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ENCLOSURE 3

SPECTRA GENERATION

SOIL VARIATION ANALYSES AND GENERATION OF IN-STRUCTURE RESPONSE SPECTRA FOR FORT CALHOUN UNIT 1

Prepared for the

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Prepared by

Omaha Public Power District

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EXECUTIVE SUMMARY

This report describes the soil-structure interaction (SSI) soil variation analyses performed for the Class I structures (Auxiliary Building/ Internal Structure/ Containment Structure and Intake Structure) at Omaha Public Power District's (OPPD) Fort Calhoun Station, Unit 1. The objective of these analyses was to incorporate effects due to uncertainties in soil properties into the in-structure response spectra developed for the plant. The analyses in this report complement those performed previously - and reviewed by the NRC Staff- using best estimate soil properties.

The soil variation analyses were performed considering a ± 30% variation in soil shear moduli from the Best Estimate (BE) case. This variation factor is based on Fort Calhoun-specific soil data reported in the plant's Updated Safety Analysis Report (USAR). Soil-Structure Interaction (SSI) analyses were performed using Upper Bound (UB, +30% variation factor) and Lower Bound (LB, -30% variation factor) soil properties.

The SSI soil variation analyses were performed using the same soil-structure models and analysis procedures previously used for the BE analyses, modified as appropriate to incorporate the new soil properties. The analysis methodology consists of frequency domain analyses in which the site-pile foundation system is modeled by a series of frequency-dependent impedance functions representing the stiffness and damping characteristics of the Fort Calhoun site.

Analyses results were generated in the form of acceleration time histories and then converted to acceleration response spectra generated at locations and damping values consistent with those reported previously for the BE analyses. The final broadened response spectra to be used for design and analysis are given by the envelop of the UB and LB response spectra and the ±15% broadened BE spectra.

The SSI analyses were performed for the Safe Shutdown Earthquake (SSE). The Operating Basis Earthquake (OBE) responses were obtained by applying suitable scaling factors to the SSE response envelopes. The in-structure response spectra plots are contained in Appendices A through D. Parametric studies, performed to support licensing of the response spectra, are described in Appendices E and F.

1.0 INTRODUCTION

This report describes the soil-structure interaction (SSI) soil variation analyses performed for the Class I structures (Auxiliary Building/ Internal Structure/ Containment Structure and Intake Structure) at Fort Calhoun Station, Unit 1. The objective of these analyses was to incorporate effects due to uncertainties in soil properties into the in-structure response spectra developed for the plant as part of the Alternate Seismic Criteria (ASC) for Fort Calhoun. The analyses reported in this report complement those performed previously using best estimate soil properties and documented in Reference 1.

The soil variation analyses were performed using a ± 30% variation in soil shear moduli from the Best Estimate (BE) case. The ± 30% variation factor is based on Fort Calhoun-specific soil data, as described in Section 2.4 this report. Throughout this report, the +30% variation analysis case is called the Upper Bound (UB) case and the -30% variation analysis is called the Lower Bound (LB) case.

The free-field control motions used as input to the SSI evaluations consist of a set of three time history components, one for each of the three mutually orthogonal earthquake directions. This set of time histories is the same set that had been used in the previous SSI evaluations for the best estimate case (Reference 1). The response spectra of each of the three time histories envelop the Fort Calhoun Design Basis ground motion response spectra.

The UB and LB SSI soil variation analyses were performed using the same SASSI/CLASSI soil-structure models previously used for the BE analyses, modified as appropriate to incorporate the new soil properties. The SSI models are described in detail in Reference 1. SSI analyses parameters used in the soil variation analyses are described in Section 2.0. The analysis methodology consists of frequency domain analyses performed using a substructuring technique. In this approach, the site-pile foundation system is modeled by a series of frequency-dependent impedance functions representing the stiffness and damping characteristics of the Fort Calhoun foundation system. These impedance functions are subsequently combined with the dynamic properties of the Fort Calhoun structures to produce earthquake response time histories. A detailed discussion of the analysis methodology is described in Section 3.0 of this report.

The SSI analyses generated acceleration time histories that were converted to acceleration response spectra at various locations throughout the Auxiliary/Containment/Internal Structure and Intake Structure models. Response spectra were generated at the base of each of these structures and at major floor elevations. These locations are consistent with the locations reported previously in Reference 1. Response spectra were generated at four damping values (2, 3, 5, and 7 % damping ratios for the SSE and 1, 2, 4,

and 5% damping ratios for OBE). A discussion of the results of the analyses is provided in Section 4.0 of this report. A summary is given in Section 5.0. The final enveloped and broadened in-structure response spectra plots are contained in Appendices A through D. Parametric studies, performed to support licensing of the response spectra, are described in Appendices E and F.

2.0 SOIL-STRUCTURE INTERACTION ANALYSES PARAMETERS

2.1 Control Motion Response Spectra

The control motion used in the SSI soil variation analyses is defined by the Fort Calhoun design basis ground response spectra shown in Figure 2.1. The design basis ground response spectra are of the modified Housner shape anchored to 0.17g (horizontal direction) peak ground acceleration for the Maximum Hypothetical Earthquake (MCE), also called Safe Shutdown Earthquake (SSE), and 0.08g (horizontal direction) peak ground acceleration for the Design Earthquake (DE), also called Operating Basis Earthquake (OBE). The vertical direction peak ground acceleration is 2/3 of the horizontal direction.

2.2 Control Motion Time Histories

The control motion time histories consist of a set of three mutually orthogonal and statistically independent components - two horizontal and one vertical. These acceleration time histories constitute the free-field input ground motions used for the SSI analyses. The acceleration time histories have 20 seconds duration and were developed in accordance with Reference 4. To ensure that there is no deficiency in power over any frequency range, Power Spectral Density (PSD) functions were developed, as documented in Reference 2. The time histories, associated response spectra and PSD's have been previously reviewed by the NRC staff, as documented in Reference 3. Figures 2.2 through 2.10 show the response spectrum of these time histories, compared with the design basis Housner spectrum, for 2, 5, and 7% damping, for the horizontal and vertical directions.

2.3 Development of Soil Properties for the SSI Soil Variation Analyses

The Fort Calhoun site consist of approximately 60 feet of silty sands and fine sands overlying limestone bedrock. The site can be characterized as a relatively shallow site. Original surface elevation ranged from +997 to +1004 feet. Bedrock elevation varied from approximately 931 feet to 935 feet (Reference 5).

For purposes of SSI analysis, each layer in the soil profile is defined by the following parameters: soil shear moduli, material hysteretic damping (expressed as viscous damping ratio), Poisson's ratio and soil mass density. Best estimate values of soil properties characterizing the site were previously developed using Fort Calhoun-specific geotechnical and geophysical data (References 5,7) supplemented with data in Reference 6. The development of these soil parameters for the BE analysis case is described in Reference 1.

Reference 1 has been previously reviewed by the NRC staff (Reference 3).

For the SSI soil variation analyses, the BE low-strain soil parameters described in Reference 1 were appropriately modified to incorporate effects due to uncertainties in the soil shear moduli, as follows:

a. The low-strain UB soil shear moduli for each soil layer were obtained by multiplying the BE shear moduli values by a factor of 1.3. The resulting UB soil column profile was analyzed using the SHAKE computer program to obtain strain-compatible (or high-strain) properties. The modulus reduction (G/Gmax) versus strain relationship previously used in the BE analyses is also used for the UB soil profile. The resulting high-strain soil column profile is compatible with the level of motion specified for Fort Calhoun.

b. A similar approach was followed for development of the LB soil column profile; in this case, the low-strain BE soil shear moduli properties were scaled by a factor of 0.7. Table 2.1 summarizes the strain-compatible soil properties obtained from the SHAKE analyses and used for the BE, UB, and LB SSI analyses.

c. Strain-compatible damping ratios were also obtained for each soil layer. The same damping ratio versus strain relationship previously used for the BE analysis was used for the UB and LB SHAKE analyses. The damping ratios for all three cases are also shown in Table 2.1. As can be seen, the damping ratios for the UB are lower than the BE and for the LB are higher than the BE. This is because the strains within the soil profile are different for each of the three cases. Conservatively, in the SASSI analyses, the BE damping ratios are also used for the LB SASSI analyses.

d. The UB and LB profiles obtained as discussed above were used together with the pile foundation system configuration to develop site-specific impedance function, for use in the SSI evaluations, as described in Section 3.0.

2.4 Development of Soil Properties Uncertainty Factor

As discussed in Section 2.3, an uncertainty factor of ±30% of the best-estimate low-strain shear modulus values has been applied to the Fort Calhoun soil variation analyses. This factor has been derived on the basis of available site-specific geotechnical information collected as part of the site investigations performed during plant design and construction. Reference 5, Appendix C, reports that a total of 95 borings were drilled at the site. Of these, 19 borings drilled underneath the major structures contain detailed Standard

Penetration Tests (SPT) data. In each boring, SPT tests were performed at depth intervals of 5 feet, from the ground surface to bedrock elevation (thirteen tests per boring on the average). Based on existing relationships correlating SPT blow count data with low-strain shear modulus (Reference 6), a statistical evaluation of the SPT blow count data was performed and a coefficient of variation of 0.2 was obtained for the soil shear moduli at Fort Calhoun. This is consistent with the results of geophysical tests performed at the site (Reference 7) which support a variation in shear modulus of ±15% to 20%.

In addition, the variability in soil properties at the Fort Calhoun site has been substantially reduced as a result of the extensive treatment of the soils at the site at the time of pile installation. This is documented in the plant's USAR, Section 5.7 and Appendices C and D (Reference 5). Reference 5, Section 5.7, reports that a statistical analysis (performed after pile installation and densification of the site) of 696 SPT results indicated that the average relative density for the entire area is not less than 85% at an overall confidence level of 96.5%.

Based on the discussion above, an uncertainty band of ±30% of the best estimate shear modulus is considered to conservatively bound the potential variation in soil properties at the Fort Calhoun site.

2.5 Structural Models

The structural models used for the SSI soil variation analyses were the same models developed for the previous SSI evaluations for the BE case. The development of the structural models is described in detail in Reference 1 and associated calculations (References 13 and 14). The structural models have been previously reviewed by the NRC Staff (References 2, 3). For purposes of completeness of this report, a brief description of the models is provided next.

Auxiliary Building/Containment Building/Internal Structure Model

The Auxiliary Building/Containment Building and Internal Structure are founded on a common basemat which is supported on 803 steel piles driven to bedrock. The Auxiliary Building includes the control room, spent fuel storage pool, safety injection and refueling water storage tank, and emergency diesel generator rooms. The Containment Building includes the Containment Shield and the Internal concrete structures. Other than sharing a common basemat, these three structures are structurally separate from each other. For this reason, separate "stick" models are developed for each, connected only at the basemat level.

The Auxiliary Building, Containment Shield and Internal Structure model is a three-dimensional stick model consisting of elastic beam elements with lumped masses at major floor elevations. Each beam element represents the stiffness of a section of the structure between two floors and is located at the center of rigidity of that section. The stiffness properties of each beam element are given by the section's axial (Az) and shear areas (Ax, Ay), moments of inertia about the horizontal axes (Ixx, Iyy) and torsional constant about the vertical axis (Jzz). The mass of each floor consists of: the mass of the concrete floor slab itself, heavy equipment, storage tanks and contained liquid, steel platforms, and one-half of the concrete walls above and below the particular floor. In addition, to account for other light equipment, piping, and miscellaneous structural steel, a distributed weight of 20 psf is uniformly distributed over the area of each floor. The calculated total mass is lumped at the center of mass of the particular floor elevation. Rigid links connect the centers of mass with the centers of rigidity at each floor elevation. Thus, the model captures torsional effects due to eccentricities that exist between the center of mass and center of rigidity. The development of the Auxiliary Building/Containment/Internal Structure is documented in References 1 and 13. Figure 2.11 shows a sketch of the mathematical model. Tables 2.2 and 2.3 tabulate the stiffness and mass properties of the Auxiliary Building/ Containment/ Internal Structure model. Consistent with previous BE case evaluations for the SSE, structural damping of 7% of critical was used in the UB and LB SSI analyses.

Fixed-base frequencies for the first ten modes (without SSI effects), corresponding mass participation factors and modes description are shown in Table 2.4. Forty modes were used in the actual SSI analyses, with cumulative mass participation of over 90% in each direction.

Intake Structure Model

The Intake Structure is located east of the Auxiliary and Containment Building alongside the Missouri River. The lower part of the structure is of concrete shear wall construction and the upper part is of steel frame construction. The foundation mat is supported on 64 piles driven to bedrock. The development of the Intake Structure stick model followed similar procedures as the Auxiliary Building/ Containment/Internal Structure model. The development of the Intake Structure model is documented in References 1 and 14. A sketch of the stick model is shown in Figure 2.12. Stiffness and mass properties are summarized in Tables 2.5 and 2.6, respectively. Fixed-base frequencies for the first ten modes (without SSI effects), corresponding mass participation factors and mode description are shown in Table 2.7. Twenty modes were used in the actual SSI

analyses, with cumulative mass participation of over 90% in each direction.

3.0 ANALYSIS METHODOLOGY

The analysis approach used for the SSI soil variation analyses is consistent with the approach previously used for the SSI best estimate analyses and described in Reference 1. The SSI analyses are performed in the frequency domain using a substructuring approach. In the substructuring approach, the SSI problem is broken down into three steps, as follows:

3.1 Step 1: Determination of the Foundation Input Motions

This is also called the scattering problem and consist of the determination of the motions of the foundation alone, without including the effects of the superstructure. For a surface-founded foundation system and for vertically propagating shear and compressional wave field, the foundation input motions are identical to the free-field motions. This is the case for the application to Fort Calhoun, i.e.: the wave field consist of vertically propagating shear and compressional waves and the foundation is assumed to be surface founded, with no deamplification of the motion over the embedment depth due to spatial variation considerations. Thus, the foundation input motions correspond to the free-field motions and are applied at the foundation elevation of the structures, in the free field. This is also in accordance with the recommendations of Revision 1 of the SRP.

3.2 Step 2: Determination of Impedance Functions

These are the complex and frequency-dependent force-displacement relationships of the soil-pile foundation system. Foundation impedance functions were calculated for the UB and the LB cases using the existing BE case SASSI three-dimensional models of the soil-pile foundation system of the Auxiliary/Containment/ Internal Structure and the Intake Structure. These soil-pile foundation models were modified as appropriate to reflect the new UB and LB soil properties. Changes to the BE case SASSI models consisted of incorporating the UB and LB strain-compatible soil properties obtained from the SHAKE analyses, as described in Section 2.3. ABB Impell's version of SASSI (Reference 8), verified for nuclear safety-related work, was used for the impedance functions computation. SASSI is a program developed specifically for SSI applications.

Separate analyses were performed for computation of impedance functions for the UB and LB cases and for each, the Auxiliary Building/Containment/ Internal Structure and the Intake Structure. Thus, there were four separate SASSI models used for impedance computation. The impedance functions are described by 6 x 6 component (horizontal translations, vertical translation, rocking about both horizontal axes and torsion) complex and frequency-

dependent matrices describing the stiffness and damping characteristics of the soil-pile foundation system. The real part of the complex terms of the matrix represent the stiffness of the soil-pile-group foundation system and the imaginary part represents the damping of the system. A 6 x 6 matrix is generated for each impedance frequency.

The SASSI models used for impedance computation incorporate the piles driven to bedrock and capped to the concrete basemat . There are 803 piles for the Auxiliary Building/Containment/Internal Structure foundation and 64 piles for the Intake Structure foundation. For purposes of impedance computation, the foundation basemats are considered to be rigid. This enables the entire pile foundation system to be represented by a 6 x 6 component impedance matrix at each frequency, as previously discussed. The assumption of rigid basemat is appropriate because there are numerous walls that stiffen the basemat in the out-of-plane direction. Also, since some separation between the bottom of the basemat and the soil is possible over time, the basemats are assumed not to be in contact with the soil and, therefore, its contribution to the impedance is conservatively neglected, i.e.: the basemat impedance is not added to the pile impedance.

3.3 Step 3: SSI Response Computation

Solution of the coupled (soil-pile foundation-structure) system of equations of motion using the results from Steps 1 and 2, and the fixed-base dynamic properties of the superstructures produces structural responses. These are in the form of acceleration time histories at specified locations throughout the structural model. The CLASSI program (Reference 9) module SSIN is used in this step to compute time histories of response using a frequency domain analysis approach. A total of 4096 points are used in the Fourier decomposition. The response acceleration time histories are calculated at a time step of 0.01 seconds. The response acceleration time histories are used to obtain floor response spectra at 2, 3, 5, and 7% damping ratios using the program RESPEC (10).

Consistent with the BE analyses, the models of the superstructures include rigid links extending from the centers of mass to the locations farthest away from the centers of mass, locations at which the contributions from rocking and torsion would be the larg . Response spectra generated at these locations are enveloped and these enveloped spectra constitute the response spectra applicable to the entire floor at a particular elevation.

4.0 ANALYSES RESULTS

This section contains the results of the SSI soil variation studies. UB and LB SSI analyses were performed for both, the Auxiliary/Containment/ Internal Structure and the Intake Structure. Results were obtained in the form of absolute acceleration time histories at various locations throughout the models. The acceleration time histories were then used to generate in-structure response spectra. The analyses procedure and results are documented in Reference 11 for the Auxiliary Building/Containment/ Internal Structure and Reference 15 for the Intake Structure. A summary of the results is provided below.

Auxiliary Building/Containment/Internal Structure

Examination of the response spectra obtained from the SSI analyses indicates that the in-structure response spectra are heavily influenced by the dynamic response amplification of the soil column overlying bedrock, with some lesser influence from the pile system. This is true in particular for the horizontal direction. The horizontal resonant frequencies of the combined soil-pile-structure system are about 2.3, 2.7 and 1.9 Hz for the BE, UB and LB, respectively and are dominated by the soil column response frequency. As expected, the in-structure spectra amplifies over the range of frequencies noted above. This is shown in Figure 4.1 which shows a comparison of the 2% damped response spectra of the free-field input ground motion (time history and Housner design basis) and the response spectrum obtained at basemat elevation from the SSI analyses (envelope of BE, UB and LB). The amplification seen for the Fort Calhoun site is consistent with amplification factors found for shallow sites (Reference 12). The pile system has a larger influence in the vertical direction; the combined soil-pile vertical resonant frequencies are 4.3 and 15.3 Hz for the BE case, 4.8 and 17.4 Hz for the UB case and 3.6 and 12.6 Hz for the LB case. Figure 4.2 shows a similar comparison for the vertical direction.

Intake Structure

The Intake Structure response spectra exhibits similar overall response characteristics as the Auxiliary/Containment/Internal Structure. That is, the Intake Structure response spectra is also heavily influenced by the dynamic response amplification of the soil column overlying the bedrock. The horizontal resonant frequencies of the combined soil-pile-structure system are about 3.2, 3.8 and 2.5 Hz for the BE, UB and LB, respectively. These frequencies are higher than those seen for the Auxiliary/ Containment/ Internal Structure because of the shorter depth of the soil column in the case of the Intake Structure due to its larger embedment depth. Figure 4.5 shows a comparison of the 2% damped response spectra of the free-field input ground motion and the response spectrum obtained at an elevation close to the basemat from the SSI analyses (envelope of BE, UB and LB). Figure 4.6 shows a similar comparison for the vertical direction.

4.1 Generation of In-Structure Raw Response Spectra, SSE

In-structure response spectra were computed at 88 frequency points, in excess of those recommended in the SRP, and distributed evenly along a logarithmic scale. The frequency points at which spectral ordinates are calculated are tabulated in Table 4.1 for the Auxiliary/Containment/Internal Structure. For the Intake Structure, some of frequency points in Table 4.1 are changed to incorporated the structure's own fixed-base frequencies. The frequency points meet the frequency intervals recommended in the SRP. Response spectra were calculated at four damping values (2, 3, 5, and 7%).

In-structure response spectra for both the UB and LB were generated at building elevations consistent with the previous BE case analysis. These elevations are described in Table 4.2. At each elevation, response spectra were generated at the center of mass and at building corner locations furthest away from the center of mass, typically four to six locations, in order to capture the maximum contributions from rocking and torsion response. The group of response spectra at each floor elevation were then enveloped to create a single spectra set applicable to that particular elevation.

Typical 2% damped curves of the enveloped raw response spectra, obtained for the UB and LB for the Auxiliary/Containment/Internal structure, are shown in Figures 4.3 and 4.4 for the north-south and east-west directions, respectively. As can be seen from figures 4.3 and 4.4 spectral peaks are controlled by the UB case. Also, from comparison of spectral peaks in Figures 4.3 (north-south), and 4.4 (east-west), larger amplitudes in the spectral peak is observed for the east-west compared to the north-south direction. This is in part related to the larger amplitudes of the east-west input motion, where, as shown in Figures 2.1 (free-field north-south, 2% damped) and 2.4 (free-field east-west, 2% damped), the amplitudes of the input spectrum are larger for the east-west than for the north-south directions, at the frequencies of the soil-structure system. Similar trends apply for the Intake Structure.

The UB and LB spectra were further enveloped with the enveloped spectra for the BE case, (with a ±15% broadening factor), and then smoothened to produce the final spectra.

4.2 Enveloping and Broadening of Design Response Spectra, SSE

As discussed above, the final broadened in-structure response spectra consist of an envelope of the following:

- The BE response spectra, broadened by a factor of ±15%. This broadening factor accounts for uncertainties other than soil property related uncertainties;

- The UB response spectra, obtained from the soil variation studies, and;

- The LB response spectra, obtained from the soil variation studies.

The enveloped and broadened spectra were further smoothed by hand to produce the final SSE response spectra, contained in Appendices A and B of this report for the Auxiliary Building/Containment/Internal Structure and the Intake Structure, respectively.

4.3 Generation of In-Structure Response Spectra, OBE

The development of response spectra for the OBE is based on the SSE response envelopes appropriately scaled to reflect the OBE/SSE peak ground acceleration ratio and other effects such as lower structural and soil damping and possible frequency shifts due to smaller strains within the soil profile.

The ratio between OBE and SSE free-field input is 0.47 (0.08g/0.17g). However, as discussed above, when OBE responses are obtained by scaling of SSE responses, this ratio is typically higher, primarily because of the lower damping in the OBE analysis. In order to derive an appropriate (and bounding) ratio for scaling SSE responses to obtain OBE response spectra for Fort Calhoun, a review of the SSE and OBE in-structure response spectra peaks was made for the BE case analyses (Reference 1). Based on this review, OBE to SSE ratios of 0.6 or less were observed. The ratio is less than 0.6 in most cases, particularly in the vertical direction. Based on this review, a factor of 0.6 was selected to conservatively scale the amplitudes of the SSE response envelopes. In addition, a frequency shift of 7% was obtained from the SHAKE soil column OBE analyses with respect to the SSE soil column analysis. Therefore, the scaled OBE curves were further broaden by 7% to the higher frequency side. The OBE procedure and OBE response envelopes are documented in Reference 15 for the Intake Structure and 16 for the Auxiliary/Containment/Internal Structure. The final OBE response spectra are contained in Appendices C and D of this report for the Auxiliary Building/ Containment/Internal Structure and the Intake Structure, respectively.

5.0 SUMMARY

This section summarizes the results of the SSI soil variation studies. UB and LB SSI analyses were performed using the same models and analyses methods used previously for the BE case analyses. An uncertainty variation factor of ±30% of the best-estimate properties was applied to the soil shear modulus to develop new properties used in the SSI variation analyses. New SSE response spectra were generated by enveloping the response spectra obtained from UB and LB analyses and the BE analyses broadened by ±15%. The OBE response spectra were obtained by scaling the SSE response spectra by a factor of 0.6 and additional broadening equal to 7% to the higher frequency side of the spectral peak. The final set of response spectra for the Class I structures are contained in Appendices A through D of this report.

6.0 REFERENCES

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2.0 "Response to NRC Questions on Fort Calhoun's Refined Seismic Spectra". Report Prepared for the Nuclear Regulatory Commission by Omaha Public Power District, October 1990. (ABB Impell Report No. 01-1390-1830, Rev.0).

3.0 Safety Evaluation by the Office of Nuclear Reactor Regulation Related to the Alternate Seismic Criteria and Methodologies, Omaha Public Power District, Fort Calhoun Station, Unit 1. Docket No 50-285, Enclosures 1 and 2, June 17, 1991.

4.0 U.S. Nuclear Regulatory Commission Standard Review Plan, NUREG-0800, Revisions 1 and 2.

5.0 Updated Safety Analysis Report (USAR) for Fort Calhoun Station, Unit 1, Revision 7/87.

6.0 Seed, H.B., Wong, R., Idriss, I.M., Tokimatsu, T.,"Moduli and Damping Factors for Dynamic Analysis of Cohesionless Soils". EERC Report 84-14, September 1984.

7.0 Preliminary Safety Analysis Report, Fort Calhoun Station, Unit 2. Omaha Public Power District.

8.0 ABB Impell Corporation Computer Program SASSI, Version 4.0

9.0 ABB Impell Corporation Computer Program CLASSI, Version 0.0

10.0 ABB Impell Corporation Computer Program RESPEC, Version 1.0

11.0 ABB Impell Corporation Calculation: "SSI Analyses for the Auxiliary/Internal/Containment Structure". Calculation No. A-01, Rev.0, Project 0139-00378/00398, July 1992.

12.0 Engineering Model of Earthquake Ground Motion for Eastern North America. EPRI Report NP-6074, October 1988.

13.0 ABB Impell Corporation Calculation: "Model Development of Auxiliary, Containment and Internal Buildings". Calculation No. AUX-01, Rev.0, Job No. 1390-027-1355.

14.0 ABB Impell Corporation Calculation: "Intake Structure Model". Calculation No. INT-01, Rev.0, Job No. 1390-027-1355.

15.0 ABB Impell Corporation Calculation: "SSI Analyses for the Intake Structure". Calculation No. I-01, Rev.0, Project 0139-00378/00398, July 1992.

16.0 ABB Impell Corporation Calculation: "OBE Response Spectra for the Auxiliary/Internal/Containment Structure". Calculation No. A-02, Rev.0, Project 0139-00378/00398, July 1992.

TABLE 2.1

STRAIN-COMPATIBLE SOIL PROPERTIES (SHAKE PROFILE)
SAFE SHUTDOWN EARTHQUAKE

Layer No.	Thickness (ft)	Unit Weight (pcf)	Best Estimate			Upper Bound			Lower Bound		
			S-Wave Velocity V_s (ft/sec)	Shear Modulus G (ksf)	Damping Ratio	S-Wave Velocity V_s (ft/sec)	Shear Modulus G (ksf)	Damping Ratio	Wave Velocity V_s (ft/sec)	Shear Modulus G (ksf)	Damping Ratio
1	2.5	115	317	358	0.037	364	474	0.032	261	244	0.046
2	2.5	115	408	594	0.049	[illegible]	789	0.043	336	403	0.057
3	2.5	115	459	754	0.054	[illegible]	1000	0.048	376	505	0.063
4	2.5	115	497	881	0.057	[illegible]	1172	0.051	404	584	0.068
5	2.5	124	509	997	0.060	[illegible]	1333	0.053	413	656	0.071
6	2.5	124	535	1103	0.062	[illegible]	1485	0.054	434	724	0.074
7	5.0	124	507	991	0.072	[illegible]	1350	0.063	404	630	0.088
8	5.0	124	539	1120	0.074	[illegible]	1523	0.066	431	714	0.089
9	5.0	124	567	1240	0.075	[illegible]	1680	0.068	455	798	0.088
10	5.0	124	569	1246	0.078	[illegible]	1696	0.071	456	801	0.092
11	5.0	124	577	1281	0.080	[illegible]	1741	0.073	459	811	0.095
12	5.0	124	561	1169	0.086	[illegible]	1619	0.077	432	718	0.105
13	5.0	124	565	1231	0.086	[illegible]	1717	0.076	442	754	0.106
14	5.0	130	565	1299	0.088	[illegible]	1806	0.077	442	797	0.108
15	5.0	130	579	1352	0.088	[illegible]	1892	0.077	450	819	0.109
Rock	--										

Poisson's Ratio (all layers) = 0.475

Elevation at top of profile = 994 ft.

TABLE 2.2

AUXILIARY BUILDING/CONTAINMENT/INTERNAL STRUCTURE STIFFNESS PROPERTIES

ELEVATIONS (FT)	BLDG.	AXIAL AREA A_x (Ft^2)	SHEAR AREA A_y (Ft^2)	SHEAR AREA A_z (Ft^2)	Mom. of INERTIA I_{xx} (Ft^4)	Mom. of INERTIA I_{yy} (Ft^4)	Mom. of INERTIA I_{zz} (Ft^4)
1044 to 1083	AUX.	450	354	97	281565	328863	1174991
1044 TO 1057	"	1117	606	511	4907144	1510073	6926157
1036 TO 1044	"	2557	1239	1318	19579039	19701249	14987791
1025 TO 1036	"	4447	2187	2260	33910292	29770067	26566505
1007 TO 1025	"	5609	2980	2630	37690000	33970000	25730000
984 TO 1007	"	6591	3519	3072	41340000	41640000	28430000
1056.5 TO 1038.5	INT.	671	212	458	487422	262222	552982
1038.5 TO 1013	"	1382	557	825	678822	645312	686091
1013 TO 994	"	1689	927	1245	722342	621119	745569
1118 TO 991	CONT.	1394	742	742	4526287	2263144	2263144

TABLE 2.3

AUXILIARY BUILDING/CONTAINMENT/INTERNAL STRUCTURE MASS PROPERTIES

Mass Point	Node #	Elev. (FT)	BLDG	M_x $(K\text{-}S^2)/FT$	M_y $(K\text{-}S^2)/FT$	M_z $(K\text{-}S^2)/FT$	M_{xx} $K\text{-}S^2\text{-}FT$	M_{yy} $K\text{-}S^2\text{-}FT$	M_{zz} $K\text{-}S^2\text{-}FT$
MA1	2	1083	AUX.	100.9	100.9	100.9	55027	194925	242719
MA2	12	1057	"	167.0	167.0	167.0	123970	784522	907651
MA3	22	1044	"	195.0	195.0	195.0	1237043	966631	2193570
MA4	42	1036	"	303.8	303.8	293.1	2219362	1593247	3810090
MA5	72	1025	"	574.8	574.8	555.6	3276540	2287913	5551136
MA6	102	1007	"	945.5	945.5	882.95	5811746	4179269	9962859
MI1	32	1056.5	INT.	41.8	41.8	41.8	26129	28245	52669
MI2	52	1045	"	46.9	46.9	46.9	34210	39438	73694
MI3	82	1038.5	"	114.2	114.2	114.2	58537	67836	118714
MI4	112	1013	"	270.8	270.8	270.8	165729	187918	316850
MC1	62	1118	CON.	273.6	273.6	273.6	204308	204308	650863
MC2	92	1099	"	330.6	330.6	330.6	424677	424677	1009021
MC3	122	1045	"	335.2	335.2	335.2	601716	601716	1036850
Foundation		989'	Aux/Int/Cont	3116.1	3116.1	3208.9	13,391,025	9,522,791	22,643,089
TOTAL			"	6816.2	6816.2	6816.6			

TABLE 2.4

AUXILIARY/CONTAINMENT/INTERNAL STRUCTURE
FIXED-BASE FREQUENCIES AND MODES

Mode No.	Frequency (Hz)	Cumulative Mass Participation Factors (%) X-Dir. (NS)	Y-Dir. (EW)	Z-Dir (V)	Description of Mode[1,2]
1	6.2	11	11	0	C, Mixed X-Y
2	6.2	22	22	0	C, Mixed X-Y
3	6.9	22	26	0	A, Y (@ 1083')
4	11.8	22	26	9	C, Torsion
5	13.3	51	26	0	A, X (Main)
6	14.9	56	26	0	I, X (Main)
7	15.4	57	70	0	A, Y (Main)
8	16.3	60	71	0	I, Y & Torsion
9	16.8	60	71	25	C, Vertical
10	17.0	61	78	25	I, Y & Torsion

(1) A = Auxiliary Building
I = Internal Structure
C = Containment Shield

(2) X = NS Direction
Y = EW Direction

Note: Only first ten modes listed. Forty modes were used in the analysis, with cumulative MPFs of over 90% in each direction

TABLE 2.5

INTAKE STRUCTURE STIFFNESS PROPERTIES

ELEVATIONS (FT)	AXIAL AREA A_x (Ft^2)	SHEAR AREA A_y (Ft^2)	SHEAR AREA A_z (Ft^2)	Mom. of INERTIA I_{xx} (Ft^4)	Mom. of INERTIA I_{yy} (Ft^4)	Mom. of INERTIA I_{zz} (Ft^4)
1024.5 TO 1035.63	3.624	0.0827	0.177	2320.73	4534.75	324.0
1014.5 TO 1024.50	3.624	0.1016	0.209	2320.73	4534.75	311.3
1007.5 TO 1014.50	244	160	84	128980	310004	299459
993.5 TO 1007.50	1795	691	1105	1189591	1547984	1682029
985.0 TO 993.50	1595	537	1057	1064568	1371371	1503321
974.6 TO 985.50	1529	485	1044	1103883	1114197	1309460

TABLE 2.5

INTAKE STRUCTURE MASS PROPERTIES

Node #	Elev. (FT)	M_x (K-S²)/FT	M_y (K-S²)/FT	M_z (K-S²)/FT	M_{xx} K-S²-FT	M_{yy} K-S²-FT	M_{zz} K-S²-FT
82	1035.63	4.43	4.43	4.43	1411.0	4130.1	5525.2
72	1024.50	5.81	5.81	5.81	2638.3	7570.5	10122.0
52	1007.50	94.00	94.90	94.00	47082.7	74408.4	114197.2
42	993.50	100.00	100.00	100.00	57911.7	80748.7	136760.7
32	985.00	78.50	78.50	78.5	51451.8	65129.9	115558.3
Basemat	974.67	279.5	279.50	279.50	153548.8	144719.5	289486.3
TOTAL		562.24	562.24	562.24			

TABLE 2.7

INTAKE STRUCTURE
FIXED-BASE FREQUENCIES AND MODES

Mode No.	Frequency (Hz)	Cumulative Mass Participation Factors (%) X-Dir. (NS)	Y-Dir. (EW)	Z-Dir (V)	Description of Mode[1,2]
1	5.6	4	0	0	X @ SF
2	7.9	4	4	0	Y @ SF
3	8.4	4	4	0	Torsion @ SF
4	12.9	5	4	0	X @ SF
5	18.5	5	5	0	Y @ SF
6	20.6	5	5	0	Torsion @ SF
7	22.3	88	5	0	X (Main)
8	30.8	90	75	1	Y (Main)
9	36.3	93	88	1	Y
10	47.6	93	89	34	Vertical (Main)

(1) X = NS Direction
Y = EW Direction
SF = Steel Frame

Note: Only first ten modes listed. Twenty modes were used in the analysis, with cumulative MPFs of over 90% in each direction

TABLE 4.1

FREQUENCY POINTS FOR IN-STRUCTURE RESPONSE SPECTRA

0.2000	0.3000	0.4000	0.5000	0.6000	0.7000	0.8000	0.9000	1.0000	1.1000
1.2000	1.3000	1.4000	1.5000	1.6000	1.7000	1.8000	1.9000	2.0000	2.1000
2.2000	2.3000	2.4000	2.5000	2.6000	2.7000	2.8000	2.9000	3.0000	3.1500
3.3000	3.4500	3.6000	3.8000	4.0000	4.2000	4.4000	4.6000	4.8000	5.0000
5.2500	5.5000	5.7500	6.0000	6.2500	6.5000	6.7500	6.9000	7.0000	7.2500
7.5000	7.7500	8.0000	8.5000	9.0000	9.5000	10.0000	10.5000	11.0000	11.5000
11.8000	12.0000	12.5000	13.0000	13.3000	13.5000	14.0000	14.5000	15.0000	15.4000
16.0000	16.3000	17.0000	18.0000	19.7000	20.0000	21.3000	21.8000	22.0000	25.0000
25.6000	28.0000	29.6000	31.0000	33.5000	34.0000	35.0000	40.0000		

TABLE 4.2

AUXILIARY BUILDING CONTAINMENT INTERNAL STRUCTURE
ELEVATIONS FOR RESPONSE SPECTRA GENERATION

AUXILIARY BUILDING MODEL

Elevation (ft.)	Location
989	Basemat
1007	Ground Floor
1025	Operating Floor
1036	Operating Floor
1044	Roof 1
1057	Roof 2
1083	Roof 3

INTERNAL STRUCTURE MODEL

Elevation (ft.)	Location
994	Basemat
1013	Ground Floor
1038.5	Mezzanine Floor
1045	Operating Floor
1056.5	Operating Floor

CONTAINMENT SHIELD MODEL

Elevation (ft.)	Location
991	Basemat
1045	Midheight of Shell
1099	Polar Crane Support
1118.2	Dome and Ring

INTAKE STRUCTURE

Elevation (ft.)	Location
985	Mezzanine Floor
1007.5	Operating Floor
1024.5	Crane Level

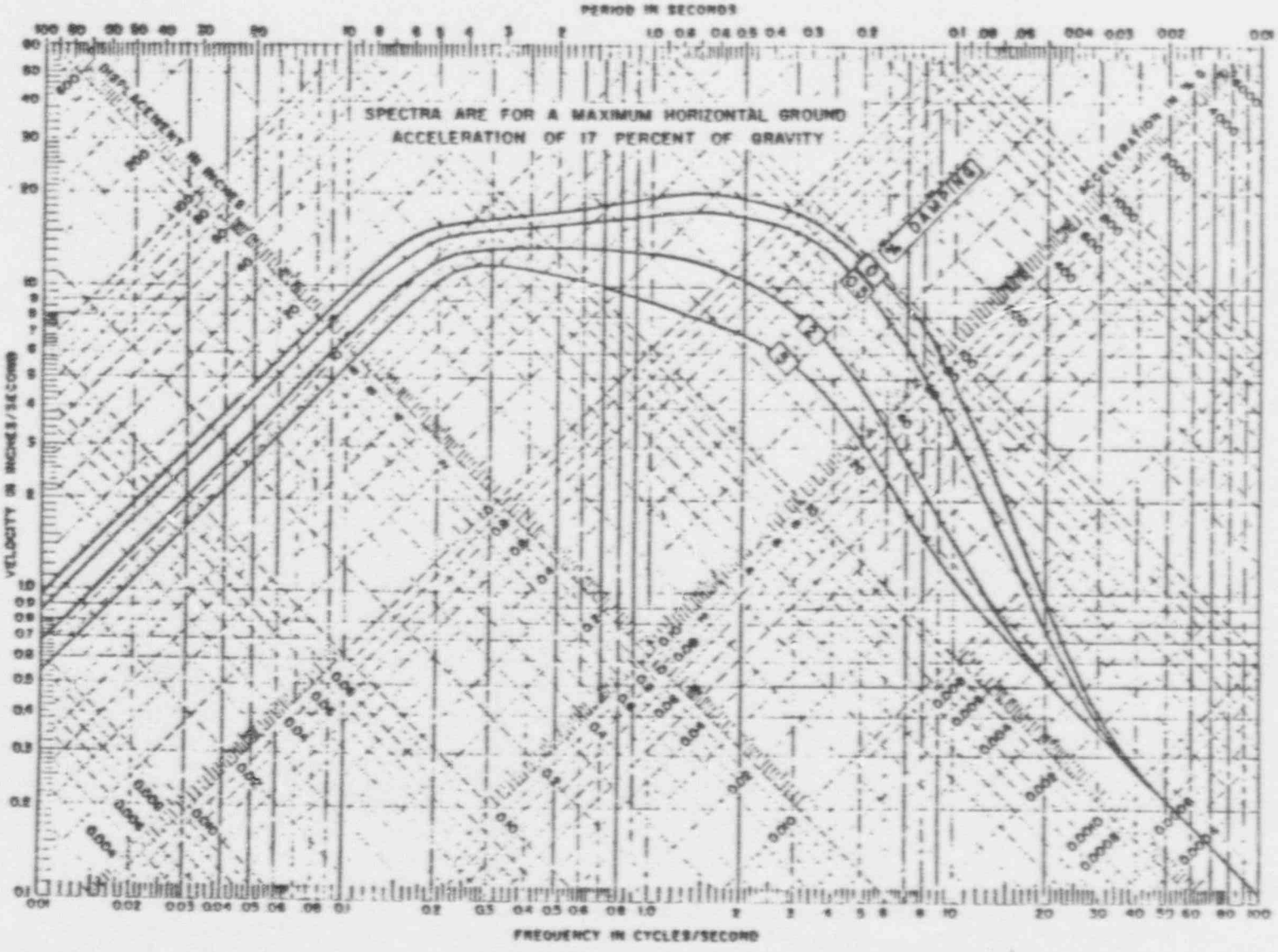


FIGURE 2.1 DESIGN BASIS HOUSNER GROUND RESPONSE SPECTRA FOR FORT CALHOUN STATION, UNIT 1

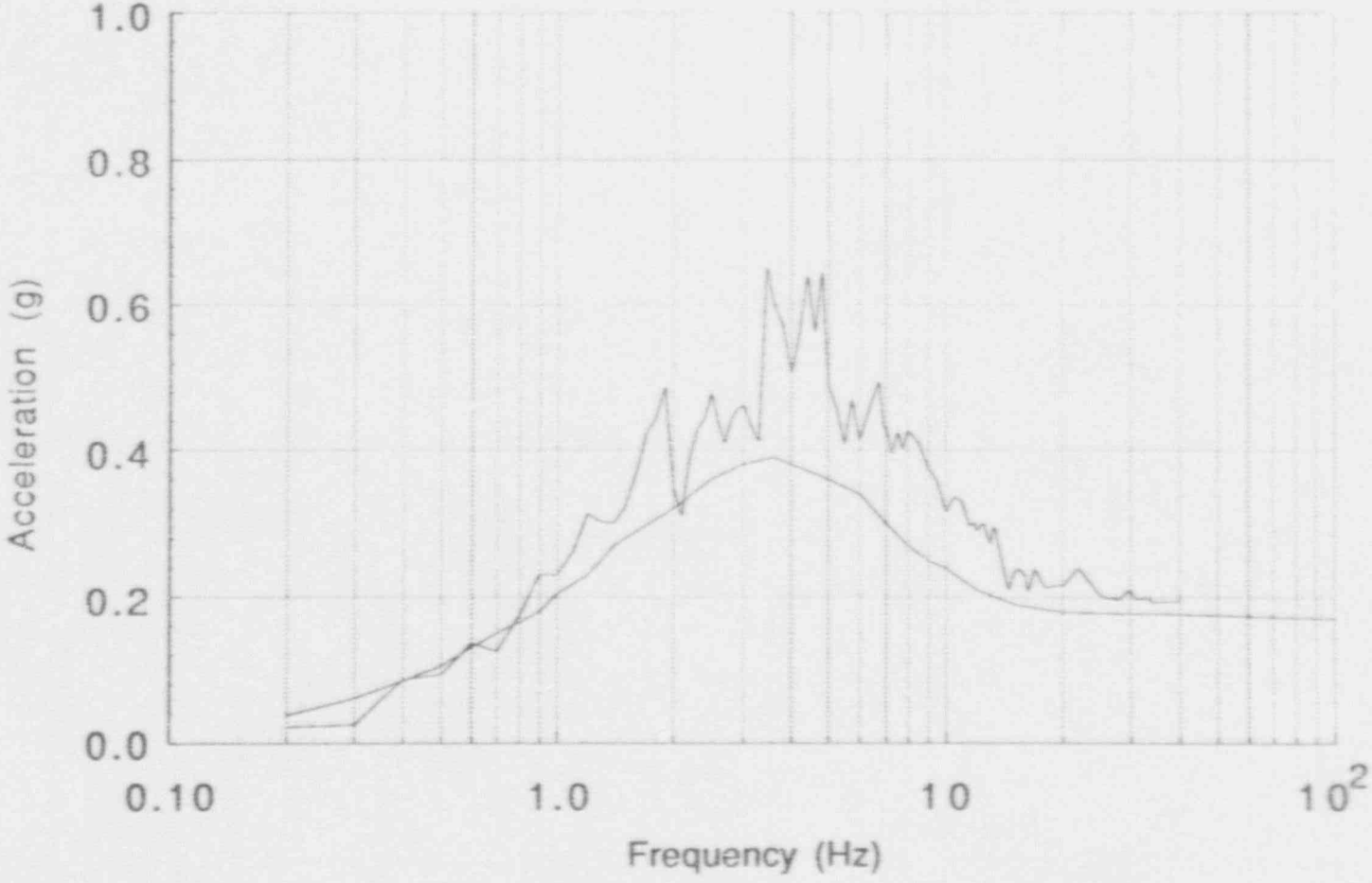


FIGURE 2.2 COMPARISON OF DESIGN BASIS GROUND RESPONSE SPECTRUM AND ENVELOPING TIME HISTORY RESPONSE SPECTRUM, NORTH-SOUTH DIRECTION, 2% DAMPING

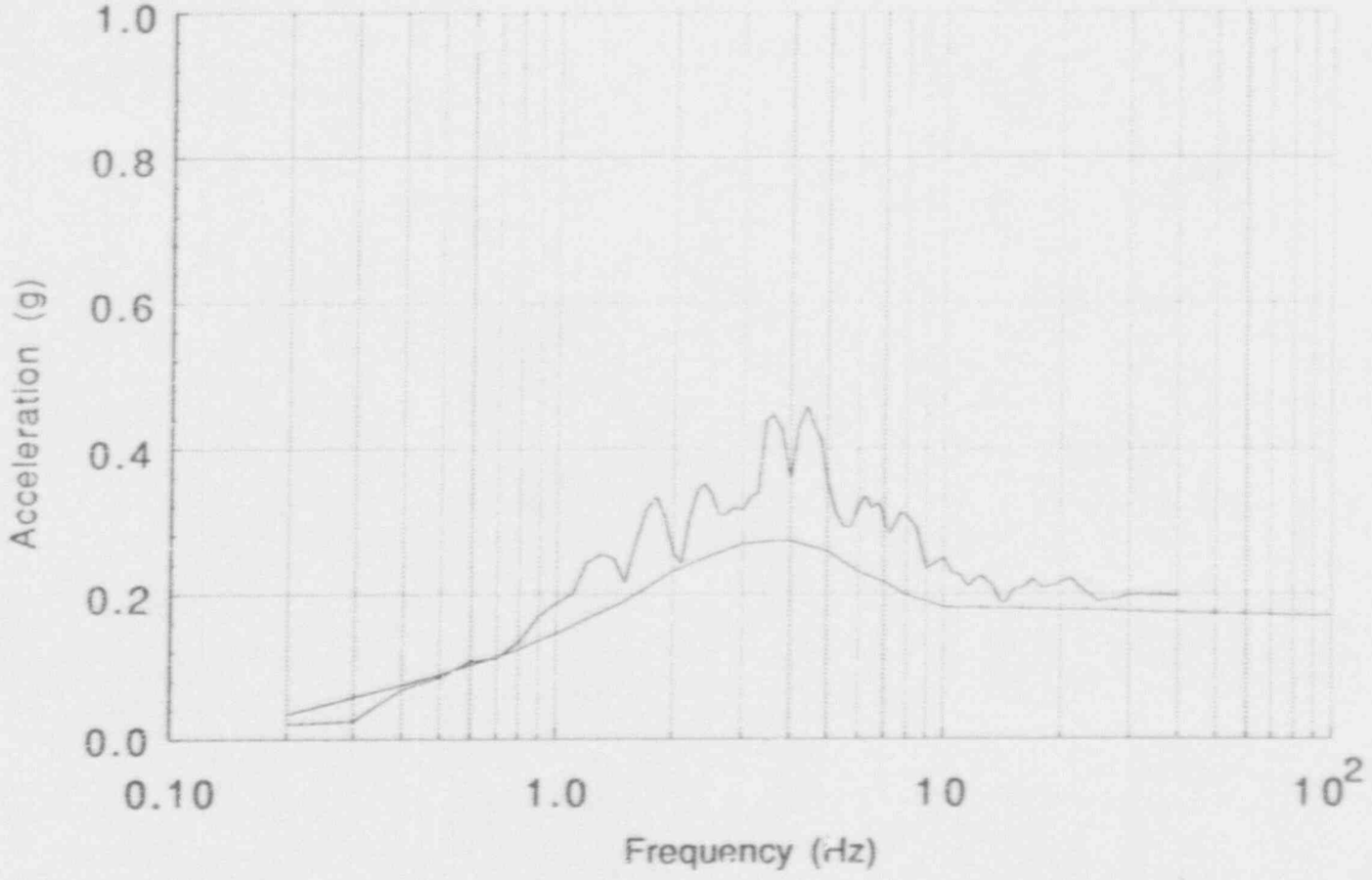


FIGURE 2.3 COMPARISON OF DESIGN BASIS GROUND RESPONSE SPECTRUM AND ENVELOPING TIME HISTORY RESPONSE SPECTRUM, NORTH-SOUTH DIRECTION, 5% DAMPING

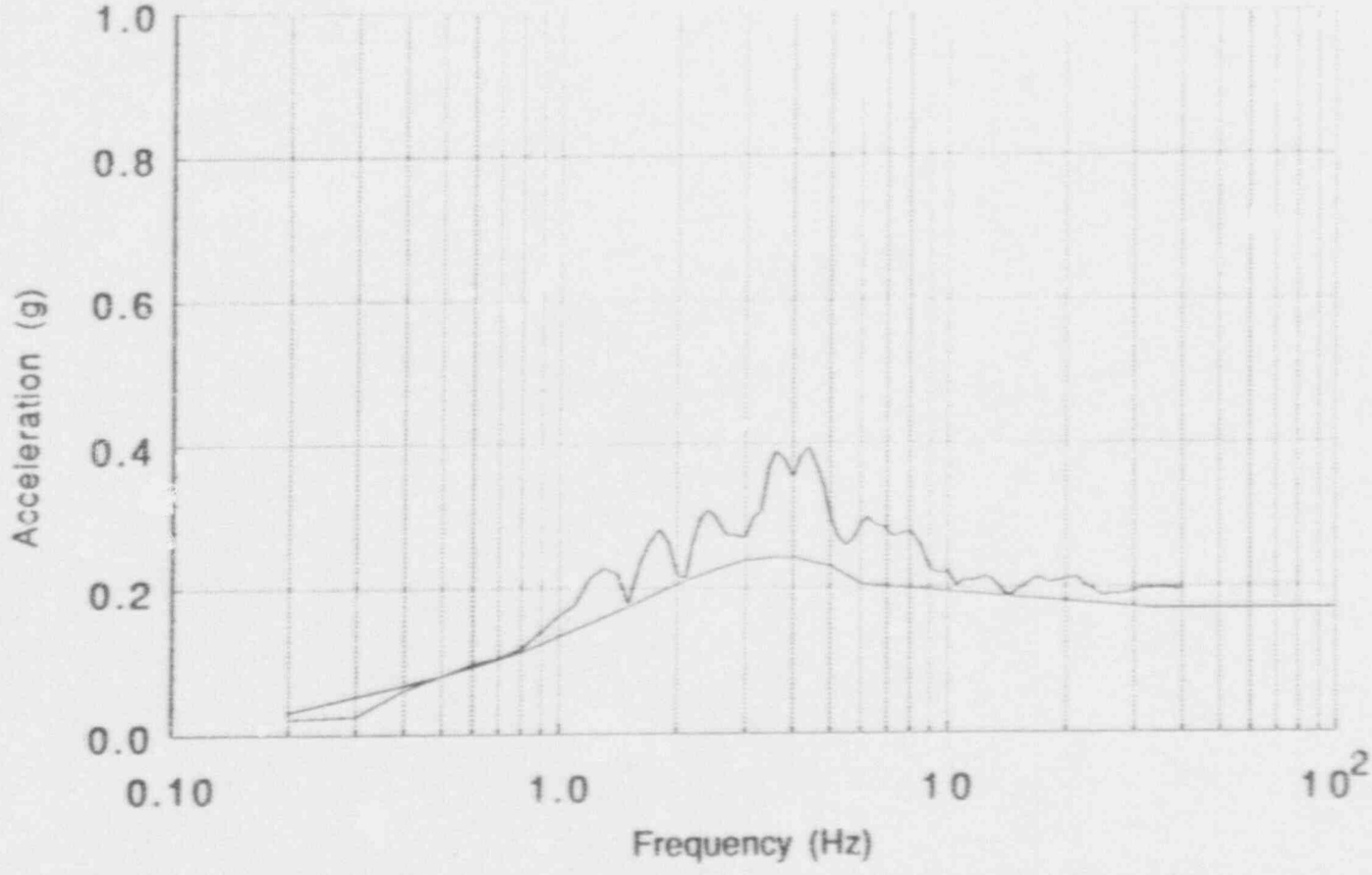


FIGURE 2.4 COMPARISON OF DESIGN BASIS GROUND RESPONSE SPECTRUM AND ENVELOPING TIME HISTORY RESPONSE SPECTRUM, NORTH-SOUTH DIRECTION, 7% DAMPING

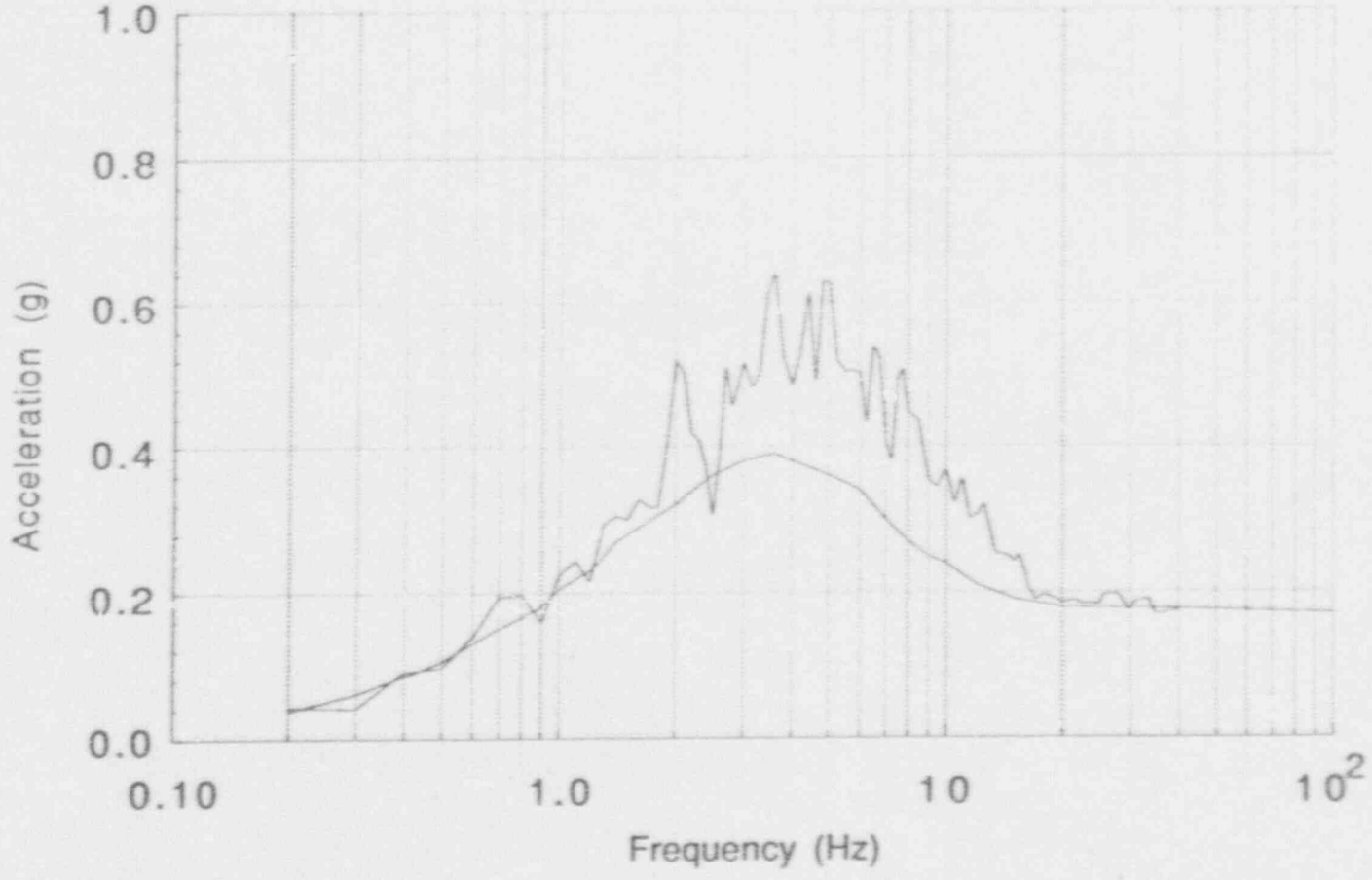


FIGURE 2.5 COMPARISON OF DESIGN BASIS GROUND RESPONSE SPECTRUM AND ENVELOPING TIME HISTORY RESPONSE SPECTRUM, EAST-WEST DIRECTION, 2% DAMPING

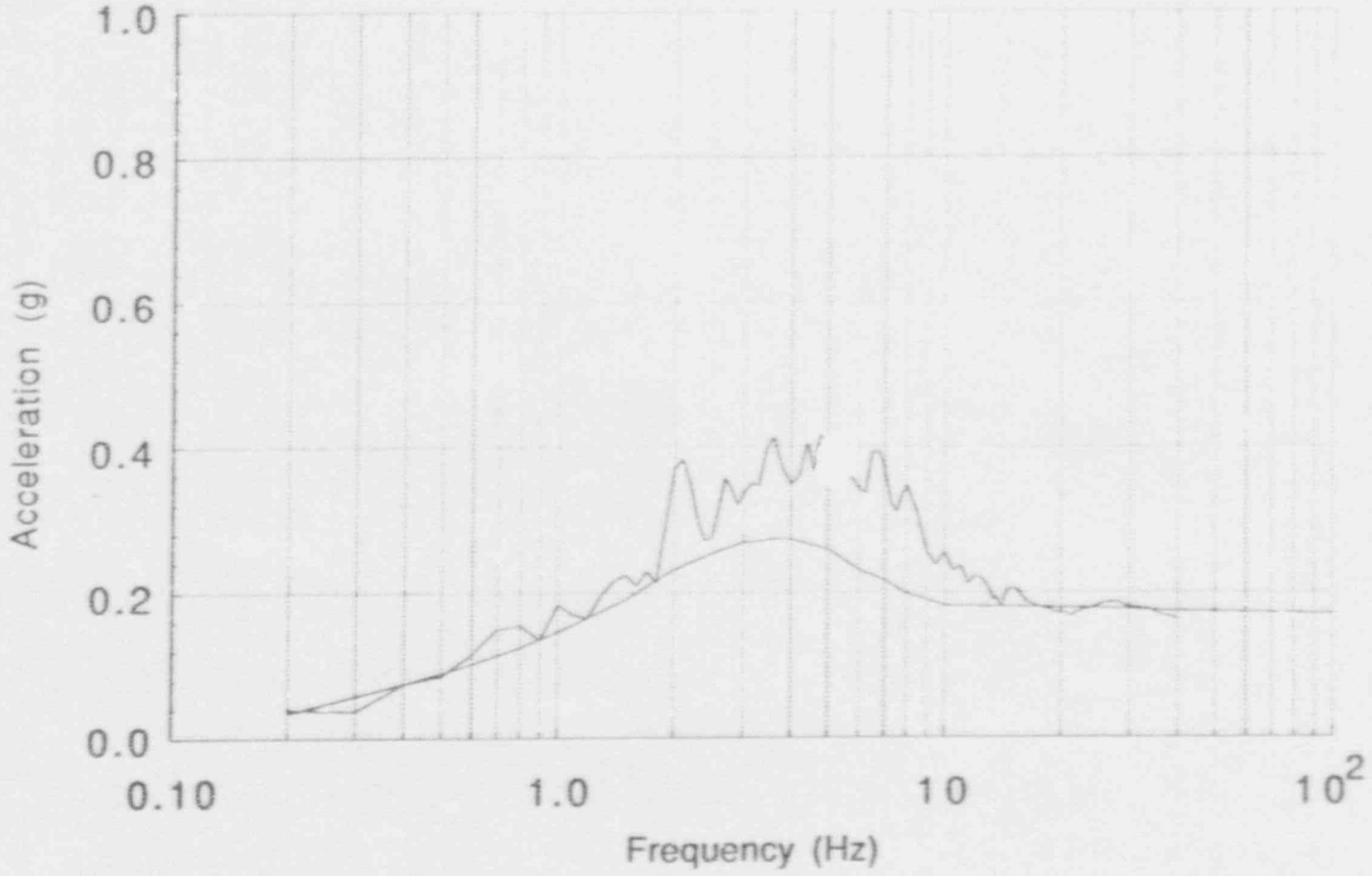


FIGURE 2.6 COMPARISON OF DESIGN BASIS GROUND RESPONSE SPECTRUM AND ENVELOPING TIME HISTORY RESPONSE SPECTRUM, EAST-WEST DIRECTION, 5% DAMPING

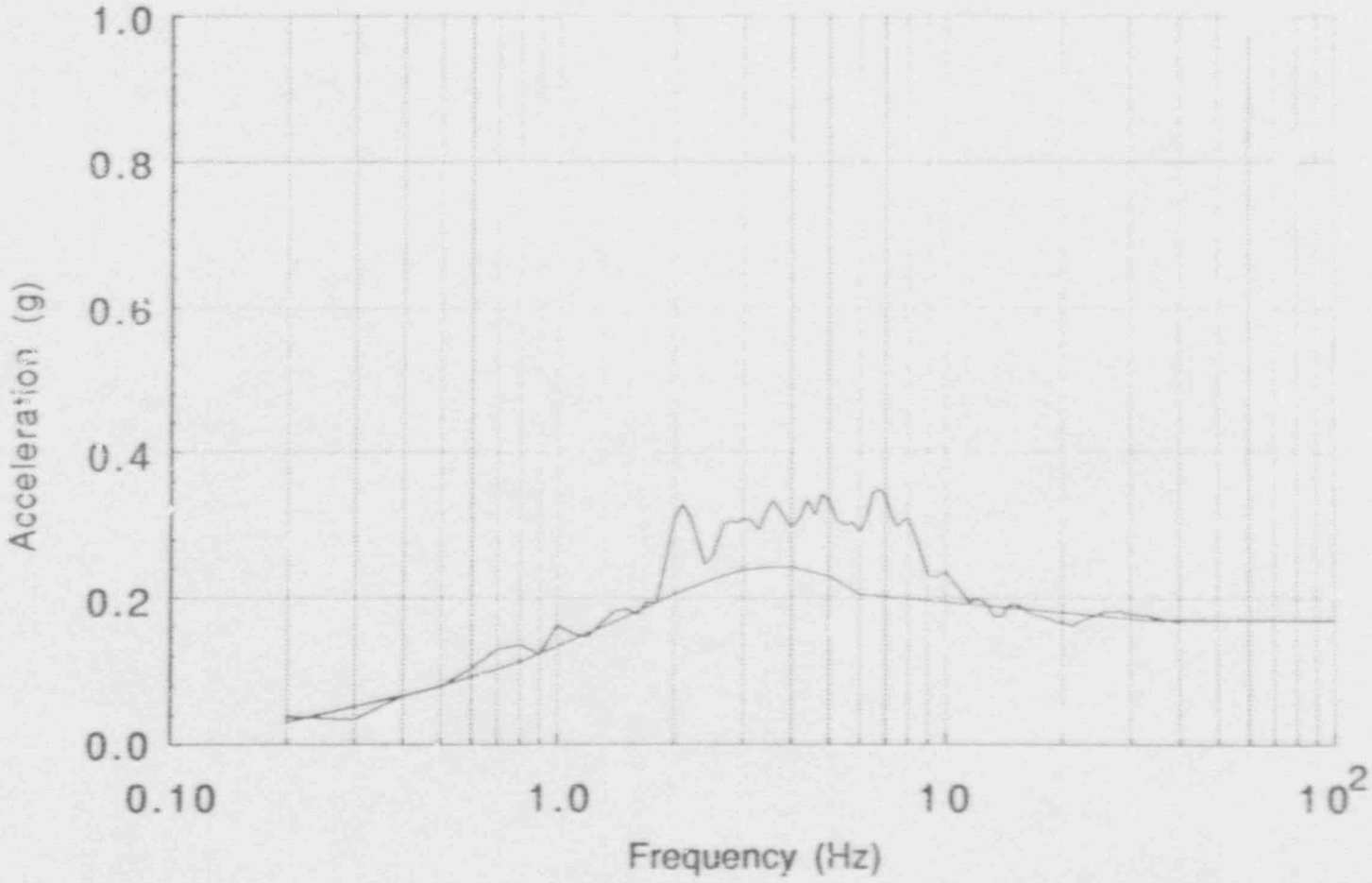


FIGURE 2.7 COMPARISON OF DESIGN BASIS GROUND RESPONSE SPECTRUM AND ENVELOPING TIME HISTORY RESPONSE SPECTRUM, EAST-WEST DIRECTION, 7% DAMPING

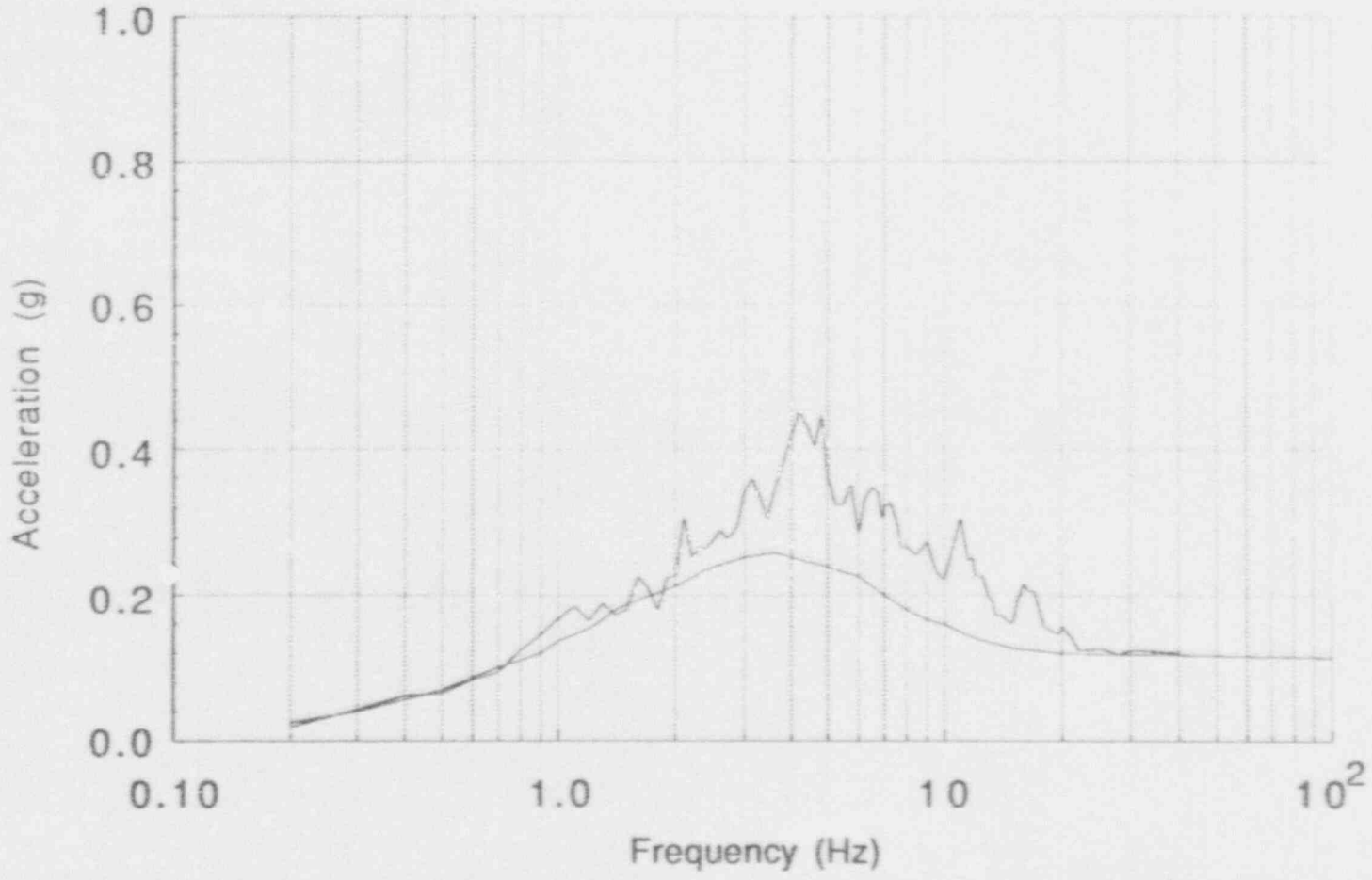


FIGURE 2.3 COMPARISON OF DESIGN BASIS GROUND RESPONSE SPECTRUM AND ENVELOPING TIME HISTORY RESPONSE SPECTRUM, VERTICAL DIRECTION, 2% DAMPING

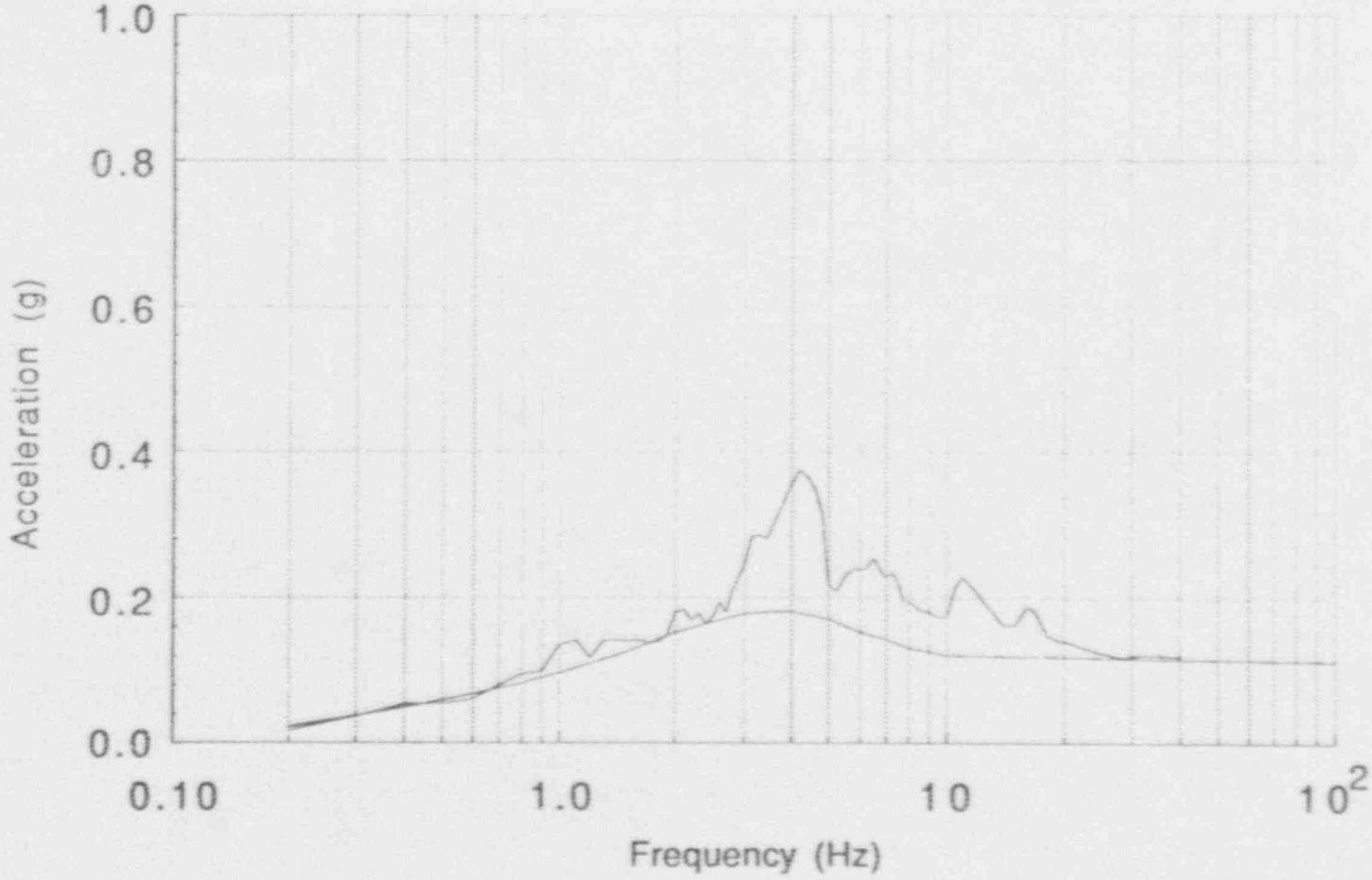


FIGURE 2.9 COMPARISON OF DESIGN BASIS GROUND RESPONSE SPECTRUM AND ENVELOPING TIME HISTORY RESPONSE SPECTRUM, VERTICAL DIRECTION, 5% DAMPING

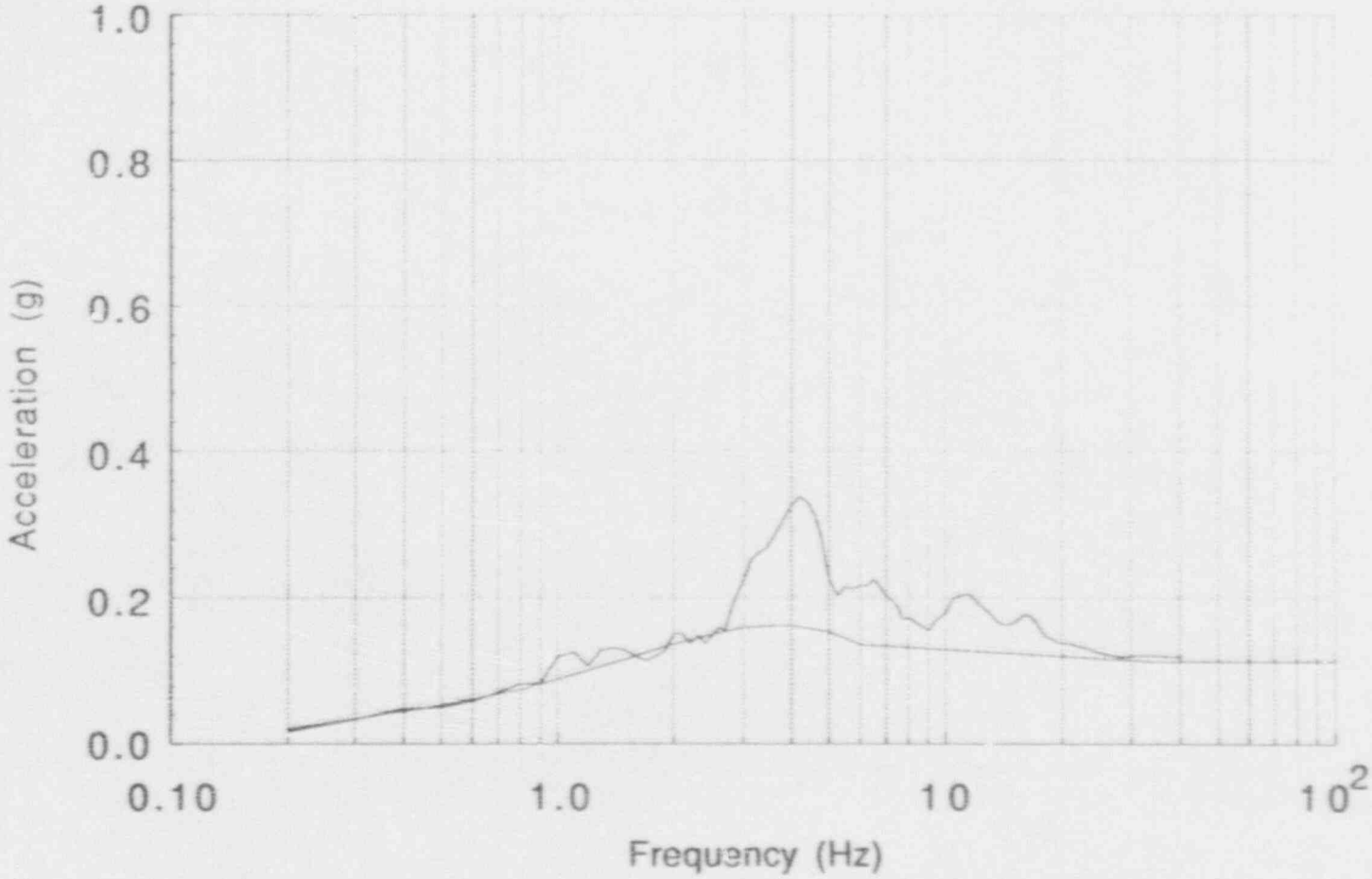


FIGURE 2.10 COMPARISON OF DESIGN BASIS GROUND RESPONSE SPECTRUM AND ENVELOPING TIME HISTORY RESPONSE SPECTRUM, VERTICAL DIRECTION, 7% DAMPING

