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 AUTH. NAME: AUTHOR AFFILIATION:
 BOUCHEY, G.D. Washington Public Power Supply System
 RECIP. NAME: RECIPIENT AFFILIATION:
 SCHWENCER, A. Licensing Branch 2

SUBJECT: Forwards study results re comparison of structural response to symmetric & asymmetric chugging & seismic loads. Results state similarity of responses between symmetric & asymmetric chugging load cases.

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The following information was obtained from the records of the
 Department of the Interior, Bureau of Land Management, at
 Washington, D. C., on the 10th day of May, 1906.

The following is a list of the names of the persons who
 have been granted patents of the United States for the
 invention of a new and useful improvement in a certain
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The names of the persons who have been granted patents of the United States for the invention of a new and useful improvement in a certain article of manufacture, to-wit:

Name of Inventor	Date of Patent	No. of Patent	Class and Div.
J. B. Smith	May 1, 1906	1,234,567	Class 1, Div. 1
W. H. Jones	May 1, 1906	1,234,568	Class 1, Div. 1
T. A. Brown	May 1, 1906	1,234,569	Class 1, Div. 1
R. C. White	May 1, 1906	1,234,570	Class 1, Div. 1
M. D. Black	May 1, 1906	1,234,571	Class 1, Div. 1
L. E. Green	May 1, 1906	1,234,572	Class 1, Div. 1
H. F. Hall	May 1, 1906	1,234,573	Class 1, Div. 1
K. G. King	May 1, 1906	1,234,574	Class 1, Div. 1
N. J. Lee	May 1, 1906	1,234,575	Class 1, Div. 1
O. P. Miller	May 1, 1906	1,234,576	Class 1, Div. 1
Q. R. Nelson	May 1, 1906	1,234,577	Class 1, Div. 1
S. T. Phillips	May 1, 1906	1,234,578	Class 1, Div. 1
U. V. Reed	May 1, 1906	1,234,579	Class 1, Div. 1
W. X. Scott	May 1, 1906	1,234,580	Class 1, Div. 1
Y. Z. Taylor	May 1, 1906	1,234,581	Class 1, Div. 1
A. B. Walker	May 1, 1906	1,234,582	Class 1, Div. 1
C. D. Young	May 1, 1906	1,234,583	Class 1, Div. 1
E. F. Adams	May 1, 1906	1,234,584	Class 1, Div. 1
G. H. Baker	May 1, 1906	1,234,585	Class 1, Div. 1
I. J. Carter	May 1, 1906	1,234,586	Class 1, Div. 1
K. L. Evans	May 1, 1906	1,234,587	Class 1, Div. 1

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Washington Public Power Supply System

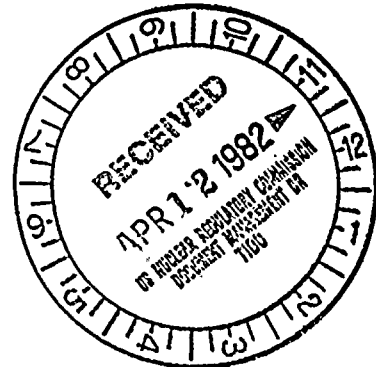
P.O. Box 968 3000 George Washington Way Richland, Washington 99352 (509) 372-5000

April 5, 1982
G02-82-362
Docket No. 50-397

Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Schwencer:

Subject: NUCLEAR PROJECT NO. 2
COMPARISON OF STRUCTURAL RESPONSE TO
SYMMETRIC AND ASYMMETRIC CHUGGING,
AND SEISMIC LOADS



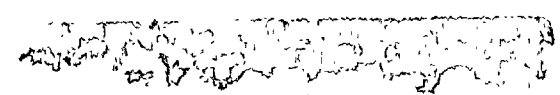
Reference: G02-82-324, Supply System to NRC, dated March 15, 1982

The Reference letter transmitted results of studies performed by Burns and Roe to address concerns raised by Professor George Bienkowski of Princeton University regarding the desynchronization methodology utilized in chugging load specifications for Mark II containments.

Professor Bienkowski's studies indicated the frequency content of the chugging load may be sensitive to the particular set of chug start times selected in the desynchronization methodology, and that this potential non-conservatism may be more pronounced in the asymmetric load case than in the symmetric load case.

The report transmitted by the Reference concluded that there is sufficient margin in the WNP-2 chugging load definition to accommodate any postulated non-conservatisms associated with using only one set of chug start times, and that structural responses outside the wetwell due to the asymmetric chugging case are insignificant.

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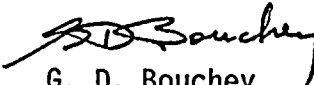


In a telephone conference call on March 19, 1982, the NRC requested additional information as a basis for evaluating whether or not the asymmetric chugging load case has any significance in plant design. The attached figures provide the information requested. These show WNP-2 structural responses to chugging loads (nearly symmetric and asymmetric cases) and to the safe shutdown earthquake, at selected representative critical locations. The responses are presented in the form of floor acceleration response spectra at 1% damping at the following locations (see Figure 1):

- o refueling floor at exterior wall (horizontal), mass point No. 7,
- o containment vessel at stabilizer level (horizontal and vertical), mass point No. 21,
- o RPV pedestal at drywell floor elevation (horizontal), mass point No. 69,
- o containment vessel at drywell floor elevation (horizontal and vertical), mass point No. 76,
- o containment vessel at point at maximum response (horizontal), mass point No. 132
- o mat at containment vessel (vertical), mass point No. 152,
- o mat at exterior wall (horizontal), mass point No. 230.

The following can be concluded from the attached figures:

- a. Reactor building responses due to the nearly symmetric and asymmetric chugging load cases are very similar, indicating that the building asymmetric (rocking) response is insignificant, and
- b. Reactor building responses due to SSE envelope those due to chugging at all locations, with the exception of the cylindrical portion of the containment vessel (in the wetwell region where the hydrodynamic pressures during chugging are applied) and in the lower portion of the conical section of the containment vessel, near the transition between drywell and wetwell.


G. D. Bouchey
Deputy Director, Safety and Security

EAF:kjf

Attachments: WNP-2 Acceleration Response Spectra for Nearly Symmetric Chugging, Asymmetric Chugging and SSE.

cc: R. Auluck - NRC w/att.
WS Chin - BPA
R. Feil - NRC Site
F. Eltawila - NRC w/att.

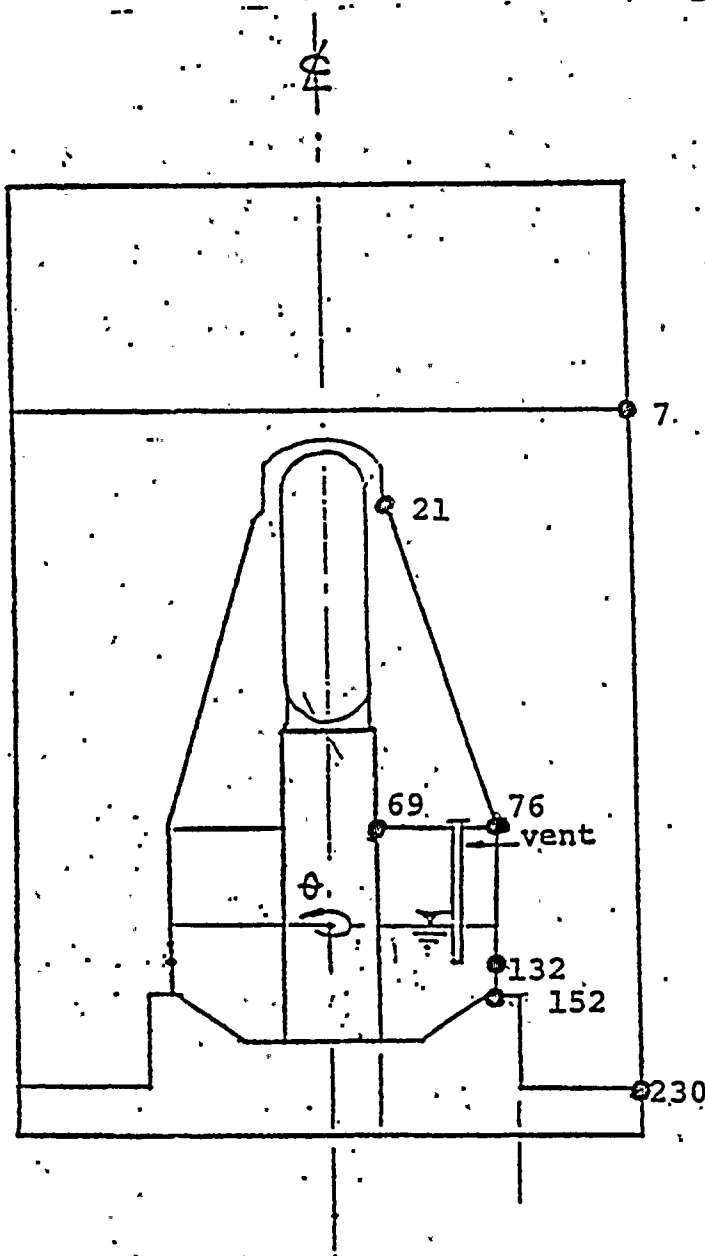
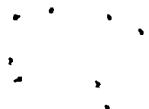


FIGURE 1: DEFINITION OF MASS POINTS



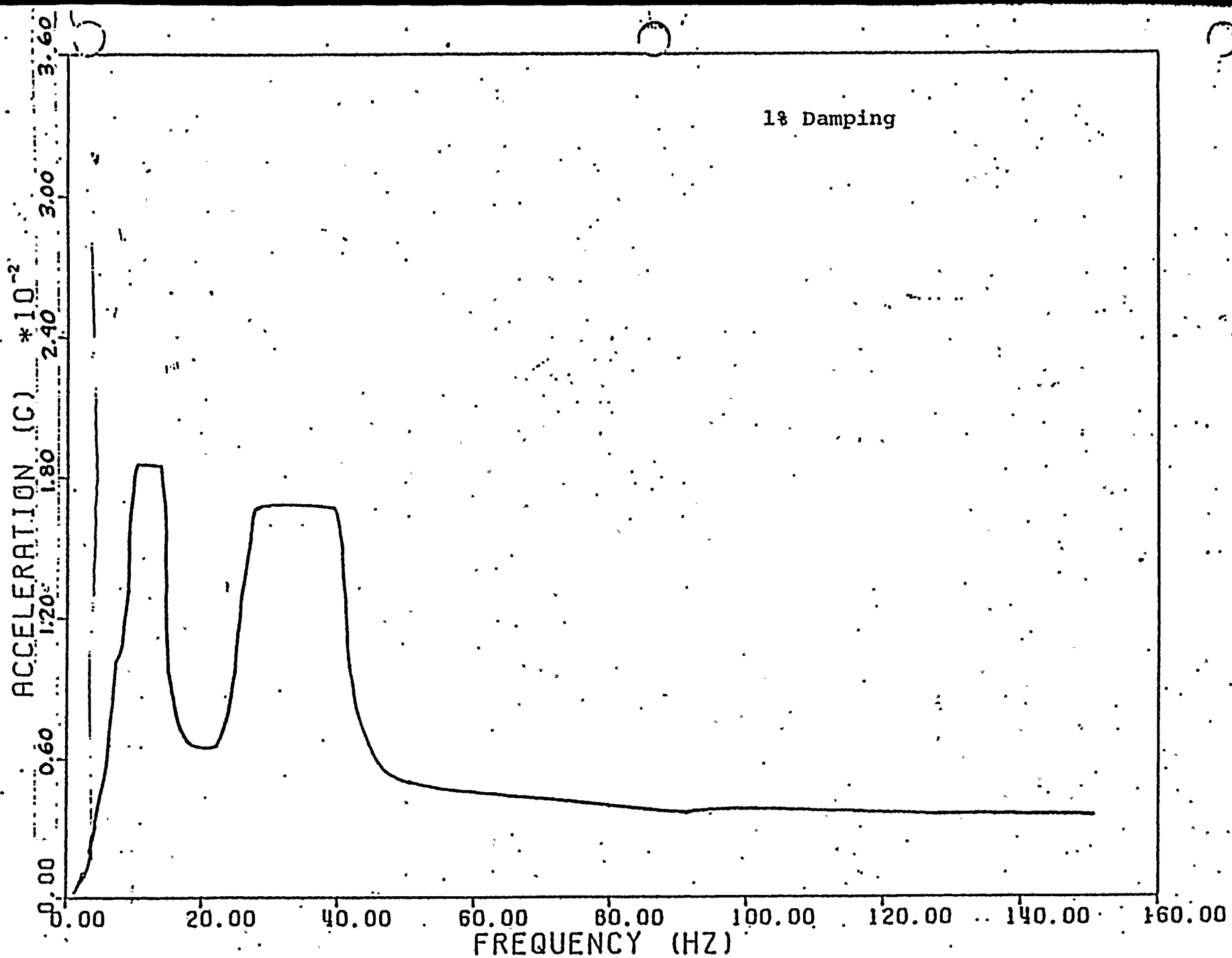


FIGURE 2: WNP-2 REACTOR BUILDING - NEARLY SYMMETRIC CHUGGING
REFUELING FLOOR AT EXTERIOR WALL (MASS NO. 7)
HORIZ. TRANSLATION

