

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: Chilled Water Pump Assemblies (Pump and Motor on Frame)
EQUIPMENT NO. : T4100C040/T4100C041 SPEC. NO.: DECO #3071-68
LOCATION: Auxiliary Building Elev. 677'6"
EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE
During and After

QUALIFICATION DOCUMENT REFERENCES:

- (1) Detroit Edison Spec. 3071-68 with Addendum "A"
- (2) Detroit Edison Drawing No. 6M721-4007 Rev. E Fdn. Details
- (3) DECO File No. B9-649 Pump Motor Outline Drawing
- (4) DECO File No. B9-646 Pump Assembly Outline Drawing
- (5) DECO File No. B9-651 "Seismic Stress Analysis of Chilled Water Pumps"; McDonald Engineering Analysis Co. Report #ME-255 9-5-75.

Prepared by: *George M. Hinkle*
Reviewed by:
Approved by:

Date: 7-14-81
Date:
Date:

QUALIFICATION SUMMARY

LOAD COMBINATIONS CONSIDERED:

OBE/SSE Seismic Loads

ORIGINAL QUALIFICATION METHOD:

A multidegree of freedom modal analysis was performed using the computer program ICES-STRUDL-II Type of elements used in analysis were beam.

Seismic loads were combined with normal operating seismic loads and stresses were compared with allowables.

REQUALIFICATION METHOD

The new response spectra curves will be compared with curves used in original qualification. The additional stresses due to new more conservative G values will be added to existing actual stresses and the results were compared with code allowables.

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME: FERMI - Unit 2 TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME: CHILLED WATER PUMP ASSEMBLIES

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: 3196 MT/7½ HP 1750 RPM on 215T Quantity: 2
Frame
3. Vendor: Goulds Pumps Inc./Westinghouse Motor
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description Appearance: Vertical output centri-fugal pump horizontally mounted and attached to a motor via a coupling
Dimensions: 3 x 4 - 8 Weight: 225 lbs.
6. Location: Building: Auxiliary Building Elev.: 677'6"
7. Field Mounting Conditions:
☒ Bolting: Number: 4 Size: 1/2" Ø A325
☐ Welding: Weld Type: _____
Leg: _____ Length: _____ Pitch: _____
☐ _____
8. Natural frequencies in each direction:
Front to back*: > 33 Hz * Per Ref. No. 5 page 8 the two lowest frequencies are 3937 and 7737
Side to side*: > 33 Hz and are for the entire pump/motor assembly.
Vertical*: > 33 Hz
9. Method of determining natural frequencies:
☐ Laboratory Test
☐ Analysis
☐ Other _____
10. a. System in which located: Control center air conditioning
b. Functional description: Provide chilled water to cooling coil to maintain control center temperature
c. Equipment required for:
☒ Hot Standby ☒ Cold Shutdown ☒ Post LOCA

11. Pertinent reference design specifications: _____

DECO Spec 3071-68

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ NoIV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☒ Analysis
☐ Combination of Test
and Analysis

1. Qualification Report

a. Title: "Seismic Stress Analysis of Chilled Water Pumps"

b. Number and Date: ME-255 Sept. 5, 1975

2. Company that prepared report: McDonald Eng. Anal. Co.

3. Company that reviewed report: Detroit Edison Co.

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only☐ Hydrodynamic only☐ Seismic and Hydrodynamic☐ Other (Specify): _____☐ _____

2. Required response spectra (attach the graphs):

SL-3988 Rev. 00 4-18-72 B-13, 14, 37, 38; C-9, 19

3. Method of combining Requiring Response Spectra:

☒ Absolute Sum☐ SRSS4. Damping Upset (OBE): 1% Basis for damping: _____Emerg. (SSE): 2% Reg. 1.61

5. Required acceleration in each direction (if required):

☐ ZPA ☒ Other (Specify): Increased to account for
future changeUpset (OBE): F/B= 1.5 S/S= 1.5 V= 1.0Emerg. (SSE): F/B= 3.0 S/S= 3.0 V= 2.0

6. Were fatigue effects or other vibration loads considered?

☐ Yes Describe loads and how they were treated in overall
qualification program: _____☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE: N/A

1. Test Method: ☐ Single frequency: _____
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____
10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☐ Static analysis
☒ Static coefficient analysis*
☐ Dynamic analysis: ☐ Response spectrum
☐ Time history
2. Model type:
☐ 1-dimensional
☐ 2-dimensional
☒ 3-dimensional

* Eigenvalues were extracted ($f_n > 33$ Hz) therefore a static coefficient analysis was sufficient.

3. Method of analysis:

☒ Computer-aided calculation
programs used: ICES-STRU DL-II☐ Hand calculations☐4. Have equipment supports been adequately considered in analysis: ☒ Yes ☐ No

5. Stress evaluation at critical structural elements*: see comments

Element	Calc Stress	Allow Stress
(See table attached)		

6. Deflection evaluation at critical structural elements (active equipment only)

Element	Calc Stress	Allow Stress
Impeller Clearance (Deflection) Inches	.00376	.025
Flexible Coupling Misalignment, Radians	.00460	.017

VIII. ADDITIONAL COMMENTS:

Values extracted from OBE and SSE; OBE allowables were in general bounding.

Element	Calc Stress	Allow Stress
Pump Hold Down Bolts Stress (Shear) PSI	7,204	12,320
(Tensile) PSI	30,048	38,473
Anchor Bolt Stress (Shear) PSI	3,261	10,000
(Tensile) PSI	15,478	20,000
Shaft Stress, PSI	4,348	15,000
Support Frame, PSI	13,386	19,300
Thrust Retainer Bolt Stress, PSI	799	20,000
Pump Frame Bolt Stress (Shear) PSI	5,453	10,000
(Tensile) PSI	5,771	19,275
Frame Adapter Flange Stress, PSI	12,298	42,000
Adapter Flange Bolt Stress, PSI	12,230	21,870
Maximum Nozzle Stress (Suction) PSI	7,502	41,400
Discontinuity (Discharge) PSI	7,758	13,800
Discharge Flange Stress (Max. Discontinuity)	14,537	41,400
Suction Flange Stress (Max. Discontinuity)	16,666	41,400
Pump Bearing Loads (Inboard) Lbs.	501	2,930
(Outboard) Lbs.	1,557	4,840
Motor Hold Down Bolts (Shear) PSI	4,617	10,000
(Tensile) PSI	8,522	20,000
Impellar Connector (Shear) PSI	2,045	7,500
(Tensile) PSI	495	15,000

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SGM

DATE April 18, 1972

CHECKED BY HRS

DATE 4/18/72

SHEET OF

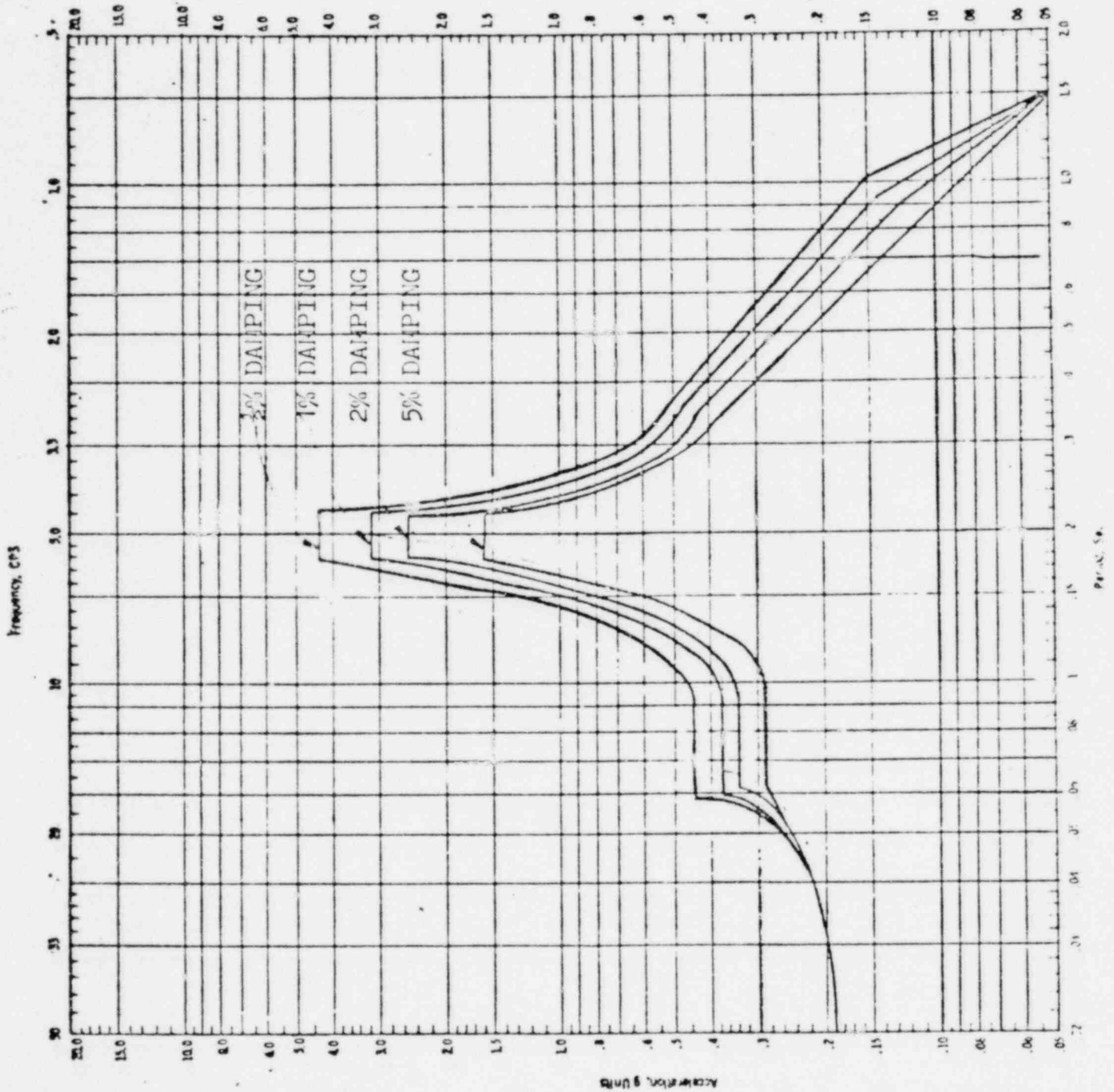


FIGURE B-13

HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION-684'-6" (SLAB NO. 5)
REACTOR AUXILIARY BUILDING NORTH-SOUTH COMPONENT,

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PROJECT ENRICO FERM1

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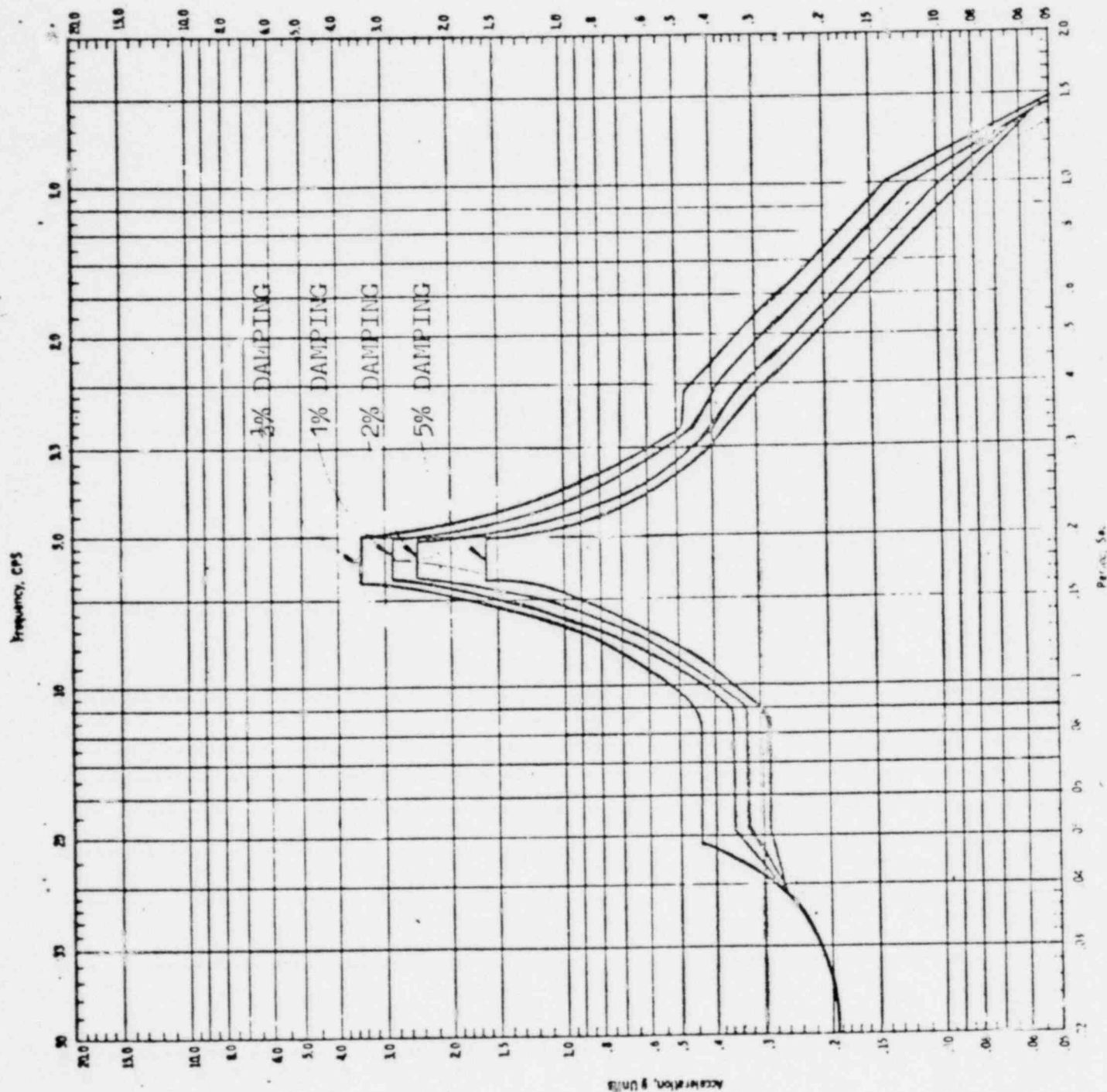


FIGURE B-14

HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION-684-6" (SLAB NO. 5)
REACTOR AUXILIARY BUILDING EAST-WEST COMPONENT

SARGENT & LUNDY

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CLIENT DETROIT EDISON
PROJECT ENRICO FERMI JOB NO. 3988-00
DESIGN BY SGM DATE April 18, 1972
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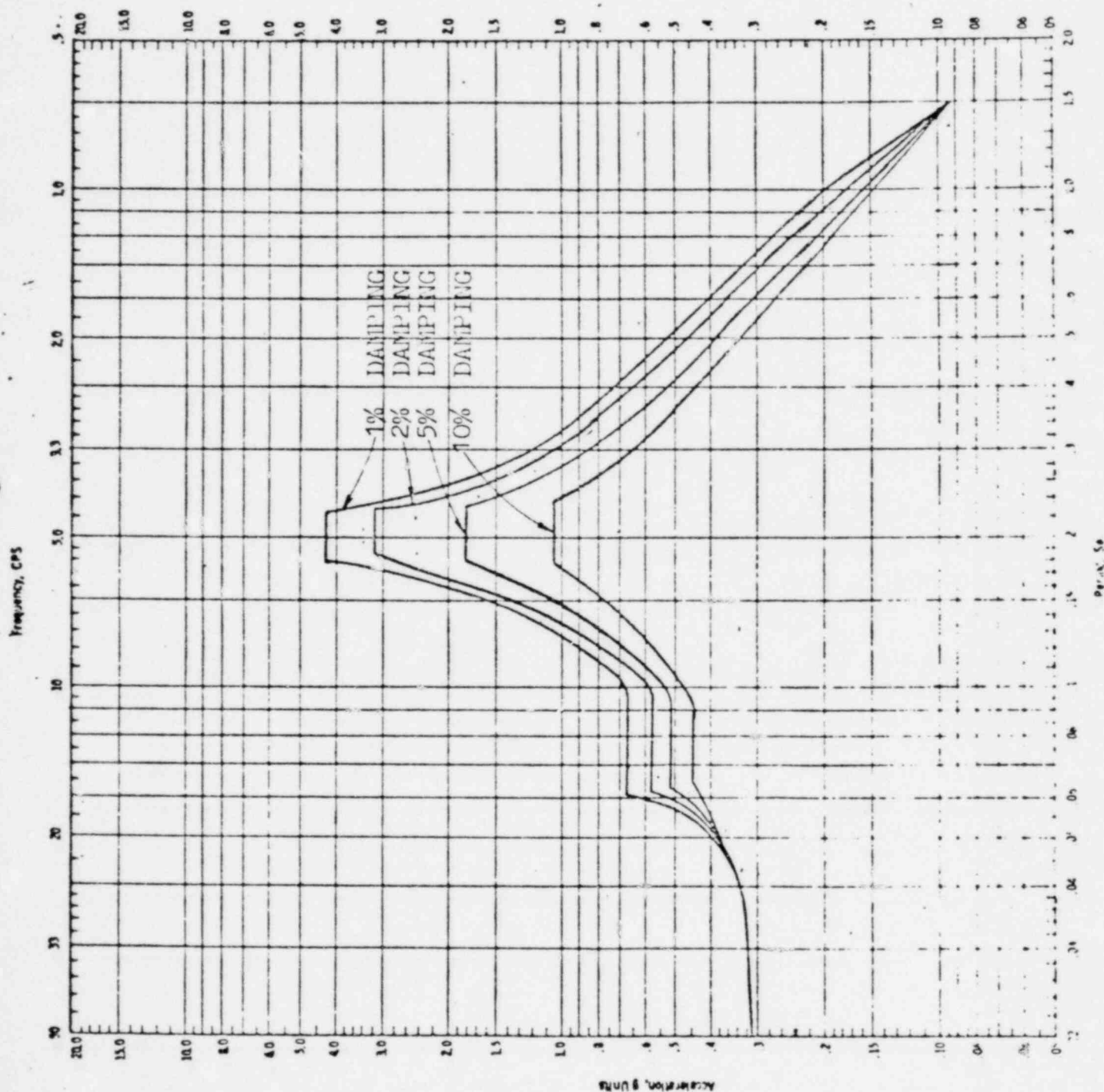


FIGURE B-37
HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE ELEVATION - 684'-6" (SLAB NO. 5)
REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

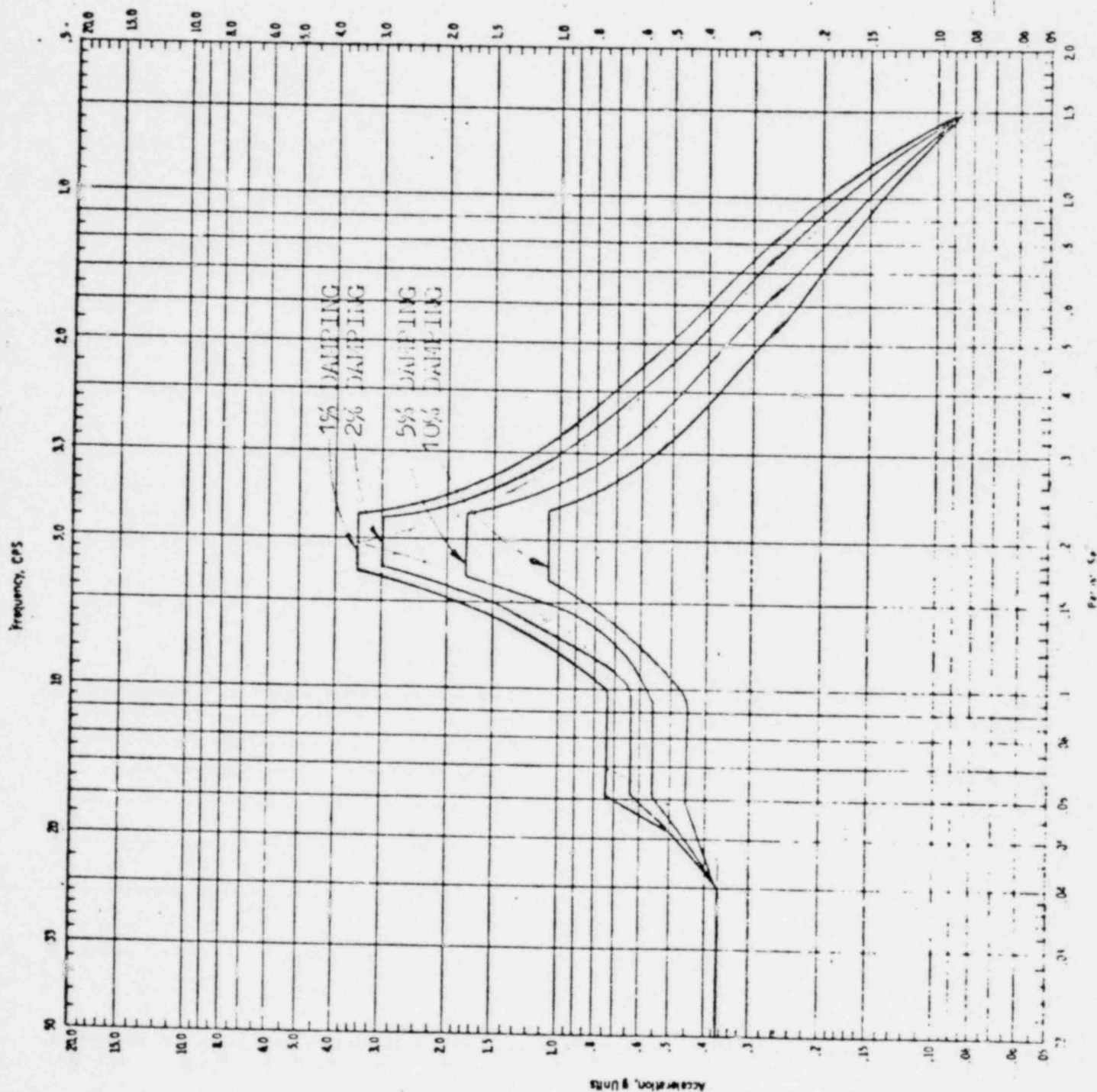


FIGURE B-38

HORIZONTAL FLOOR RESPONSE SPECTRA

DESIGN BASIS EARTHQUAKE ELEVATION - 684'-6" (SLAB NO. 5)

REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

SARGENT & LUNDY

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CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

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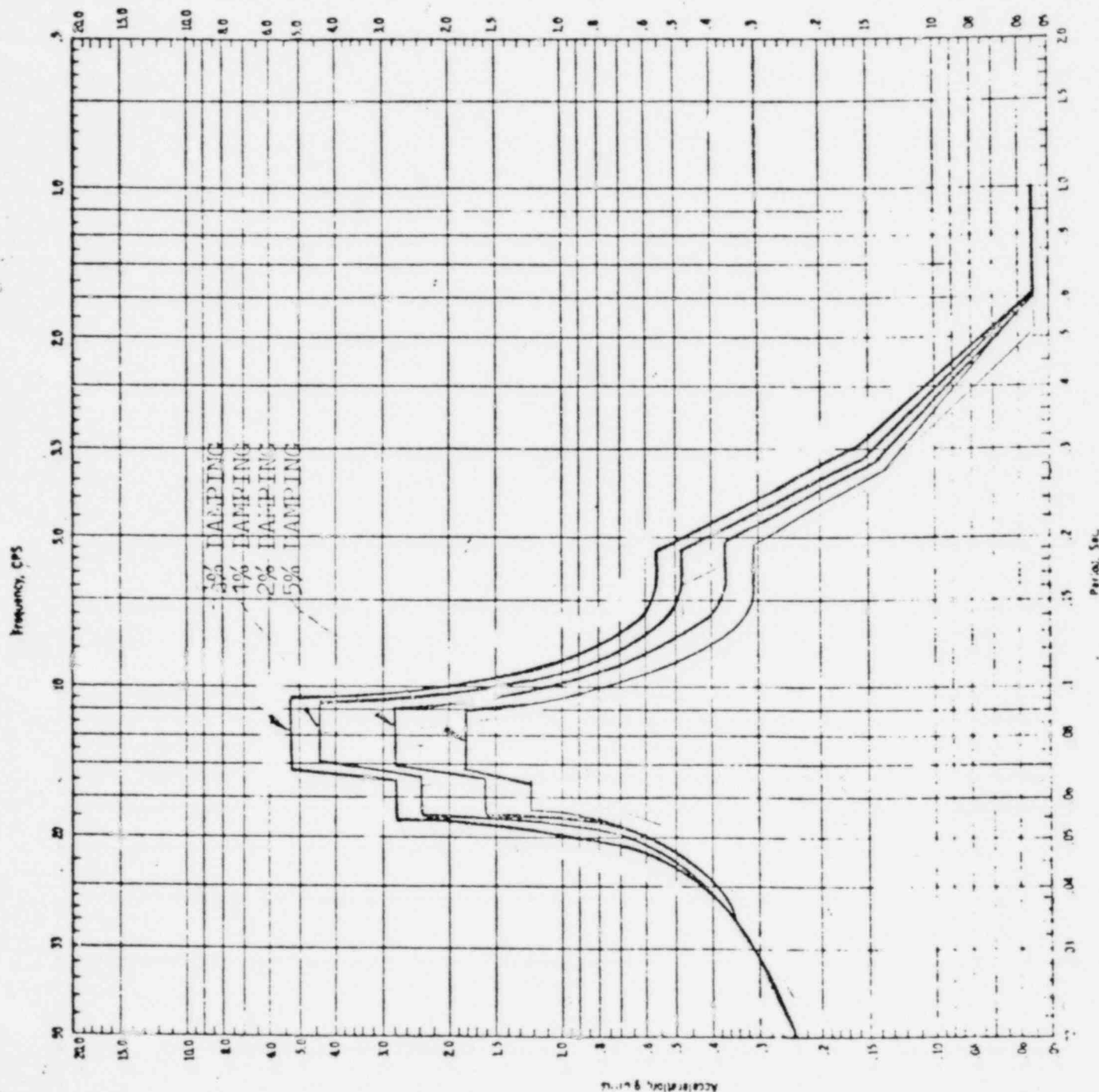
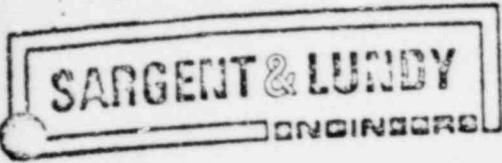


FIGURE C-9
VERTICAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE AUXILIARY BUILDING
SLAB EL. 643'-6" & 677'-6"

10.2
7.5



CLIENT DETROIT EDISON CO.
PROJECT ENRICO FERMI JOB NO. 3988
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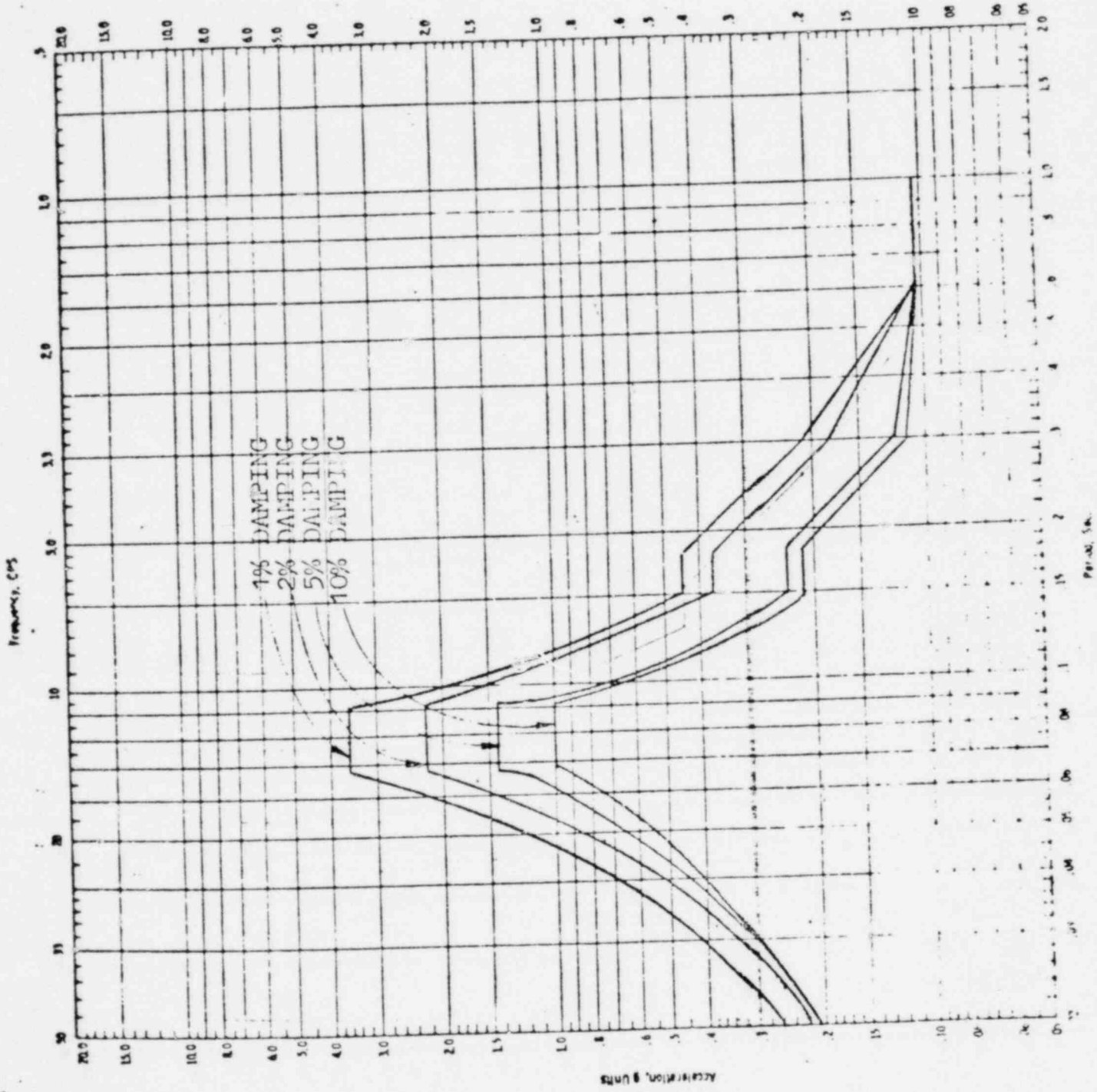


FIGURE C-19
VERTICAL RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE AUXILIARY BUILDING
SLAB EL. 643'-6" & 677'-6"

10.95
6.9
10.7
4.76

SARGENT & LUNDY

ENGINEERS
CHICAGO

FERMI UNIT 2
EQUIPMENT DYNAMIC
QUALIFICATION SUMMARY

Project #6139-40

EMD File #

Page 1 of 6

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: 10"Ø Shan-Rod Valve Type Dampers with Bettis
Actuators

EQUIPMENT NO. : T4100F063A/063B

SPEC. NO.:

LOCATION: Reactor Building T.O.D. Elevation 673'-3"

EQUIPMENT CLASSIFICATION: ☒ ACTIVE* ☐ PASSIVE

*To fail open.

QUALIFICATION DOCUMENT REFERENCES:

1. Ralph M. Parsons Co., Drawing No. 6M721-2849, Rev. L.
2. Detroit Edison Company File No. B9-781.
3. DECO Bill of Material No. B9-266M T4100-F-900-CA-005.
4. DECO File No. B9-1119.

Prepared by: *George M. Spick*
Reviewed by:
Approved by:

Date: 7-14-61

Date:

Date:

QUALIFICATION SUMMARY

LOAD COMBINATIONS CONSIDERED:

OBE/SSE Seismic Loads

ORIGINAL QUALIFICATION METHOD:

Static Coefficient Method qualified to 5g Horz. (both)
3g Vert.

REQUALIFICATION METHOD:

Show that the new seismic levels are below the levels originally used.

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CHICAGOFERMI UNIT 2
EQUIPMENT DYNAMIC
QUALIFICATION SUMMARY

Project #6139-40

EMD File #

Page 3 of 6

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME:

FERMI - Unit 2

TYPE:

1. Utility: Detroit Edison Company

PWR ☐

2. NSSS: General Electric

BWR ☒

3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME:

10"Ø ISO. Valve/Dampers with Actuators

1. Scope: ☐ NSSS ☒ BOP

2. Model Number: Type 4340 (Dampers)/CB525-SF (Act.) Quantity: 2

3. Vendor: Shan-Rod Inc. (Dampers)/Bettis (Actuators)

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description Appearance: Isolation Damper

Mounted in a circular duct with actuator mounted in a cantilever fashion.
Dimensions: 15"Øx6" (long)/5-3/4"Øx 28"(H)x20"(L) Weight: 207 lbs. valve
70 lbs. actuator

6. Location: Building: Reactor Building Elev.: 673'-3"

7. Field Mounting Conditions:

☒ Bolting: Number: 8 Size: 5/8"Ø☐ Welding: Weld Type: _____

Leg: _____ Length: _____ Pitch: _____

☐

8. Natural frequencies in each direction:

Front to back: Not Calculated

Side to side: Not Calculated

Vertical: Not Calculated

9. Method of determining natural frequencies: N/A

☐ Laboratory Test☐ Analysis☐ Other _____

10. a. System in which located: Control Center Air Cond.

b. Functional description: Normal Open-must close in event

of L.O.C.A. to permit premitizing control center with

c. Equipment required for: min. makeup air

☐ Hot Standby☐ Cold Shutdown☐ Post LOCA

11. Pertinent reference design specifications: _____

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☒ Analysis
☐ Combination of Test and Analysis

1. Qualification Report

"Seismic Analysis of Shan-Rod Inc. Type 4340 Heavy
a. Title: Duty Butterfly Dampers"

b. Number and Date: DECO File No. B9-1119, 8-19-77, Rev. 10-24-77

2. Company that prepared report: Shan-Rod Inc.

3. Company that reviewed report: Detroit Edison Co.

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only

☐ Hydrodynamic only

☐ Seismic and Hydrodynamic

☐ Other (Specify): _____

☐ _____

2. Required response spectra (attach the graphs):

SL-3988 Rev. 00, 4-18-72, B-11, 12, 13, 14, 35, 36, 37, 38; C-5, 7, 15, 17

3. Method of combining Requiring Response Spectra:

☒ Absolute Sum

☐ SRSS

4. Damping Upset (OBE): 1% Basis for damping: Reg. Guide 1.61

Emerg. (SSE): 2%

5. Required acceleration in each direction (if required):

☐ ZPA ☒ Other (Specify): Per Ref. No. 3

Upset (OBE): F/B= 5g S/S= 5g V= 3g

Emerg. (SSE): F/B= 5g S/S= 5g V= 3g

6. Were fatigue effects or other vibration loads considered?

☐ Yes Describe loads and how they were treated in overall qualification program: _____

☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE: N/A

1. Test Method: ☐ Single frequency: _____
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____
10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☐ Static analysis
☒ Static coefficient analysis
☐ Dynamic analysis: ☐ Response spectrum
☐ Time history
2. Model type:
☐ 1-dimensional
☐ 2-dimensional
☒ 3-dimensional

3. Method of analysis:

☐ Computer-aided calculation
programs used: _____☒ Hand calculations☐ _____4. Have equipment supports been adequately considered in
analysis: ☒ Yes ☐ No

5. Stress evaluation at critical structural elements:

Element	Calc Stress	Allow Stress
Anchor Bolts Stress Intensity (PSI)	15,530	85,000
Actuator Plate Weld Stress Intensity (PSI)	2,940	20,000
Flange Bolts Stress Intensity (PSI)	4,219	85,000

6. Deflection evaluation at critical structural elements
(active equipment only)

Element	Calc Stress	Allow Stress
Disc. Deflection (in)	0.000462	0.05

VIII. ADDITIONAL COMMENTS:

None

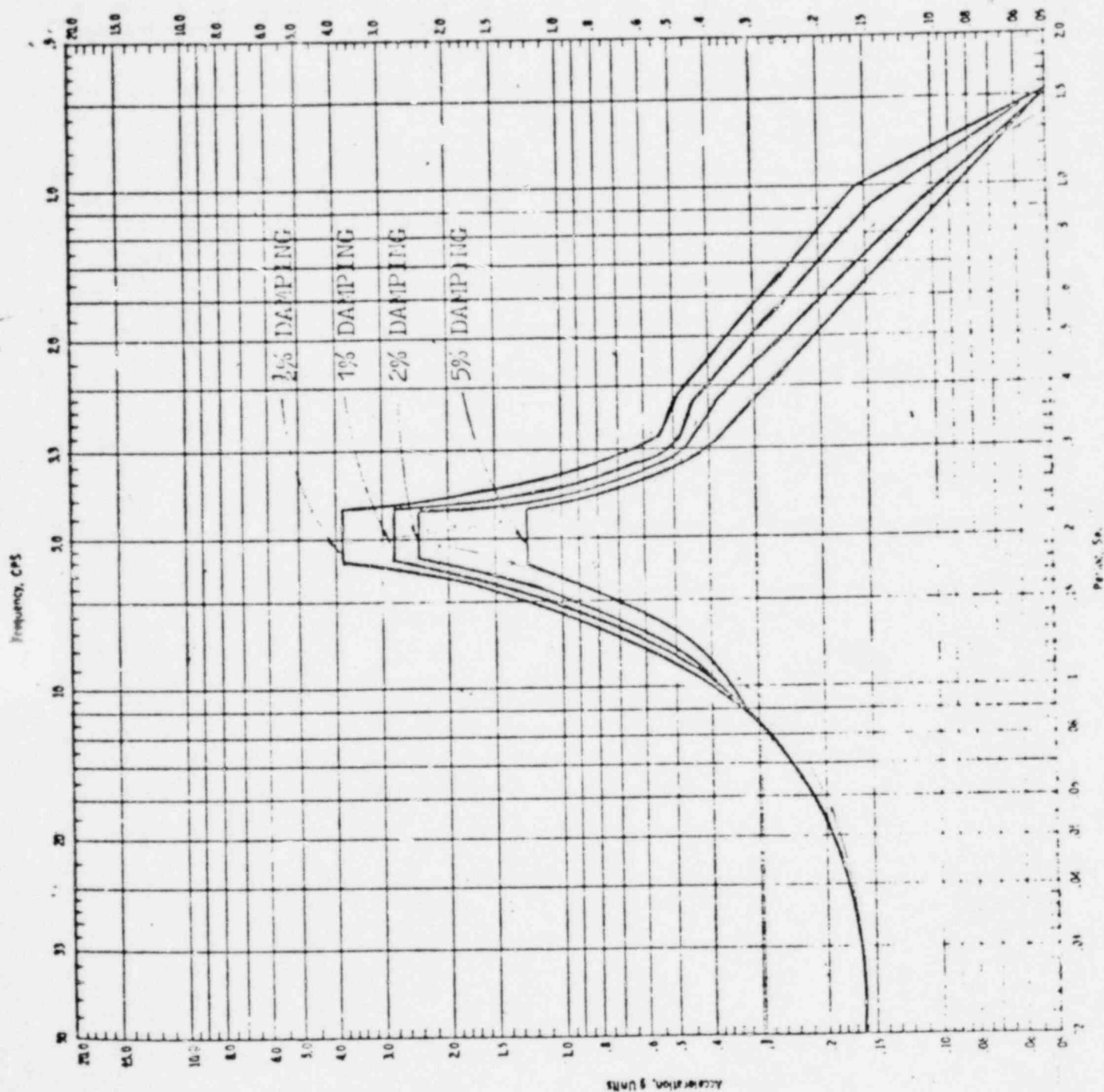


FIGURE B-11
HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION - 659'-0" (SLAB NO. 4)
REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SGM

DATE April 18, 1972

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DATE 4/18/72

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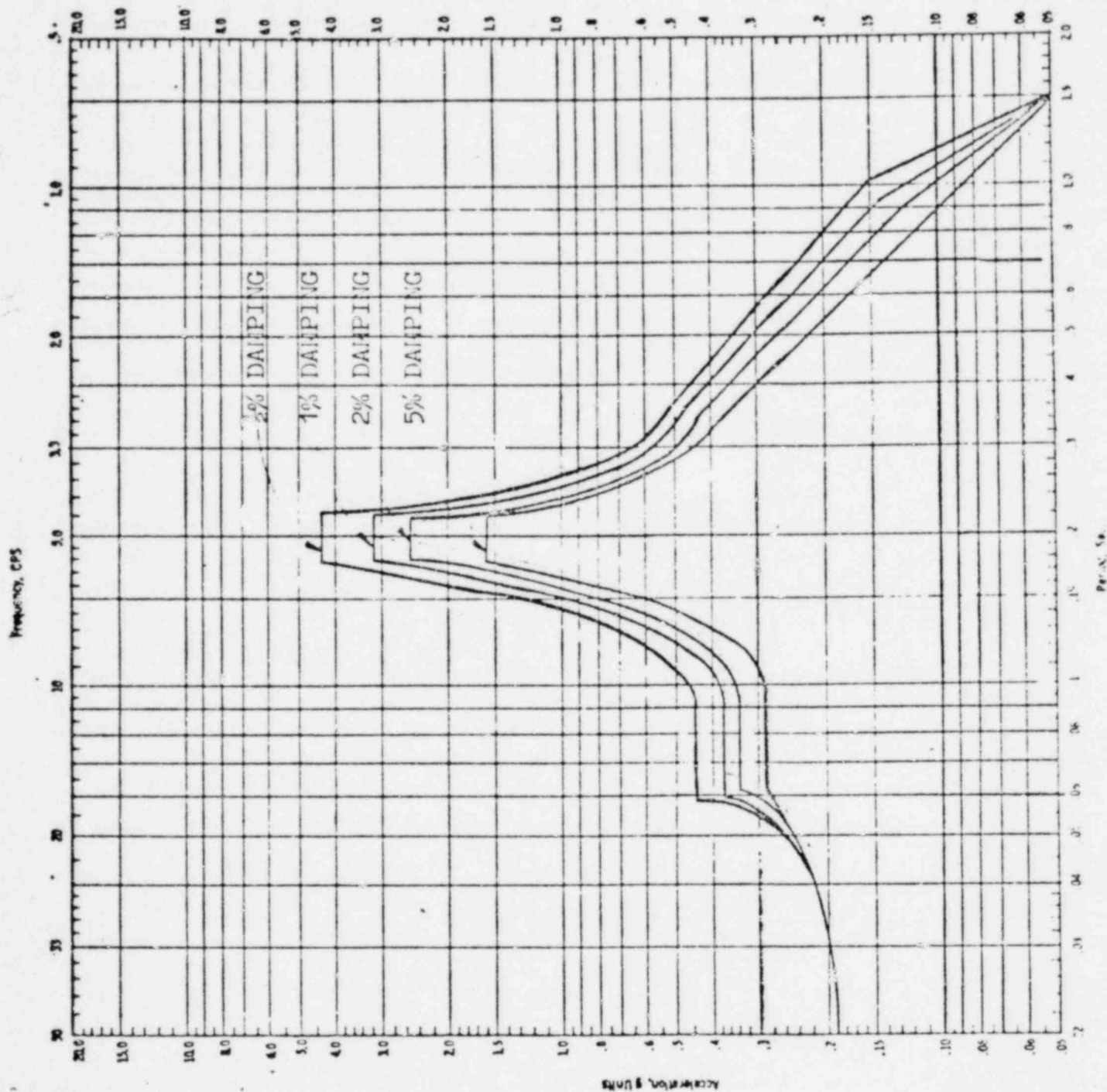


FIGURE B-13

HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION -684'-6" (SLAB NO. 5)
REACTOR AUXILIARY BUILDING NORTH-SOUTH COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3000-00

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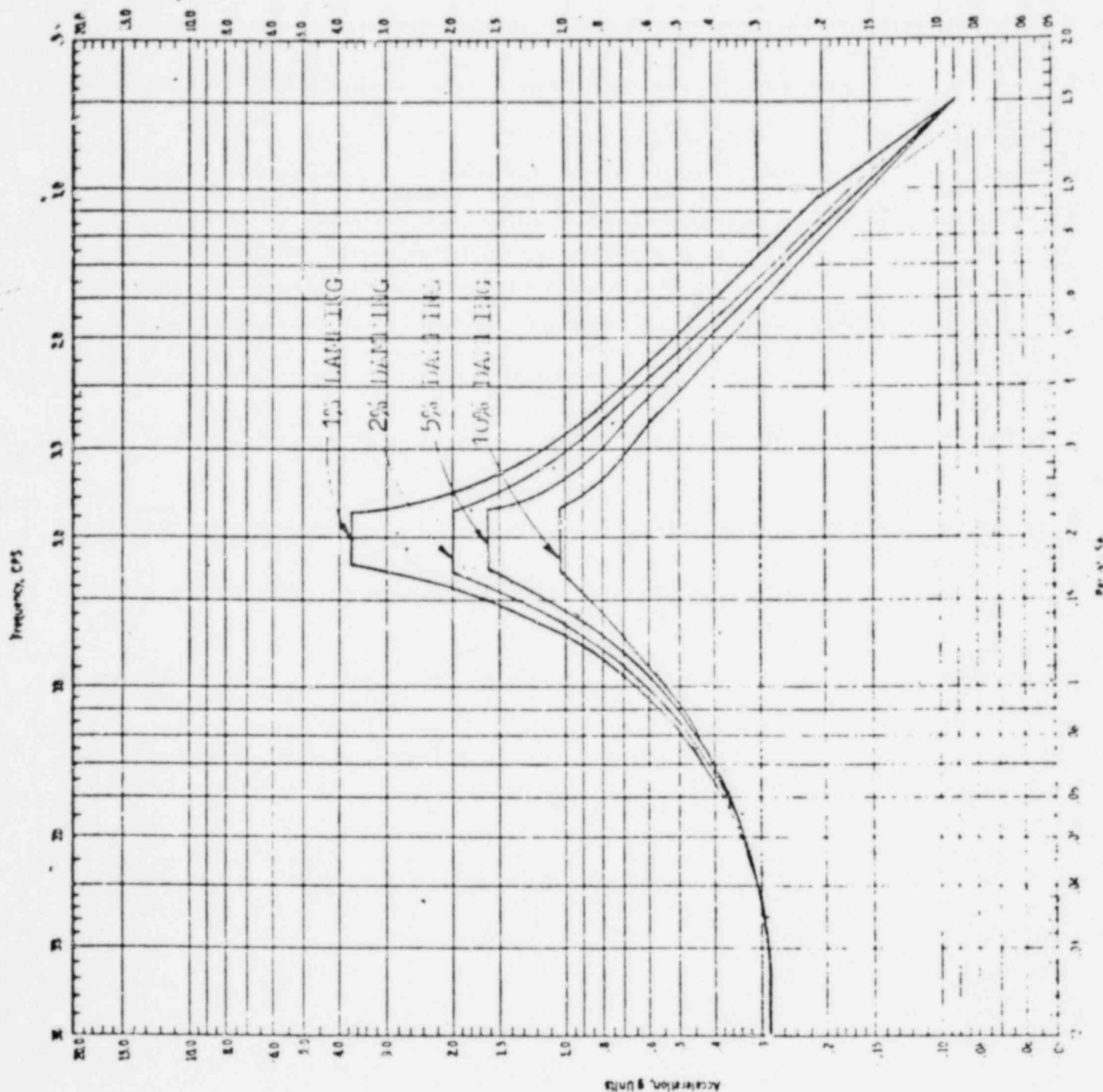


FIGURE B-35

HORIZONTAL FLOOR RESPONSE SPECTRA

DESIGN BASIS EARTHQUAKE ELEVATION - 659'-0" (SLAB NO. 4)

REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

SARGENT & LUNDY

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CLIENT DETROIT EDISON
PROJECT ENRICO FERMI JOB NO. 3988-00
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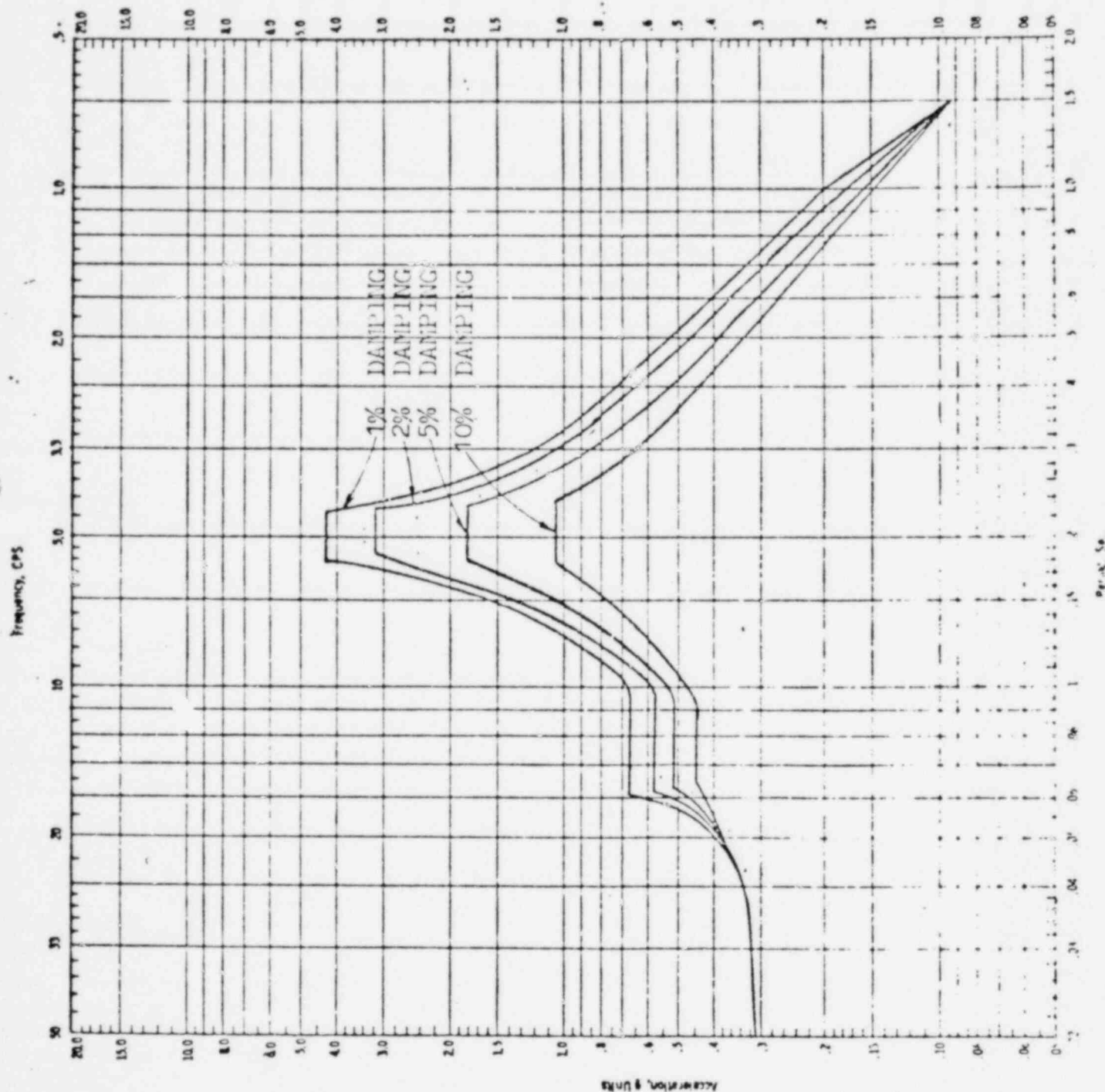
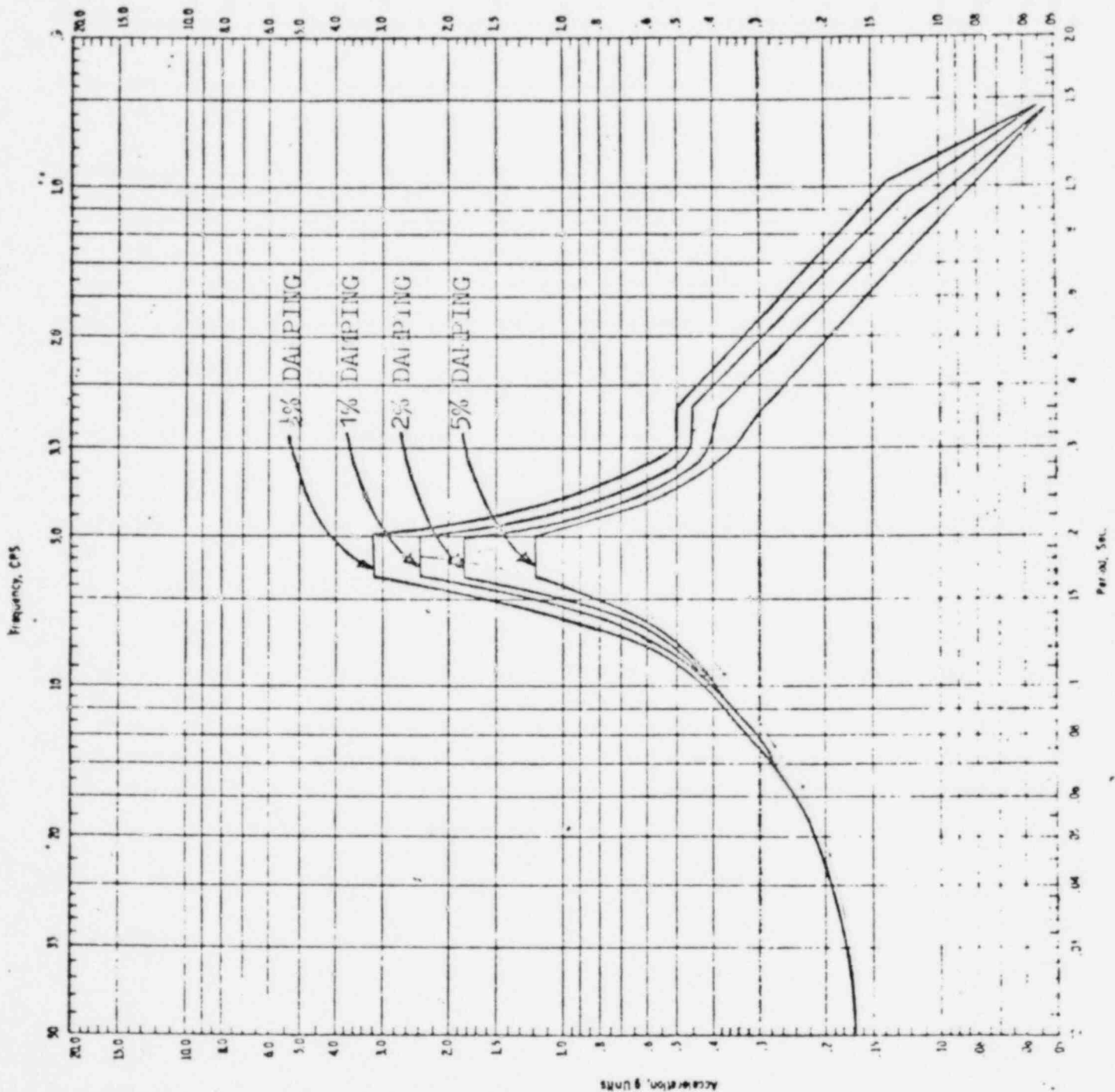


