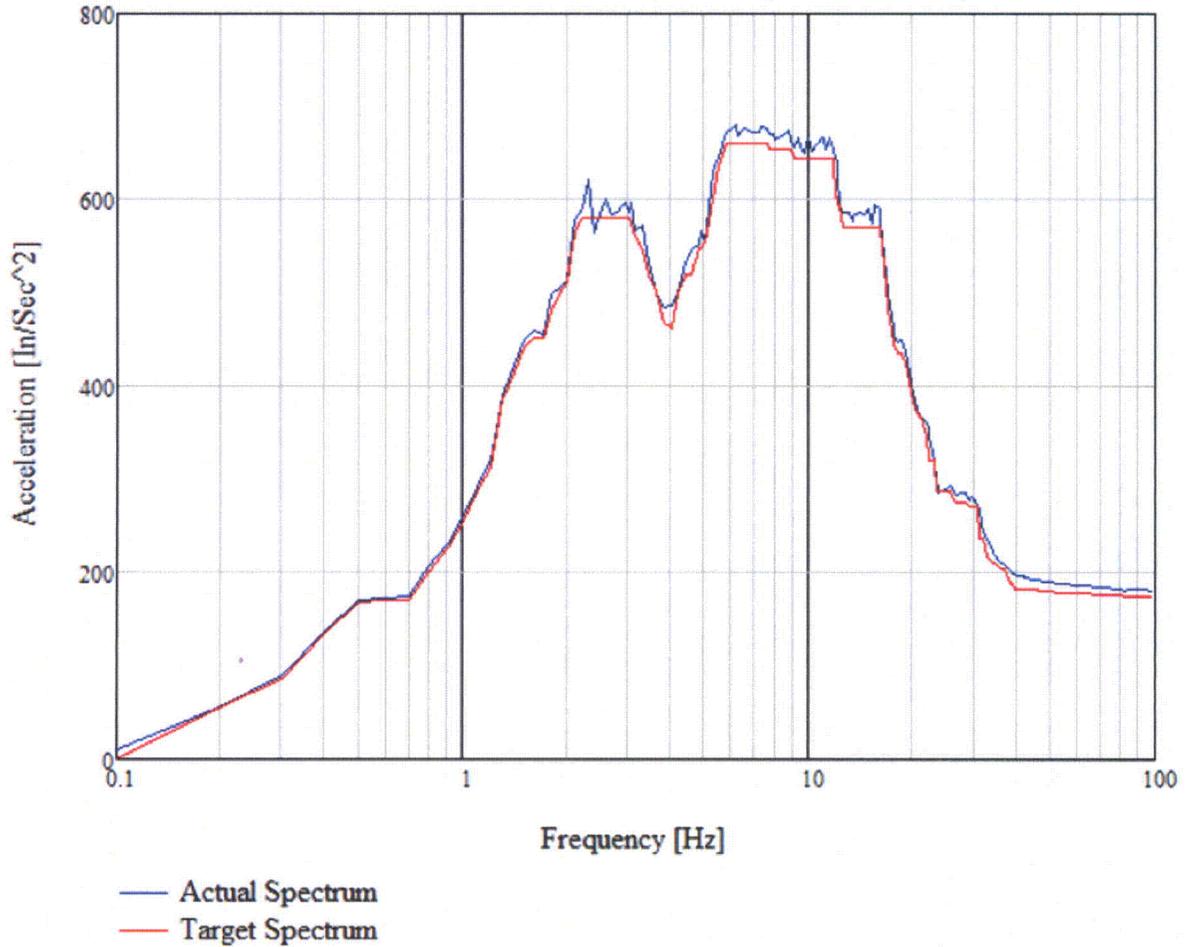


Title = "New Fuel Storage Racks Amplified Earthquake - Horizontal X, 4% Damping"
North-South

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Final Factored Acceleration Response Spectrum Comparison



