

ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Friday, October 21, 2011 12:48 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 489 (5802), FSAR Ch. 3, Supplement 2
Attachments: RAI 489 Supplement 2 Response US EPR DC - INTERIM.pdf

Getachew,

On June 23, 2011, AREVA NP Inc. provided a schedule for a technically correct and complete response to the 1 question in RAI 489. Supplement 1 was sent on October 14, 2011 to provide a revised schedule.

The attached file, "RAI 489 Supplement 2 Response US EPR DC - Interim.pdf" provides an INTERIM response to Question 03.07.02-75.

The following table indicates the respective pages in the response document, "RAI 489 Supplement 2 Response US EPR DC - Interim.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 489 — 03.07.02-75	2	100

The schedule for a technically correct and complete final response to the question has been changed as provided below.

Question #	Interim Response Date	Response Date
RAI 489 — 03.07.02-75	October 21, 2011 (Actual)	February 17, 2012

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: Friday, October 14, 2011 3:47 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 489 (5802), FSAR Ch. 3, Supplement 1

Getachew,

On June 23, 2011, AREVA NP Inc. provided a schedule for a technically correct and complete response to the 1 question in RAI 489.

The schedule for a technically correct and complete interim and final response to the question has been changed as provided below.

Question #	Interim Response Date	Response Date
RAI 489 — 03.07.02-75	October 21, 2011	January 10, 2012

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: Thursday, June 23, 2011 11:49 AM
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. 489 (5802), FSAR Ch. 3

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 489 Response US EPR DC.pdf" provides a schedule since a technically correct and complete response to the question cannot be provided at this time.

The following table indicates the respective pages in the response document, "RAI 489 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 489 — 03.07.02-75	2	2

The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 489 — 03.07.02-75	October 14, 2011

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager

AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
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Phone: 704-805-2223

Email: Dennis.Williford@areva.com

From: Tesfaye, Getachew [<mailto:Getachew.Tesfaye@nrc.gov>]

Sent: Tuesday, May 24, 2011 4:20 PM

To: ZZ-DL-A-USEPR-DL

Cc: Xu, Jim; Shams, Mohamed; Hawkins, Kimberly; Miernicki, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource

Subject: U.S. EPR Design Certification Application RAI No. 489 (5802), FSAR Ch. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on May 16, 2011, and on May 24, 2011, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. 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: 3491

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D4937F56)

Subject: Response to U.S. EPR Design Certification Application RAI No. 489 (5802),
FSAR Ch. 3, Supplement 2
Sent Date: 10/21/2011 12:47:48 PM
Received Date: 10/21/2011 12:49:00 PM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

Recipients:

"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
Tracking Status: None
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Tracking Status: None
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Tracking Status: None
"Tsfaye, Getachew" <Getachew.Tsfaye@nrc.gov>
Tracking Status: None

Post Office: auscharm02.adom.ad.corp

Files	Size	Date & Time
MESSAGE	4779	10/21/2011 12:49:00 PM
RAI 489 Supplement 2 Response US EPR DC - INTERIM.pdf		2860817

Options

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

Response to

**Request for Additional Information No. 489(5802), Revision 0,
Supplement 2**

5/24/2011

U.S. EPR Standard Design Certification

AREVA NP Inc.

Docket No. 52-020

SRP Section: 03.07.02 - Seismic System Analysis

Application Section: 3.7.2

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

Question 03.07.02-75:**POTENTIAL OPEN ITEM**

The Defense Nuclear Facilities Safety Board (DNFSB) issued a letter on April 8th, 2011 requesting the Department of Energy (DOE) to address technical and software quality assurance issues related to potentially erroneous seismic analyses performed using the SASSI Subtraction method. A version of SASSI is used by AREVA in the seismic analyses performed in support of the U.S. EPR design certification (DC) application.

The analyses included in Rev. 0 and Rev. 1 of the FSAR were performed considering the NI basemat structures, the NAB, and the EPGB as surface structures. Therefore, the subtraction method is not a concern in these calculations. The ESWB is analyzed as an embedded structure. Therefore the subtraction issue may be of concern for this analysis if it were used in the SASSI modeling approach. The response to RAI 320 indicates that the updated analyses involve considering embedment effects for these structures.

To ensure the applicant has adequately met General Design Criteria (GDC) 1 and 2 to Part 50 and Appendix B to Part 50, the staff requests AREVA to provide the following information:

- a. Confirm whether the SASSI Subtraction method is used in the seismic analyses
- b. Provide how AREVA addresses the technical and software quality assurance issues raised by DNFSB letter in the version of SASSI which AREVA uses for seismic analyses
- c. If the SASSI Subtraction method is used by AREVA, provide an assessment to establish: a) the seismic analyses performed in support of the U.S. EPR DC application do not contain any errors or anomalies as identified in DNFSB letter, b) QA steps taken to ensure any future seismic analyses in support of the U.S. EPR DC application will be free from errors or anomalies as identified in DNFSB letter

Response to Question 03.07.02-75:**Item a:**

The Subtraction Method (SM) in MTR/SASSI is used for the soil-structure interaction (SSI) analysis of the following structures:

- Nuclear Island (NI) (and NAB).
- Emergency power generating building (EPGB).
- Essential service water building (ESWB) – in-progress.

The NI and NAB were originally modeled as surface-founded structures in Rev. 0 and Rev. 1 of the U.S. EPR FSAR, but they are now analyzed as embedded structures using the MTR/SASSI Subtraction method. The SSI analysis is described in response to RAI 320, Question 03.07.02-63.

The Emergency Power Generating Building was originally modeled as a surface-founded structure in Rev. 0 and Rev. 1 of the U.S. EPR FSAR, but is now analyzed using the MTR/SASSI Subtraction Method. The SSI analysis is described in response to RAI 376, Question 03.08.05-31.

The Essential Service Water Building was originally analyzed using Bechtel's SASSI2000 Subtraction Method in Rev. 0 and Rev. 1 of the FSAR, but it is now being reanalyzed in response to RAI 376, Question 03.08.05-31. The method that will be used will be described in response to RAI 376, Question 03.08.05-31.

Item b:

To investigate the potential technical issues raised by the DNFSB regarding the Subtraction Method, two test problems are analyzed using MTR/SASSI to examine the accuracy of different impedance modeling schemes. The first is a benchmark problem that compares the results of the Direct, Subtraction, and Modified Subtraction Methods in terms of scattering and impedance solutions against those of published literature. The second represents a simplified model of a nuclear power plant structure analyzed for a standard soil site in the Western United States (WUS) and a hard rock site in the Central and Eastern United States (CEUS). The results of the second model in terms of computed transfer functions, maximum accelerations, response spectra and dynamic soil pressures obtained from different modeling schemes are compared at several key locations in the structure.

Based on the results of these comparisons, it was concluded that the Subtraction Method is valid for limited applications and that the Direct Method should be used when feasible. The Modified Subtraction Method, where surface nodes are also included as interaction nodes, produces results close to the Direct Method and is a good alternative if used with proper caution.

Item c:

To assess the impact of the Subtraction Method, AREVA has performed sensitivity analyses. SSI analyses were performed for the Nuclear Island (NI) based on soil cases 4ue-m and hfub (also known as BB_UB). The Modified Subtraction Method (MSM), which adds the surface nodes to the list of interaction nodes, was used in these studies. Transfer functions and in-structure response spectra (ISRS) at key locations were generated from these analyses and compared against the ISRS and transfer functions from the Subtraction Method. A comparison of transfer functions and ISRS for both soil cases are shown in Figure 03.07.02-75-1 through Figure 03.07.02-75-96. The ISRS and transfer functions for other key locations are currently under review. The results for these locations will be provided in the final response.

The comparisons demonstrate that:

- The MSM produces transfer functions and corresponding ISRS that are generally in very good agreement up to 15 Hz with the results from SM.
- While some transfer functions determined using SM may contain variances, the impact on ISRS due to these variances is minimal. Most of the variances are in the high frequency region where some spikes from the SM analyses produce very conservative ISRS peaks.
- SSI analyses performed for DC would not change significantly if reanalyzed using MSM or DM. Therefore, the analyses performed using SM provided adequate seismic design demands.
- MSM method is appropriate for future SSI analyses provided transfer functions are reviewed for variances.

FSAR Impact:

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

Figure 03.07.02-75-1—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), Transfer Functions for 4UE-M at Node 19717, SM vs. MSM, X (E-W) Response due to X (E-W) Input

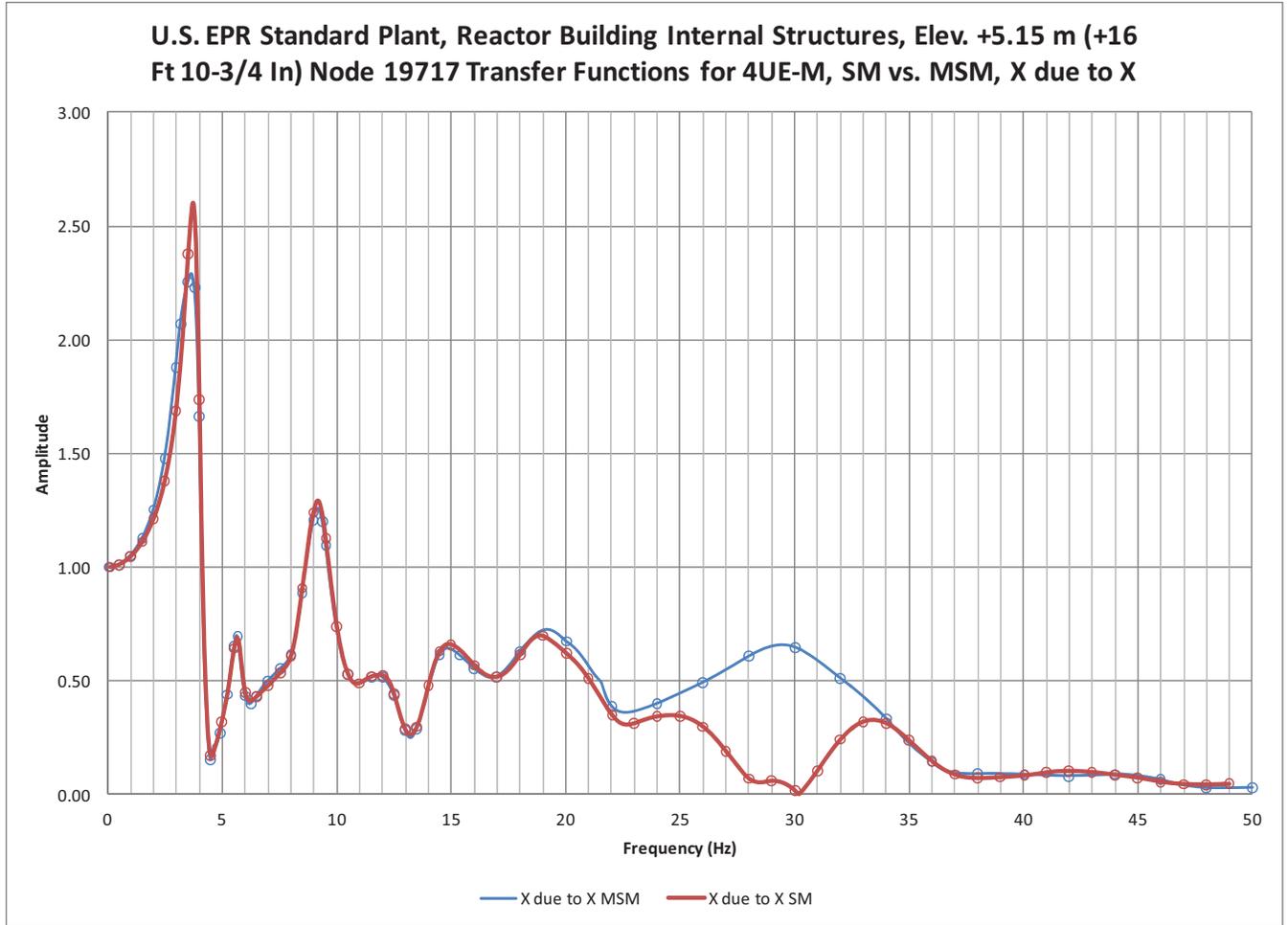


Figure 03.07.02-75-2—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), Transfer Functions for 4UE-M at Node 19717, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input

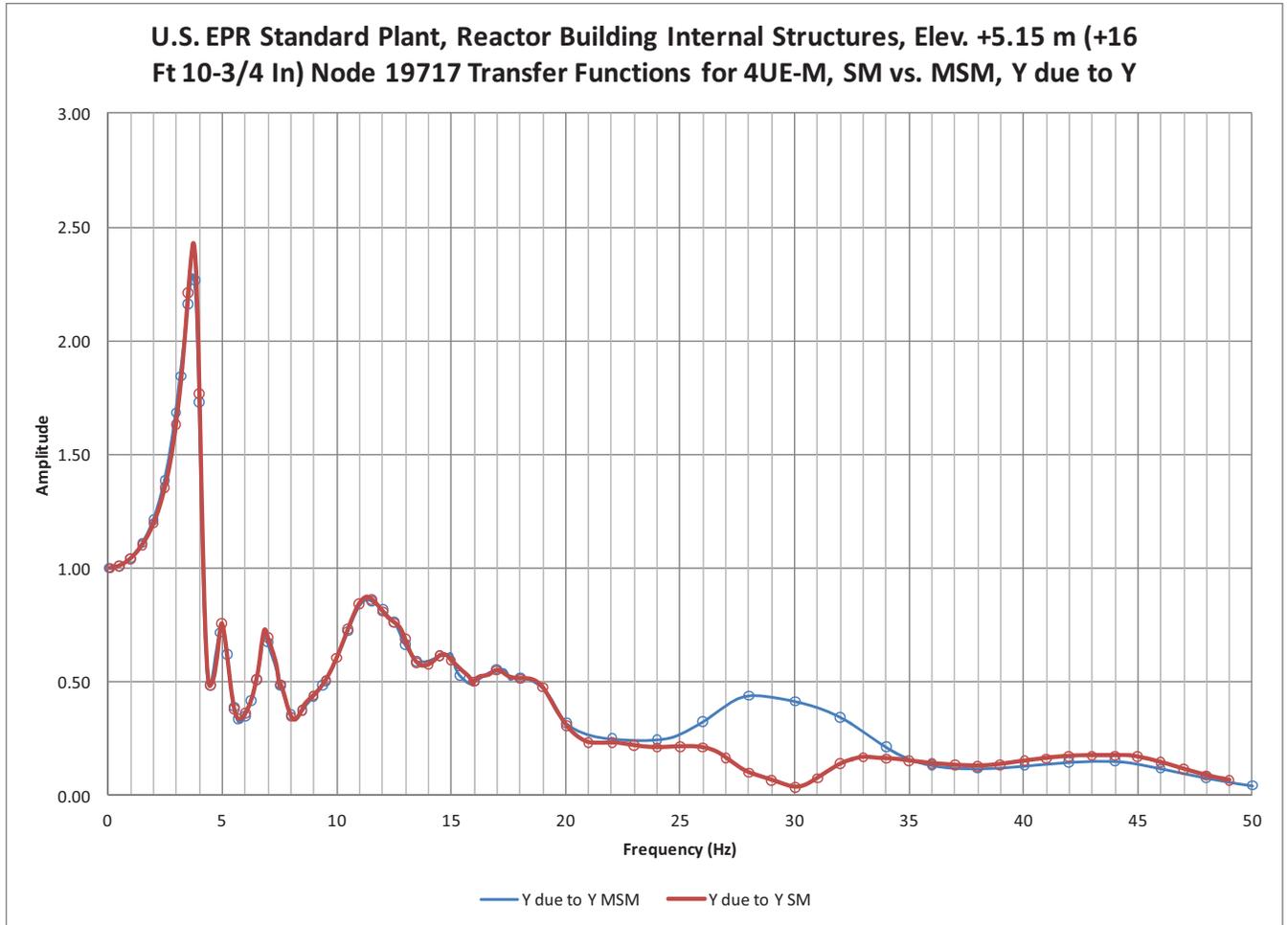


Figure 03.07.02-75-3—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), Transfer Functions for 4UE-M at Node 19717, SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input

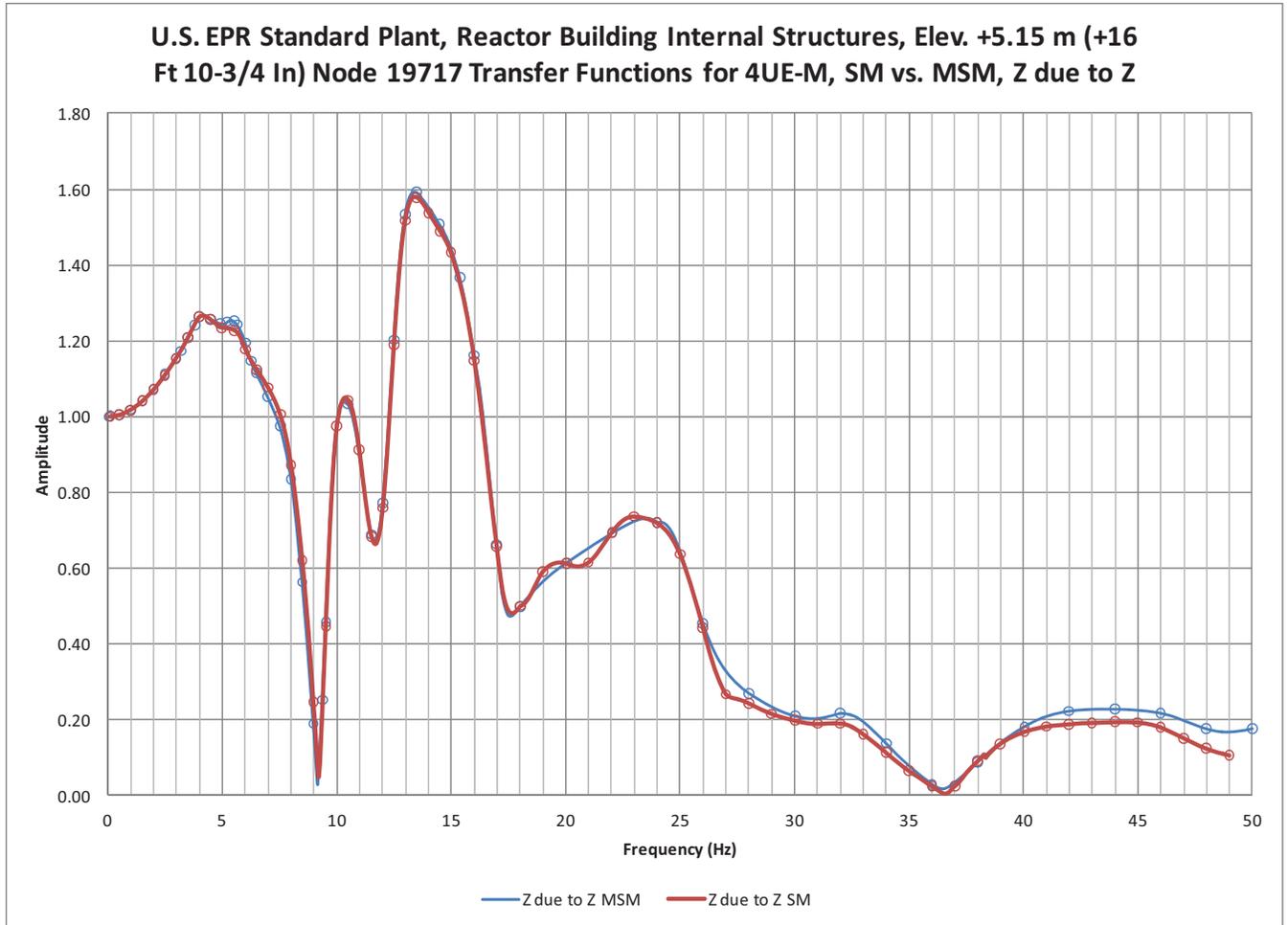


Figure 03.07.02-75-4—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +19.50 m (+63 ft 11-3/4 in), Transfer Functions for 4UE-M at Node 37467, SM vs. MSM, X (E-W) Response due to X (E-W) Input

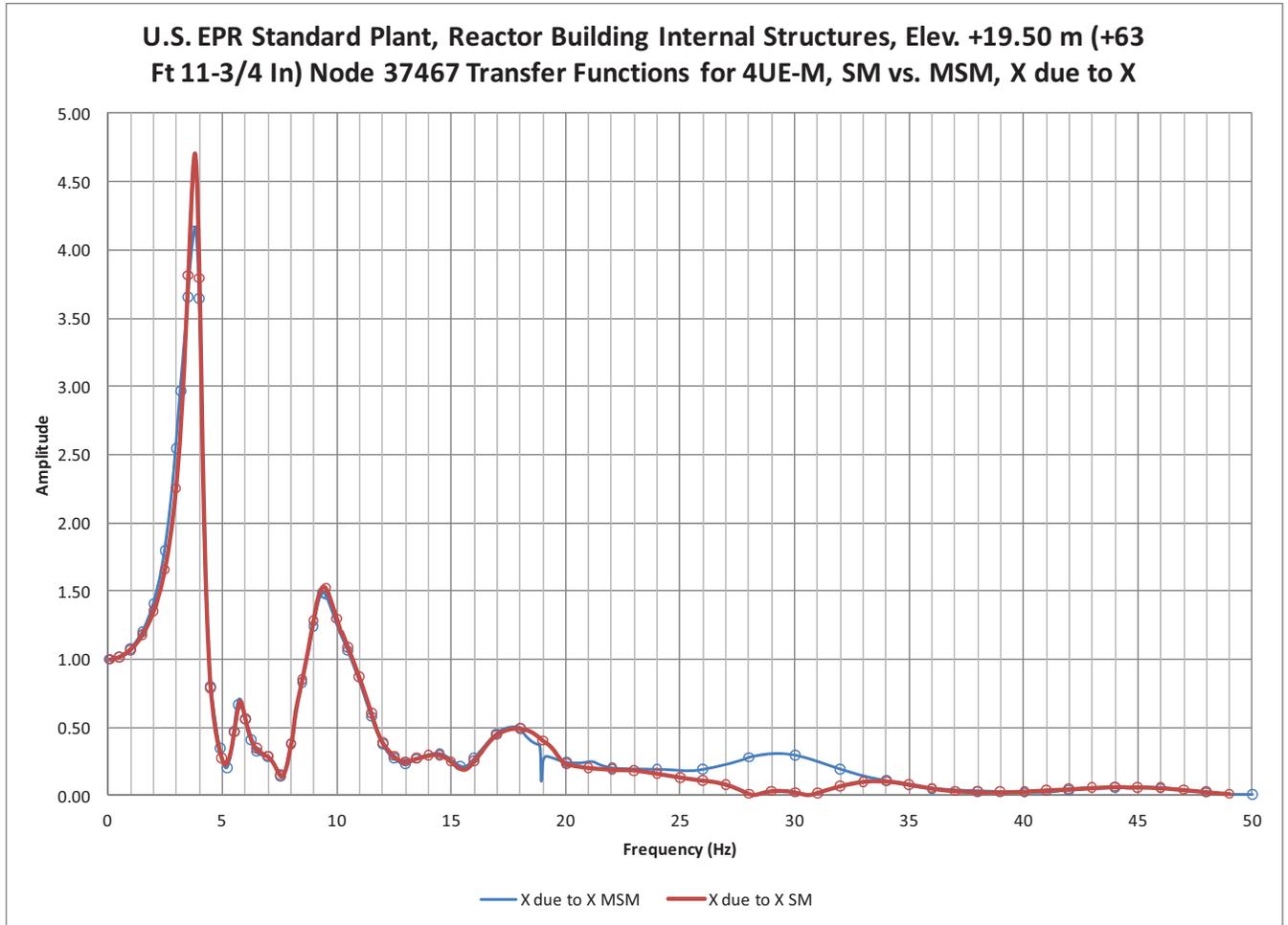


Figure 03.07.02-75-5—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +19.50 m (+63 ft 11-3/4 in), Transfer Functions for 4UE-M at Node 37467, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input

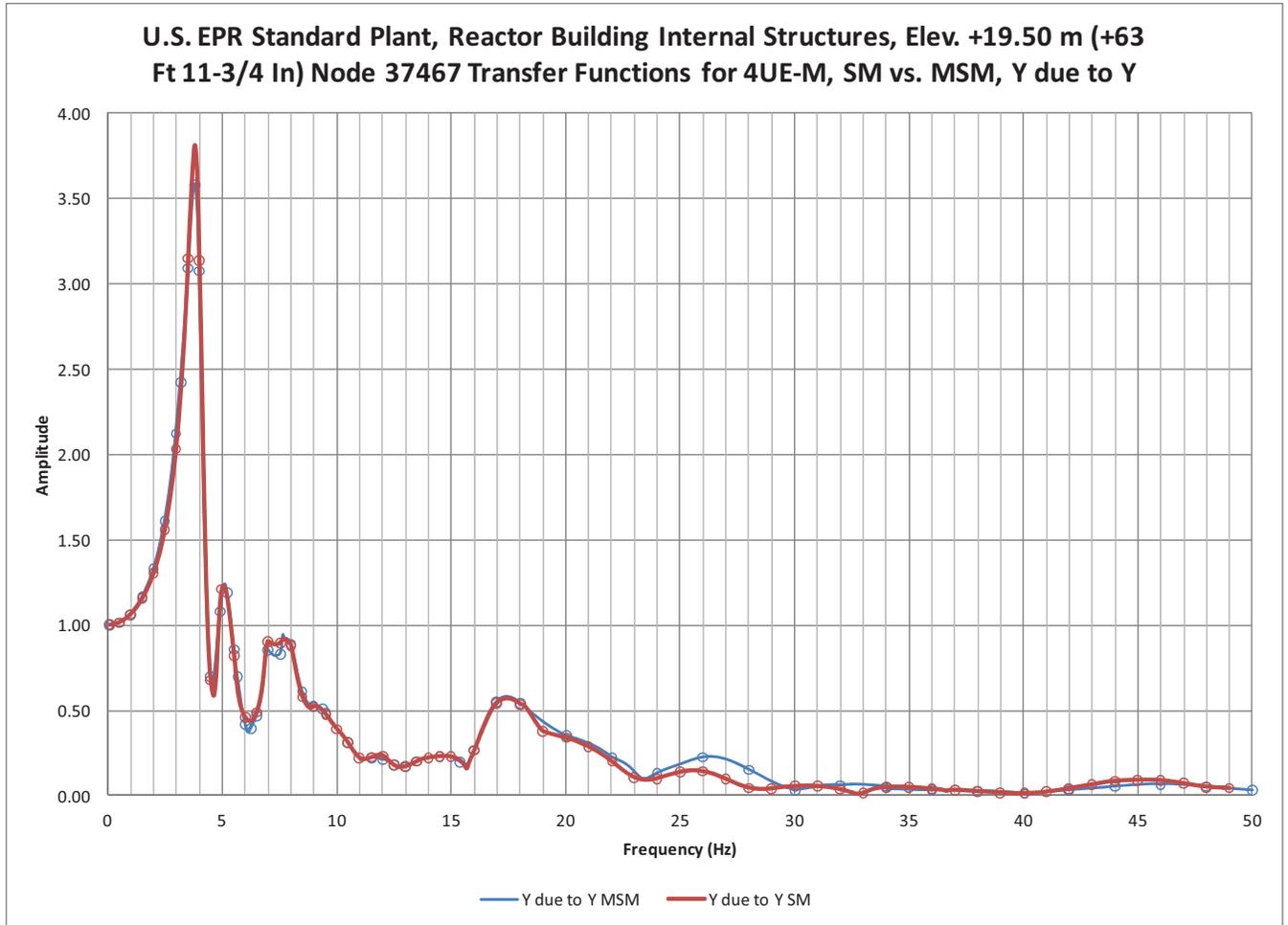


Figure 03.07.02-75-6—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +19.50 m (+63 ft 11-3/4 in), Transfer Functions for 4UE-M at Node 37467, SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input

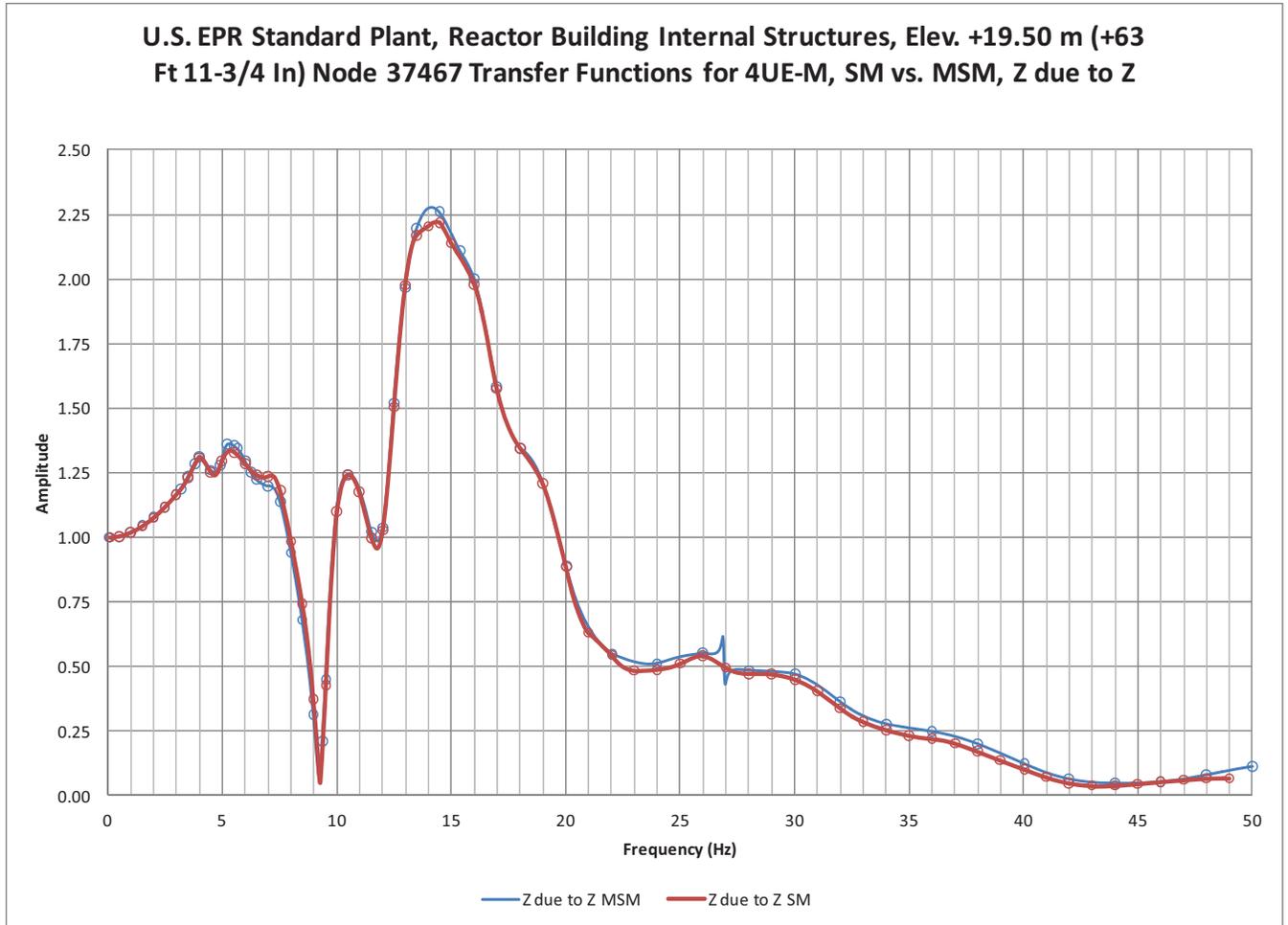


Figure 03.07.02-75-7—U.S. EPR Standard Plant, Safeguard Building 1, Elev. +8.10 m (+26 ft 7 in), Transfer Functions for 4UE-M at Node 24211, SM vs. MSM, X (E-W) Response due to X (E-W) Input

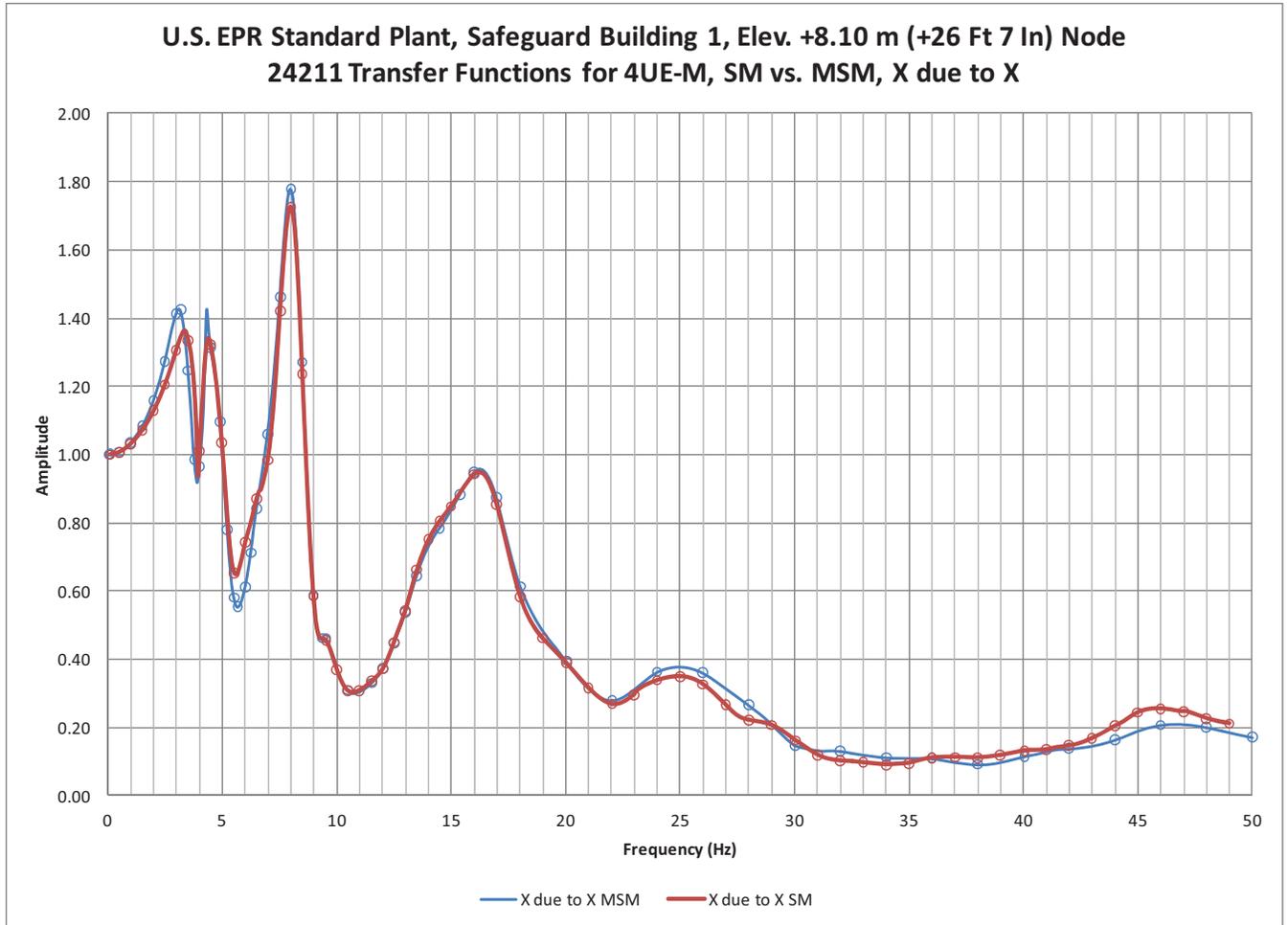


Figure 03.07.02-75-8—U.S. EPR Standard Plant, Safeguard Building 1, Elev. +8.10 m (+26 ft 7 in), Transfer Functions for 4UE-M at Node 24211, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input

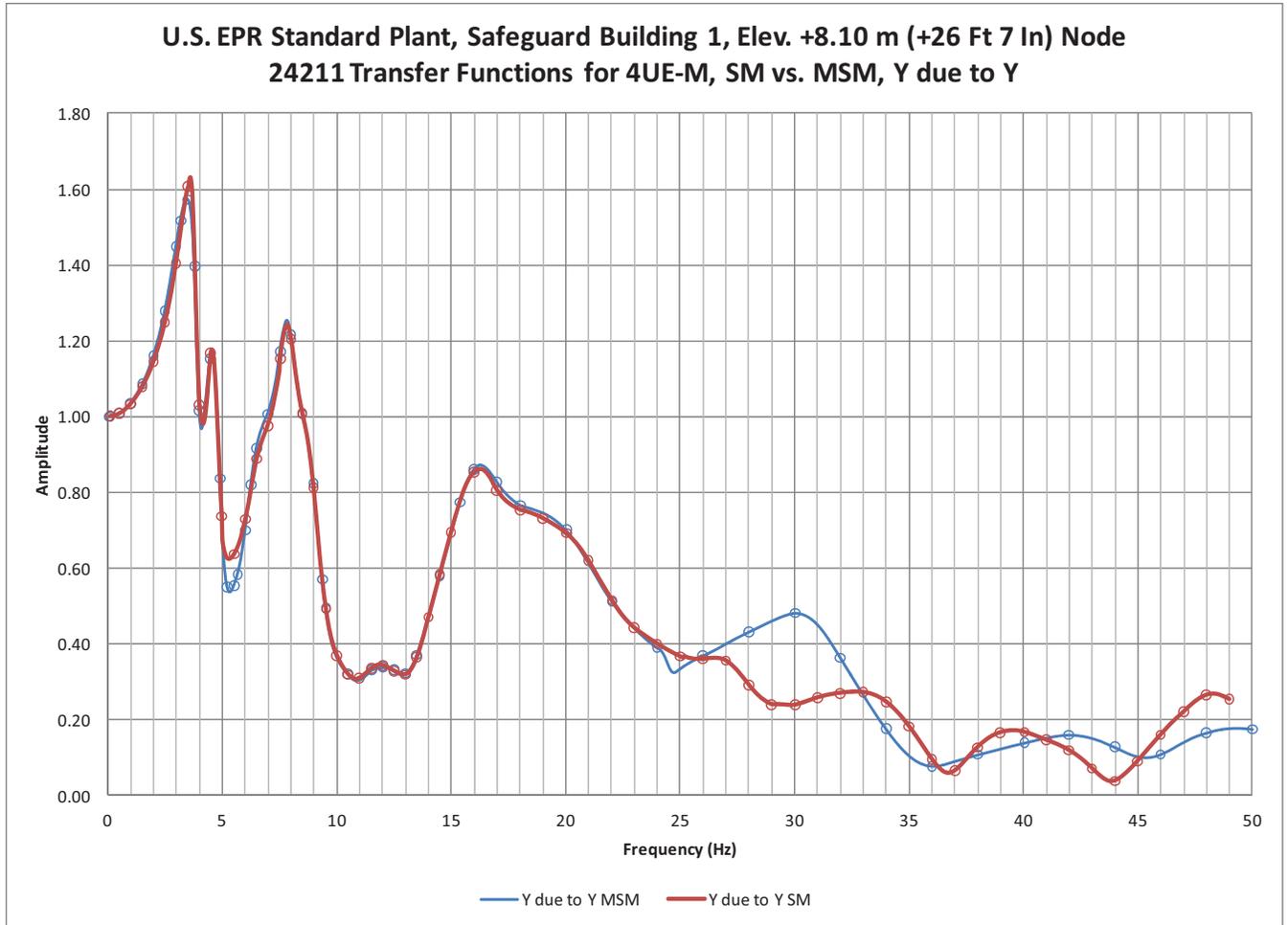
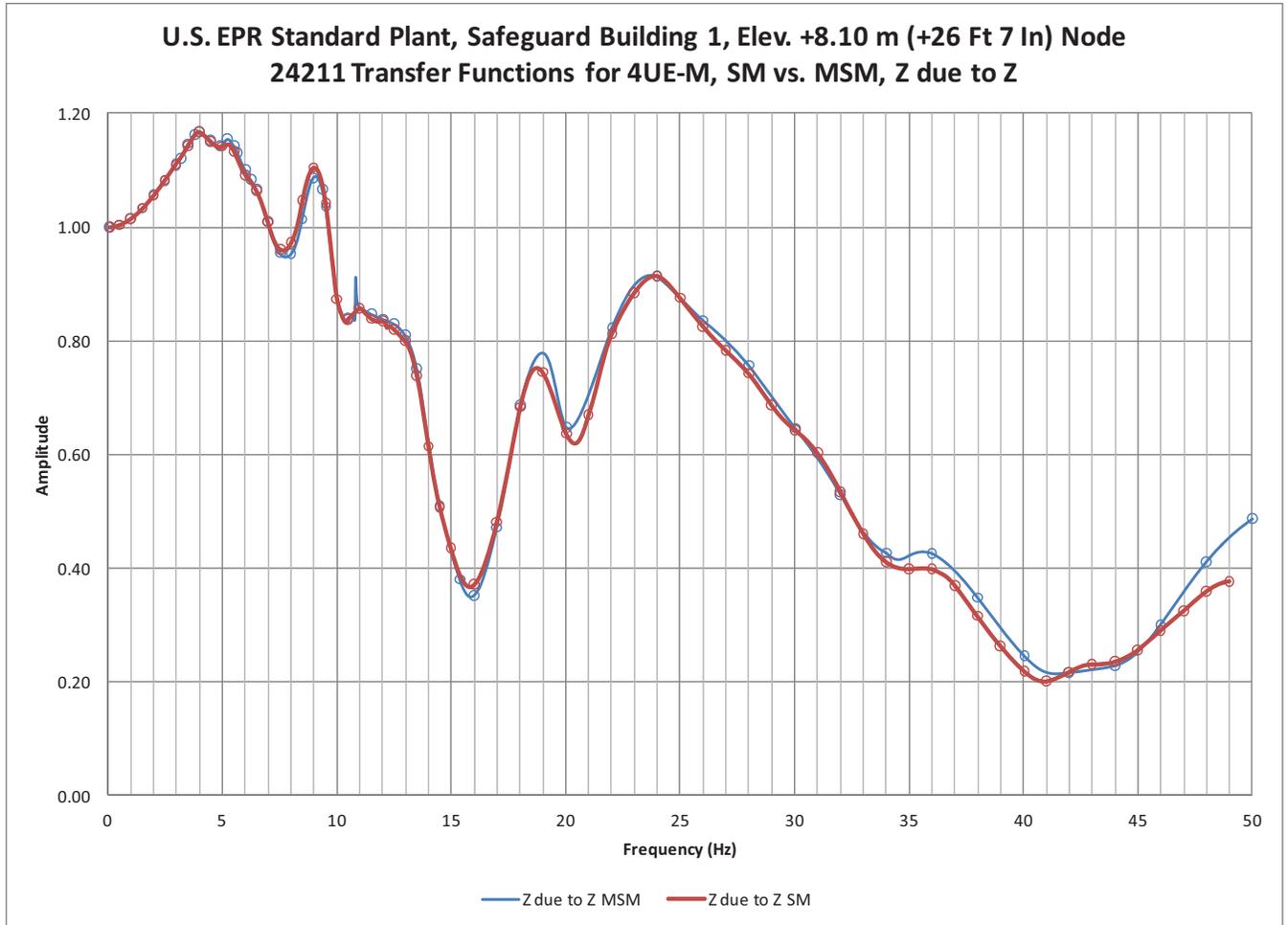
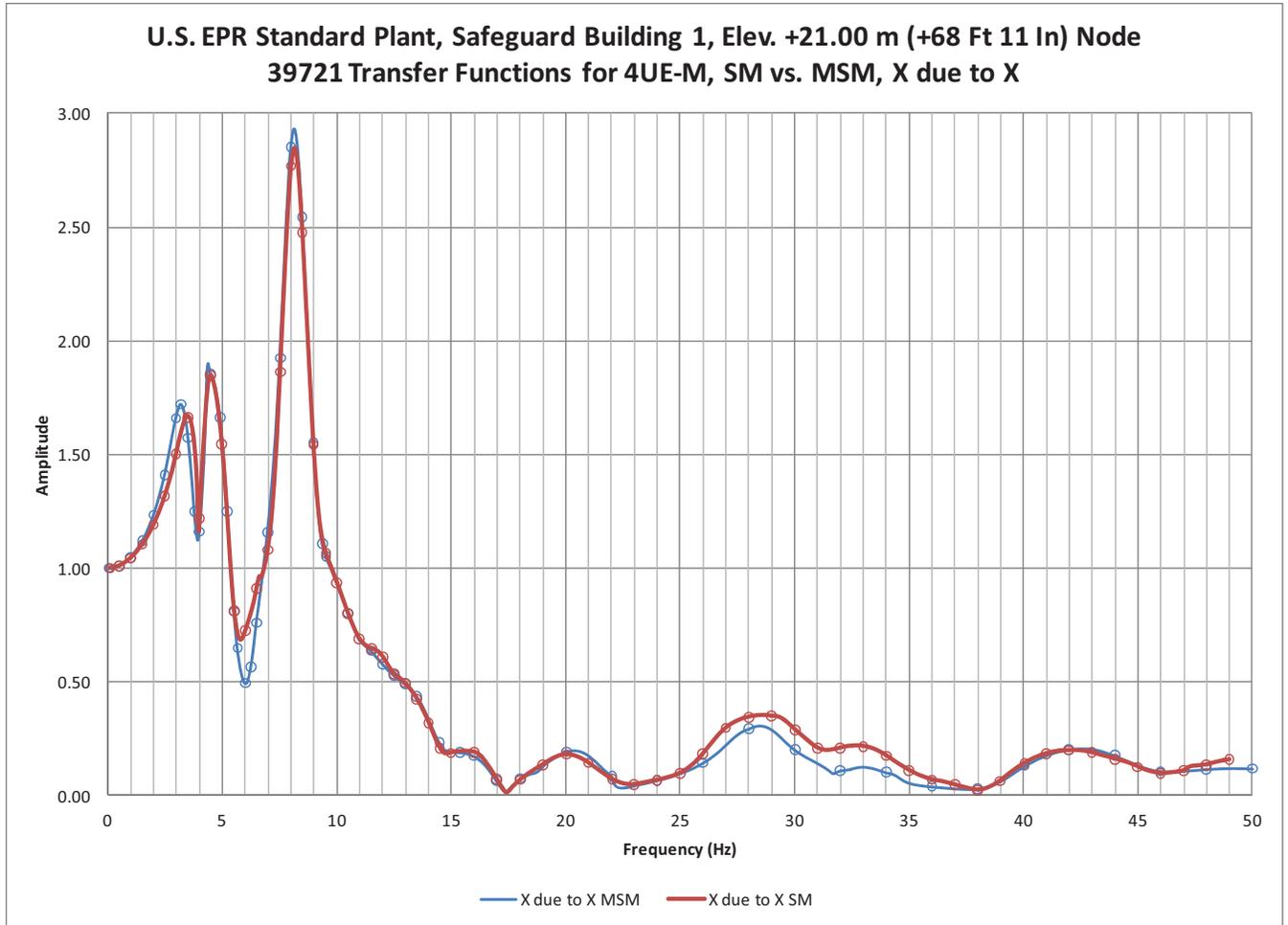


