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RECIP.NAME RECIPIENT AFFILIATION
SCHWENCER,A. Licensing Branch 2

SUBJECT: Forwards responses to NRC telcon questions re B&R technical rept, "Effect of Hydrodynamic Loads on Safety-Related Equipment & Piping Outside Containment," transmitted by 830328 ltr.

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Washington Public Power Supply System
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June 16, 1983
G02-83-530

Docket No. 50-397

Director of Nuclear Reactor Regulation
Attention: 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 2
HYDRODYNAMIC LOADS OUTSIDE CONTAINMENT

Reference : Supply System letter to NRC, No. G02-83-260, dated March 28, 1983

Attached is a summary of responses to questions raised by the NRC during a telephone conversation concerning the report on Hydrodynamic Loads Outside Containment, transmitted by the reference. Please advise us if additional information is necessary to complete your review of this item.

Very truly yours,

GD Bouchey

G. D. Bouchey
Manager, Nuclear Safety and Regulatory Programs

EAF/fl

Enclosure

cc: Mr. R. Auluck - NRC
Mr. W. S. Chin - BPA
Mr. A. Toth - NRC Site

B001
1/1

ATTACHMENT

HYDRODYNAMIC LOADS OUTSIDE CONTAINMENT
(Reference: Supply System Letter to NRC, No. G02-83-260, dated March 28, 1983, with attached Report)

NRC Question:

Explain why response spectrum comparisons (Figures 1 through 6) were not made at the same damping values.

Response:

The purpose of the response spectra comparisons submitted with the Reference was to compare the original design basis for piping and equipment outside containment with what the current design basis would be if such piping and equipment were reanalyzed.

The damping values indicated in Figures 1 through 6 for the original design were used for analysis of piping and major equipment. The damping values indicated in Figures 1 through 6 for load combinations which include SRV or chugging are in accordance with Regulatory Guide 1.61 for equipment and piping larger than 12 inches in diameter. These combined response spectra reflect building responses to seismic loads developed on the basis of the ground design response spectra of Regulatory Guide 1.60. These comparisons, at the three locations indicated in the Reference Report, are representative for piping and equipment outside containment.

NRC Question:

Explain why the response spectra comparisons (Figures 1 through 6) do not show responses beyond 30 to 40 Hz.

Response:

The frequency range of the acceleration response spectra in Figures 1 through 6 of the Report has been selected to show all pertinent acceleration values. Consequently, the spectral curves have been terminated at the upper end of the frequency range at a frequency beyond which no substantive increase in acceleration magnitude occurs; this frequency is generally between 30 and 40 Hz.

The following characteristics of the constituent response spectra are pertinent:

(1) The original seismic spectra are monotonically decreasing beyond 10 Hz.

(2) The new seismic spectra have no increase greater than .02 g for frequencies beyond 30 Hz.

(3) The SRV spectra are monotonically decreasing beyond 30 Hz.

(4) The chugging spectra have no increase greater than .02 g for frequencies beyond 30 Hz.

As noted in the Report, the new acceleration response spectra are obtained as the square root of the sum of the squares of the constituent spectra. In view of the characteristics of the constituent spectra stated above, no substantive increase in spectral magnitude results at frequencies beyond the upper ends of the figures. Thus, the magnitude in each figure at the highest frequency shown is representative for frequencies beyond the range of the figure.

NRC Question:

Describe the basis for design assessment of safety-related equipment and piping, for hydrodynamic loads, inside and outside containment.

Response:

Reports on the detailed assessment of the equipment and piping inside containment (up to the first anchor outside primary containment) are being finalized. Assessment of such material inside the wetwell is described in the Plant Design Assessment Report, Revision 3. The assessment of the equipment and piping inside the drywell is reported in the Final Safety Analysis Report, Section 3.9.

For equipment and piping outside containment beyond the first anchor, the Reference Report demonstrated that the acceleration response spectra for the original seismic loads effectively equal or exceed the acceleration response spectra due to comparable combinations of new seismic and hydrodynamic loads. Thus the loadings for the design of the equipment and piping was at all frequencies of interest equal to or greater than the comparable loadings due to combinations of new seismic and hydrodynamic loads. Consequently, the use of the original seismic loads as the basis for the design assessment of safety-related equipment and piping outside containment is justified.

Burns and Roe, Inc.
185 Crossways Park Drive ■ Woodbury, New York 11797 ■ Telephone (516) 677-4000
TWX 510-221-2195 ■ Cable BURNS ROE WDBY

Main Office
550 Kinderkamack Road
Oradell, New Jersey 07649
(201) 265-2000

Subject: Work Order 3900/4000
Washington Public Power Supply System
WNP-2
B&R Technical Report entitled "Effect of Hydrodynamic Loads on Safety Related Equipment and Piping Outside Containment"

May 10, 1983
BRWP-83-087

Mr. L. T. Harrold, Assistant Director
Washington Public Power Supply System
3000 George Washington Way
Richland, Washington 99352

Attention: Mr. B. A. Holmberg

Gentlemen:

Reference is made to the telephone conference on the subject report held on April 28, 1983 between representatives of USNRC, WPPSS, and Burns and Roe. The conferees discussed several subjects in the report in response to questions raised by the USNRC representatives. It was decided that additional information would be furnished by letter to provide appropriate clarification. Accordingly, this letter furnishes clarification relative to the following topics:

a. Damping Values
b. Acceleration Response Spectra at Higher Frequencies
c. Design Assessment of Equipment and Piping (Safety Related).

Damping Values

The basis for the damping values for safety related equipment and piping as used in the report in connection with building responses to the original seismic loads and building responses to the new seismic and hydrodynamic loads is described herein; the terms "original" and "new" are used as defined in the report.

FOR INFO ONLY

Damping criteria for the original seismic loads are defined in the FSAR and in the contract specifications. The damping criteria for the new seismic loads are given in Regulatory Guide 1.61. It is noted that the building responses to the new seismic loads have been developed on the basis of the design response spectra of Regulatory Guide 1.60 and combination of three orthogonal effects as in Regulatory Guide 1.92. The damping criteria of Regulatory Guide 1.61 are extended herein to include other dynamic events occurring in the same load combination with the seismic event.

Table 1 below lists these damping values in percent of critical damping.

TABLE 1 - DAMPING VALUES

	ORIGINAL (OBE)		NEW (OBE+SRV)	ORIGINAL (SSE)		NEW (SSE+SRV+CHUGGING)
	FSAR	SPEC.	REG.GUIDE 1.61	FSAR	SPEC.	REG.GUIDE 1.61
EQUIPMENT						
MAJOR (PREPURCHASED)	1.0	0.5	2.0	2.0	1.0	3.0
OTHER (AUXILIARY)	1.0	1.0	2.0	2.0	2.0	3.0
PIPING						
LARGER THAN 12"ϕ	0.5	0.5	2.0	1.0	1.0	3.0
12"ϕ OR LESS	0.5	0.5	1.0	1.0	1.0	2.0

Response spectra have been developed on the basis of the above damping values. The report includes, as typical, the results which are applicable to the major (prepurchased) equipment and to piping larger than 12 inches in diameter. The damping values used with the original loads are those specified for design; thus, 0.5 percent and 1.0 percent damping are associated with OBE and SSE, respectively. For the new loads, the damping values in the current Regulatory Guide 1.61 are used and the corresponding damping values are 2.0 and 3.0 percent. Comparison is then made between the original and the new acceleration response spectra using the preceding damping values with findings as stated in the report.

