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April 11, 2011
U7-C-NINA-NRC-110059

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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Rockville MD 20852-2738

South Texas Project
Units 3 and 4
Docket Nos. 52-012 and 52-013
Supplemental Response to Request for Additional Information

During an audit on March 14-18, 2011, the NRC Staff requested that Nuclear Innovation North America LLC (NINA) provide additional information to support the review of the Combined License Application (COLA). Attached are supplemental responses to NRC staff questions included in Request for Additional Information (RAI) related to COLA Part 2, Tier 2, Sections 3.7 and 3.8. The attachments provide supplemental responses to the RAI questions listed below:

03.07.01-2
03.07.02-20
03.08.01-7
03.08.01-9

Where there are COLA markups, they will be made at the first routine COLA update following NRC acceptance of the RAI response.

There are no commitments in this letter.

If you have any questions regarding these responses, please contact me at (361) 972-7136 or Bill Mookhoek at (361) 972-7274.

D091
NRO

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 4/11/11

Scott Head
Manager, Regulatory Affairs
South Texas Project Units 3 & 4

jep

Attachments:

1. RAI 03.07.01-2, Supplement 2
2. RAI 03.07.02-20, Supplement 1
3. RAI 03.08.01-7, Supplement 1
4. RAI 03.08.01-9, Supplement 1

cc: w/o attachment except*
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RAI 03.07.01-2, Supplement 2

QUESTION:

10 CFR 50 Appendix S specifies that the Safe Shutdown Earthquake (SSE) Ground Motion for the site is characterized by both horizontal and vertical free-field ground motion response spectra at the free ground surface. As such, site-specific SSE ground motion should be established as free-field ground motion response spectra together with site-specific design time histories. Per guidance of SRP Acceptance Criteria 3.7.1 II.1.A & B, the applicant is requested to provide the following in the FSAR:

1. Site-specific SSE design response spectra for all applicable damping values (include specific figures) used for seismic reconciliation with the standard plant results as well as for site-specific seismic analysis and design of applicable site-specific structures (Ultimate Heat Sink, and Reactor Service Water (RSW) Piping Tunnel.)
2. Site-specific statistically independent three components of SSE design time histories and their bases that apply for the site-specific analysis.
3. Site-specific Operating Basis Earthquake (OBE) to be used for setting up the seismic instrumentation (FSAR Section 3.7.4).

SUPPLEMENTAL RESPONSE:

The original response to this RAI, submitted with letter U7-C-STP-NRC-090105, dated August 20, 2009, provided information on the site-specific Safe Shutdown Earthquake (SSE) time histories. In the seismic analyses performed for the Diesel Generator Fuel Oil Tunnel and Diesel Generator Fuel Oil Storage Vault, consistent time histories for the Certified Seismic Design Response Spectra are required. These time histories were developed and subsequently reviewed during the NRC Audit of March 14-18, 2011. The NRC Staff requested that information on these time histories be added to the COLA to reflect the analysis performed for the Diesel Generator Fuel Oil Tunnel and Diesel Generator Fuel Oil Storage Vault.

The following pages provide the COLA mark-up. These mark-ups are based on COLA Rev. 5 and subsequent mark-ups provided in RAI responses submitted through March 25, 2011.

3C.20 SYNQKE-R

3C.20.1 Description

SYNQKE-R is a Personal-Computer (PC)-based computer program for generating acceleration time histories compatible with single-damping or multiple-damping response spectra. The program allows the user to specify an initial acceleration time history, to perform a parabolic base-line correction, and to scale the time histories to the user-specified maximum acceleration value.

3C.20.2 Validation

SYNQKE-R was developed and validated by Paul C. Rizzo Associates (RIZZO), Inc. The program validation documentation is available at RIZZO.

3C.20.3 Extent of application

SYNQKE-R is used to generate acceleration time histories compatible with single or multiple damping response spectra.

3C.21 HIST

3C.21.1 Description

HIST uses a seed time history and modifies the frequency content of this time history based on frequency dependent ratios of the target spectral accelerations to the spectral accelerations calculated from the time history. This process is iterated until a satisfactory match between the target and calculated response spectrum is obtained.

3C.21.2 Validation

HIST was developed and validated by RIZZO. The program validation documentation is available at RIZZO.

3C.21.3 Extent of Application

HIST is used to scale a given acceleration time history in the frequency domain such that its response spectrum for desired damping matches a given target spectrum.

3C.22 QUAKE

3C.22.1 Description

QUAKE calculates the Fourier transform of a given time history, produces raw and smoothed Fourier spectra, creates Husid plot data, power spectral density and can interpolate it in the frequency domain to create a time history with new time increment.

3C.22.2 Validation

QUAKE was developed and validated by RIZZO. The program validation documentation is available at RIZZO.

3C.22.3 Extent of Application

QUAKE is used to calculate the power spectral density of given acceleration time histories.

3H.8 Development of Standard Plant SSE Time Histories

The seismic analysis of the Diesel Generator Fuel Oil Storage Vaults and Diesel Generator Fuel Oil Tunnels use the SSE ground motion included in Tier 1 Table 5.0, in addition to the site-specific SSE ground motion, as described in Sections 3H.6.7 and 3H.7, respectively. Since the DCD does not include the digitized information for the SSE time histories, new time histories consistent with Regulatory Guide 1.60 response spectra anchored to peak ground acceleration of 0.3g were developed for use in these analyses. Acceleration time history records obtained from 1994 Northridge Earthquake were used as seed time histories in generating these synthetic time histories. The time histories were developed in accordance with the criteria described in Section 3.7.1.2, using computer programs SYNQKE-R, HIST, and QUAKE described in Appendix 3C.

The plots of the acceleration, velocity, and displacement time histories of the two horizontal and the vertical components are shown in Figures 3H.8-1 through 3H.8-3. The plots of response spectra for 2%, 3%, 4%, 5%, and 7% damping, showing the comparison of the target response spectra (Regulatory Guide 1.60 spectra) with the spectra of the synthetic time histories, are shown in Figures 3H.8-4 through 3H.8-18. The plots of power spectral density functions (PSD) showing the comparison of the target PSD, corresponding to the Regulatory Guide 1.60 spectra, with the PSD of the synthetic time histories are shown in Figures 3H.8-19 through 3H.8-21.

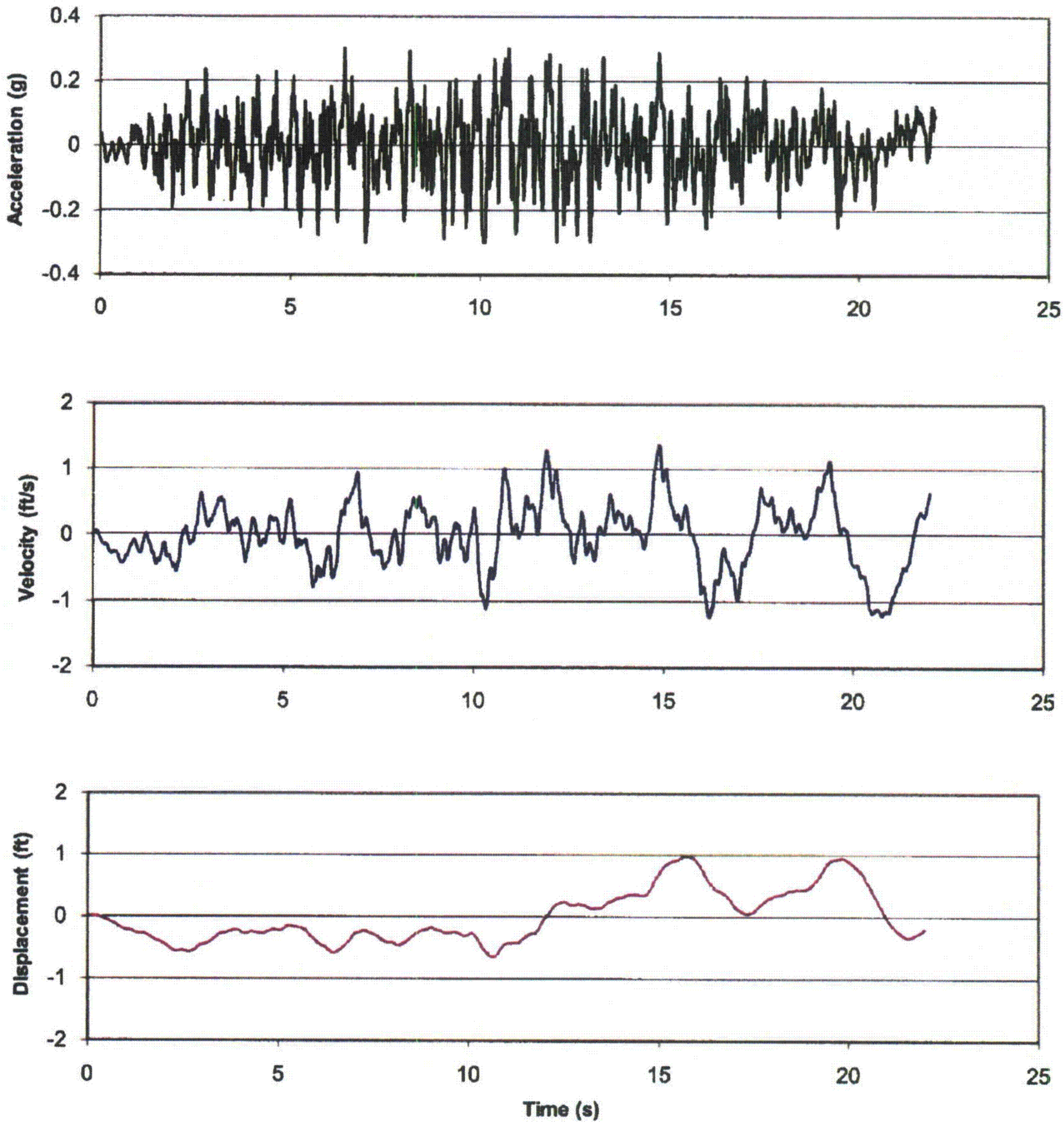

Figure 3H.8-1: Horizontal H1 Time History, Matching Horizontal R.G. 1.60 Response Spectrum