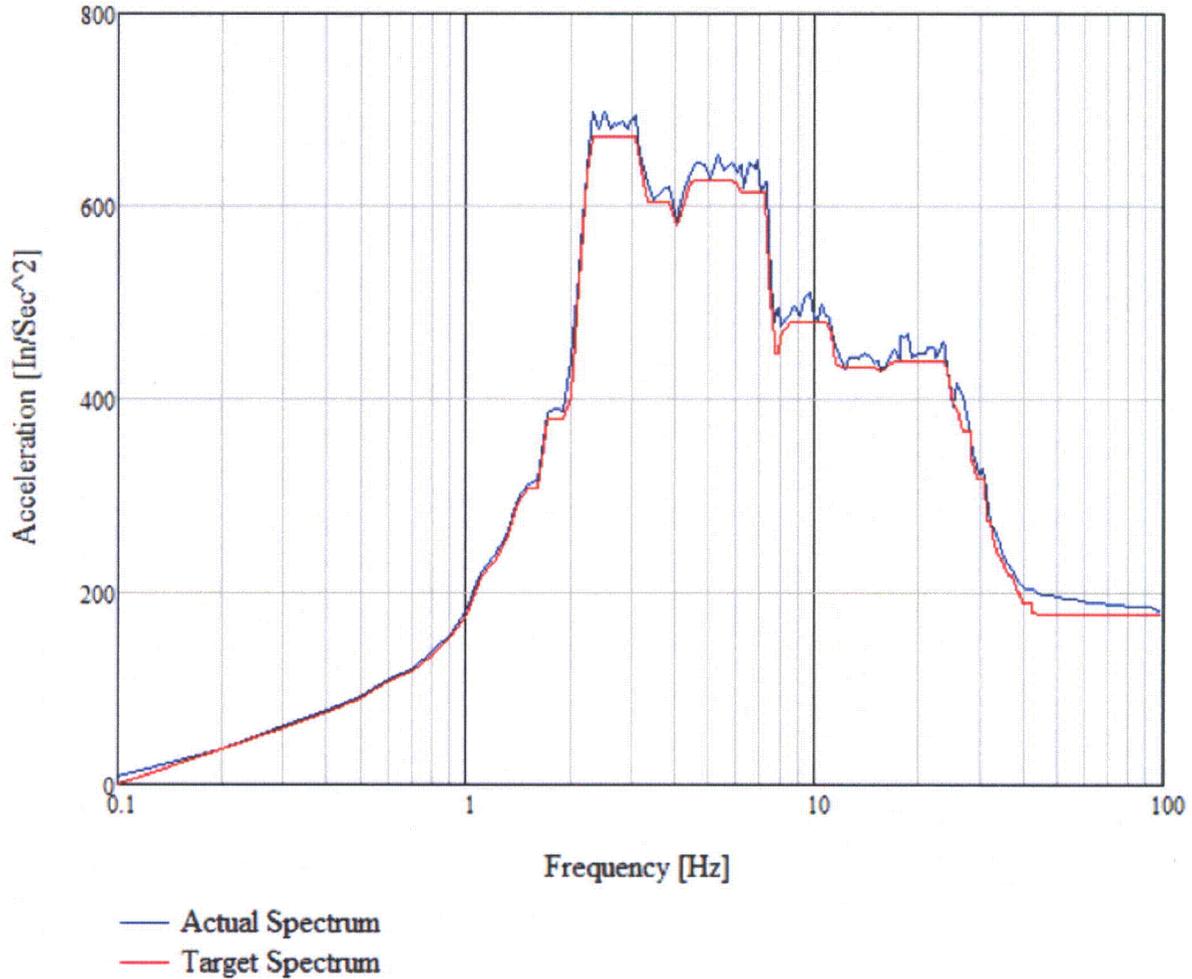
Title = "New Fuel Storage Racks Amplified Earthquake - Horizontal Y, 4% Damping"

East-West

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Final Factored Acceleration Response Spectrum Comparison



Title = "New Fuel Storage Racks Amplified Earthquake - Vertical Z, 4% Damping"
Vertical