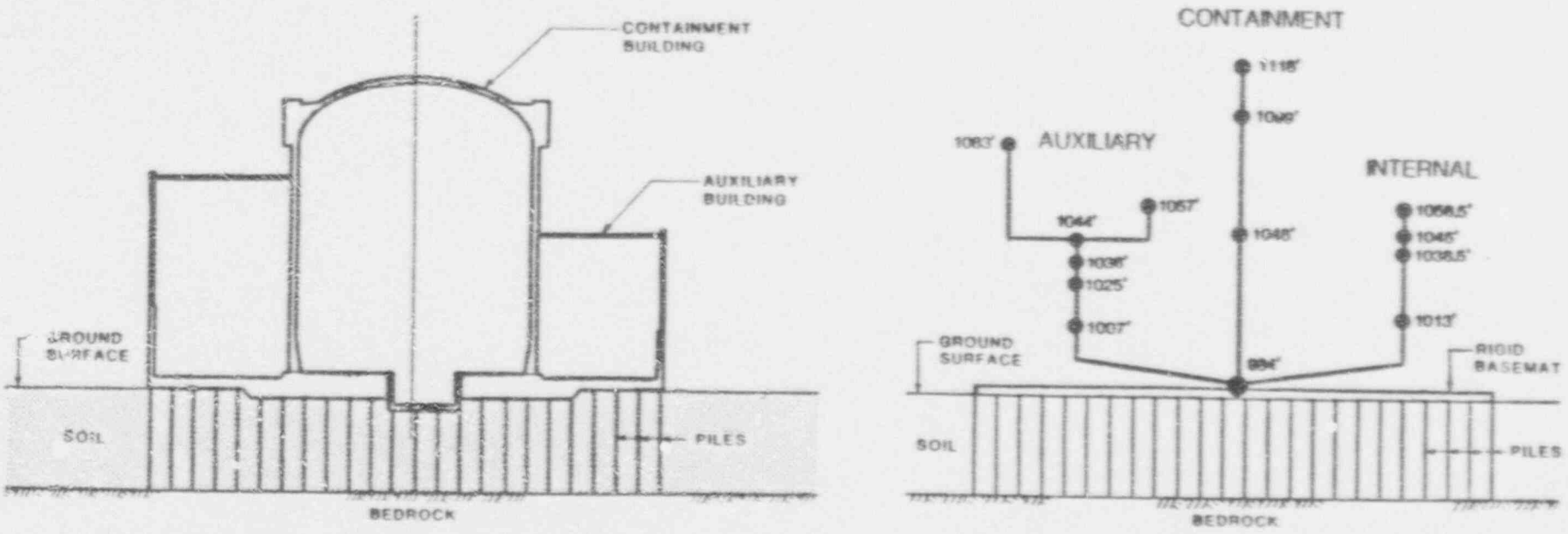


FIGURE 2.11 SKETCH OF AUXILIARY BUILDING/CONTAINMENT/INTERNAL STRUCTURE MATHEMATICAL MODEL

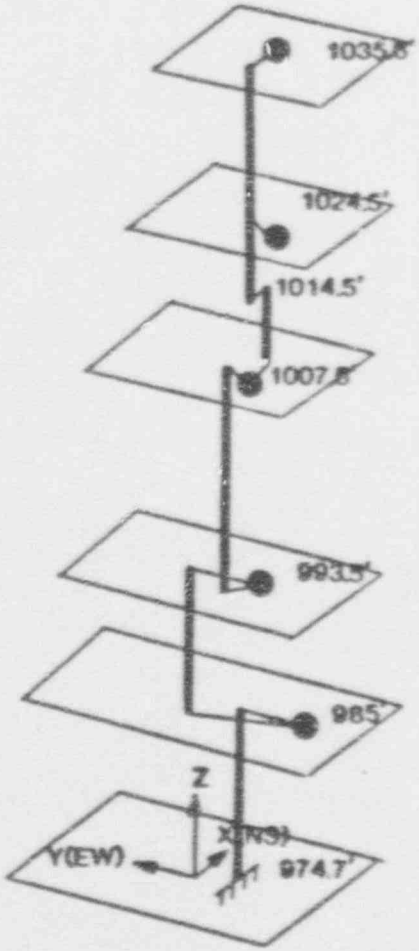


FIGURE 2.12 SKETCH OF INTAKE STRUCTURE MATHEMATICAL MODEL

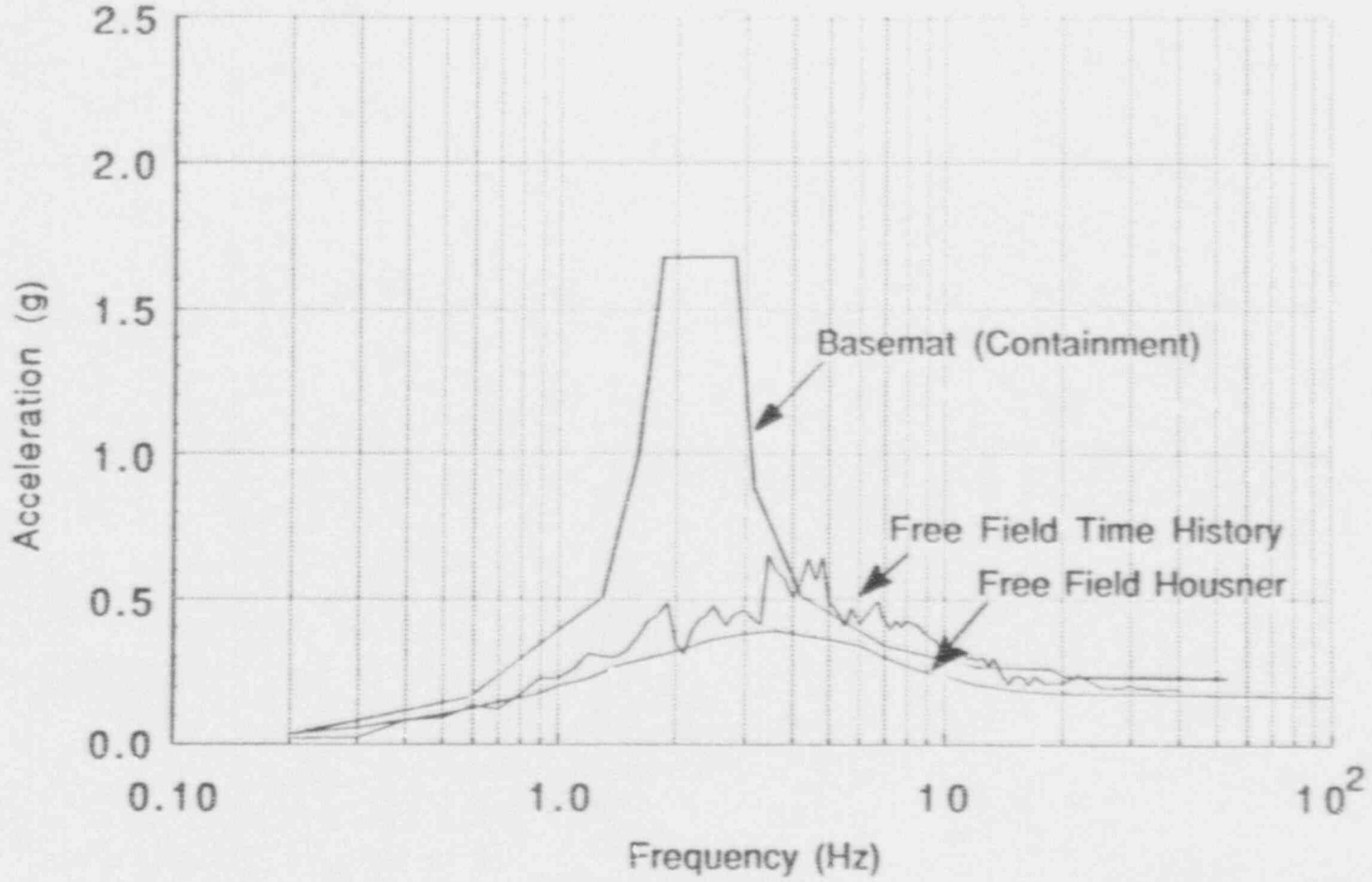


FIGURE 4.1 COMPARISON OF FREE-FIELD VERSUS AUXILIARY/CONTAINMENT/INTERNAL STRUCTURE BASEMAT RESPONSE SPECTRUM - HORIZONTAL DIRECTION, 2% DAMPING

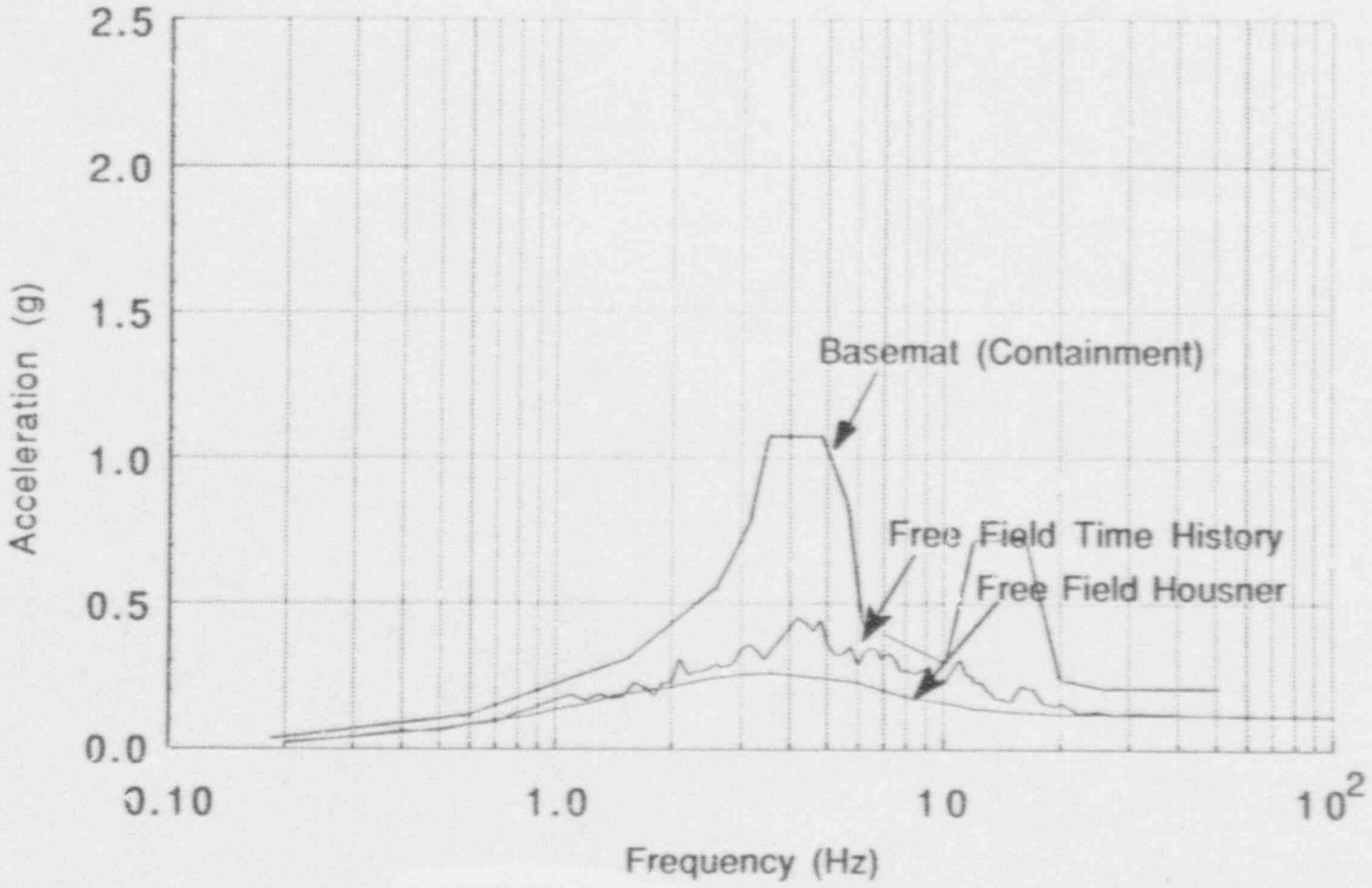


FIGURE 4.2 COMPARISON OF FREE-FIELD VERSUS AUXILIARY/CONTAINMENT/INTERNAL STRUCTURE BASEMAT RESPONSE SPECTRUM - VERTICAL DIRECTION, 2% DAMPING

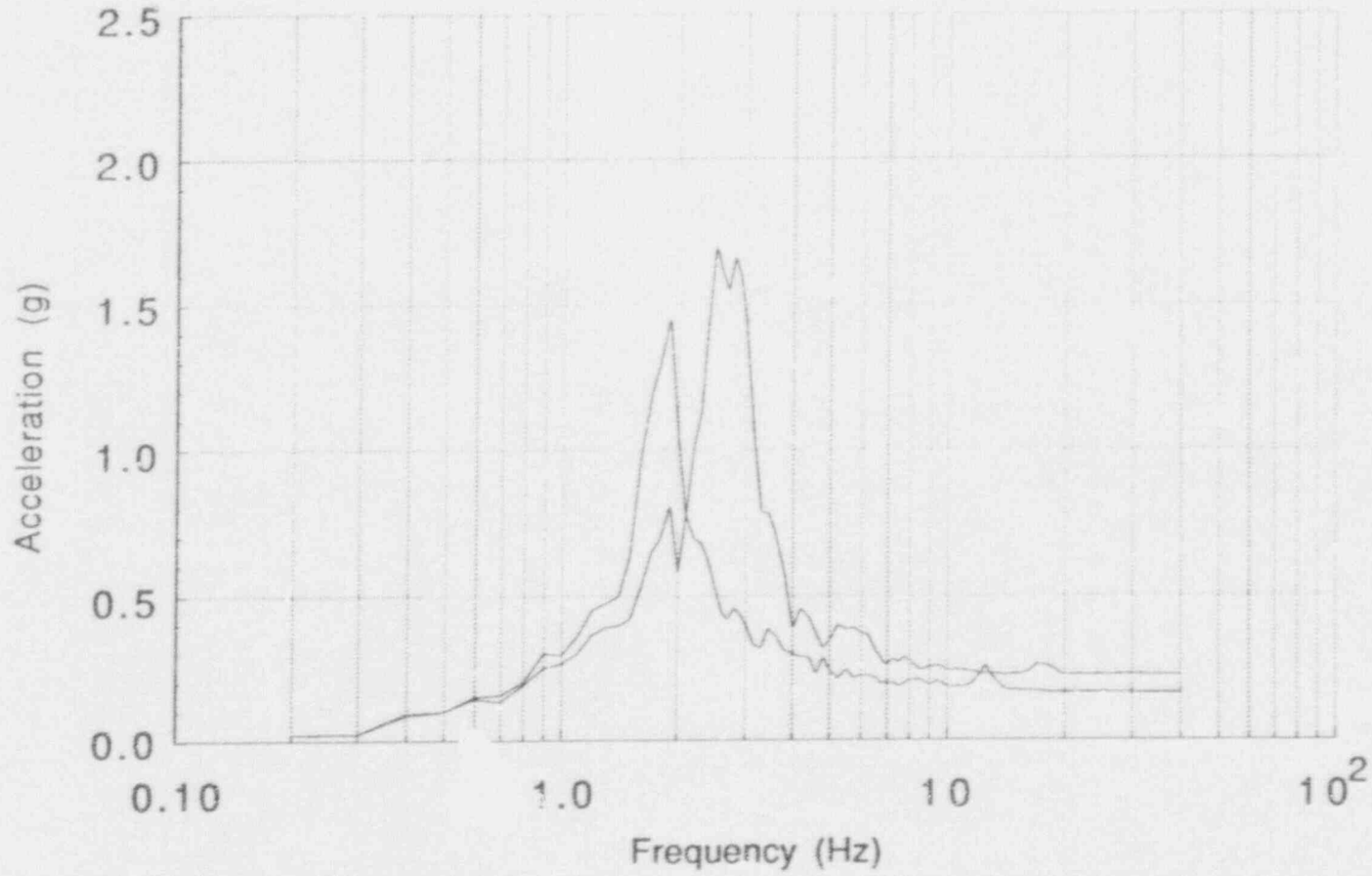


FIGURE 4.3 COMPARISON OF UPPER BOUND AND LOWER BOUND RAW RESPONSE SPECTRA, AUXILIARY/CONTAINMENT/INTERNAL STRUCTURE, NORTH SOUTH DIRECTION,2% DAMPING

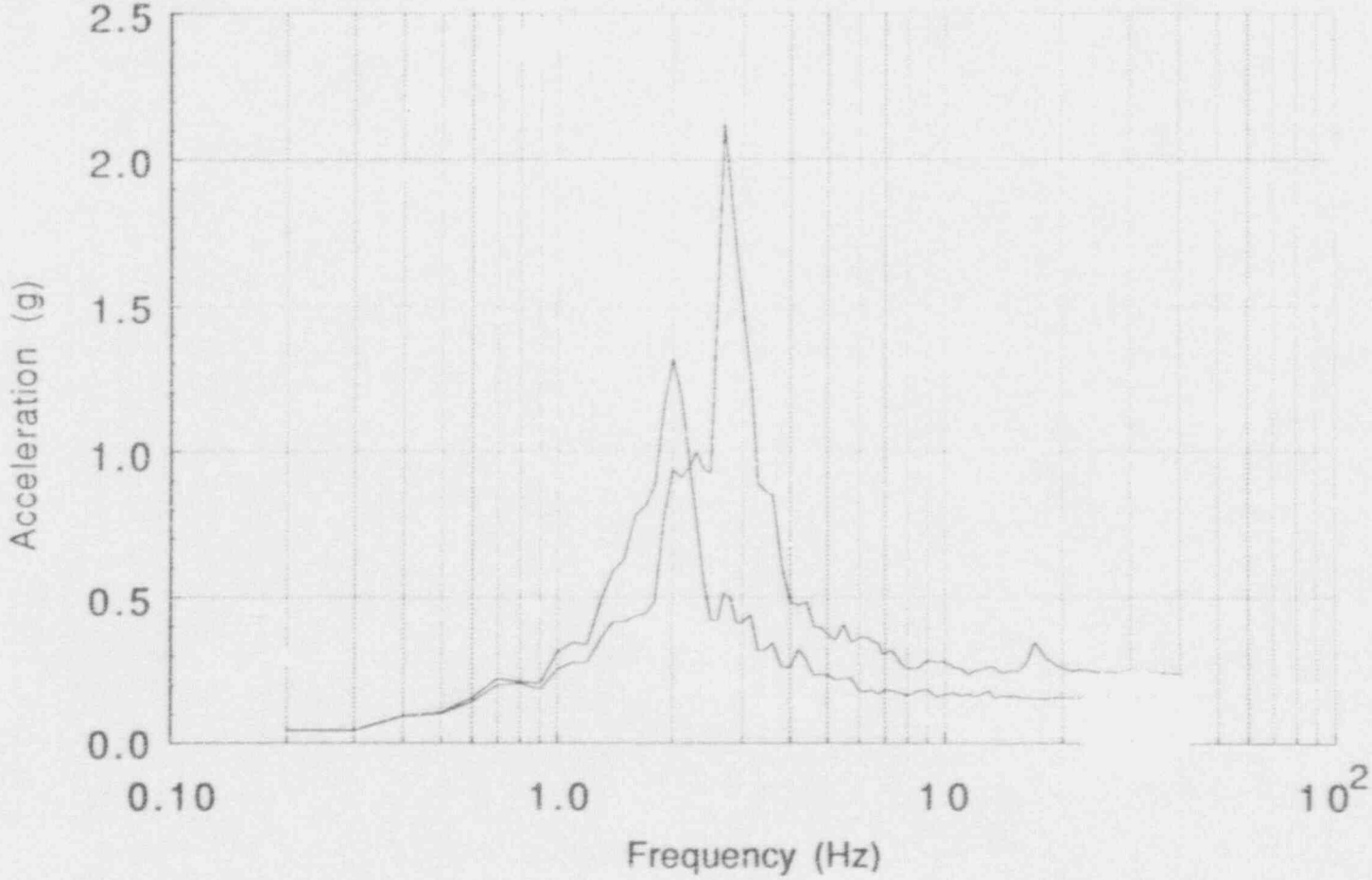


FIGURE 4.4 COMPARISON OF UPPER BOUND AND LOWER BOUND RAW RESPONSE SPECTRA, AUXILIARY/CONTAINMENT/INTERNA STRUCTURE, EAST-WEST DIRECTION,2% DAMPING

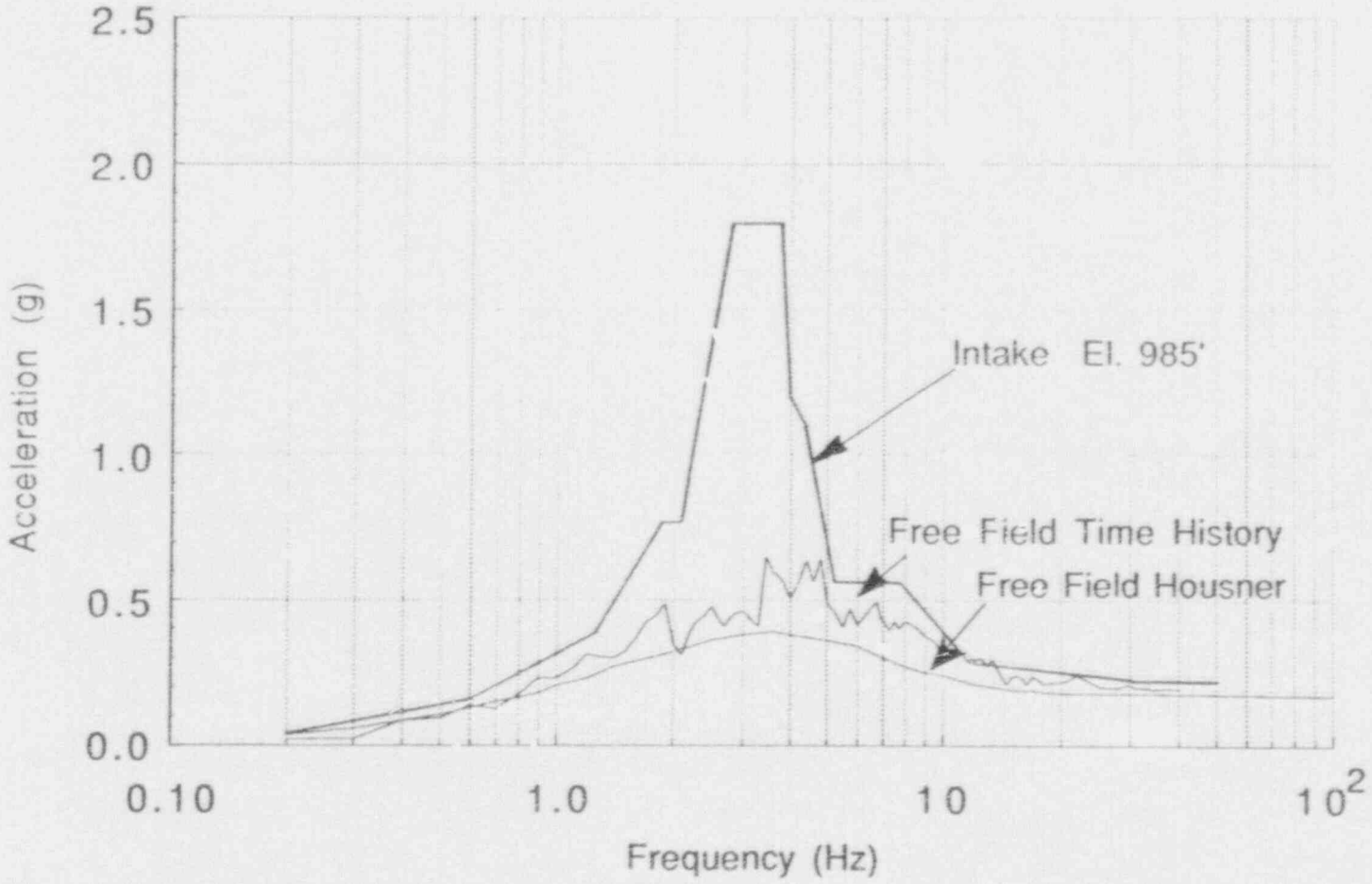


FIGURE 4.5 COMPARISON OF FREE-FIELD VERSUS INTAKE STRUCTURE EL. 985' RESPONSE SPECTRUM - HORIZONTAL DIRECTION, 2% DAMPING

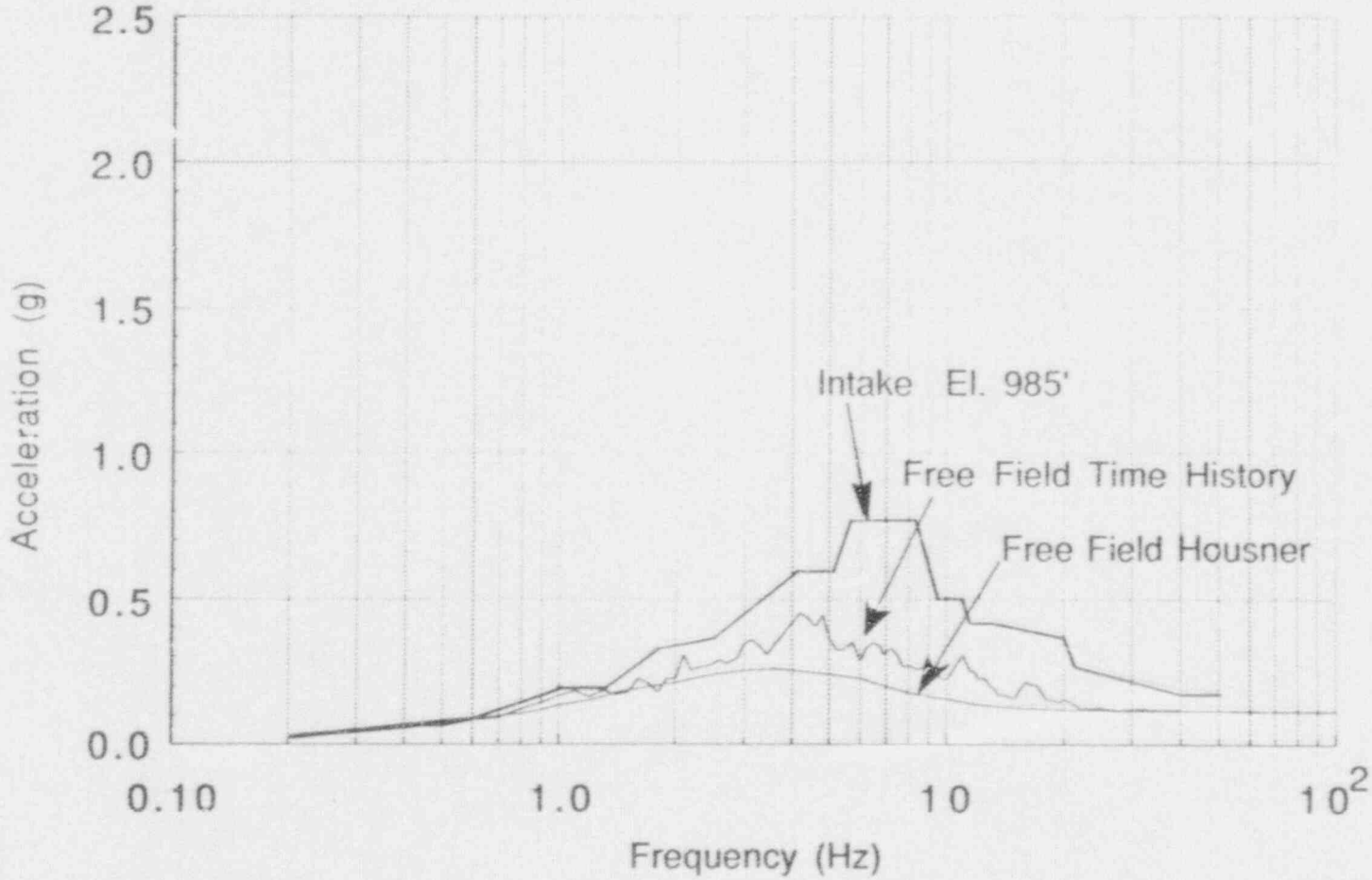
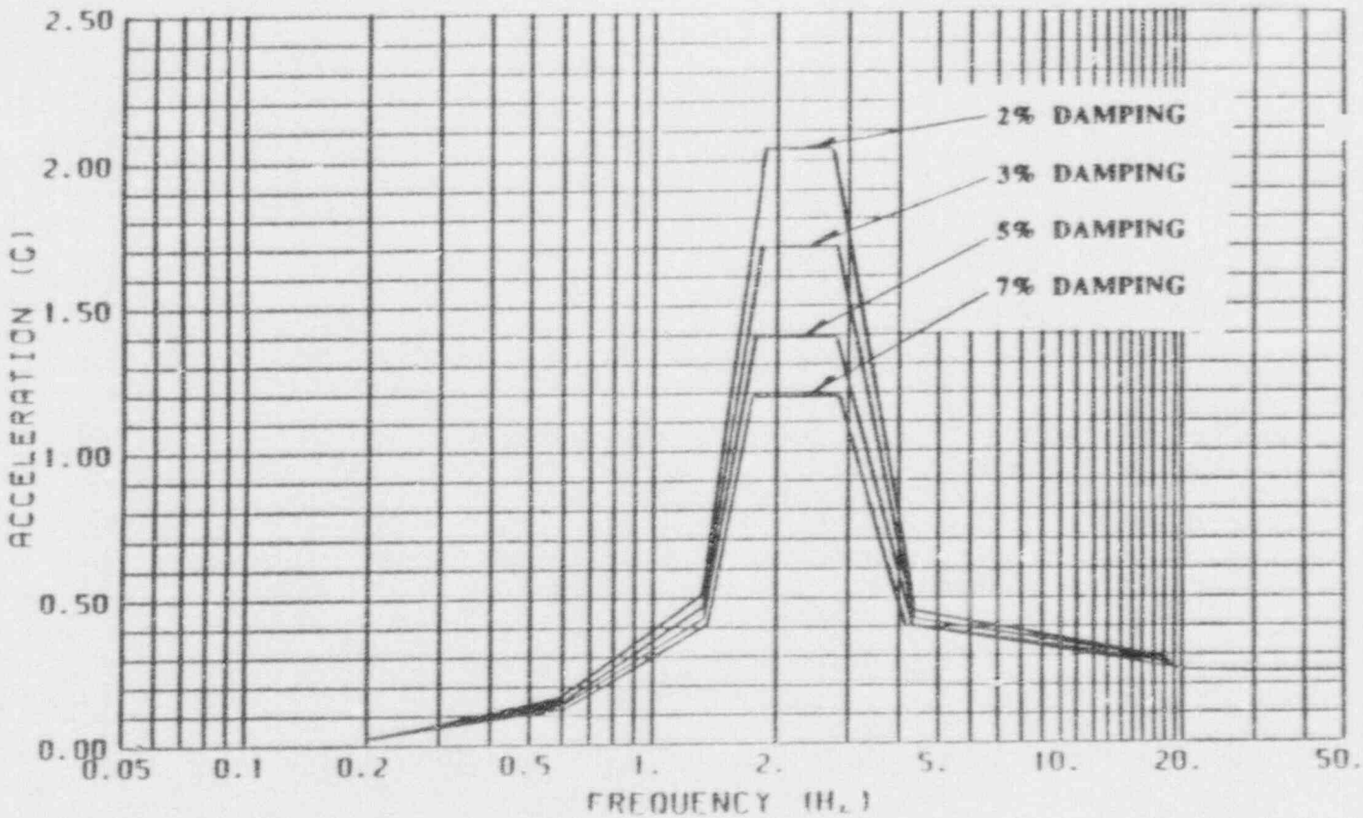


FIGURE 4.6 COMPARISON OF FREE-FIELD VERSUS INTAKE STRUCTURE EL. 985' RESPONSE SPECTRUM - VERTICAL DIRECTION, 2% DAMPING

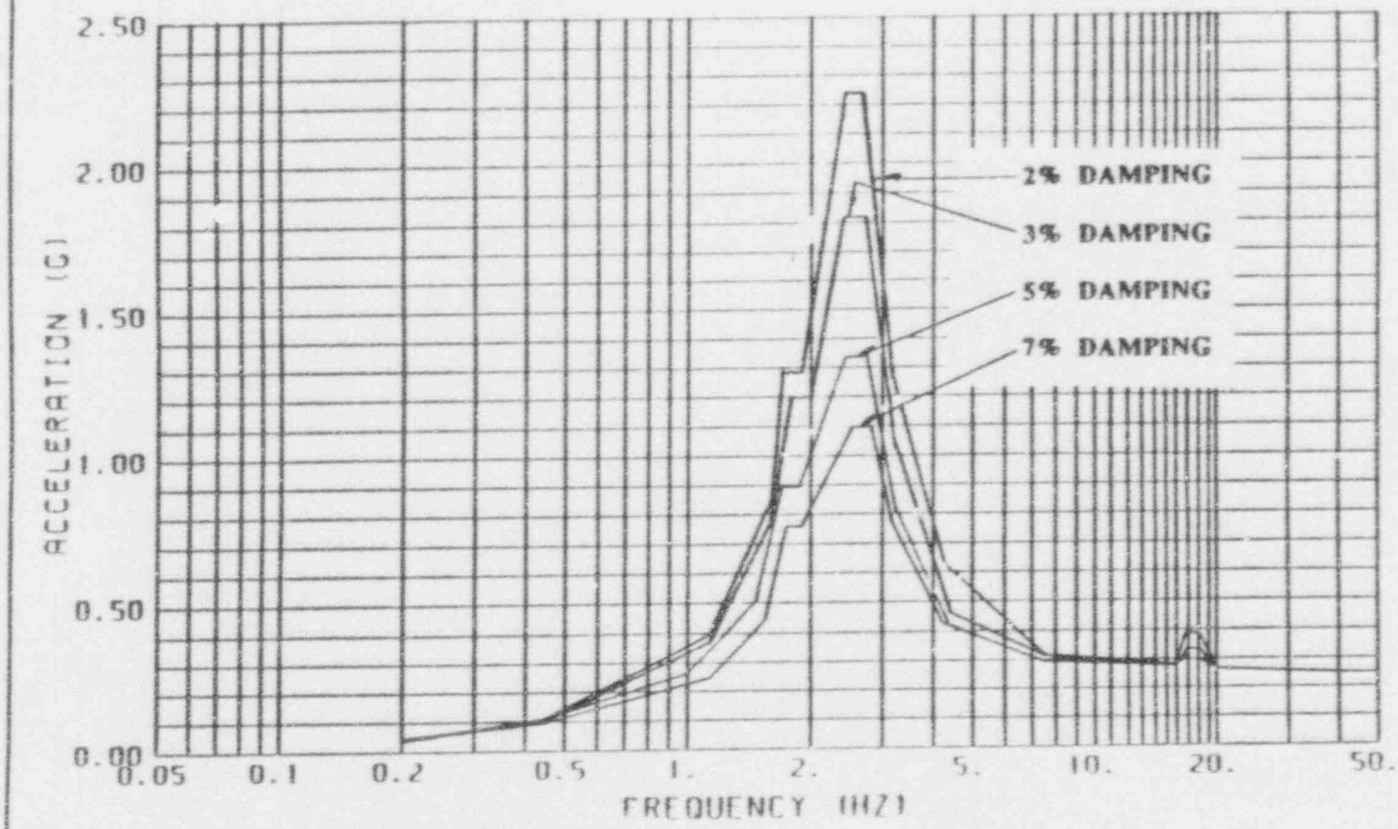
APPENDIX A

FORT CALHOUN STATION, UNIT 1
IN-STRUCTURE RESPONSE SPECTRA
AUXILIARY BUILDING/ CONTAINMENT STRUCTURE/ INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE

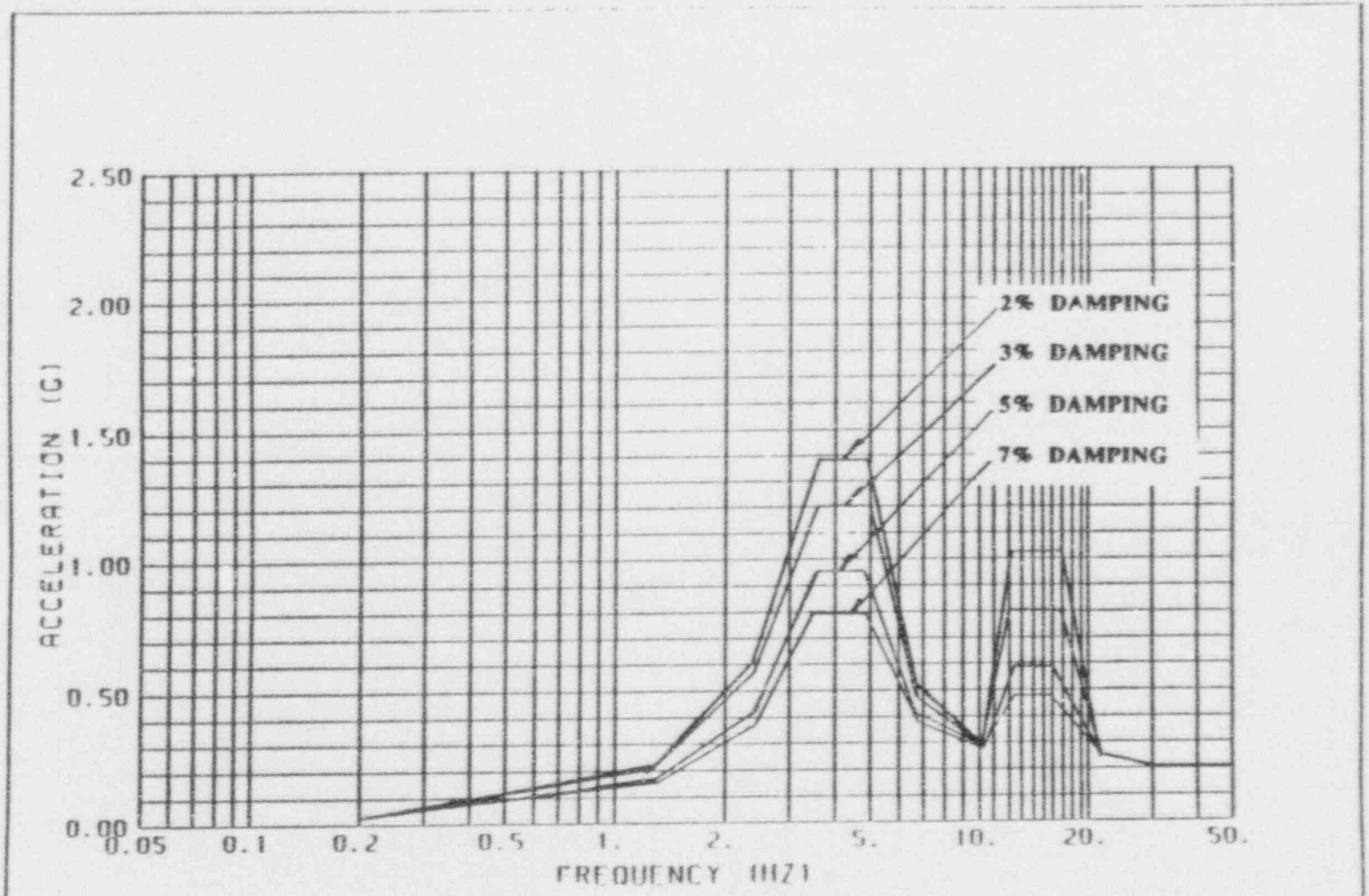
(48 pages; this cover page not included)



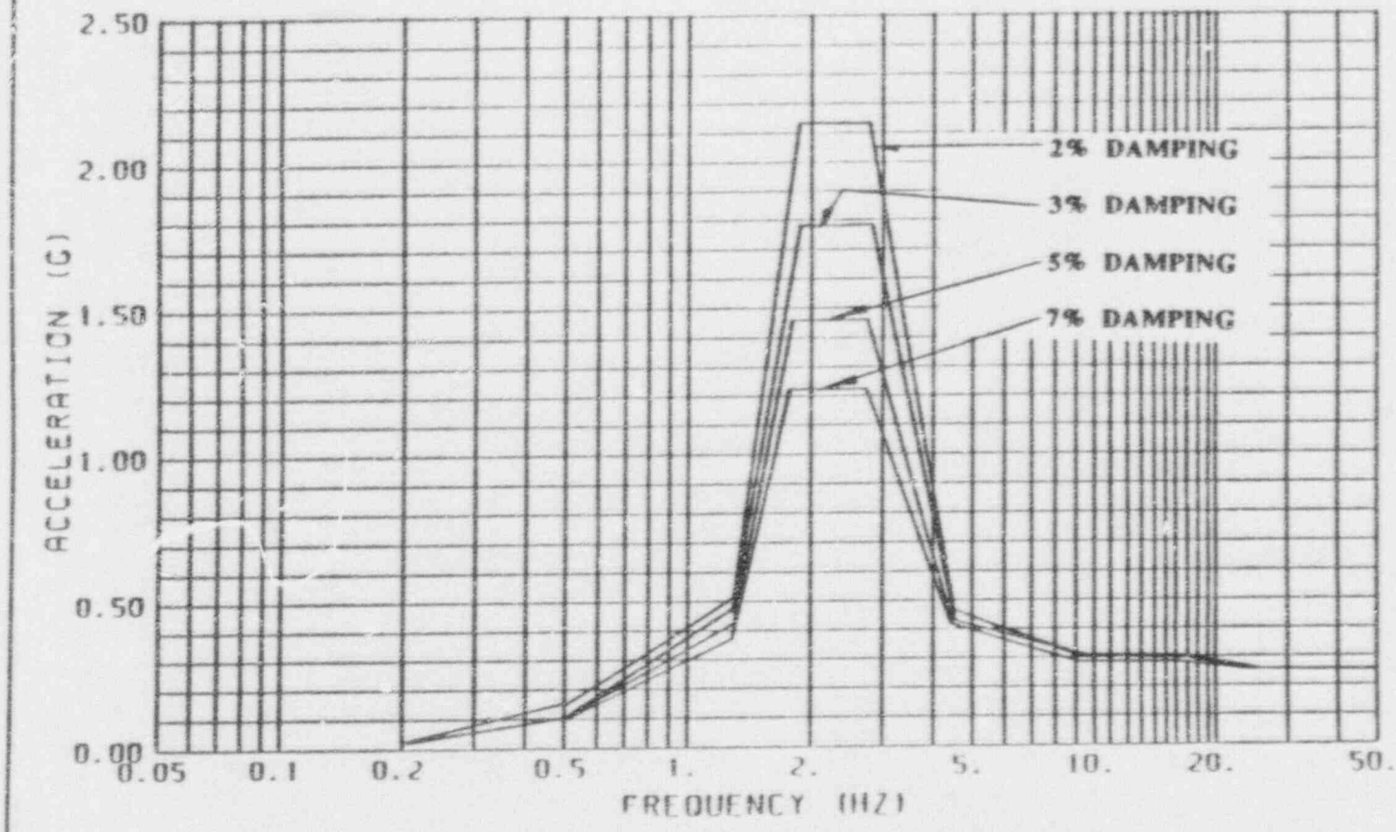
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 989'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY ADC DATE 7-1-92 CHKD [illegible] DATE [illegible]	SKETCH NO. REV.



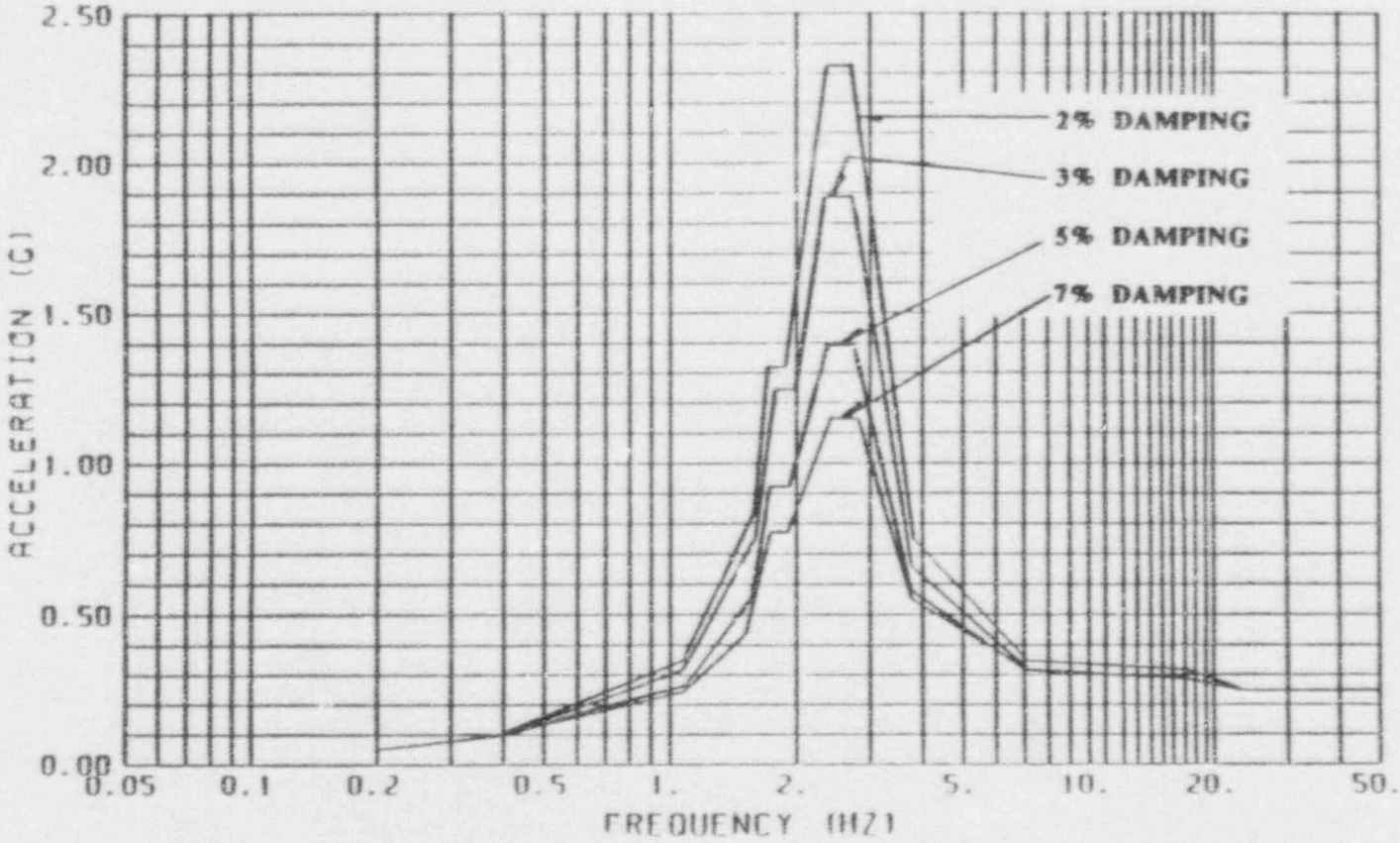
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 989'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY ADC DATE 7-1-92 CHKD AMW DATE 07/01/92	SKETCH NO REV



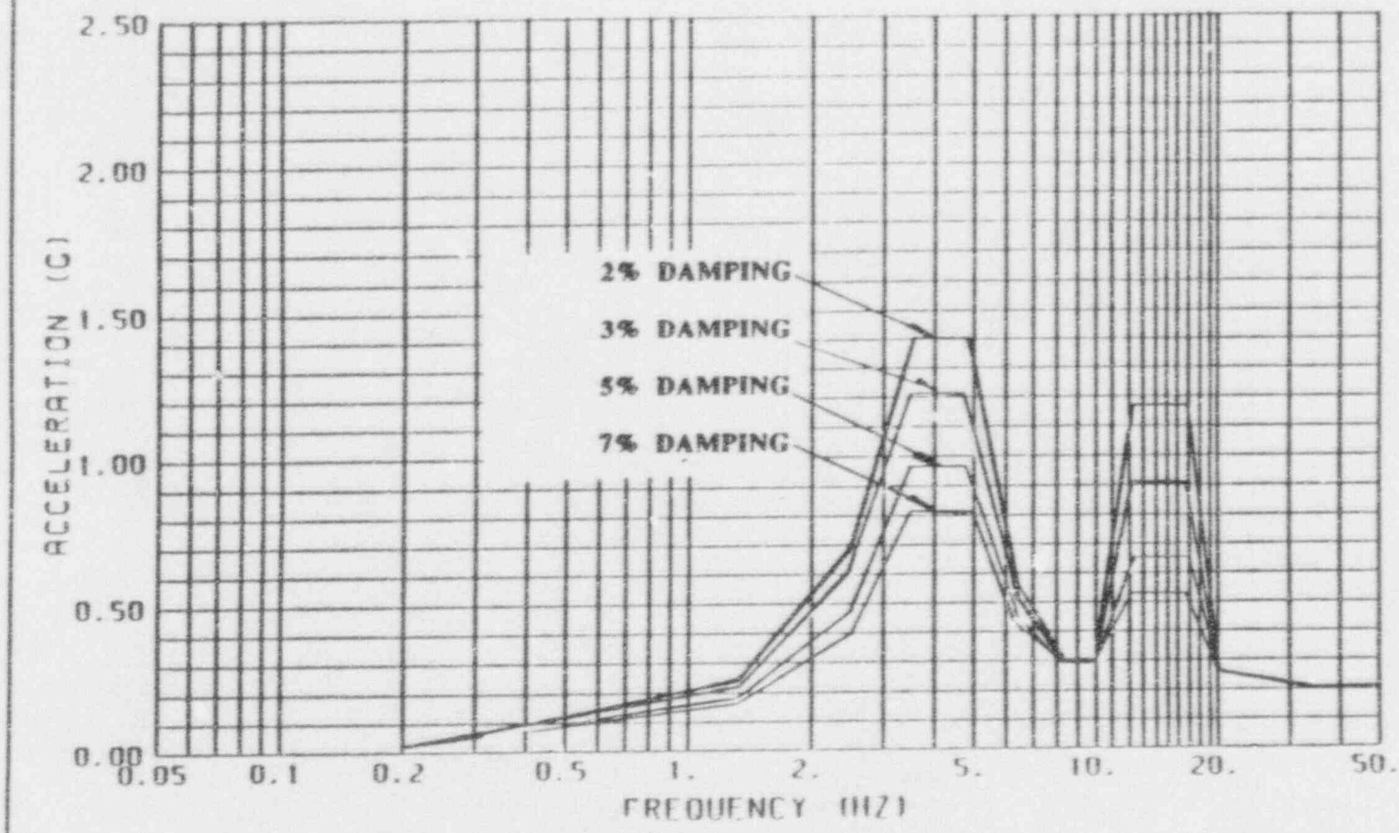
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 989'-0" AUXILIARY BUILDING	
SAFE SHUTDOWN EARTHQUAKE		
BY ADC DATE 7-1-92 CHKD [illegible] DATE 7/01/92	SKETCH NO.	REV.



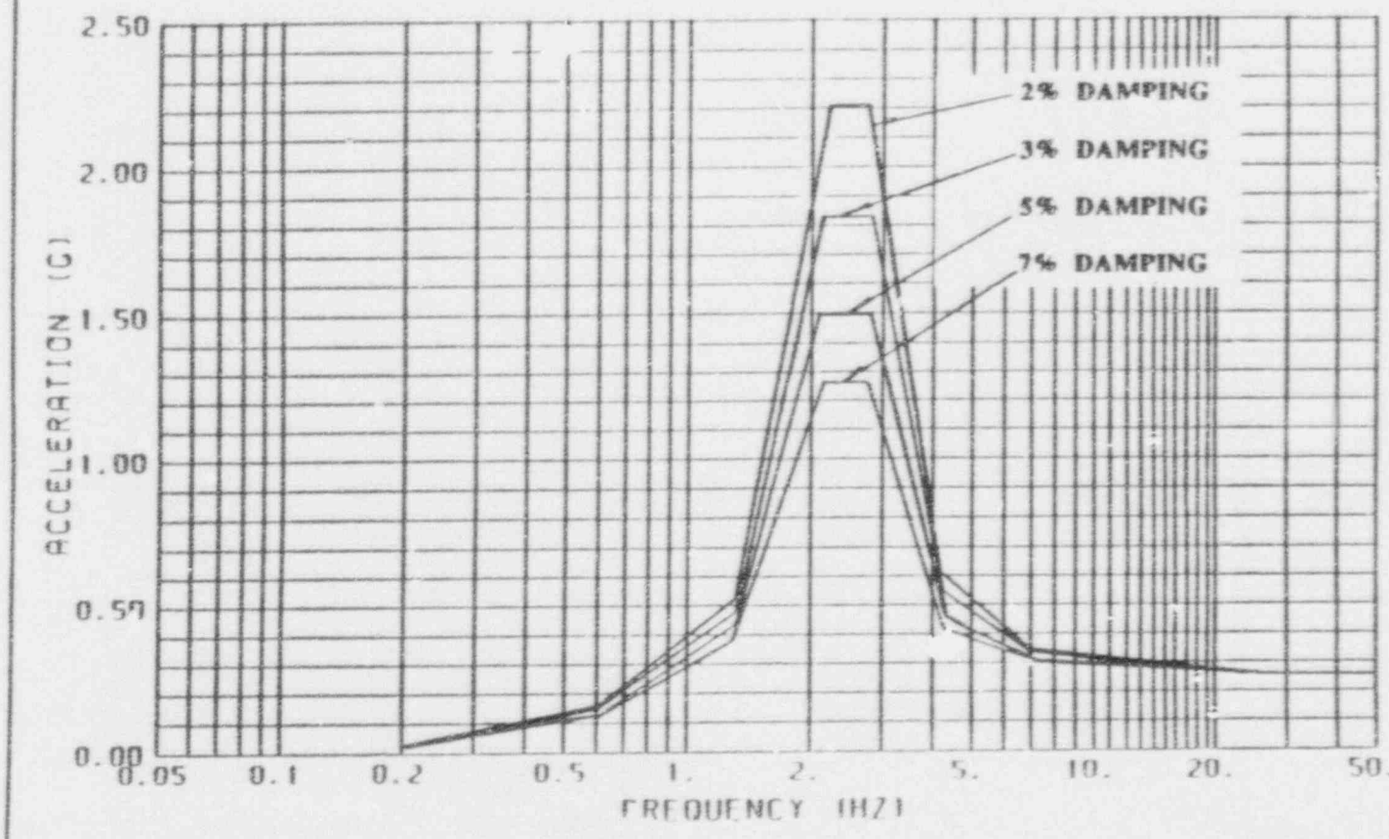
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1007'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY ARC DATE 7-1-92 CHKD AMM DATE 11/01/92	SKETCH NO. REV.



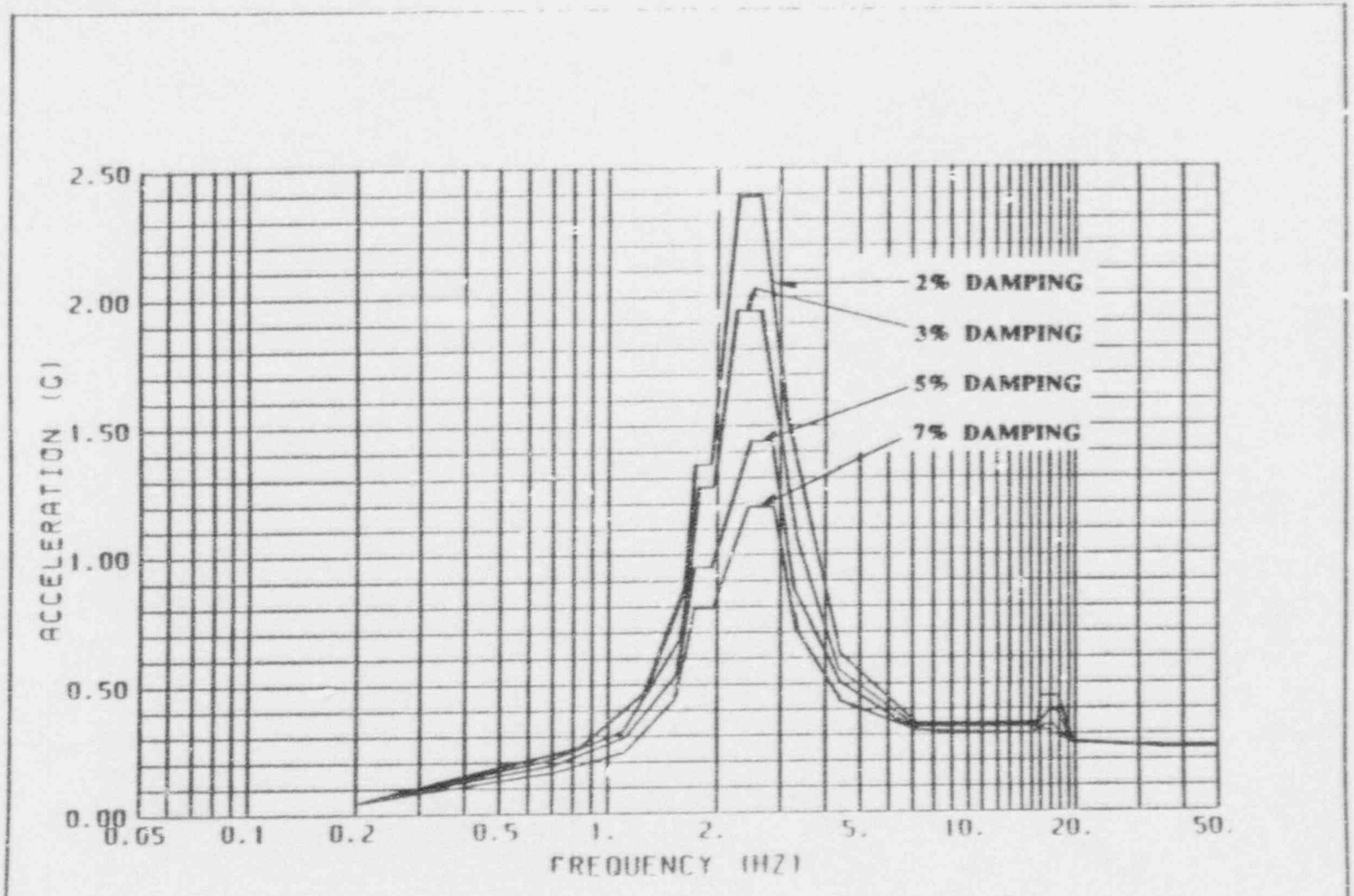
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1007'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY ADC DATE 7-1-92 CHKD AW DATE 07/01/92	SKETCH NO REV



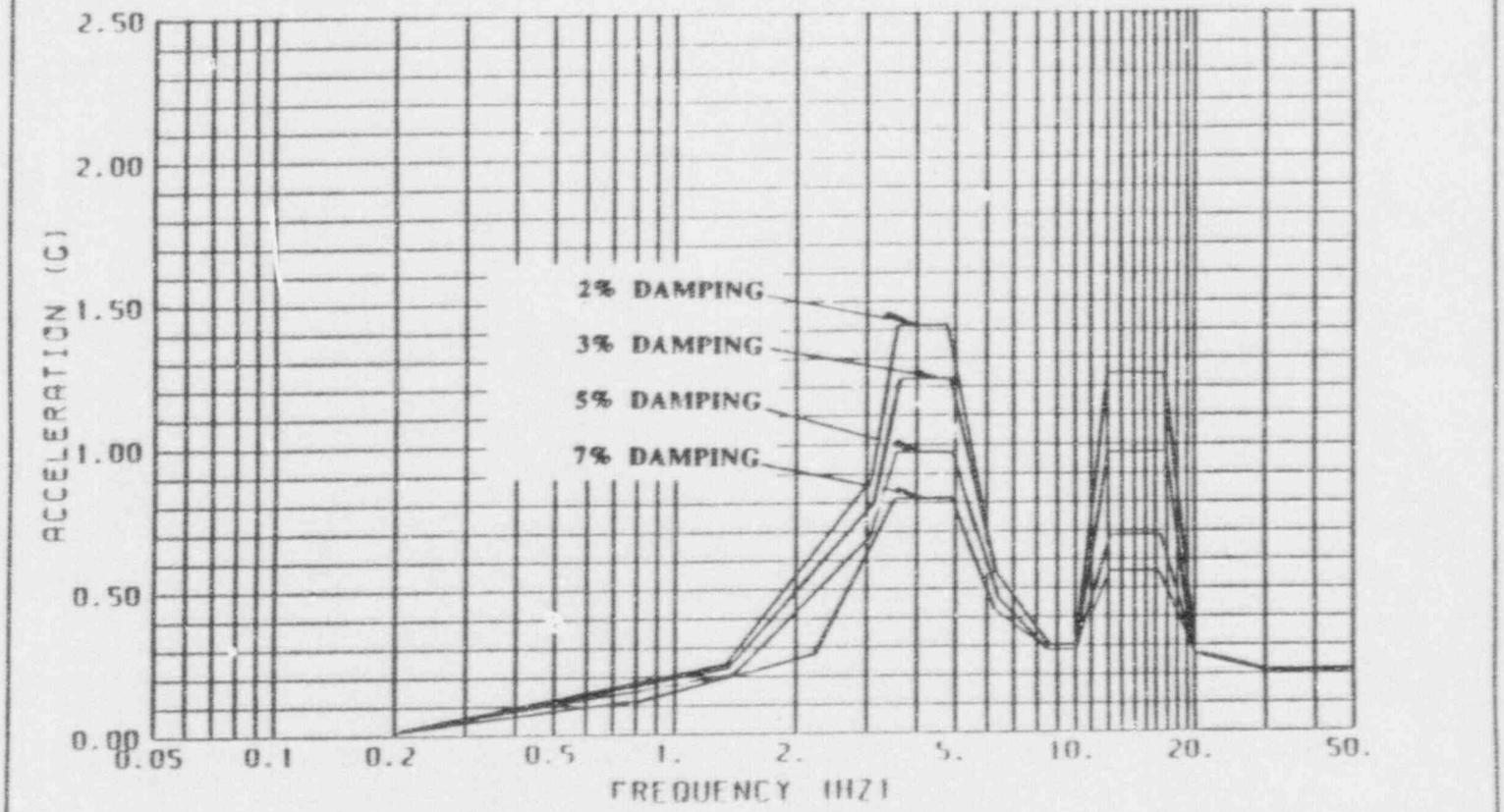
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1007'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY RPE DATE 7-1-92 CHKD [illegible] DATE 07/01/92	SKETCH NO. REV.



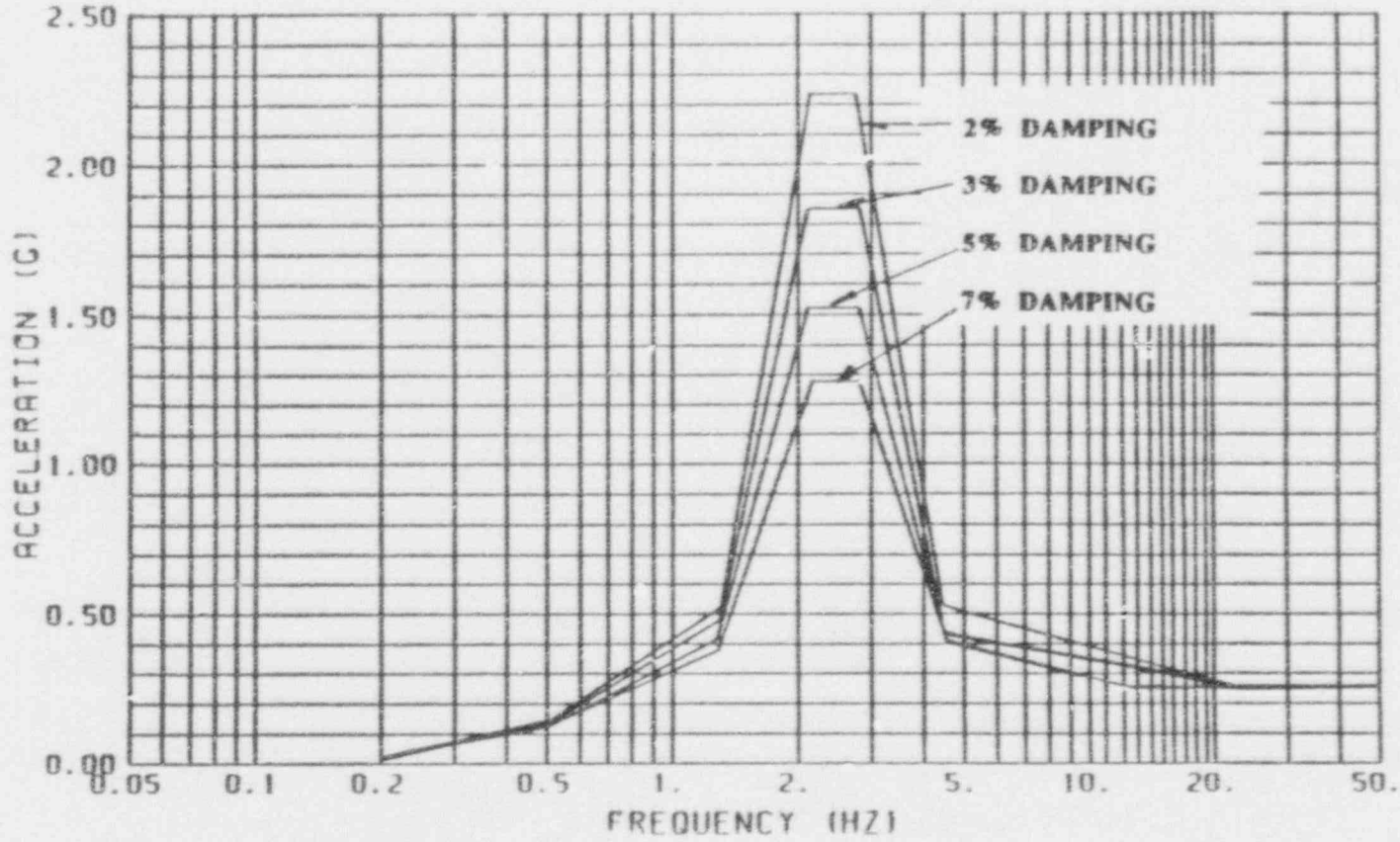
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1025'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY [illegible] DATE 7-1-92 CHKD [illegible] DATE 7/01/92	SKETCH NO. REV



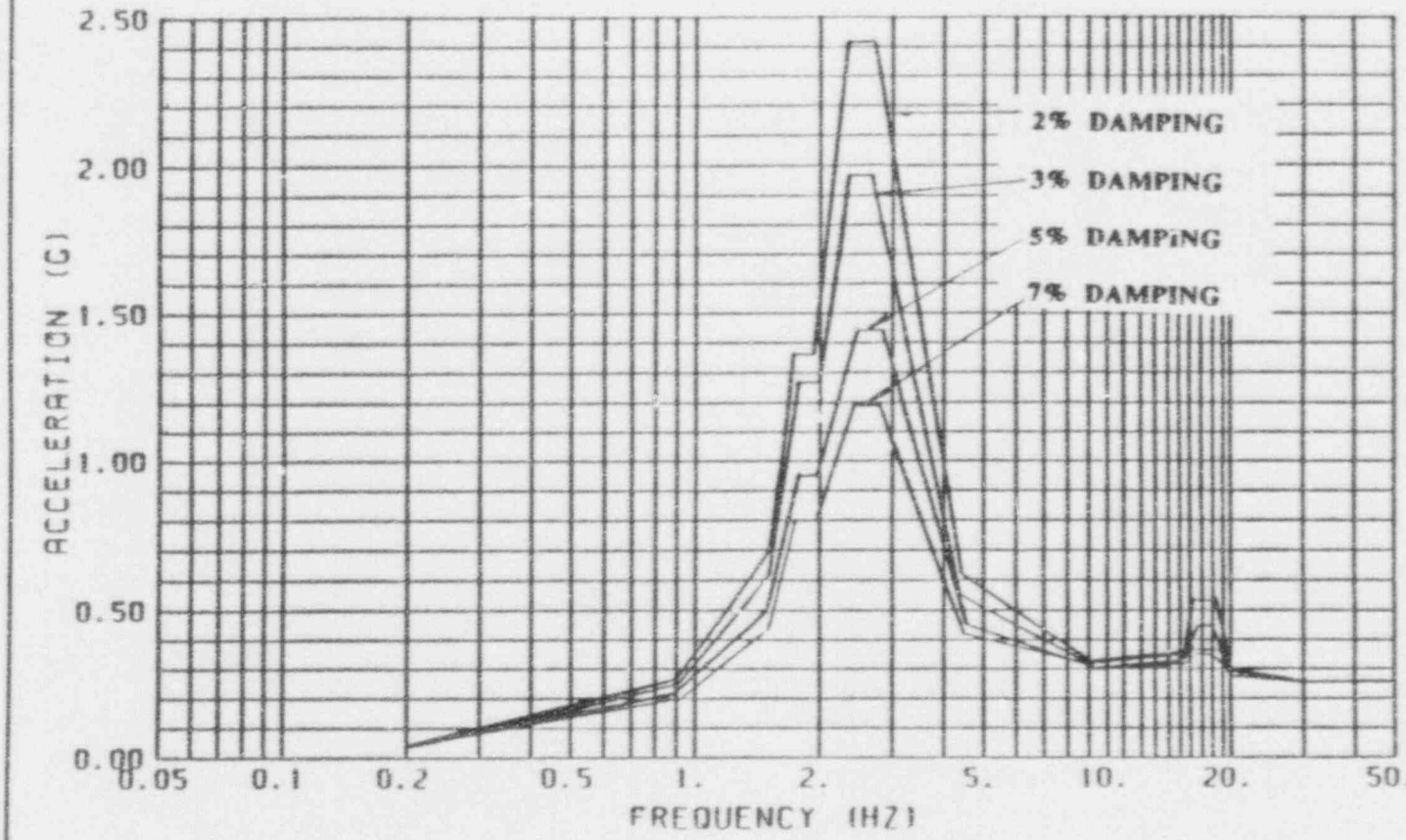
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1025'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY [illegible] DATE 7-1-92 CHKD AWJ DATE 07/01/92	SKETCH NO. REV



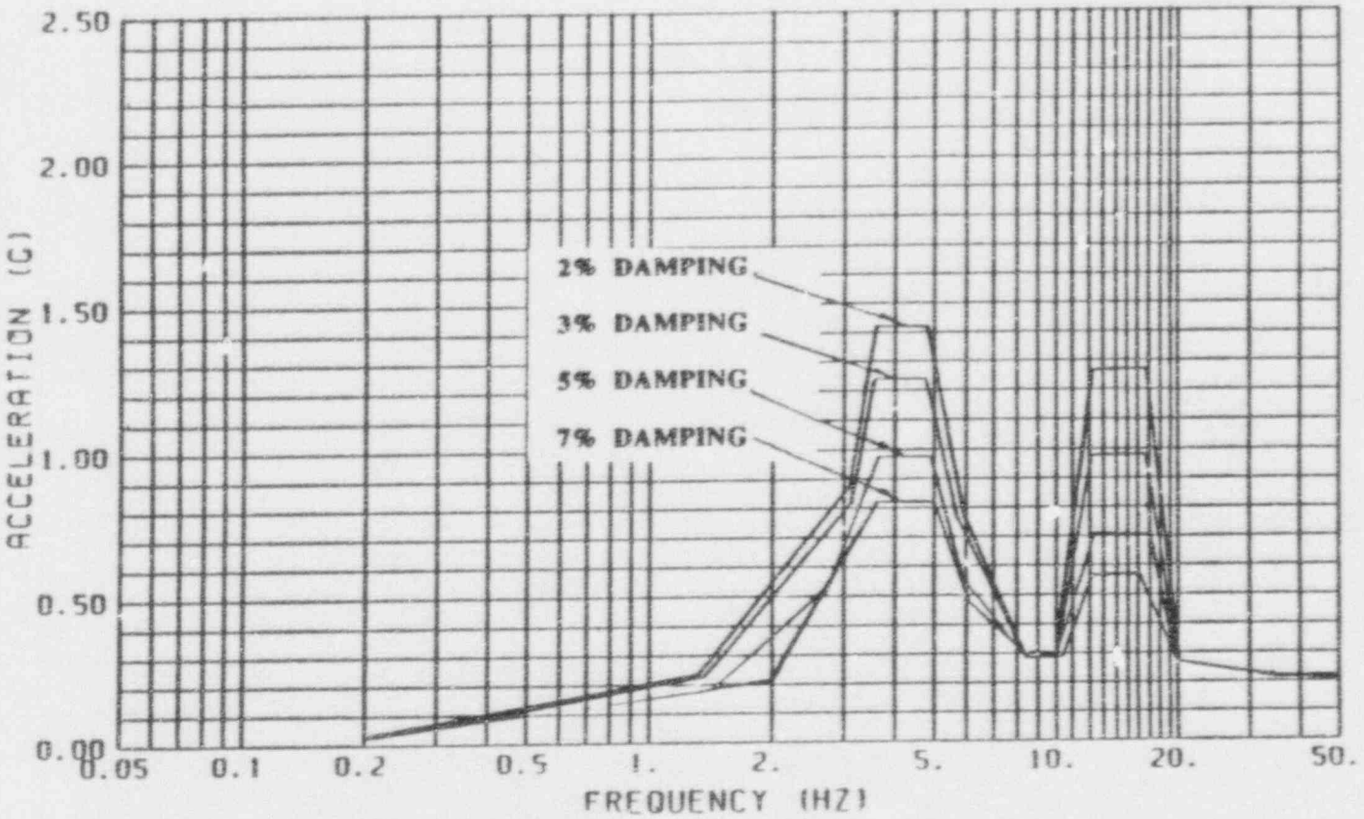
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1025'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY DATE 7-1-92 CHKD DATE 07/01/92	SKETCH NO REV



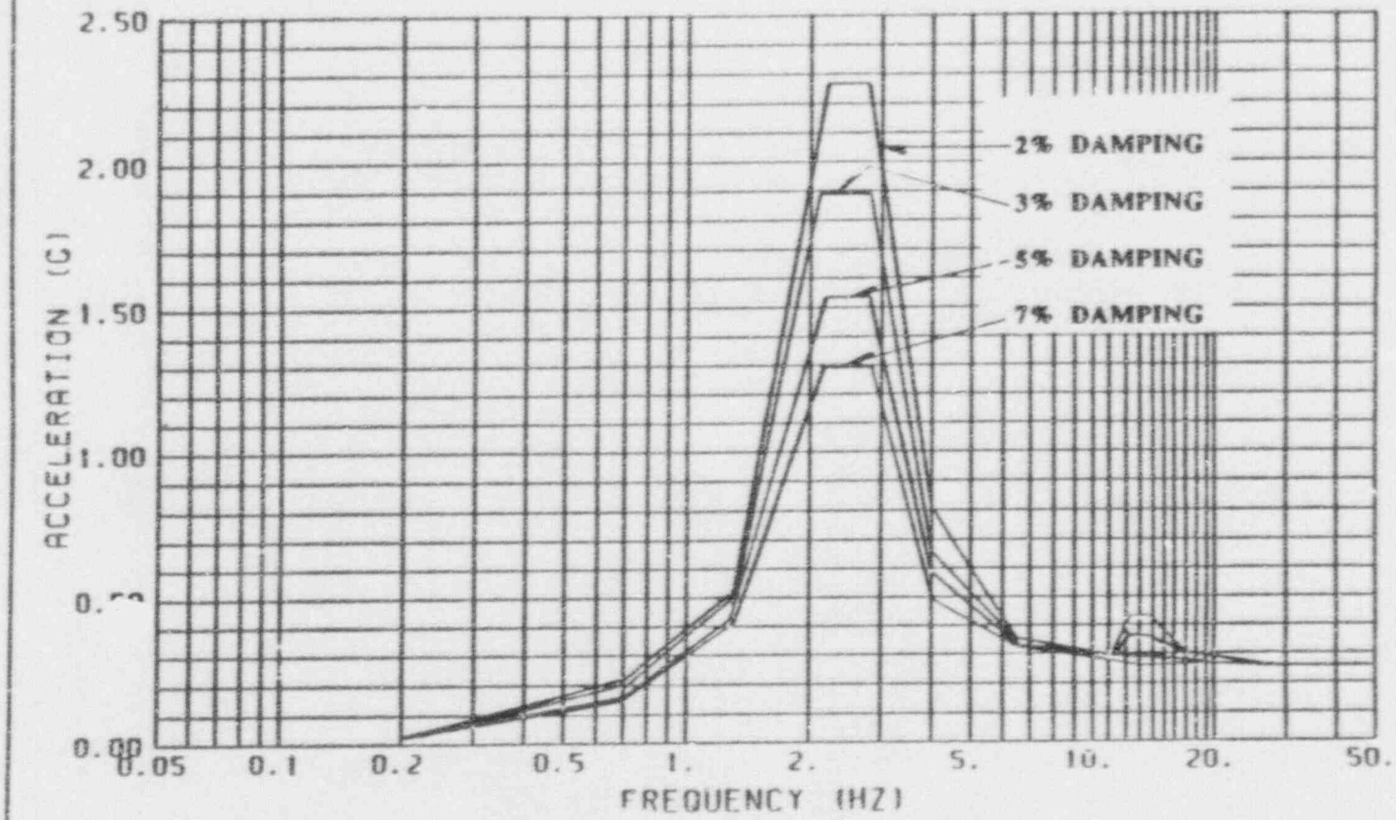
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1036'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY DMC DATE 7-1-92 CHKD AMN DATE 7/11/92	SKETCH NO. REV.



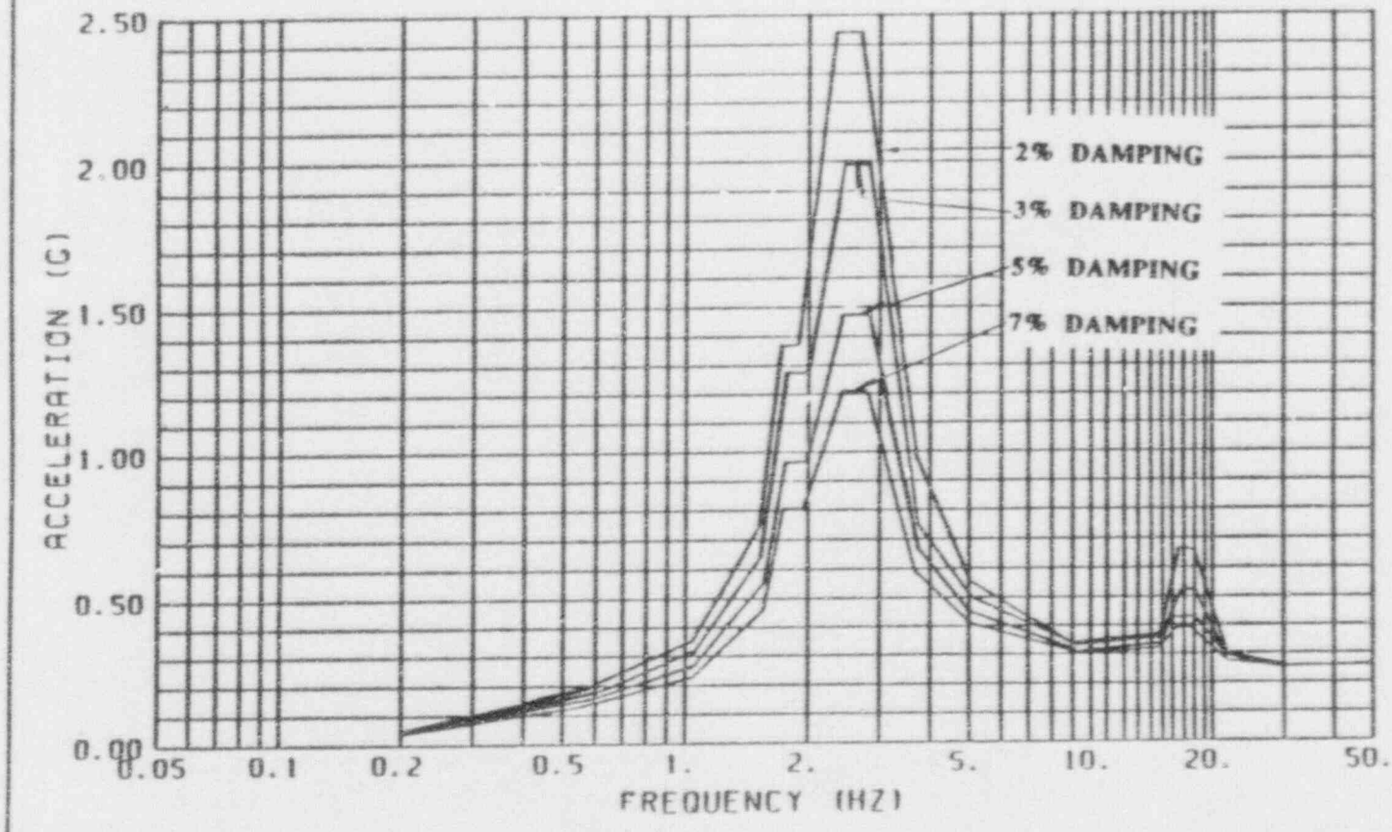
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1036'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY Amc DATE 7-1-92 CHKD Ann DATE 07/01/92	SKETCH NO. REV.



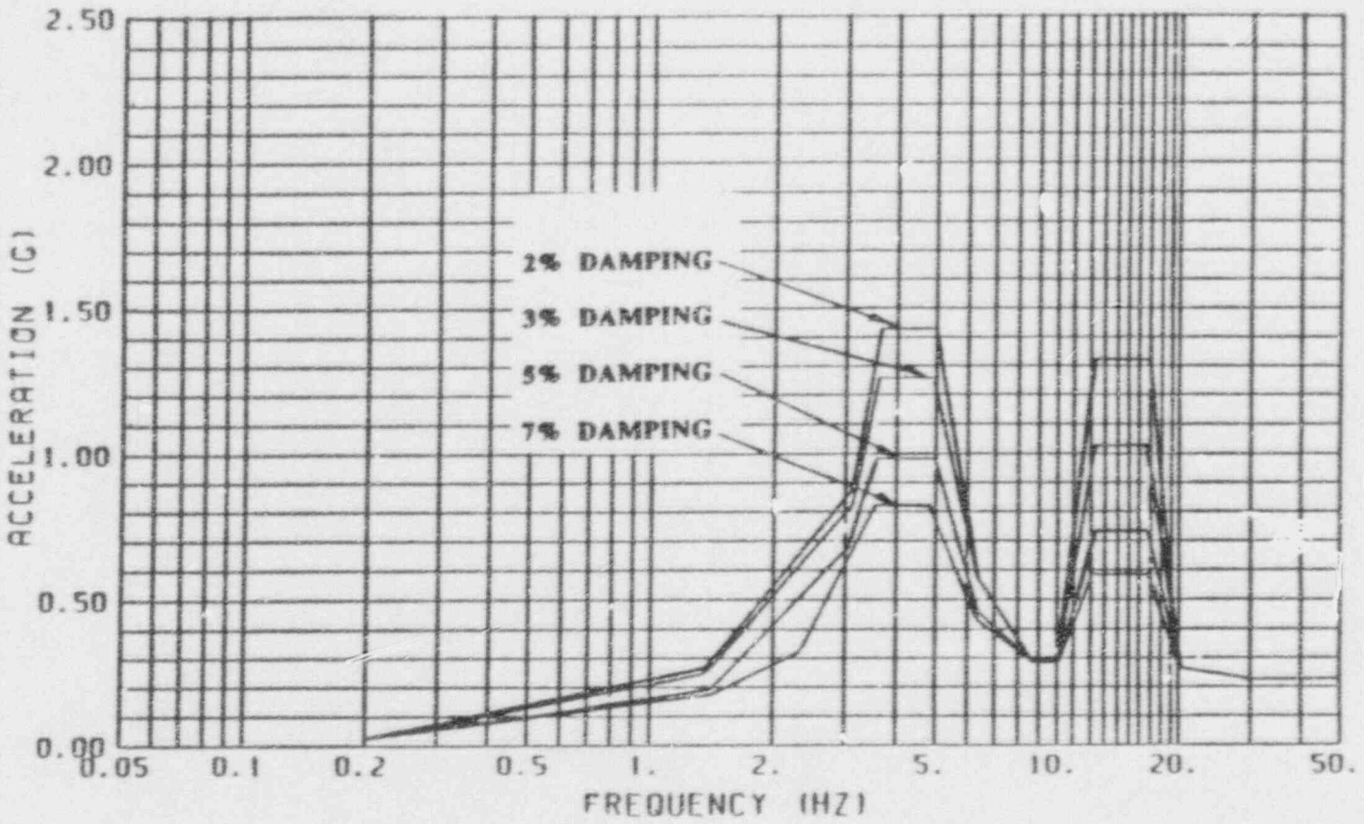
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1036'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY AMC DATE 7-1-92 CHKD AMM DATE 07/01/92	SKETCH NO. REV.