FIGURE B-37
HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE ELEVATION - 684'-6" (SLAB NO. 5)
REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

SARGENT & LUNDY**ENGINEERS**CLIENT DETROIT EDISONPROJECT ENRICO FERMIJOB NO. 3088DESIGN BY SGMDATE April 18, 1972CHECKED BY HHSDATE 4/8/72 SHEET OF **FIGURE B-12****HORIZONTAL FLOOR RESPONSE SPECTRA****OPERATING BASIS EARTHQUAKE ELEVATION - 659'-0"****(SLAB NO. 4) REACTOR AUXILIARY BUILDING EAST-WEST COMPONENT**

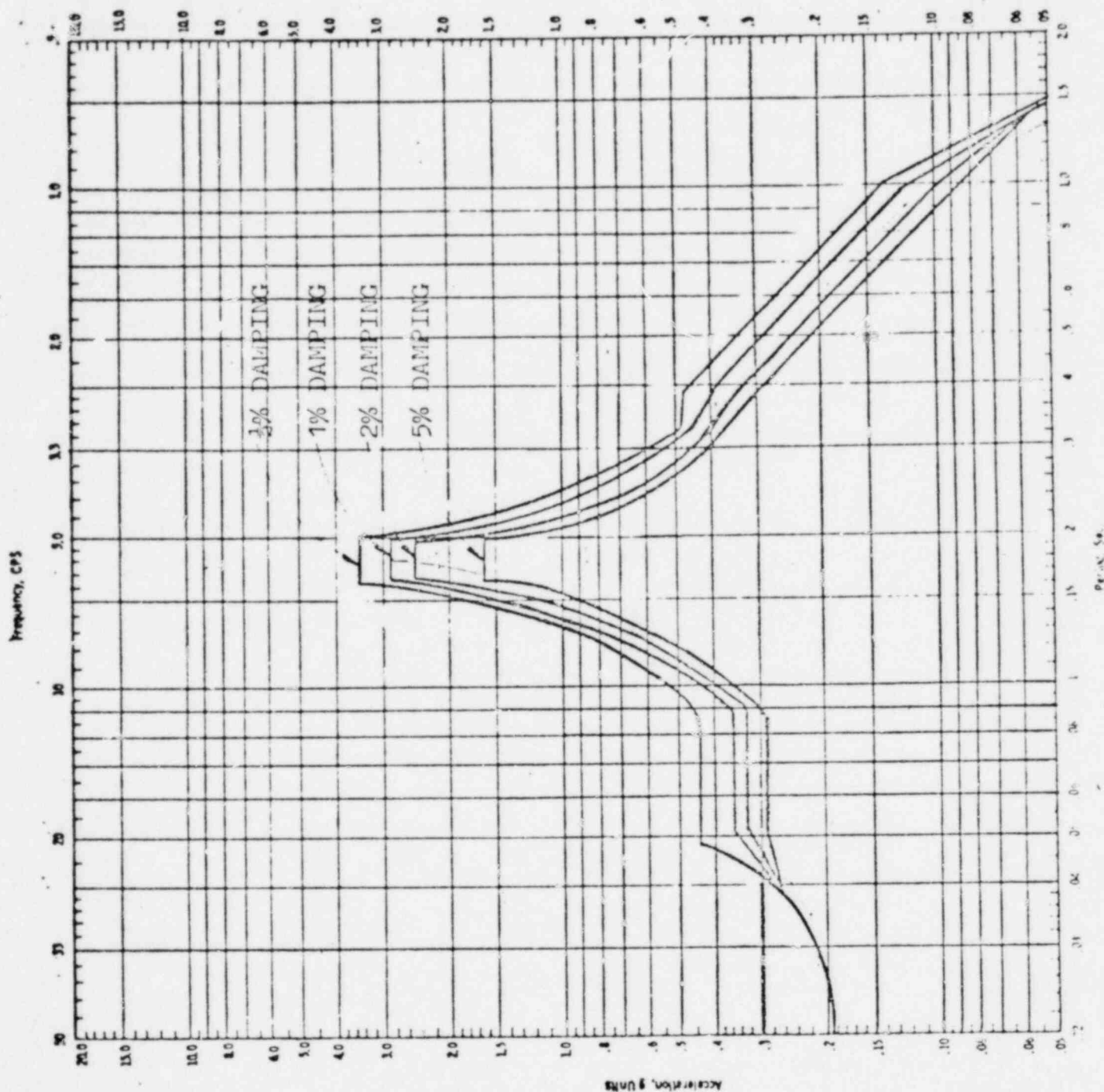


FIGURE B-14

HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION-684'-6" (SLAB NO. 5)
REACTOR AUXILIARY BUILDING EAST-WEST COMPONENT

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PROJECT ENRICO AERUI

JOB NO. 406-11

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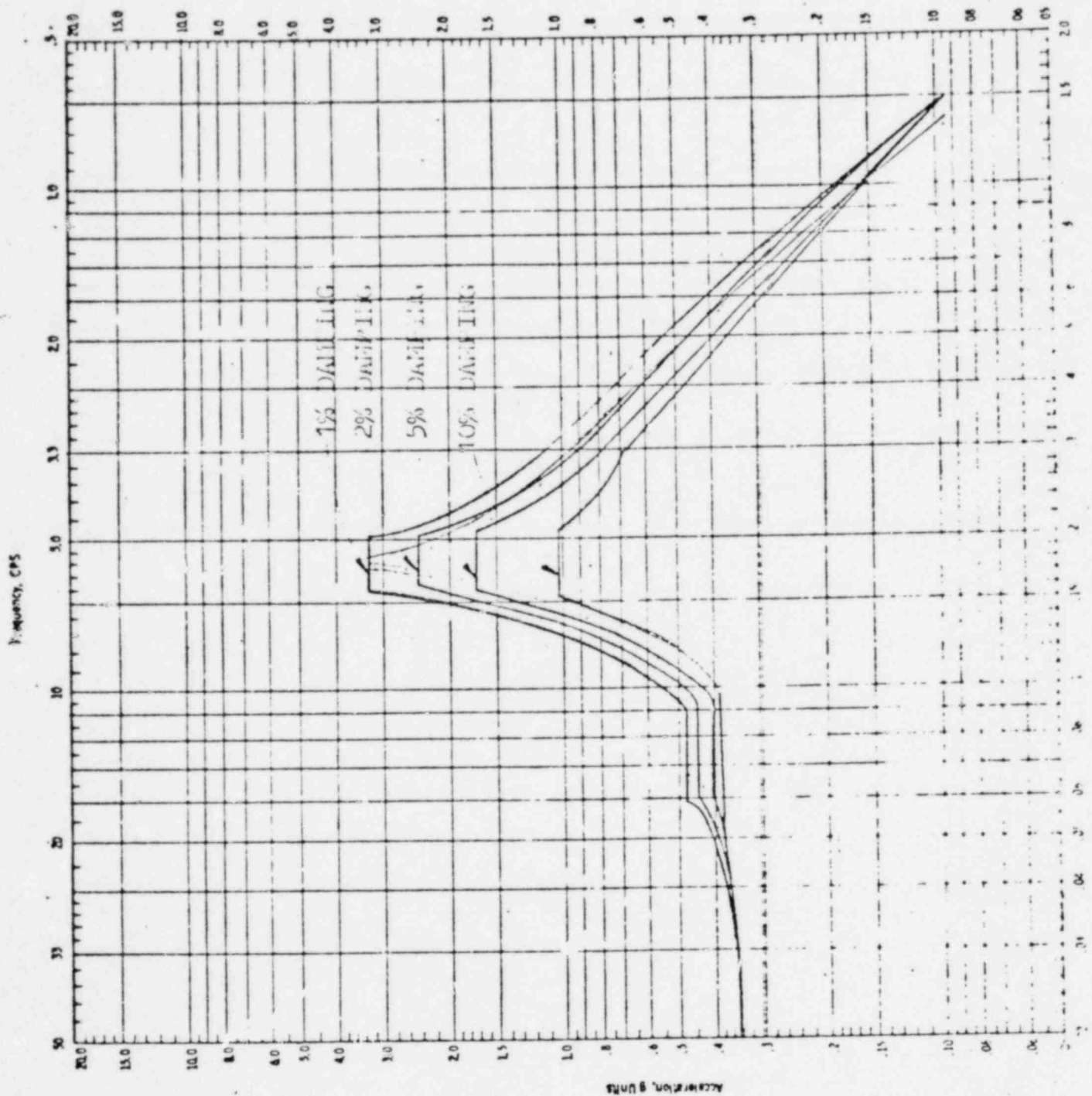


FIGURE B-36

HORIZONTAL FLOOR RESPONSE SPECTRA

DESIGN BASIS EARTHQUAKE ELEVATION - 659'-0" (SLAB NO. 4)

REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

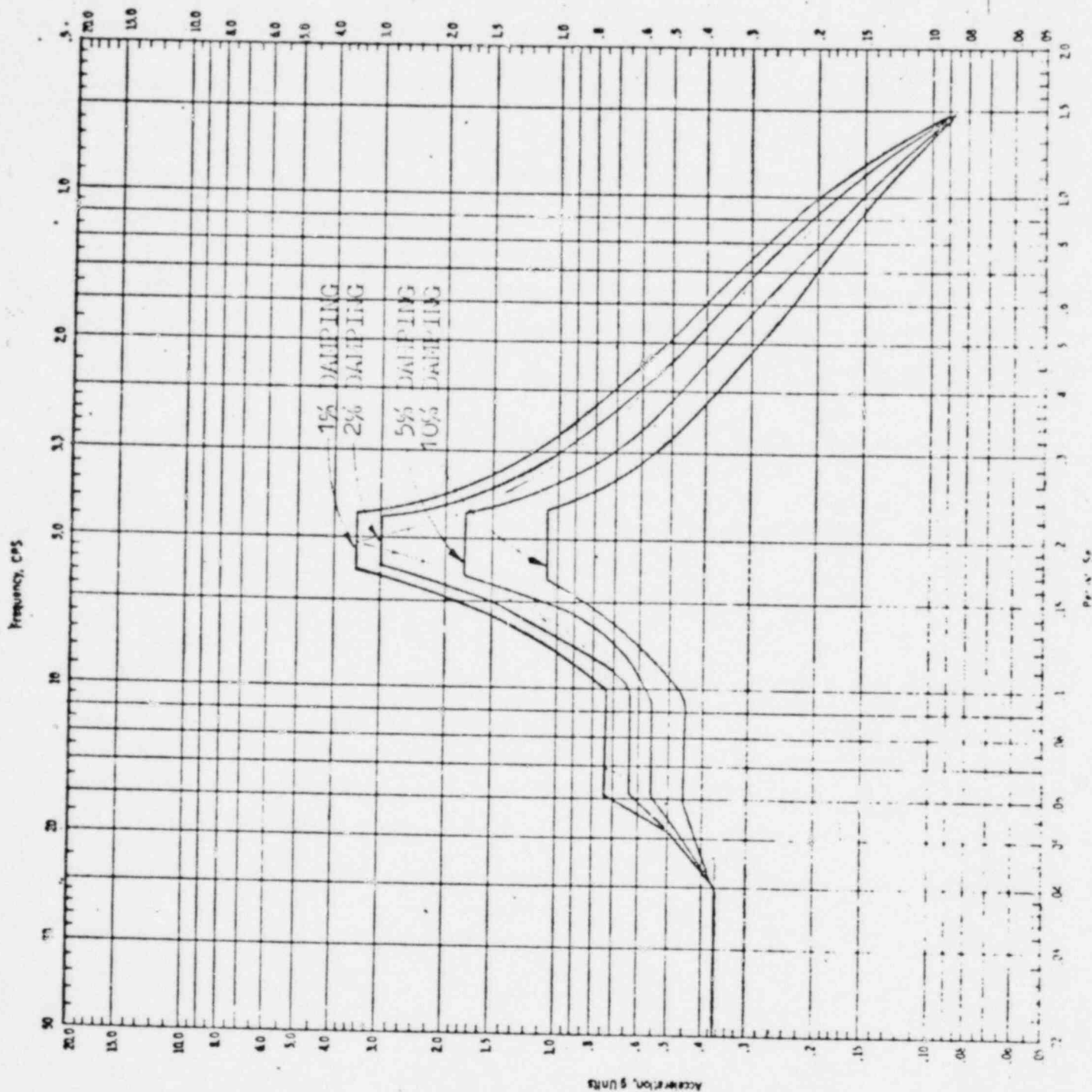


FIGURE B-38

HORIZONTAL FLOOR RESPONSE SPECTRA

DESIGN BASIS EARTHQUAKE ELEVATION - 684'-6" (SLAB NO. 5)

REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

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ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SGM

DATE April 18, 1972

CHECKED BY RHS

DATE 4/12/72

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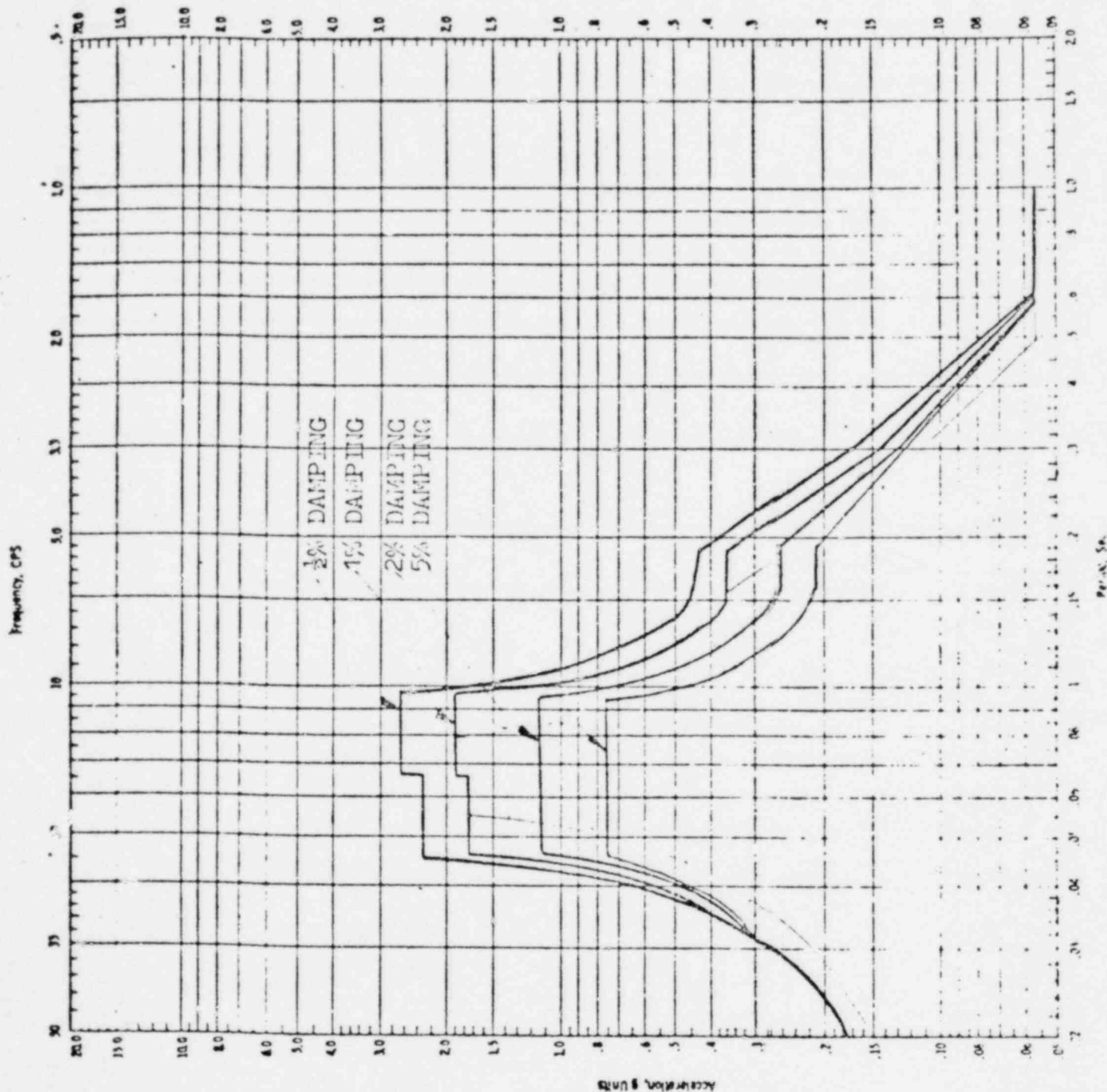


FIGURE C-7
VERTICAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE REACTOR BUILDING
SLAB EL. 641'-6", 659'-6" & 684'-6"

7.06

11/11

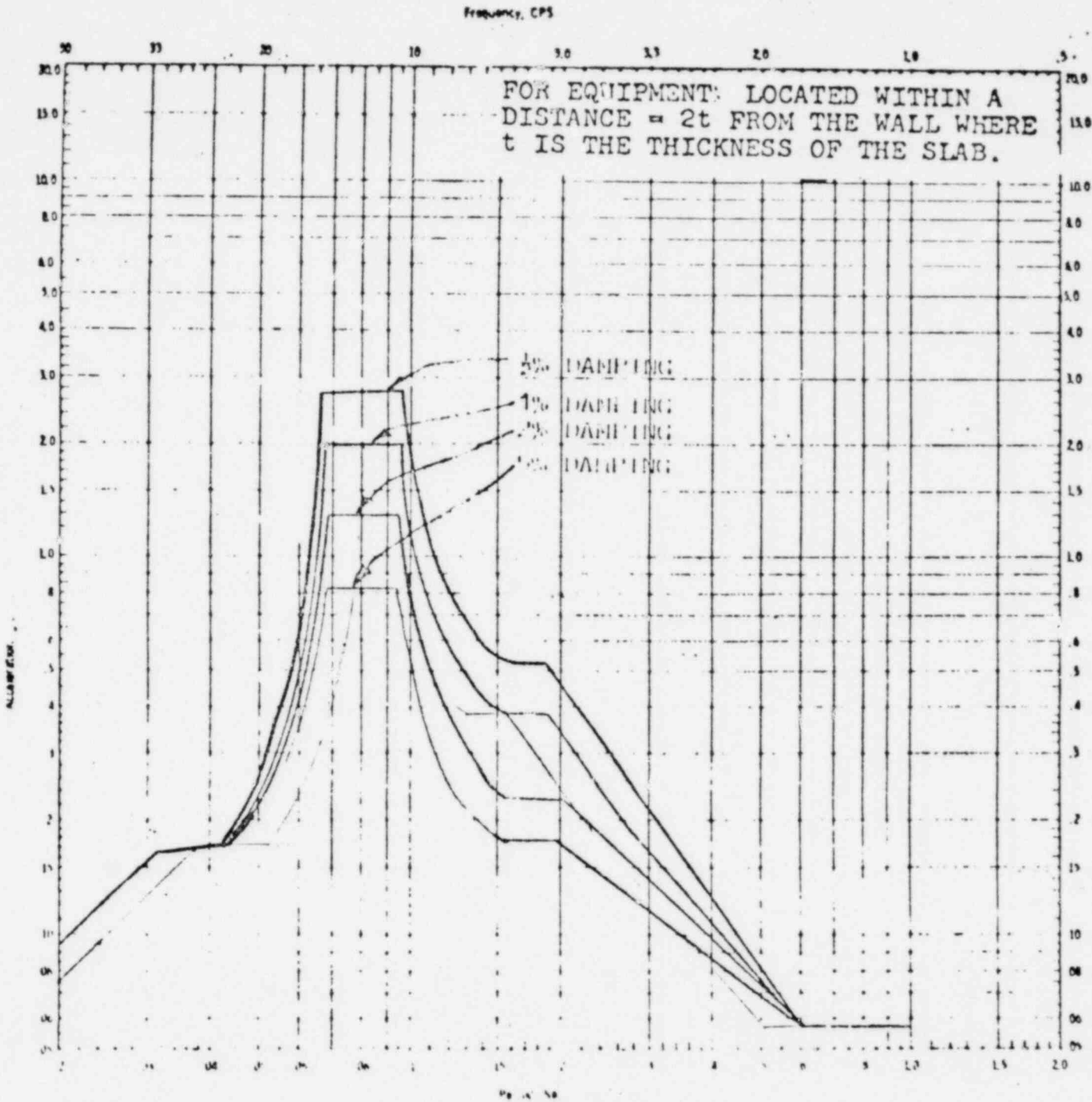


FIGURE C-5
VERTICAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE REACTOR BUILDING
WALL EL. 641'-6", 659'-6", 684'-6"

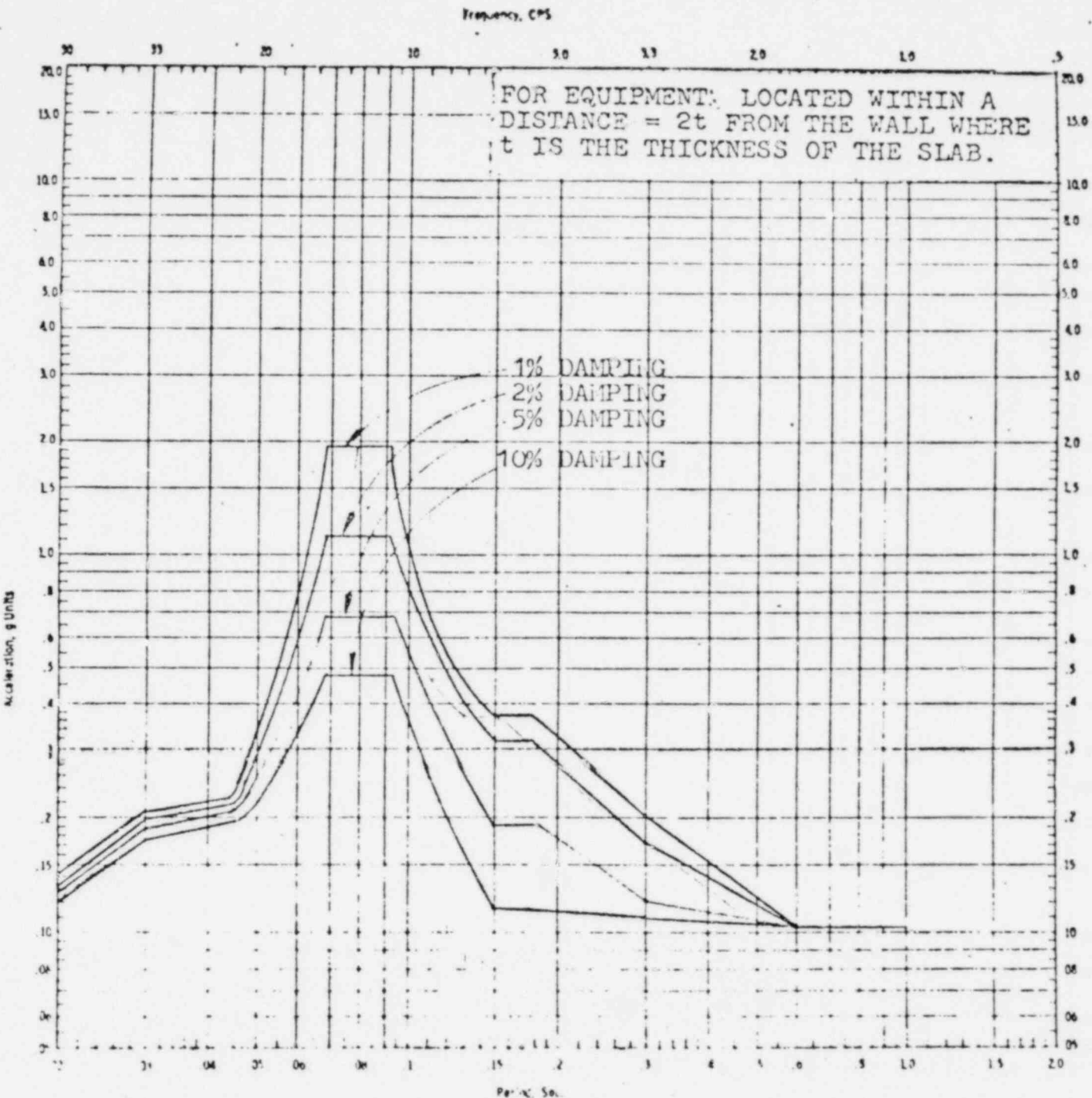


FIGURE C-15
VERTICAL RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE REACTOR AND
AUXILIARY BLDG. WALL EL. 641'-6", 659'-6" & 684'-6"

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CLIENT DETROIT EDISON CO.

PROJECT ENRICO FERMI

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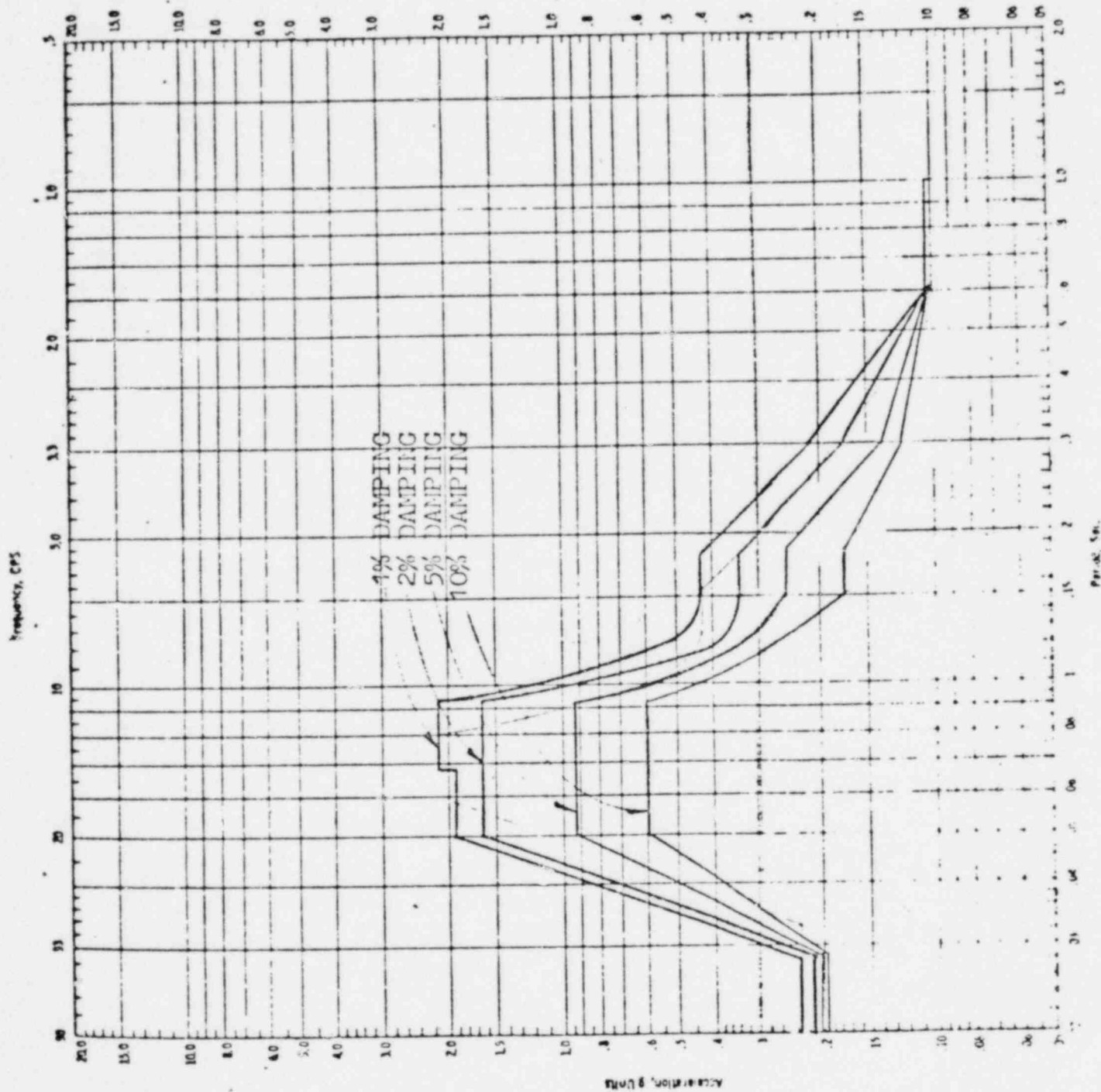


FIGURE C-

VERTICAL RESPONSE SPECTRA

DESIGN BASIS EARTHQUAKE REACTOR BUILDING

SLAB EL. 641'-6", 659'-6" & 684'-6"

7.9
4.6
3.2
5%
10%

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: Diesel Generator Gauge and Instrument Panel

EQUIPMENT NO. : SPEC. NO.: 3071-19

LOCATION: RHR Complex, El. 590'

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE

QUALIFICATION DOCUMENT REFERENCES:

1. EMD File #013860 Containing Seismic Test report from Wyle Laboratories, report #43961, DECo File #TI-3175.
2. EMD File #001659 Containing Seismic Analysis of Support Structure for Engine Instrument Panel.

Prepared by:

Date:

Reviewed by:

Date:

Approved by:

Date:

QUALIFICATION SUMMARYLOAD COMBINATIONS CONSIDERED:

Normal+Operating Basis Earthquake

Normal + Design Basis Earthquake

ORIGINAL QUALIFICATION METHOD:

Instruments and gages are mounted on this panel. Active instruments, namely Synchro-Start Electric Switch Model ESSB-3AT, Dresser Industries Ashcraft Pneumatic Temperature Transmitter Model C-5680, Moore Products Co. Pneumatic Temperature Transmitter Model 33, and Nullmatic Pneumatic Controller Model 55 were premounted in a fabricated test fixture and were subjected to biaxial random motion test in the frequency range of 1-40 Hz - 5 OBE's and 1 - SSE each of 30 sec. duration. Test was conducted in the two principal planes. Panel is mounted on a support structure through vibration isolators. Support structure was analyzed by considering the panel and vibration isolators as a system of springs and mass. Frequencies were obtained by computer program A033. The panel was found to bottom out due to the seismic loads. Due to seismic and impact loads, stresses in the support structure were obtained.

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME:

FERMI - Unit 2

TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME:

Diesel Generator Gage and Instrument Panel

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: _____ Quantity: 1
3. Vendor: Colt Industries
4. If the component is a cabinet or panel, name and model No. of the devices included: attached
5. Physical Description Appearance: Panel made up of sheet metal and angles
Dimensions: 28" x 8" x 62" Weight: 320 lbs.
6. Location: Building: RHR Complex Elev.: 590'
7. Field Mounting Conditions: or diesel generator skid
☐ Bolting: Number: _____ Size: _____
☐ Welding: Weld Tyep: _____
Leg: _____ Length: _____ Pitch: _____
☒ Vibration Isolators
8. Natural frequencies in each direction:
Front to back: 6.4 g 9.3 Hz
Side to side : 6.6 g 9.1 Hz
Vertical: 3.45 Hz
9. Method of determining natural frequencies:
☐ Laboratory Test
☒ Analysis
☐ Other _____
10. a. System in which located: P.H.R.
b. Functional description: operation of Diesel Generator
c. Equipment required for:
☐ Hot Standby ☐ Cold Shutdown ☐ Post LOCA

11. Pertinent reference design specifications: 3071-19

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☐ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☐ Analysis
☒ Combination of Test
and Analysis

1. Qualification Report

a. Title: Seismic Simulation Test Report

b. Number and Date: 43961-1, 5-1-78

2. Company that prepared report: Wyle Laboratories & Colt Industries

3. Company that reviewed report: Sargent & Lundy

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only
☐ Hydrodynamic only
☐ Seismic and Hydrodynamic
☐ Other (Specify): _____
☐ _____

2. Required response spectra (attach the graphs):

Attached

3. Method of combining Requiring Response Spectra: N/A

☐ Absolute Sum

☐ SRSS

4. Damping Upset (OBE): 2% Basis for damping: Nureg 101
Emerg. (SSE): 2%

5. Required acceleration in each direction (if required): N/A

☐ ZPA ☐ Other (Specify): _____

Upset (OBE): F/B=_____ S/S=_____ V=_____

Emerg. (SSE): F/B=_____ S/S=_____ V=_____

6. Were fatigue effects or other vibration loads considered?

☐ Yes Describe loads and how they were treated in overall
qualification program: _____

☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE:

1. Test Method: ☐ Single frequency: _____
☒ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☒ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) 5 Emerg. (SSE) 1
4. Frequency range: 1 to 40 Hz
5. For multiple frequency test does TRS envelop RRS?
☐ No ☒ Yes (attach TRS graphs)
6. Input g-level test: N/A
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☒ Bolting: Number: 10 Size 3/8" Gr 5
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☒ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: Passed
10. Other tests performed: None

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☐ Static analysis
☐ Static coefficient analysis
☒ Dynamic analysis: ☒ Response spectrum
☐ Time history
2. Model type:
☐ 1-dimensional
☐ 2-dimensional
☒ 3-dimensional

3. Method of analysis: for Support

☒ Computer-aided calculation
programs used: A033☒ Hand calculations☐4. Have equipment supports been adequately considered in analysis: ☒ Yes ☐ No

5. Stress evaluation at critical structural elements:

Element	Calc Stress	Allow Stress
Support Tubing	19941 psi	28800 psi
Weld on Tubing	1772 lb/in	2816 lb/in
Vibration Isolator	294 lb	380 lb

6. Deflection evaluation at critical structural elements (active equipment only)

Deflections are not critical.

Element	Calc Stress	Allow Stress

VIII. ADDITIONAL COMMENTS:

List of Devices on Diesel Generator Instrument Panel

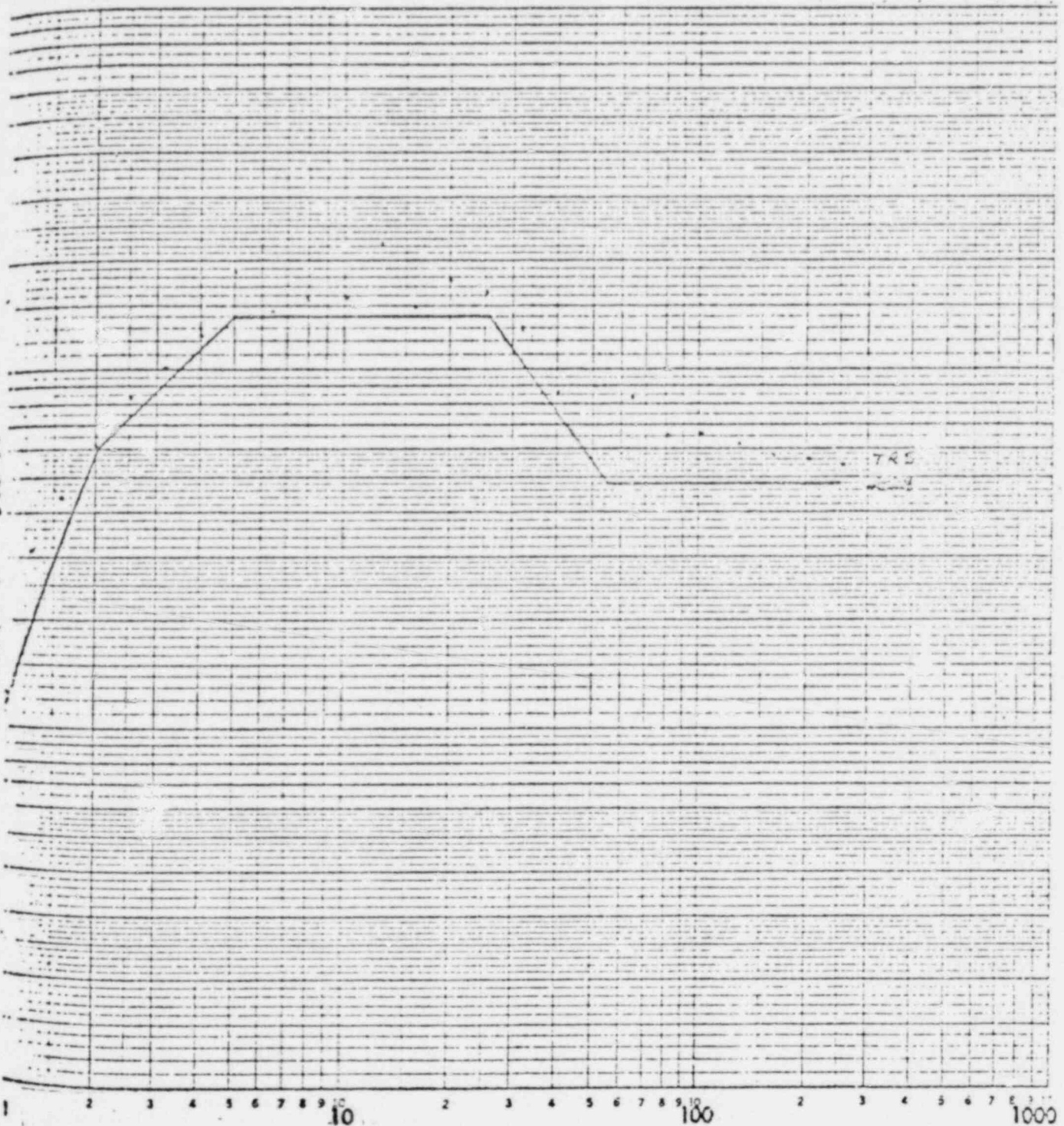
a. Manometer	Passive
b. Pyrometer	Passive
c. Temperature Gage	Passive
d. Temperature Gate	Passive
e. Pressure Gage	Passive
f. Pressure Gage	Passive
g. Pressure Gage	Passive
h. Pressure Gage	Passive
i. Pressure Gage	Passive
j. Tachometer Indicator	Passive
k. Pressure Switch (3)	Passive
l. Pneumatic Transmitter	Active
m. Pneumatic Controller	Active
n. Slenood Valve	Passive
o. Speed Switch	Active

6.7
Dual Grapher Control Panel
Instrumentation
FULL SCALE SHOCK SPECTRUM (1/2 Peak)

Page No. 48
Report No. 43961-1

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING ☒ 2%



Frequency (Hz)

AXIS S-S/V

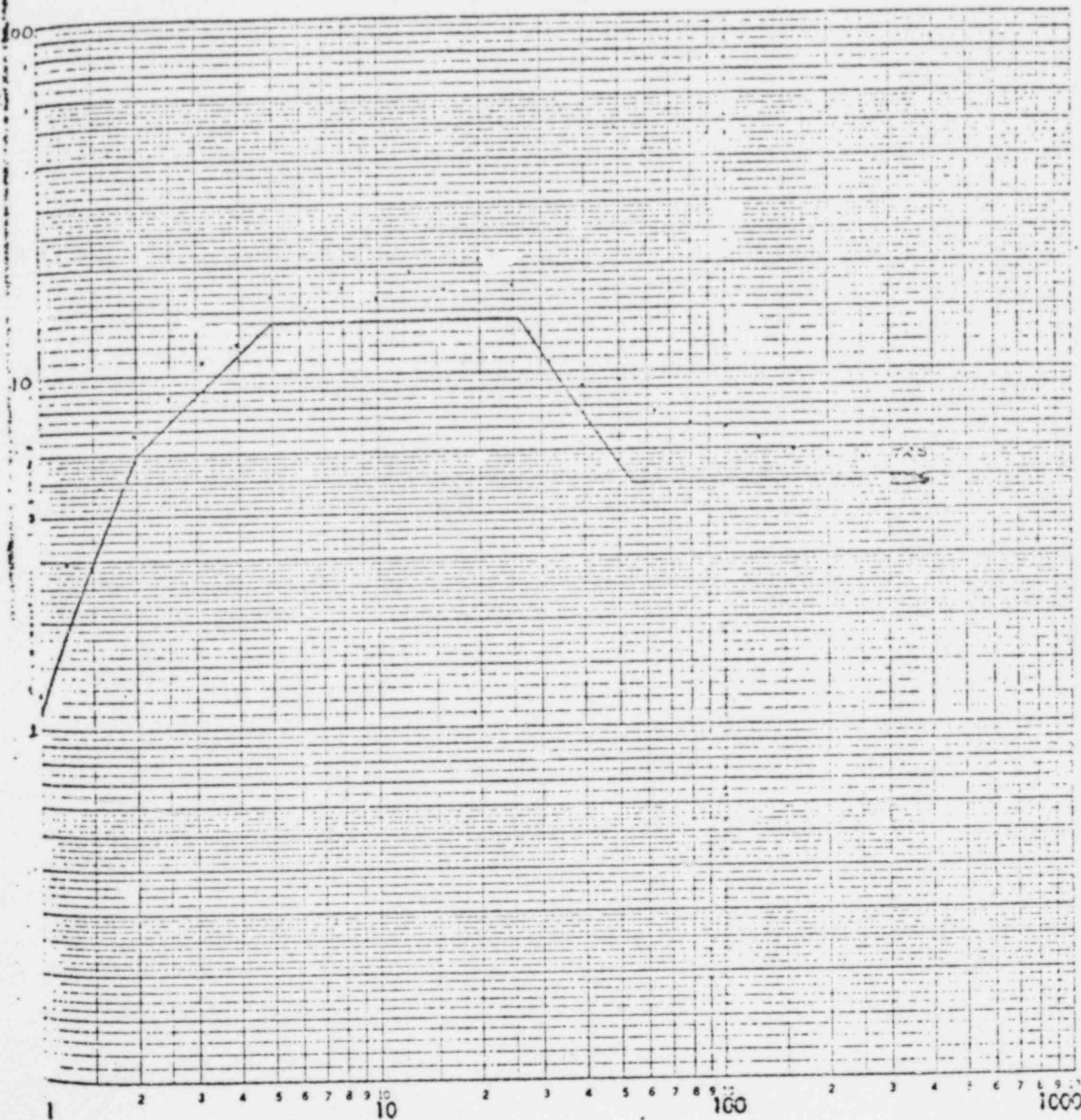
LOCATION NO. HCB

TEST RUN NO. 15

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING ☒ 2%



Frequency (Hz)

AXIS F-B/V

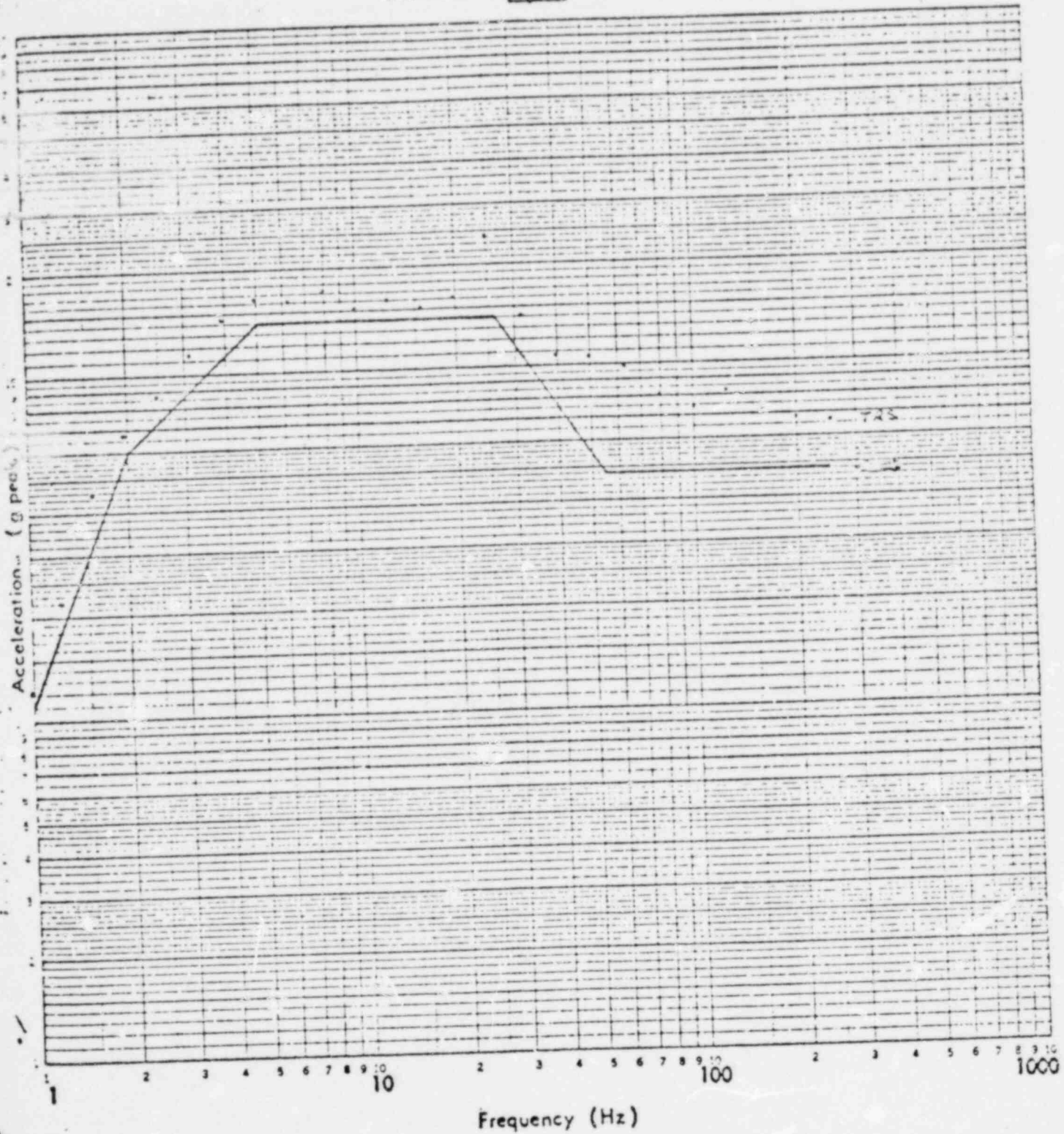
LOCATION: NO. 1-CA

TEST RUN NO. 26

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☐ 1000 ☐

DAMPING ☐ 5%

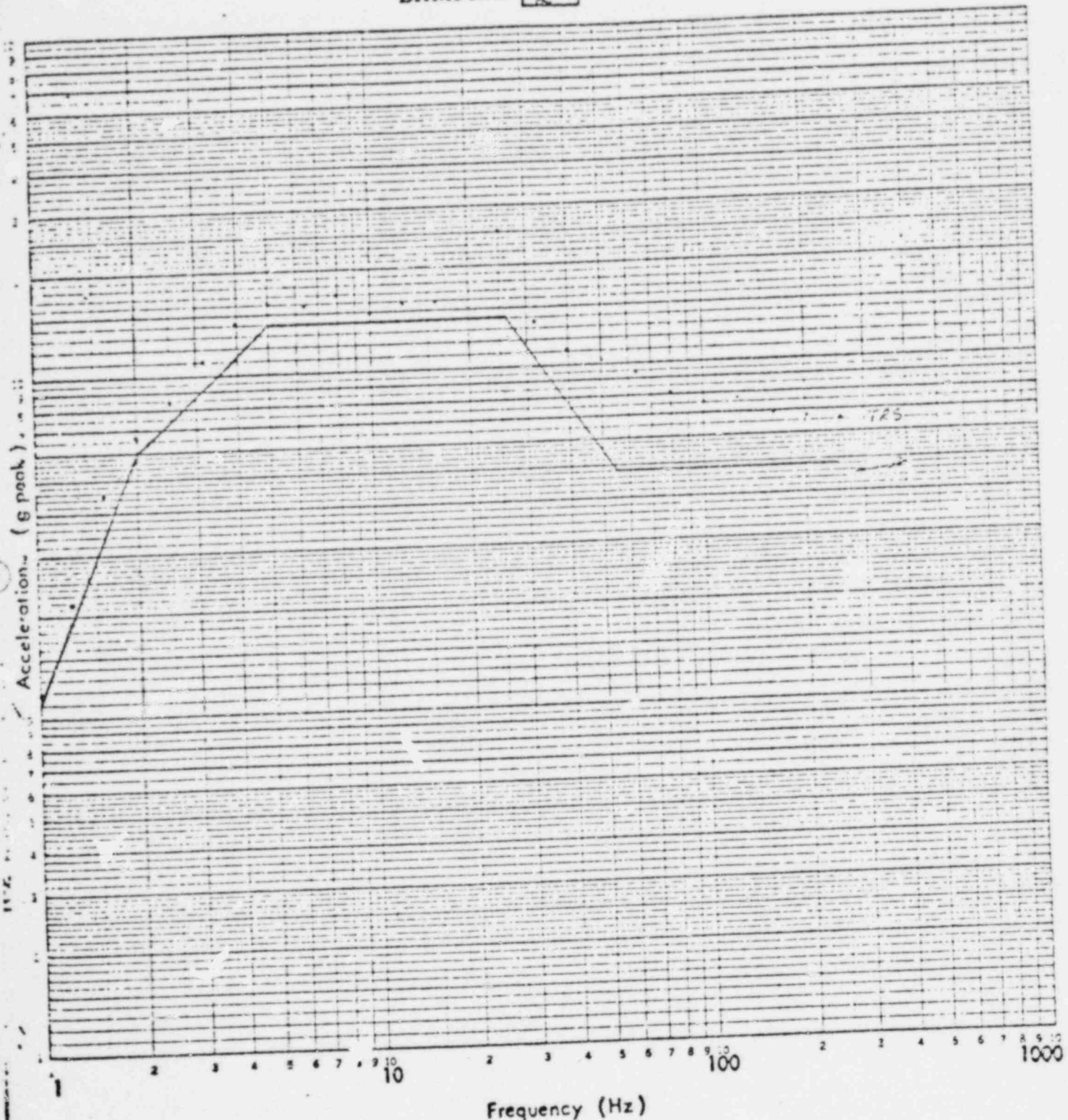


AXIS F-B/V
LOCATION NO. VLR
TEST RUN NO. 1/2

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING ☒ 5%



AXIS S-5/V
LOCATION NO. V/A
TEST RUN NO. 15

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISONPROJECT ENRICO PERMITDESIGN BY CLMCHECKED BY SGM

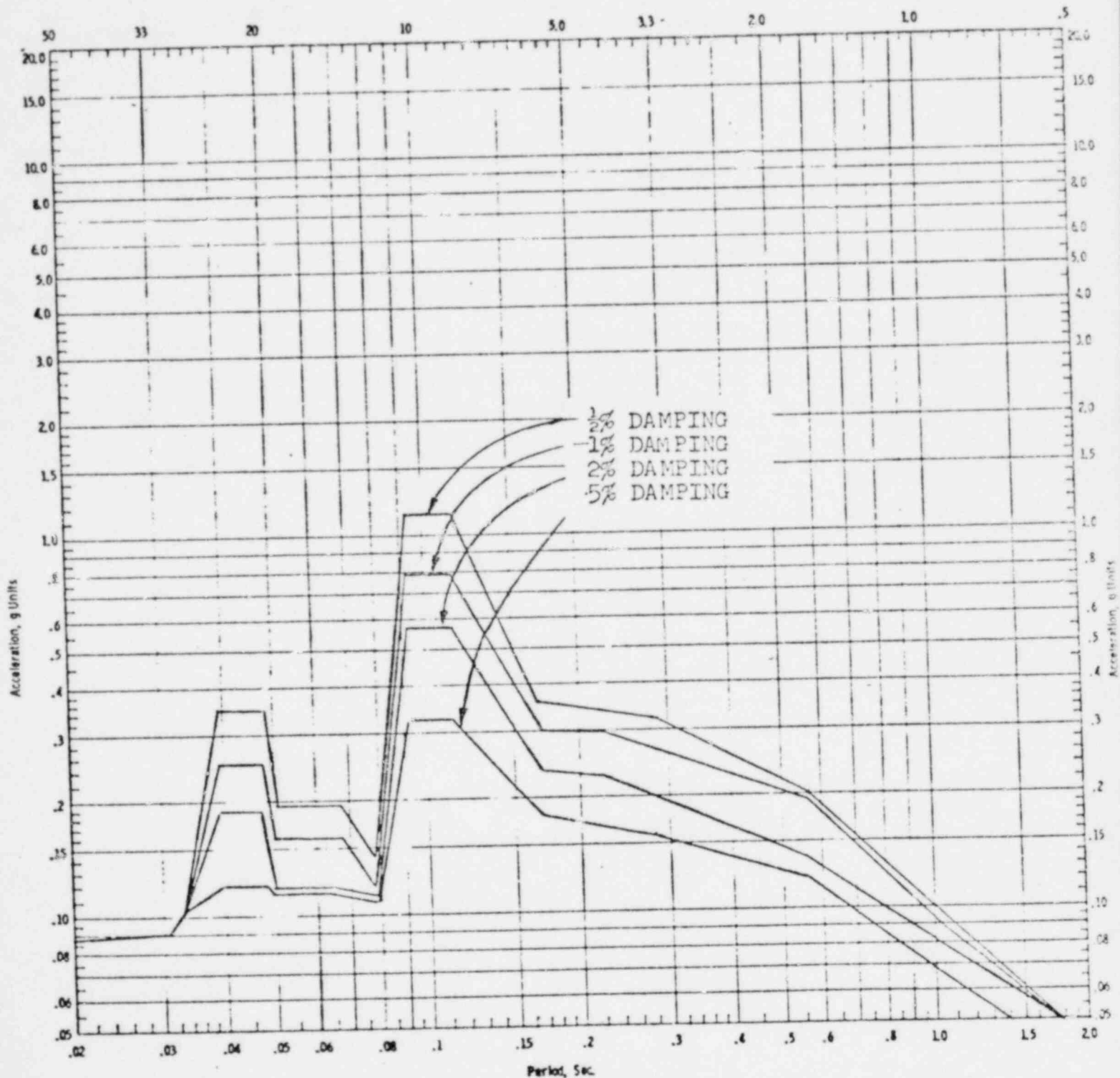
APPENDIX A

SL-3147

Rev. 1, 11-15-76

REV. NO.	1					
DATE	12-15-76					
INITIALS	K K S					

Frequency, CPS



HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE
R.H.R. COMPLEX, NORTH-SOUTH
COMPONENT SLAB NO. 1,
ELEVATION: 590'-0"