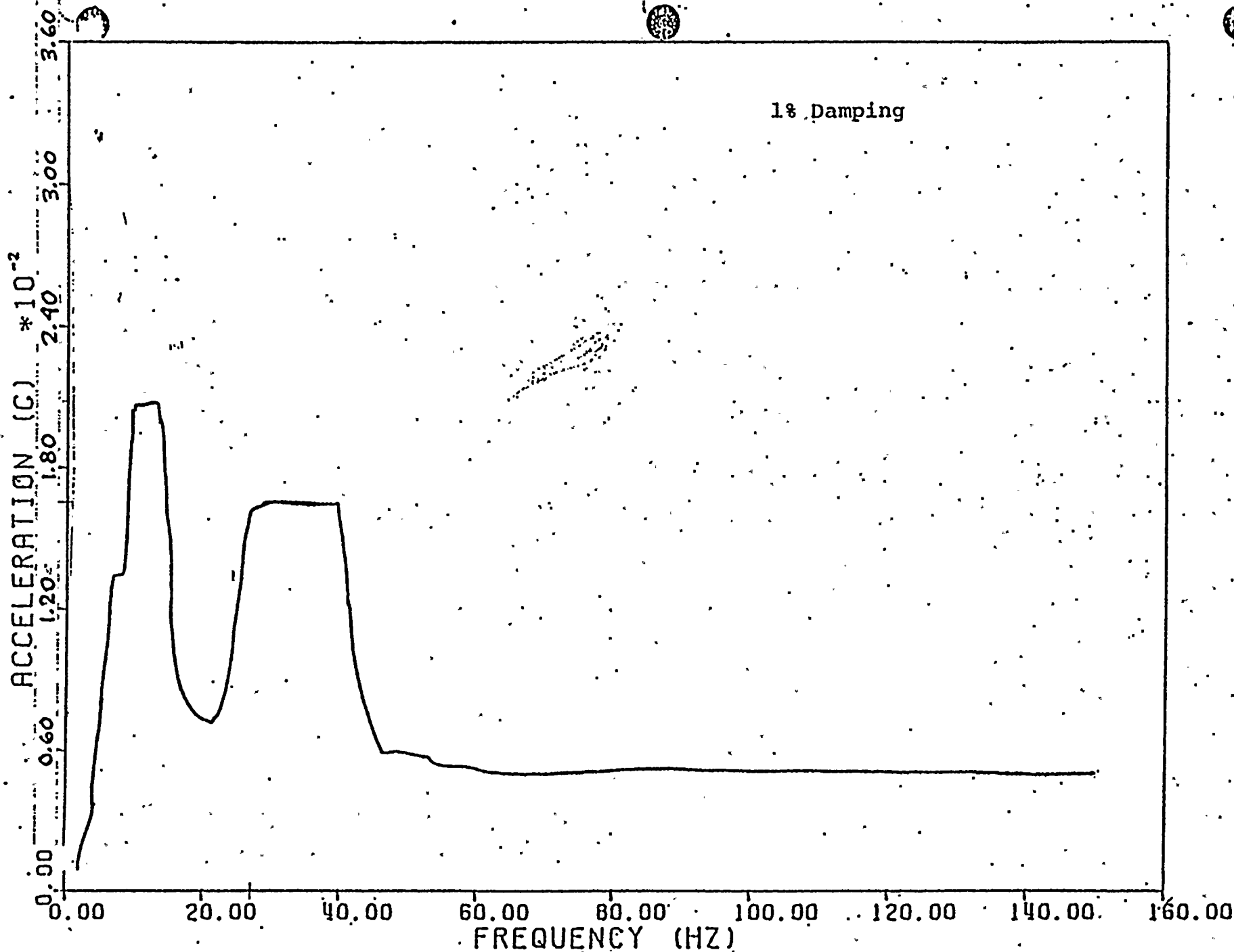


FIGURE: 3: WNP-2 REACTOR BUILDING - ASYMMETRIC CHUGGING
REFUELING FLOOR AT EXTERIOR WALL (MASS NO. 7)
HORIZ. TRANSLATION

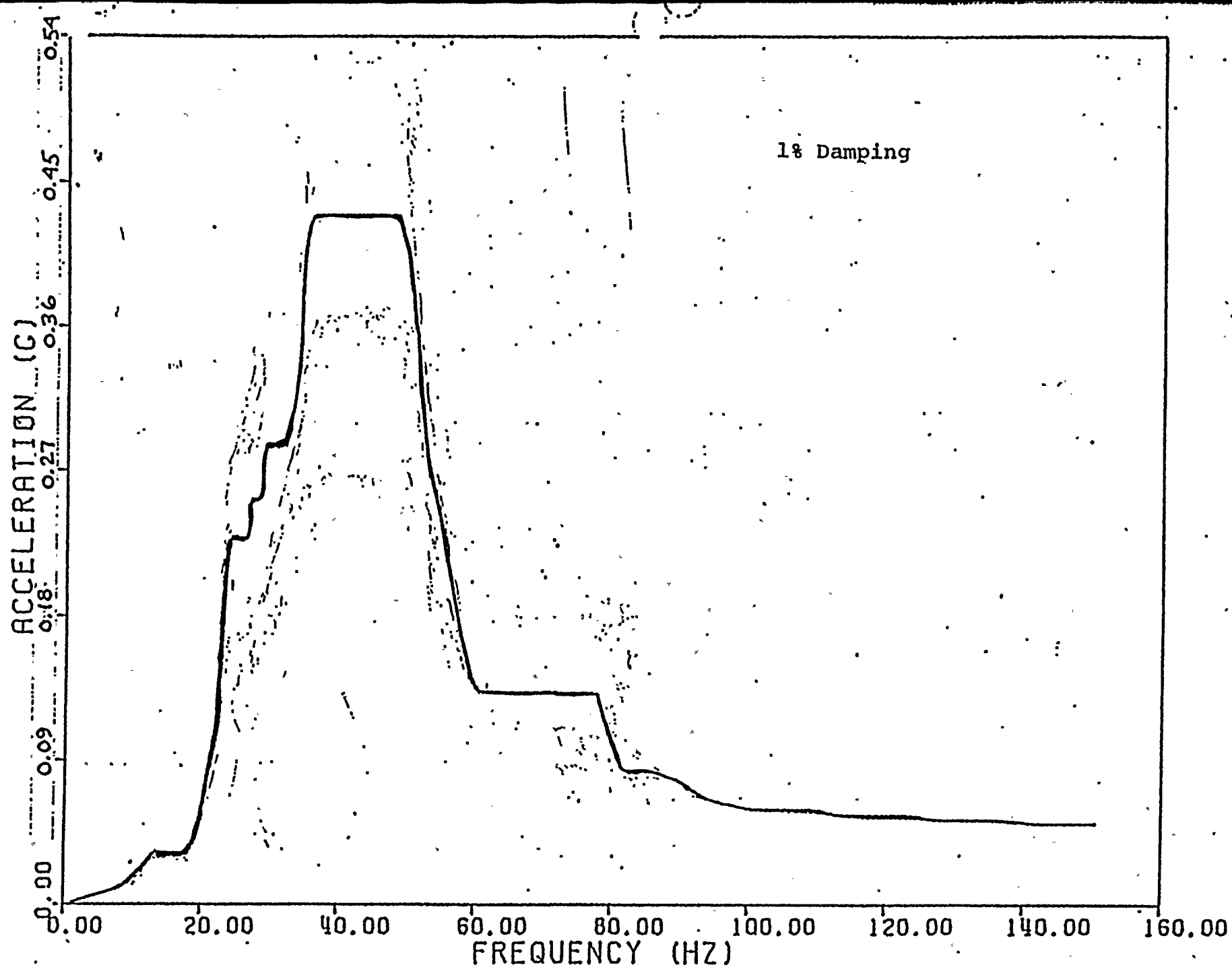


FIGURE 4: WNP-2 REACTOR BUILDING - NEARLY SYMMETRIC CHUGGING
CONTAINMENT VESSEL AT STABILIZER LEVEL (MASS NO. 21)
HORIZ. TRANSLATION

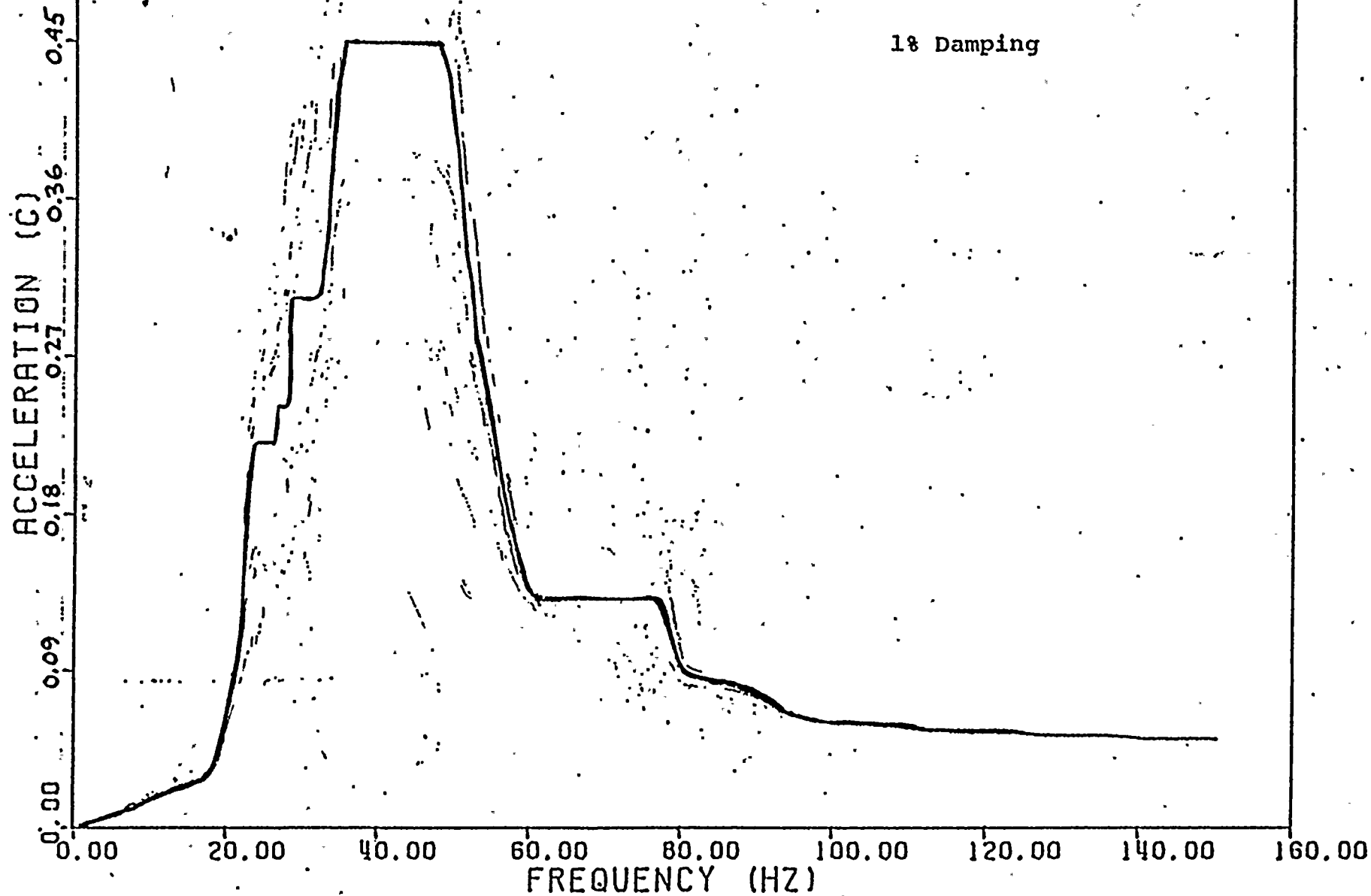


FIGURE 5: WNP-2 REACTOR BUILDING - ASYMMETRIC CHUGGING
CONTAINMENT VESSEL AT STABILIZER LEVEL (MASS NO. 21)
HORIZ. TRANSLATION

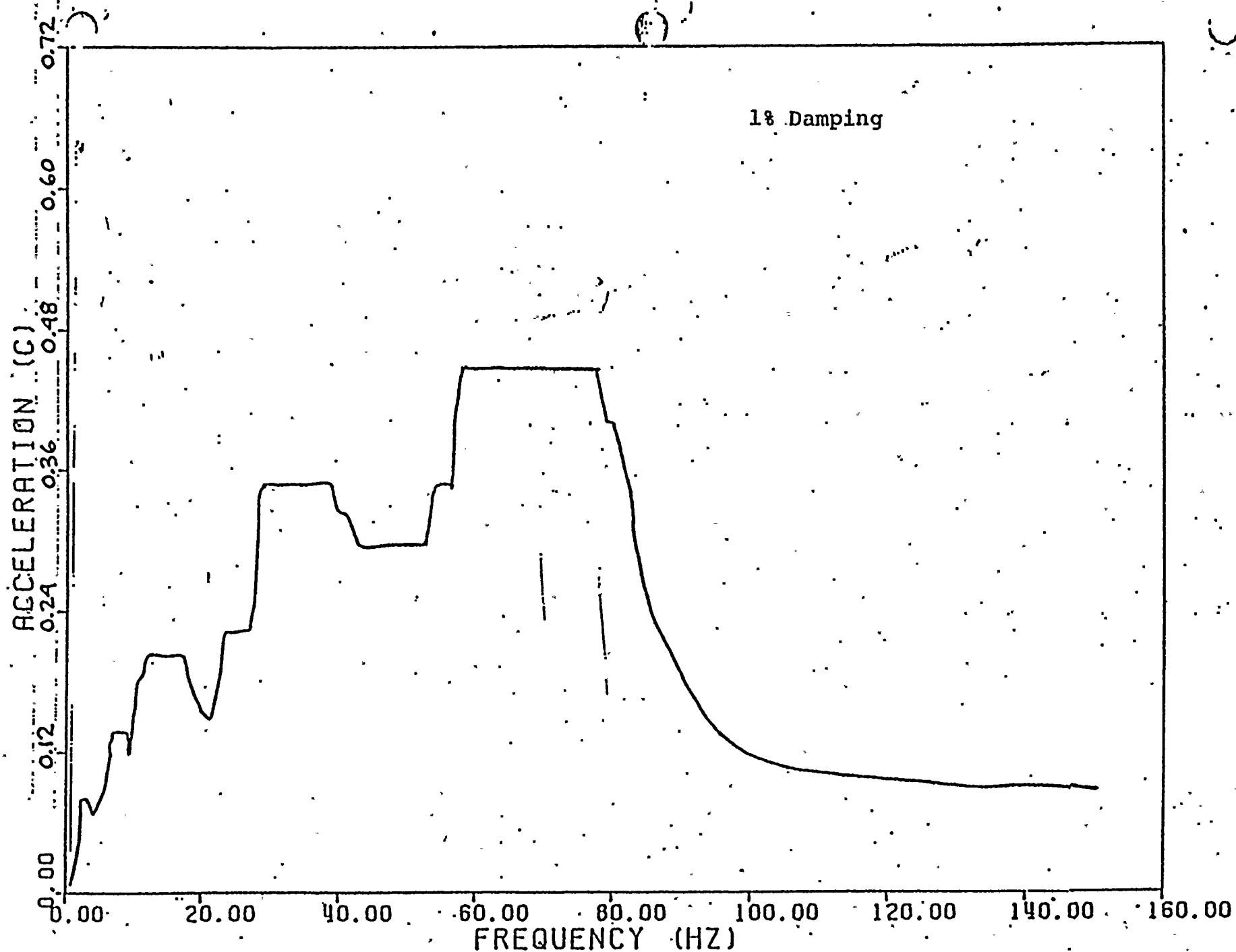


FIGURE 6: WNP-2 REACTOR BUILDING - NEARLY SYMMETRIC CHUGGING
CONTAINMENT VESSEL AT STABILIZER LEVEL (MASS NO. 21)
VERT. TRANSLATION