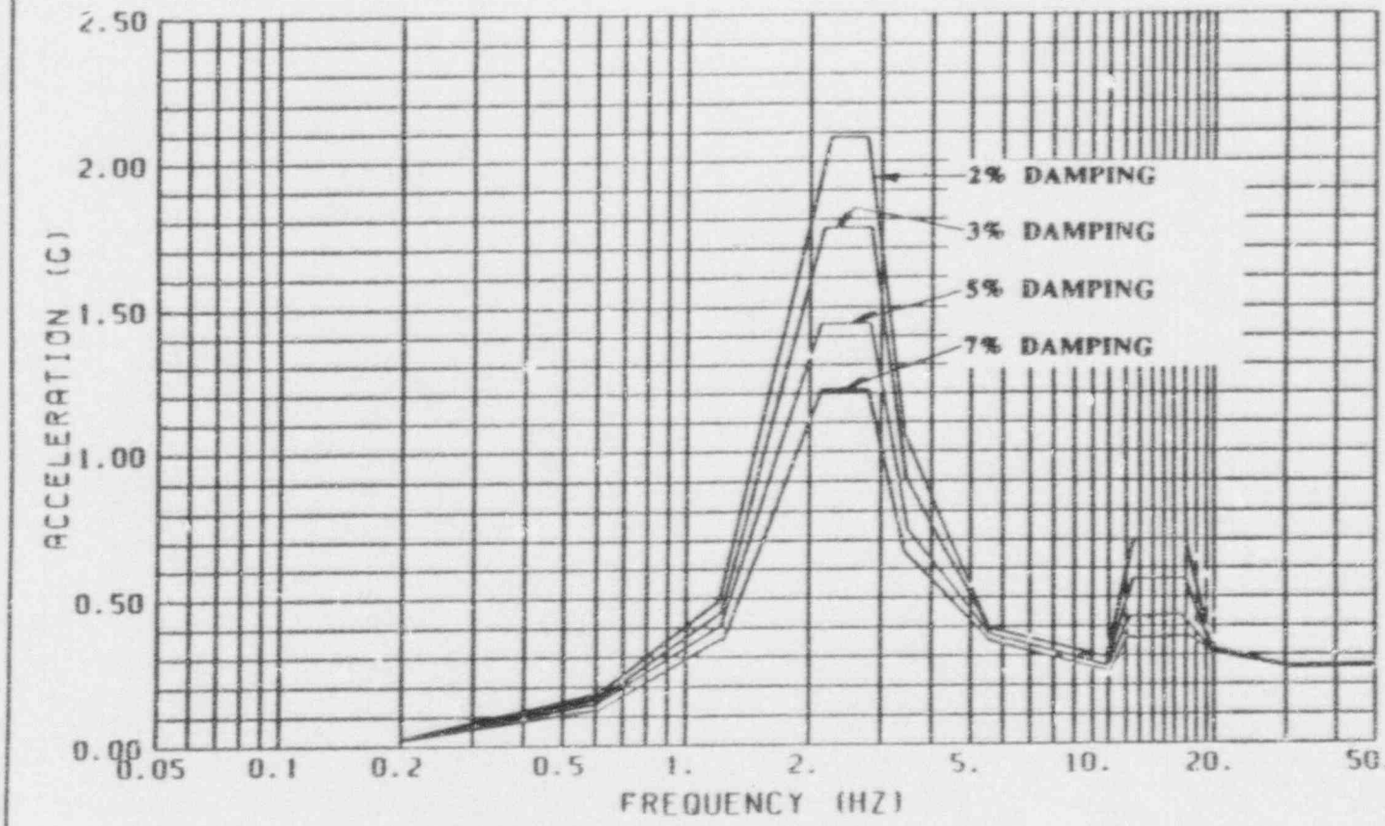
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1044'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY RMC DATE 7-1-92 CHKD AmJ DATE 07/01/92	SKETCH NO. REV.



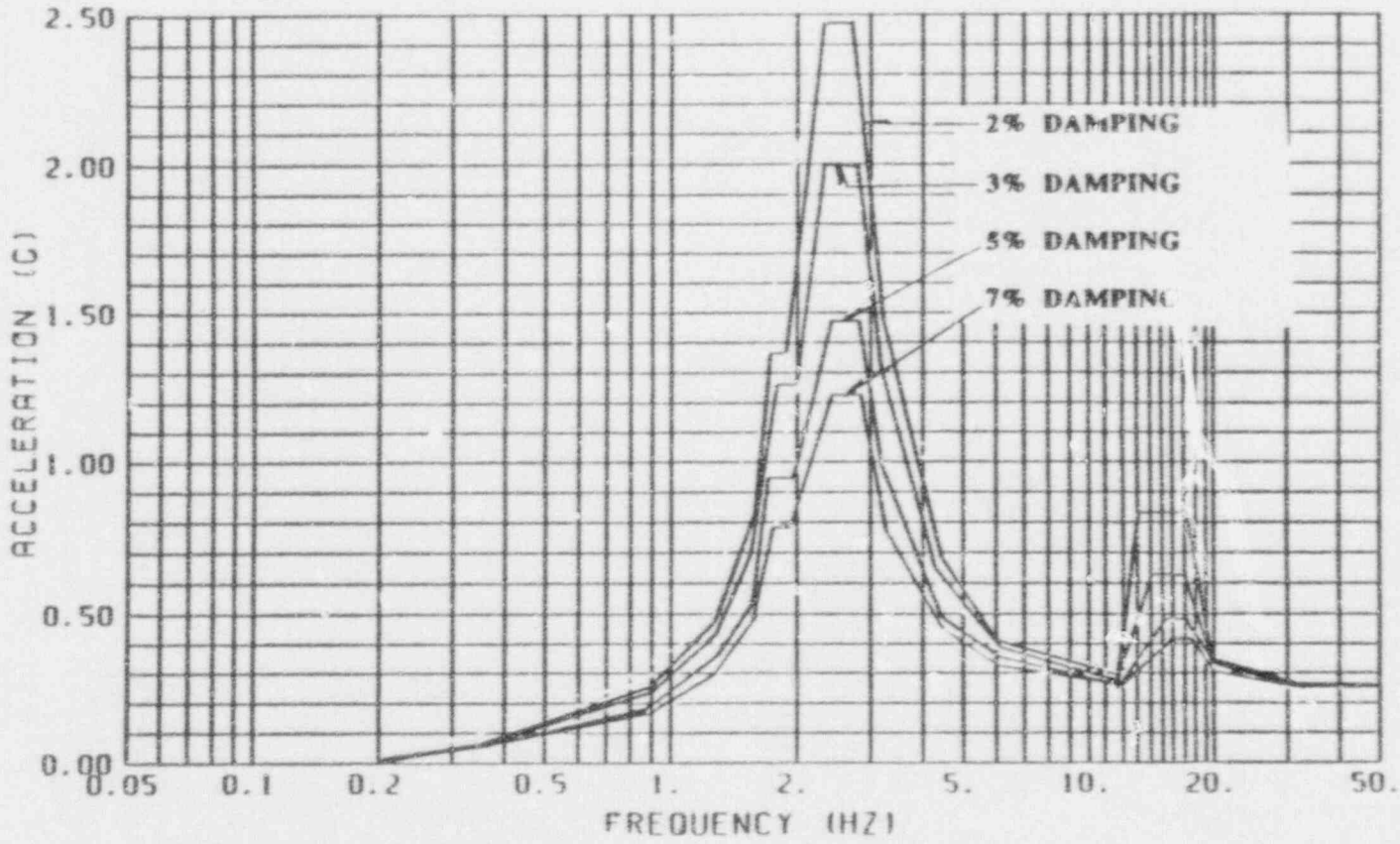
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1044'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY ATC DATE 7-1-92 CHKD [illegible] DATE 07/01/92	SKETCH NO. REV.



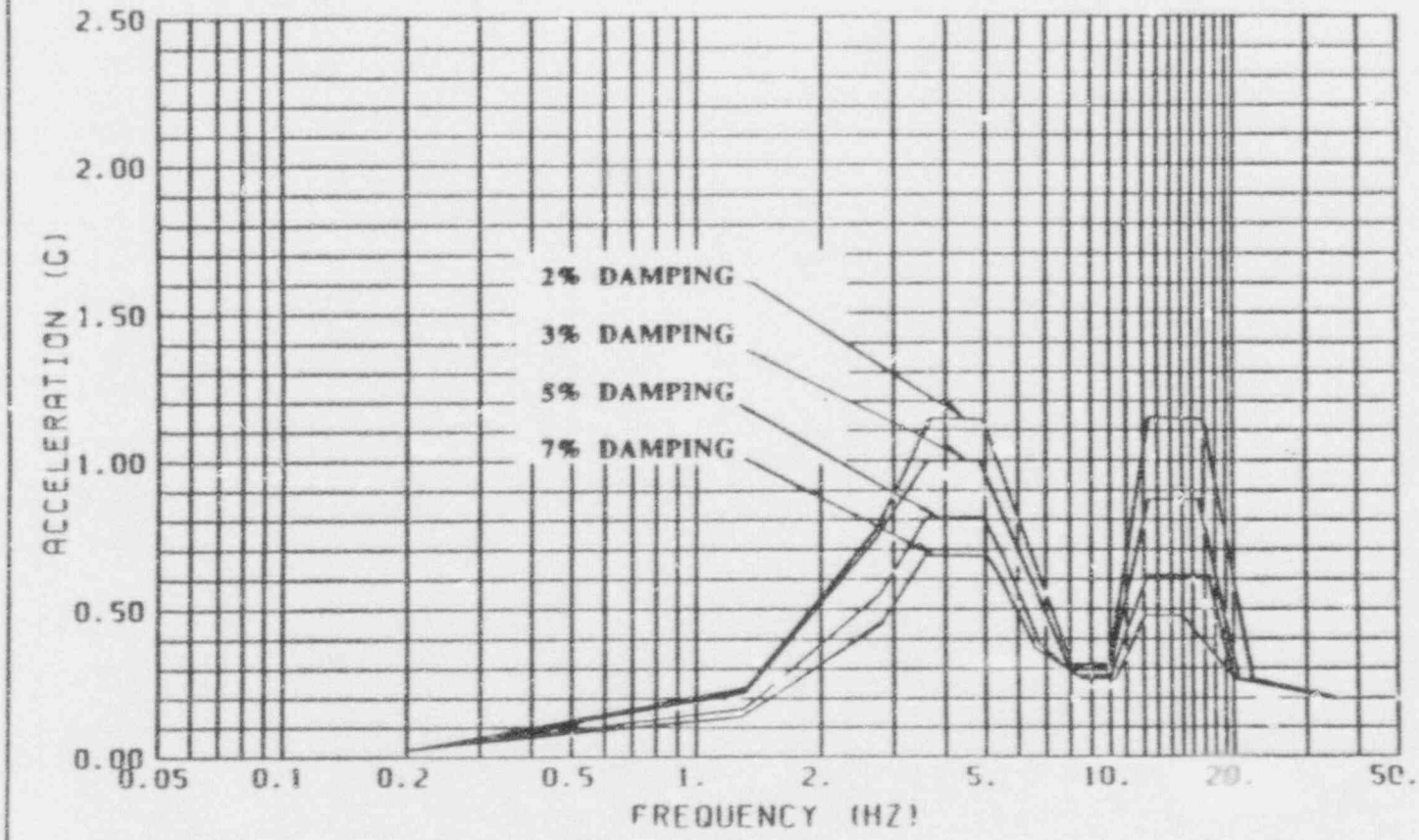
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1044'-0" AUXILIARY BUILDING	
SAFE SHUTDOWN EARTHQUAKE		
BY [illegible] DATE 7-1-92 CHKD [illegible] DATE 07/01/92	SKETCH NO.	REV.



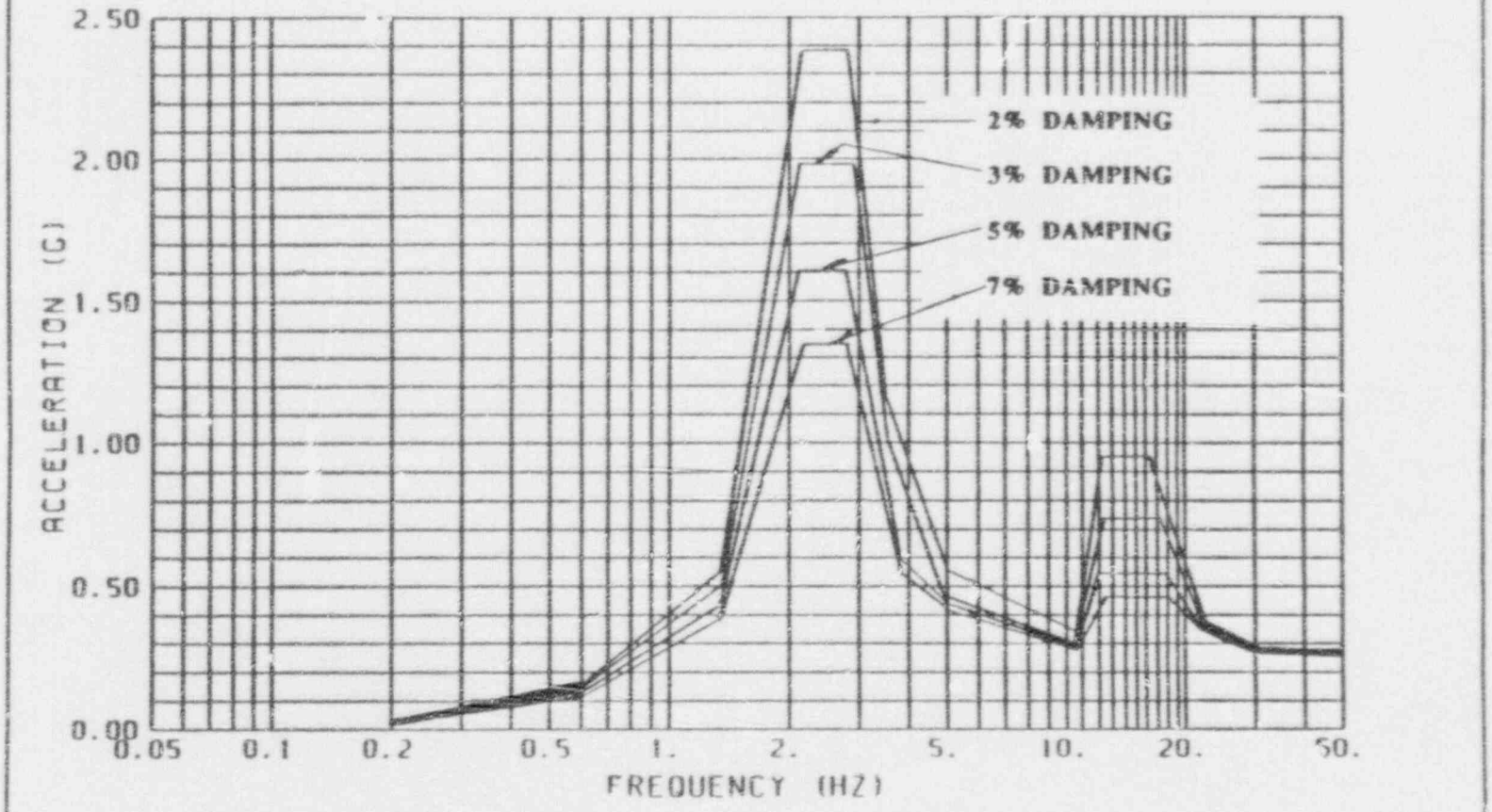
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1057'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY mre DATE 7-1-92 CHKD AWJ DATE 07/01/92	SKETCH NO. REV. 5



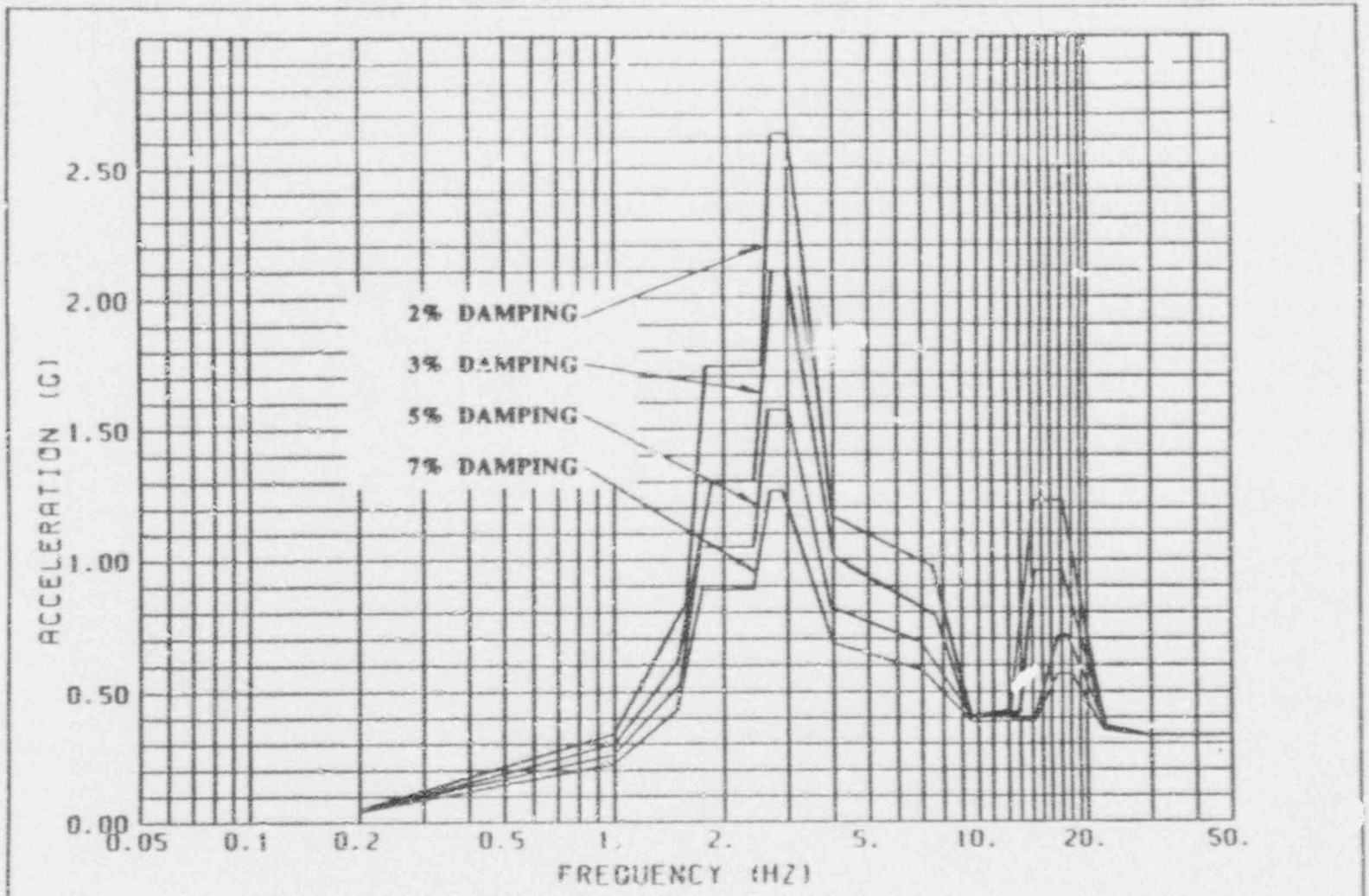
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1057'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY [illegible] DATE 7-1-92 CHKD [illegible] DATE 07/01/92	SKETCH NO. REV.



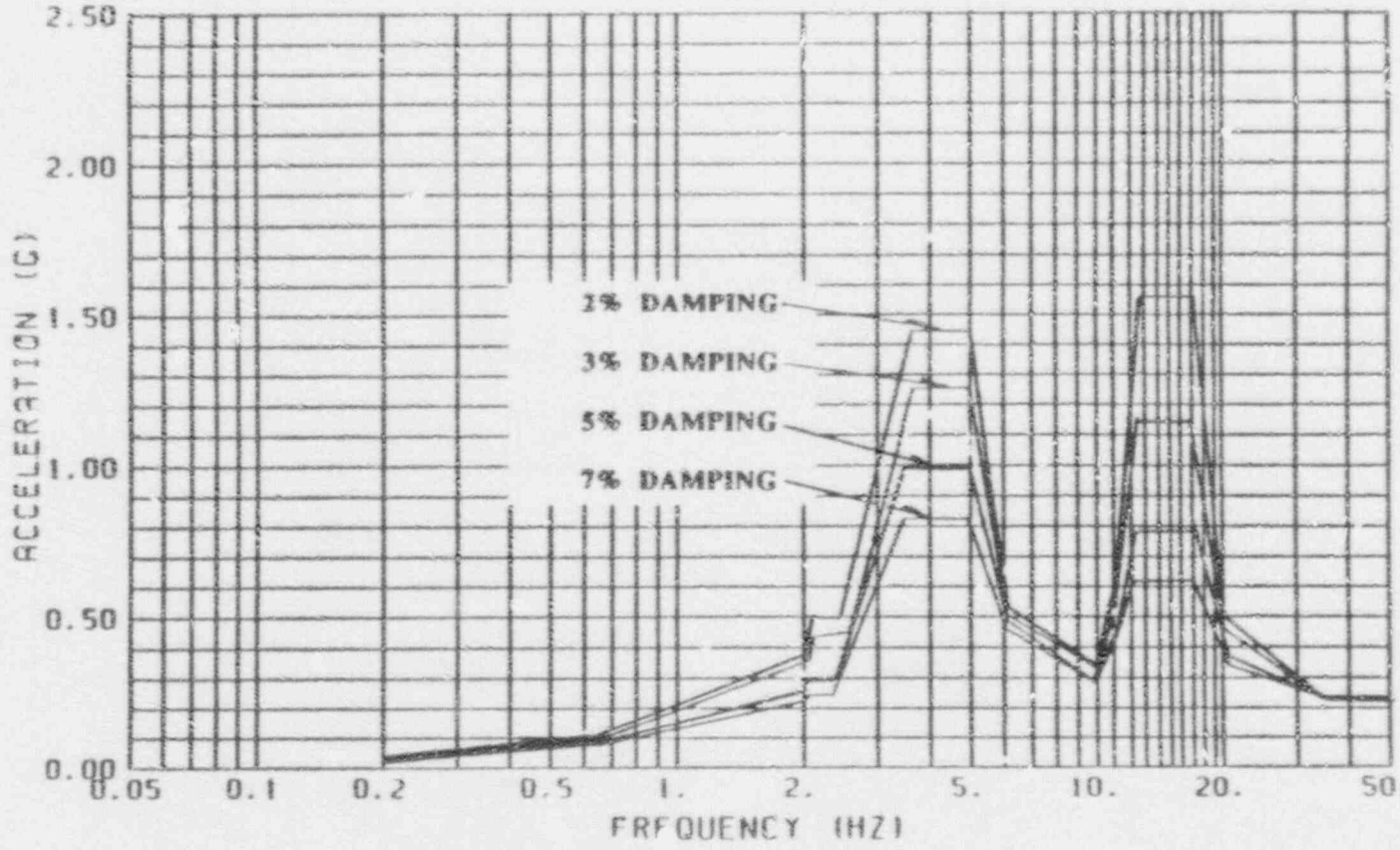
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1057'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY Ame DATE 7-1-92 CHKD Ame DATE 07/01/92	SKETCH NO. REV.



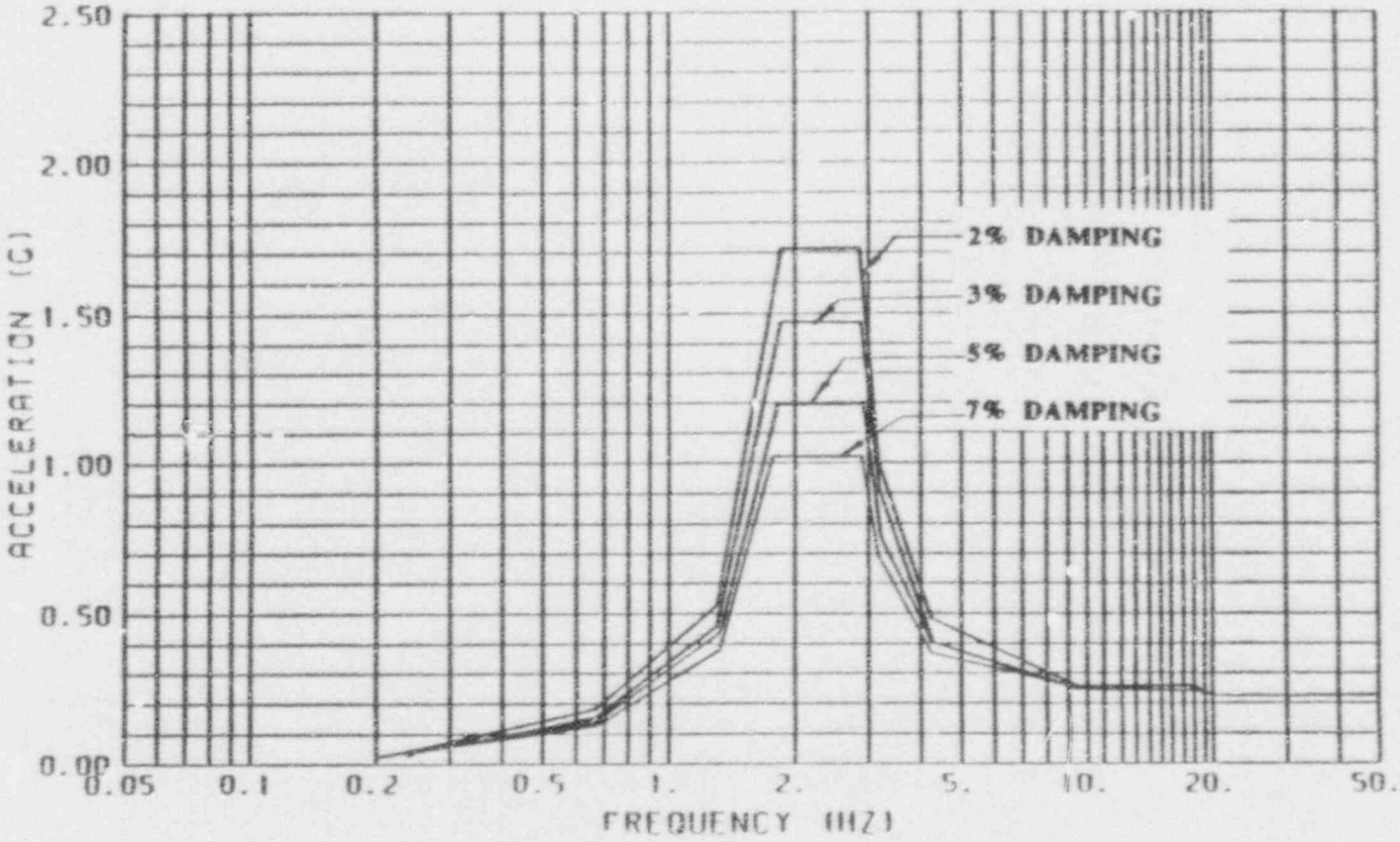
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1083'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY DATE 7-1-92 CHKD DATE 07/01/92	SKETCH NO. REV.



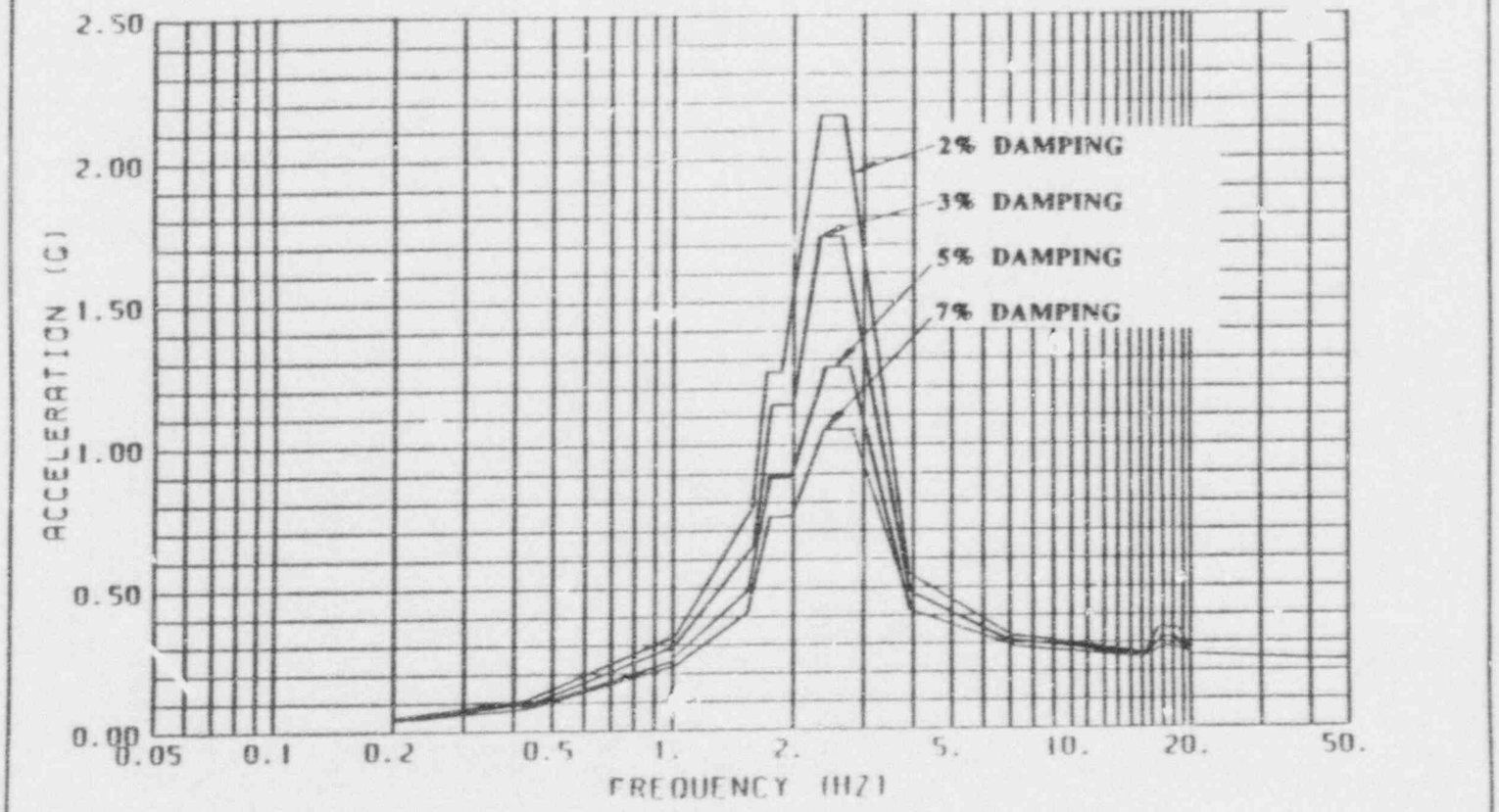
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1083'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY Axc DATE 7-1-92 CHKD Ann DATE 07/01/92	SKETCH NO. REV.



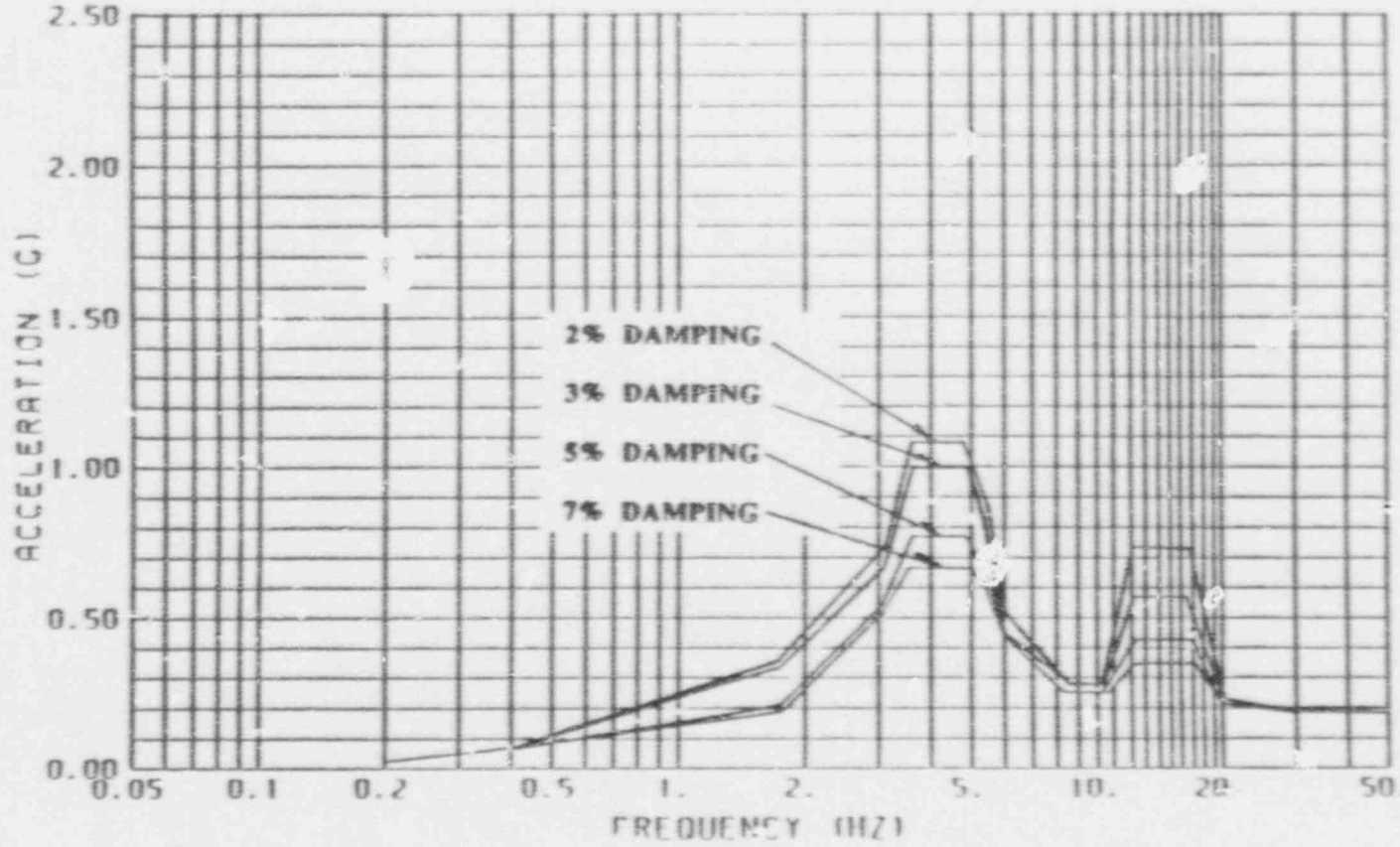
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1083'-0" AUXILIARY BUILDING	
SAFE SHUTDOWN EARTHQUAKE		
BY [illegible] DATE 7-1-92 CHKD AMJ DATE 07/01/92	SKETCH NO.	REV.



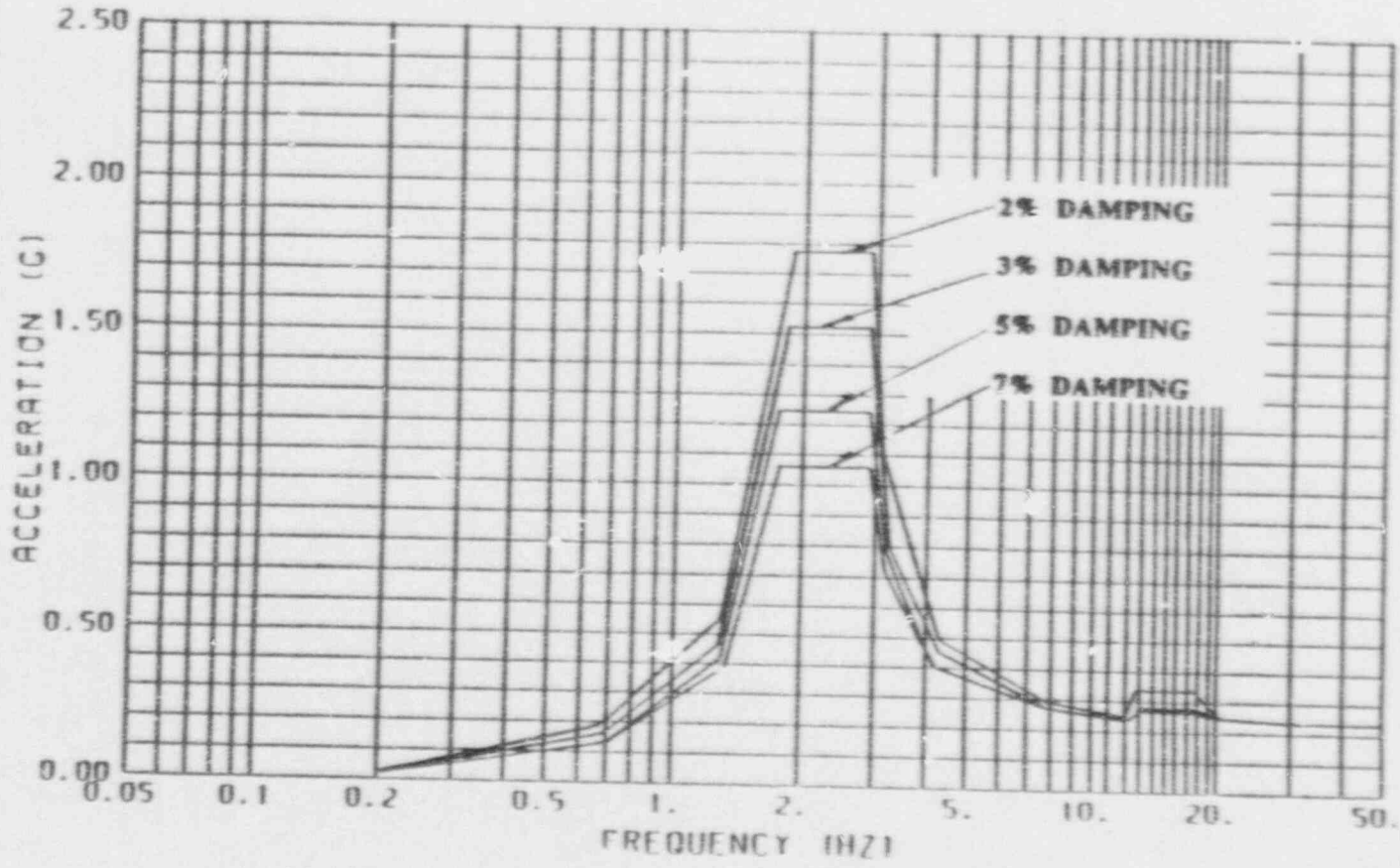
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 994'-0" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY [illegible] DATE 7-1-92 CHKD [illegible] DATE 07/01/92	SKETCH NO. REV.



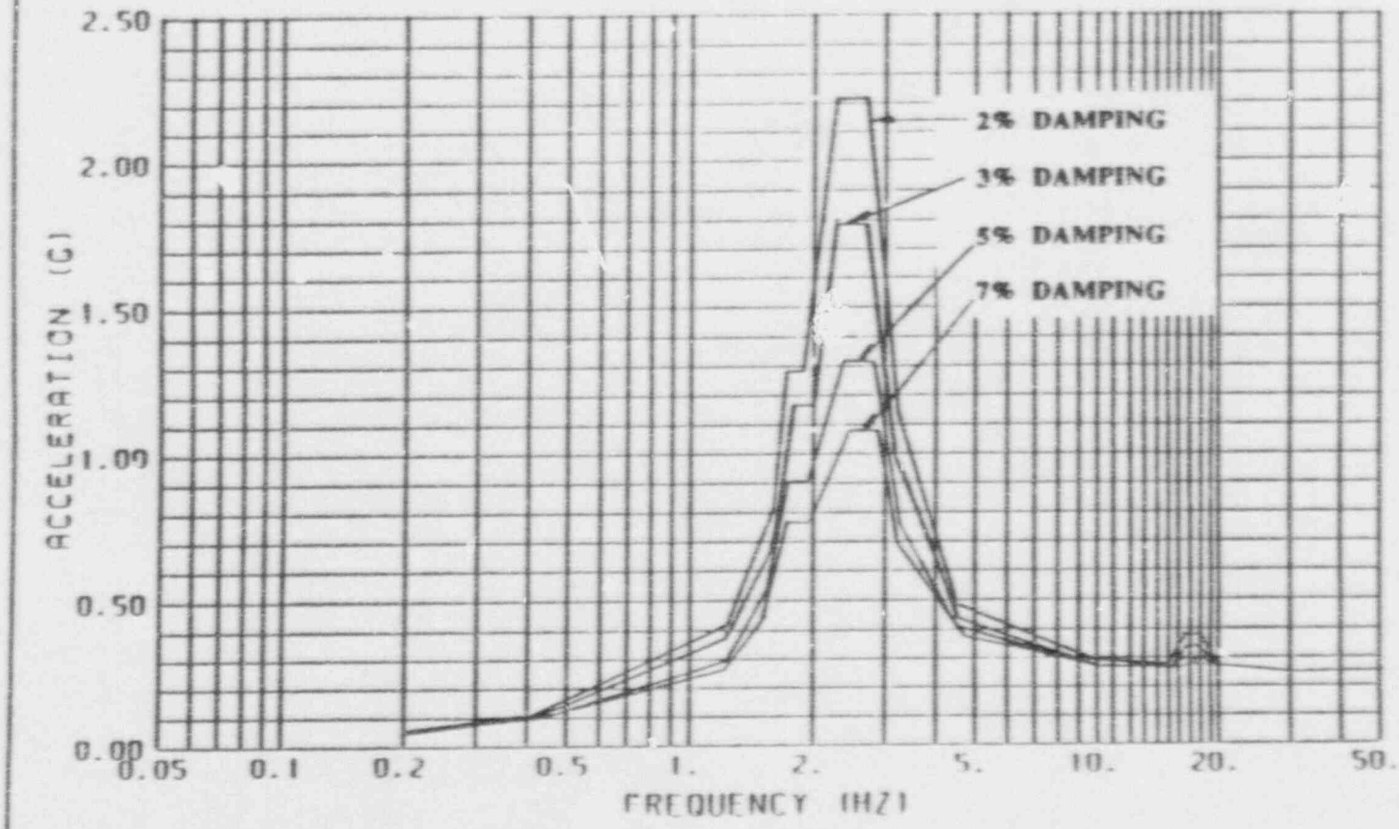
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 994'-0" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY ATC DATE 7-1-92 CHKD AWW DATE 07/01/92	SKETCH NO. REV.



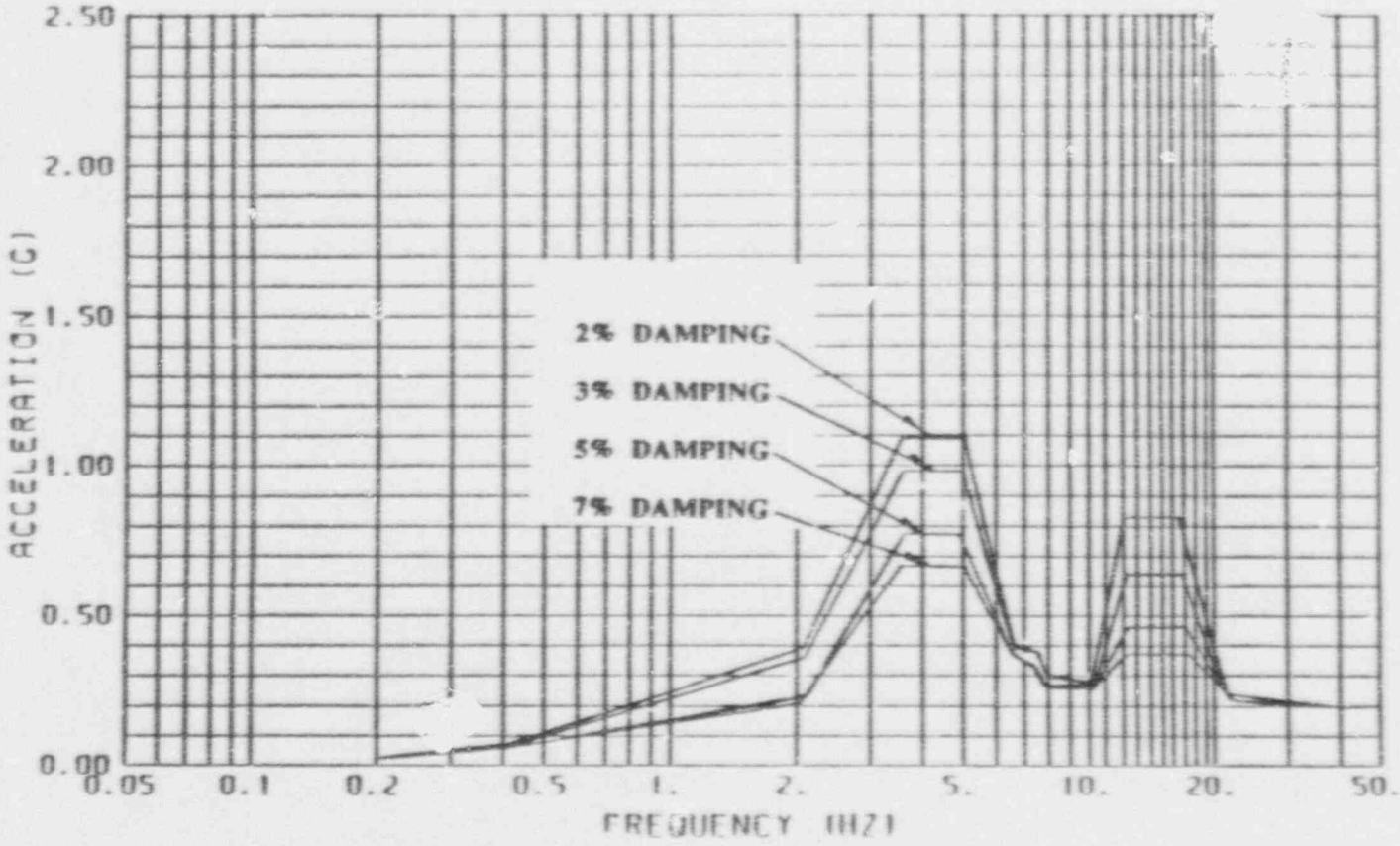
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 994'-0" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY ADC DATE 7-1-92 CHKD AW DATE 07/01/92	SKETCH NO. REV.



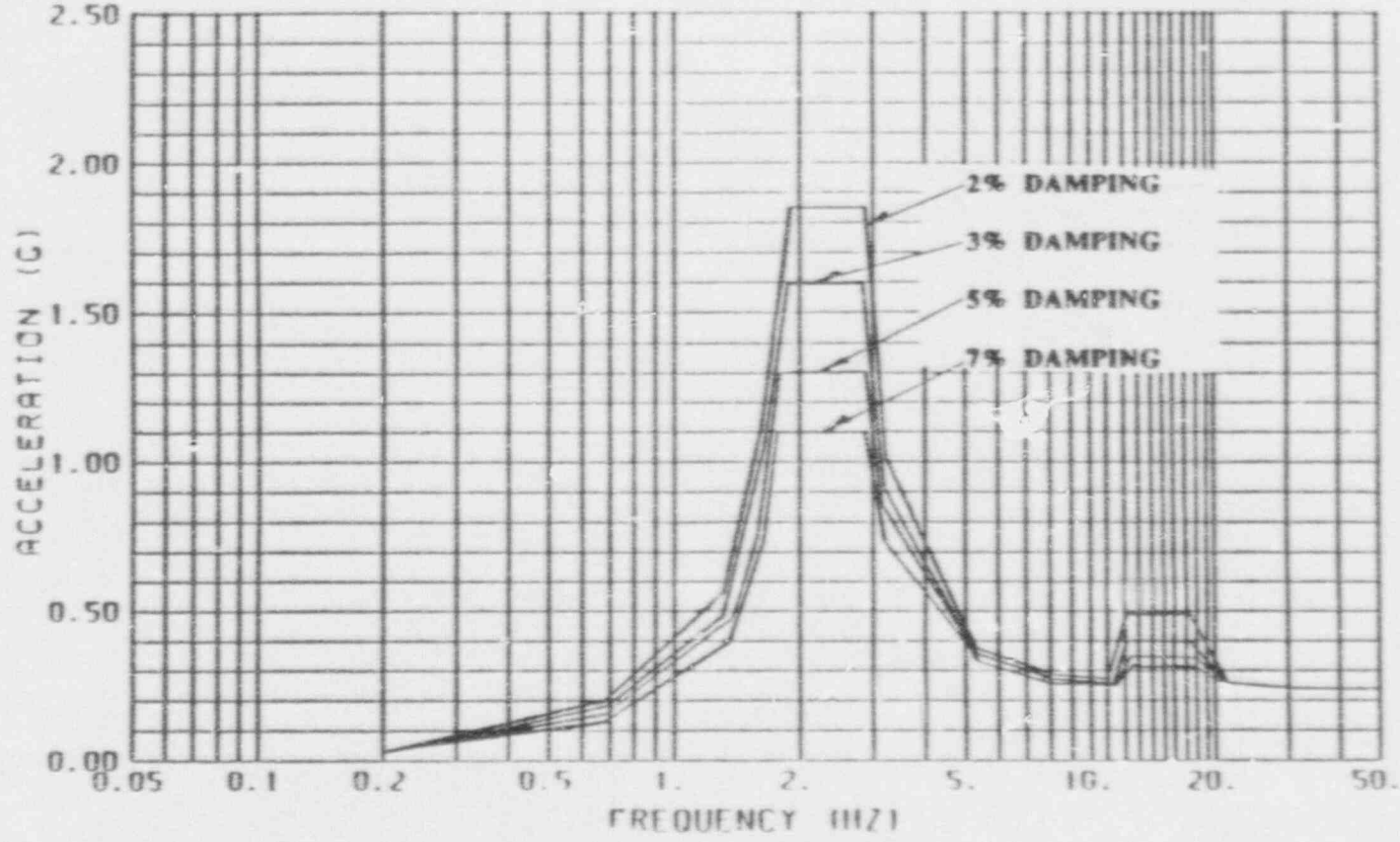
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1013'-0" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY Amt DATE 7-1-92 CHKD Ann DATE 07/01/92	SKETCH NO. REV.



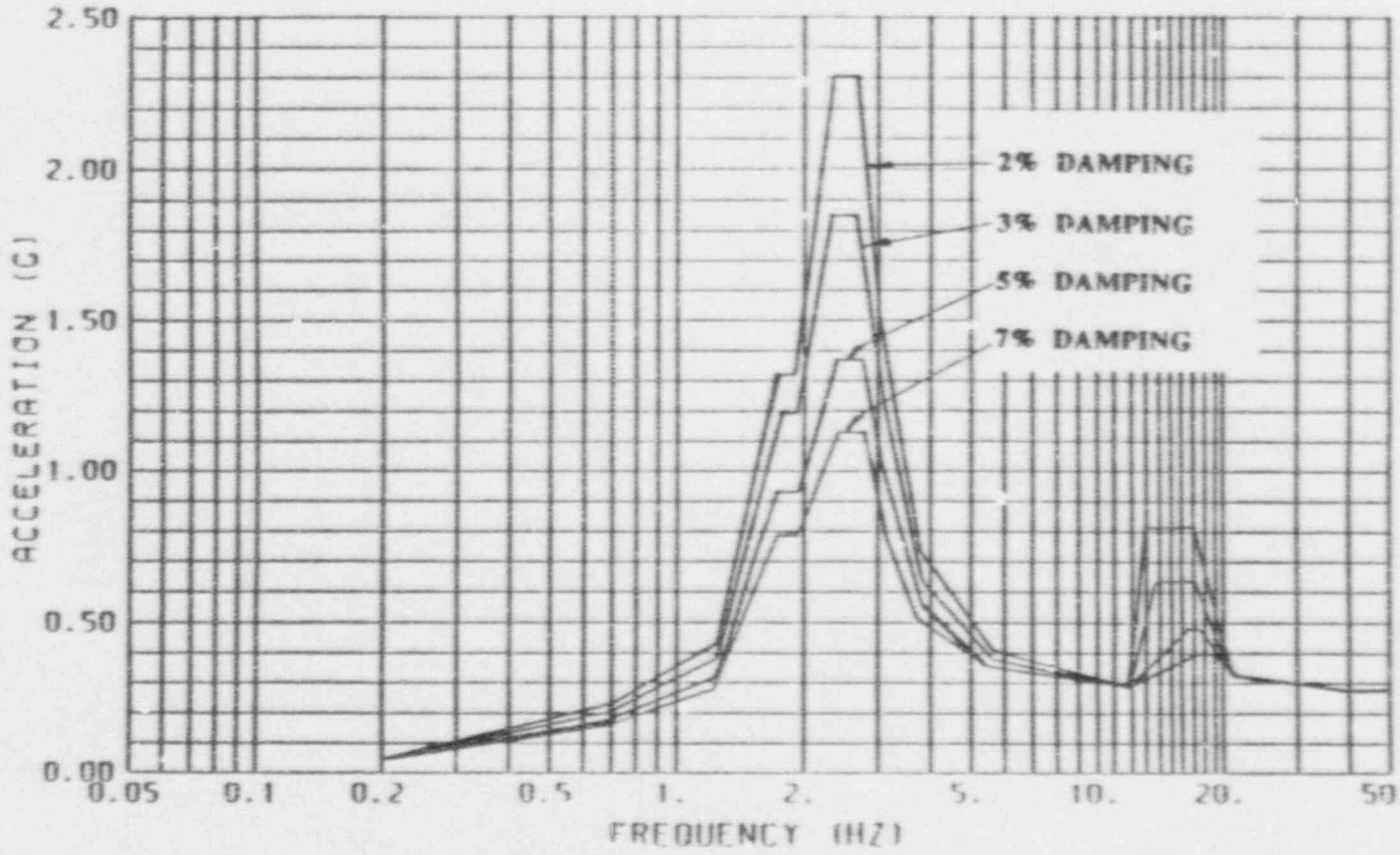
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1013'-0" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY Ame DATE 7-1-92 CHKD Ame DATE 07/01/92	SKETCH NO. REV



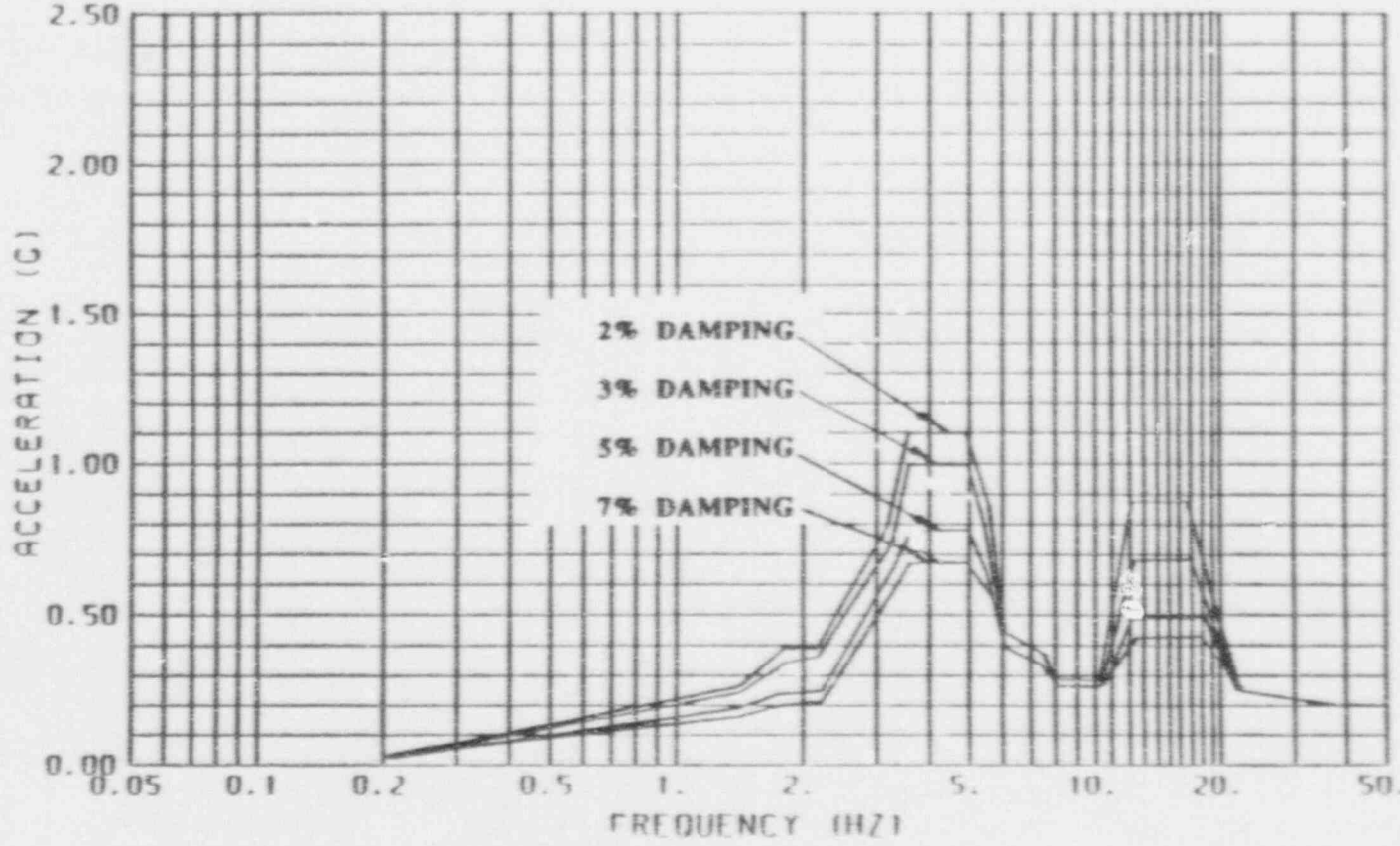
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1013'-0" INTERNAL STRUCTURE	
SAFE SHUTDOWN EARTHQUAKE		
BY [illegible] DATE 7-1-92 CHKD [illegible] DATE 07/01/92	SKETCH NO	REV



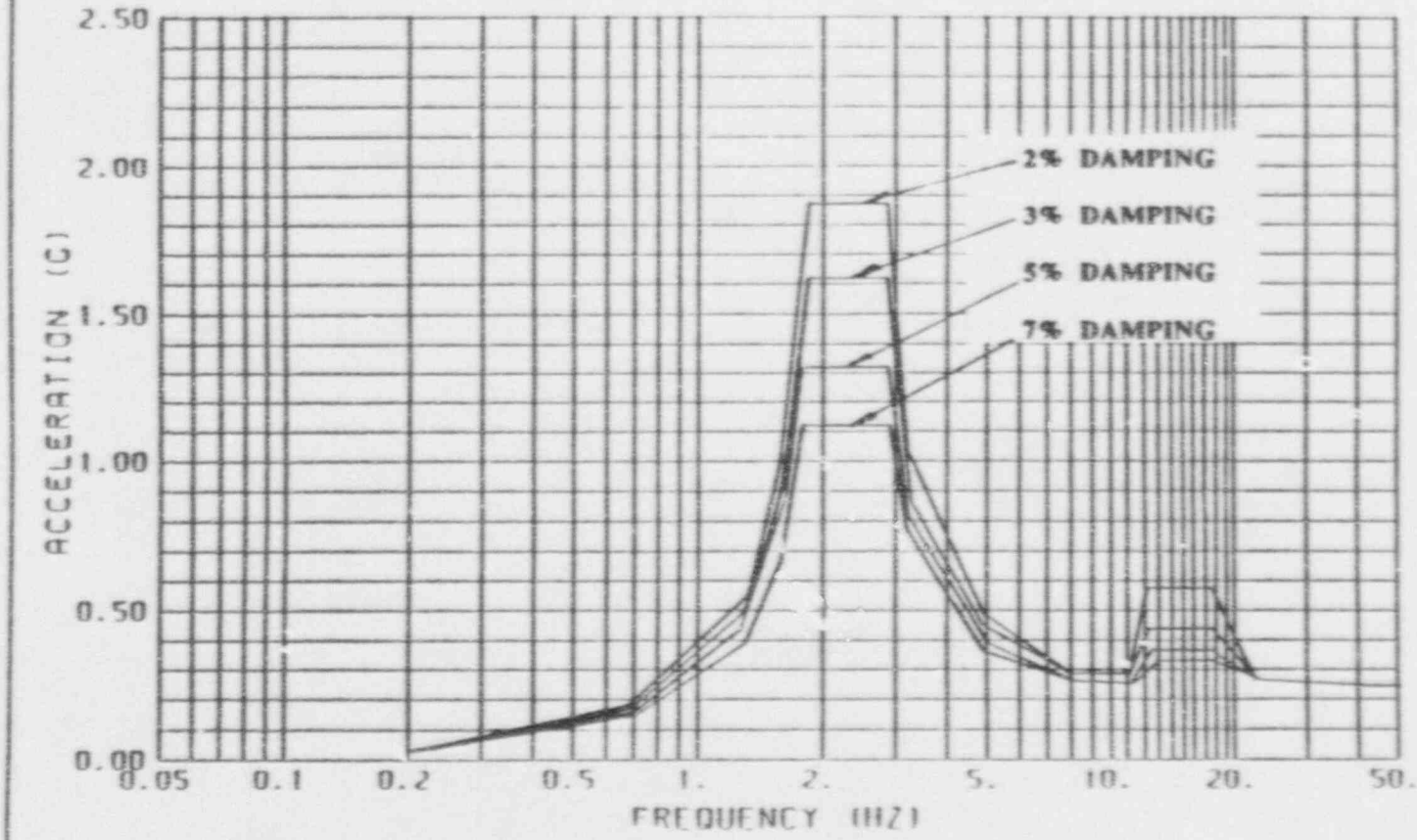
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1038'-6" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY ADE DATE 7-1-92 CHKD PMN DATE 07/01/92	SKETCH NO. REV



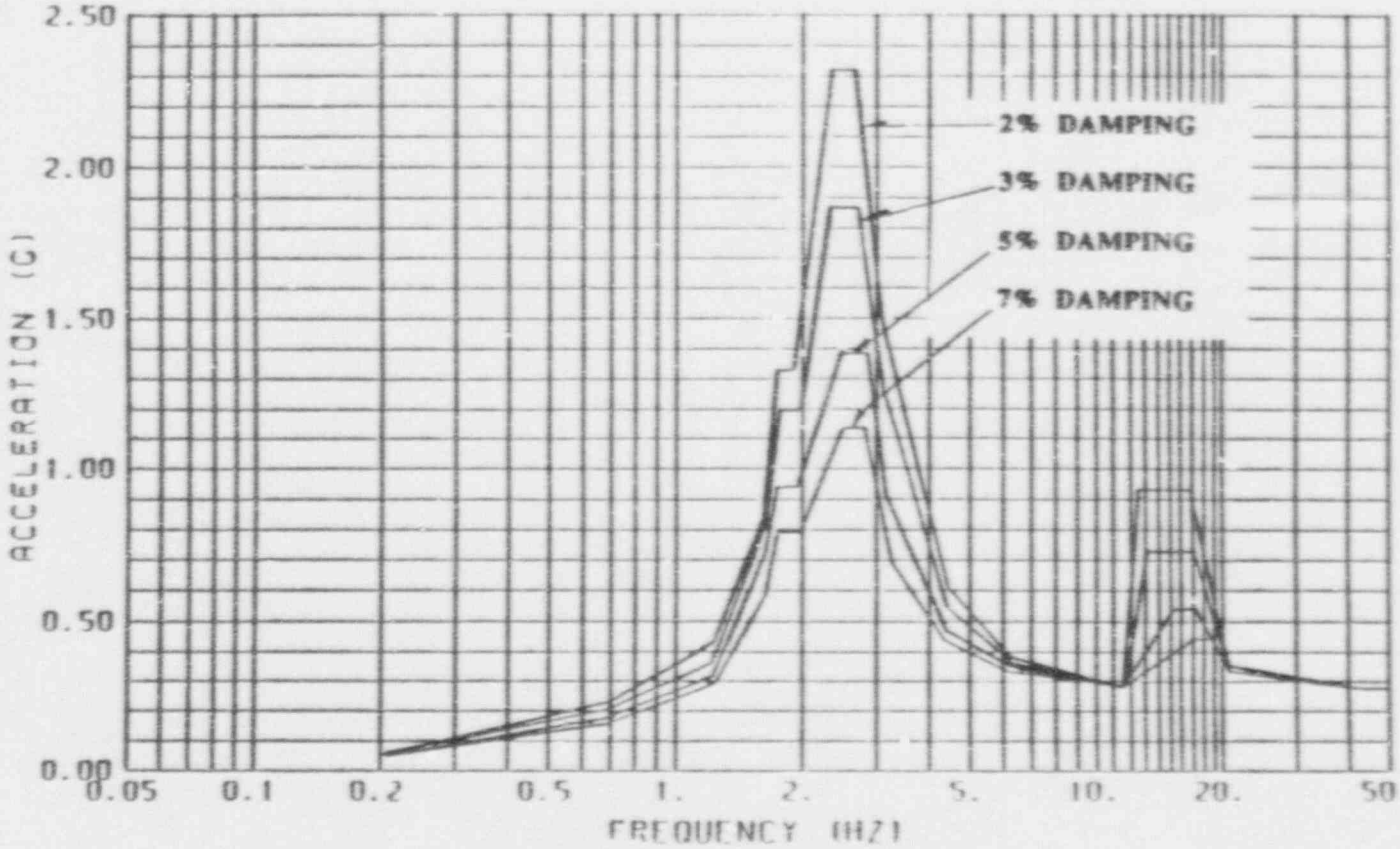
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1038'-6" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY Ame DATE 7-1-92 CHKD Dmw DATE 07/01/92	SKETCH NO. REV.



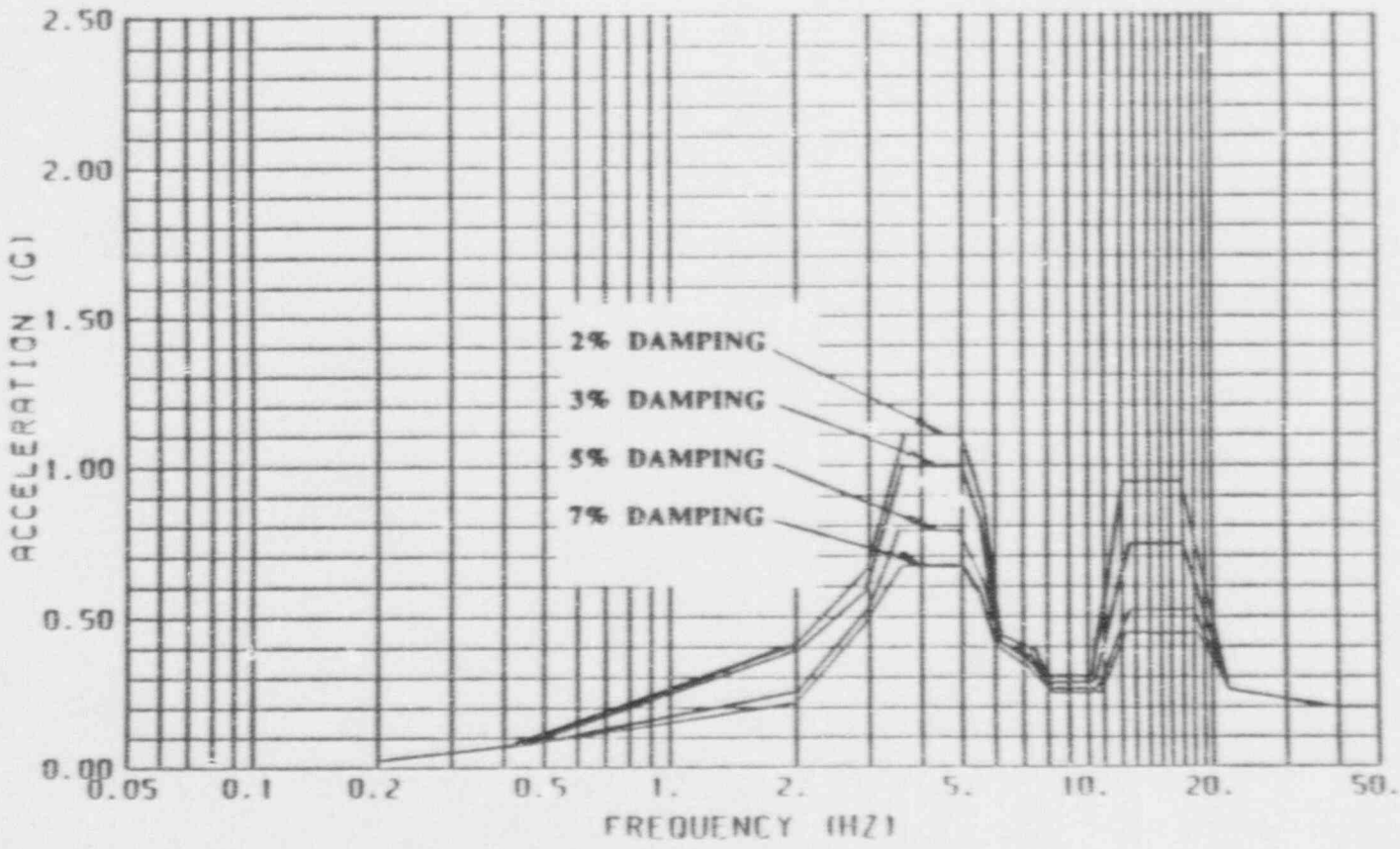
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1038'-6" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY Arze DATE 7-1-92 CHKD [illegible] DATE 7/1/92	SKETCH NO. REV



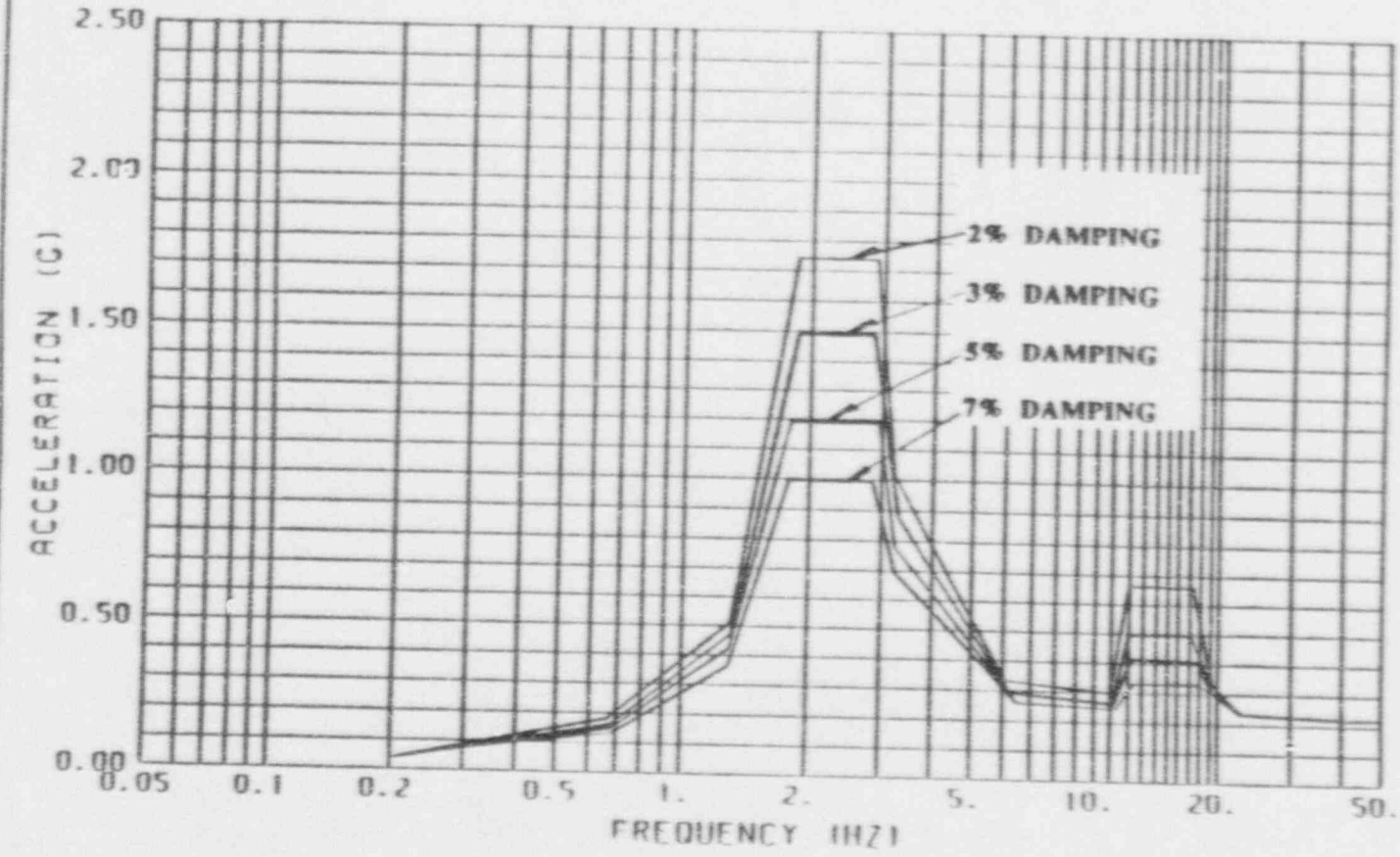
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1045'-0" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY Amc DATE 7-1-92 CHKD [illegible] DATE 7/1/92	SKETCH NO. REV.



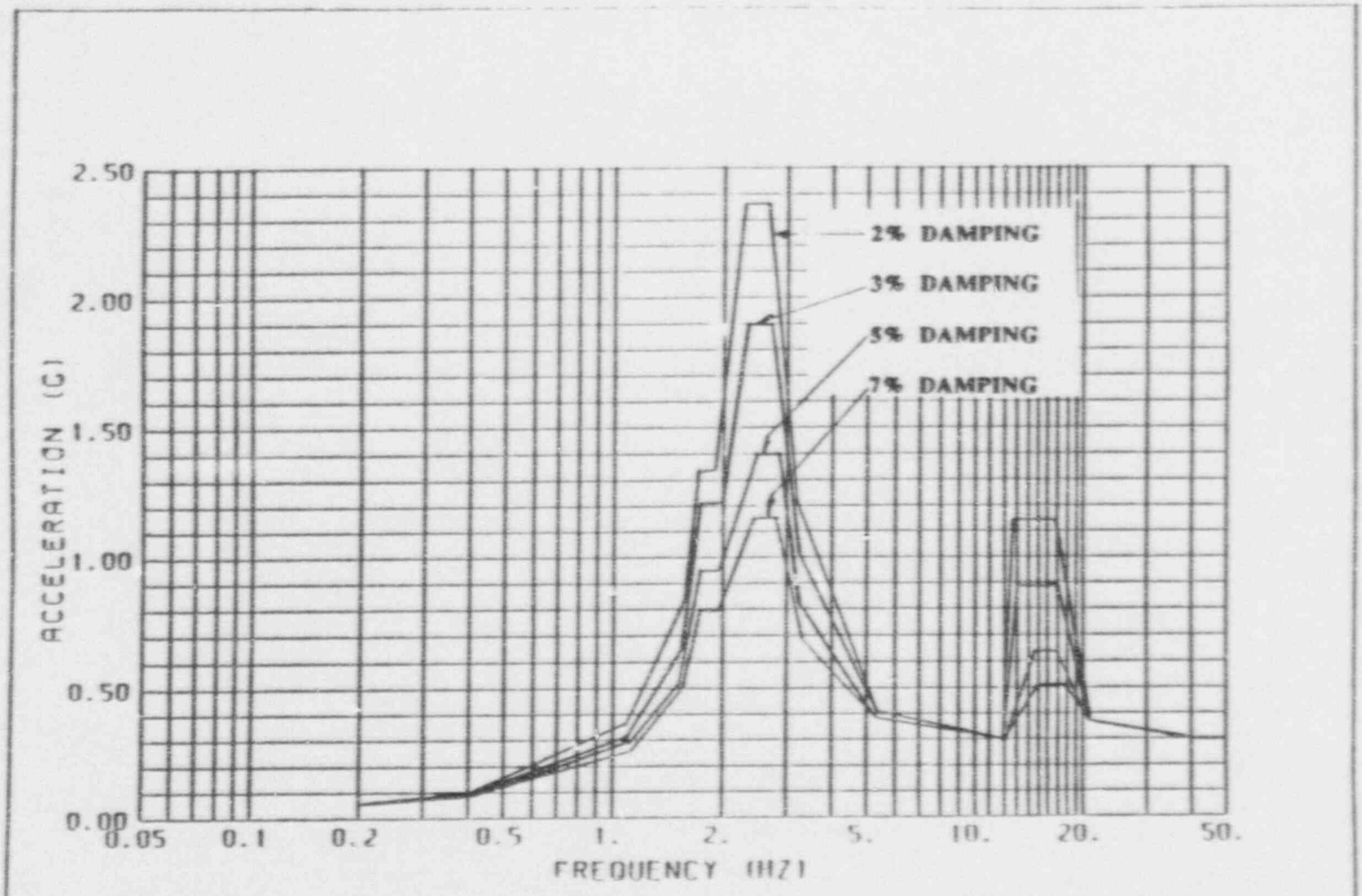
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1045'-0" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY [illegible] DATE 7-1-92 CHKD [illegible] DATE 07/01/92	SKETCH NO REV



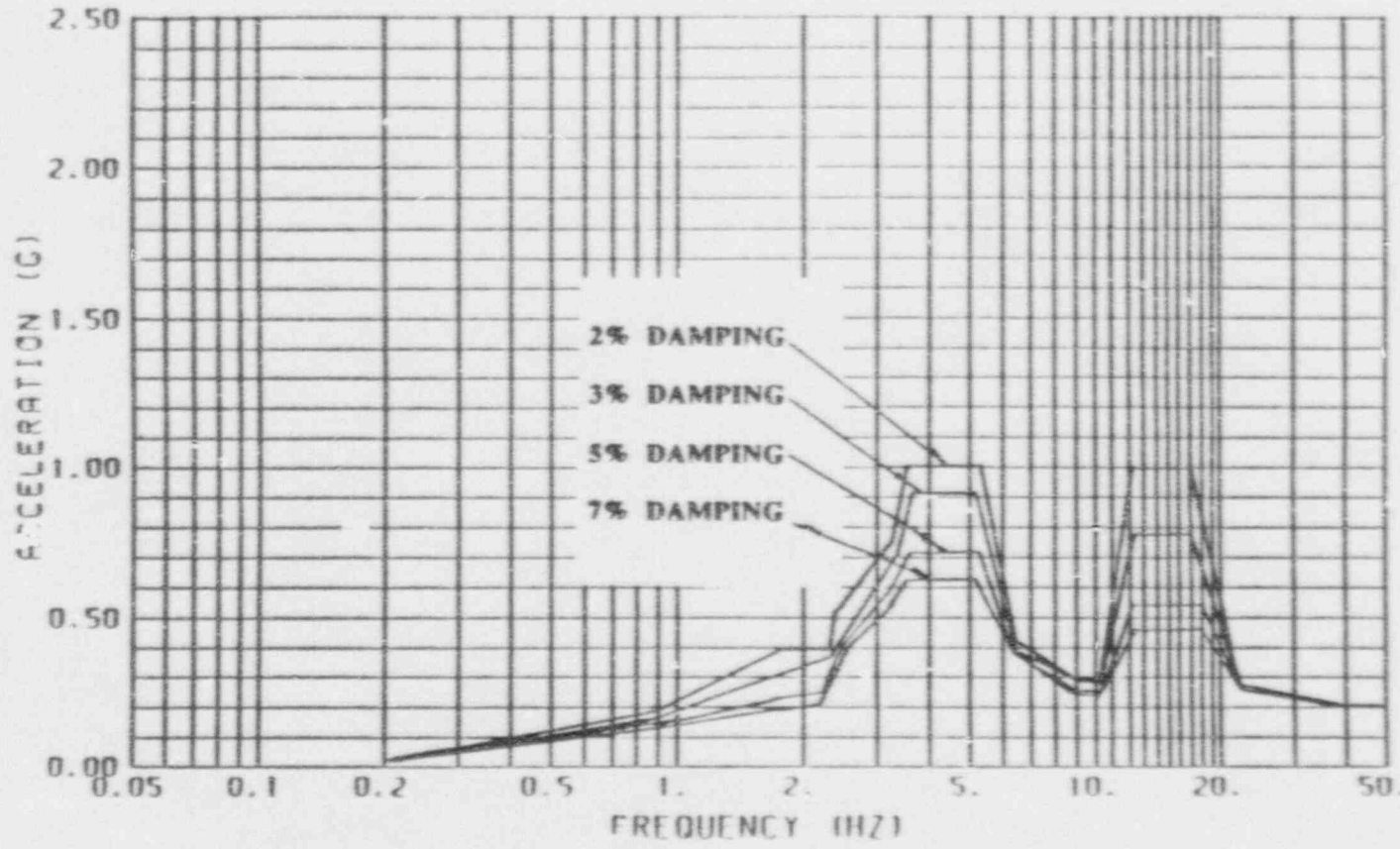
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1045'-0" INTERNAL STRUCTURE	
SAFE SHUTDOWN EARTHQUAKE		
BY Apc DATE 7-1-92 CHKD AMJ DATE 07/01/92	SKETCH NO.	REV



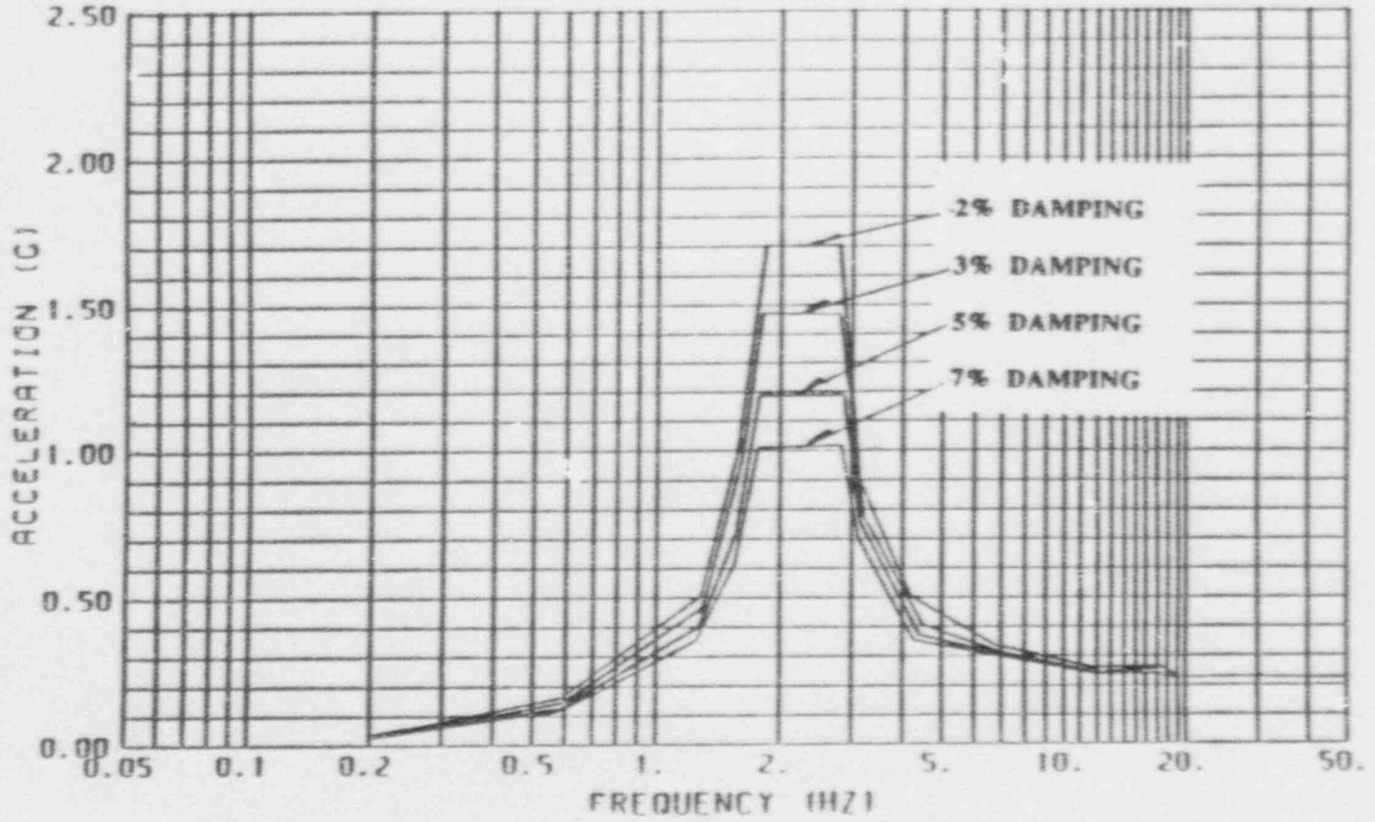
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1056'-6" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY mc DATE 7-1-92 CHKD [illegible] DATE 7/01/92	SKETCH NO. REV.