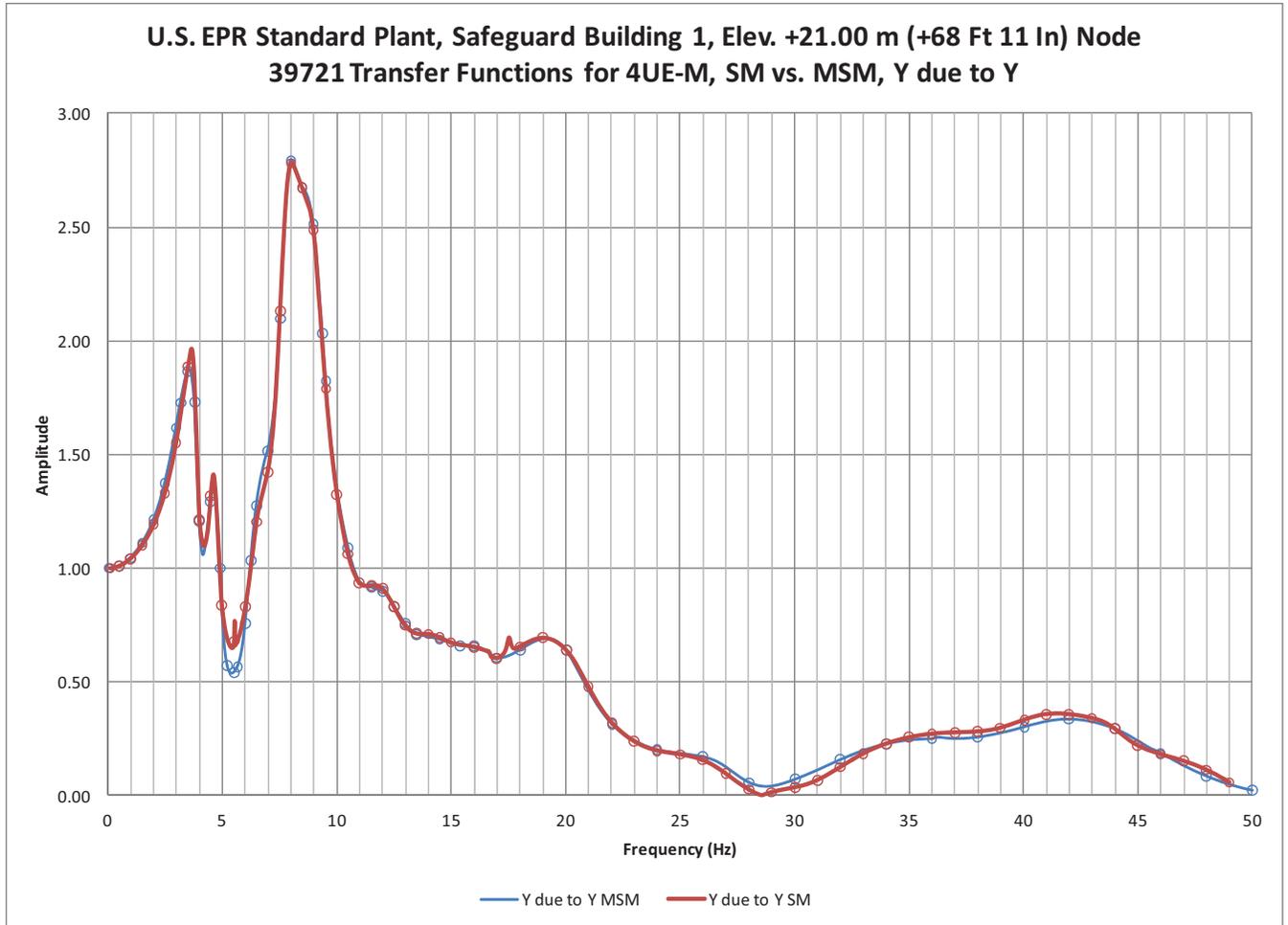
Figure 03.07.02-75-9—U.S. EPR Standard Plant, Safeguard Building 1, Elev. +8.10 m (+26 ft 7 in), Transfer Functions for 4UE-M at Node 24211, SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input



**Figure 03.07.02-75-10—U.S. EPR Standard Plant, Safeguard Building 1,
Elev. +21.00 m (+68 ft 11 in), Transfer Functions for 4UE-M at Node 39721,
SM vs. MSM, X (E-W) Response due to X (E-W) Input**



**Figure 03.07.02-75-11—U.S. EPR Standard Plant, Safeguard Building 1,
Elev. +21.00 m (+68 ft 11 in), Transfer Functions for 4UE-M, at Node 39721,
SM vs. MSM, Y (N-S) Response due to Y (N-S) Input**



**Figure 03.07.02-75-12—U.S. EPR Standard Plant, Safeguard Building 1,
Elev. +21.00 m (+68 ft 11 in), Transfer Functions for 4UE-M at Node 39721,
SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input**

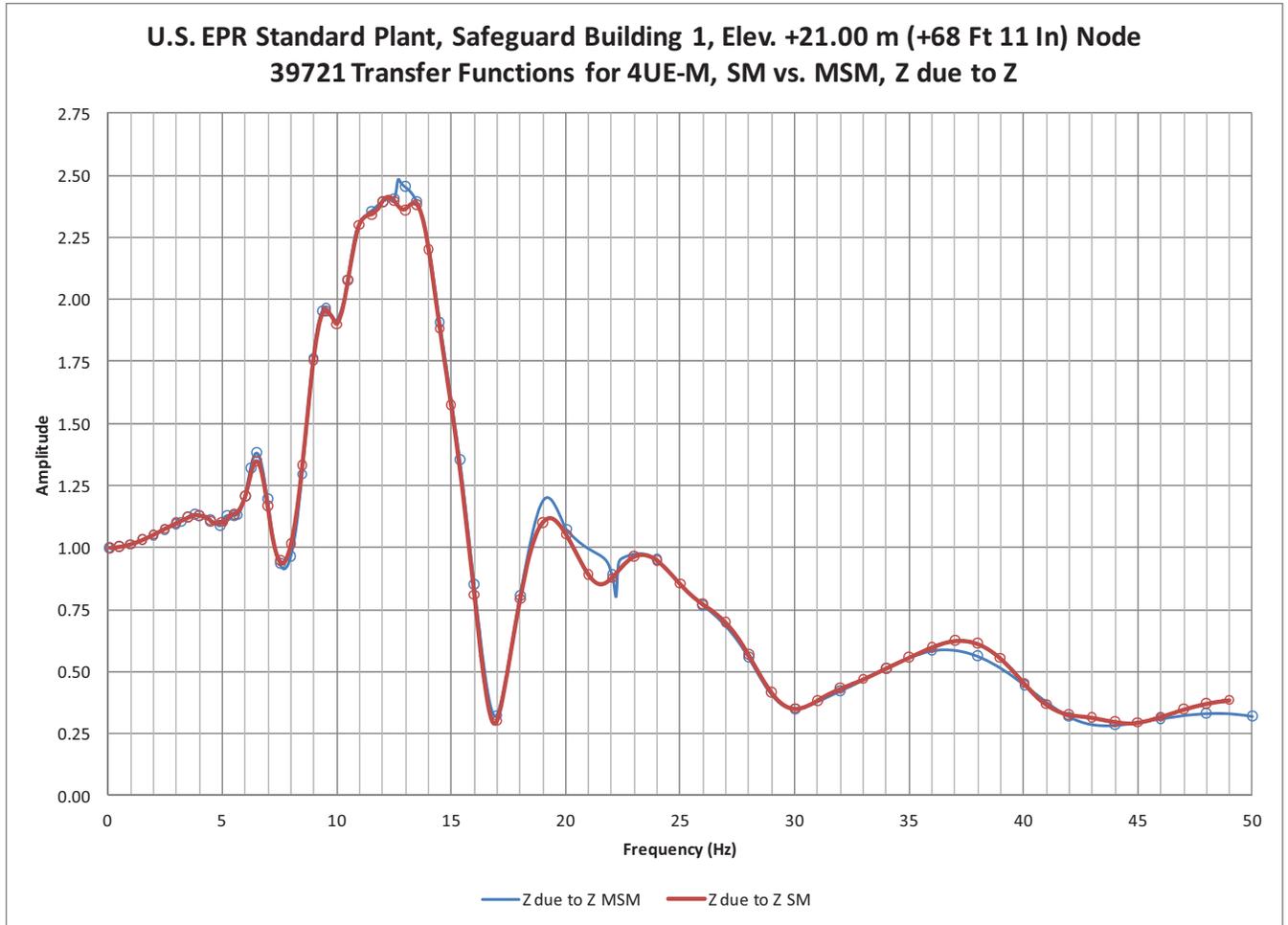


Figure 03.07.02-75-13—U.S. EPR Standard Plant, Safeguard Building 2/3, Elev. +8.10 m (+26 ft 7 in), Transfer Functions for 4UE-M at Node 22993, SM vs. MSM, X (E-W) Response due to X (E-W) Input

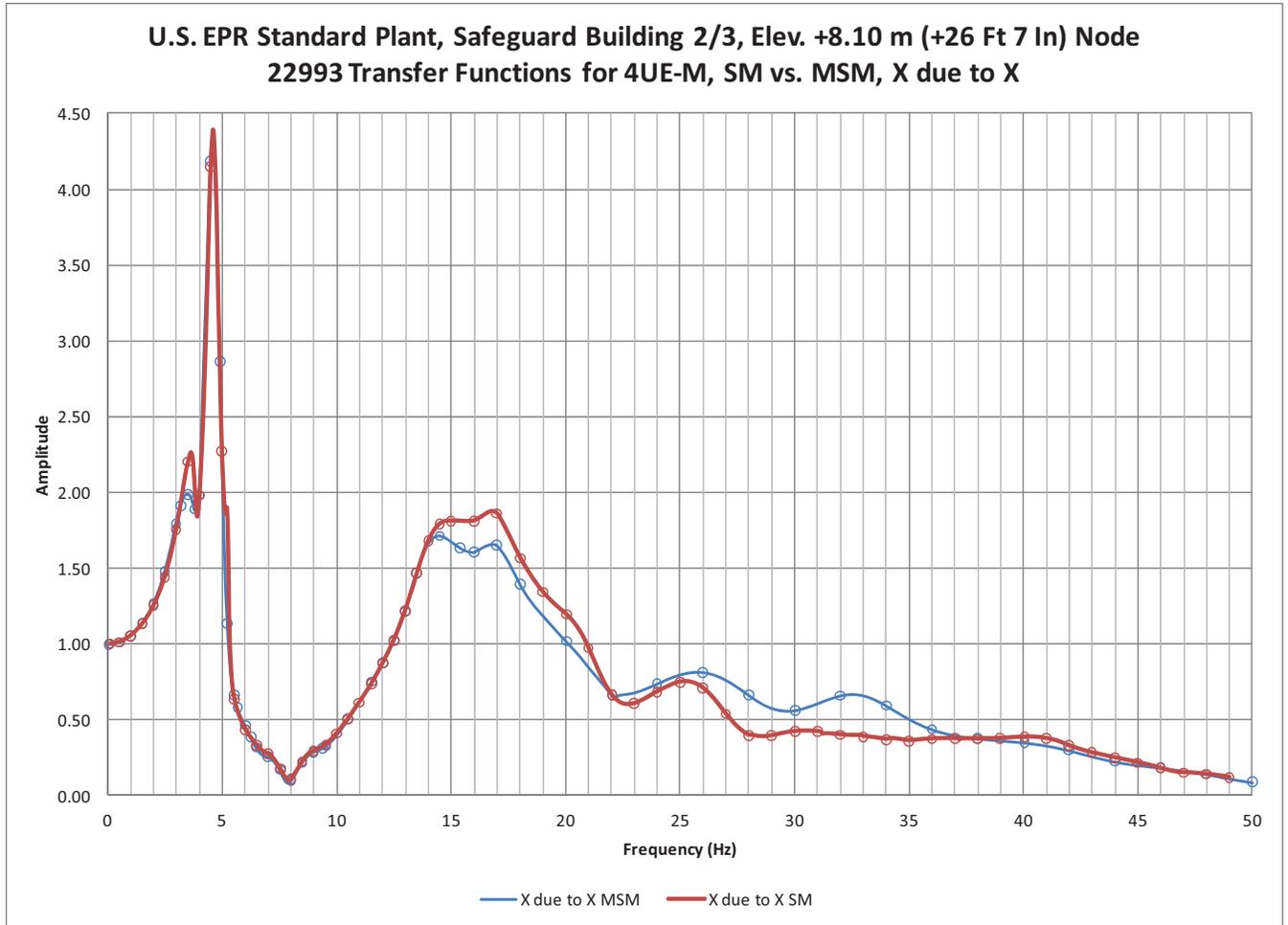


Figure 03.07.02-75-14—U.S. EPR Standard Plant, Safeguard Building 2/3, Elev. +8.10 m (+26 ft 7 in), Transfer Functions for 4UE-M at Node 22993, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input

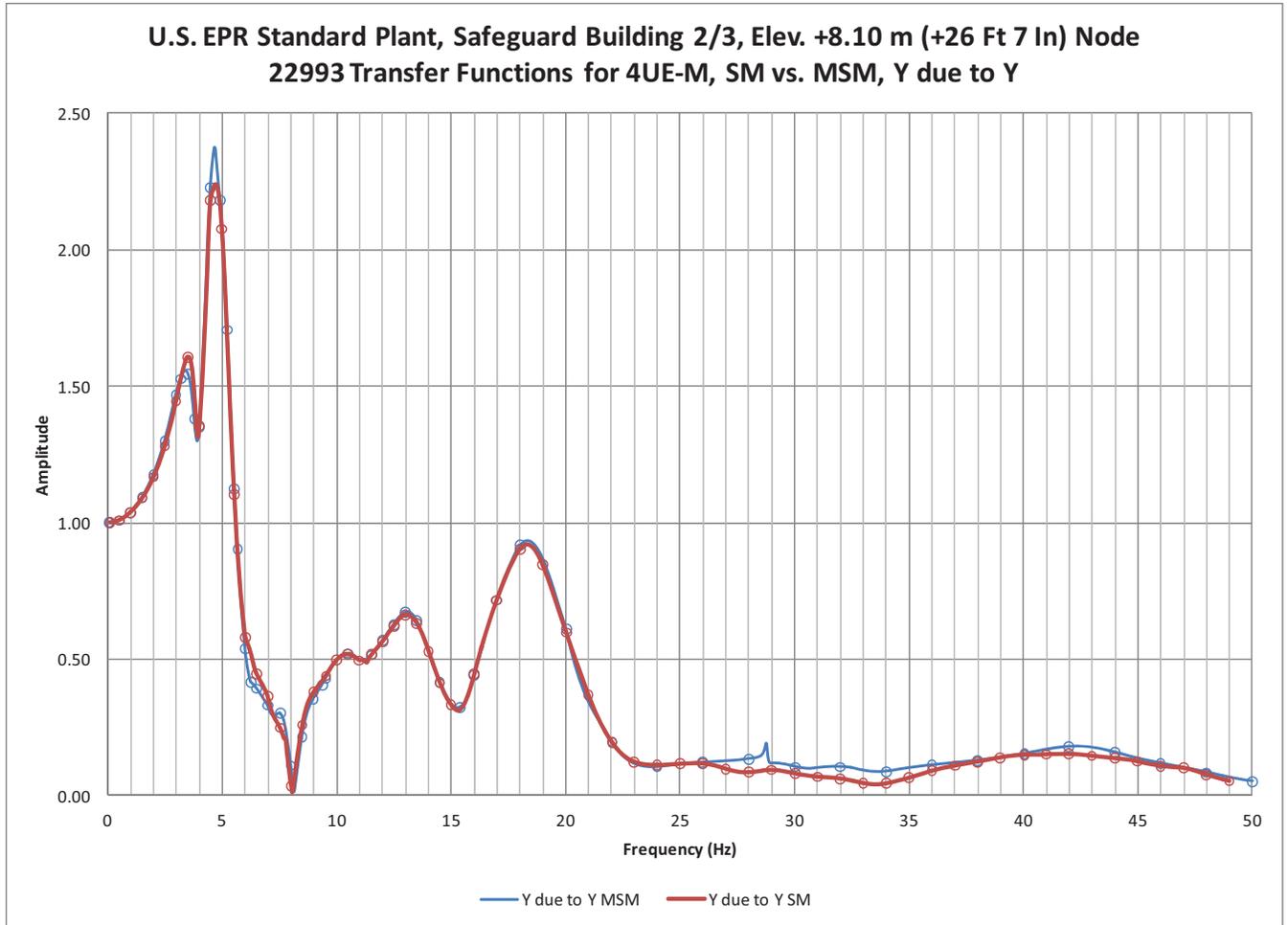
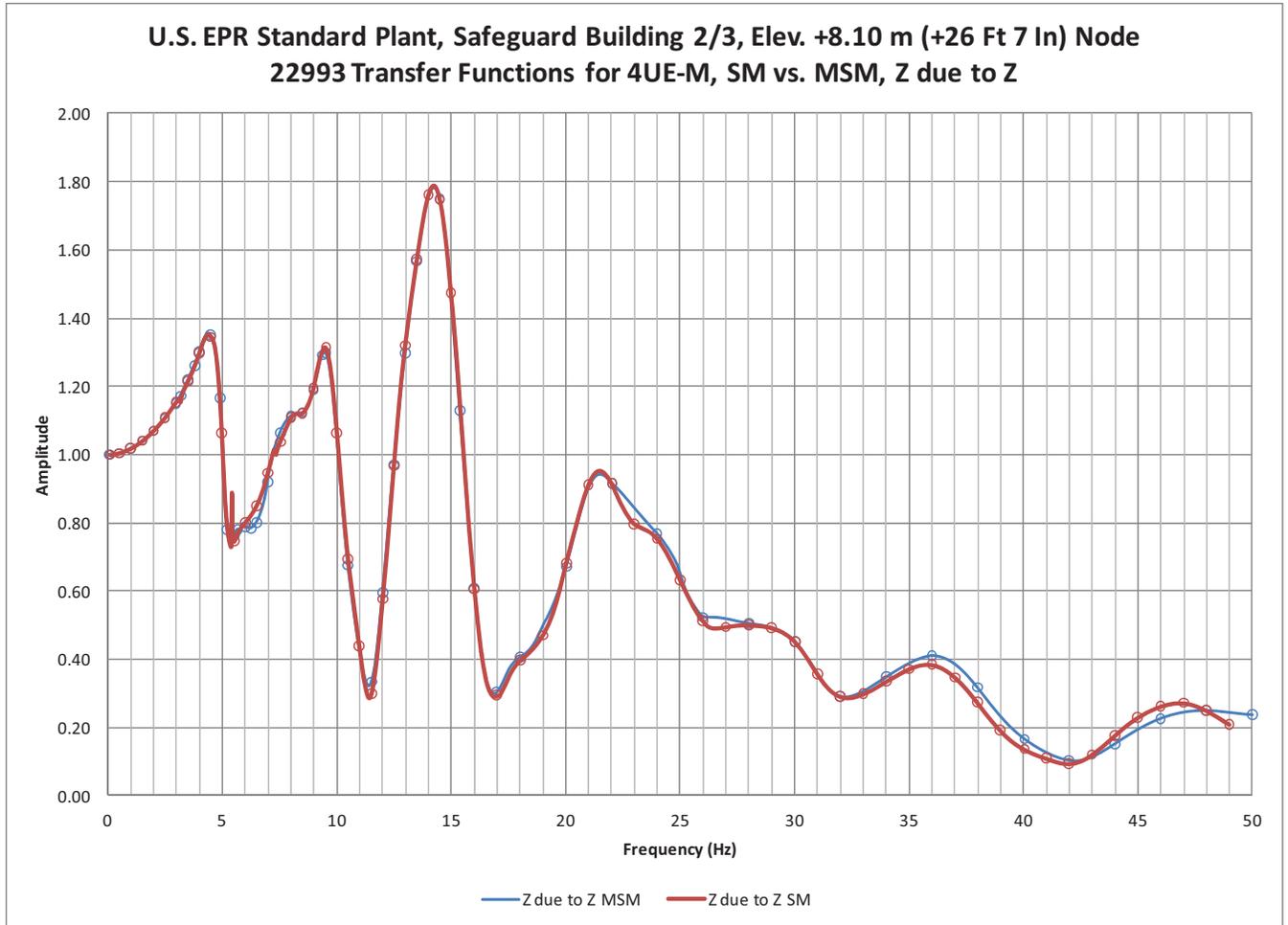


Figure 03.07.02-75-15—U.S. EPR Standard Plant, Safeguard Building 2/3, Elev. +8.10 m (+26 ft 7 in), Transfer Functions for 4UE-M at Node 22993, SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input



**Figure 03.07.02-75-16—U.S. EPR Standard Plant, Safeguard Building 2/3,
Elev. +16.30 m (+53 ft 6 in), Transfer Functions for 4UE-M at Node 33720,
SM vs. MSM, X (E-W) Response due to X (E-W) Input**

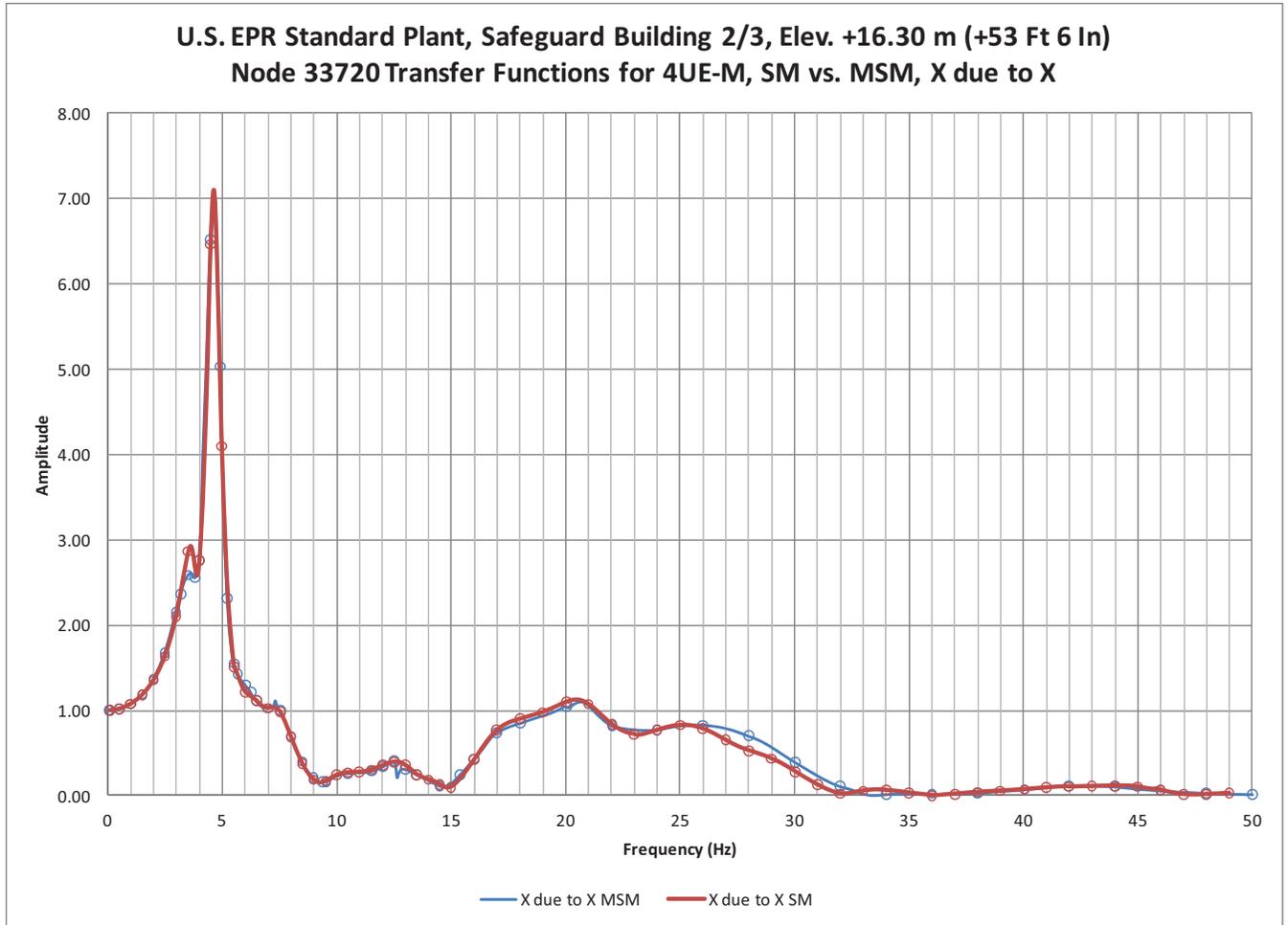


Figure 03.07.02-75-17—U.S. EPR Standard Plant, Safeguard Building 2/3, Elev. +16.30 m (+53 ft 6 in), Transfer Functions for 4UE-M at Node 33720, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input

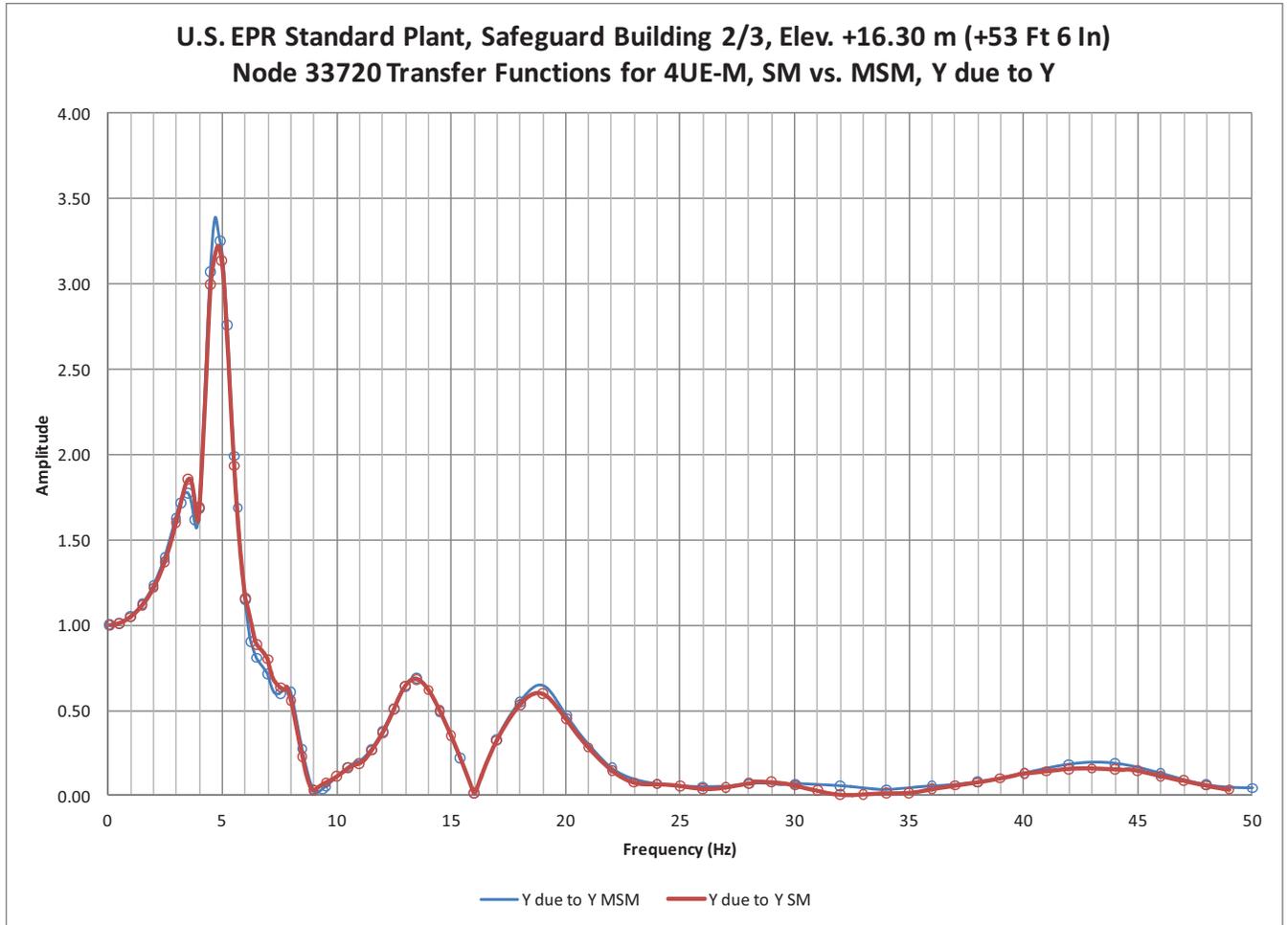


Figure 03.07.02-75-18—U.S. EPR Standard Plant, Safeguard Building 2/3, Elev. +16.30 m (+53 ft 6 in), Transfer Functions for 4UE-M at Node 33720, SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input

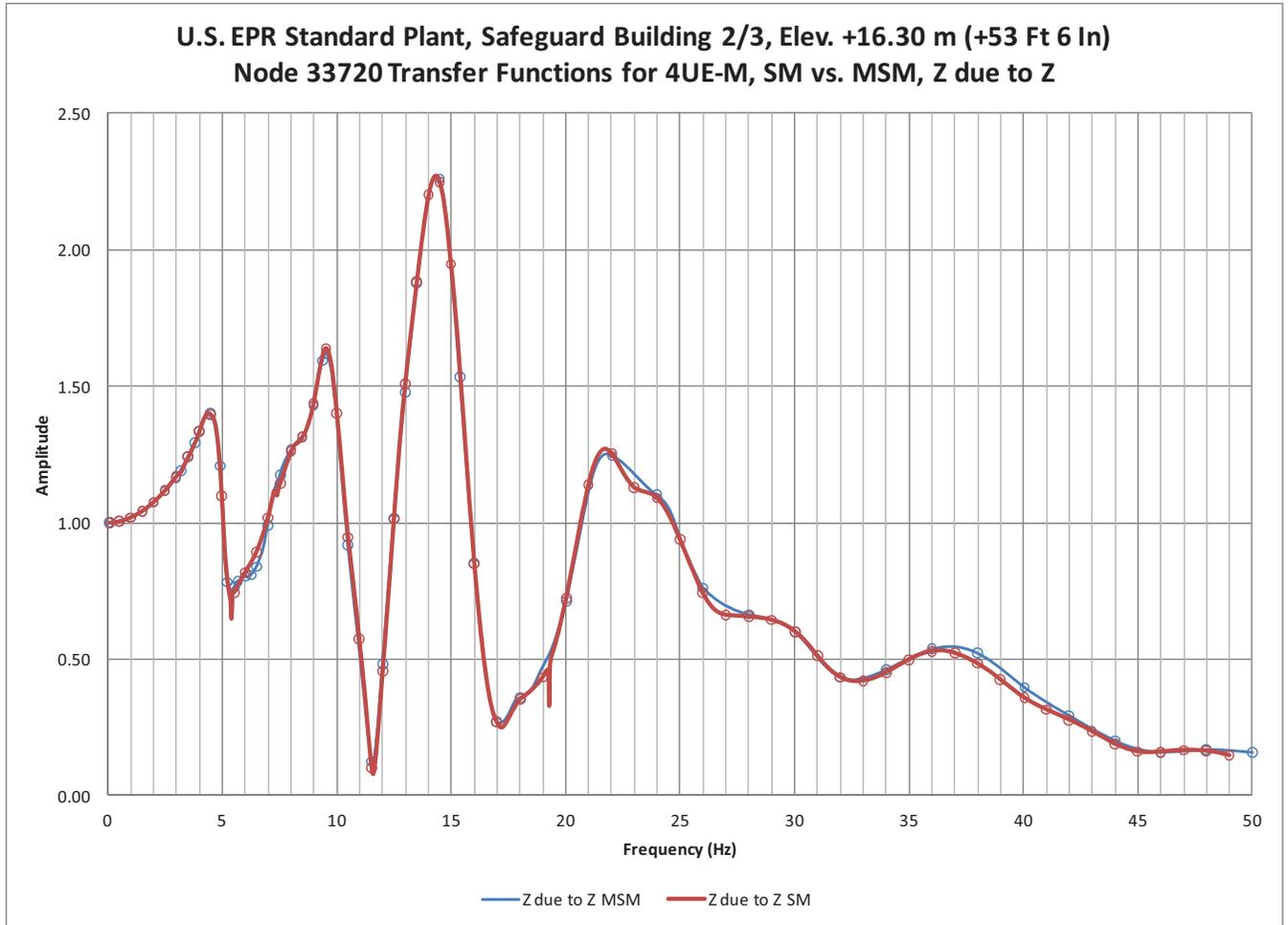


Figure 03.07.02-75-19—U.S. EPR Standard Plant, Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), Transfer Functions for 4UE-M at Node 51588, SM vs. MSM, X (E-W) Response due to X (E-W) Input

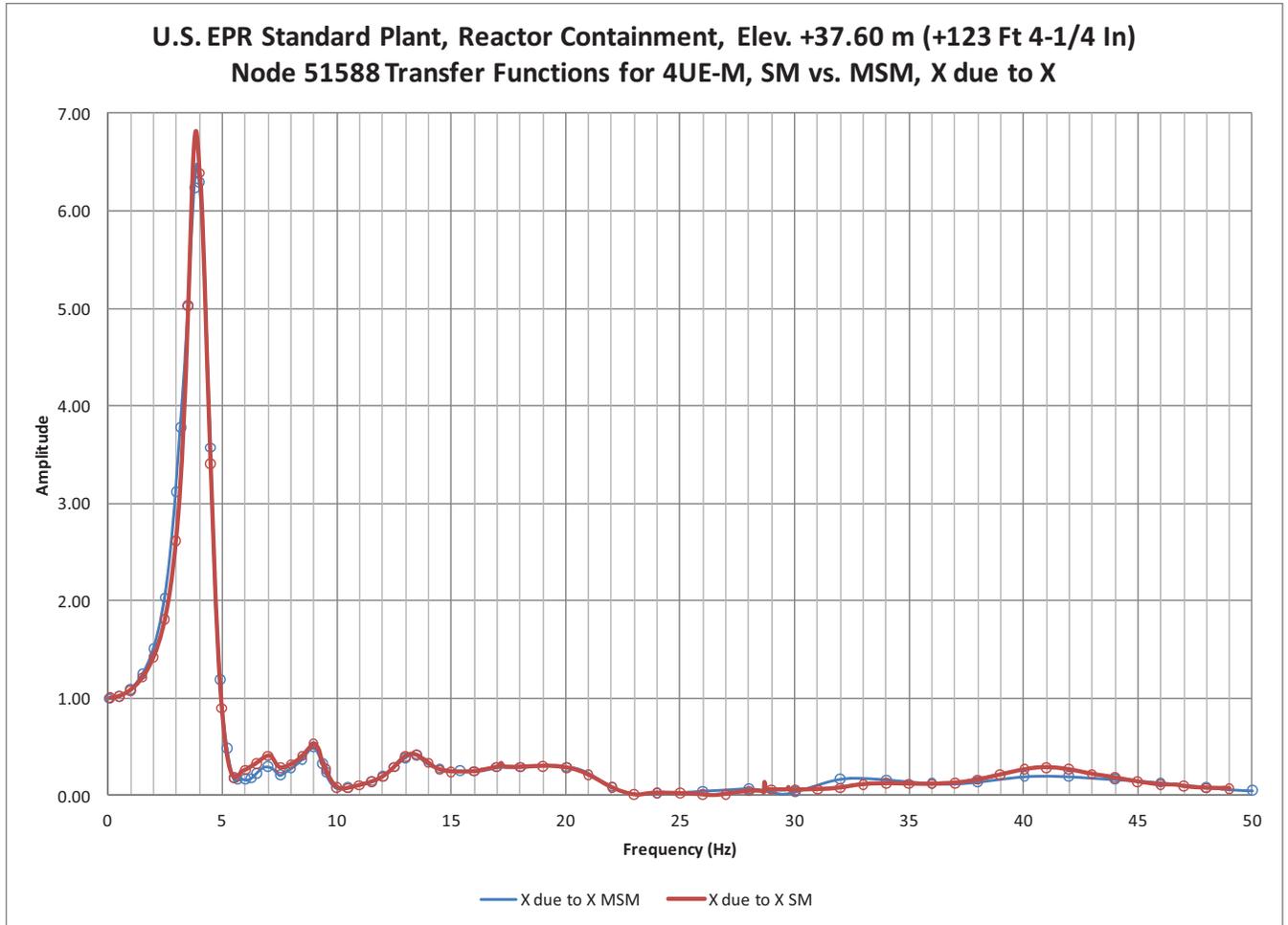


Figure 03.07.02-75-20—U.S. EPR Standard Plant, Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), Transfer Functions for 4UE-M at Node 51588, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input

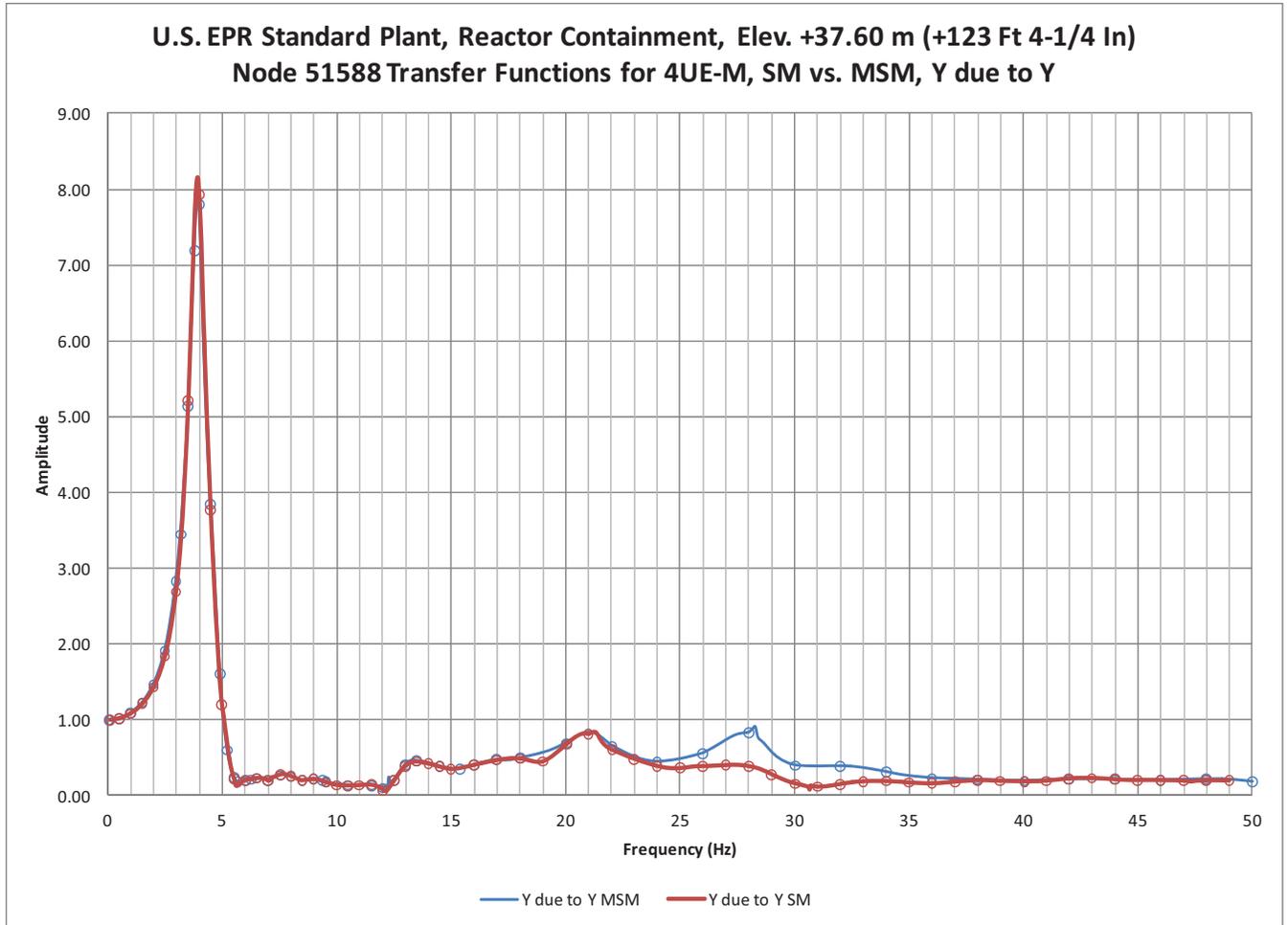


Figure 03.07.02-75-21—U.S. EPR Standard Plant, Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), Transfer Functions for 4UE-M at Node 51588, SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input

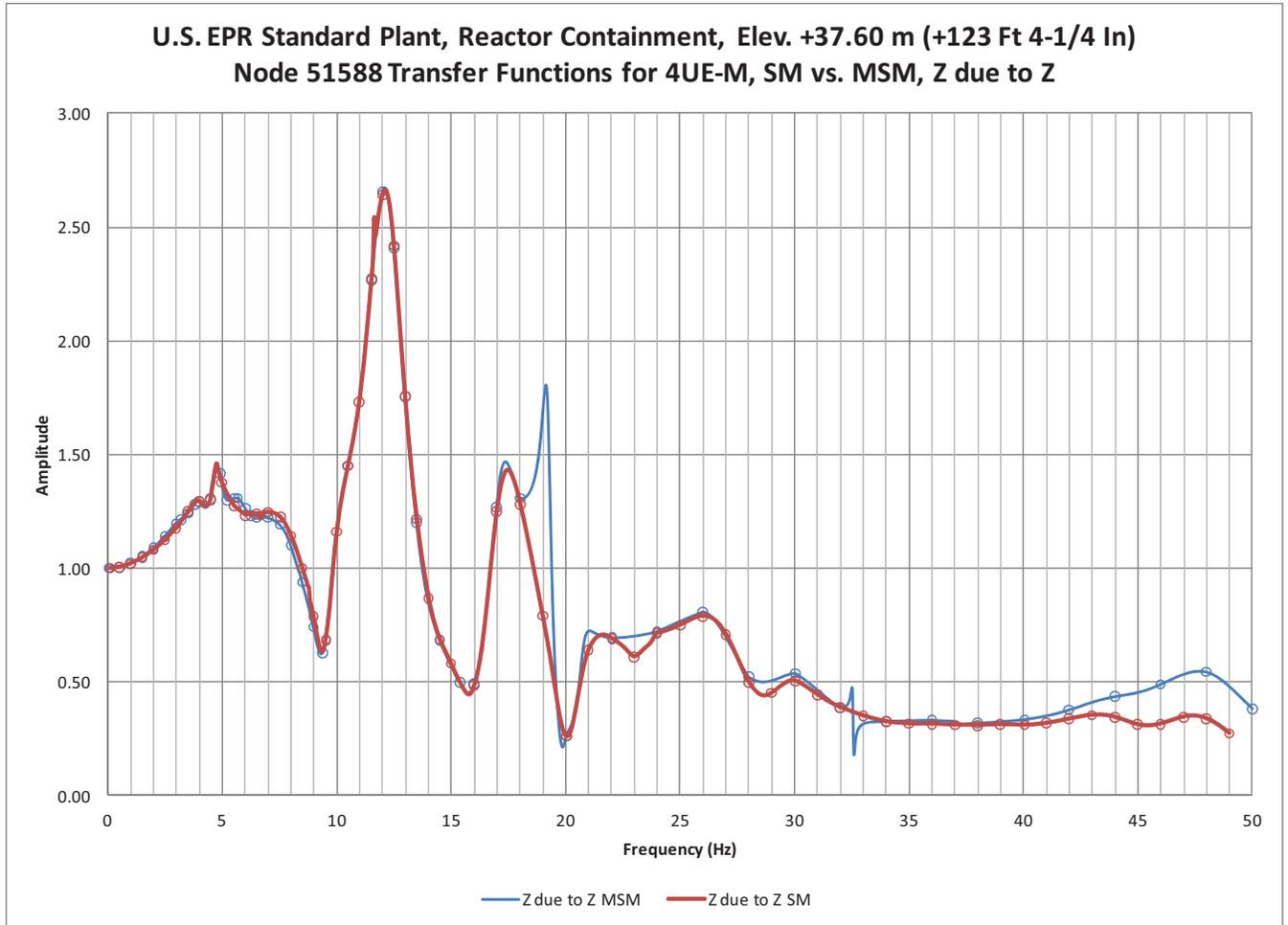


Figure 03.07.02-75-22—U.S. EPR Standard Plant, Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), Transfer Functions for 4UE-M at Node 53162, SM vs. MSM, X (E-W) Response due to X (E-W) Input

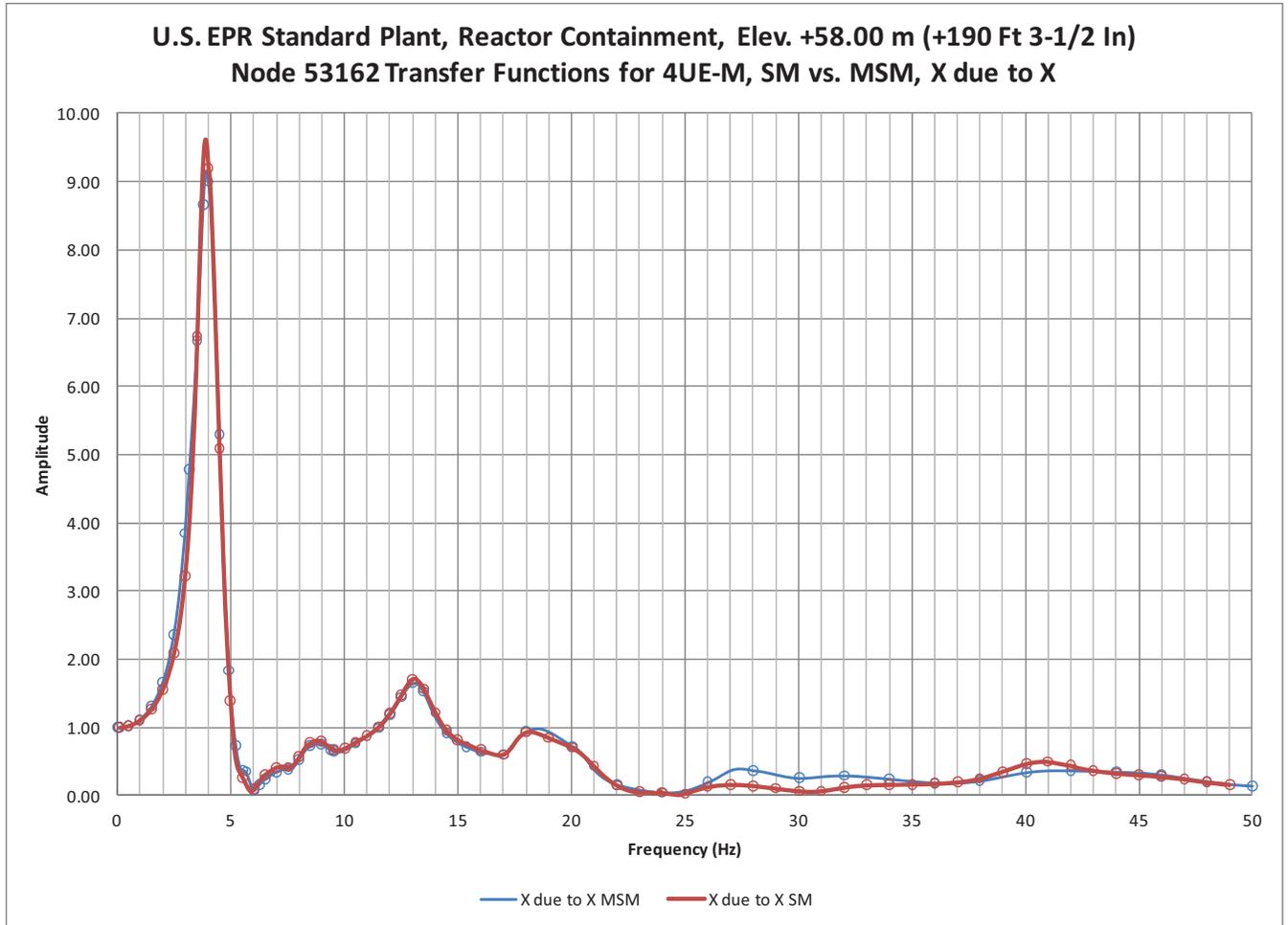


Figure 03.07.02-75-23—U.S. EPR Standard Plant, Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), Transfer Functions for 4UE-M at Node 53162, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input