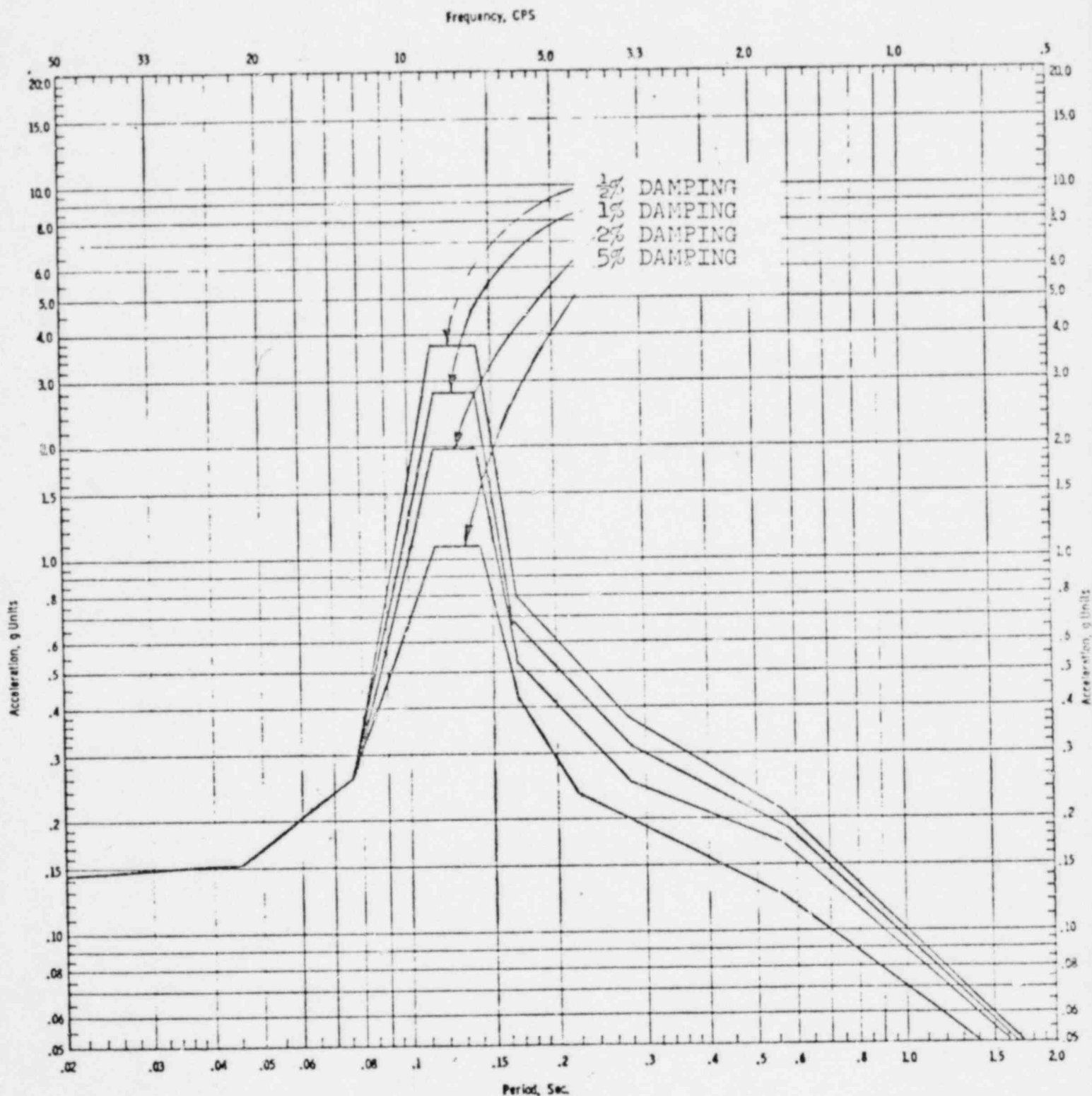
SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON
 PROJECT ENRICO FERMI
 DESIGN BY CLM
 CHECKED BY SGM

APPENDIX A
 SL-3147
 Rev. 1, 11-15-76

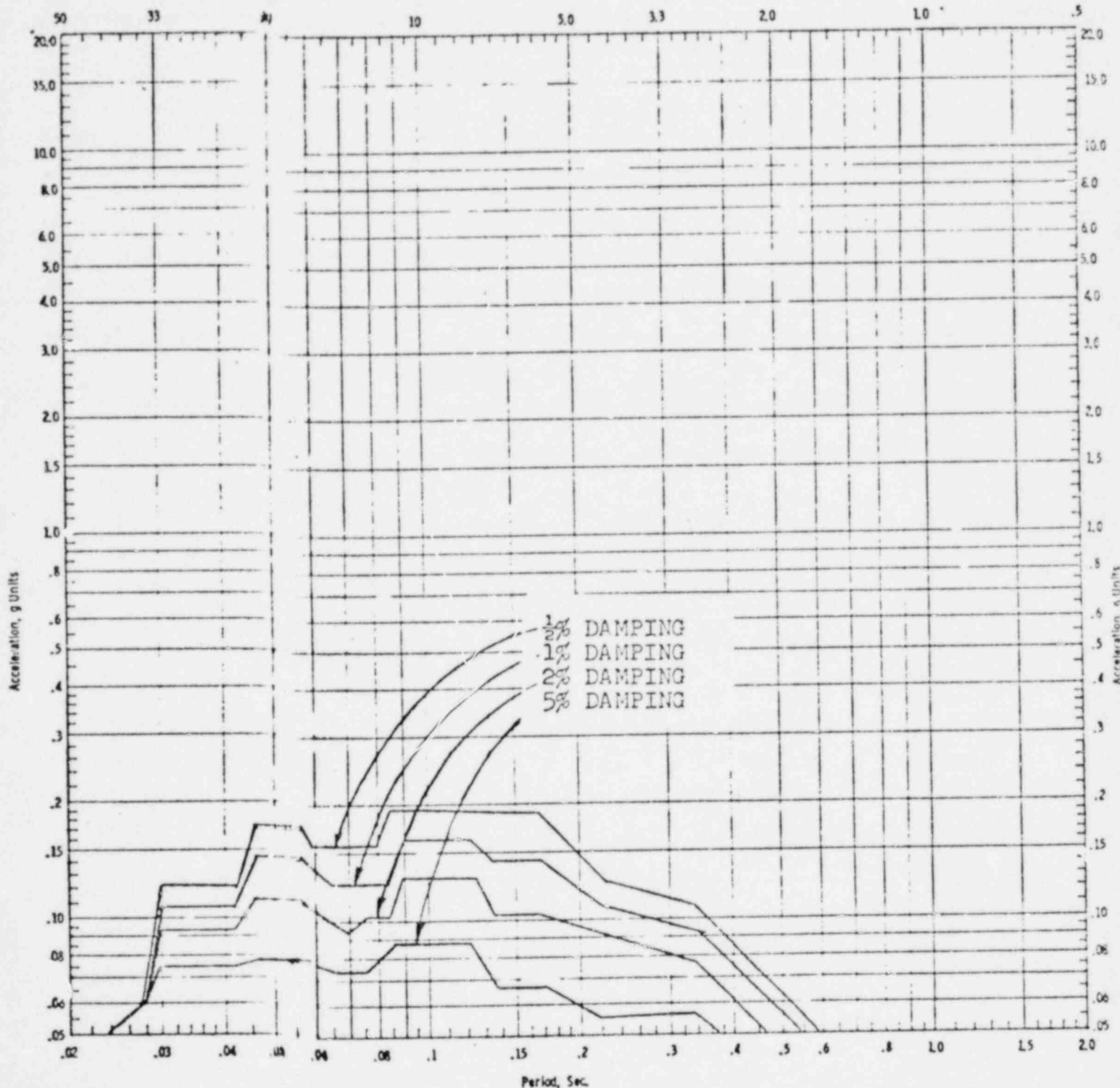
REV. NO.	1								
DATE	12-15-76								
INITIALS	K K S								



HORIZONTAL FLOOR RESPONSE SPECTRA
 OPERATING BASIS EARTHQUAKE
 R.H.R. COMPLEX, EAST-WEST
 COMPONENT SLAB NO. 1,
 ELEVATION: 590'-0"

REV. NO.	1								
DATE	10-16-74								
INITIALS	K K S								

Frequency, CPS

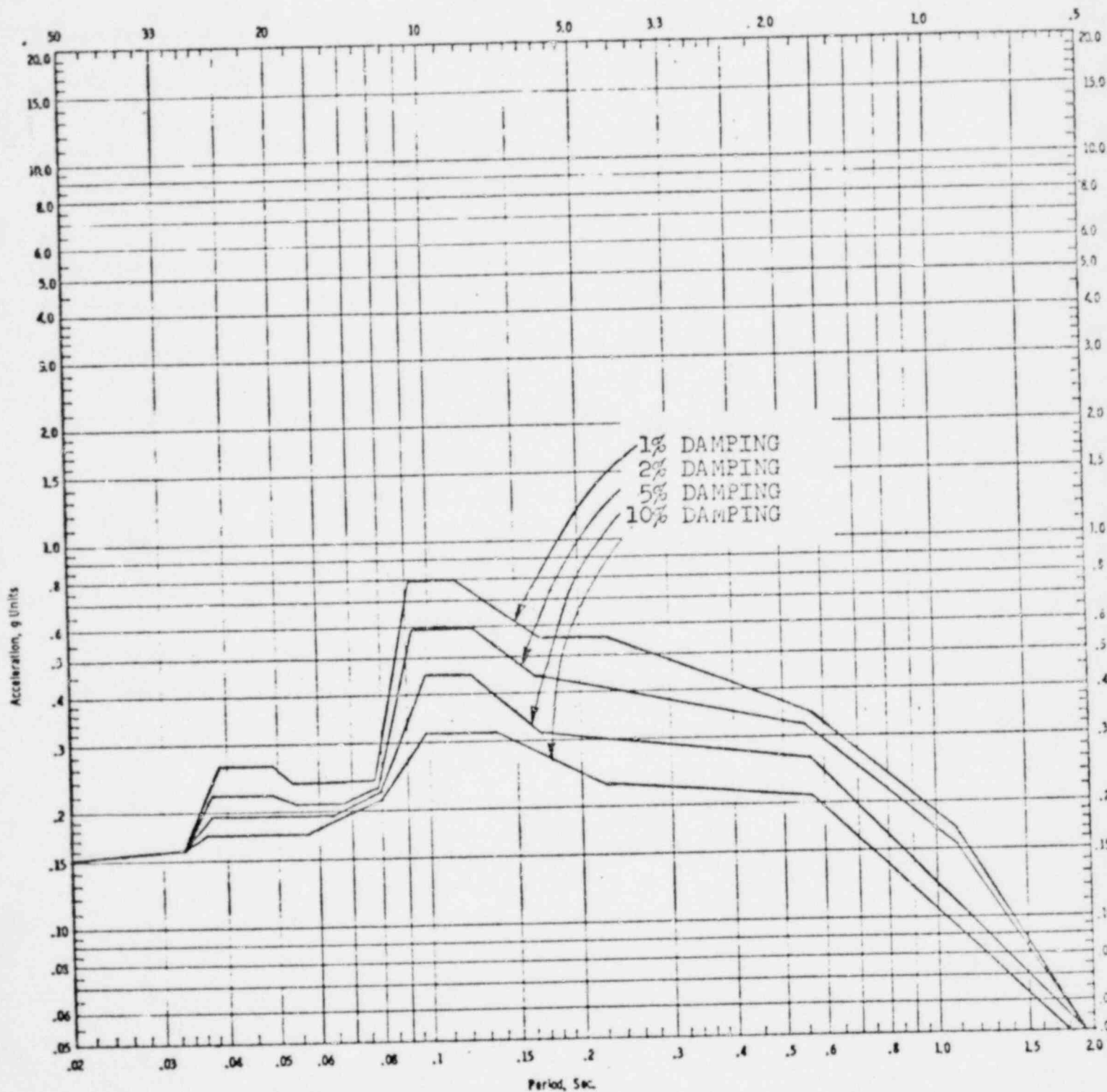


VERTICAL RESPONSE SPECTRA
 OPERATING BASIS EARTHQUAKE
 R.H.R. COMPLEX, WALLS AND
 STAIR NO. 1A, ELEVATION: 590'-0"

109-05-VW

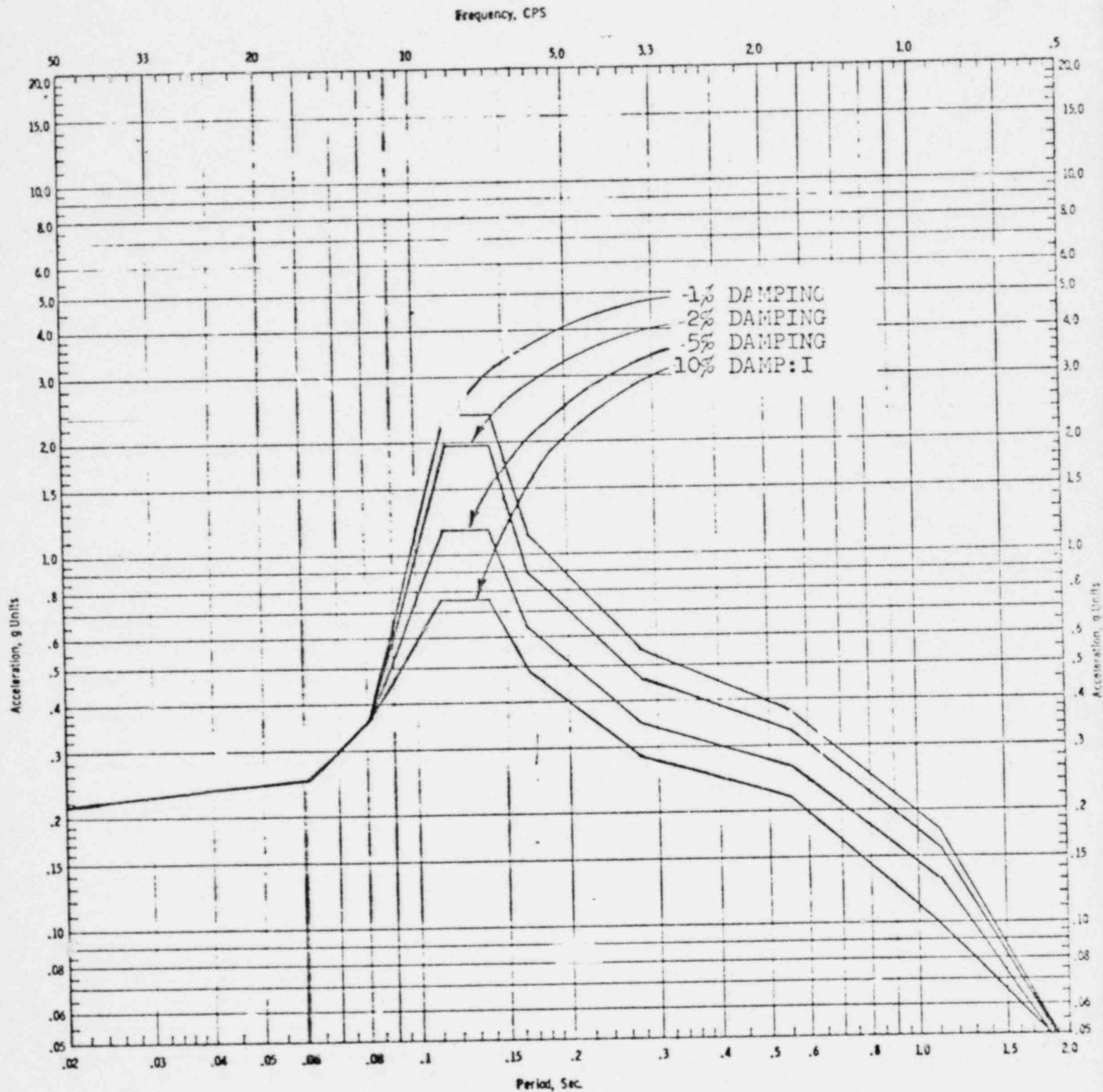
REV. NO.	1						
DATE	10-1-76						
INITIALS	K.A.S.						

Frequency, CPS



HORIZONTAL FLOOR RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE
 R.H.R. COMPLEX, NORTH-SOUTH
 COMPONENT SLAB NO. 1
 ELEVATION: 590'-0"

REV. NO.	1								
DATE	12-16-74								
INITIALS	M.K.S								



HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE
R.H.R. COMPLEX, EAST - WEST
COMPONENT SLAB NO. 1,
ELEVATION: 590'-0"

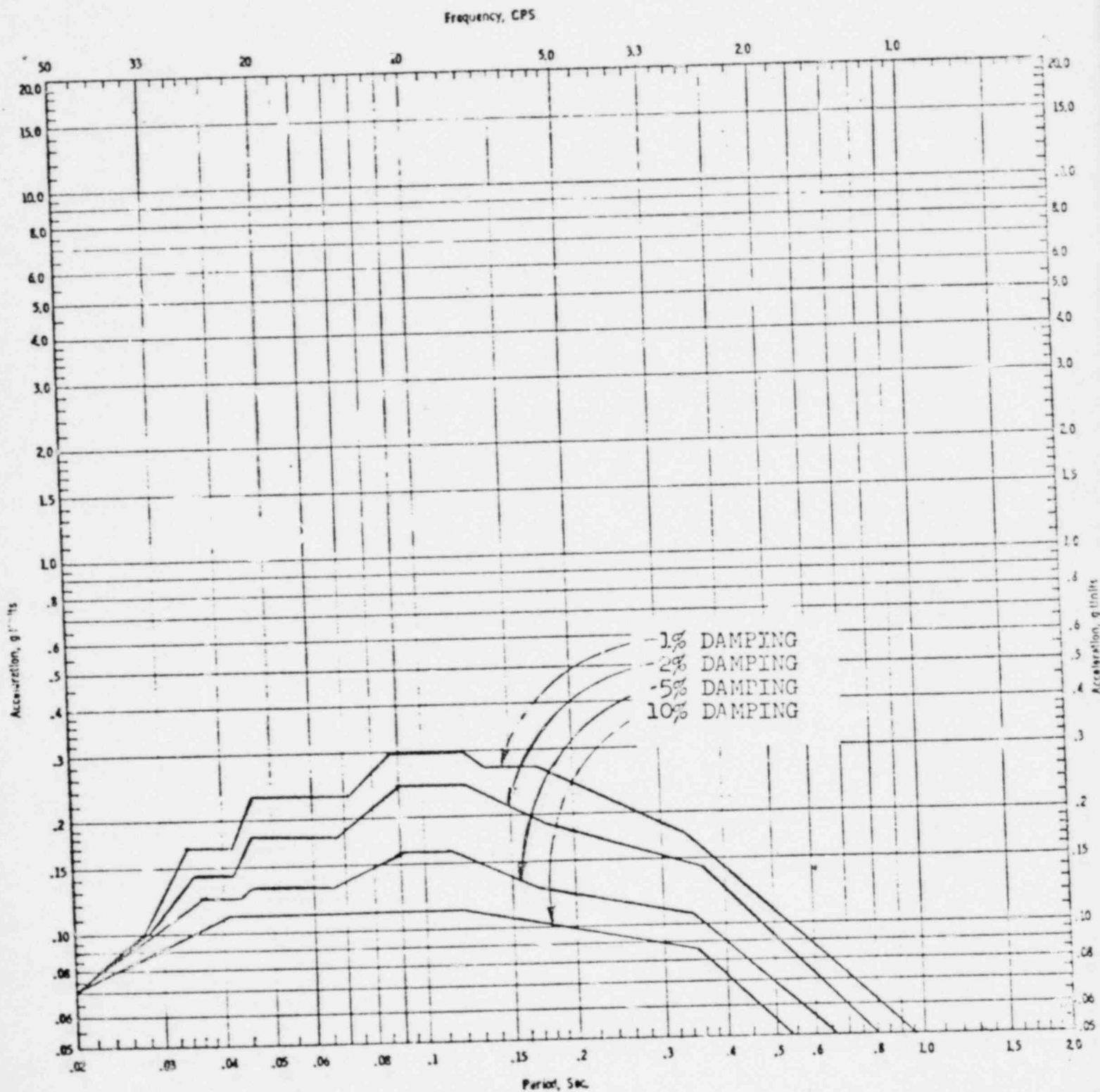
SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON
 PROJECT EMISCO FERRI
 DESIGN BY CLM
 CHECKED BY SGM

APPENDIX B
 SL-3147
 Rev. 1, 11-15-76

REV. NO.	1								
DATE	12-16-76								
INITIALS	K K S								



VERTICAL RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE
 R.H.R. COMPLEX, WALLS AND
 SLAB NO. 1A, ELEVATION: 590'-0"

115-DB-VW

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: DG. Service Water Pump Assembly (Pump and Motor)

EQUIPMENT NO. : R3000C005/C006/C007/C008 SPEC. NO.: DECO 3071-134

LOCATION: RHR Complex Elevation 590'-0"

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE

QUALIFICATION DOCUMENT REFERENCES:

1. McDonald Engineering Analysis Co. Report #ME-230, dated June 20, 1975.
2. Goulds Pumps Drawing No. N-302276, Rev. B2, Pump Outline Drawing.
3. Detroit Edison File No. S22-189 Pump Assembly Drawing.
4. Detroit Edison Specification 3071-134.
5. Sargent & Lundy SL-3147, Rev. 1, 11-15-76, Appendices A and B.

Prepared by: *Henry M. Spick*
Reviewed by:
Approved by:Date: 7-14-81
Date:
Date:

QUALIFICATION SUMMARYLOAD COMBINATIONS CONSIDERED:

OBE/SSE Seismic Loads

ORIGINAL QUALIFICATION METHOD:

A multidegree of freedom modal analysis was performed using the computer program ICES-STRUDL-IL. Type of elements used in analysis were beam.

Seismic Loads were combined with normal operating seismic loads and stresses were compared with allowables.

REQUALIFICATION METHOD:

The new response spectra curves will be compared with curves used in original qualification. The additional stresses due to new more conservative G values will be added to existing actual stresses and the results were compared with code allowables.

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME:

FERMI - Unit 2

TYPE:

1. Utility: Detroit Edison Company

PWR ☐

2. NSSS: General Electric

BWR ☒

3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME:

Diesel Generator Service Water Pump Assemblies

1. Scope: ☐ NSSS ☒ BOP 50 HP, 1760 RPM VSS

2. Model Number: 8x12 JMC-2 STC/HT PI (ENCL.) Quantity: 4

3. Vendor: Goulds Pumps, Inc./Allis-Chalmers Corp. ^{326 VP Frame}

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description Appearance: Vertical Turbine Pump

Mounted to a vertical motor via a coupling.

Dimensions: 43'-11 5/8" (long) X 11 3/8" (dia.) Weight: 4990 lbs. ^{total w/}

6. Location: Building: RHR Complex Elev.: 590'-0"

7. Field Mounting Conditions:

☒ Bolting: Number: 4 Size: 7/8"Ø☐ Welding: Weld Type: _____

Leg: _____ Length: _____ Pitch: _____

☐

8. Natural frequencies in each direction:

Lateral : 0.64, 4.34, 12.77, 14.24, 25.74 Hz

Vertical: >33 Hz

9. Method of determining natural frequencies:

☐ Laboratory Test☒ Analysis☐ Other _____

10. a. System in which located: D.G.

b. Functional description: Maintain Service Water temperature to the Emer. D.G. system

c. Equipment required for:

☒ Hot Standby☐ Cold Shutdown☒ Post LOCA

11. Pertinent reference design specifications: DECO 3071-134

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☒ Analysis
☐ Combination of Test and Analysis

1. Qualification Report

a. Title: "Seismic Stress Analysis of ASME Section III Class 3 Pumps" MDLWIT Size 8 x 12 JMC-2.

b. Number and Date: ME-230 June 20, 1975

2. Company that prepared report: McDonald Engineering Analysis Co.

3. Company that reviewed report: The Detroit Edison Company

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only
☐ Hydrodynamic only
☐ Seismic and Hydrodynamic
☐ Other (Specify): _____
☐ _____

2. Required response spectra (attach the graphs):

SL-3147, Rev. 1, 11-15-76, A-6, A-7, B-6, B-9, B-10

3. Method of combining Requiring Response Spectra:

☒ Absolute Sum

☐ SRSS

4. Damping Upset (OBE): 1% Basis for damping: Reg. Guide 1.61
Emerg. (SSE): 2%

5. Required acceleration in each direction (if required):

☐ ZPA ☐ Other (Specify): _____

Upset (OBE): F/B= _____ S/S= _____ V= _____

Emerg. (SSE): F/B= _____ S/S= _____ V= _____

6. Were fatigue effects or other vibration loads considered?

☐ Yes Describe loads and how they were treated in overall qualification program: _____

☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE: N/A

1. Test Method: ☐ Single frequency: _____
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____
10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☐ Static analysis
☐ Static coefficient analysis
☒ Dynamic analysis: ☒ Response spectrum
☐ Time history
2. Model type:
☐ 1-dimensional
☒ 2-dimensional
☐ 3-dimensional

3. Method of analysis:

☒ Computer-aided calculation
programs used: ICRS-STRUDL II

☐ Hand calculations

☐

4. Have equipment supports been adequately considered in analysis: ☒ Yes ☐ No

5. Stress evaluation at critical structural elements:

*See Comments.

Element	Calc Stress	Allow Stress
Maximum Column Stress, PSI	7,586	24,750
Max. Column Flange Stress, PSI	13,178	28,875
Bolt Stress, PSI	24,320	27,500
Max. Pump Flange Stress, PSI	2,694	23,100
Bolt Stress, PSI	9,496	27,500
Max. Pump Casing Stress, PSI	1,688	14,000
Max. Shaft Stress, PSI	7,709	10,000
Motor Hold Down Bolt Stress, PSI		
Tensile	133	27,500
Shear	488	13,750
Shaft Key Stress, PSI	4,000	10,000
Nozzle Stress, PSI	14,550	24,750
Nozzle Flange Equivalent Pressure, PSIG	237	275
Anchor Bolt Stress, PSI		
Tensile	10,578	22,000
Shear	2,139	11,000
Discharge Head Hold Down Bolts		
Tensile	11,003	27,500
Shear	1,913	13,750
Discharge Head Stress, PSI	4,010	24,750
Discharge Head Flange Stress, PSI	7,326	28,875
Discharge Head Weld Stress, PSI	6,104	16,500

3. Method of analysis:

☐ Computer-aided calculation
programs used: _____☐ Hand calculations☐ _____4. Have equipment supports been adequately considered in
analysis: ☐ Yes ☐ No

5. Stress evaluation at critical structural elements:

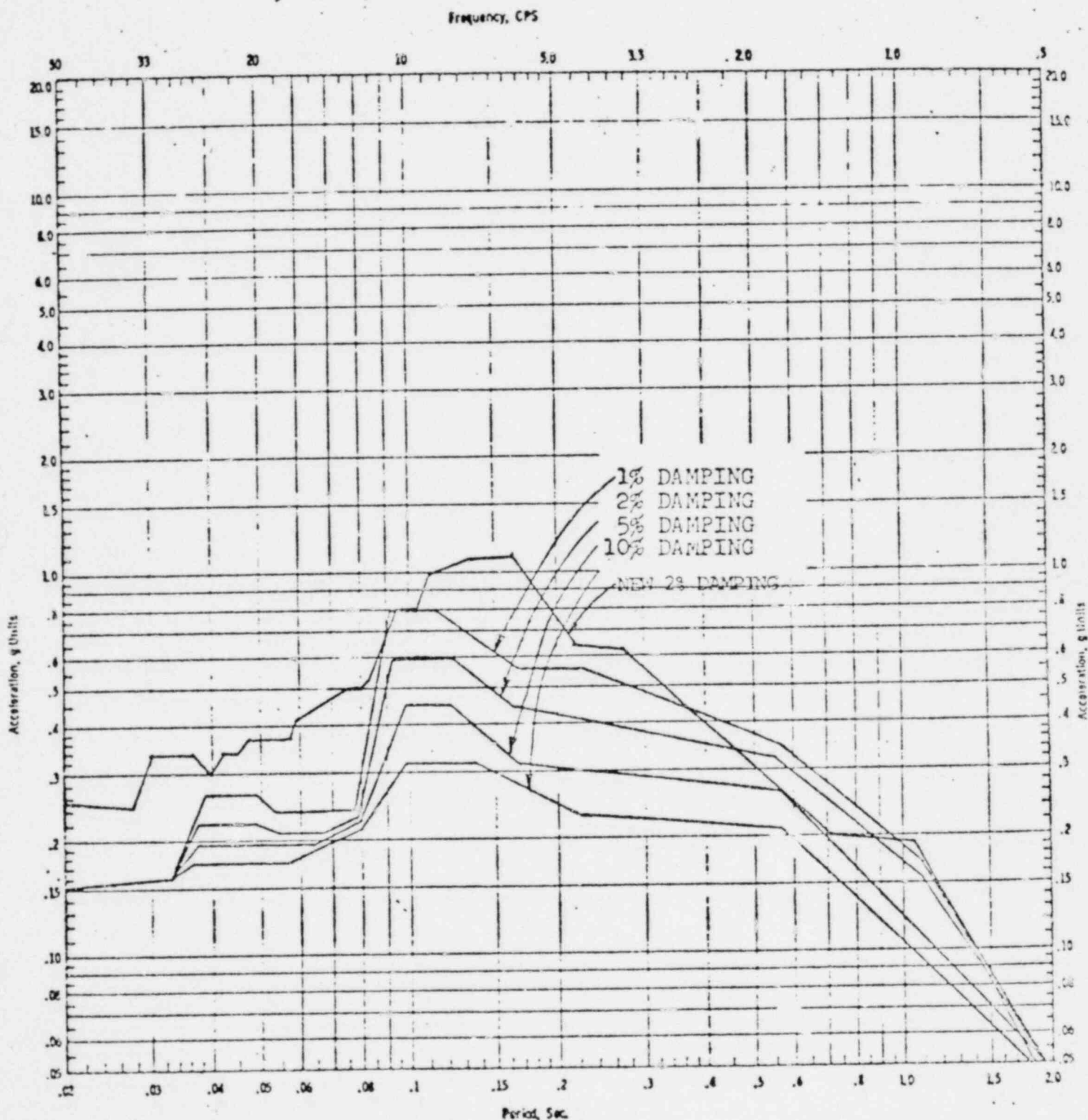
Element	Calc Stress	Allow Stress

6. Deflection evaluation at critical structural elements
(active equipment only)

Element	Calc Stress	Allow Stress
Shaft Deflection, Inches	.035	.05
Impeller Deflection (clearance), Inches	.00001	.009

VIII. ADDITIONAL COMMENTS:OBE \neq SSE Values; OBE values in general are bounding.

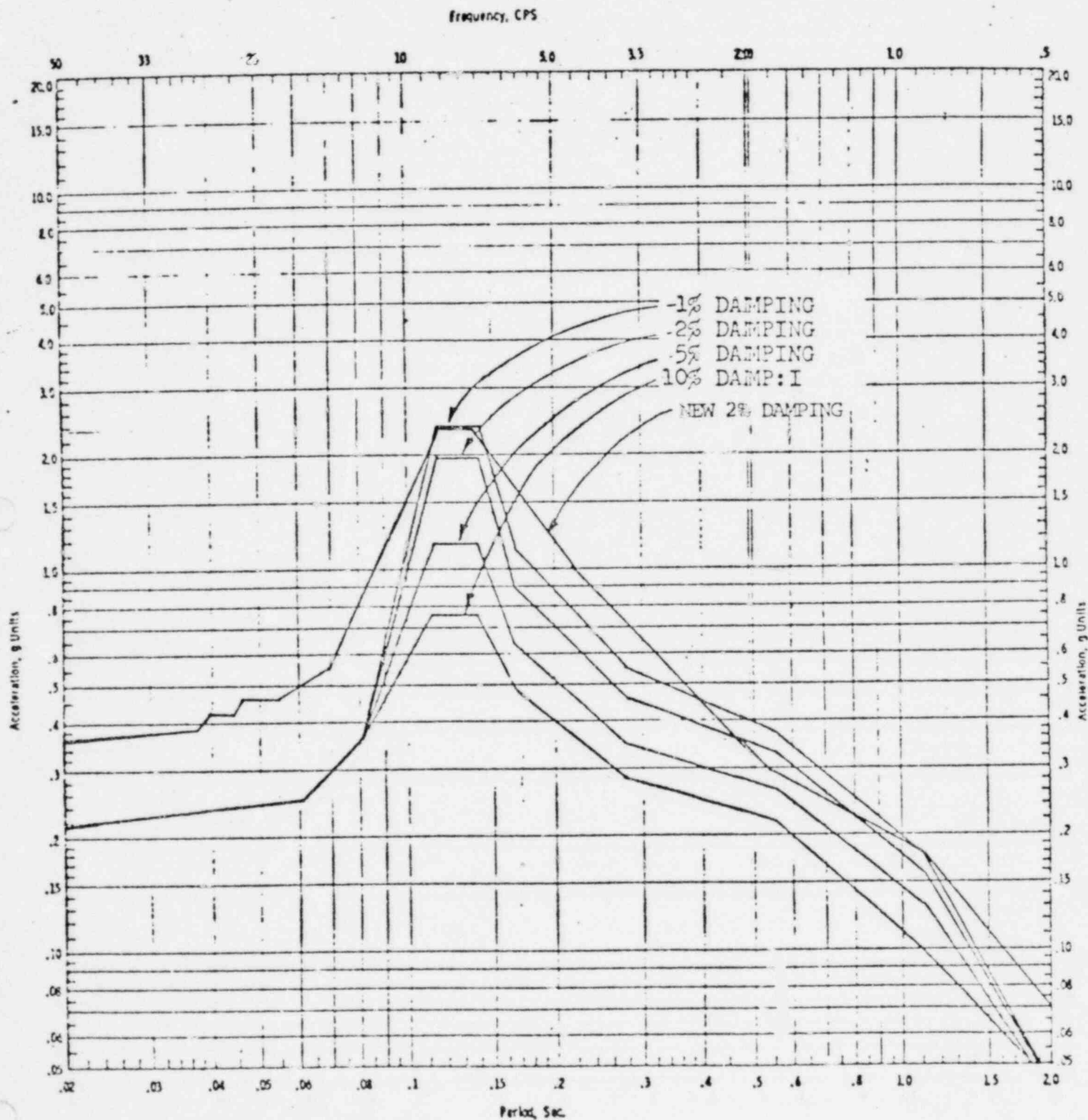
REV. NO.	1								
DATE	11-15-76								
INITIALS	K.K.S.								



HORIZONTAL FLOOR RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE
 R.H.R. COMPLEX, NORTH-SOUTH
 COMPONENT SLAB NO. 1
 ELEVATION: 590'-0"

Fig#1

REV. NO.	1								
DATE	10-16-74								
INITIALS	K.K.S.								



HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE
R.H.P. COMPLEX, EAST - WEST
COMPONENT SLAB NO. 1,
ELEVATION: 590'-0"

Fig#2

A-7

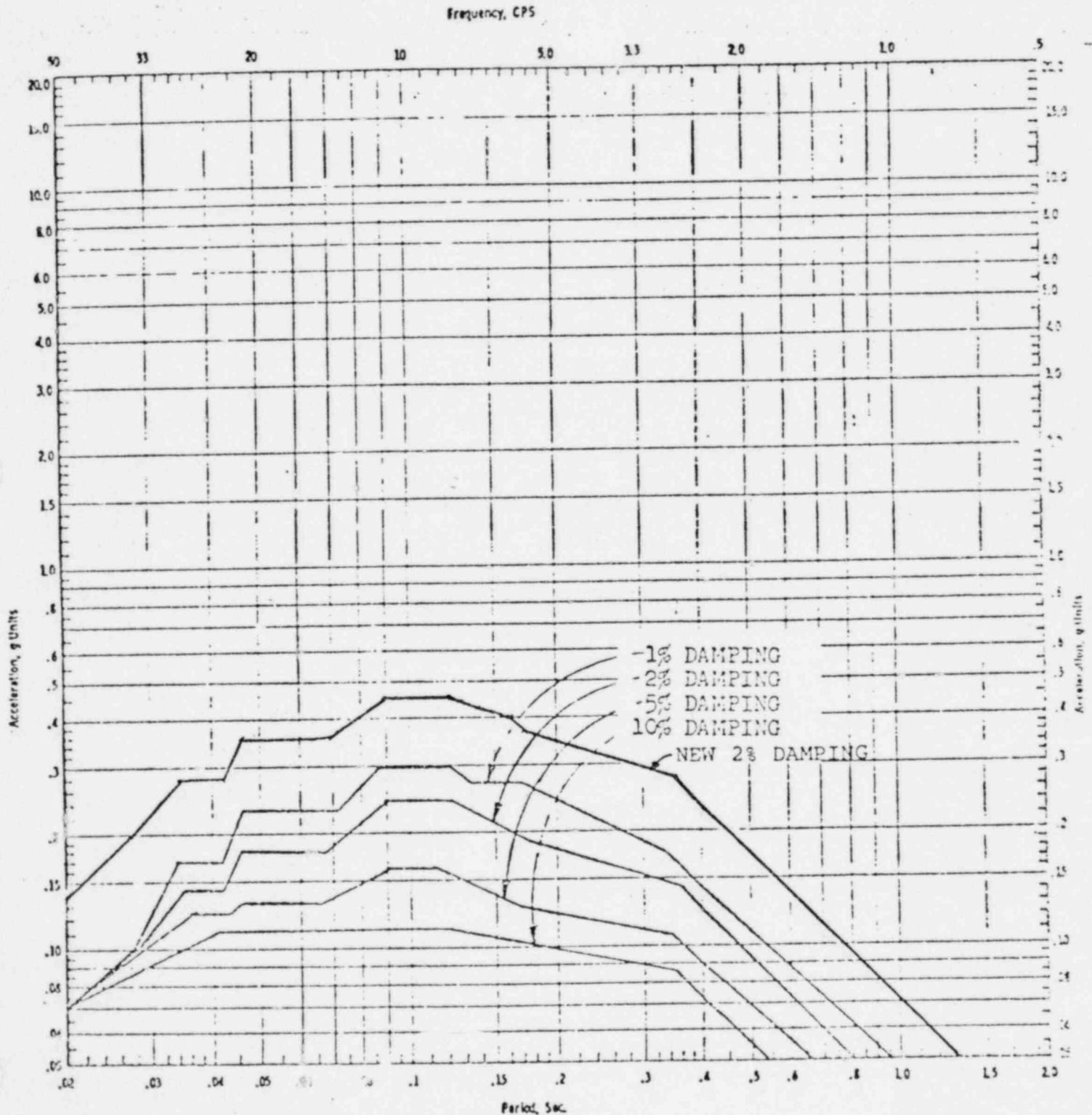
SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON
 PROJECT ENRICO FERMI
 DESIGN BY CLM
 CHECKED BY SGM

APPENDIX B
 SL-3147
 Rev. 1, 11-15-76

REV. NO.	1								
DATE	10-18-76								
INITIALS	K K S								

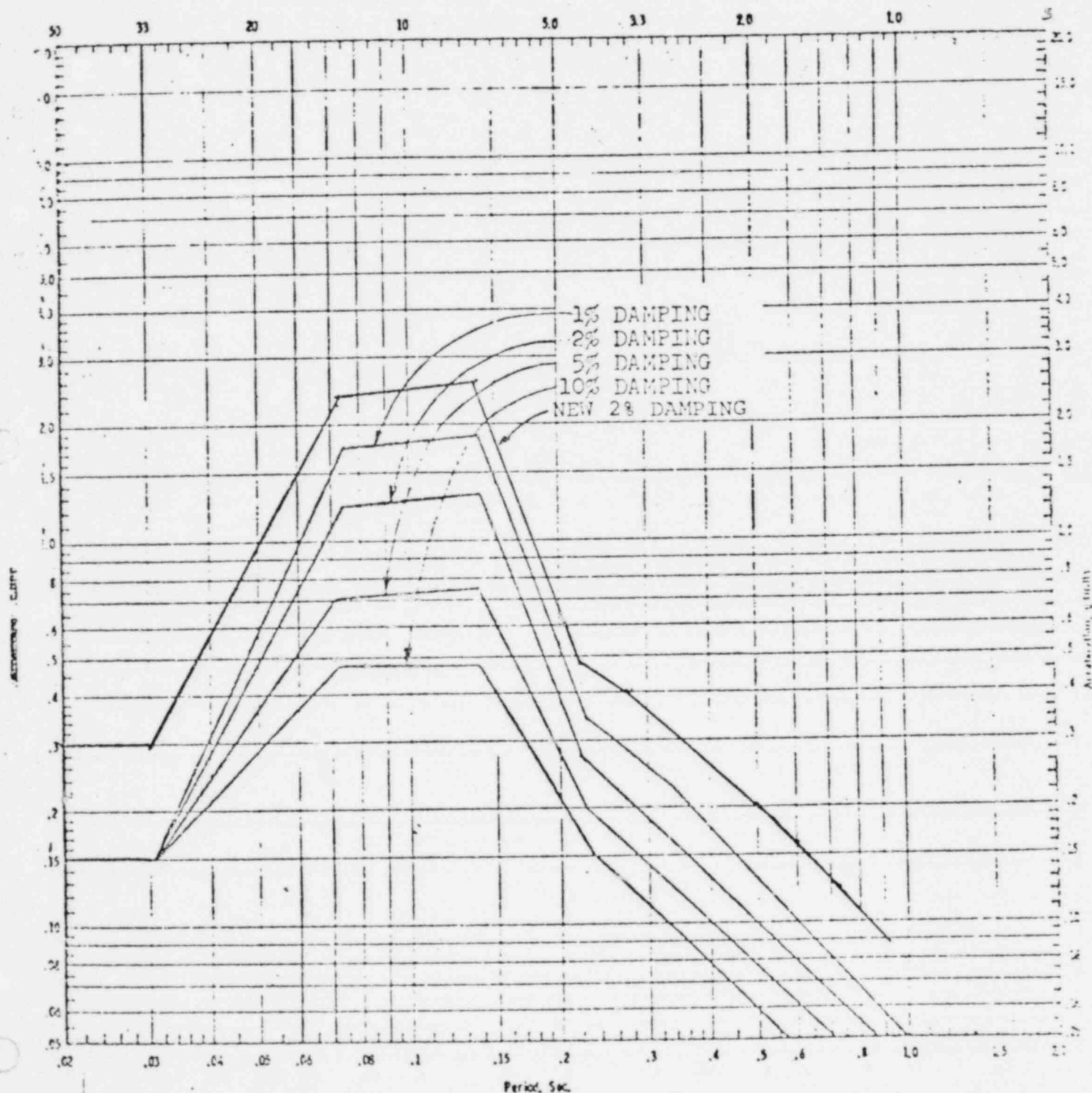


VERTICAL RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE
 SARGENT & LUNDY ENGINEERS

Fig#13

REV. NO.	1								
DATE	10-18-74								
INITIALS	K K S								

Frequency, CPS



VERTICAL RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE
 R.H.R. COMPLEX,
 SLAB NO. 1B, ELEVATION: 590'-0"

116-DB-VS

Fig #4

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT EMIGO FERRI

DESIGN BY CLM

CHECKED BY SGM

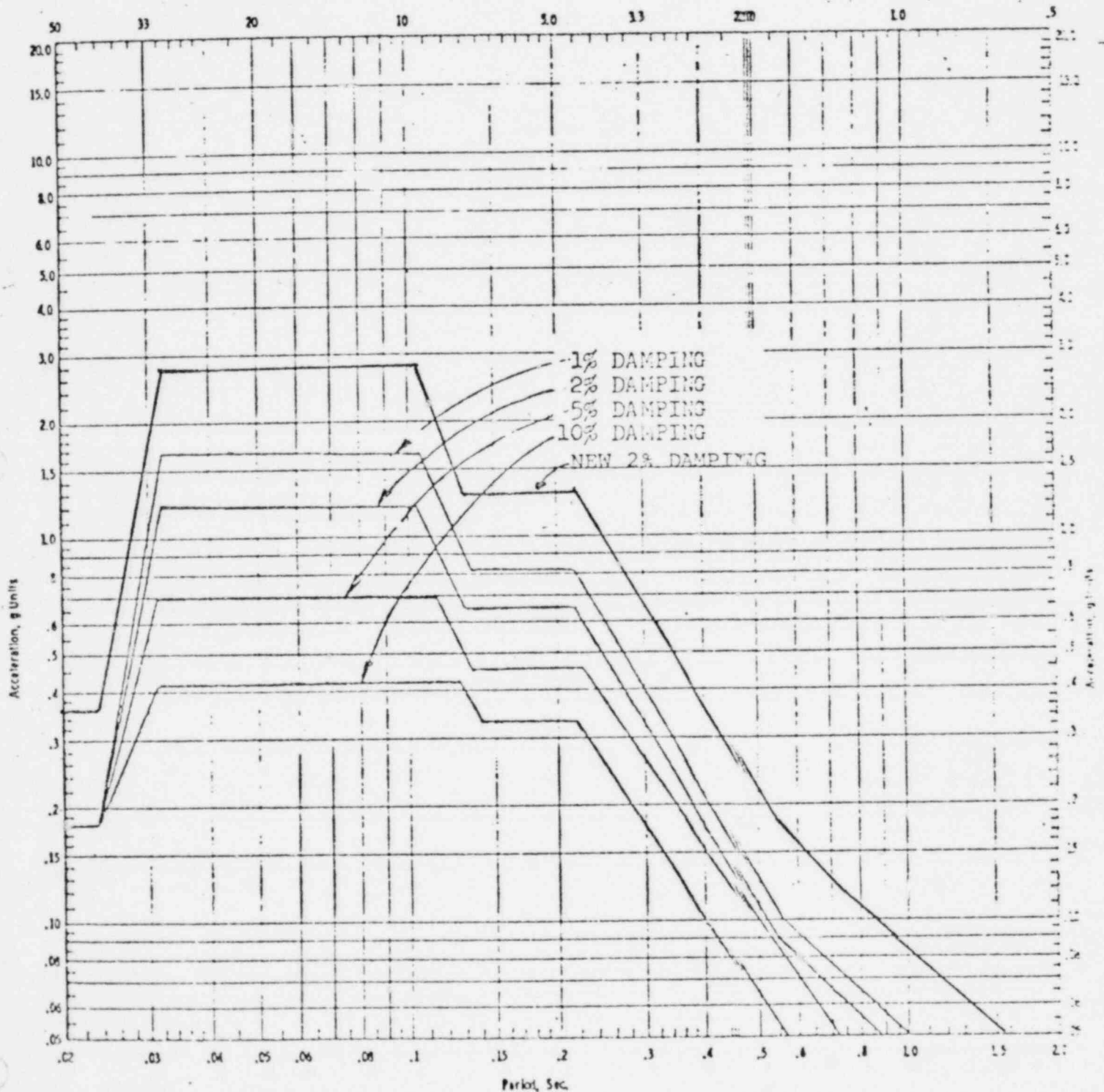
APPENDIX B

SL-3147

Rev. 1, 11-15-75

REV. NO.	1					
DATE	12-18-74					
INITIALS	K K S					

Frequency, CPS



VERTICAL RESPONSE SPECTRA

DESIGN BASIS EARTHQUAKE

R.H.R. COMPLEX

SLAB NO. 10, ELEVATION: 590'-0"

Fig#5

117-DB-VS

B-10

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: RHR COOLING TOWER

EQUIPMENT NO. : E1156B001A E1156B002A SPEC. NO.: 3071-93
E1156B001B E1156B002B

LOCATION: RHR Complex (Top of Cooling Tower - Elev. 637'6")

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE

QUALIFICATION DOCUMENT REFERENCES:

1. S&L Fermi-2 Drawings: M-6 Rev. C Dated 1-11-80
M-7 Rec. E Dated 3-13-81
M-8 Rev. B Dated 7-12-78
M-9 Rev. B Dated 7-12-78
M-10 Rev. D Dated 8-22-78
M-11 Rev. C Dated 3-13-81
2. EMD File #011785, Enrico Fermi Atomic Power Plant, Unit #2, Residual Heat Removal Service Water System Cooling Tower Component Design Criteria and Design Calculations, Dated February 8, 1974 by the Marley Co.
3. Westinghouse Drawing No. KC-67605, Sh. 1, Dated 3/4/73; Sh. 2, Dated 2/12/74.
4. Marley Company Drawings Nos: SD 72-4361 Rev. C Dated 5/17/74
SD 72-4362 Rev. C Dated 5/17/74
SD 72-4363 Rev. C Dated 5/17/74
73-41173 Dated 4/18/73
74-452 Rev. A Dated 7/17/74
74-453 Rev. A Dated 5/17/74
74-455 Rev. A Dated 5/17/74
74-4843 Dated 2/11/74
5. S&L Report #2682, Dated 9/27/74.

Prepared by: *Thomas E. Fornek*
Reviewed by:
Approved by:Date: 7-14-81
Date:
Date:

QUALIFICATION SUMMARYLOAD COMBINATIONS CONSIDERED:

1. Tornado Loads, dead loads, operating loads.
2. Seismic loads, dead loads, operating loads.

ORIGINAL QUALIFICATION METHOD:

The original qualification of this equipment consisted of the analysis of the various subsystems of the equipment. The subsystems analyzed were: Spray System; Fill System; Eliminators; Fill and Eliminator retainers; Equipment Supports. Natural frequencies and damping values for the ACB Fill Bundle were determined by testing. Natural frequency and damping values for the Belgium Wave Eliminator were determined by testing. All mechanical equipment was assumed to be rigid. Piping and concrete beam supports were analyzed using a response spectrum dynamic analysis. The motor supports, pipe supports and mist and eliminator retainers were considered in the analysis. In all cases where tornado loads were applicable the tornado loads were much higher than the seismic loads and the tornado loads were used in the analysis.

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME: FERMI - Unit 2 TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME: RHR Cooling Tower

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: Not Applicable Quantity: 4
3. Vendor: Marley Co.
4. If the component is a cabinet or panel, name and model No. of the devices included: Not Applicable
5. Physical Description Appearance: Fans, motors, piping
contained in a concrete structure* See
Dimensions: Approx. 73'6" x 45' Weight: Attachment A
6. Location: Building: RHR Complex Elev.: 637'6" Top of
Cooling Tower
7. Field Mounting Conditions: Motor - 4 Motor - 3/4" Dia.
☒ Bolting: Number: Fan - 3 Size: Fan - 1" Dia.
☐ Welding: Weld Type: _____
Leg: _____ Length: _____ Pitch: _____
☐ _____
8. Natural frequencies in each direction:
Front to back: Rigid
Side to side: 5.86 Hz (Cross-Beam)
Vertical: 9.49 Hz (Cross-Beam)
9. Method of determining natural frequencies:
☒ Laboratory Test
☒ Analysis
☐ Other _____
10. a. System in which located: RHR
b. Functional description: Required for removing residual
heat from the service water system.
c. Equipment required for:
☒ Hot Standby ☒ Cold Shutdown ☒ Post LOCA

*Concrete structure is part of the RHR complex and not included in this qualification.

11. Pertinent reference design specifications: 3071-92

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☐ Analysis
☒ Combination of Test and Analysis

1. Qualification Report
a. Title: Enrico Fermi Atomic Power Plant Unit #2 Residual Heat Removal Service Water System Cooling Tower Design Criteria and Design Calculations
b. Number and Date: EMD File #011785 Dated 1-16-78
2. Company that prepared report: The Morley Co.
3. Company that reviewed report: Sargent & Lundy

V. VIBRATION INPUT:

1. Loads considered: ☐ Seismic only
☐ Hydrodynamic only
☐ Seismic and Hydrodynamic
☒ Other (Specify): Tornado loads,
☐ Seismic loads

2. Required response spectra (attach the graphs):

A-6, A-7, A-8, A-9, B-8, B-11 of SL-3147

3. Method of combining Requiring Response Spectra:

- ☒ Absolute Sum
☐ SRSS

4. Damping Upset (OBE): Basis for damping: Reg. Guide
Emerg. (SSE): 1.61 and Testing

*5. Required acceleration in each direction (if required):

☐ ZPA ☐ Other (Specify):

Upset (OBE): F/B= S/S= V=

Emerg. (SSE): F/B= S/S= V=

6. Were fatigue effects or other vibration loads considered?

☐ Yes Describe loads and how they were treated in overall qualification program:

☒ No

*Response Spectrum Dynamic Analyses were performed.