Response spectra have also been developed for the other components in the table with damping values as listed. As above the damping values for the original spectra are those actually specified for the equipment and piping and the damping values for the new spectra are those provided by Regulatory Guide 1.61. Thus, in association with the other, auxiliary equipment, the damping values for the original OBE and SSE spectra are 1.0 and 2.0 percent and the damping values with the new comparable spectra are 2.0 and 3.0 percent. Similarly, in association with piping 12 inches or less in diameter, the damping values for the original OBE and SSE spectra are 0.5 and 1.0 percent and the damping values with the new comparable spectra are 1.0 and 2.0 percent. The response spectra associated with other, auxiliary equipment are shown in Figures 9-14 and those associated with piping 12 inches and less in diameter are shown in Figures 15-20. Figures 9-20 are included herewith.

Comparison is made between the original and the new response spectra developed for other auxiliary equipment and between the original and the new response spectra developed for piping 12 inches or less in diameter. In both cases, it is seen that the findings stated in Section 2 of the Report (Comparison of In-Structure Acceleration Response Spectra) are applicable.

In summary, for all safety related equipment and piping outside containment, the original acceleration response spectra equal or exceed the new comparable spectra except for the vertical direction in a relatively narrow range of frequencies.

Acceleration Response Spectra at Higher Frequencies

The frequency range of the acceleration response spectra in Figures 1-6 of the Report has been selected to show all pertinent acceleration values. Consequently, the spectral curves have been terminated at the upper end of the frequency range at a frequency beyond which no substantive increase in acceleration magnitude occurs; this frequency is generally between 30 and 40 Hz.

The following characteristics of the constituent response spectra are pertinent.

(1) The original seismic spectra are monotonically decreasing beyond 10 Hz.

(2) The new seismic spectra have no increase greater than .02 g for frequencies beyond 30 Hz.

(3) The SRV spectra are monotonically decreasing beyond 30 Hz.

(4) The chugging spectra have no increase greater than .02 g for frequencies beyond 30 Hz.

As noted in the Report, the new acceleration response spectra are obtained as the square root of the sum of the squares of the constituent spectra. In view of the characteristics of the constituent spectra stated above, no substantive increase in spectral magnitude results at frequencies beyond the upper ends of the figures. Thus, the magnitude in each figure at the highest frequency shown is representative for frequencies beyond the range of the figure.

Design Assessment of Equipment and Piping, Safety Related

The design of all safety related equipment and piping has been or is now being assessed for adequacy to sustain the new hydrodynamic loads in addition to seismic and other loads in applicable load combinations. It is noted that the new hydrodynamic load definitions have been reviewed and accepted by USNRC. Report on the assessment is made in different documents depending on the location of the equipment and piping.

Reports on the detailed assessment of the equipment and piping inside containment (up to the first anchor outside primary containment) are being finalized. Assessment of such material inside the wetwell is described in the Plant Design Assessment Report, Revision 3. The assessment of the equipment and piping inside the drywell is reported on in the Final Safety Analysis Report, Section 3.9.

For equipment and piping outside containment, the subject report and this letter have demonstrated that the acceleration response spectra for the original seismic loads effectively equal or exceed the acceleration response spectra due to comparable combinations of new seismic and hydrodynamic loads. Thus the loadings used for the design of the equipment and piping are effectively more severe or equally severe as the comparable loadings due to combinations of new seismic and hydrodynamic loads. Consequently, it is not necessary to assess this equipment and piping as to capacity under the latter set of loads.

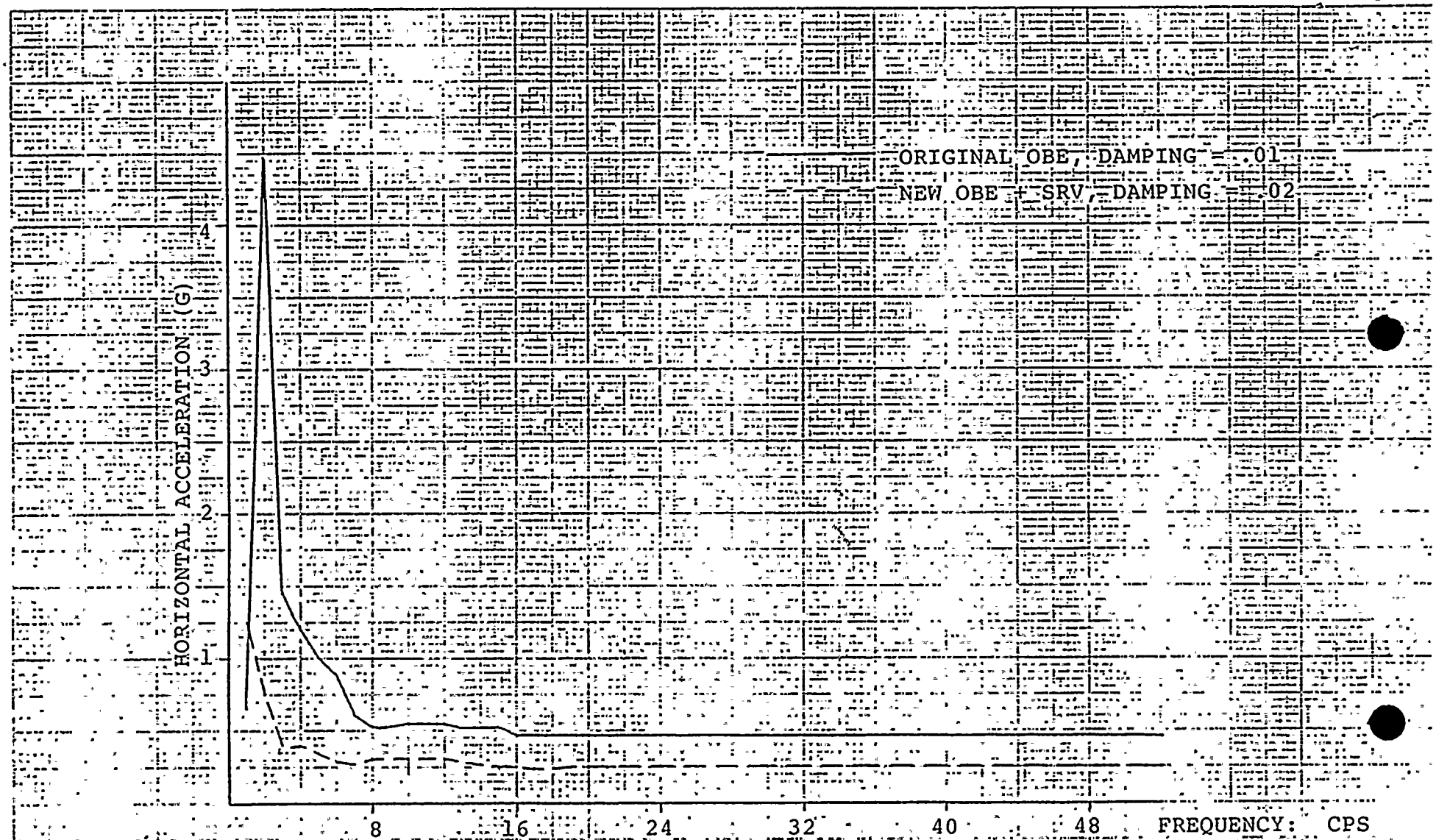
I trust the foregoing furnishes the necessary clarification. Please contact us if there are any questions on this matter.