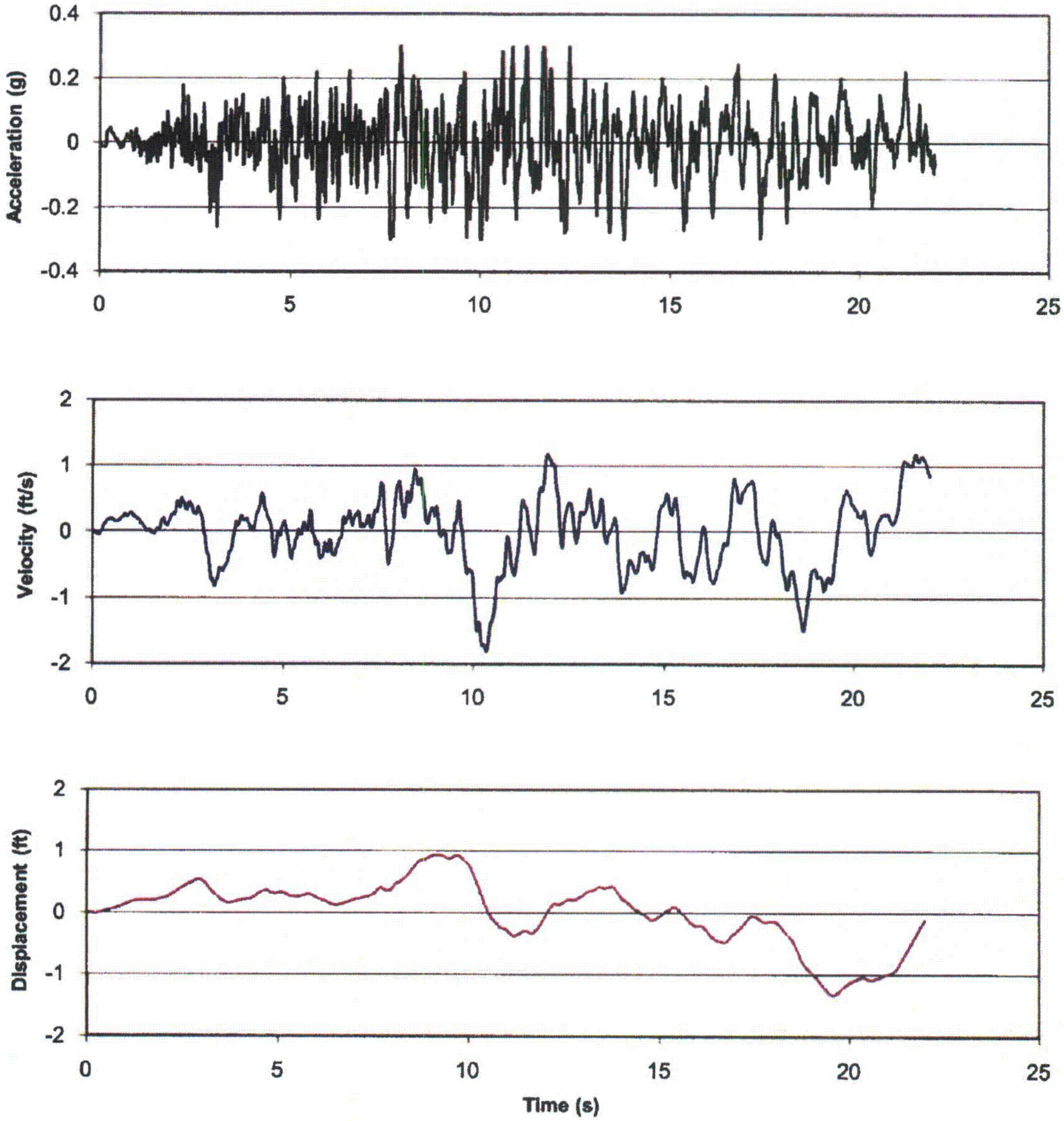

Figure 3H.8-2: Horizontal H2 Time History, Matching Horizontal R.G. 1.60 Response Spectrum

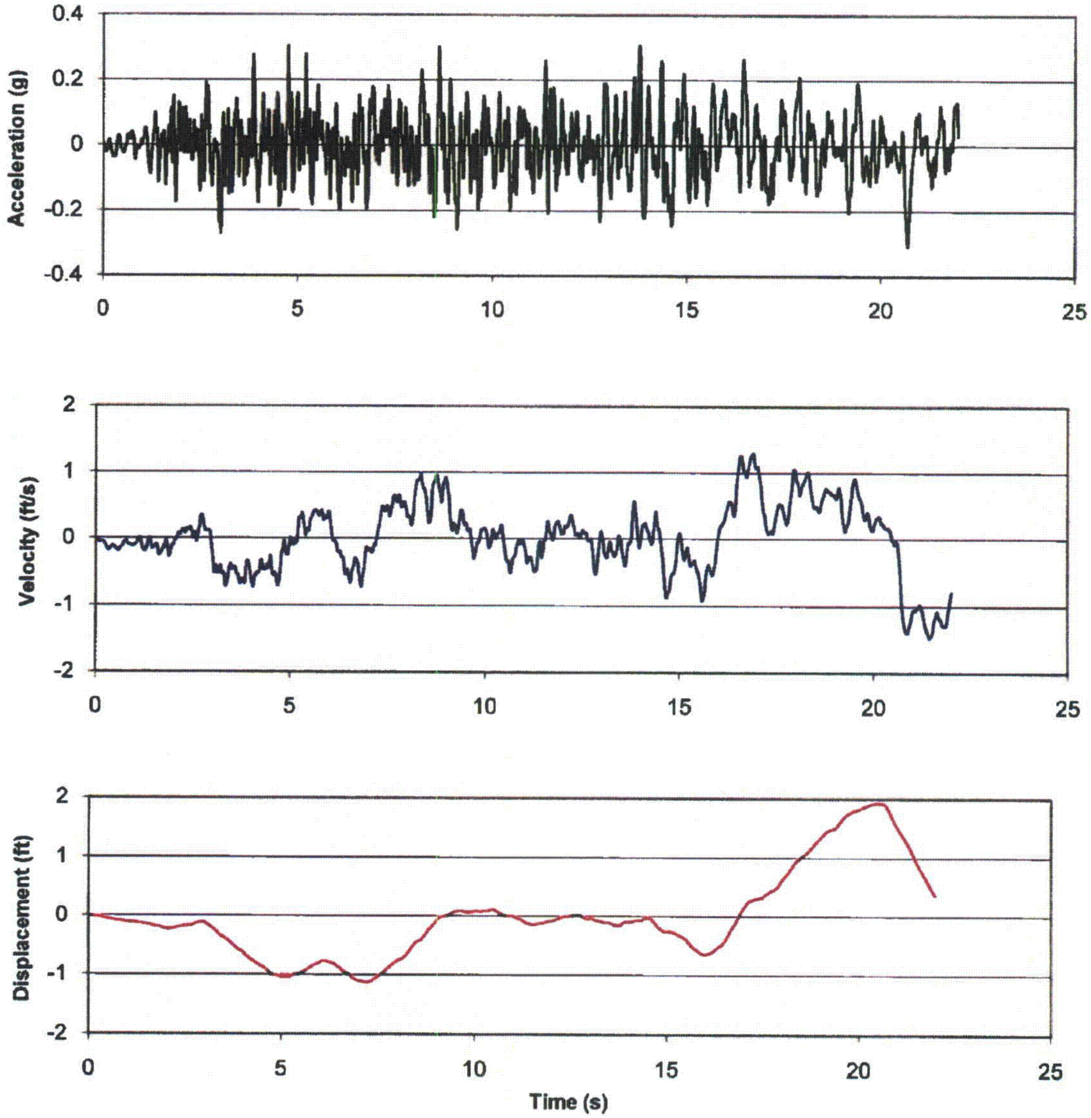

Figure 3H.8-3: Vertical V1 Time History, Matching Vertical R.G. 1.60 Response Spectrum