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

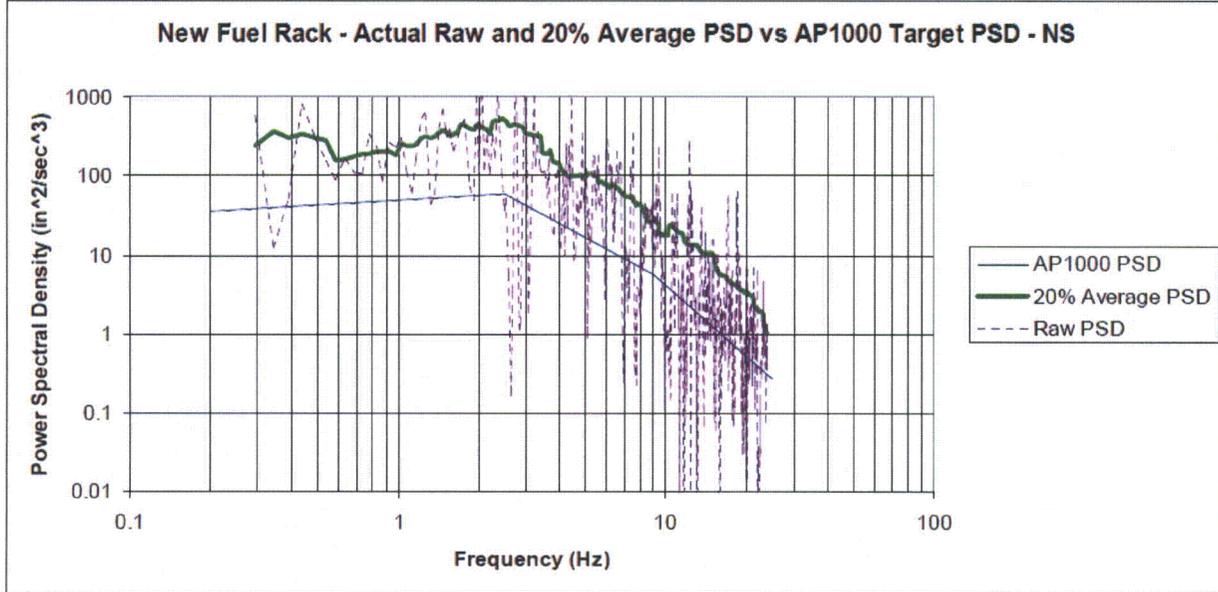


Figure 5-11: Comparison of Raw, Average, and AP100 Target PSD for New Fuel Rack, NS Direction

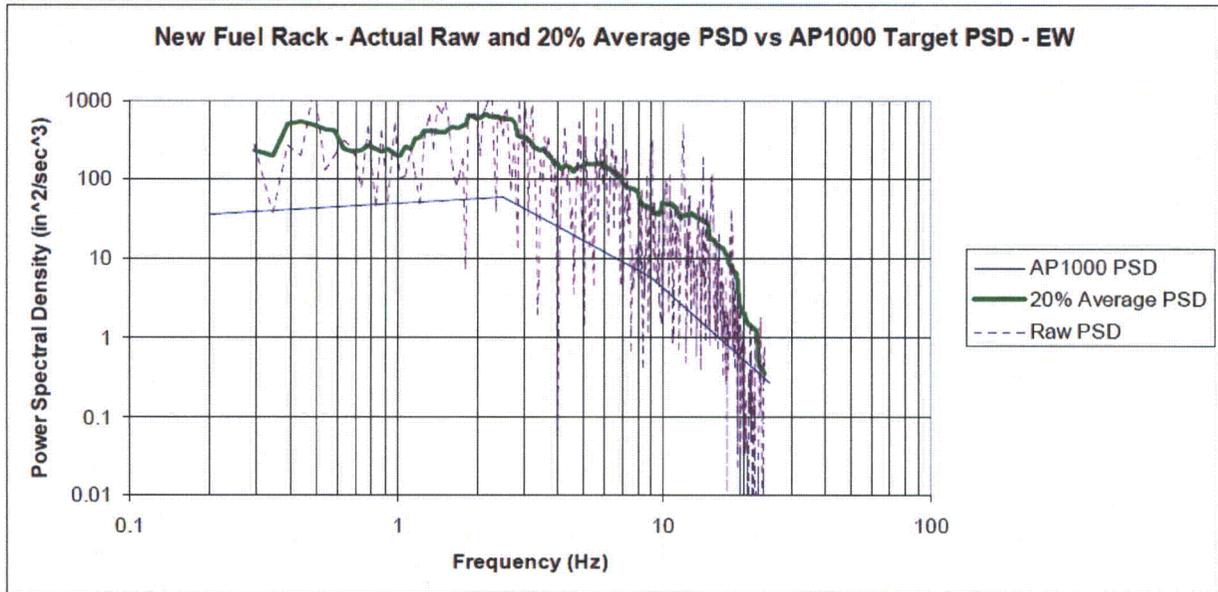


Figure 5-12: Comparison of Raw, Average, and AP100 Target PSD for New Fuel Rack, EW Direction