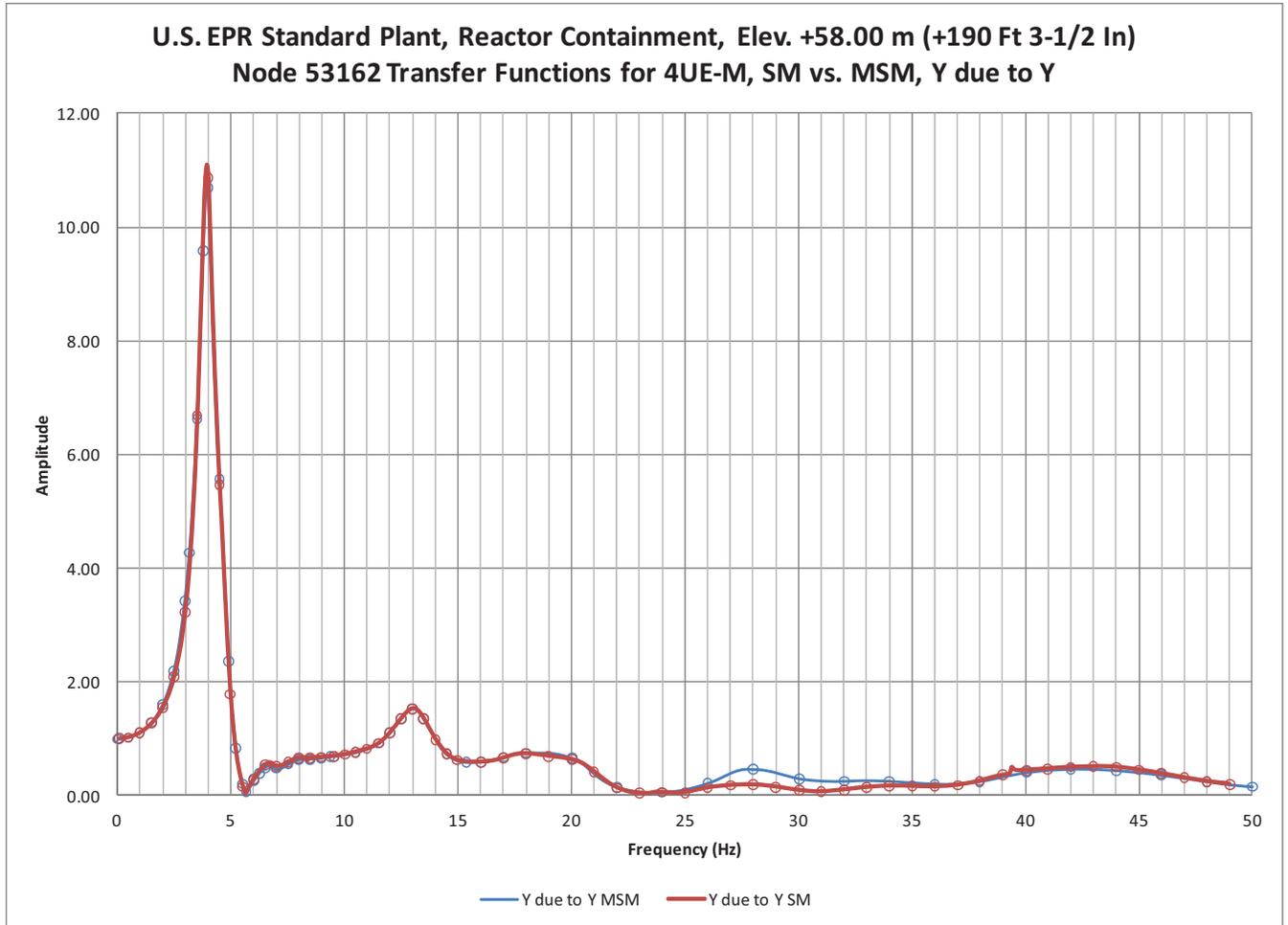


Figure 03.07.02-75-24—U.S. EPR Standard Plant, Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), Transfer Functions for 4UE-M at Node 53162, SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input

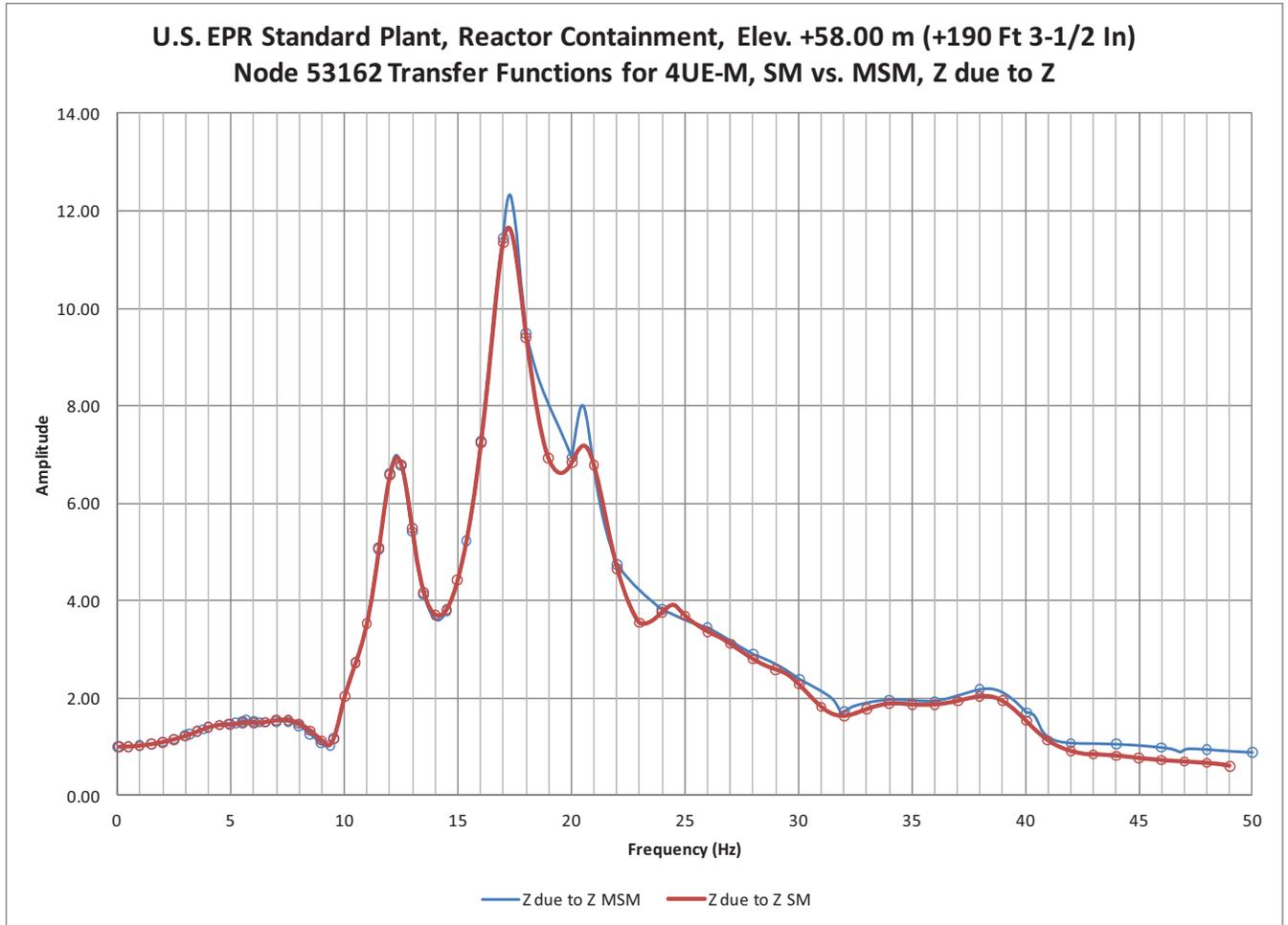


Figure 03.07.02-75-25—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), X (E-W) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

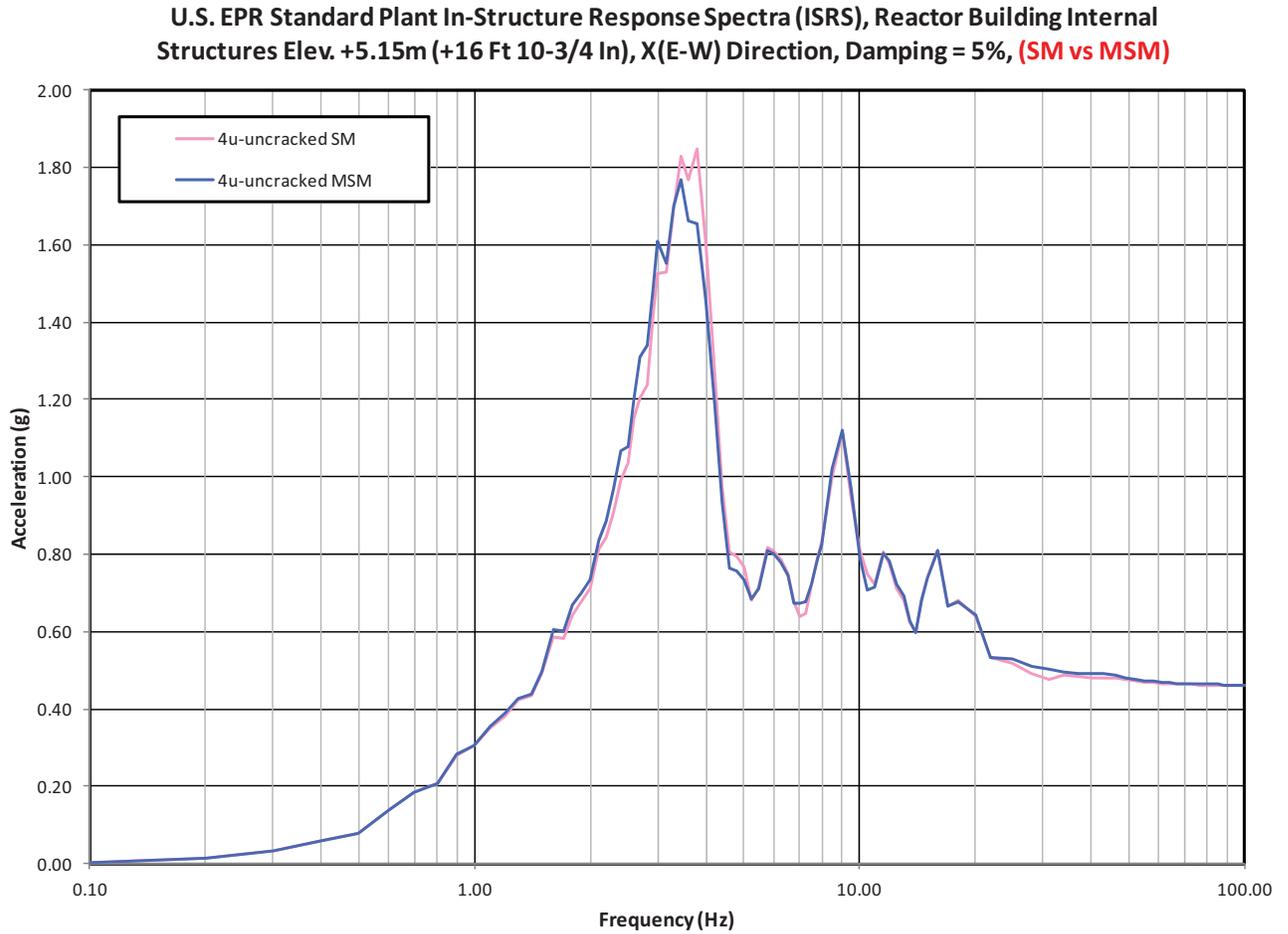


Figure 03.07.02-75-26—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), Y (N-S) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

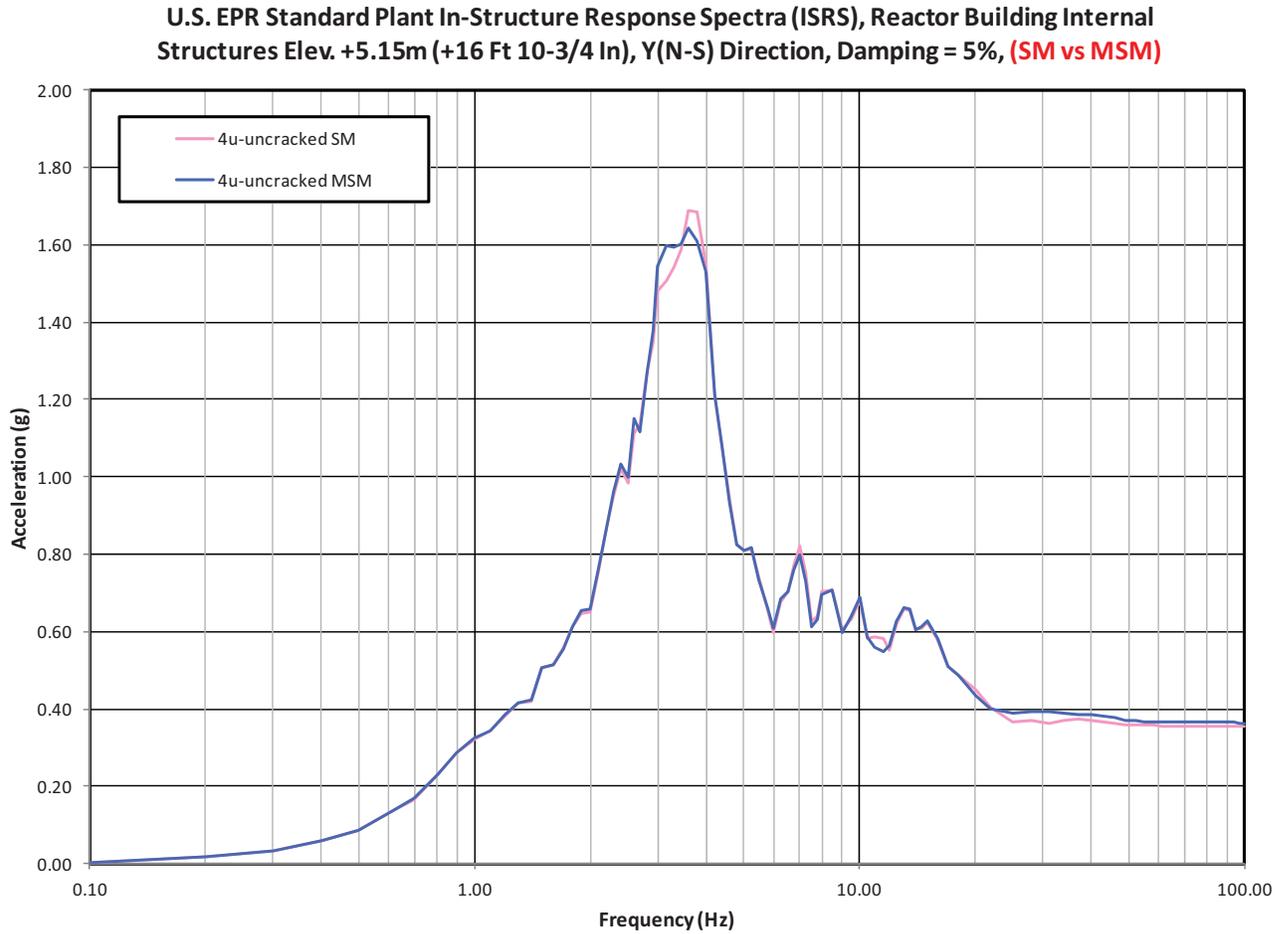


Figure 03.07.02-75-27—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), Z (Vert.) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

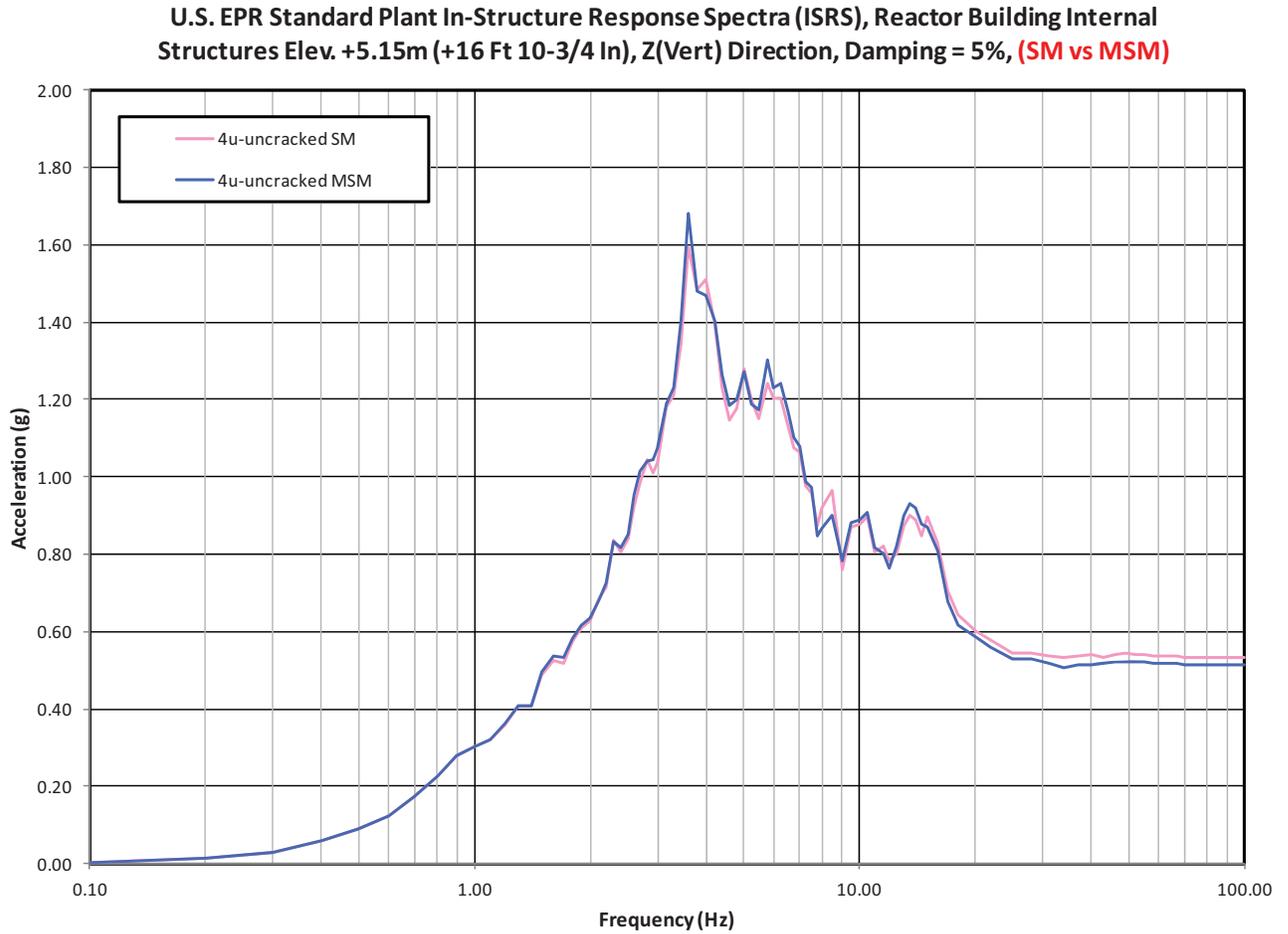


Figure 03.07.02-75-28—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +19.5 m (+63 ft 11-3/4 in), X (E-W) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

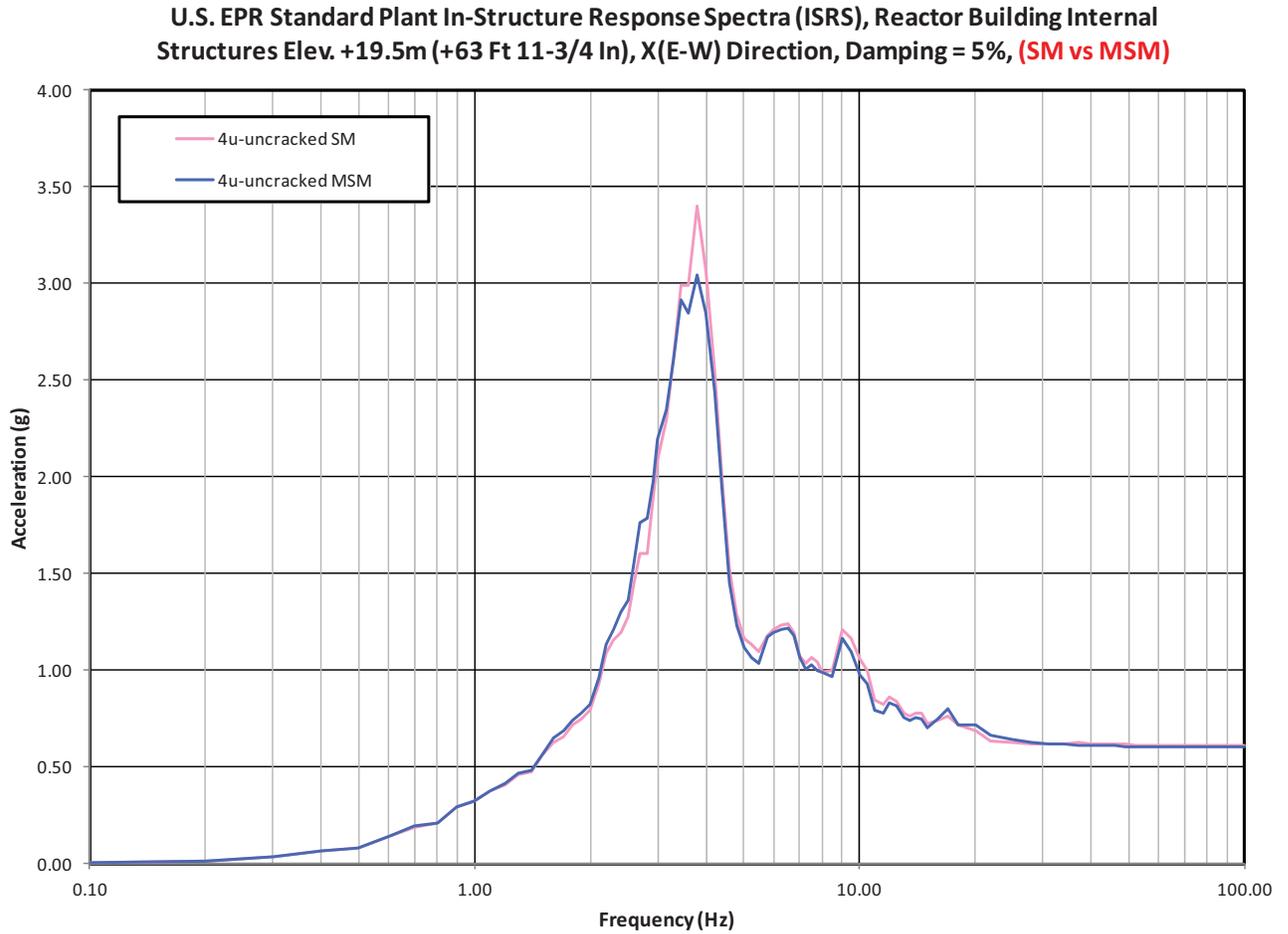


Figure 03.07.02-75-29—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +19.5 m (+63 ft 11-3/4 in), Y (N-S) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

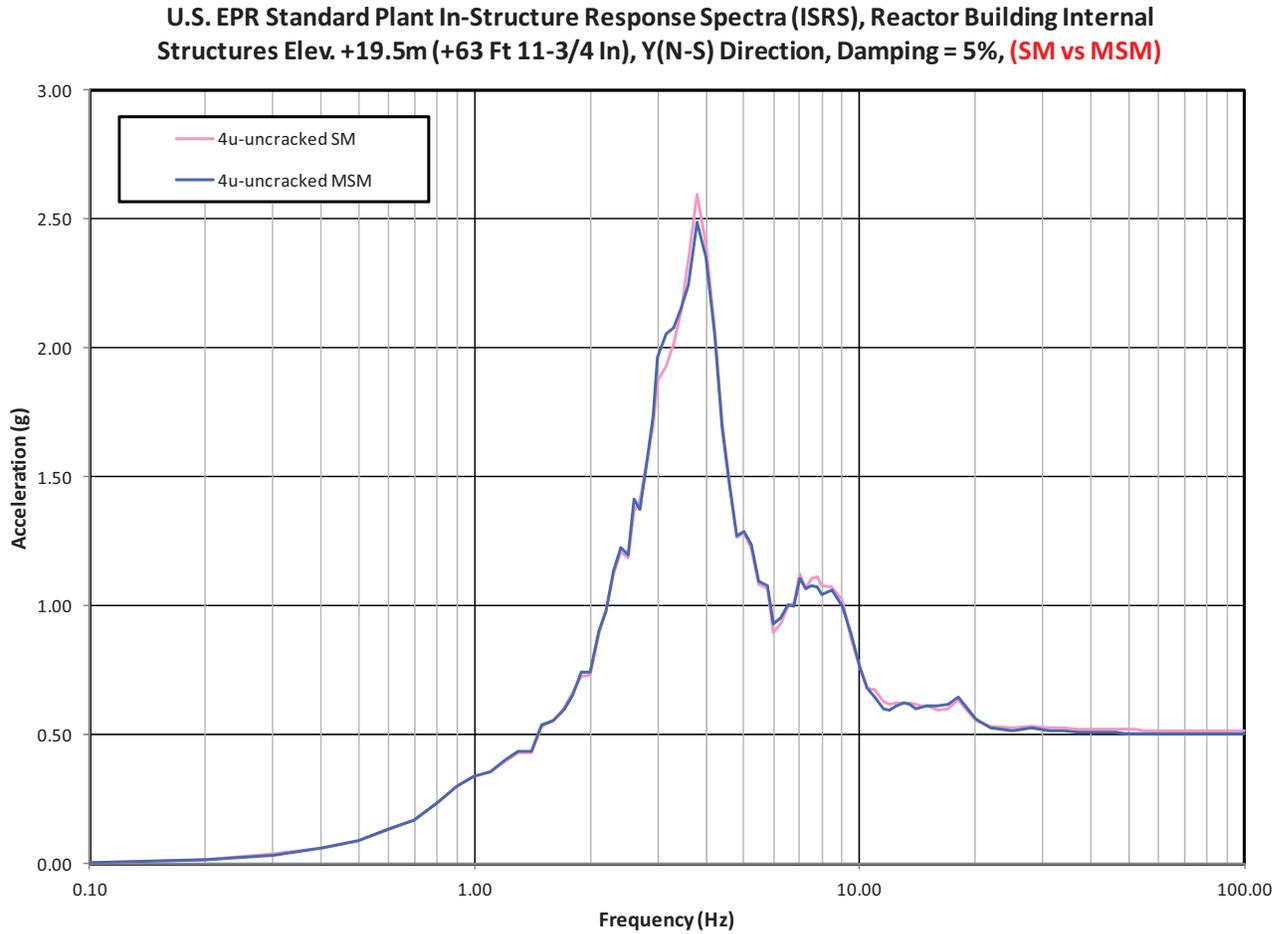


Figure 03.07.02-75-30—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +19.5 m (+63 ft 11-3/4 in), Z (Vert.) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

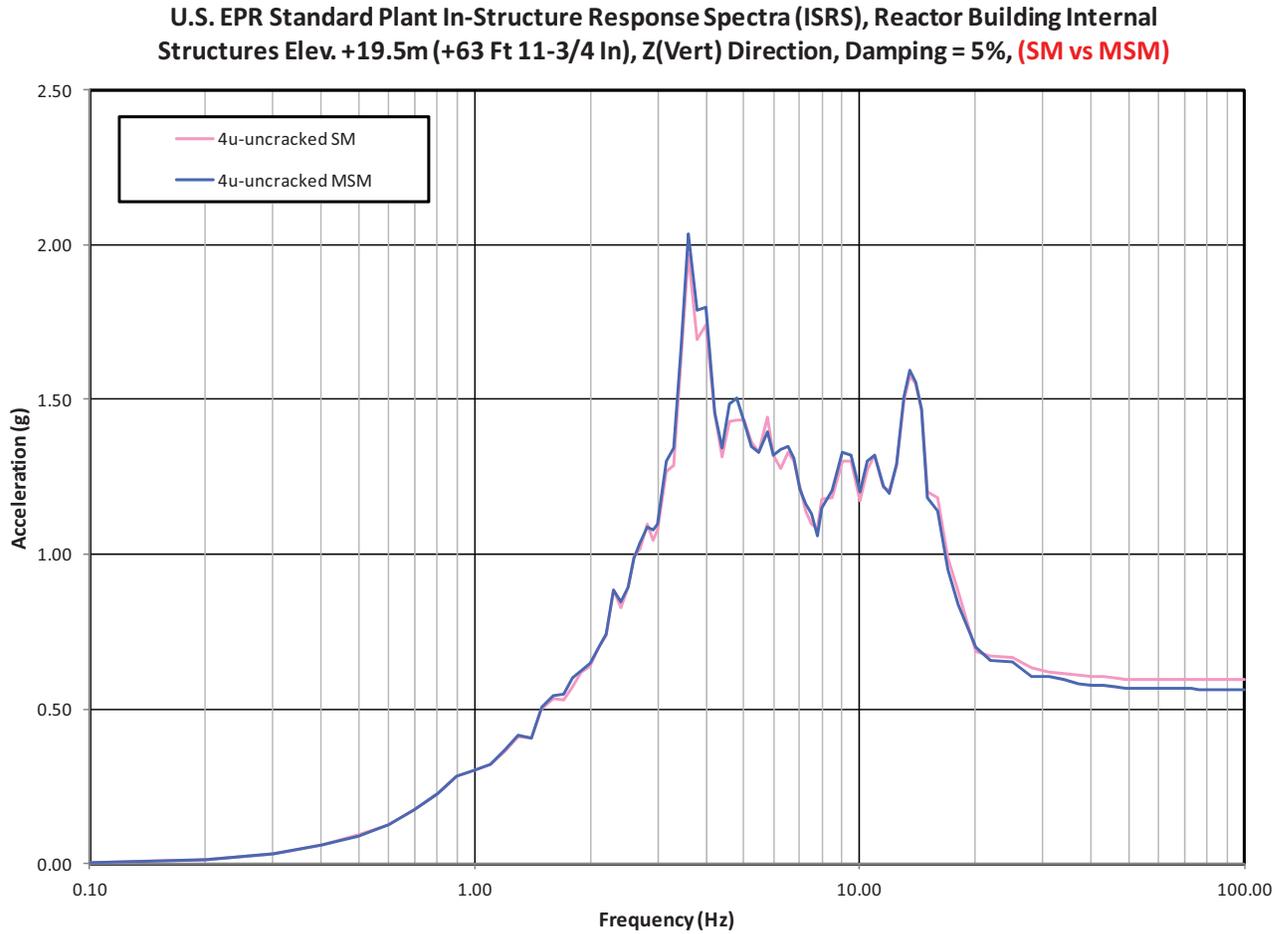


Figure 03.07.02-75-31—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +8.10 m (+26 ft 7 in), X (E-W) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1 Elev. +8.10m (+26 Ft 7 In), X(E-W) Direction, Damping = 5%, (SM vs MSM)

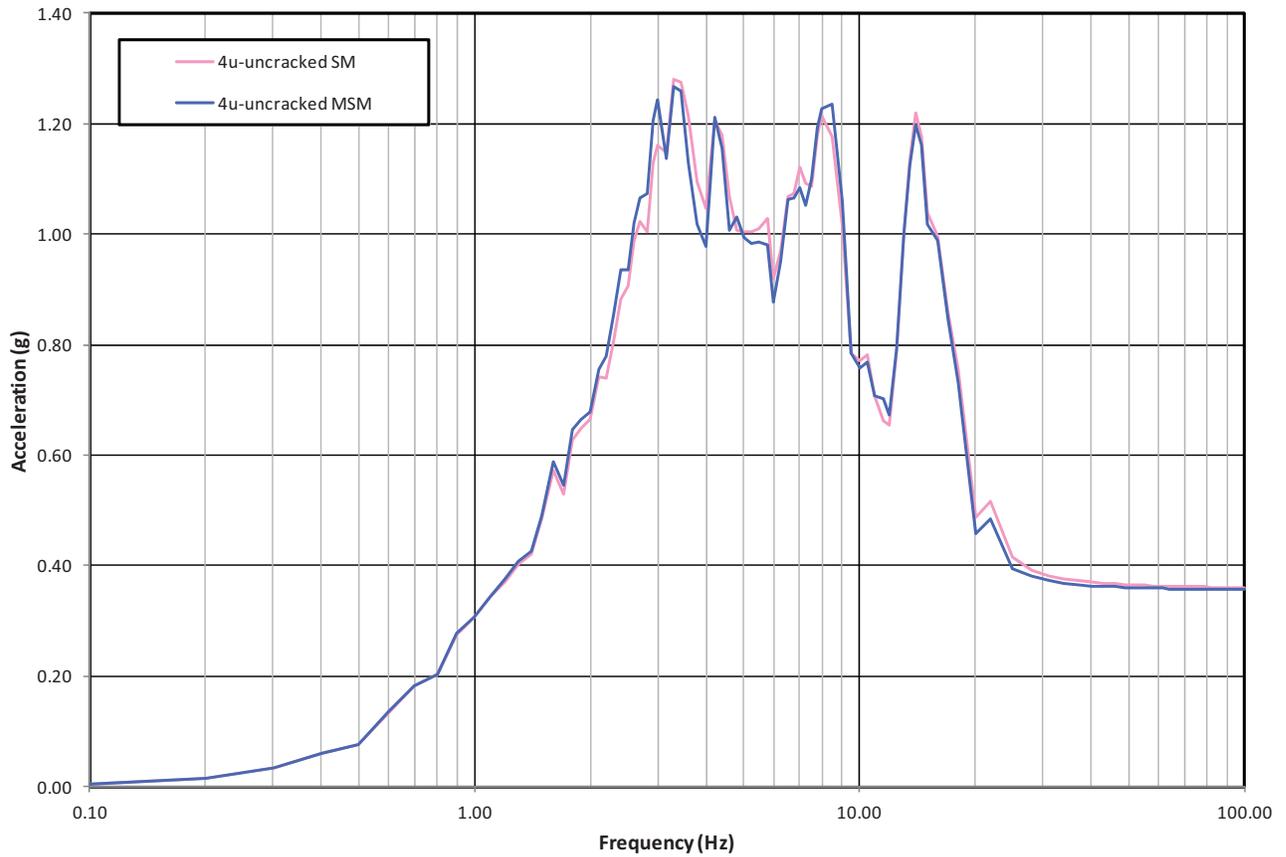


Figure 03.07.02-75-32—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +8.10 m (+26 ft 7 in), Y (N-S) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1 Elev. +8.10m (+26 Ft 7 In), Y(N-S) Direction, Damping = 5%, (SM vs MSM)

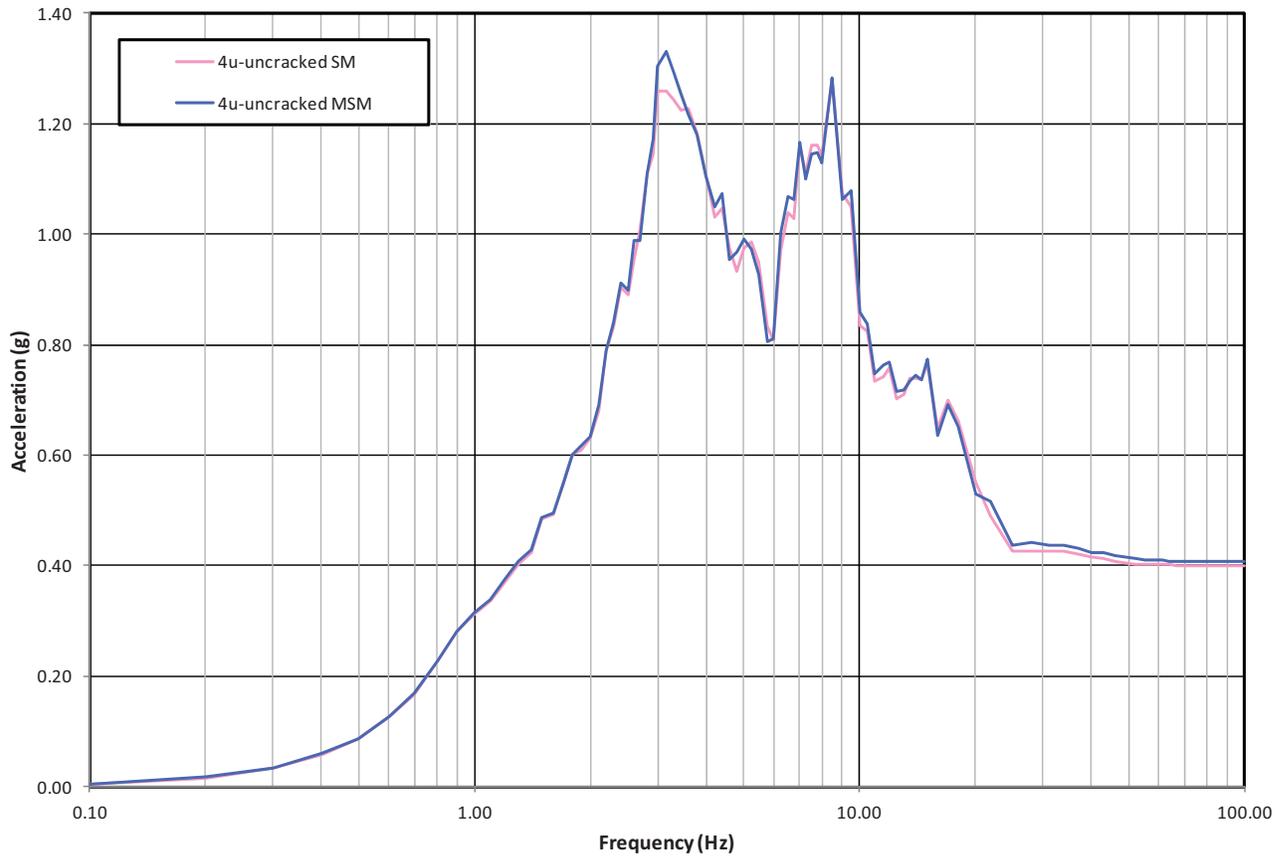


Figure 03.07.02-75-33—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +8.10 m (+26 ft 7 in), Z (Vert.) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1 Elev. +8.10m (+26 Ft 7 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

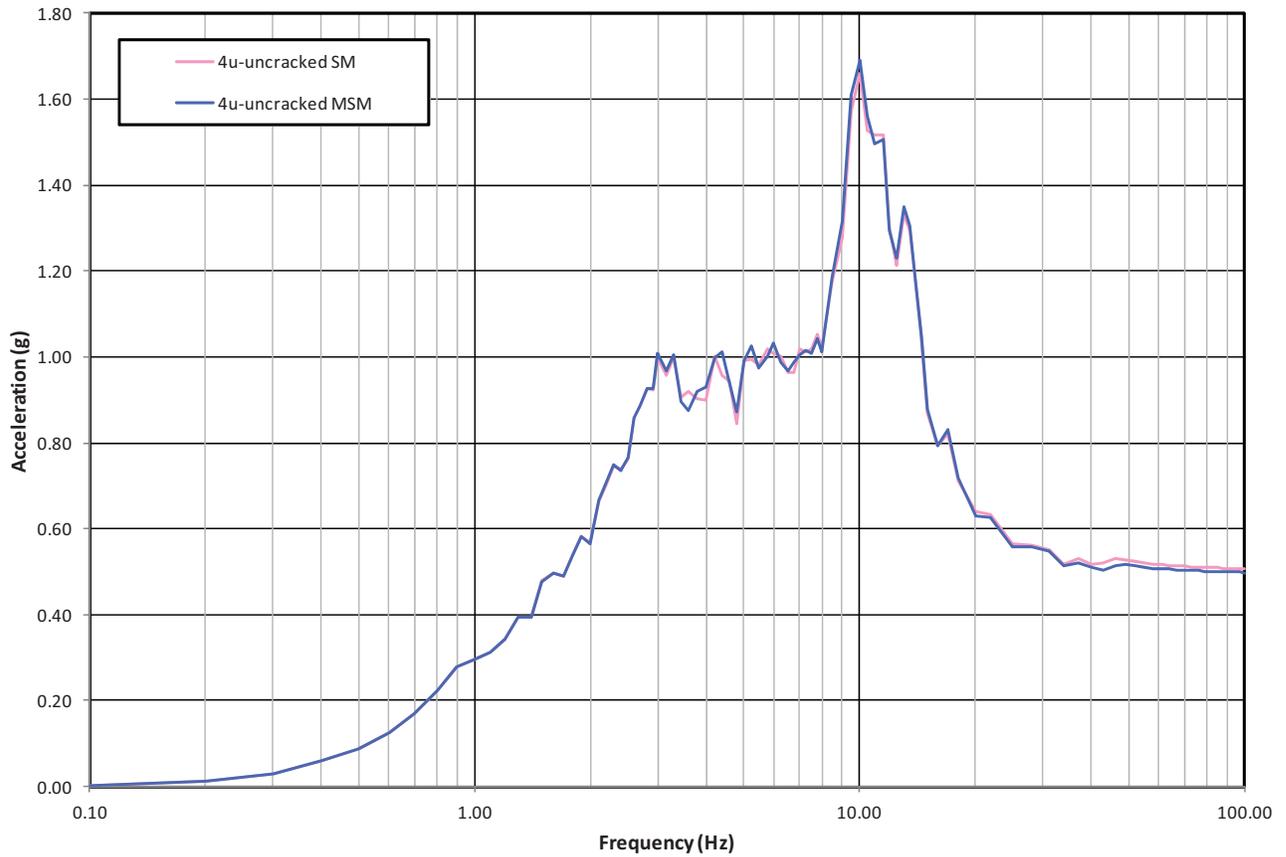


Figure 03.07.02-75-34—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +21.00 m (+68 ft 11 in), X (E-W) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1 Elev. +21.00m (+68 Ft 11 In), X(E-W) Direction, Damping = 5%, (SM vs MSM)

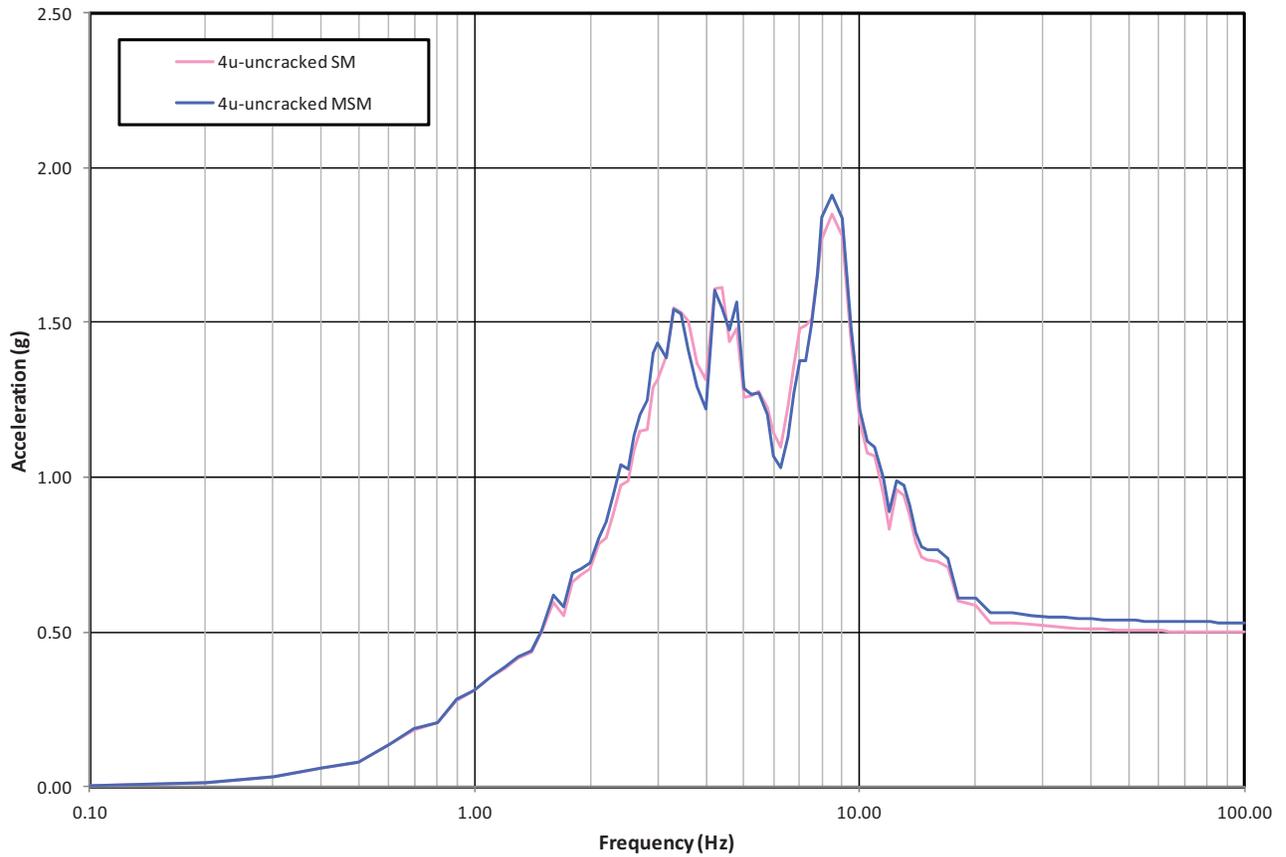


Figure 03.07.02-75-35—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +21.00 m (+68 ft 11 in), Y (N-S) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1 Elev. +21.00m (+68 Ft 11 In), Y(N-S) Direction, Damping = 5%, (SM vs MSM)