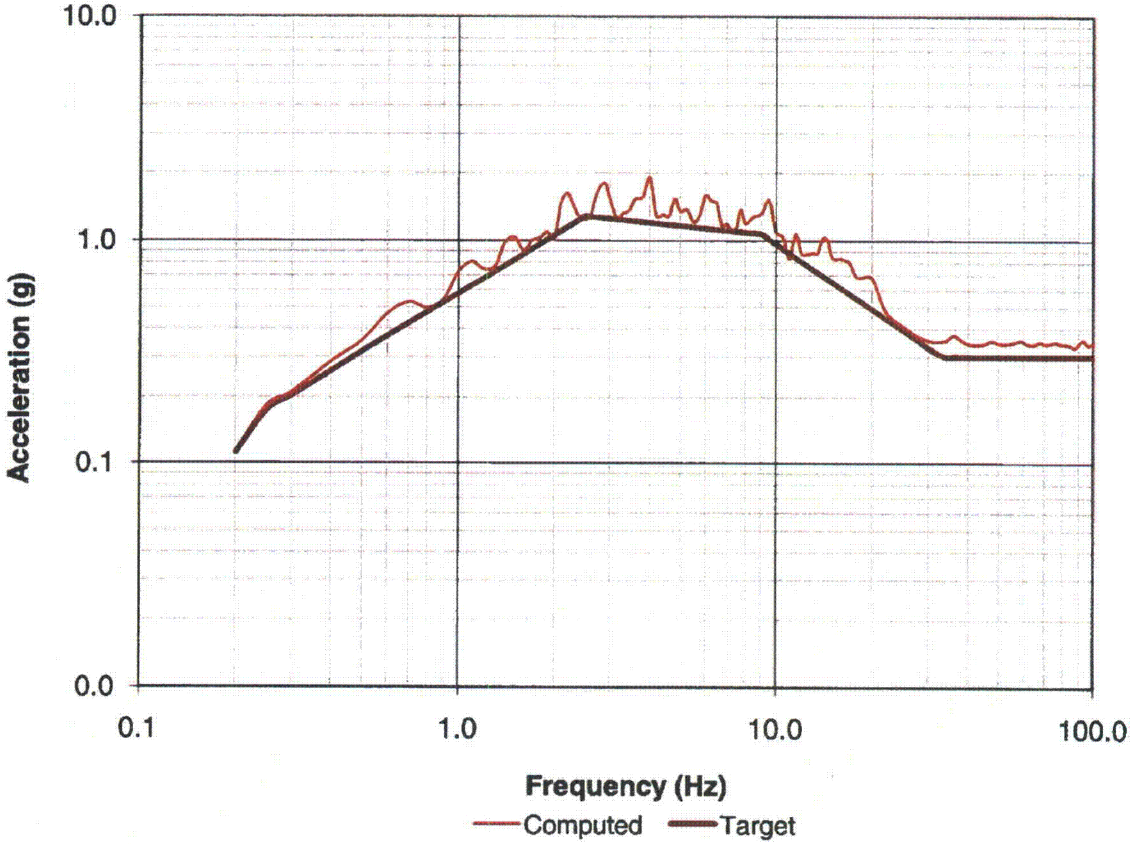

Figure 3H.8-4: Target vs. Computed Response Spectra, H1 Component, 2% damping

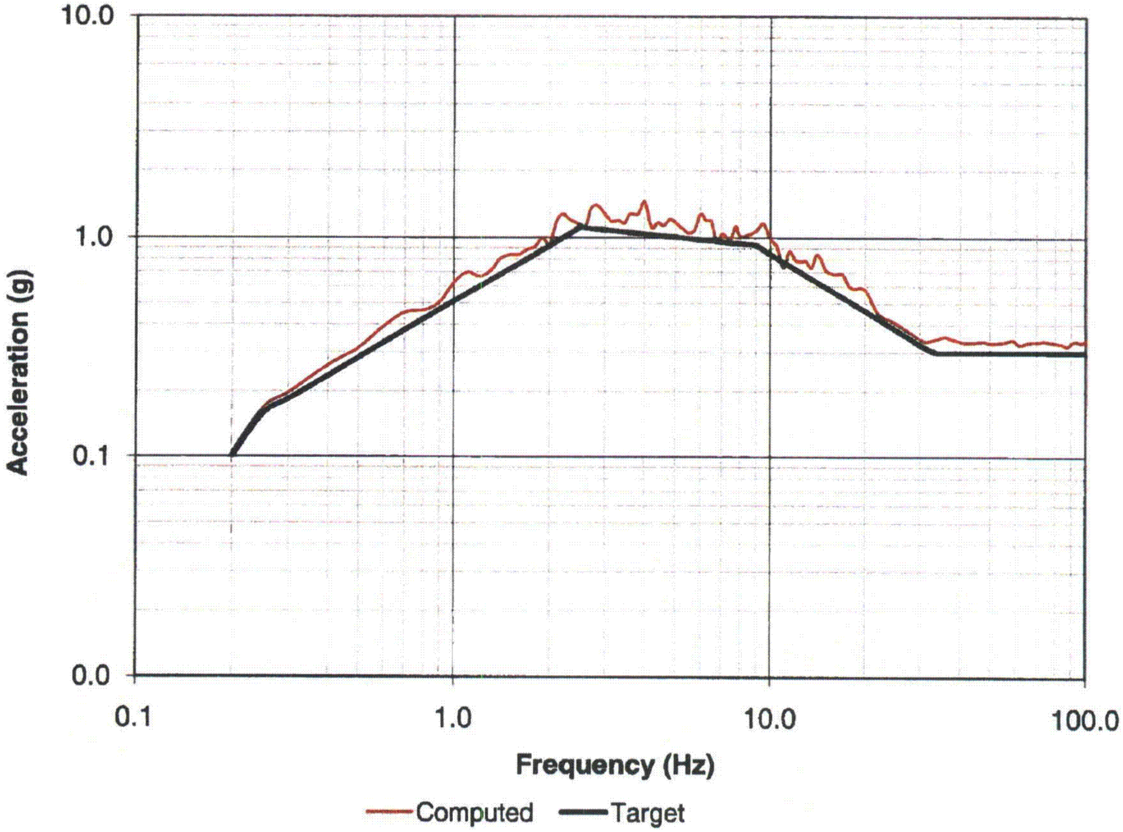

Figure 3H.8-5: Target vs. Computed Response Spectra, H1 Component, 3% damping

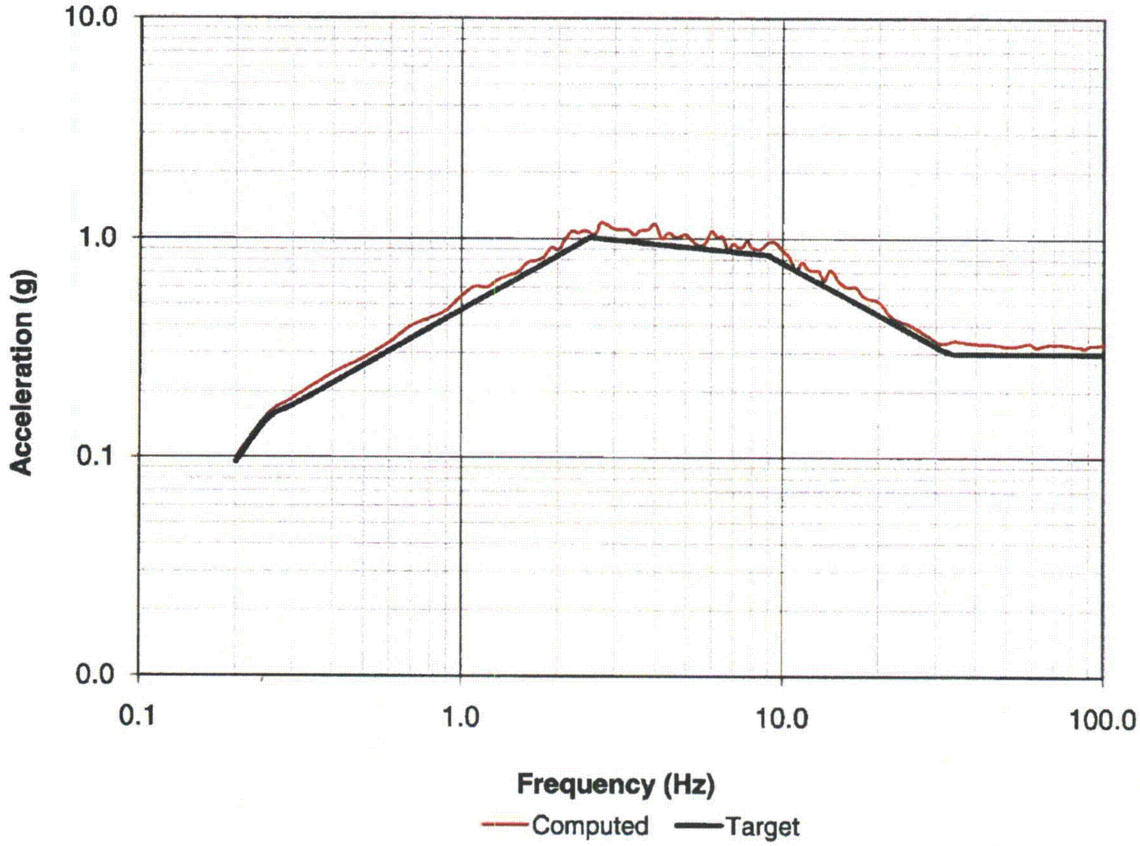

Figure 3H.8-6: Target vs. Computed Response Spectra, H1 Component, 4% damping

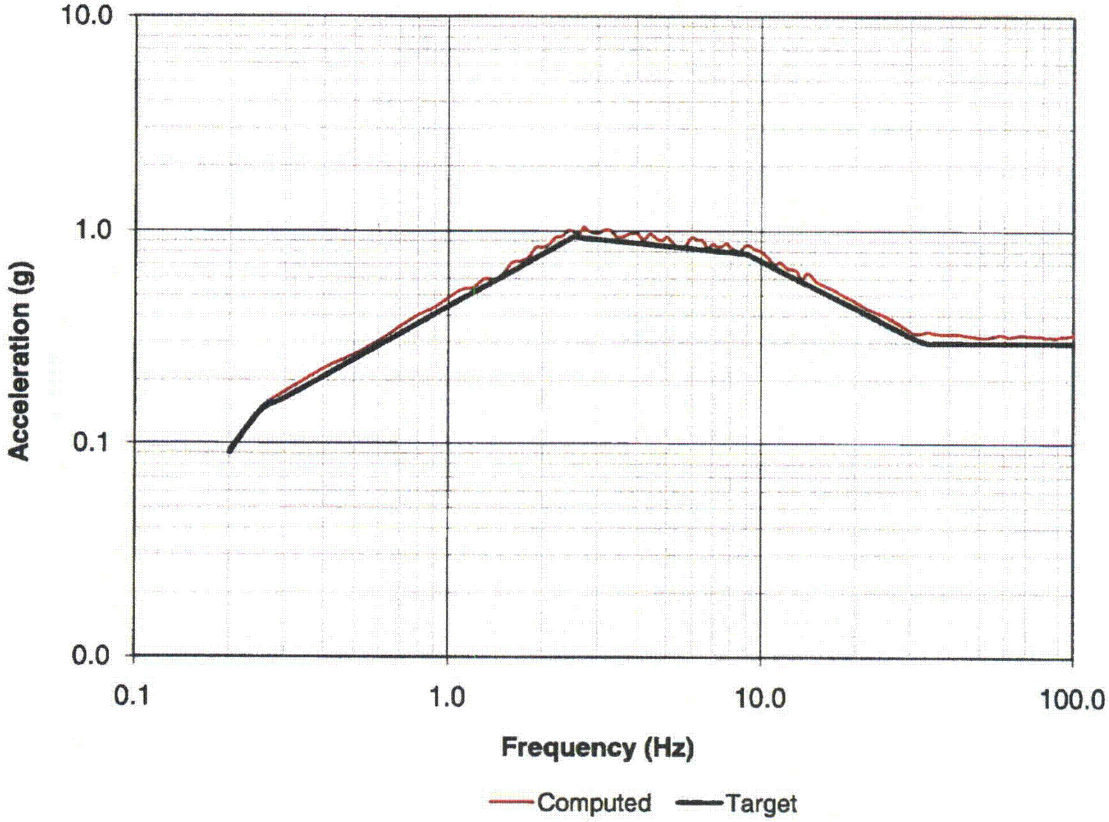

Figure 3H.8-7: Target vs. Computed Response Spectra, H1 Component, 5% damping

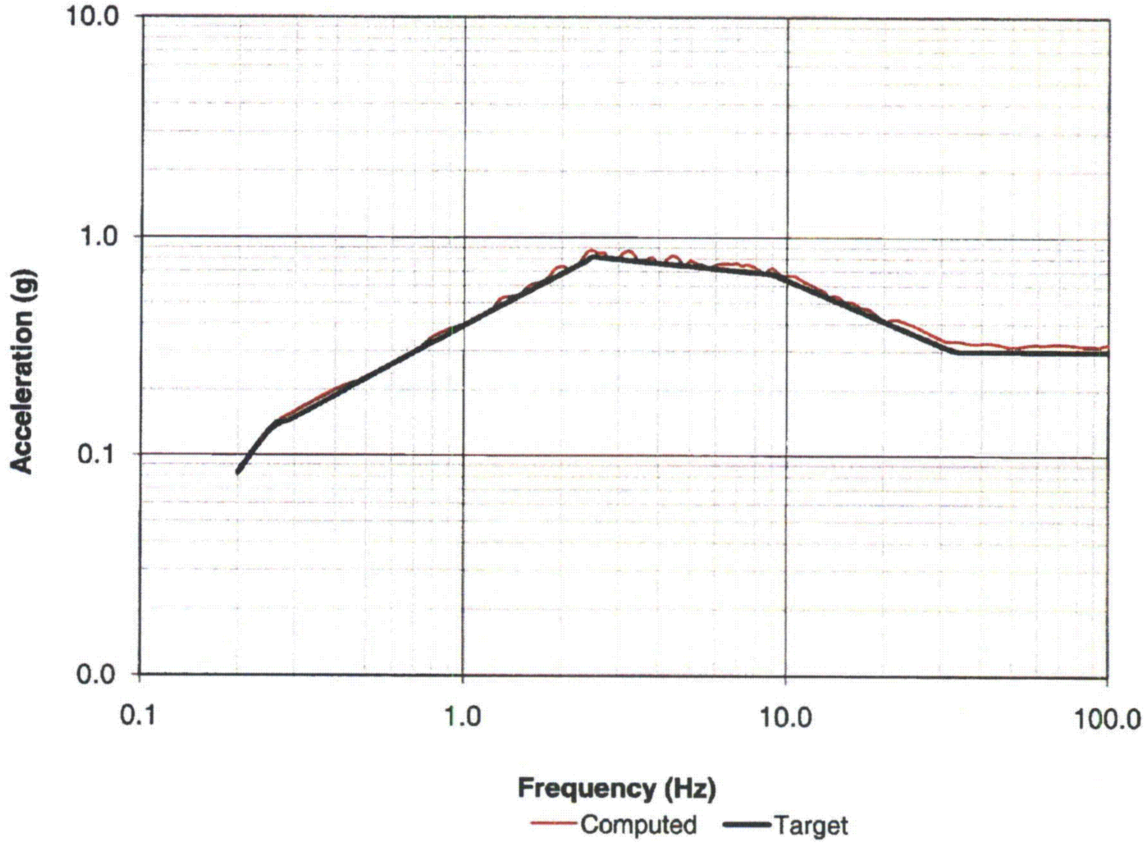

Figure 3H.8-8: Target vs. Computed Response Spectra, H1 Component, 7% damping

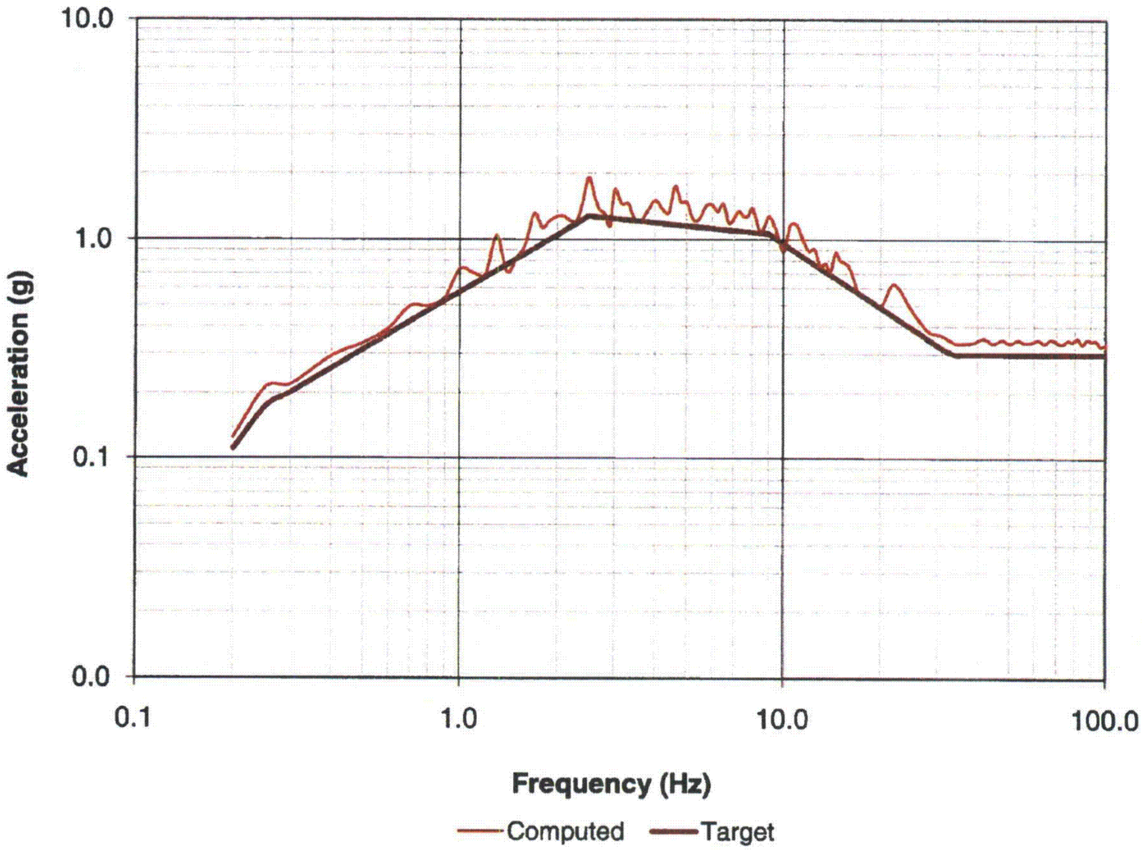

Figure 3H.8-9: Target vs. Computed Response Spectra, H2 Component, 2% Damping

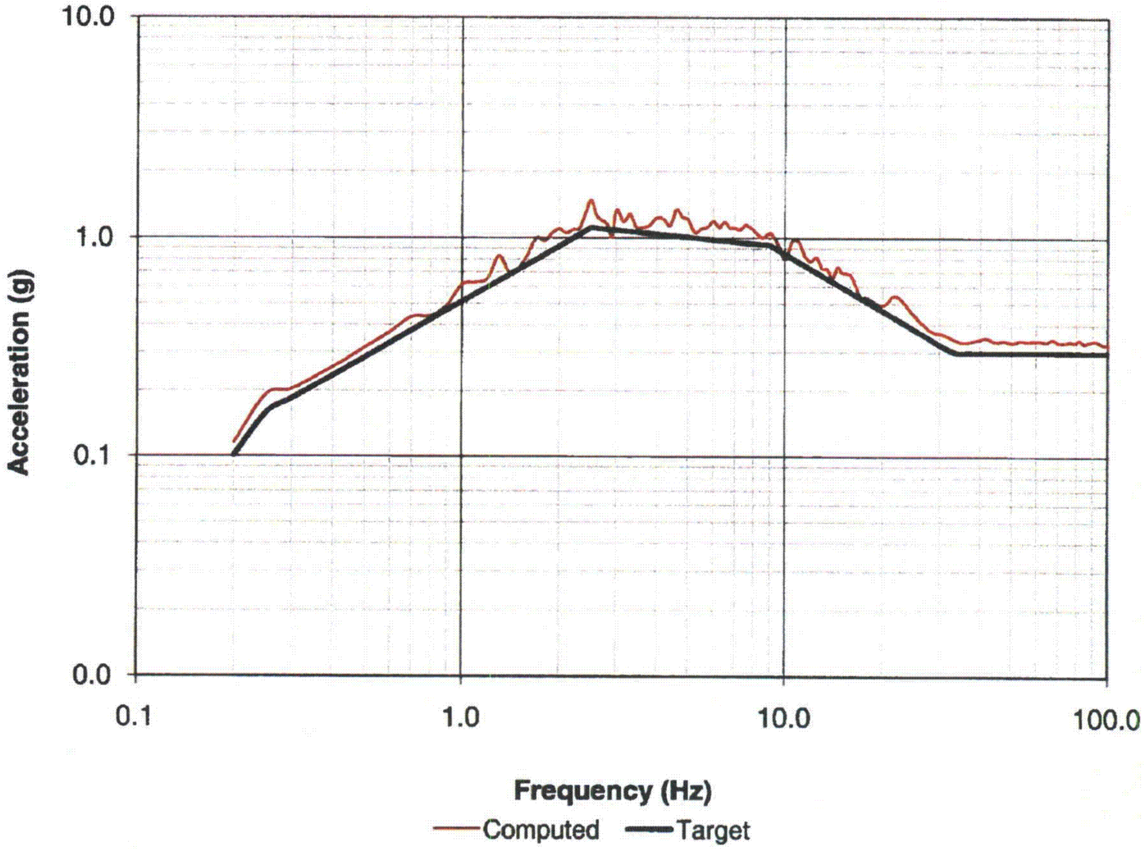

Figure 3H.8-10: Target vs. Computed Response Spectra, H2 Component, 3% Damping

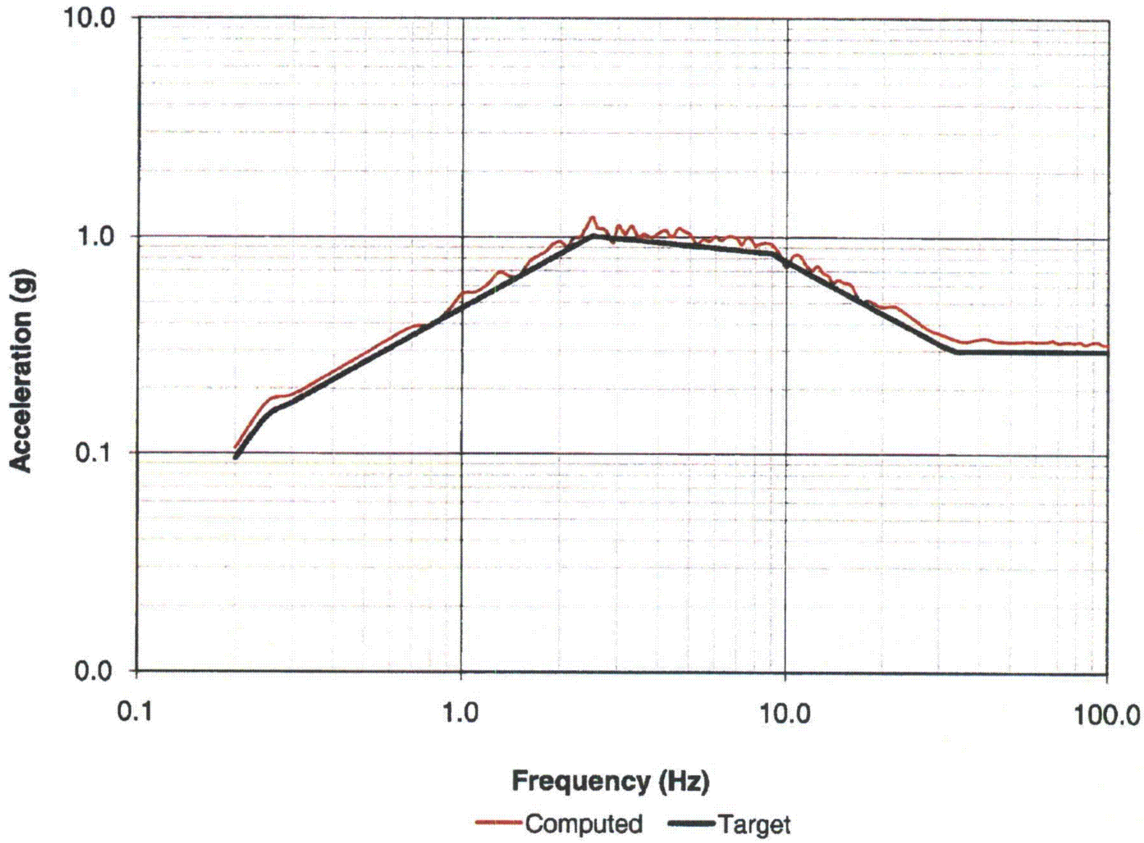

Figure 3H.8-11: Target vs. Computed Response Spectra, H2 Component, 4% Damping

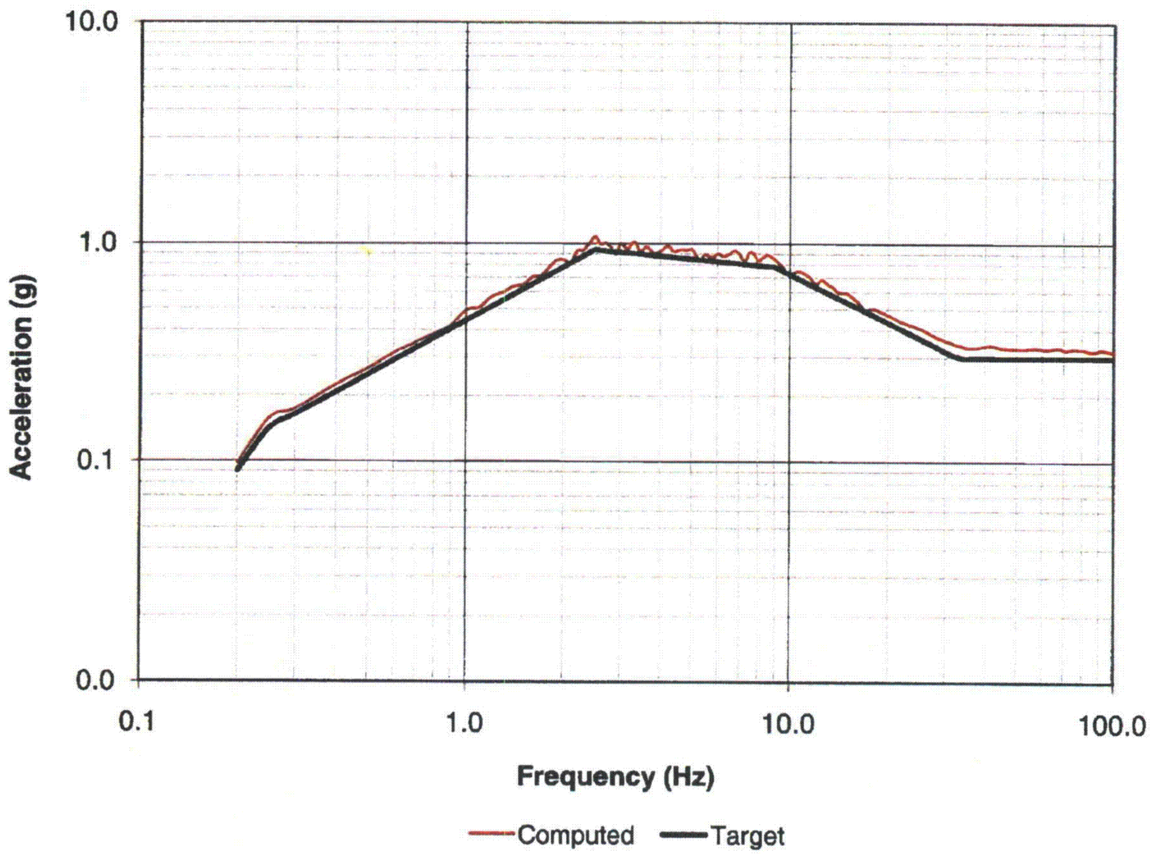

Figure 3H.8-12: Target vs. Computed Response Spectra, H2 Component, 5% Damping