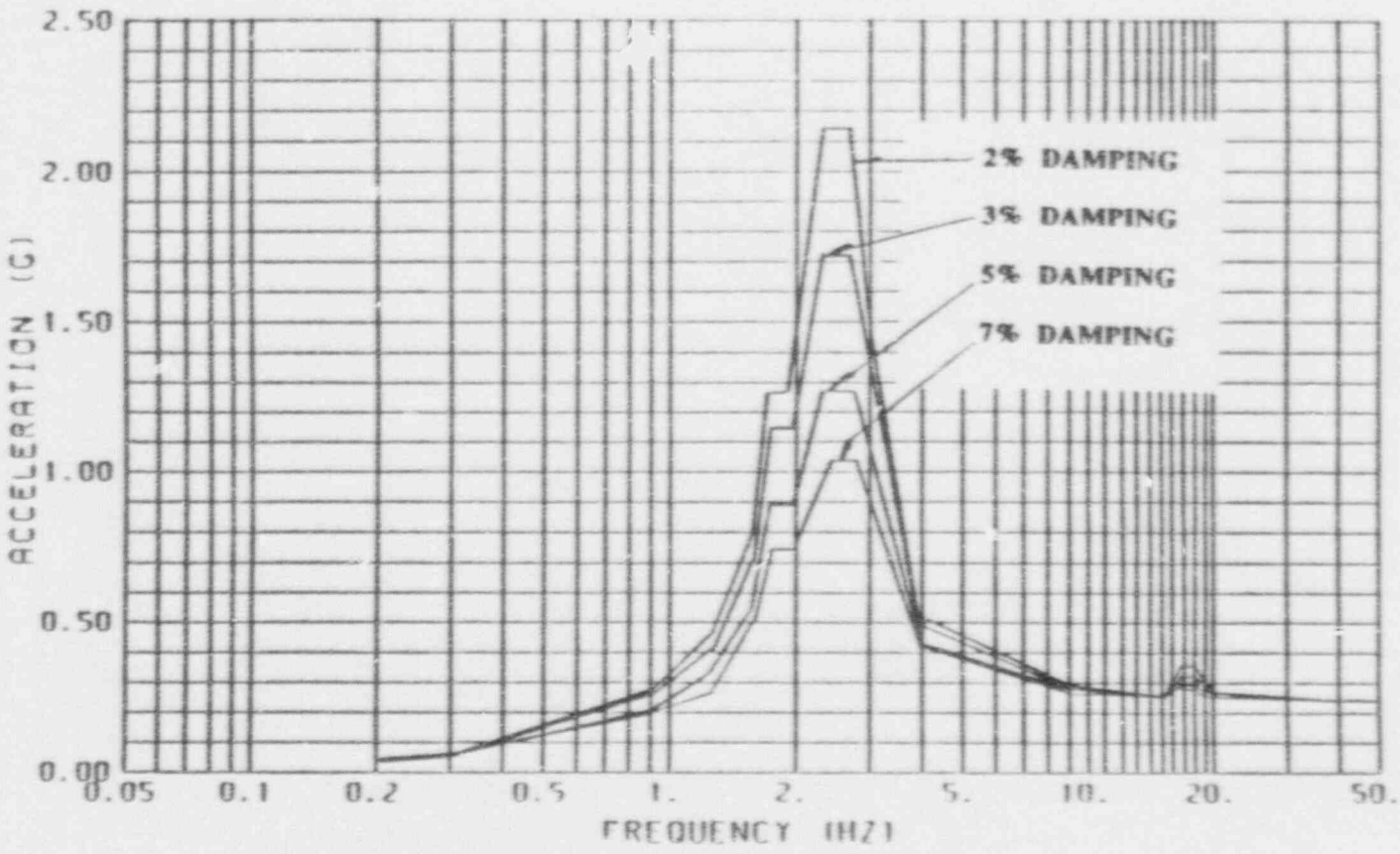
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1056'-6" INTERNAL STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY [illegible] DATE 7-1-92 CHKD [illegible] DATE 7/31/92	SKETCH NO. REV.



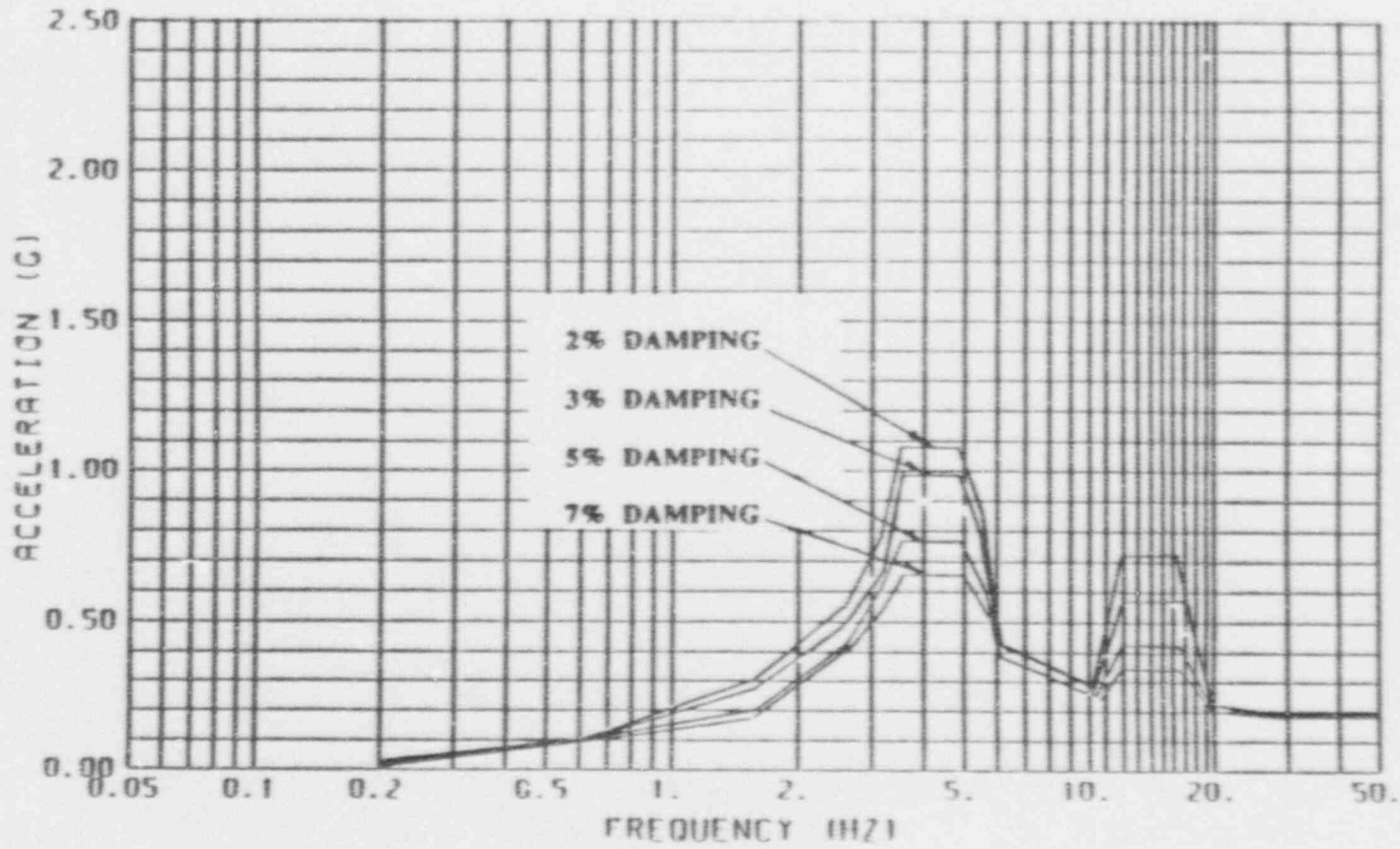
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1056'-6" INTERNAL STRUCTURE	
SAFE SHUTDOWN EARTHQUAKE		
BY Ame DATE 7-1-92 CHKD Ame DATE 07/01/92	SKETCH NO	REV



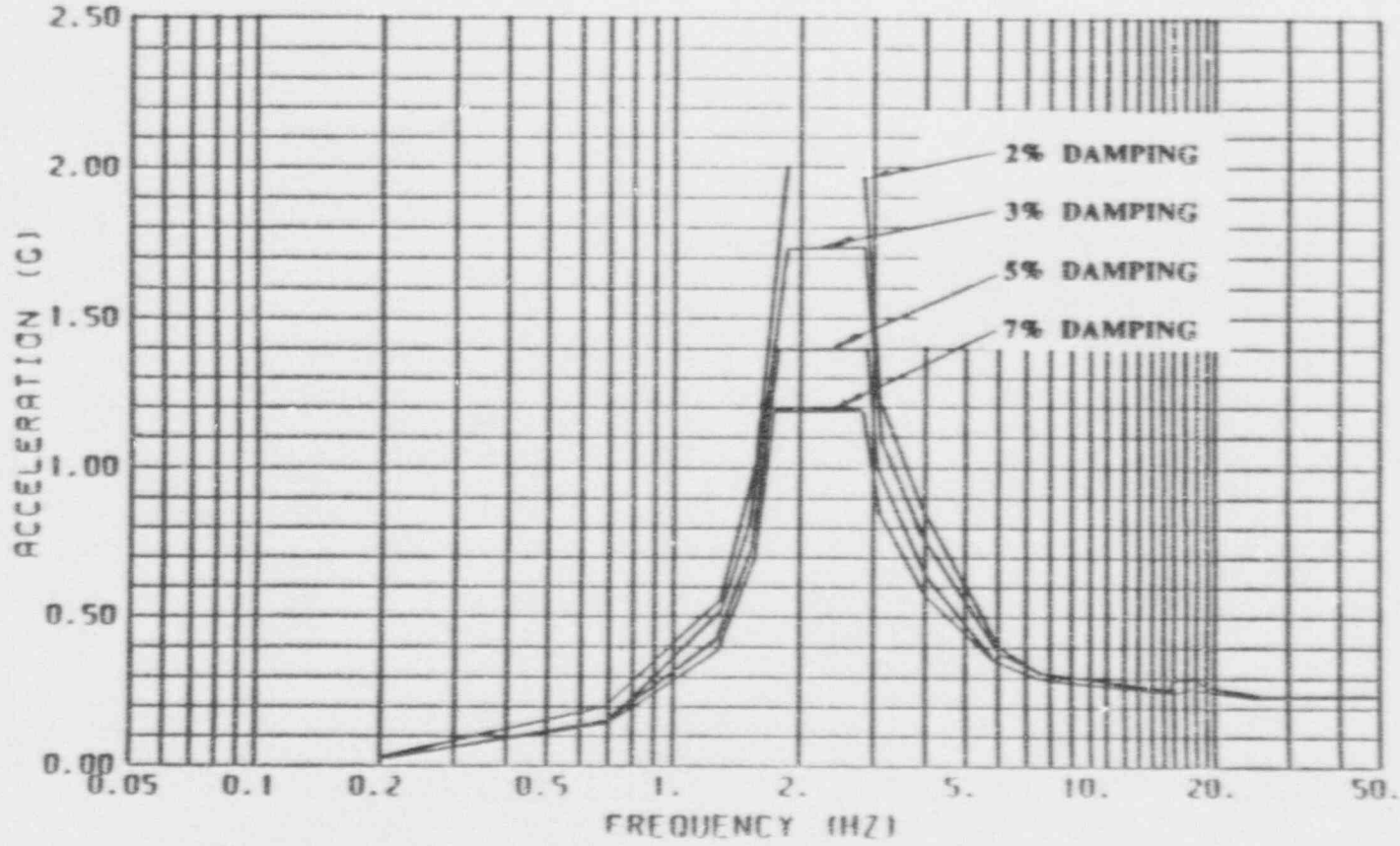
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 991'-0" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY ADT DATE 7-1-92 CHKD AJW DATE 07/31/92	SKETCH NO. REV.



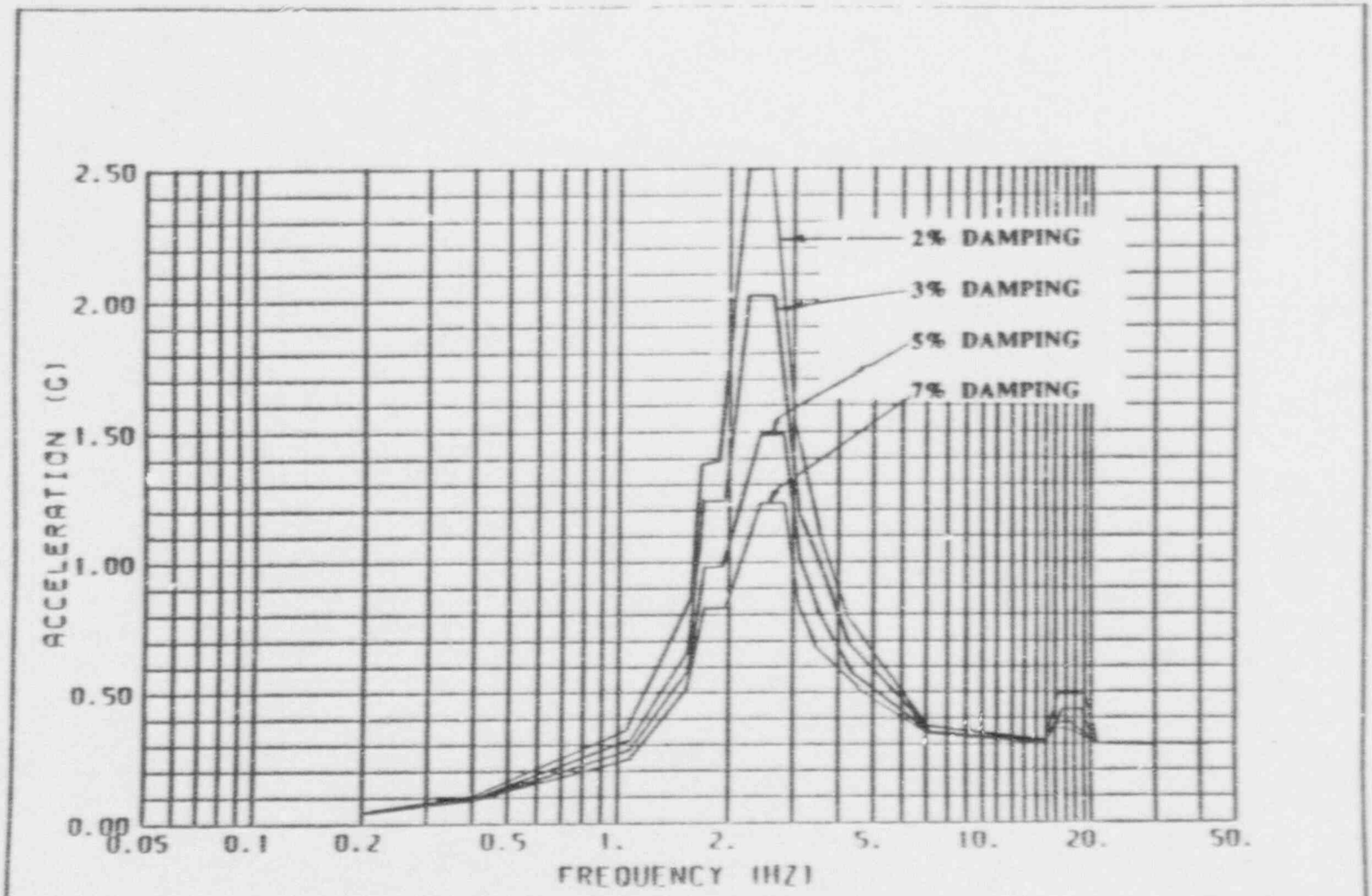
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 991'-0" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY DATE 7-1-92 CHKD DATE 07/01/92	SKETCH NO. REV



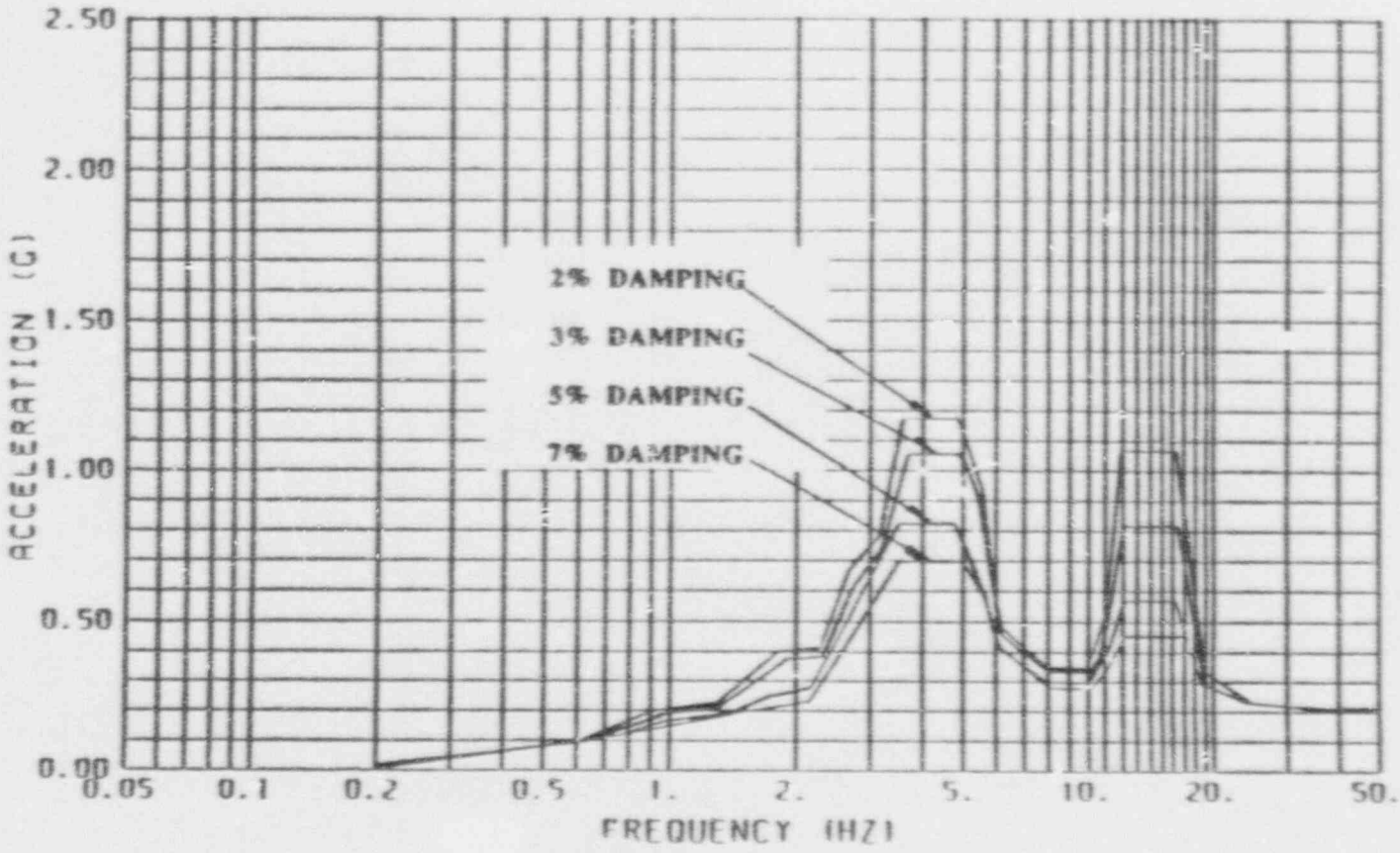
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 991'-0" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY AMT DATE 7-1-92 CHK'D [illegible] DATE 07/01/92	SKETCH NO. REV



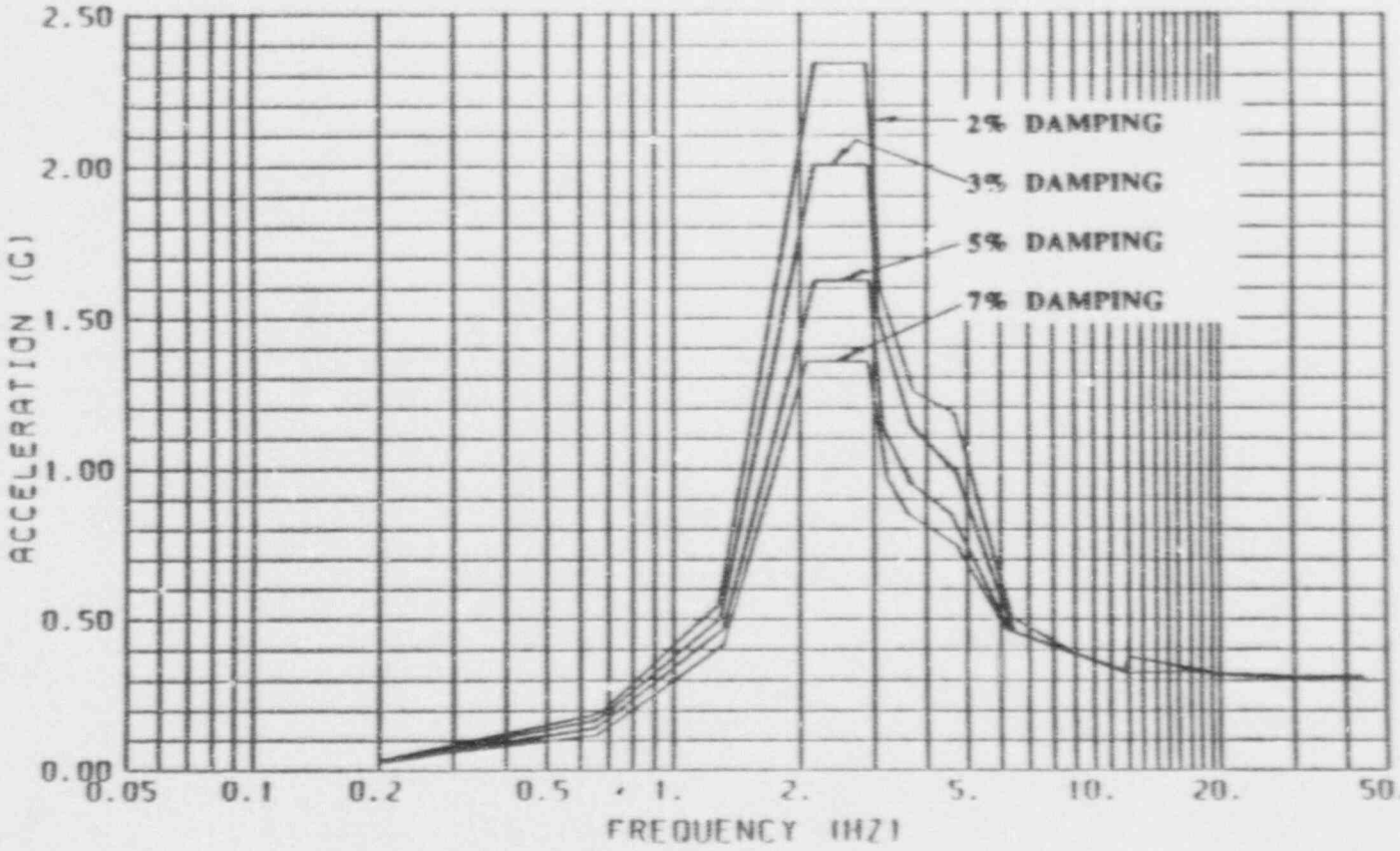
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1045'-0" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY ATE DATE 7-1-92 CHKD Awl DATE 07/01/92	SKETCH NO REV



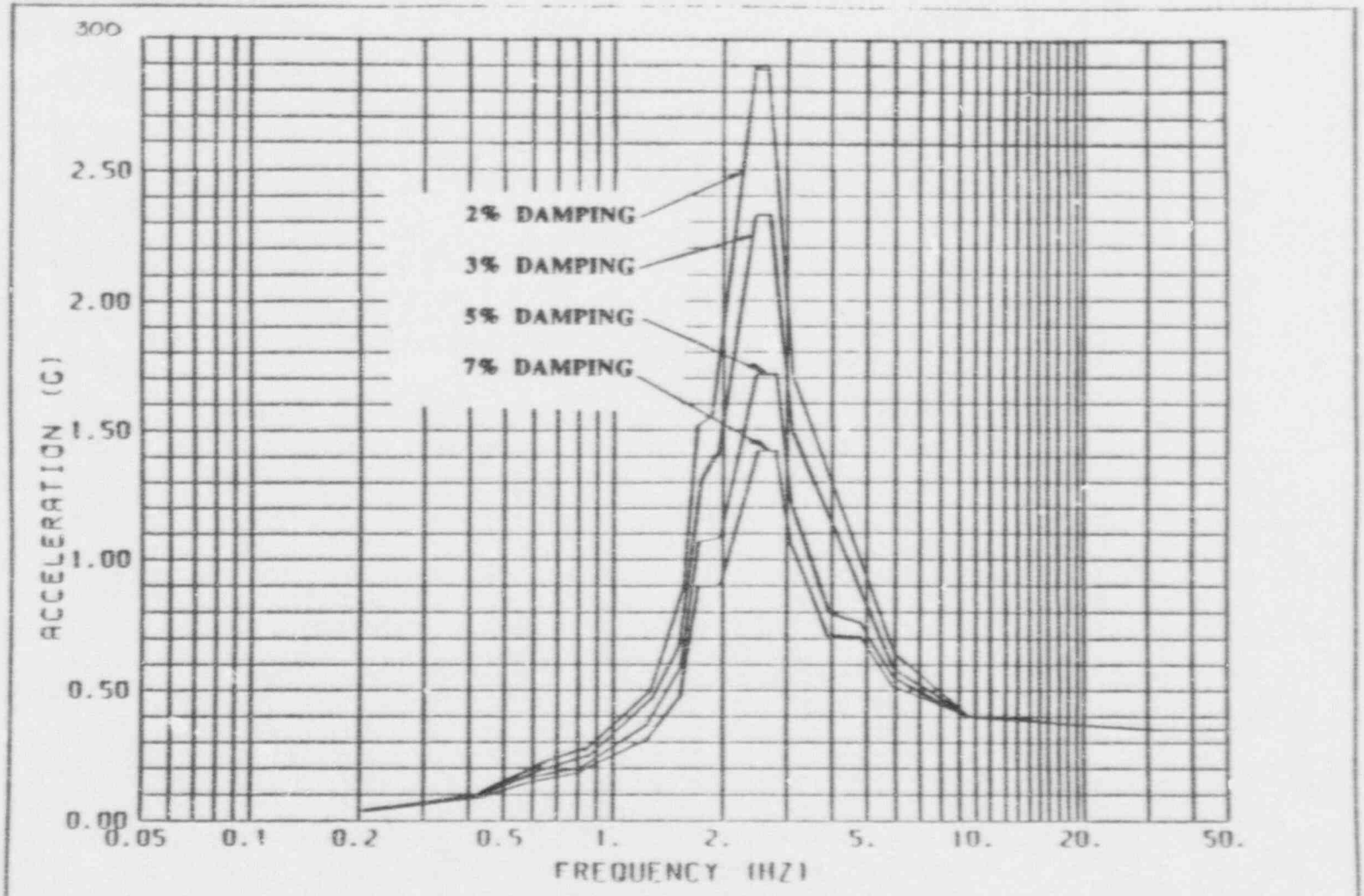
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1045'-0" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY RTC DATE 7-1-92 CHKD [illegible] DATE 07/01/92	SKETCH NO. REV



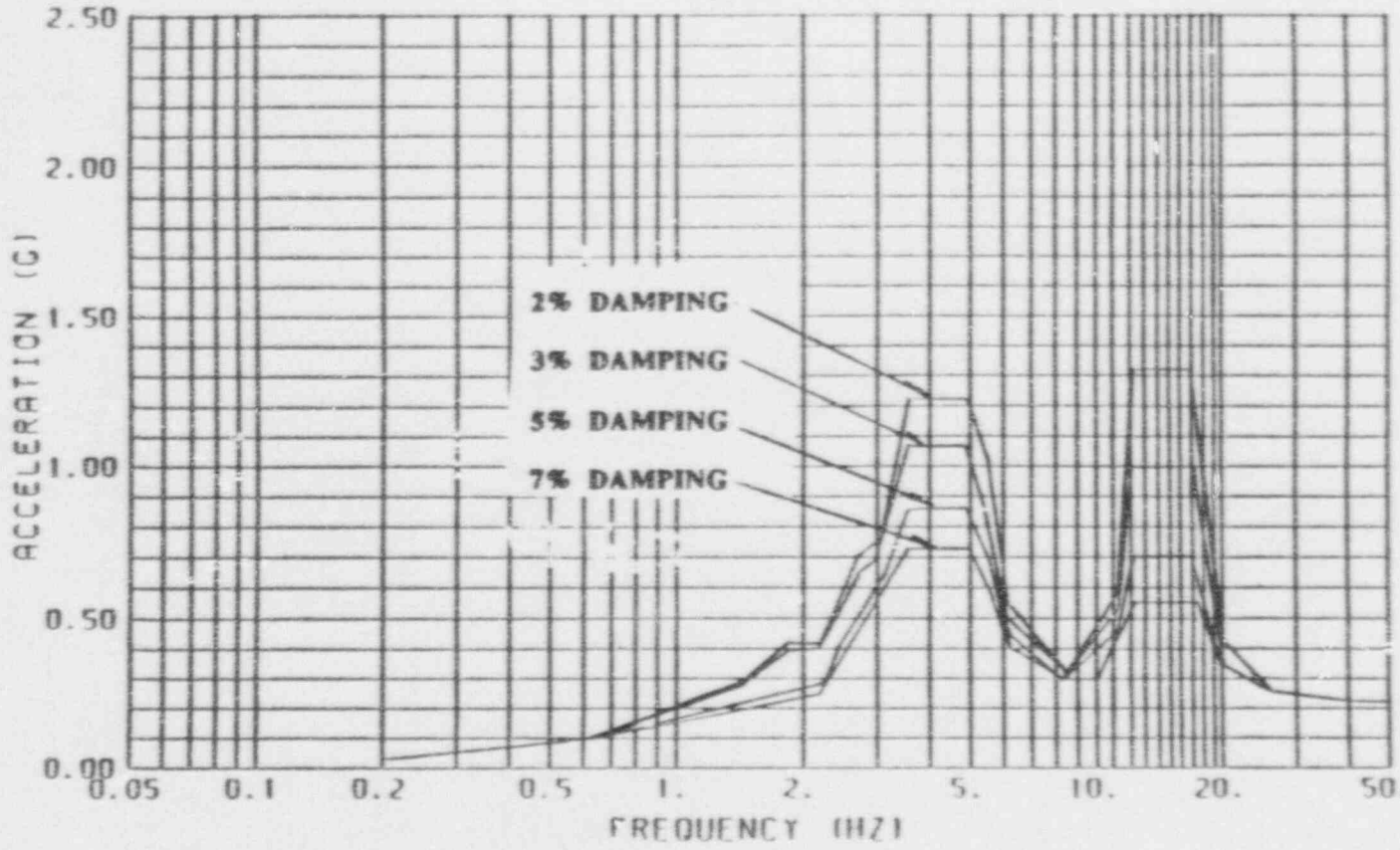
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1045'-0" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY ADE DATE 7-1-92 CHKD Ann DATE 07/01/92	SKETCH NO. REV



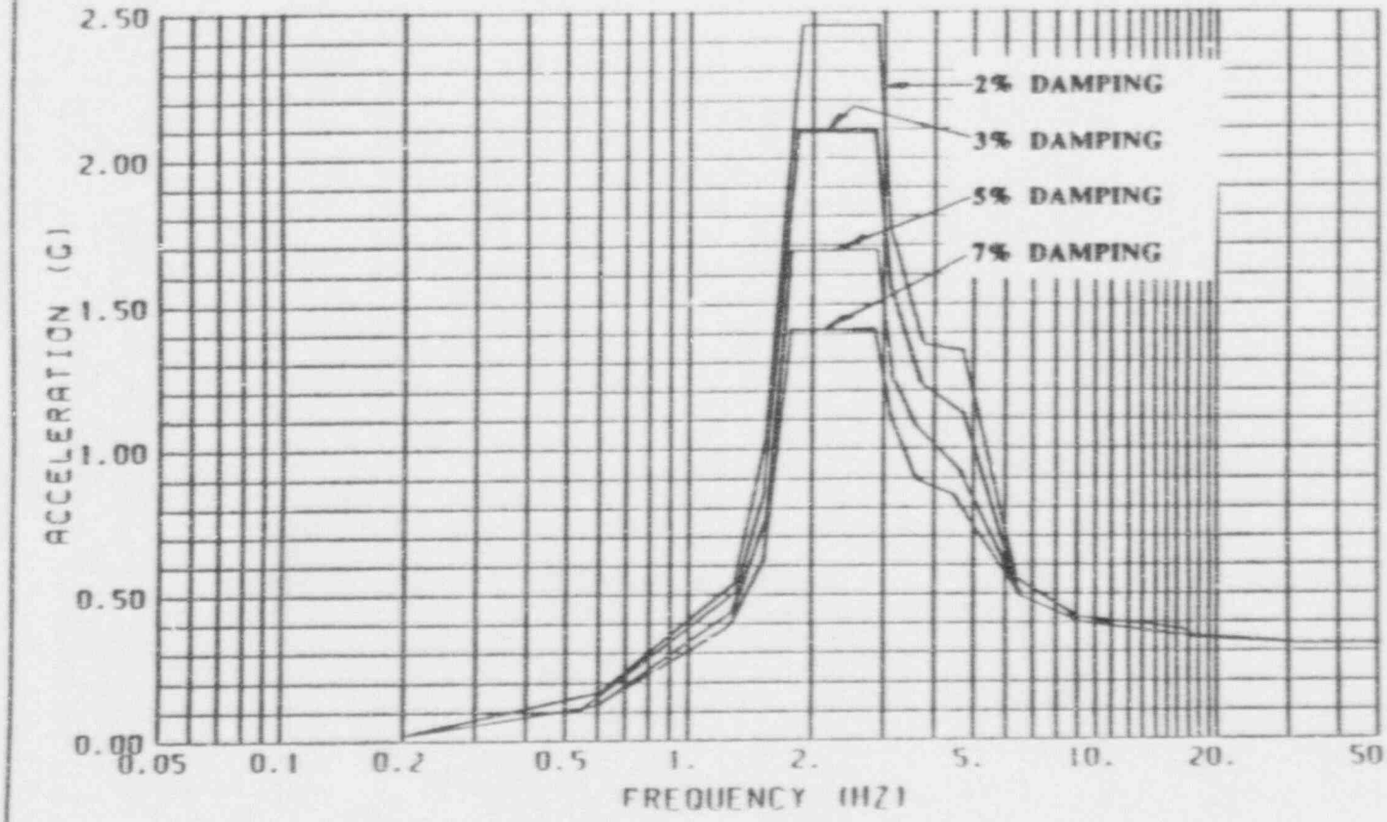
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1099'-0" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY DTE DATE 7-1-92 CHKD Arnd DATE 07/01/92	SKETCH NO. REV



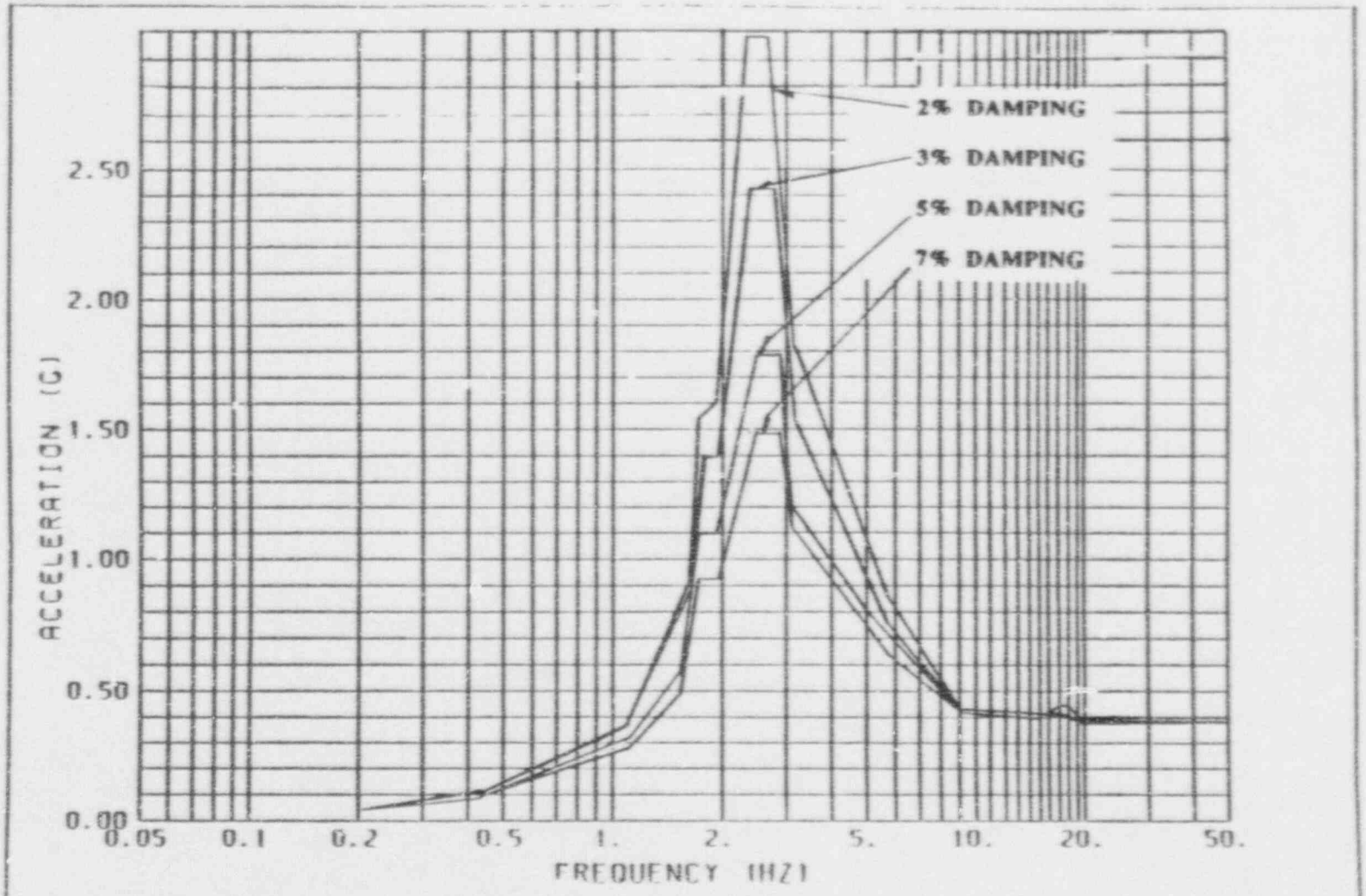
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1099'-0" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY ADC DATE 7-1-92 CHKD [illegible] DATE 07/01/92	SKETCH NO. REV.



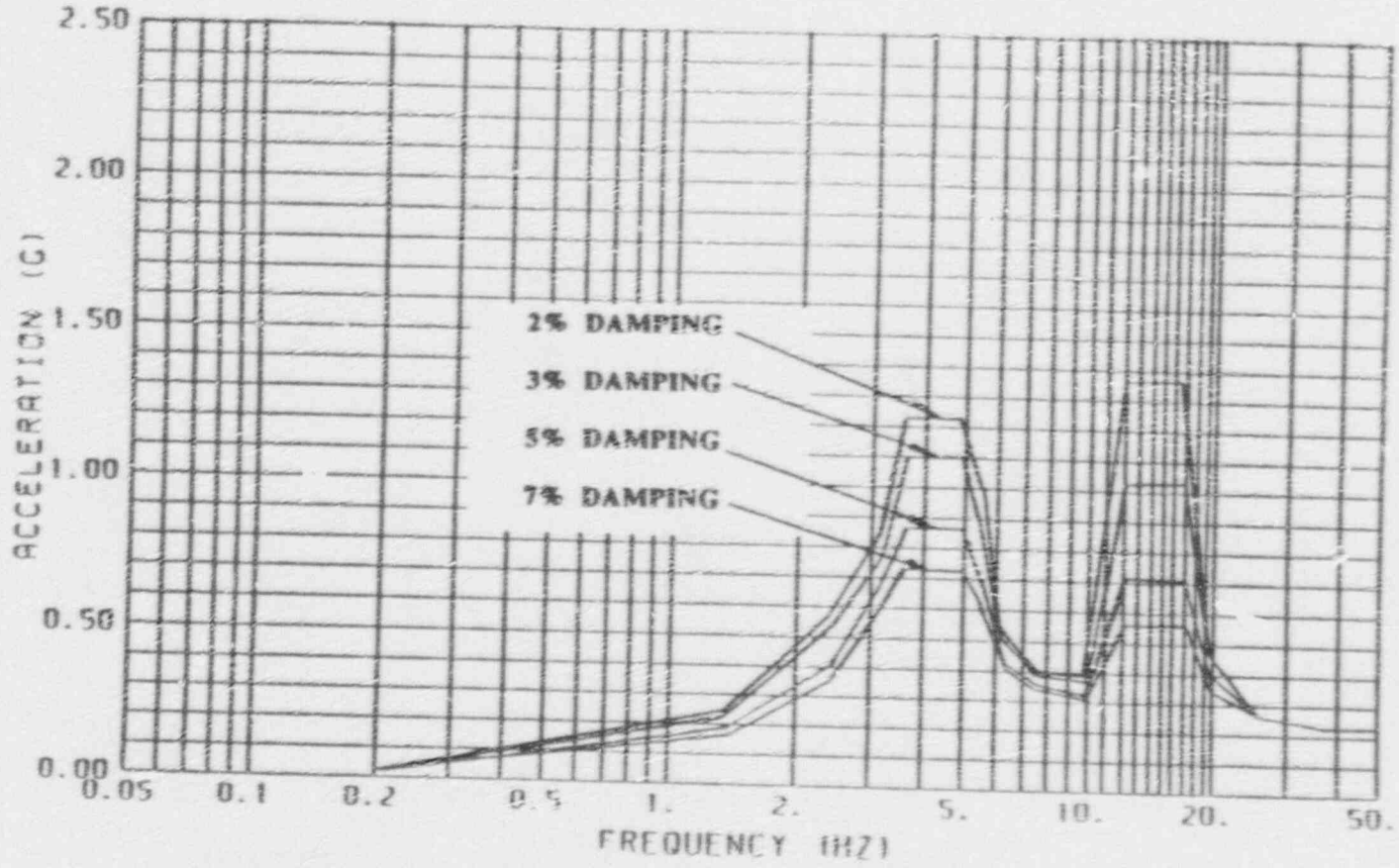
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1099'-8" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY Apc DATE 7-1-92 CHKD Awn DATE 07/01/92	SKETCH NO. Rev.



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1118'-2" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY ATH DATE 7-1-92 CHKD [illegible] DATE 07/01/92	SKETCH NO. REV.



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1118'-2" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY AMC DATE 7-1-92 CHKD AMW DATE 07/01/92	SKETCH NO. REV.

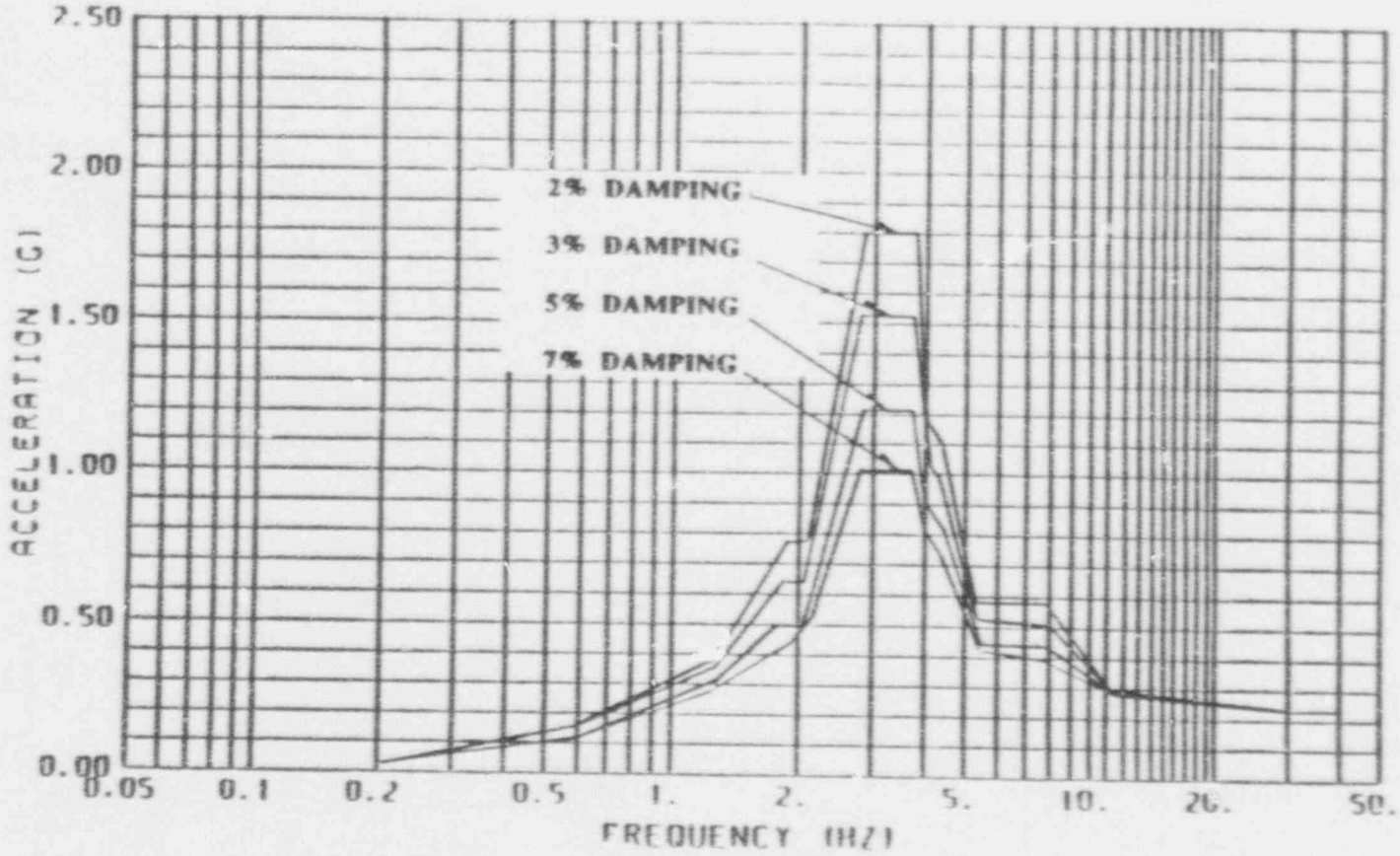


OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1118'-2" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY RPE DATE 7-1-92 CHKD [illegible] DATE 07/01/92	SKETCH NO. REV.

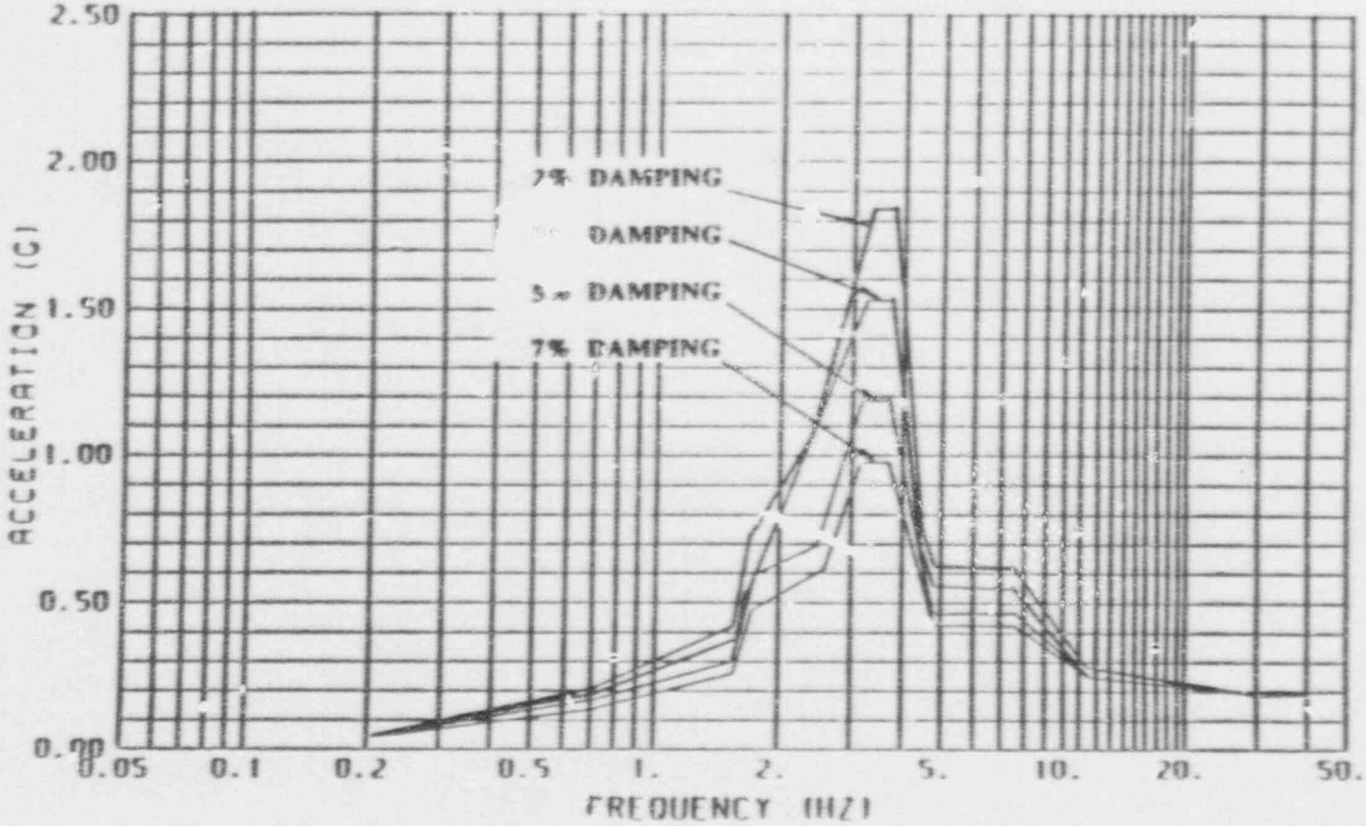
APPENDIX B

FORT CALHOUN STATION, UNIT 1
IN-STRUCTURE RESPONSE SPECTRA
INTAKE STRUCTURE
SAFE SHUTDOWN EARTHQUAKE

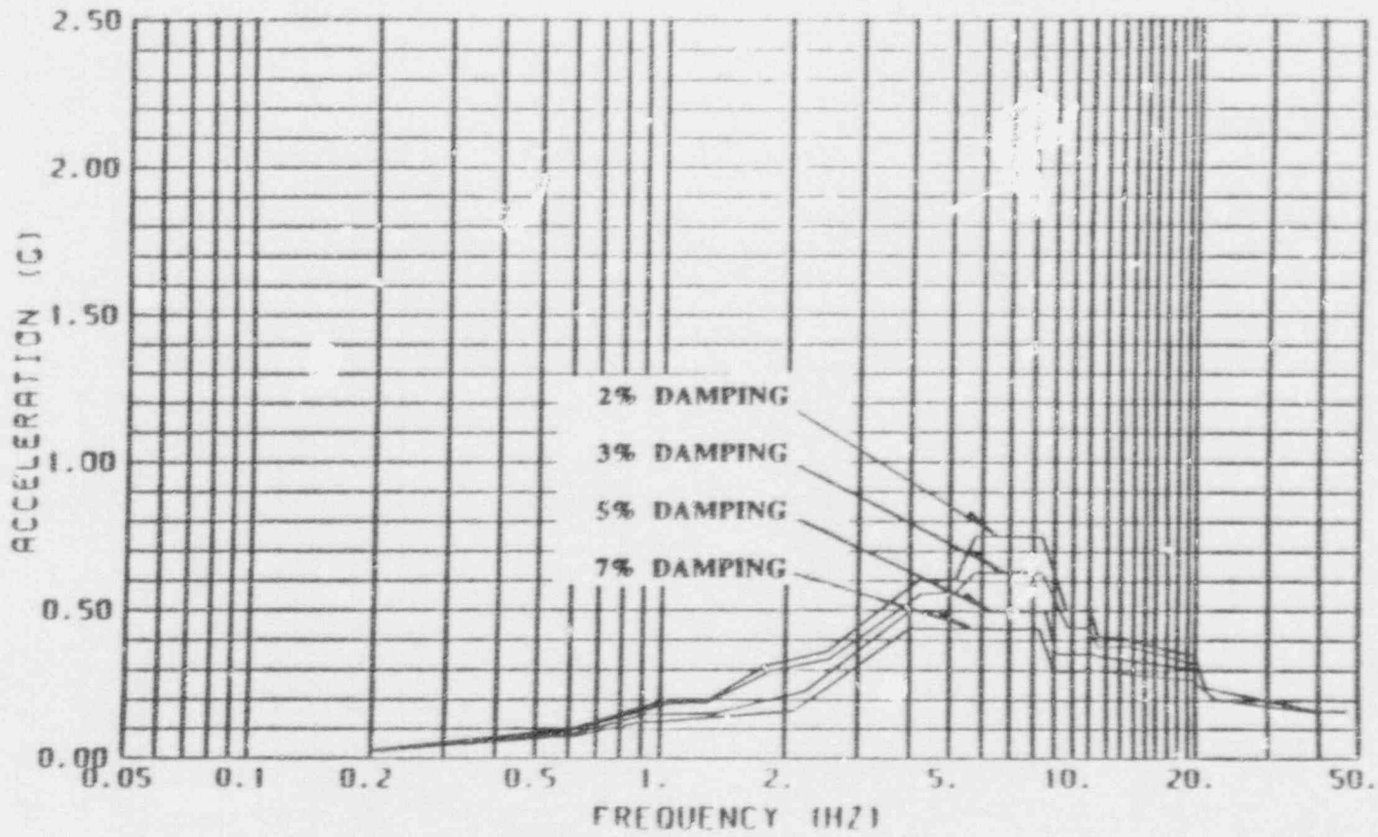
(9 pages; this cover page not included)



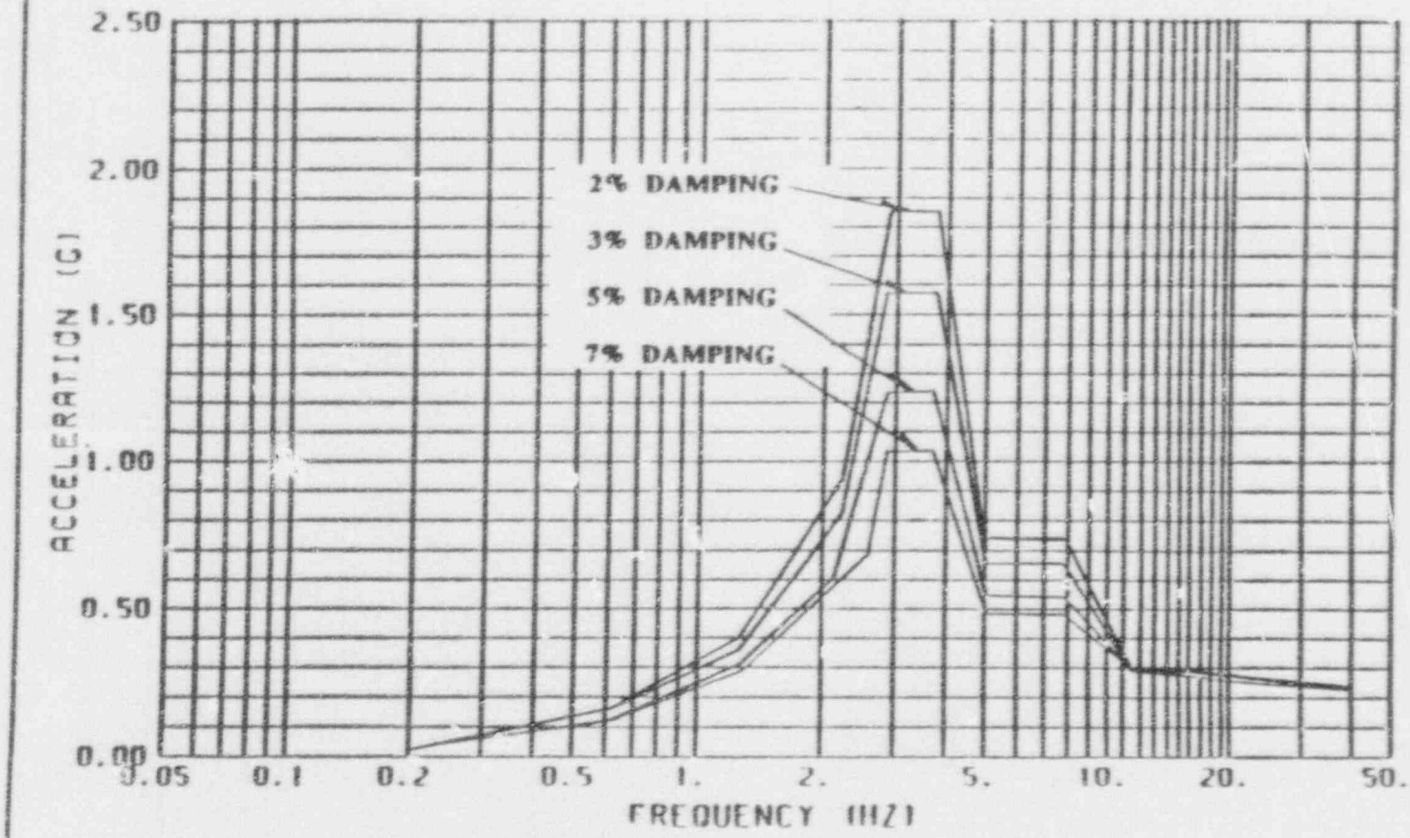
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 985'-0" INTAKE STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY ADC DATE 7-17-92 CHKD A-N DATE 7/17/92	SKETCH NO REV



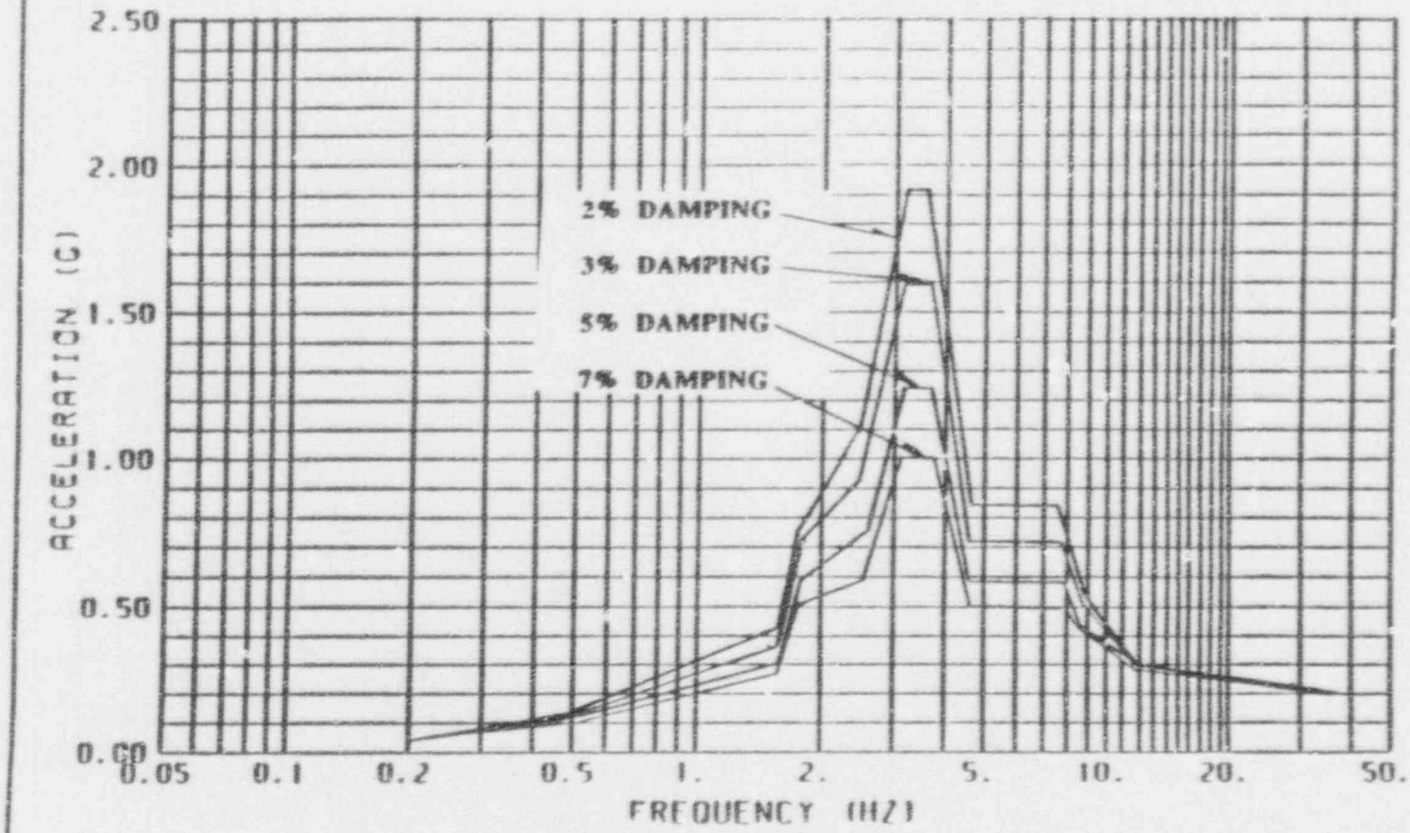
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 985'-0" INTAKE STRUCTURE
SAFF SHUTDOWN EARTHQUAKE	
BY Amc DATE 7-17-92 CHKD DATE 7/17/92	SKETCH NO REV



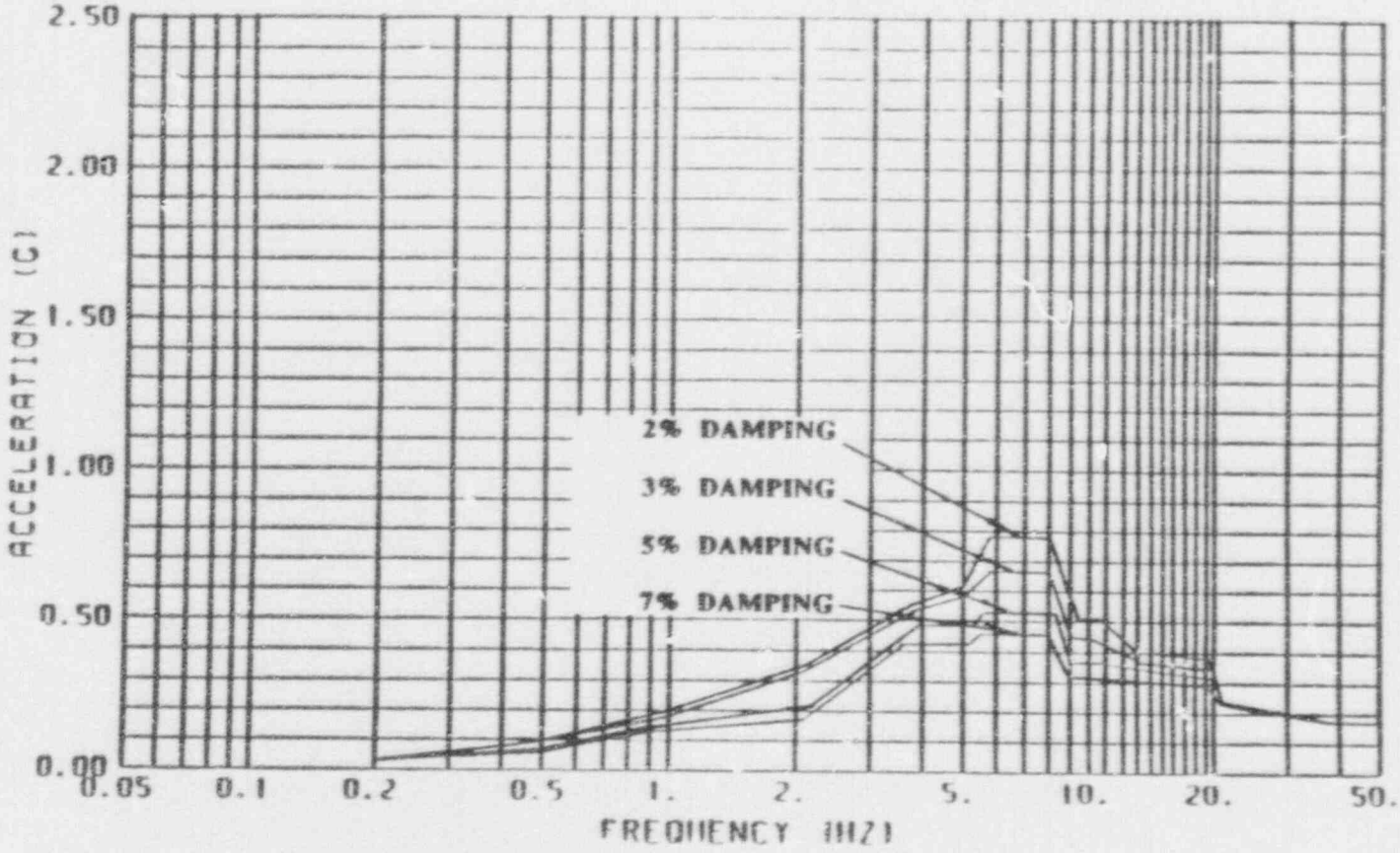
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 985'-0" INTAKE STRUCTURE	
SAFE SHUTDOWN EARTHQUAKE		
BY Amc DATE 7-17-92 CHKD Ayw DATE 7/17/92	SKETCH NO	REV



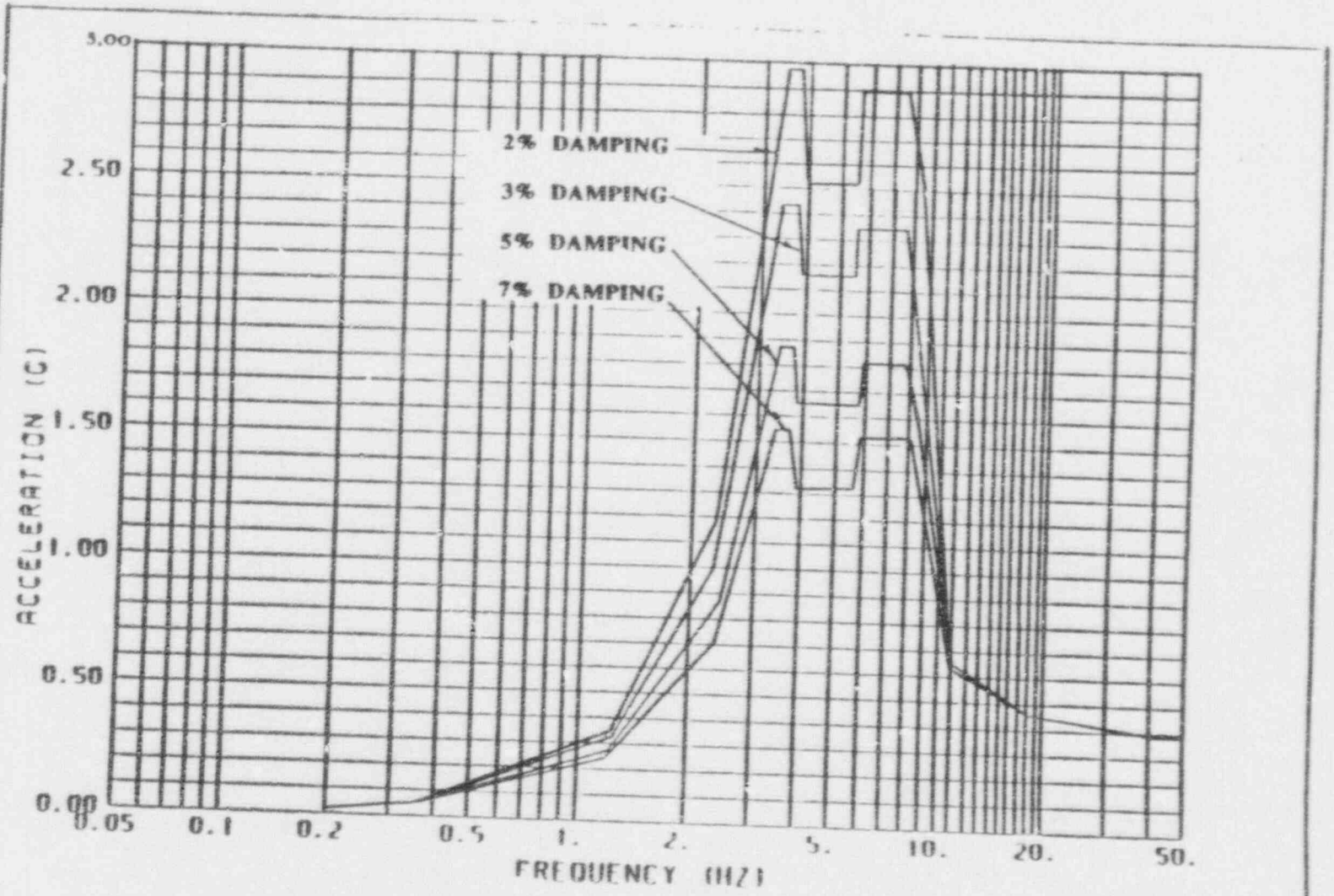
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1007'-6" INTAKE STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY AMC DATE 7-17-92 CHKD AWN DATE 7/17/92	SKETCH NO REV



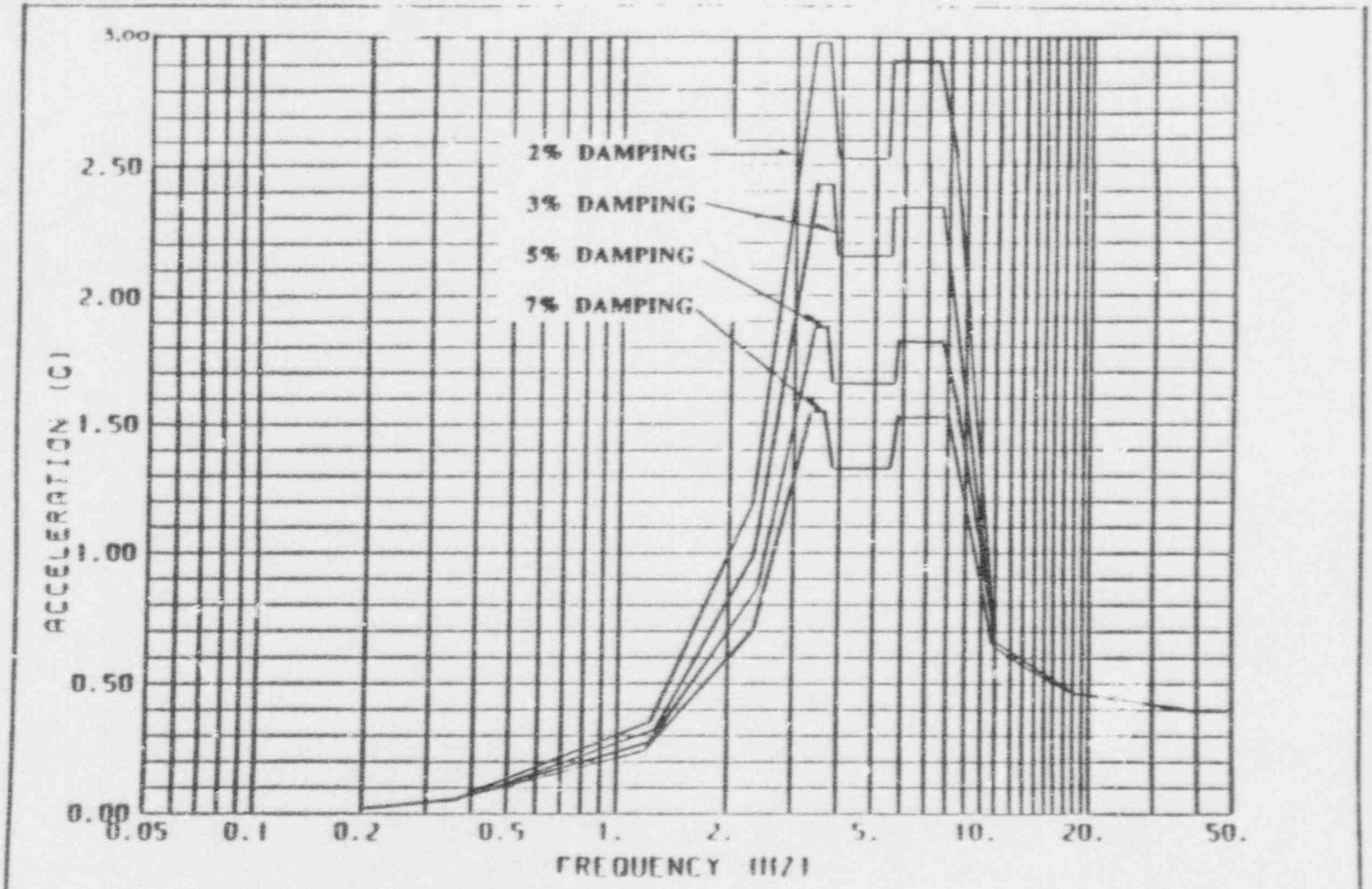
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1007'-6" INTAKE STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY Amc DATE 7-17-92 CHKD Amc DATE 7/17/92	SKETCH NO REV



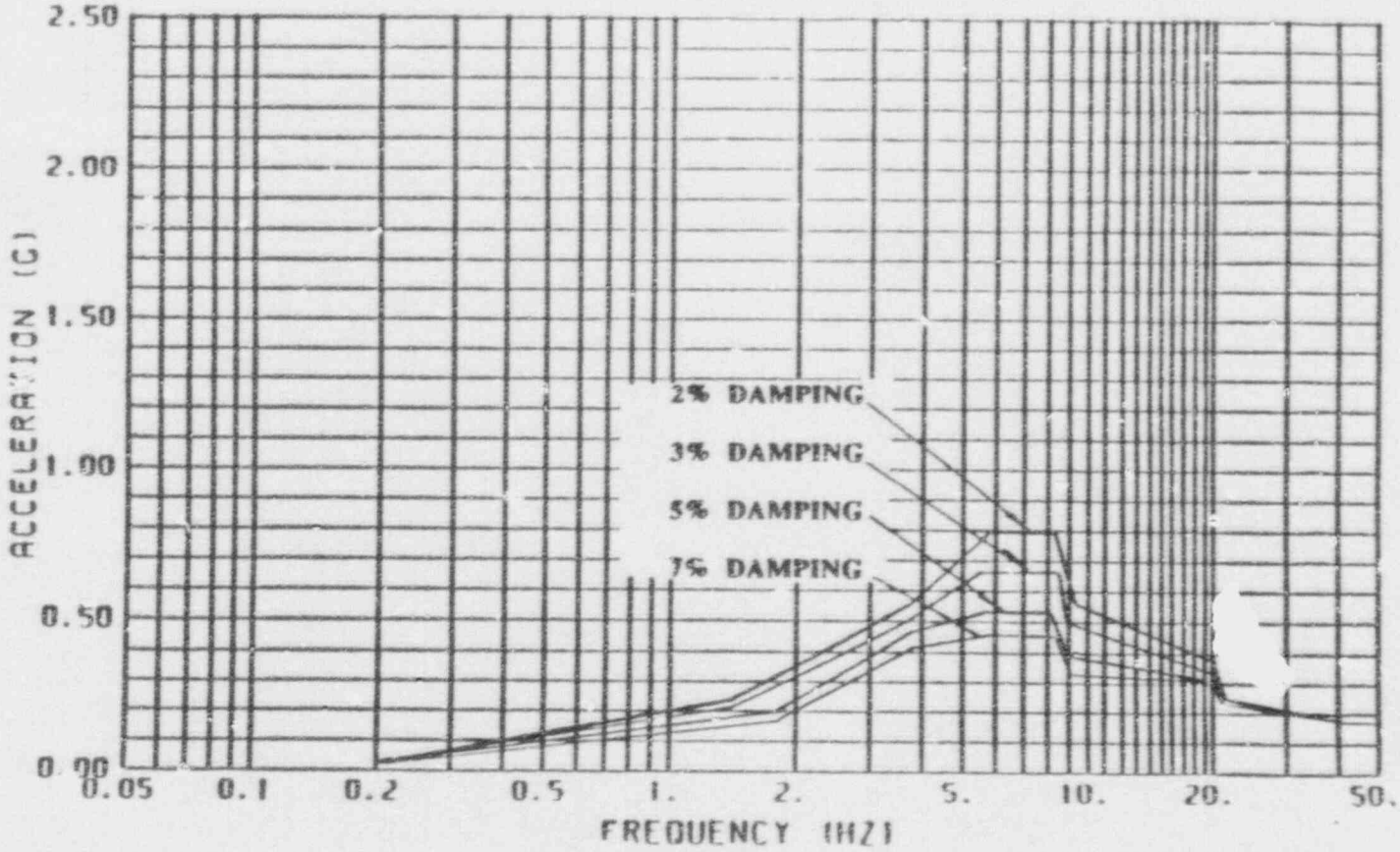
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1007'-6" INTAKE STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY AME DATE 7-17-92 CHKD DNN DATE 7/17/92	SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1024'-6" INTAKE STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY Amc DATE 7-17-92 CHKD AWJ DATE 7/17/92	SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1024'-6" INTAKE STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY AJK DATE 7-17-92 CHKD AJW DATE 7/17/92	SKETCH NO REV

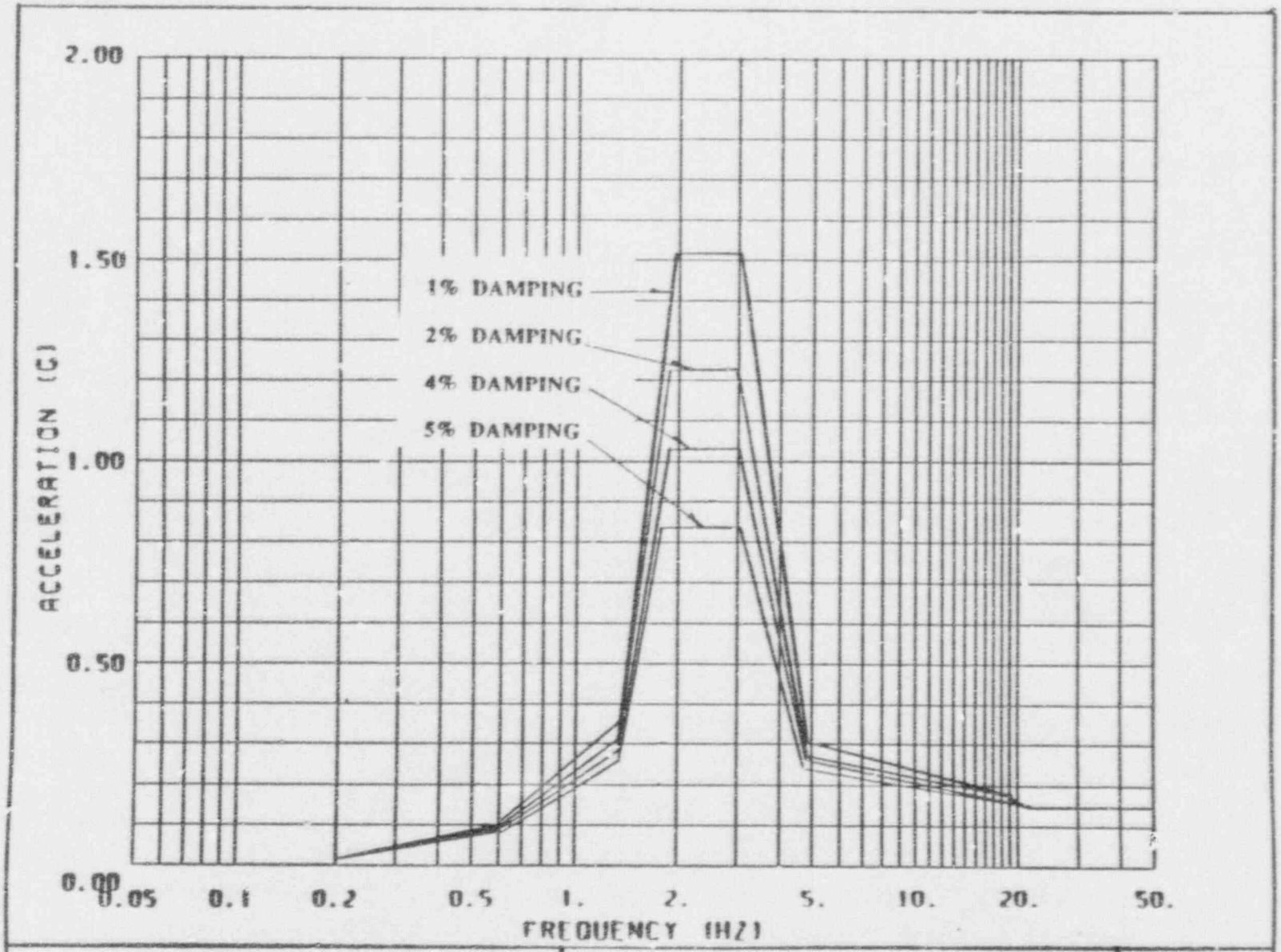


OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1024'-6" INTAKE STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY AMC DATE 7-17-92 CHKD AW DATE 7/17/92	SKETCH NO REV.