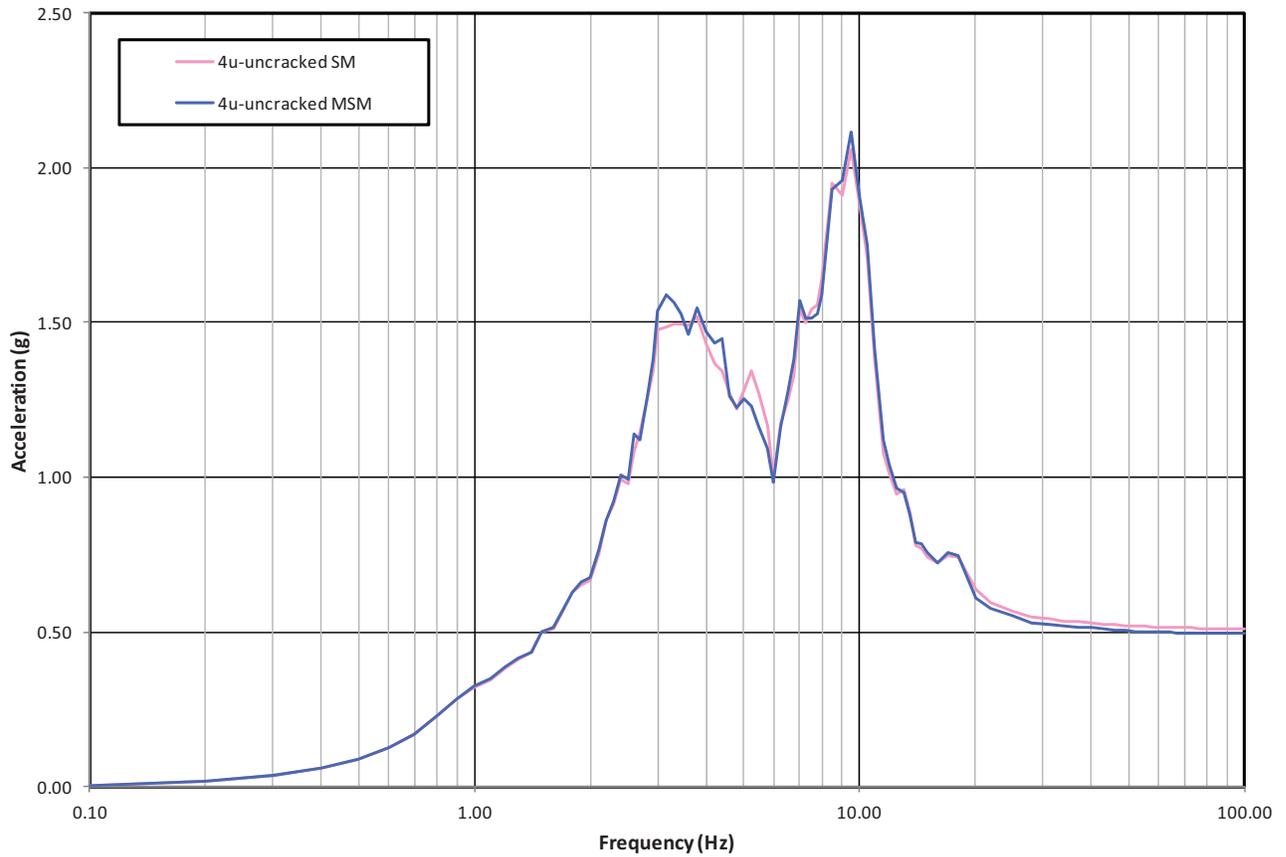


Figure 03.07.02-75-36—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +21.00 m (+68 ft 11 in), Z (Vert.) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1 Elev. +21.00m (+68 Ft 11 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

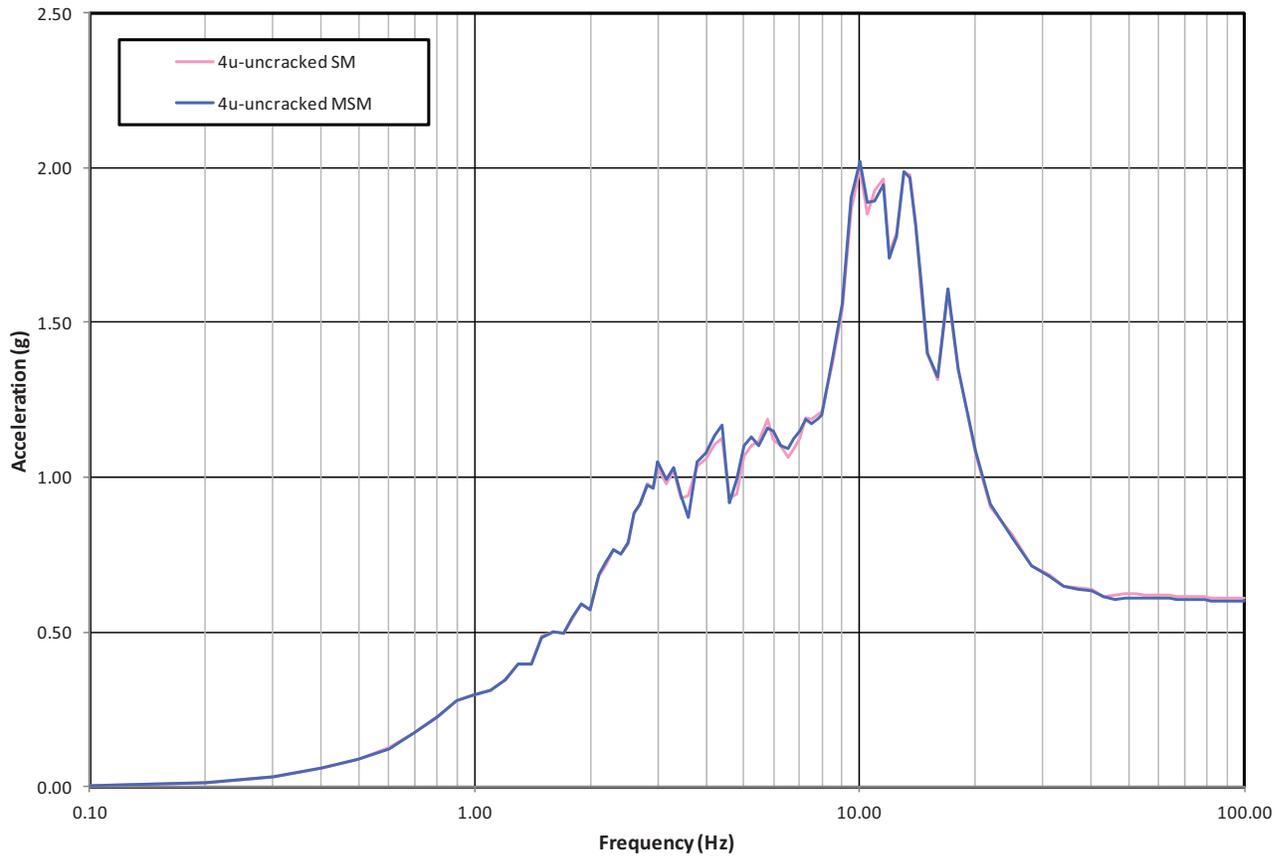


Figure 03.07.02-75-37—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +8.10 m (+26 ft 7 in), X (E-W) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +8.10m (+26 Ft 7 In), X(E-W) Direction, Damping = 5%, (SM vs MSM)

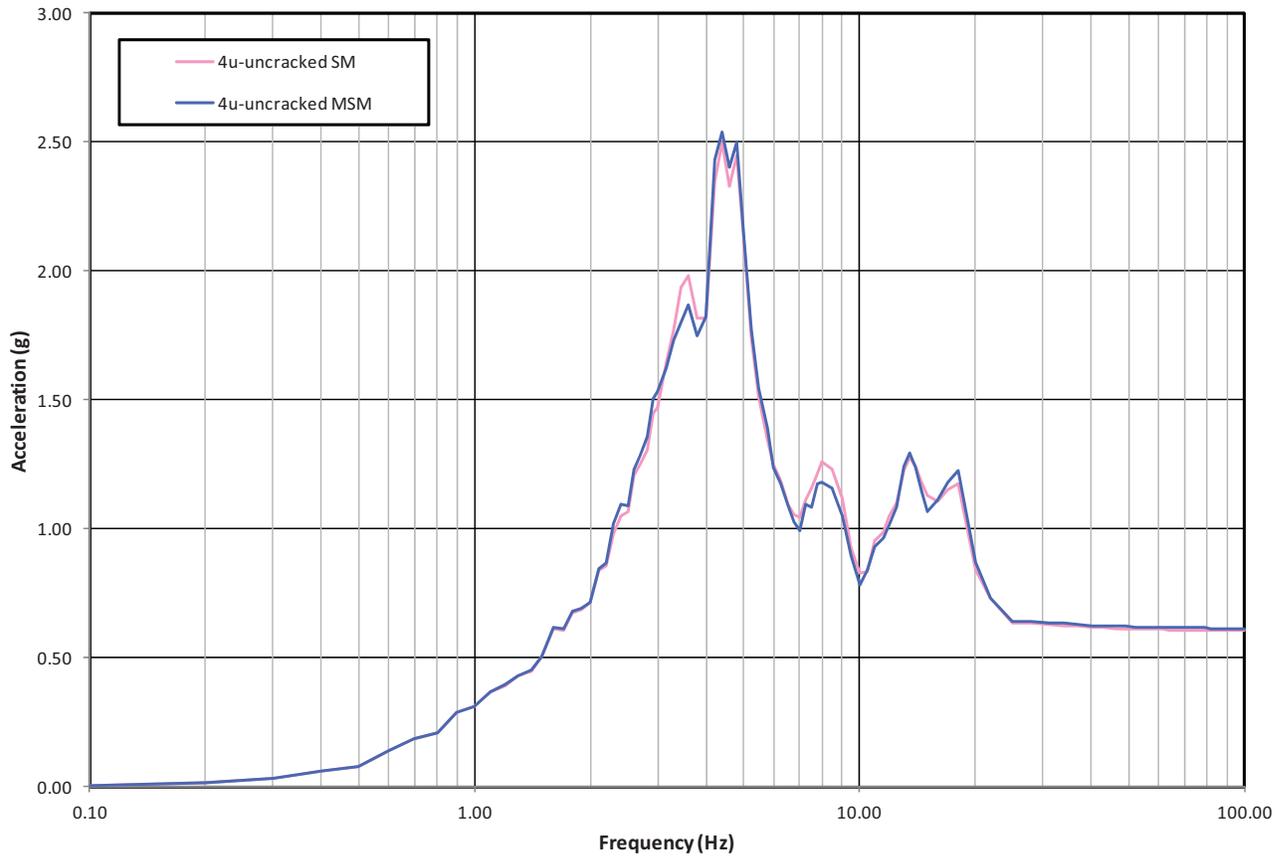


Figure 03.07.02-75-38—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +8.10 m (+26 ft 7 in), Y (N-S) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +8.10m (+26 Ft 7 In), Y(N-S) Direction, Damping = 5%, (SM vs MSM)

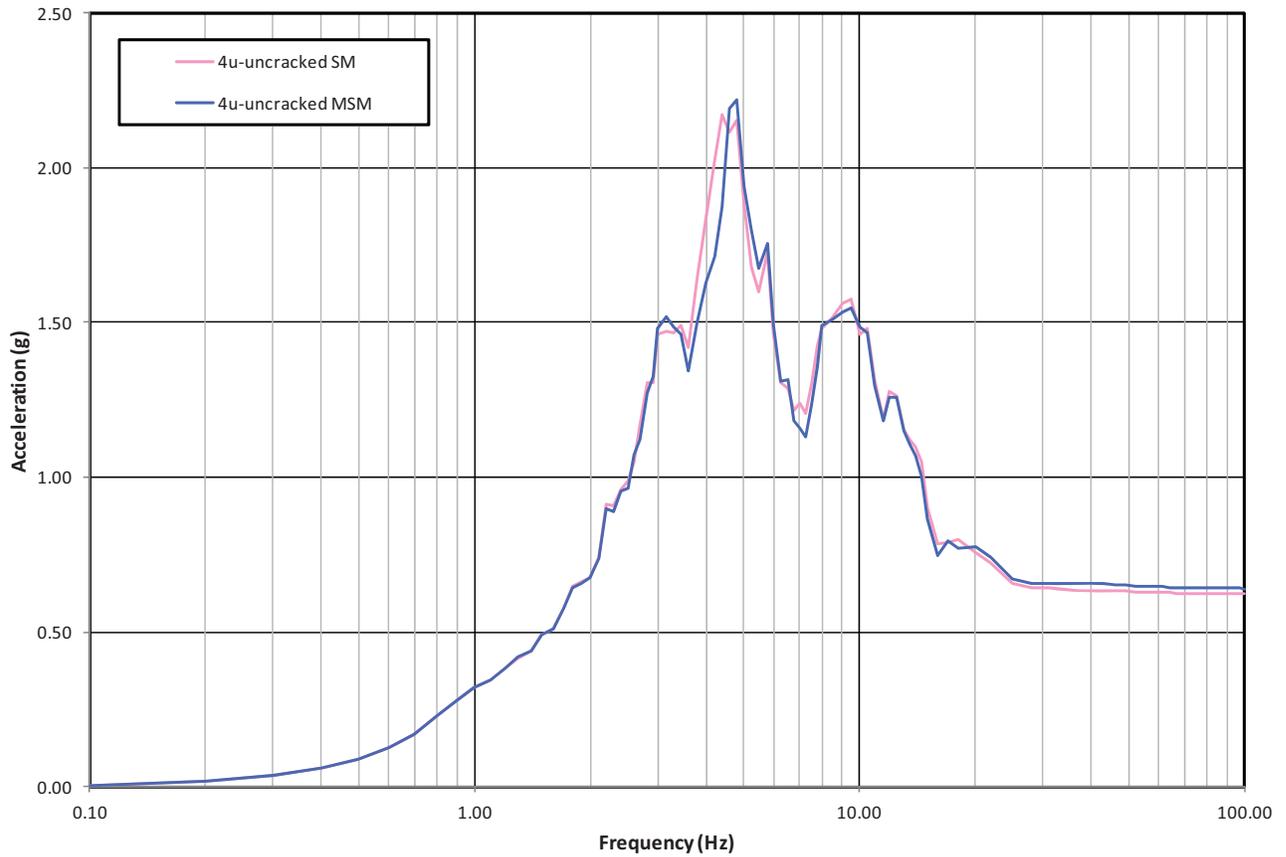


Figure 03.07.02-75-39—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +8.10 m (+26 ft 7 in), Z (Vert.) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +8.10m (+26 Ft 7 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

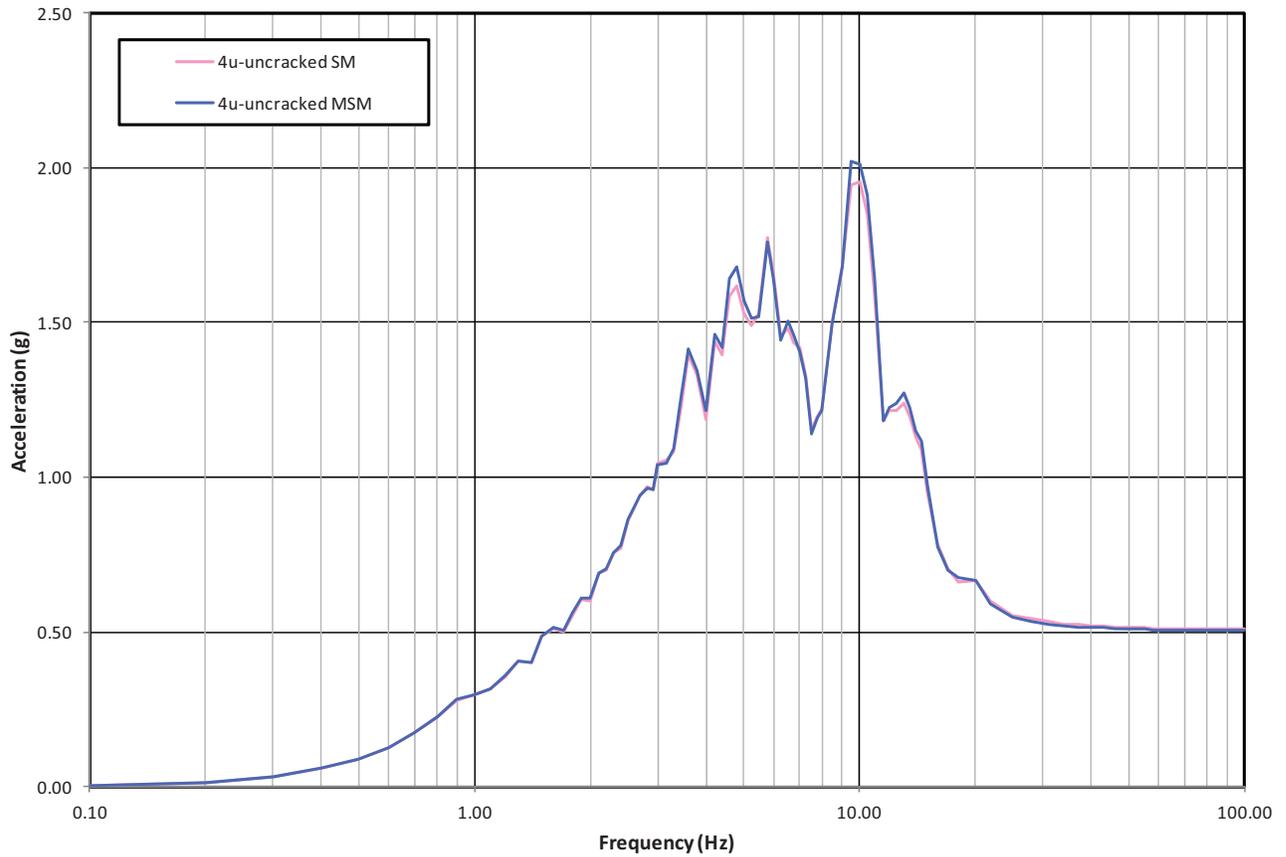


Figure 03.07.02-75-40—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +16.30 m (+53 ft 6 in), X (E-W) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +16.30m (+53 Ft 6 In), X(E-W) Direction, Damping = 5%, (SM vs MSM)

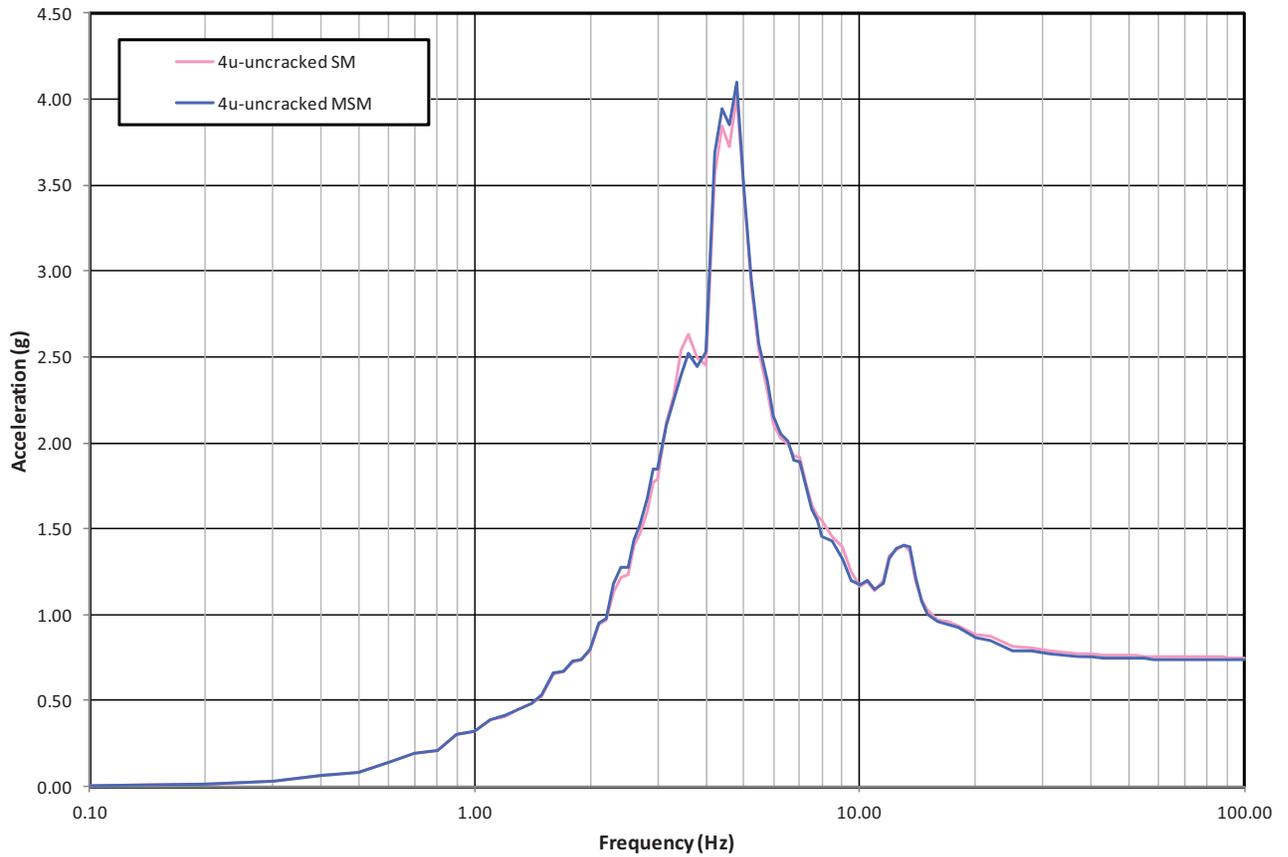


Figure 03.07.02-75-41—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +16.30 m (+53 ft 6 in), Y (N-S) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +16.30m (+53 Ft 6 In), Y(N-S) Direction, Damping = 5%, (SM vs MSM)

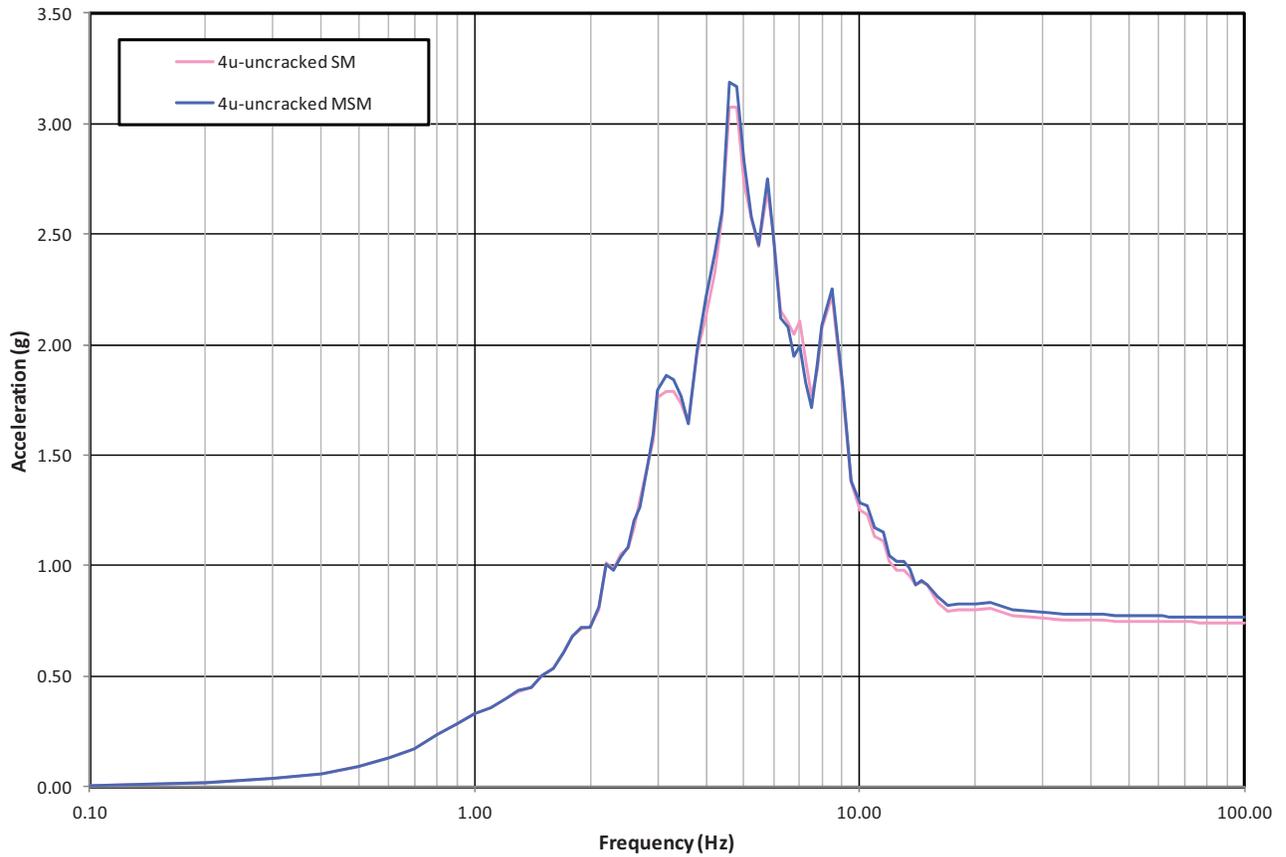


Figure 03.07.02-75-42—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +16.30 m (+53 ft 6 in), Z (Vert.) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +16.30m (+53 Ft 6 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

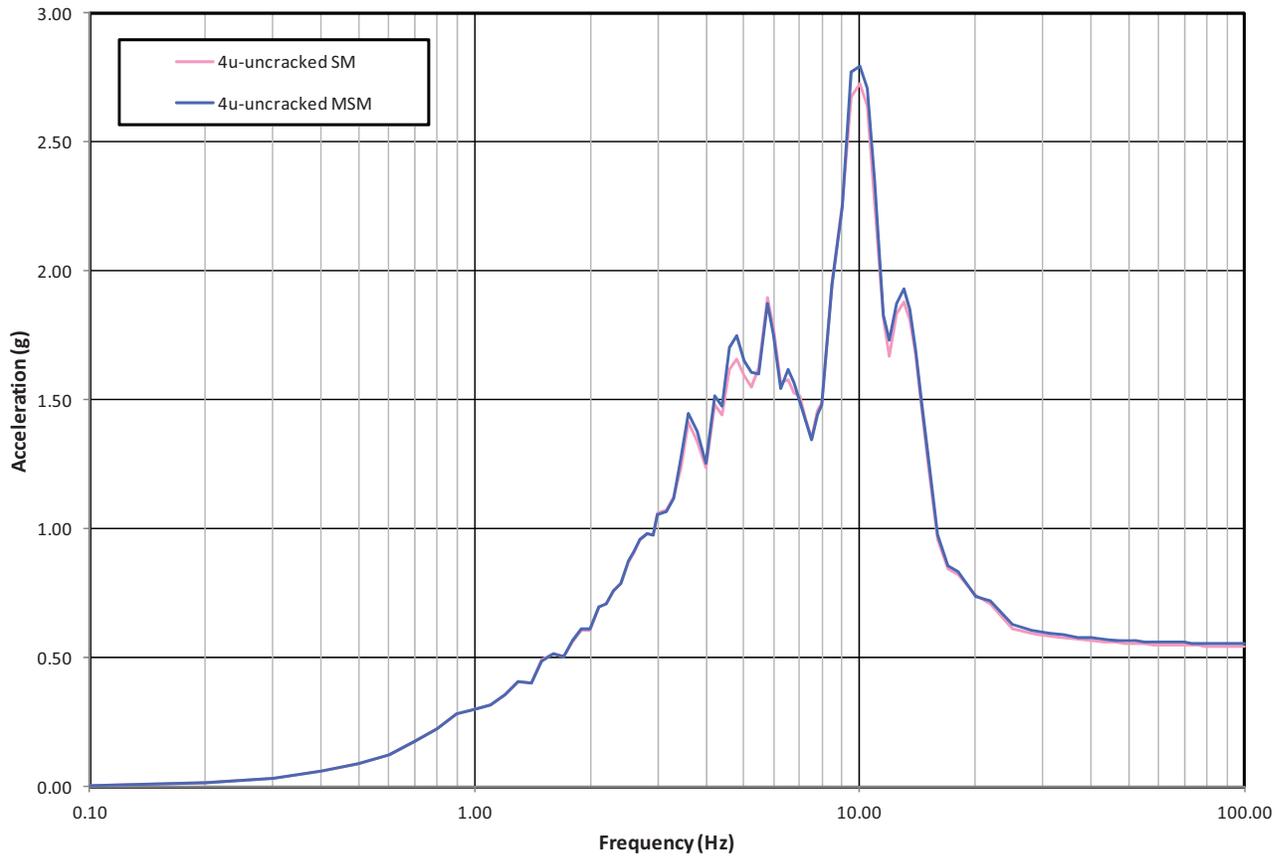


Figure 03.07.02-75-43—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), X (E-W) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment Elev. +37.60m (+123 Ft 4-1/4 In), X(E-W) Direction, Damping = 5%, (SM vs MSM)

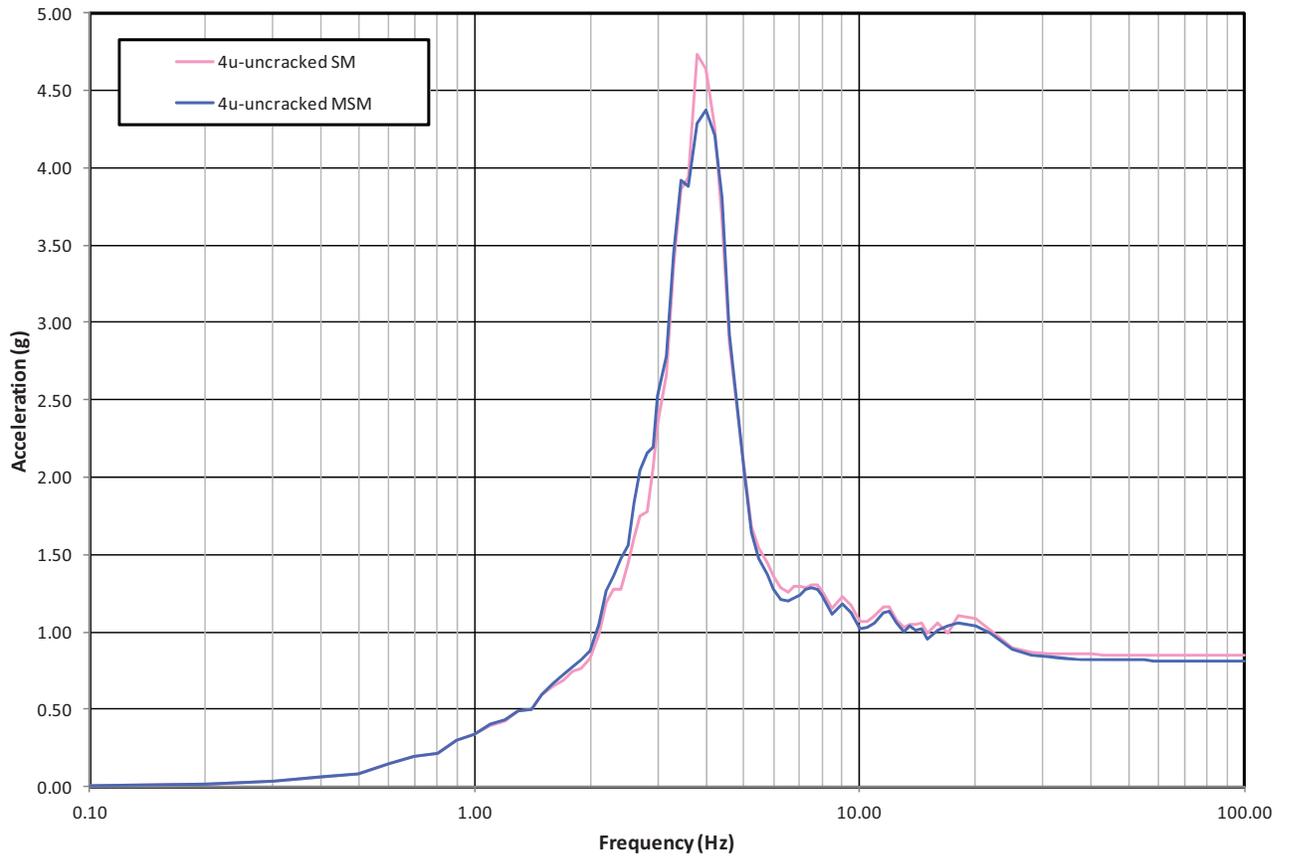


Figure 03.07.02-75-44—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), Y (N-S) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

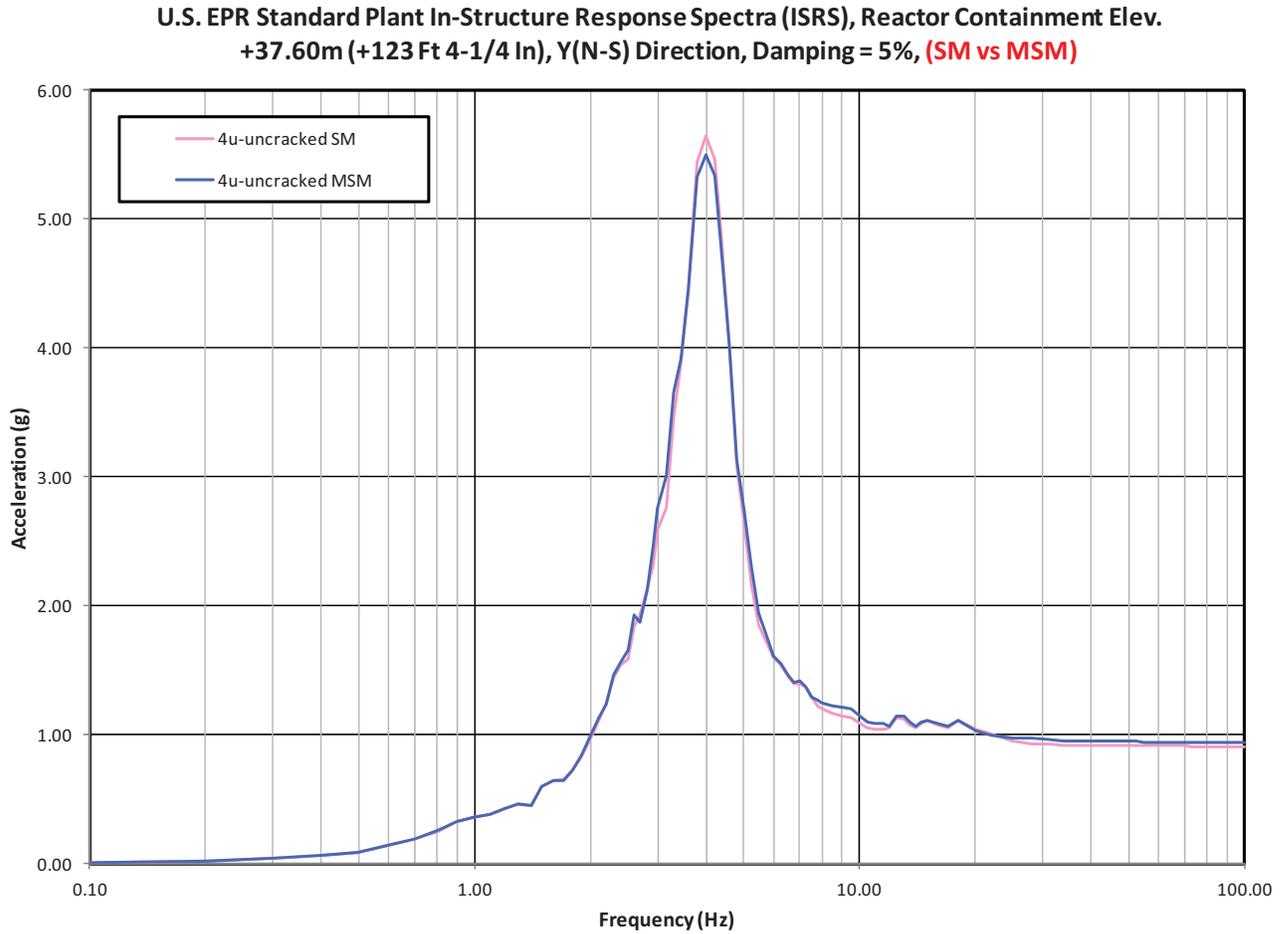


Figure 03.07.02-75-45—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), Z (Vert.) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

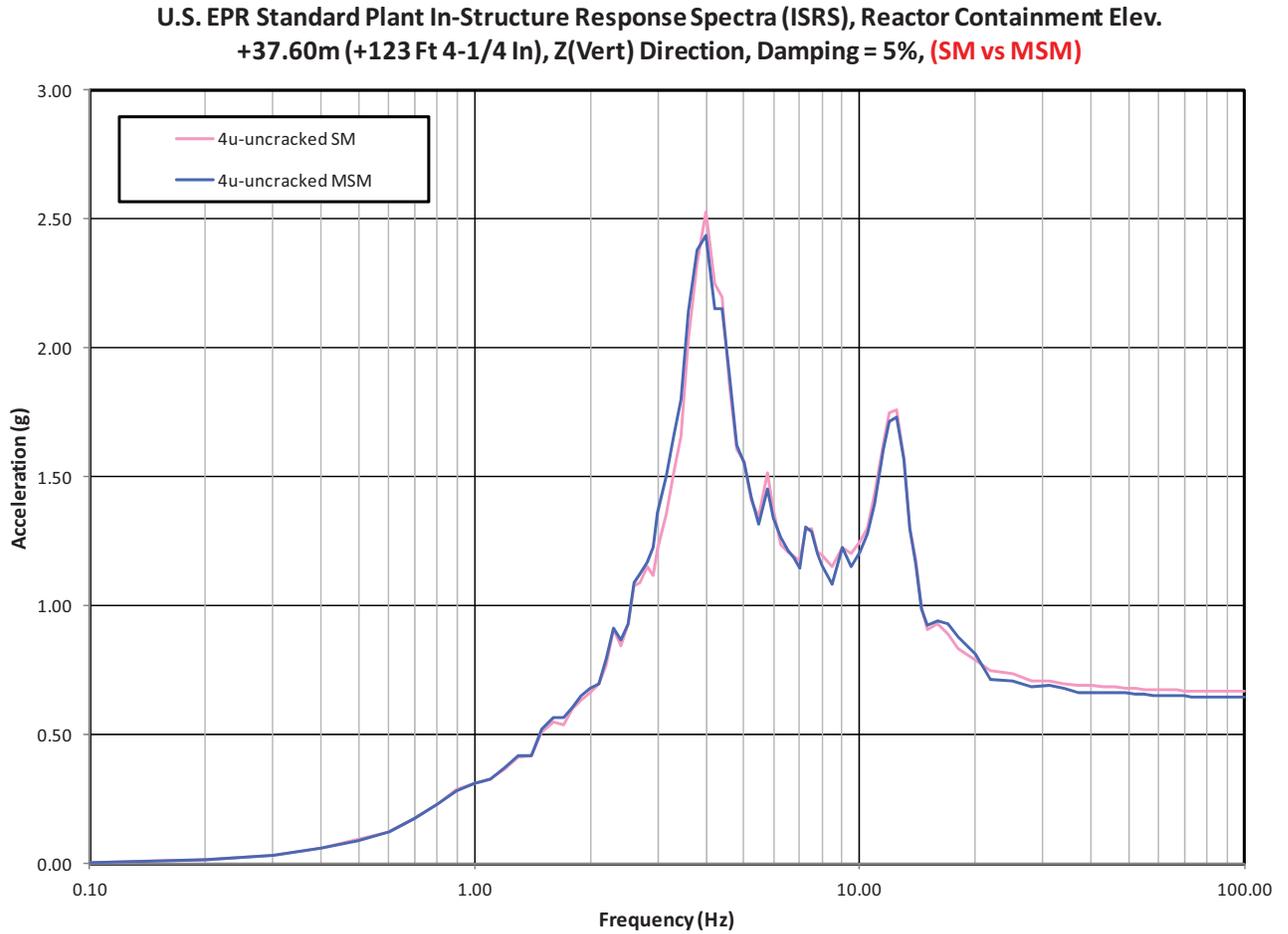


Figure 03.07.02-75-46—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), X (E-W) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

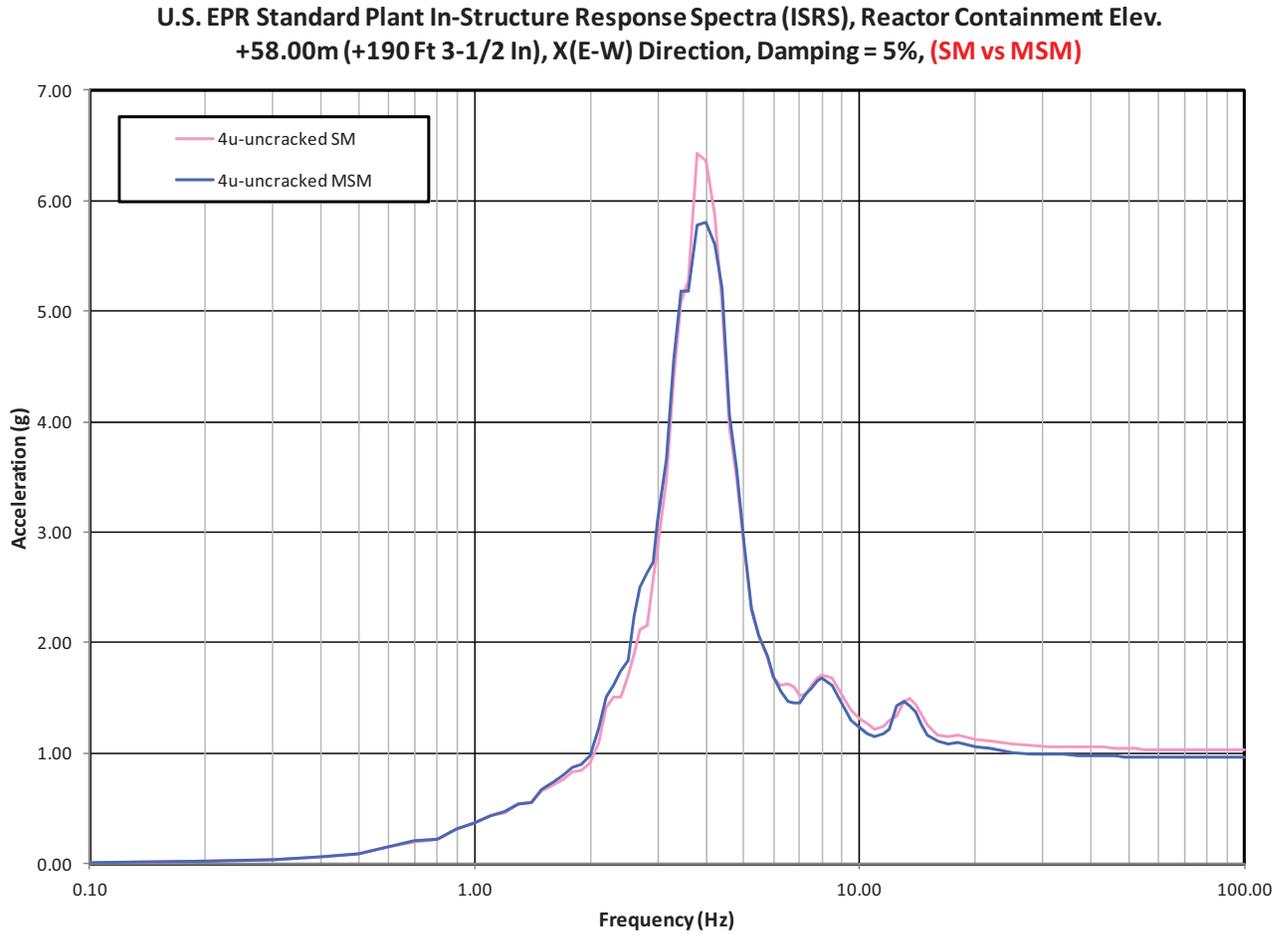


Figure 03.07.02-75-47—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), Y (N-S) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

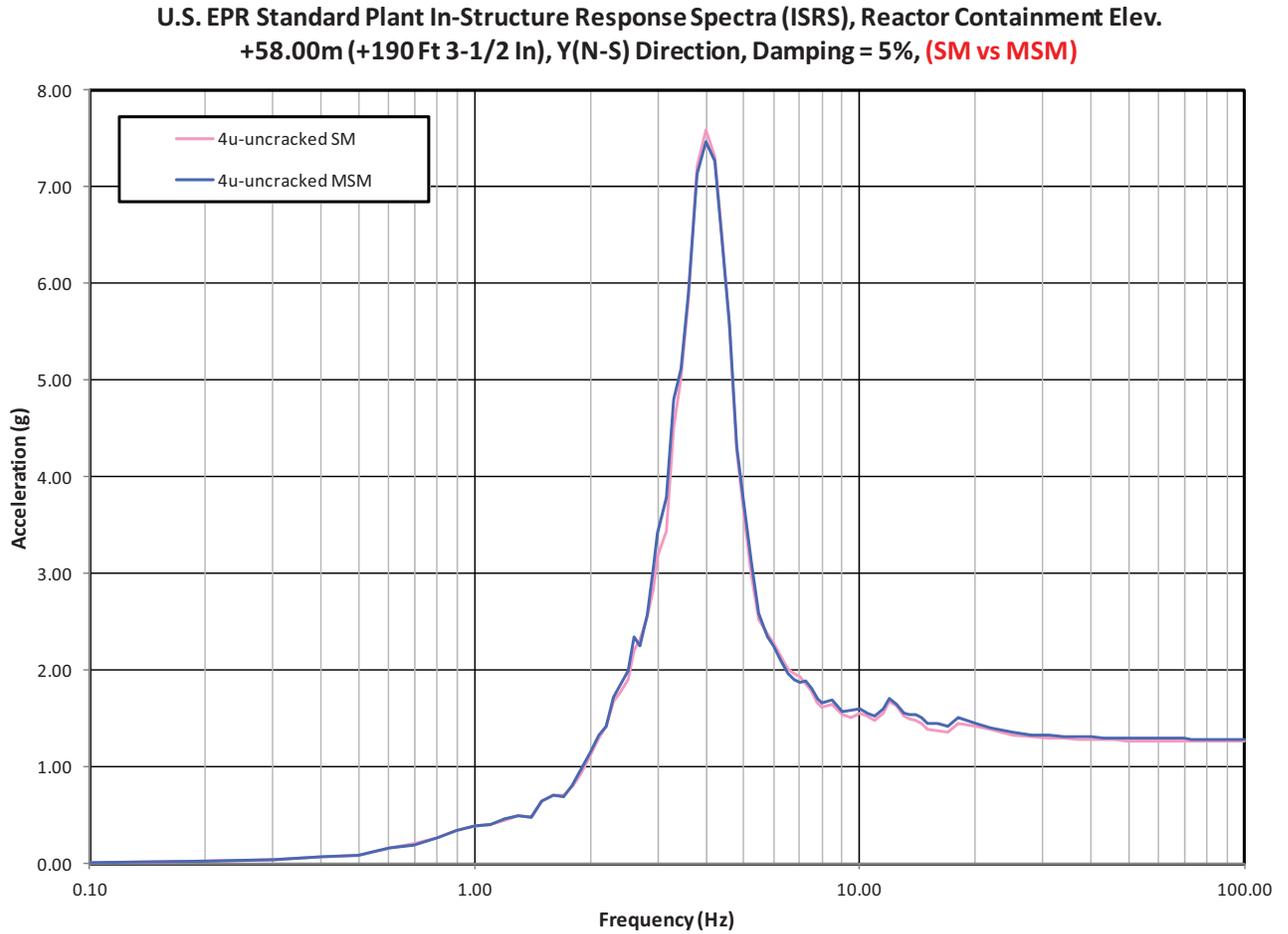


Figure 03.07.02-75-48—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), Z (Vert.) Direction, 5% Damping, Case 4UE-M, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment Elev. +58.00m (+190 Ft 3-1/2 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