VI. IF QUALIFICATION BY TEST, THEN COMPLETE:

1. Test Method: ☐ Single frequency: _____
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____

10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☒ Static analysis
☐ Static coefficient analysis
☒ Dynamic analysis: ☒ Response spectrum
☐ Time history
2. Model type:
☒ 1-dimensional
☐ 2-dimensional
☐ 3-dimensional

3. Method of analysis:

☒ Computer-aided calculation
programs used: _____☒ Hand calculations☐ _____4. Have equipment supports been adequately considered in
analysis: ☒ Yes ☐ No

5. Stress evaluation at critical structural elements:

Element	Calc Stress	Allow Stress
1. Fill Retainer Bolt Shear Stress	8.22 Ksi	14.40 Ksi
2. Fill Retainer Angle Bending Stress	4.87 Ksi	24.00 Ksi
3. Eliminator Reatiner Bending Stress	19.35 Ksi	24.00 Ksi
4. Eliminator Retainer Bolt Tension	23.10 Ksi	26.60 Ksi
5. Geareducer Anchor Bolt Tension	17.28 Ksi	26.60 Ksi
6. Motor Anchor Bolt Shear	.58 Ksi	13.30 Ksi
7. Branch Arm Pipe Support Anchor Bolt Shears	7.18 Ksi	13.30 Ksi

6. Deflection evaluation at critical structural elements
(active equipment only)

Element	Calc Stress	Allow Stress
1) No Critical Deflections		

VIII. ADDITIONAL COMMENTS:

No comments.

FERMI UNIT 2
EQUIPMENT DYNAMIC
QUALIFICATION SUMMARY

Project #6139-40
EMD File #

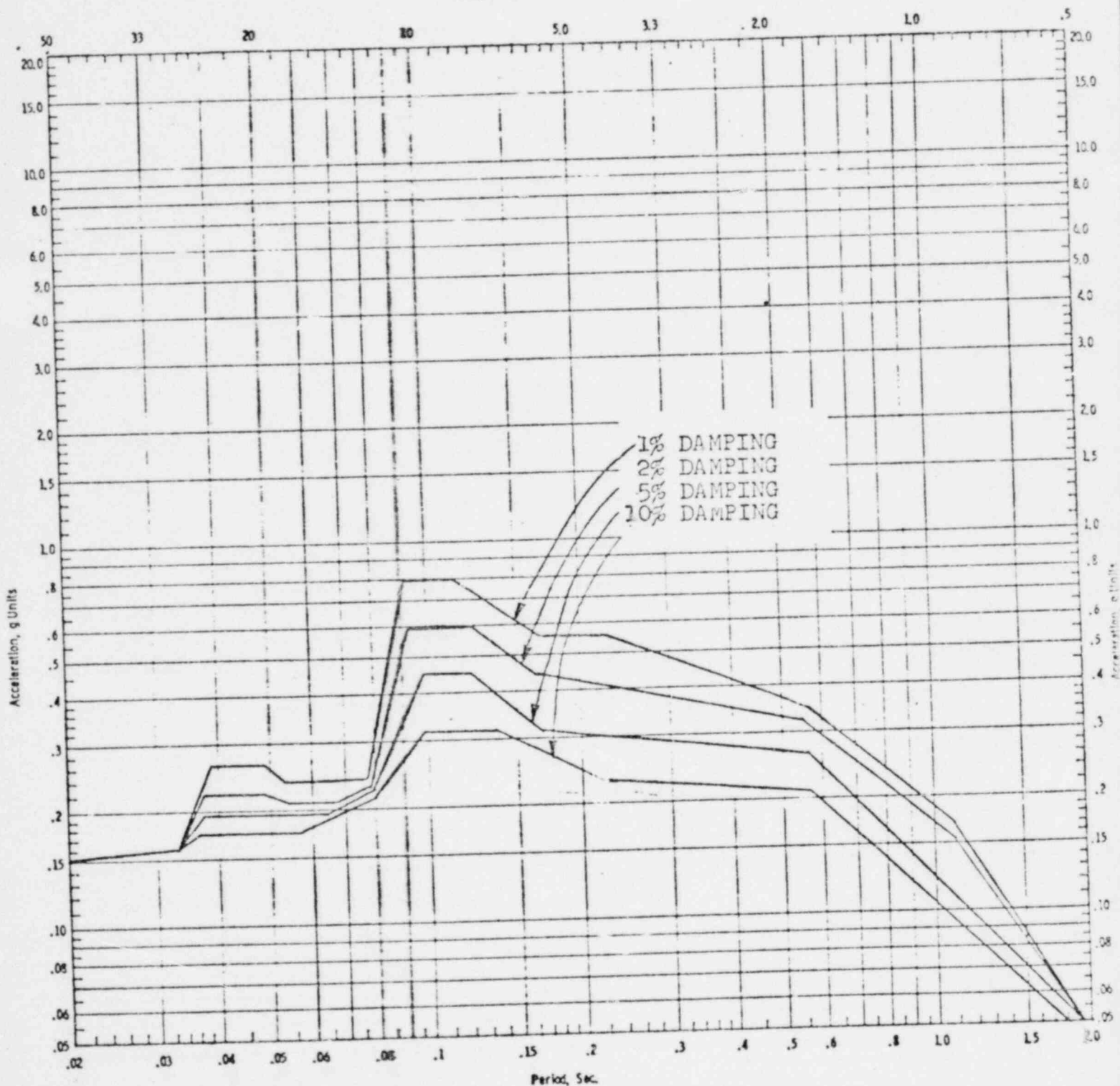
ATTACHMENT A

WEIGHTS OF COOLING TOWER COMPONENTS

- | | |
|-------------------|-------------------|
| 1) #36 Geareducer | 3,150 Lb. |
| 2) 240" Dia. Fan | 1,913 Lb. |
| 3) 150 H.P. Motor | 2,510 Lb. |
| 4) Drive Shaft | 142 Lb. |
| 5) Fill | 240,000 Lb. (Wet) |
| 6) Eliminators | 39,000 Lb. (Wet) |

REV. NO.	1								
DATE	10-15-74								
INITIALS	K.A.S.								

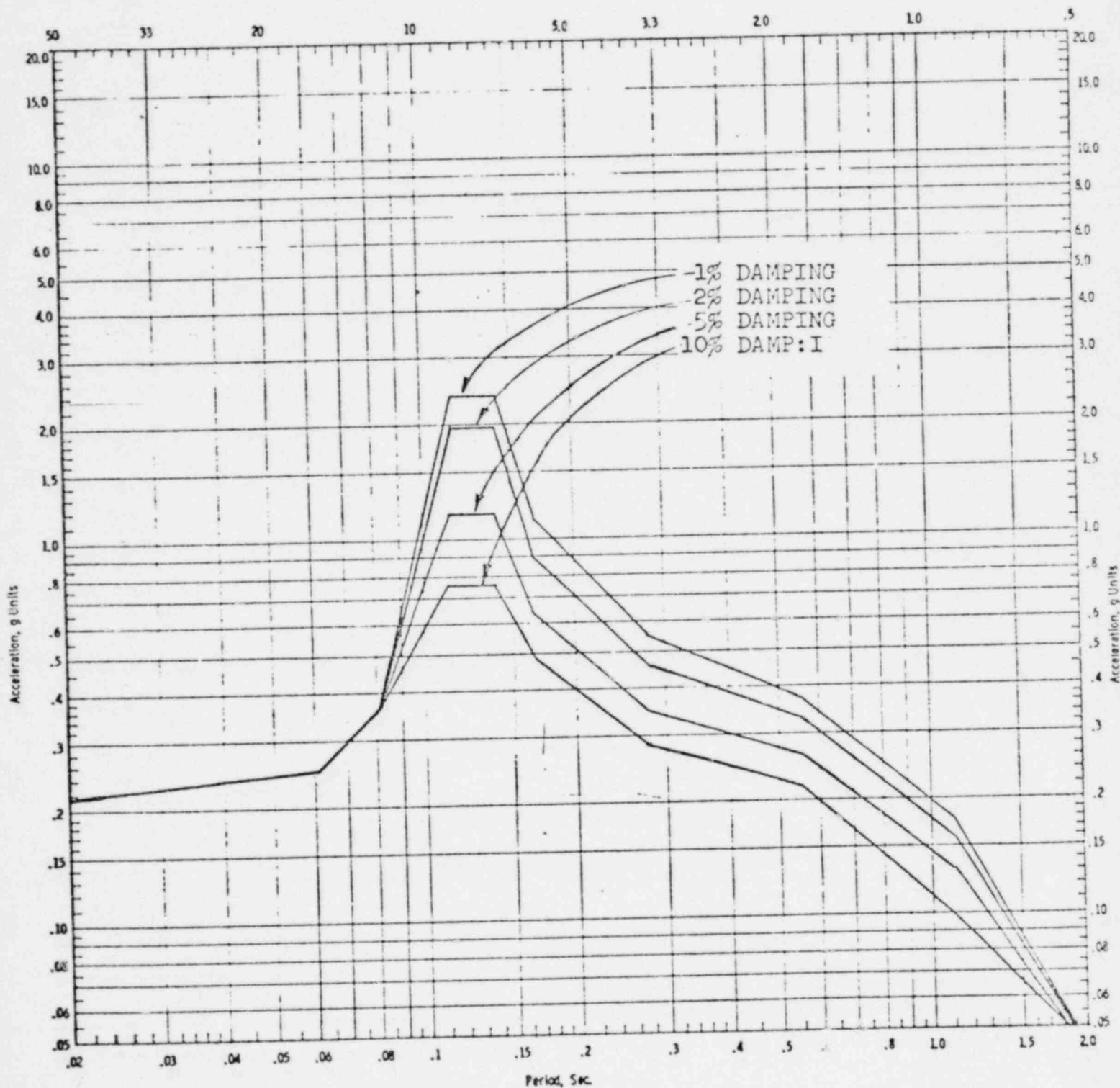
Frequency, CPS



HORIZONTAL FLOOR RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE
 R.H.R. COMPLEX, NORTH-SOUTH
 COMPONENT SLAB NO. 1
 ELEVATION: 590'-0"

REV. NO.	1								
DATE	12-16-74								
INITIALS	K.K.S								

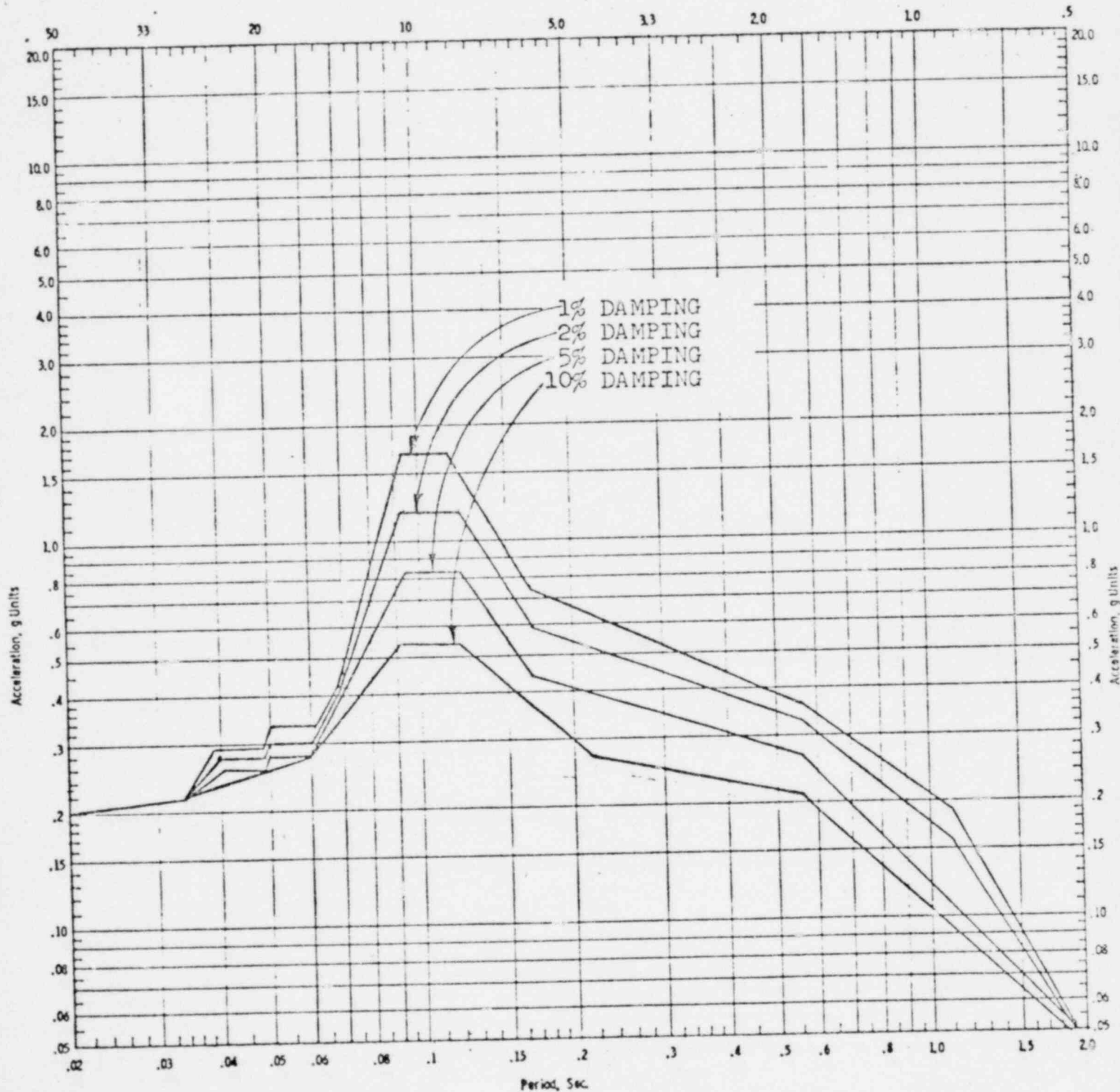
Frequency, CPS



HORIZONTAL FLOOR RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE
 R.H.R. COMPLEX, EAST - WEST
 COMPONENT SLAB NO. 1,
 ELEVATION: 590'-0"

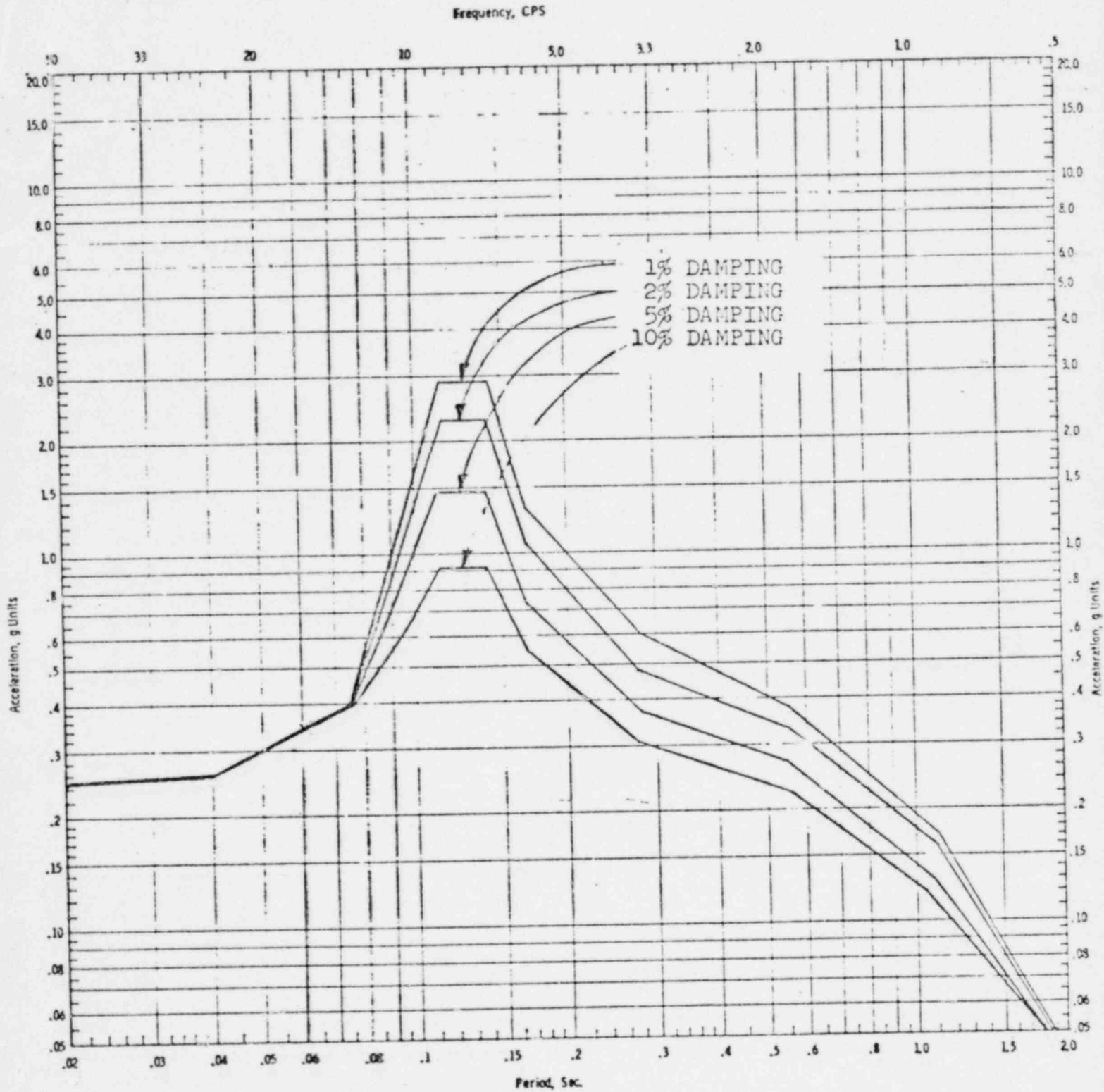
REV. NO.	1						
DATE	10-16-74						
INITIALS	K.K.S.						

Frequency, CPS



HORIZONTAL FLOOR RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE
 R.H.R. COMPLEX, NORTH-SOUTH
 COMPONENT SLAB NO. 2
 ELEVATION: 617'-0"

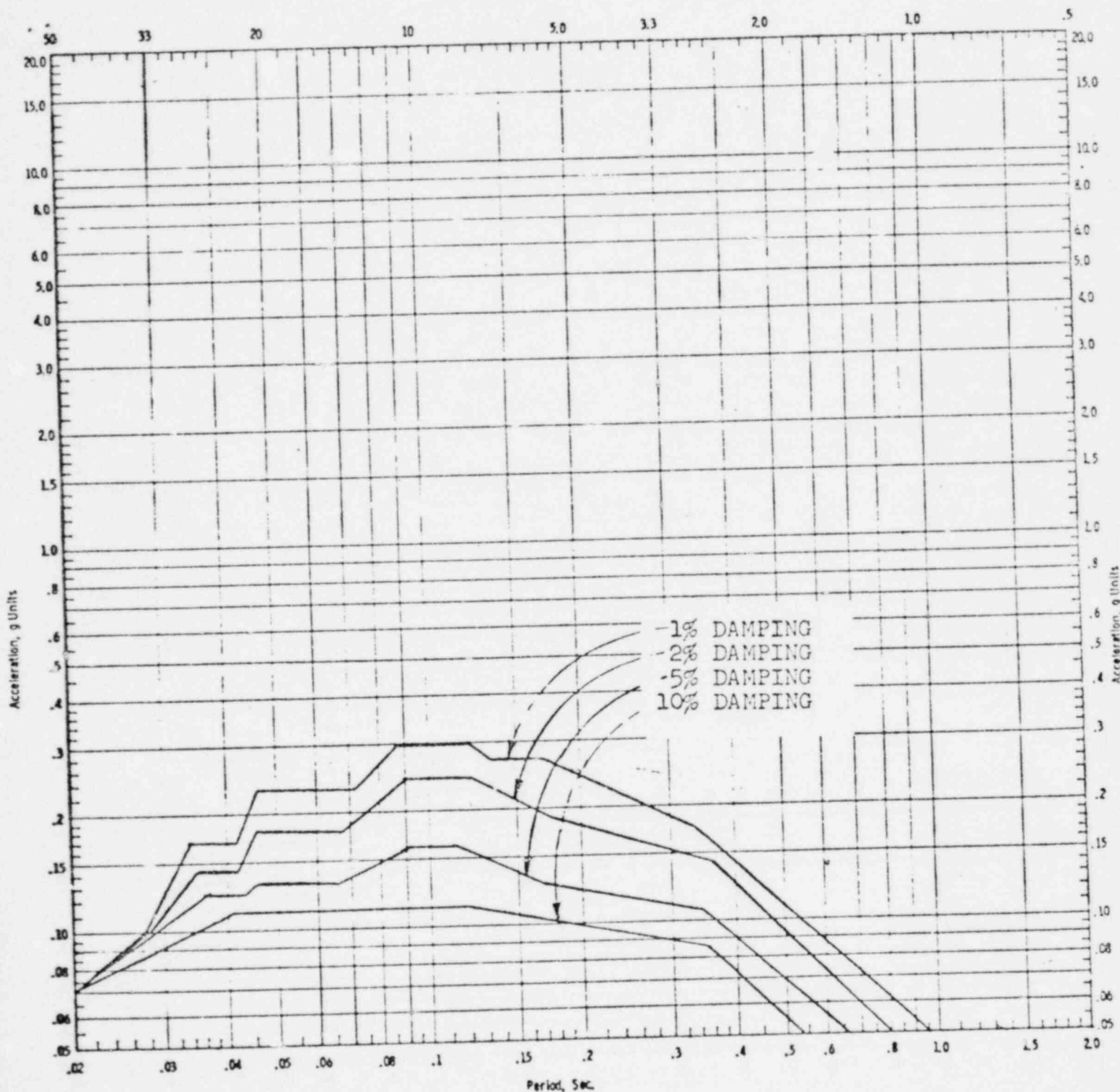
REV. NO.	1								
DATE	2-16-74								
INITIALS	K R S								



HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE
R.H.R. COMPLEX, EAST - WEST
COMPONENT SLAB NO. 2
ELEVATION: 617'-0"

REV. NO.	1								
DATE	10-18-74								
INITIALS	K X S								

Frequency, CPS



VERTICAL RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE
 R.H.R. COMPLEX, WALLS AND
 SLAB NO. 1A, ELEVATION: 590'-0"

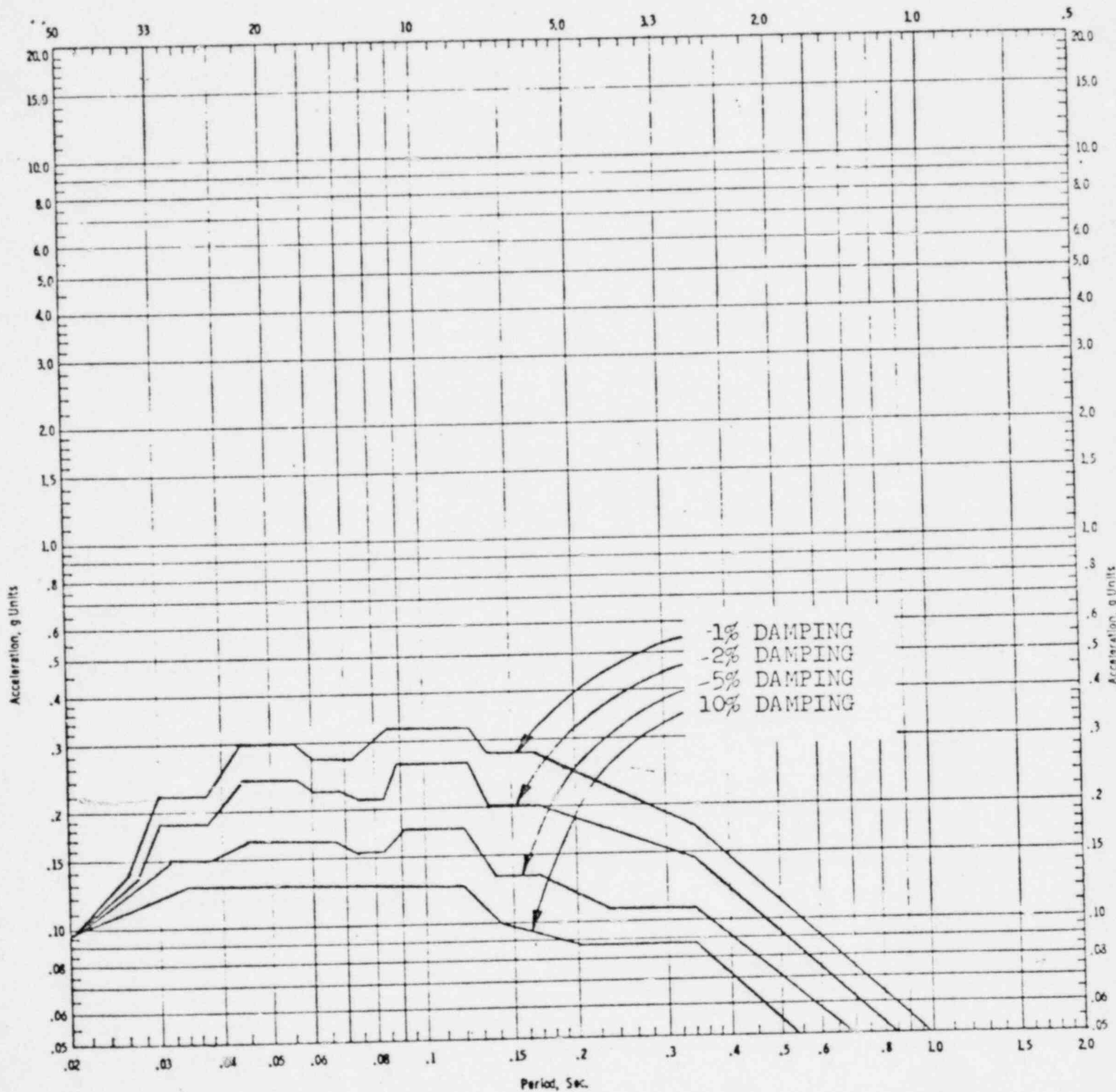
115-DB-VII

CLIENT DETROIT EDISON
 PROJECT ENRICO FERMI
 DESIGN BY CLM
 CHECKED BY SGM

APPENDIX B
 SL-3147
 Rev. 1, 11-15-76

REV. NO.	1						
DATE	10-18-74						
INITIALS	K. K. S.						

Frequency, CPS



VERTICAL RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE
 R.H.R. COMPLEX,
 WALLS, ELEVATION: 617'-0"

118-DB-V

B-11

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: Powell 24", 300 lbs. Motor operated Globe Valve

EQUIPMENT NO. : V8-2139, V8-2140 SPEC. NO.: 3071-501

LOCATION: Reactor Building

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE

QUALIFICATION DOCUMENT REFERENCES:

Wm. Powell Co's. Sesimic Analysis Report for a 24", 300 lbs.
globe valve figure 3051 W. E. with a Limitorgue SMB-4-200
Motor Operator, Report No. S-64048, dated November 21, 1973.

Prepared by: *Hemant D. Patel*
Reviewed by:
Approved by:

Date: *7-14-81*
Date:
Date:

QUALIFICATION SUMMARYLOAD COMBINATIONS CONSIDERED:

Normal + OBE

Normal + SSE

ORIGINAL QUALIFICATION METHOD:

Hand calculations were performed at critical sections of the valve structure for static loading. Extended structure was assumed as a cantilever beam with concentrated loads at various locations. Maximum bending moment, and corresponding bending stress was calculated for critical sections. Natural frequency was calculated based on maximum deflection for an equivalent cantilever beam. Maximum allowable g's were calculated for each critical section.

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME:

FERMI - Unit 2

TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME:

24" GLOBE VALVE

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: V8-2139, V8-2140 Quantity: 2
3. Vendor: Wm. Powell Co.
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description Appearance: T-shape
Dimensions: 100 in. high Weight: 7375#
6. Location: Building: Reactor Elev.: 605'-11" (2139)
58'-6" (2140)
7. Field Mounting Conditions:
☐ Bolting: Number: Size:
☒ Welding: Weld Type: Butt welding-full penetration
Leg: Length: Pitch:
☐
8. Natural frequencies in each direction:
Front to back: 24 Hz
Side to side :
Vertical:
9. Method of determining natural frequencies:
☐ Laboratory Test
☒ Analysis
☐ Other
10. a. System in which located: Residual Heat Removal, normally
b. Functional description: open, closes by-pass loop of
RHR Heat Ex. to allow shutdown cooling
c. Equipment required for:
☒ Hot Standby ☒ Cold Shutdown ☐ Post LOCA

11. Pertinent reference design specifications: _____

Deco Spec: 3071-501

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☒ Analysis
☐ Combination of Test and Analysis

1. Qualification Report

a. Title: Seismic Analysis Report for a 24", 300lbs. Globe

b. Number and Date: S-64048, 11-21-73 Valve

2. Company that prepared report: Midwest Technical Service, Inc.

3. Company that reviewed report: The Ralph M. Parsons Co.

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only

☐ Hydrodynamic only

☐ Seismic and Hydrodynamic

☐ Other (Specify): _____

☐ _____

2. Required response spectra (attach the graphs):

N/A

3. Method of combining Requiring Response Spectra:

☐ Absolute Sum N/A

☐ SRSS

4. Damping Upset (OBE): _____ Basis for damping: N/a

Emerg. (SSE): _____

5. Required acceleration in each direction (if required):

☐ ZPA ☒ Other (Specify): Accelerations from piping analysis at valve location

Upset (OBE): F/B= _____ S/S= _____ V= _____

Emerg. (SSE): F/B= _____ S/S= _____ V= _____

6. Were fatigue effects or other vibration loads considered?

☐ Yes Describe loads and how they were treated in overall qualification program: _____

☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE:

1. Test Method: ☐ Single frequency: N/A
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____
10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☒ Static analysis
☐ Static coefficient analysis
☐ Dynamic analysis: ☐ Response spectrum
☐ Time history
2. Model type:
☒ 1-dimensional
☐ 2-dimensional
☐ 3-dimensional

3. Method of analysis:

☐ Computer-aided calculation
programs used: _____☒ Hand calculations☐ _____4. Have equipment supports been adequately considered in
analysis: ☐ Yes ☐ No N/A

5. Stress evaluation at critical structural elements:

Element	Calc Stress	Allow
Operator/yoke bolting		48.67 g's
Bennet		10.27 g's
Bennet/body bolting		248.14 g's
Body Neck		103.05 g's

6. Deflection evaluation at critical structural elements
(active equipment only) (stresses are limited to Sm.)

Element	Calc Stress	Allow Stress

VIII. ADDITIONAL COMMENTS:

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: Powell 4", 600 lbs. Y-Globe Valve with
motor operator

EQUIPMENT NO. : V8-2196, V8-2232

SPEC. NO.: 3071-501

LOCATION: Reactor Building

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☒ PASSIVE
During and After 2196 2232

QUALIFICATION DOCUMENT REFERENCES:

Wm. Powell Co.'s Seismic Analysis Report for a 4" 600 lbs.
Y-globe valve, Figure 16051-Y W.E. with a limitorque SMB-0-40
motor operator, Report No. S-65867, dated 1-25-1974.

Prepared by: *Hemant A. Patel*
Reviewed by:
Approved by:

Date: *7/14/81*
Date:
Date:

QUALIFICATION SUMMARYLOAD COMBINATIONS CONSIDERED:

Normal + OBE

Normal + SSE

ORIGINAL QUALIFICATION METHOD:

Hand calculations were performed at critical sections of the valve structure for static loading. Extended structure was assumed as a cantilever beam with concentrated loads at various locations. Maximum bending moment and corresponding bending stress was calculated for critical sections. Natural frequency was calculated based on max. deflection for a equivalent cantilever beam. Maximum allowable g's were calculated for each critical section.

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME:

FERMI - Unit 2

TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME:

4" Y-Globe Valve

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: V8-2196, V8-2232 Quantity: 2
3. Vendor: Wm. Powell Co.
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description Appearance: Y-shape
Dimensions: 36" high Weight: 593 lbs.
6. Location: Building: Reactor Elev.: 555'6" (2196)
7. Field Mounting Conditions: & 575'0" (2232)
☐ Bolting: Number: Size:
☒ Welding: Weld Type: Butt welding - full penetration
Leg: Length: Pitch:
☐
8. Natural frequencies in each direction:
Front to back: 22 Hz
Side to side :
Vertical:
9. Method of determining natural frequencies:
☐ Laboratory Test
☒ Analysis
☐ Other
10. a. System in which located: RCIC-2232 HPCS-2196. Normally
b. Functional description: closed. Used for test of RCIC
System/Normally closed, opens minimum flow by-pass line.
c. Equipment required for:
☐ Hot Standby ☐ Cold Shutdown ☒ Post LOCA
2196

11. Pertinent reference design specifications: _____

DECO Spec 3071-501III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ NoIV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☒ Analysis
☐ Combination of Test
and Analysis

1. Qualification Report

a. Title: Seismic Analysis Report for a 4", 600 lbs. Y-globe valveb. Number and Date: S-65867, dated 1-25-742. Company that prepared report: Midwest Technical Service Inc.3. Company that reviewed report: The Ralph M. Parsons Co.

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only☐ Hydrodynamic only☐ Seismic and Hydrodynamic☐ Other (Specify): _____☐ _____

2. Required response spectra (attach the graphs):

N/A

3. Method of combining Requiring Response Spectra:

☐ Absolute Sum N/A☐ SRSS4. Damping Upset (OBE): _____ Basis for damping: N/A

Emerg. (SSE): _____

5. Required acceleration in each direction (if required):
Accelerations from piping analysis
☐ ZPA ☒ Other (Specify): at valve location

Upset (OBE): F/B= _____ S/S= _____ V= _____

Emerg. (SSE): F/B= _____ S/S= _____ V= _____

6. Were fatigue effects or other vibration loads considered?

☐ Yes Describe loads and how they were treated in overall
qualification program: _____☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE: N/A

1. Test Method: ☐ Single frequency: _____
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____

10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☒ Static analysis
☐ Static coefficient analysis
☐ Dynamic analysis: ☐ Response spectrum
☐ Time history
2. Model type:
☒ 1-dimensional
☐ 2-dimensional
☐ 3-dimensional

3. Method of analysis:

☐ Computer-aided calculation
programs used: _____☒ Hand calculations☐ _____4. Have equipment supports been adequately considered in
analysis: ☐ Yes ☐ No N/A

5. Stress evaluation at critical structural elements:

Element	Calc Stress	Allow g's
Operator/yoke bolting		38.7
Yoke Arm		9.4
Bonnet/Body Bolting		7.52
Body Neck		14.05

6. Deflection evaluation at critical structural elements
(active equipment only) (stresses limited to S_m)

Element	Calc Stress	Allow Stress

VIII. ADDITIONAL COMMENTS:

SARGENT & LUNDY

ENGINEERS
CHICAGO

FERMI UNIT 2
EQUIPMENT DYNAMIC
QUALIFICATION SUMMARY

Project #6139-40

EMD File #

Page 1 of 6

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: 20 in. Wafer Sphere Valve

EQUIPMENT NO. : V21-2015,2016 SPEC. NO.: 3071-301
VR3-3013,3014,3015,3016

LOCATION:

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE

QUALIFICATION DOCUMENT REFERENCES:

Seismic Qualification of valves covered by Detroit Edison Company Purchase Order No. IE-86782 for the Enrico Fermi Atomic Plant Unit No. 2 and processed under Jamesbury Order No. NC-46261, NC-34252 and JPB 73111. John Henry Associates Report No. JHA-7634, dated August 31, 1977.

Prepared by: *Hemant A. Patel*

Reviewed by:

Approved by:

Date: *7-14-81*

Date:

Date:

QUALIFICATION SUMMARYLOAD COMBINATIONS CONSIDERED:

Normal + OBE

Normal + SSE

ORIGINAL QUALIFICATION METHOD:

Finite Element Method was used for static analysis, upset and emergency load combinations were analyzed separately. Critical Stress for various locations was hand calculated using computer run output. Calculated stresses were found to be within allowables.

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME: FERMI - Unit 2 TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME: 20 in. Wafer-Sphere Valve

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: V21-2015, 2016 Quantity: 6
3. Vendor: Jamesbury Corporation
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description Appearance: _____

Dimensions: _____ Weight: _____

6. Location: Building: _____ Elev.: _____

7. Field Mounting Conditions:

☐ Bolting: Number: _____ Size: _____☐ Welding: Weld Type: _____

Leg: _____ Length: _____ Pitch: _____

☐

8. Natural frequencies in each direction:

Front to back: _____

Side to side : _____

Vertical: _____

9. Method of determining natural frequencies:

☐ Laboratory Test☐ Analysis☐ Other _____

10. a. System in which located: VR3 - containment purge
V21 - containment
b. Functional description: VR3 - used to purge airspace of
torus and isolation/V21: normally closed. Used for con-
tainment purge and isolation
c. Equipment required for:

☐ Hot Standby ☐ Cold Shutdown ☒ Post LOCA

11. Pertinent reference design specifications: _____

3071-501 & 3071-12

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☒ Analysis
☐ Combination of Test and Analysis

1. Qualification Report

a. Title: Seismic Qualification of Jamesbury Valves

b. Number and Date: JHA-76-34, August 31, 1977

2. Company that prepared report: John Henry Associates, Inc.

3. Company that reviewed report: Daniel International Corp.

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only

☐ Hydrodynamic only

☐ Seismic and Hydrodynamic

☐ Other (Specify): _____

☐ _____

2. Required response spectra (attach the graphs): N/A

3. Method of combining Requiring Response Spectra:

☐ Absolute Sum N/A

☐ SRSS

4. Damping Upset (OBE): _____ Basis for damping: N/A

Emerg. (SSE): _____

5. Required acceleration in each direction (if required):

☐ ZPA ☒ Other (Specify): accelerations from piping analysis at valve location

Upset (OBE): F/B= _____ S/S= _____ V= _____

Emerg. (SSE): F/B= _____ S/S= _____ V= _____

6. Were fatigue effects or other vibration loads considered?

☐ Yes Describe loads and how they were treated in overall qualification program: _____

☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE: N/A

1. Test Method: ☐ Single frequency: _____
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____

10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☒ Static analysis
☐ Static coefficient analysis
☐ Dynamic analysis: ☐ Response spectrum
☐ Time history
2. Model type:
☐ 1-dimensional
☐ 2-dimensional
☒ 3-dimensional

3. Method of analysis:

☒ Computer-aided calculation
programs used: Stardyne

☒ Hand calculations

☐ _____

4. Have equipment supports been adequately considered in analysis: ☐ Yes ☐ No N/A

5. Stress evaluation at critical structural elements:

Element		Calc Stress	Allow Stress
		ksi	ksi
Body Neck	Tension	4.271	38.00
	Shear	2.596	22.80
Shaft	Tension	25.628	110.00
	Shear	26.090	66.00
Bracket	Tension	20.591	30.00
	Shear	14.044	18.00
Bracket Flange Bolts	Tension	52.226	105.00
	Shear	40.628	63.00

6. Deflection evaluation at critical structural elements (active equipment only)

Element	Calc Stress	Allow Stress

VIII. ADDITIONAL COMMENTS:

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: Testable Swing Check Valve 20" - 900 lb.

EQUIPMENT NO. : V12-2001,2,3,4 SPEC. NO.: 3071-501

LOCATION: Reactor Building, El. 278' 9-1/2"

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE

QUALIFICATION DOCUMENT REFERENCES:

DECO File #PL-738 containing Anamet Laboratories report #373.98 Rev. A dated October 30, 1973 on the stress and seismic analysis of Anchor Valve Company's 20" Exercisable swing check valve.

Prepared by:

Date:

Reviewed by:

Date:

Approved by:

Date:

QUALIFICATION SUMMARYLOAD COMBINATIONS CONSIDERED:

Normal + Operating Bases Earthquake

Normal + Design Basis Earthquake

ORIGINAL QUALIFICATION METHOD:

Valve was analyzed to the requirements of ASME-B&PV Code Section III, 1971 with Winter 1971 Addenda. pressure retaining parts are qualified for class 1 valve design requirements of NB-3500. Non-pressure retaining components have been qualified to the criteria established in NB-3200. The connection between valve body and bonnet is evaluated by using Anamet's computer program BILAPSS.

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME: FERMI - Unit 2 TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME: Anchor 20" Swing Check V12-2001 V12-2003
V12-2002 V12-2004

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: 20"-900# Exercisable Swing Check Quantity: 4
3. Vendor: Anchor Valve Co.
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description Appearance: Check valveDimensions: 20" Weight: 6. Location: Building: Reactor Bldg. Elev.: 278'9½"

7. Field Mounting Conditions:

- ☐ Bolting: Number: Size:
☒ Welding: Weld Type: Butt welding to pipe
Leg: Length: Pitch:
☐

8. Natural frequencies in each direction:

Front to back: Rigid }
Side to side: Rigid } assumed
Vertical: Rigid }

9. Method of determining natural frequencies: N/A

- ☐ Laboratory Test
☐ Analysis
☐ Other

10. a. System in which located: Feedwaterb. Functional description: provide isolation of Reactor

c. Equipment required for:

- ☒ Hot Standby ☒ Cold Shutdown ☒ Post LOCA

11. Pertinent reference design specifications: _____

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☐ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☒ Analysis
☐ Combination of Test and Analysis

1. Qualification Report
 - a. Title: Design of 20" 900 lb. Exercisable swing check valve
 - b. Number and Date: 373-98 Rev. A, October 30, 1973
2. Company that prepared report: Anamet Laboratories, Inc.
3. Company that reviewed report: Detroit Edison Co.

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only
☐ Hydrodynamic only
☐ Seismic and Hydrodynamic
☐ Other (Specify): _____
☐ _____
2. Required response spectra (attach the graphs):

3. Method of combining Requiring Response Spectra: N/A
☐ Absolute Sum
☐ SRSS
4. Damping Upset (OBE): N/A Basis for damping: _____
Emerg. (SSE): _____
5. Required acceleration in each direction (if required):
☐ ZPA ☒ Other (Specify): from piping analysis
Upse (OBE): F/B= Resultant 5.83 max. in any direction S/S= _____ V= _____
Emerg. (SSE): F/B= Resultant 5.83 max. in any direction S/S= _____ V= _____
6. Were fatigue effects or other vibration loads considered?
☐ Yes Describe loads and how they were treated in overall qualification program: _____

☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE: N/A

1. Test Method: ☐ Single frequency: _____
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____

10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☒ Static analysis
☐ Static coefficient analysis
☐ Dynamic analysis: ☐ Response spectrum
☐ Time history
2. Model type:
☐ 1-dimensional
☐ 2-dimensional
☒ 3-dimensional

3. Method of analysis:

☒ Computer-aided calculation
programs used: BILAPSS (Anamet)☒ Hand calculations☐ _____4. Have equipment supports been adequately considered in analysis: ☐ Yes ☐ No

5. Stress evaluation at critical structural elements:

Element	Calc Stress	Allow Stress
(attached)		

6. Deflection evaluation at critical structural elements (active equipment only)

There are no elements for which deflections are critical

Element	Calc Stress	Allow Stress

VIII. ADDITIONAL COMMENTS:

SUBJECT _____

H. SUMMARY OF STRESS INTENSITIES

The following table of stress intensities denote the stress - intensity limits stated in NB-3200. Valve body stress limits are not provided in this section since the design criteria of NB-3500 are expressed by other limits. Deviations from the basic stress limits are covered by the special stress limits, NB-3227.

Summary of Stress Intensities (ksi.)

Location	Description	S ₁₂	S ₂₃	S ₃₁
Body to Bonnet Joint				
Zone 2	P _L + P _D + Q + F	- 21.32	+ 31.04	- 9.72
Zone 3	P _M	- 4.12	+ 4.12	0.0
	P _L	+ 5.62	+ 4.12	- 9.74
	P _L + P _D + Q	- 8.42	+ 17.56	- 9.14
Zone 4	P _M	- 2.93	+ 16.70	- 13.77
	P _L	+ 5.35	+ 16.70	- 22.05
	P _L + P _D + Q	- 9.60	+ 24.40	- 14.80
Disc	P _M	- 4.40	+ 10.02	- 5.62
	P _L + P _D	0.0	+ 18.66	- 18.66
	P _M	- 10.63	+ 24.20	- 13.57
	P _L + P _D	0.0	+ 33.40	- 33.40
Bonnet	P _M	- 6.49	+ 14.20	- 7.71
	P _L + P _D	- 12.56	0.0	+ 12.56
Seat Ring	P _M	+ 9.44	- 14.98	+ 5.54
Seat Ring Weld	P _L + P _D + Q	- 19.26	+ 14.10	+ 5.16

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: EMERGENCY EQUIPMENT COOLING WATER PUMP ASSEMBLIES
(Pump & Motor)

EQUIPMENT NO. : P4400C001A/1B SPEC. NO.: DECo 3071-512
3071-85

LOCATION: Reactor Building 613'-6"

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE

QUALIFICATION DOCUMENT REFERENCES:

1. McDonald Engineering Analysis Co. Report No. ME-131, Dated 9-28-73
2. Detroit Edison Drawing No. 6M721-2196 Rev. E Foundation Drawings
3. Detroit Edison Spec. No. 3071-85 Pump Spec.
4. DECo Spec. 3071-512 D.G. Spec.
5. DECo File No. 524-108

Prepared by:

George M. Hark

Date: 7-14-81

Reviewed by:

Date:

Approved by:

Date:

QUALIFICATION SUMMARYLOAD COMBINATIONS CONSIDERED:

OBE/SSE Seismic Loads

ORIGINAL QUALIFICATION METHOD:

A multidegree of freedom modal analysis was performed using the computer program ICES-STRUDL-H. Type of elements used in analysis were beam.

Seismic Loads were combined with normal operating loads and stresses were compared with allowables.

REQUALIFICATION METHOD:

The new response spectra curves will be compared with curves used in original qualification. The additional stresses due to new more conservative G values will be added to existing actual stresses and the results compared with code allowables.

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME: FERMI - Unit 2 TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME: EECW PUMP ASSEMBLIES

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: 8 x 6 x 14 1/2 / 100 HP 1750 RPM Quantity: 2
3. Vendor: Deming Division of the Crane Co./General Electric Co.
4. Is the component a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description Appearance: Horizontal Output centrifugal pump horizontally mounted and attached to a motor via a coupling.

Dimensions: 53"(L) x 40"(W) x 27"(H) Weight: 2,750 lbs. Total

6. Location: Building: Reactor Building Elev.:

7. Field Mounting Conditions:

☒ Bolting: Number: 4 Size: 3/4" Ø
☐ Welding: Weld Type:
Leg: Length: Pitch:

8. Natural frequencies in each direction:

Lateral: 20.12, 33.7 Hz
Vertical: 15.87, 21.51, 25.40, 30.90, 32.25 Hz

9. Method of determining natural frequencies:

- ☐ Laboratory Test
☒ Analysis
☐ Other

10. a. System in which located: EECW
b. Functional description: PROVIDE COOLING WATER FOR EMERGENCY EQUIPMENT
c. Equipment required for:

☒ Hot Standby ☒ Cold Shutdown ☒ Post LOCA

11. Pertinent reference design specifications: DECo 3071-512,
& DECo 3071-85

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ No

- IV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☒ Analysis
☐ Combination of Test
and Analysis

1. Qualification Report
"Certified Seismic Analysis Report of Crane-Deming
a. Title: Horizontal Split Case Pump
b. Number and Date: ME-131 September 28, 1973
2. Company that prepared report: McDonald Engineering Analysis Co.
3. Company that reviewed report: Detroit Edison Co.

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only
☐ Hydrodynamic only
☐ Seismic and Hydrodynamic
☐ Other (Specify): _____
☐ _____
2. Required response spectra (attach the graphs):
SL-3988 Rev. 00 4-18-72 B-8, 32, 7, 31, C-6, 16
3. Method of combining Requiring Response Spectra:
☒ Absolute Sum
☐ SRSS
4. Damping Upset (OBE): 1% Basis for damping: Reg. Guide 1.6
Emerg. (SSE): 2%
5. Required acceleration in each direction (if required):
☐ ZPA ☒ Other (Specify): Combined Resultant
$$[(0.5)^2 + (1.41)^2]^{1/2} = 1.50g$$

Upset (OBE): F/B= 1.41g S/S= 1.41g V= 0.5g
Emerg. (SSE): F/B= 1.41g S/S= 1.41g V= 0.5g
6. Were fatigue effects or other vibration loads considered?
☐ Yes Describe loads and how they were treated in overall
qualification program: _____

☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE: N/A

1. Test Method: ☐ Single frequency: _____
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____
10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☐ Static analysis
☒ Static coefficient analysis*
☐ Dynamic analysis: ☐ Response spectrum
*Eigen Values Extracted ☐ Time history
2. Model type:
☐ 1-dimensional
☐ 2-dimensional
☒ 3-dimensional

3. Method of analysis:

☒ Computer-aided calculation
programs used: _____

ICES STRUDL II

☐ Hand calculations☐ _____4. Have equipment supports been adequately considered in analysis: ☒ Yes ☐ No

5. Stress evaluation at critical structural elements:

Element	DBE Calc Stress	OBE Allow Stress
Stress in Pump Shaft	11,004	17,500
Pump Bearings - Radial load, lbs		
Inboard	620	1382
Outboard	1,545	6,215
Seismic Stress in Pump Casing Bolts	50	--
Pump to Baseplate Bolts (Cont'd on next page)		

6. Deflection evaluation at critical structural elements (active equipment only)

Element	DBE Calc Stress	OBE Allow Stress
Deflection of Impeller Shaft	.0044"	.006"
Misalignment of Flexible Coupling	.0056 Radians	.017 Radians

VIII. ADDITIONAL COMMENTS:

DBE stresses and deflections are compared with OBE allowables.