APPENDIX C

FORT CALHOUN STATION, UNIT 1
IN-STRUCTURE RESPONSE SPECTRA
AUXILIARY BUILDING/ CONTAINMENT STRUCTURE/ INTERNAL STRUCTURE
OPERATING BASIS EARTHQUAKE

(48 pages; this cover page not included)

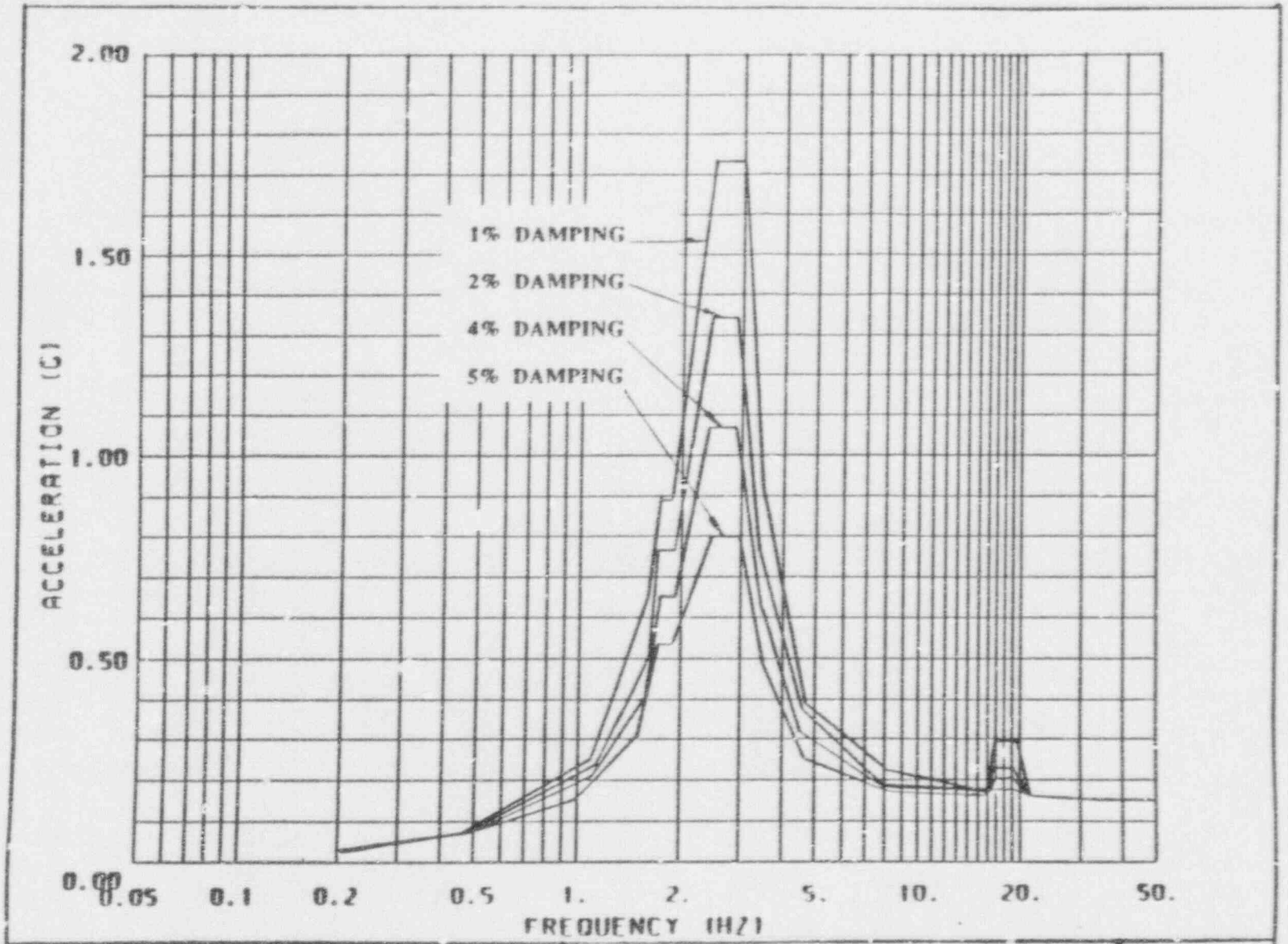


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

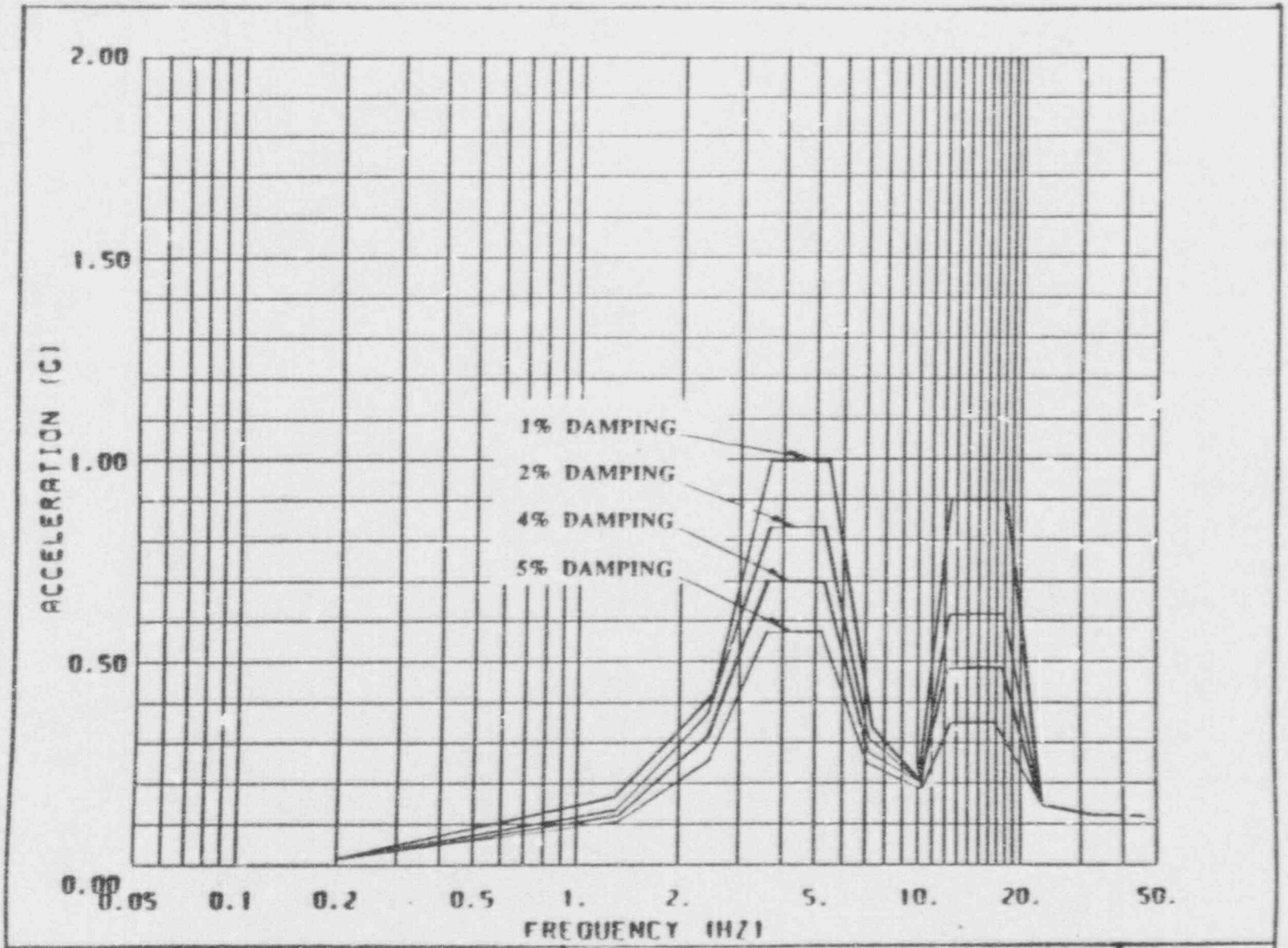
OPERATING BASIS EARTHQUAKE

HORIZONTAL (NORTH-SOUTH) DIRECTION
AT ELEVATION 989'-0"
AUXILIARY BUILDING

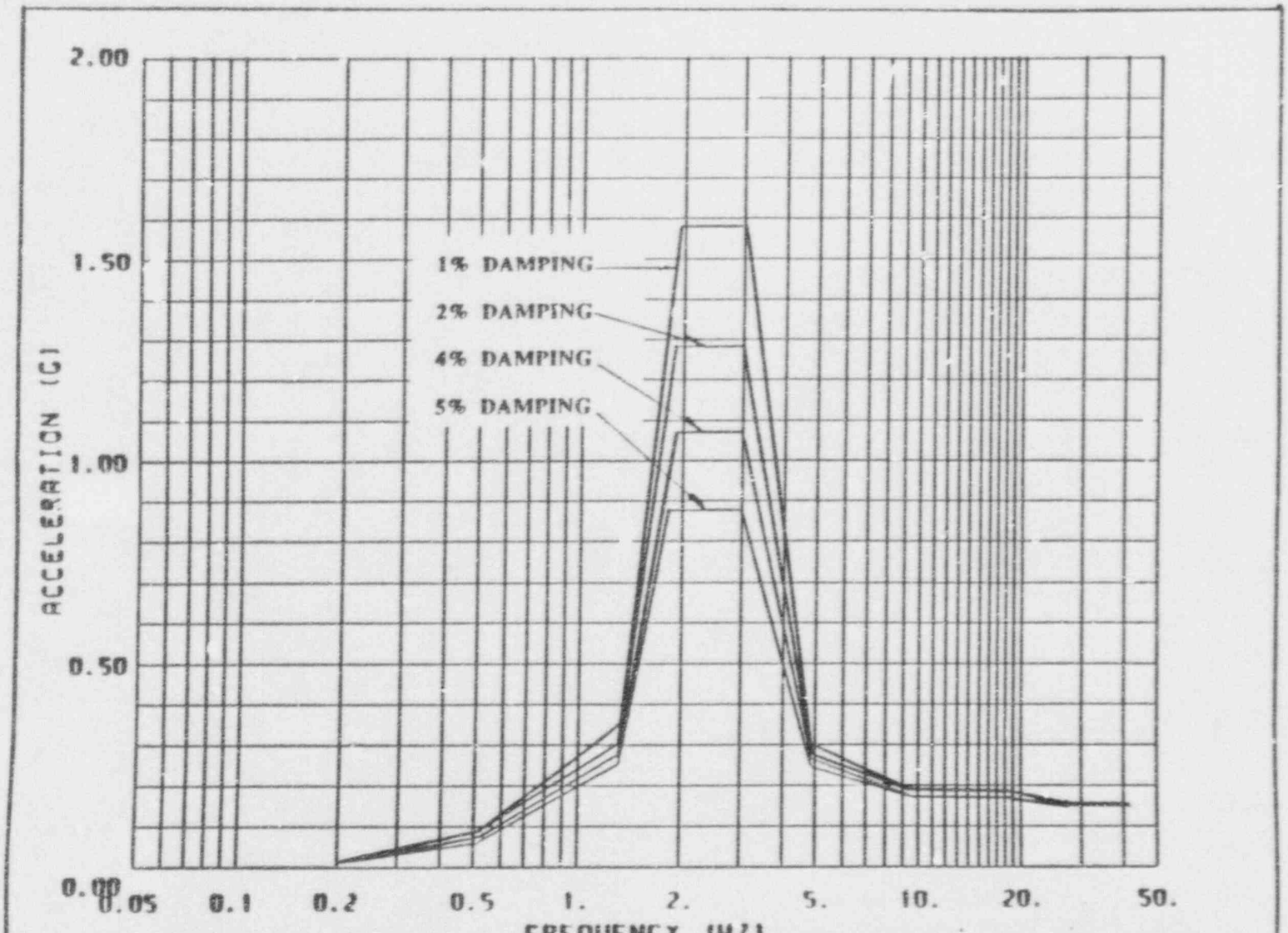
BY ADC DATE 7-17-92 CHKD DATE 7/17/92 SKETCH NO REV



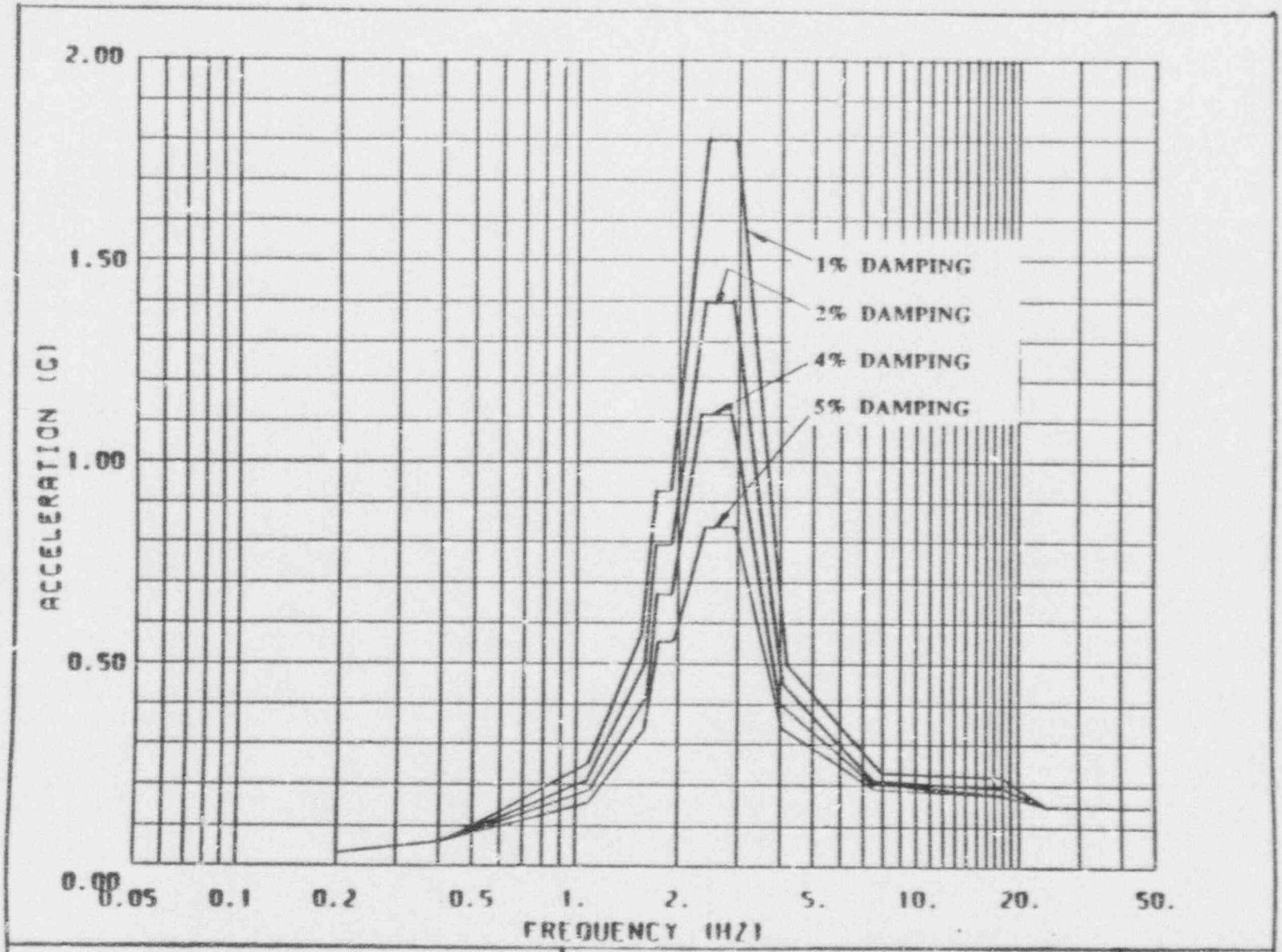
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 989'-0" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY Ame DATE 7-17-92 CHKD Ame DATE 7/17/92	SKETCH NO REV



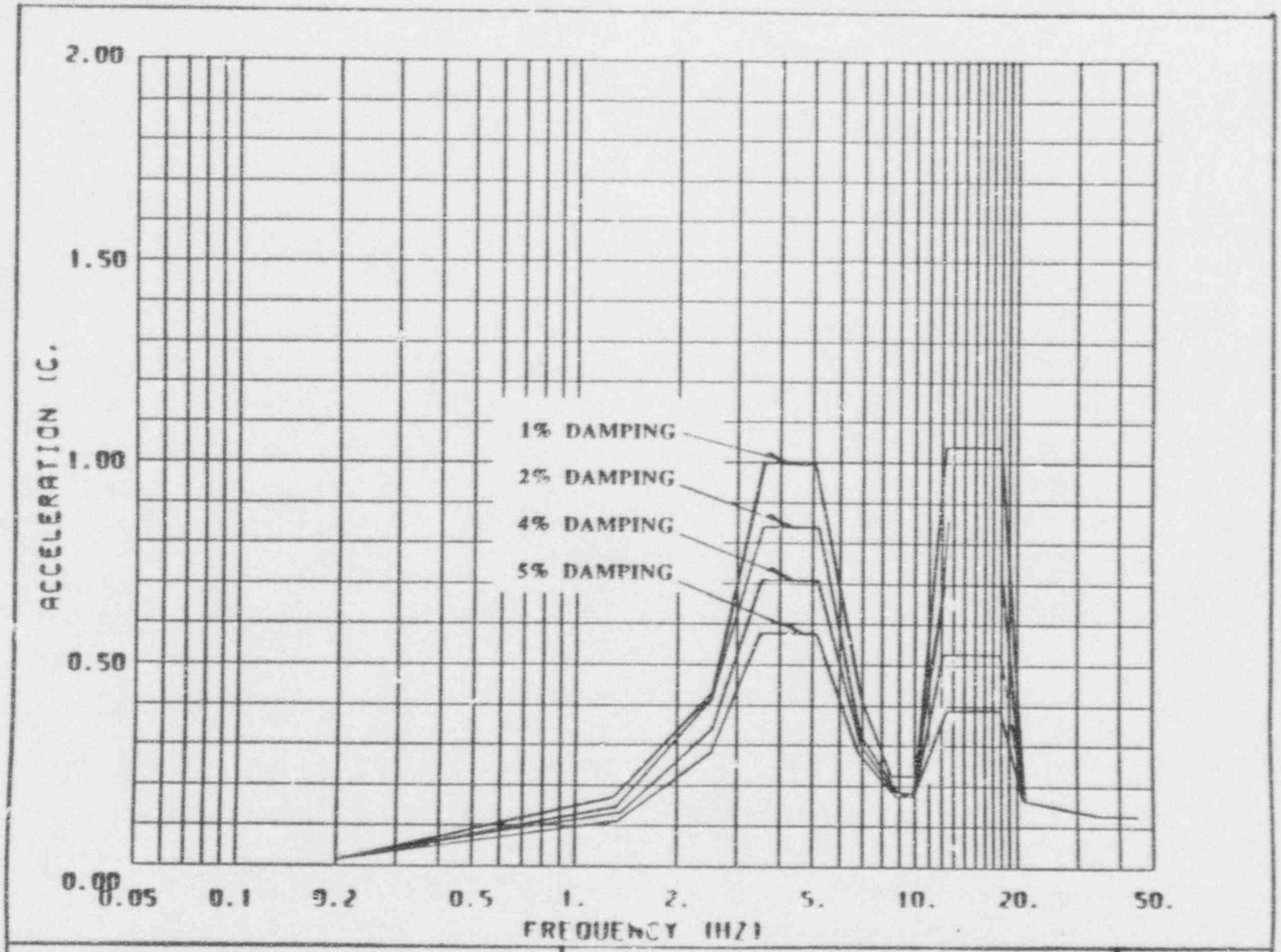
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 989'-0" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY ADC DATE 7-17-92 CHKD [illegible] DATE 7/17/92	SKETCH NO REV



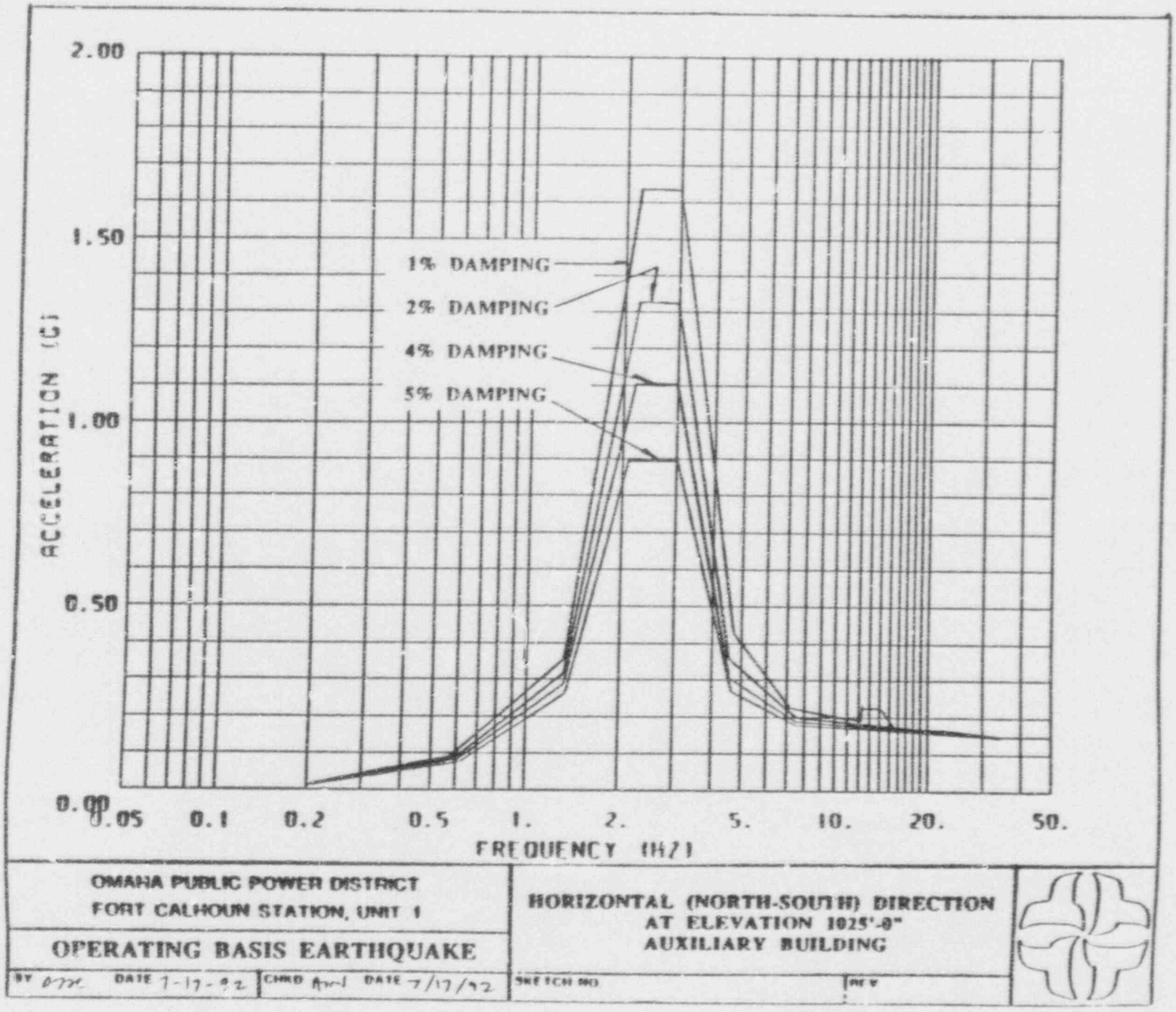
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1007'-0" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY Amc DATE 7-17-92 CHKD Amw DATE 7/17/92	SKETCH NO. REV



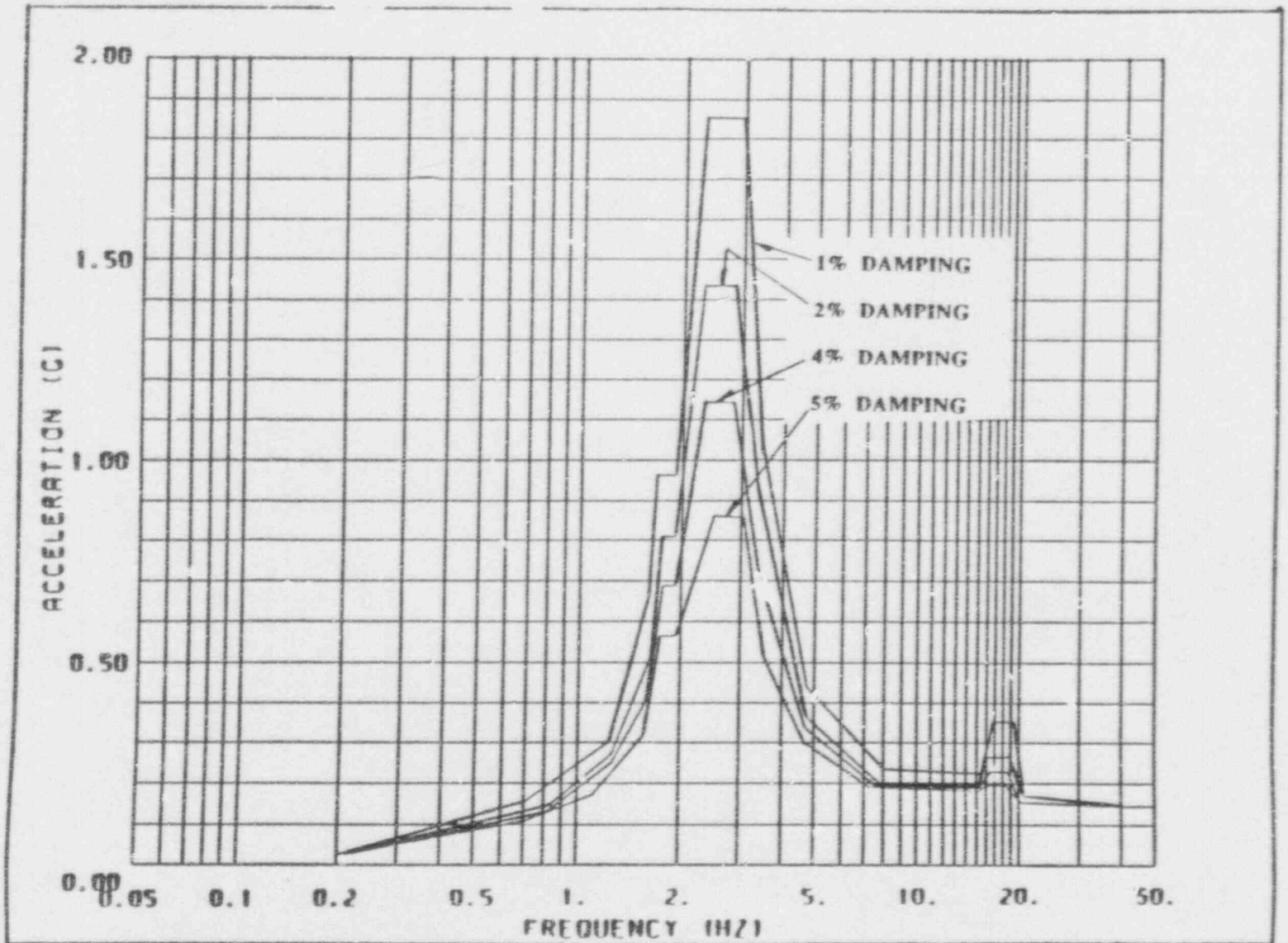
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1007'-0" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY DMC DATE 7-17-92 CHKD DMC DATE 7/17/92	SKETCH NO. REV



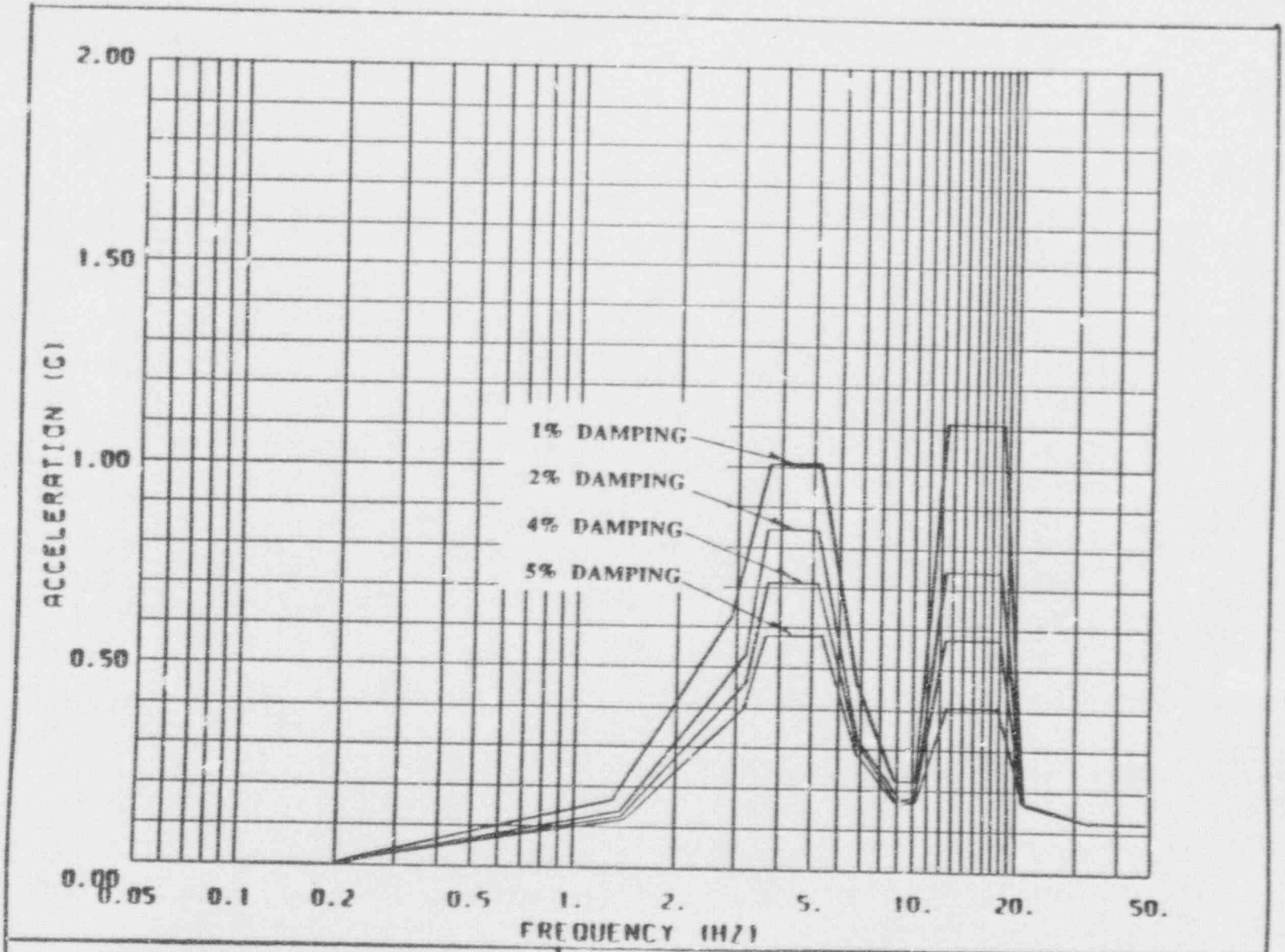
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1007'-0" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY Amc DATE 7-17-92 CHKD Amc DATE 7/17/92	SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1025'-0" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY DTK DATE 7-17-92 CHKD Awl DATE 7/17/92	SKETCH NO. REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1025'-0" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY [illegible] DATE 7-17-92 CHKD [illegible] DATE 7/17/92	SKETCH NO REV

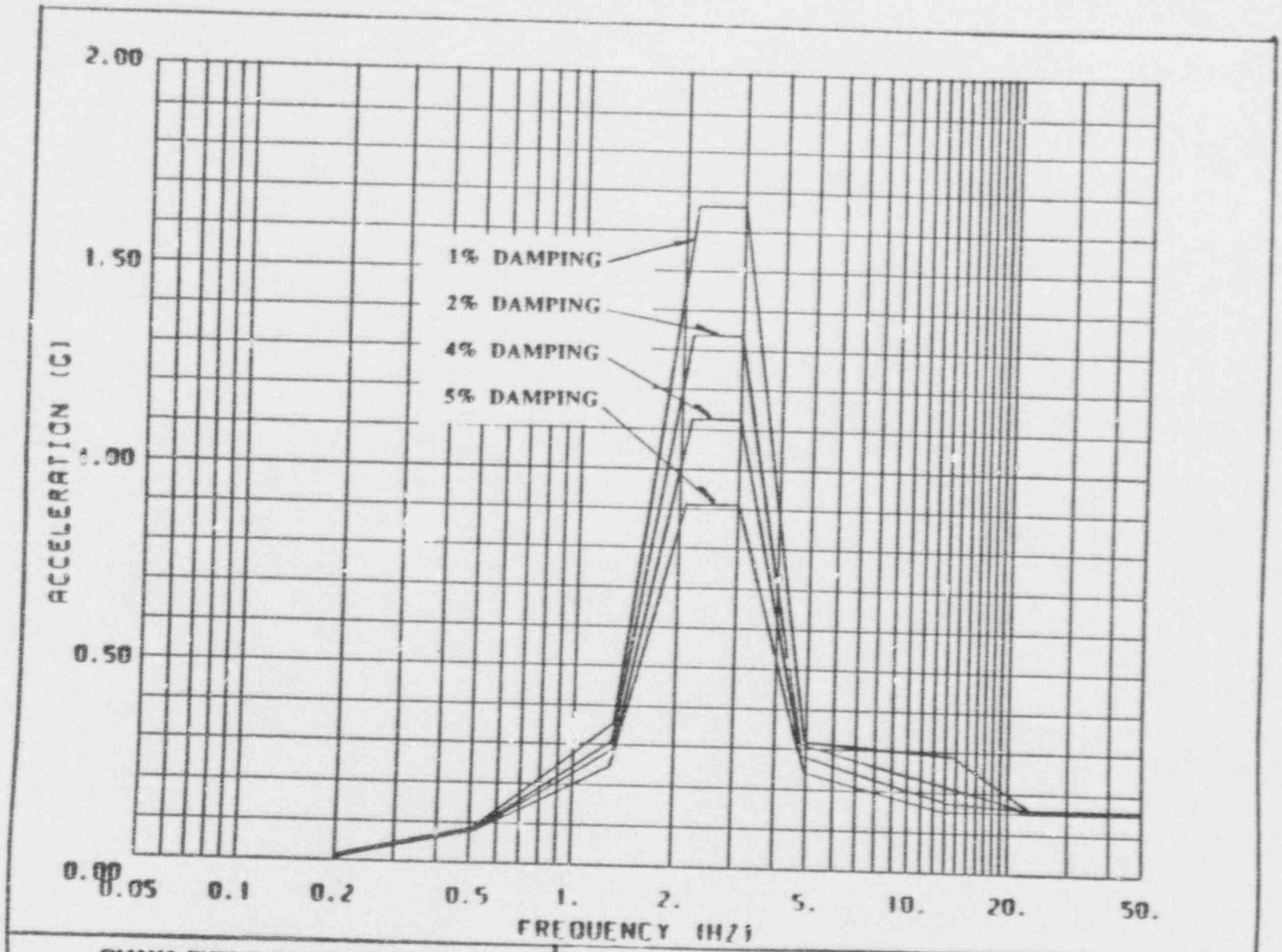


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 1023'-0"
AUXILIARY BUILDING

BY [illegible] DATE 7-17-92 CHKD [illegible] DATE 7/17/92 SKETCH NO REV



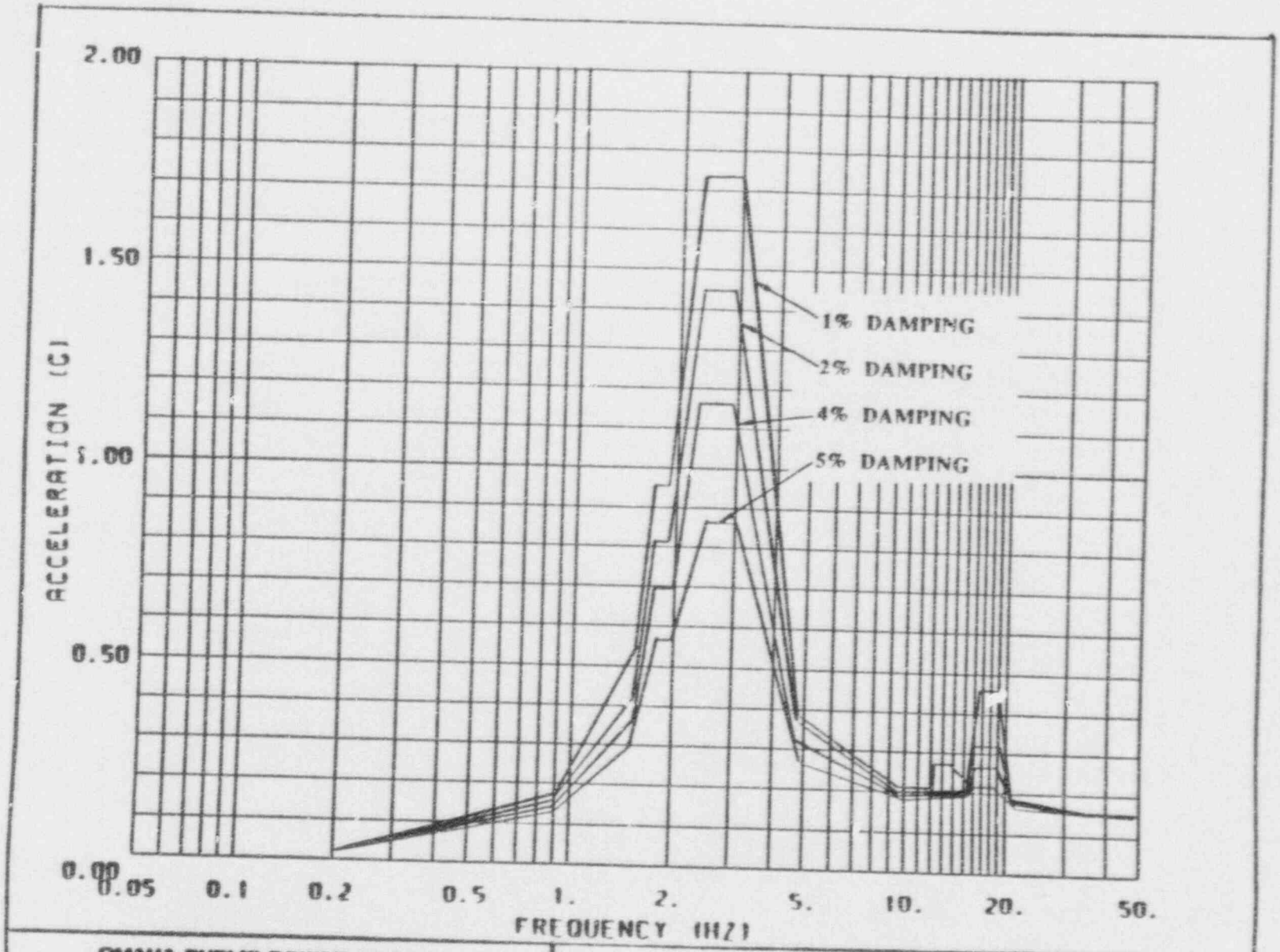
OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (NORTH-SOUTH) DIRECTION
AT ELEVATION 1036'-0"
AUXILIARY BUILDING

BY ame DATE 7-17-92 CHKD AMJ DATE 7/17/92

SKETCH NO REV

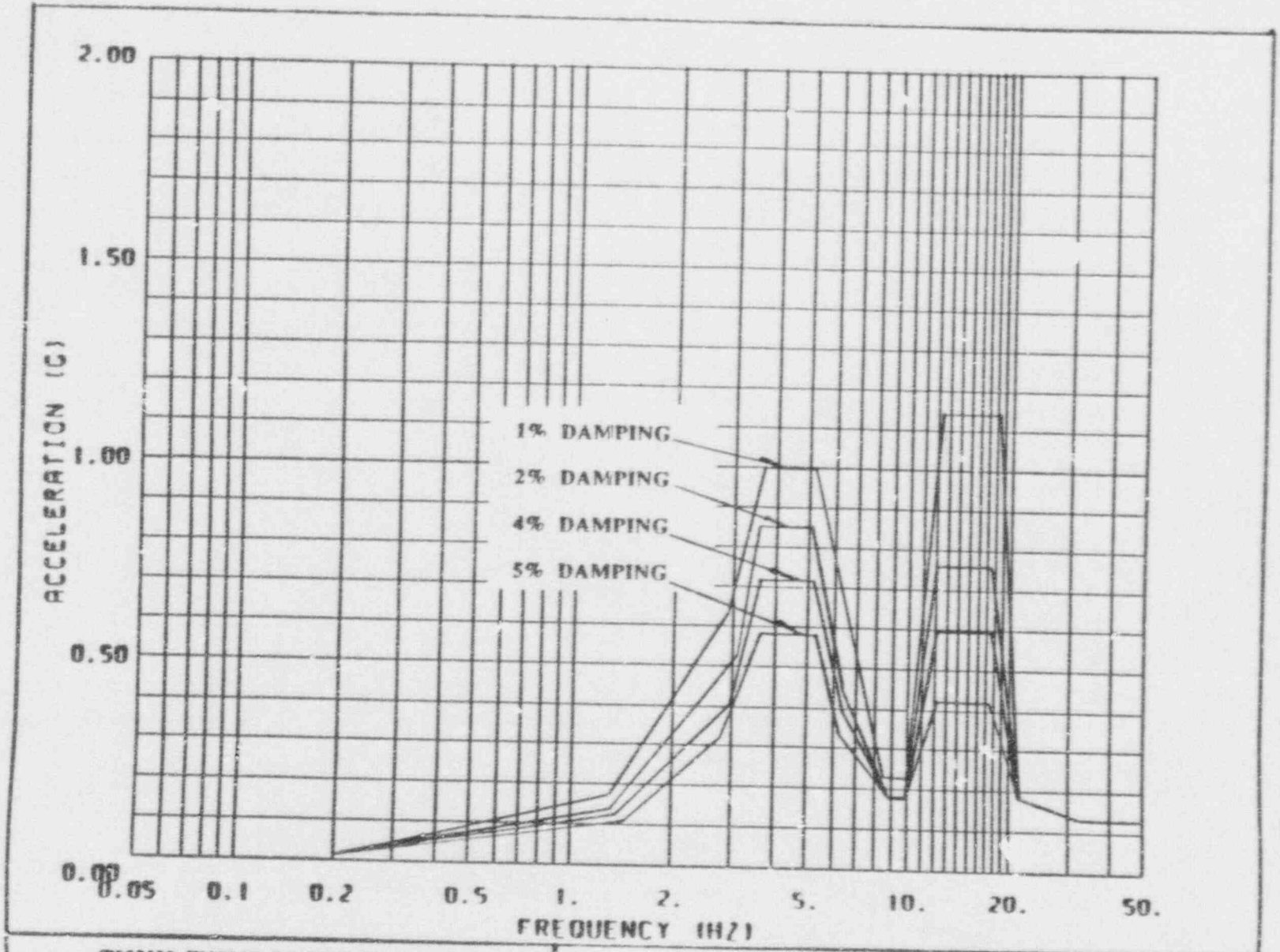


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (EAST-WEST) DIRECTION
AT ELEVATION 1036'-0"
AUXILIARY BUILDING

BY [illegible] DATE 7-17-92 CHKD [illegible] DATE 7/17/92 SKETCH NO REV

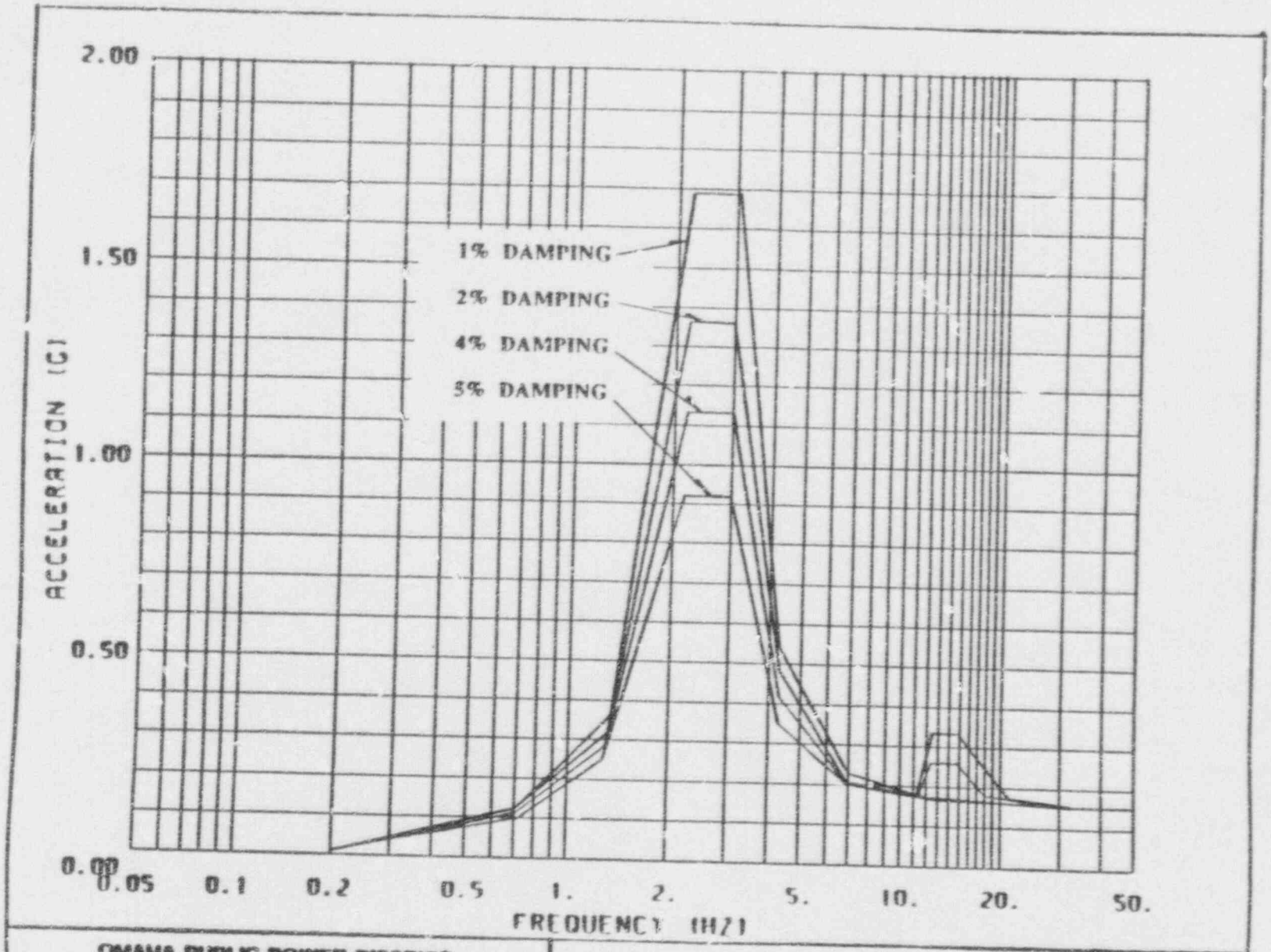


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

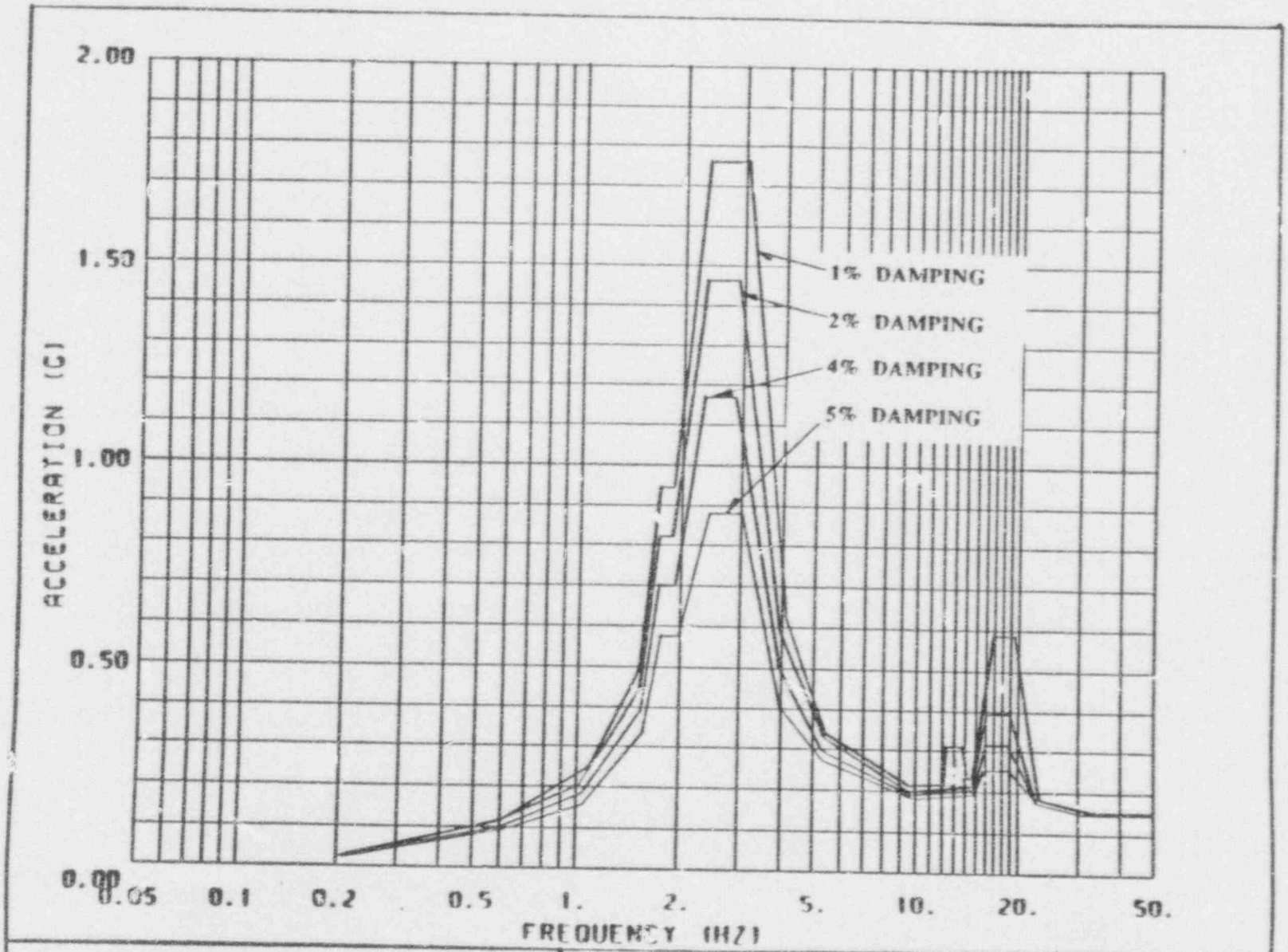
OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 1036'-8"
AUXILIARY BUILDING

BY Ame DATE 7-17-92 CHKD AmN DATE 7/17/92 SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1044'-0" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY ARC DATE 7-17-92 CHKD AWW DATE 7/17/92	SKETCH NO REV

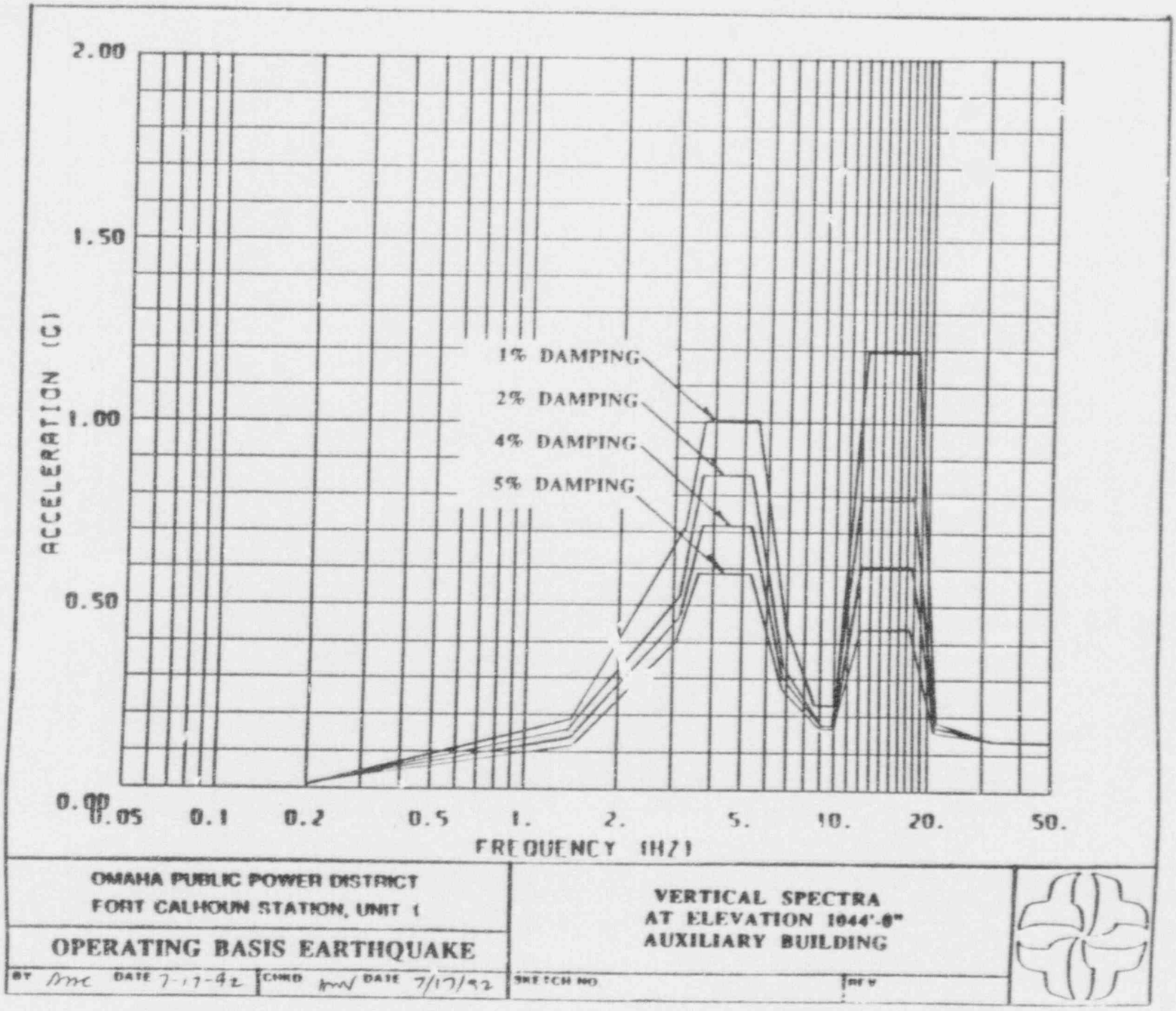


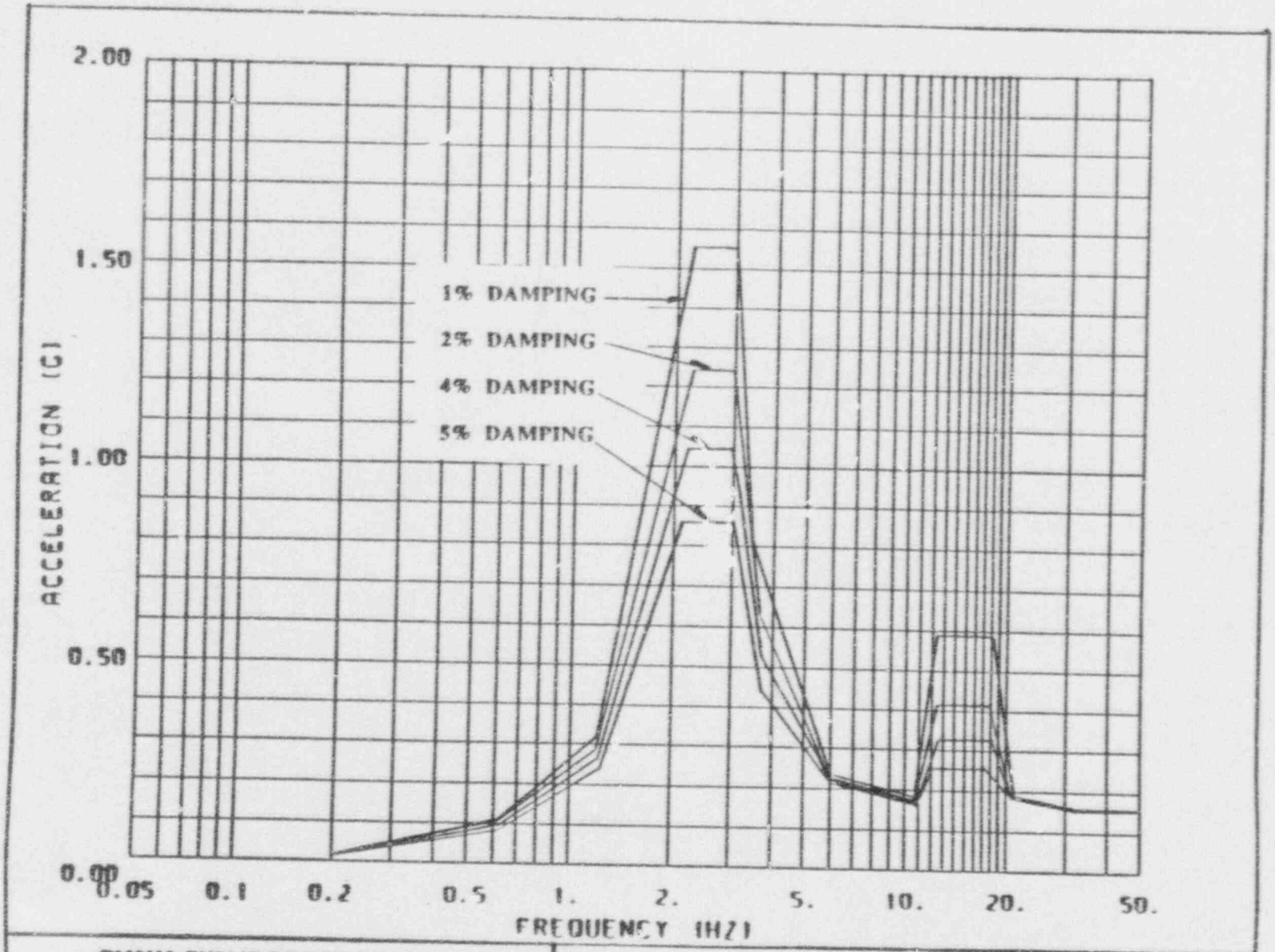
OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

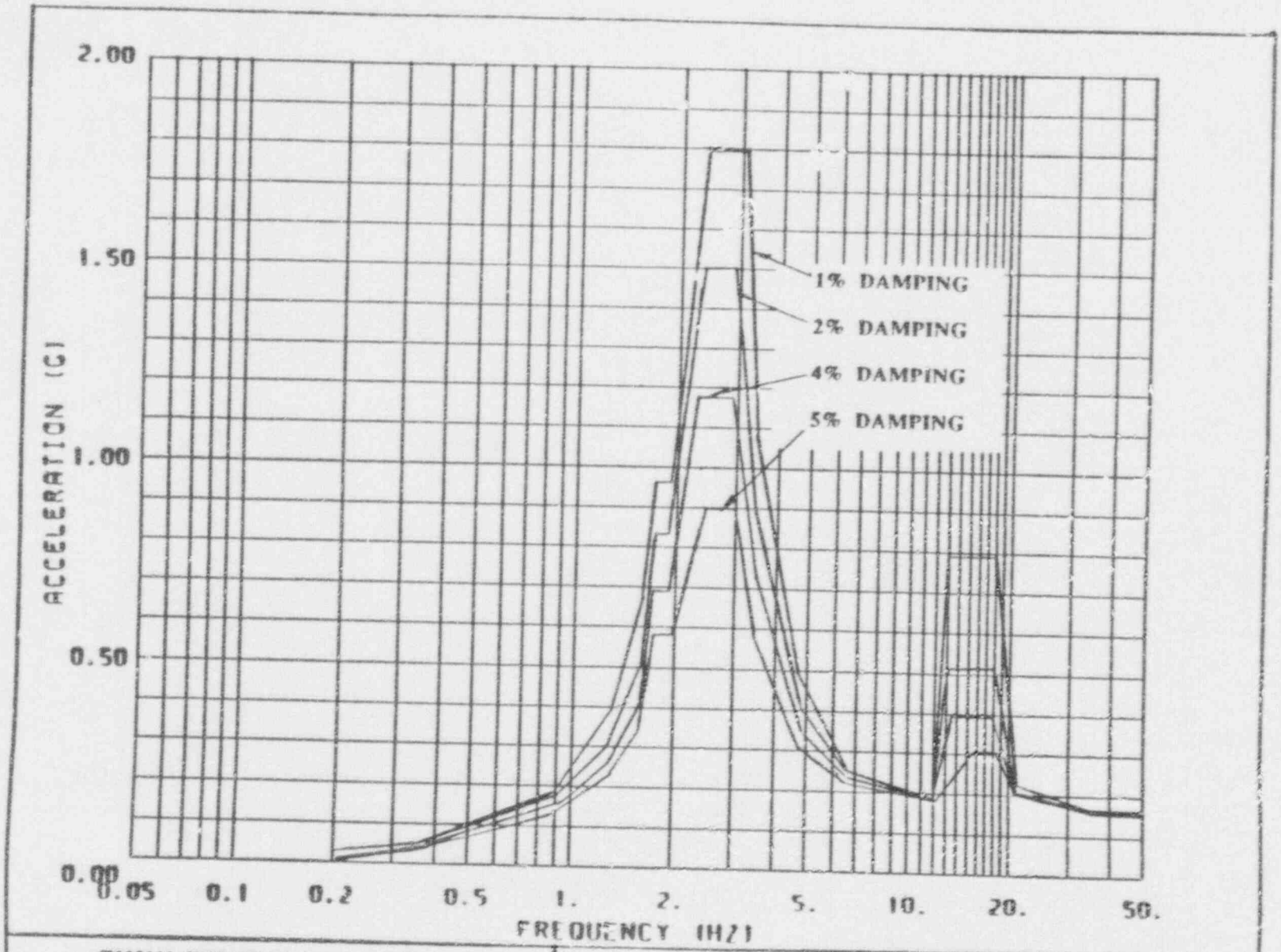
HORIZONTAL (EAST-WEST) DIRECTION
AT ELEVATION 1044'-9"
AUXILIARY BUILDING

BY MC DATE 7-17-92 CHKD AW DATE 7/17/92 SKETCH NO REV

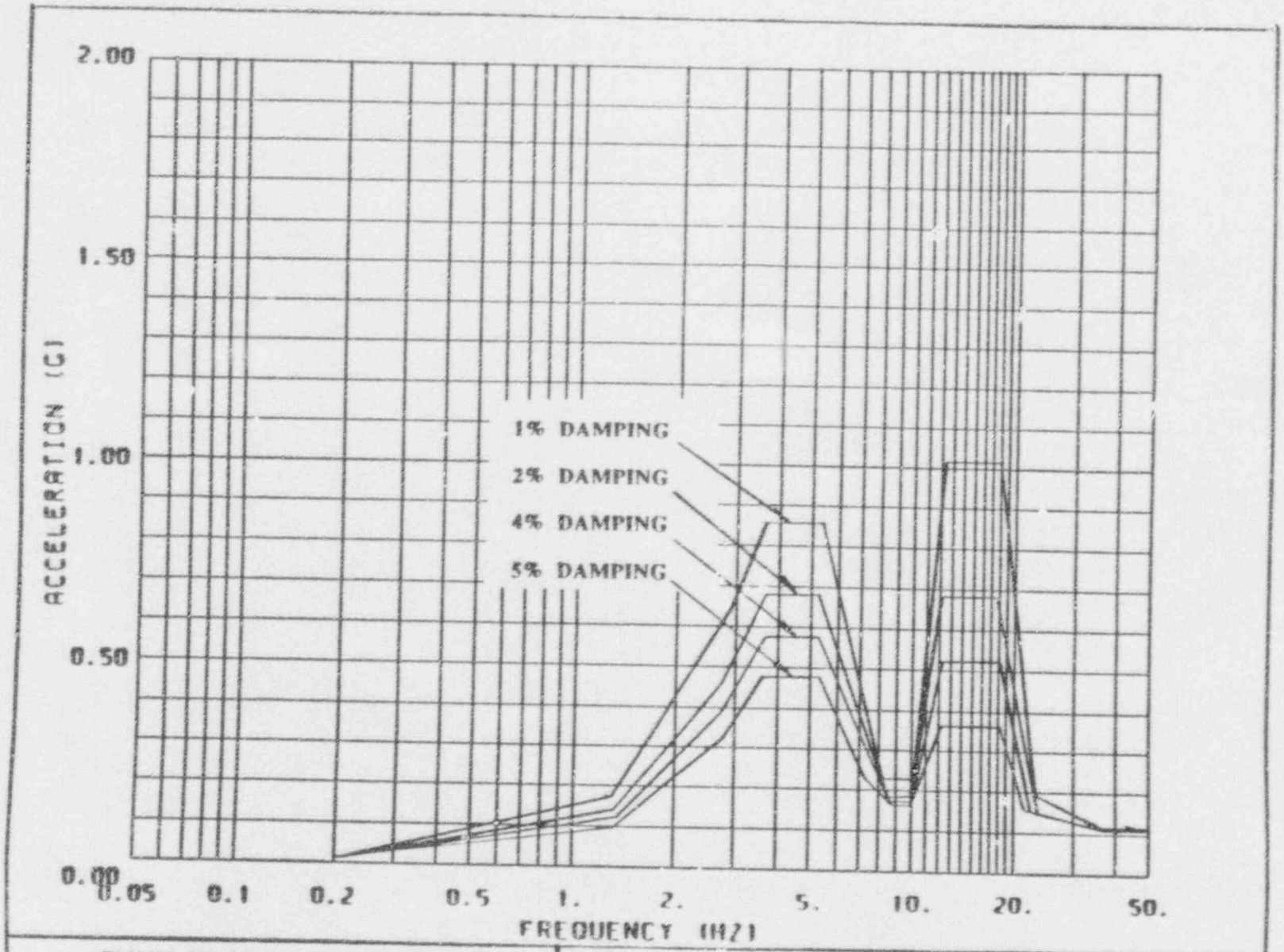

2.00
1.50
1.00
0.50
0.00
ACCELERATION (G)
1% DAMPING
2% DAMPING
4% DAMPING
5% DAMPING
0.05
0.1
0.2
0.5
1.
2.
5.
10.
20.
50.
FREQUENCY (HZ)
OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1
OPERATING BASIS EARTHQUAKE
VERTICAL SPECTRA
AT ELEVATION 1044'-8"
AUXILIARY BUILDING
BY DMC DATE 7-17-92
CHKD MW DATE 7/17/92
SKETCH NO
REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1057'-0" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY lmc DATE 7-17-92 CHKD bmv DATE 7/17/92	SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1057'-8" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY Ame DATE 7-17-92 CHKD Ame DATE 7/17/92	SKETCH NO REV

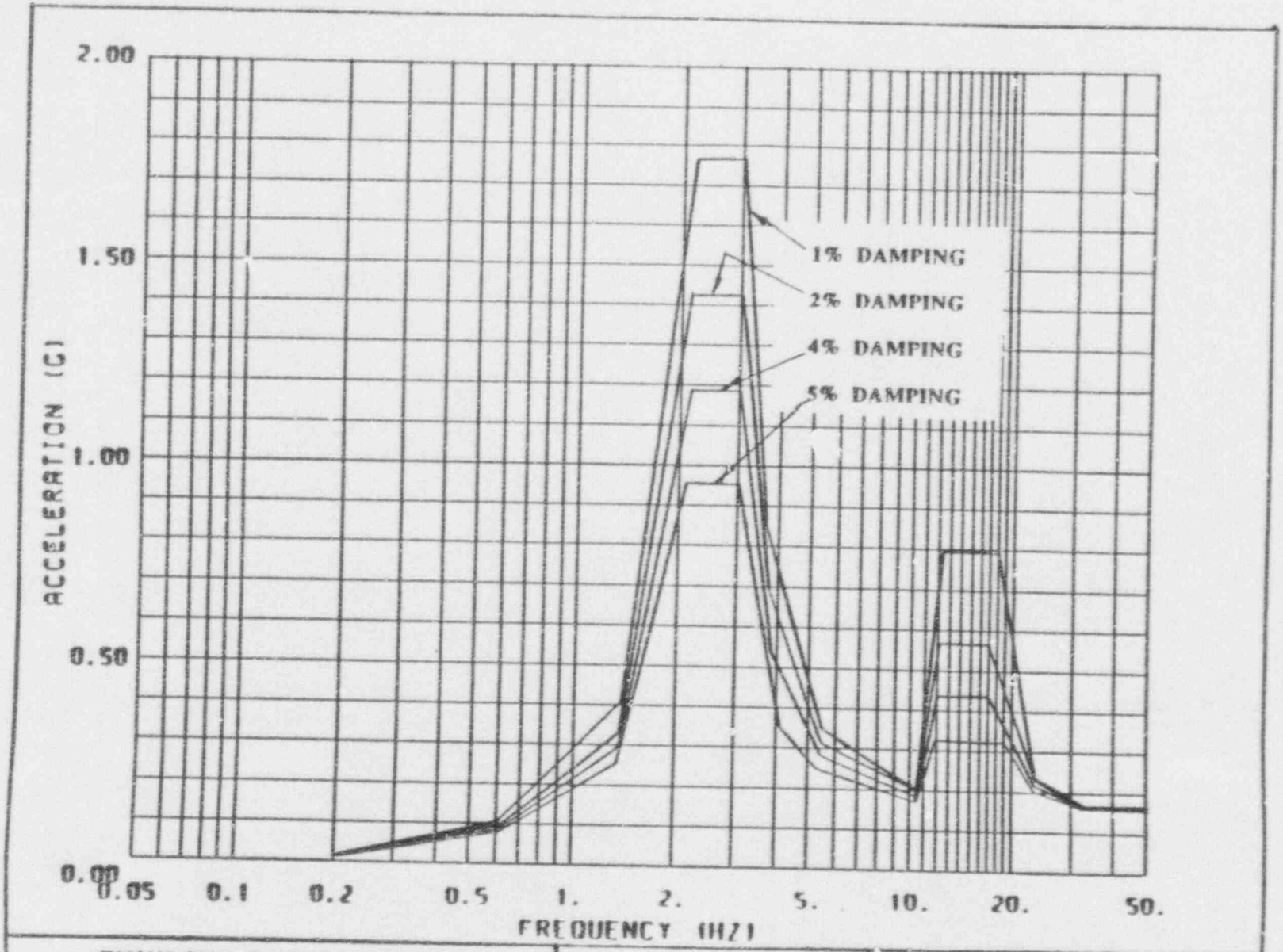


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

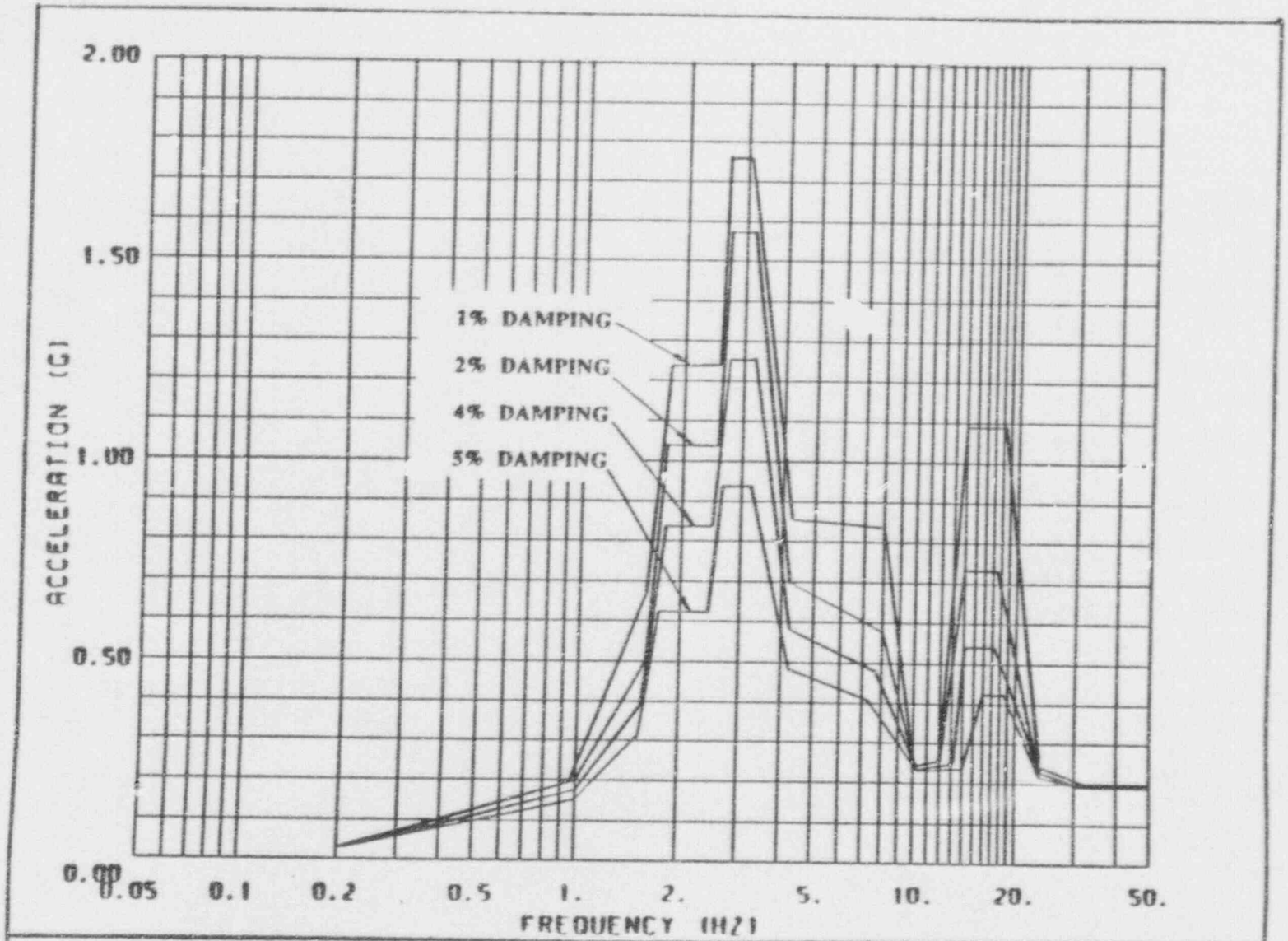
OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 1057'-0"
AUXILIARY BUILDING

BY AMC DATE 7-17-92 | CHKD Amw DATE 7/17/92 | SKETCH NO. | REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1083'-0" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY Arc DATE 7-17-92 CHKD Arc DATE 7/17/92	SKETCH NO REV