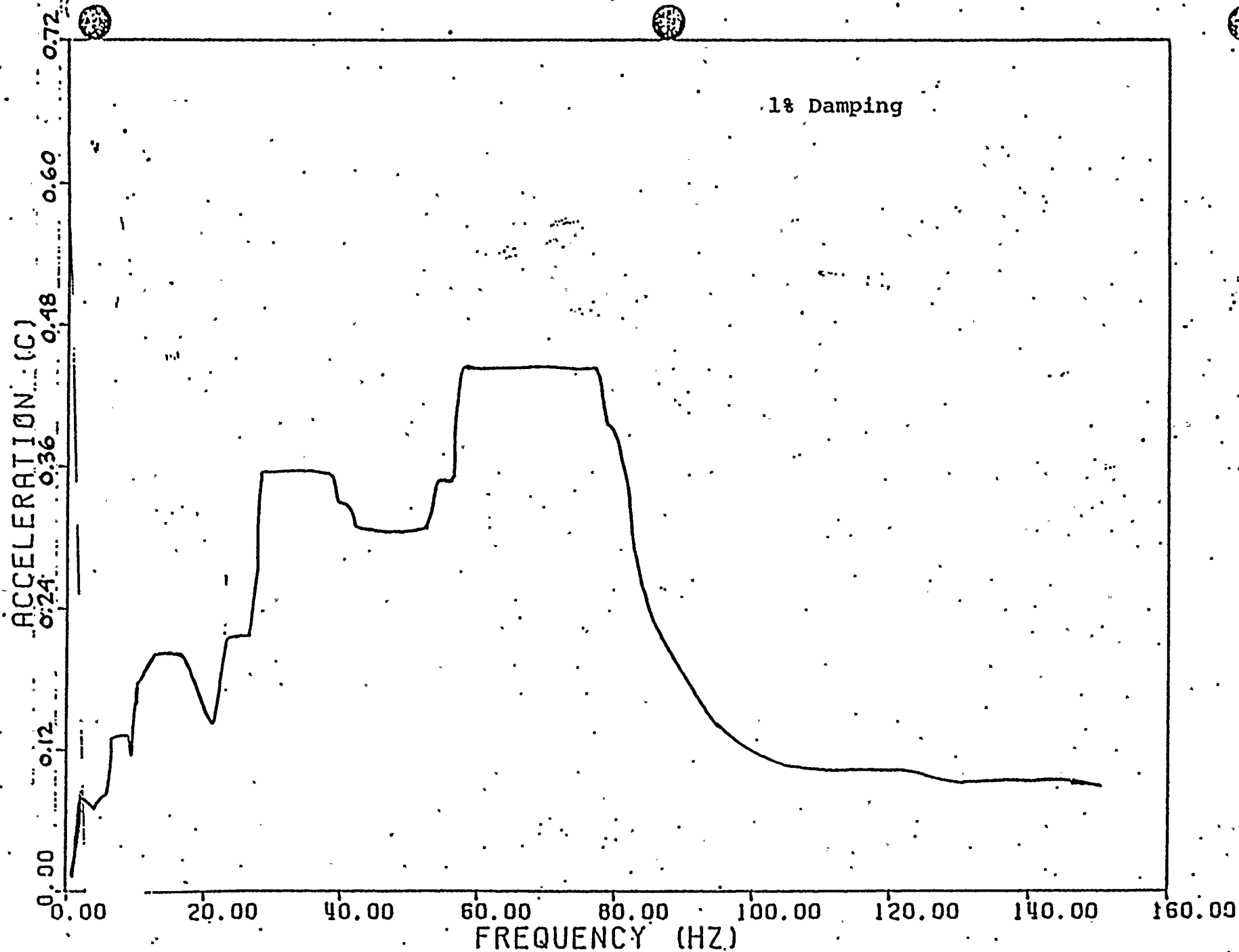


FIGURE 7: WNP-2 REACTOR BUILDING - ASYMMETRIC CHUGGING
CONTAINMENT VESSEL AT STABILIZER LEVEL (MASS NO. 21)
VERT. TRANSLATION

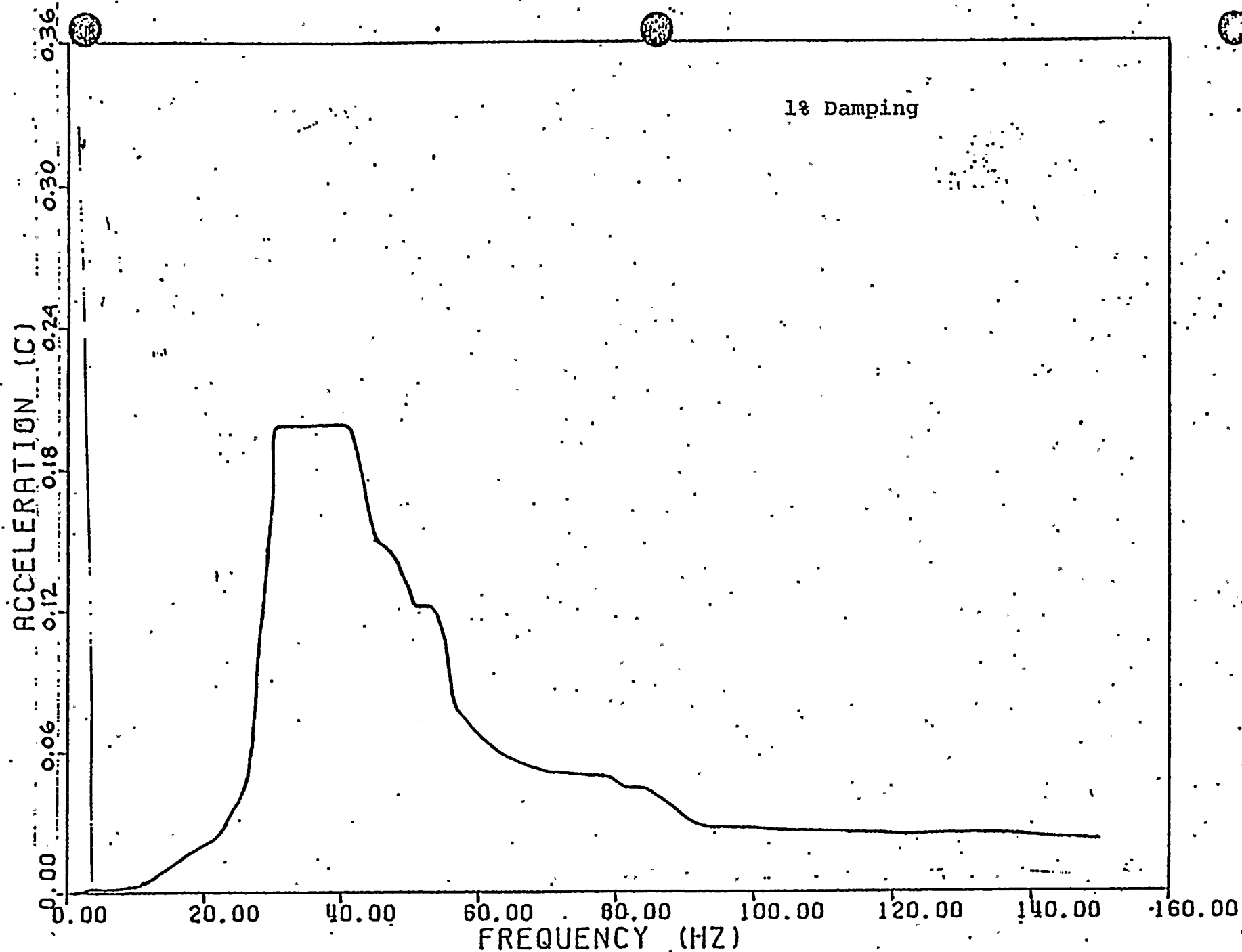


FIGURE 8: WNP-2 REACTOR BUILDING - NEARLY SYMMETRIC CHUGGING
R.P.V. PEDESTAL AT DRYWELL FLOOR ELEVATION (MASS NO: 69)
HORIZ. TRANSLATION

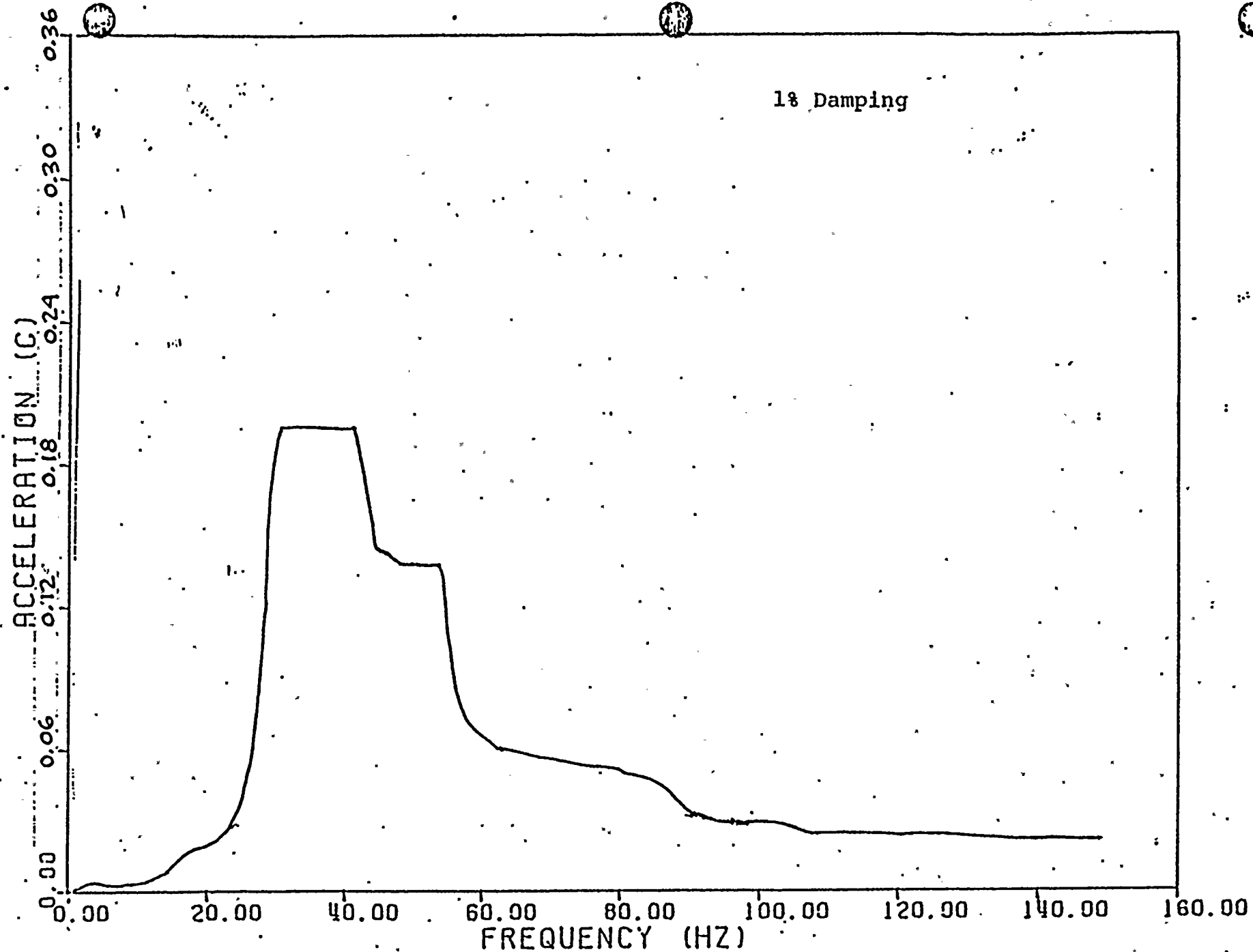


FIGURE 9: WNP-2 REACTOR BUILDING - ASYMMETRIC CHUGGING
R.P.V. PEDESTAL AT DRYWELL FLOOR ELEVATION (MASS No. 69)
HORIZ. TRANSLATION

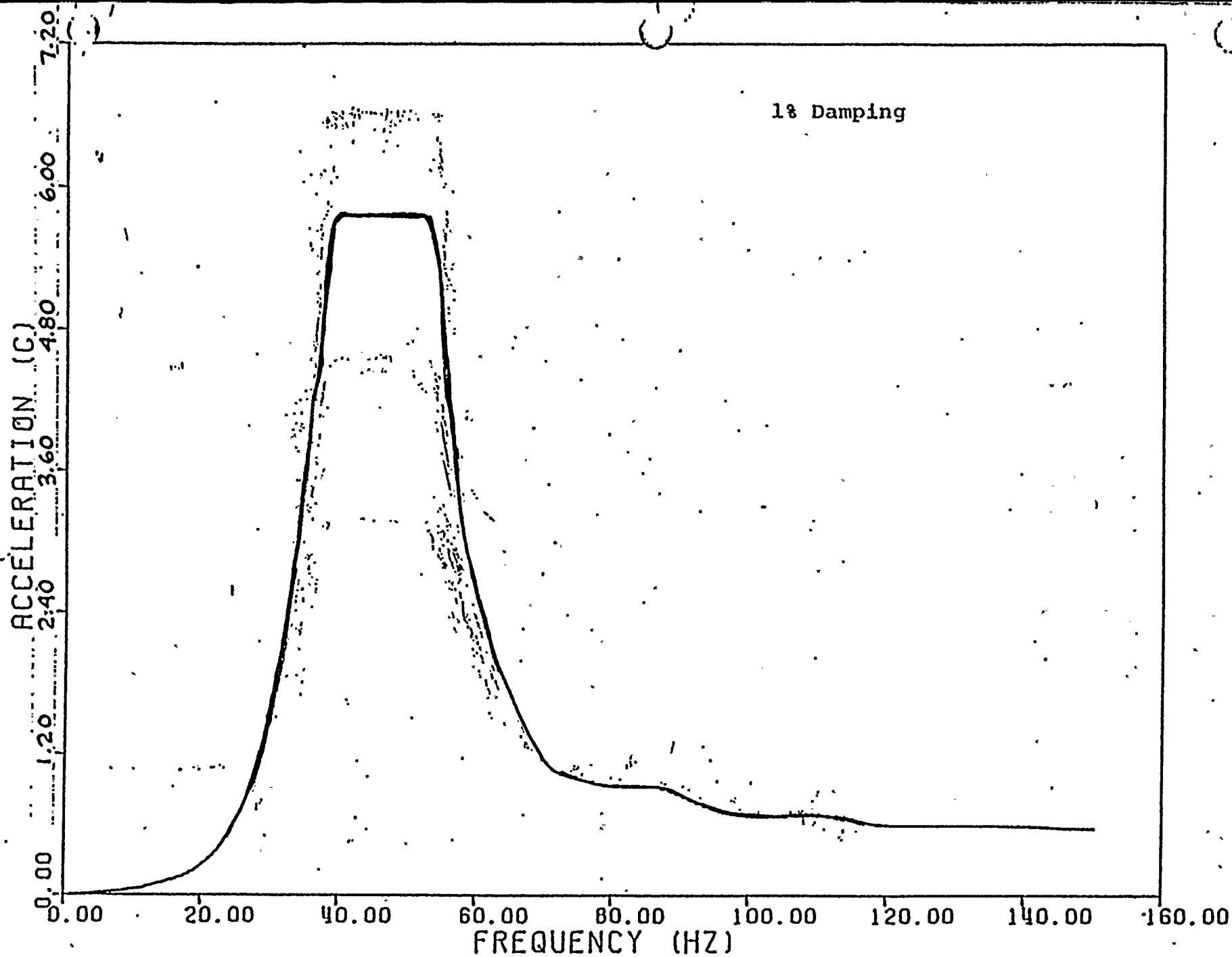


FIGURE 10: WNP-2 REACTOR BUILDING - NEARLY SYMMETRIC CHUGGING
CONTAINMENT VESSEL AT DRYWELL FLOOR ELEVATION (MASS NO. 76)
HORIZ. TRANSLATION