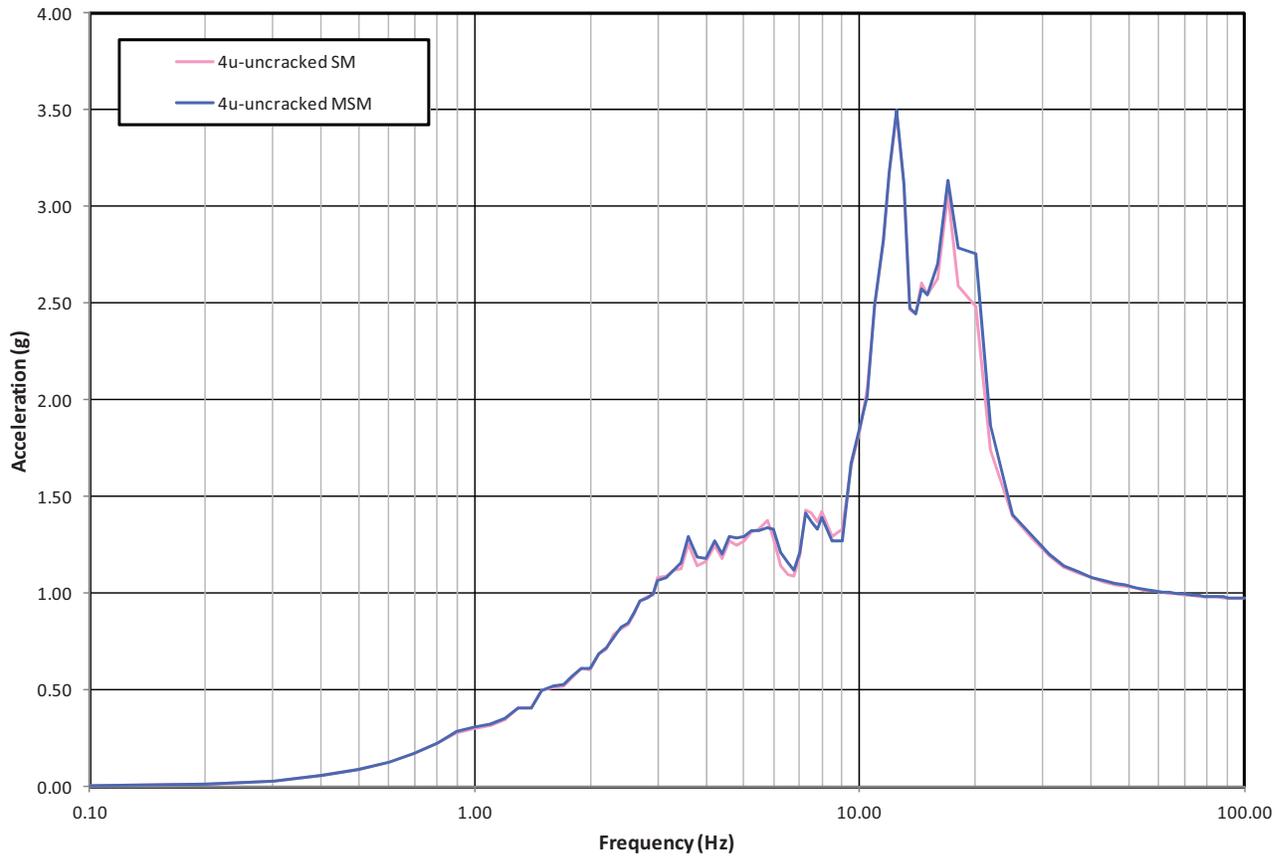


Figure 03.07.02-75-49—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), Transfer Functions for BB_UB at Node 19717, SM vs. MSM, X (E-W) Response due to X (E-W) Input

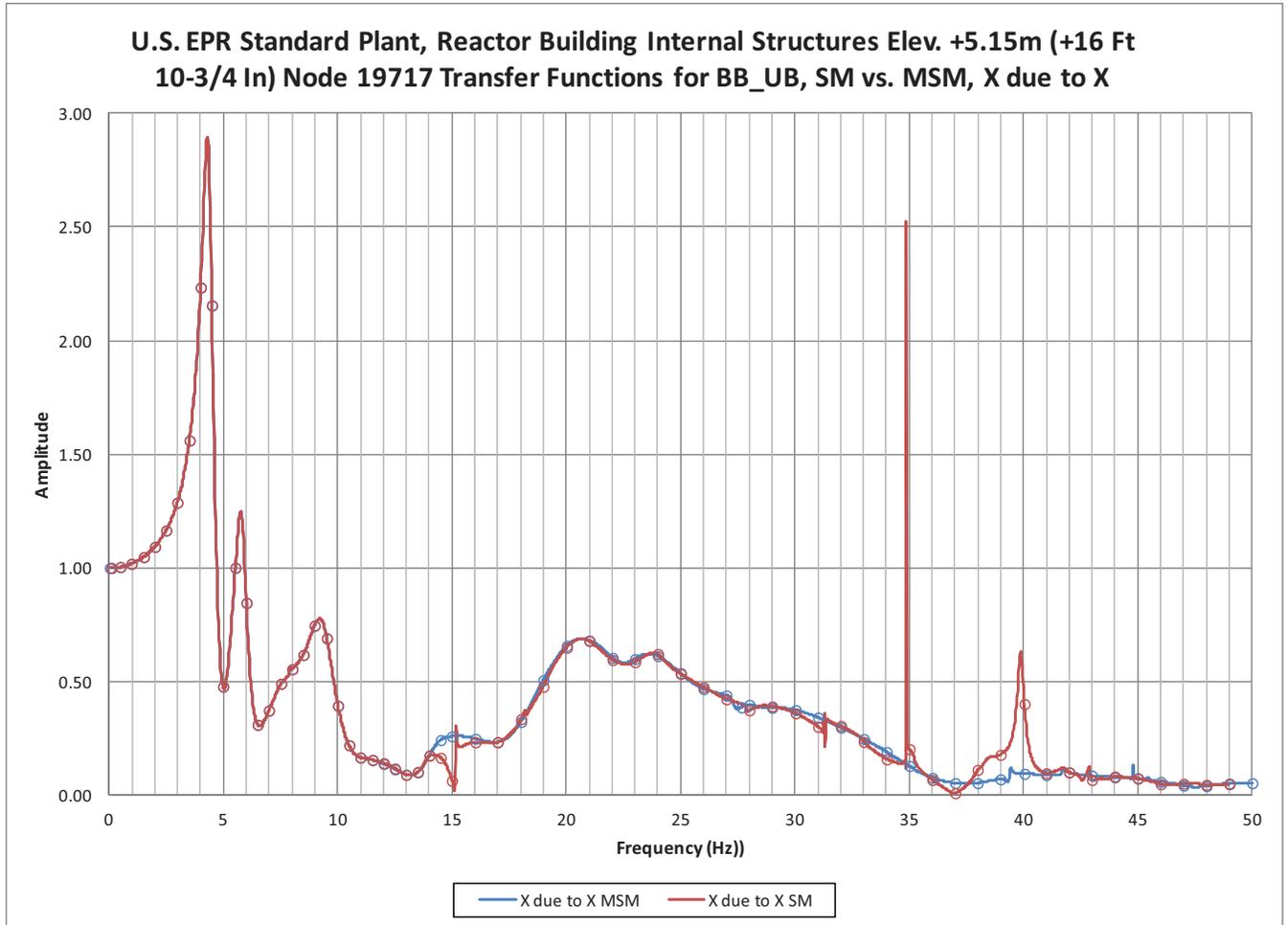


Figure 03.07.02-75-50—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), Transfer Functions for BB_UB at Node 19717, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input

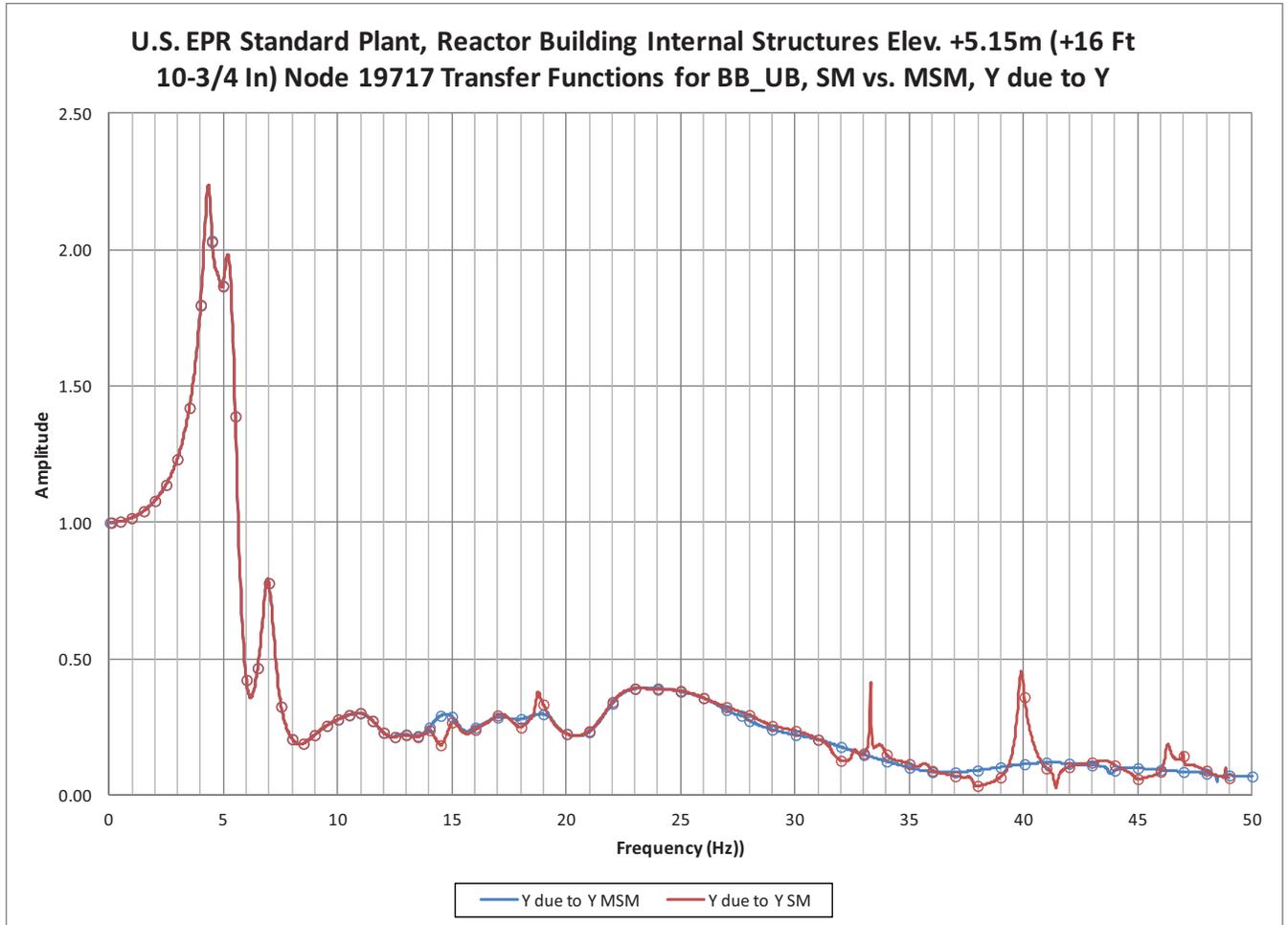


Figure 03.07.02-75-51—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), Transfer Functions for BB_UB at Node 19717, SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input

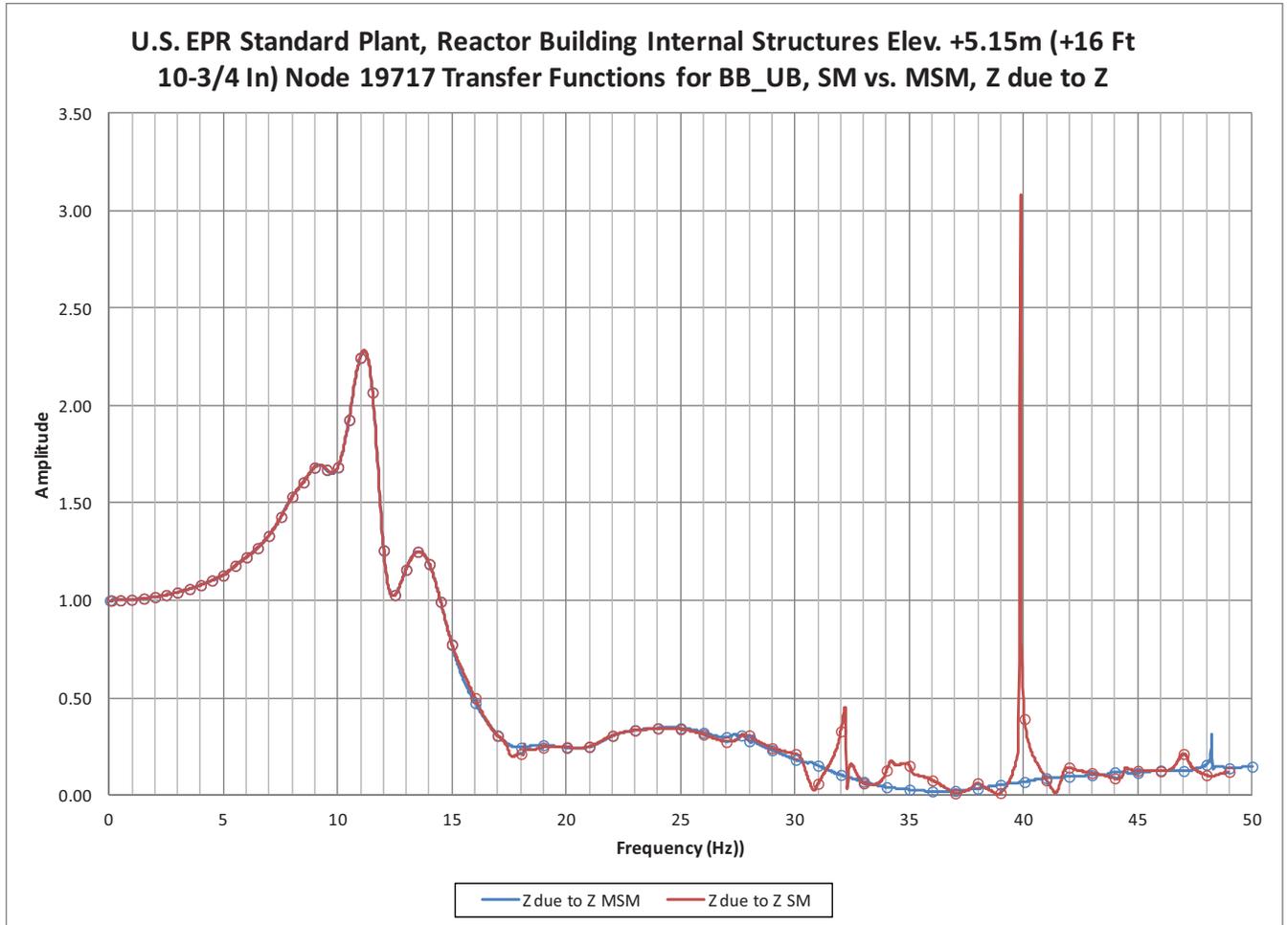


Figure 03.07.02-75-52—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +19.50 m (+63 ft 11-3/4 in), Transfer Functions for BB_UB at Node 37467, SM vs. MSM, X (E-W) Response due to X (E-W) Input

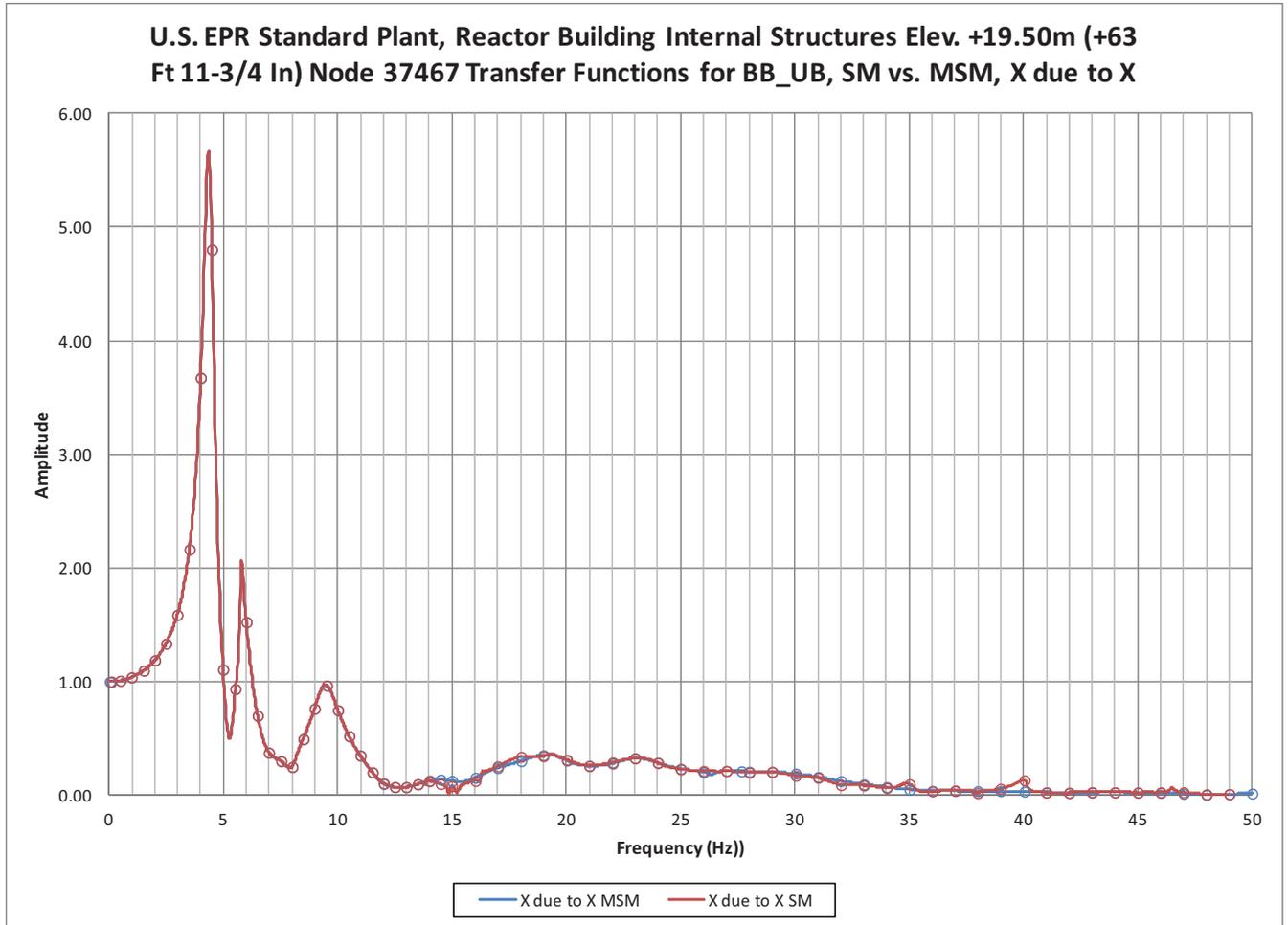


Figure 03.07.02-75-53—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +19.50 m (+63 ft 11-3/4 in), Transfer Functions for BB_UB at Node 37467, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input

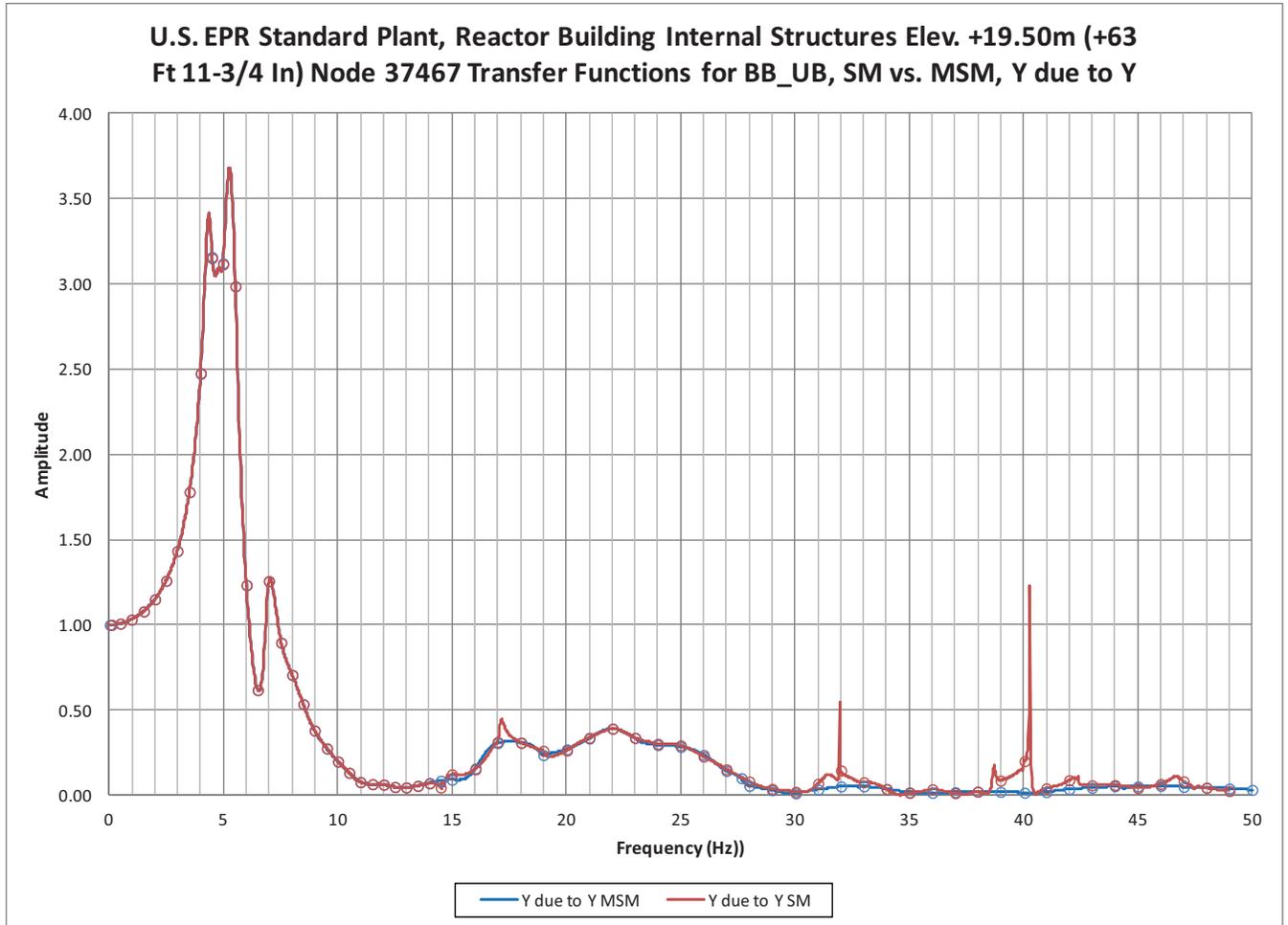
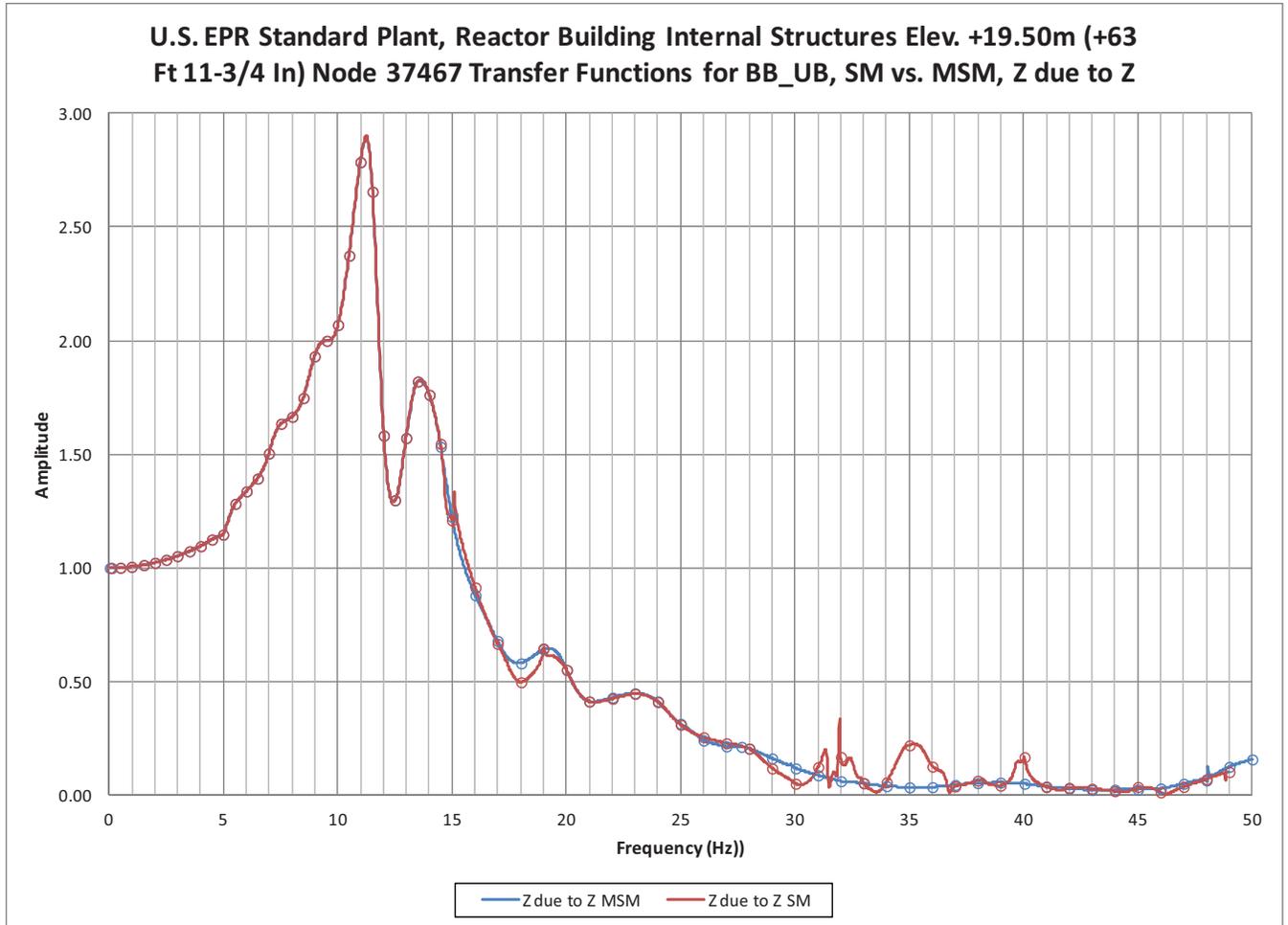
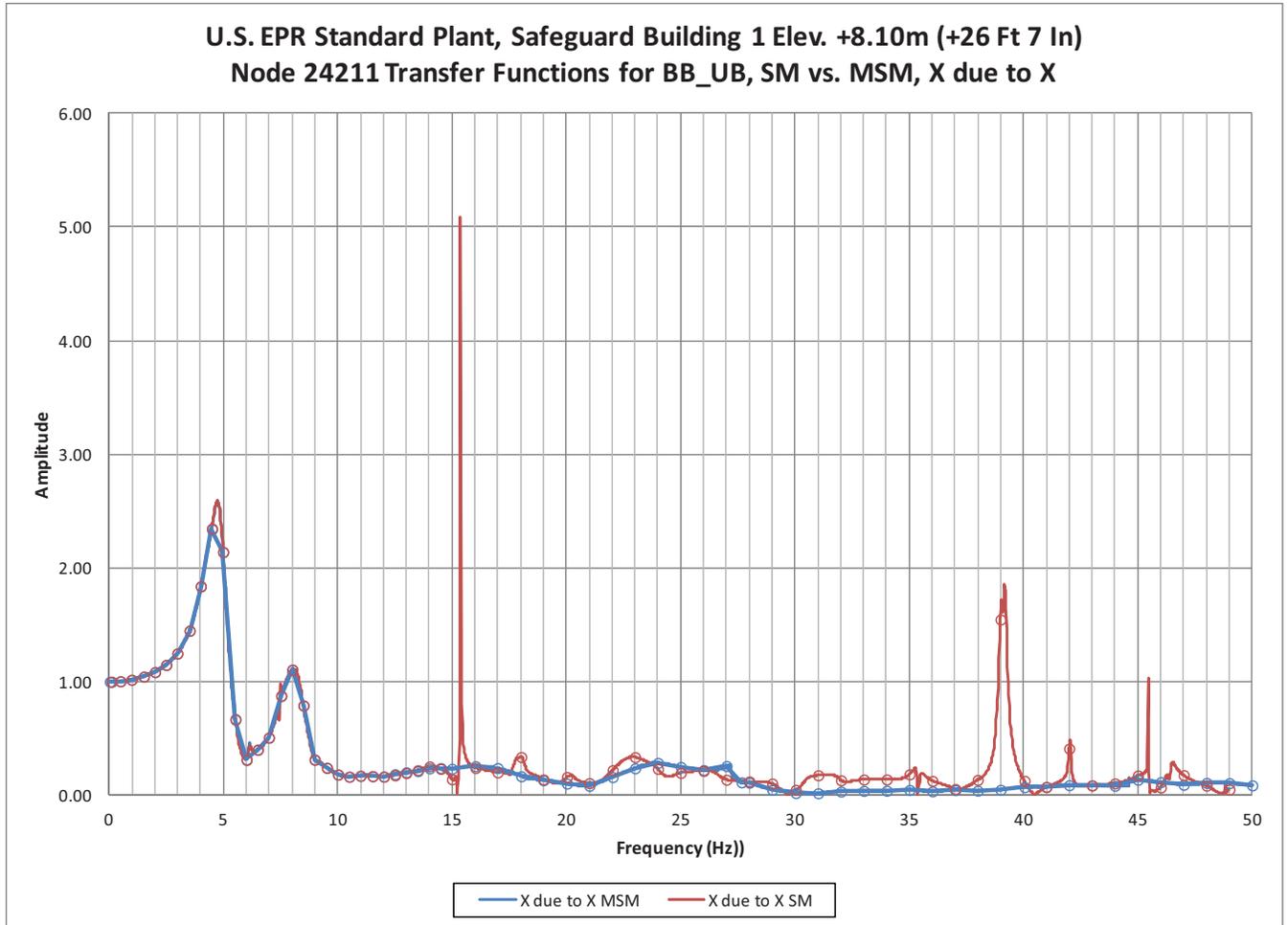


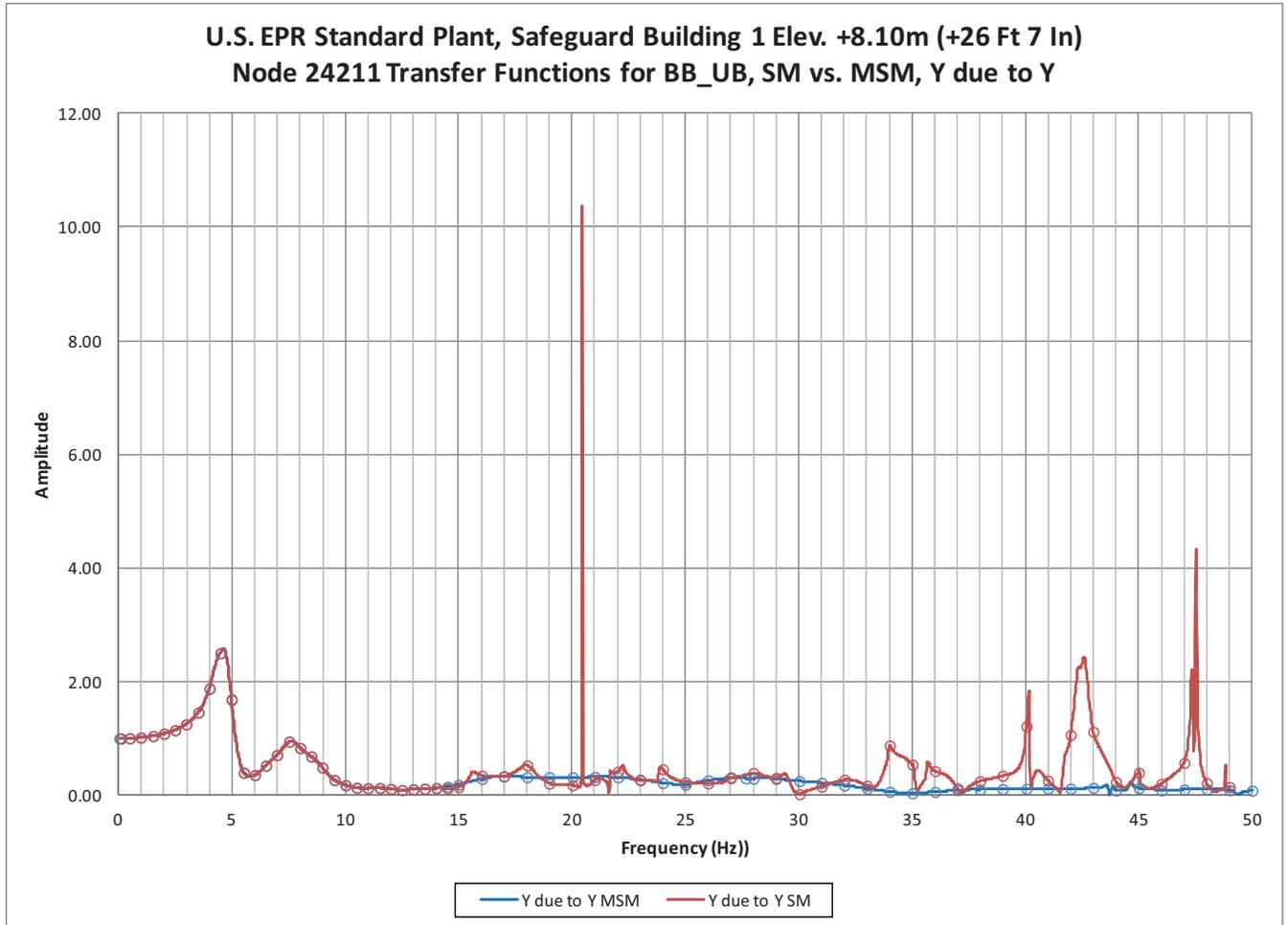
Figure 03.07.02-75-54—U.S. EPR Standard Plant, Reactor Building Internal Structures, Elev. +19.50 m (+63 ft 11-3/4 in), Transfer Functions for BB_UB at Node 37467, SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input



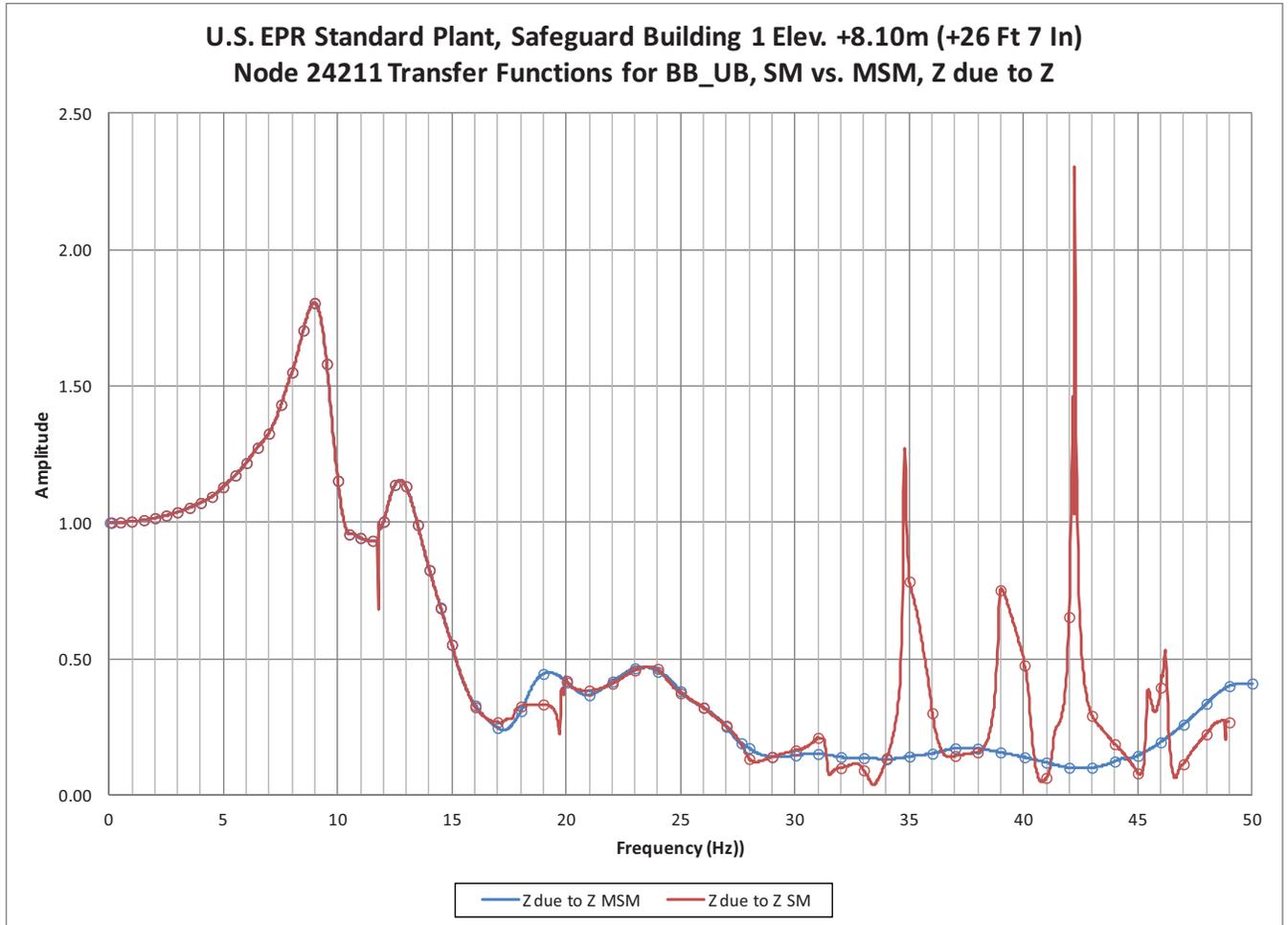
**Figure 03.07.02-75-55—U.S. EPR Standard Plant, Safeguard Building 1,
Elev. +8.10 m (+26 ft 7 in), Transfer Functions for BB_UB at Node 24211, SM
vs. MSM, X (E-W) Response due to X (E-W) Input**



**Figure 03.07.02-75-56—U.S. EPR Standard Plant, Safeguard Building 1,
Elev. +8.10 m (+26 ft 7 in), Transfer Functions for BB_UB at Node 24211, SM
vs. MSM, Y (N-S) Response due to Y (N-S) Input**



**Figure 03.07.02-75-57—U.S. EPR Standard Plant, Safeguard Building 1,
Elev. +8.10 m (+26 ft 7 in), Transfer Functions for BB_UB at Node 24211, SM
vs. MSM, Z (Vert.) Response due to Z (Vert.) Input**



**Figure 03.07.02-75-58—U.S. EPR Standard Plant, Safeguard Building 1,
Elev. +21.00 m (+68 ft 11 in), Transfer Functions for BB_UB at Node 39721,
SM vs. MSM, X (E-W) Response due to X (E-W) Input**

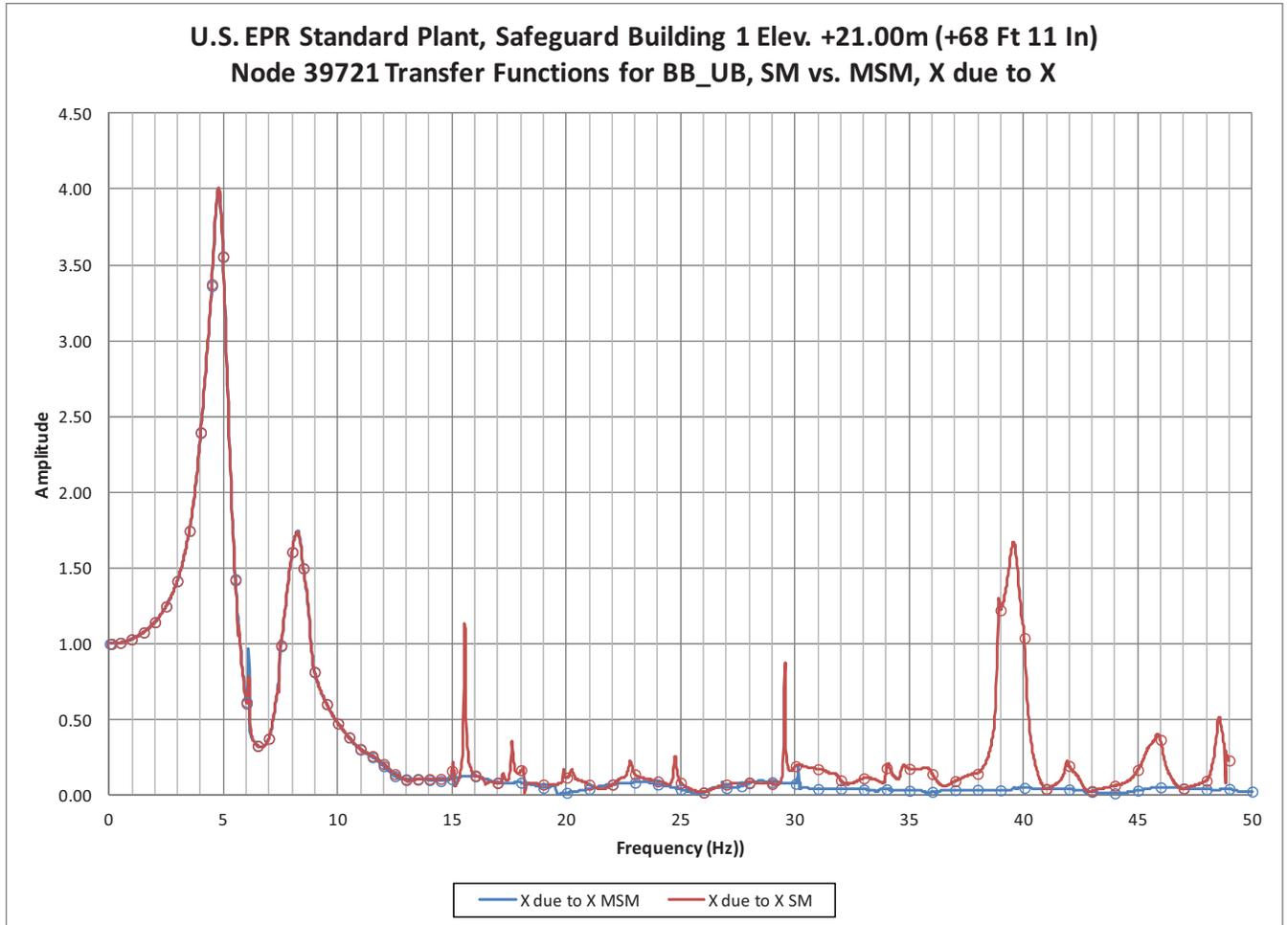
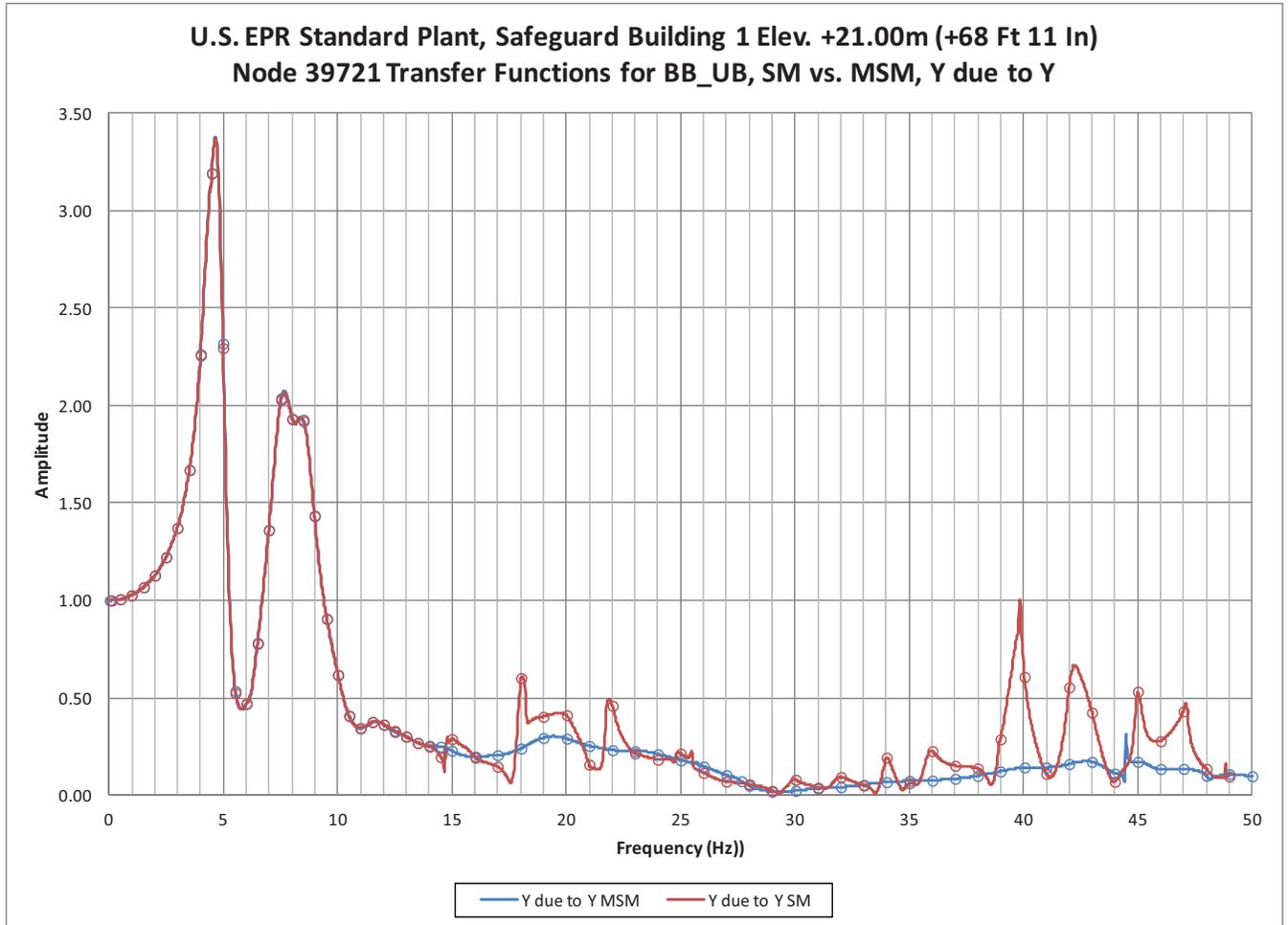
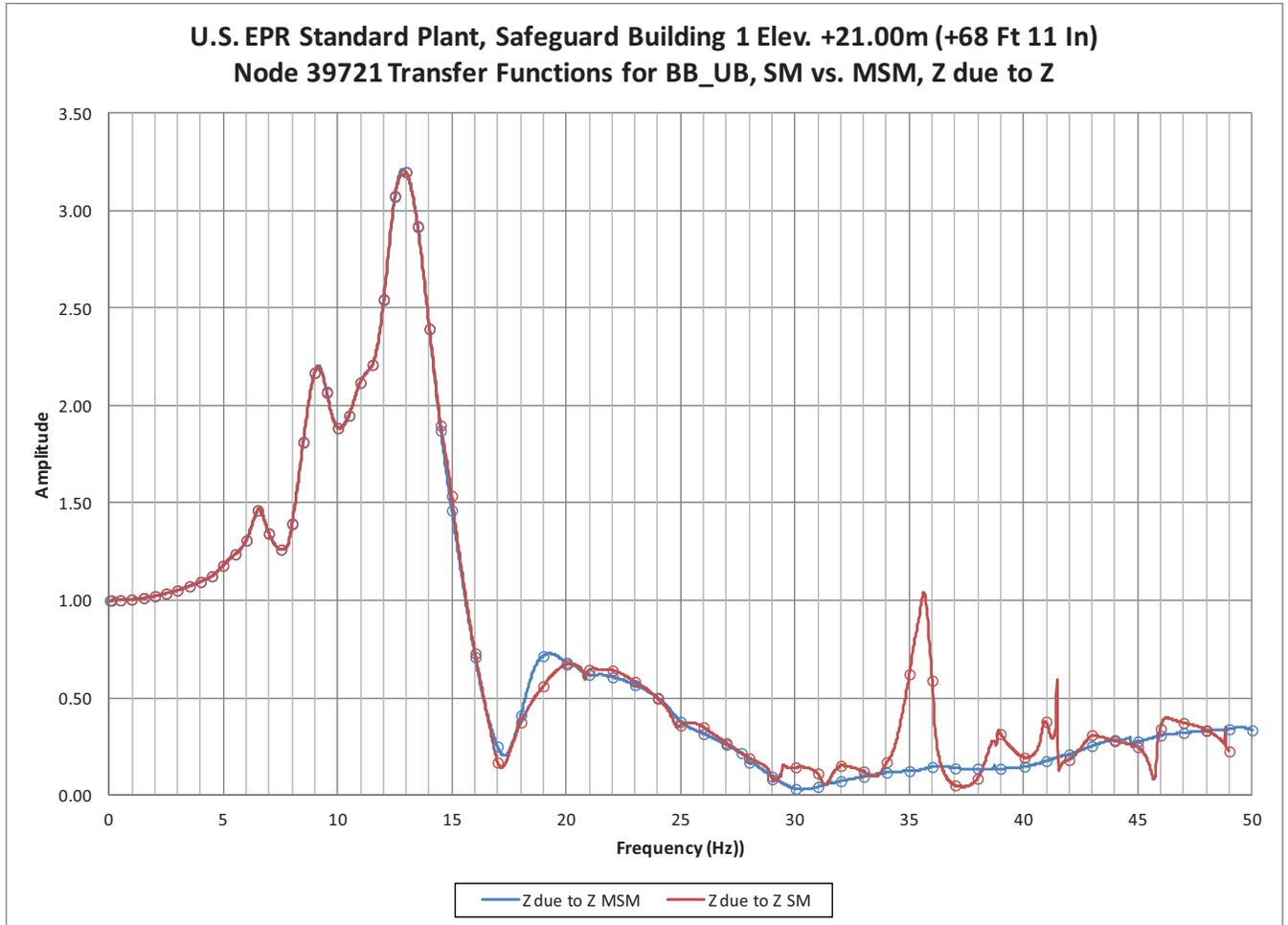