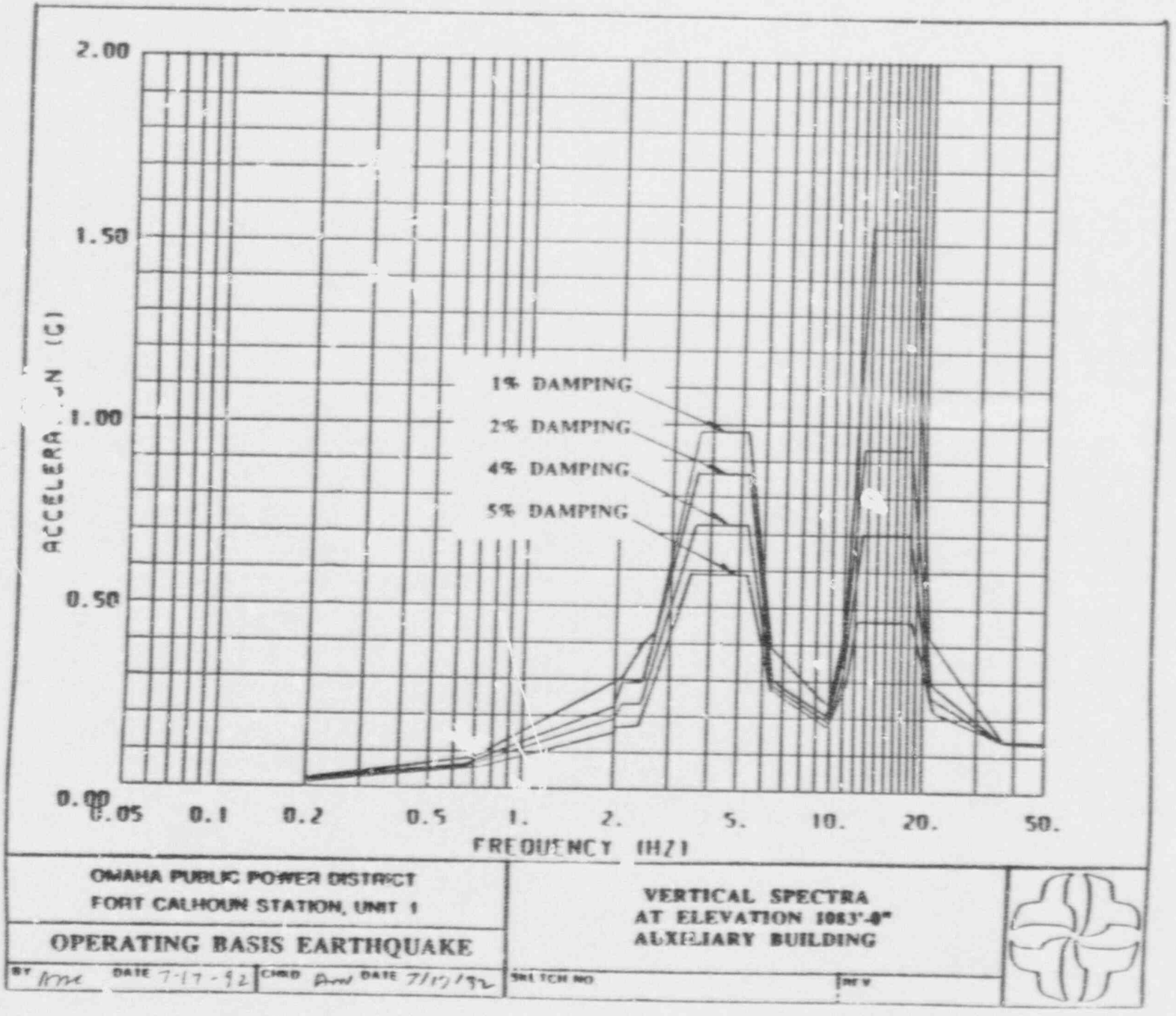


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

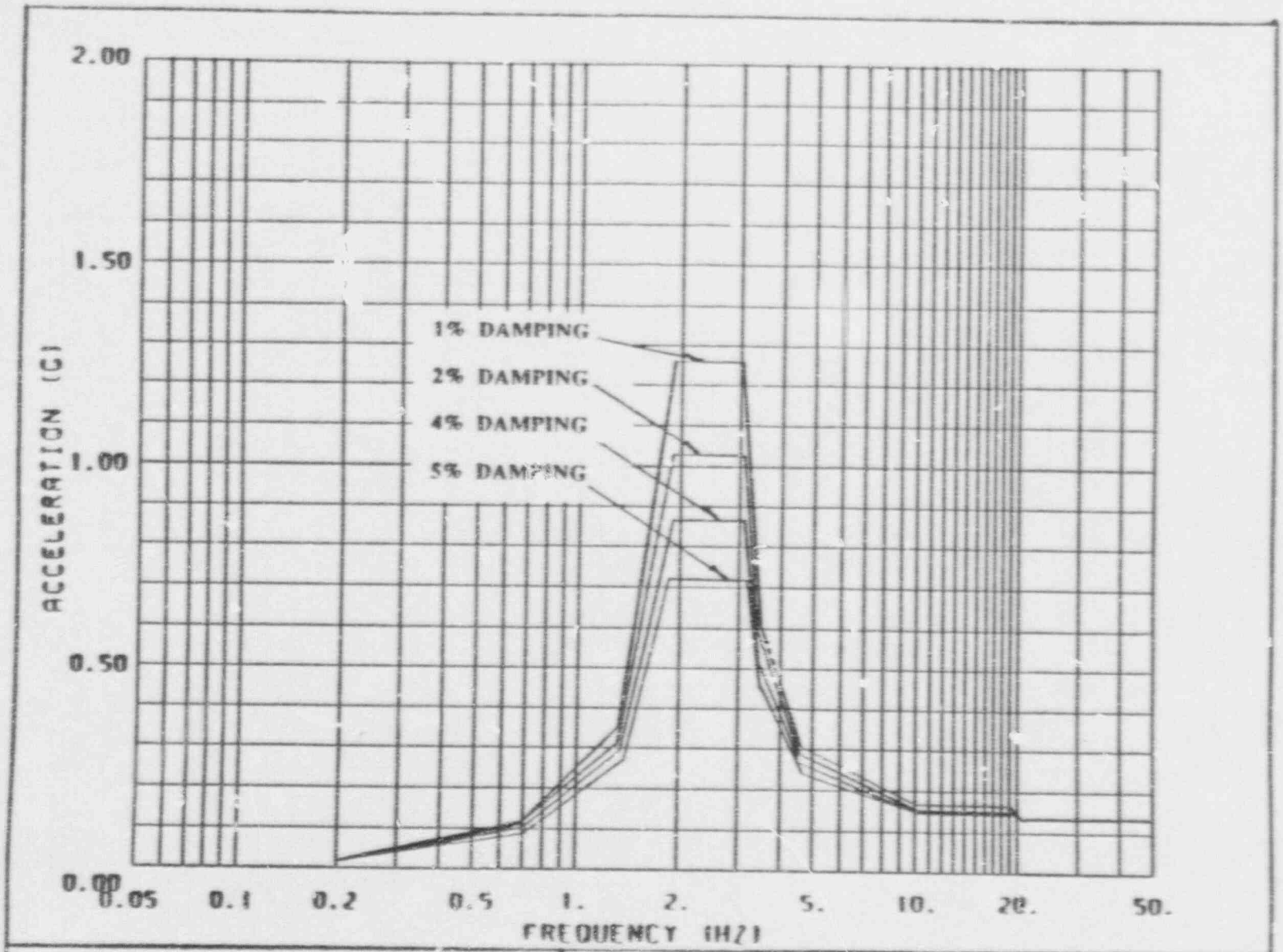
OPERATING BASIS EARTHQUAKE

HORIZONTAL (EAST-WEST) DIRECTION
AT ELEVATION 1053'-0"
AUXILIARY BUILDING

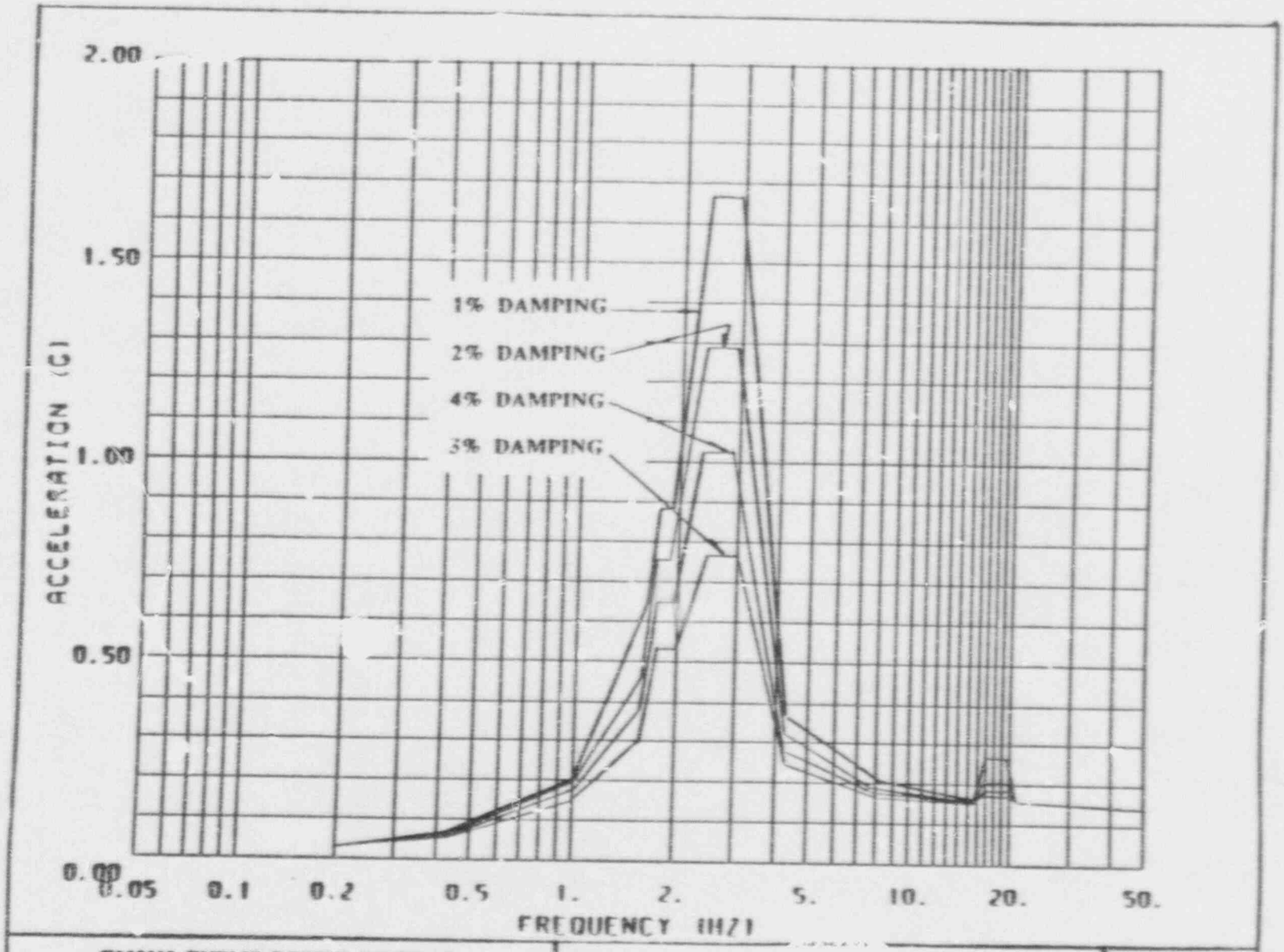
BY Ame DATE 7-17-92 CHKD Ame DATE 7/17/92 SKETCH NO REV



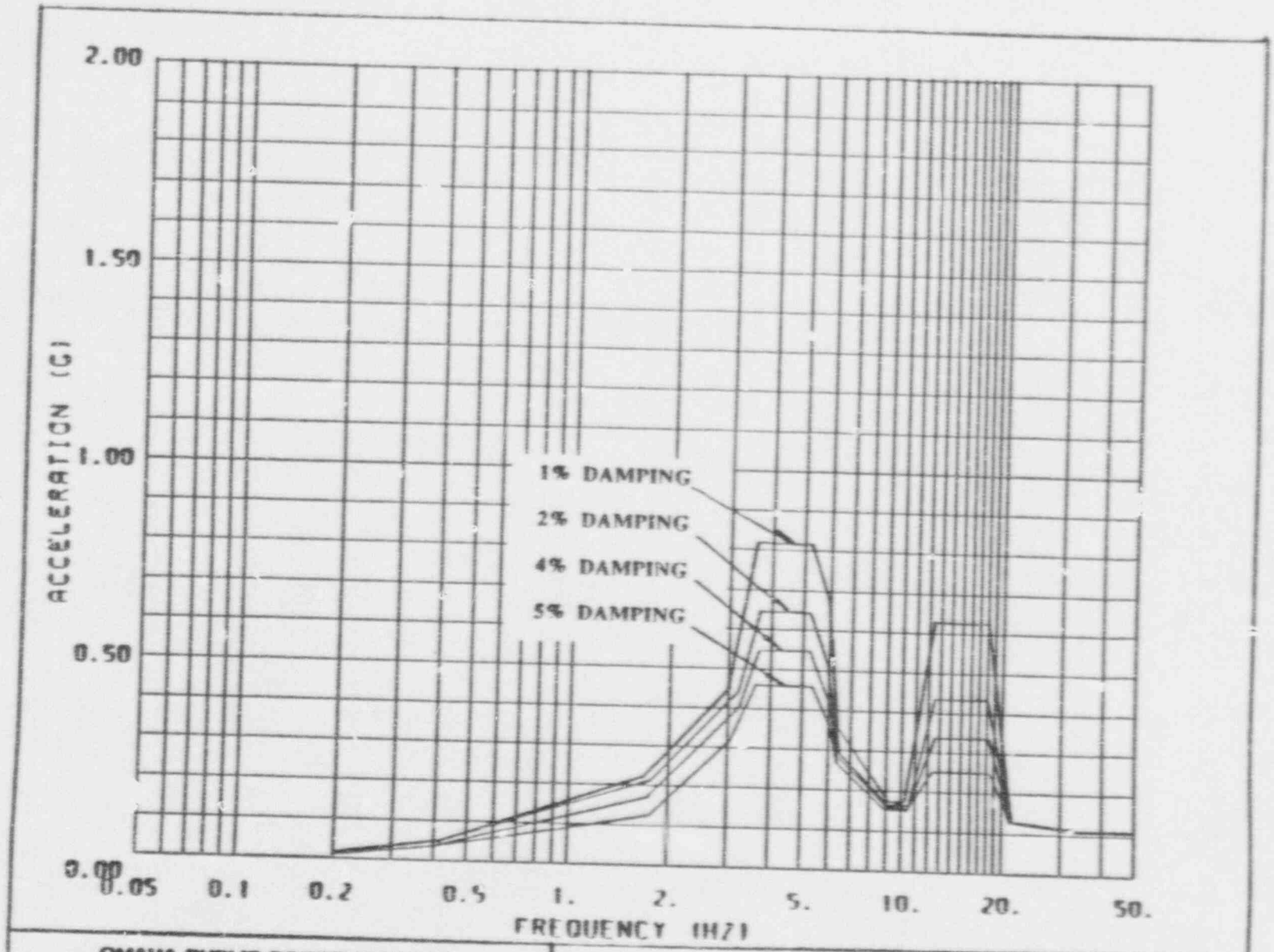
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 1063'-0" AUXILIARY BUILDING
OPERATING BASIS EARTHQUAKE	
BY Arne DATE 7-17-92 CHKD Arne DATE 7/17/92	SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 994'-8" INTERNAL STRUCTURE
OPERATING BASIS EARTHQUAKE	
BY Amc DATE 7-17-92 CHKD Amd DATE 7/17/92	SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 994'-0" INTERNAL STRUCTURE
OPERATING BASIS EARTHQUAKE	
BY AMC DATE 7-17-92 CHKD AMC DATE 7/17/92	SKETCH NO REV

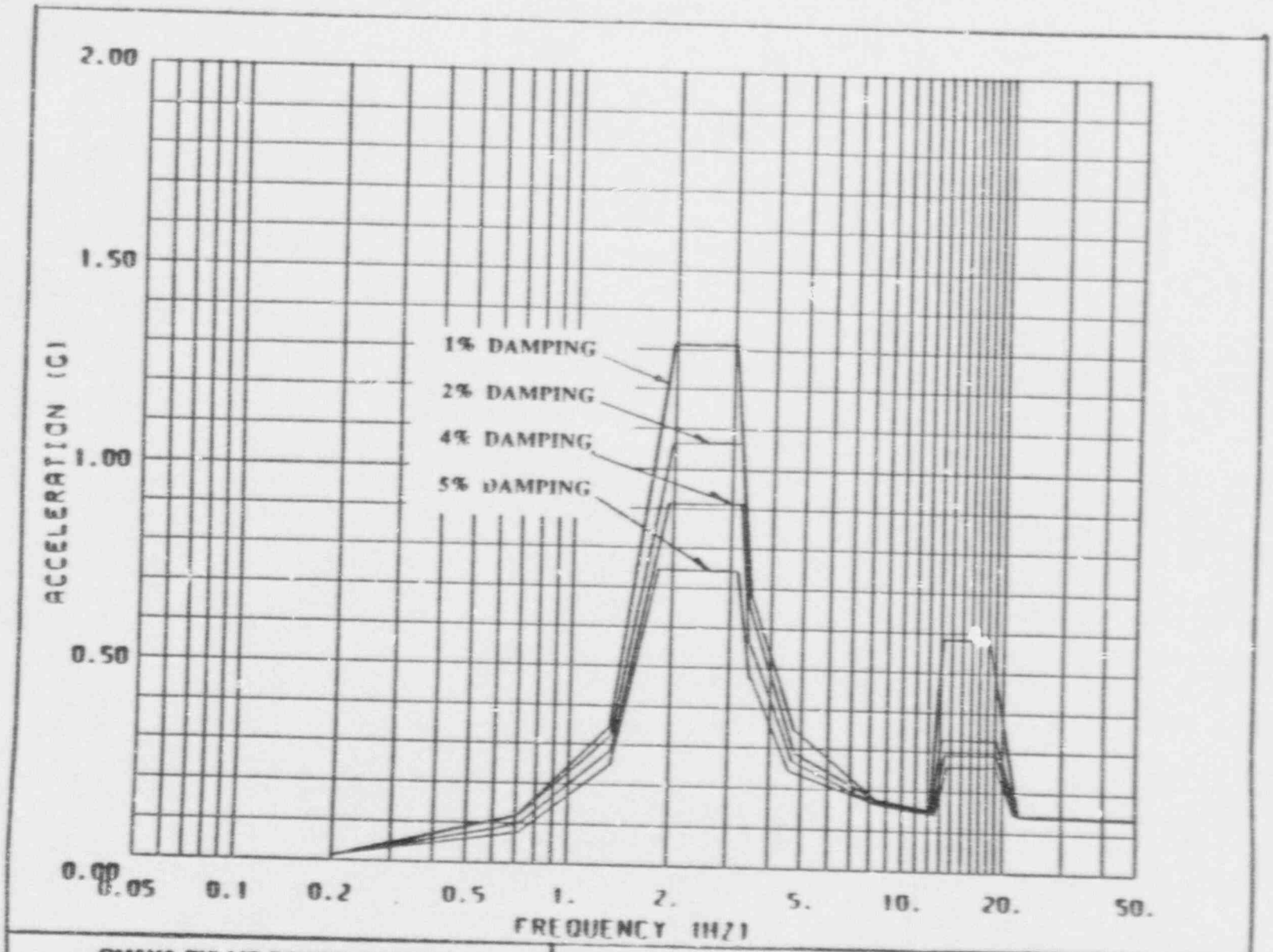


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 994'-8"
INTERNAL STRUCTURE

BY AMC DATE 7-17-92 CHKD AMC DATE 7/17/92 SKETCH NO REV

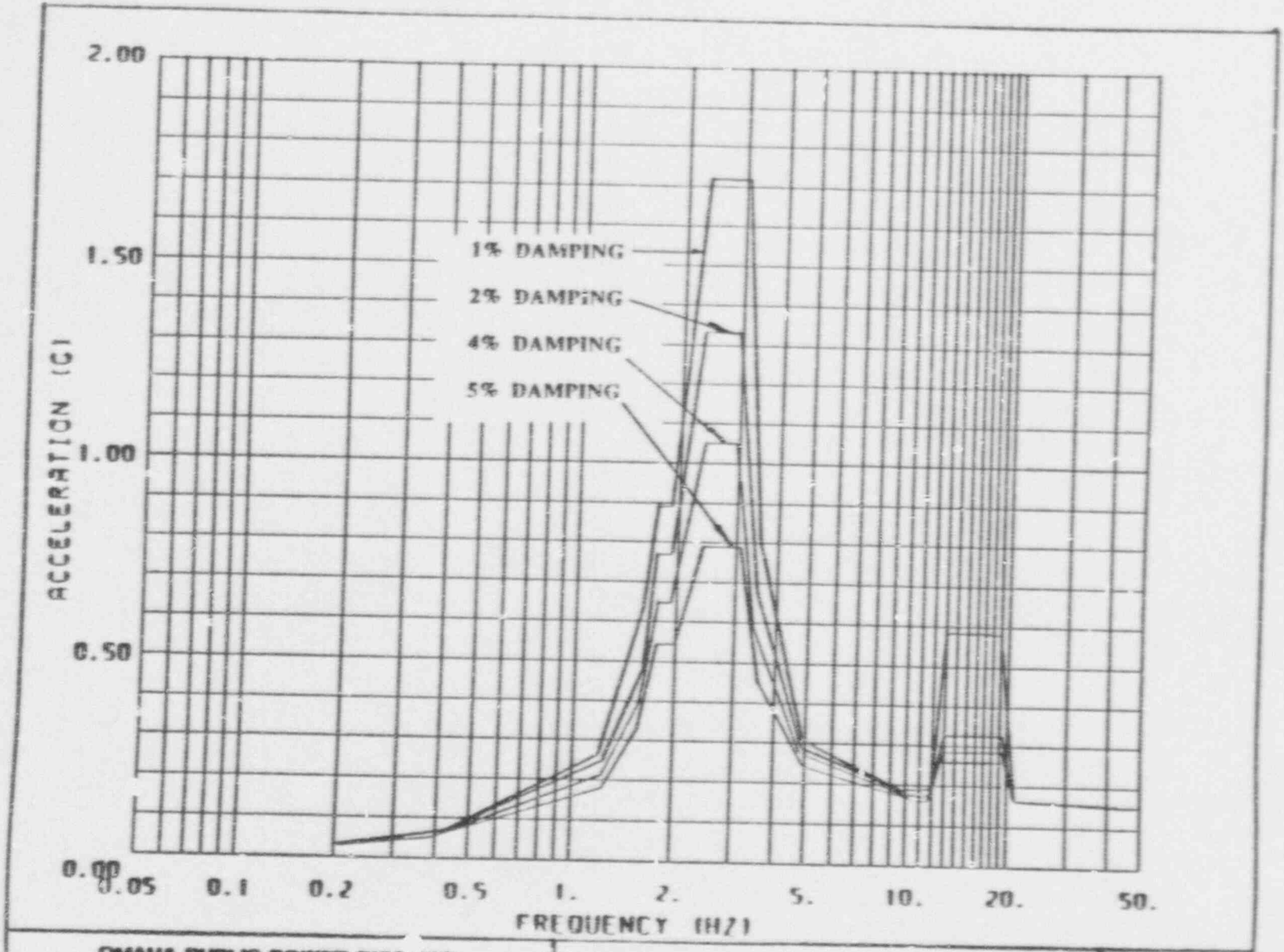


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

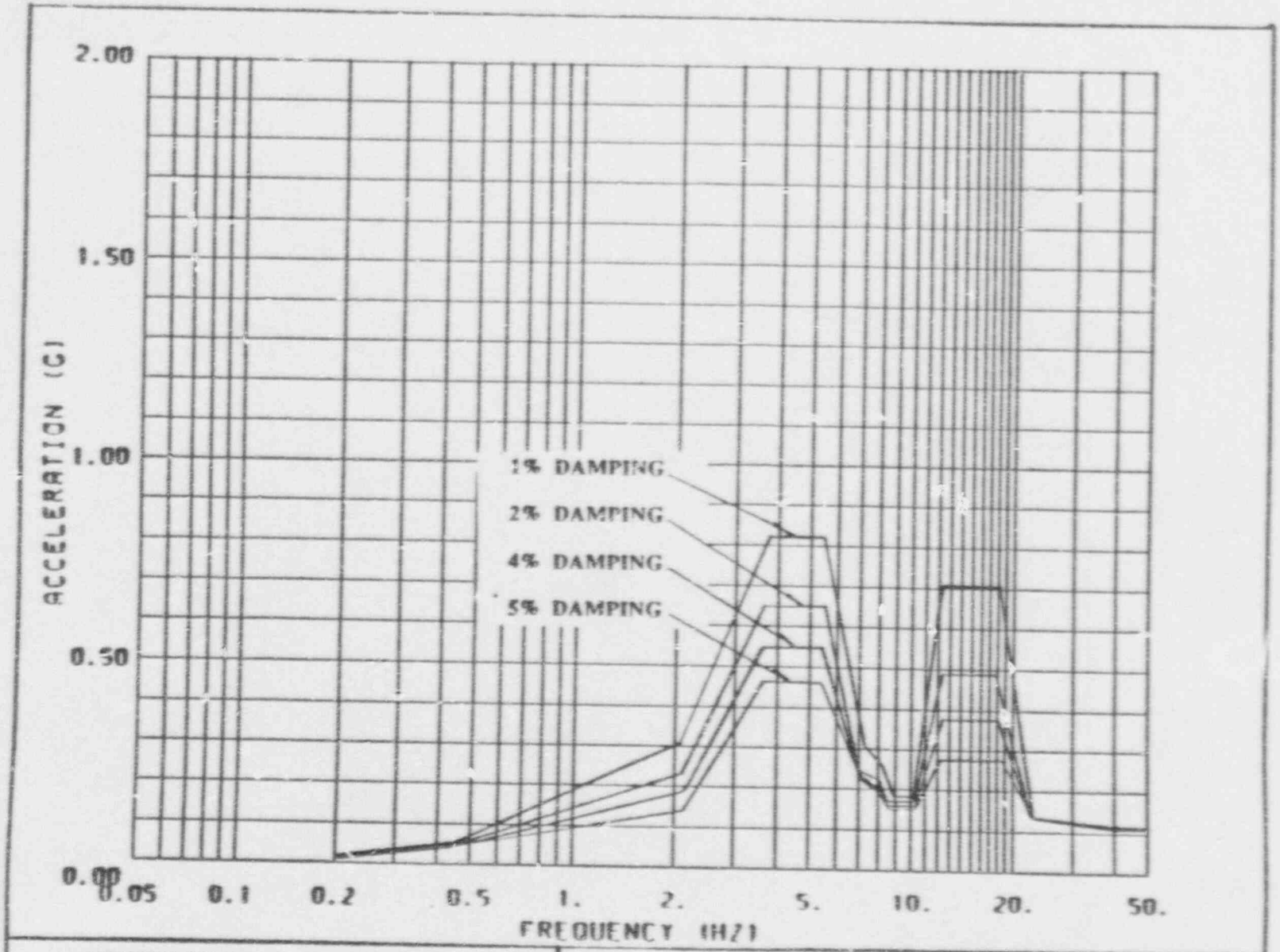
OPERATING BASIS EARTHQUAKE

HORIZONTAL (NORTH-SOUTH) DIRECTION
AT ELEVATION 1013'-6"
INTERNAL STRUCTURE

BY ATTC DATE 7-17-92 CHKD ATW DATE 7/17/92



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION ELEVATION 1013'-0" INTERNAL STRUCTURE
OPERATING BASIS EARTHQUAKE	
BY lrm DATE 7-17-92 CHKD AW DATE 7/17/92	SKETCH NO REV



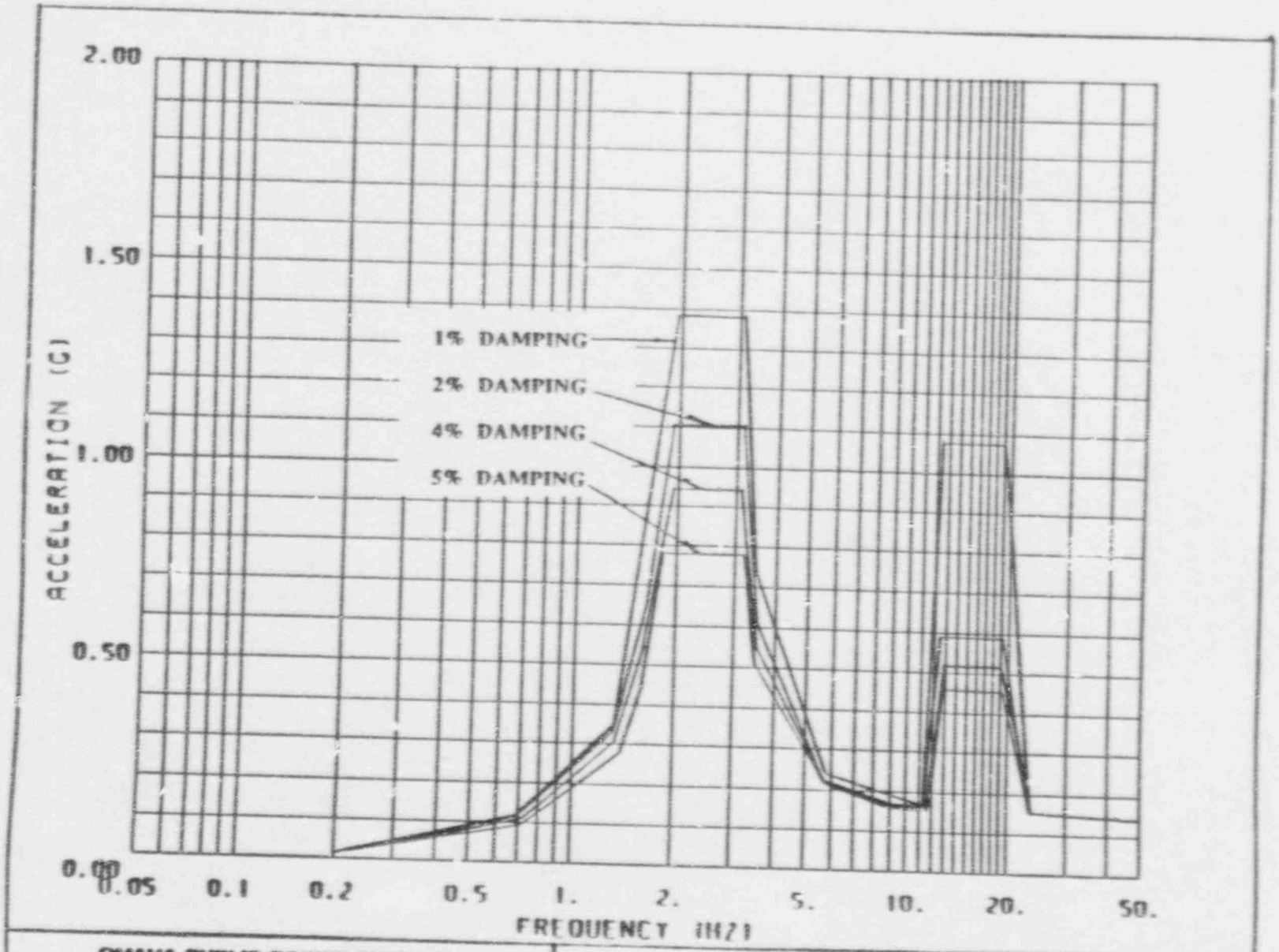
OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 1013'-8"
INTERNAL STRUCTURE

BY Amc DATE 7-17-92 CHKD AWW DATE 7/17/92

SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1038'-6" INTERNAL STRUCTURE
OPERATING BASIS EARTHQUAKE	
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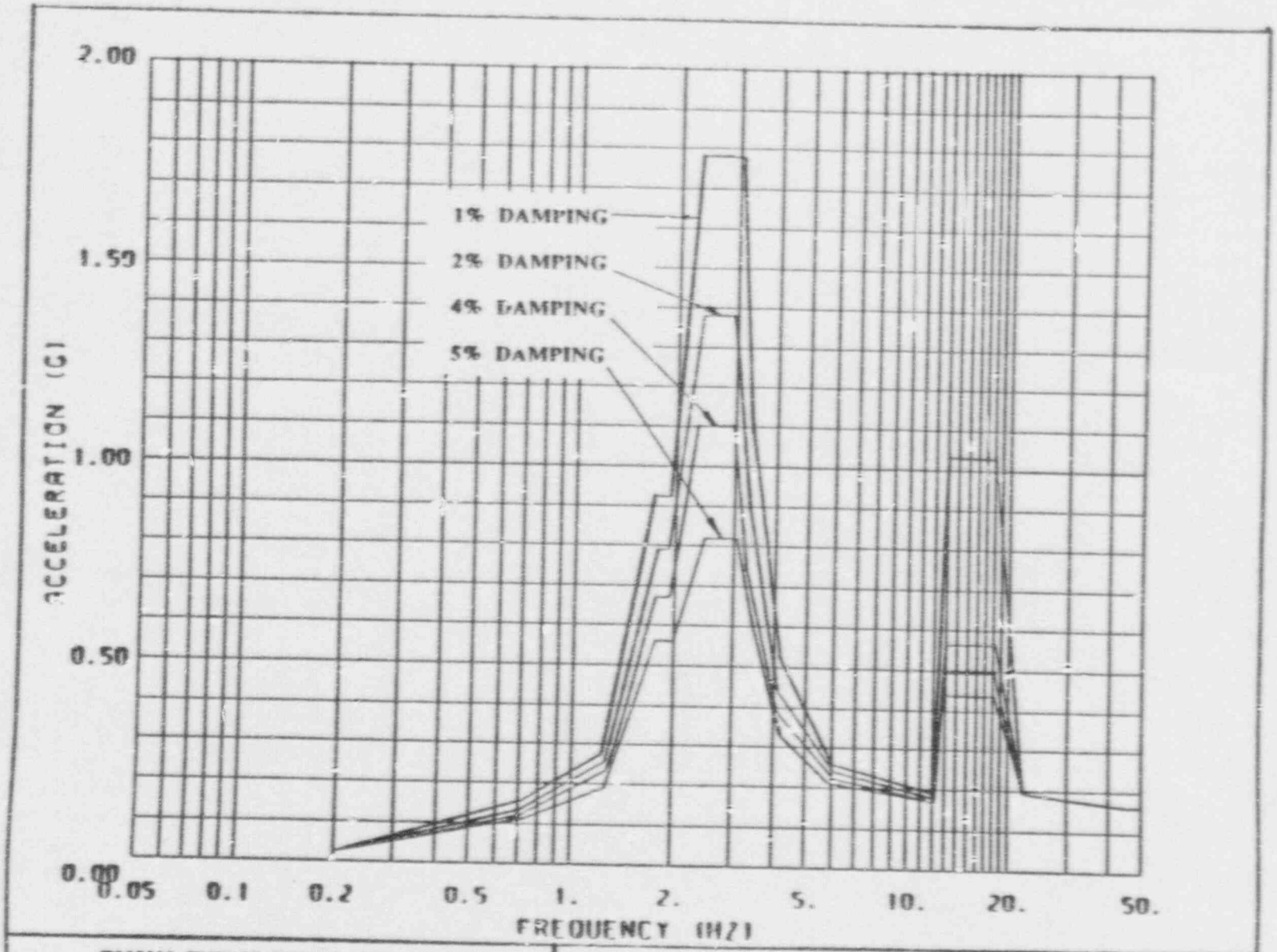
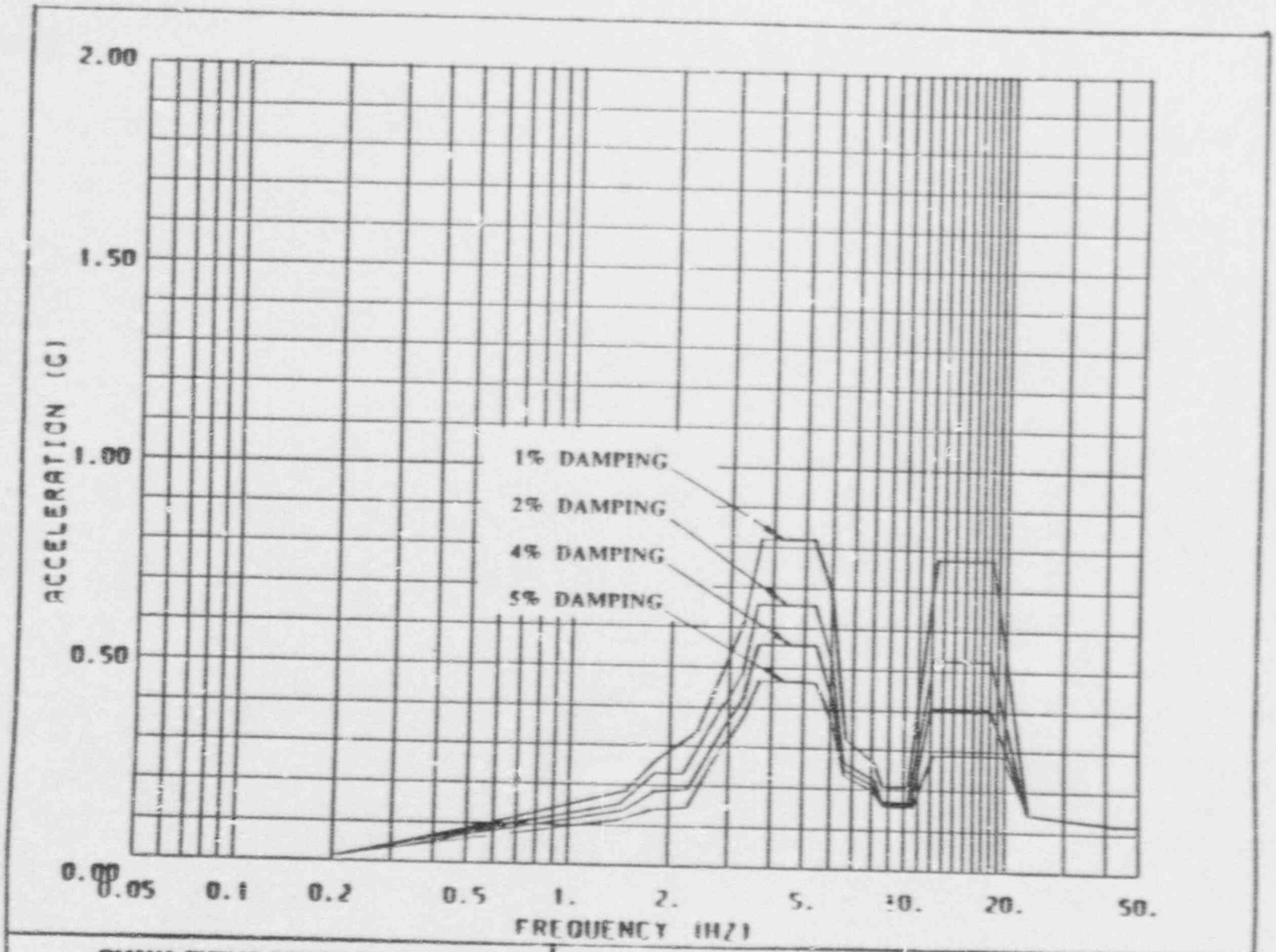


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (EAST-WEST) DIRECTION
AT ELEVATION 1038'-6"
INTERNAL STRUCTURE

BY ADE DATE 7-17-92 CHKD Awl DATE 7/17/92 SHEET NO REV

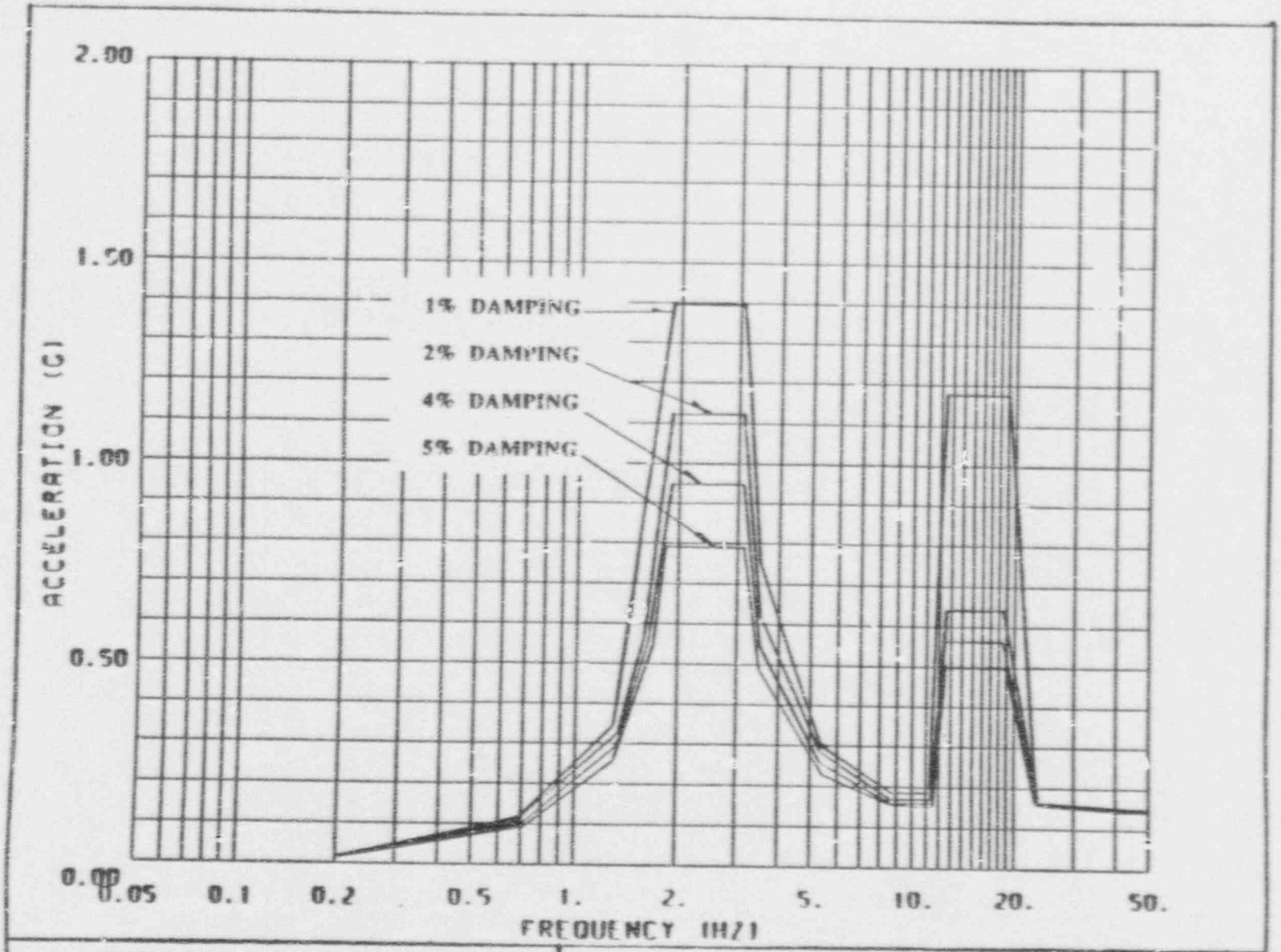


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 1038'-6"
INTERNAL STRUCTURE

BY [illegible] DATE 7-17-92 CHKD [illegible] DATE 7/17/92 SKETCH NO REV

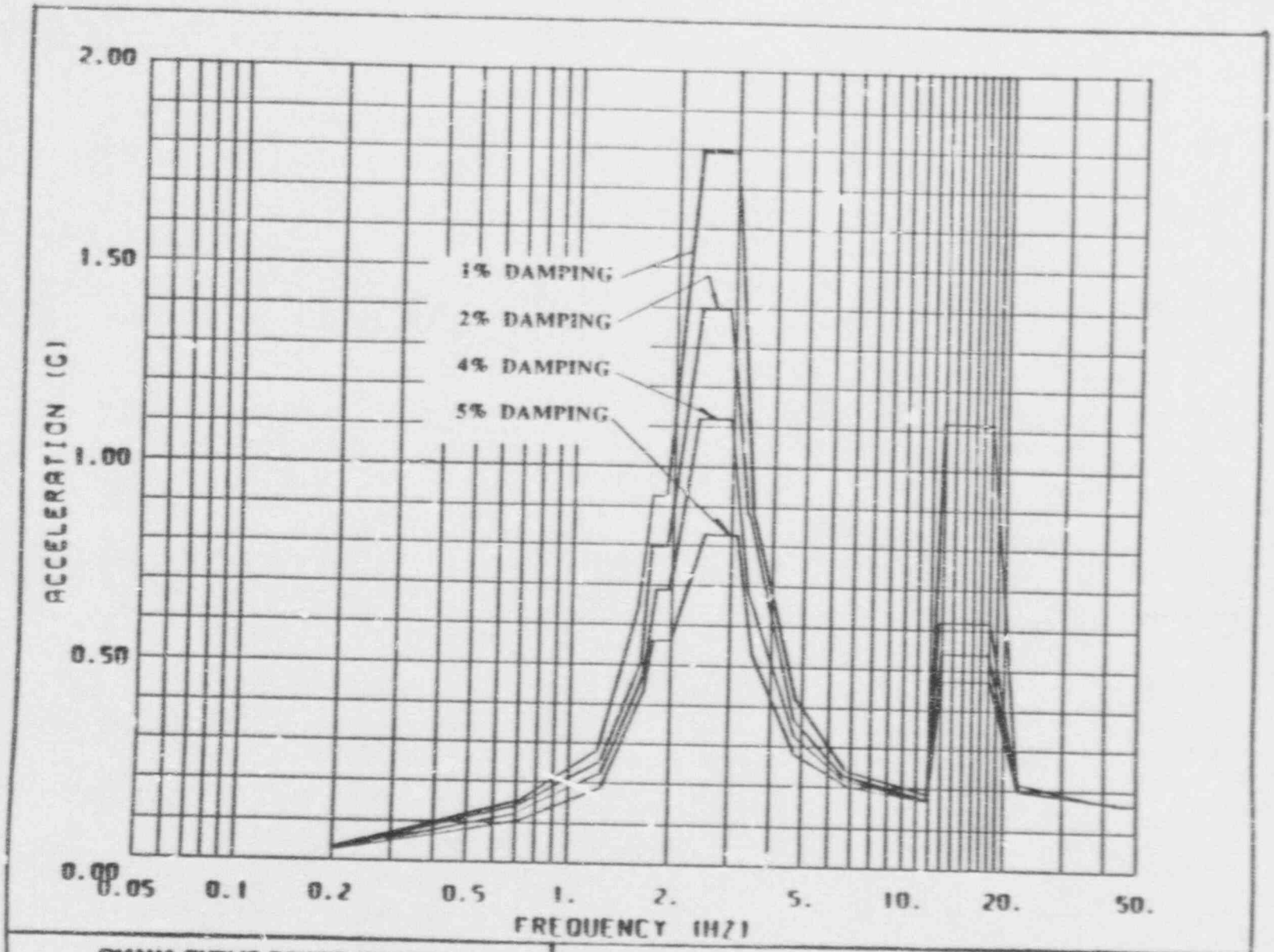


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

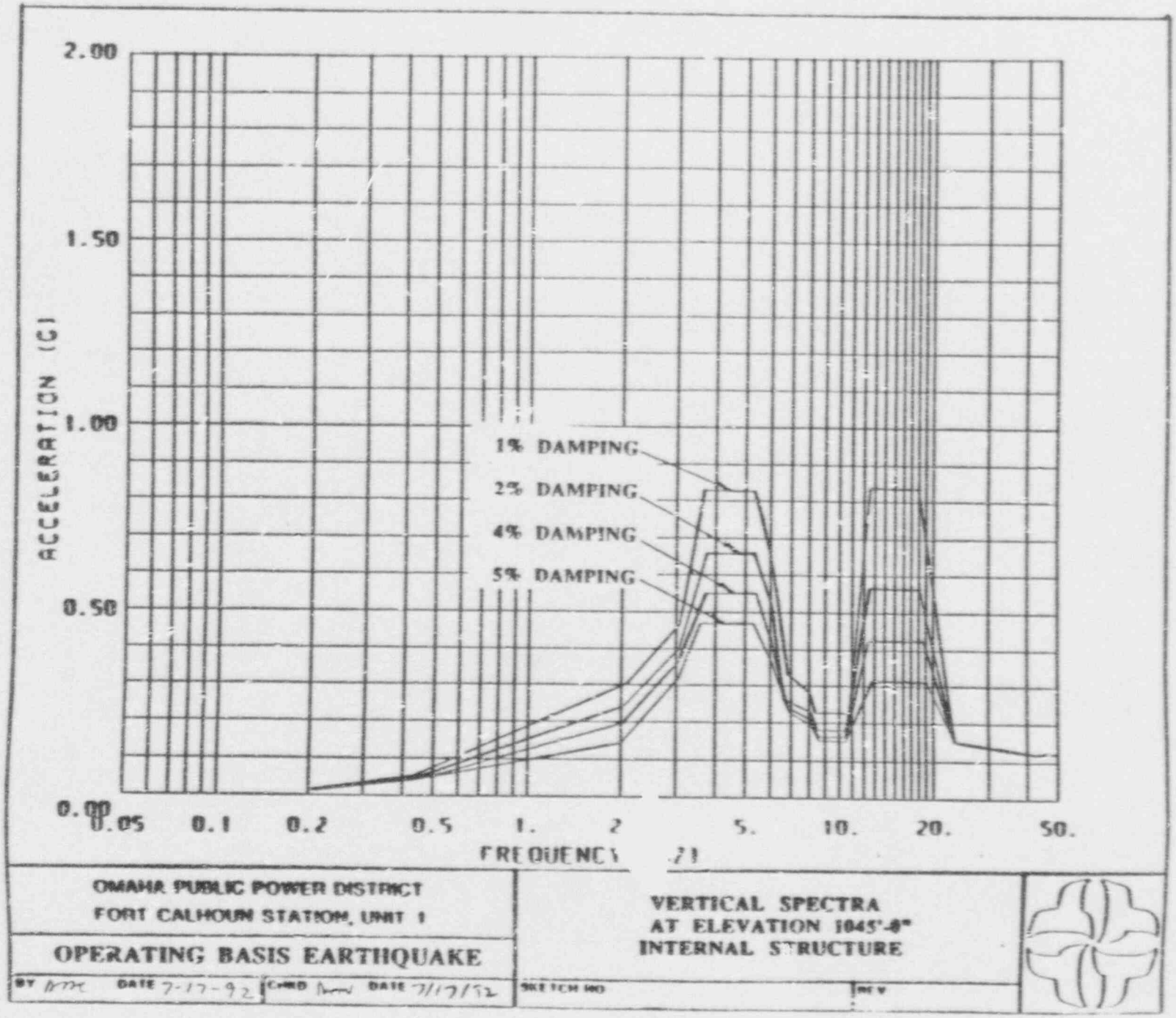
OPERATING BASIS EARTHQUAKE

HORIZONTAL (NORTH-SOUTH) DIRECTION
AT ELEVATION 1045'-0"
INTERNAL STRUCTURE

BY AMC DATE 7-17-92 CHKD JWW DATE 7/17/92 SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 1045'-0" INTERNAL STRUCTURE
OPERATING BASIS EARTHQUAKE	
BY AJC DATE 7-17-92 CHKD AWV DATE 7/17/92	SKETCH NO. REV

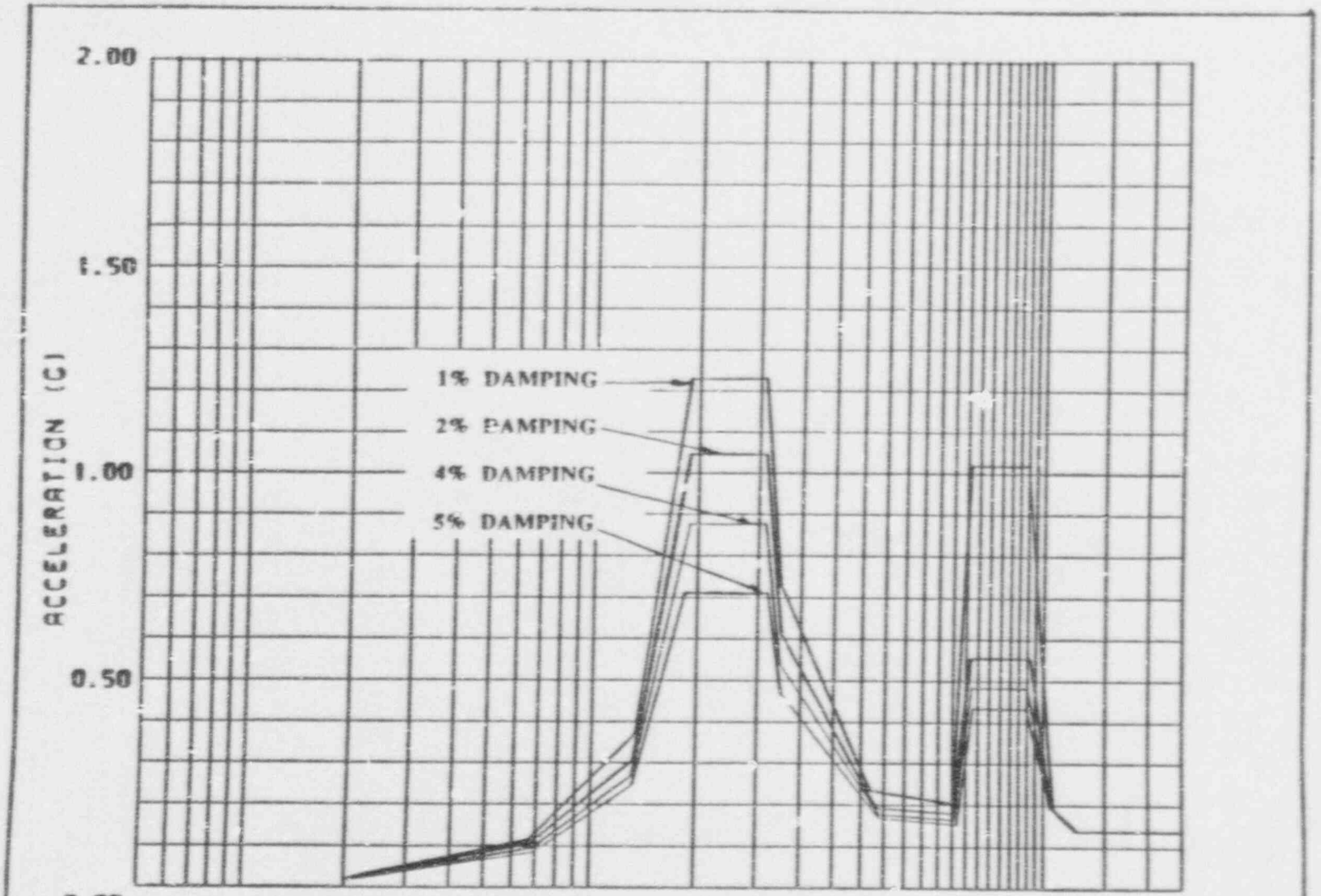


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

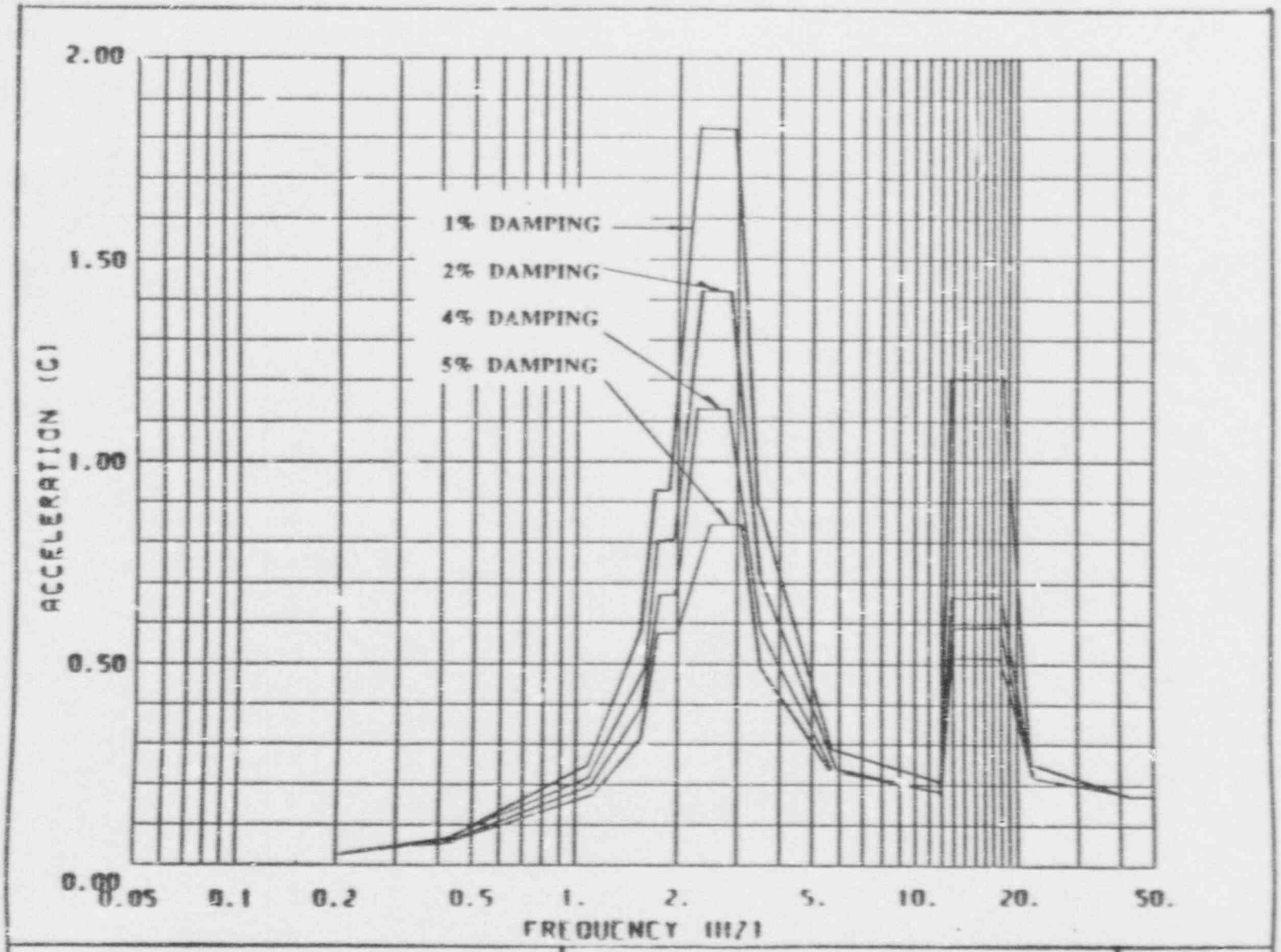
OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 1045'-8"
INTERNAL STRUCTURE

BY [illegible] DATE 7-17-92 CHKD [illegible] DATE 7/17/92 SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1056'-6" INTERNAL STRUCTURE
OPERATING BASIS EARTHQUAKE	
BY Amc DATE 7-17-92 CHKD Awl DATE 7/17/92	SKETCH NO REV

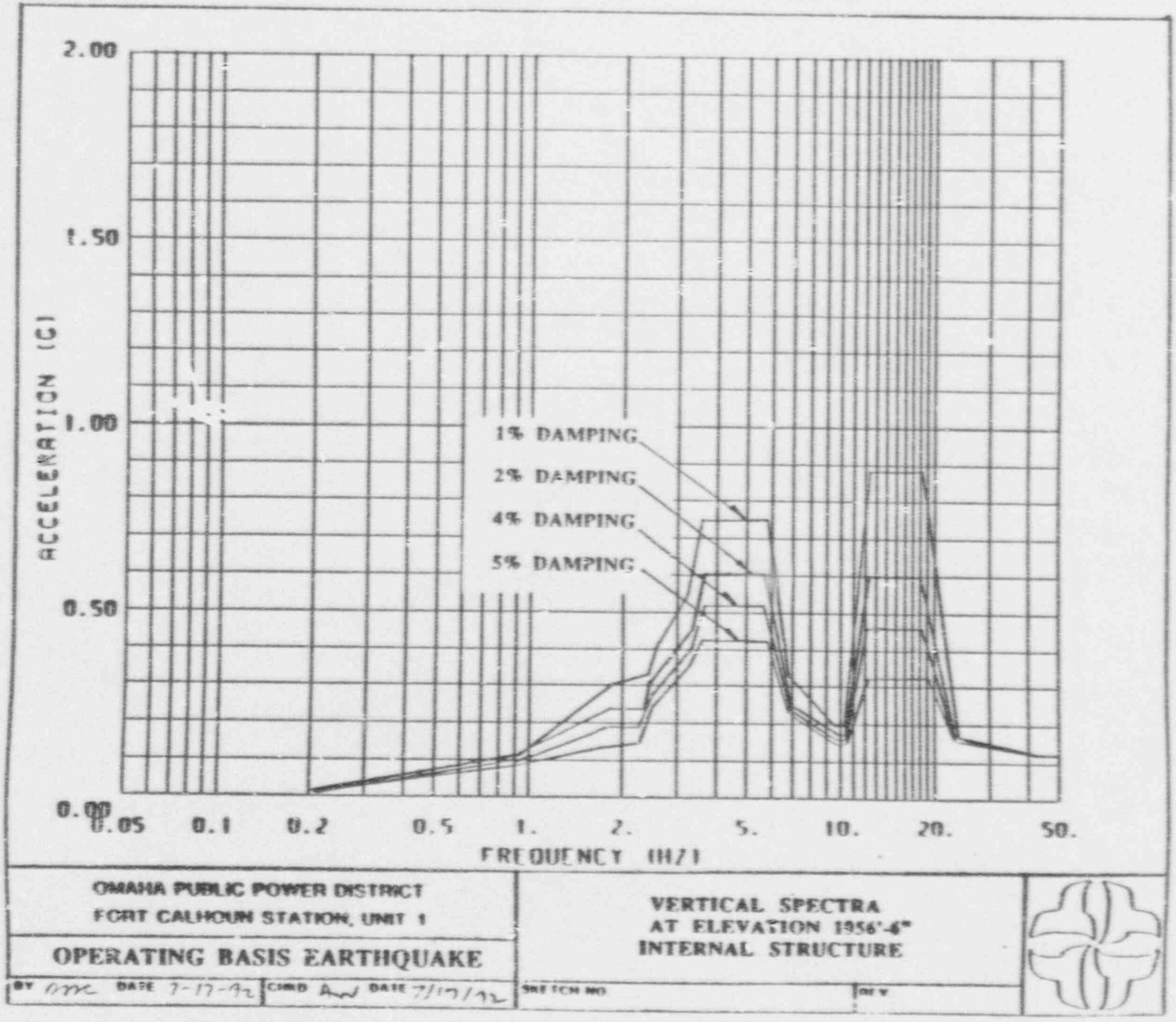


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (EAST-WEST) DIRECTION
AT ELEVATION 1056'-4"
INTERNAL STRUCTURE

BY DJE DATE 7-17-92 CHKD BW DATE 7/17/92 SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 1956'-6"
INTERNAL STRUCTURE

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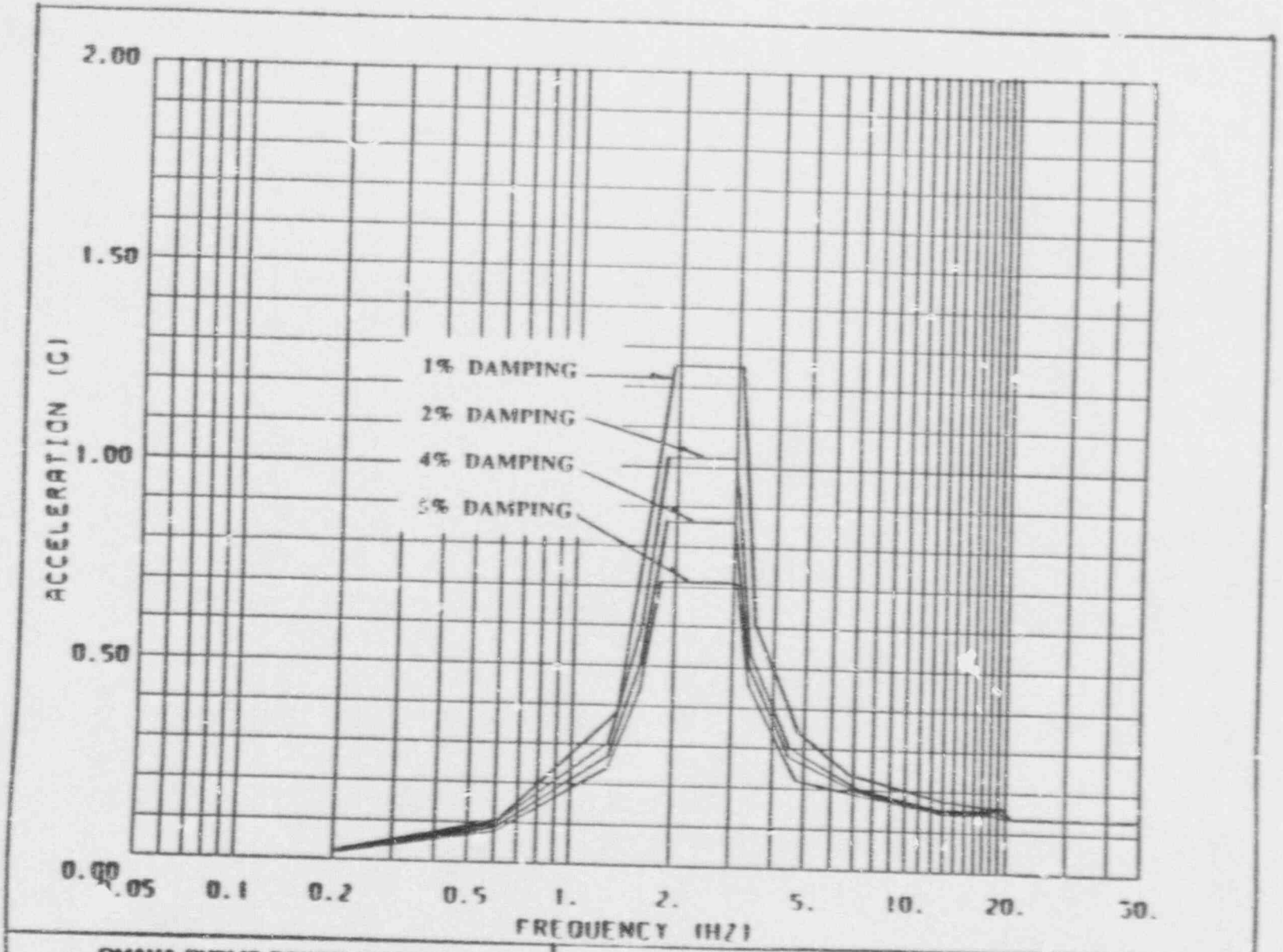
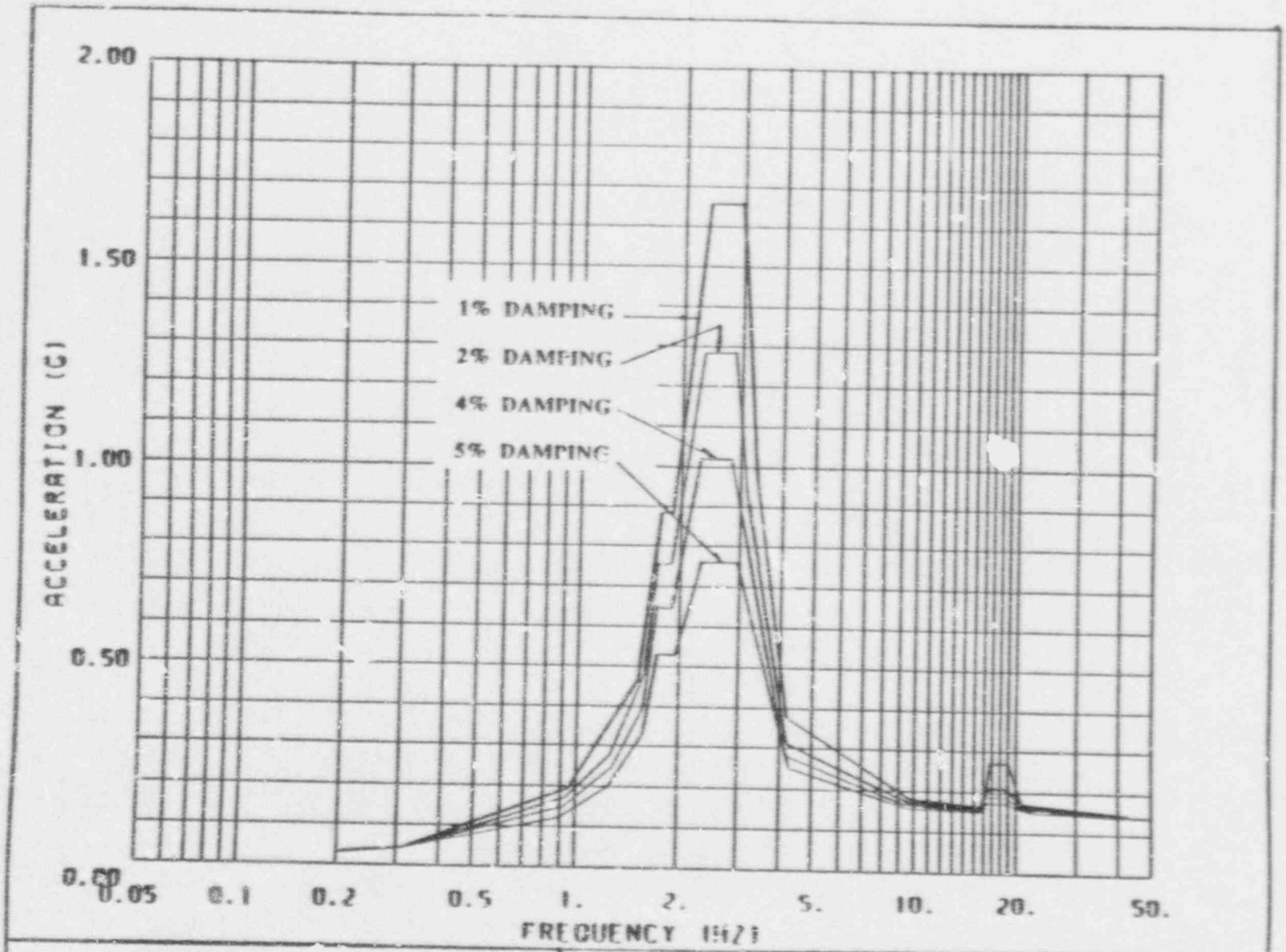


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (NORTH-SOUTH) DIRECTION
AT ELEVATION 991'-0"
CONTAINMENT STRUCTURE

BY [illegible] DATE 7-17-92 CHKD [illegible] DATE 7/17/92 SKETCH NO REV

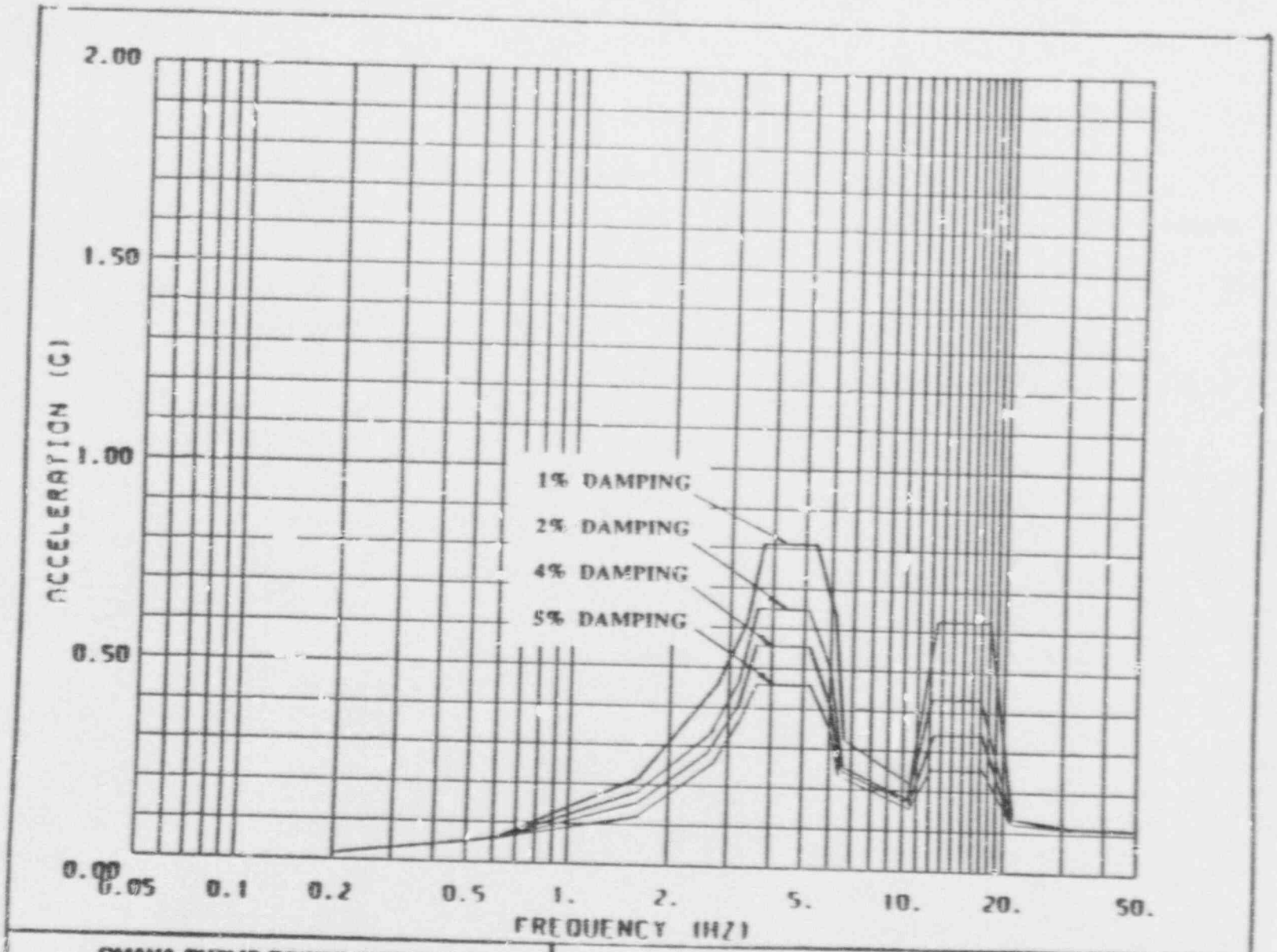


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

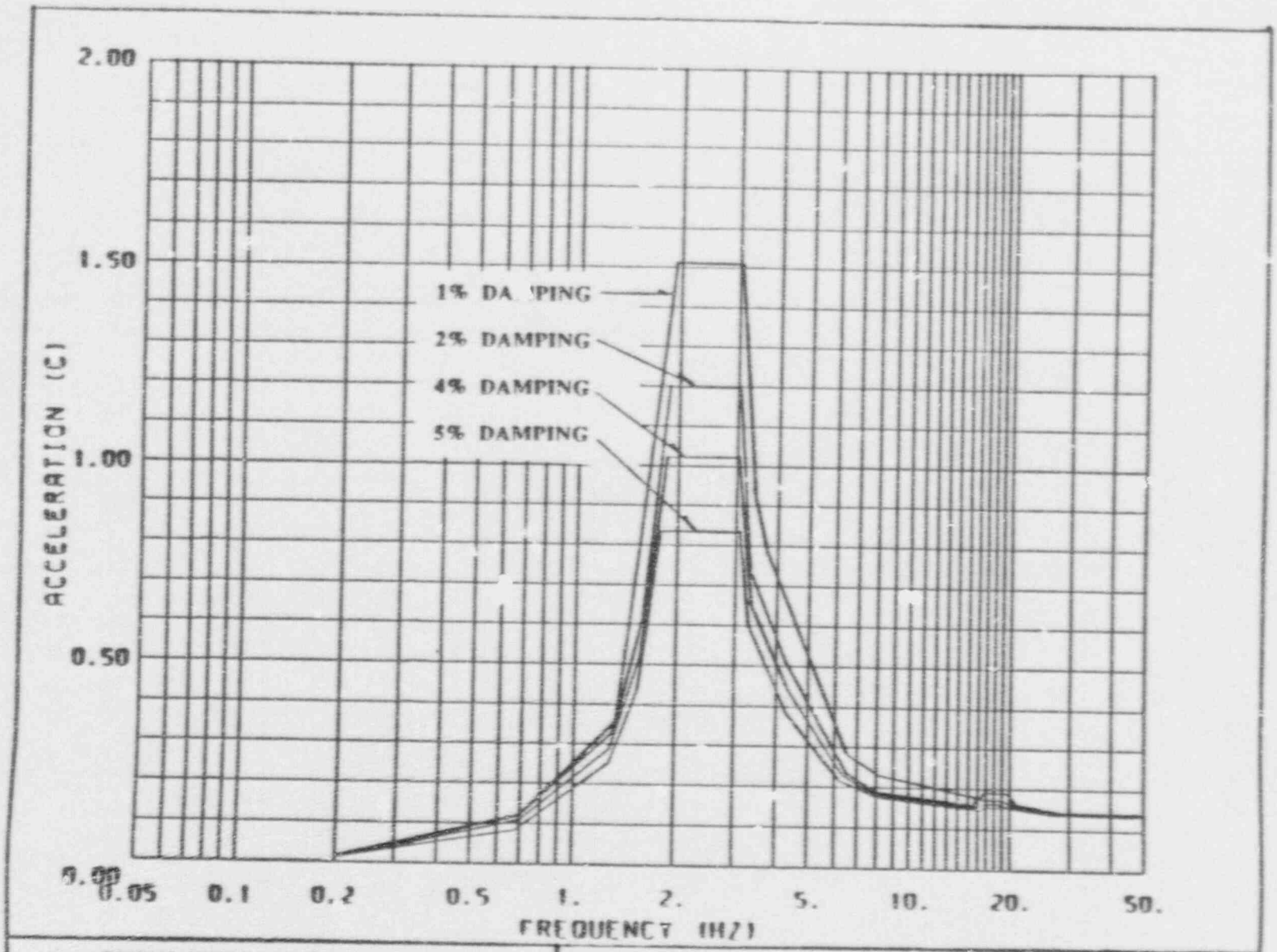
OPERATING BASIS EARTHQUAKE

HORIZONTAL (EAST-WEST) DIRECTION
AT ELEVATION 991'-0"
CONTAINMENT STRUCTURE

BY [illegible] DATE 7-17-92 CHKD [illegible] DATE 7/17/92 SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	VERTICAL SPECTRA AT ELEVATION 991'-0" CONTAINMENT STRUCTURE
OPERATING BASIS EARTHQUAKE	
BY Ame DATE 7-17-92 CHKD AJW DATE 7/17/92	SKETCH NO REV