Very truly yours,

John J. Verderber
Project Engineering Manager

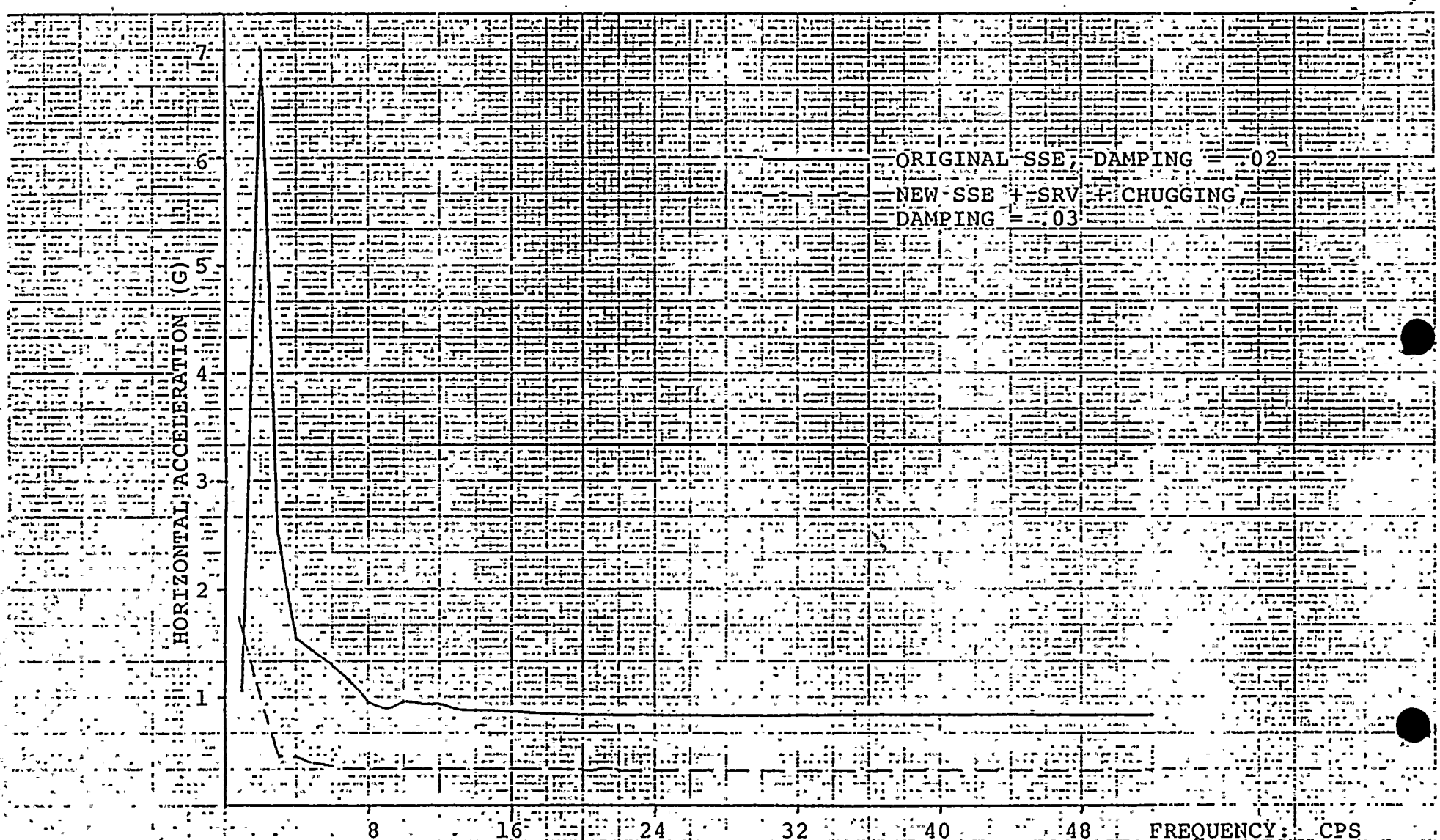
JJV/MF/ws
Enclosures

cc: Mr. W. S. Chin - BPA - 1 w/1
Mr. E. Fredenburg - WPPSS - 1 w/1



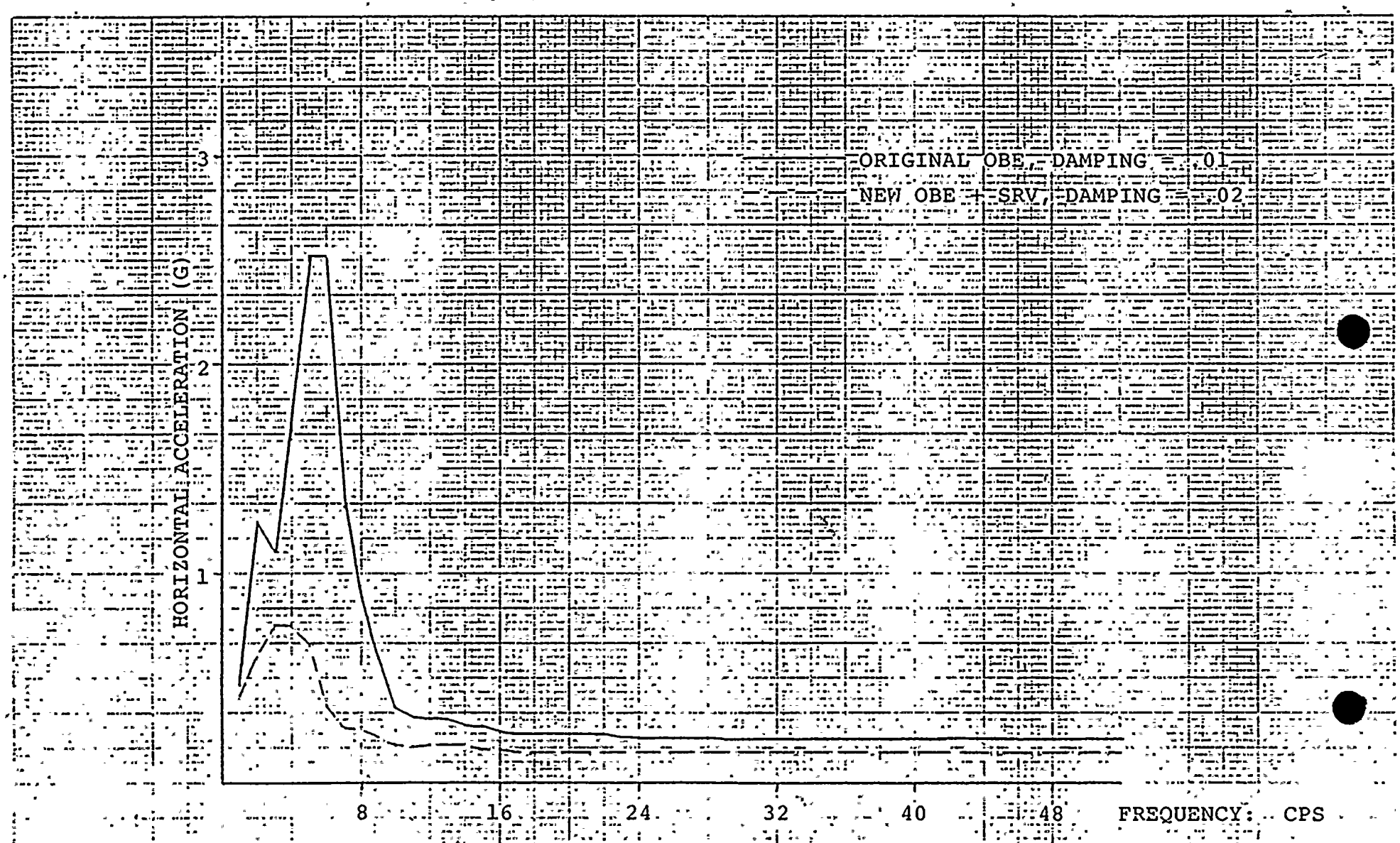
HORIZONTAL ACCELERATION vs. FREQUENCY - EL. 567'
RESPONSE SPECTRA OUTSIDE CONTAINMENT - OTHER (AUXILIARY) EQUIPMENT
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 9