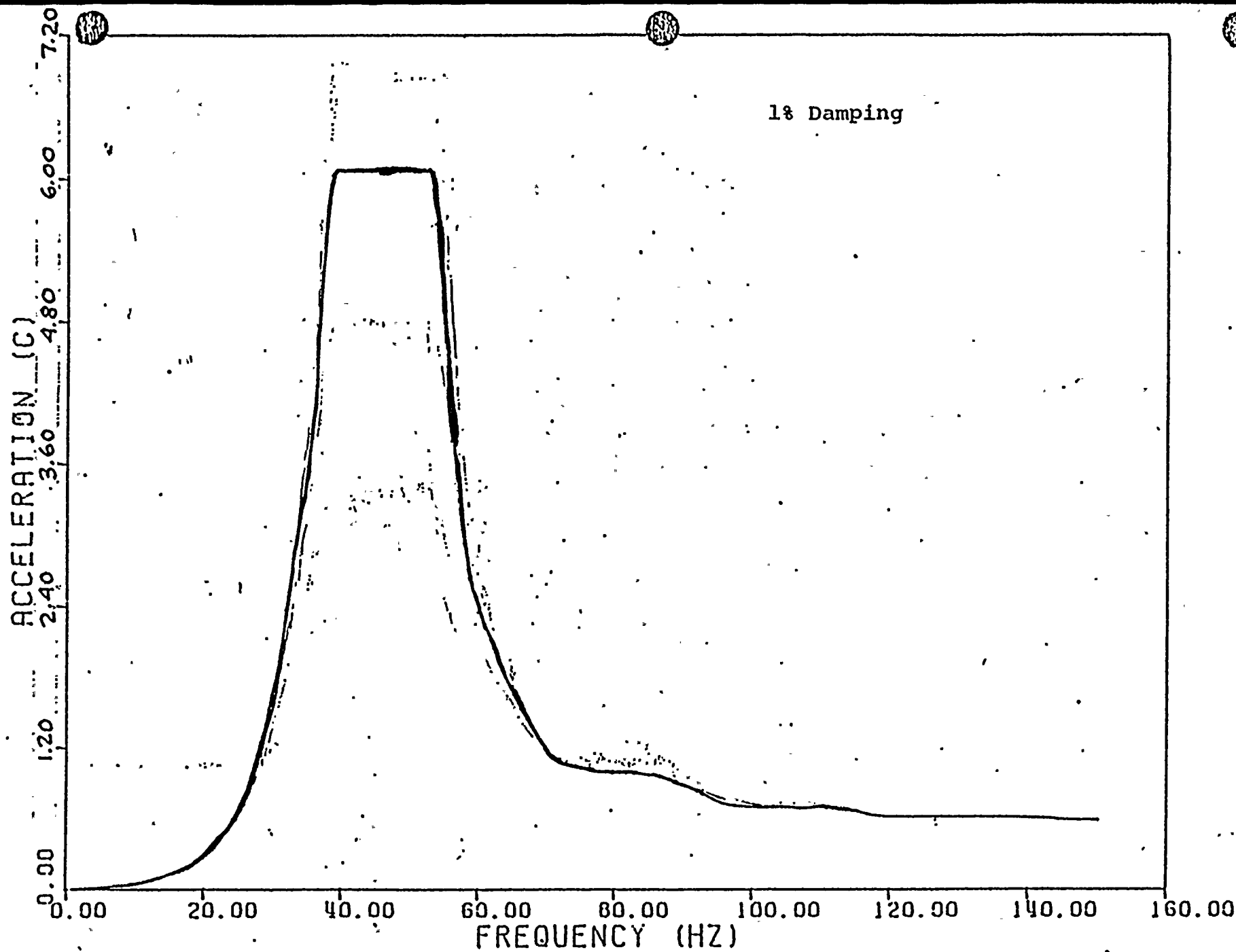


FIGURE 11: WNP-2 REACTOR BUILDING - ASYMMETRIC CHUGGING
CONTAINMENT VESSEL AT DRYWELL FLOOR ELEVATION (MASS NO. 76)
HORIZ. TRANSLATION

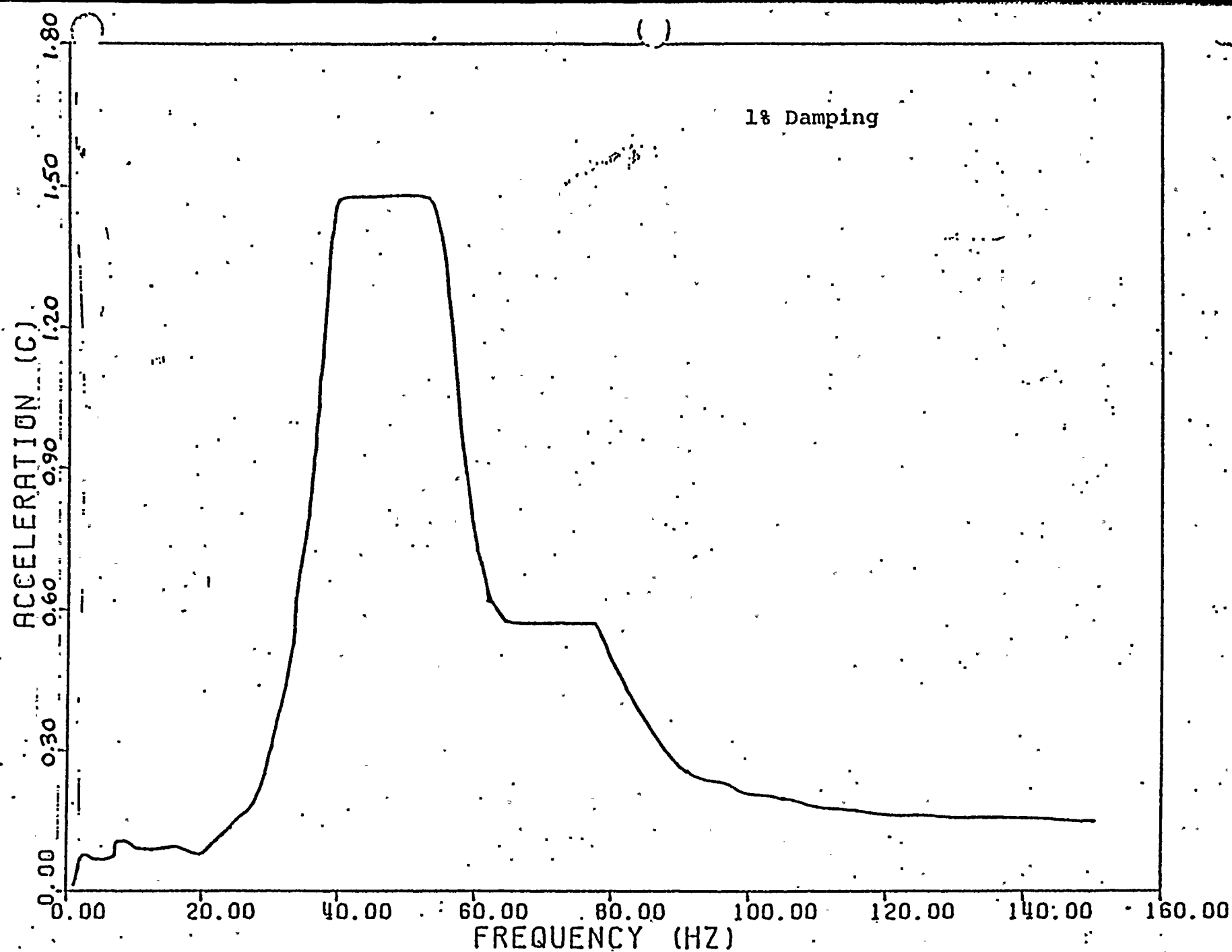


FIGURE 12: WNP-2 REACTOR BUILDING - NEARLY SYMMETRIC CHUGGING
CONTAINMENT VESSEL AT DRYWELL FLOOR ELEVATION (MASS NO. 76)
VERT. TRANSLATION

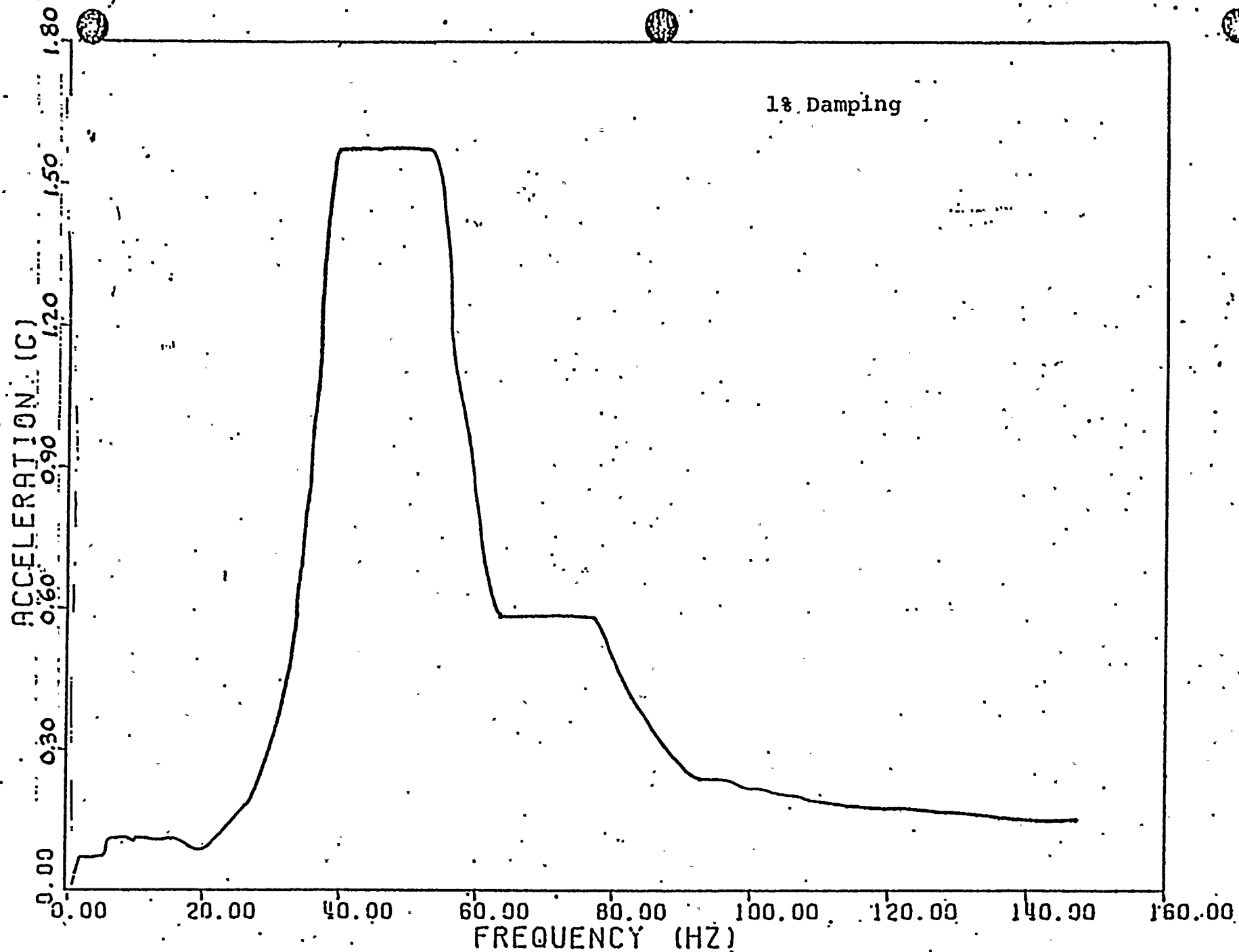


FIGURE 13: WNP-2 REACTOR BUILDING - ASYMMETRIC CHUGGING
CONTAINMENT VESSEL AT DRYWELL FLOOR ELEVATION (MASS NO. 76)
VERT. TRANSLATION