5. Stress evaluation at critical structural elements: (Cont'd)

Element	DBE Calc Stress	OBE Allow Stress
Pump to Baseplate Bolts		
Tension	3692	20,000
Shear	1012	10,000
Motor to Baseplate Bolts		
Tension	1965	20,000
Shear	1689	10,000
Motor Bearings - Radial Load, lbs	717	30,000
Anchor Bolts		
Tension	8112	20,000
Shear	2194	10,000

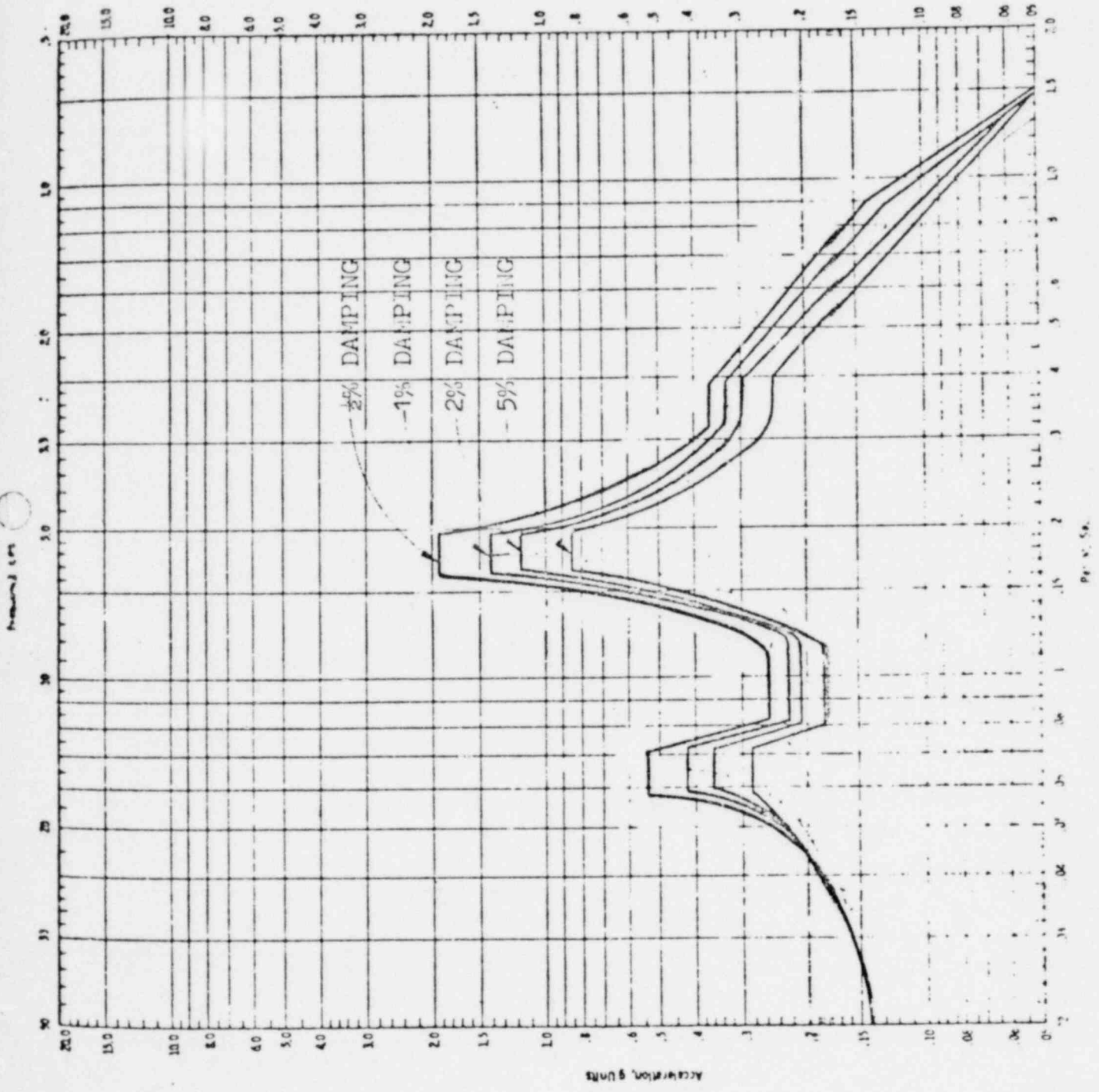


FIGURE B-8
HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION - 613'-6" (SLAB NO. 2)
REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT X - ECL

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3482-00

DESIGN BY SGM

DATE April 18, 1972

CHECKED BY HHS

DATE 4/18/72

SHEET OF

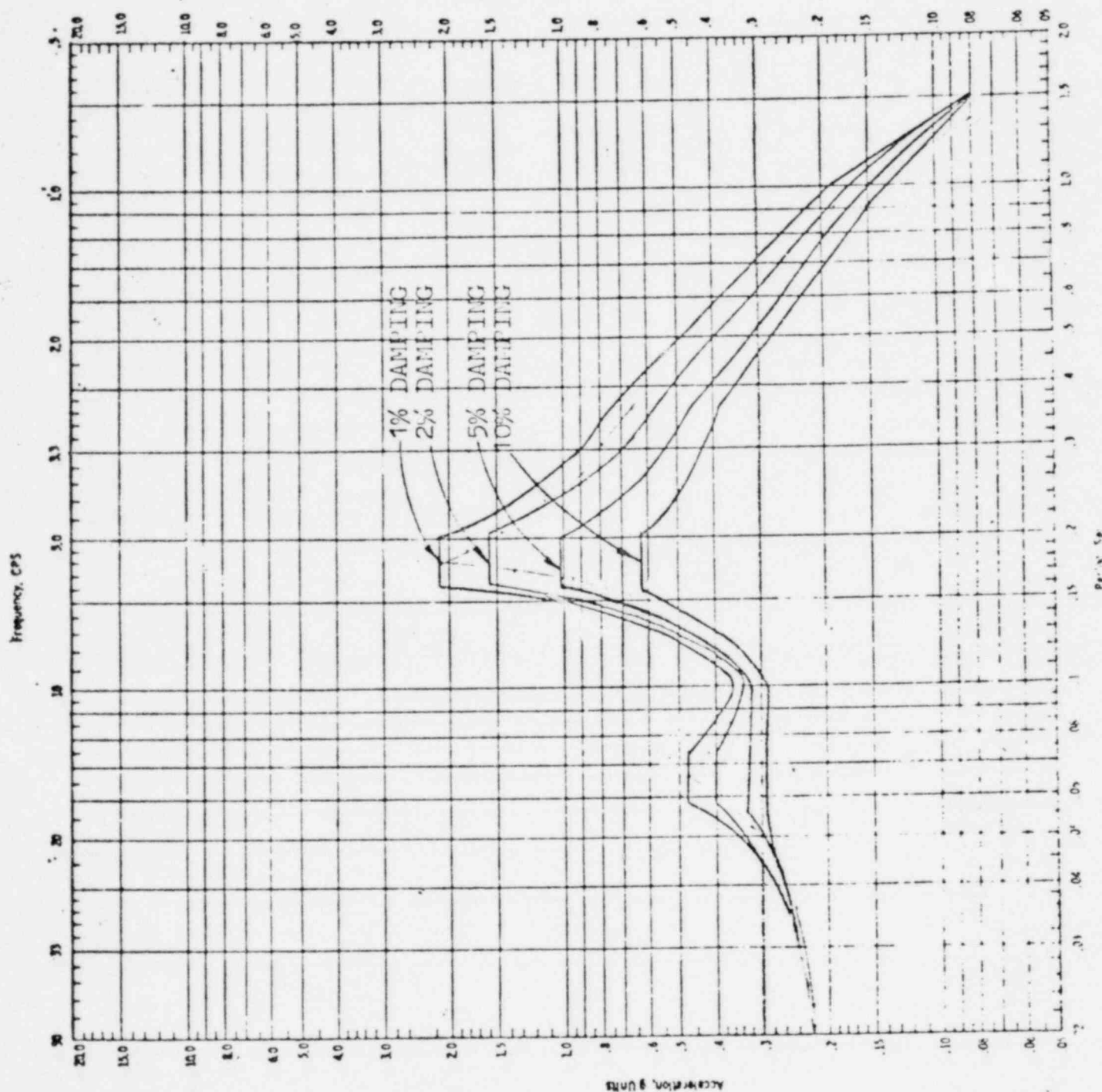


FIGURE B-32
HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE ELEVATION - 613'-6" (SLAB NO. 2)
REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 5088

DESIGN BY SGM

DATE April 18, 1972

CHECKED BY HHS

DATE 5/18/72 SHEET OF

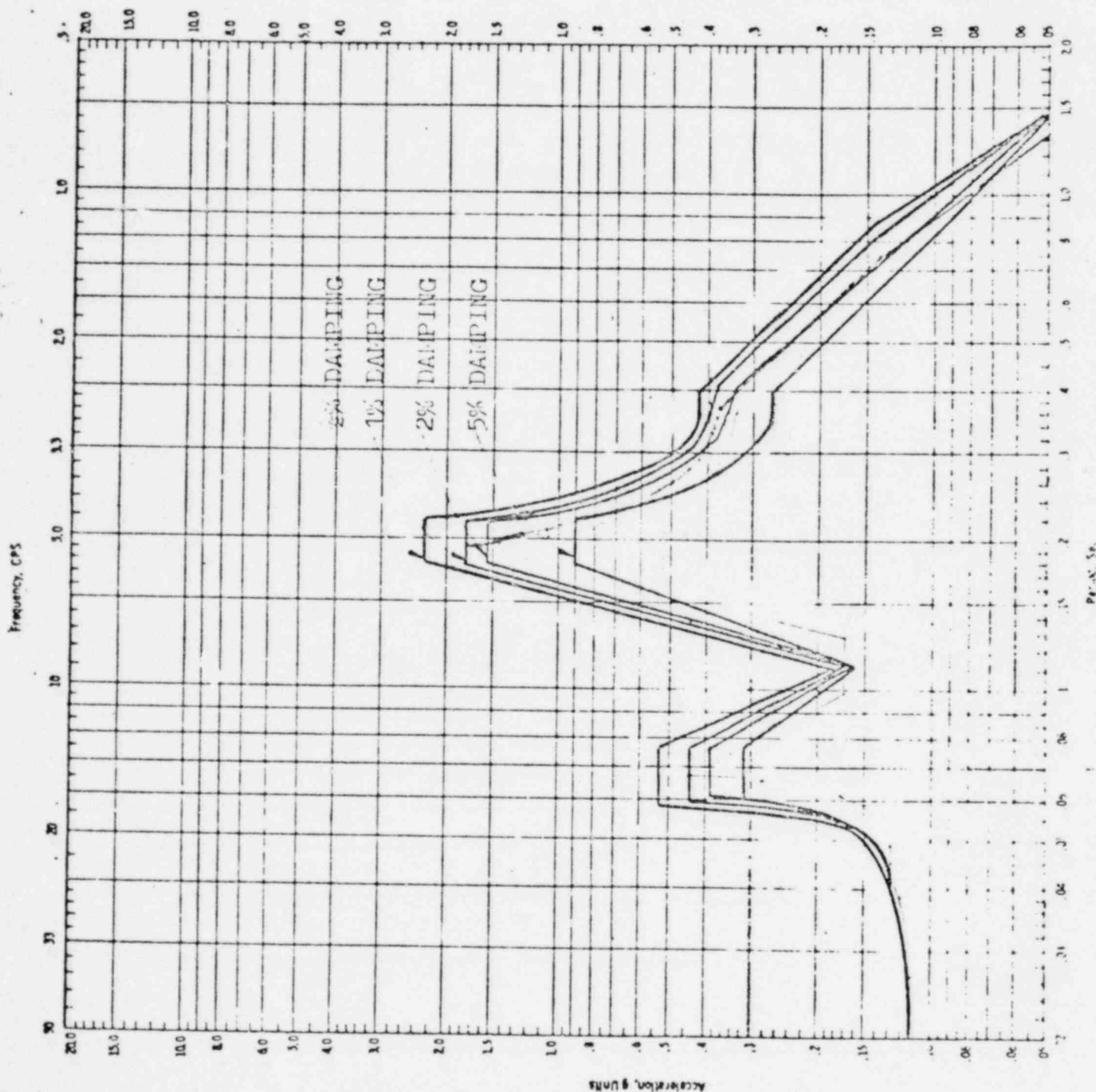


FIGURE B-7
HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION - 613'-6" (SLAB NO. 2)
REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

7-300

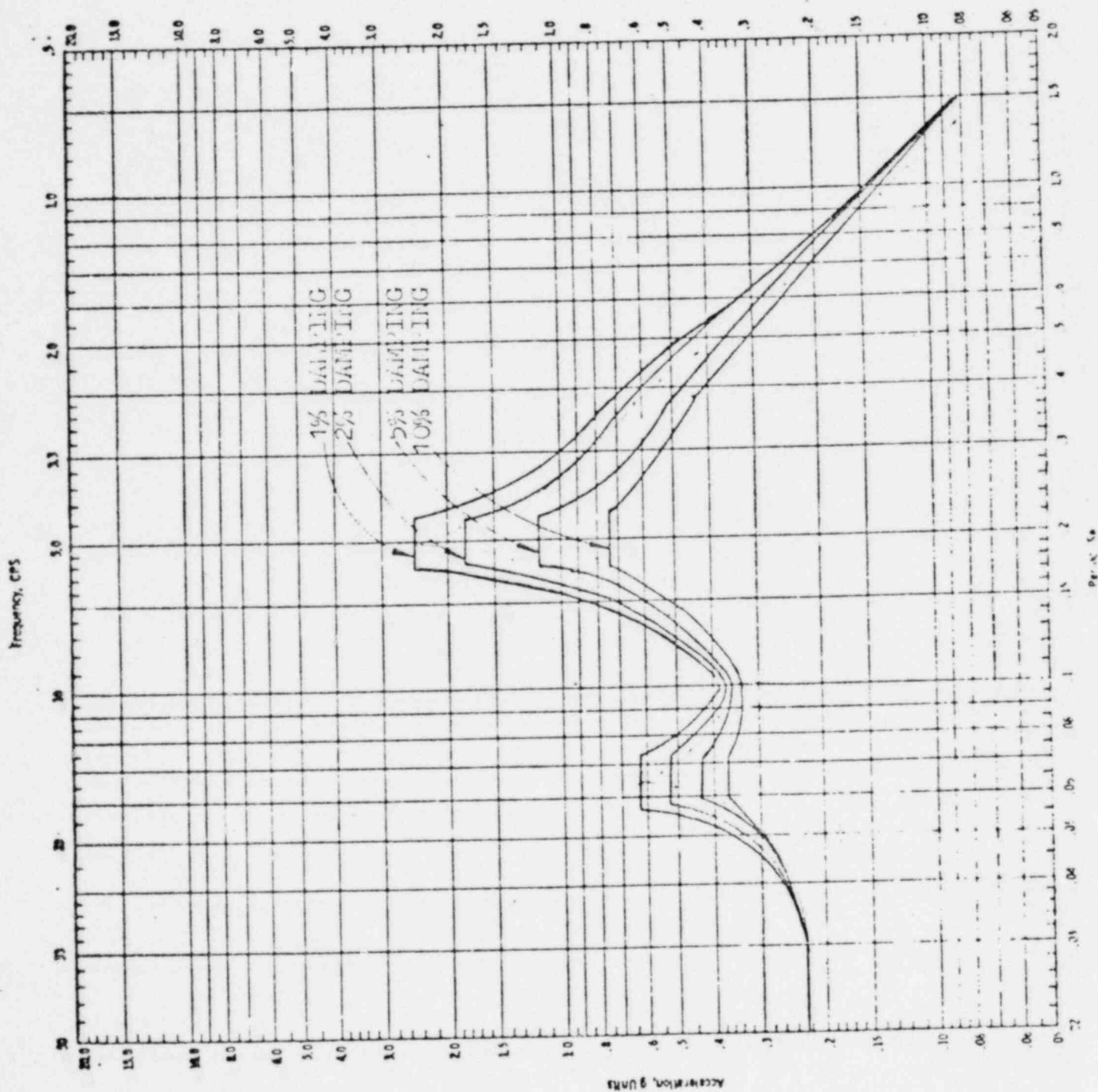


FIGURE B-31
HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE ELEVATION - 613'-6" (SLAB NO. 2)
REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SGM

DATE April 18, 1972

CHECKED BY LHS

DATE 4/18/72

SHEET OF

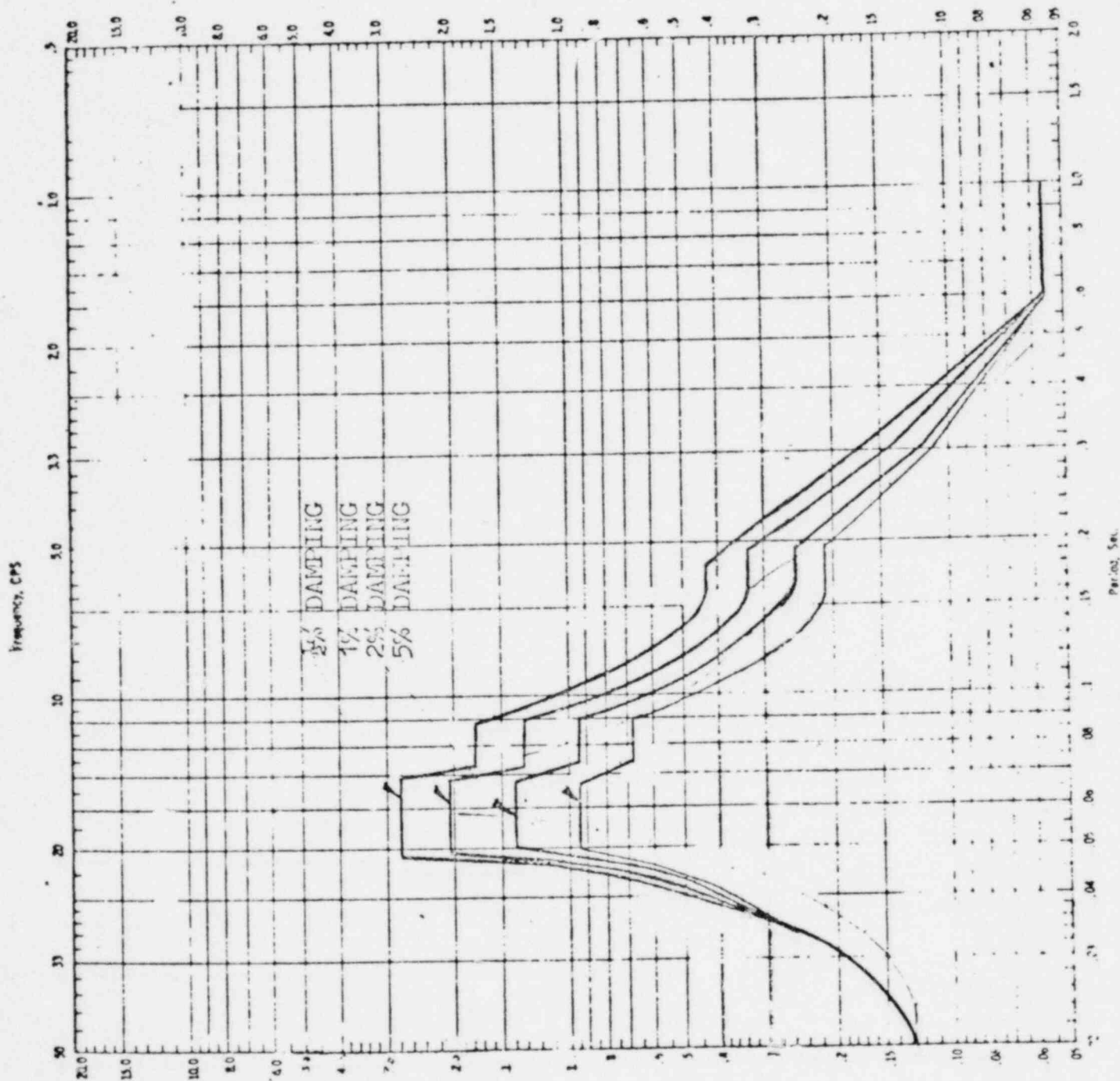


FIGURE C-6
VERTICAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE REACTOR
BUILDING SLAB EL. 583'-6", 613'-6"

2.8
12.1
2.7
1.1
1.1

SARGENT & LUNDY
ENGINEERS

CLIENT DETROIT EDISON CO.

PROJECT ENRICO FERMI

JOB NO. _____

DESIGN BY SGM

DATE April 5, 1972

CHECKED BY HHS

DATE 4/10/72 SHEET _____ OF _____

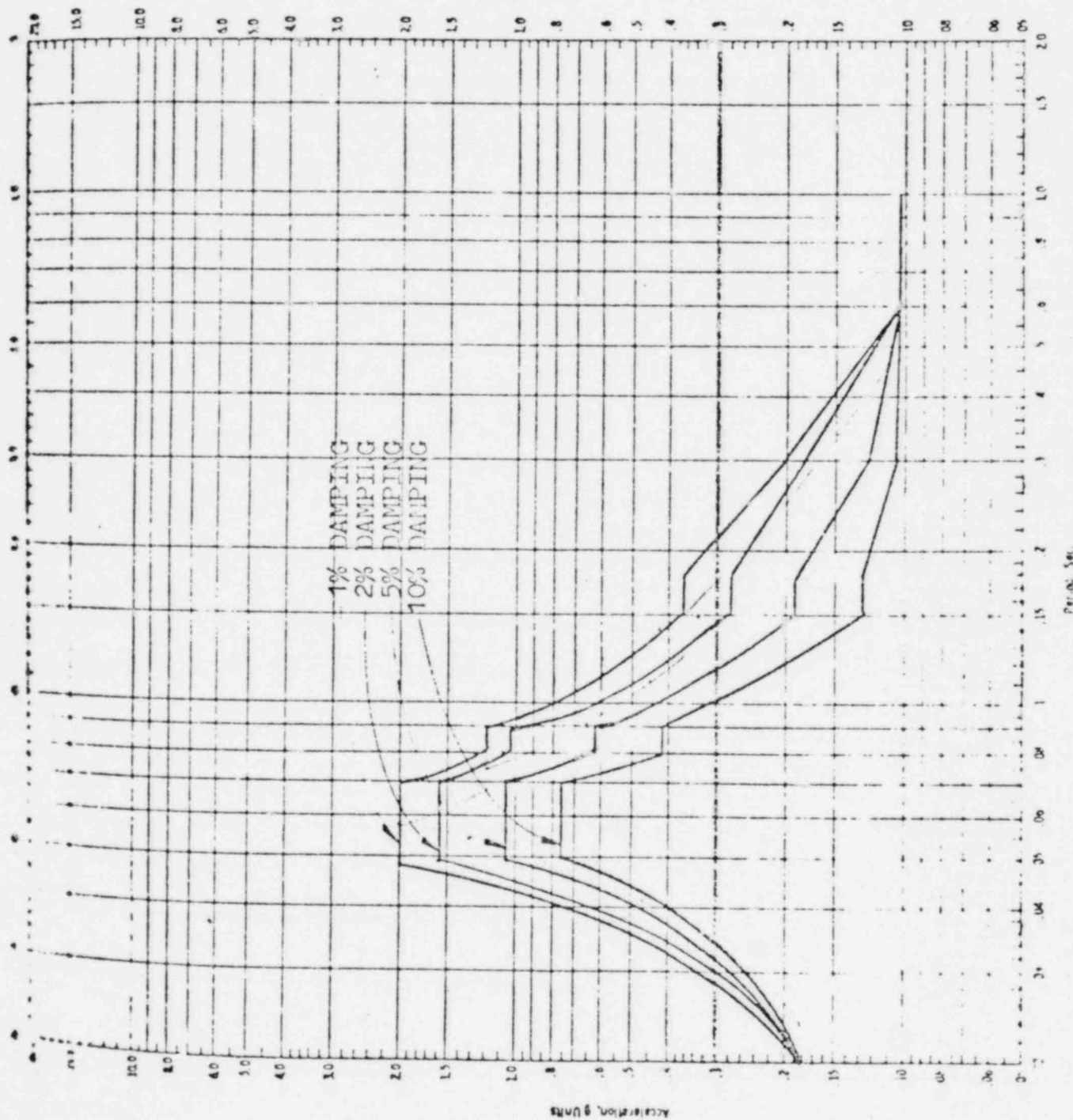


FIGURE C-16
VERTICAL RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE REACTOR BUILDING
SLAB EL. 583'-6", 613'-6"

SARGENT & LUNDY

CHICAGO

FERMI UNIT 2
EQUIPMENT DYNAMIC
QUALIFICATION SUMMARY

Project #6139-40

EMD File #

Page 1 of 6

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: FLOOR MOUNTED YORK INSTRUMENT RACK

EQUIPMENT NO. : H21-P501B

SPEC. NO.: 3071-165

LOCATION: Reactor Building 551'-0"

EQUIPMENT CLASSIFICATION: ☐ ACTIVE ☒ PASSIVE

*Rack is Passive

QUALIFICATION DOCUMENT REFERENCES:

1. Detroit Edison Spec. 3071-165 + Addendum A June 1977
2. DECo Drawing No. 6I721-2525-7.
3. DECo Drawing No. 6I721-2525-9.
4. DECo Drawing No. 6I721-2525-25
5. DECo Drawing No. 6I721-2525-89
6. DECo MATRIX No. EF2-38,244 Vendor Document List
7. Analytical Engineering Associates, Inc. Report #77113-2, 12-22-77

Prepared by: *George L. Hake*

Date: 1-14-81

Reviewed by:

Date:

Approved by:

Date:

QUALIFICATION SUMMARY

LOAD COMBINATIONS CONSIDERED:

OBE/SSE Seismic Loads

ORIGINAL QUALIFICATION METHOD:

Finite element (Stardyne) generic (worst case) Dynamic Analysis was performed. Type of elements used in the analysis were beam.

Seismic loads were combined with the normal operating loads and stresses were compared with the allowables.

REQUALIFICATION METHOD:

The new response spectra curves will be compared with the curves used in the existing qualification. The additional stresses due to the new more conservative G values will be added to the existing actual stresses and the results compared with code allowables.

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME:

FERMI - Unit 2

TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME:

YORK FLOOR MOUNTED INSTRUMENT RACKS

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: H21-P501B Quantity: 1
3. Vendor: York Electro-Panel Control Co., Inc.
4. If the component is a cabinet or panel, name and model No. of the devices included: See Drawing No. 61721-2520-89 Rev. C
C/V-P50-F403/F441; PXE-P50-NW03B/N409B; PSE-P50-N410B, PDS-P50-N413B;
PSE-P50-NY23; PI-P50-RH10B
5. Physical Description Appearance: Rack composed of
structural tubing used to mount instruments
Dimensions: 78"(H) x 48"(W) x 39"(D) Weight: 617.0 lbs.
6. Location: Building: Reactor Building Elev.: 551'-0"
7. Field Mounting Conditions:
☒ Bolting: Number: 6 Size: 1/2"Ø Expansion
Anchors
☐ Welding: Weld Type: _____
Leg: _____ Length: _____ Pitch: _____
☐ _____
8. Natural frequencies in each direction:
Front to back: 13.8, 19.2, 33.4 Hz
Side to side: 13.8, 33.4 Hz
Vertical: 13.8, 19.2, 33.4 Hz
9. Method of determining natural frequencies:
☐ Laboratory Test
☒ Analysis
☐ Other _____
10. a. System in which located: Control Air
b. Functional description: _____
c. Equipment required for:
☐ Hot Standby ☐ Cold Shutdown ☐ Post LOCA

11. Pertinent reference design specifications: DECo 3071-165

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☐ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☒ Analysis
☐ Combination of Test and Analysis

1. Qualification Report

a. Title: "Seismic Analysis of Floor Mounted Instrument Racks"

b. Number and Date: #77113-2 December 22, 1977

2. Company that prepared report: Analytical Engineering Assoc., Inc.

3. Company that reviewed report: Detroit Edison Co.

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only

☐ Hydrodynamic only

☐ Seismic and Hydrodynamic

☐ Other (Specify): _____

☐ _____

2. Required response spectra (attach the graphs):

SL-3988 Rev. 00 4-18-72 B-5,29,6,30,13,37, C-1,6,11,16,5,9,19,15

3. Method of combining Requiring Response Spectra:

☒ Absolute Sum

☐ SRSS

4. Damping Upset (OBE): 1/2% Basis for damping: Reg. Guide 1.6.1

Emerg. (SSE): 1%

5. Required acceleration in each direction (if required):

☐ ZPA ☐ Other (Specify): Not Required

Upset (OBE): F/B=_____ S/S=_____ V=_____

Emerg. (SSE): F/B=_____ S/S=_____ V=_____

6. Were fatigue effects or other vibration loads considered?

☐ Yes Describe loads and how they were treated in overall qualification program: _____

☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE: N/A

1. Test Method: ☐ Single frequency: _____
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size: _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____

10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☐ Static analysis
☐ Static coefficient analysis
☒ Dynamic analysis: ☒ Response spectrum
☐ Time history
2. Model type:
☐ 1-dimensional
☐ 2-dimensional
☒ 3-dimensional

3. Method of analysis:

- ☒ Computer-aided calculation
programs used: Stardyne
- ☐ Hand calculations
- ☐ _____

4. Have equipment supports been adequately considered in analysis: ☒ Yes ☐ No

5. Stress evaluation at critical structural elements:

Element	Calc Stress	Allow Stress
DBE + Deadweight Stress Tensile	10,984	21,600
DBE + Deadweight Stress Tensile	12,521	32,400

6. Deflection evaluation at critical structural elements (active equipment only) N/A

Element	Calc Stress	Allow Stress

VIII. ADDITIONAL COMMENTS:

Load stresses are due to generic worst case (per reference No. 7).
Actual loads will in general be less.

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON
PROJECT INDICO FERRI JOB NO. 3082
DESIGN BY SM DATE April 10, 1972
CHECKED BY HHS DATE 4/18/72 SHEET OF

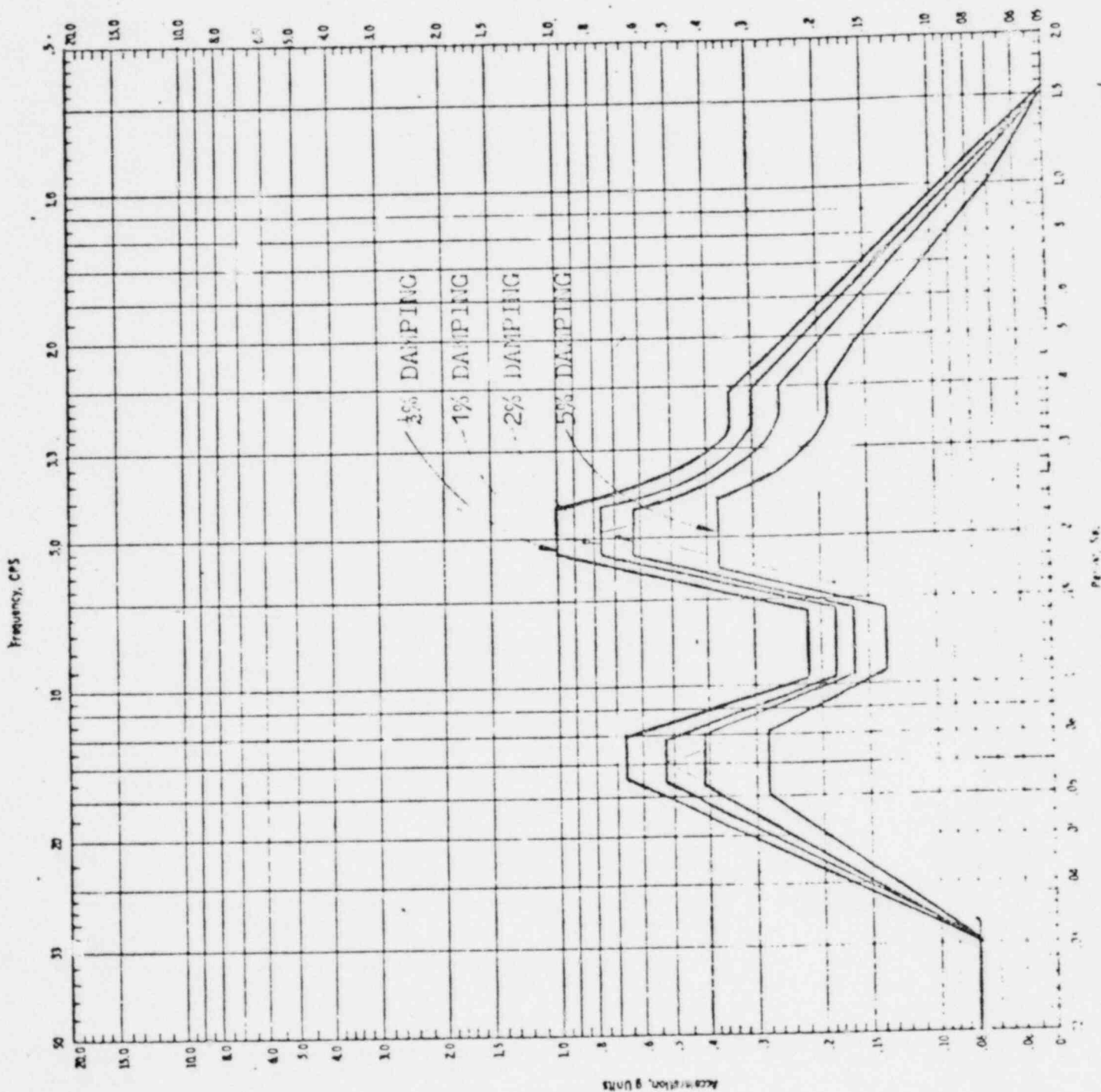


FIGURE B-5

HORIZONTAL FLOOR RESPONSE SPECTRA OPERATING
BASIS EARTHQUAKE ELEVATION - 583'-6" (SLAB NO. 1)
REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

Y-Exc

583'-6"

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 1000-100

DESIGN BY SGM

DATE April 10, 1972

CHECKED BY HHS

DATE 4/12/72

SHEET OF

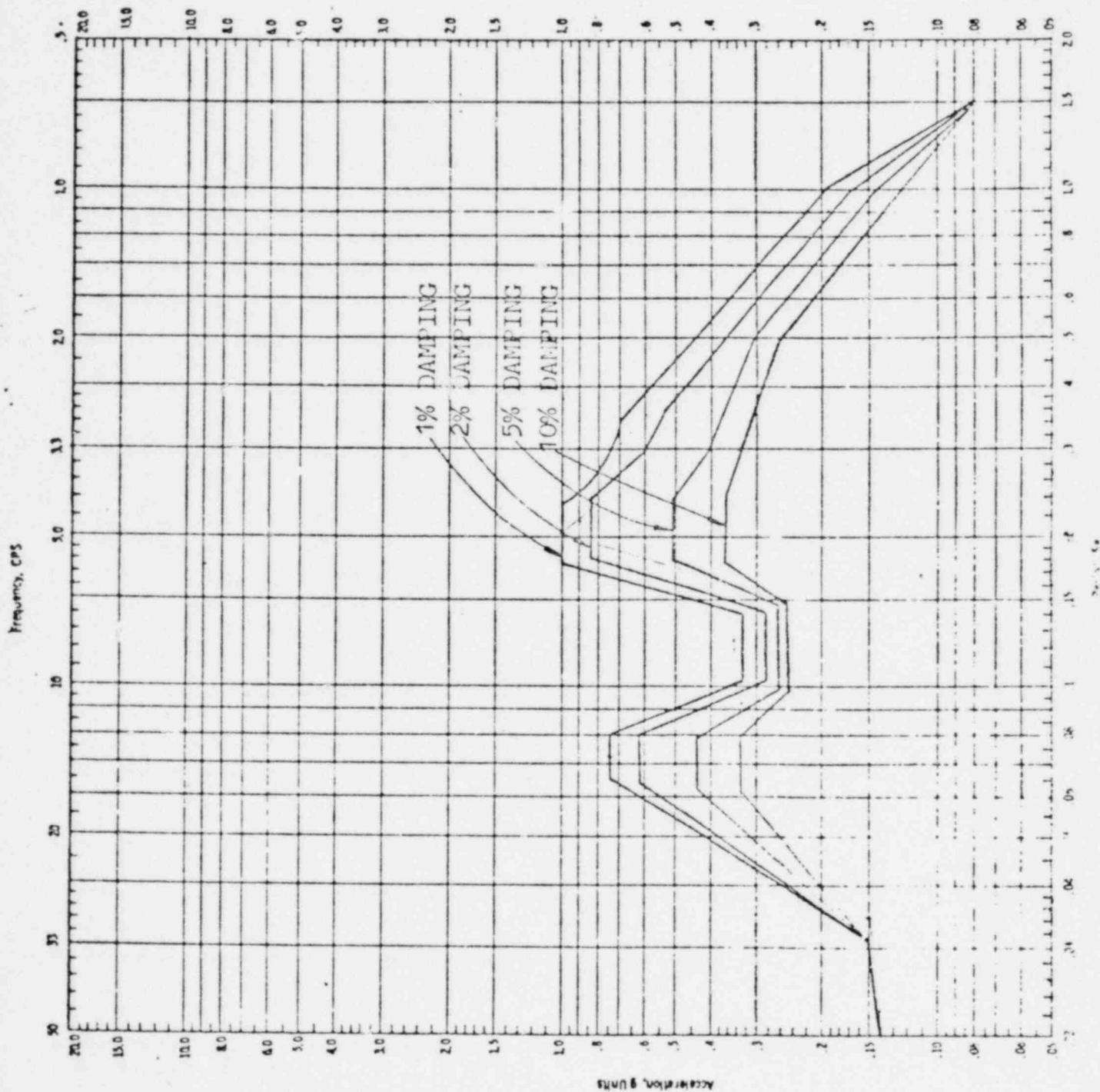


FIGURE B-29
HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE ELEVATION - 583'-6" (SLAB NO. 1)
REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

551-0

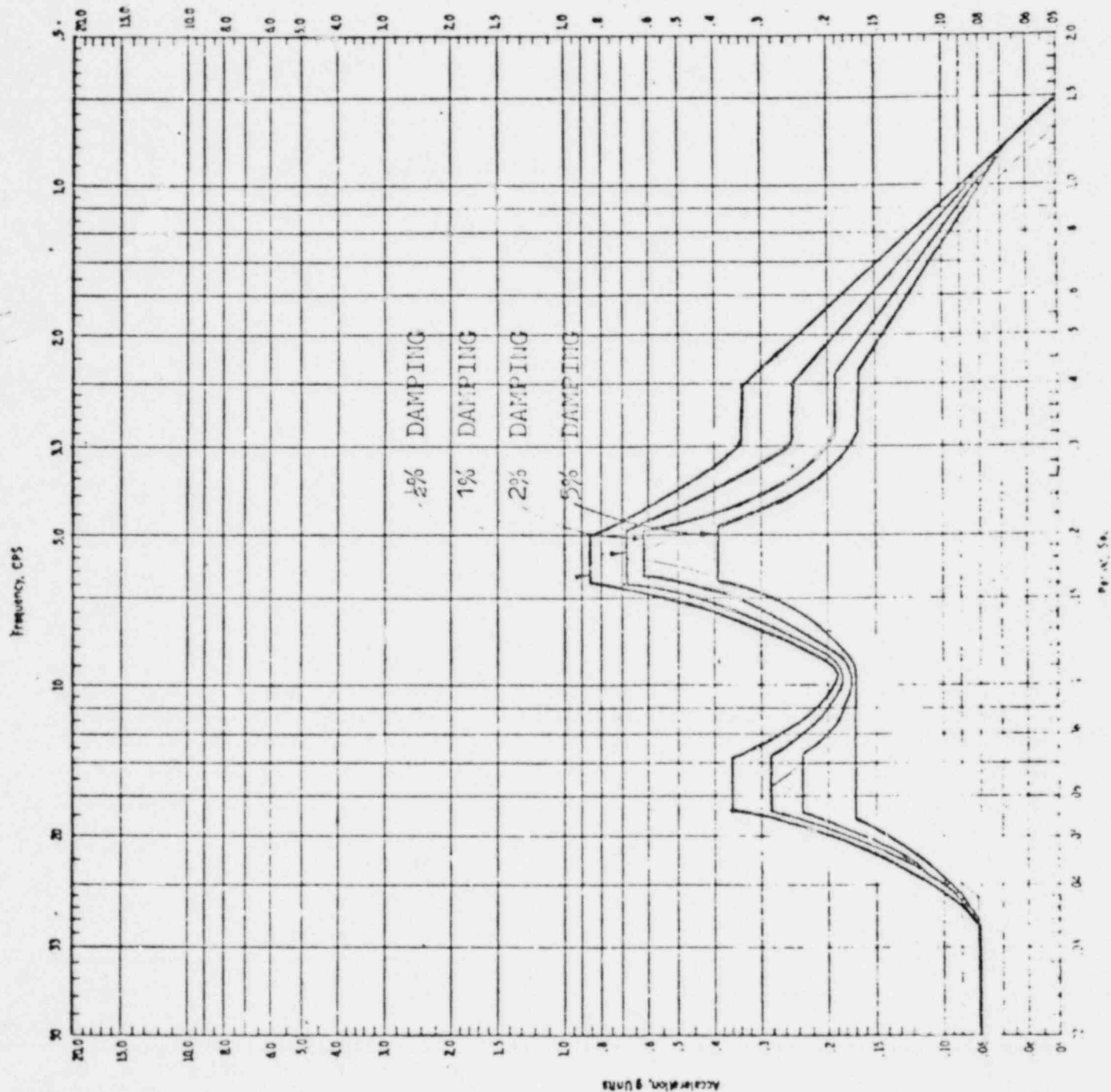


FIGURE B-6
HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION - 583'-6" (SLAB NO. 1)
REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

651-0"

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDITION
PROJECT ENRICO FERRI JOB NO. 3000-01
DESIGN BY SGM DATE April 10, 1972
CHECKED BY HMS DATE 4/12/72 SHEET OF

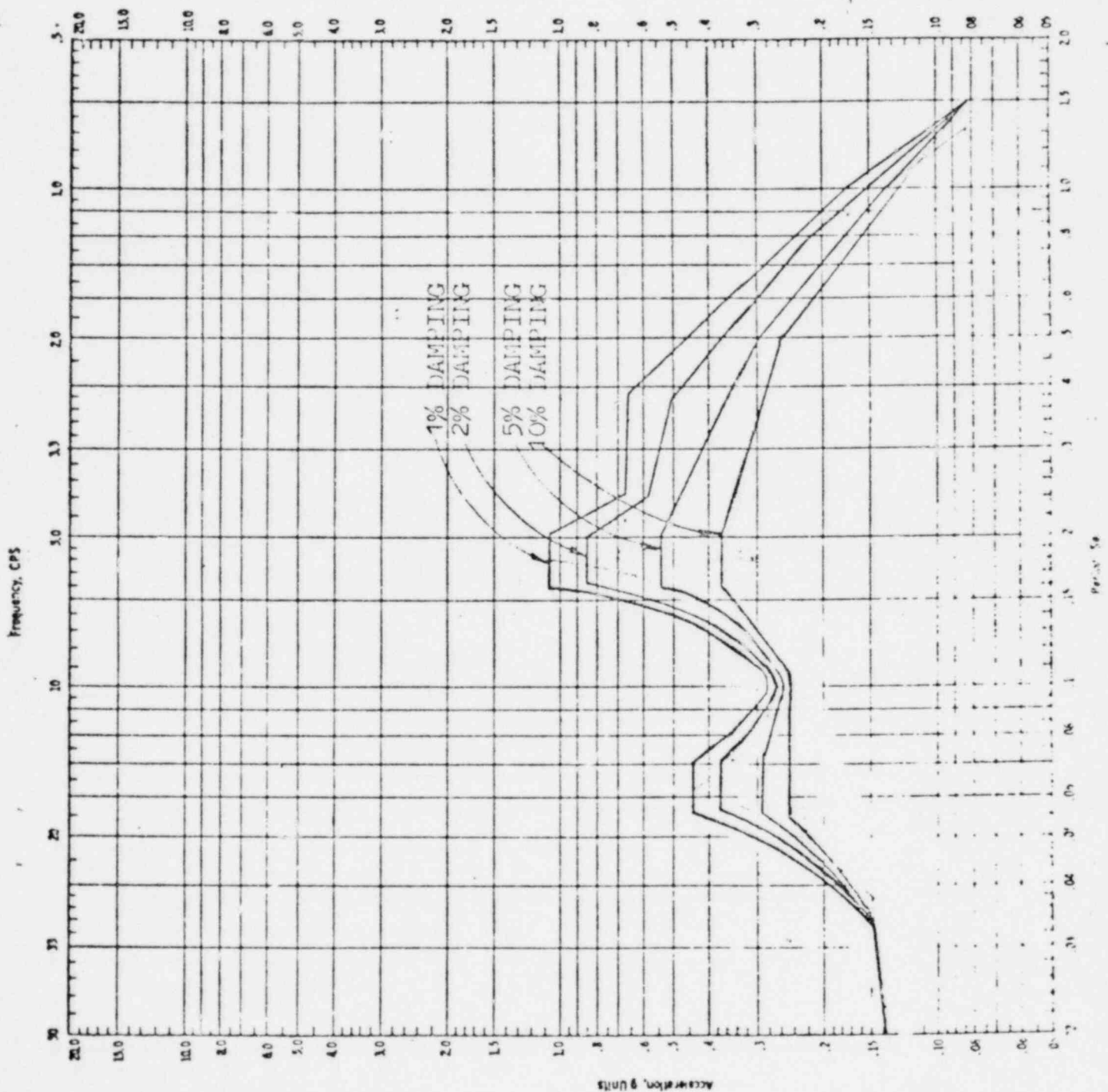


FIGURE B-30
HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE ELEVATION - 583'-6" (SLAB NO. 1)
REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

551'-0"

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SGM

DATE April 18, 1972

CHECKED BY HHS

DATE 4-18-72 SHEET OF

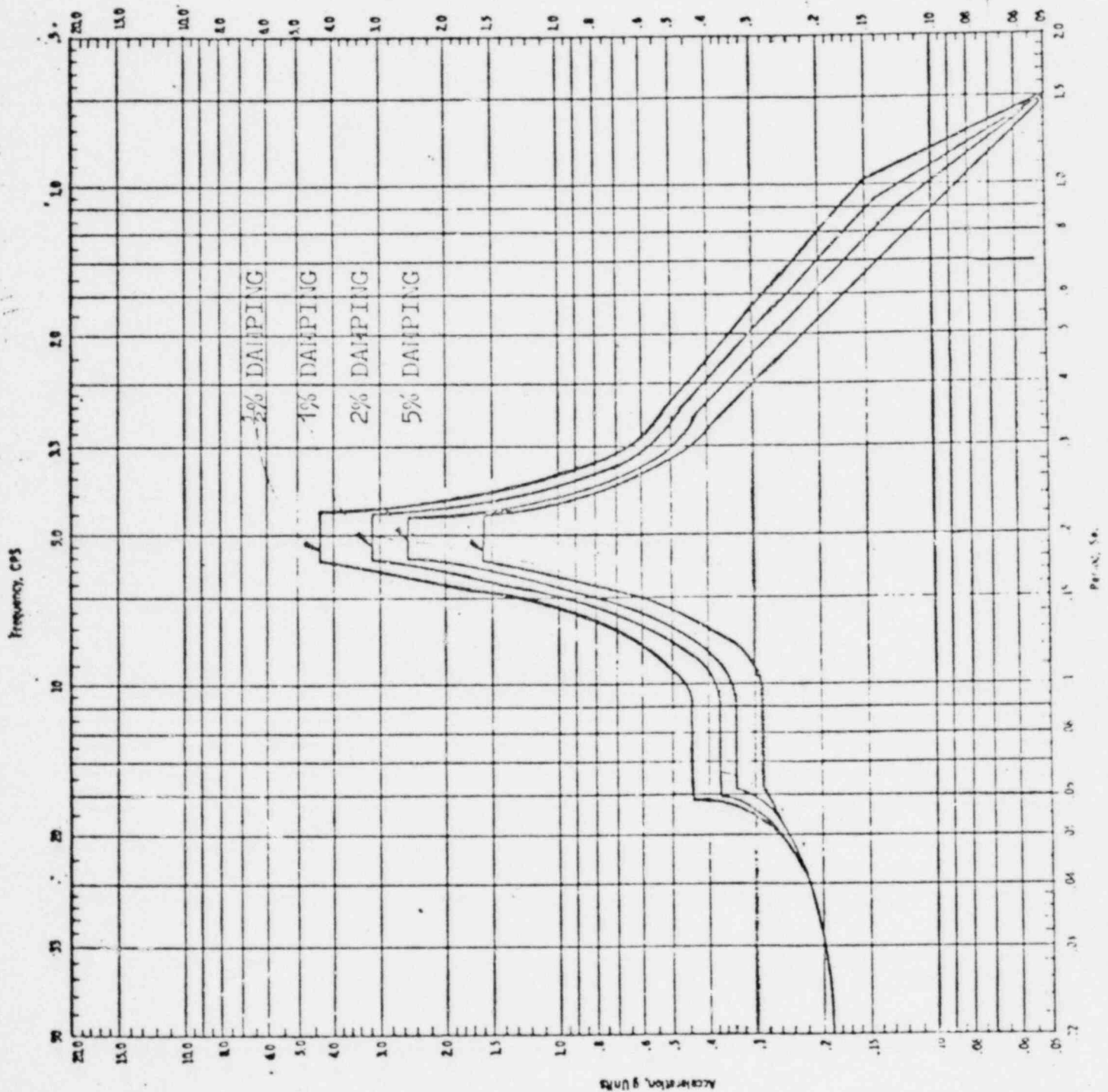


FIGURE B-13

HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION-684'-6" (SLAB NO. 5)
REACTOR AUXILIARY BUILDING NORTH-SOUTH COMPONENT

Report

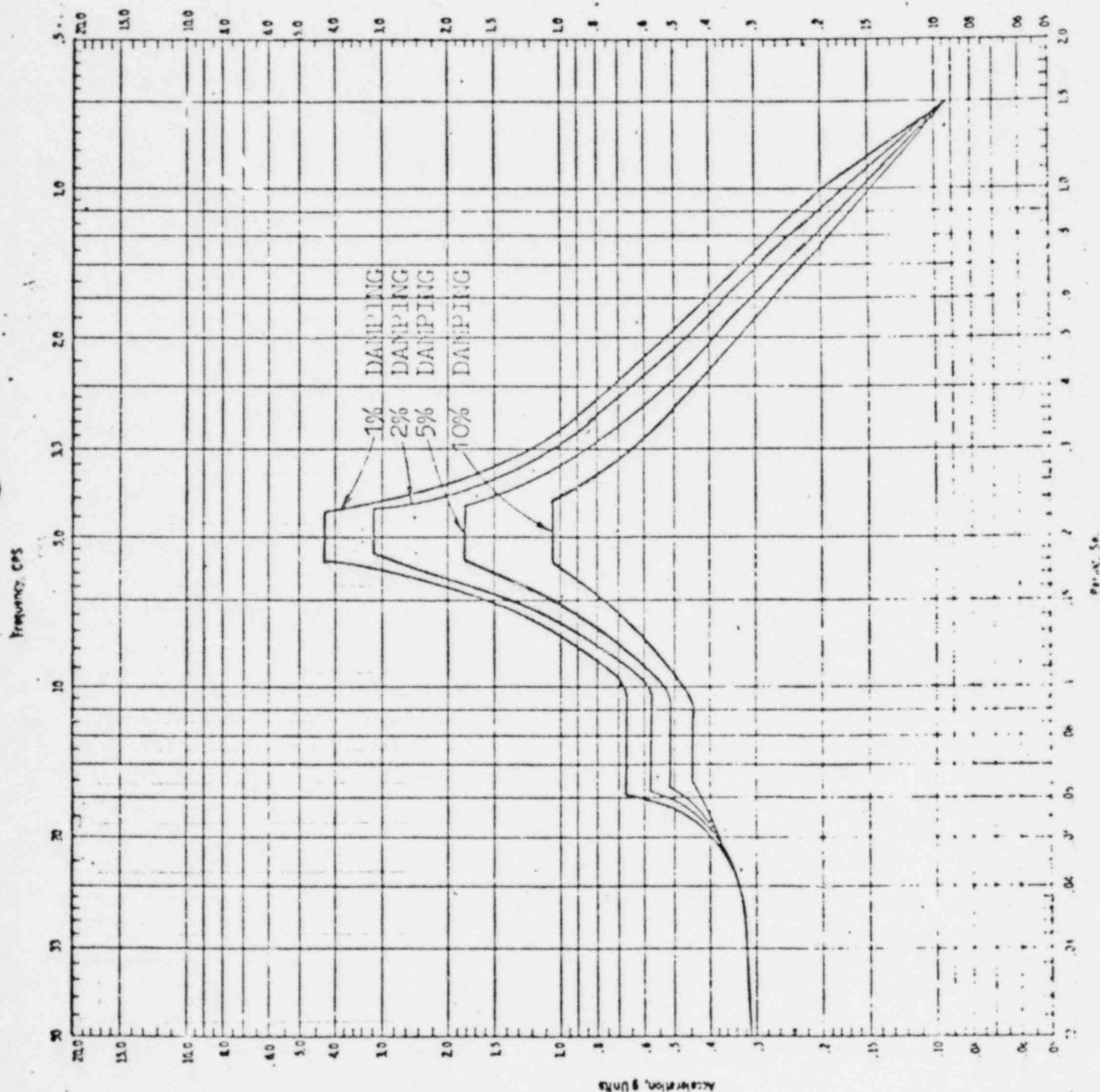


FIGURE B-37
 HORIZONTAL FLOOR RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE ELEVATION - 684'-6" (SLAB NO. 5)
 REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT MURICO FERRY

JOB NO. 3982-00

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DATE April 12, 1972

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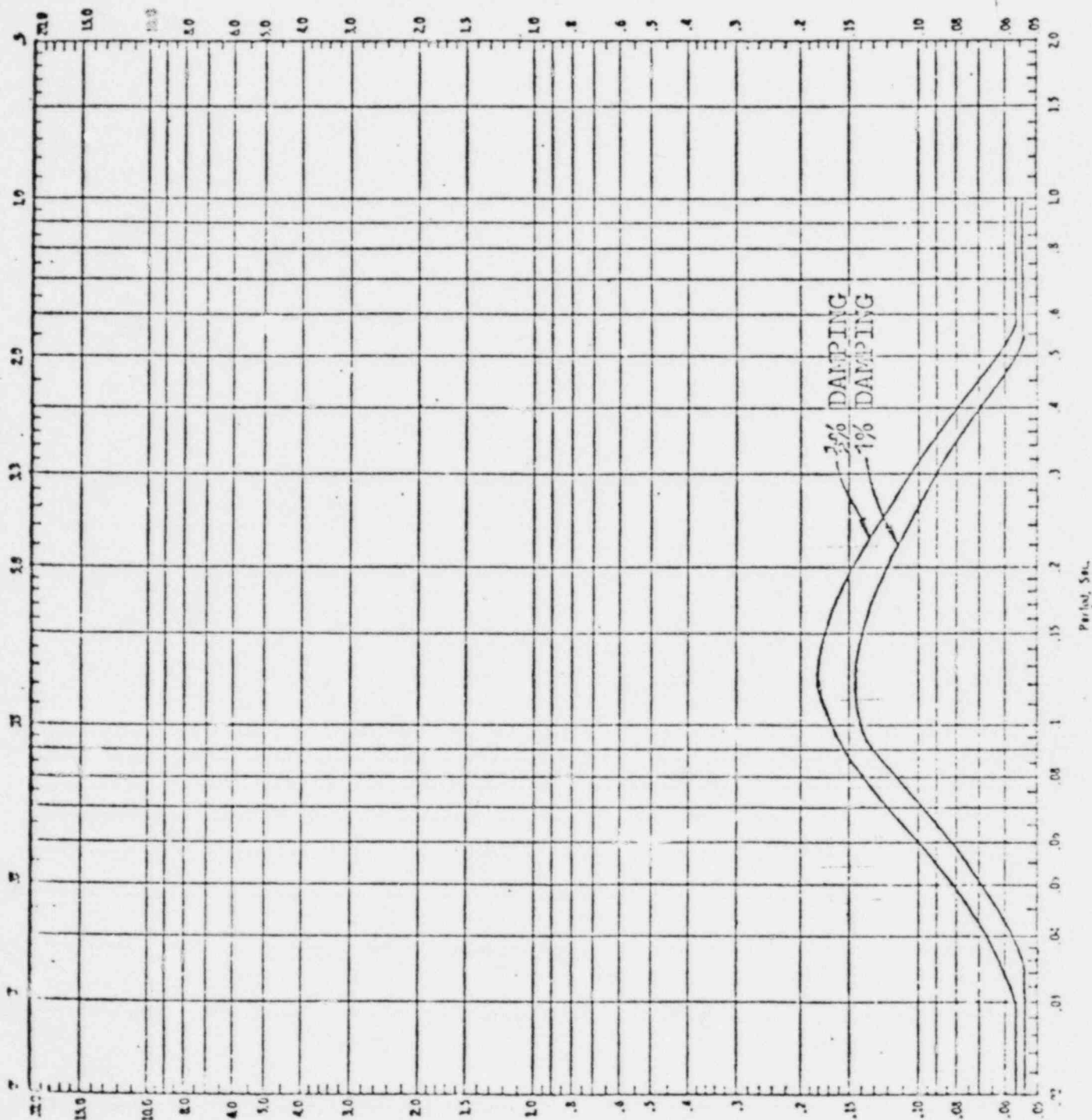