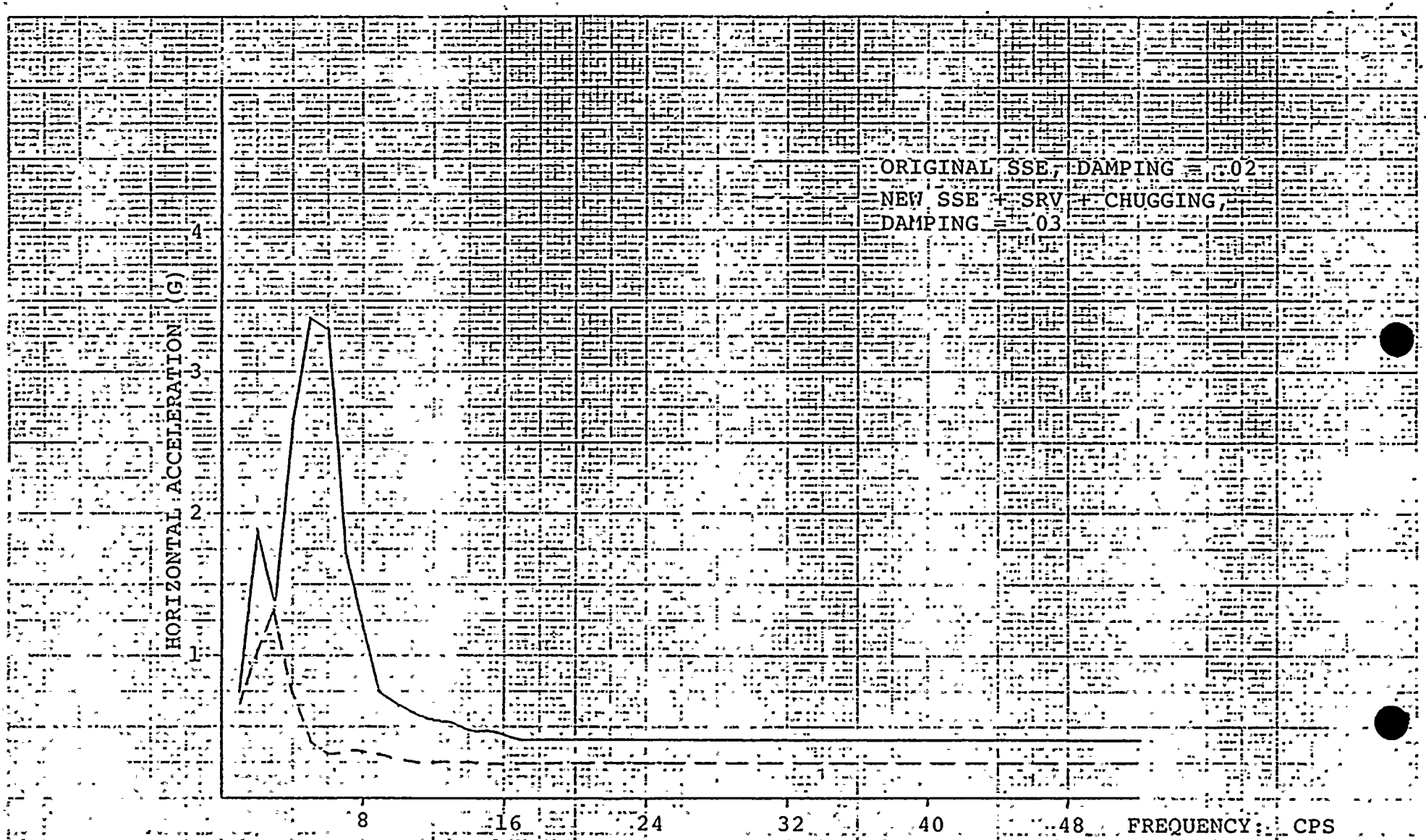
HORIZONTAL ACCELERATION vs. FREQUENCY - EL 567'
RESPONSE SPECTRA OUTSIDE CONTAINMENT - OTHER (AUXILIARY) EQUIPMENT
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 10



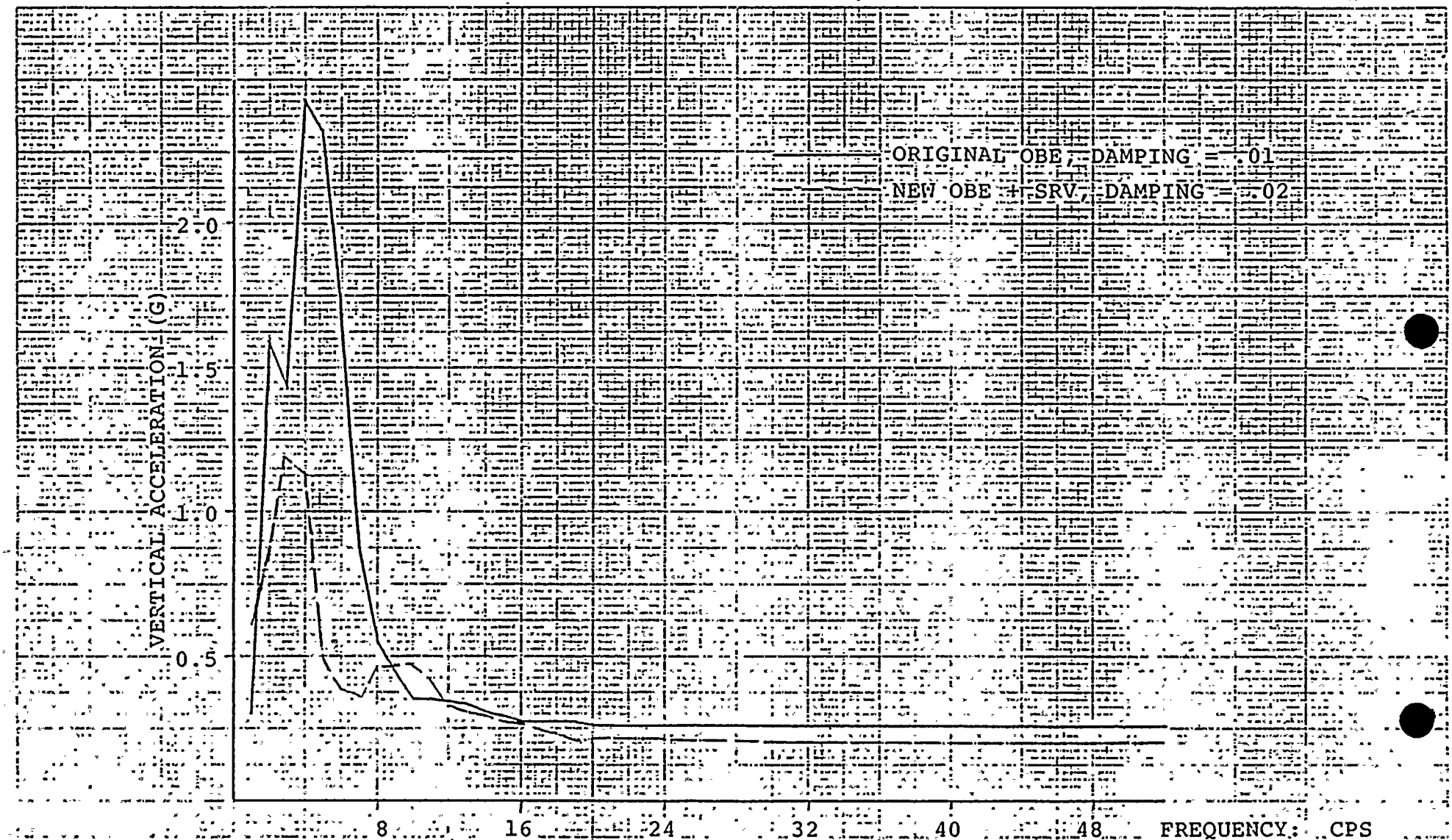
HORIZONTAL ACCELERATION vs. FREQUENCY - EL. 435'
RESPONSE SPECTRA OUTSIDE CONTAINMENT - OTHER (AUXILIARY) EQUIPMENT
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 11