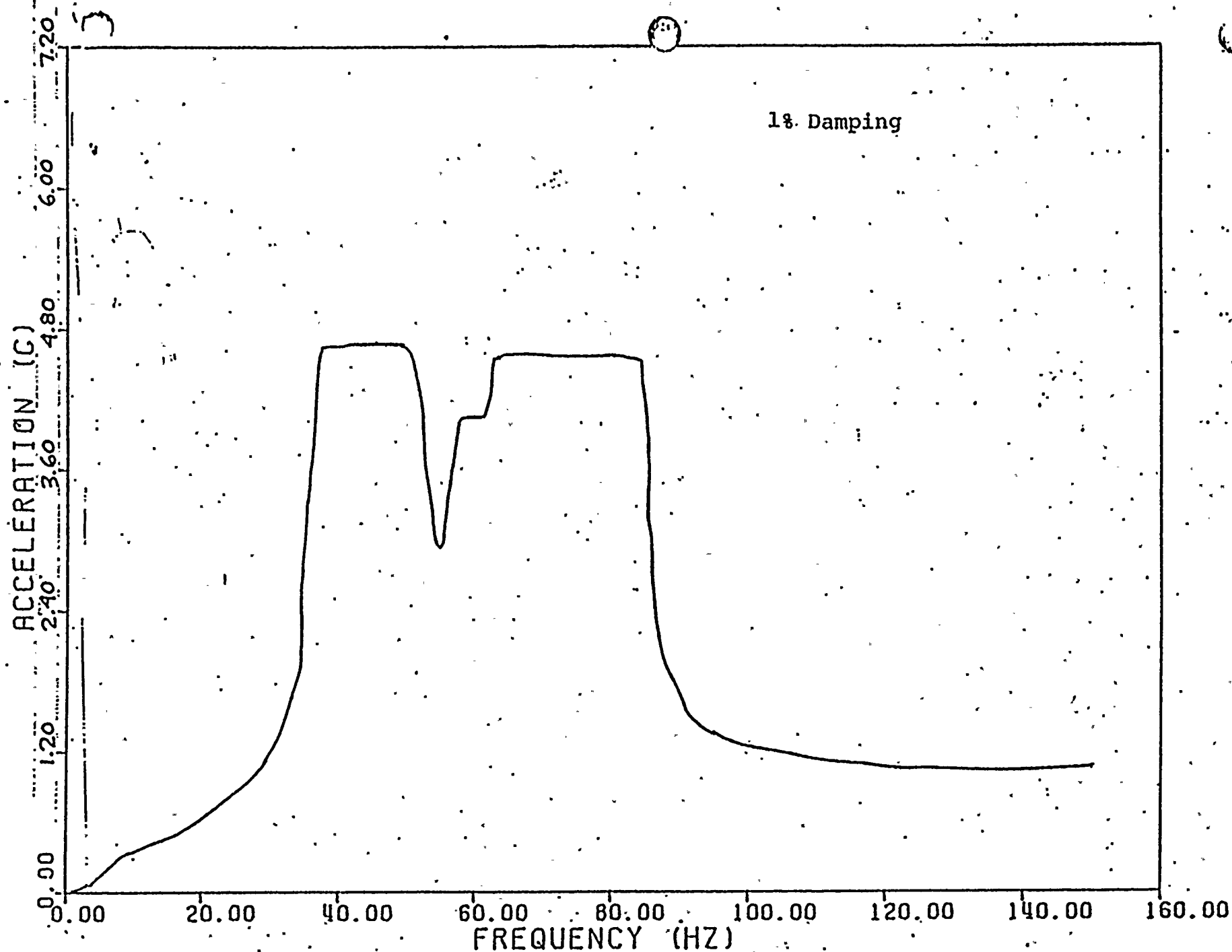


FIGURE 14: WNP-2 REACTOR BUILDING - NEARLY SYMMETRIC CHUGGING
CONTAINMENT VESSEL AT POINT OF MAXIMUM RESPONSE
(APPROX. AT MIDSUBMERGENCE) (MASS NO. 132)
HORIZ. TRANSLATION

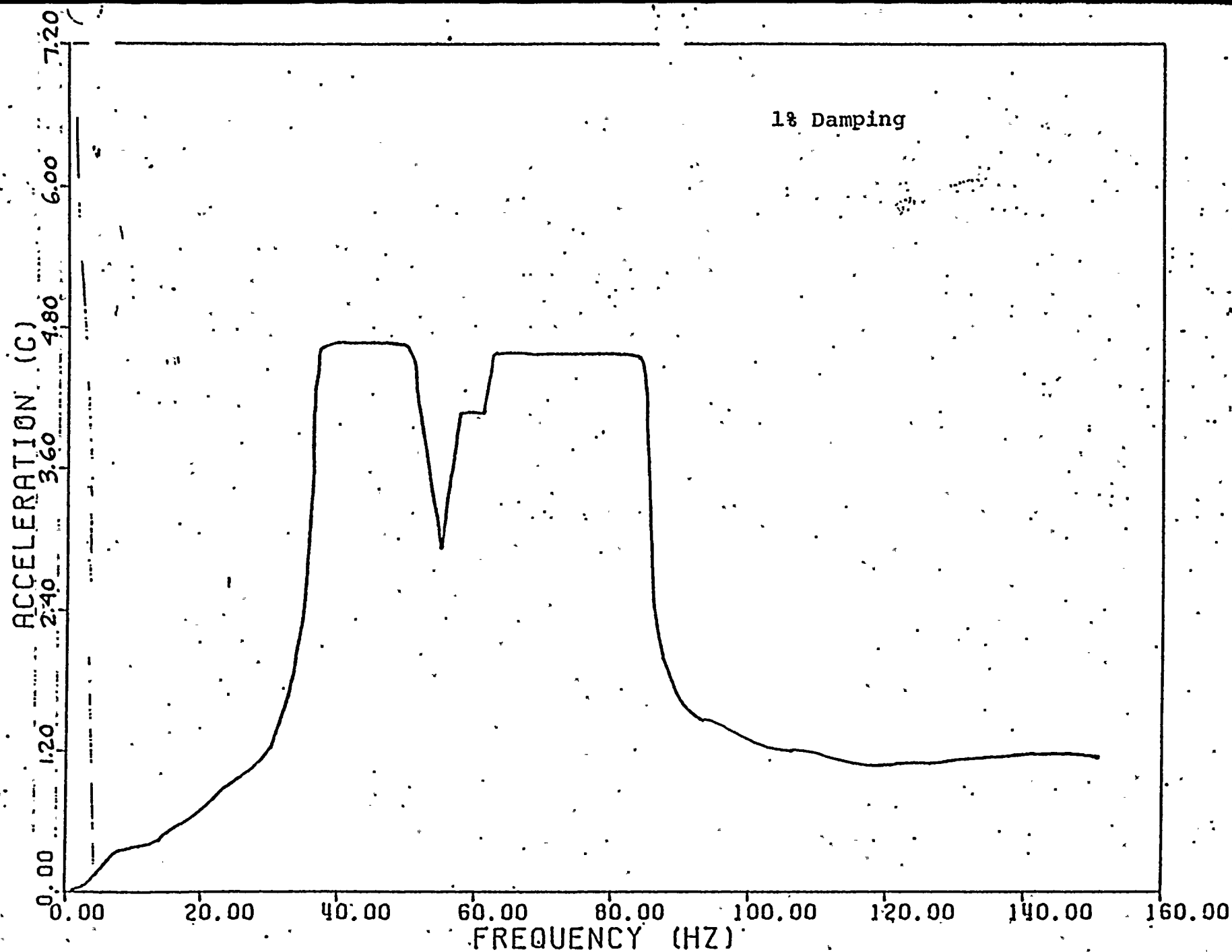


FIGURE 15: WNP-2 REACTOR BUILDING - ASYMMETRIC CHUGGING
CONTAINMENT VESSEL AT POINT OF MAXIMUM RESPONSE
(APPROX. AT MIDSUBMERGENCE) (MASS NO. 132)
HORIZ. TRANSLATION

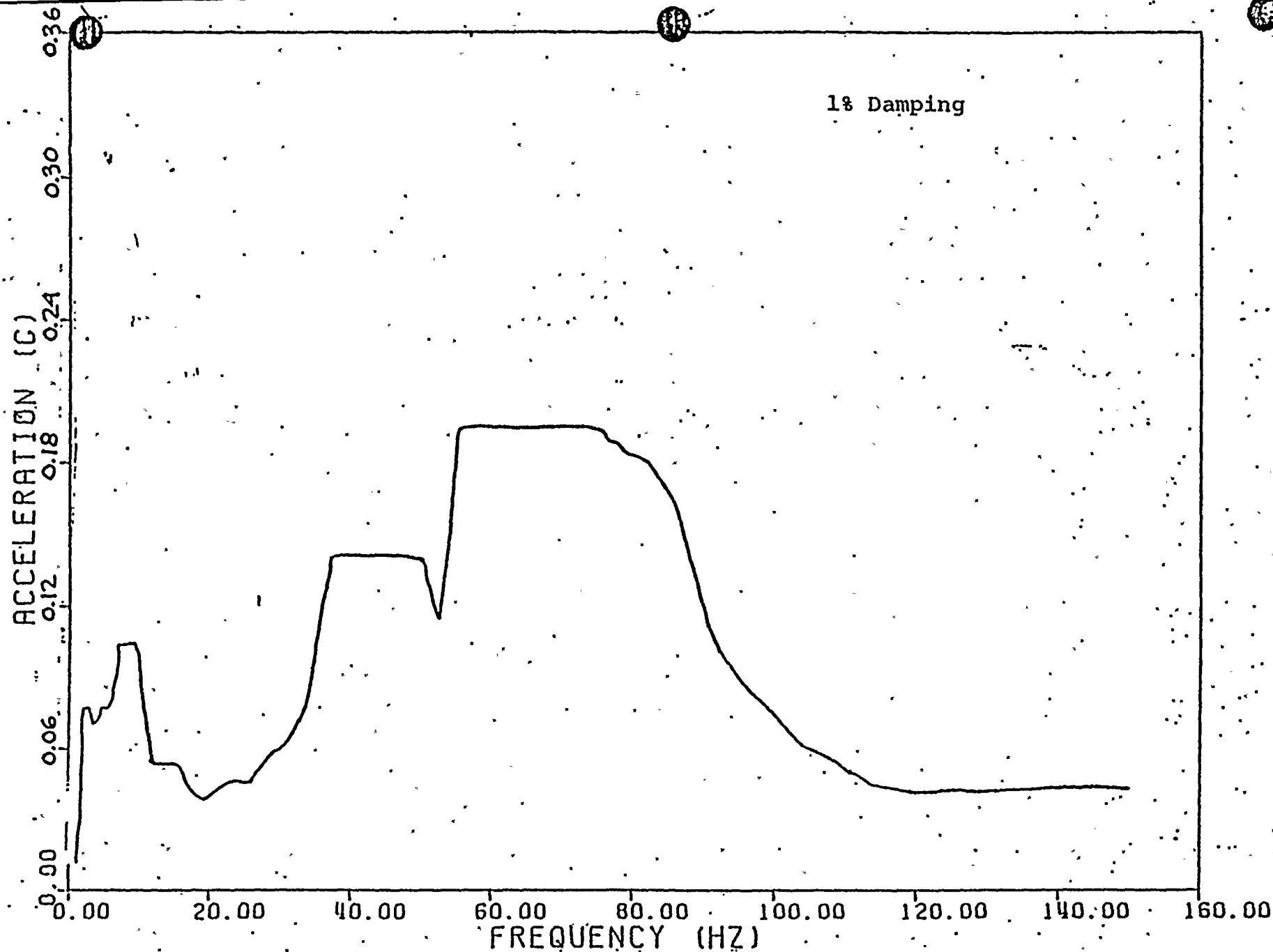


FIGURE 16: WNP-2 REACTOR BUILDING - NEARLY SYMMETRIC CHUGGING.
MAT AT CONTAINMENT VESSEL (MASS NO. 152)
VERT. TRANSLATION