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

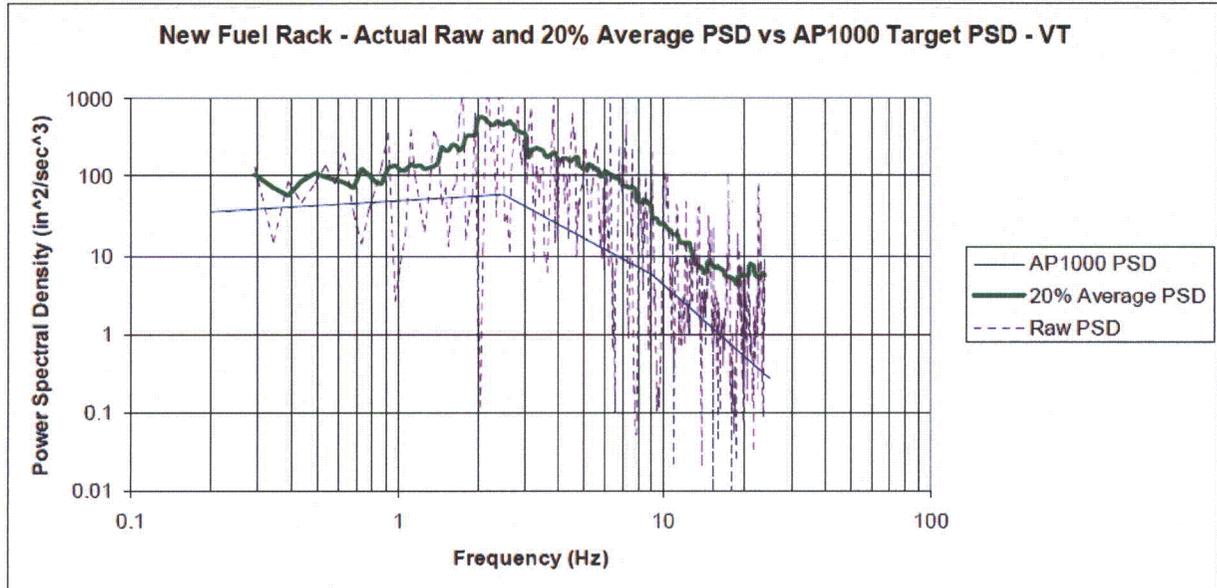


Figure 5-13: Comparison of Raw, Average, and AP100 Target PSD for New Fuel Rack, VT Direction

- (1) present comparisons of the old design-basis spectra to the new design-basis spectra, at the bottom of the New Fuel Pit:

A comparison of the FRS for the existing seismic input provided in Revision 1 of this RAI response with the FRS for the new seismic input discussed in Revision 2 of this RAI response is as follows. The existing input is shown as the blue line labeled “-056 R1”, and the new input is shown as the red line labeled “-056 R2”.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