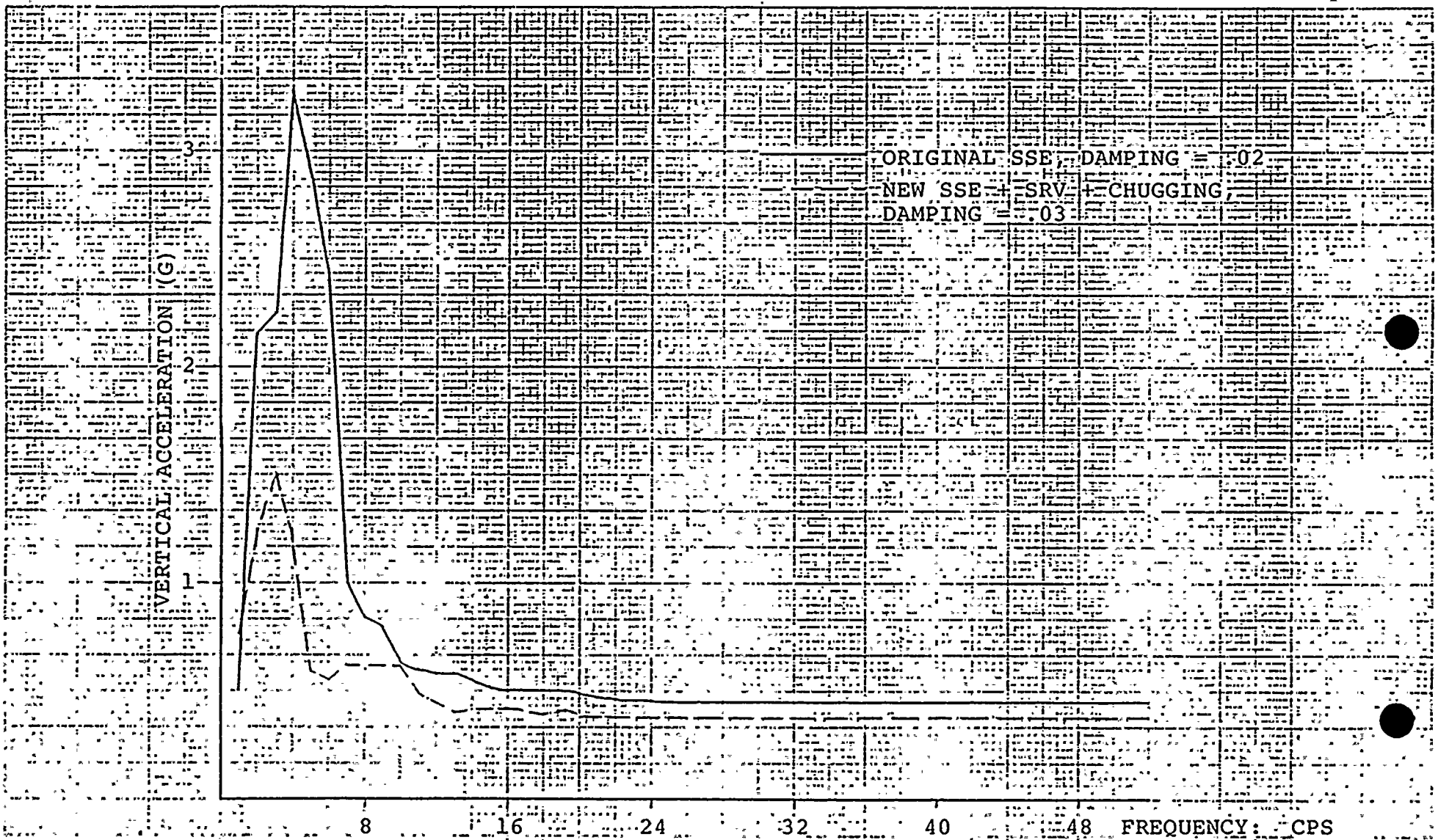
HORIZONTAL ACCELERATION vs. FREQUENCY - EL. 435'
RESPONSE SPECTRA - OUTSIDE CONTAINMENT - OTHER (AUXILIARY) EQUIPMENT
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 12



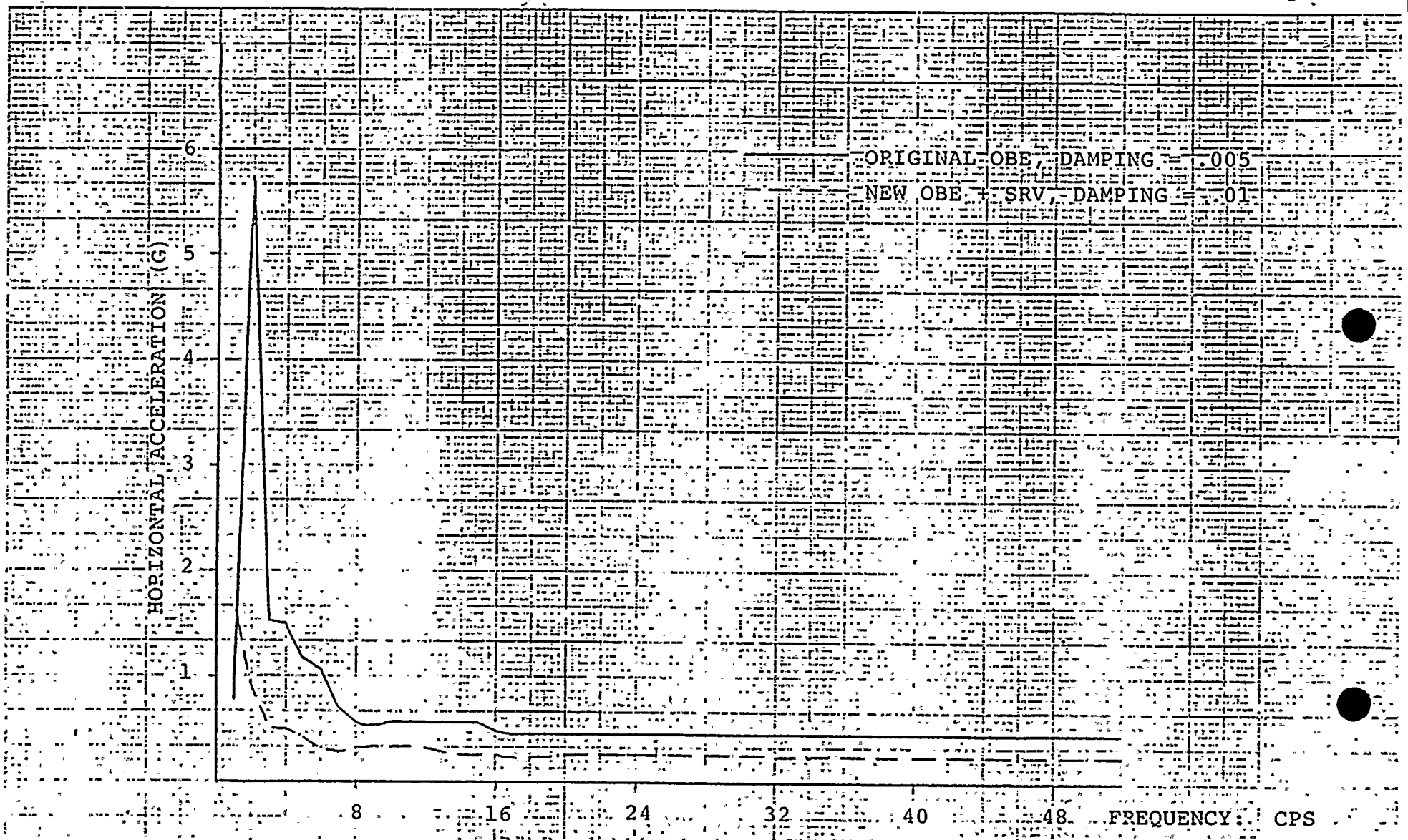
VERTICAL ACCELERATION vs. FREQUENCY - EL. 470'
RESPONSE SPECTRA OUTSIDE CONTAINMENT - OTHER (AUXILIARY) EQUIPMENT
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 13