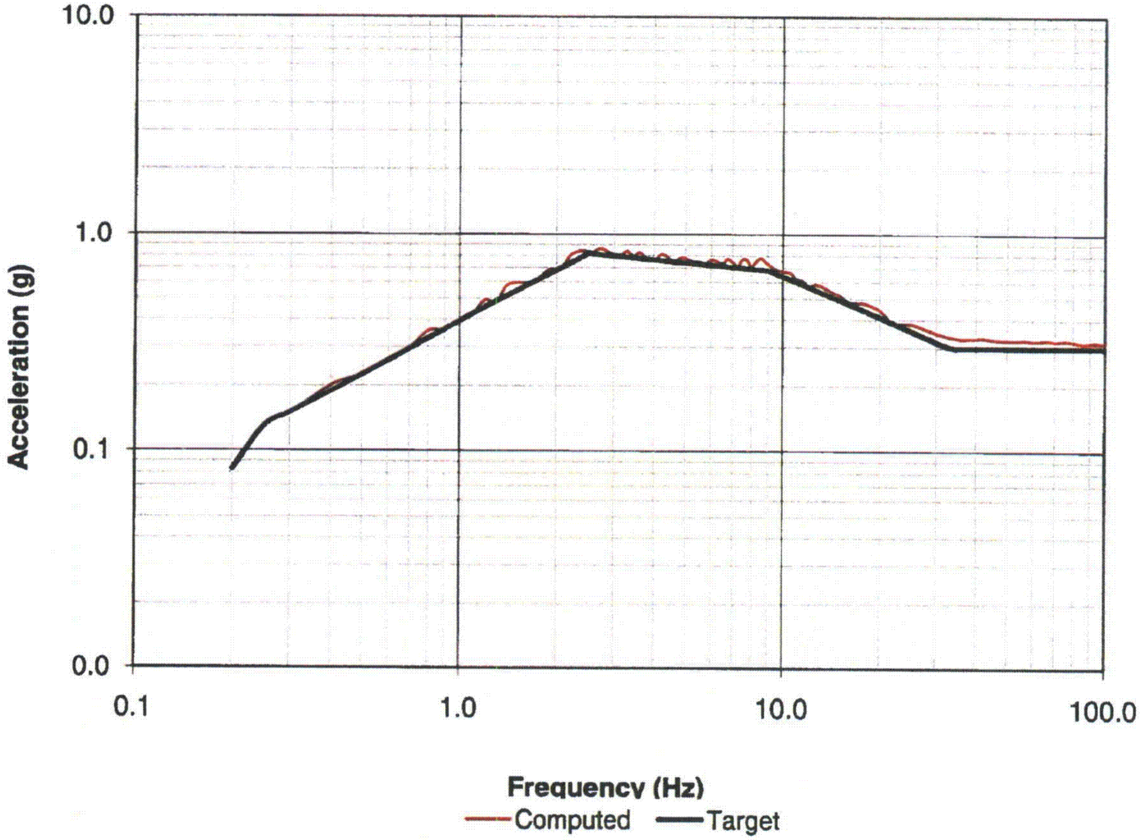

Figure 3H.8-13: Target vs. Computed Response Spectra, H2 Component, 7% Damping

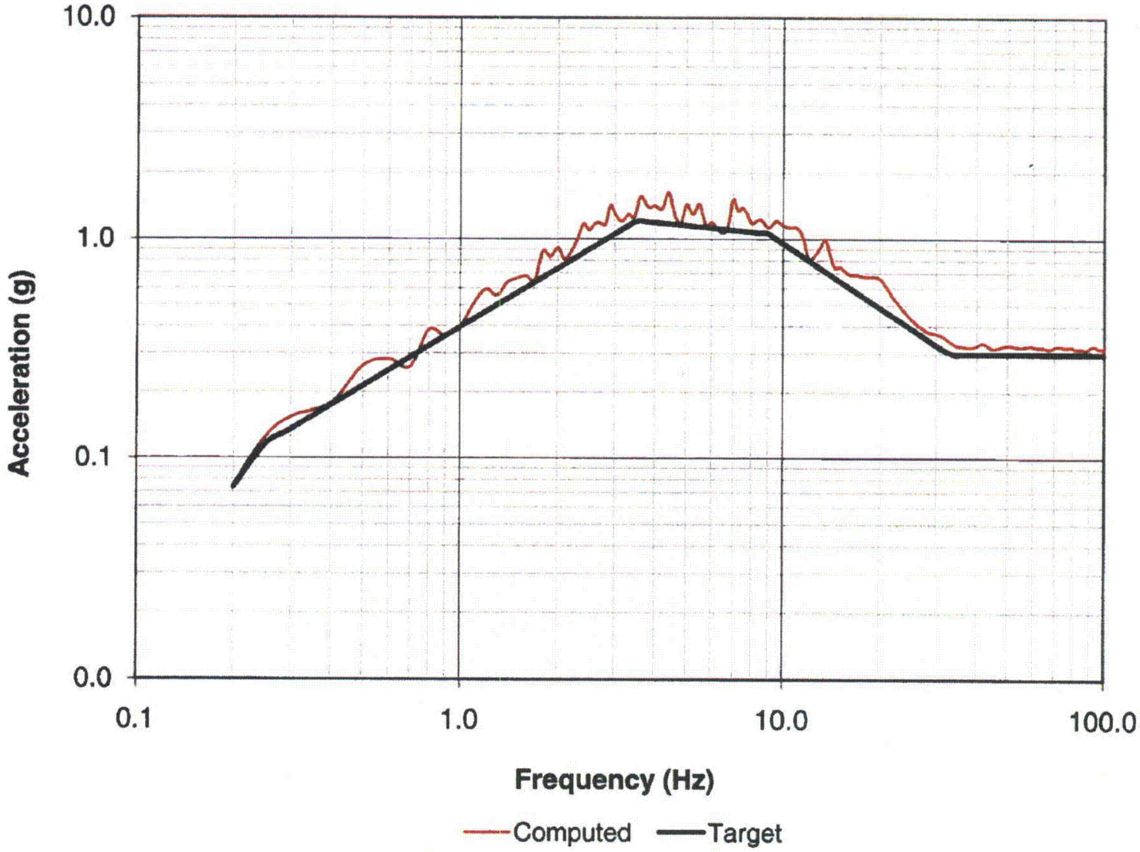

Figure 3H.8-14: Target vs. Computed Response Spectra, V1 Component, 2% Damping

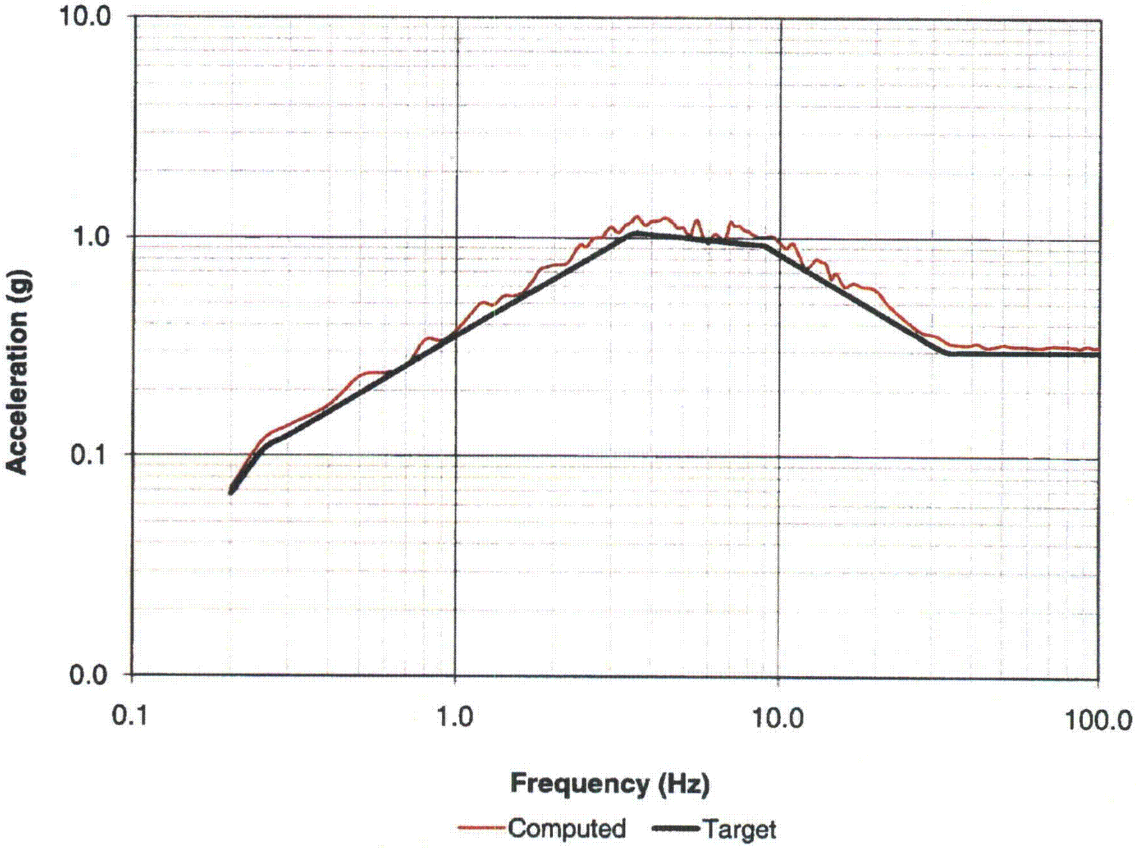

Figure 3H.8-15: Target vs. Computed Response Spectra, V1 Component, 3% Damping

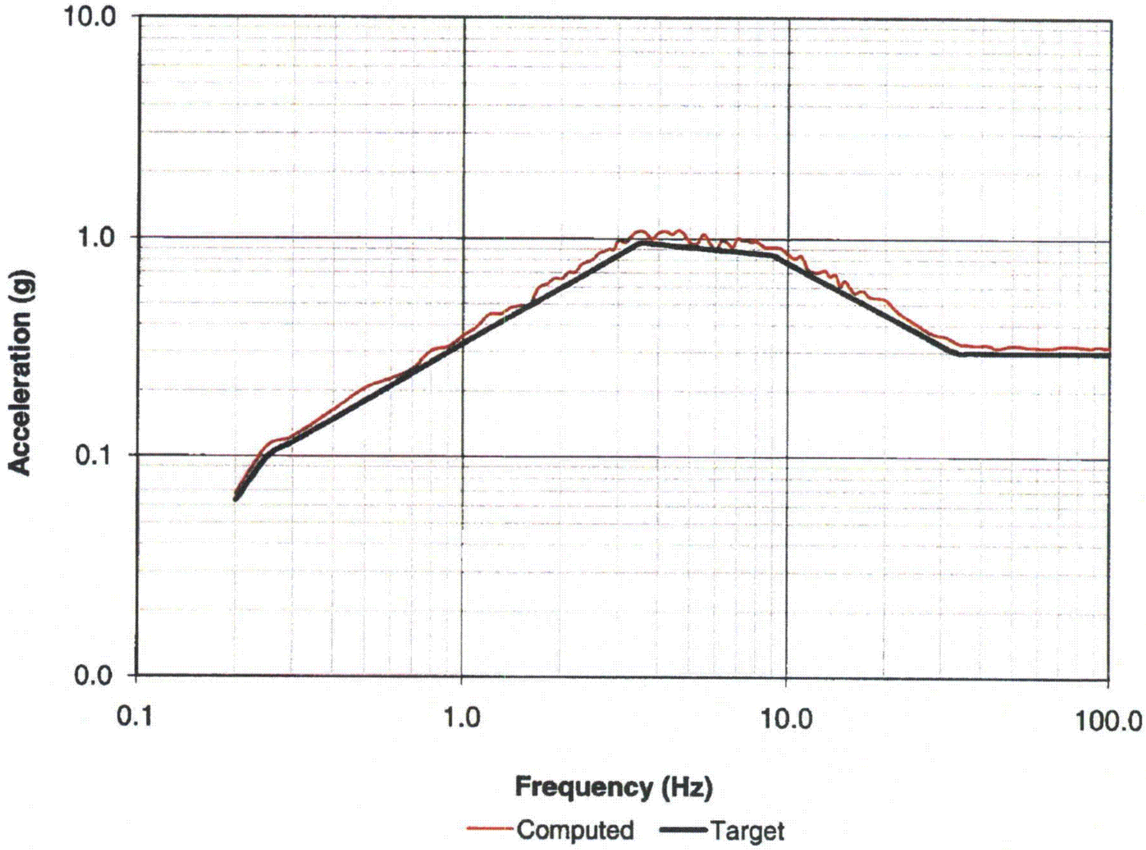

Figure 3H.8-16: Target vs. Computed Response Spectra, V1 Component, 4% Damping

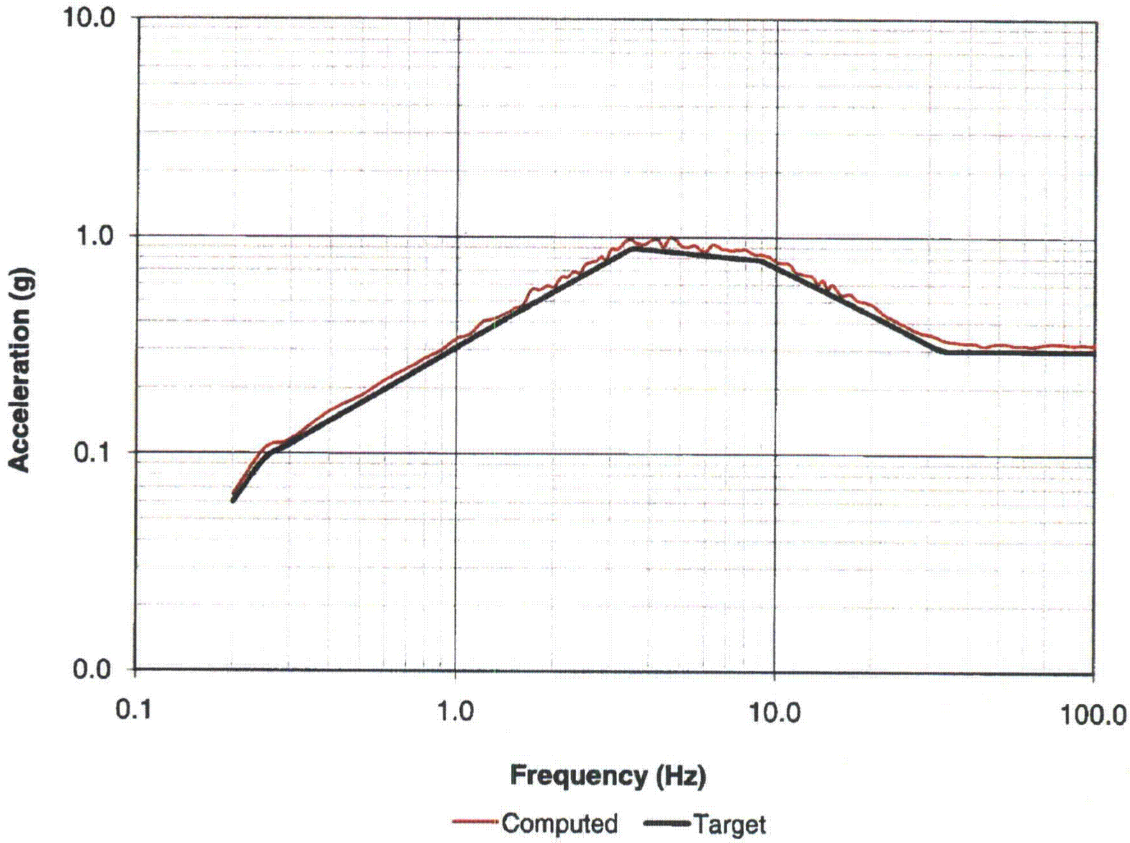

Figure 3H.8-17: Target vs. Computed Response Spectra, V1 Component, 5% Damping

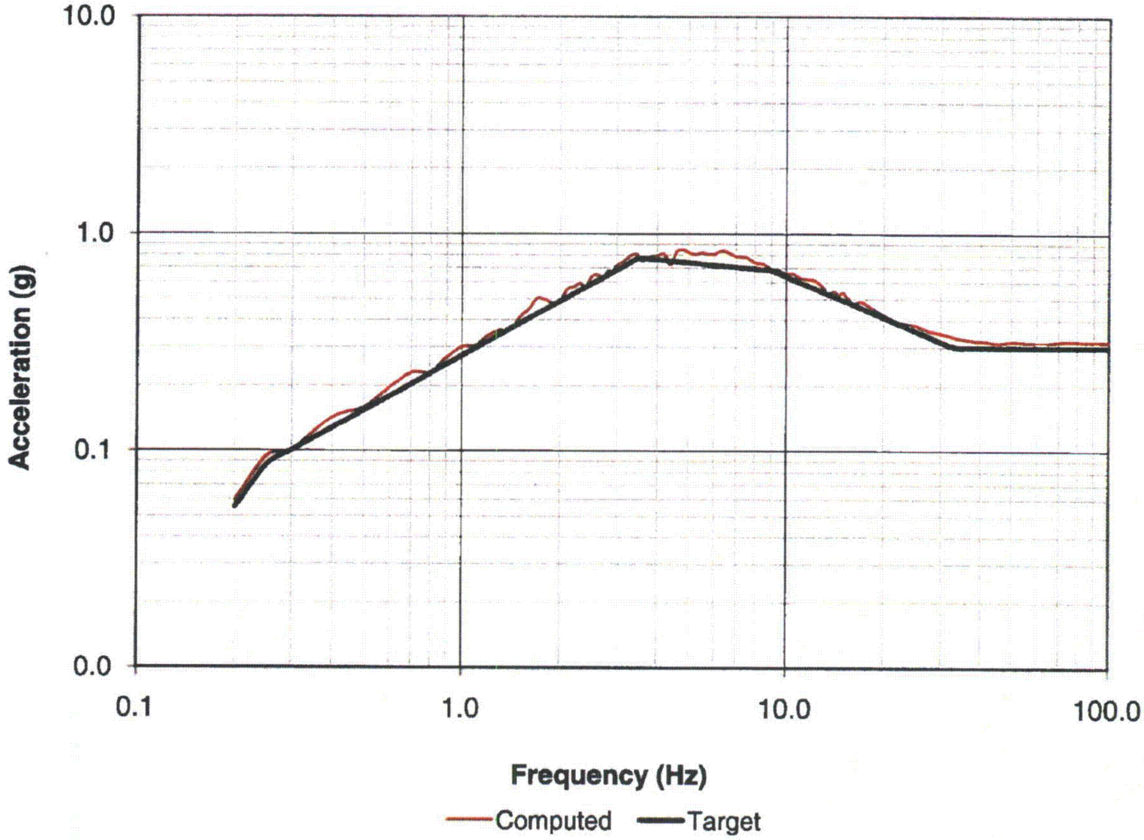

Figure 3H.8-18: Target vs. Computed Response Spectra, V1 Component, 7% Damping

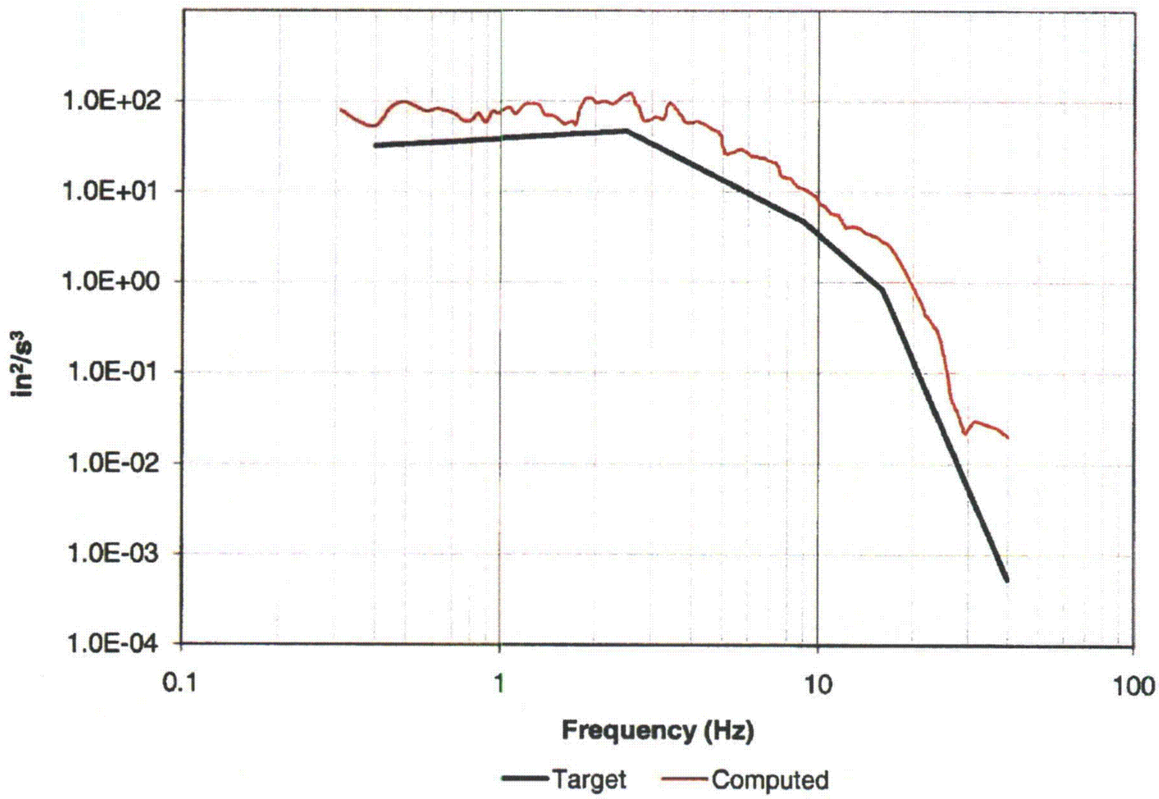

Figure 3H-19: Target vs. Computed Power Spectral Density, Horizontal H1 Component

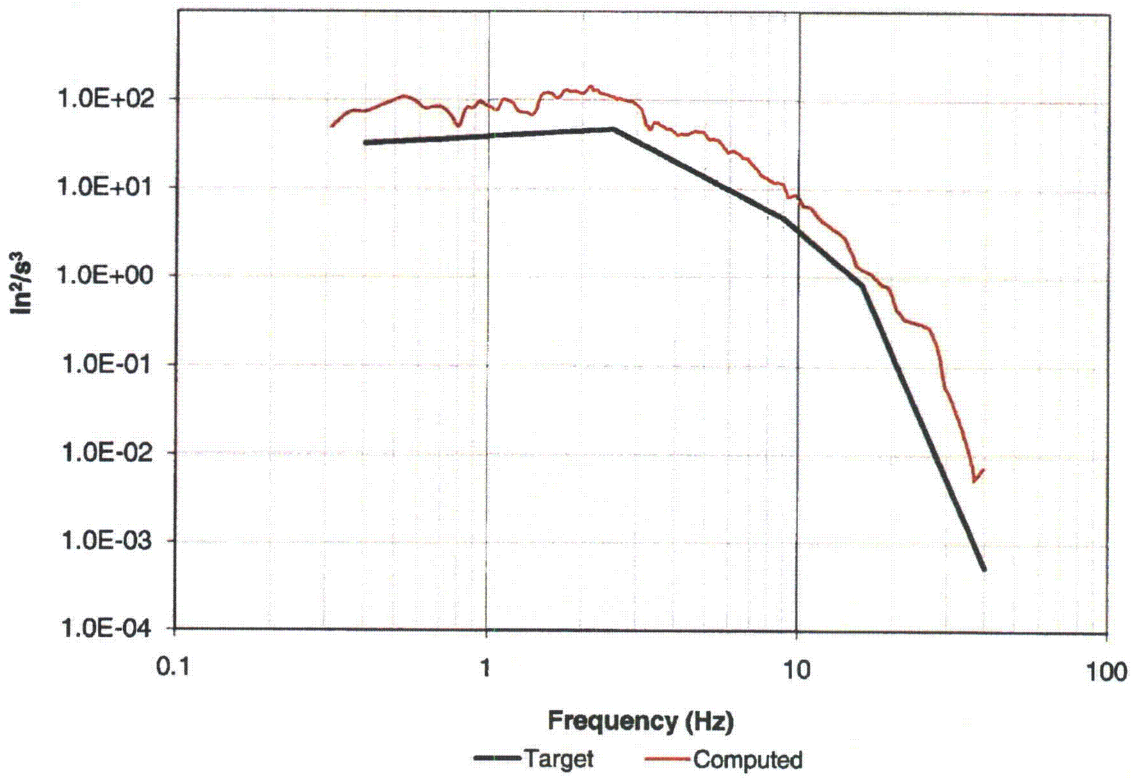

Figure 3H.8-20: Target vs. Computed Power Spectral Density, Horizontal H2 Component

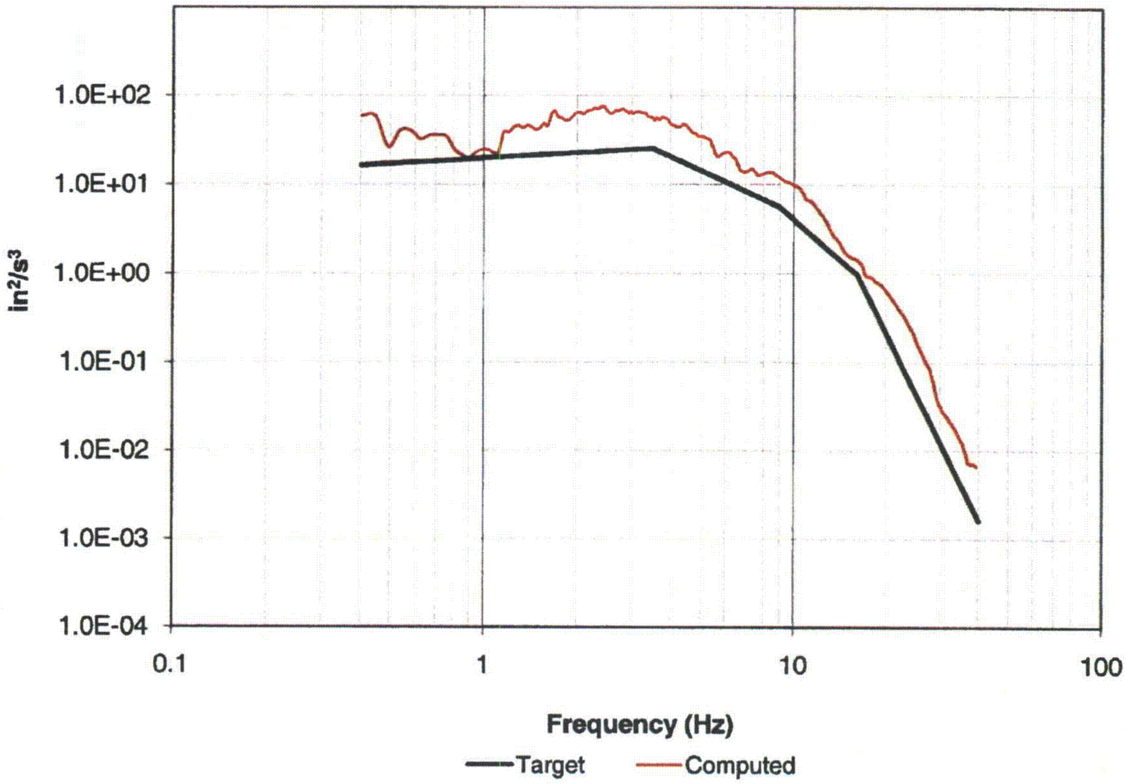