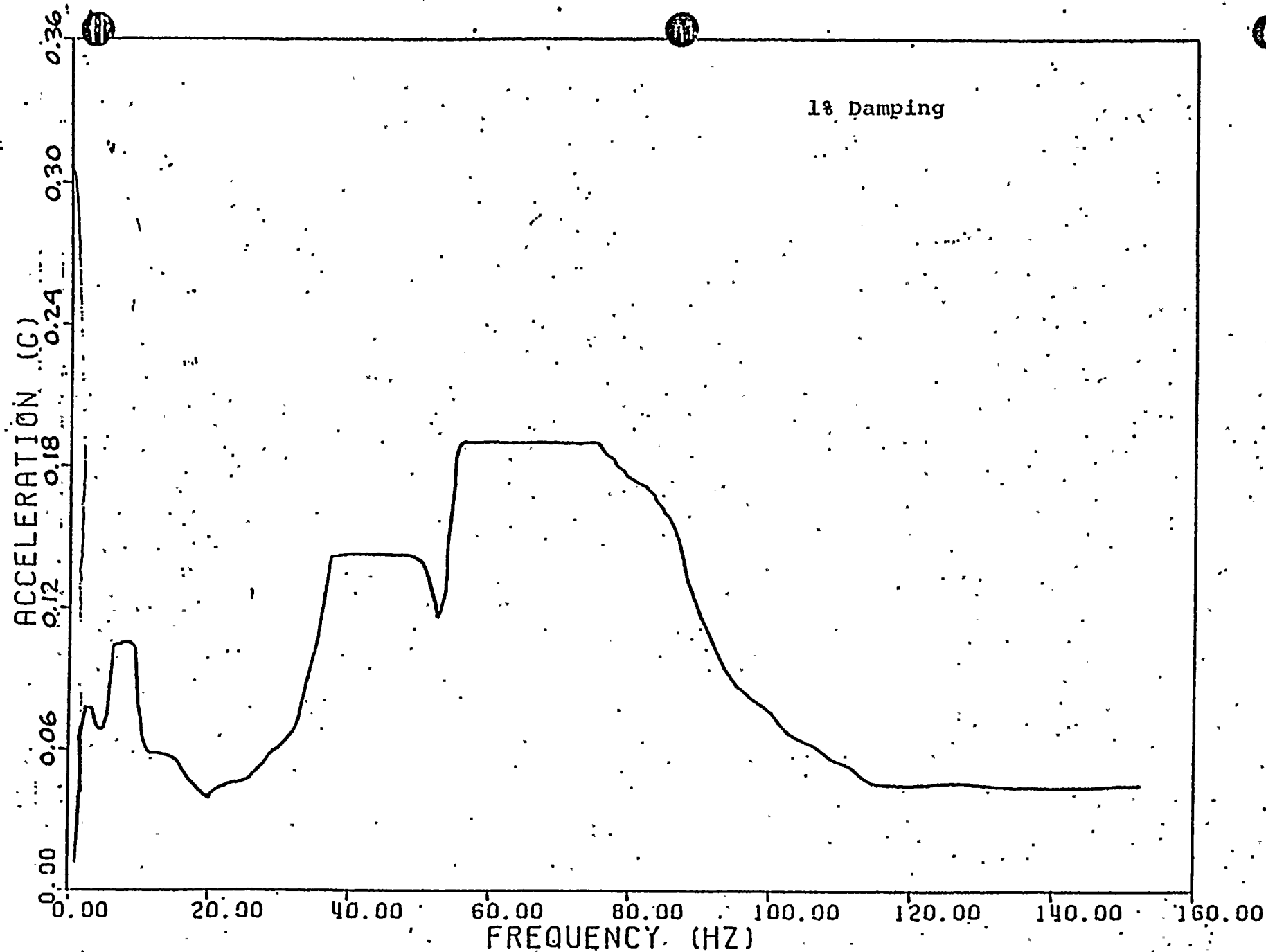


FIGURE 17: WNP-2 REACTOR BUILDING - ASYMMETRIC CHUGGING:
MAT AT CONTAINMENT VESSEL (MASS NO. 152)
VERT. TRANSLATION

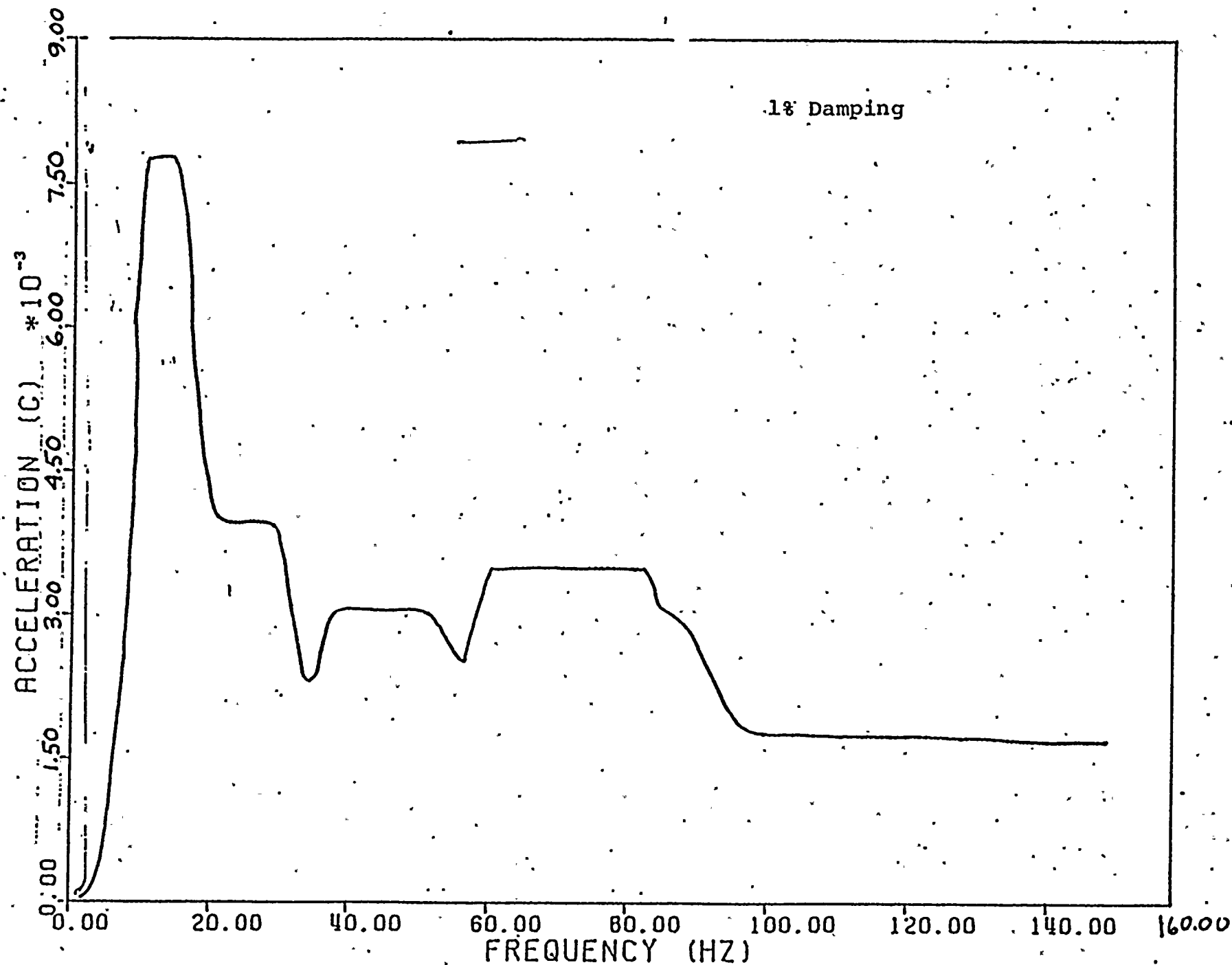
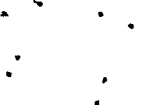


FIGURE 18: WNP-2 REACTOR BUILDING - NEARLY SYMMETRIC CHUGGING :
MAT AT EXTERIOR WALL (MASS NO. 230)
HORIZ. TRANSLATION



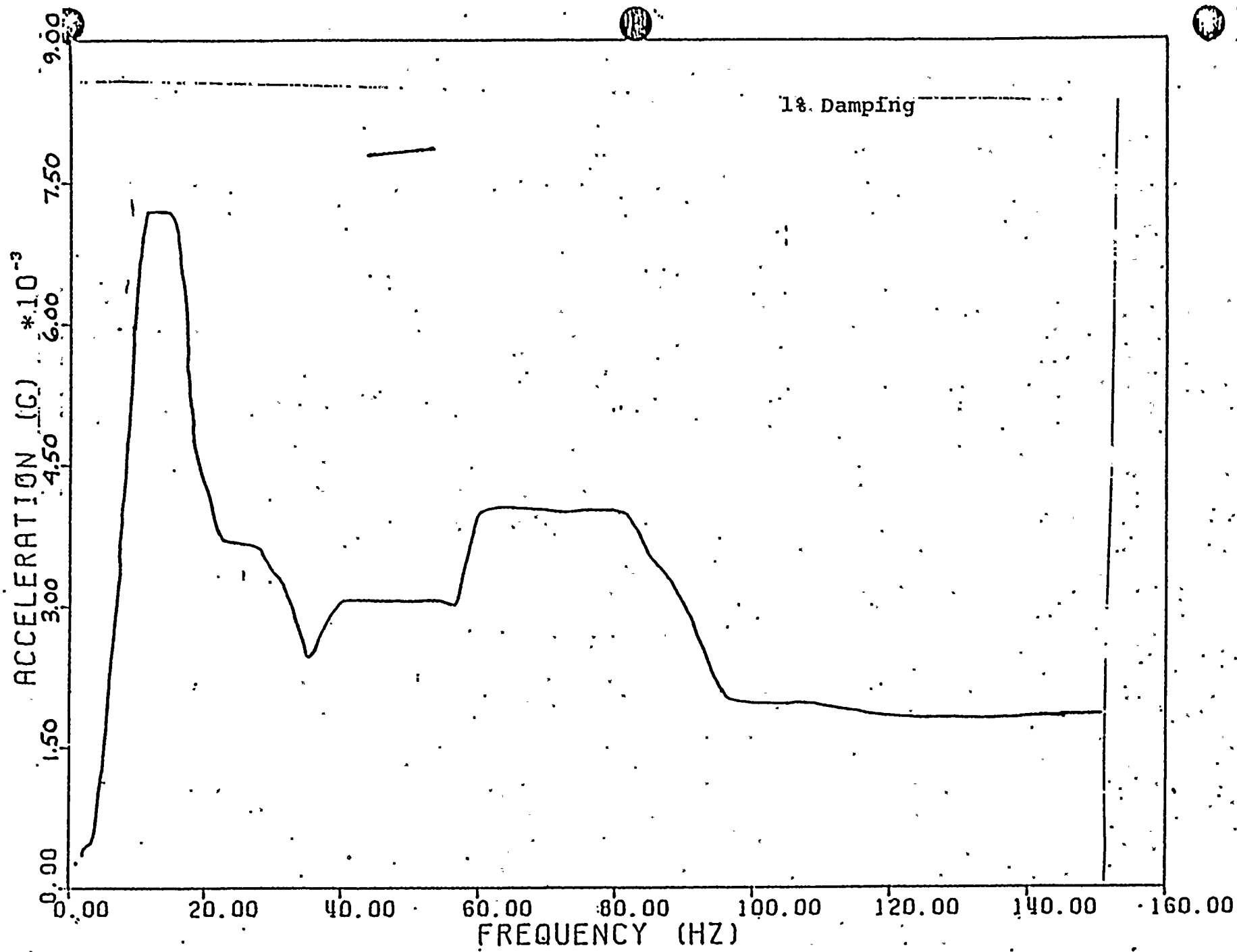


FIGURE 19: WNP-2 REACTOR BUILDING - ASYMMETRIC CHUGGING
MAT AT EXTERIOR WALL (MASS NO. 230)
HORIZ. TRANSLATION

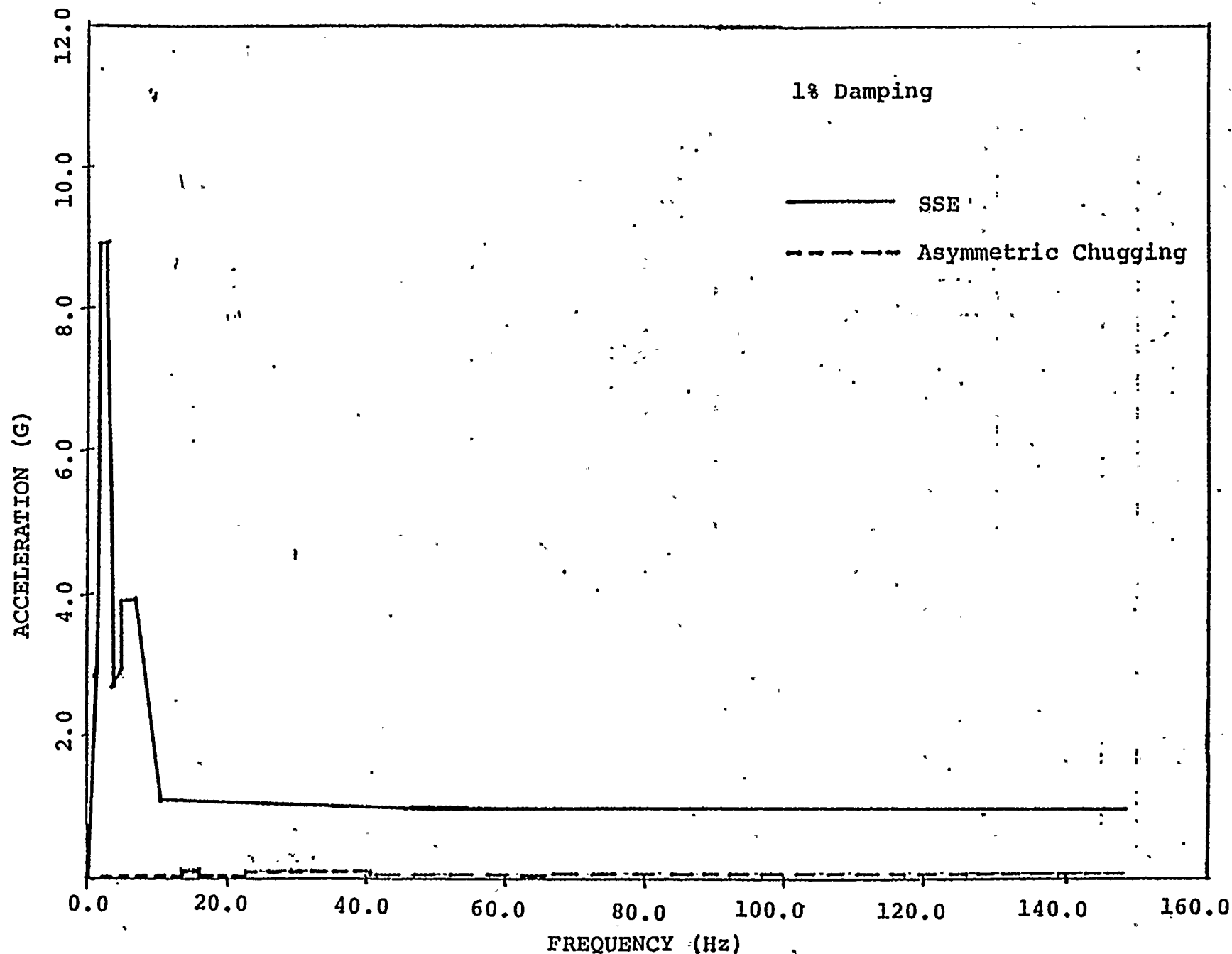


FIGURE 20: WNP-2 REACTOR BUILDING - SSE AND ASYMMETRIC CHUGGING LOAD
REFUELING FLOOR AT EXTERIOR WALL (MASS NO. 7)
HORIZ. TRANSLATION

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BOURNS AND ROE, INC.



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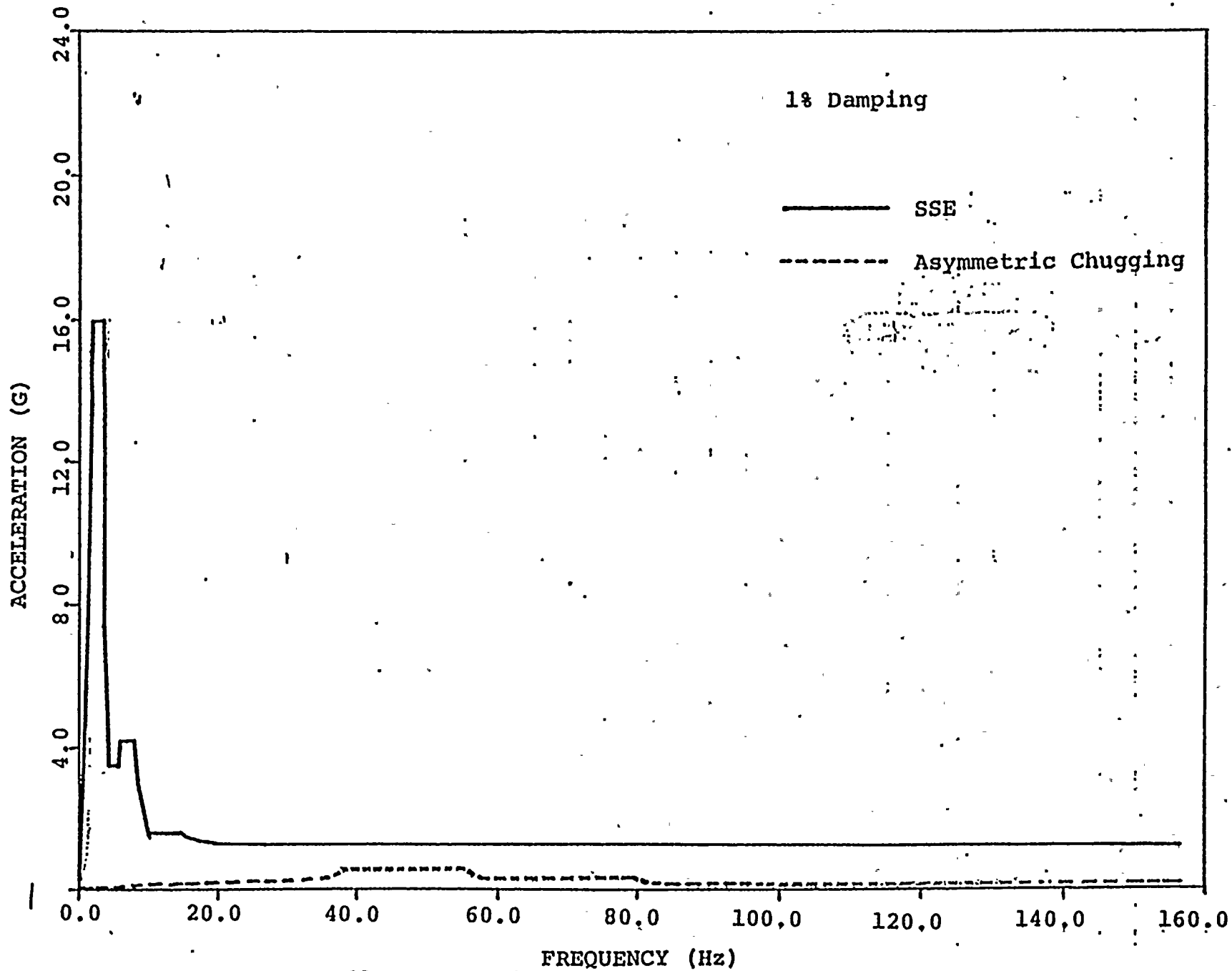
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FIGURE 21: WNP-2 REACTOR BUILDING -- SSE AND ASYMMETRIC CHUGGING LOAD.
CONTAINMENT VESSEL AT STABILIZER LEVEL (MASS NO. 21)
HORIZ. TRANSLATION