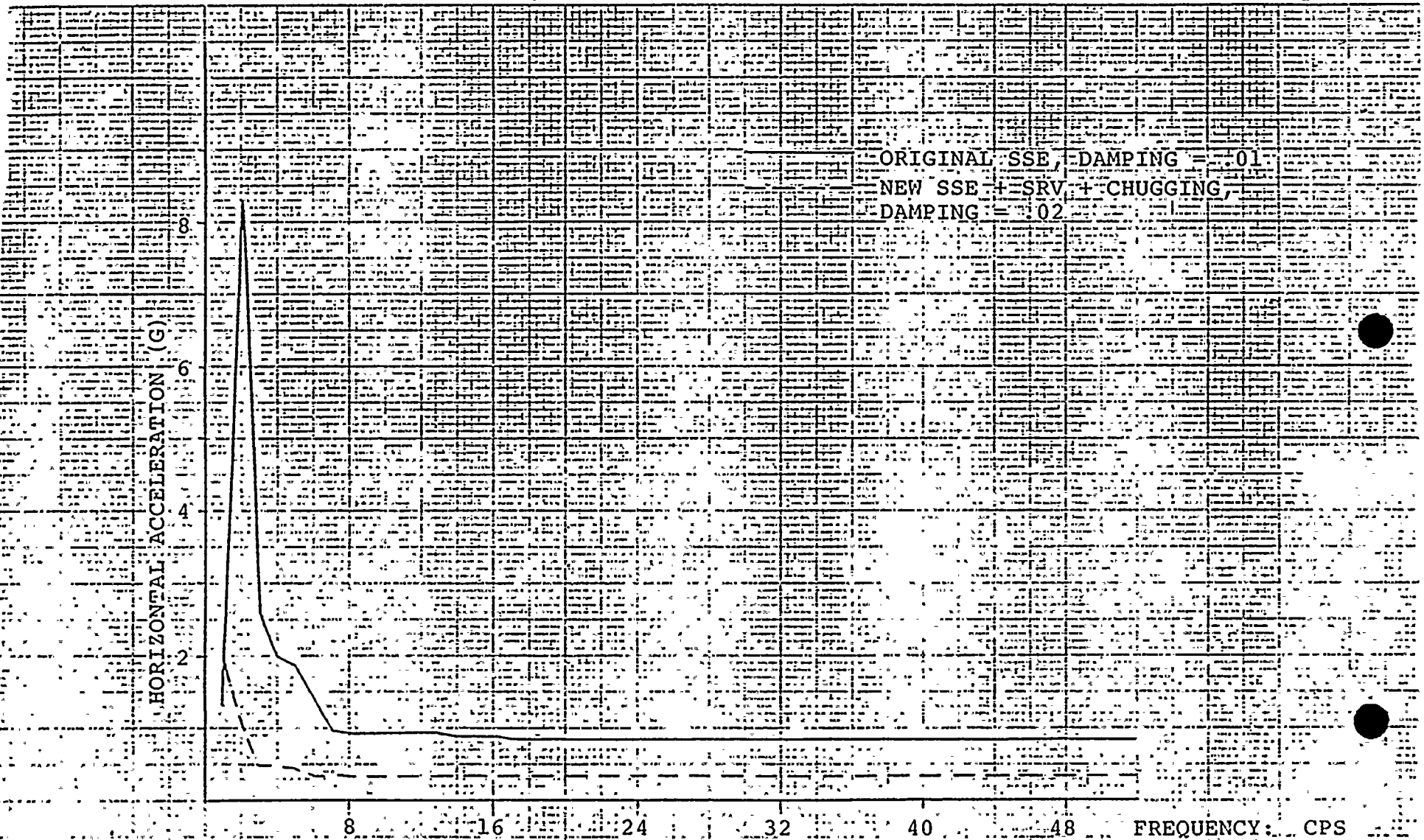
VERTICAL ACCELERATION vs. FREQUENCY - EL. 470'
RESPONSE SPECTRA OUTSIDE CONTAINMENT - OTHER (AUXILIARY) EQUIPMENT
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 14