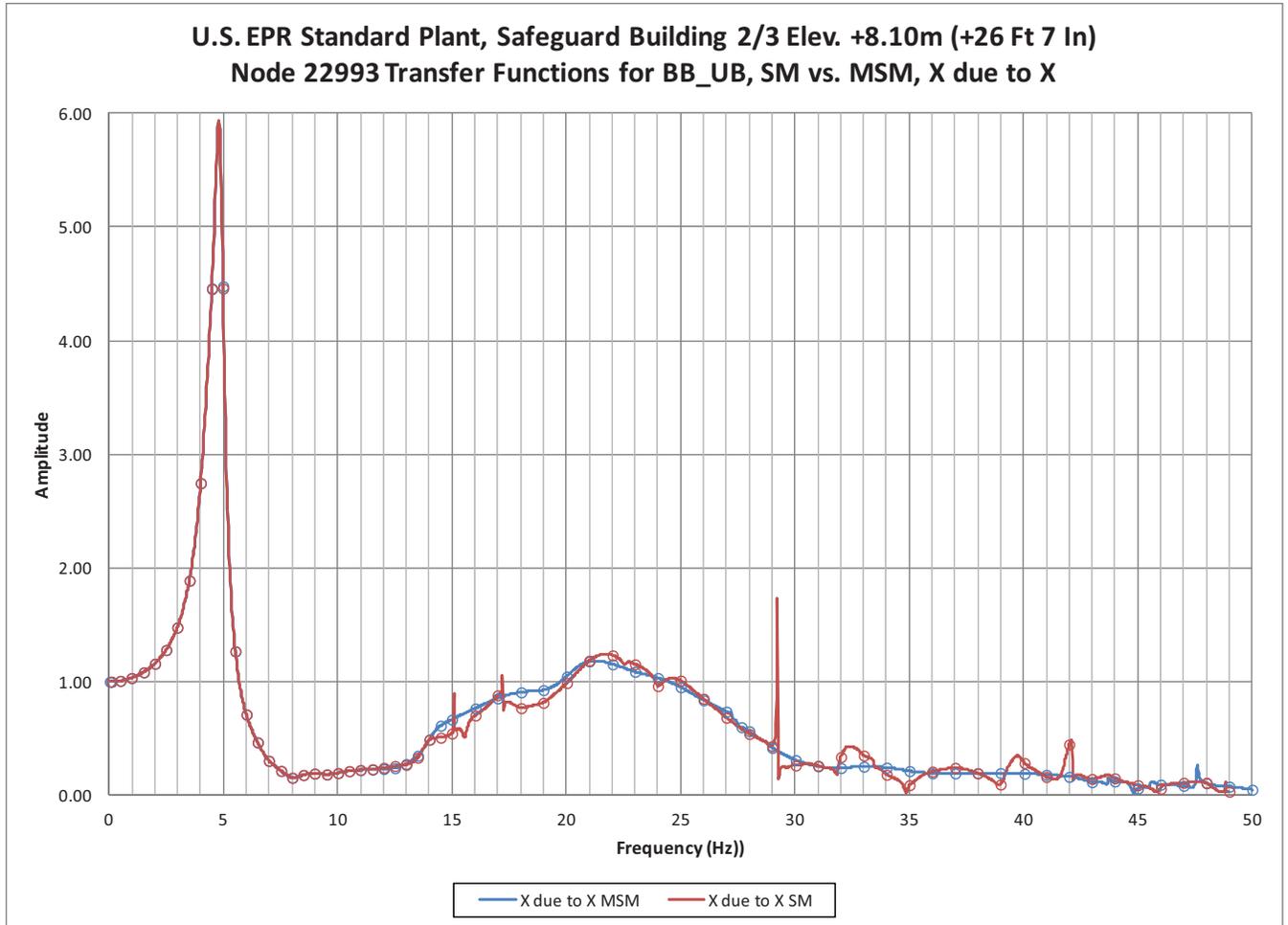
Figure 03.07.02-75-59—U.S. EPR Standard Plant, Safeguard Building 1, Elev. +21.00 m (+68 ft 11 in), Transfer Functions for BB_UB at Node 39721, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input



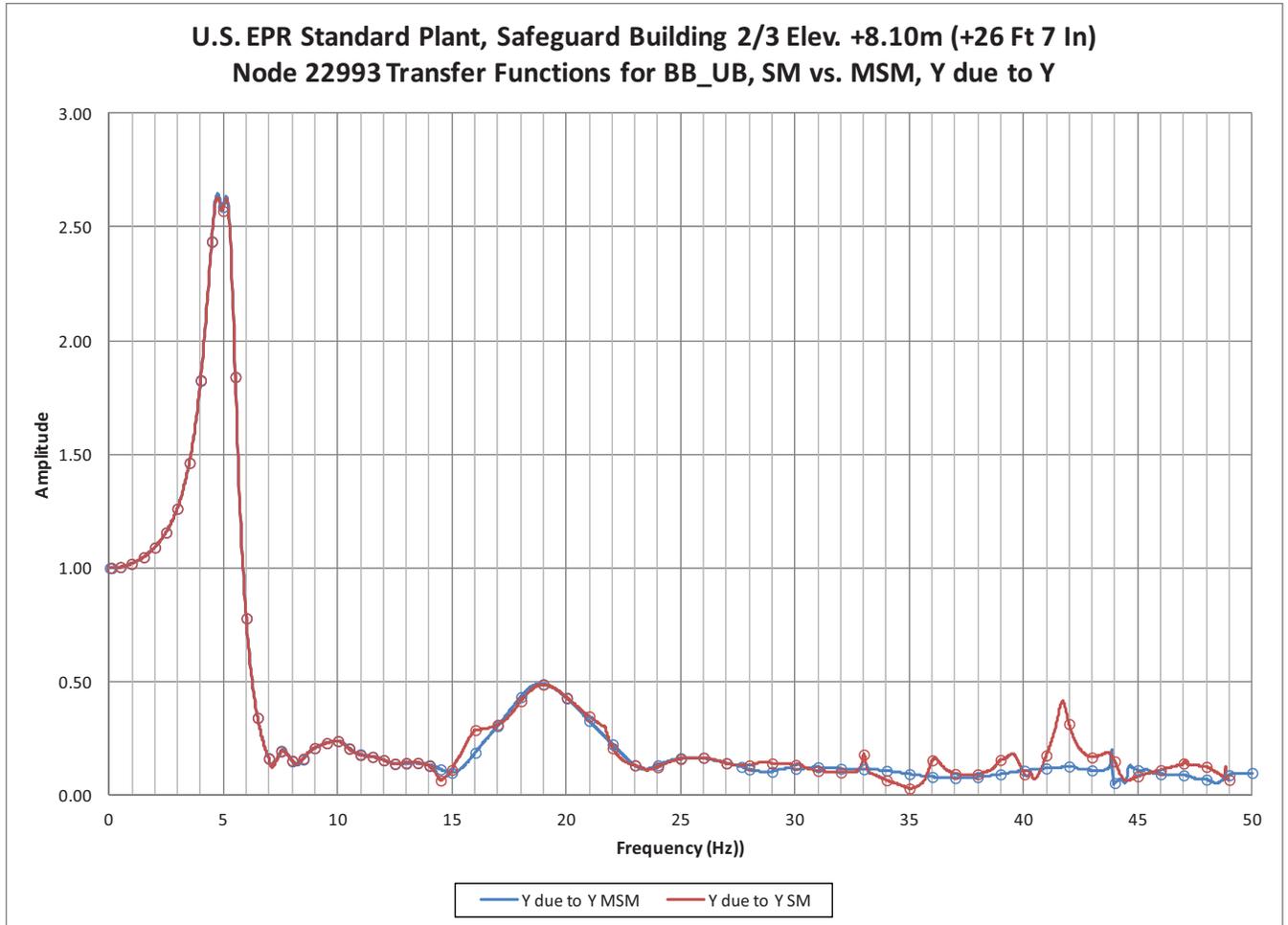
**Figure 03.07.02-75-60—U.S. EPR Standard Plant, Safeguard Building 1,
Elev. +21.00 m (+68 ft 11 in), Transfer Functions for BB_UB at Node 39721,
SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input**



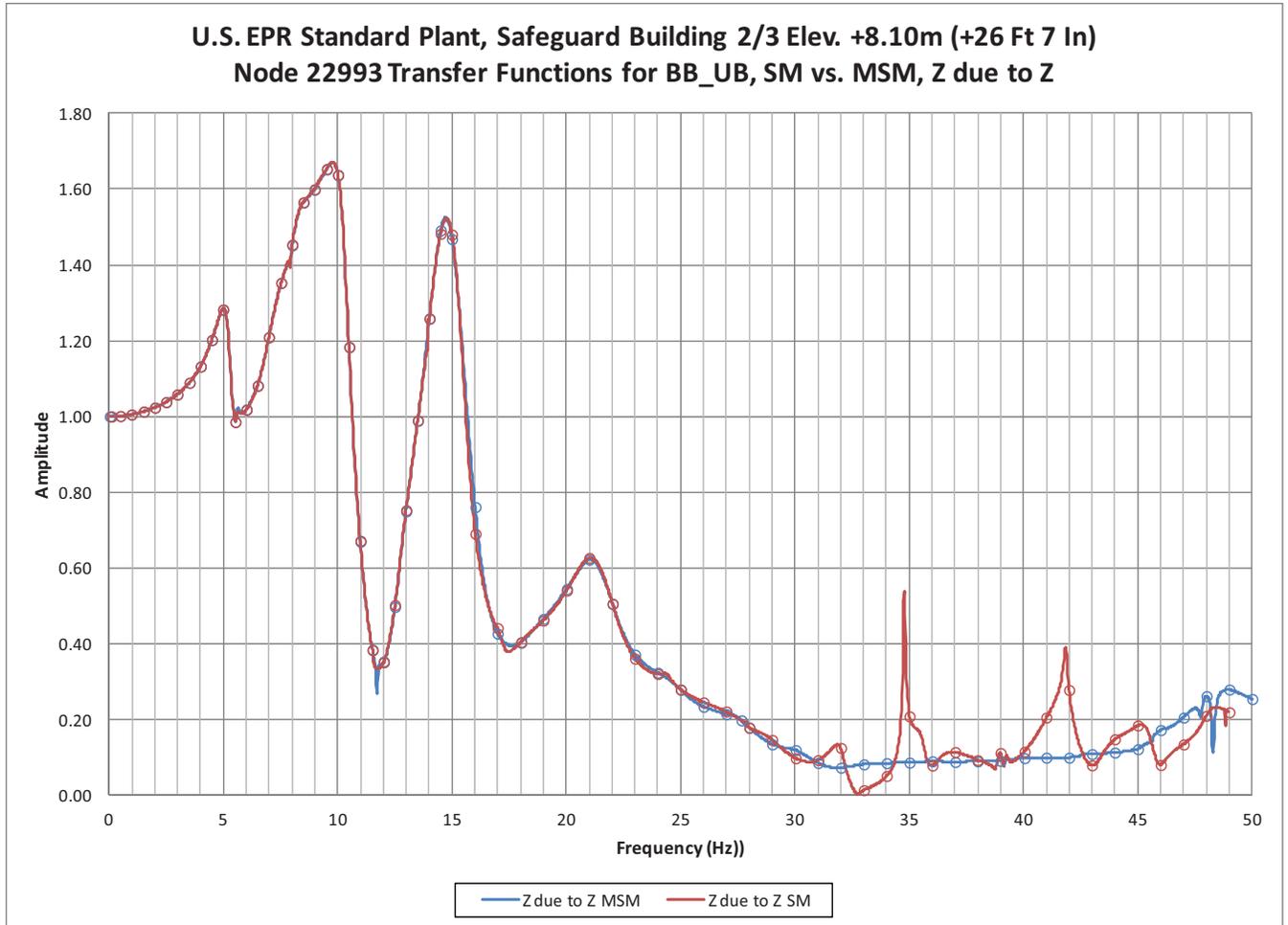
**Figure 03.07.02-75-61—U.S. EPR Standard Plant, Safeguard Building 2/3,
Elev. +8.10 m (+26 ft 7 in), Transfer Functions for BB_UB at Node 22993, SM
vs. MSM, X (E-W) Response due to X (E-W) Input**



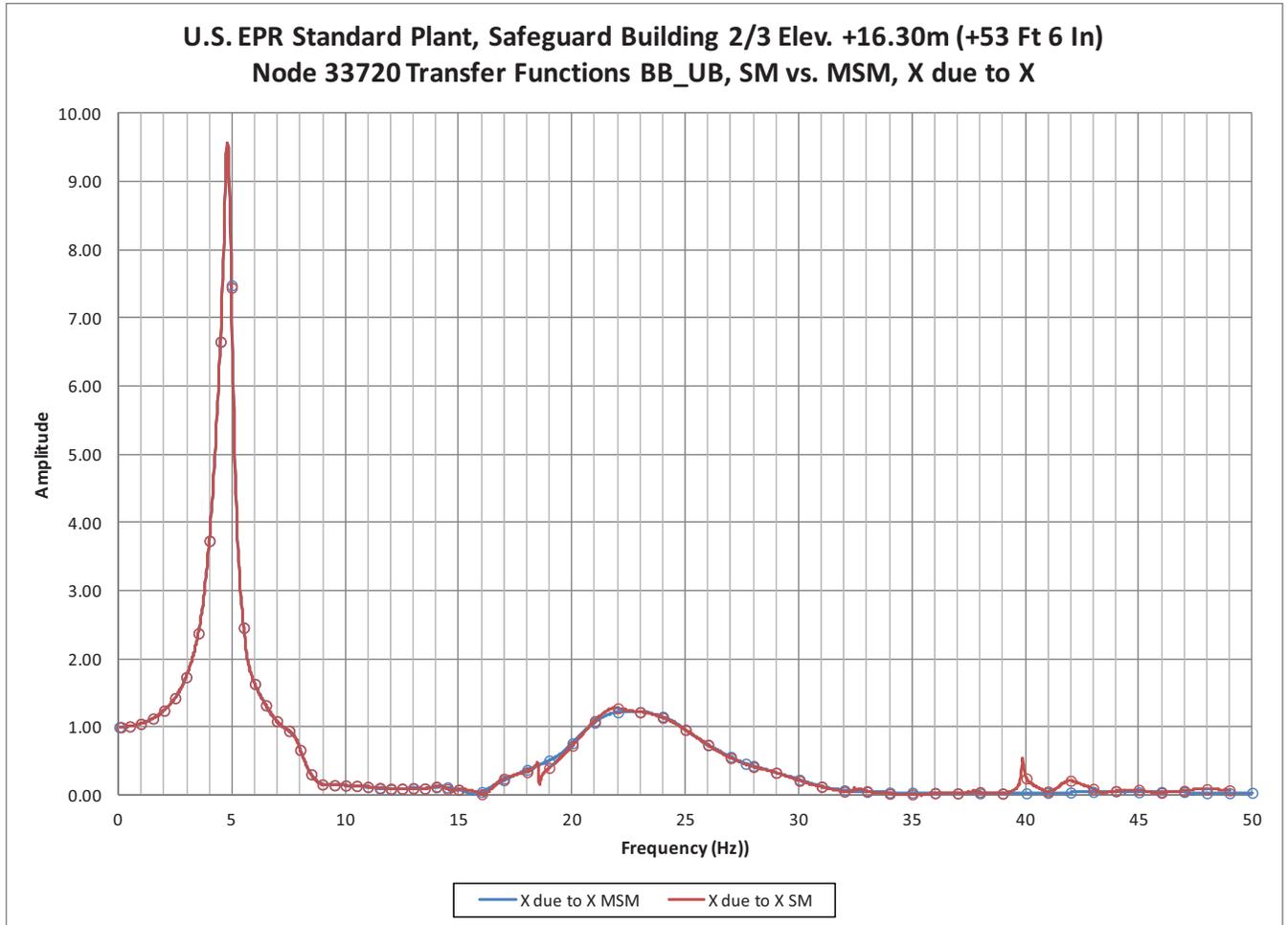
**Figure 03.07.02-75-62—U.S. EPR Standard Plant, Safeguard Building 2/3,
Elev. +8.10 m (+26 ft 7 in), Transfer Functions for BB_UB at Node 22993, SM
vs. MSM, Y (N-S) Response due to Y (N-S) Input**



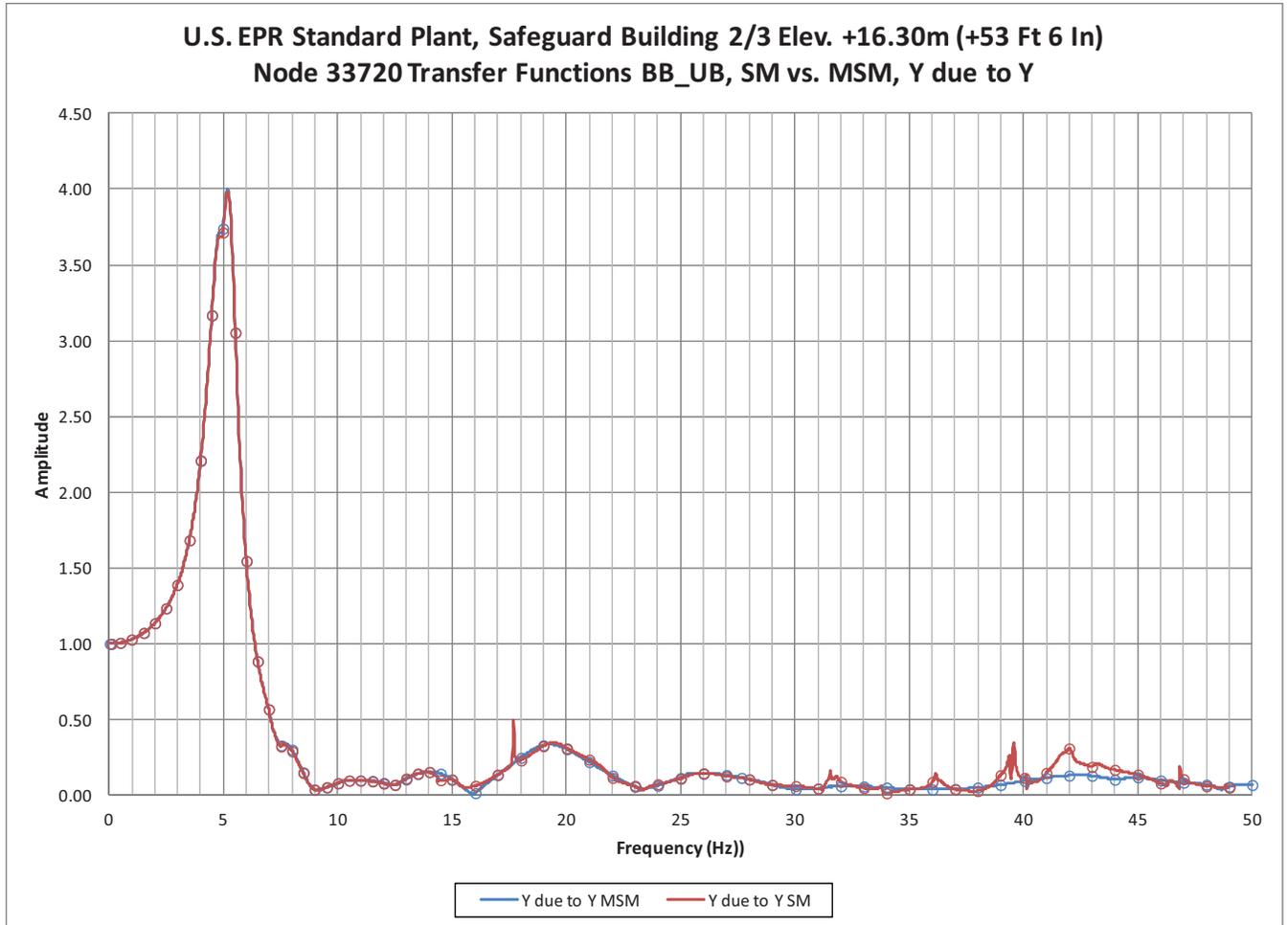
**Figure 03.07.02-75-63—U.S. EPR Standard Plant, Safeguard Building 2/3,
Elev. +8.10 m (+26 ft 7 in), Transfer Functions for BB_UB at Node 22993, SM
vs. MSM, Z (Vert.) Response due to Z (Vert.) Input**



**Figure 03.07.02-75-64—U.S. EPR Standard Plant, Safeguard Building 2/3,
Elev. +16.30 m (+53 ft 6 in), Transfer Functions for BB_UB at Node 33720,
SM vs. MSM, X (E-W) Response due to X (E-W) Input**



**Figure 03.07.02-75-65—U.S. EPR Standard Plant, Safeguard Building 2/3,
Elev. +16.30 m (+53 ft 6 in), Transfer Functions for BB_UB at Node 33720,
SM vs. MSM, Y (N-S) Response due to Y (N-S) Input**



**Figure 03.07.02-75-66—U.S. EPR Standard Plant, Safeguard Building 2/3,
Elev. +16.30 m (+53 ft 6 in), Transfer Functions for BB_UB at Node 33720,
SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input**

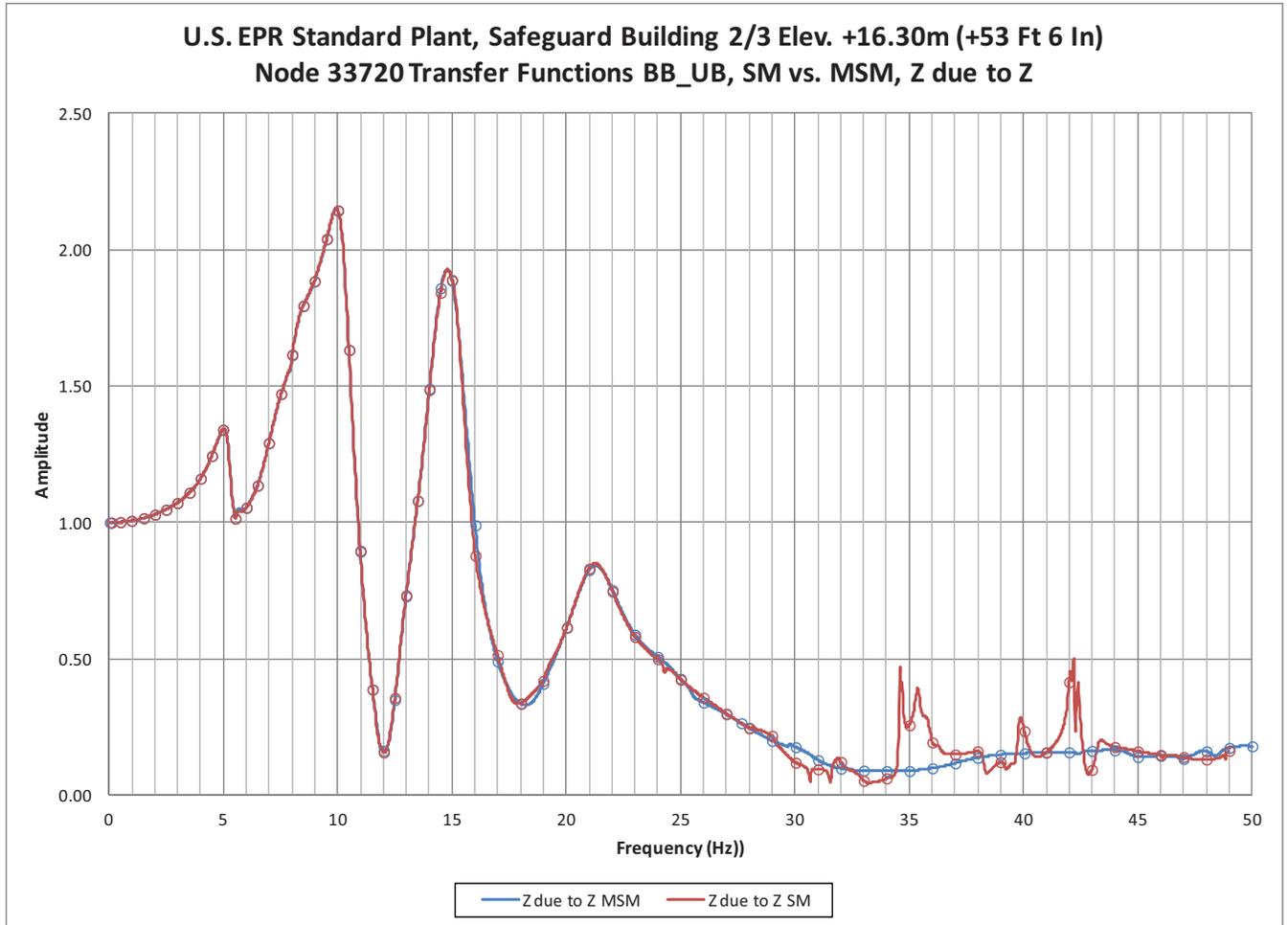


Figure 03.07.02-75-67—U.S. EPR Standard Plant, Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), Transfer Functions for BB_UB at Node 51588, SM vs. MSM, X (E-W) Response due to X (E-W) Input

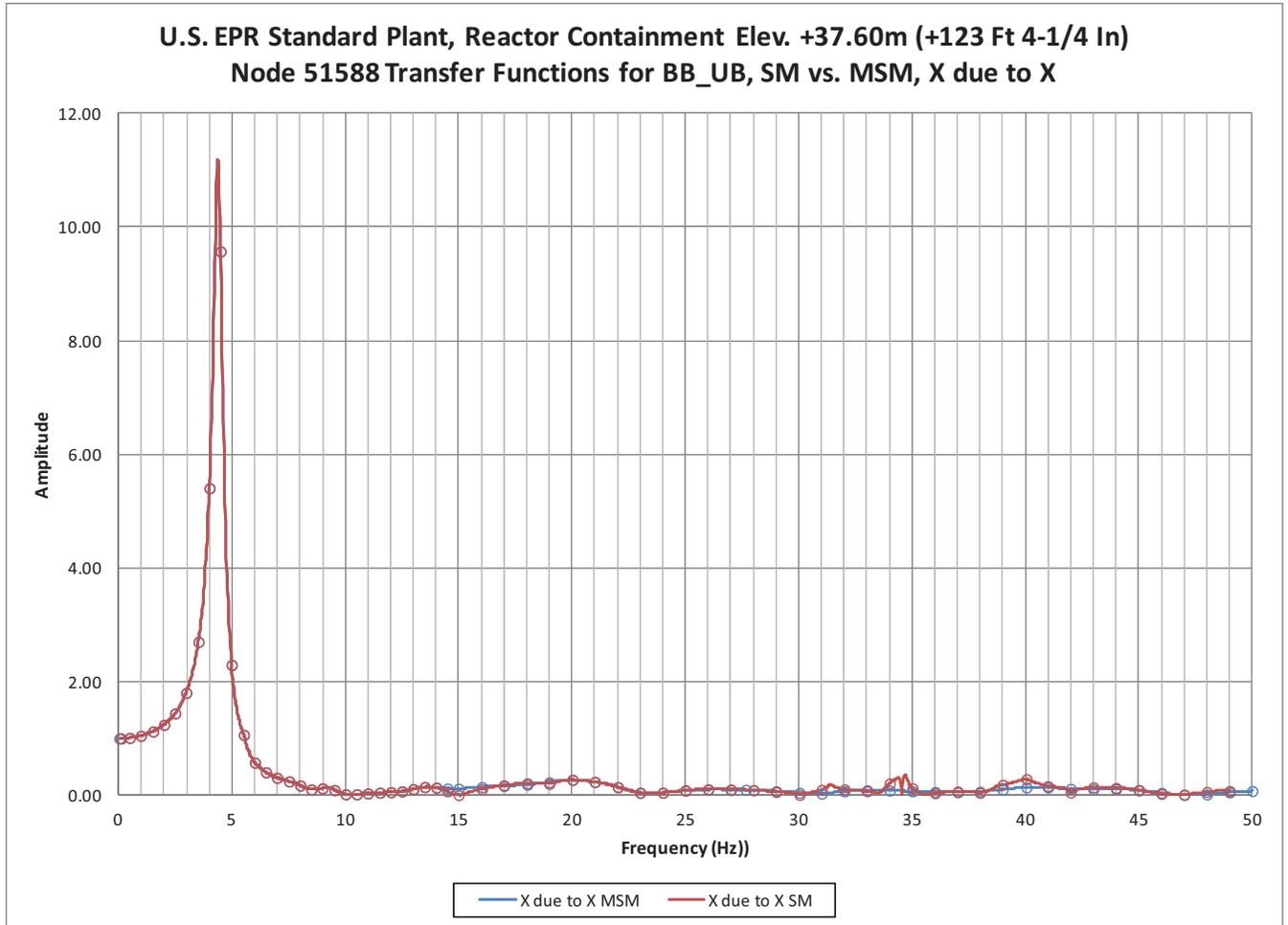


Figure 03.07.02-75-68—U.S. EPR Standard Plant, Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), Transfer Functions for BB_UB at Node 51588, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input

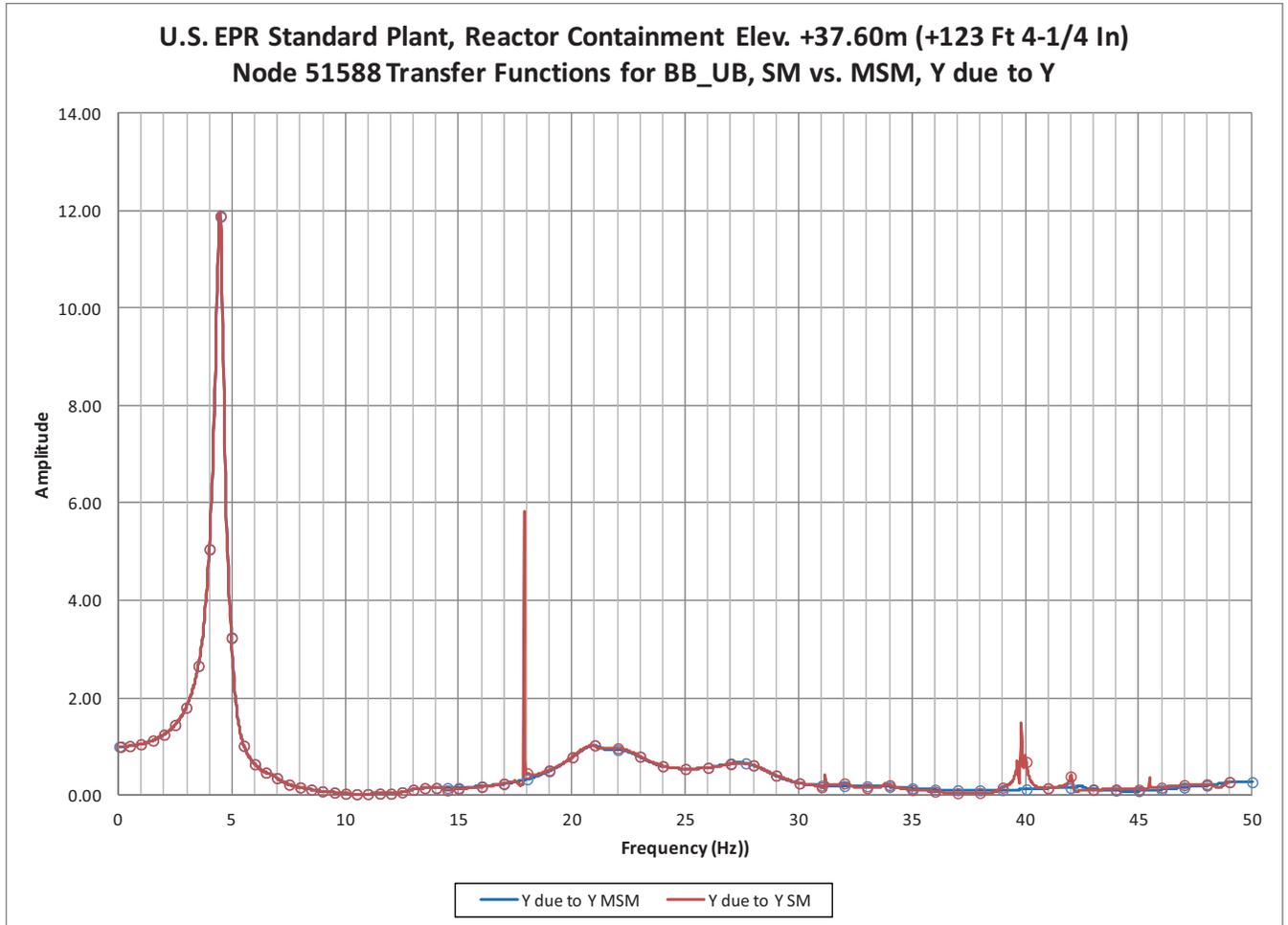


Figure 03.07.02-75-69—U.S. EPR Standard Plant, Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), Transfer Functions for BB_UB at Node 51588, SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input

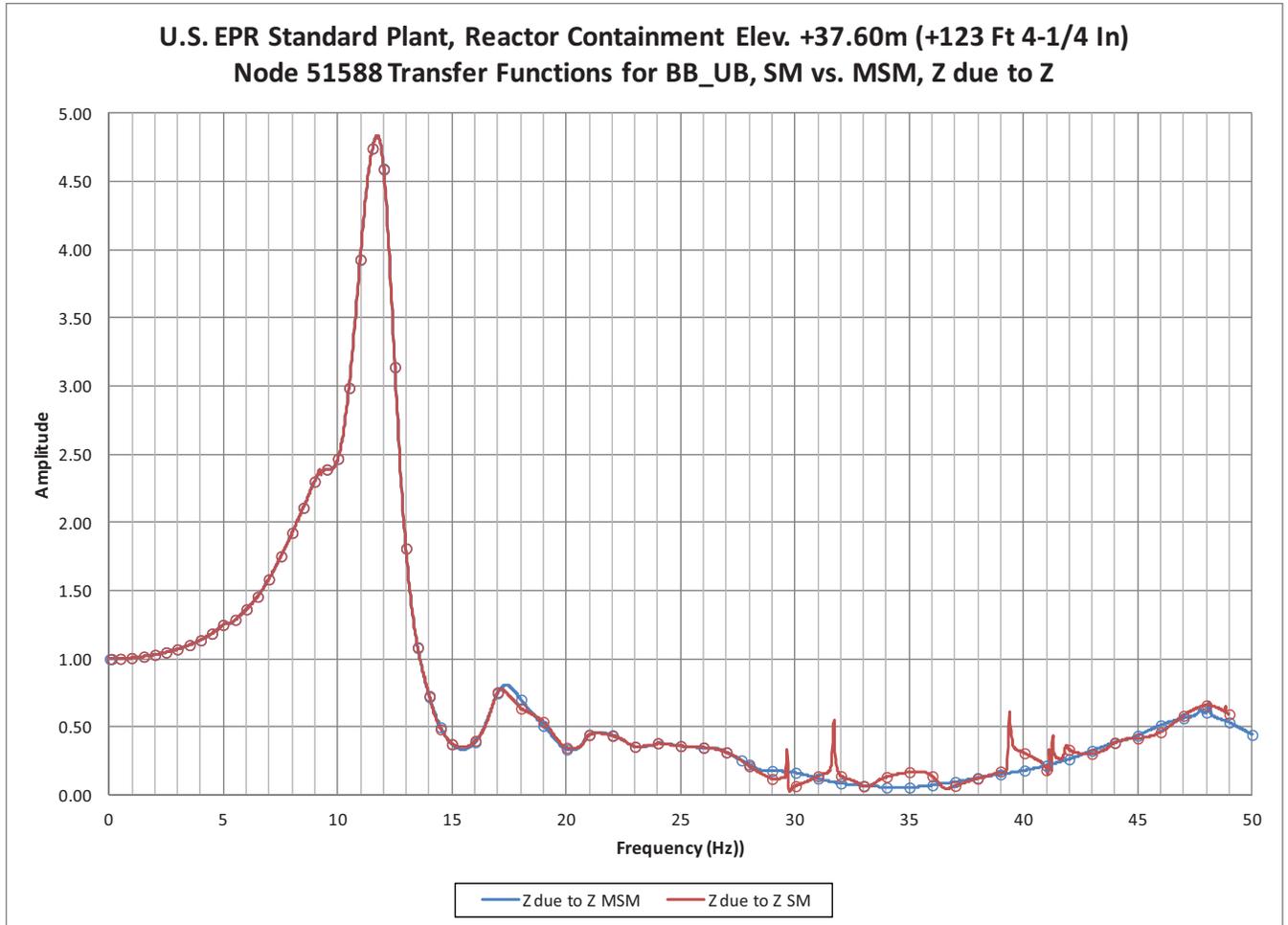


Figure 03.07.02-75-70—U.S. EPR Standard Plant, Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), Transfer Functions for BB_UB at Node 53162, SM vs. MSM, X (E-W) Response due to X (E-W) Input

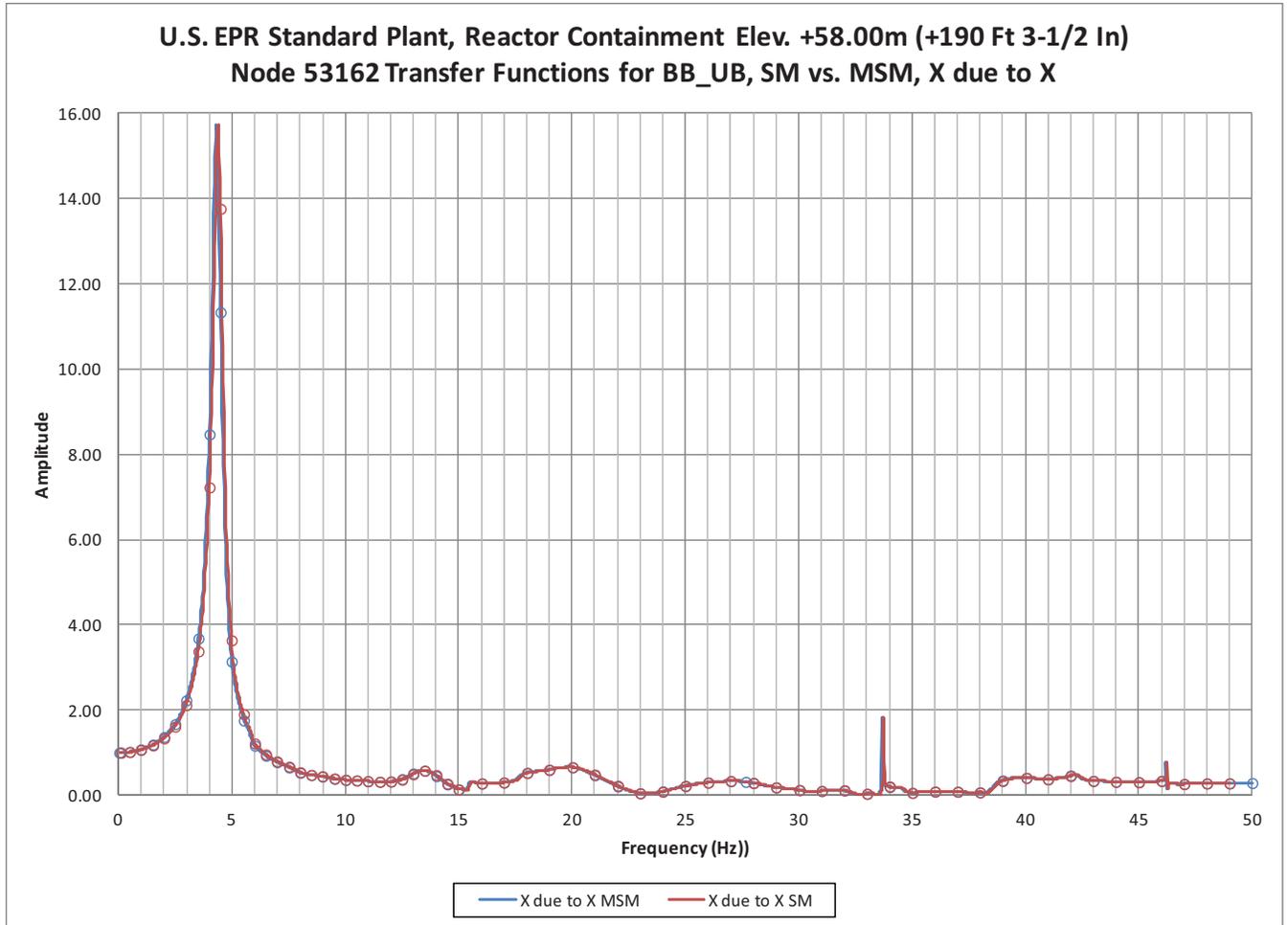


Figure 03.07.02-75-71—U.S. EPR Standard Plant, Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), Transfer Functions for BB_UB at Node 53162, SM vs. MSM, Y (N-S) Response due to Y (N-S) Input