Figure 3H.8-21: Target vs. Computed Power Spectral Density, Vertical V1 Component

RAI 03.07.02-20, Supplement 1

QUESTION:

In response to COL License Information Item 3.22 the applicant in FSAR Section 3.7.5.4 states that ***"Nonsafety-related SSCs that are located in the same room as safety-related SSCs will be reviewed to determine if their failure will impact the ability of the safety-related SSC to perform its safety function. Non-seismic Category 1 SSCs whose failure could jeopardize the function of a safety-related SSC will be analyzed to demonstrate that structural integrity will be maintained in an SSE."*** Additional information is needed to determine how this review will be implemented. As such, the applicant is requested to describe in the FSAR in detail (a) the process for completing the design of balance-of-plant and non-safety related systems to minimize II/I interactions, (b) criteria to be used for determining if the failure of non-safety related SSCs will impact the ability of the safety-related SSCs to perform its safety function, and (c) the analysis/design criteria to be used for demonstrating structural integrity of non-seismic Category I SSCs.

SUPPLEMENTAL RESPONSE:

The original response to this RAI was submitted with STPNOC letter U7-C-STP-NRC-100035, dated February 4, 2010. This supplemental response provides a site-specific ITAAC for Seismic II/I Interaction, as requested by the NRC during the audit performed during the week of March 14, 2011.

COLA Revision 5, Part 9 will be revised as shown on the following page as a result of this supplemental response.

3.0 Site-Specific ITAAC

- Main Steam Lines Dynamic Analysis
- **Seismic II/I Interaction**

Table 3.0-19 Seismic II/I Interaction

Design Requirement	Inspections, Tests, Analyses	Acceptance Criteria
Failure of non-Seismic Category I SSCs located within a Seismic Category I structure will not impair the ability of the Seismic Category I SSCs within that structure to perform their intended safety function.	a. A Seismic II/I Interaction analysis will be performed.	a. A Seismic II/I Interaction analysis report exists that concludes that failure of non-Seismic Category I SSCs located within a Seismic Category I structure will not impair the ability of the Seismic Category I SSCs within that structure to perform their intended safety function by one of the following criteria: • The failing non-Seismic Category I SSC will not strike the Seismic Category I SSC. • The intended safety function of the Seismic Category I SSC is not impaired as a result of impact from the non-Seismic Category I SSC. • The non-Seismic Category I SSC is designed to prevent its failure (i.e. maintain structural integrity) under SSE condition.
	b. Inspection of as-built plant will be performed to confirm that the configuration is consistent with the Seismic II/I Interaction analysis.	b. As-built configuration is consistent with the Seismic II/I Interaction analysis. Reconciliation of deviations from the Seismic II/I Interaction analysis has been performed to conclude that these deviations will not impair the ability of the Seismic Category I SSCs to perform their intended safety function.