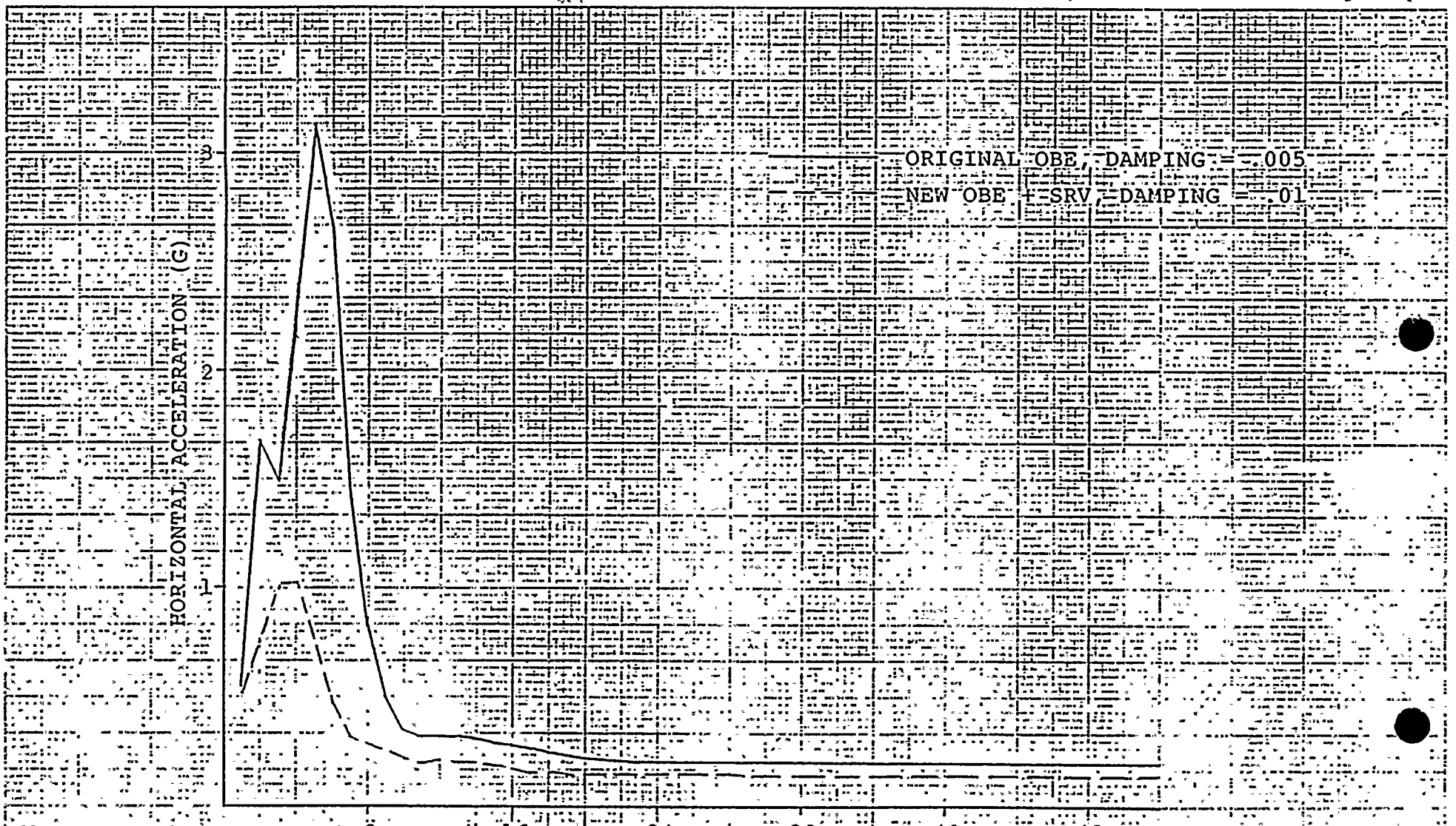
HORIZONTAL ACCELERATION vs. FREQUENCY - EL. 567'
RESPONSE SPECTRA OUTSIDE CONTAINMENT - PIPING, 12" AND SMALLER
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 15



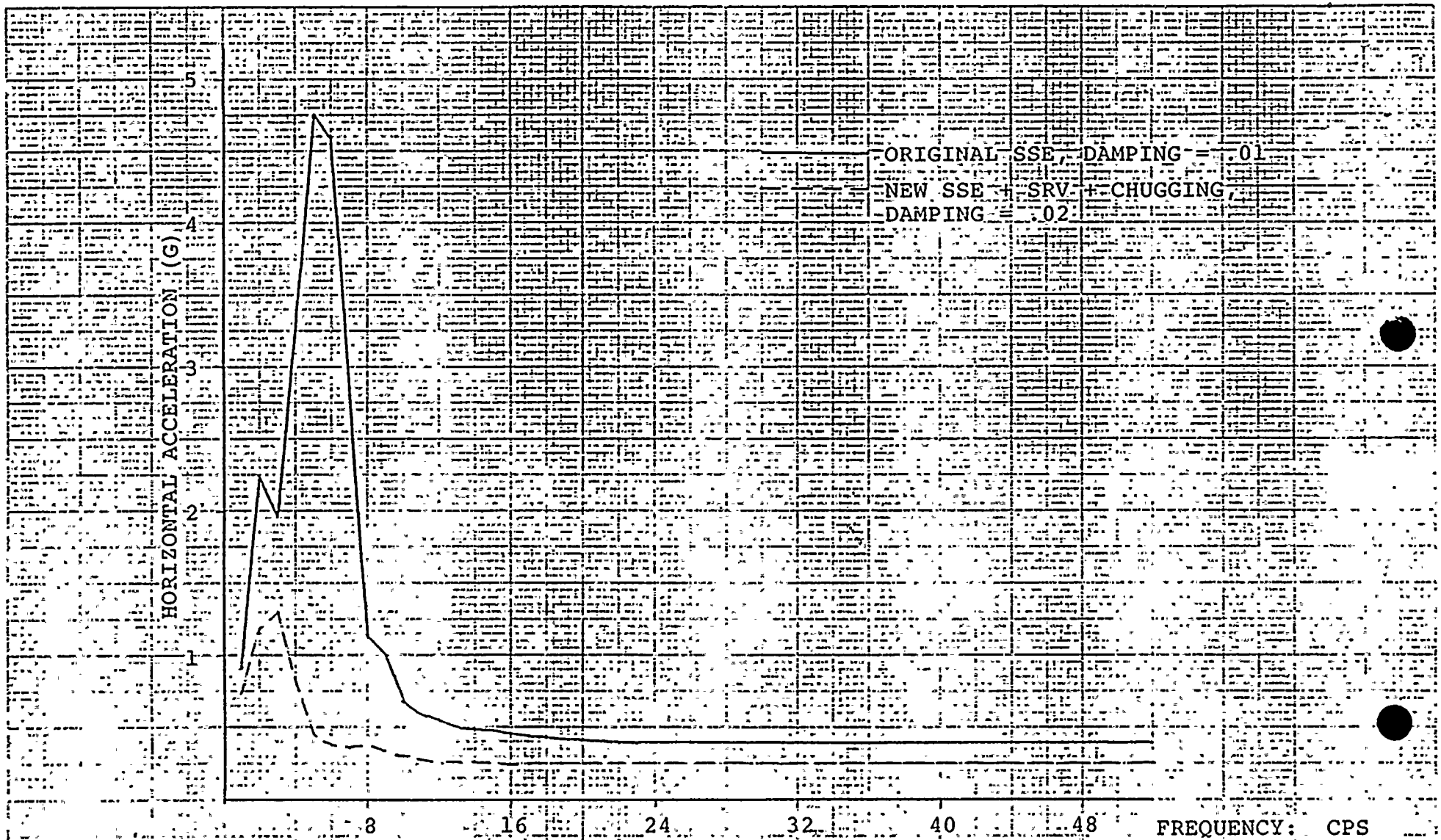
HORIZONTAL ACCELERATION vs. FREQUENCY - EL. 567'
RESPONSE SPECTRA OUTSIDE CONTAINMENT - PIPING, 12" AND SMALLER
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 16