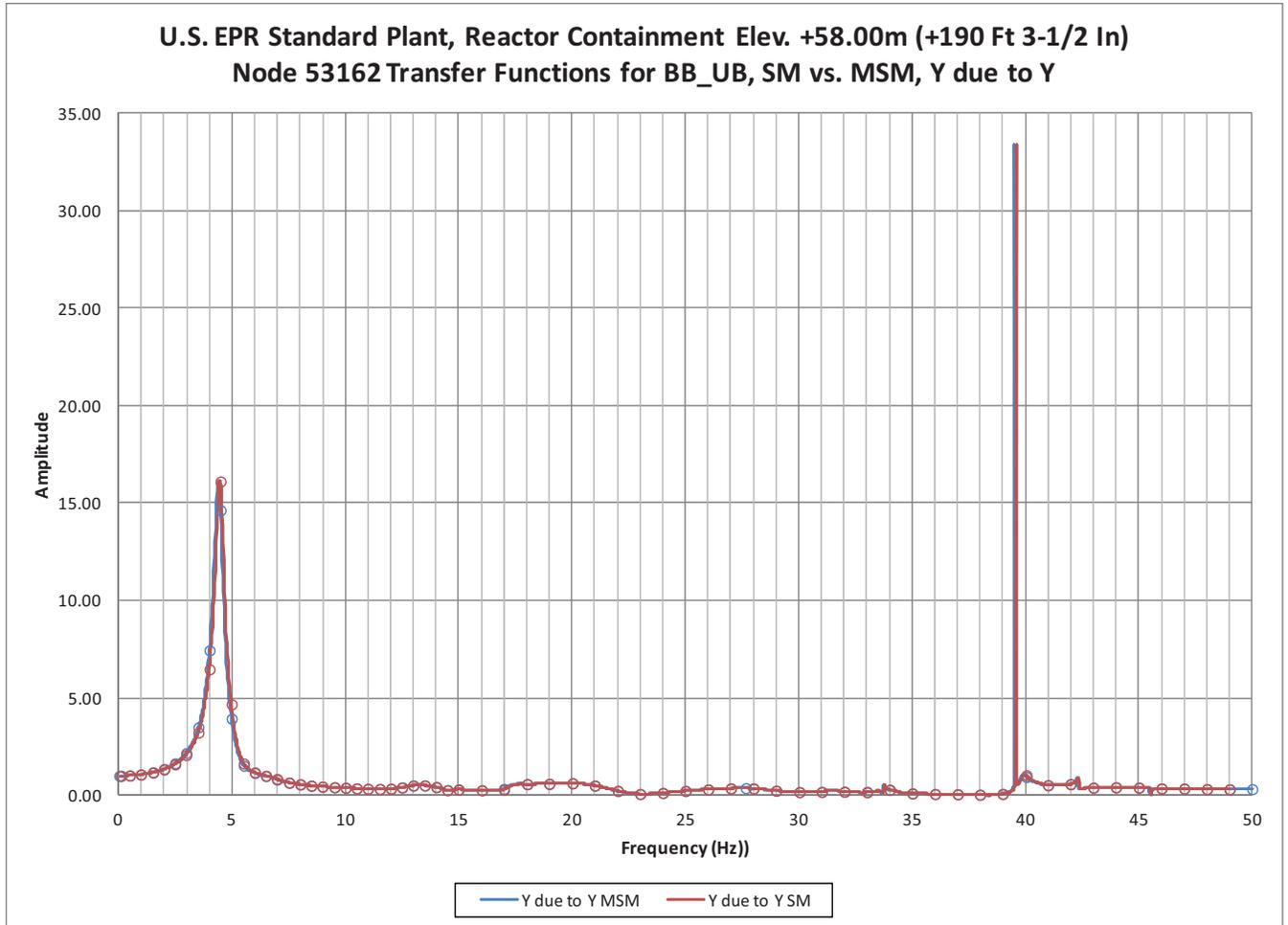


Figure 03.07.02-75-72—U.S. EPR Standard Plant, Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), Transfer Functions for BB_UB at Node 53162, SM vs. MSM, Z (Vert.) Response due to Z (Vert.) Input

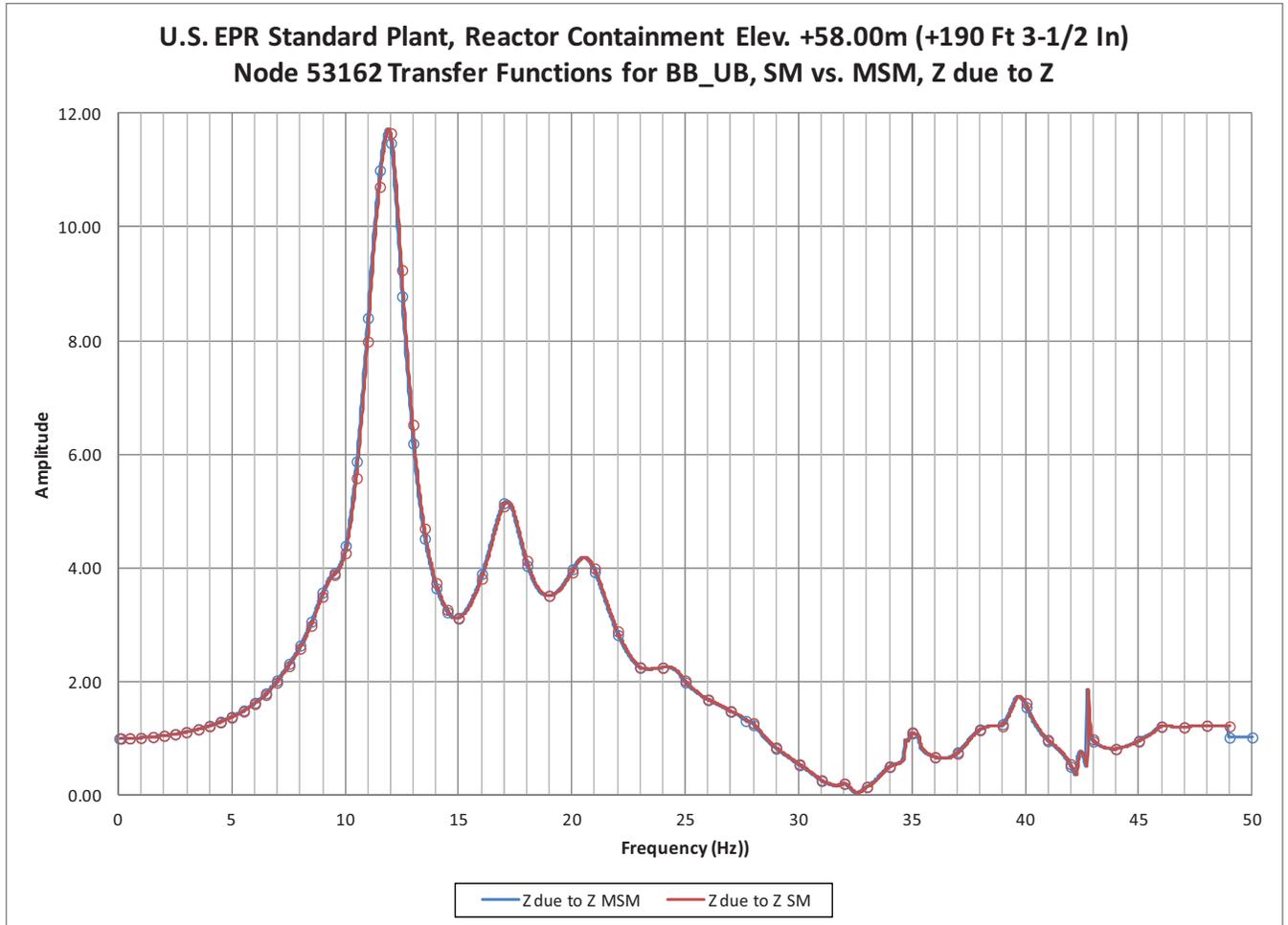


Figure 03.07.02-75-73—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), X (E-W) Direction, 5% Damping, Case BB_UB, SM vs. MSM

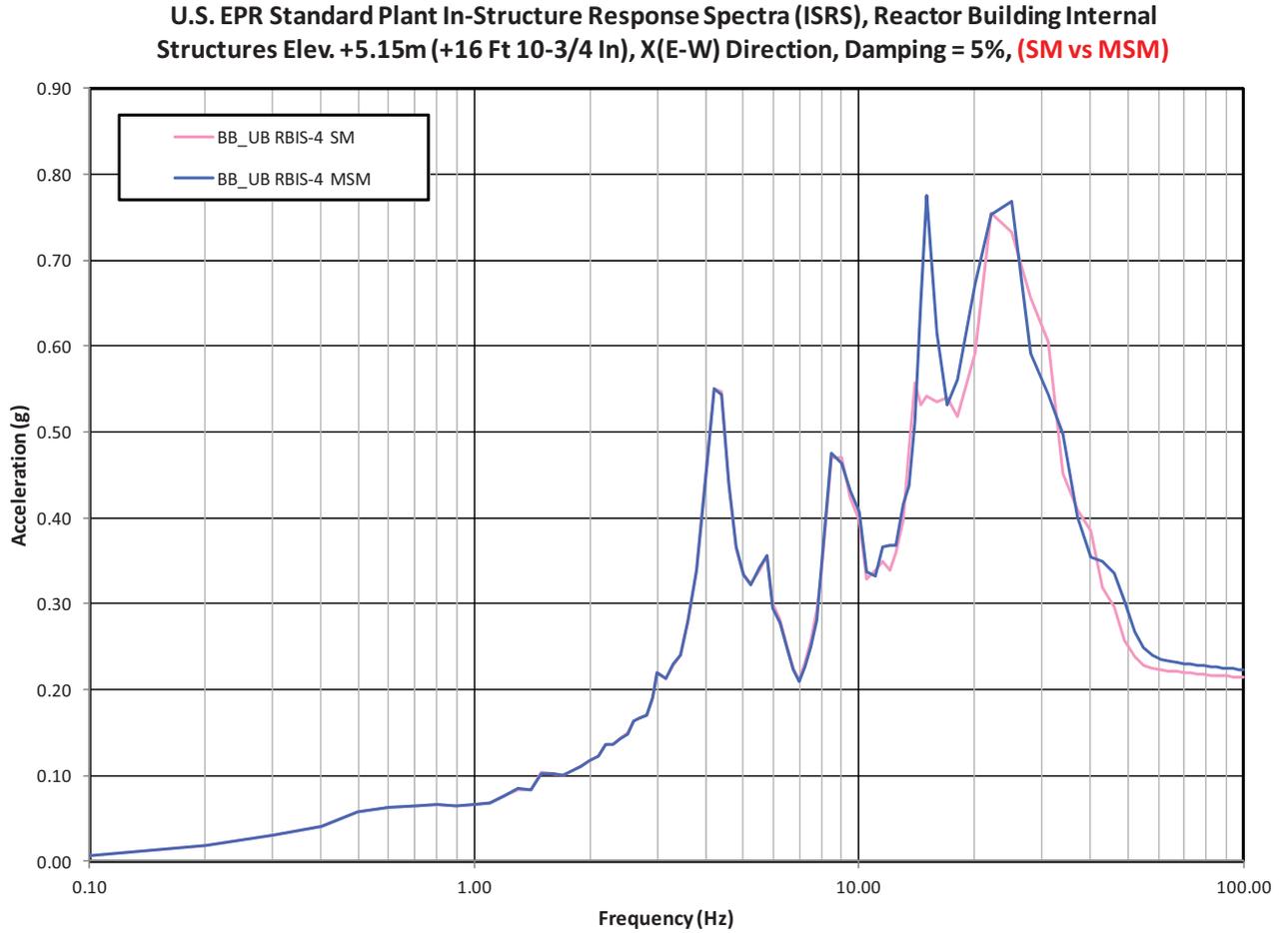


Figure 03.07.02-75-74—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), Y (N-S) Direction, 5% Damping, Case BB_UB, SM vs. MSM

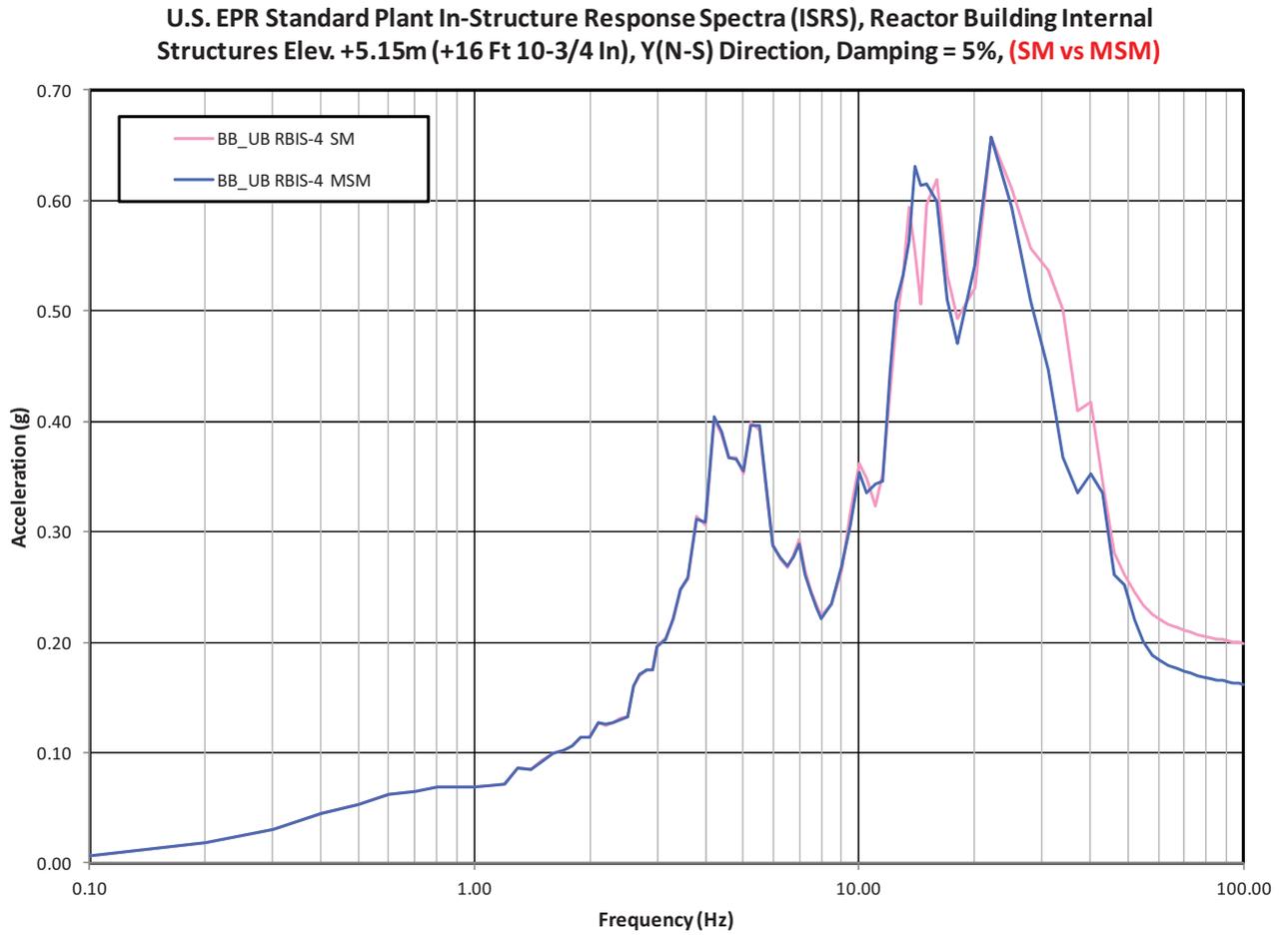


Figure 03.07.02-75-75—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +5.15 m (+16 ft 10-3/4 in), Z (Vert.) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures Elev. +5.15m (+16 Ft 10-3/4 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

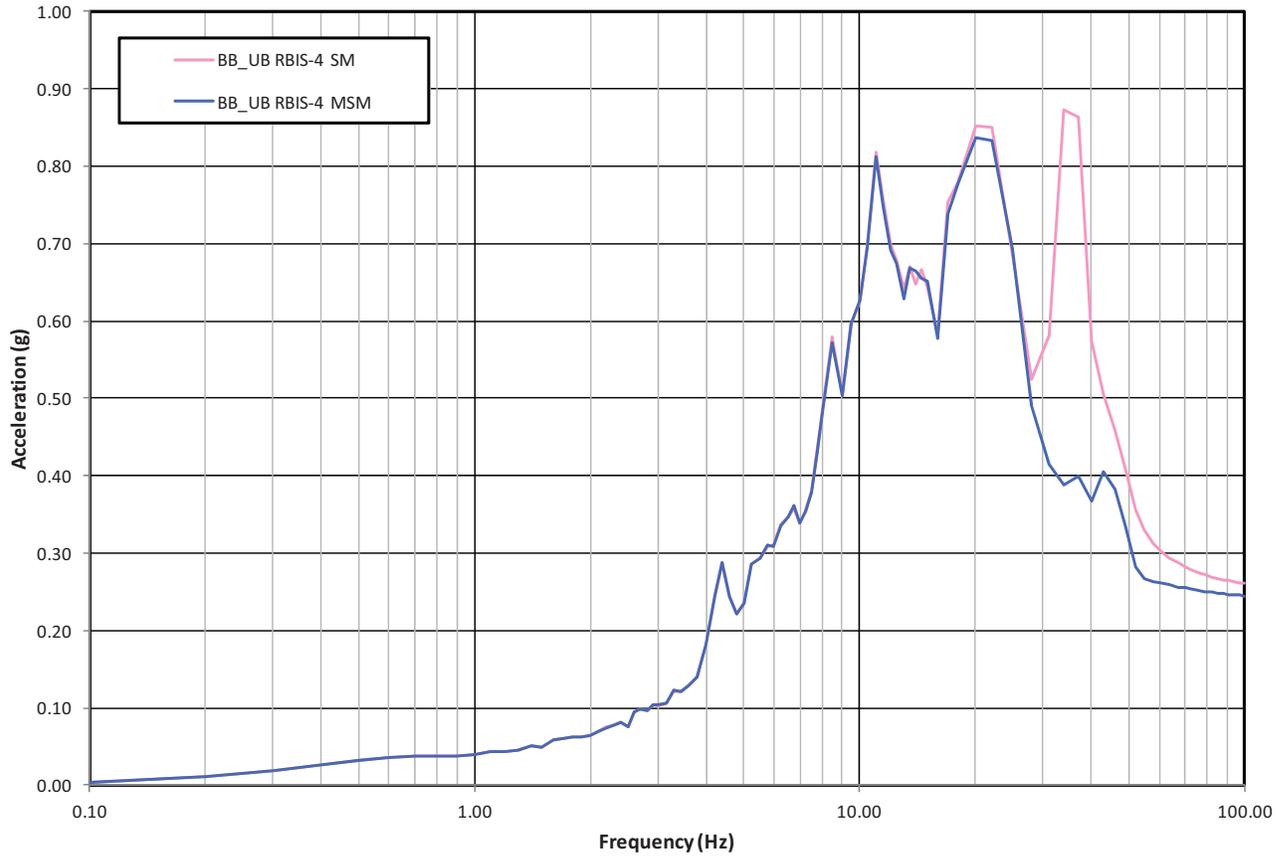


Figure 03.07.02-75-76—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +19.50 m (+63 ft 11-3/4 in), X (E-W) Direction, 5% Damping, Case BB_UB, SM vs. MSM

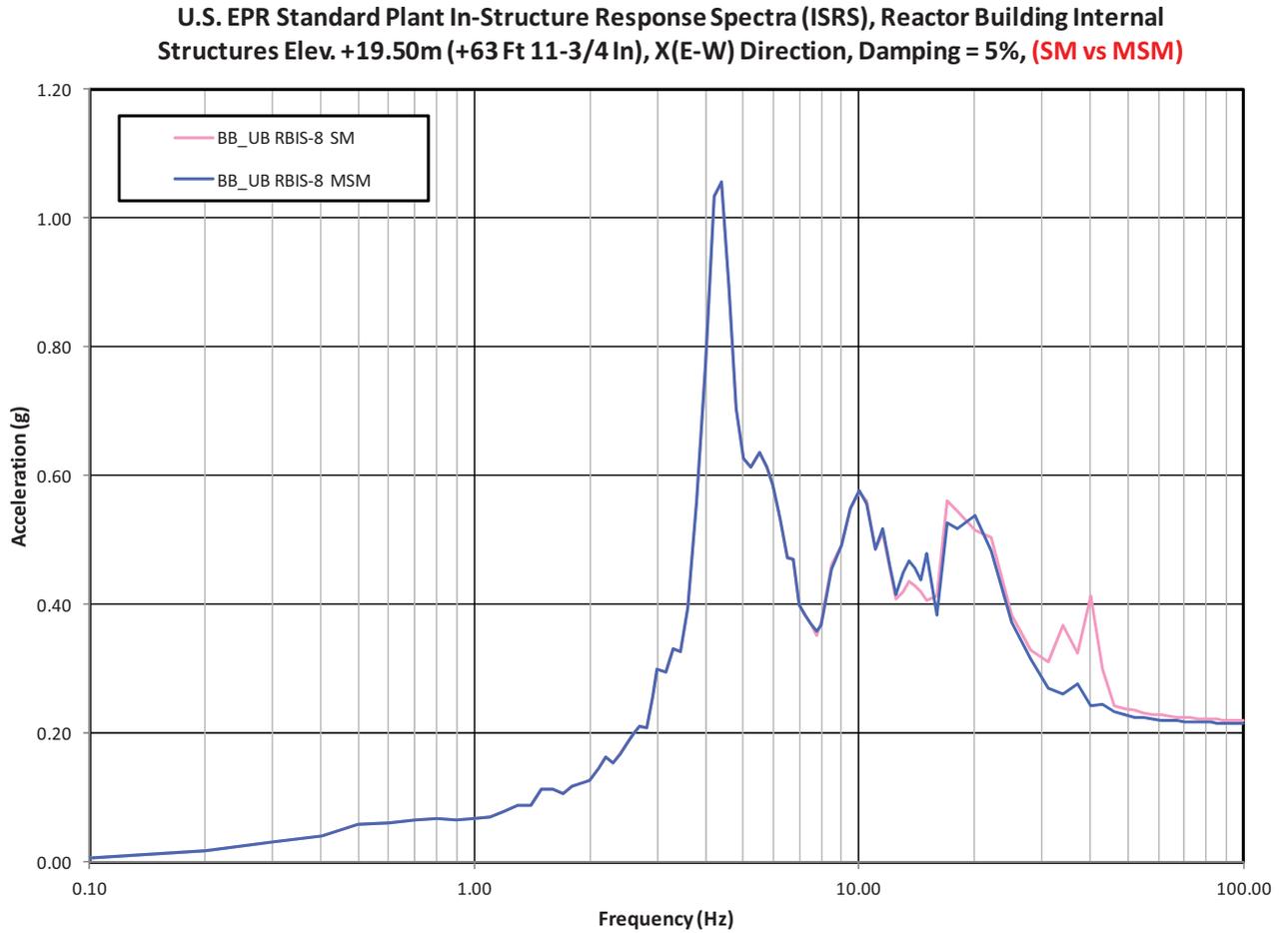


Figure 03.07.02-75-77—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +19.50 m (+63 ft 11-3/4 in), Y (N-S) Direction, 5% Damping, Case BB_UB, SM vs. MSM

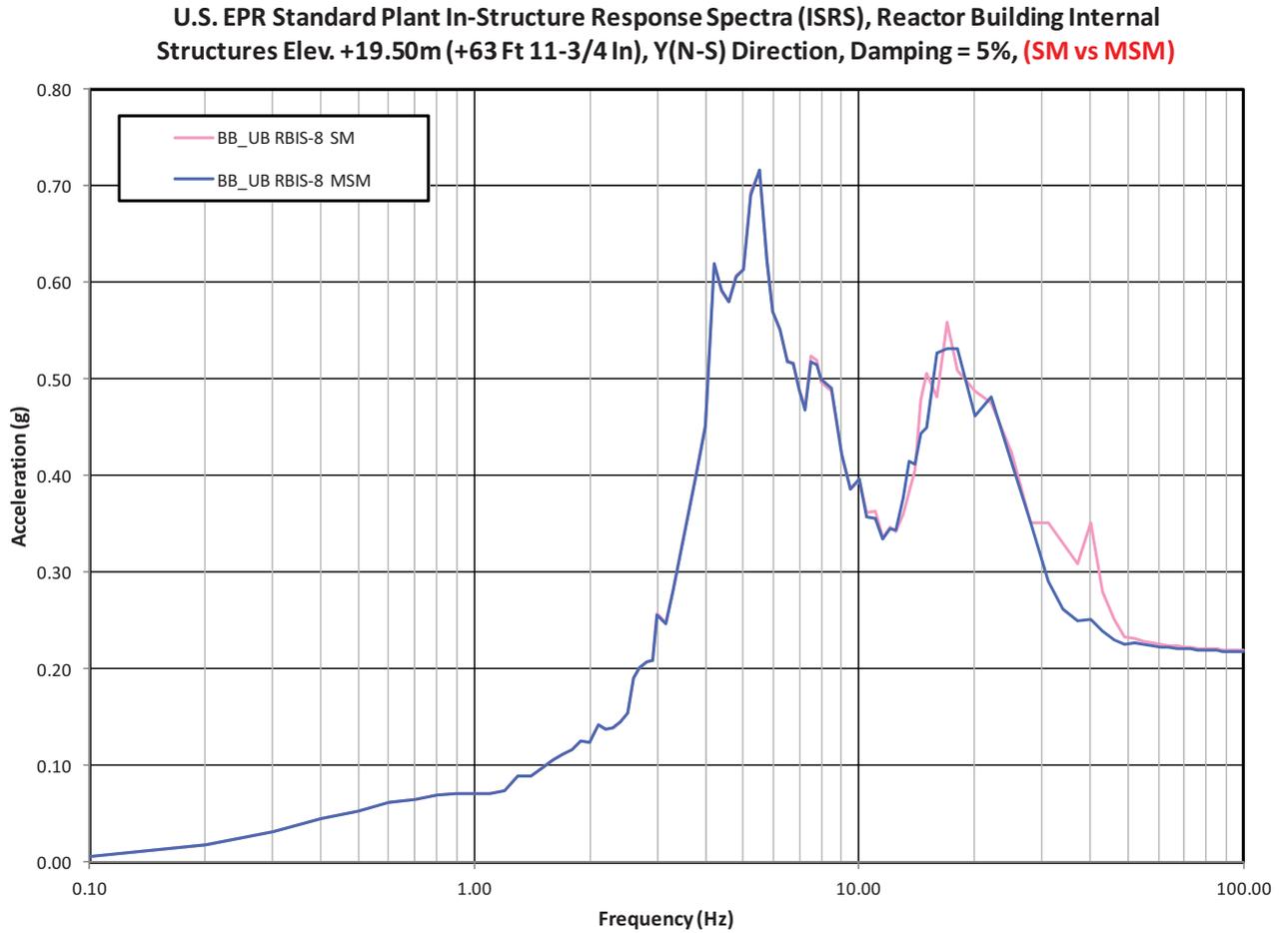


Figure 03.07.02-75-78—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Building Internal Structures, Elev. +19.50 m (+63 ft 11-3/4 in), Z (Vert.) Direction, 5% Damping, Case BB_UB, SM vs. MSM

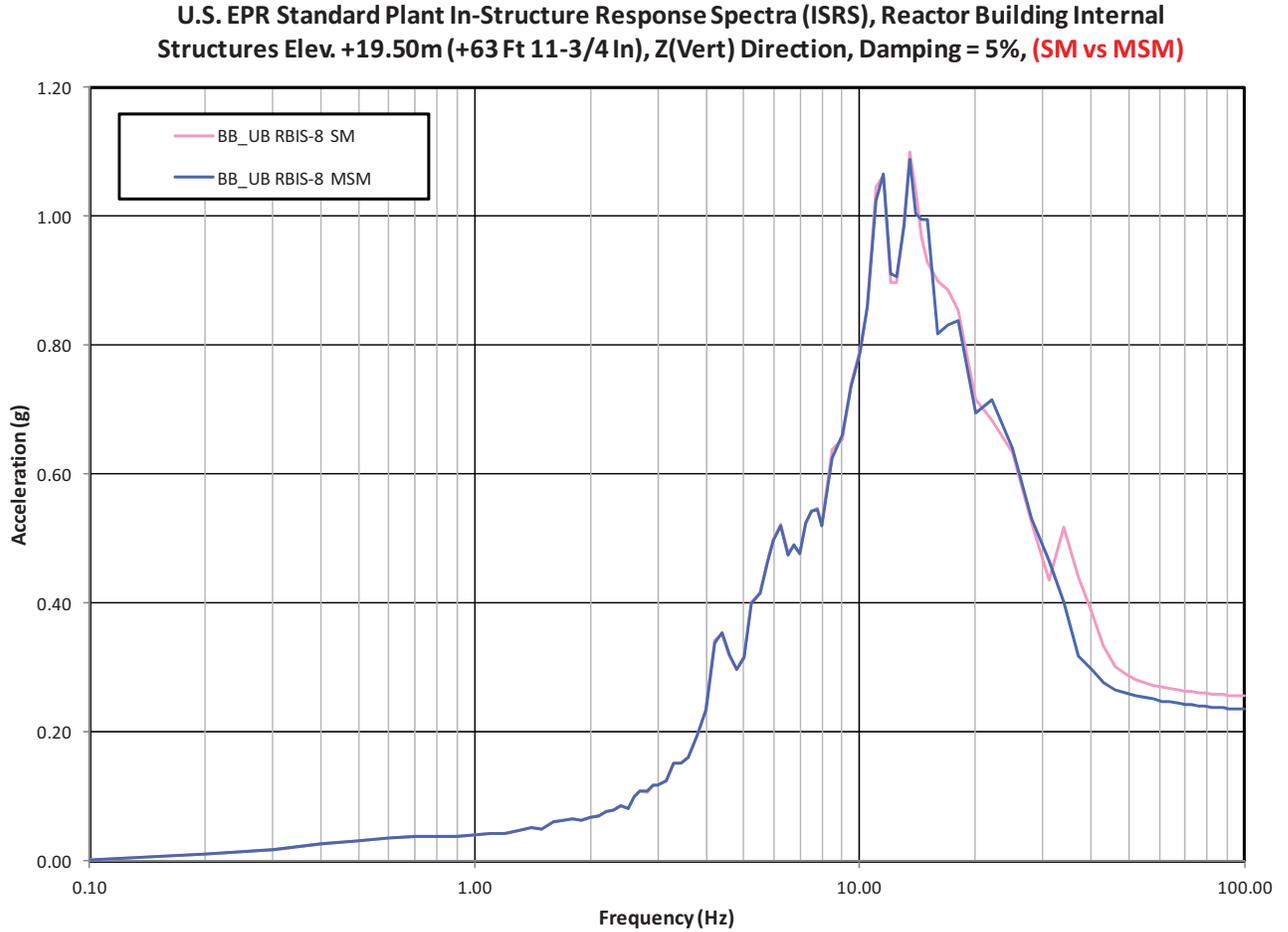


Figure 03.07.02-75-79—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +8.10 m (+26 ft 7 in), X (E-W) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1 Elev. +8.10m (+26 Ft 7 In), X(E-W) Direction, Damping = 5%, (SM vs MSM)

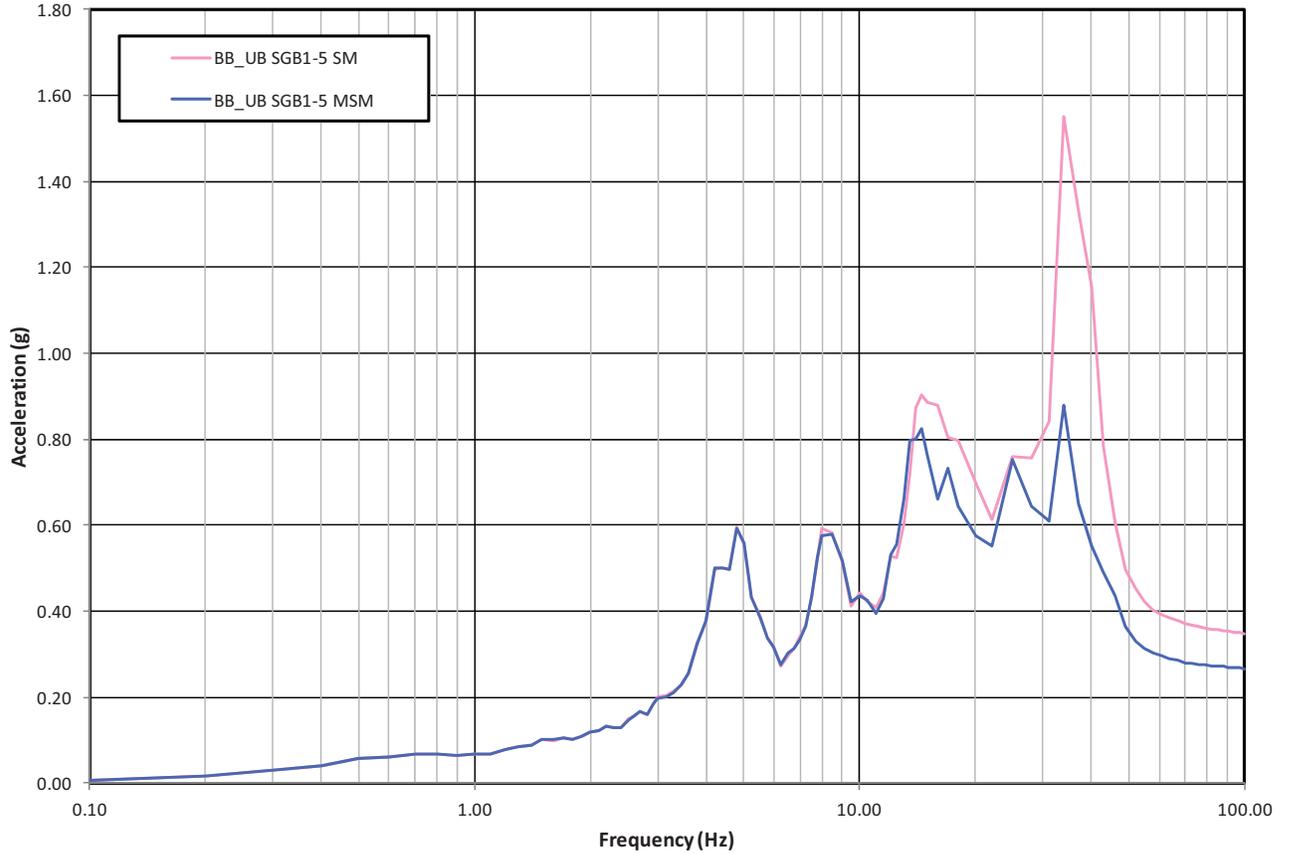


Figure 03.07.02-75-80—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +8.10 m (+26 ft 7 in), Y (N-S) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1 Elev. +8.10m (+26 Ft 7 In), Y(N-S) Direction, Damping = 5%, (SM vs MSM)

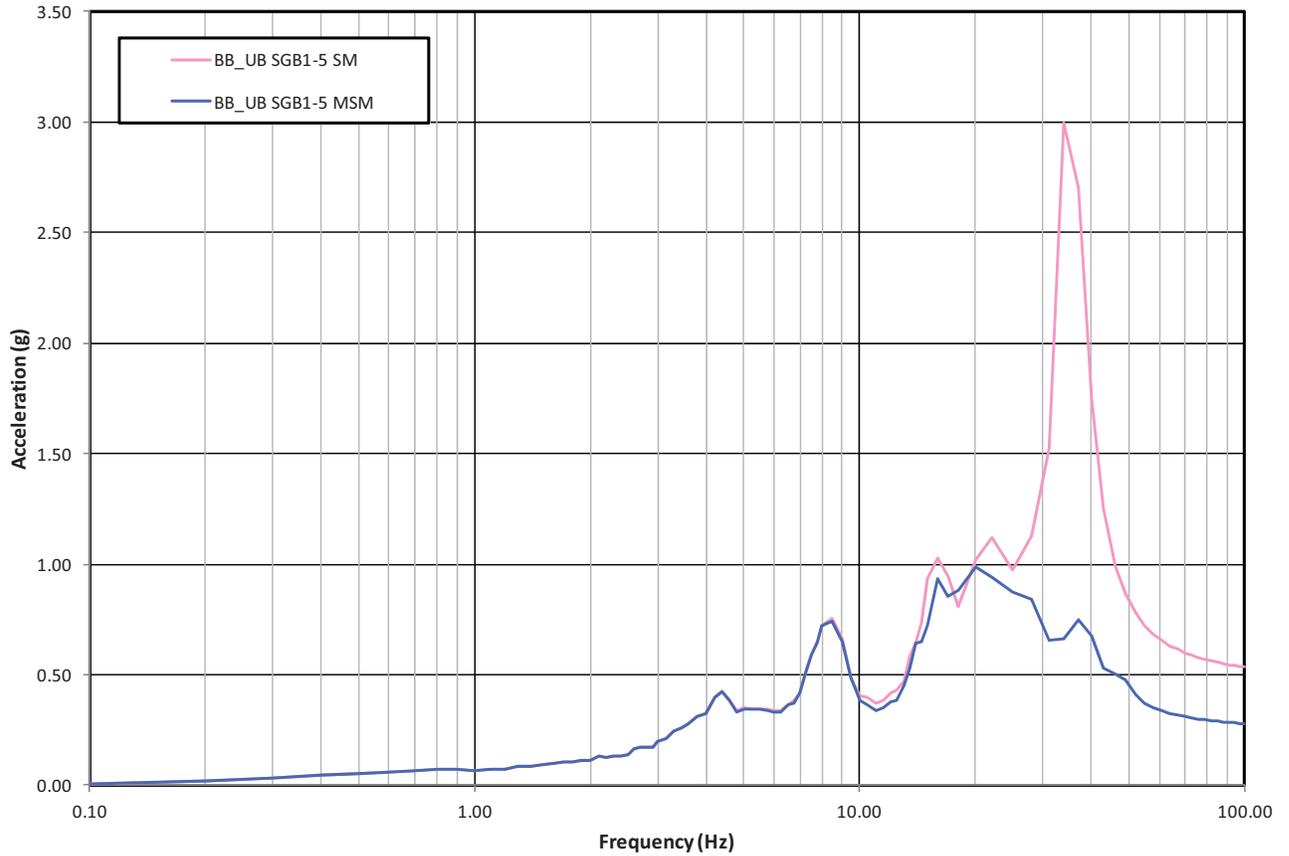


Figure 03.07.02-75-81—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +8.10 m (+26 ft 7 in), Z (Vert.) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1 Elev. +8.10m (+26 Ft 7 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

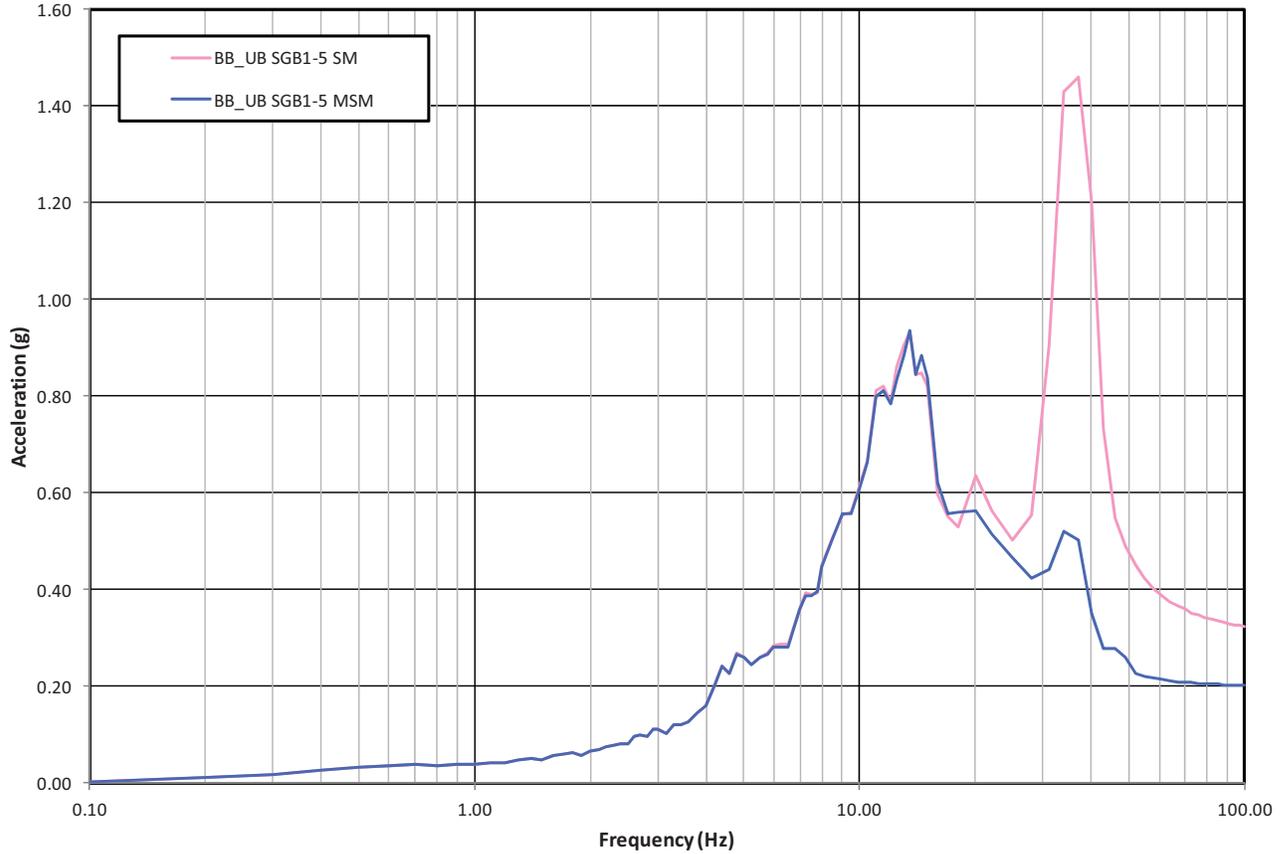


Figure 03.07.02-75-82—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +21.00 m (+68 ft 11 in), X (E-W) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1 Elev. +21.00m (+68 Ft 11 In), X(E-W) Direction, Damping = 5%, (SM vs MSM)

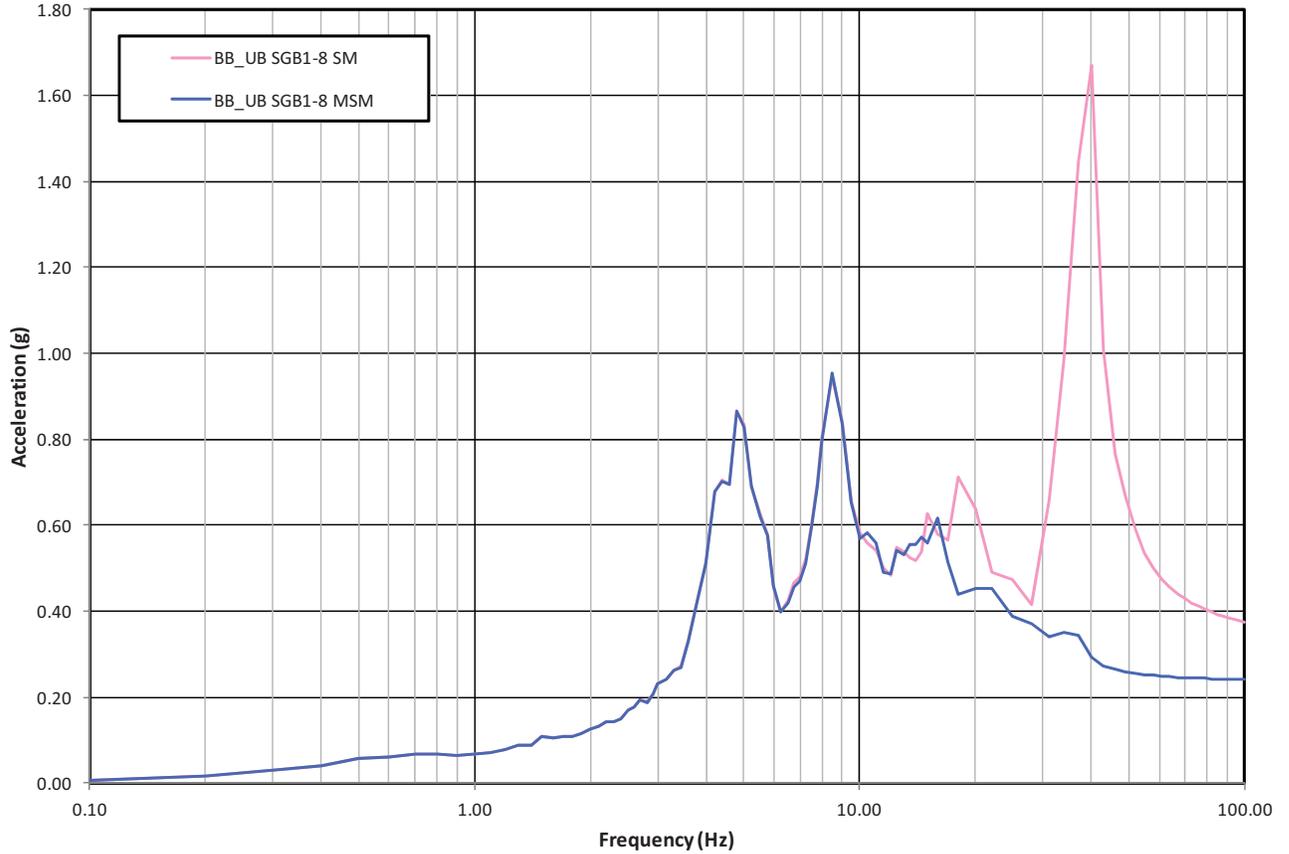


Figure 03.07.02-75-83—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +21.00 m (+68 ft 11 in), Y (N-S) Direction, 5% Damping, Case BB_UB, SM vs. MSM