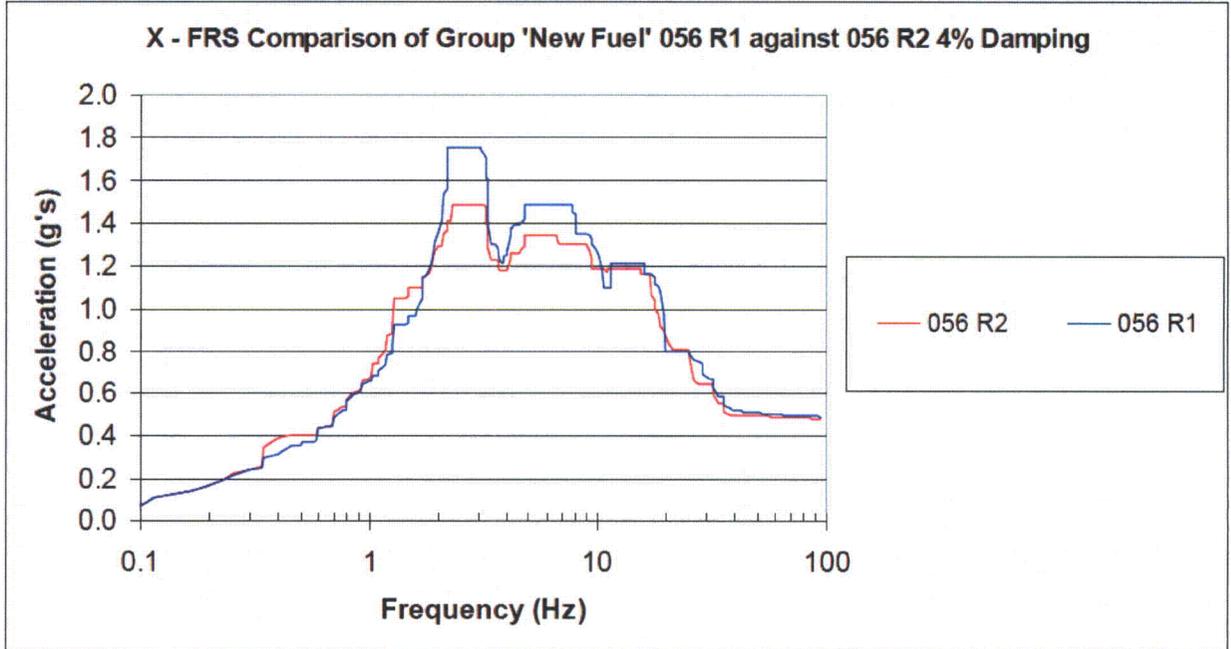


Figure 4-2: New Fuel Storage Racks – Comparison of Design FRS North-South Direction

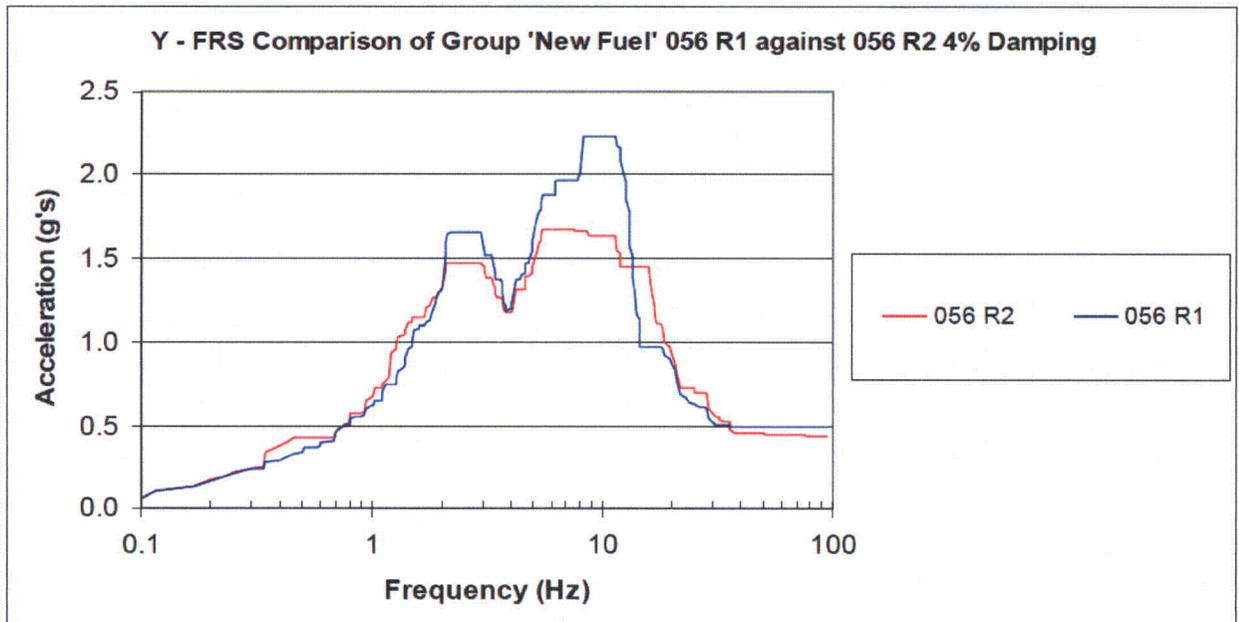


Figure 4-3: New Fuel Storage Racks – Comparison of Design FRS East-West Direction