RAI 03.08.01-7, Supplement 1

QUESTION:

Follow-up question to Question 03.08.01-4 (RAI 2962)

The staff reviewed the applicant's response to Question 03.08.01-4 addressing the evaluation of standard plant structures for the increased flood level and needs the following additional information to complete the review:

(1) The applicant's response compares the out-of-plane shear and moment demands due to flood pressure with those due to the seismic load. The applicant did not include in its response any description or explanation about how the out-of-plane shear and moment demand for flood load and seismic load were obtained for the evaluation. Therefore, the staff requests the applicant to provide a detailed description of how the representative wall elements for the reactor building (RB) and the control building (CB) were selected for the evaluation, and how the reported shear and moment demands for flood and seismic load were determined.

(2) In its evaluation for impact of increased flood level on sliding and overturning stability, the applicant considered only the flood load acting on the bottom 6 ft of the above ground portion of the RB and the CB excluding buoyancy, and made a qualitative statement that the flood load is substantially less than the seismic load. Please explain why sliding and overturning of the structures due to flooding need not consider the hydrodynamic loads and the buoyancy effects on the structures, and provide a quantitative evaluation of sliding and overturning stability due to flooding. Please also update the FSAR to reflect that sliding and overturning of the RB and the CB were evaluated for the increased flood load on these structures.

(3) The applicant's response revises the factors of safety due to floatation for the RB and the CB, which are different from the values reported in Tables 3H.1-23 and 3H.2-5 of the ABWR DCD and in revised FSAR Sections 3H.1.6 and 3H.2.6. However, the applicant's response does not include the revision to the above ABWR DCD tables. Because the values of the floatation safety factors reported in DCD Tables 3H.1-23 and 3H.2-5 are no longer valid for the STP Units 3 and 4, the applicant is requested to address the issue appropriately.

SUPPLEMENTAL RESPONSE:

Revision 2 of the response to this RAI was submitted with STPNOC letter U7-C-STP-NRC-100253 dated November 29, 2010. This supplemental response revises the out-of-plane loads on the Reactor and Control Building walls under the flooded condition (see the following paragraph) as discussed in the NRC audit held during March 14-18, 2011. The flood water height is revised from 7' to 8' above groundwater elevation for calculating a pressure load on the walls; there is no impact on the conclusion presented in the previous response.

The increase in the out-of-plane load on the exterior walls of the RB and CB under flooded condition will be caused by a design basis flood elevation of 40 ft, which is 8 ft above the groundwater elevation reflected in the Tier 1 Table 5.0. The increased load includes above grade flood water pressure of 6' x 63.85pcf = 383.1 psf and below grade water pressure of 2' x 62.4 pcf = 124.8 psf, for a total pressure due to design basis flood of 507.9 psf. Referring to DCD Tier 2 Figures 3H.1-11 and 3H.2-14, the minimum seismic lateral soil pressure considered for design of below grade exterior walls of the RB and CB is 39.26 kPa or 819.96 psf which exceeds the 507.9 psf due to flood.

No COLA change is required as a result of this response.

RAI 03.08.01-9, Supplement 1

QUESTION:

Follow-up to Question 03.08.01-6

In its response to Question 03.08.01-6, the applicant addressed some of the issues regarding the watertight doors. However, additional information is needed to completely address all of the issues pertaining to the design of the watertight doors. In order for the staff to complete its review, the applicant is requested to provide the following additional information:

1. In Section 2 of the response, the applicant provided a sketch that shows the location of the watertight door between the Control building and the Radwaste Building Access Corridor. However, the applicant did not include the sketch in the FSAR mark-up provided with the response. Therefore, the applicant is requested to include the sketch in the FSAR to clearly identify locations of all seismic category I watertight doors.

2. In Section 3(a) of the response, the applicant provided loadings and loading combinations for design of watertight doors considering flooding. The staff needs the following clarifications for the loads and load combinations provided in the response:

    a. Since ANSI/AISC N690 and ACI 349 do not specifically address flood loads, please explain how the flood loads and the loading combinations, including the load factors used in loading combinations involving flood load, were determined with reference to applicable industry codes and standards. Please include in FSAR Section 3H.6.4.3.3.4, "Extreme Environmental Flood (FL)," a description of the various components of flood load, e.g., hydrostatic load, hydrodynamic load, impact load from debris transported by flood water, etc., and the corresponding design values used.

    b. The applicant defined pressure load 'P' as hydrostatic or differential pressure, and used t in several loading combinations. Please explain why only pressure load 'P' need to be considered for design of watertight doors, and not the other components of FL, e.g., hydrodynamic load and load from debris transported by flood.

3. In Section 3(b) of the response, the applicant stated that the doors will be designed in accordance with AISC N690. Since it is not clear which version of ANSI/AISC N690 was used by the applicant, please confirm that the version of the specification used is the same as that referenced in SRP 3.8.4 and update FSAR accordingly, or provide justification for using a different version.

4. In response to the staff's question regarding design and analysis procedure used for the watertight doors, the applicant stated in Section 3(c) of the response that "the design of the door will be performed in accordance with the requirements of SRP Section 3.8.4."

SRP 3.8.4 provides general guidance and acceptance criteria for analysis and design procedure of concrete and steel category I structure. Merely referencing the SRP does not provide any information about the analysis and design procedure used by the applicant. Therefore, the applicant is requested to include in the FSAR a description of the analysis and design procedure including how seismic loads are determined for the watertight doors.

5. In response to the staff's question regarding testing and in-service inspection of the watertight doors, the applicant stated in Section 3(f) of the response, and the FSAR mark-up included in the response, that the watertight doors will allow slight seepage during an external flooding in accordance with criteria for Type 2 closures in U.S. Army Corps of Engineers (COE) EP 1165-2-314. The applicant also stated that this criterion will be met under hydrostatic loading of 12 inches of water above the design basis flood level. The applicant further stated that the water retaining capability of the doors will be demonstrated by qualification tests that shall not allow leakage more than 1/10 gallon per linear foot of gasket when subjected to the specified head pressure plus a 25% margin for one hour. The applicant did not provide in the response any information regarding in-service inspections of the watertight doors. In order for the staff to assess adequacy of the watertight doors and their availability when needed, please provide the following additional information:

    a. The allowable leakage of 1/10 gallon per linear foot of gasket per hour may potentially allow ingress of significant amount of water over time. Please provide justification why this leakage is considered to meet criterion for Type 2 closure, which is defined to form essentially dry barriers or seals, and the basis for the underlying assumption that such leakage will not compromise functionality of any safety related commodity or any other design basis.

    b. Since hydrostatic pressure on the door may help in providing a seal for the door, please explain why testing these doors against the maximum water pressure only is adequate, and will envelope performance of the seals during lower hydrostatic pressure.

    c. Since the applicant did not include in its response any information about the in-service surveillance programs for the watertight doors, and corresponding FSAR update, please explain how availability of the normally open watertight doors during a flooding event is ensured considering that these doors will need to be closed upon indication of an imminent flood.

6. In Section 6 of the response, the applicant states that the access doors between the Reactor Building (RB) and Control building (CB) are not required to be watertight since both buildings are separately protected from design basis flood, and the gap between the two buildings will be sealed using the detail shown in Figure 03.08-04-15A, which is attached to the response to RAI 03.08.04-15 (see STPNOC letter U7-C-STP-NRC-090160 dated October 5, 2009). The above referenced Figure provides

only a conceptual detail of a joint seal between the buried Reactor Service Water (RSW) tunnels, and the RSW Pump House and the Control Buildings. In its response to a subsequent follow-up question 03.08.04-25 for the above referenced joint seal, the applicant provided additional design criteria for the seals to accommodate differential movements across the seal, and explained that because of the low rate with which groundwater can flow through the seal if it were to fail in any particular location, the in-leakage of groundwater is a housekeeping issue and not a safety concern. Since the seals for the gaps between the RB and the CB are credited to prevent ingress of flood water into these buildings and provide protection to safety related commodities against flooding, reference to the joint seals used for the RSW tunnels does not adequately address the issue of ingress of flood water and potential damage to safety related components. Therefore, the applicant is requested to include in the FSAR a description of the seal between the RB and the CB including information about seismic classification, performance demand, qualification, and in-service inspection of the seal to demonstrate that the seals will be capable of preventing flood water from entering these buildings under all postulated design basis loading conditions.

The staff needs the above information to conclude that the watertight doors are designed for appropriate loads and load combinations, pertinent design information per guidance provided in SRP 3.8.4 are included in the FSAR, and there is reasonable assurance that the normally open watertight doors will be available during a flooding event.

SUPPLEMENTAL RESPONSE:

Revision 2 of the response to this RAI was submitted with NINA letter U7-C-NINA-NRC-110042, dated March 7, 2011. This supplemental response reflects changes discussed in the NRC audit held during March 14-18, 2011 to clarify the testing commitments for the watertight joint seals when subjected to the expected long-term settlement. Specifically, the testing program will demonstrate that the seal material can withstand a movement of ±25% of the gap size or the expected long-term settlement, whichever is larger, in any resultant direction and still be watertight.

The following page provides the revised mark-up for COLA Part 2, Tier 2, Section 3.4.3.1. This mark-up is based on COLA Rev. 5 and subsequent mark-ups provided in RAI responses submitted through March 25, 2011.

3.4.3.1 Flood Elevation

The seal material and joint seal assembly shall be tested to be watertight when subjected to the maximum anticipated hydrostatic head. The testing program will demonstrate the following:

- The seal material can withstand a movement of ±25% of the gap size or the expected long-term settlement, whichever is larger, in any resultant direction and still be watertight.
- The seal material can compress to 1/3 of its thickness without developing more than 25 psi pressure on the adjacent structures.
- The entire joint seal assembly, including the watertight joint seal and redundant water stop, prevents the total leakage during an SSE event from exceeding that which would cause internal flooding to exceed the height of the flooding protection curbs or raised equipment pads. The total permitted leakage of the joint seal assembly shall be determined for the entire duration of the SSE when subjected, simultaneously, to the maximum anticipated hydrostatic head pressure, the maximum differential displacements due to long term settlement or tilt, and the maximum differential displacements due to SSE.
- The seal material will function as a watertight barrier after being subjected to the maximum displacements due to a SSE and the redundant water stop on the interior side of the joint can withstand the SSE maximum displacements without degradation.

The foregoing requirements will demonstrate that the material is capable of being watertight after the effects of long term settlement or tilt, as well as during normal operating vibratory loading such as SRV actuation and not impact the adjacent structures. Although this will provide margin to accommodate differential displacements from the majority of the movements from short duration extreme environmental loading such as SSE, the seals need not be designed to be watertight during the maximum differential displacements from these extreme environmental loadings.