FIGURE C-1
VERTICAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE GROUND LEVEL

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SEM

DATE April 18, 1972

CHECKED BY HHS

DATE 4/12/72

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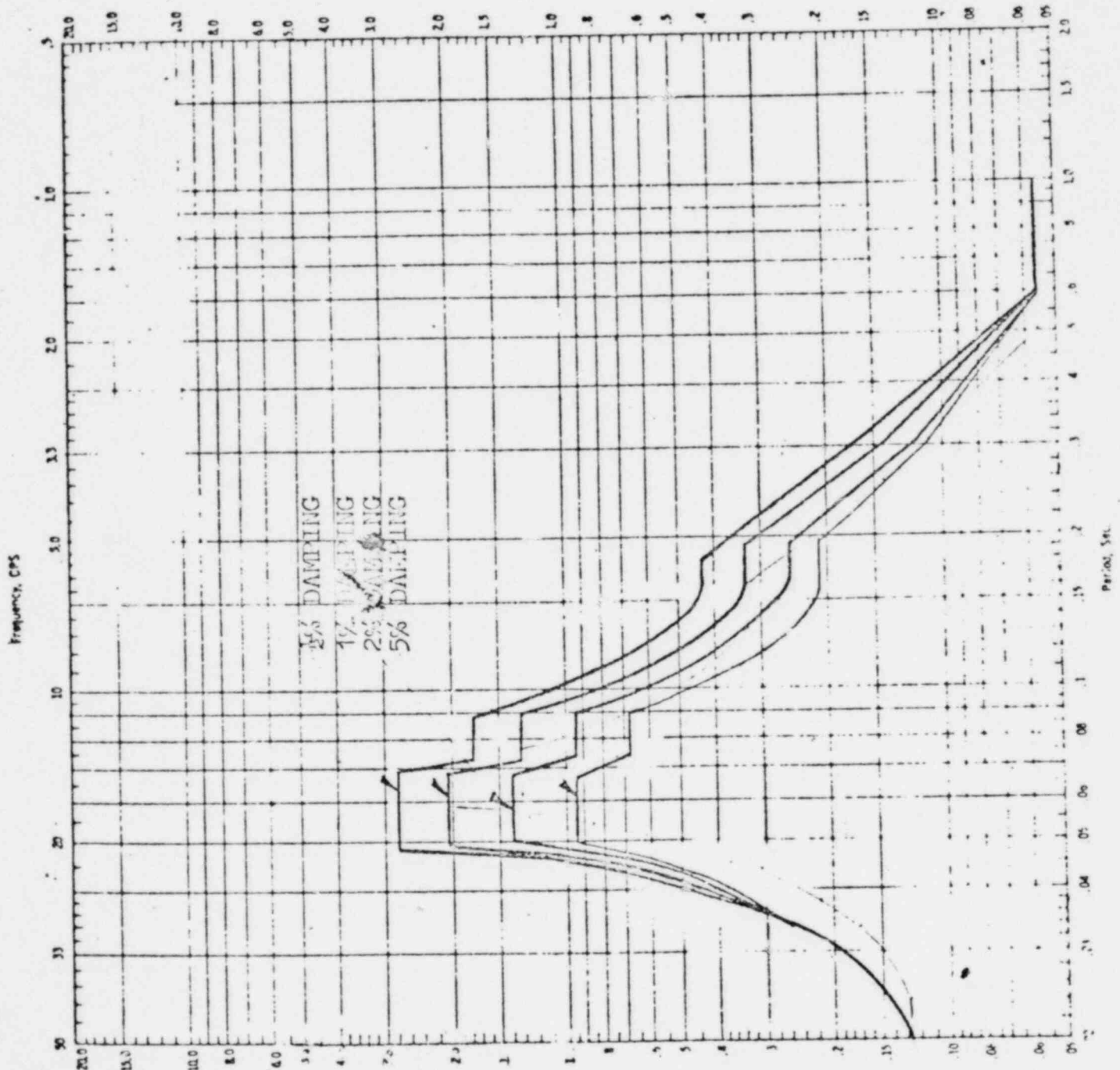


FIGURE C-6
VERTICAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE REACTOR
BUILDING SLAB EL. 583'-6", 613'-6"

2% 12.8
5% 7.2
10% 10.1

y 581'-0" a between ground and 583'-6"

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3088

DESIGN BY SGM

DATE April 18, 1972

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DATE 4/10/72

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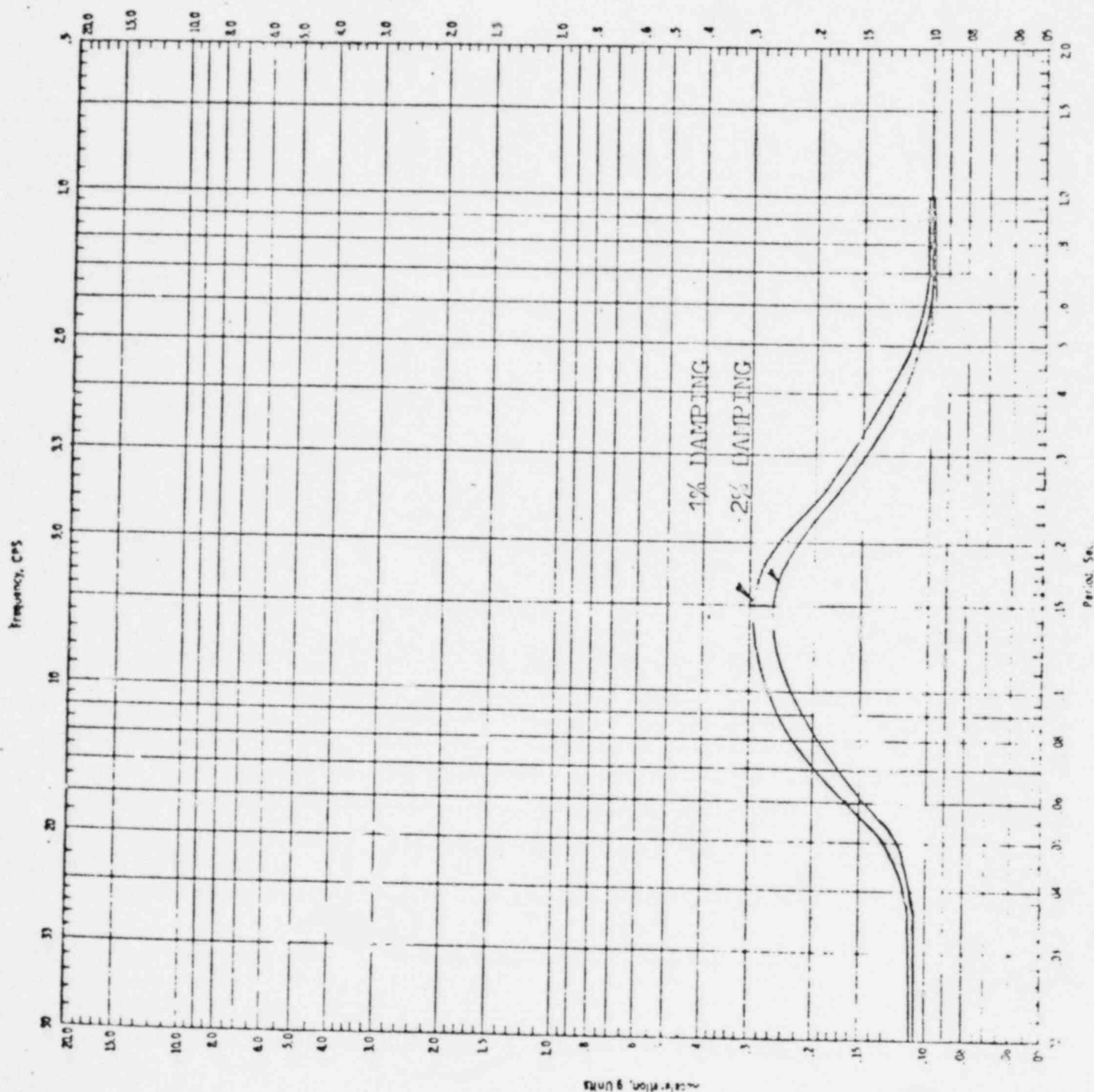


FIGURE C-11
VERTICAL RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE GROUND LEVEL

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3088

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DATE 4/10/72 SHEET OF

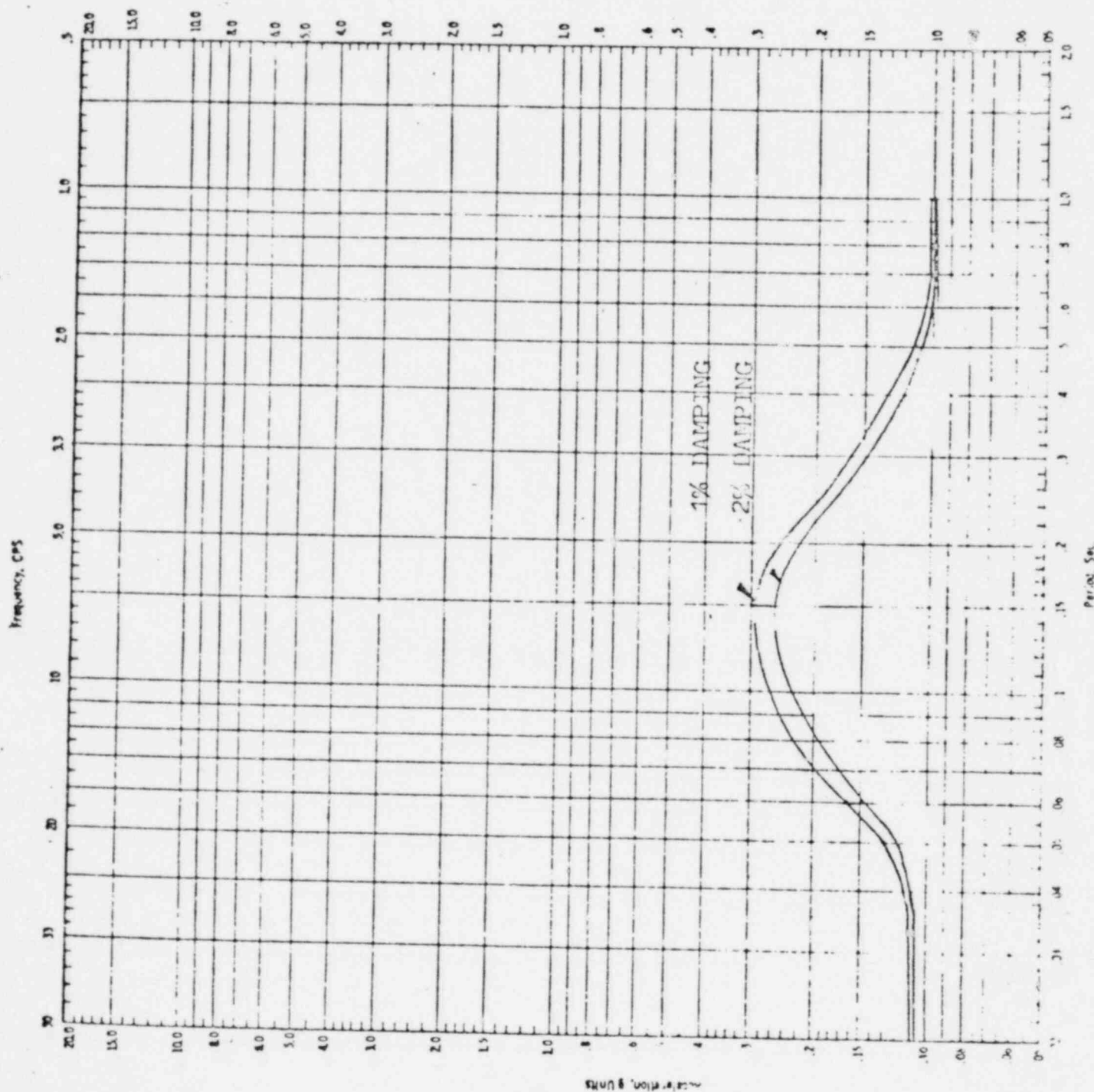


FIGURE C-11
VERTICAL RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE GROUND LEVEL

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON CO.

PROJECT ENRICO FERRI

JOB NO. _____

DESIGN BY SGM

DATE April 5, 1972

CHECKED BY HHS

DATE 4/10/72

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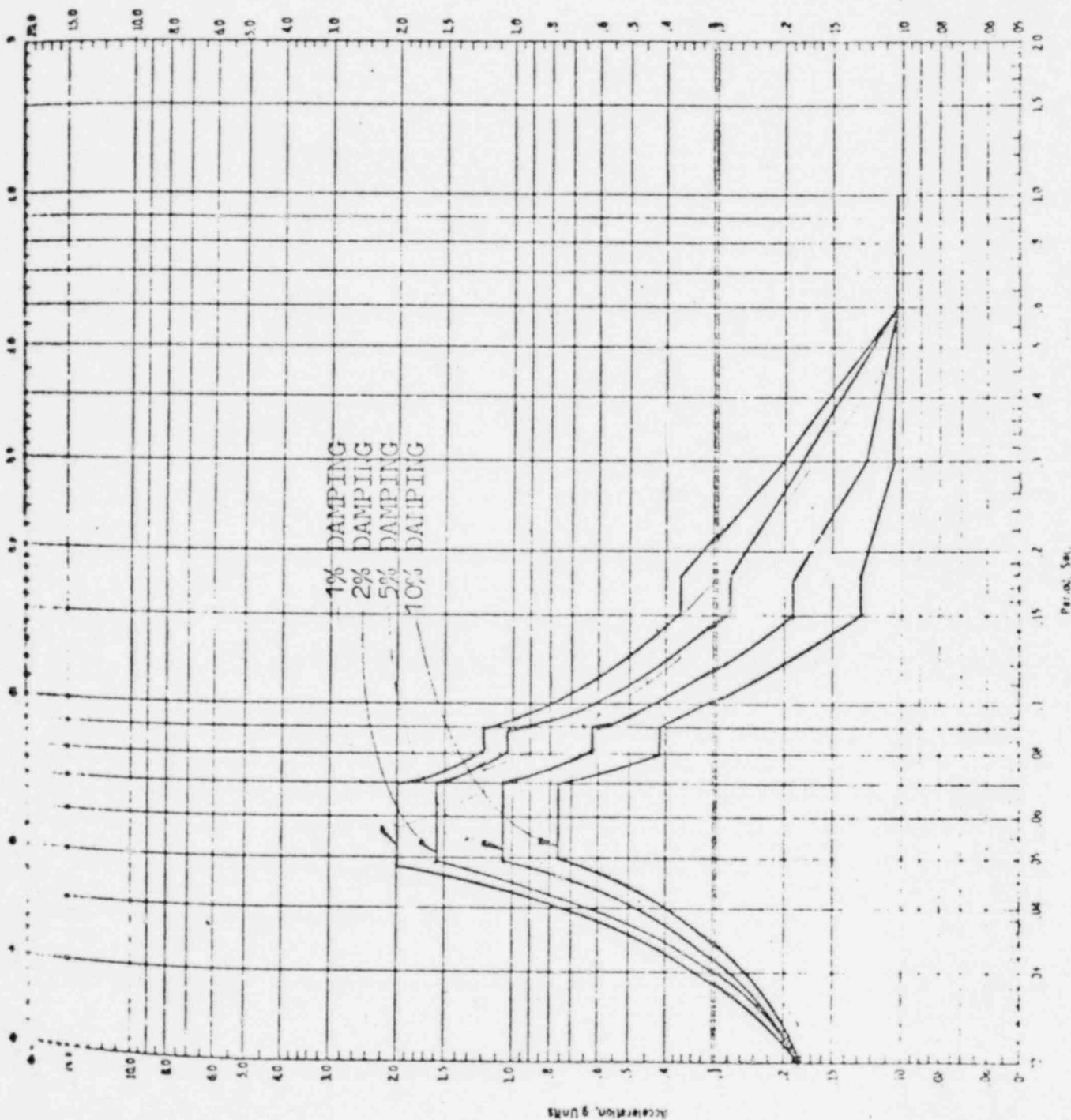


FIGURE C-16
VERTICAL RESPONSE SPECTRA
DESIGN BASIS E/ RTHQUAKE REACTOR BUILDING
SLAB EL. 583'-6", 613'-6"

g 581'-0" is below ground level - 2'-6"

CLIENT DETROIT Edison

PROJECT ERICO FERRI

DESIGN BY SGM

CHECKED BY HHS

JOB NO. 7522

DATE APRIL 18, 1972

DATE 5/2/72 SHEET OF

Frequency, CPS

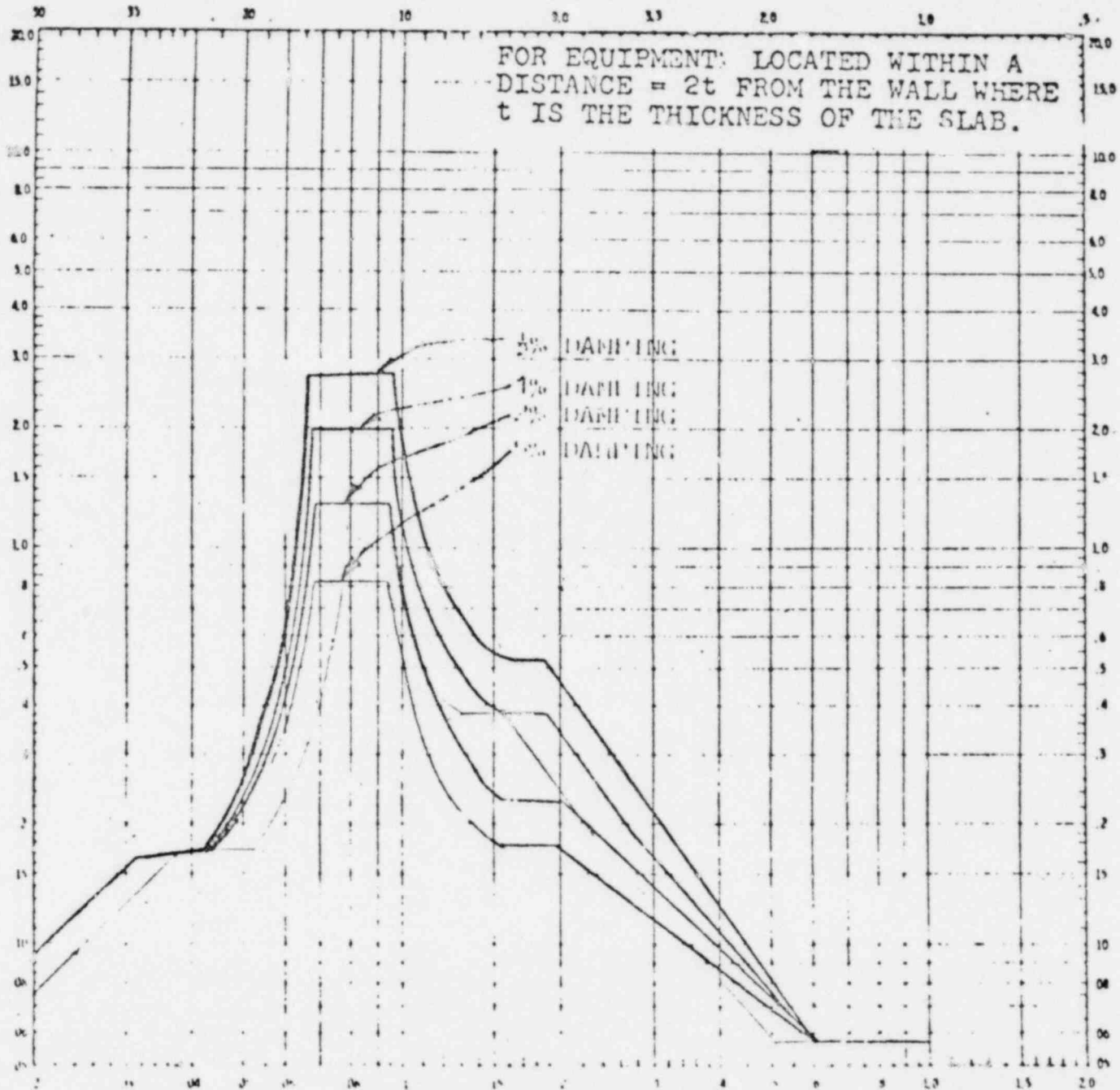


FIGURE C-5

VERTICAL RESPONSE SPECTRA

OPERATING BASIS EARTHQUAKE REACTOR BUILDING

WALL EL. 641'-6" , 659'-6" \$ 684'-6"

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SGM

DATE April 18, 1972

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DATE 4/18/72

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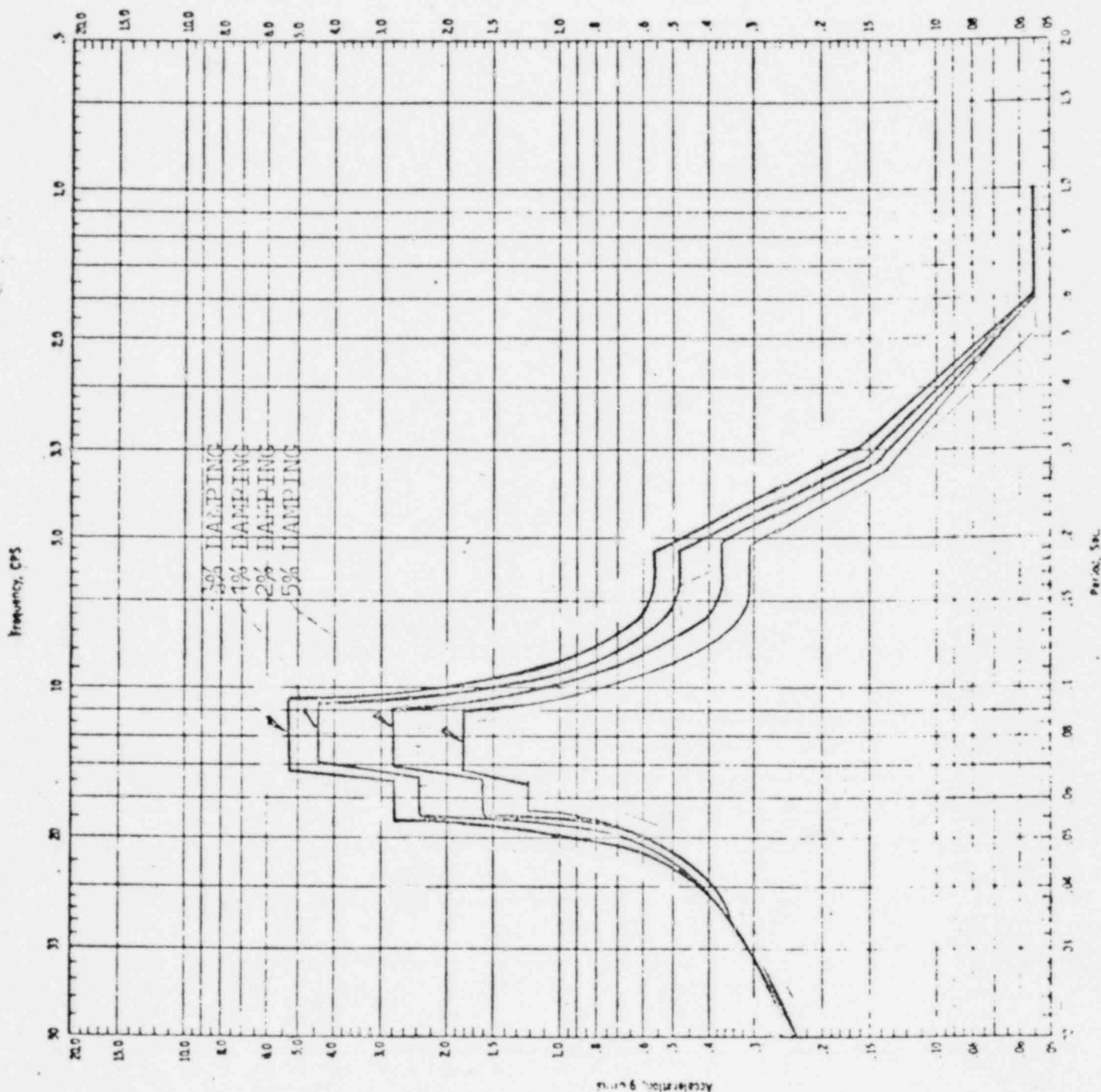


FIGURE C-9
VERTICAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE AUXILIARY BUILDING
SLAB EL. 643'-6" & 677'-6"

10.2
7.5



CLIENT DETROIT EDISON CO.
PROJECT ENRICO FERRI JOB NO. 3988
DESIGN BY SGM DATE April 5, 1977
CHECKED BY HHS DATE 4/13/77 SHEET OF

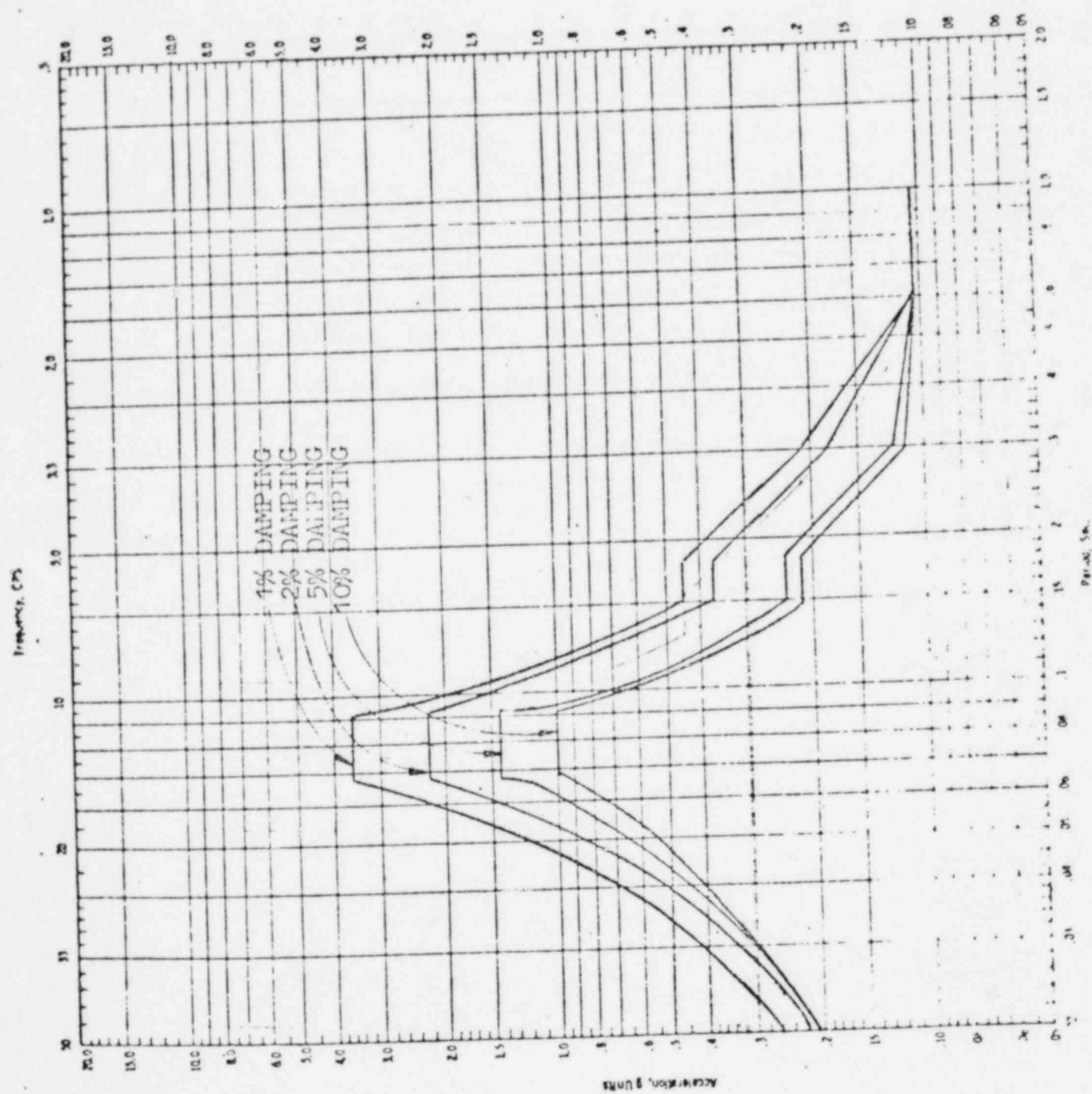


FIGURE C-19
VERTICAL RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE AUXILIARY BUILDING
SLAB EL. 643'-6" & 677'-6"

10.95
6.9
10.7
4.76

Signat

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON CO.PROJECT ENRICO FERMI

JOB NO. _____

DESIGN BY SGMDATE April 5, 1972CHECKED BY HHSDATE 4/18/72

SHEET _____ OF _____

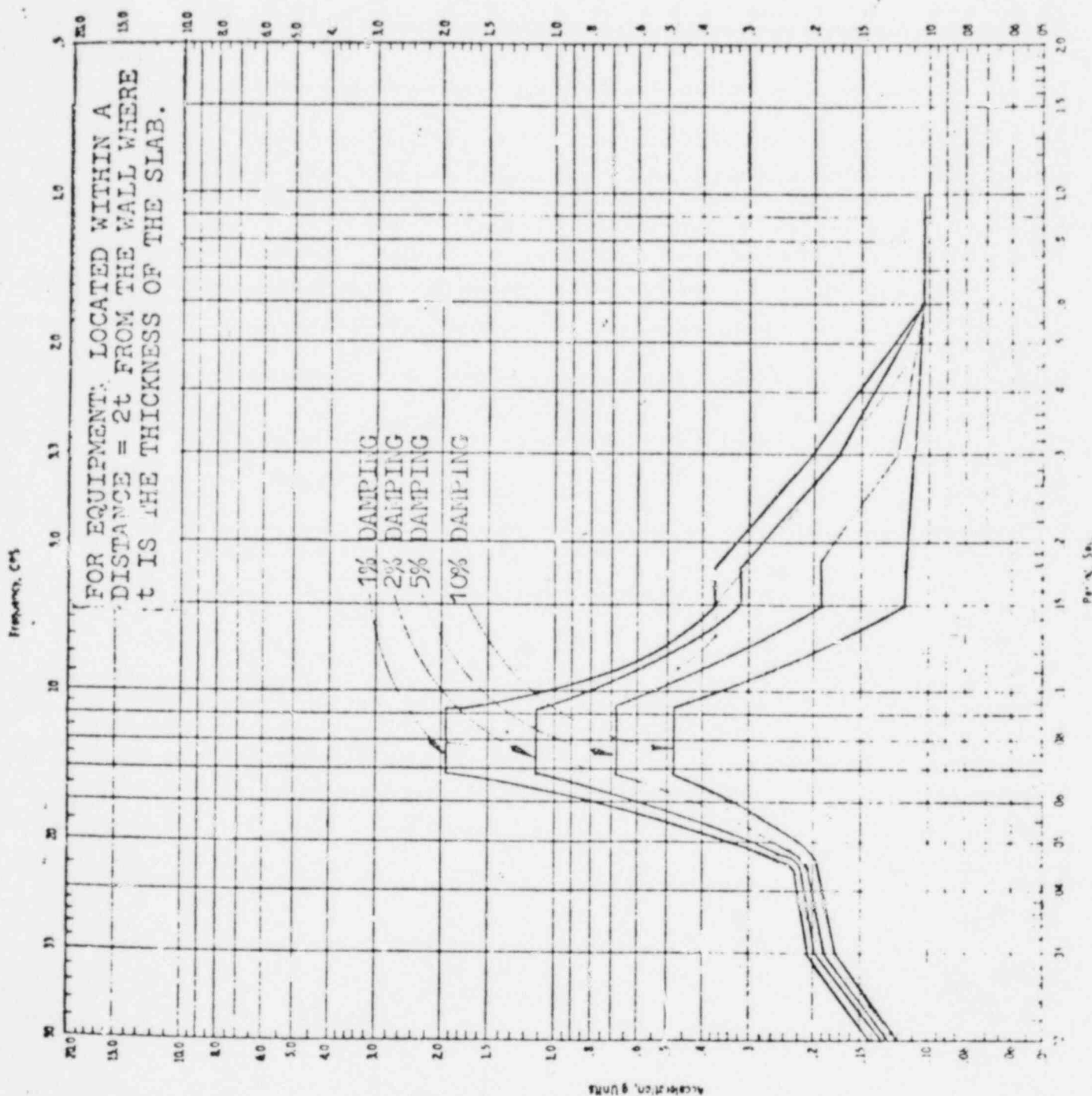


FIGURE C-15
VERTICAL RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE REACTOR AND
AUXILIARY BLDG. WALL EL. 641'-6", 659'-6" & 684'-6"

Report

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: Remote Shutdown Panel

EQUIPMENT NO. : H21-P100 (Panel PSI#)
C35-P001 (Sys. PIS#)

SPCC. NO.: BM C1-303E

LOCATION: Reactor Building Elevation 613'-6"

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE

QUALIFICATION DOCUMENT REFERENCES:

1. Wyle Laboratories Test Report #43414-1, dated 6-6-77.
2. Wyle Laboratories Test Report #43414-2, dated 11-1-77.
3. S&L Report SL-2682 containing applicable response spectra.
4. DECO Dwg. Nos: 61721-2798-1, dated 11-16-77
61721-2798-2, dated 11-15-77
61721-2798-3, Rev. A
61721-2796-1, Rev. A
61721-2791-1, Rev. C

Prepared by: *Thomas E. Fornick*
Reviewed by:
Approved by:

Date: 7-14-81
Date:
Date:

QUALIFICATION SUMMARYLOAD COMBINATIONS CONSIDERED:

Dead Weight & SSE

ORIGINAL QUALIFICATION METHOD:

The equipment was originally qualified by testing. A low-level bi-axial sine sweep in each direction was used to establish major resonances. Bi-axial random multifrequency tests were then performed in the front-to-back/vertical and side-to-side/vertical directions. The frequency bandwidths were spaced 1/3 octave apart over the frequency range of 1 Hz to 40 Hz. Five OBE tests and one SSE test were conducted in each test orientation. The instruments were monitored for operability (except the reactor pressure meter which was subsequently tested in Ref. 2).

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME: FERMI - Unit 2 TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME: Remote Shutdown Panel

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: Not Applicable Quantity: 1
3. Vendor: Reliance Electric Co.
4. If the component is a cabinet or panel, name and model No. of the devices included: see attachment
5. Physical Description Appearance: Re-inforced sheet metal panel.
Dimensions: 96" x 36" x 90" Weight: 3000 lbs.
6. Location: Building: Reactor Elev.: 613'-6"
7. Field Mounting Conditions:
☐ Bolting: Number: Size:
☒ Welding: Weld Type: Fillet and plug
Leg: 1/4" Length: 6" Pitch: 22"
Plug weld 5 rear mounting holes.
*8. Natural frequencies in each direction:
Front to back: *Random multi-frequency test was performed.
Side to side :
Vertical:
*9. Method of determining natural frequencies:
☐ Laboratory Test
☐ Analysis
☐ Other
10. a. System in which located: Remote Shutdown System
b. Functional description: Provides the ability to shutdown reactor in the event of inhabitability of the Control Room.
c. Equipment required for:
☒ Hot Standby ☒ Cold Shutdown ☒ Post LOCA

11. Pertinent reference design specifications: BM CI-303E

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☒ Test
☐ Analysis
☐ Combination of Test and Analysis

1. Qualification Report

a. Title: Seismic Simulation Test Program on a Remote Shutdown Panel.

b. Number and Date: 43414-1, dated 6-6-77

2. Company that prepared report: Wyle Laboratories

3. Company that reviewed report: Detroit Edison

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only

☐ Hydrodynamic only

☐ Seismic and Hydrodynamic

☐ Other (Specify): _____

☐ _____

2. Required response spectra (attach the graphs):

B-7, B-8, B-31, B-32, C-6, C-12

3. Method of combining Requiring Response Spectra:

☒ Absolute Sum

☐ SRSS

4. Damping Upset (OBE): 1% Basis for damping: NRC Reg

Emerg. (SSE): 2% Guide 1.61

5. Required acceleration in each direction (if required):

☒ ZPA ☐ Other (Specify): _____

Upset (OBE): F/B=_____ S/S=_____ V=_____

Emerg. (SSE): F/B=_____ S/S=_____ V=_____

6. Were fatigue effects or other vibration loads considered?

☐ Yes Describe loads and how they were treated in overall qualification program: _____

☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE:

1. Test Method: ☐ Single frequency: _____
☒ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☒ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) 10 Emerg. (SSE) 2
4. Frequency range: 1 Hz to 40 Hz.
5. For multiple frequency test does TRS envelop RRS?
☐ No ☒ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: .4 to .44 g S/S: .46 to .50 g V: .29 to .31 g
Emerg. (SSE) F/B: .6g S/S: .6g V: .42g
7. Laboratory mounting:
☒ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☒ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____
TRS envelopes RRS
10. Other tests performed: Sine sweep to determine major
resonances (natural frequencies not reported)

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☐ Static analysis
☐ Static coefficient analysis
☐ Dynamic analysis: ☐ Response spectrum
☐ Time history
2. Model type:
☐ 1-dimensional
☐ 2-dimensional
☐ 3-dimensional

3. Method of analysis:

☐ Computer-aided calculation
programs used: _____☐ Hand calculations☐ _____4. Have equipment supports been adequately considered in
analysis: ☐ Yes ☐ No

5. Stress evaluation at critical structural elements:

Element	Calc Stress	Allow Stress

6. Deflection evaluation at critical structural elements
(active equipment only)

Element	Calc Stress	Allow Stress

VIII. ADDITIONAL COMMENTS:

The reactor pressure vessel meter was tested in a separate test.

ATTACHMENT TO EMD FILE #
REMOTE SHUTDOWN PANEL
DEVICES INCLUDED

- Western Series 1316 Optical Ribbon Indicator
- Foxboro Model 6401 HC and Model 6402 HC
Single Point Indicators
- Flays/Republic Flow Indicator
Model 3600, Type 507
- Honeywell CMC Unit #910AEA531,
#910MFA531, #910MGA531
- Electro-Switch #24203-1 & #24207B-1
- Master Specialties Back Lighted Pushbuttons
and Backlighted Display
- General Electric CR2940VA203B Pushbutton
- Analogic Model PI2455 Digital Process Indicator

SARGENT & LUNDY

ENGINEERING

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 4988

DESIGN BY SGM

DATE April 18, 1972

CHECKED BY HHS

DATE 5/8/72 SHEET OF

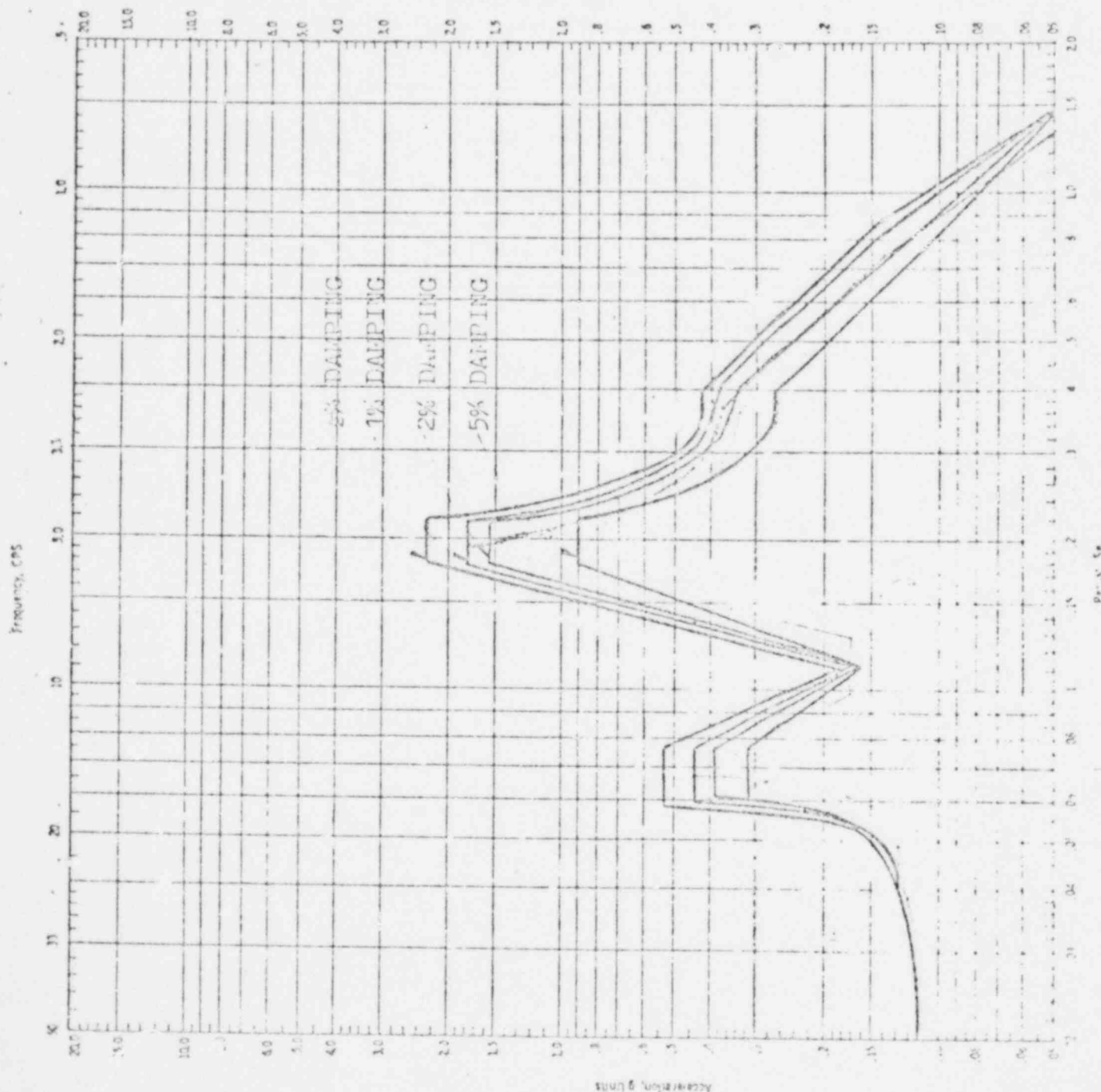


FIGURE B-7
HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION - 613'-6" (SLAB NO. 2)
REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

7-244

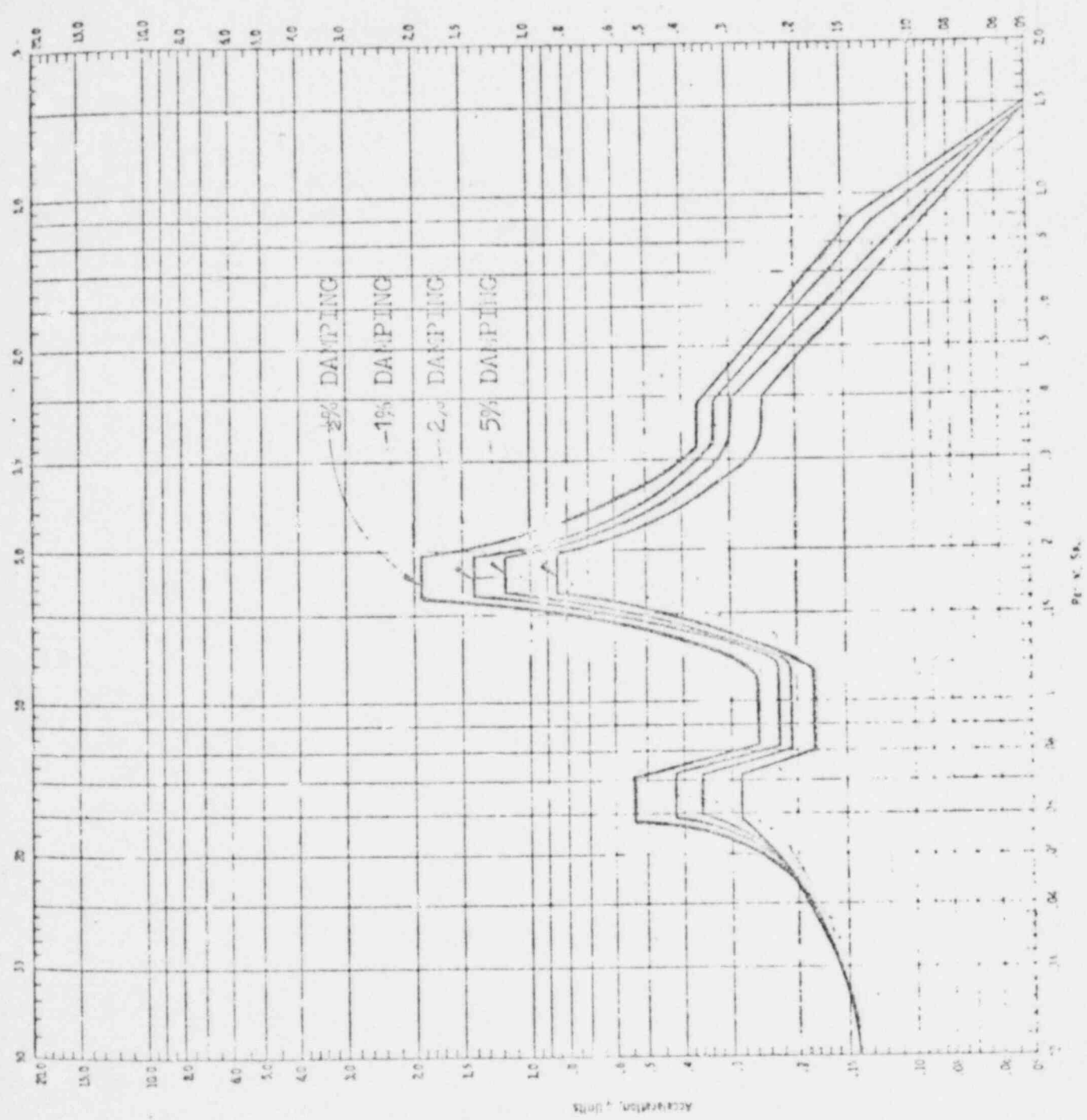


FIGURE B-8
HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION - 613'-6" (SLAB NO. 2)
REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT Edison
 PROJECT MERICO FERRA JOB NO. 5988-00
 DESIGN BY SGM DATE April 12, 1972
 CHECKED BY HHS DATE 4/18/72 SHEET OF

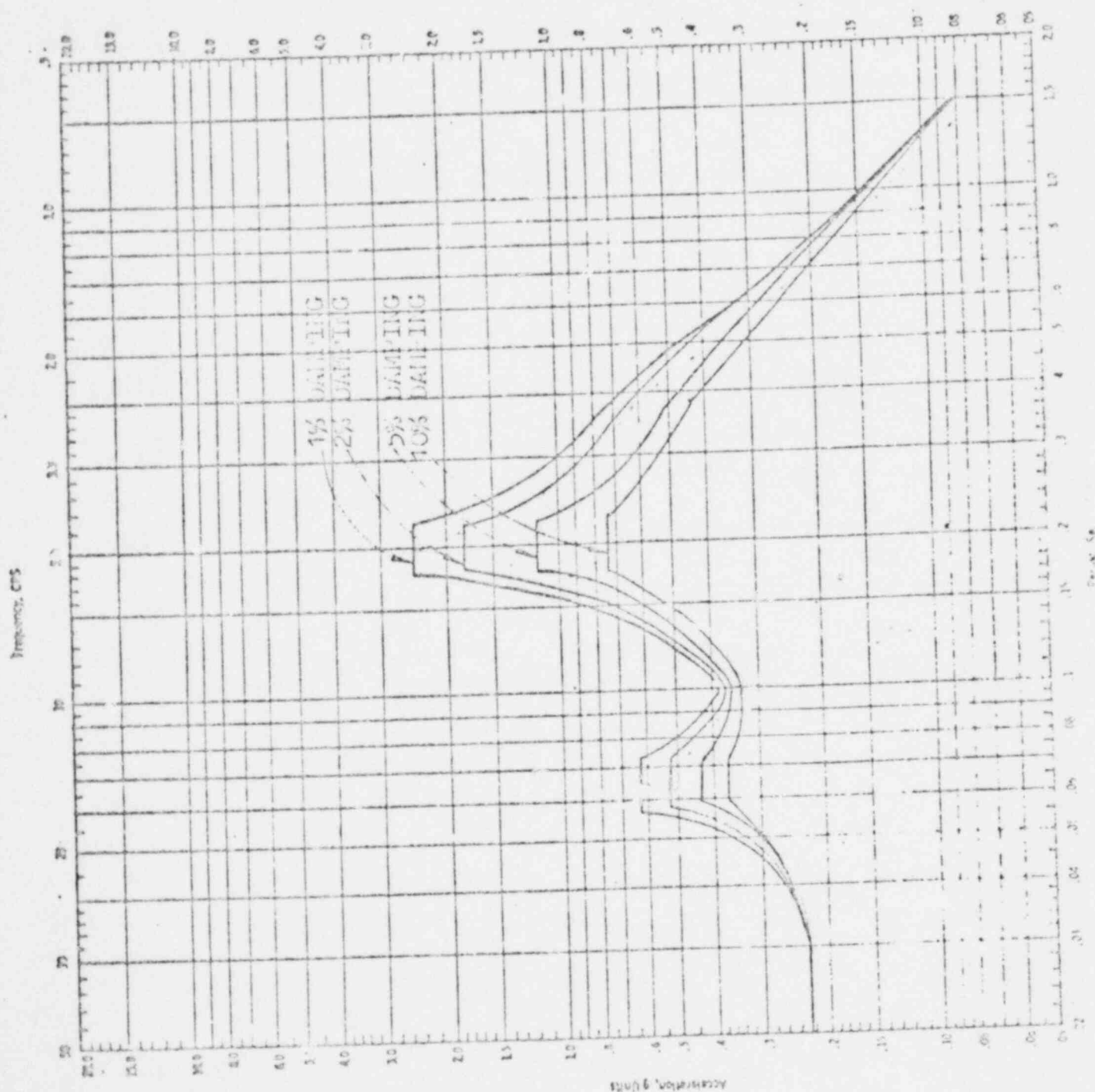


FIGURE B-31
 HORIZONTAL FLOOR RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE ELEVATION - 613'-6" (SLAB NO. 2)
 REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3488-CO

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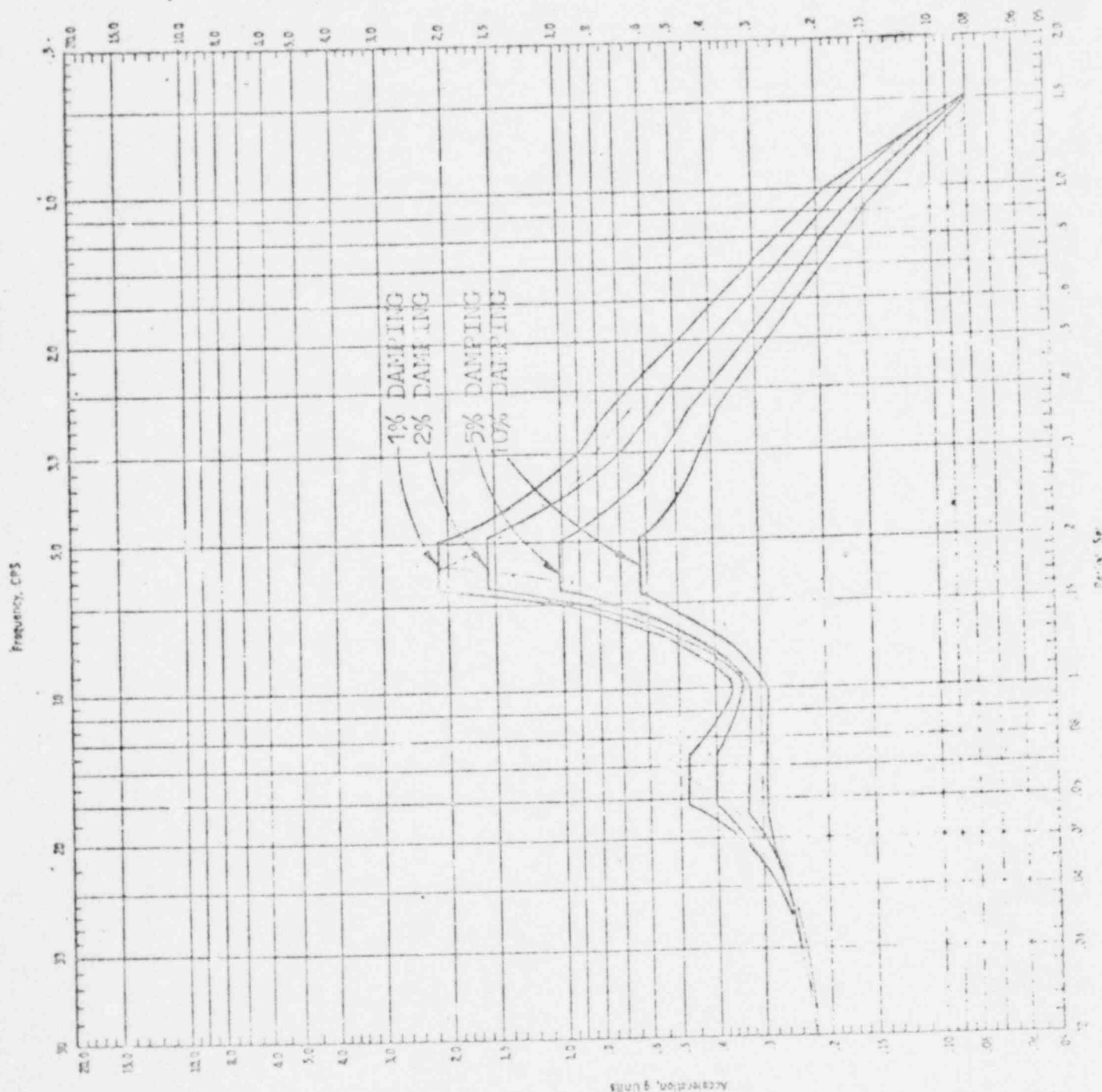


FIGURE B-32
HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE ELEVATION - 613'-6" (SLAB NO. 2)
REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SGM

DATE April 18, 1972

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DATE 4/12/72

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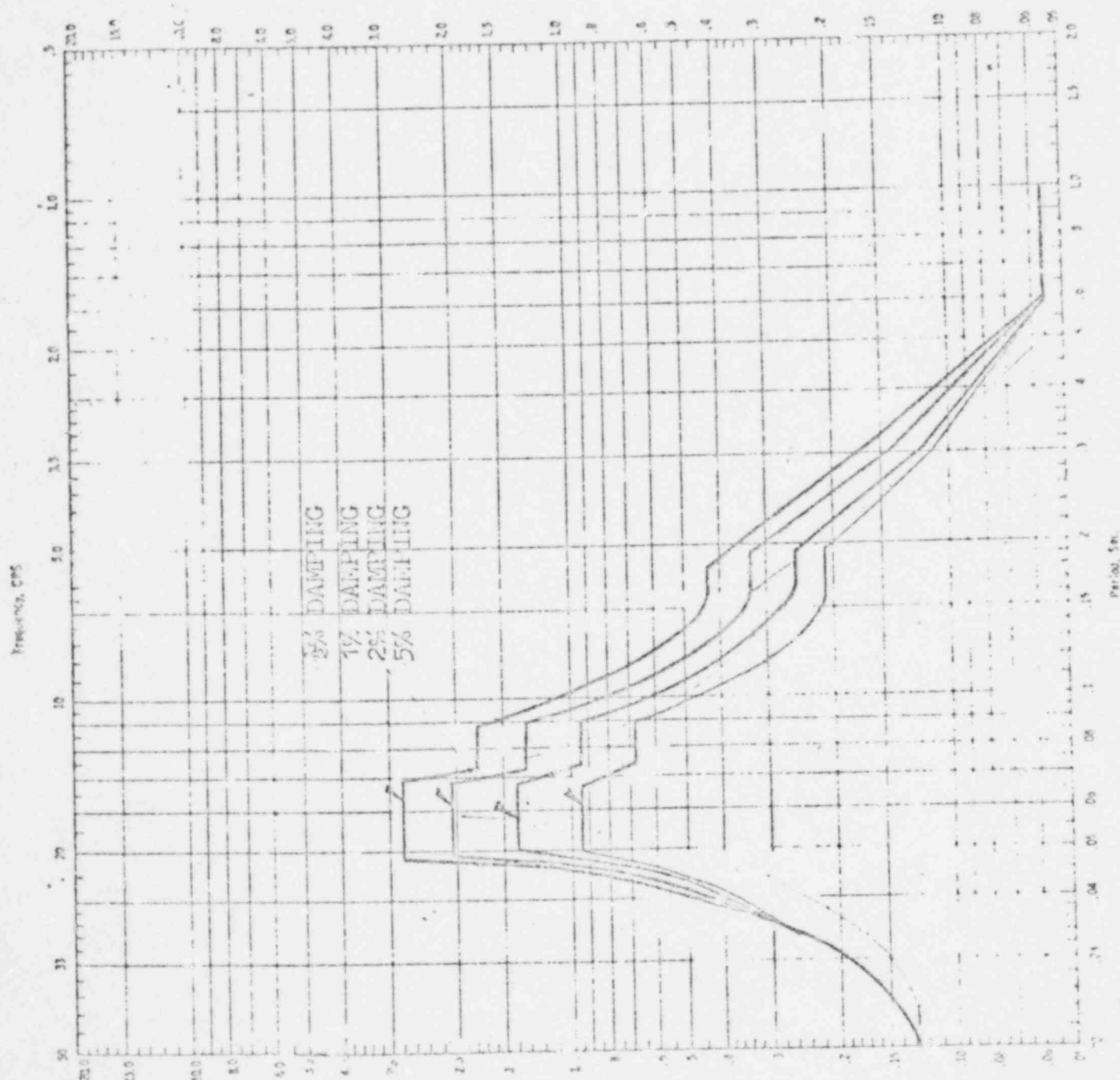


FIGURE C-6
VERTICAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE REACTOR
BUILDING SLAB EL. 583'-0", 613'-6"

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON CO.