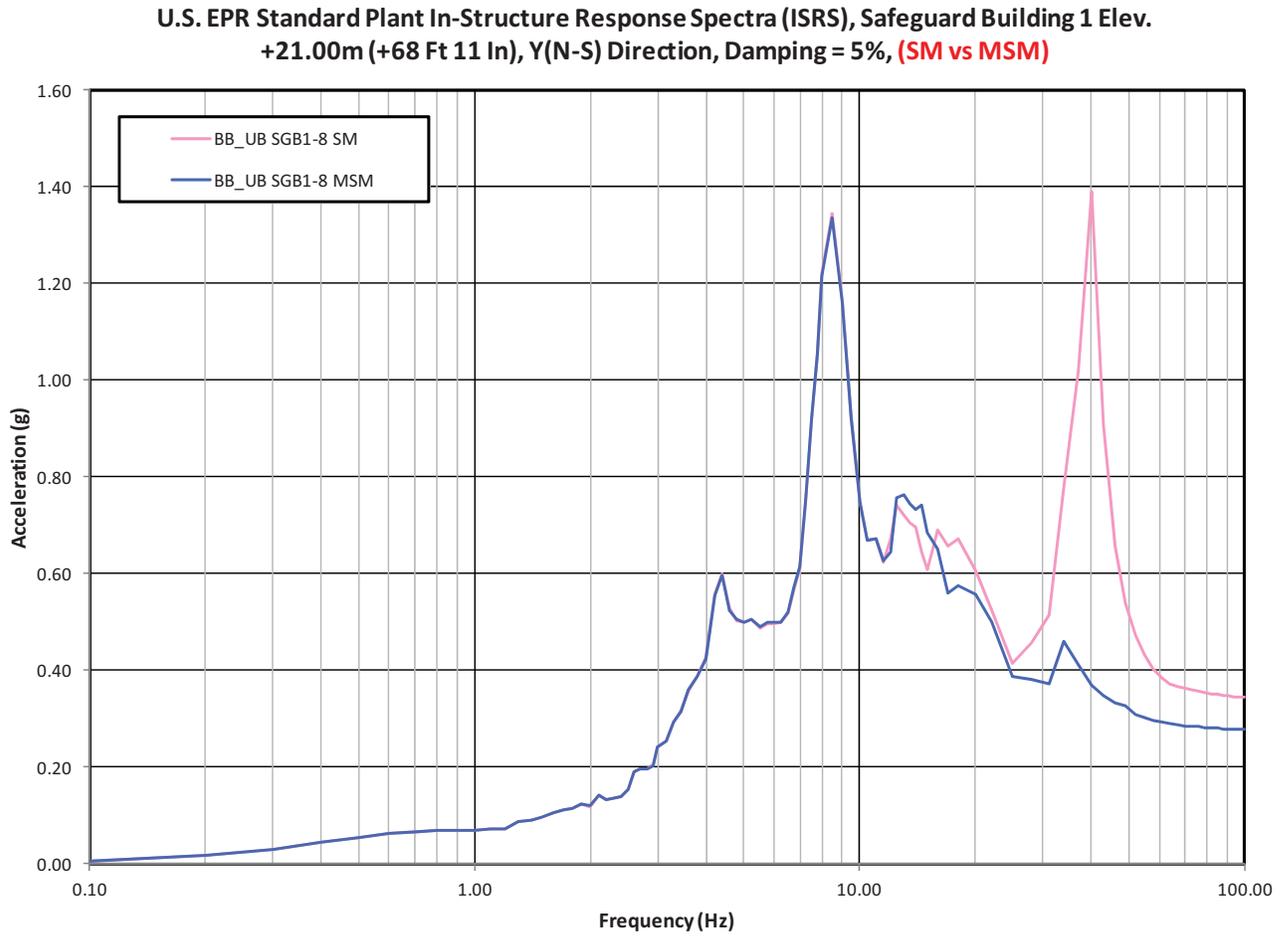


Figure 03.07.02-75-84—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1, Elev. +21.00 m (+68 ft 11 in), Z (Vert.) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 1 Elev. +21.00m (+68 Ft 11 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

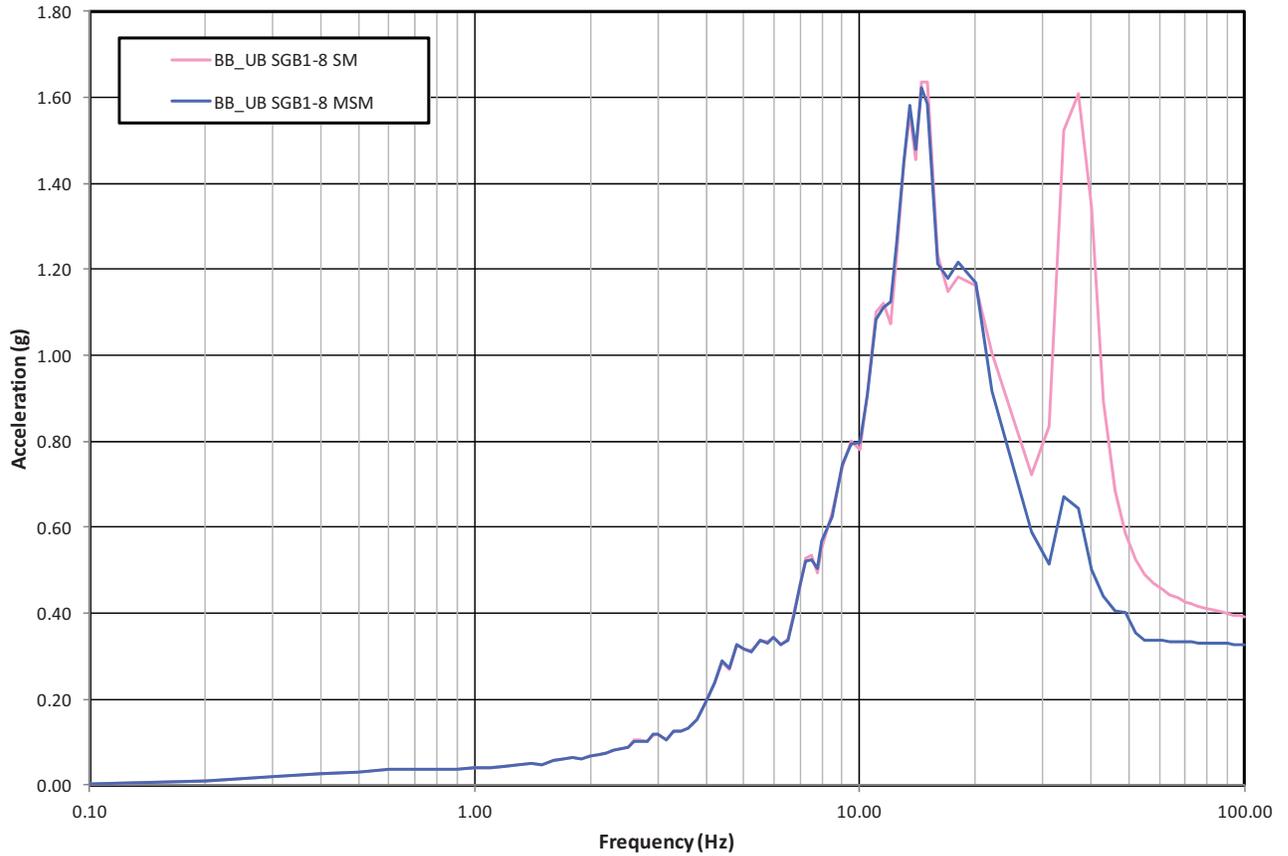


Figure 03.07.02-75-85—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +8.10 m (+26 ft 7 in), X (E-W) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +8.10m (+26 Ft 7 In), X(E-W) Direction, Damping = 5%, (SM vs MSM)

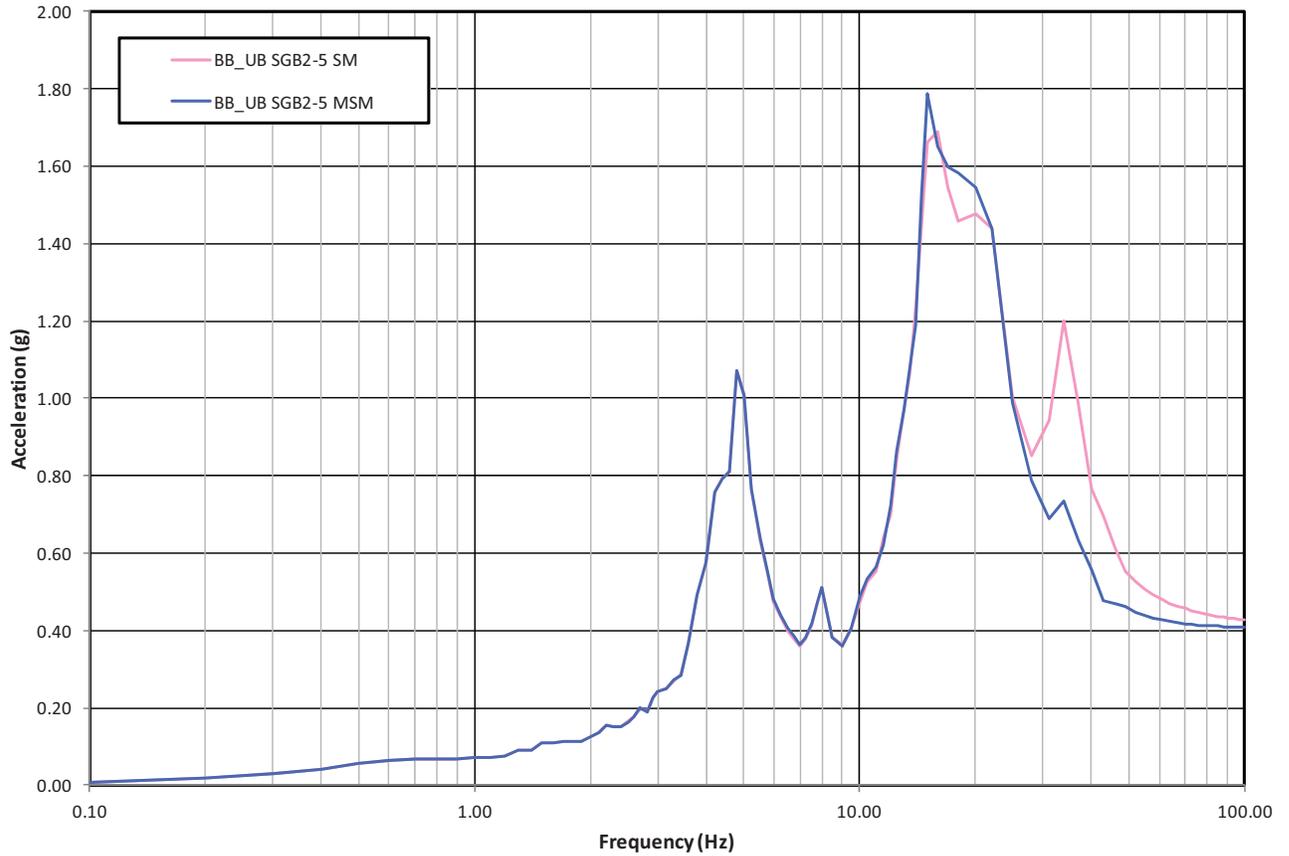


Figure 03.07.02-75-86—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +8.10 m (+26 ft 7 in), Y (N-S) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +8.10m (+26 Ft 7 In), Y(N-S) Direction, Damping = 5%, (SM vs MSM)

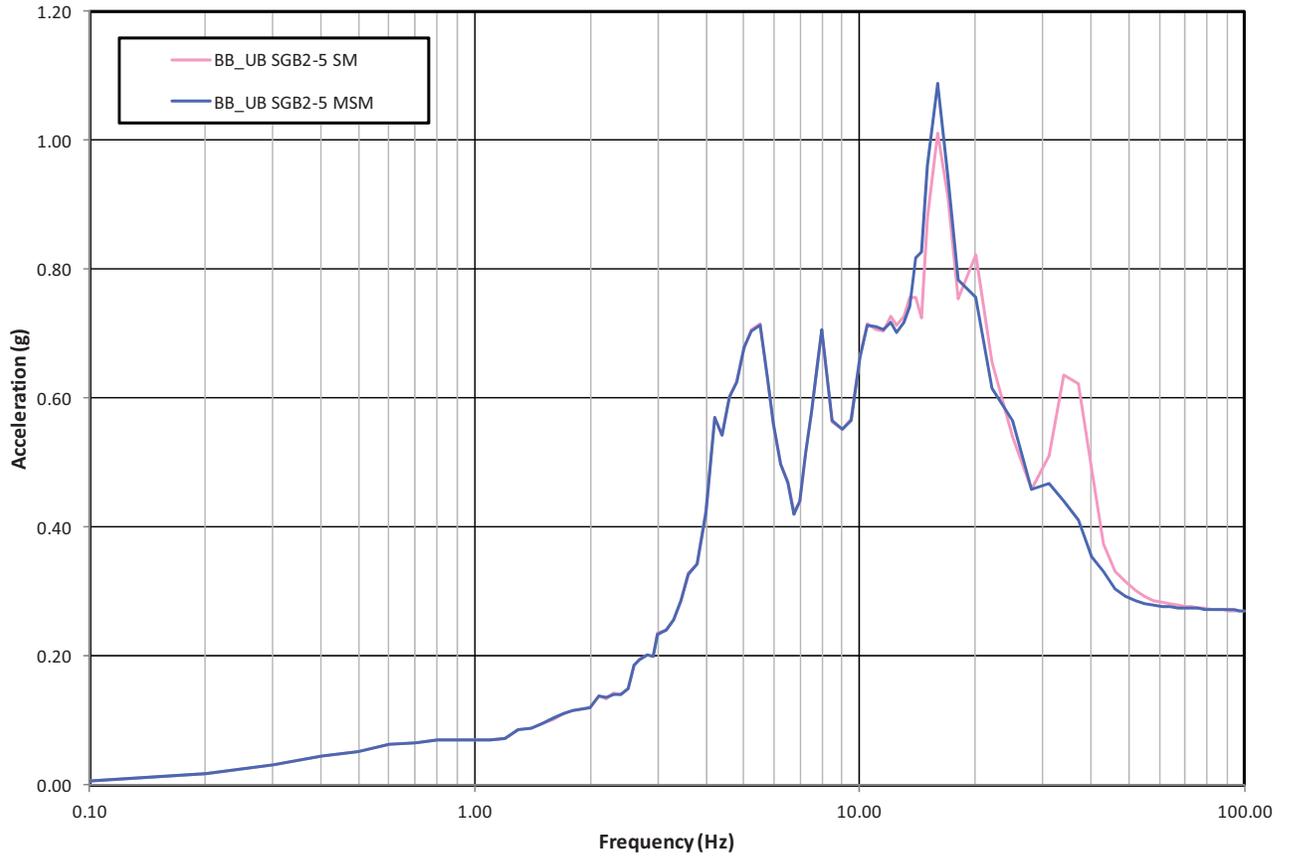


Figure 03.07.02-75-87—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +8.10 m (+26 ft 7 in), Z (Vert.) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +8.10m (+26 Ft 7 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

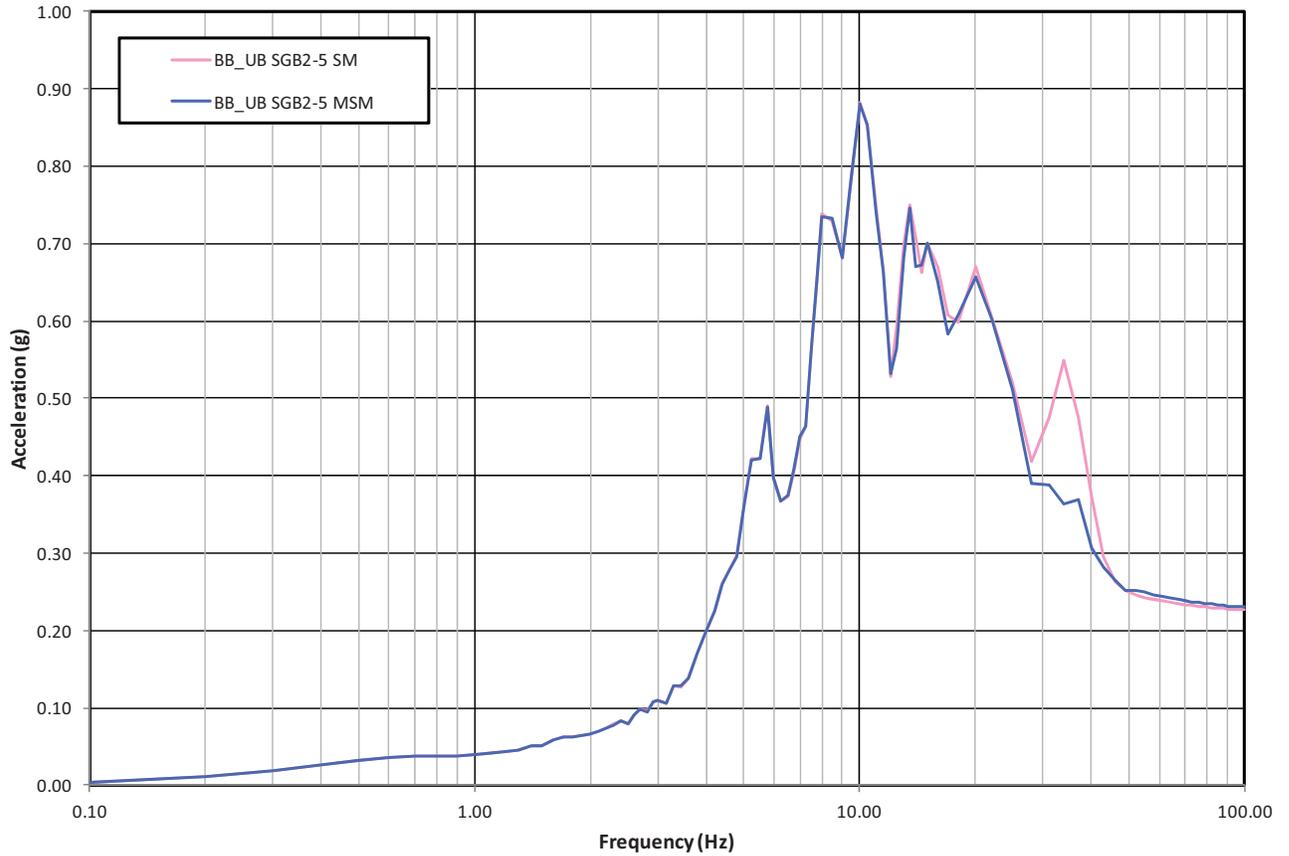


Figure 03.07.02-75-88—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +16.30 m (+53 ft 6 in), X (E-W) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +16.30m (+53 Ft 6 In), X(E-W) Direction, Damping = 5%, (SM vs MSM)

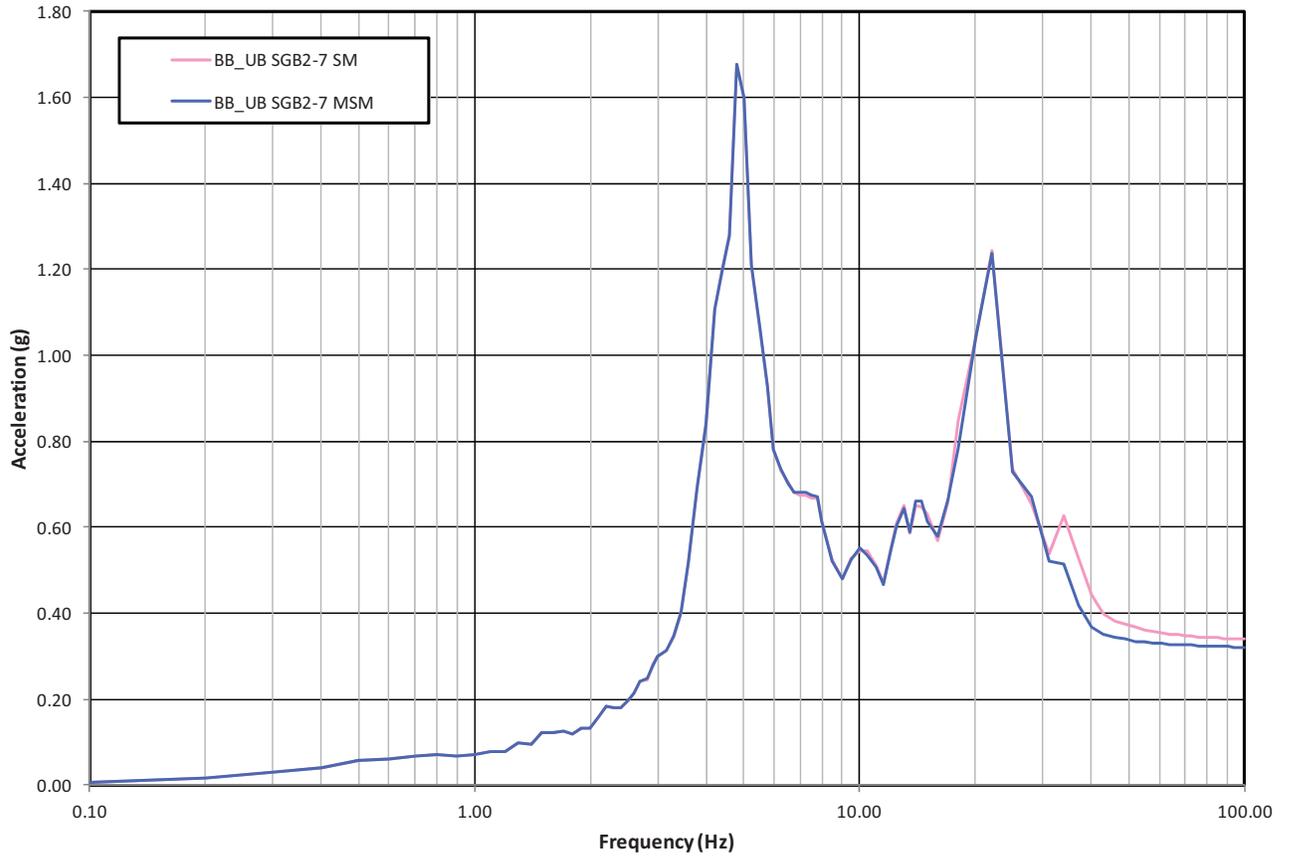


Figure 03.07.02-75-89—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +16.30 m (+53 ft 6 in), Y (N-S) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +16.30m (+53 Ft 6 In), Y(N-S) Direction, Damping = 5%, (SM vs MSM)

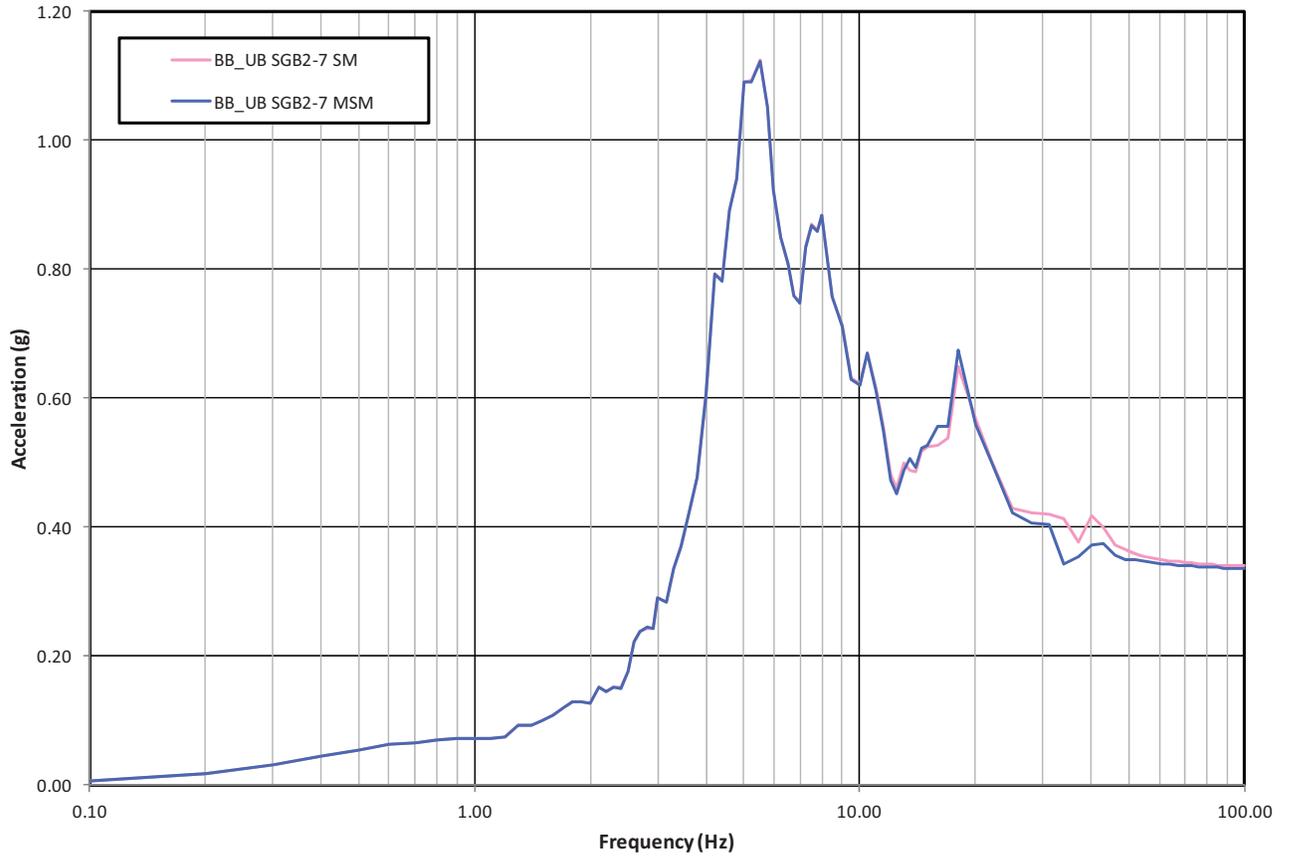


Figure 03.07.02-75-90—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3, Elev. +16.30 m (+53 ft 6 in), Z (Vert.) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Safeguard Building 2/3 Elev. +16.30m (+53 Ft 6 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

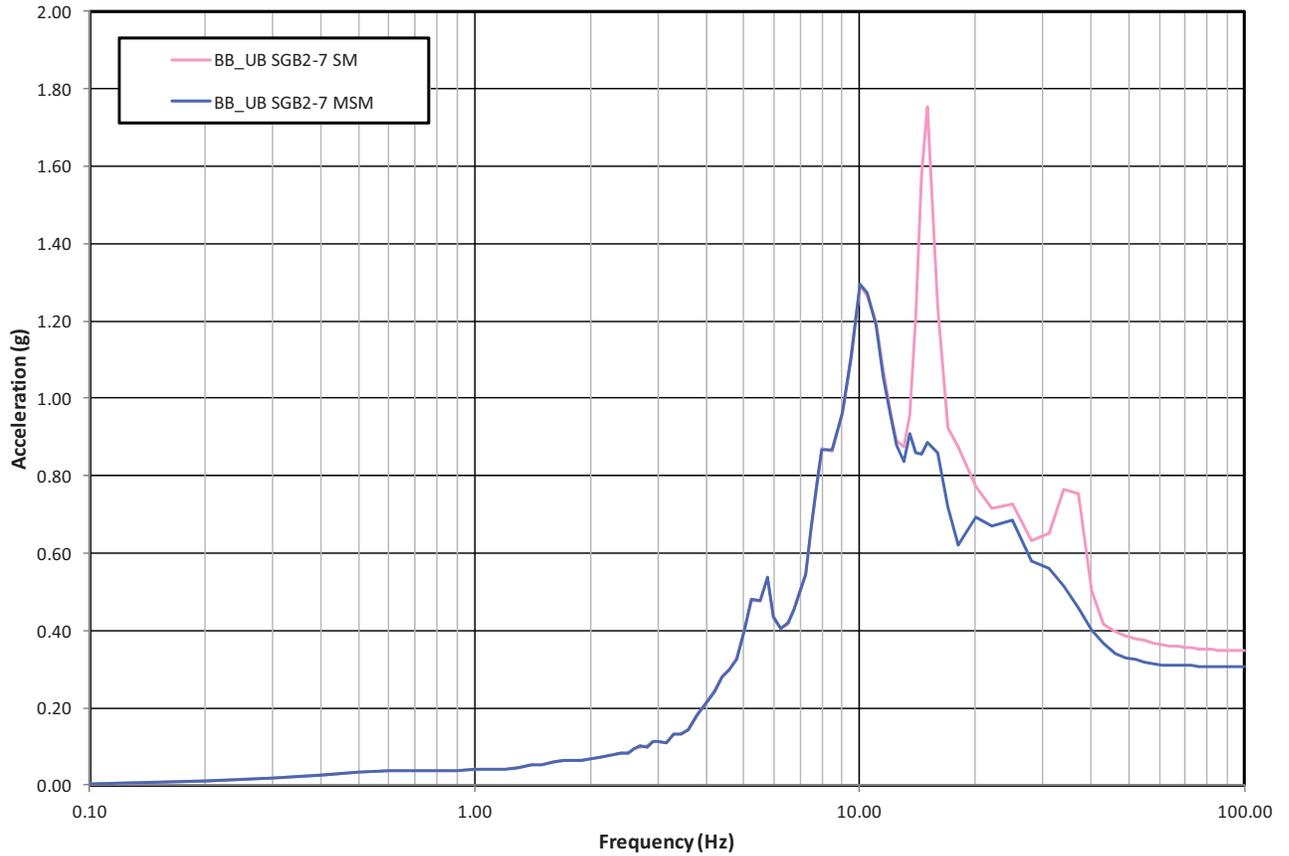


Figure 03.07.02-75-91—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), X (E-W) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment Elev. +37.60m (+123 Ft 4-1/4 In), X(E-W) Direction, Damping = 5%, (SM vs MSM)

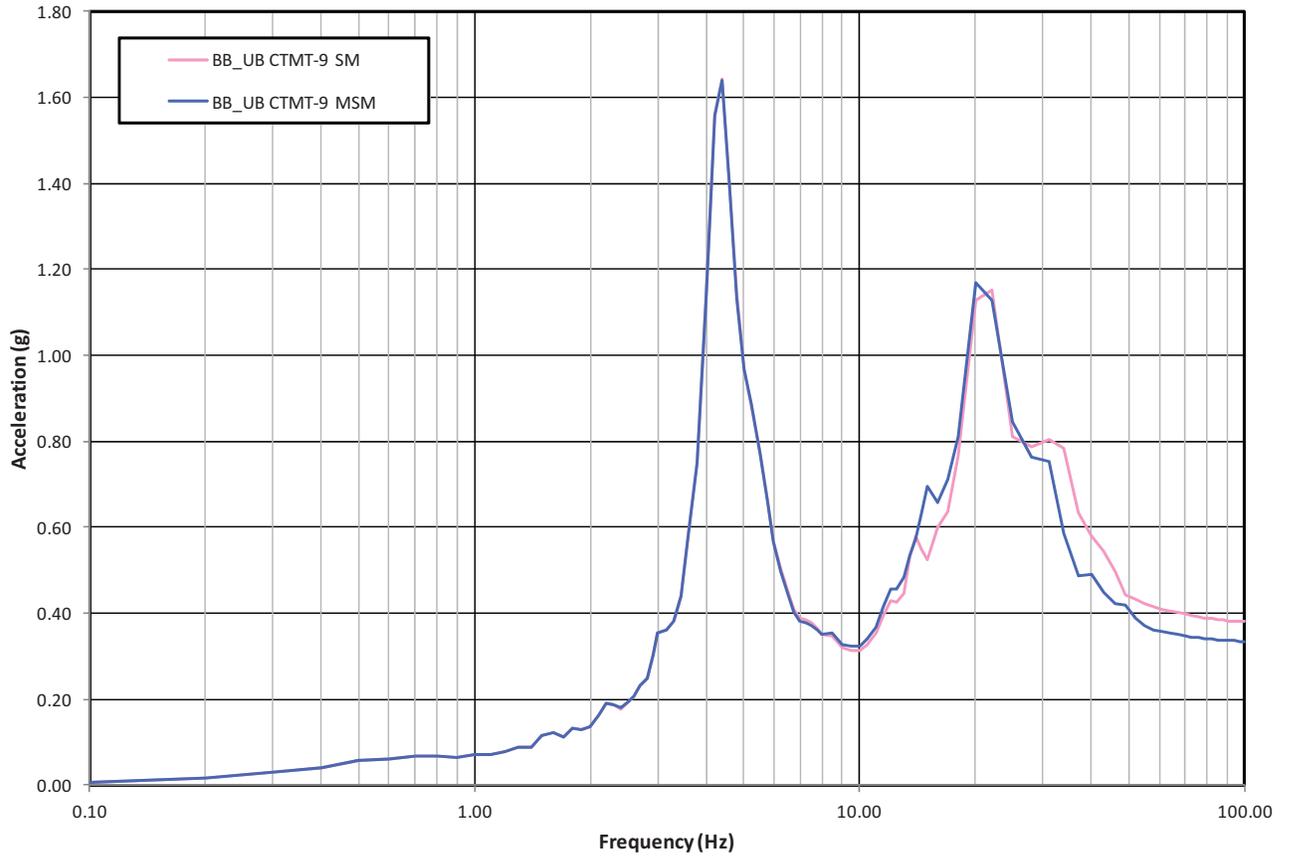


Figure 03.07.02-75-92—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), Y (N-S) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment Elev. +37.60m (+123 Ft 4-1/4 In), Y(N-S) Direction, Damping = 5%, (SM vs MSM)

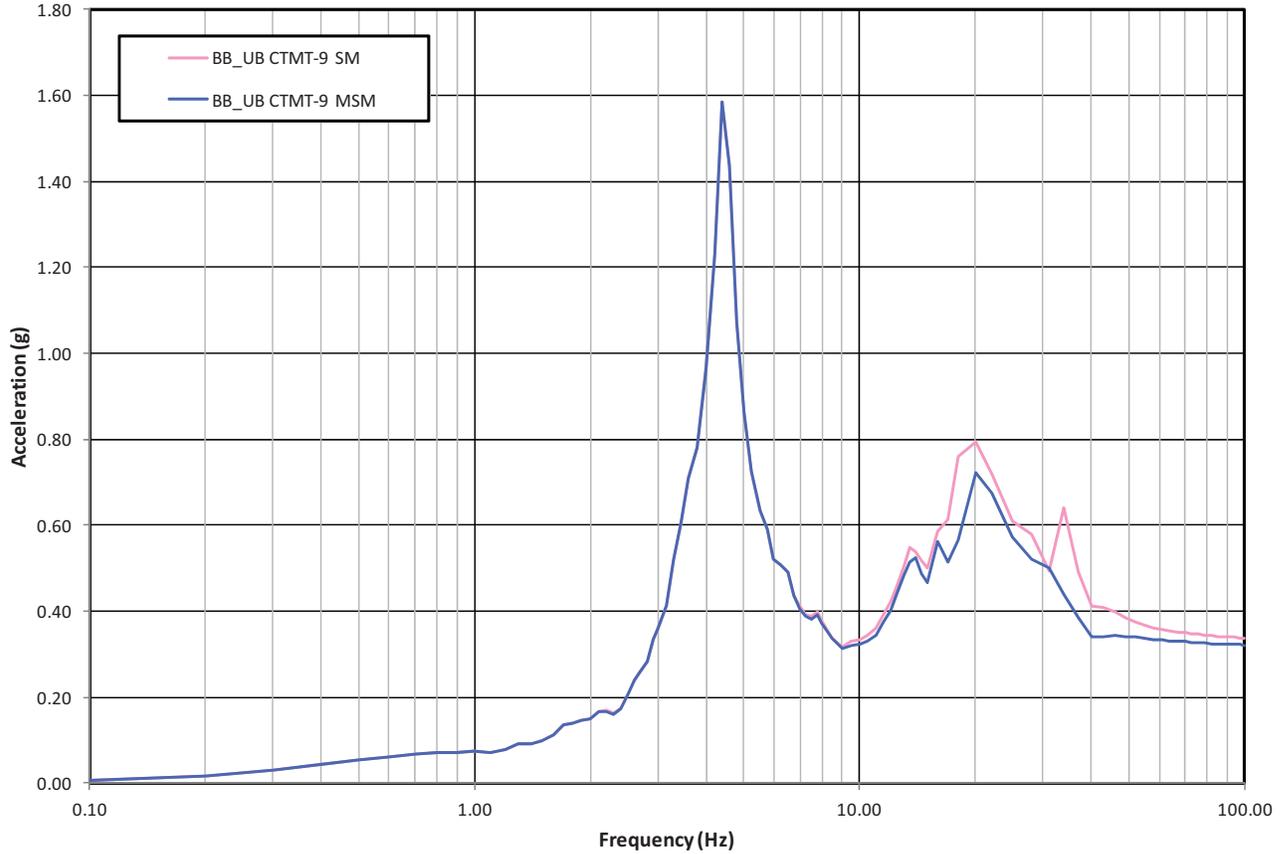


Figure 03.07.02-75-93—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +37.60 m (+123 ft 4-1/4 in), Z (Vert.) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment Elev. +37.60m (+123 Ft 4-1/4 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

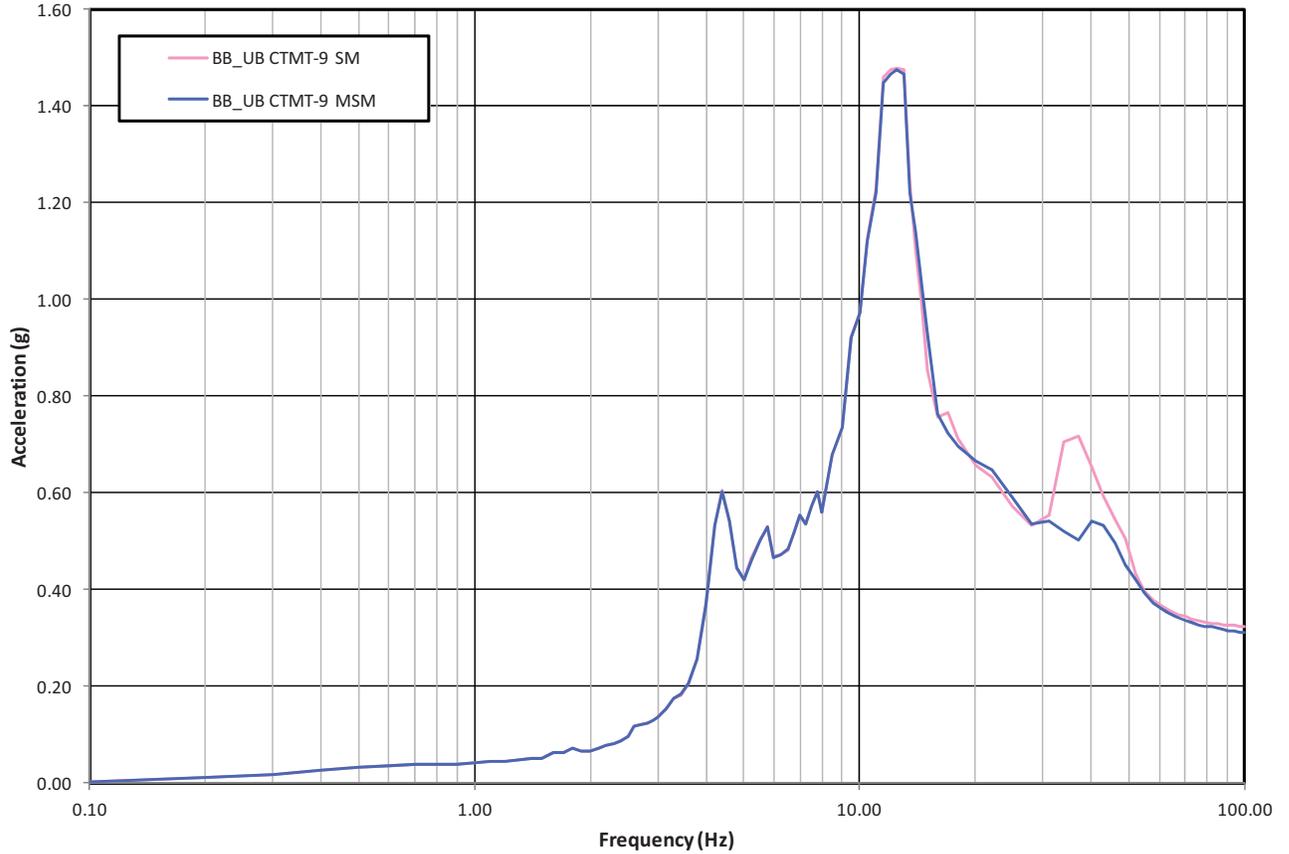


Figure 03.07.02-75-94—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), X (E-W) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment Elev. +58.00m (+190 Ft 3-1/2 In), X(E-W) Direction, Damping = 5%, (SM vs MSM)

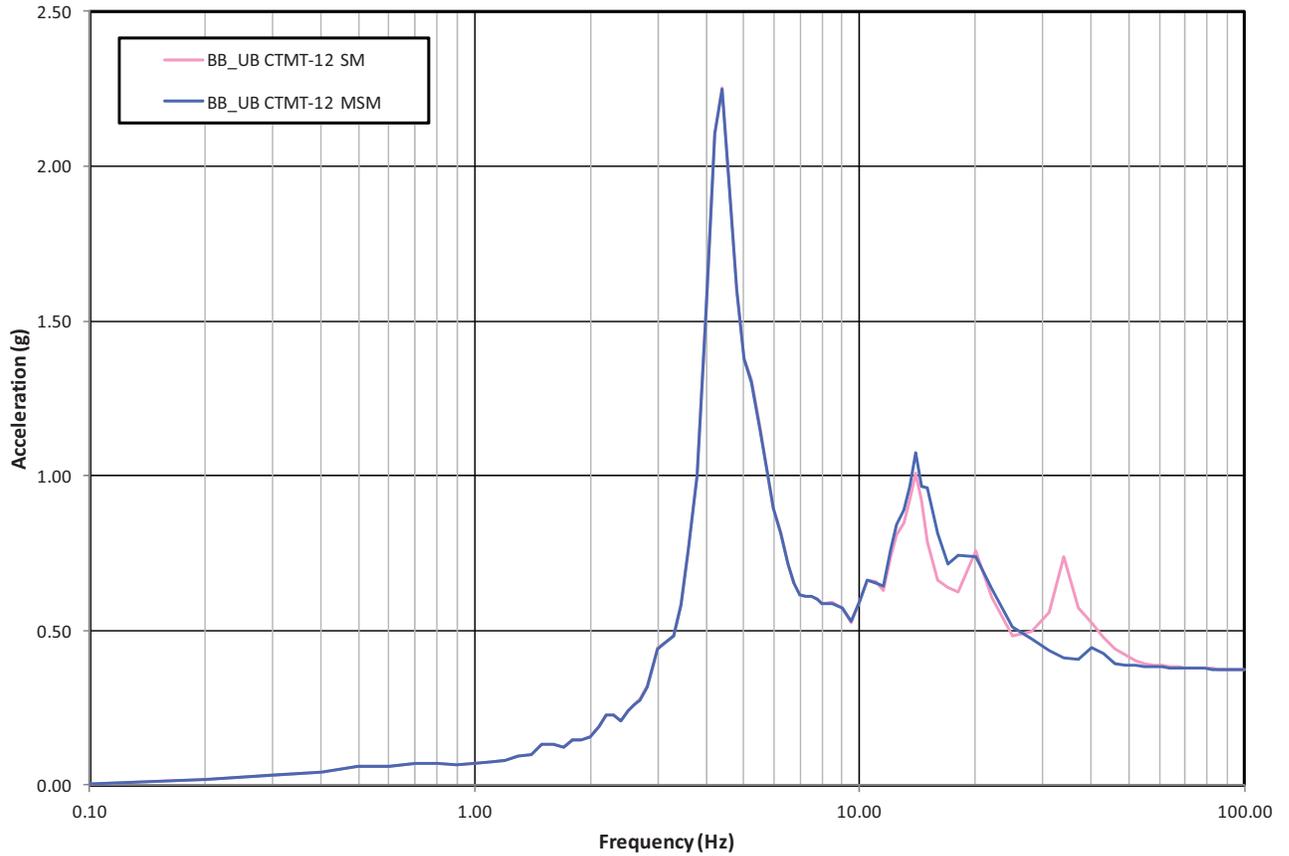


Figure 03.07.02-75-95—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), Y (N-S) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment Elev. +58.00m (+190 Ft 3-1/2 In), Y(N-S) Direction, Damping = 5%, (SM vs MSM)

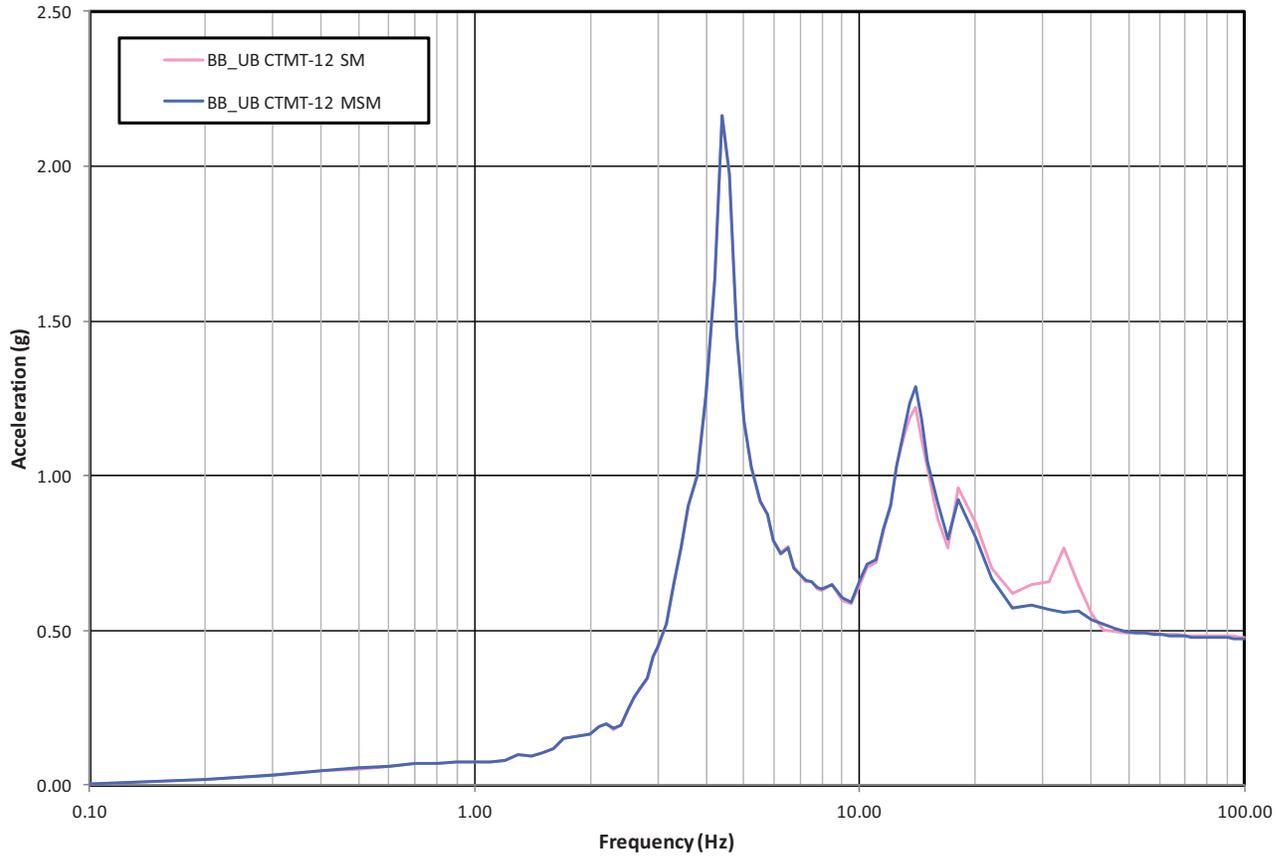


Figure 03.07.02-75-96—U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment, Elev. +58.00 m (+190 ft 3-1/2 in), Z (Vert.) Direction, 5% Damping, Case BB_UB, SM vs. MSM

U.S. EPR Standard Plant In-Structure Response Spectra (ISRS), Reactor Containment Elev. +58.00m (+190 Ft 3-1/2 In), Z(Vert) Direction, Damping = 5%, (SM vs MSM)