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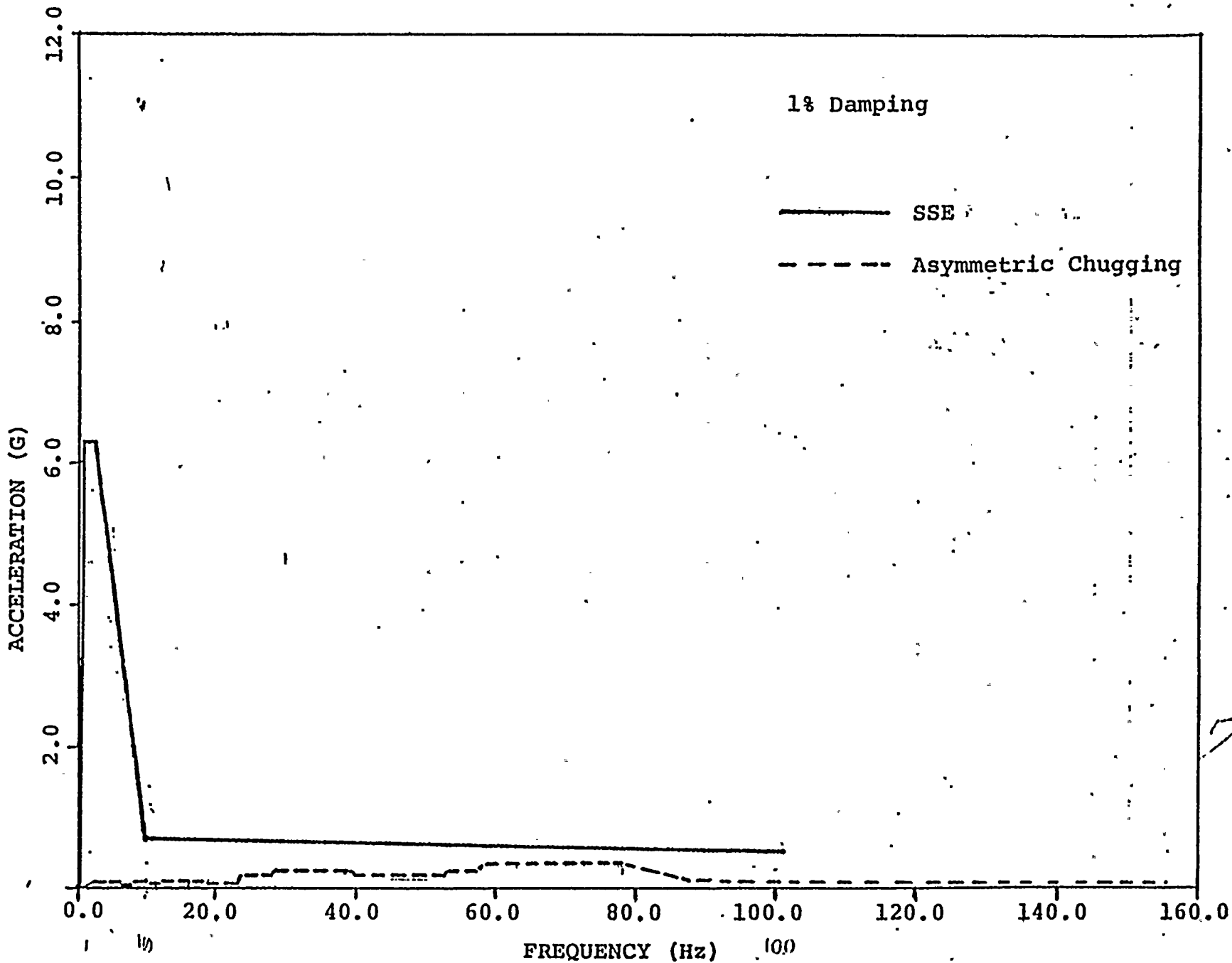


FIGURE 22: WNP-2 REACTOR BUILDING - SSE AND ASYMMETRIC CHUGGING LOAD CONTAINMENT VESSEL AT STABILIZER LEVEL (MASS NO. 21) VERT. TRANSLATION

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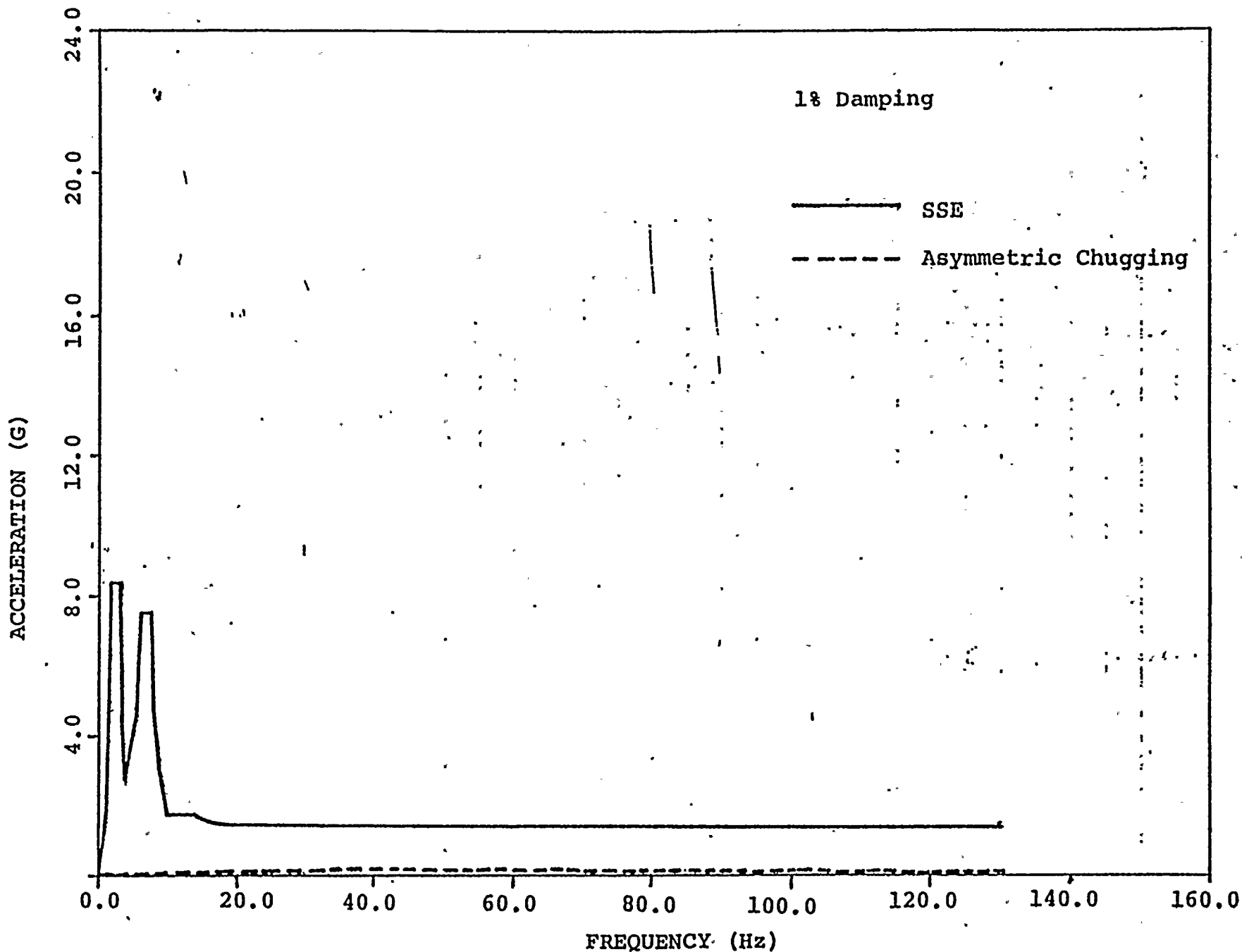


FIGURE 23: WNP-2: REACTOR BUILDING - SSE AND ASYMMETRIC CHUGGING LOAD
R.P.V. PEDESTAL AT DRYWELL FLOOR ELEVATION (MASS NO. 69)
HORIZ. TRANSLATION

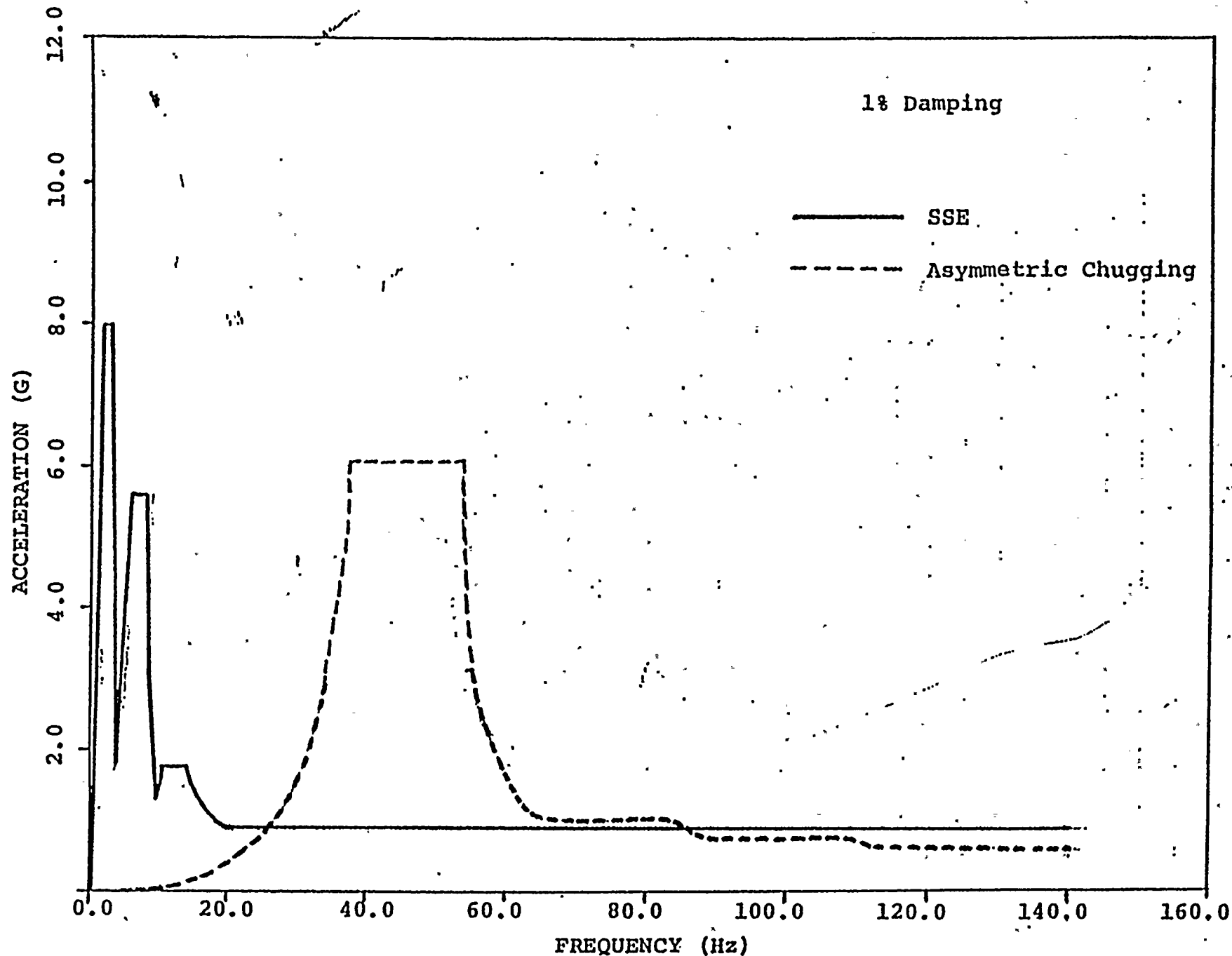


FIGURE 24; WNP-2 REACTOR BUILDING - SSE AND ASYMMETRIC CHUGGING LOAD
 CONTAINMENT VESSEL AT DRYWELL FLOOR ELEVATION (MASS NO. 76)
 HORIZ: TRANSLATION