PROJECT ENRICO FERMI

LOG NO. 3088-00

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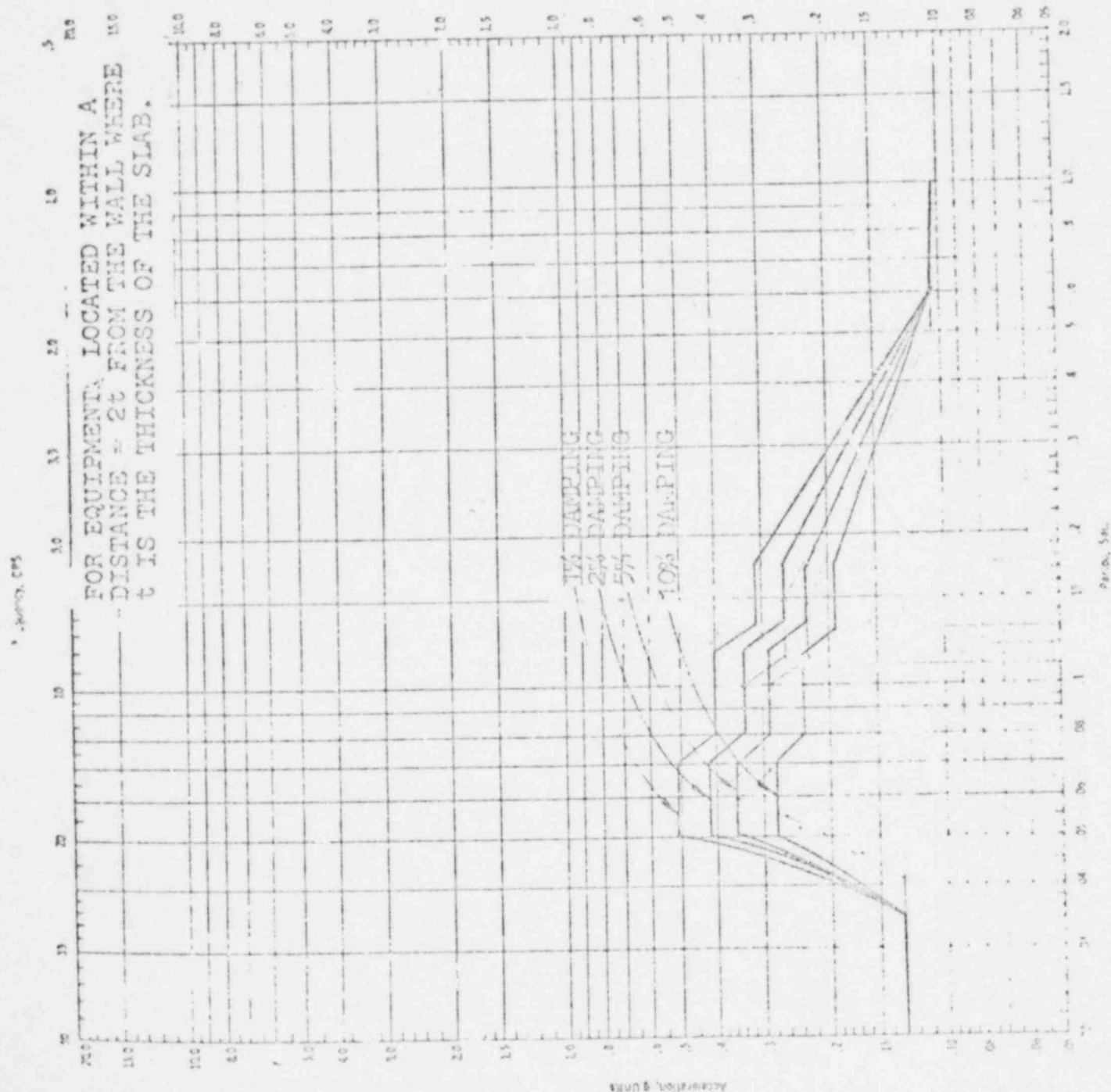
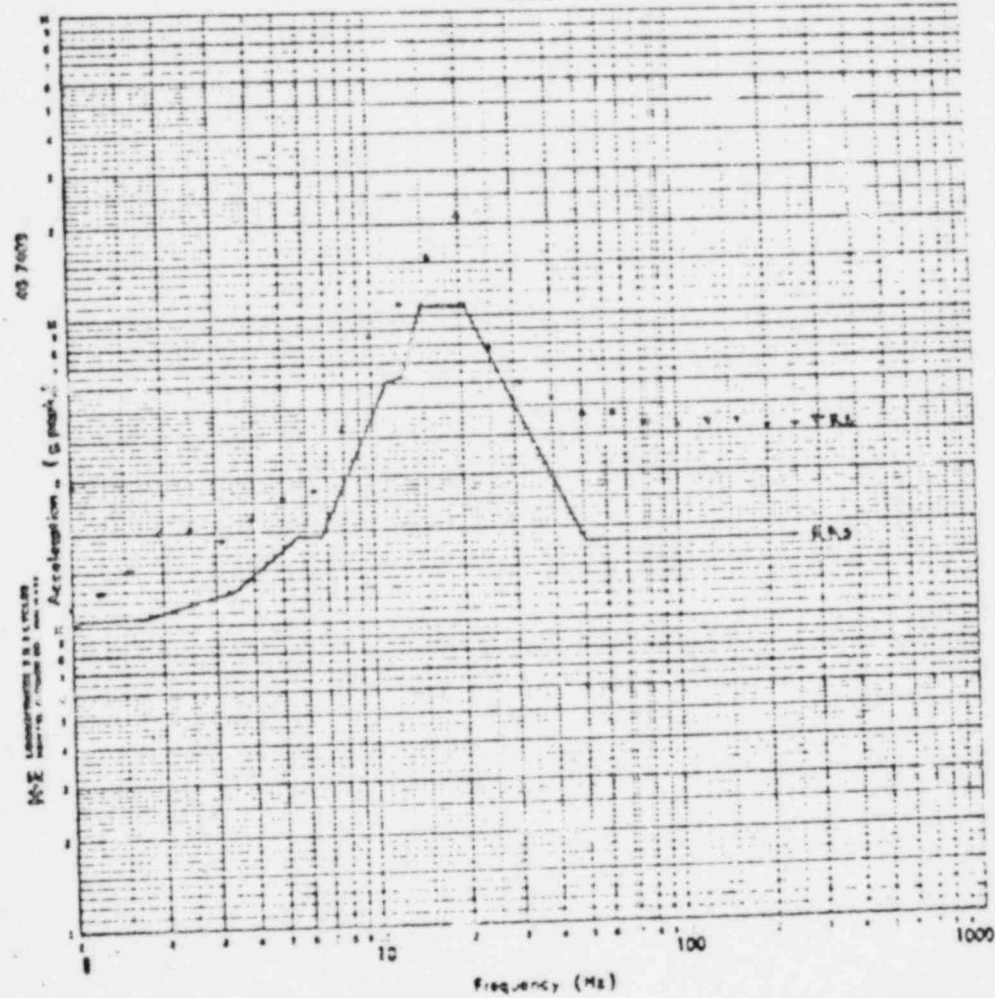


FIGURE C-12
VERTICAL RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE REACTOR
CONT. SHIELD EL. 583'-6", 613'-6"

FULL SCALE SHOCK SPECTRUM & Wave

100 10 100 1000

DAMPING 5

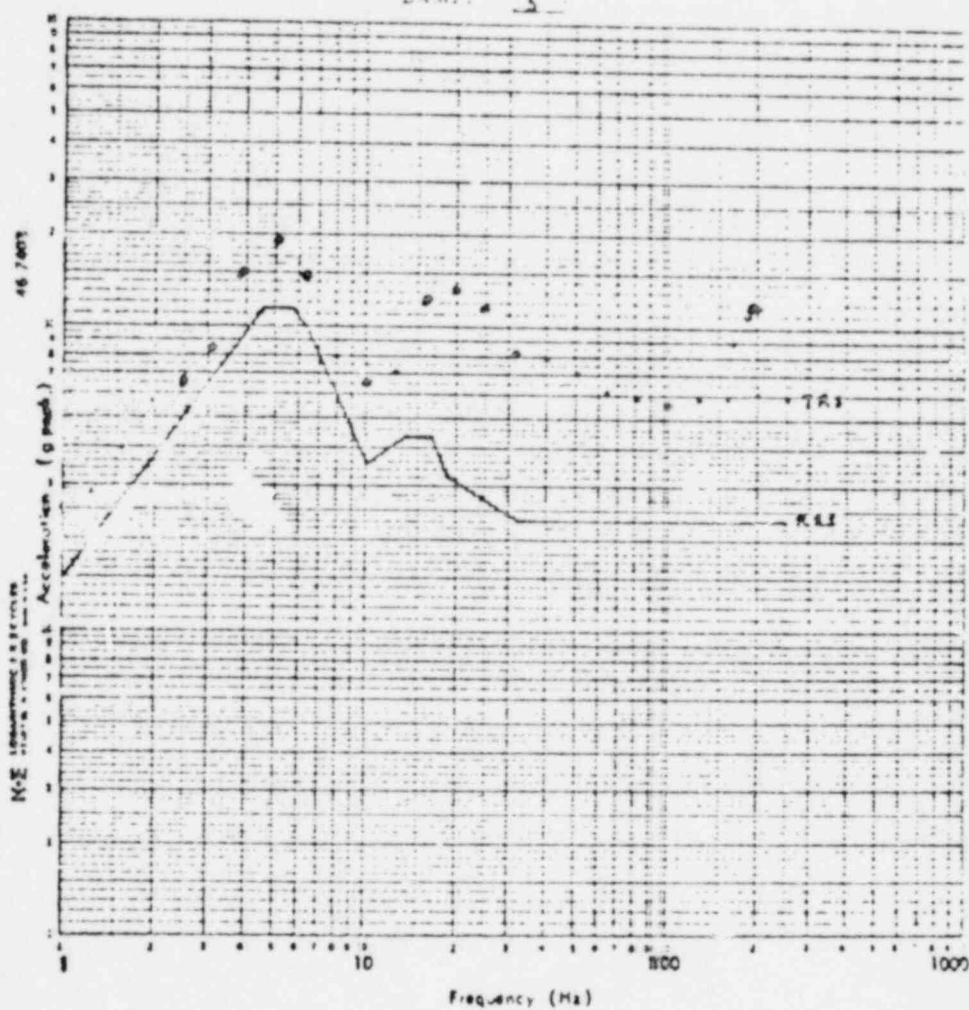


AXIS E-B/YART
LOCATION NO. VCR
TEST RUN NO. 9

FULL SCALE SENSITIVITY 1.0 g

100 100 100 100

DAMPED 5



AXIS E-B/VERT

LOCATION NO. HCB

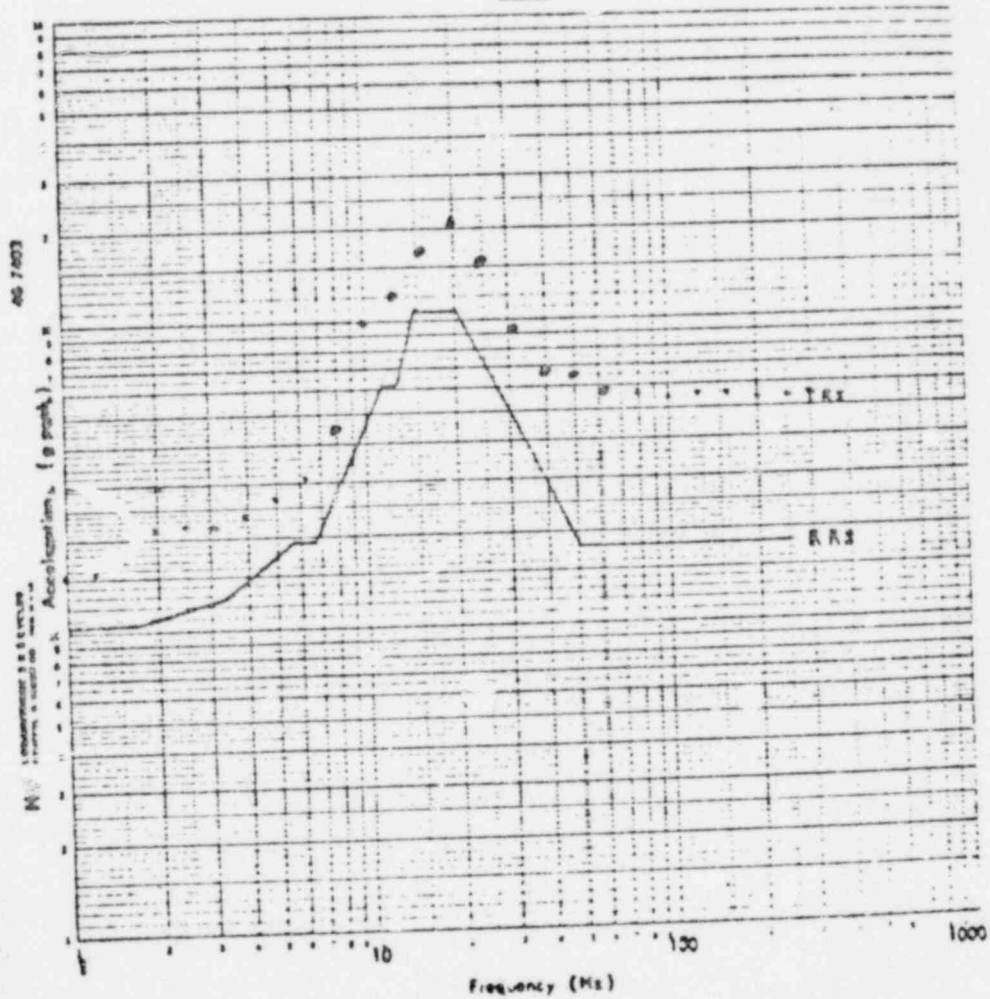
TEST RUN NO. 9

Page No.
 Project No.
 Date

FULL SCALE SHOCK SPECTRUM 2-Phase

100 10 100 1000

DAMPING 5



Frequency (Hz)

AXIS 5 5/16" BT

LOCATION NO. VGA

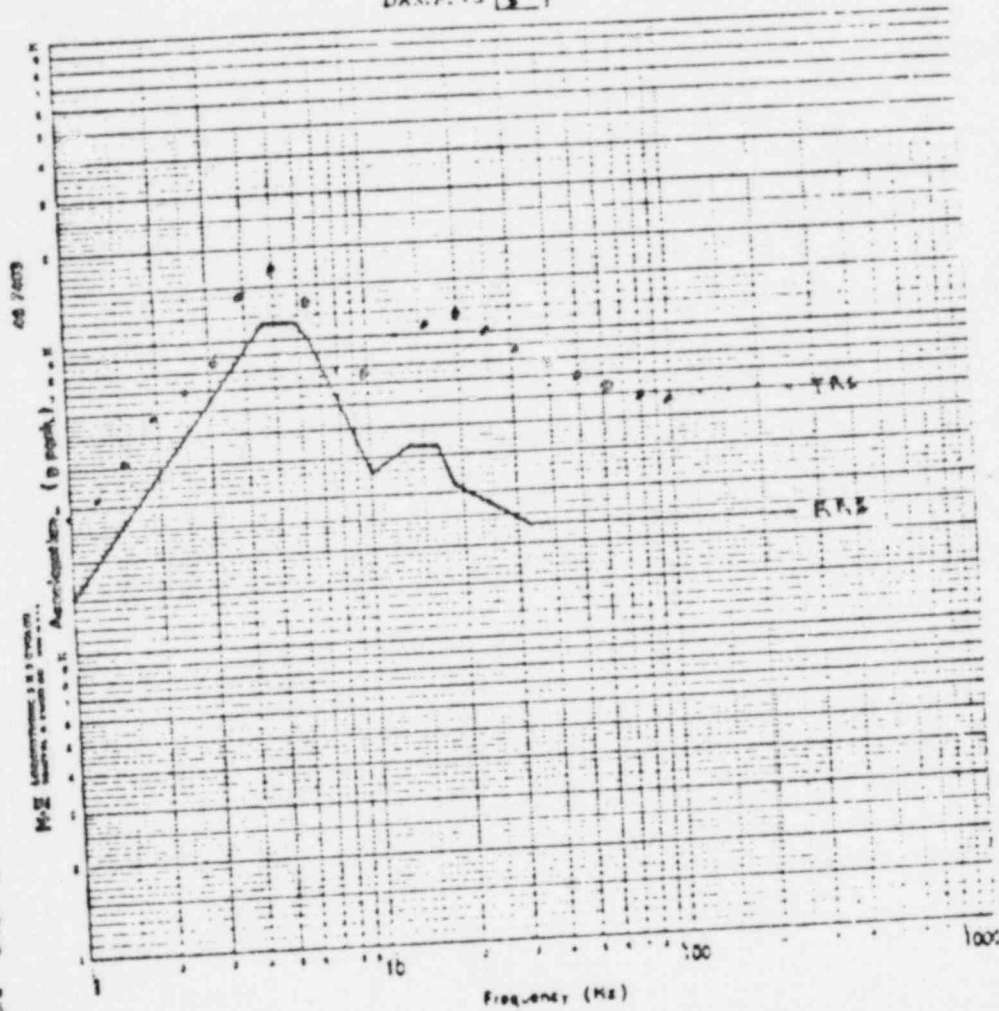
TEST RUN NO. 17

Page No. 2
Project No. 4-1-1-1

FULL SCALE SPECTROGRAM

100 100 100 100

DANGER 5



AXIS S-S/VERT
LOCATION NO HCA
TEST RUN NO. 17

SARGENT & LUNDY

ENGINEERS
CHICAGO

FERMI UNIT 2
EQUIPMENT DYNAMIC
QUALIFICATION SUMMARY

Project #6139-40

EMD File #

Page 1 of 6

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: 480 Volt Switchgear Voltage Regulator

EQUIPMENT NO. :

R1400S0208

SPEC. NO.: 3071-43

R1400S0218

LOCATION:

Reactor Building - 643'-6"

EQUIPMENT CLASSIFICATION:

☒ ACTIVE

☐ PASSIVE

QUALIFICATION DOCUMENT REFERENCES:

1. Wyle Laboratories Test Report No. 42949-1, dated April 9, 1975.
2. S&L Report SL-2682 containing applicable response spectra for the Reactor/Auxiliary Buildings.
3. S&L Report SL-3147 containing response spectra for the RHR Complex.

Prepared by: *Thomas E. Fornek*
Reviewed by:
Approved by:

Date: 7-14-81
Date:
Date:

QUALIFICATION SUMMARY

LOAD COMBINATIONS CONSIDERED:

1. OBE + Deadweight
2. SSE + Deadweight

QUALIFICATION METHOD:

The equipment was qualified by testing. A low level sine sweep was performed in both the front-to-back/vertical and the side-to-side/vertical orientations to determine the major resonances. The equipment was then subjected to 30-second duration simultaneous horizontal and vertical inputs of random waveform motion consisting of frequencies spaced one-third octave apart over the frequency range of 0.5 Hz to 50 Hz as necessary to envelope the Required DBE Response Spectra (RRS). The amplitude of each one-third octave frequency was independently adjusted in each axis until the Test Response Spectra (TRS) enveloped the RRS. The control accelerometers were recorded on tape and oscillograph recorders. The resulting table motion was analyzed by a spectrum analyzer at a damping of one percent (1%) and plotted at one-third octave frequency intervals over the frequency range of interest. The tuning to develop shaping of the TRS was done at one-half RRS or greater. A minimum of five Operational Basis Earthquake (OBE), including those of the tuning phase, were applied to the equipment prior to performing the full-level DBE tests.

SARGENT & LUNDYENGINEERS
CHICAGOFERMI UNIT 2
EQUIPMENT DYNAMIC
QUALIFICATION SUMMARY

Project #6139-40

EMD File #

Page 3 of 6

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME: FERMI - Unit 2 TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME: 480 Volt Switchgear Voltage Regulator

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: 787C484 AE-Part #2 Quantity: 2
3. Vendor: I-T-E Imperial Corporation
4. If the component is a cabinet or panel, name and model No. of the devices included: Same as 2 above.
5. Physical Description Appearance: Rectangular
Sheet metal box enclosing voltage regulator
Dimensions: 70 in. x 48 in. x 61 in. Weight: 6300 lbs.
6. Location: Building: See Sheet 1 Elev.: See Sheet 1
7. Field Mounting Conditions:
☒ Bolting: Number: 6 Size: 7/8"
☐ Welding: Weld Type: _____
Leg: _____ Length: _____ Pitch: _____
☐ _____
*8. Natural frequencies in each direction:
Front to back: _____
Side to side: _____
Vertical: _____
*9. Method of determining natural frequencies:
☐ Laboratory Test
☐ Analysis
☐ Other _____
10. a. System in which located: Electrical Auxiliary
b. Functional description: Voltage regulation for the Electrical Auxiliary System
c. Equipment required for:

☒ Hot Standby ☒ Cold Shutdown ☒ Post LOCA

*Natural frequencies not determined since a multifrequency test was

11. Pertinent reference design specifications: 3071-43

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☒ Test
☐ Analysis
☐ Combination of Test and Analysis

1. Qualification Report
Seismic Simulation Test Program on a
a. Title: Voltage Regulator
b. Number and Date: Wyle Report #42949-1, dated 4-9-75.
2. Company that prepared report: Wyle Laboratories
3. Company that reviewed report: Detroit Edison

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only
☐ Hydrodynamic only
☐ Seismic and Hydrodynamic
☐ Other (Specify): _____
☐ _____
2. Required response spectra (attach the graphs):
B-9, B-10, B-33, B-34, C-7, dated 4-18-72
3. Method of combining Required Response Spectra: C-17
☒ Absolute Sum dated 4-5-72
☐ S/S
4. Damping Upset (OBE): 1% Basis for damping: Reg. Guide 1.61
Emerg. (SSE): 2%
5. Required acceleration in each direction (if required):
☒ ZPA ☐ Other (Specify): _____
Upset (OBE): F/B= _____ S/S= _____ V= _____
Emerg. (SSE): F/B= _____ S/S= _____ V= _____
6. Were fatigue effects or other vibration loads considered?
☐ Yes Describe loads and how they were treated in overall qualification program: _____

☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE:

1. Test Method: ☐ Single frequency: _____
☒ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☒ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) 10 Emerg. (SSE) 6
4. Frequency range: 0.5 Hz to 50.0 Hz
5. For multiple frequency test does TRS envelop RRS?
☐ No ☒ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: >0.9g S/S: >1.0g V: >0.5g
Emerg. (SSE) F/B: >1.3g S/S: >1.2g V: >0.6g
7. Laboratory mounting:
☒ Bolting: Number: 5 Size 7/8"
☒ Welding: Weld type: *
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☒ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: Equipment operated suitably after a loose adjustment knob was secured with tape.
10. Other tests performed: Sine sweep to establish major resonances.

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☐ Static analysis
☐ Static coefficient analysis
☐ Dynamic analysis: ☐ Response spectrum
☐ Time history
2. Model type:
☐ 1-dimensional
☐ 2-dimensional
☐ 3-dimensional

*One bolt hole on the test table would not line up with the mounting hole on the equipment so this one mounting leg was welded to the test table.

3. Method of analysis:

☐ Computer-aided calculation
programs used: _____☐ Hand calculations☐ _____4. Have equipment supports been adequately considered in
analysis: ☐ Yes ☐ No

5. Stress evaluation at critical structural elements:

Element	Calc Stress	Allow Stress

6. Deflection evaluation at critical structural elements
(active equipment only)

Element	Calc Stress	Allow Stress

VIII. ADDITIONAL COMMENTS:

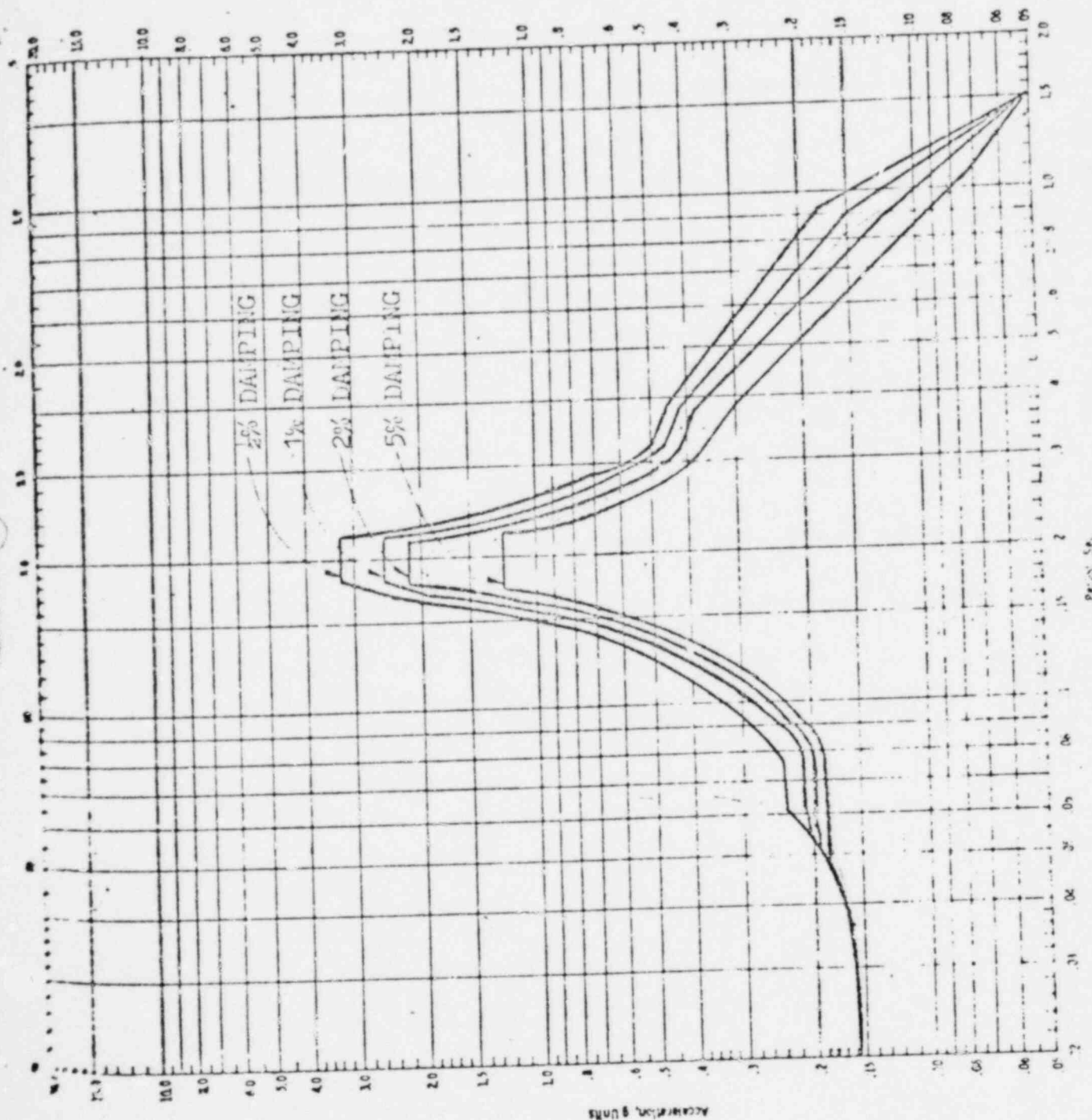


FIGURE B-9
HORIZONTAL FLOOR RESPONSE SPECTRA
ITERATING BASIS EARTHQUAKE ELEVATION - 641'-6" (SLAB NO. 3)
REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

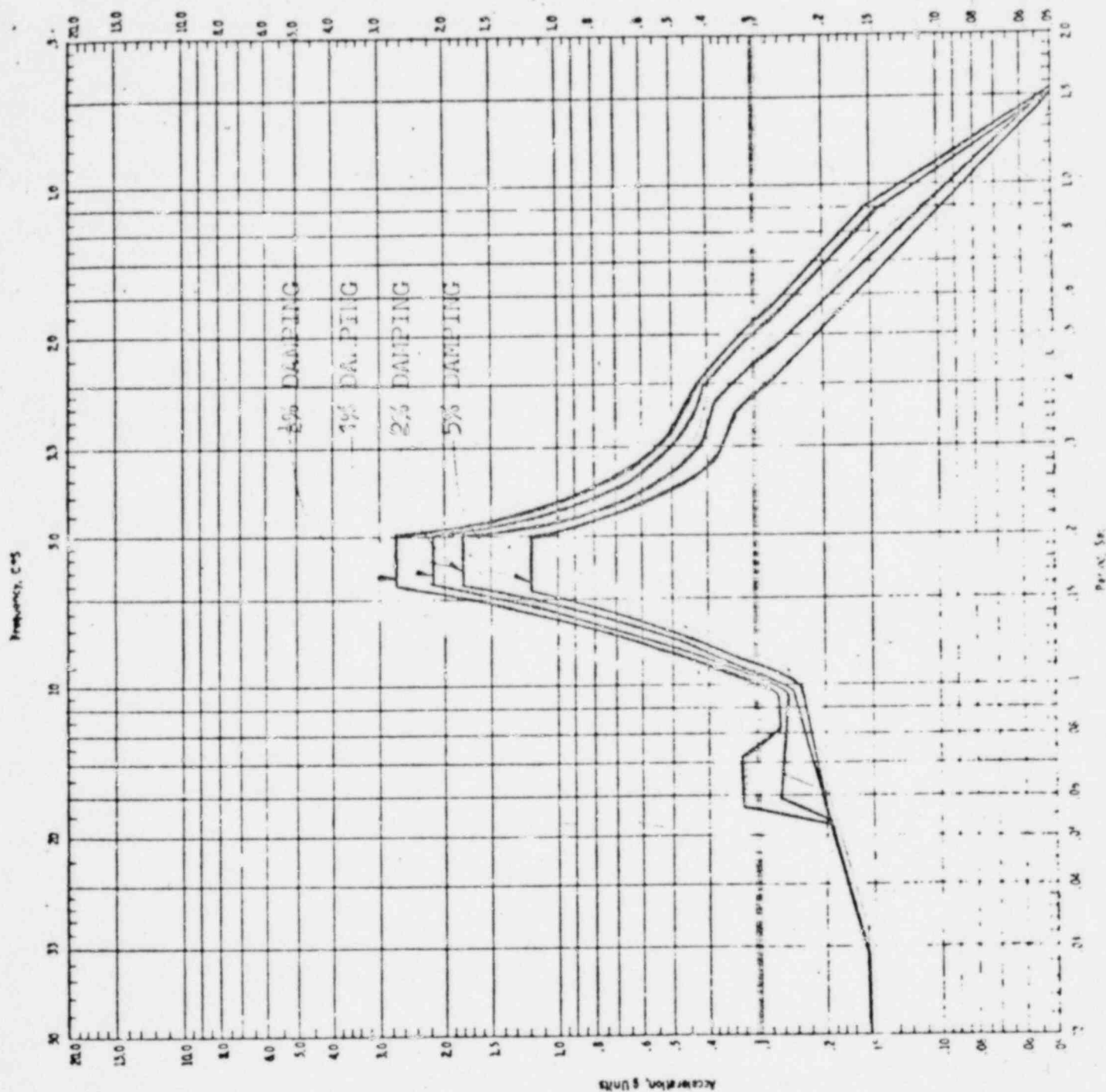


FIGURE E-10
 HORIZONTAL FLOOR RESPONSE SPECTRA
 OPERATING BASIS EARTHQUAKE ELEVATION - 641'-6" (SLAB NO. 3)
 REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SGM

DATE April 18, 1972

CHECKED BY HHS

DATE 4/12/72

SHEET OF

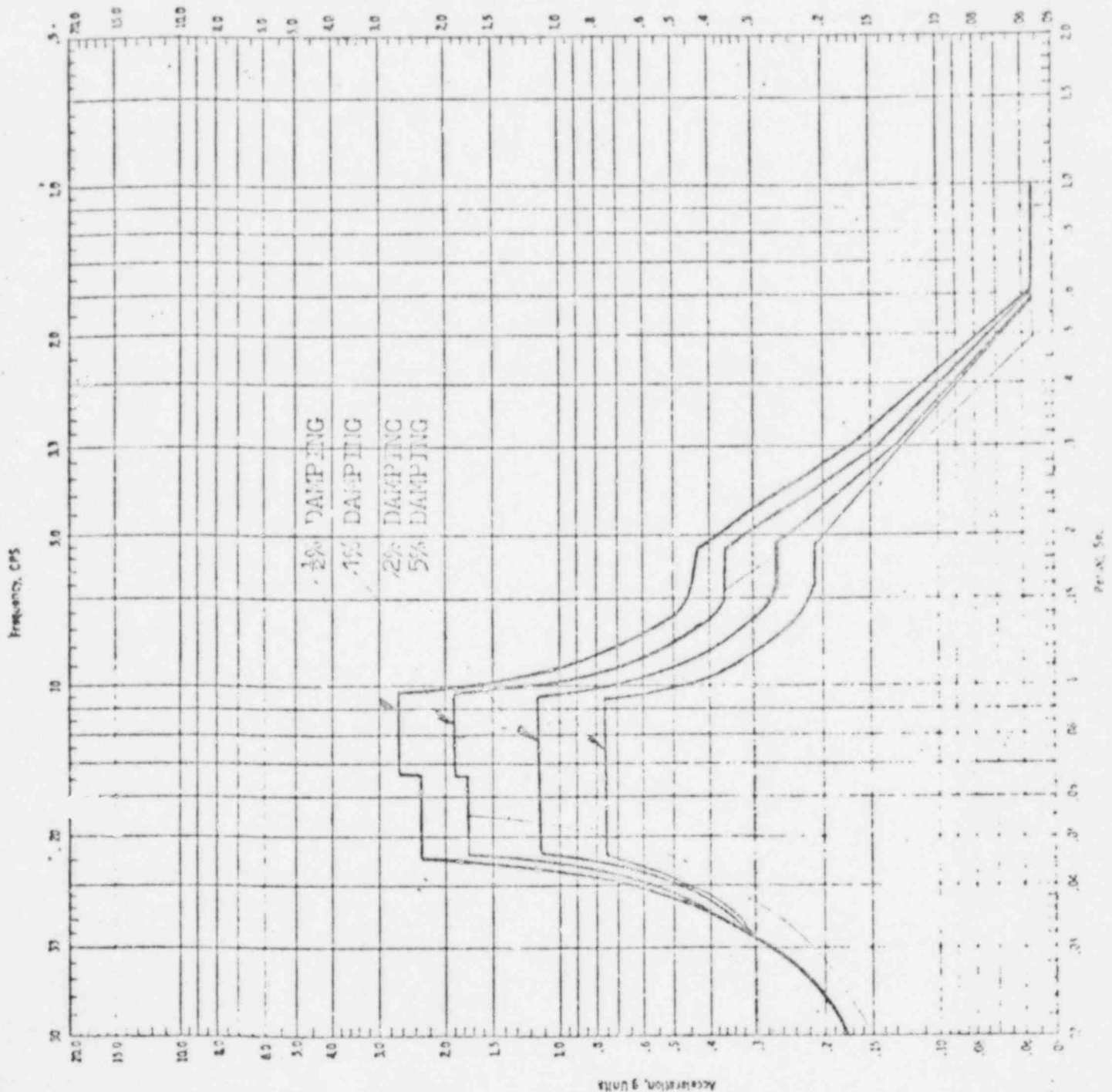


FIGURE C-7
VERTICAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE REACTOR BUILDING
SLAB EL. 641'-6", 659'-6" & 684'-6"

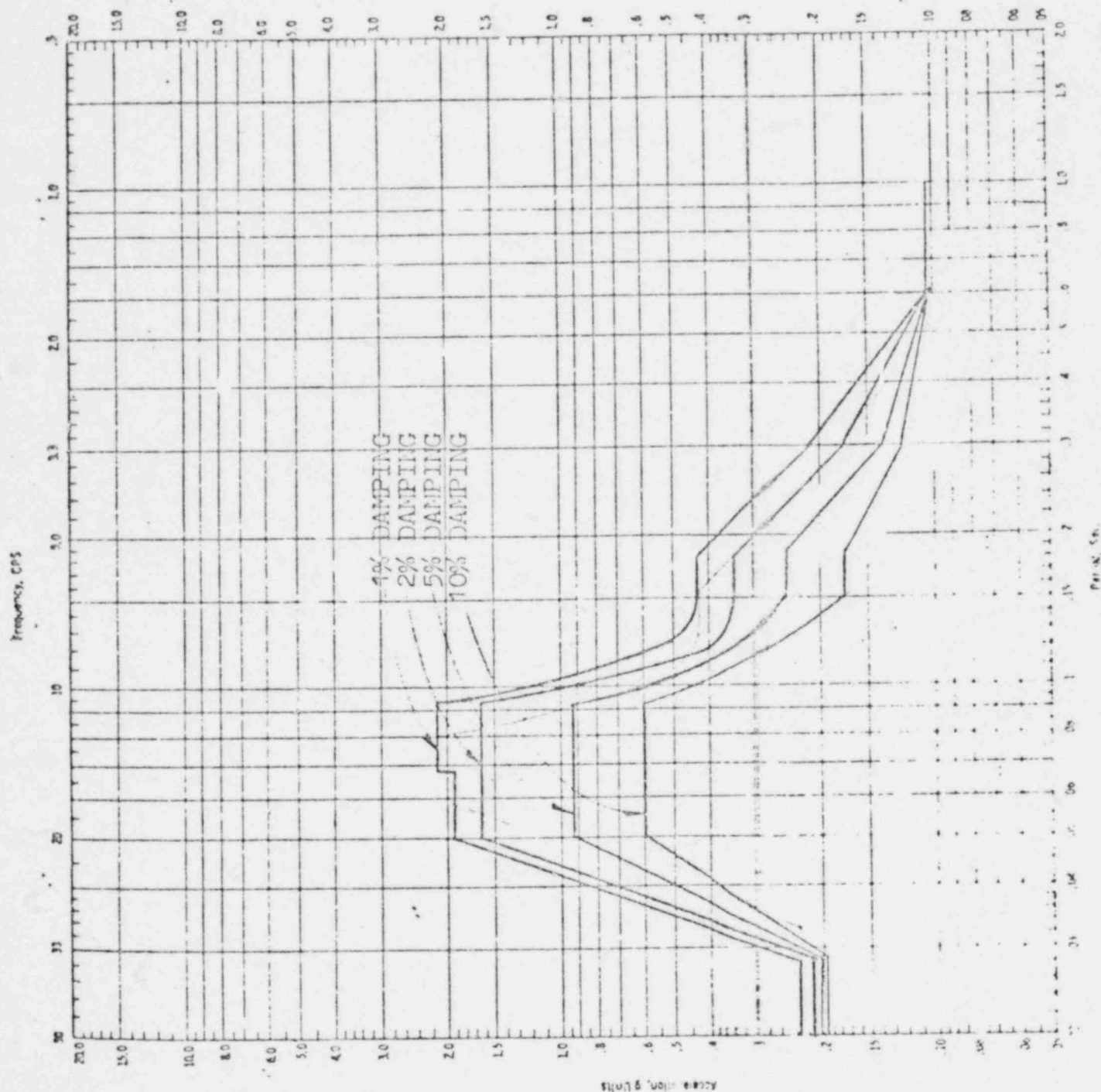


FIGURE C-17
 VERTICAL RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE REACTOR BUILDING
 SLAB EL. 641'-6", 659'-6" & 684'-6"

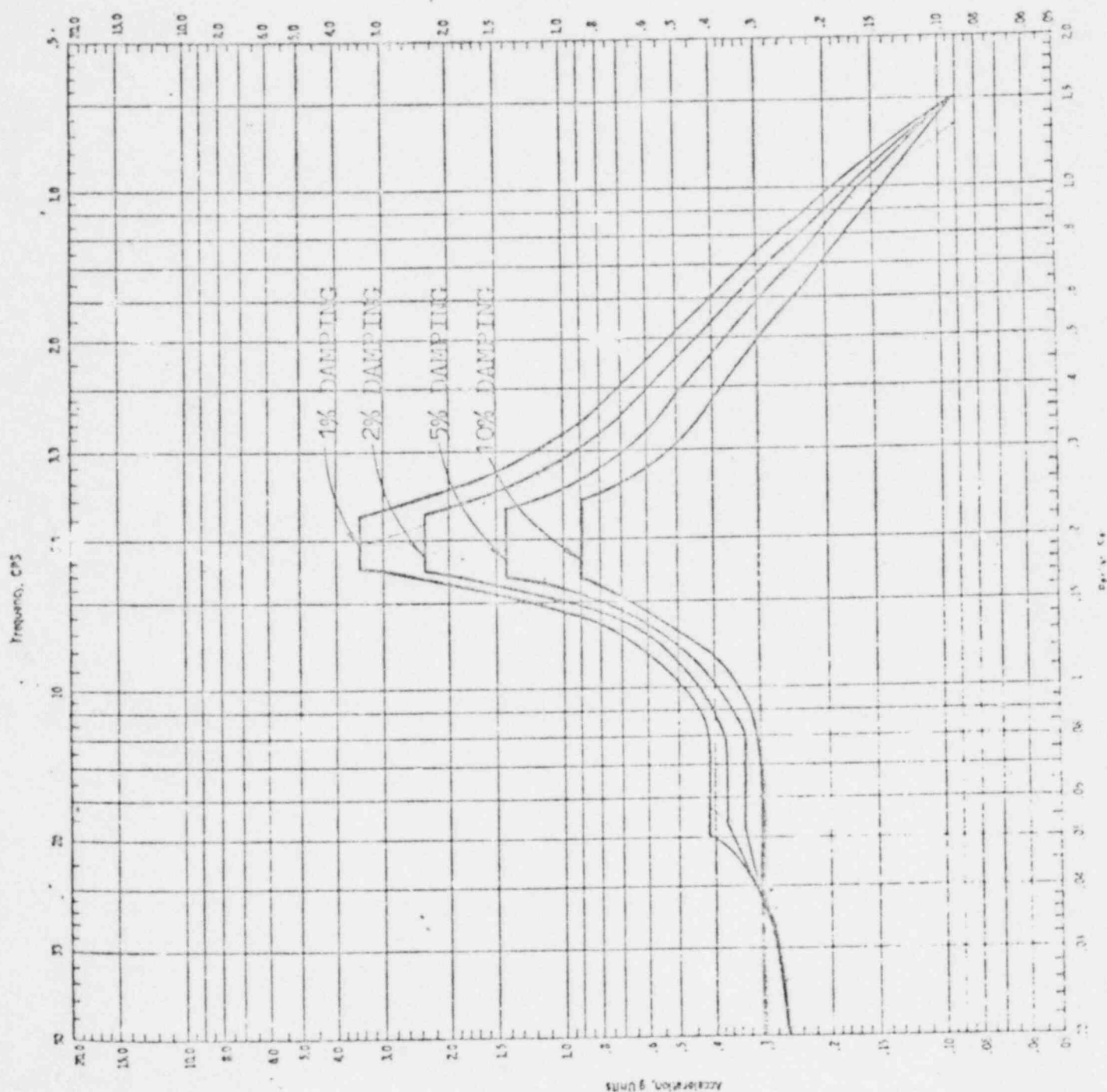


FIGURE B-33

HORIZONTAL FLOOR RESPONSE SPECTRA

DESIGN BASIS EARTHQUAKE ELEVATION — 641'-0" (SLAB NO. 3)

REACTOR AUXILIARY BUILDING NORTH — SOUTH COMPONENT

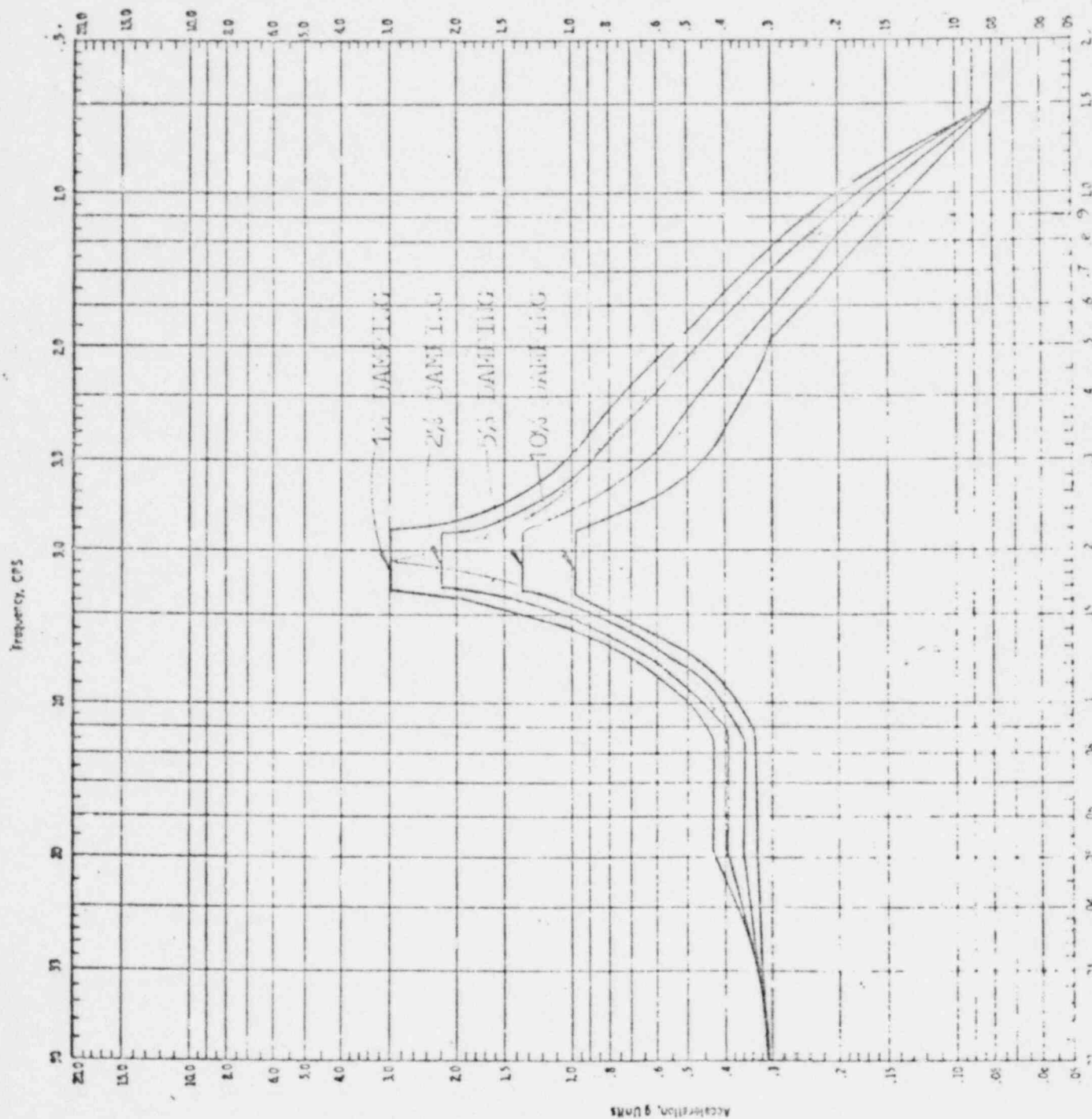


FIGURE B-34
 HORIZONTAL FLOOR RESPONSE SPECTRA
 DESIGN BASIS EARTHQUAKE ELEVATION - 641'-6" (SLAB NO. 3)
 REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