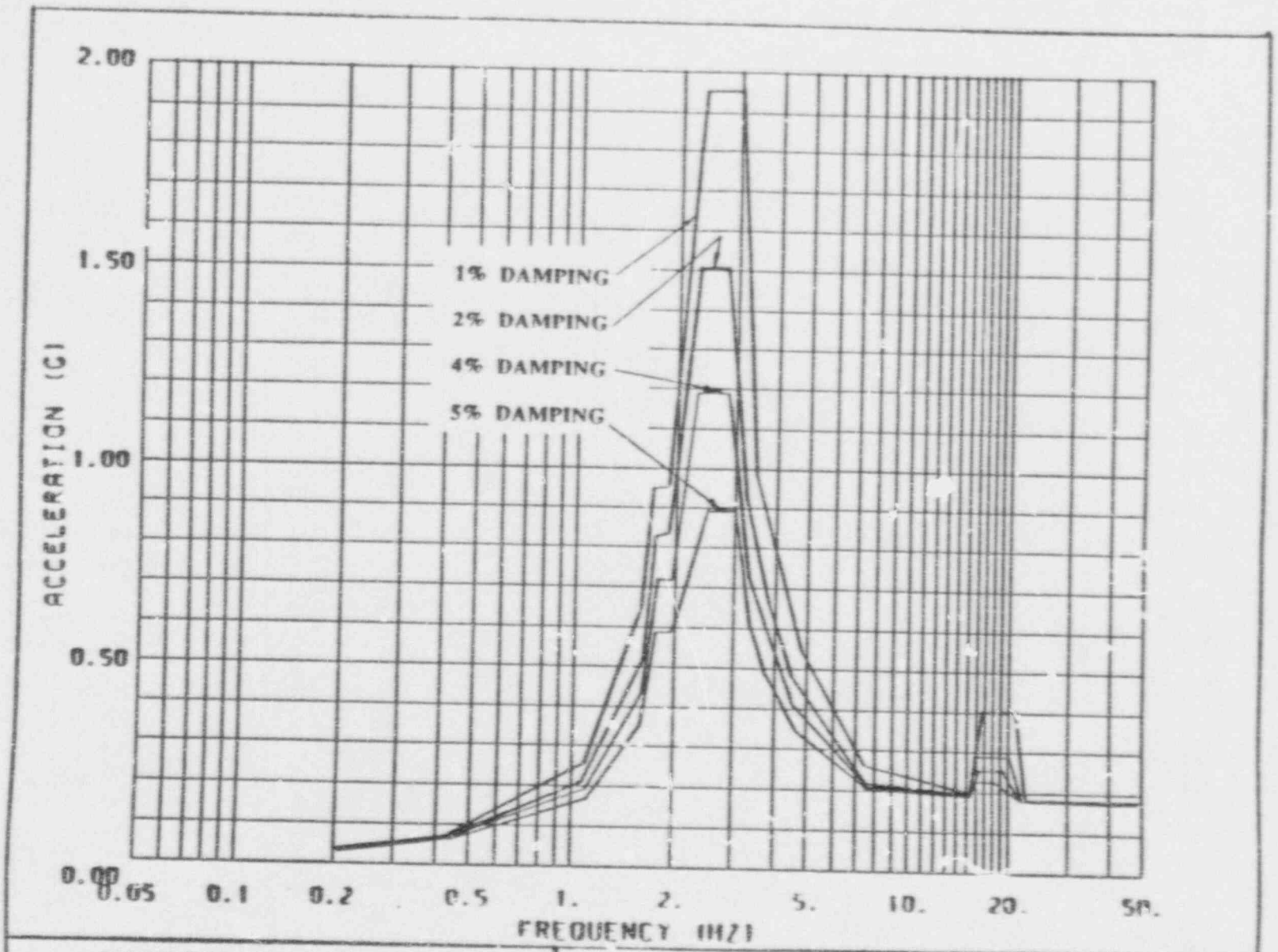


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (NORTH-SOUTH) DIRECTION
AT ELEVATION 1045'-0"
CONTAINMENT STRUCTURE

BY [illegible] DATE 7-17-92 CHKD [illegible] DATE 7/17/92 SKETCH NO REV

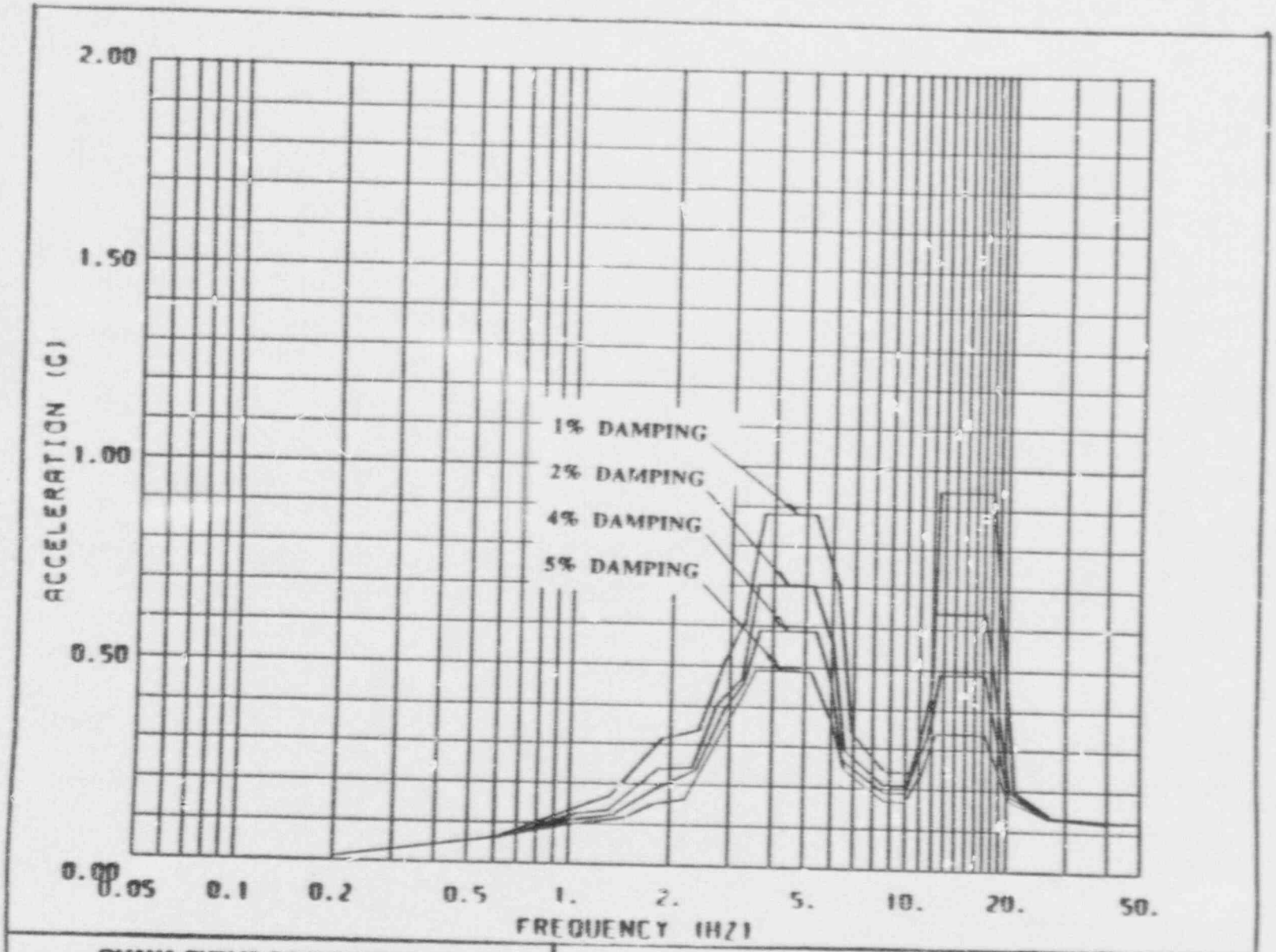


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (EAST-WEST) DIRECTION
AT ELEVATION 1045'-0"
CONTAINMENT STRUCTURE

BY DMC DATE 7-17-92 CHKD AWJ DATE 7/17/92 SKETCH NO REV

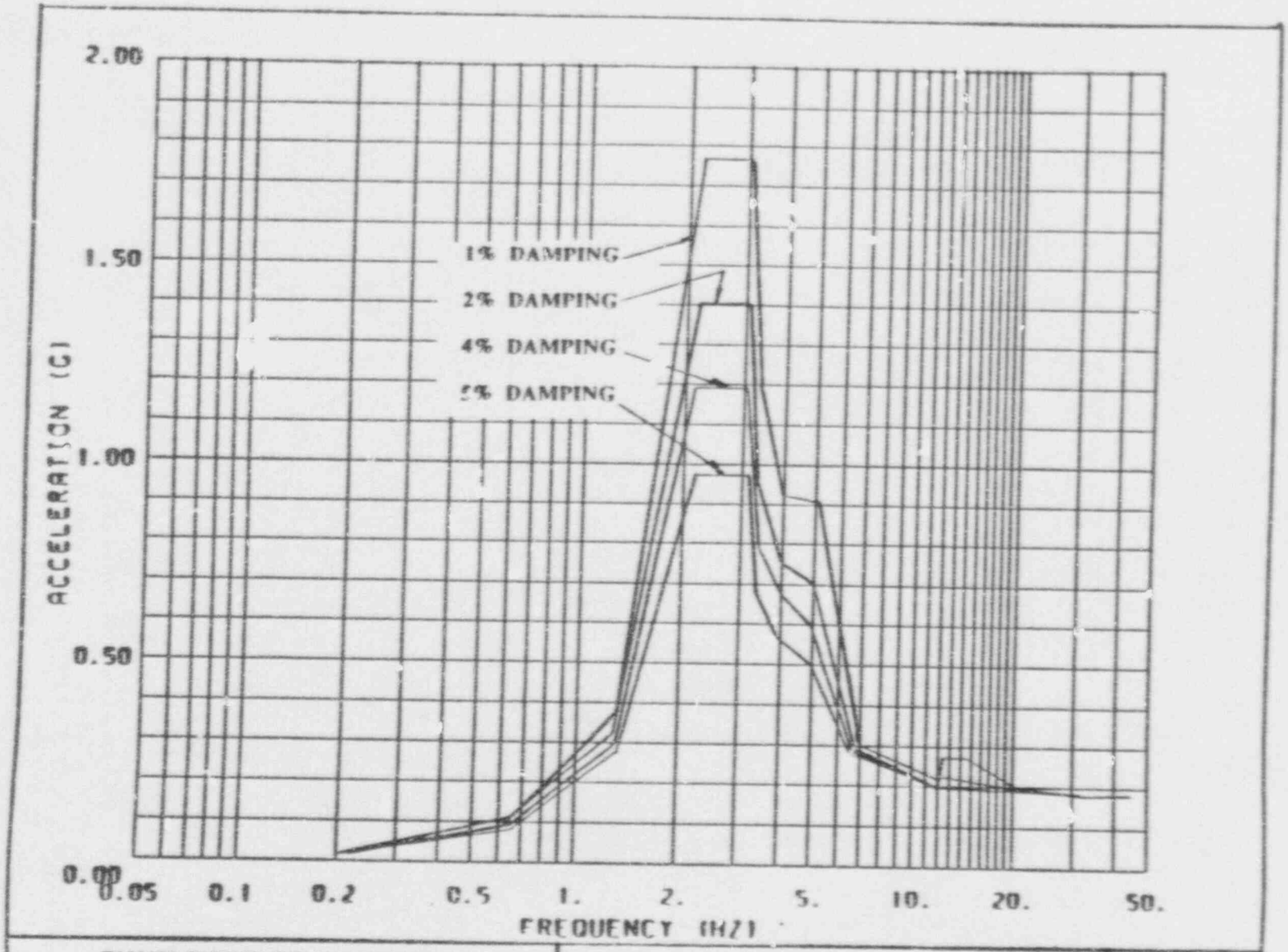


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 1045'-8"
CONTAINMENT STRUCTURE

BY [illegible] DATE 7-17-92 CHKD [illegible] DATE 7/17/92 SKETCH NO REV



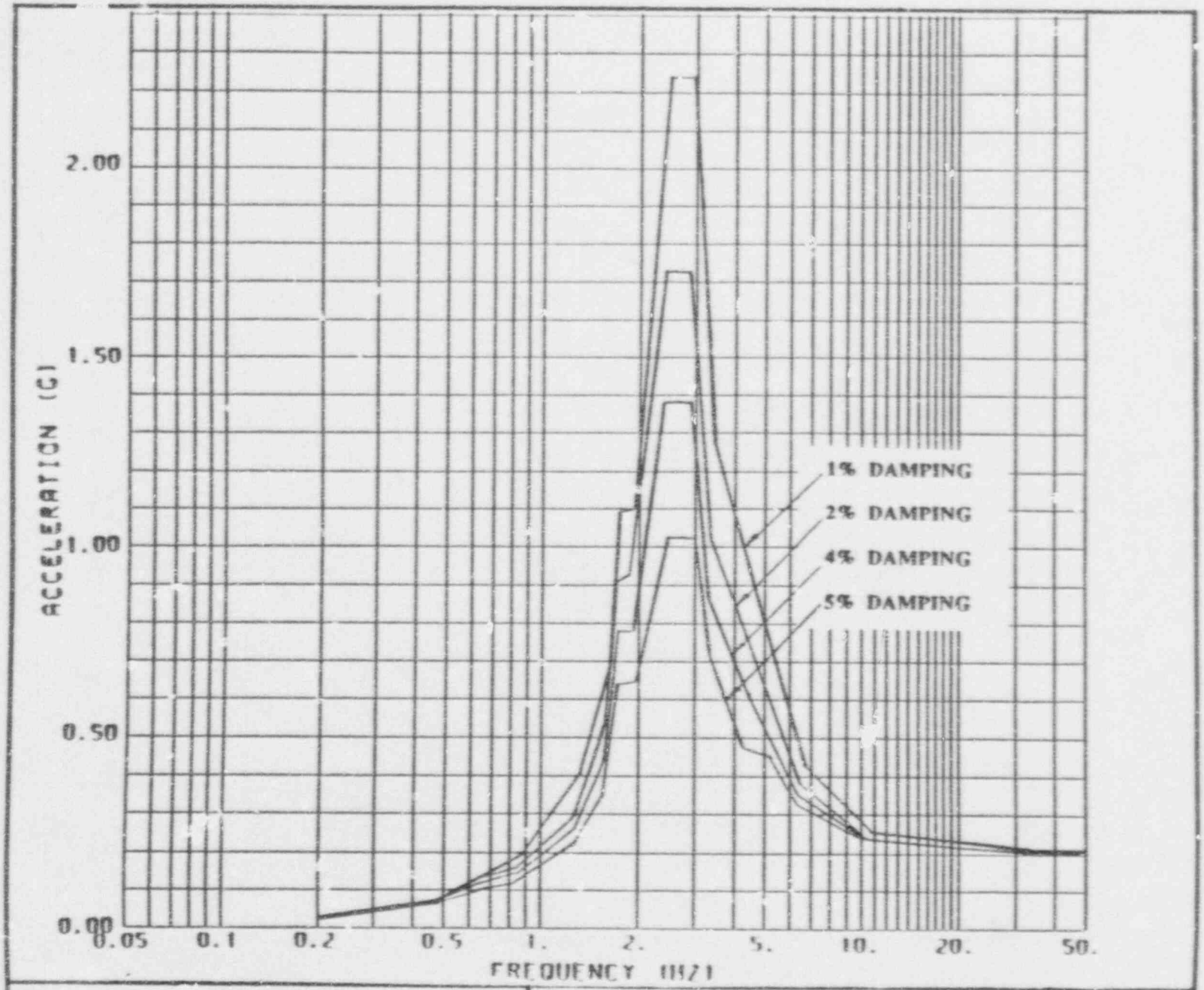
OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

BY NPC DATE 7-17-92 CHKD AWJ DATE 7/17/92

HORIZONTAL (NORTH-SOUTH) DIRECTION
AT ELEVATION 1099'-0"
CONTAINMENT STRUCTURE

SKETCH NO REV

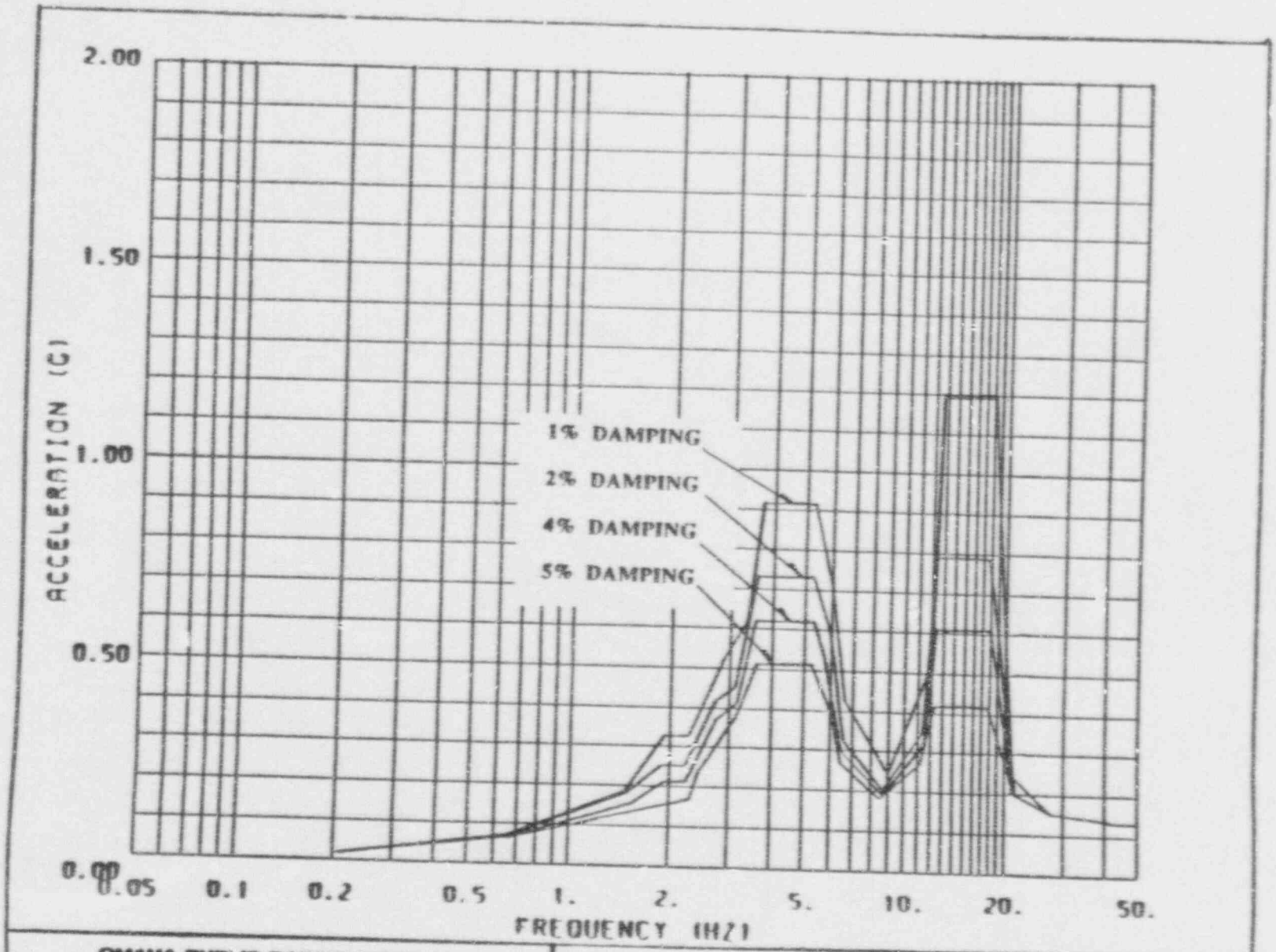


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (EAST-WEST) DIRECTION
AT ELEVATION 1099'-0"
CONTAINMENT STRUCTURE

BY ARC DATE 7-17-92 CHKD [illegible] DATE 7/17/92 SKETCH NO REV

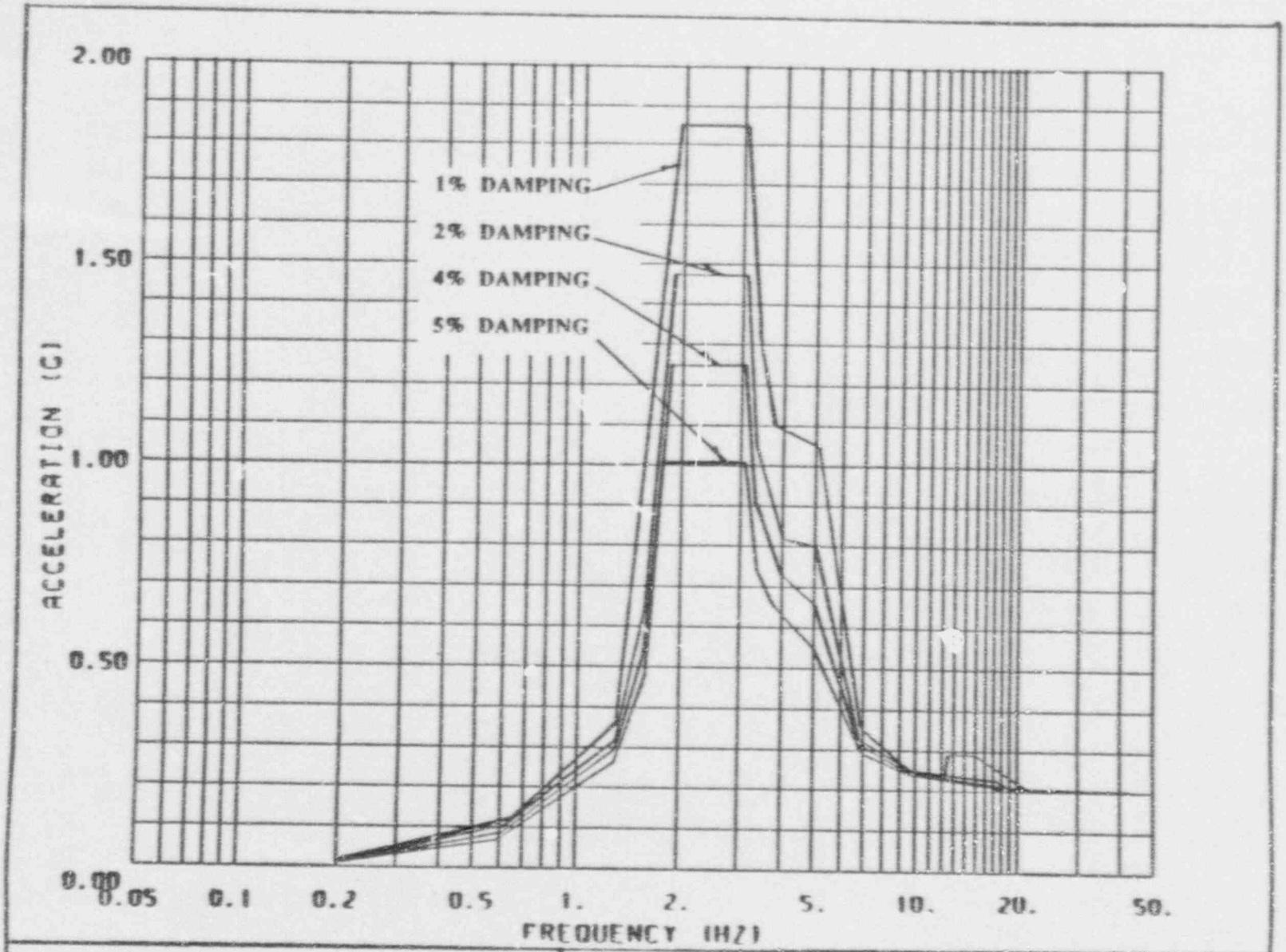


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 1099'-8"
CONTAINMENT STRUCTURE

BY JMC DATE 7-17-92 CHKD JMW DATE 7/17/92 SKETCH NO REV

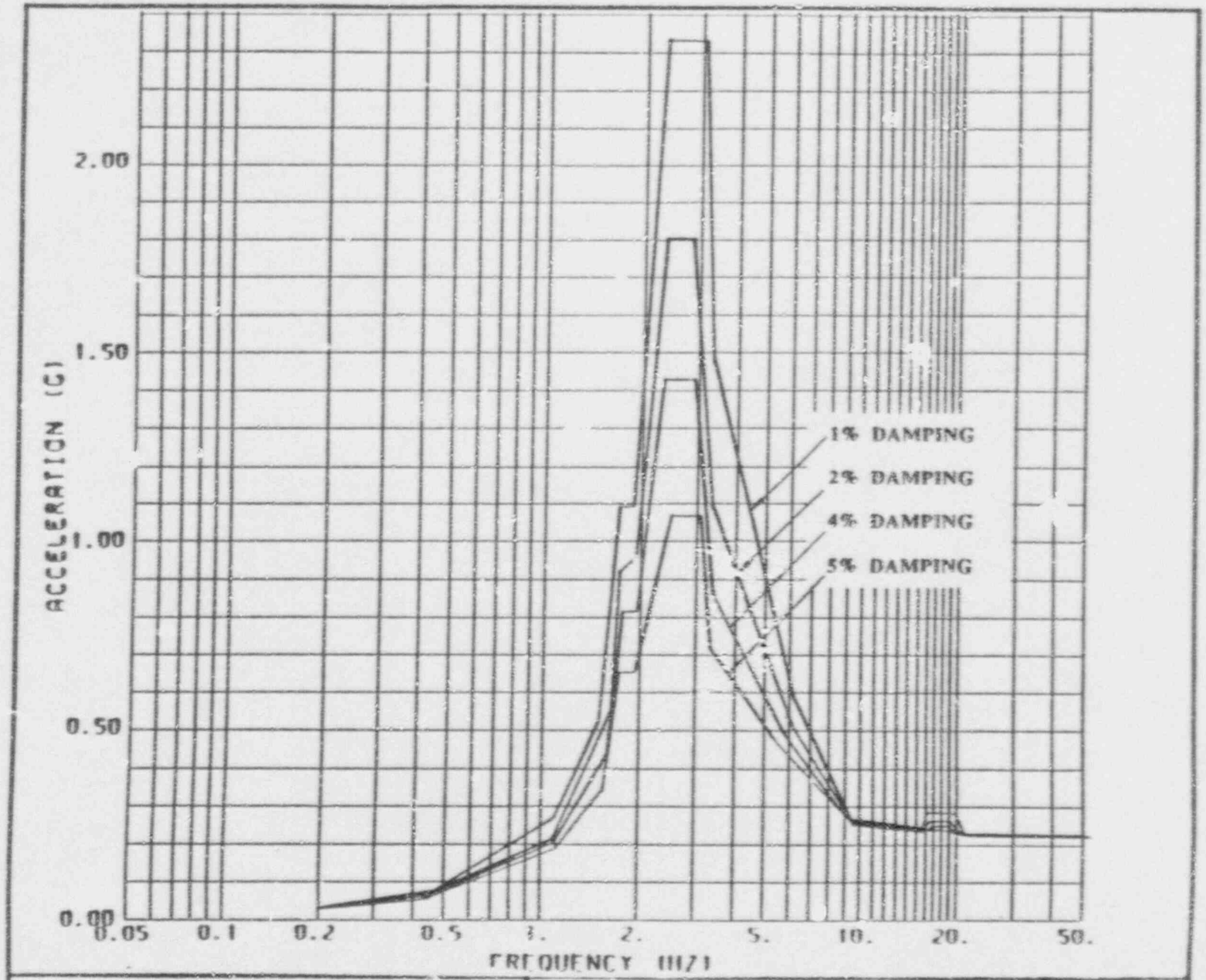


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (NORTH-SOUTH) DIRECTION
AT ELEVATION 1118'-2"
CONTAINMENT STRUCTURE

BY MMC DATE 7-17-92 CHKD DW DATE 7/17/92 SKETCH NO REV



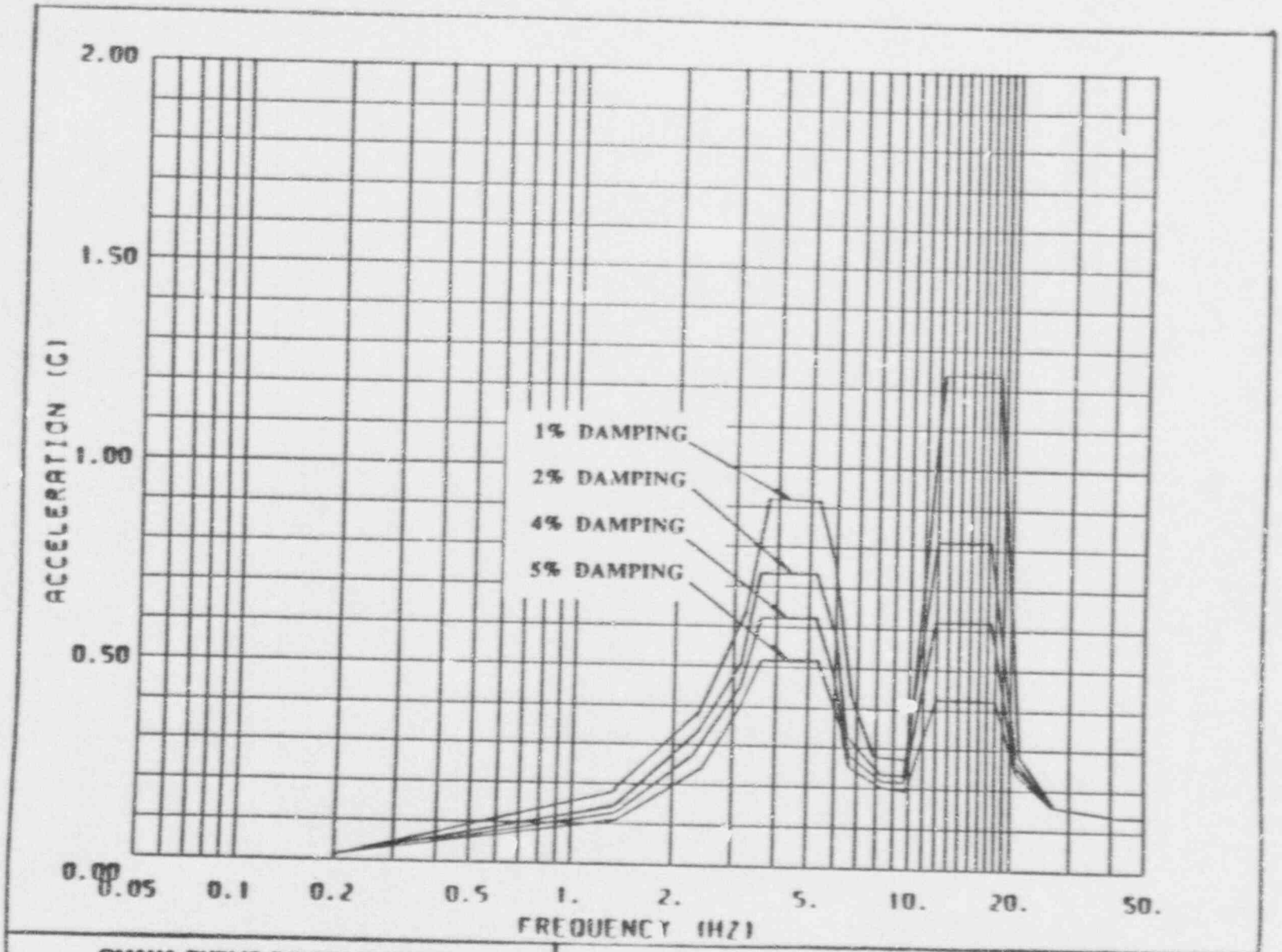
OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

BY mc DATE 7-17-92 CHKD AW DATE 7/17/92

HORIZONTAL (EAST-WEST) DIRECTION
AT ELEVATION 1118'-2"
CONTAINMENT STRUCTURE

SKETCH NO



OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

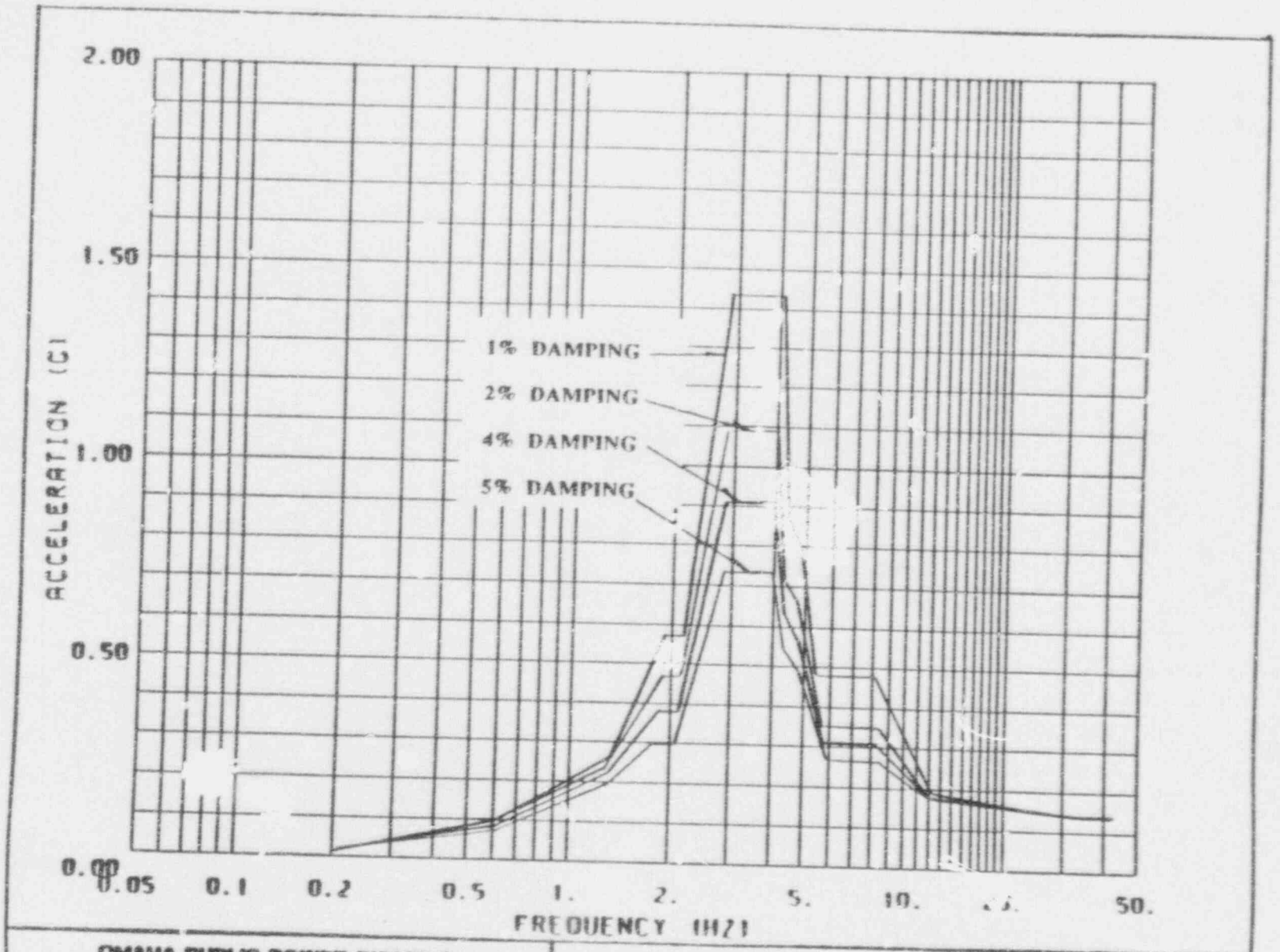
VERTICAL SPECTRA
AT ELEVATION 1118'-2"
CONTAINMENT STRUCTURE

BY ARE DATE 7-17-92 CHKD AMW DATE 7/17/92 SKETCH NO REV

APPENDIX D

FORT CALHOUN STATION, UNIT 1
IN-STRUCTURE RESPONSE SPECTRA
INTAKE STRUCTURE
OPERATING BASIS EARTHQUAKE

(9 pages; this cover page not included)

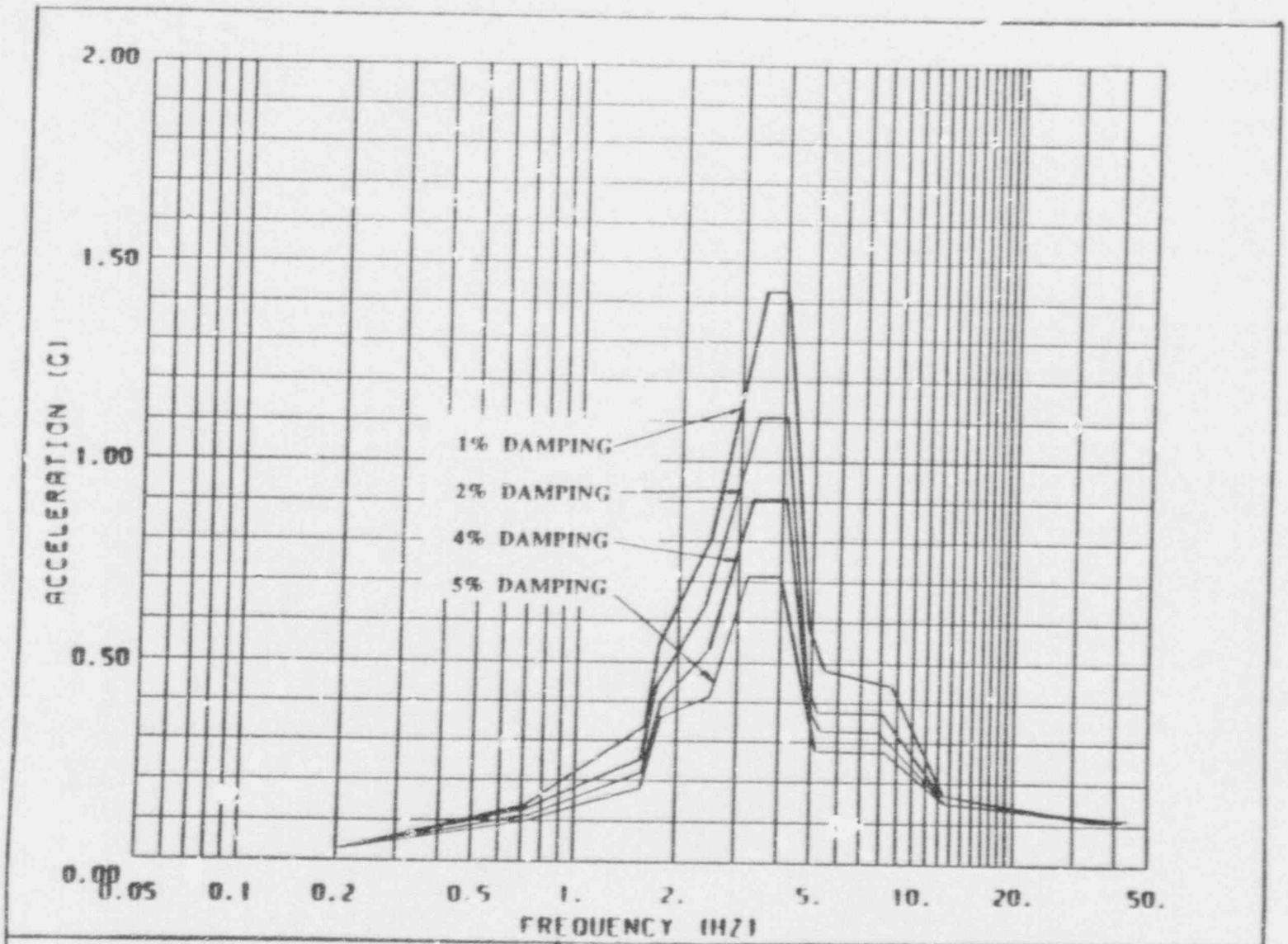


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

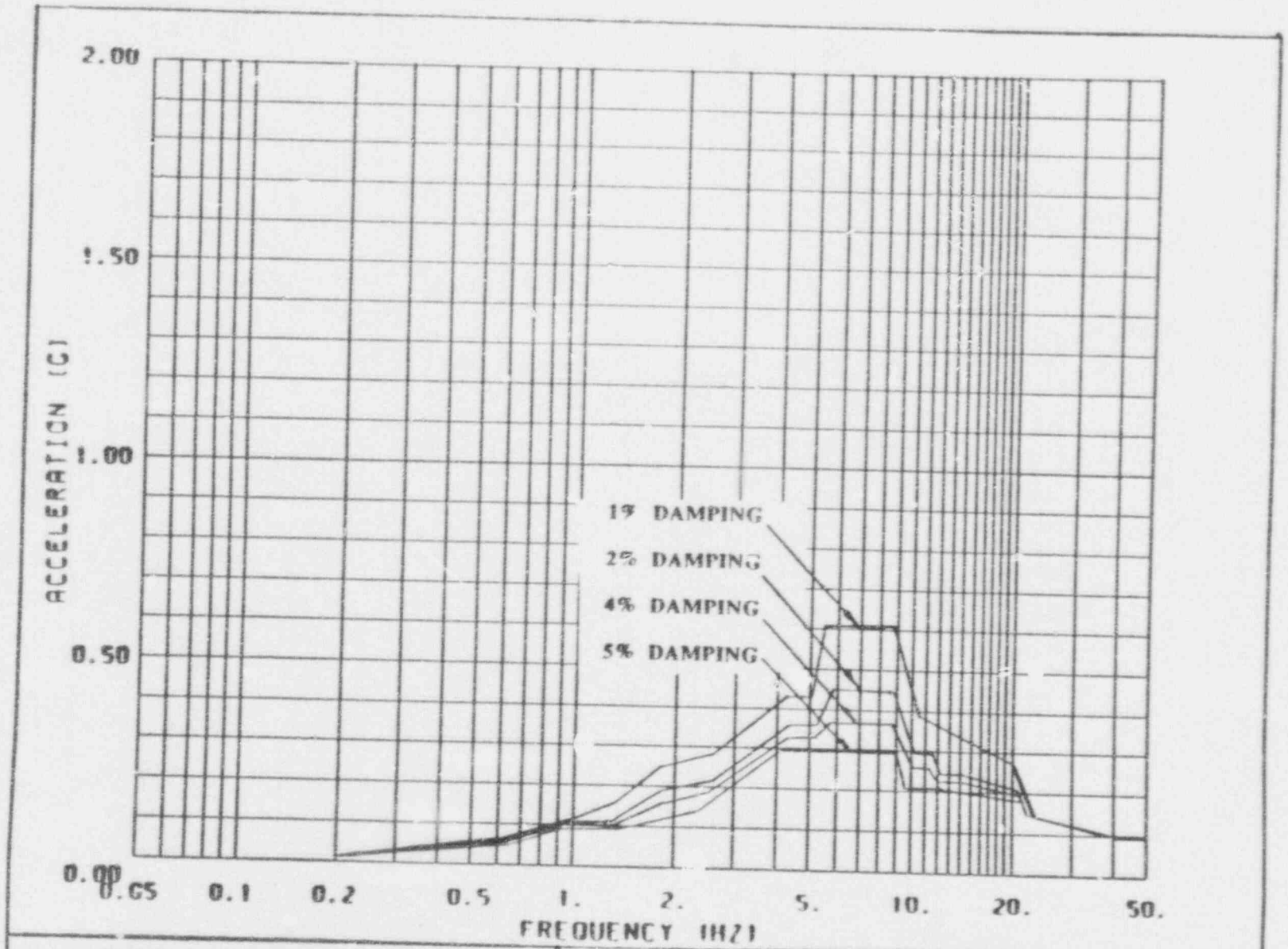
OPERATING BASIS EARTHQUAKE

HORIZONTAL (NORTH-SOUTH) DIRECTION
AT ELEVATION 965'-0"
INTAKE STRUCTURE

BY AMC DATE 7-17-92 CHKD AMN DATE 7/17/92 SKETCH REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (EAST-WEST) DIRECTION AT ELEVATION 985'-0" INTAKE STRUCTURE
OPERATING BASIS EARTHQUAKE	
BY ADC DATE 7-17-92 CHKD AYW DATE 7/17/92	SKETCH NO REV

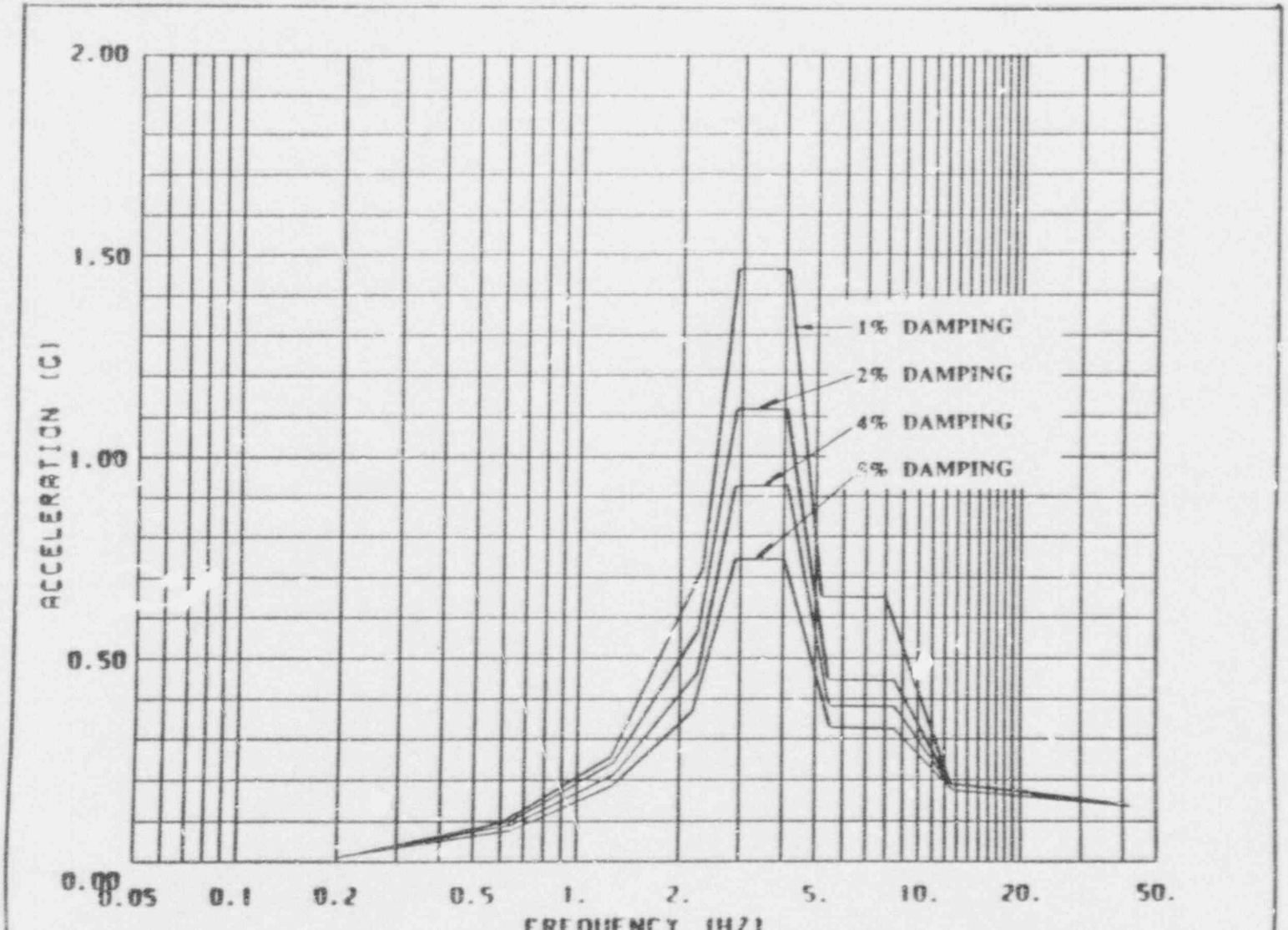


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

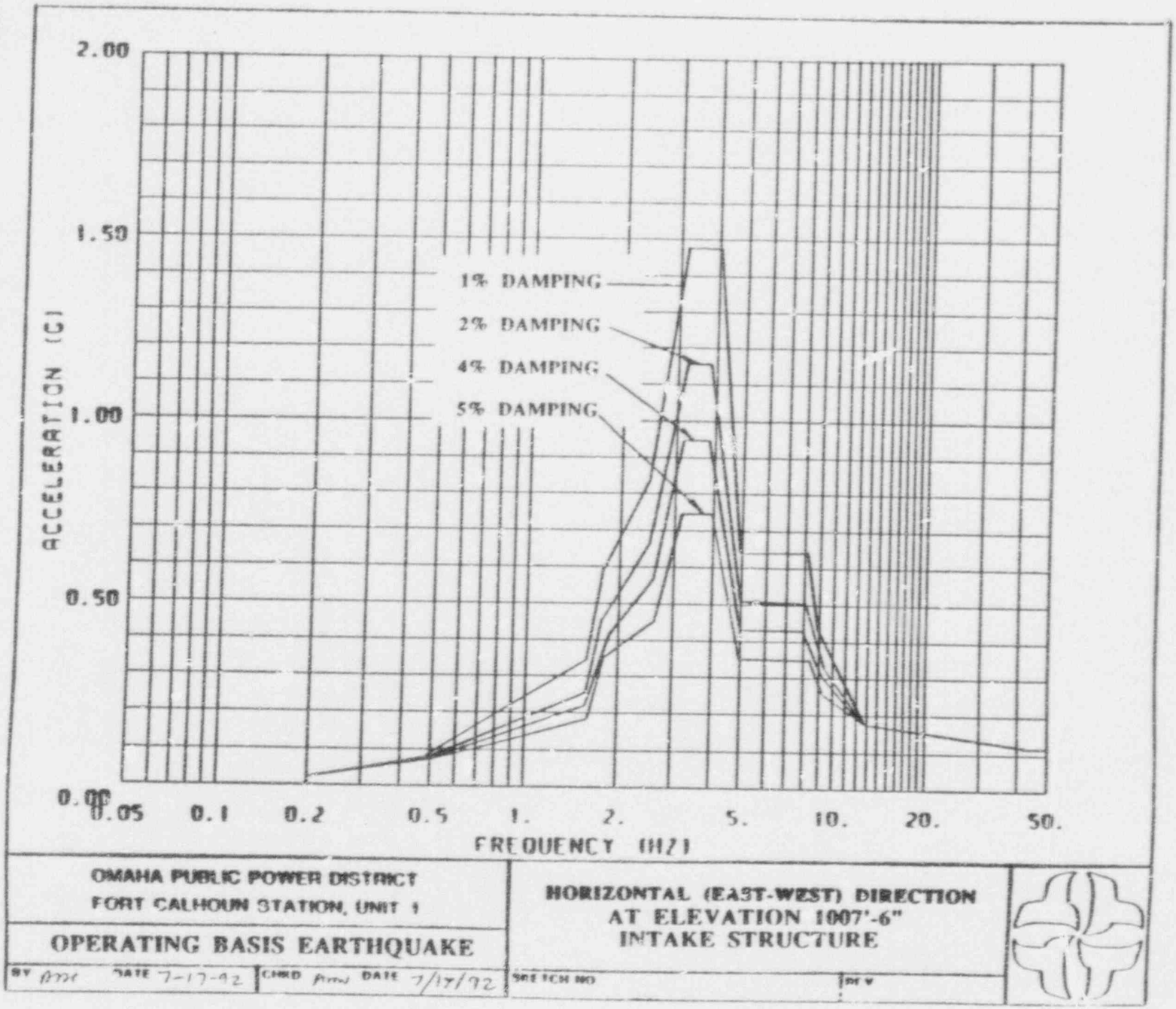
OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 985'-0"
INTAKE STRUCTURE

BY mc DATE 7-17-92 CHKD Ann DATE 7/17/92 SHEET NO REV



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1007'-6" INTAKE STRUCTURE
OPERATING BASIS EARTHQUAKE	
BY Arc DATE 7-17-92 CHKD Arm DATE 7/17/92	SKETCH NO REV

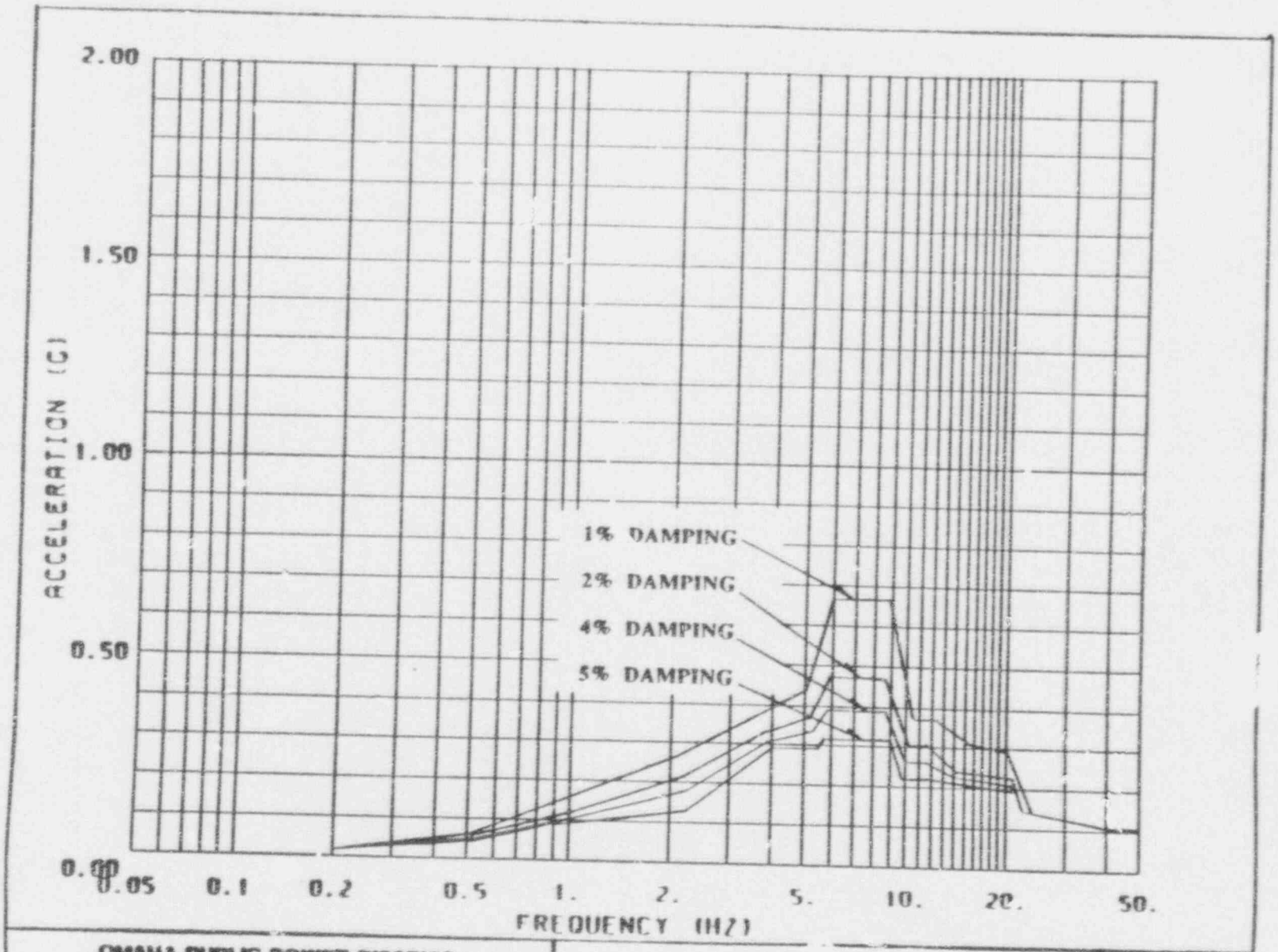


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (EAST-WEST) DIRECTION
AT ELEVATION 1007'-6"
INTAKE STRUCTURE

BY AMC DATE 7-17-92 CHKD AMC DATE 7/17/92 SKETCH NO REV

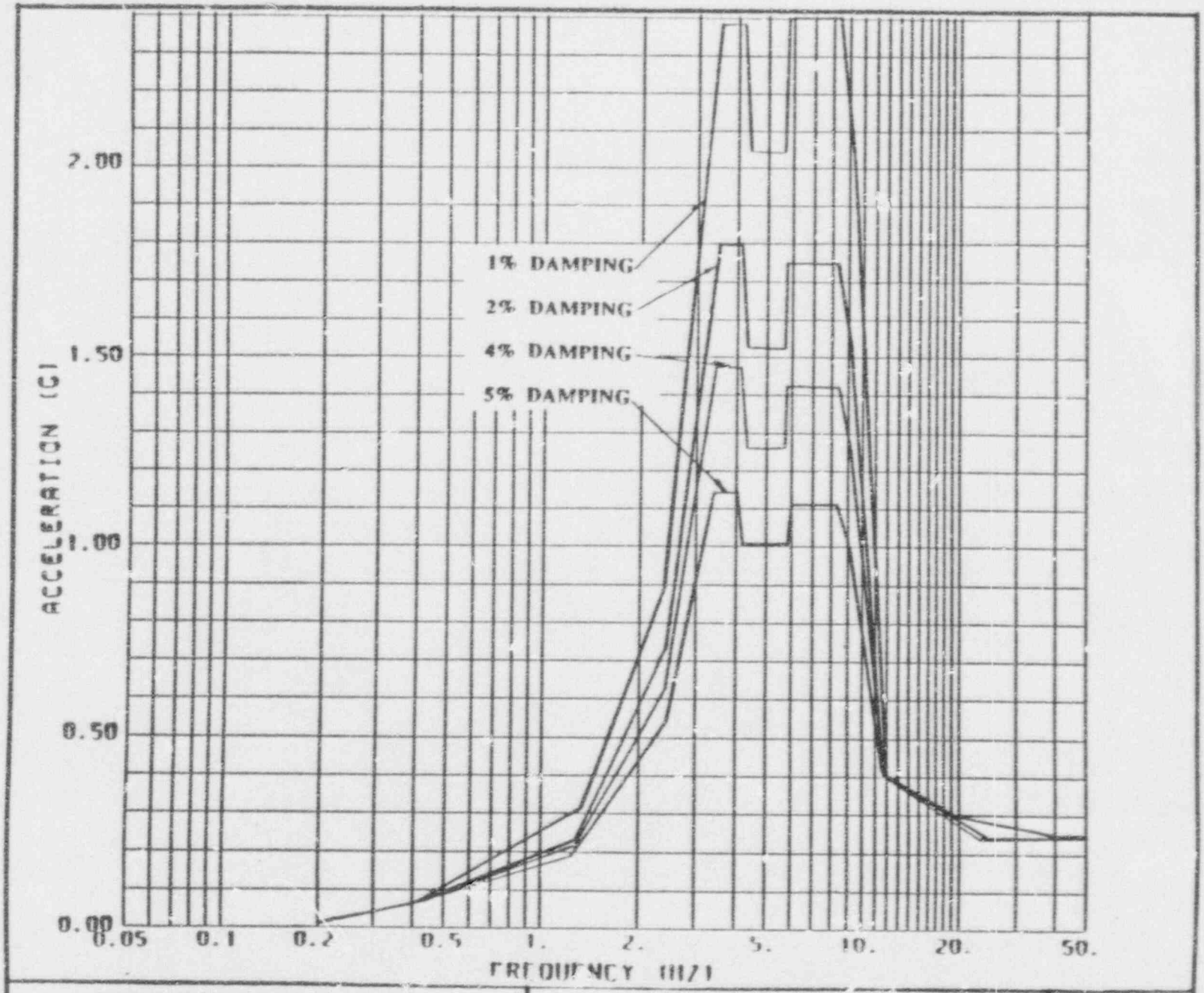


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 1007'-6"
INTAKE STRUCTURE

BY Amc DATE 7-17-92 CHKD Amc DATE 7/17/92 SKETCH NO REV

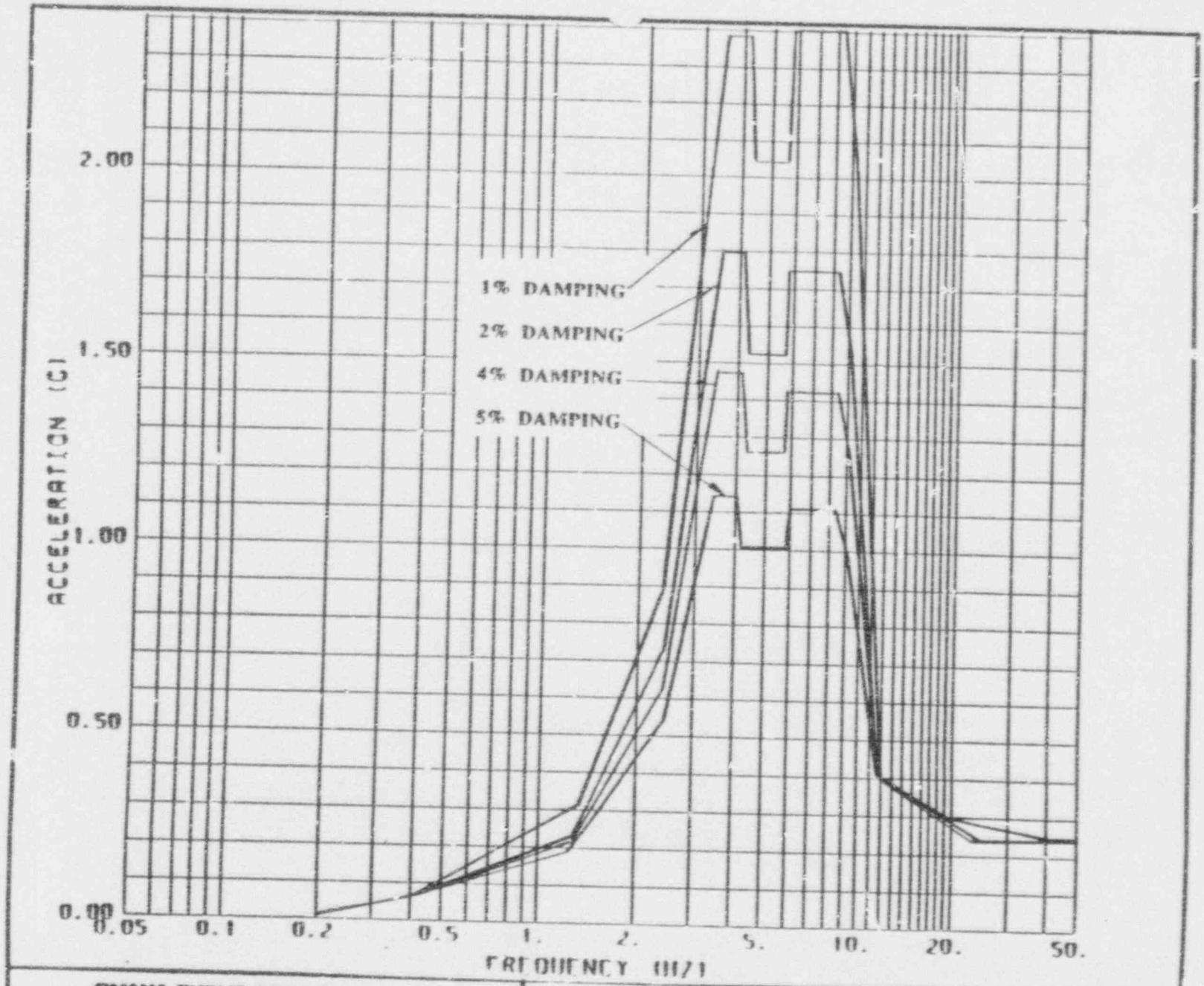


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (NORTH-SOUTH) DIRECTION
AT ELEVATION 1024'-6"
INTAKE STRUCTURE

BY ADC DATE 7-17-92 CHKD Ams DATE 7/17/92

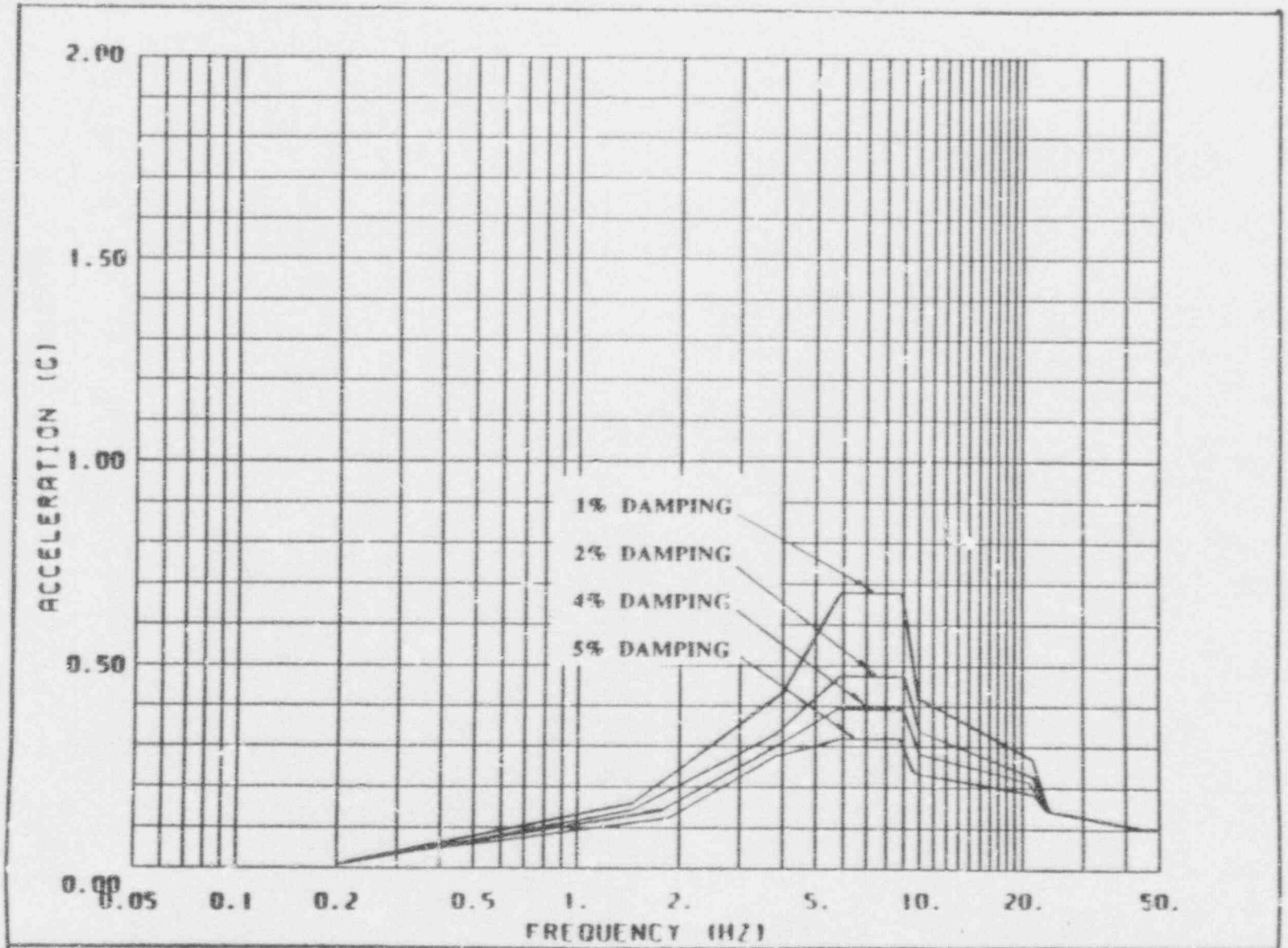


OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

HORIZONTAL (EAST-WEST) DIRECTION
AT ELEVATION 1024'-6"
INTAKE STRUCTURE

BY ADC DATE 7-17-92 CHKD AMW DATE 7/17/92 SKETCH NO REV



OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT 1

OPERATING BASIS EARTHQUAKE

VERTICAL SPECTRA
AT ELEVATION 1024'-6"
INTAKE STRUCTURE

BY AMC DATE 7-17-92 CHKD AWW DATE 7/17/92 SKETCH NO REV

APPENDIX E

FORT CALHOUN STATION, UNIT 1
STRUCTURAL PROPERTIES VARIATION STUDIES

(6 pages; this cover page not included)

E1.0 INTRODUCTION

This Appendix describes the parametric analyses performed to assess the effect of variation in structural properties on the in-structure response spectra developed for Fort Calhoun Station.

E2.0 ANALYSIS MODEL

The analysis model used for the parametric evaluations consisted of a three-dimensional soil-springs soil-structure interaction model and is briefly described below.

The soil spring constants used to represent the site/foundation characteristics correspond to the design basis constants contained in the plant's USAR (Reference E-1). The soil spring constants in the plant's USAR are based on results from in-situ tests of the combined soil-pile system, performed at the Fort Calhoun site at the time of plant construction.

The structural properties in the SSI model correspond to the updated three-dimensional model of the Auxiliary Building/Containment/ Internal Structure developed as part of the Alternate Seismic Criteria (ASC), and used in the ASC SASSI/CLASSI SSI calculations (Reference E-2). Thus, the structural model is an updated three-dimensional representation of the Fort Calhoun structures.

Two SSI analysis were performed using the same soil-spring constants, but varying the stiffness properties of the superstructure The first analysis used design-basis values to calculate the elastic shear stiffness of the building walls. In the second analysis, the elastic stiffness values are multiplied by a factor of 0.6. This factor represents a reasonable range of structural stiffness degradation, and is based, in part, on review, by others, of shear wall test data (Reference E-3). The actual range of variation is likely to be less, because stiffness degradation due to cracking is counteracted by the stiffness increase due to concrete aging.

The SSI analyses were performed using the north-south free-field time history used in the SASSI/CLASSI ASC SSI evaluations (Reference E-2). The model and analyses results are described in Reference E-4.

E3.0 ANALYSES RESULTS

Results were generated in the form of response spectra at various locations throughout the Auxiliary Building/Containment/Internal structure model. These are shown in Figures E-3.1 through E-3.4.

Comparison of in-structure response spectra with and without variation of structural stiffness properties indicates that relatively large changes in structural-related stiffness causes only a mino. effect on the overall SSI system response. This is because the response for a soil site such as Fort Calhoun's is dominated by the coupled soil-structure frequency.

E4.0 SUMMARY

This appendix describes the parametric evaluations performed to assess the effects of changes in structural stiffness properties. A soil-springs model is used for the SSI evaluations. The model of the building structures is the detailed three-dimensional model used in the ASC SSI evalautions. Results of the analyses indicate that relatively large variation in structural stiffness properties has a negligible effect on the in-structure response spectra for Fort Calhoun.

E5.0 REFERENCES

E-1 Updated Safety Analysis Report (USAR) for Fort Calhoun Station, Unit 1, Revision 7/87.

E-2 "Generation of In-Structure Response Spectra for Fort Calhoun Station, Unit 1". Report Prepared for the Nuclear Regulatory Commission by Omaha Public Power District, January 1989. (ABB Impell Report No.01-1390-1711, Rev.0)

E-3 Moehle, J. P., Sozen, M. A., Tang, H. T. "Concrete Wall Stiffness: Calculation Versus Measurement". Paper IX/2 presented at the Third Symposium on Current Issues Related to Nuclear Power Plant Structures, Equipment and Piping. December 1990.

E-4 ABB Impell Corporation Calculation: "Structural Stiffness Properties Variation Study". Calculation No. 0139-00378-03, Rev.0, Project 0139-00378, April 1992.

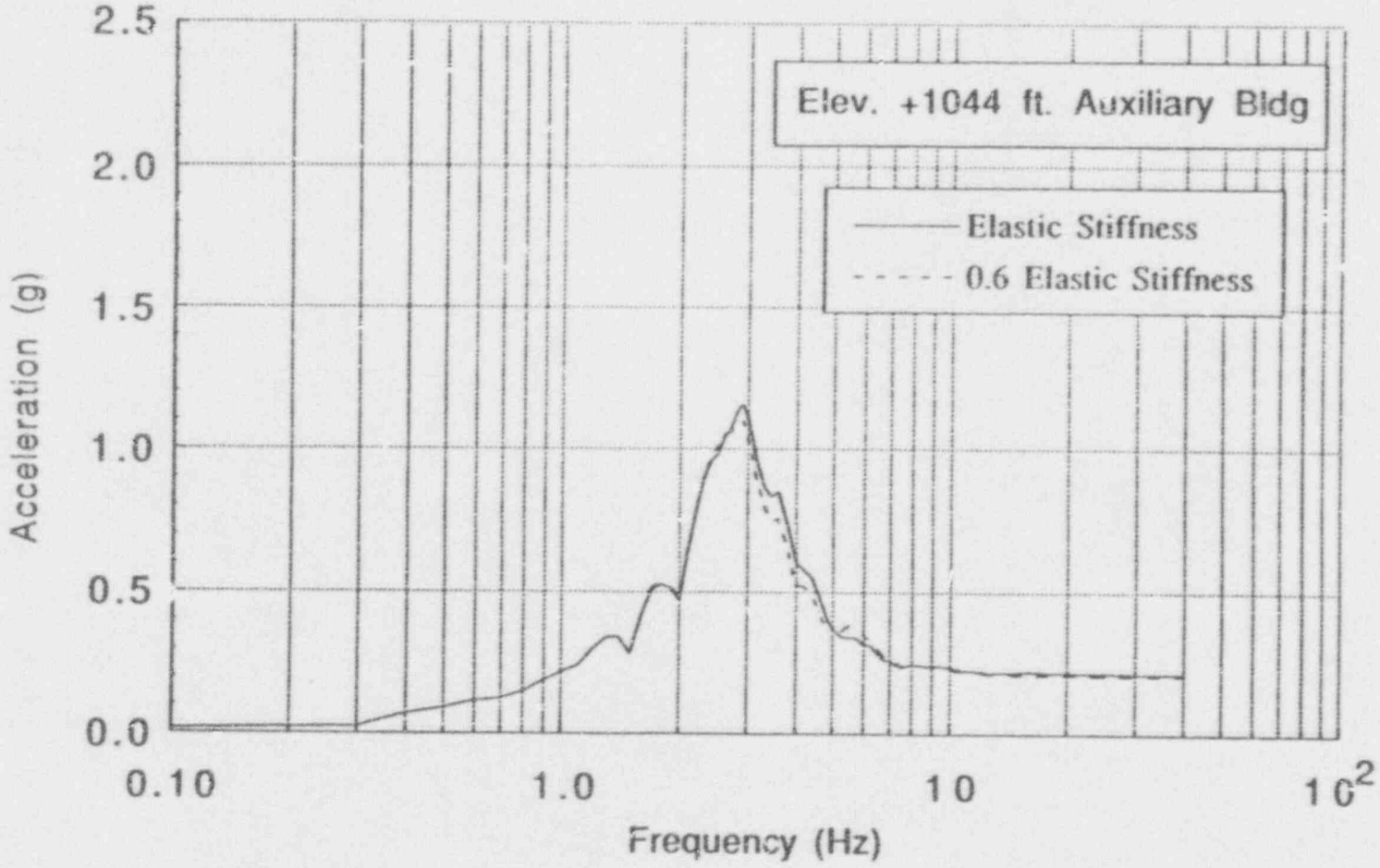


FIGURE E-3.1 COMPARISON OF RESPONSE SPECTRA (5% DAMPING) ELASTIC STIFFNESS VS 0.6 ELASTIC STIFFNESS, ELEV. 1044 FT AUXILIARY BUILDING

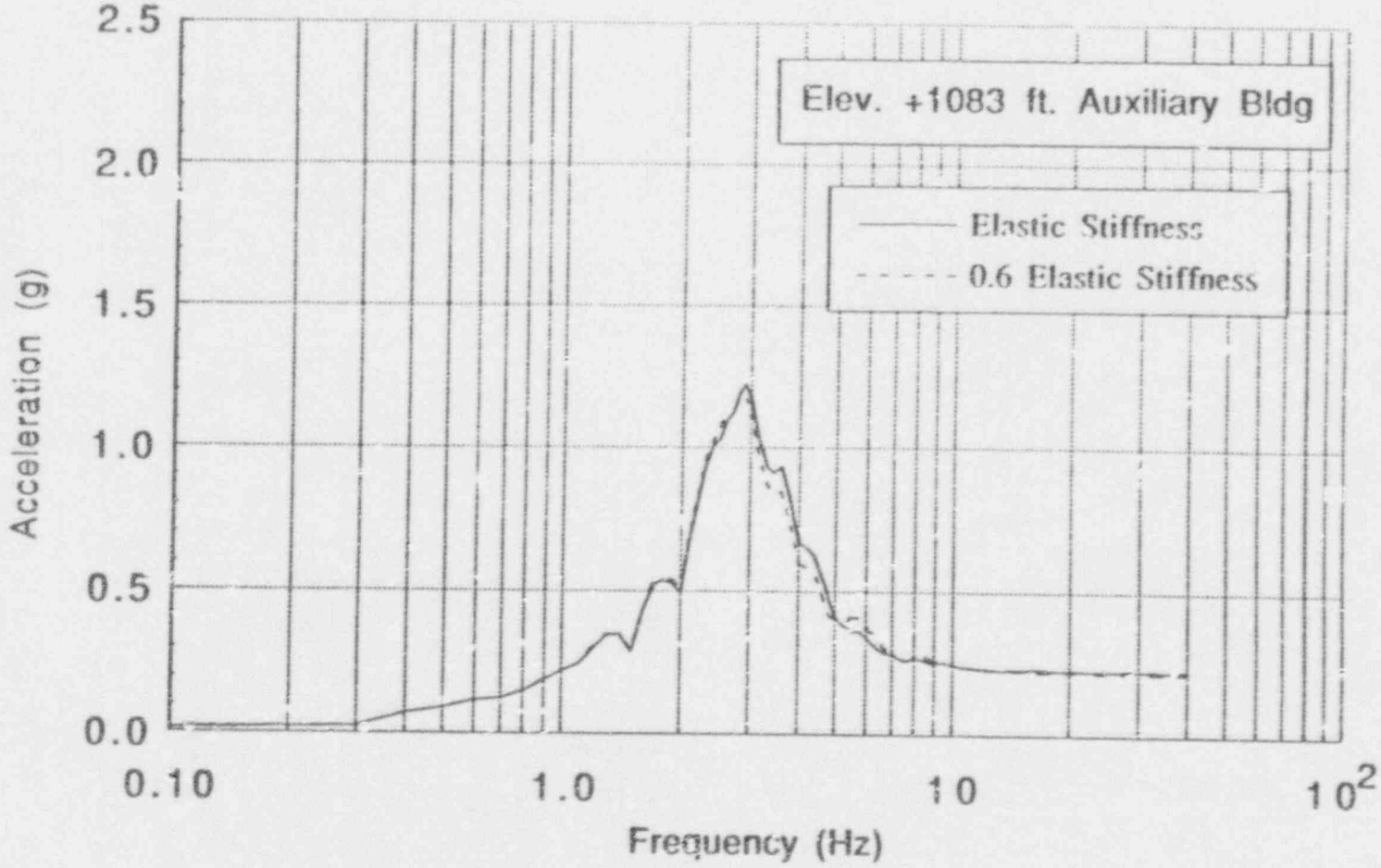


FIGURE E-3.2 COMPARISON OF RESPONSE SPECTRA (5% DAMPING) ELASTIC STIFFNESS VS 0.6 ELASTIC STIFFNESS, ELEV. 1083 FT AUXILIARY BUILDING

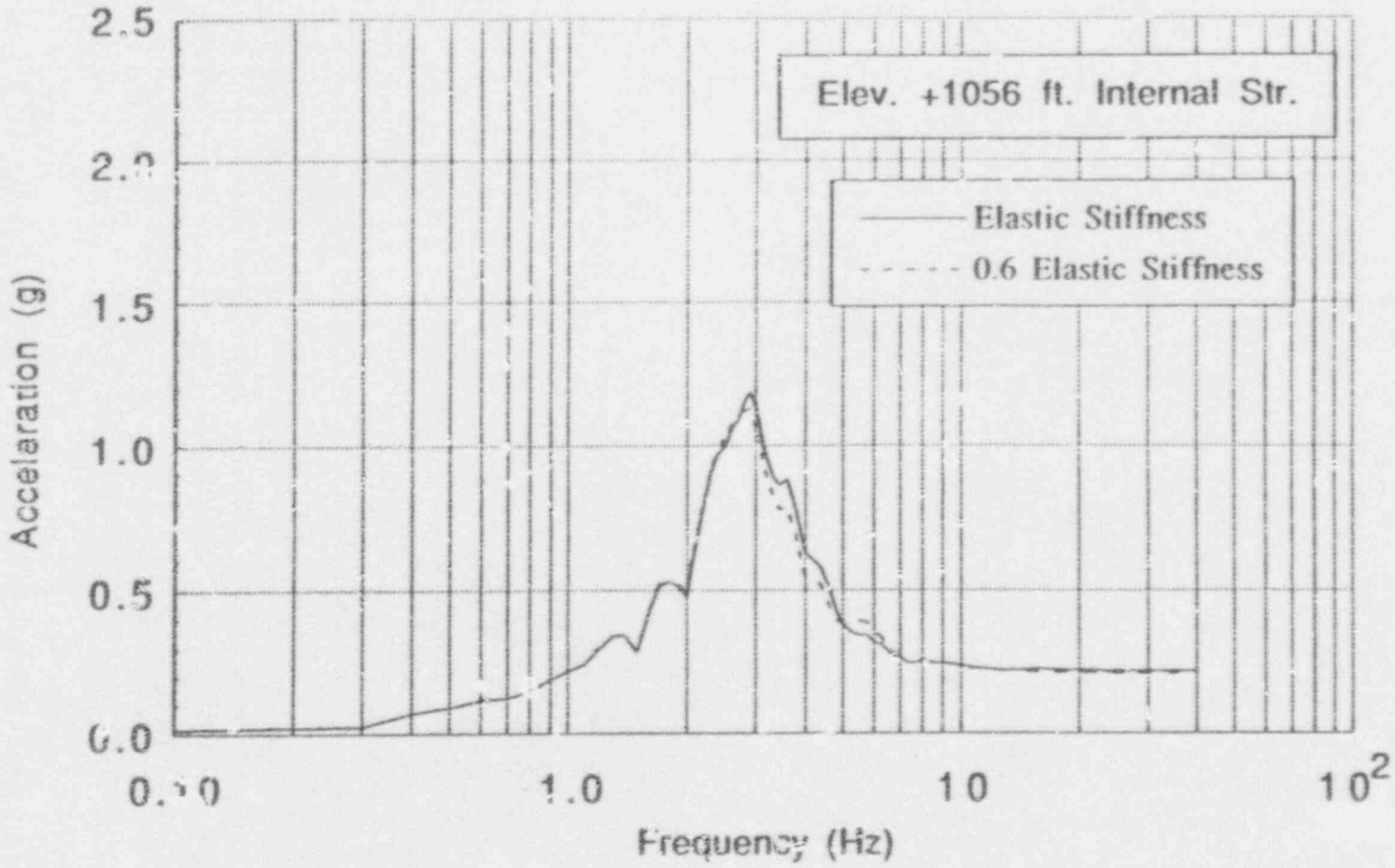


FIGURE 7-3.3 COMPARISON OF RESPONSE SPECTRA (5% DAMPING) ELASTIC STIFFNESS VS 0.6 ELASTIC STIFFNESS, ELEV. 1056 FT INTERNAL STRUCTURE

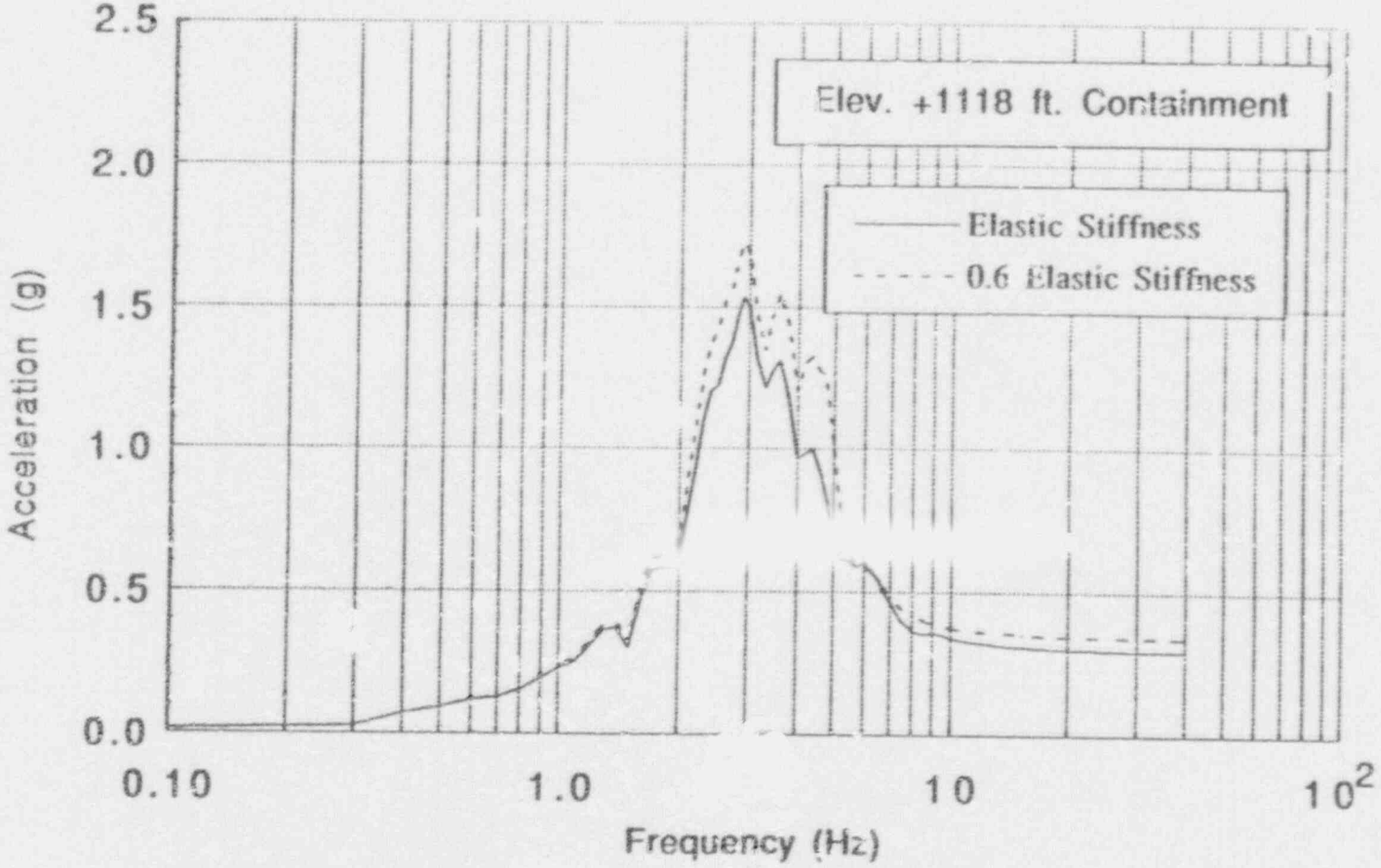


FIGURE E-3.4 COMPARISON OF RESPONSE SPECTRA (2% DAMPING) ELASTIC STIFFNESS VS 0.6 ELASTIC STIFFNESS, ELEV. 1118 FT CONTAINMENT BUILDING

APPENDIX F

FORT CALHOUN STATION, UNIT 1
SOIL-STRUCTURE INTERACTION DAMPING STUDY

(4 pages; not including this cover page)

F1.0 INTRODUCTION

At the September 5, 1991 meeting with the NRC Staff, OPPD was requested to provide clarification on how radiation damping is considered in the SSI analysis methodology. Specifically, OPPD was requested to estimate the amount of radiation damping due to the piles and to clarify that the contribution of the basemat impedance is not added to the pile impedance (Open Item 4b, Reference F-1). This Appendix describes the parametric soil-structure interaction (SSI) analysis performed to address this open item.