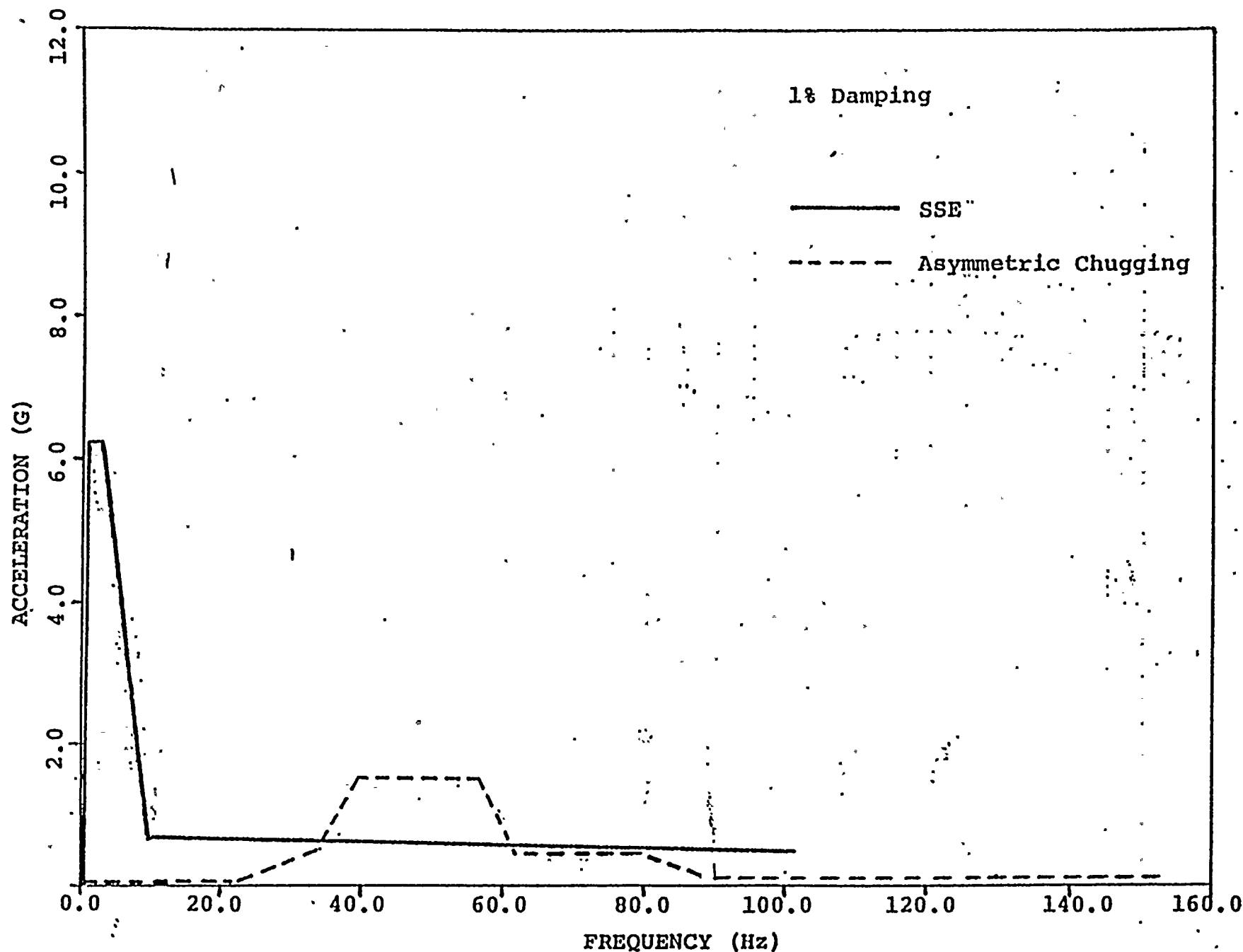


FIGURE 25: WNP-2 REACTOR BUILDING - SSE AND ASYMMETRIC CHUGGING LOAD
CONTAINMENT VESSEL AT DRYWELL FLOOR ELEVATION (MASS NO. 76).
VERT. TRANSLATION

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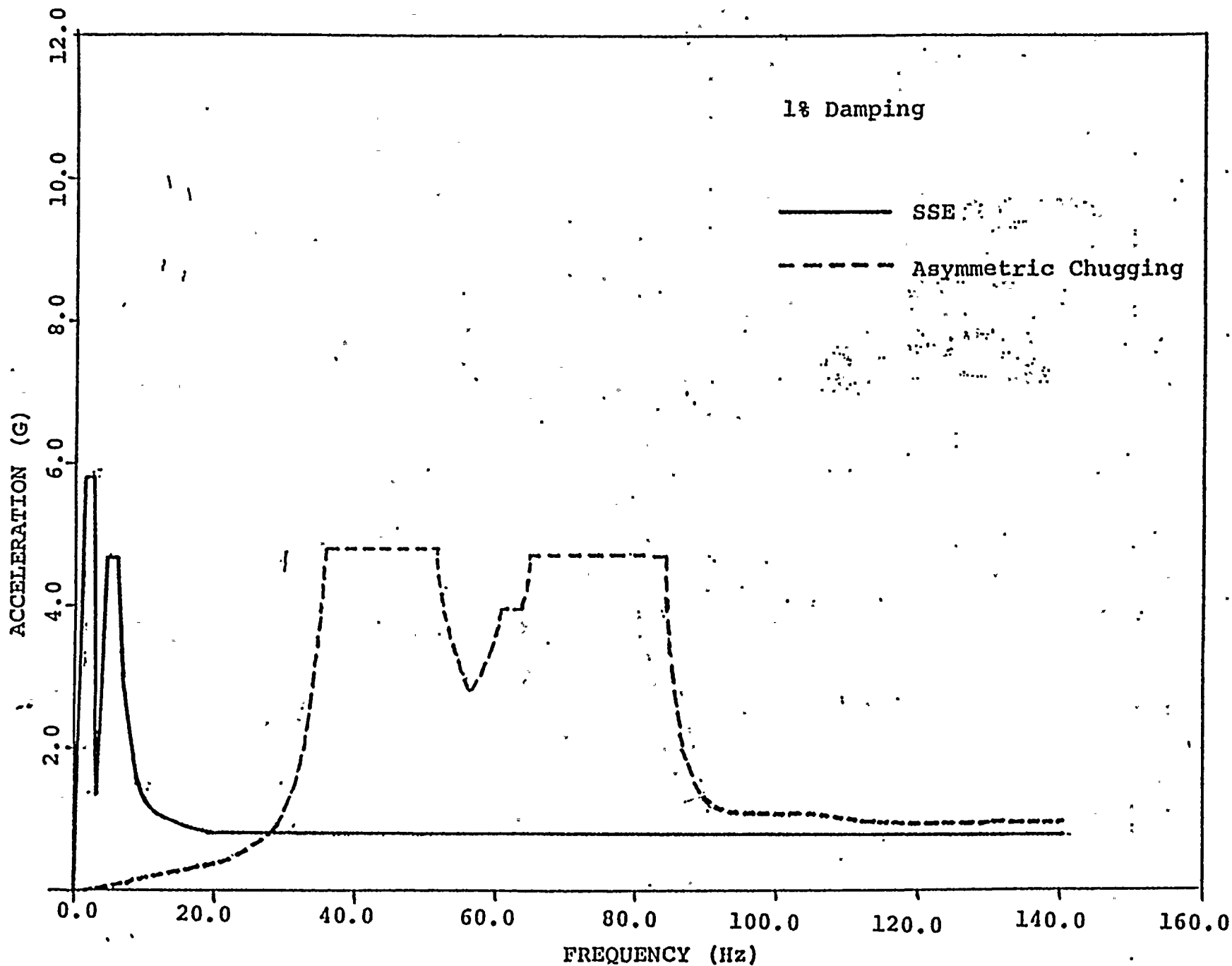


FIGURE 26: WNP-2 REACTOR BUILDING - SSE AND ASYMMETRIC CHUGGING LOAD
CONTAINMENT VESSEL AT POINT OF MAXIMUM RESPONSE
(APPROX. AT MIDSUBMERGENCE) (MASS NO. 132)
HORIZ. TRANSLATION

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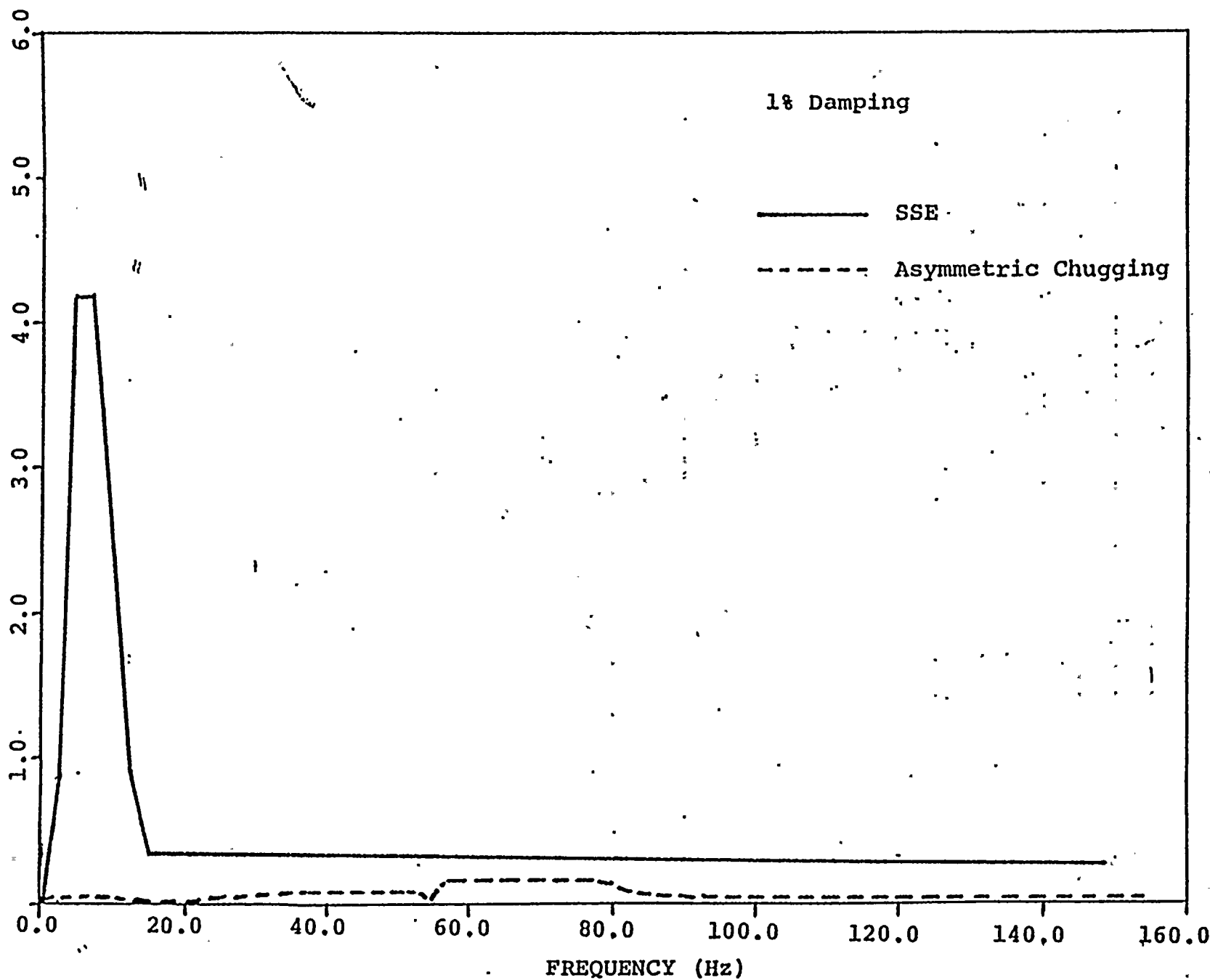


FIGURE 27: WNP-2 REACTOR BUILDING - SSE AND ASYMMETRIC CHUGGING LOAD MAT AT CONTAINMENT VESSEL (MASS NO. 152) VERT. TRANSLATION

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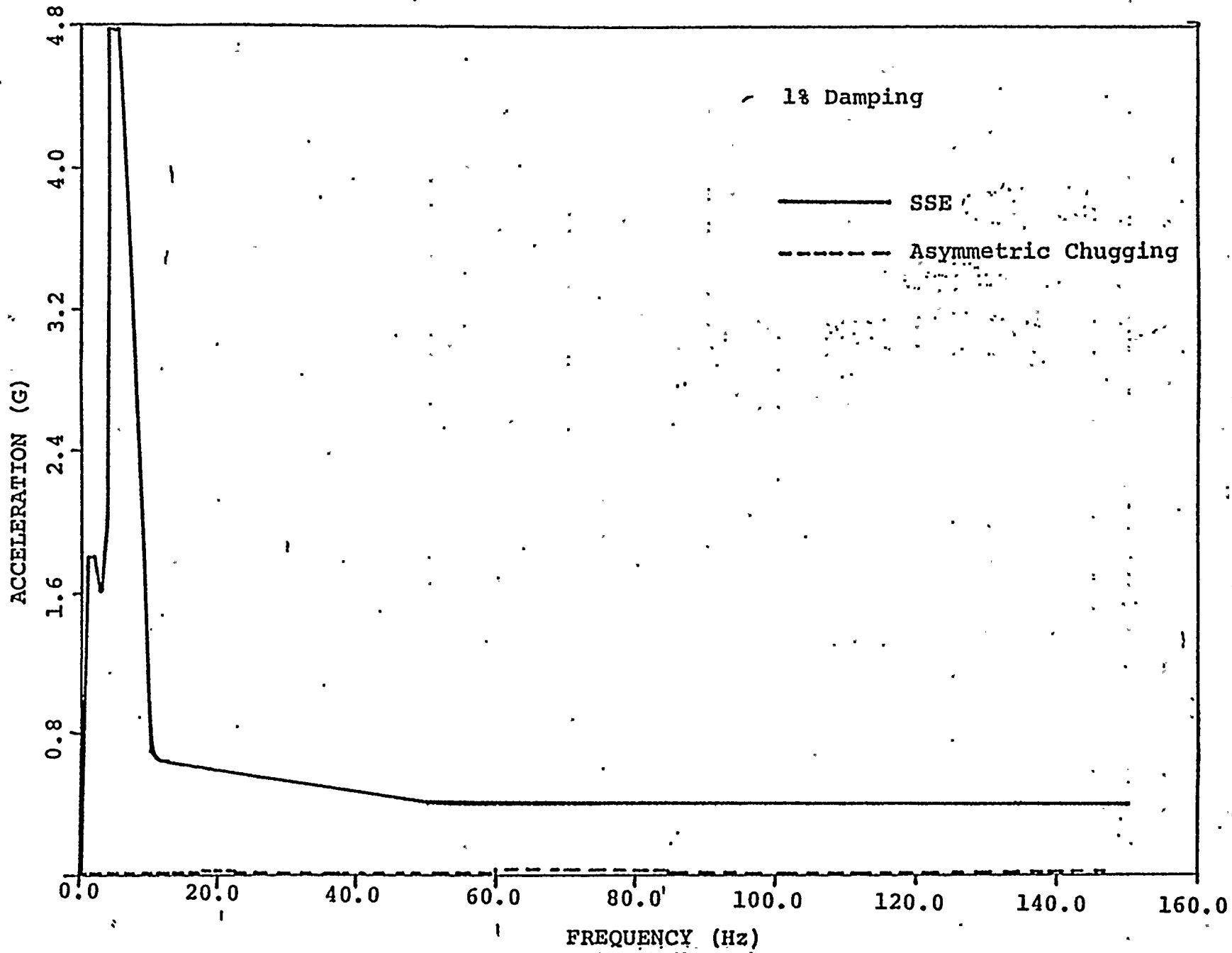


FIGURE 28: WNP-2 REACTOR BUILDING - SSE AND ASYMMETRIC CHUGGING LOAD
 MAT AT EXTERIOR WALL (MASS NO. 230)
 HORIZ. TRANSLATION