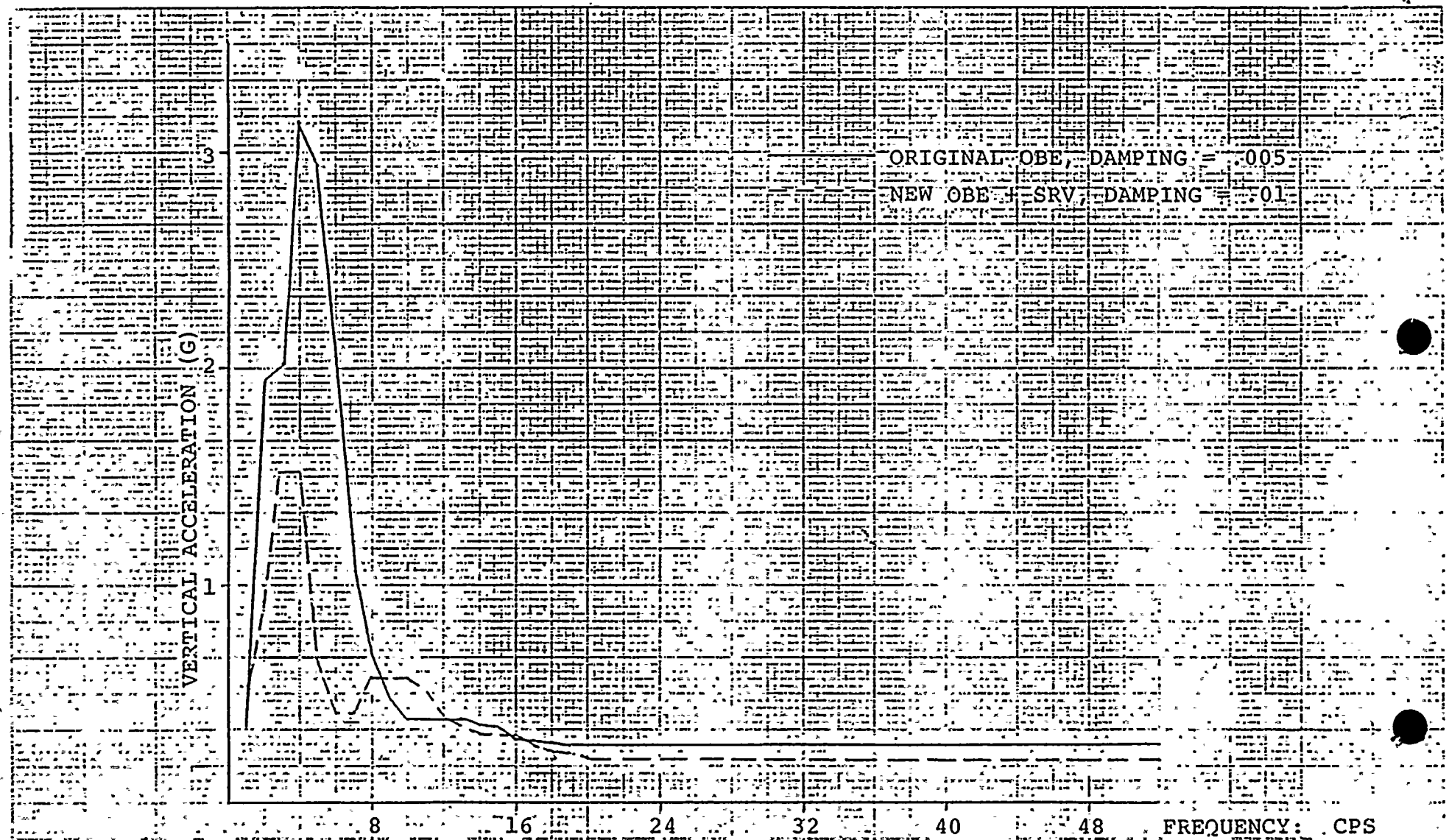
HORIZONTAL ACCELERATION vs. FREQUENCY - EL. 435'
RESPONSE SPECTRA OUTSIDE CONTAINMENT - PIPING, 12" AND SMALLER
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 17



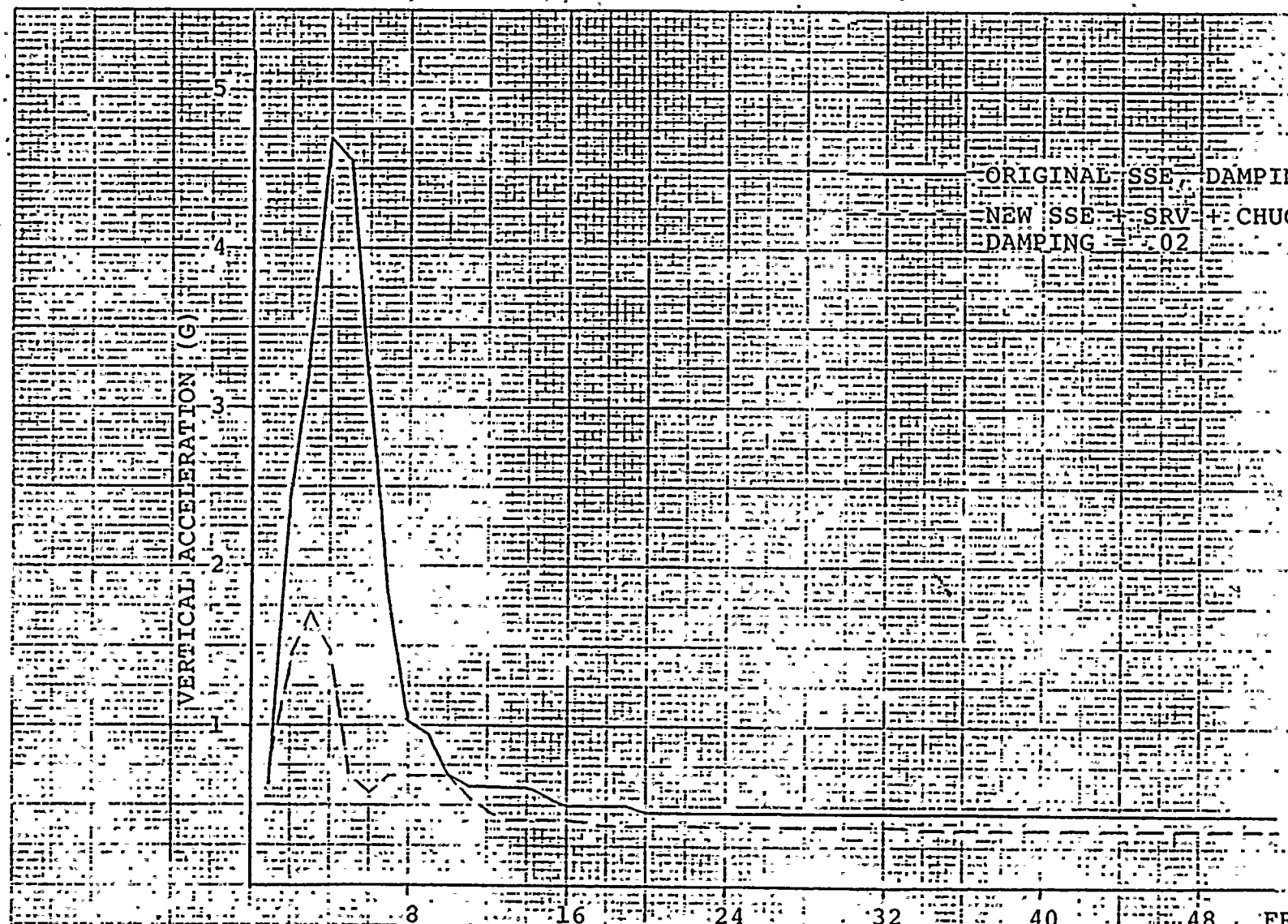
HORIZONTAL ACCELERATION vs. FREQUENCY - EL. 435'
RESPONSE SPECTRA OUTSIDE CONTAINMENT - PIPING, 12" AND SMALLER
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 18



VERTICAL ACCELERATION vs. FREQUENCY - EL. 470'
RESPONSE SPECTRA OUTSIDE CONTAINMENT - PIPING, 12" AND SMALLER
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 19



VERTICAL ACCELERATION vs. FREQUENCY--EL. 470'
RESPONSE SPECTRA OUTSIDE CONTAINMENT - PIPING, 12" AND SMALLER
WPPSS - NUCLEAR PROJECT NO. 2 - REACTOR BUILDING

FIGURE 20