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

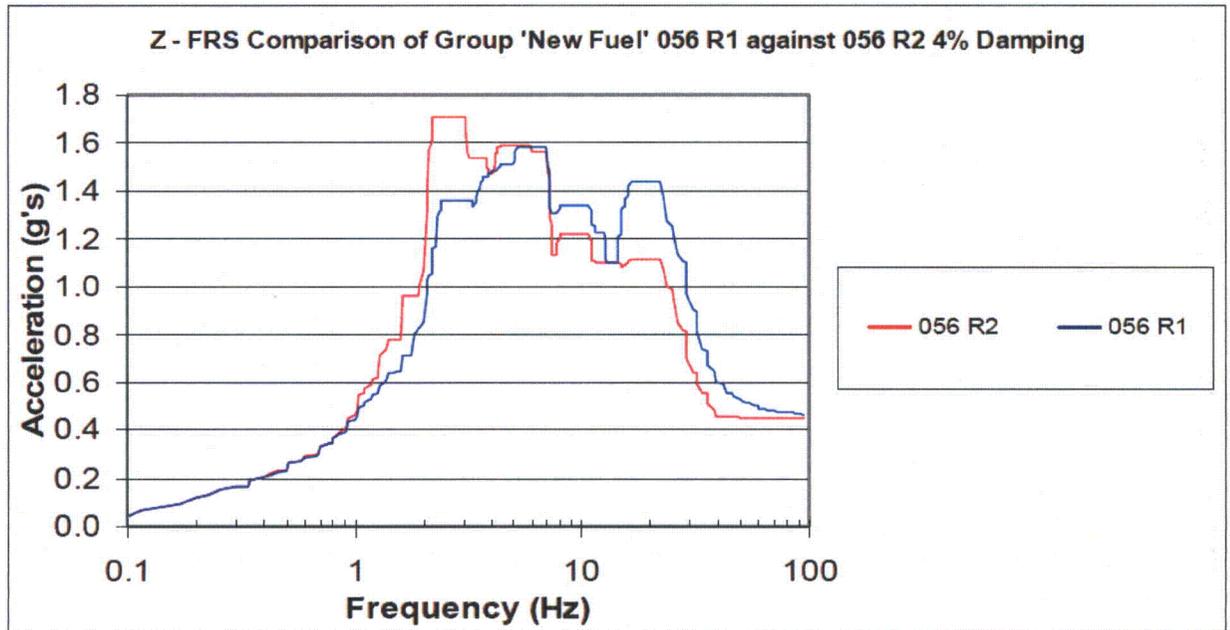


Figure 4-4: New Fuel Storage Racks – Comparison of Design FRS Vertical Direction

(2) explain why the spectra have changed or why they have not changed:

The seismic input has changed due to the shield building enhancement and the correction of the SASSI model.

(3) compare the old loads to the new loads used in the HOLTEC new fuel rack analysis:

A comparison of the resulting loads from the new vs. existing seismic input is provided in Table 2-6 of TR44.

References:

1. APP-GW-GLR-026, Revision 0, May 2006, "New Fuel Storage Rack Structural/Seismic Analysis," (Technical Report Number 44, TR44)
2. Westinghouse Calculation APP-GW-S2R-010, Revision 2, May 2008, "Extension of NI Structures Seismic Analysis to Soil Sites" (Technical Report Number 3, TR03)
3. APP-GW-GLR-026, Revision 3, May 2010, "New Fuel Storage Rack Structural/Seismic Analysis," (Technical Report Number 44, TR44)
4. Westinghouse Calculation APP-GW-S2R-010, Revision 4, March 2010, "Extension of NI Structures Seismic Analysis to Soil Sites", (Technical Report Number 3, TR03)

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision: (Revision 0 and 1)

Technical Report Number 44 has been revised to reflect the change in floor response spectra.

Section 2.2.1 was revised to include the following paragraph:

"The acceleration time histories for the New Fuel FRS are used as the input motion for the seismic analysis of the new fuel rack. The three orthogonal components are input and solved simultaneously together with a constant 1-g gravity acceleration."

TR Revision (Revision 2)

The evaluation of the new seismic input has been incorporated into Revision 3 of TR44.