F2.0 RADIATION DAMPING: ANALYSIS MODEL AND RESULTS

To estimate the amount of radiation damping in the Fort Calhoun soil-pile foundation system, as calculated by the SASSI/CLASSI model used for the Alternate Seismic Criteria (ASC) SSI calculations, a free-vibration analysis was performed. The SSI analysis model used corresponds to the "best estimate" case model described in Reference F-1. In this model best estimate soil properties were used and a SASSI model of the pile-foundation system was developed to generate impedance functions. The SASSI-generated impedance functions are combined with the dynamic properties of the superstructure and the input time history to produce structural responses throughout the structure using the CLASSI program.

The analysis approach consisted of applying a very short duration (0.2 seconds) acceleration pulse to the model and determining the free-vibration response time history at the basemat location. The total damping in the system was estimated from the logarithmic decay of the basemat response by using the following standard expression:

$$\xi = \frac{a_n - a_{n+1}}{2\pi\, a_{n+1}} \times 100$$

The decay function of the response at the basemat location is shown in Figure F2.1. This response and expression (1) are used to calculate the total damping in the SSI system. The estimated total damping as given by expression (1) is 13.1%. Assuming that the total damping is the sum of the radiation and material portions, the radiation damping portion can be estimated by subtraction of the material damping from the total damping. The average material damping from the soil column analysis is 6.3% (Reference F-1).

damping due to actual embedment has not been considered (the analysis model is surface founded).The free-vibration analysis and results are documented in Reference F-2.

F3.0 IMPEDANCE COMPUTATION

As described in the main body of this report, the analysis model used for impedance computation is a three dimensional SASSI model. This model incorporates the site configuration, layering and soil properties as well as the pile system configuration and properties. Separate SASSI models were developed for the Auxiliary/ Containment/Internal Structure and the Intake Structure. The basemat in these SASSI models is not explicitly modeled, but is considered rigid for purposes of condensing the entire pile-foundation system to a 6 x 6 matrix (at each frequency) which characterizes the force-displacement relationships of the foundation system. Thus, impedance contribution from the basemat is conservatively neglected and therefore pile impedance is not added to the basemat impedance. The approach used for impedance computation considers that the basemat, over time, may separate from the soil surface.

F4.0 SUMMARY

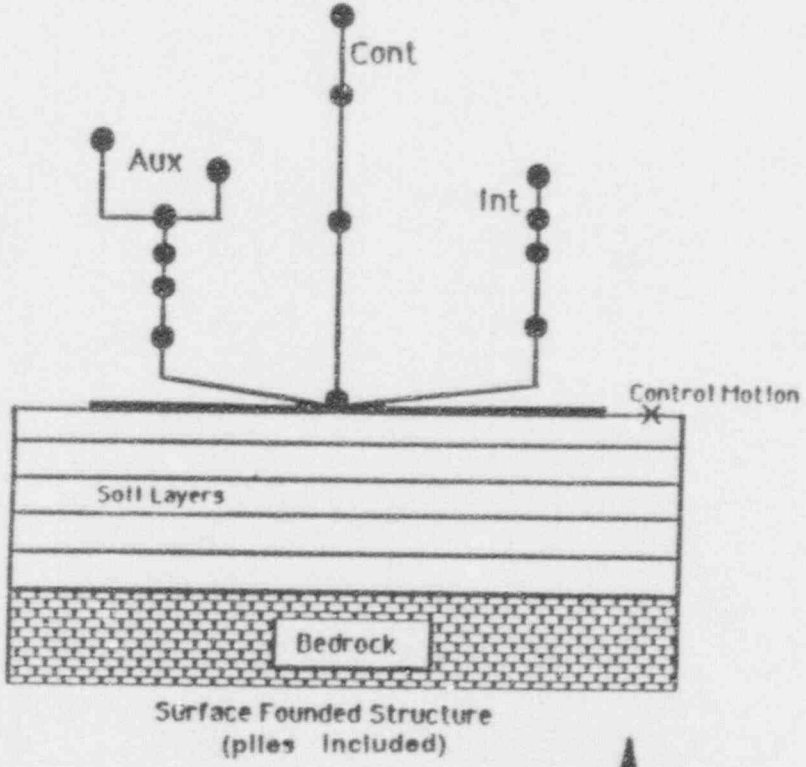
This appendix describes the analytical study performed to determine the amount of radiation damping in the SSI model used to develop in-structure response spectra for Fort Calhoun. Based on free-vibration analysis results, the total critical damping ratio in the SSI system is estimated at 13.1%. Since material damping ratio is approximated as 6.3%, the radiation damping portion is estimated to be 6.8% of critical.

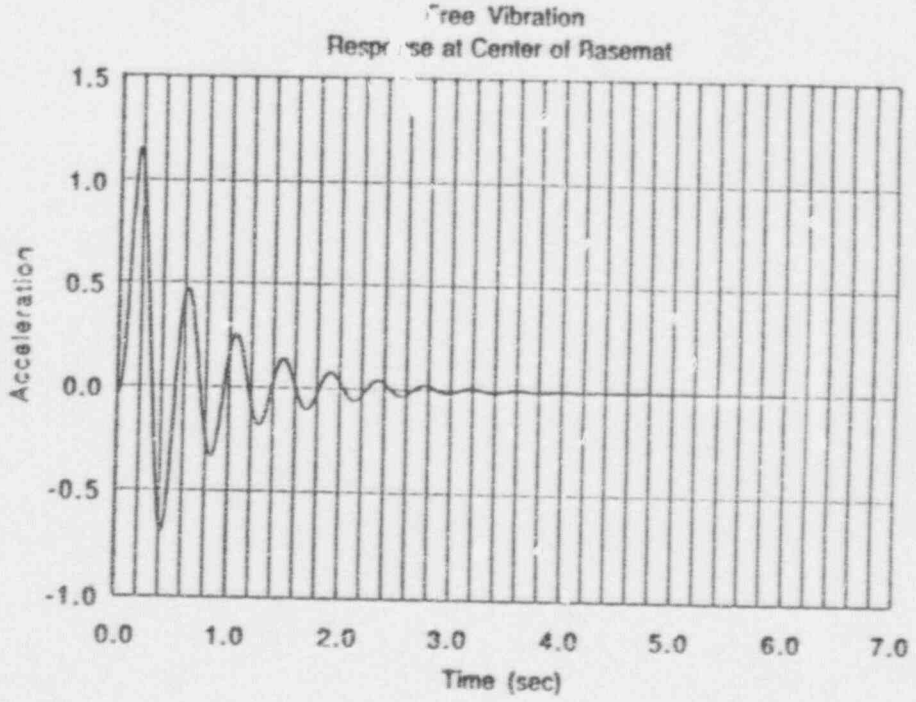
In addition, the modeling approach used for computation of impedance functions conservatively neglects the impedance contribution from the basemat and is based only on the pile contribution, i.e.: the basemat impedance is not added to the pile impedance.

F5.0 REFERENCES

F-1 "Generation of In-Structure Response Spectra for Fort Calhoun Station, Unit 1". Report Prepared for the Nuclear Regulatory Commission by Omaha Public Power District, January 1989. (ABB Impell Report No.01-1390-1711, Rev.0)

F-2 ABB Impell Corporation Calculation: "Radiation Damping Study". Calculation No. FV-1, Rev.0, Project 0139-00378, April 1992.





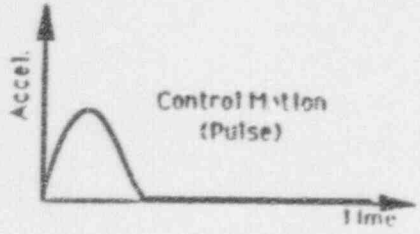


FIGURE F-2.1 FREE VIBRATION RESPONSE AT BASEMAT ELEVATION AUXILIARY/CONTAINMENT INTERNAL STRUCTURE SSI MODEL

LIC-92-016R

ENCLOSURE 4

SURVEILLANCE TEST

SE-ST-CONT-001

4.0 EQUIPMENT LIST

4.1 Tools

- Feeler Gauge
- Flashlight
- 6-foot folding rule or tape measure
- Binoculars (optional)
- Camera (optional)

4.2 Parts

None required

5.0 PRECAUTIONS AND LIMITATIONS

5.1 A radiation work permit (RWP) shall be issued to cover work in radiation controlled areas.

5.2 Follow precautions and instructions stated on the RWP.

5.3 Follow recommendations in OPPD Safety Manual.

5.4 All anomalies and deficiencies shall be reported immediately to the immediate Supervisor, the System Engineer, the Shift Supervisor, and noted on the Comment Sheet/Chronological Log. An immediate check shall be made to verify Limiting Conditions for Operation, per Technical Specifications, have not been exceeded.

5.5 If required by the immediate Supervisor, an Incident Report shall be initiated to report any anomalies or deficiencies. The Station Incident Report number shall be recorded on the Comment Sheet/Chronological Log.

5.6 No maintenance shall be conducted within this Surveillance Test, other than that specifically directed by this procedure.

5.7 A Maintenance Work Request (MWR) shall be initiated to correct any reported deficiency. The MWR number shall be referenced on the Comment Sheet/Chronological Log.

5.8 If satisfactory results cannot be achieved during performance of this procedure, notify immediate Supervisor and proceed as directed.

(54)

CONTAINMENT INSPECTION

SAFETY RELATED 2-25-90

1.0 PURPOSE

1.1 The purpose of this Surveillance Test is to obtain visual evidence of any significant structural deterioration of the accessible interior and exterior surfaces of the containment structure.

1.2 This test shall be performed prior to the Type A Test contained in Surveillance Test SS-ST-ILRT-0001 (ST-CONT-7-F.1), Containment Integrated Leak Rate Test.

1.3 This test satisfies the general inspection requirements of Technical Specification, Section 3.5, Item (2)b.

2.0 REFERENCES

2.1 Technical Specification, Section 3.5, Item (2)b, Containment Tests-Pretest Requirements

2.2 PED Quality Procedure QP-8 (GSE Administrative Procedure A-8), Control of Deficiencies and Corrective Action

2.3 Surveillance Test SS-ST-ILRT-0001 (ST-CONT-7-F.1), Containment Integrated Leak Rate Test.

2.4 Drawing 11405-A-5, Primary Plant Basement Floor Plan (File No. 12162)

2.5 Drawing 11405-A-6, Primary Plant Ground Floor Plan (File No. 12163)

2.6 Drawing 11405-A-7, Primary Plant Intermediate Operating Floor Plans (File No. 12164)

2.7 Drawing 11405-A-8, Primary Plant Operating Floor Plan (File No. 12165)

2.8 Drawing 11405-A-13, Primary Plant Section A-A (File No. 12170)

3.0 DEFINITIONS

- QCR# - Quality Control Inspection Report Number. This is a unique number assigned to an inspection report written by Quality Control Inspectors.

ST for SE

Sys. Engr. Donald D Floyd

Supv. Sys. Engr. K R Hays

File RAB

2617 1252

SE-ST-CONT-0001
QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: [illegible] Date 4/18/89

Report No. 88-3711

System or Component CONT. BLDG.

QC LOG

Document Number: ST. CONT-5

Title: CONTAINMENT INSP.

Location: ROOM 5

Date/Time: [illegible]

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: VERTICAL CRACK ABOUT 5' INSIDE FROM WALK AND ABOUT 5' ABOVE FLOOR. CONTAINMENT ALSO HAS GENERAL CRACKING, CREEP & SHRINKAGE IN VARIOUS LOCATIONS WIDTH 1/32"

Acceptable [ ] N/A

Corrective Action Required [X] N/A

Notified: Name: SAM PANDE Date: 10-17-88 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED 11/19/88 [illegible]

QC LOG # 88-4176

Acceptable [✓]

Sketch if Required:

[illegible] 11-16-88
QC Inspector Date Time

Tom Sullivan
Lead QC Inspector

[illegible]
Supervisor - Quality Control

For

5.9 If the procedure becomes contaminated or damaged, the "Lead Man" or designee shall ensure that all data, verifications, and other pertinent information is transcribed to another copy of the procedure, which will become the official copy.

5.10 All initials/signature shall be those of person(s) actually performing the work. The person completing the Surveillance Test shall sign and date.

5.11 All personnel participating in the performance of this test shall enter their printed name, signature and initials on the Surveillance Test Signature Sheet.

5.12 During the performance of this test, any step or data entry that is not applicable shall be identified by "N/A," initialed, dated and an explanation provided on the Comment Sheet/Chronological Log.

5.13 Performance of this procedure requires a knowledgeable member of System Engineering, Special Services or Design Engineering in the Civil or Structural disciplines.

5.14 Performance of this procedure requires one or more Quality Control Inspectors certified Level II in VT-3 inspection.

6.0 INITIAL CONDITIONS INITIALS/DATE

NOTE: Initial conditions need not be performed in numerical sequence.

6.1 Compare procedure revision date with current revision of Master Procedure.

Master Procedure Rev. No. R0 DJ7 ~~2-19-90~~, 2-19-90 DJ7

INITIALS/DATE

NOTE: A review of previous containment inspections is necessary during the pre-job briefing. The last performance of this test shall be attached to this test for reference and comparison of conditions.

6.2 A prejob briefing has been conducted prior to the start of this test. **ALL** personnel participating in the performance of this test have read **AND** understand the procedure and have completed the Surveillance Test Signature Sheet. SAB 12-20-90

6.3 Work is covered by Radiation Work Permit(s).

✓ RWP No. 90-0164 (AUX SPECIAL) DJ7 12-19-90

RWP No. 90-0165 See Comments DJ7 12-23-90 DJ7 12-19-90

✓ RWP No. 90-0106 (AUX ROUTINE) DJ7 12-19-90

6.4 Radiation Protection (RP) notified in time to provide coverage for areas requiring full time coverage or entrance into "high" or "very high" radiation areas. 12-19-90
RP

6.5 Security notified in time to allow entrance to areas or access to areas locked. 12-19-90
Security

6.6 The Plant is in a Refueling Shutdown condition. 12/20/90
Shift Supv

6.7 Chemistry has performed an analysis of an air sample from the stressing gallery and has authorized personnel entry.

Confined Space Entry Permit No. N/A 12/20/90
Chemistry

INITIALS/DATE

6.8 The Shift Supervisor has granted approval and released equipment necessary to perform this test.

Shift Sup Sig

0837 12/20/90
Time Date

7.0 PROCEDURE

NOTE: The containment areas may be inspected in any logical sequence.

7.1 Perform a thorough visual inspection of all accessible surfaces (interior and external) of the containment structure as listed on the attached Containment Integrity Inspection Worksheets to discover evidence of any significant structural deterioration which may affect the containment's structural integrity or leak tightness. See Section 9.0 for complete definition.

7.2 Record the inspection results on the Containment Integrity Inspection Worksheet as follows:

7.2.1 If evidence of significant structural deterioration is discovered:

A. Describe the [illegible] found condition in the "Structural Condition" block next to the appropriate "Room/Area" on the Containment Integrity Inspection Worksheet.

B. Record location of condition as to elevation and distance from a stationary, known object (wall, pump, penetration, etc.) in the "Location" block on the Containment Integrity Inspection Worksheet.

(1) Any sketches, photographs or supplemental sheets that are required shall have this procedure number, date of inspection, location, room/area and signature of the inspector.

(2) These items will be attached to this procedure and shall be retained as part of the test record.

C. QC record the Quality Control Report Number (QCR#) in the "QCR/MWR" block on the Containment Integrity Inspection Worksheet for all inspections completed.

7.2.1 D. The Engineer shall initiate a Maintenance Work Request (MWR) and record the MWR number in the "QCR/MWR" block on the Containment Integrity Inspection Worksheet.

E. QC and engineer shall initial and date for each inspection in the "Initials/Date" block on the Containment Integrity Inspection Worksheet.

7.2.2 If no evidence of structural deterioration is noted:

A. Make a statement in the "Structural Condition" block on the Containment Integrity Inspection Worksheet that explains the results.

B. "N/A" the "Location" block on the Containment Integrity Inspection Worksheet.

C. "N/A" the MWR# in the "QCR/MWR" block on the Containment Integrity Inspection Worksheet.

D. QC record the Quality Control Report Number (QCR#) in the "QCR/MWR" block on the Containment Integrity Inspection Worksheet for all inspections completed.

E. QC and Engineer shall initial and date for each inspection in the "Initials/Date" block on the Containment Integrity Inspection Worksheet.

8.0 RESTORATION

INITIALS/DATE

8.1 If required, all evidence of structural degradation has been evaluated and, if required the appropriate corrective action has been initiated in accordance with PED Quality Procedure QP-8. ~~N/A~~ DJ7, 2-23-90 ~~DJ7~~ See S. Bothun comments

8.2 If required, all corrective action resulting from this inspection has been reported in the Type "A" Test Report. N/A DJ7, 2-23-90 See 6 in Comments

INITIALS/DATE

8.3 The Shift Supervisor has been notified the test is complete.

D O'Connor
Shift Sup Sig

1325 12-23-90
Time Date

8.4 The Surveillance Test Signature Sheet contains the printed name, signature and initials of all persons whose signature or initials appear within this procedure.

DJF 12-23-90

8.5 Test is complete

Donald J Fyfe, 2-23-90
Signature

9.0 ACCEPTANCE CRITERIA

Any evidence of structural deterioration which may affect either the containment structural integrity or leak-tightness, as defined below, has been noted for evaluation.

Significant structural deterioration can be defined as measurable structural deterioration that when it is compared with past containment inspections, there is strong evidence of an increase structural deterioration which could affect the containment's structural integrity or leak-tightness. Evidence of cosmetic or superficial deterioration, unless determined by sound engineering judgement, is not considered to be significant structural deterioration.

10.0 TEST RECORD

This entire procedure, plus any sketches, photographs, the last performance of this test, and supplemental sheets acquired or developed during the conduct of this inspection.

11.0 REVIEW

11.1 The Supervisor-Systems Engineering is responsible for ensuring the completed Surveillance Test is reviewed in a timely manner and is forwarded to the Administrative department for retention.

11.2 The Supervisor-Systems Engineering must review and certify the adequacy of this Surveillance Test.

11.3 The Manager-PED Civil Engineering is responsible for comparing the results of this inspection with the results of the previous inspections to determine if an increase in the structural deterioration has occurred.

11.3.1 If the structural deterioration has increased, the Manager-PED Civil Engineering shall assure that corrective actions have been initiated.

ATTACHMENT 1
AREA LOCATION AND ENTRANCE REQUIREMENTS

CAUTION
The atmosphere in confined spaces may not be suitable for human occupation.

NOTE: Protective clothing requirements can change daily. Consult RP prior to entry into any room.

NOTE: RP may wish to monitor all activities. Consult RP prior to start for restrictions or special conditions.

NOTE: Call security at extension 6657 for entry into security locked areas. Follow instructions given by security officer.

ROOM/AREA		
Room 20 El. 989'	Aux Bldg Non-RCA, downstairs from Room 57	Key Card Access Only
Room 57 El. 1013'-1025'	Aux Bldg Non-RCA, Upper and Lower Levels, enter through Room 56W	Key Card Access Only
Room 81 El. 1036'	Aux Bldg Non-RCA, off Turbine Deck	Key Card Access Only
Room 65 El. 1009'-1037'	Aux Bldg Non-RCA, Upper and Lower Levels, enter through Room 66 or through Room 65/DG1 Bay	Key Card, Security to unlock door
Room 66 El. 1009'	Aux Bldg Non-RCA enter outside roll up door or through Room 65	Key Card, Security to unlock door
Tendon Tunnel El. 991'	Enter through door in Room 22, or through floor hatch in Room 66	Key Card, Security to unlock door, Chemistry to take air samples
Outdoors West of Room 66	Ground Level and up, binoculars are suggested	Site Access
Aux Bldg Roof El. 1057'-1083'	Enter through Room 82 (Mechanical Equipment Room off of Turbine Deck, ladder at M & 26 (1036)) NW corner	Key Card, Security to unlock hatch

ATTACHMENT 1
AREA LOCATION AND ENTRANCE REQUIREMENTS

CAUTION
The atmosphere in confined spaces may not be suitable for human occupation.

NOTE: Protective clothing requirements can change daily. Consult RP prior to entry into any room.

NOTE: RP may wish to monitor all activities. Consult RP prior to start for restrictions or special conditions.

NOTE: Call security at extension 6657 for entry into security locked areas. Follow instructions given by security officer.

ROOM/AREA		
Containment Dome El. 1119'	Enter same as Aux Bldg Roof, go to ladder to Aux Bldg Roof over Fuel Handling, ladder to dome NW side of Containment	Key Card, Security to unlock hatch, and latter gates
Room 5 El. 989'	Aux Bldg RCA, enter through Corridor 4	RWP, High Rad Key, RP,
Room 12 El. 989'	Aux Bldg RCA, enter through Corridor 4	RWP, RP,
Room 13 El. 989'	Aux Bldg RCA, enter through Corridor 4	RWP, RP,
Room 14 El. 989'	Aux Bldg RCA, enter through Corridor 4	RWP, RP,
Room 15A El. 989'	Aux Bldg RCA, enter through Corridor 4	RWP, RP,
Room 58 El. 1012'	Aux Bldg RCA, Aux Bldg Side PAL	RWP, RP,
Room 59 El. 1007'	Aux Bldg RCA, enter through Corridor 26	RWP, RP,

ATTACHMENT 1
AREA LOCATION AND ENTRANCE REQUIREMENTS

NOTE: Protective clothing requirements can change daily. Consult RP prior to entry into any room.

NOTE: RP may wish to monitor all activities. Consult RP prior to start for restrictions or special conditions.

NOTE: Call security at extension 6657 for entry into security locked areas. Follow instructions given by security officer.

ROOM/AREA		
Room 60 El. 1007'	Aux Bldg RCA, enter through Corridor 26	RWP, RP,
Room 61 El. 1007'	Aux Bldg RCA, enter through Corridor 26	RWP, RP, High Rad Key
Room 62 El. 1007'	Aux Bldg RCA, enter through Room 69 (El. 1025') down ladder at T and 3b SW corner	RWP, RP, hatch key, Chemistry to take air samples
Room 69 El. 1025'	Aux Bldg RCA, upstairs	RWP, RP,
Room 71 El. 1025'	Aux Bldg RCA, enter through Room 69 SE corner	RWP, RP, I&C Cage Key
Containment El. 995'	Enter through PAL door, check in with senior RP at desk	RWP, RP, High Rad Key
Containment El. 1019'	Enter through PAL door, check in with senior RP at desk	RWP, RP, High Rad Key
Containment El. 1045'	Enter through PAL door, check in with senior RP at desk	RWP, RP, High Rad Key
Containment El. 1060'	Enter through PAL door, check in with senior RP at desk	RWP, RP, High Rad Key
Polar Crane El. 1099' to Apex	Binoculars are recommended	Respirator required if on Polar Crane walkway

CONTAINMENT INTEGRITY INSPECTION WORKSHEET

ROOM/AREA	STRUCTURAL CONDITION	LOCATION	QCR/MWR	INITIALS/DATE
Room 65 Ventilation Enclosure Dwg:11405-A-6&7	No SIGNIFICANT STRUCTURAL DETERIORATION. APPEARANCE IS GOOD.	N/A	QCR# 90-0944 MWR# N/A	QC 12-21-90 ENGR SAB 12-21-90
Room 66 Equipment Hatch Enclosure Dwg: 11405-A-7	No SIGNIFICANT STRUCTURAL DETERIORATION. OBSERVED NUMEROUS STAINS FROM VARIOUS SPILLED COATINGS	N/A	QCR# 90-0944 MWR# N/A	QC 12-21-90 ENGR SAB 12-21-90
Tendon Tunnel	No SIGNIFICANT STRUC DETERIORATION OBSERVED. OBSERVED ITEMS NOTED IN PREVIOUS INSPECTION, & FROM PREVIOUS INSPECTIONS. MARKED & DATED SOME PREVIOUSLY IDENTIFIED MINOR CRACKS TO VERIFY NO INCREASE IN CRACK WIDTH. → CON'T BELOW	VARIOUS AS NOTED PERIMETER	QCR# 90-0972 MWR# N/A	QC 12-22-90 ENGR SAB 12-22-90
Room 58 Per Air Lock (PAL) Dwg: 11405-A-6	No SIGNIFICANT STRUC. DETERIORATION OBSERVED. APPEARANCE IS GOOD. WALL PARTIALLY COVERED BY HERCULITE.	N/A	QCR# 90-1001 MWR# N/A	QC 12-27-90 ENGR SAB 12-27-90
Room 59 Pipe Penetration Room Dwg: 11405-A-6	No SIGNIFICANT STRUCTURAL DETERIORATION.	N/A	QCR# 90-0945 MWR# N/A	QC 12-21-90 ENGR SAB 12-21-90
Room 60 Sampling Room Dwg: 11405-A-6	No SIGNIFICANT STRUCTURAL DETERIORATION. OBSERVED ONE 1/4" ANCHOR HOLE ABOUT 18" ABOVE JB-344A (OLD HOLE) (SAB 12/21/90	JB-344A	QCR# 90-0944 MWR# N/A	QC 12-21-90 ENGR SAB 12-21-90
Room 61 Valve Room Dwg: 11405-A-6	No SIGNIFICANT STRUCTURAL DETERIORATION. APPEARANCE IS GOOD	N/A	QCR# 90-0944 MWR# N/A	QC 12-21-90 ENGR SAB 12-21-90

→ T. TUNNEL CONTINU

MARKED + DATED SIX (6) NEW ITEMS: 5 VERT. MINOR CRACKS & 1 PREVIOUSLY PATCHED AREA.
NUMEROUS SEEPAGE STAINS, MINOR IN NATURE, NOTED FROM PREVIOUS REPORTS; SEEPAGE STILL ACTIVE.
NON STRUC ITEM: SPILLAGE STAIN ON 480V ELEC. DISCONNECT AT BOTTOM OF ACCESS HATCH LADDER. RO

FC/ST/57A

2617 1226

CONTAINMENT INTEGRITY INSPECTION WORKSHEET

ROOM/AREA	STRUCTURAL CONDITION	LOCATION	QCR/MWR	INITIALS/DATE
Room 62 Ion Exchange Room Dwg: 11405-A-6	NO SIGNIFICANT STRUCTURAL DETERIORATION OBSERVED. APPEARANCE IS GOOD.	N/A	QCR# 90-0972 MWR# N/A	[illegible] 12-22-90 QC SHB 12-22-90 ENGR
Room 69 Ventilation Equipment Room DWG: 11405-A-7	NO SIGNIFICANT STRUCTURAL DETERIORATION OBSERVED. MISC. OIL OR GREASE STAINS. "OLD" TENDON SHEATH POINT OBSERVED SE OF COL N-68. MINOR GROUTING OF EXP. ANC. HOLES OBSERVED.	SE OF COL N-68	QCR# 90-0944 MWR# N/A	[illegible] 12-21-90 QC SHB 12-21-90 ENGR
Room 71 I&C Instrument Shop DWG: 11405-A-7	NO SIGNIFICANT STRUCTURAL DETERIORATION OBSERVED. MISC. GREASE STAINS.	N/A	QCR# 90-0944 MWR# N/A	[illegible] 12-21-90 QC SHB 12-21-90 ENGR
Containment Outdoors West of Room 66 Dwg: 11405-A-6	NO SIGNIFICANT STRUCTURAL DETERIORATION OBSERVED. OBSERVED SAME ELECTRICAL BOXES & CONDUIT STUB-OUTS DESCRIBED IN PREWORK INSPECTION (10-88).	N/A	QCR# 90-0956 MWR# N/A	[illegible] 12-20-90 QC SHB 12-20-90 ENGR
Auxiliary Building Roof Dwg: 11405-A-8	NO SIGNIFICANT DETERIORATION OBSERVED. COSMETIC SURFACE CRACKING AT 180° SOUTH AT THICKENED SECTION AT ANNULUS FOR EQUIP HATCH, 12' ABOVE & 6' ABOVE ROOF OF RM 66. 12' HIGH CRACKED IS (1) cont' SHB 4/22/90	180° SOUTH	QCR# 90-0956 MWR# N/A	[illegible] 12-20-90 QC SHB 12-20-90 ENGR
Containment Dome Dwg: 11405-A-13	NO SIGNIFICANT DETERIORATION OBSERVED. OBSERVED COSMETIC FLAKING OF ROOF COATING AT BASE OF DOME. NE LIGHTNING ROD MISSING TIP OF RESTING AT BASE OF ROD.	~N.E. ROD	QCR# 90-0956 MWR# N/A	[illegible] 12-20-90 QC SHB 12-20-90 ENGR

cont' (1) HORIZ ~ ABOUT 3' LONG. EVIDENCE OF PREVIOUS COSMETIC REPAIRS IN VICINITY.

WEST SIDE @ LADDER TO DOME: 2"x2" SURFACE SPALL W/ EXPOSED RUSTED MESH. ITEM REPORTED IN PREVIOUS REPORT, NO VISIBLE CHANGE. 270° WEST 5' NORTH OF LADDER

GENERAL: TENDON GREASE AROUND CIRCUMFERENCE AT VARIOUS LOCATIONS, BIRD NESTS UP UNDER STRESSING GALLERY CANOPY. COSMETIC

FC/ST/57A RO

2617 1227

CONTAINMENT INTEGRITY INSPECTION WORKSHEET

ROOM/AREA	STRUCTURAL CONDITION	LOCATION	QCR/MWR	INITIALS/DATE
Room 5 Heat Exchanger and Pump Room Dwg: 11405-A-5	No significant structural deterioration observed. Minor paint flaking adjacent to Col R-5C. Three 1/4" ø expansion anchors from previous support, south of Col R-5C.	Col R-5C	QCR# 90-0944 MWR# N/A	QC 12-21-90 ENGR SHB 12-21-90
Room 12 Letdown Heat Exchanger Dwg: 11405-A-5	No significant structural deterioration observed. Observed 8 grouted anchor holes; 4 @ 8' above floor; 4 @ 8' above floor.	4'+8' above floor.	QCR# 90-0972 MWR# N/A	QC 12-22-90 ENGR SHB 12-22-90
Room 13 Mechanical Penetration Dwg: 11405-A-5	No significant structural deterioration observed. Appearance is good SHB 12/22/90	N/A	QCR# 90-0944 MWR# N/A	QC 12-21-90 ENGR SHB 12-21-90
Room 14 Shutdown Heat Exchanger Dwg: 11405-A-5	No significant structural deterioration observed. Wall has been painted; appearance is good. Cracks reported in previous report not visible.	N/A	QCR# 90-0972 MWR# N/A	QC 12-22-90 ENGR SHB 12-22-90
Room 15a Valve Room Dwg: 11405-A-5	No significant structural deterioration observed. Observed items noted in previous report QC 88-3715 noted two(2) abandoned 3/4" CEA's; 12" above floor. Support has been removed.	12" above floor	QCR# 90-0972 MWR# N/A	QC 12-22-90 ENGR SHB 12-22-90

2617 1228

CONTAINMENT INTEGRITY INSPECTION WORKSHEET

ROOM/AREA	STRUCTURAL CONDITION	LOCATION	QCR/MWR	INITIALS/DATE
Room 20 Lower Electrical Penetration Dwg: 11405-A-5	No SIGNIFICANT STRUCTURAL DETERIORATION OBSERVED. OBSERVED PREVIOUSLY REPORTED ELEC BOX EMBED AT SW CORNER + 2 ELEC BOXES, SAME LOC. ABOVE 3' ABOVE FLOOR	SW CORNER WEST OF COL 27	QCR# 90-0194 MWR# N/A	QC 12-21-90 ENGR SHB 12-21-90
Room 57 Mid Electrical Penetration Dwg: 11405-A-6	No SIGNIFICANT STRUCTURAL DETERIORATION OBSERVED. APPEARANCE IS GOOD.	N/A	QCR# 90-0194 MWR# N/A	QC 12-21-90 ENGR SHB 12-21-90
Room 57 Upper Electrical Penetration Dwg: 11405-A-7	No SIGNIFICANT STRUCTURAL DETIORATION OBSERVED. SAME ELECTRICAL PLATES REPORTED IN PREVIOUS INSPECTION.	N/A	QCR# 90-0194 MWR# N/A	QC 12-21-90 ENGR SHB 12-21-90
Room 81 Condensate Ser. Water Room Dwg: 11405-A-8	NO SIGNIFICANT STRUCTURAL DETERIORATION. APPEARANCE IS GOOD	N/A	QCR# 90-0194 MWR# N/A	QC 12-21-90 ENGR SHB 12-21-90

2617 1229

CONTAINMENT INTEGRITY INSPECTION WORKSHEET

ROOM/AREA	STRUCTURAL CONDITION	LOCATION	QCR/MWR	INITIALS/DATE
CONTAINMENT ELEVATION: 995 ft. Dwg: 11405-A- 5	NO SIGNIFICANT STRUCTURAL DETERIORATION OBSERVED. STAINS FROM FLUID LEAK AT COL 14 OLD FLUID STAINS BETWEEN COL's 10-11 MINOR PAINT PEELING	COL 14 COL 10-11	QCR# 90-1001 MWR# N/A	QC ENGR SNB 12-23-90
CONTAINMENT ELEVATION: 1013 ft. Dwg: 11405-A-6	NO SIGNIFICANT STRUCTURAL DETERIORATION OBSERVED. OBSERVED PEELED PAINT ABOVE PAL DOOR, ABOUT 20' HIGH. PEELED PAINT ON LINER ADJACENT TO SI-6A TANK ABOUT 2 FT ABOVE FLOOR.	ABOVE PAL DOOR. SI-6A TANK	QCR# 90-1001 MWR# N/A	QC ENGR SNB 12-23-90
CONTAINMENT ELEVATION: 1045 ft. Dwg: 11405-A-7	NO SIGNIFICANT STRUCTURAL DETERIORATION OBSERVED. PEELED PAINT BETWEEN COL's 13+14 (BEHIND HVAC DUCT) (EAST).	COLS 13+14	QCR# 90-1001 MWR# N/A	QC ENGR SNB 12-23-90
CONTAINMENT ELEVATION: 1060 ft. Dwg: 11405-A-8	NO SIGNIFICANT STRUCTURAL DETERIORATION OBSERVED. MINOR PEELED PAINT AT 235° AZIMUTH (SW), SOUTH OF VENT DUCT.	235° AZI (SW)	QCR# 90-1001 MWR# N/A	QC ENGR SNB 12-23-90
POLAR CRANE AREA AND UPWARDS Dwg: 11405-A-13	NO SIGNIFICANT STRUCTURAL DETERIORATION OBSERVED. PEELED PAINT AT 90° AZIMUTH (EAST) & AT 315° AZIMUTH (NW)	90° AZI & 315°	QCR# 90-1001 MWR# N/A	QC ENGR SNB 12-23-90

0217 1230

SURVEILLANCE TEST SIGNATURE TEST

All persons participating in the performance of this test shall enter their printed name, signature and initials below.

NAME (PRINT)	SIGNATURE	INITIALS
STEVEN H. BOTTUM	Steven H. Bottum	SHB
DONALD G. FLEGLE	Donald G. Flegle	DGF
STEPHEN P. SMIAT	S.P.S.	SPS
CAMERON MCBRIDE	Cameron McBride	CMCB
Bruce Renaud	Bruce Renaud	BR
R. Hodson	R. Hodson	RH
Al Clark	Al Clark	AC

COMMENT SHEET/CHRONOLOGICAL LOG

(1) INSPECTED CONTAINMENT OUT OF DOORS : ITEMS " CONT. OUTDOORS... En 66 " ; AUXILIARY BLDG ROOF ; CONT DOME — 2/20/90 1300-1600 hrs.

(2) INSPECTION OF NON-RCA ROOMS 81, 57(2), 20, 65, 66 & RCA ROOMS 59, 60, 61, 5, 13, 69, 71 — 2/21/90 0700-1400 hrs

(3) INSPECTION OF RCA AUX BLDG ROOMS : 15a, 14, 12, 62, TENDON TUNNEL — 2/22/90 0730-1500 hrs

(4) 2-2340 RWP 205 replaced RWP 0165 for Containment Special Areas - D/87

(5) INSPECTED RM 58 (PAL DOOR) & CONTAINMENT INTERIOR : 994', 1013', 1045', 1060', CRANE TO APEX. — 2/23/90 0730-1200 hrs.

(6) No corrective actions required for Type A report

SUMMARY COMMENT : NO SIGNIFICANT STRUCTURAL DETERIORATION WAS OBSERVED. COSMETIC ITEMS HAVE BEEN NOTED. THE SYSTEM ENGINEER MAY REVIEW THESE ITEMS & ISSUE COSMETIC ~~MWR~~ MWR'S AS DEEMED APPROPRIATE. NO MWR'S FOR SIGNIFICANT STRUCTURAL DETERIORATION WERE WRITTEN. S.H. BOTTUM 2/23/90

FC-1115
Rev. 2 ISSUED 07-01-89

SURVEILLANCE TEST BACK SHEET

Documentation for Completion/Postponement of Scheduled Surveillance Tests

This form is to be attached to each Surveillance Test prior to test issuance and performance. (Ref. SO-G-23, Section 3.8.)

PROCEDURE: SF-ST-CONT-0001

DATE SCHEDULED: REFUELING

SURVEILLANCE TEST POSTPONEMENT EXPLANATION

N/A DJ7 2-23-90

Expected Completion Date: N/A DJ7 2-23-90

First Line Supervisor: N/A DJ7 2-23-90

A copy of FC-1115, with postponement explanation and expected completion date shall be DELIVERED to the STA Surveillance Test Drop Box on the Scheduled Due Date. (Ref. SO G-23, Section 4.3.2.)

Feb 23, 1990
Date Surveillance Test Completed

Donald H. Hoyt / Kenneth R. King 2/24/90
First Line Supervisor or System Engineer

NOTE: Signature denotes proper review in accordance with SO-G-23, Section 4.5.

FC-1115 form shall remain attached to the Surveillance Test Procedure.

Completed Surveillance Tests sh[illegible]e DELIVERED to the STA Surveillance Test Drop Box by t[illegible]e Lead Craft.

FC/FORM/09(WP)

SE-ST-CONT-0001

ST-CONT-5-1

Fort Calhoun Station Unit No. 1
SURVEILLANCE TEST
ST-CONT-5

Containment Inspection

QA Record
TEMPORARY RETENTION
for 5 years until Nov. 1993
Initials CEM Date 12-16-88

Surveillance Test Procedure
Section F. 1
Due Date: 10-17-84
Month No. Refueling

A. PURPOSE

1. To obtain visual evidence of any significant structural deterioration of the containment structure.
2. To effect the necessary corrective action if deterioration is noted.

B. REFERENCES

1. Technical Specifications, Paragraph 3.5(1)b.

C. EQUIPMENT/MATERIAL

1. Feeler gauge.
2. Flashlight.

D. PREREQUISITES

INITIALS/DATE

1. Verify that the latest revision of this procedure is being used.

ST for QC
QC Tech. _____
Mgr. QA & QC _____
File CEM

PROCEDURE
REVISION VERIFICATION

Master Revision No. R8
Signature for Superv.
Date 9/16/88

D. PREREQUISITES (Continued)

INITIALS/DATE

2. Conduct a prejob briefing on this surveillance test prior to performance of the test. Personnel responsible for performance of the test should review the procedure to ensure they understand what is to be done, and review completed ST-CONT-5 from previous outage.

JVS 10-14-88
Resp. Craft
First-Line
For Supervisor

3. The plant is in a refueling shutdown condition.

JVS 10-14-88

4. A radiation work permit has been obtained for containment entry, and Auxiliary building entries.

JVS 10-14-88

(General Employee Training)

JVS

E. PRECAUTIONS

1. Use normal plant safety practices.

F. TEST PROCEDURE

INITIALS/DATE

1. Containment Inspection

Frequency: Each refueling and before the start of ST-CONT-7 test.

Responsibility: Quality Control/Engineering

a. Initial Conditions

(1) Qualified individual from Technical Services or GSE Engineering to accompany Q.C. Inspector Individual should be structrual or civil engineer.

(2) Notify QC prior to start of this procedure. JVS 10/14/88 Q.C.

b. Test Procedure

(1) Perform a thorough visual inspection of all accessible exterior surfaces of the containment structure from the locations listed below. This inspection is to uncover evidence of any significant structural deterioration which may affect the containment's structural integrity or leak tightness.

NOTE: If there is evidence of significant structural deterioration, measure, sketch and describe this information in Section C and compare the deterioration with the records of the past containment inspections to determine if an increase in the structural deterioration has occurred.

NOTE: If any evidence of significant structural deterioration is noted, corrective action must be initiated.

NOTE: Any structural deterioration and resulting corrective action must be reported in the "Type A" test report.

(a) Room 57 levels 1013' and 1025'.
QC Loc 88-3720

LAM 10-14-88 QC

GRande 10/14/88 Engineering

(b) Room 59
QC Loc 88-3858

LAM 10-14-88 QC

GRande 10/14/88 Engineering

SE-STCONT-0001
ST-CONT-5-4

F.1 TEST PROCEDURE (Continued)

INITIALS/DATE

Room 66

LAm 10-16-88
QC

GGPande 10/16/88
Engineering

(d) Outdoor on the ground level west of Room 66.
QC Log # 88-3722

LAm 10-16-88
QC

GGPande 10/15/88
Engineering

(e) Room 20
QC Log # 88-3716

LAm 10-16-88
QC

GGPande 10/16/88
Engineering

(f) Room 69
QC Log # 88-3723

LAm 10-15-88
QC

GGPande 10/15/88
Engineering

(g) Auxiliary Building roof.
QC Log # 88-3860

LAm 10-15-88
QC

GGPande 10/15/88
Engineering

(h) Containment Dome.
QC Log # 88-3853

LAm 10-16-88
QC

GGPande 10/16/88
Engineering

(i) Room 81
QC Log # 88-3724

LAm 10-14-88
QC

GGPande 10-14-88
Engineering

(j) The tendon tunnel, including the vertical tendon end anchorage.
QC Log # 88-3726

LAm 10-17-88
QC

GGPande 10/17/88
Engineering

F.1 TEST PROCEDURE (Continued)

INITIALS/DATE

(k) Room 5 QC Log # 88-3711

LAM 10-16-88 QC

CSPande 10/16/88 Engineering

(l) Room 12 QC Log # 88-3712

LAM 10-14-88 QC

CSPande 10/14/88 Engineering

(m) Room 13 QC Log # 88-3713

LAM 10-14-88 QC

CSPande 10/14/88 Engineering

(n) Room 14 QC Log # ~~88-3714~~ 88-3715

LAM 10-15-88 QC

CSPande 10/15/88 Engineering

(o) Room 15a QC Log # 88-3715

LAM 10-16-88 QC

CSPande 10/16/88 Engineering

(p) Room 22 QC Log # 88-3717

LAM 10-16-88 QC

CSPande 10/16/88 Engineering

(q) Room 23 QC Log # 88-3718

LAM 10-16-88 QC

CSPande 10/16/88 Engineering

(r) Room 58 QC Log # 88-3857

LAM 10-16-88 QC

CSPande 10/16/88 Engineering

(s) Room 60 QC Log # 88-3959

LAM 10-14-88 QC

CSPande 10/14/88 Engineering

(t) Room 61 QC Log # 88-3721

LAM 10-14-88 QC

CSPande 10/14/88 Engineering

SE-ST-CONT-0001

ST-CONT-5-6

F.1 TEST PROCEDURE (Continued)

INITIALS/DATE

(u) Room 62 QC Log # 88-3407 LAm QC 12-9-88 GSPande 12/9/88

QC LAm 12-9-88

Engineering GSPande 12/9/88

(v) Room 65 QC Log # 88-3855

QC LAm 10-16-88

Engineering GSPande 10/16/88

(w) Room 65 QC Log # 88-3722

QC LAm 10-16-88

Engineering GSPande 10/16/88

(x) Room 71 QC Log # 88-3854

QC LAm 10-16-88

Engineering GSPande 10/16/88

(2) Perform a thorough visual inspection of all accessible interior surfaces of the containment liner from the locations listed below.

NOTE: If there is evidence of significant structural deterioration, measure, sketch and describe this information in Section C and compare the deterioration with the records of the past containment inspections to determine if an increase in the structural deterioration has occurred.

NOTE: If an evidence of significant structural deterioration is noted, corrective action must be initiated.

NOTE: Any structural deterioration and resulting corrective action must be reported in the "Type A" test reported.

(a) Elevation 995' QC Log # 88-3725

QC LAm 10-16-88

Engineering GSPande 10/16/88

(b) Elevation 1013' QC Log # 88-3851

QC LAm 10-16-88

Engineering GSPande 10/16/88

SE-ST-CONT-0001

ST-CONT-5-7

F.1 TEST PROCEDURE(Continued)

INITIALS/DATE

(c) Elevation 1045'

QC Log # 88-3852

~~LAM~~ 10-16-88 QC

~~C.C.Pande~~ ~~10-16-88~~ Engineering

(d) Elevation 1060'

QC Log # 88-3852

~~C.C.Pande CC LAM~~ ~~LAM 10-16-88~~ QC

C.C.Pande 10/16/88 Engineering

(e) Polar Crane

QC Log # 88-3852

LAM 10-16-88 QC

C.C.Pande 10/16/88 Engineering

c. REMARKS:

~~*DUE TO THE VERY HIGH RADIATION LEVEL IN~~
~~ROOM 62 HEALTH PHYSICS DEPT. WOULD NOT ALLOW~~
~~FOR CONTAINMENT BLDG. INSPECTION IN THAT AREA.~~ L.G. Manning 12-9-88 C.C.Pande 12/9/88

NOTE** → INSPECTION OF CONTAINMENT WALL DONE 12-9-88; NO DISCREPANCIES L.G. Manning 12-9-88 QC C.C.Pande 12-9-88

ALL DISCREPANCIES NOTED ON QC. LOG
REPORTS 88-3711 THROUGH 88-3726 AND
ATTACHED VISUAL EXAMINATION REPORTS. ENGINEERING
EVALUATION SUBMITTED TO ENGINEERING FOR DISPOSITION.
NDE'S TO BE WAIVED BY ENGINEERING FOR ANY REQUIRED
REPAIRS. LAM 10/19/88

Test Completed By: C.C.Pande Engineering Date/Time 10-17-88 1600

L.G. Manning QC Date/Time 10-17-88 1600

Room 62 completed 12-9-88 QC

FC/ST/04

OCT 0 - 1988

R8 10-07-88

BEST COPY SUBMITTED 2617 1241

SE-ST-CONT-0001
QC Report # BB-417.

QDP-20
Appendix L

REQUEST FOR ENGINEERING EVALUATION

DESCRIPTION:

ATTACHED ARE COPIES OF ALL QC INSPECTION REPORTS COVERING THE ST-CONT-5 INSPECTION. PLEASE ADVISE THE QUALITY CONTROL DEPARTMENT IF INSPECTION RESULTS ARE ACCEPTABLE. IF REPAIRS ARE REQUIRED, PLEASE INITIATE MAINTENANCE ORDER TO COVER THE WORK. INFO COPIES OF QC LOG # BB-3711, ~~THRU~~ 115 3712, 3713, 3714, 3715, 3717, 3719, 3720, 3721, 3722, 3723, 3724, 3725, 3726, 3951 THRU 3960.

REQUESTOR: J L Dyer DATE: 11/19/88

(FORWARD TO PRODUCTION ENGINEERING)

INSPECTION CRITERIA/DISPOSITION:

THE CONTAINMENT INSPECTION DONE PER ST-CONT-5 INDICATES THAT THE STRUCTURAL INTEGRITY OF THE CONTAINMENT STRUCTURE IS NOT DEGRADED NCR IN JEOPARDY. THE VISUAL INSPECTION DID INDICATE SOME HAIRLINE CRACKS OF CREEP AND SHRINKAGE TYPE. WE INTEND TO MONITOR CRACK PROPOGATION IN ROOM 22 23 AND THE TENDON GALLERY ON AN ANNUAL BASIS AND WILL CONSIDER THE USE OF MECHANICAL GAGES SHOULD THE SITUATION CONTINUE TO DEVELOP.

WRITTEN BY: G Prinda, 12/12/88
ENGINEER DATE

APPROVED BY: M. Henderson
PRODUCTION ENGINEERING

J L Dyer 12-13-88
QC INSPECTOR DATE

12-14-88
LEAD QC INSPECTOR DATE

Copy 2 Quality Control (log)

2617 1242

SE-ST.CONT.0001

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: LJS Date: 4/19/89

Report No. 88-3712

System or Component CONT. BLDG

QC LOG

Document Number: ST.CONT-5 Title: CONTAINMENT INSP

Location: RM 12 Date/Time: 10/14/88 1

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: INSPECTION OF CONTAINMENT WALL IN RM. 12 SHOWS HAIRLINE SHRINKAGE CRACKS FROM BOTTOM OF WALL TO 4'-0" TO 8'-0" UPWARD, MOSTLY VERTICAL 1/32" DEEP

BY RECORDS MANAGEMENT

Acceptable [X] Corrective Action Required [ ]

Notified: Name: SAM PANDE Date: 10-17-88 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED 4/19/89 QC Log # 89-4176

Acceptable [ ]

Sketch if Required:

10-14-88 1
QC Inspector Date Time

Lead QC Inspector

Supervisor - Quality Control
for

SE-57-[illegible]-0001

2617 1243

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: RLS Date: 11/9/88

Report No. 88 3713

System or Component CONT. BLDG

QC LOG

Document Number: ST. CONT-5 Title: CONTAINMENT INSP.

Location: RM. B Date/Time: 10/[illegible]

Craftsman: PAUDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] MDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: INSPECTION OF CONTAINMENT WALL IN RM. 13 SHOWS DRY SUBSTANCE RUNNING DOWN CONTAINMENT WALL AND PENETRATION M-13. DRIPPING FROM PENETRATION M-13 WHICH IS ABOVE. DRIPPING IS EXCESSIVE.

BY RECORDS MANAGEMENT

Acceptable [ ] N/A Corrective Action Required [ ] N/A

Notified: Name: Sam Powell Date: 10-17-88 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED 11/9/88

QC LOG # 88-4176

Acceptable [ ]

Sketch if Required:

L C Maury 10-17-88 1
QC Inspector Date Time

Tom Sullivan
Lead QC Inspector

[illegible]
Supervisor - Quality Control

F2

SE-ST-CONT-0001

2617 1244

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: RLS Date: 11/9/88

Report No. 88 3720

System or Component CONT BLDG.

QC LOG

Document Number: ST-CONT-5

Title: CONTAINMENT INSP.

Location: RM. 57

Date/Time: 10-14-88 /

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: _____ [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper- ability [ ] Rad Waste

Description: THREE 6"X3" PLATES OR COVERS FOR CONDUIT ARE EXPOSED ON CONTAINMENT WALL. IF CONDUIT CONTAIN WIRES THAT EXTEND THRU CONT. WALL NEAR PENETRATION E-11 ALSO ONE AT OPPOSITE END OF ROOM.

BY FOREMAN'S MANAGEMENT

Acceptable X

Corrective Action Required X

Notified: Name: SAN PANDE Date: 10-17-88 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED, RLS 11/9/88

QC LOG # 88-9176

Acceptable [ ]

Sketch if Required:

[signature] 11-9-88
QC Inspector Date Time

[signature]
Lead QC Inspector

[signature]
Supervisor - Quality Control

FO.

SE-ST-CONT-0001

2617 1245

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: RLS Date: 11/4/88

Report No. 88 3721

System or Component CONT. BLDG

QC LOG

Document Number: ST-CONT-5 Title: CONTAINMENT INSP.

Location: Rm. 61 Date/Time: 10-17-88 /

Craftsman: PANDE

INFORMATIONAL ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: VISUAL INSPECTION OF CONTAINMENT BLDG IN ROOM 61 SHOWS CONNECTION OF ROOM WALL AND CONTAINMENT WALL AT DOORWAY EXHIBITS GREASY SUBSTANCE LEAKING PAST ELEMENT. NO MAJOR DISCREPANCIES

Acceptable [X]

Corrective Action Required [ ]

Notified: Name: N/A Date: N/A Time: N/A

Corrective Action: N/A

SEE PAGE 6 NOTIFIED 10-17-88 @ 1600
ENGINEERING EVALUATION SUBMITTED 11/19/88
QC LOG # 88-476

Acceptable [N/A]

Sketch if Required:

N/A

R C Williams 11/4/88
QC Inspector Date Time

R. Felton
Lead QC Inspector

For L Tyler
Supervisor - Quality Control

SE-ST-CONT-0006

2617 1246

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: LJS Date: 11/19/93

Report No. 88 372

System or Component CONT. BLDG.

QC LOG

Document Number: ST-CONT-5 Title: CONTAINMENT INSP.

Location: RM 81 Date/Time: 10-14-88 /

Craftsman: PANDE / ENG.

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [ ] NOE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper- ability [ ] Rad Waste

Description: VISUAL INSPECTION OF RM. 81 SHOWS (3"X3" PLATE EXPOSED. APPEARS TO BE CONDUIT IN DRYWALL APPROX. 15' ABOVE 1036' EL. WEAK DOOR # 1034-17

Acceptable N/A Corrective Action Required N/A

Notified: Name: Sam Pande Date: 10-17-88 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED 1/25 per 11/19/88 QC Log # 88-4176

Acceptable [ ]

Sketch if Required:

L A Maxwell 10-14-88 0800
QC Inspector Date Time

Jon Sullivan
Lead QC Inspector

[illegible]
Supervisor - Quality Control

FS2

SE-ST-CONT0001

2617 1247

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: [illegible] Date: 4/28/88

Report No. 88-3858

System or Component CONT. WALL

QC LOG

Document Number: ST-CONT-S

Title: CONTAINMENT INSP.

Location: ROOM 59

Date/Time: 10-14-88 0935

Craftsman: PANDE

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mach. [ ] Elec. [ ] Surv.

Other: [ ] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] L < Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: VISUAL INSPECTION OF RM. 59 SHOWS NO DISCREPANCIES TO CONTAINMENT WALL

NOTE: NEW PAINT APPLIED

Corrective Action Required N/A

Notified: Name: N/A Date: N/A Time: N/A

Corrective Action: N/A

Acceptable N/A

Sketch if Required:

N/A

[illegible] 10-14-88
QC Inspector Date Time

B. Pellone
Lead QC Inspector

For Supervisor - Quality Control

SE-ST-CONT-0001

17 1248

QDP-20
Attachment 2

QA Record
PERMANENT RETENTION
Initials: LLS Date: 4/18/89

Report No. 88-385T

System or Component CONT. BLDG.

QC LOG

Document Number: ST-CONT-5 Title: CONTAINMENT INSP.

Location: Rm. 60 Date/Time: 10-14-88 /

Craftsman: PAIGE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper.-ability [ ] Rad Waste

Description: CONTAINMENT WALL INSPECTION SHOWS IT IS IN GOOD CONDITION
NOTE: NEW PAINT.

Acceptable [X] N/A 1/25 Corrective Action Required [ ] N/A

Notified: Name: N/A Date: N/A Time: N/A

Corrective Action: N/A

Acceptable [ ]

Sketch if Required:

N/A

L. C. Mungo 10-14-88
QC Inspector Date

R. Fellows
Lead QC Inspector

for Supervisor - Quality Control

SE-ST-CONT-0001

2617 1249

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: JJS Date: 11/15/88

Report No. 88 3714

System or Component CONT. BLDG.

QC LOG

Document Number: ST. CONT. 5 Title: CONTAINMENT INSP

Location: Rm 14 Date/Time: [illegible]

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: _____ [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Pack [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: VISUAL INSPECTION SHOWS, HORIZONTAL CRACK ABOUT 12'4" FROM FLOOR; ABOUT 6" LONG & 1/16" WIDE & APPEARS CRACKED, AREA LOOKS TO HAVE BEEN GROUTED AT SOME TIME. VERTICAL CRACK STILL EXISTS FROM PREVIOUS INSPECTION

Acceptable [X] N/A

Corrective Action Required [X] N/A

Notified: Name: Sam Pande Date: 10-17-88 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED 11/9/88 PER QC LOG # 88-476

Acceptable [ ]

Sketch if Required:

[signature] 10-15-88
QC Inspector Date Time

[signature]
Lead QC Inspector

[signature]
Supervisor - Quality Control

FC

2617 1250

QA Record
PERMANENT RETENTION
Initials: [handwritten initials] Date: 11/19/88

SE-ST-CONT-0001
QDP-20
Attachment 12

Report No. 88 3723

System or Component CONT. BLDG.

QC LOG

Document Number: ST-CONT-5

Title: CONTAINMENT INSP.

Location: RM. 69

Date/Time: 10-15-88 /

INFORMATION ONLY

Craftsman: PANDE

Type of Inspection: [✓] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: ______ [✓] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

COPY

Description: VISUAL INSPECTION OF RM 69 SHOWS OIL DRIPPING DOWN THE SIDE OF CONTAINMENT WALL ACROSS FROM RM. 62 VERY HEAVY LEAKAGE NOTED. REMAINDER OF ROOM SHOWS LESSER OIL MARKS ON REMAINDER OF AREA

Acceptable [N/A]

Corrective Action Required [N/A]

Notified: Name: N/A Date: N/A Time: N/A

Corrective Action: N/A

SAM PANDE NOTIFIED 10-17-88 @ 1600
ENGINEERING EVALUATION SUBMITTED 11/19/88
QC LOG # 88-4176 [initials]

Acceptable [N/A]

Sketch if Required:
N/A

[signature] 10-15-88 /
QC Inspector Date Time

[signature: Jim Sullivan]
Lead QC Inspector

[signature]
For Supervisor - Quality Control

2617 1251

SE-ST-CONT-0001

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: RS Date: 11/5/88

Report No. 88-3860

System or Component CONT. BLDG.

QC LOG

Document Number: ST-CONT-S

Title: CONTAINMENT ISI

Location: [redacted]

Date/Time: [redacted]

Craftsman: PAINE

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: VISUAL EXAMINATION SHOWS NO DISCREPANCIES ON AUX. BLDG ROOF.

AUX. ROOF EL 1083' REINFORCEMENT ON CONTAINMENT WALL AT ACCESS LADDER IS SHOWING THRU CONCRETE. THIS CONDITION MAY BE OF SOME CONCERN

Acceptable YES

Corrective Action Required N/A

Notified: Name: N/A Date: N/A Time: N/A

Corrective Action: N/A

COPY BY RECORDS MANAGEMENT

Acceptable N/A

Sketch if Required:

N/A

L. Manning 10-13-88 1
QC Inspector Date Time

R. Pilgrim
Lead QC Inspector

For W. Shaw
Supervisor - Quality Control

SE-ST-CONT-0001

2617 1253

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: [illegible] Date: 11/19/84

Report No. 3715

System or Component CONT. BLDG

QC LOG

Document Number: ST-CONT-5

Title: CONTAINMENT INSP.

Location: RM 15A

Date/Time: [illegible]

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. Elec. Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper- ability [ ] Rad Waste

Description: SHRINKAGE CRACKS NEAR BOTTOM OF CONTAINMENT WALL (GENERAL) LITTLE OILY LIQUID LEAKING FROM TOP OF ROCK; PAINT PEELING FROM FLASHING PLATE IN CORNER OF ROOM. SHRINKAGE CRACKS ARE 1/32" IN WIDTH.

Acceptable Y/A

Corrective Action Required [X]

Notified: Name: SAM PANDE Date: 10-17-84 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED 11/19/84, NCR# QC LOG #4176

Acceptable [ ]

Sketch if Required:

[signature] 10/16-84
QC Inspector Date Time

[signature]
Lead QC Inspector

[signature]
Supervisor - Quality Control
FOR

2617 1254

SE-ST-CONT-0001

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: [illegible] Date: 11/19/88

Report No. 88 3717

System or Component CONT. BLDG.

QC LOG

Document Number: ST-CONT-5

Title: CONTAINMENT INSP

Location: Room 22

Date/Time: 10-16-88

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: ______ [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Operability [ ] Rad Waste

Description: VISUAL INSPECTION OF CONTAINMENT WALL SHOWS CRACK EXTENDS THE TOTAL LENGTH OF EXPOSED CONTAINMENT WALL AT 9' ABOVE FLOOR ELEVATION AND ABOUT 1/32" WIDE

ALSO NOTED CRACK AROUND HATCHWAY TO THE TUNNEL WHICH IS APPROX. 1/32" WIDE

Acceptable [X]

Corrective Action Required [X]

Notified: Name: Sam Pande Date: 10-17-88 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED [illegible] 11/19/88

QC LOG # 88-4176

Acceptable [ ]

Sketch if Required:

[signature] 11-16-88

QC Inspector Date Time

Jim Sullivan

Lead QC Inspector

[signature]

Supervisor - Quality Control

SE-ST-CONT-0001

2617 1255

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: JJS Date: 11/9/88

Report No. 88 3718

System or Component CONT. BLDG.

QC LOG

Document Number: ST-CONT-5

Title: CONTAINMENT INSPECTION

Location: RM 23

Date/Time: 10-16-88 / 0830

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: VISUAL INSPECTION OF CONTAINMENT WALL IN RM 23 SHOWS 3 LARGE CRACKS

① .34' LONG 1/32" WIDE VERTICAL
② 91" LONG 1/32" WIDE VERTICAL
③ 21'-9" LONG 1/32" WIDE HORIZONTAL

LARGE CRACK THAT HAS BORON SEEPAGE IS 7'10" ABOVE FLOOR EL. THIS CRACK IS BEHIND BASE PLATE FOR PIPE SUPPORT # SIS-44A (SNUBBER) ALSO AN 8' CRACK IS LOCATED UNDER ELEV 383-3B AND UNDER ELEV 383-3B ENTERS THRU CONTI WALL; SAME FOR ELEV 383-9A

Acceptable [X]

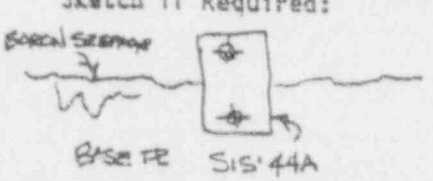
Corrective Action Required [ ]

Notified: Name: SAM PANDE Date: 10-17-88 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED, LLS 11/18/88
QC LOG #3176

Acceptable [ ]

Sketch if Required:



L. C. Marcus 10-18-88
QC Inspector Date Time

Jon Sullivan
Lead QC Inspector

For L. L. Smith
Supervisor - Quality Control

SE-ST-CONT-0001

2617 1256

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: RLS Date: 10/18/88

Report No. 88 3722

System or Component CONT. BLDG.

QC LOG

Document Number: ST-CONT-5

Title: CONTAINMENT INSPECTION

Location: RM 66 (OUTSIDE CONT.)

Date/Time: 10-13-88 1 LAM 10/16

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: VISUAL EXAMINATION SHOWS 3 EXPOSED PLATES, POSSIBLY FROM CONDUIT LOCATED AT CORNER NEAR LOADING BAY (EL 130 FT HP). ALSO FOUND 3 EXPOSED WIRES FROM POSSIBLY A REMOVED OR RELOCATED GAI-TRONICS. TWO 6"x6" SQUARE HOLES 3" TO 4" DEEP ABOUT 7' UP FROM BOTTOM OF OUTSIDE WALL.

Acceptable [ ] Corrective Action Required [X]

Notified: Name: SAM PANDE Date: 10-17-88 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED 4/R/88

QC LOG # 88-4176

Acceptable [ ]

Sketch if Required:

K. Mylavarapu 10-18-88 KM LAM 10/18/88
QC Inspector Date Time

Jim Sullivan
Lead QC Inspector

Supervisor - Quality Control

FSL

SE-ST-CONT-3001

2617 1257

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: RJS Date: 4/19/88

Report No. 88-3725

System or Component CONT BLDG.

QC LOG

Document Number: ST-CONT-5 Title: CONTAINMENT INSP.

Location: EL. 995' CONTAINMENT Date/Time: 10-16-88 1

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: ANNUAL INSPECTION OF CONTAINMENT BLDG. AT 995' EL. SHOWS SIGNIFICANT AMOUNT OF OIL LEAKAGE AT PENETRATION AREA NEAR M-10, M9, & M-12. ORIGIN OF OIL IS INDETERMINATE.

Acceptable N/A Corrective Action Required N/A

Notified: Name: Sam Pande Date: 10-17-88 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED 4/19/88, QA Spec QC LOG 88-4176

Acceptable [ ]

Sketch if Required:

K. G. Manay 10-16-88
QC Inspector Date Time

Jim Sullivan
Lead QC Inspector

Supervisor - Quality Control

SES5-CONT-0001

2617 1258

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: JJS Date: 4/15/88

Report No. 88-3851

System or Component CONT. BLDG

QC LOG

Document Number: ST-CONT-5 Title: CONTAINMENT INSP.

Location: CONTAINMENT EL. 1013' Date/Time: 10/16-88 1

Craftsman: ANDE

INFORMAT... ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper- ability [ ] Rad Waste

Description: VISUAL INSPECTION OF THE 1013' EL. OF INSIDE OF CONTAINMENT SHOWS ONLY GENERAL PAINT PEELING NO DAMAGE NOTED.

Acceptable [X] Corrective Action Required [ ]

Notified: Name: N/A Date: N/A Time: N/A

Corrective Action: N/A

Acceptable [N/A]

Sketch if Required

N/A

[signature] 10-16-88
QC Inspector Date Time

[signature]
Lead QC Inspector

[signature]
FOR Supervisor - Quality Control

2617 1259

SE-ST-CONT-0001
QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: VS Date: 11/15/88

Report No. 88-3852

System or Component CONT. BLDG

QC LOG

Document Number: ST-CONT-5 Title: CONTAINMENT INSP.

Location: CONT. EL. 1045', 1060', POLAR CRANE Date/Time: 10/26/88 0/

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper- ability [ ] Rad Waste

Description: VISUAL INSPECTION OF CONTAINMENT LINER AT EL. 1045' EL. 1060, AND POLAR CRANE SHOWS NO DISCREPANCIES. CONT. GENERAL PAINT PEELING

Acceptable X VS Corrective Action Required N/A

Notified: Name: N/A Date: N/A Time: N/A

Corrective Action: N/A

Acceptable N/A

Sketch if Required:

N/A

QC Inspector / Date Time

Lead QC Inspector

For Supervisor - Quality Control

2617 1260

SE-ST-CONT-0001

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: [illegible] Date: 11/5/88

Report No. 88-353

System or Component CONT. BLDG.

QC LOG

Document Number: ST-CONT-5 Title: CONTAINMENT INSP.

Location: CONTAINMENT DOME Date/Time: 10/26-88 /

Craftsman: PAIPE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper- ability [ ] Rad Waste

Description: INSPECTION OF CONTAINMENT DOME SHOWS NO DISCREPANCIES.

Acceptable [X] [illegible]

Corrective Action Required [ ]

Notified: Name: N/A Date: N/A Time: N/A

Corrective Action: _____

Acceptable [N/A]

Sketch if Required:

N/A

[illegible] 10-26-88
QC Inspector Date Time

[illegible]
Lead QC Inspector

[illegible]
For Supervisor - Quality Control

SE-ST-CONT-0001

2617 1261

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: LLS Date: 4/5/88

Report No. 88-3854

System or Component CONT. BLDG.

QC LOG

Document Number: ST. CONT-5

Title: CONTAINMENT INSP.

Location: RM. 71

Date/Time: 10/6/88 /

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: VISUAL INSPECTION OF CONTAINMENT BLDG. IN ROOM 71 SHOWS NO DISCREPANCIES

Acceptable [X] N/A [ ]

Corrective Action Required [ ] N/A

Notified: Name: N/A Date: N/A Time: N/A

Corrective Action: N/A

Acceptable [ ] N/A

Sketch if Required:

N/A

L. G. Manning 10-16-88
QC Inspector Date Time

D. Pekins
Lead QC Inspector

C. L. Lyon
Supervisor - Quality Control
FOR

2617 1262

SE-ST-CONT-0001

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: LP Date: 11/15/88

Report No. 88-3955

System or Component CONT. BLDG.

QC LOG

Document Number: ST-CONT-5 Title: CONTAINMENT INSP

Location: ROOM 65 Date/Time: 10-16-88 / 1

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mach. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: VISUAL INSPECTION OF CONTAINMENT BLDG IN RM. 65 SHOWS NO DISCREPANCIES.

Acceptable N/A

Corrective Action Required N/A

Notified: Name: N/A Date: N/A Time: N/A

Corrective Action: N/A

Acceptable N/A

Sketch if Required:

N/A

L. Manning 10-16-88 / 1
QC Inspector Date Time

C. Fellure
Lead QC Inspector

For
Supervisor - Quality Control

2617 1263

SE-ST-CONT-0001

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: RLS Date: 11/9/88

Report No. 883857

System or Component CONT. BLDG.

QC LOG

Document Number: ST-CONT-5 Title: CONT. INSP

Location: Rm. 58 Date/Time: 10-16-88 /

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [ ] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: VISUAL INSPECTION OF RM. 58 SHOWS IN GOOD CONDITION.

NOTE: CONTAINMENT WALL PARTIALLY COVERED BY HERCULITE FOR ANTI-CONTAMINATION REASONS.

Acceptable [X] N/A Corrective Action Required [ ] N/A

Notified: Name: N/A Date: N/A Time: N/A

Corrective Action: N/A

Acceptable [ ] N/A

Sketch if Required:

N/A

L. R. Mann, 10-16-88 /
QC Inspector Date Time

C. Pelton
Lead QC Inspector

[signature]
Supervisor - Quality Control
For

2617 126'4

SE-ST-CONT-0001

QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: JLS Date: 11/19/88

Report No. 88 3726

System or Component CONT. BLDG

QC LOG

Document Number: ST-CONT-5 Title: CONTAINMENT INSPECTION

Location: TENDON GALLERY Date/Time: 10-17-88 /

Craftsman: PANDE

Type of Inspection: [X] VT [ ] PT [ ] MT [ ] UT/T [ ] UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [X] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Perso. Qual. [ ] Oper- ability [ ] Rad Waste

Description: ISI/A INSPECTION OF TENDON GALLERY SHOWS: 6'8" CRACK AT CE9·AA·004, SAME AT CE 143 AA·359, A 6'8" LONG CRACK AT CE121·AA·372, SAME AT CE22·AA·209. CRACK WITH WATER SEEPAGE AT CE·192·AA·382, LOCATION 3046 - 7" CRACK, LOCATION 2078 - 7' CRACK & 15' CRACK, LOC. 1038 7' VERTICAL CRACK & HORIZONTAL CRACK AT SOUND BOX 7' ABOVE FLOOR. LOCATION 2024 7' VERTICAL CRACK. 7' CRACK AT LOCATIONS 2024, 2017 2014 2010. DIAGONAL CRACK AT LOCATION 1125 ALSO LEAKING. GREASE CAP AT LOCATION 1099 0° AZ. LOCATION 1083 7' VERT. CRACK. LOCATION 1075 7' VERT. CRACK. BORON LEAKAGE NEAR DOORWAY. THESE AREAS ARE THE MOST PROMINENT. EVIDENCE OF SOME CRACKS HAD BEEN REPAIRED IN PAST. ALL CRACKS MEASURED 1/32" WIDE

Acceptable [X] Corrective Action Required [ ]

Notified: Name: SAM PANDE Date: 10-17-88 Time: 1600

Corrective Action: ENGINEERING EVALUATION SUBMITTED 11/5/88 11/19/88
QC LOG # 88-4176

Acceptable [ ]

Sketch if Required:

[signature] 10-17-88 1
QC Inspector Date Time

[signature]
Lead QC Inspector

[signature] for
Supervisor - Quality Control

2617 1265

SE-ST-CONT-0001
QDP-20
Attachment 12

QA Record
PERMANENT RETENTION
Initials: [redacted] Date: 12-11-88

Report No. 88-5407

System or Component CONT. BLDG.

QC LOG

Document Number: ST-CONT-5 Title: CONTAINMENT INSP.

Location: [redacted] AUX BLDG Date/Time [redacted] / 1430

Craftsman: PANDE

INFORMATION ONLY

Type of Inspection: [ ] VT [ ] PT [ ] MT [ ] UT/T UT [ ] RT/I [ ] Mech. [ ] Elec. [ ] Surv.

Other: [ ] NDE Report [ ] Fire Barrier [ ] Close Out [ ] Hydro [ ] Leak Check [ ] Equip. Cals. [ ] Person. Qual. [ ] Oper-ability [ ] Rad Waste

Description: INSPECTION OF CONTAINMENT WALL IN ROOM #62 SHOWS NO DISCREPANCIES

Acceptable [X] BY RECEIVER Corrective Action Required [ ]

Notified: Name: SAM PANDE Date: 12-9-88 Time: 1525

Corrective Action: NONE C.P. 12/9/88

Acceptable [X]

Sketch if Required:

12-9-88, 1510
QC Inspector Date Time

Lead QC Inspector

Supervisor - Quality Control

TANK ENTRY PERMIT #1

		SIGN OFF/DATE
A.	A prejob briefing has been conducted in accordance with Standing Order C-45 step 1.6.2. Standing Order G-41 has been reviewed by the job foreman/supervisor. Attachment A is completed.	SHB 12-22-90
B.	Flush tank as required to achieve as low as reasonably achievable exposure. (N/A if not applicable.)	N/A DJ7, 2-19-90
C.	Pump or drain tank to the lowest practical level. (N/A if not applicable.)	N/A DJ7 12-19-90
D.	Tag out the tank to be entered. Tank Number Stressing Gallery Tag Number _____	DJ7, 2-19-90
E.	Remove the manway cover from the tank.	[illegible], 2/20/90
F.	Sample the atmosphere of the tank to ensure that combustible gases are less than 10% and oxygen is 19.5% or greater.	[illegible], 2/20/90 Chem
	NOTE: Another Tank Entry Permit shall be filled out if the atmospheric conditions of the tank may have changed (i.e., welding in tank or the tank has been closed and re-opened).	2/22/90
	Combustible Gases 0.0 %	0.0%
	Oxygen 21.0 %	21.1% [illegible]
G.	This Tank Entry Permit expires after Job completion.	[illegible] 12/20/90
H.	Constant oxygen and/or combustible gas monitoring (during personnel entries) is required.	YES (NO) [illegible], 2/19/90 Chem
I.	Forced ventilation is recommended for entry. (Circle one). Yes / (No)	[illegible], 2/20/90

		SIGN OFF/DATE
J.	R.P. samples the contents in the tank, survey the tank and record the result. (N/R if not required). Contents NA Surveys ≈ 4 kdpm Area posted CA	Qwl 12/20/90 R.P. JK 2/22/90
K.	Obtain a Radiation Work Permit for entry of the tank. (NR if not required). RWP No. contact RP for appropriate RWP	Qwl 12/20/90 R.P.
L.	Assign an individual to be the station watch outside the tank to render assistance to the individual entering the tank. Individual assigned has located the nearest Gaitronics in order to have direct communication with the control room in case of an emergency. This individual shall maintain personnel accountability and have (✓ verbal _____ line of sight) contact with personnel working inside of the tank. (Job foreman/supervisor will determine contact requirements.)	SHB 12-22-90
M.	Post Tank Entry Permit at access to tank.	SHB 12-22-90

FORT CALHOUN STATION
GENERAL FORM

SE-ST-CONT-0001
FC-62
R4 ISSUED 06-01-89
PAGE 3 OF 3

ATTACHMENT A

Tank Number Stressing gallery

Briefing was conducted by Steven V. Bottum (Signature) 1130 (Time) 2-22-90 (Date)

Personnel Briefed:

Print Name	Signature	Date
STEVEN BOTTUM	Steven V. Bottum	2-22-90
CAMERON McBRIDE	Cameron McBride	2-22-90
Scott Kirk	Scott Kirk	2-22-90

** If additional personnel were briefed at a later date, annotate person who performed briefing in remarks section. Ensure the person performing the briefings as reviewed step B of this tank entry permit.

Remarks: WORK COMPLETED ON 2-22-90. SNB

FC/FORM/10

ORIGINAL

LIC-92-016R

ENCLOSURE 5

HVAC DESIGN BASIS VS ASCM

COMPARISON OF HVAC DESIGN CRITERIA

CRITERIA:	DESIGN BASIS	ASCM*
Restraint Spacing	8'-0"	Limited by Stress
Seismic Acceleration Rigid Non-rigid	H=0.311g, V=0.129g USAR Spectra	Per appropriate FRS based on calculated frequency
Normal Allowables	1.0*Working Stress	1.0*Working Stress
Upset (OBE) Allowables	1.33*Normal	1.0*Normal
Emergency Allowables	Not Defined	1.33*Normal
Faulted (SSE) Allowables Cold Formed Hot Rolled	 0.9*Yield 0.9*Yield	 1.60*Normal 1.0*Yield
Seismic Loads	Horiz + Vert	SRSS(X, Y, Z)

*Comparison is for Qualification by "Analysis" method only since other methods in ASCM are not addressed by Design Basis.