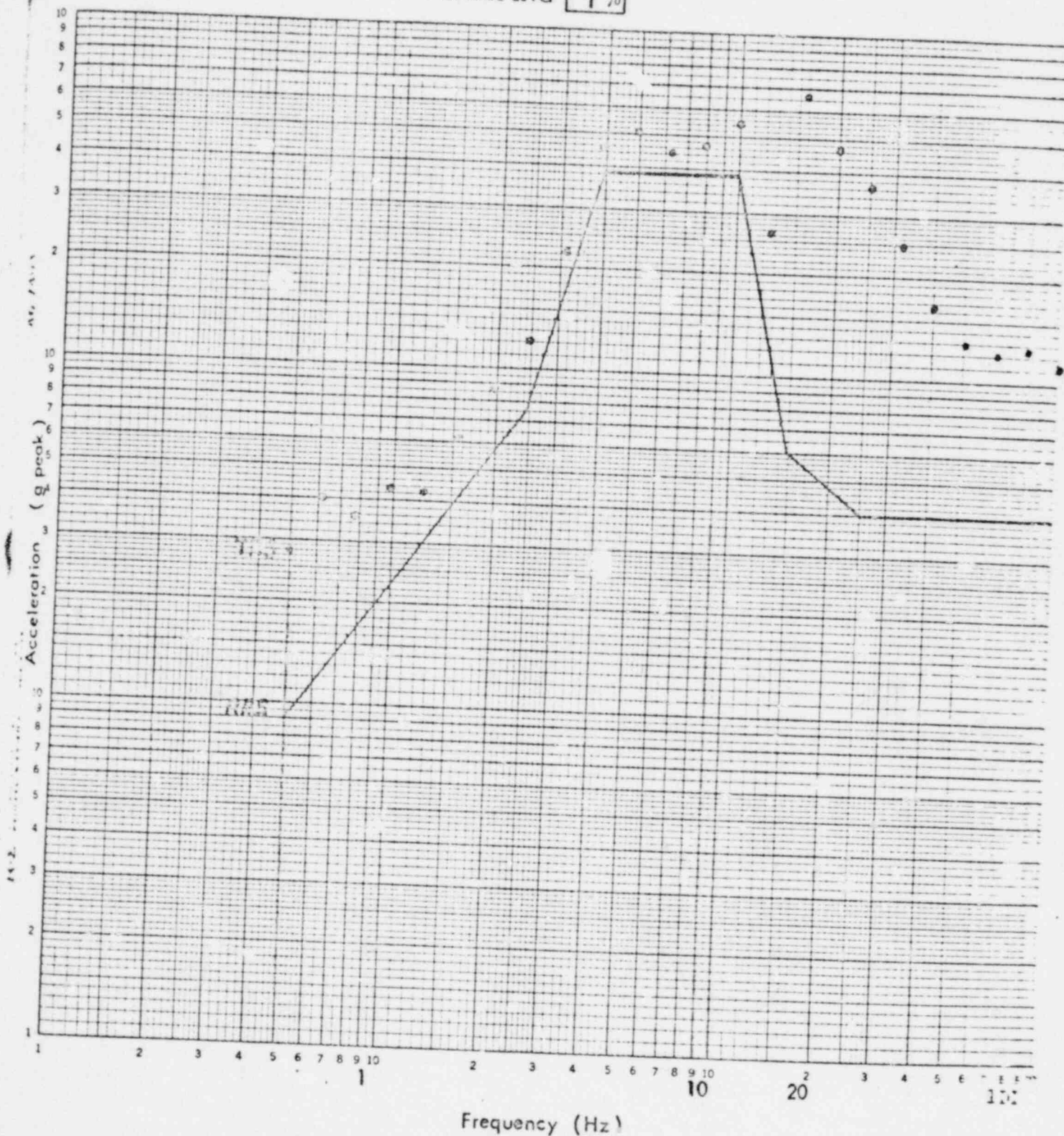
FULL SCALE SHOCK SPECTRUM (g Peak)

Page No. 65
Report No. 424-1-1

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

1595-116

DAMPING ☐ 1%



CUSTOMER _____
SPECIMEN _____
S/N _____

AXIS SS/V
LOCATION NO. HCA
TEST RUN NO. 13 DBE

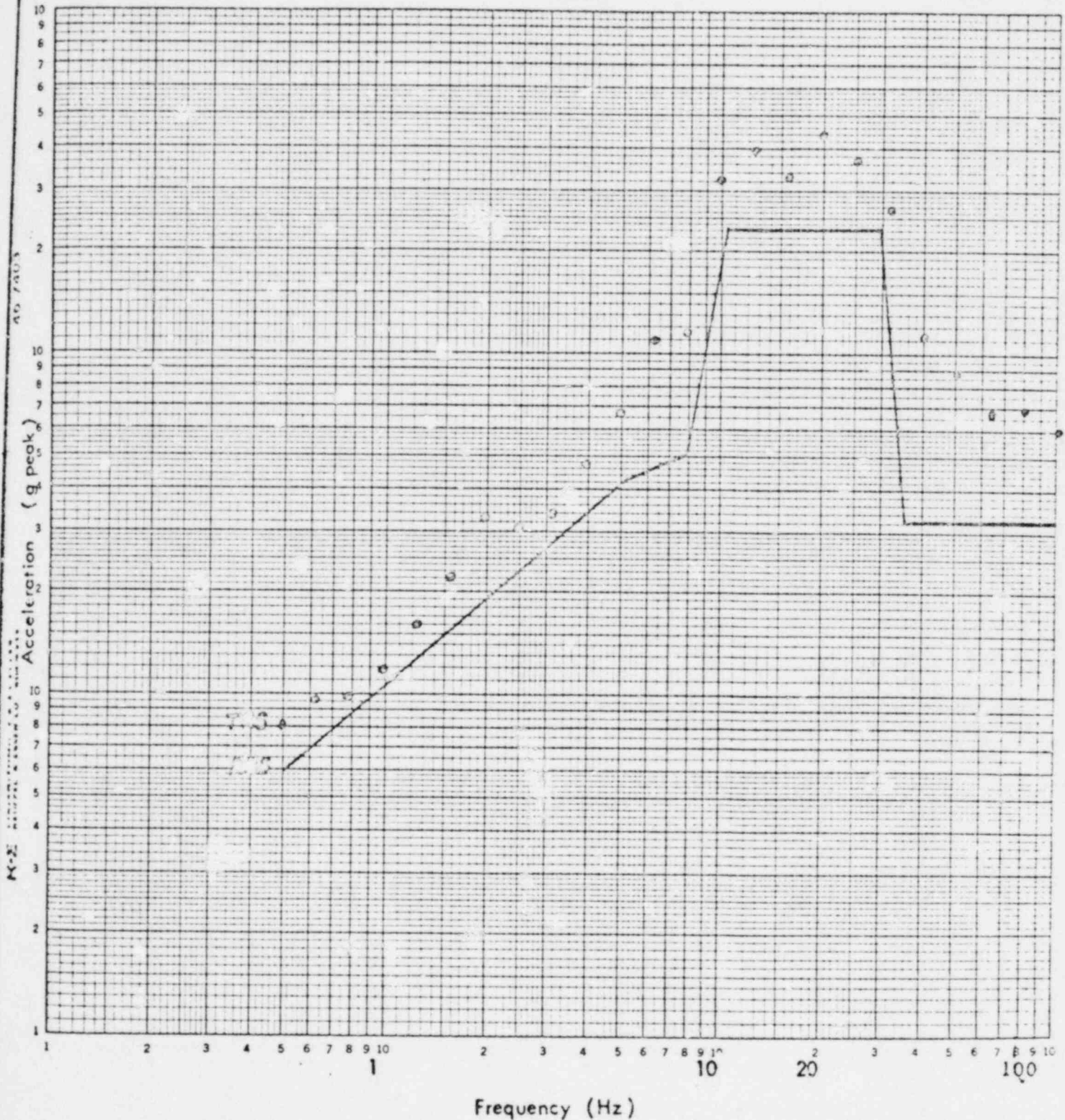
FULL SCALE SHOCK SPECTRUM (g Peak)

Page No. 66
Report No. 42949-1

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

DAMPING ☐ 1%

1595-117



CUSTOMER _____
SPECIMEN _____
S/N _____

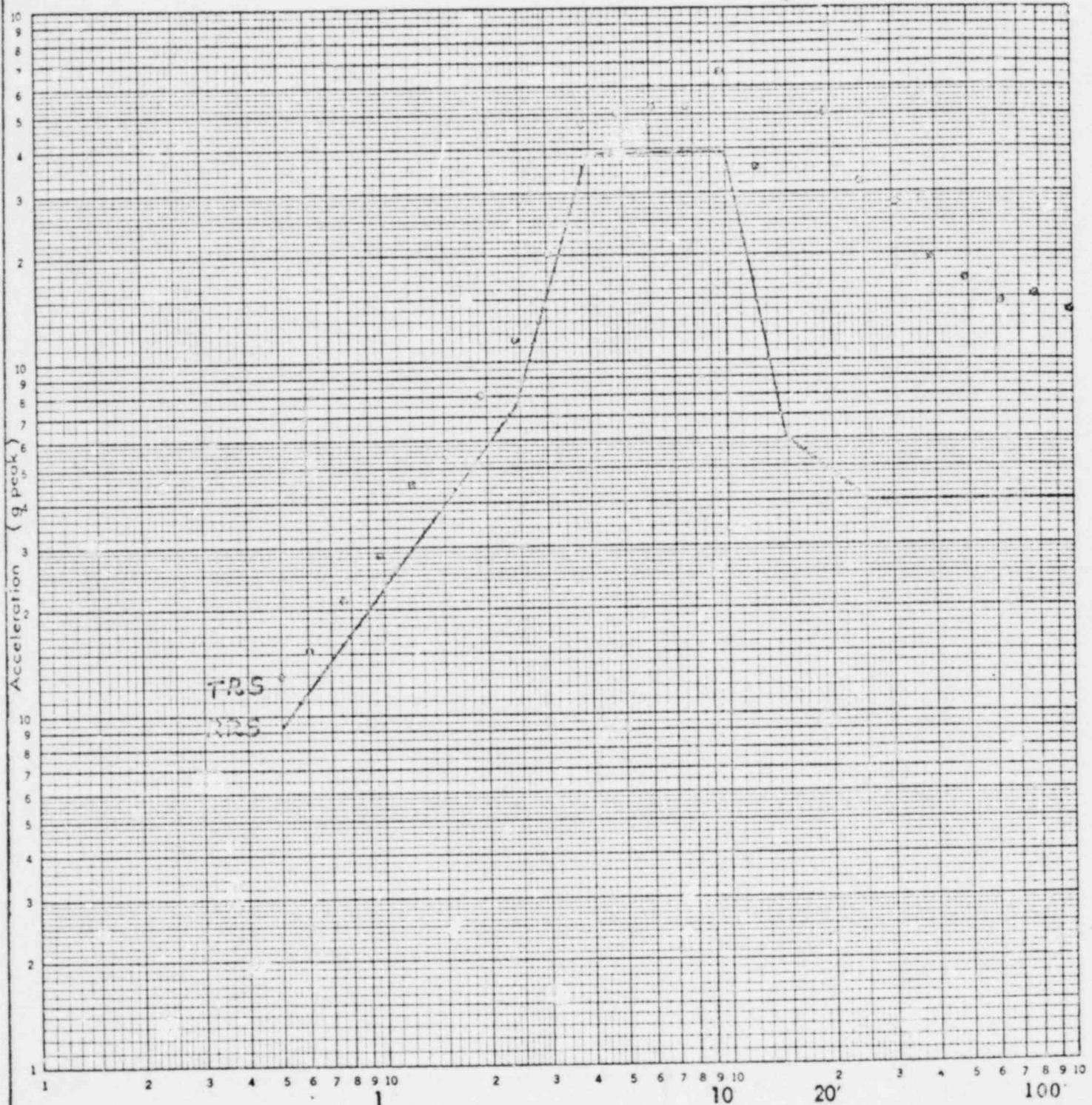
AXIS SSIV
LOCATION NO. VCA
TEST RUN NO. 13 DDE

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

1595-136

DAMPING ☒ 1%



Frequency (Hz)

CUSTOMER _____

AXIS FBIV

SPECIMEN _____

LOCATION NO. HCA

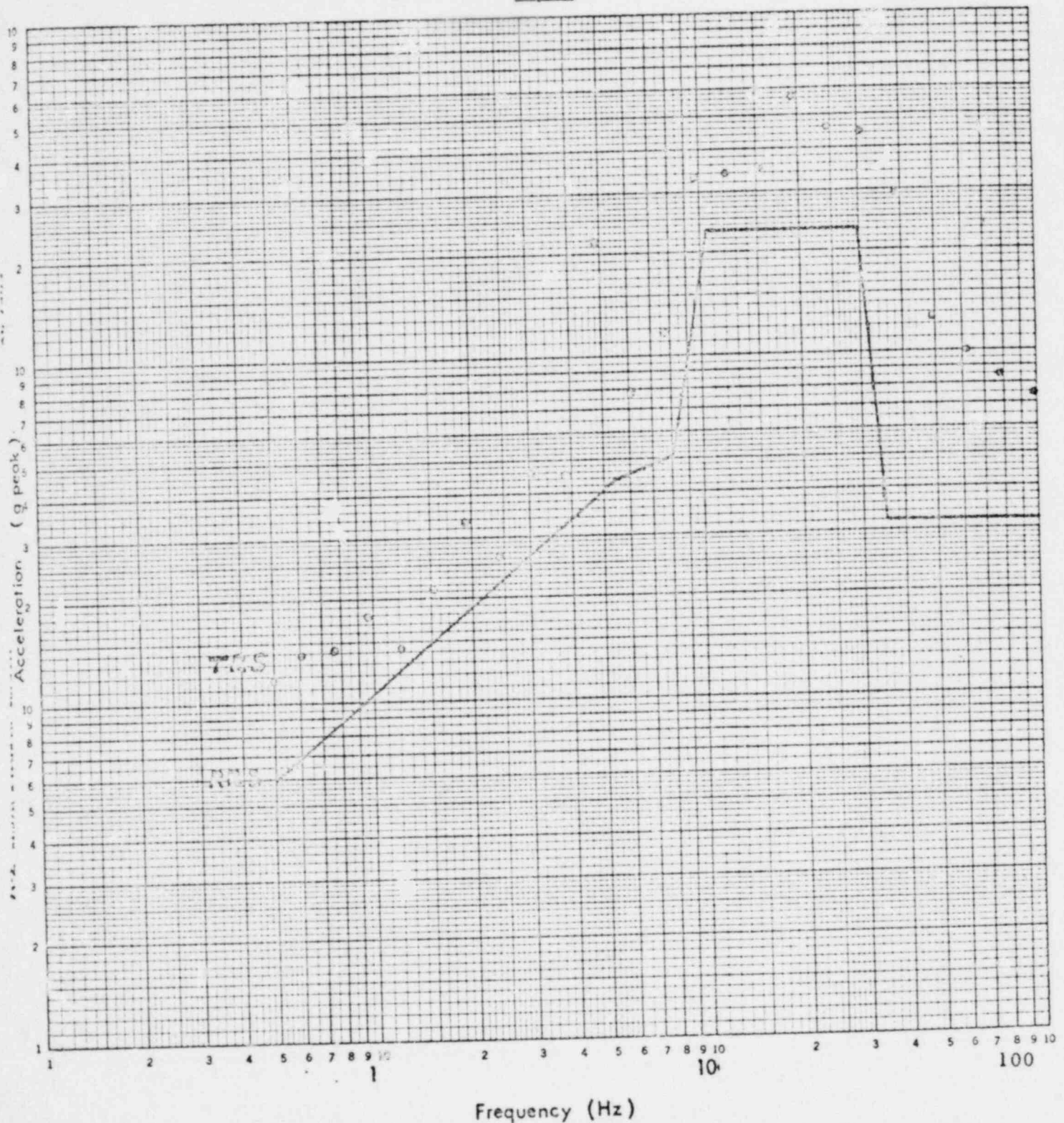
S/N _____

TEST RUN NO. 27 DBE

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

1595-137

DAMPING ☐ 1%

CUSTOMER _____

AXIS FB/V

SPECIMEN _____

LOCATION NO. VCA

S/N _____

TEST RUN NO. 27 DBE

SARGENT & LUNDY

ENGINEERS
CHICAGO

FERMI UNIT 2
EQUIPMENT DYNAMIC
QUALIFICATION SUMMARY

Project #6139-40

EMD File #

Page 1 of 6

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: KCU-17 SINGLE TIER BATTERY RACK

EQUIPMENT NO. : RB32S003
RB32S004

SPEC. NO.: 3071-82

LOCATION: AUXILIARY BUILDING ELEV. 643'-6"

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE

QUALIFICATION DOCUMENT REFERENCES:

1. Corporate Consulting and Development Co. Qualification Report #A-119-77
Dated June 1, 1977.
2. Sargent & Lundy Report SL-2682 Dated September 27, 1974, containing
Response Spectra.
3. CD Batteries Div. Dwg. #M-6586 Dated 11-8-77.
4. CD Batteries Div. Dwg. #K-5282-1 Rev. 10-24-77.
5. CD Batteries Div. Dwg. #K-5098-1 Rev. 9-16-74.
6. CD Batteries Div. Dwg. #K-5281-1 Rev. 10-24-77.
7. DECo Dwg. #6E721-2833-10 Rev. D Dated 10-10-80.
8. DLCo Dwg. #6E721-2833-12 Rev. G Dated 1-24-81.
9. DECo Dwg. #6E721-2833-2 Rev. C Dated 12-20-79.

Prepared by: *Thomas E. Fornell*
Reviewed by:
Approved by:

Date: 7-14-81
Date:
Date:

QUALIFICATION SUMMARY

LOAD COMBINATIONS CONSIDERED:

1. ENVELOPE (DBE, OBE) + DEAD WT

ORIGINAL QUALIFICATION METHOD:

The KCU-17 Single tier battery rack is qualified using a simplified dynamic analysis. This simplified dynamic analysis takes advantage of the similarity of the KCU-17 Rack to the LC-15 Rack. The LC-15 Rack was analyzed using a detailed finite element response spectrum dynamic analysis's. The similarity of the KCU-17 Rack and the LC-15 Rack allow the dynamic behavior of the KCU-17 Rack to be characterized by the same mode shapes and approximately the same degree of modal interaction, although the natural frequencies for each mode shape are different. The simplified model is used to calculate the modal frequencies for the KCU-17 Rack. (Validation of the simplified model is accomplished by calculating the modal frequencies for the LC-15 Rack and comparing them to the detailed dynamic model). The largest DBE floor response spectrum acceleration which exists at or above the smaller of the transverse and longitudinal frequencies described above was determined for both the N-S and E-W curves. These two values were combined by the SRSS (square root of the sum of the squares) method to determine the worst possible horizontal response of the KCU-17 rack. The worst possible vertical response was determined by the largest DBE floor response spectrum which exists at or above the fundamental frequency described above. By using the horizontal and vertical accelerations determined above and multiplying by a static coefficient to account for modal interaction, a conservative static stress analysis was performed to qualify the KCU-17 battery rack. A conservative value for the appropriate static coefficient was determined by comparing the results of the static and dynamic stress analyses of the LC-15 battery rack.

SARGENT & LUNDYENGINEERS
CHICAGOFERMI UNIT 2
EQUIPMENT DYNAMIC
QUALIFICATION SUMMARY

Project #6139-40

EMD File #

Page 3 of 6

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME:

FERMI - Unit 2

TYPE:

1. Utility: Detroit Edison Company

PWR ☐

2. NSSS: General Electric

BWR ☒

3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME:

KCU-17 SINGLE TIER BATTERY RACK

1. Scope: ☐ NSSS ☒ BOP

2. Model Number: KCU-17

Quantity: 2 ASSEMB.

16 UNITS

3. Vendor: C&D Batteries Division

4. If the component is a cabinet or panel, name and model No.
of the devices included: Not Applicable

5. Physical Description Appearance: Cross-braced

structural steel framework

RACK=2595 LB.

Dimensions: 11'-6.75" X 21.75" X 18.6"

Weight: CELLS=46350 LB.

6. Location: Building: Auxiliary

Elev.: 643'-6"

7. Field Mounting Conditions:

☒ Bolting: Number: 4 PER LEG Size: 1/2"-13 STUD☐ Welding: Weld Type:

Leg: Length: Pitch:

☐

8. Natural frequencies in each direction:

Front to back: 21 HZ

Side to side: 74 HZ

Vertical: 31 HZ

9. Method of determining natural frequencies:

☐ Laboratory Test☒ Analysis☐ Other

10. a. System in which located: DC Distribution System

b. Functional description: Provide D.C.
power for outside primary containment isolation valves

c. Equipment required for:

☒ Hot Standby☒ Cold Shutdown☒ Post LOCA

11. Pertinent reference design specifications: 3071-82

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☒ Analysis
☐ Combination of Test and Analysis

1. Qualification Report
Seismic Analysis Report of KCU-17
a. Title: Single Tier Battery Rack
b. Number and Date: A-119-77 Dated June 1, 1977
2. Company that prepared report: Corporate Consulting and Development
3. Company that reviewed report: Detroit Edison

V. VIBRATION INPUT:

1. Loads considered: ☒ Seismic only
☐ Hydrodynamic only
☐ Seismic and Hydrodynamic
☐ Other (Specify): _____
☐ _____
2. Required response spectra (attach the graphs): S&L Report #2682 - Figures B-9, B-10, B-33, B-34, C-7, C-17
3. Method of combining Requiring Response Spectra:
☒ Absolute Sum
☐ SRSS
4. Damping Upset (OBE): 1% Basis for damping: NRC Reg. Guide
Emerg. (SSE): 2% 1.61
5. Required acceleration in each direction (if required):
☐ ZPA ☒ Other (Specify): See Note
Upset (OBE): F/B= - S/S= - V= -
@21.4 HZ Emerg. (SSE): F/B= .42g S/S= .42g V= 2.85g
6. Were fatigue effects or other vibration loads considered?
☐ Yes Describe loads and how they were treated in overall qualification program: _____

☒ No

NOTE: ENV of SSE and OBE Loads was used. Stresses were compared to OBE allowables.

VI. IF QUALIFICATION BY TEST, THEN COMPLETE:

1. Test Method: ☐ Single frequency: _____
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____
10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☐ Static analysis
☒ Static coefficient analysis (Simplified Dynamic)
☐ Dynamic analysis: ☐ Response spectrum
☐ Time history
2. Model type:
☒ 1-dimensional
☒ 2-dimensional
☐ 3-dimensional

3. Method of analysis:

☒ Computer-aided calculation
programs used: FRAME 2D (Validated using Stardyne)

☒ Hand calculations

☐

4. Have equipment supports been adequately considered in analysis: ☒ Yes ☐ No

5. Stress evaluation at critical structural elements:

Element	Calc Stress	Allow Stress
1. Maximum Frame Member Normal Stress	15.5 KSI	18.0 KSI
2. Diagonal Brace Tensile Stress	1.4 KSI	18.0 KSI
3. Maximum Tie Rod Normal Stress	6.7 KSI	18.0 KSI
4. Vertical Supports Rail Bending Stress	14.6 KSI	18.0 KSI
5. Horizontal Restraint Rail Bending Stress	3.4 KSI	18.0 KSI
6. Maximum Anchor Bolt Shear Stress	7.1 KSI	12.0 KSI
7. Maximum Anchor Bolt Tensile Stress	4.1 KSI	38.6 KSI

6. Deflection evaluation at critical structural elements (active equipment only)

Element	Calc Stress	Allow Stress
No critical deflections		

VIII. ADDITIONAL COMMENTS:

NO COMMENTS

ARGENT & LUNDY
ENGINEERS

CLIENT DETROIT EDISON
PROJECT ENRICO FERMI JOB NO. 3988
DESIGN BY SGH DATE April 18, 1972
CHECKED BY HHS DATE 4-22-72 SHEET OF

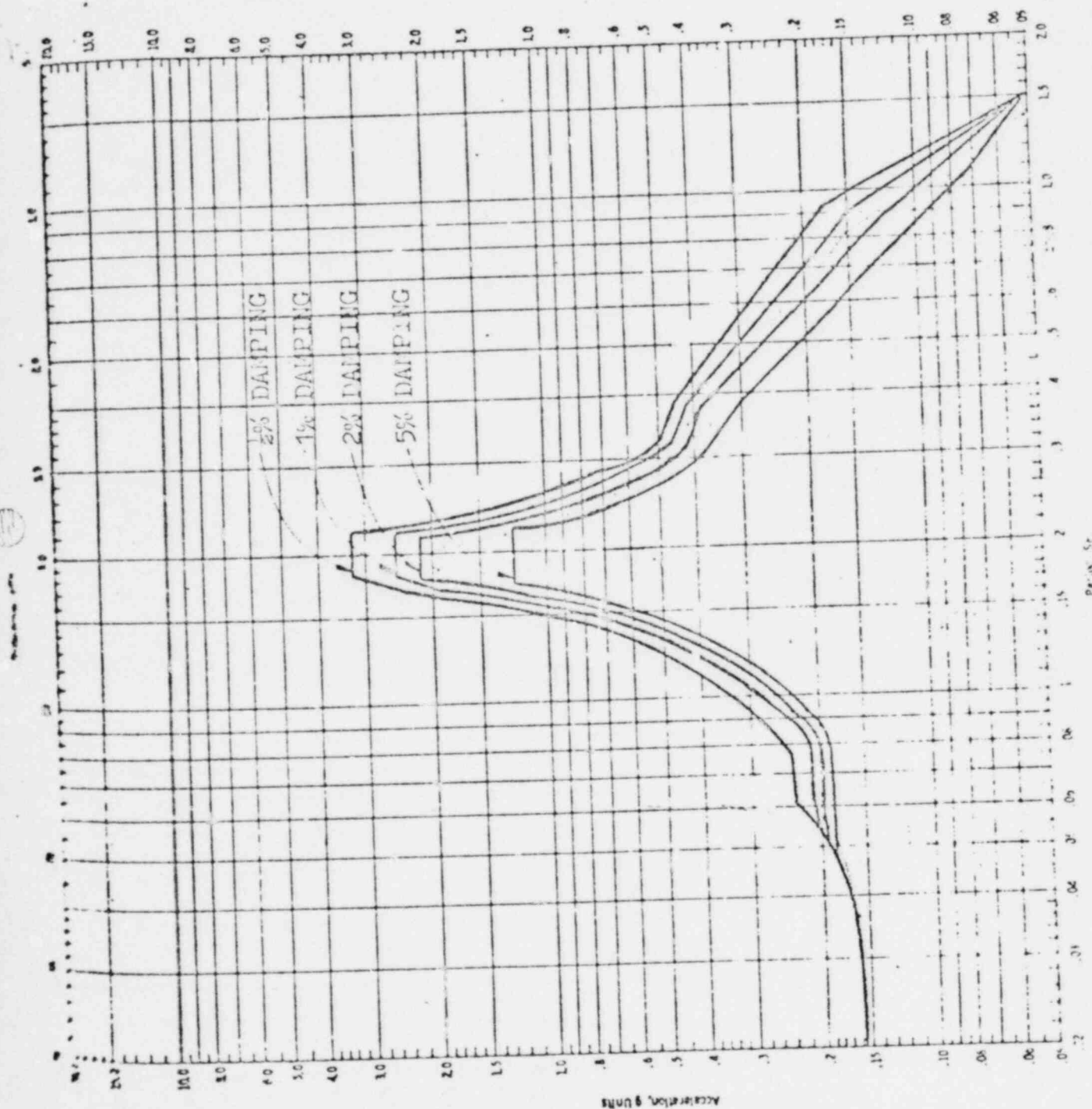


FIGURE B-9
HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION - 641'-6" (SLAB NO. 3)
REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

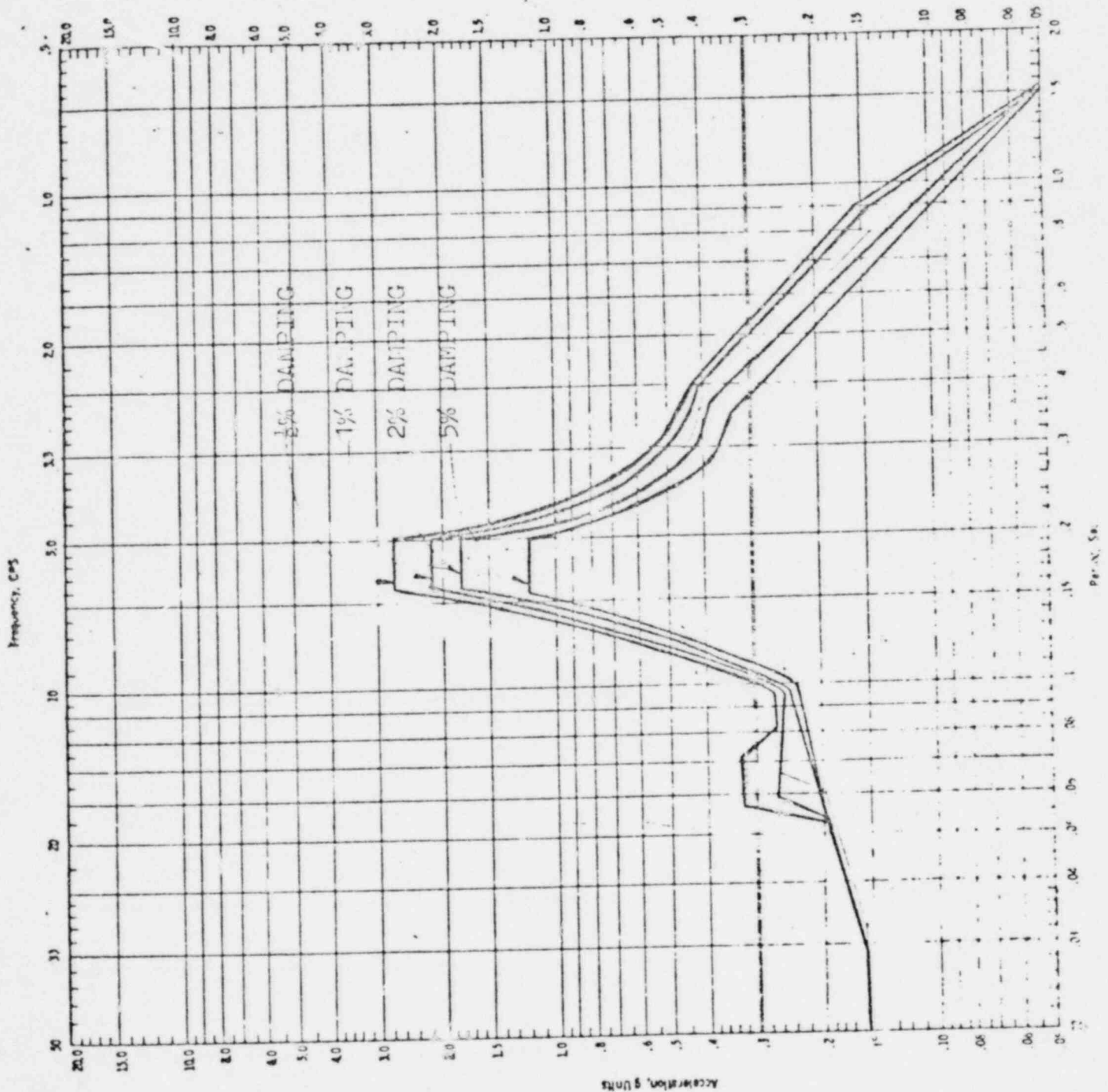


FIGURE B-10
HORIZONTAL FLOOR RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE ELEVATION - 641'-6" (SLAB NO. 3)
REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON.

PROJECT ENRICO FERMI

JOB NO. 3988-00

DESIGN BY SGM

DATE April 18, 1972

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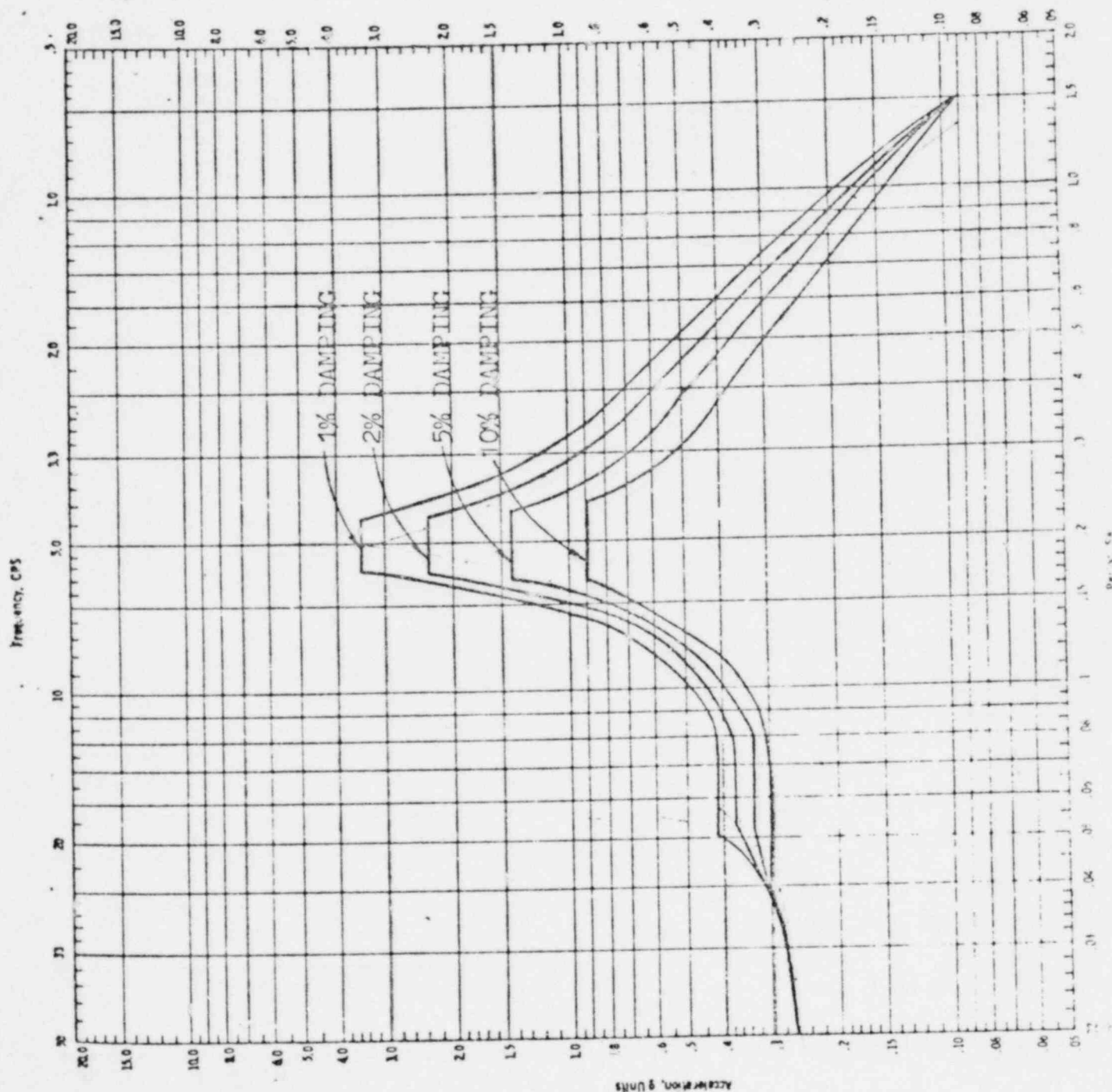


FIGURE B-33
HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE ELEVATION - 641'-6" (SLAB NO. 3)
REACTOR AUXILIARY BUILDING NORTH - SOUTH COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988-00

DESIGN BY SCM

DATE April 16, 1972

CHECKED BY HHS

DATE 4/19/72

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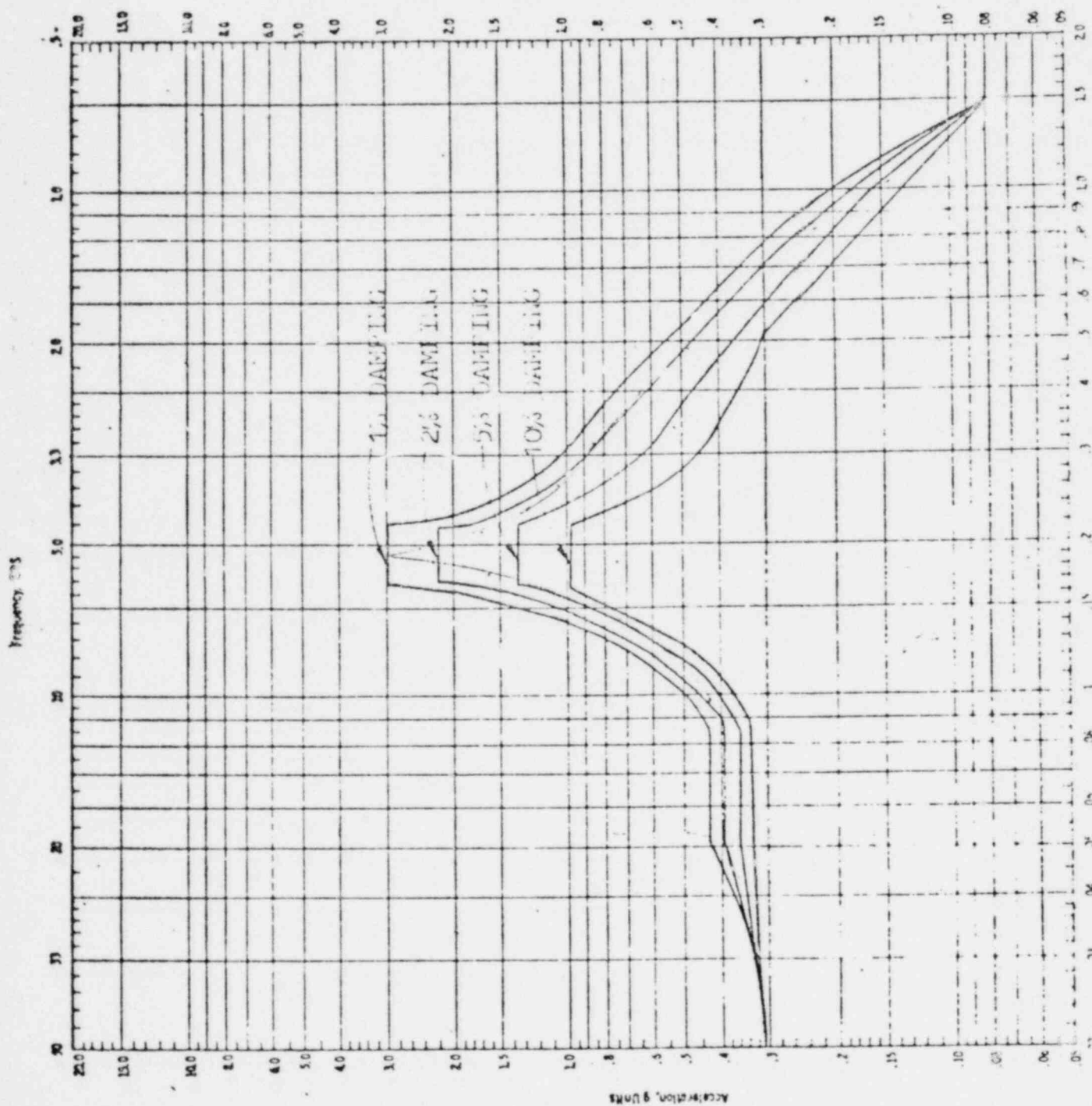


FIGURE B-34
HORIZONTAL FLOOR RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE ELEVATION - 641'-6" (SLAB NO. 3)
REACTOR AUXILIARY BUILDING EAST - WEST COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO PERMI

JOB NO. 3988

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DATE April 18, 1972

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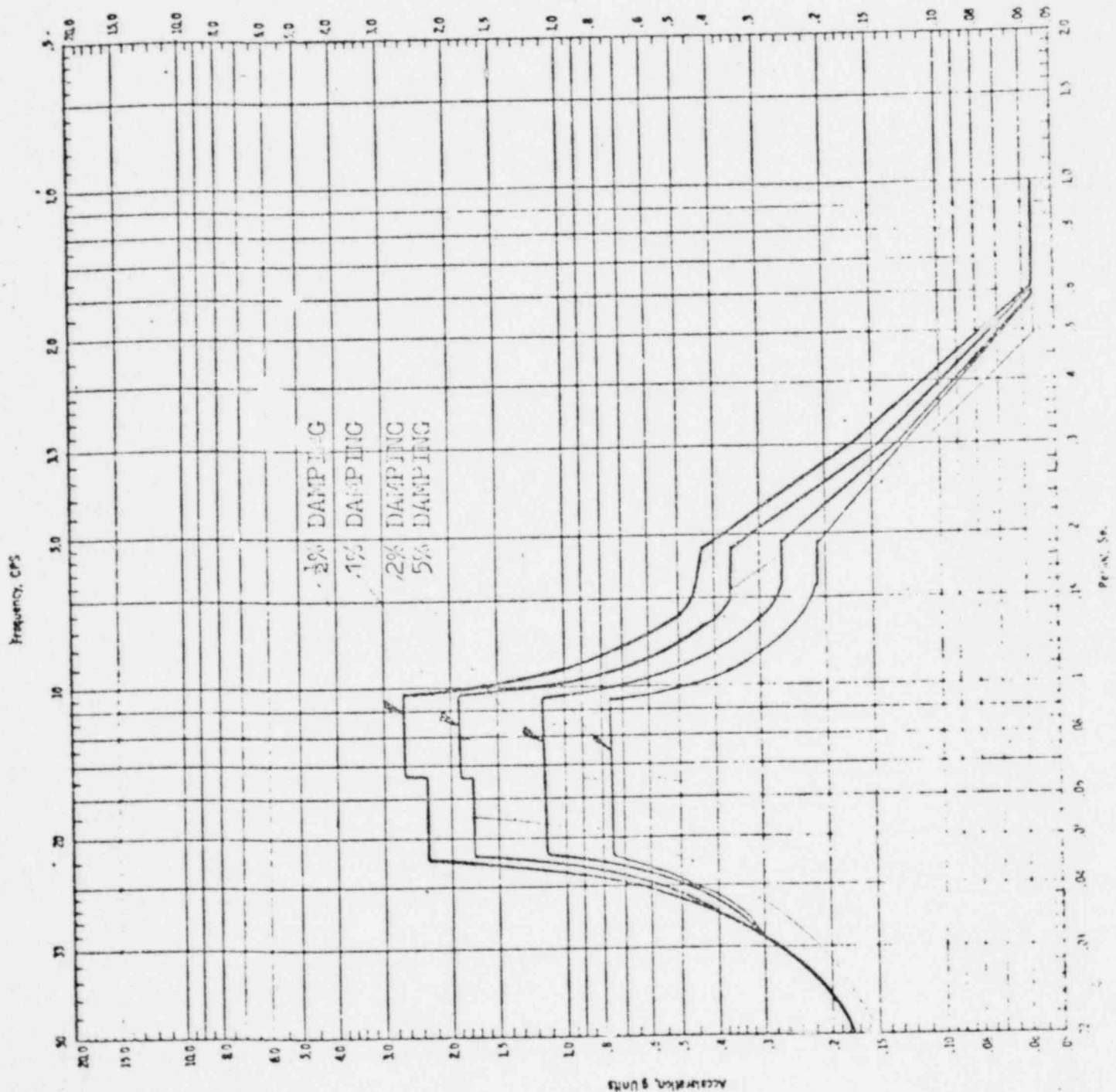


FIGURE C-7
VERTICAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE REACTOR BUILDING
SLAB EL. 641'-6", 659'-6" & 684'-6"

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON CO.

PROJECT ENRICO FERMI

JOB NO. _____

DESIGN BY SGM

DATE April 5, 1972

CHECKED BY HHS

DATE 4/13/72

SHEET _____ OF _____

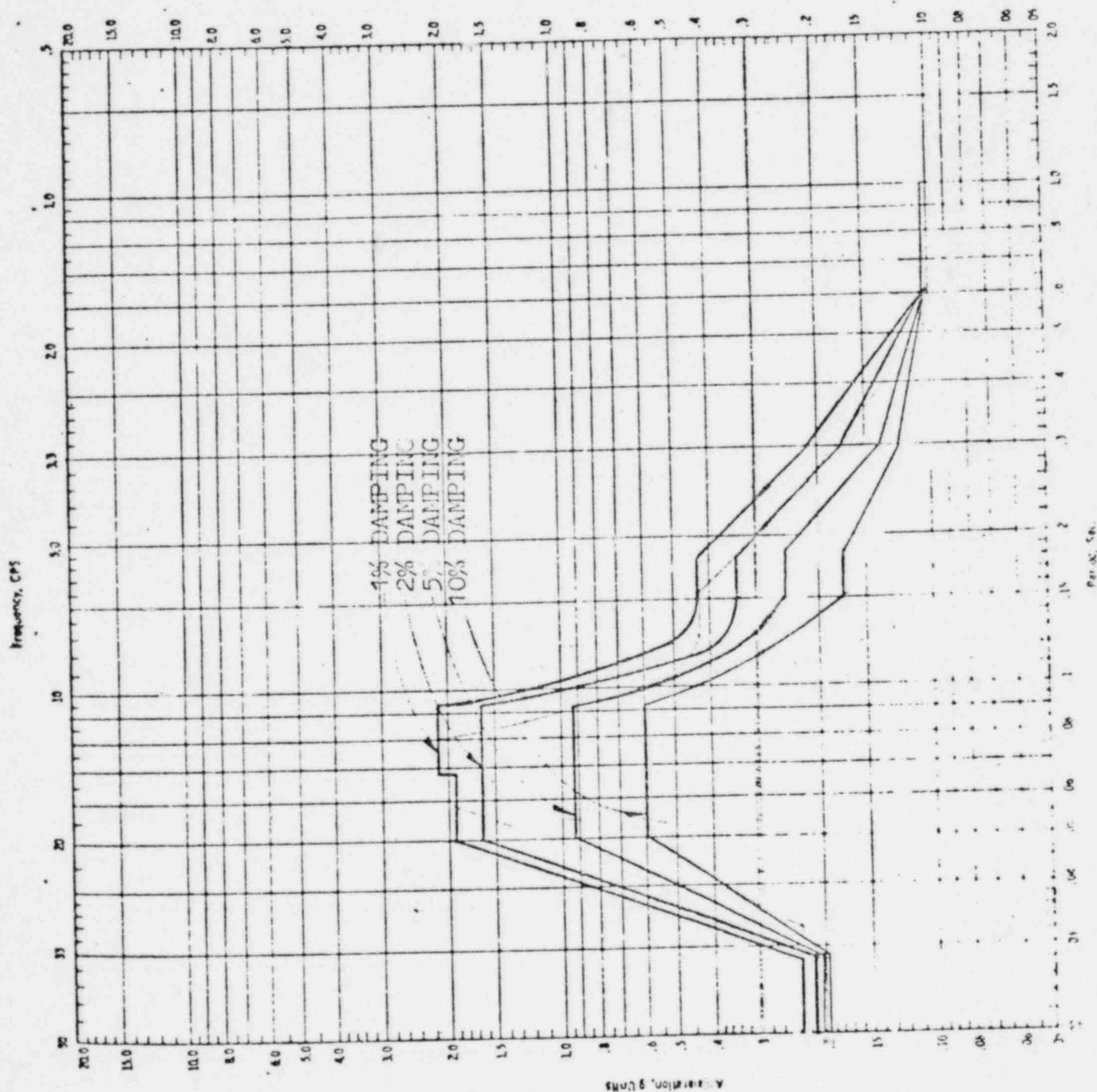


FIGURE C-17
VERTICAL RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE REACTOR BUILDING
SLAB EL. 641'-6", 659'-6" & 684'-6"

FERMI NUCLEAR STATION UNIT 2
DETROIT EDISON COMPANY
BALANCE OF PLANT
EQUIPMENT DYNAMIC QUALIFICATION SUMMARY

EQUIPMENT NAME: Nuclear Penetration Canister Assembly

EQUIPMENT NO. : See Reference 3

SPEC. NO.: 3071-74

LOCATION: Reactor Bldg.
(Primary Containment)

Elev. 603'-3" to 604'

EQUIPMENT CLASSIFICATION: ☐ ACTIVE ☒ PASSIVE

QUALIFICATION DOCUMENT REFERENCES:

1. Conax Corp. Report, Stress Analysis for Nuclear Penetration Canister Assembly, Rev. C, dated 4-19-74, DECO File #ES-284.
2. Conax Corp. Report, Seismic Analysis of Electrical Penetration Assemblies, dated 1-16-74, DECO File #ES-335.
3. DECO Dwg. Nos.: 6E721-2831-8 Rev. B Dated 3-24-74
6E721-2831-21 Rev. A Dated 7-30-80
6E721-2831-22 Dated 4-12-75
4. S&L Report #SL-2682 containing applicable response spectra.

Prepared by: *Thomas E. Fornek*
Reviewed by:
Approved by:

Date: *7-11-81*
Date:
Date:

QUALIFICATION SUMMARYLOAD COMBINATIONS CONSIDERED:

1. Pressure + Dead Load + OBE + Jet Force
2. Pressure + Dead Load + SSE + Jet Force

ORIGINAL QUALIFICATION METHOD:

The penetrations were qualified by analysis using the maximum values from the applicable seismic response spectra. These values were used because the first natural frequency of the penetrations were between 8 Hz and 20 Hz (lateral and vertical). Pressure, dead load, and jet force were considered in the analysis.

SARGENT & LUNDYENGINEERS
CHICAGOFERMI UNIT 2
EQUIPMENT DYNAMIC
QUALIFICATION SUMMARY

Project #6139-40

EMD File #

Page 3 of 6

QUALIFICATION SUMMARY OF EQUIPMENT

I. PLANT NAME:

FERMI - Unit 2

TYPE:

1. Utility: Detroit Edison Company PWR ☐
2. NSSS: General Electric BWR ☒
3. A/E: Detroit Edison/Sargent & Lundy

II. COMPONENT NAME:

Nuclear Penetration Canister Assembly

1. Scope: ☐ NSSS ☒ BOP
2. Model Number: Not Applicable Quantity: 23
3. Vendor: Conax Corp.
4. If the component is a cabinet or panel, name and model No. of the devices included: Not Applicable
5. Physical Description Appearance: Flanged
Tubular Penetration
Dimensions: 19" x 19" x 113-1/4" Long Weight: See Ref. 3.
6. Location: Building: Primary Containment Elev.: 603'-3" to 604'
7. Field Mounting Conditions:
☐ Bolting: Number: Size:
☒ Welding: Weld Type:
Leg: Length: Pitch:
☐
8. Natural frequencies in each direction:
Front to back: 269 Hz (min.)
Side to side: 8 Hz (min.)
Vertical: 8 Hz (min.)
9. Method of determining natural frequencies:
☐ Laboratory Test
☒ Analysis
☐ Other
10. a. System in which located: See Reference 3
b. Functional description: Provide Containment Isolation
for electrical feedthroughs
c. Equipment required for:
☒ Hot Standby ☒ Cold Shutdown ☒ Post LOCA

11. Pertinent reference design specifications: 3071-74

III. IS EQUIPMENT AVAILABLE FOR INSPECTION IN THE PLANT: ☒ Yes ☐ No

IV. EQUIPMENT QUALIFICATION METHOD: ☐ Test
☒ Analysis
☐ Combination of Test
and Analysis

1. Qualification Report
IPS-87 Stress Analysis for Nuclear Penetration Canister Assembly
a. Title: IPS-88 Seismic Analysis of Electrical Penetration Assemblies
b. Number and Date: IPS-87: 6-18-73
IPS-88: 6-17-74
2. Company that prepared report: Conax Corp.
3. Company that reviewed report: R. M. Parsons Co., Detroit Edison

V. VIBRATION INPUT:

1. Loads considered: ☐ Seismic only
☐ Hydrodynamic only
☒ Seismic and Hydrodynamic
☐ Other (Specify): _____
☐ _____
2. Required response spectra (attach the graphs):
B-19, B-20, B-43, B-44, C-2, dated 4-12-72, C-12, dated 4-15-72
3. Method of combining Requiring Response Spectra:
☒ Absolute Sum
☐ SRSS
4. Damping Upset (OBE): 1/2% Basis for damping: NRC Reg.
Emerg. (SSE): 1% Guide 1.61
5. Required acceleration in each direction (if required):
☐ ZPA ☐ Other (Specify): _____
Upset (OBE): F/B=1.06/1.0 S/S=1.0/1.06 V=.59
Emerg. (SSE): F/B=1.33/1.13 S/S=1.13/1.33 V=.51
6. Were fatigue effects or other vibration loads considered?
☐ Yes Describe loads and how they were treated in overall
qualification program: _____

☒ No

VI. IF QUALIFICATION BY TEST, THEN COMPLETE:

1. Test Method: ☐ Single frequency: _____
☐ Multiple frequency: _____
2. Input Motion: ☐ Single axis
☐ Multi axis
☐ _____
3. No. of qualification tests:
Upset (OBE) _____ Emerg. (SSE) _____
4. Frequency range: _____
5. For multiple frequency test does TRS envelop RRS?
☐ No ☐ Yes (attach TRS graphs)
6. Input g-level test:
Upset (OBE) F/B: _____ S/S: _____ V: _____
Emerg. (SSE) F/B: _____ S/S: _____ V: _____
7. Laboratory mounting:
☐ Bolting: Number: _____ Size _____
☐ Welding: Weld type: _____
Leg _____ Length _____ Pitch _____
☐ _____
8. Functional operability verified: ☐ Yes ☐ No
☐ Not applicable
9. Test results including modifications made: _____
10. Other tests performed: _____

VII. IF QUALIFICATION BY ANALYSIS, THEN COMPLETE:

1. Type of analysis
☐ Static analysis
☒ Static coefficient analysis
☐ Dynamic analysis: ☐ Response spectrum
☐ Time history
2. Model type:
☒ 1-dimensional
☐ 2-dimensional
☐ 3-dimensional

3. Method of analysis:

☐ Computer-aided calculation
programs used: _____☒ Hand calculations☐ _____4. Have equipment supports been adequately considered in
analysis: ☒ Yes ☐ No

5. Stress evaluation at critical structural elements:

Element	Calc Stress	Allow Stress
Canister Tube (DW+PRES+SSE+JET)	21.5 KSI	26.0 KSI (S)
Flange Bolts (DW+PRES+SSE+JET)	18.4 KSI	27.5 KSI (S)
Flange Hob Beading (DW+PRES+SSE+JET)	15.1 KSI	26.0 KSI

6. Deflection evaluation at critical structural elements
(active equipment only)

Element	Calc Stress	Allow Stress
No critical deflections necessary for calculation.		

VIII. ADDITIONAL COMMENTS:

No Comments

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SGH

DATE April 18, 1972

CHECKED BY HHS

DATE 4/18/72 SHEET OF

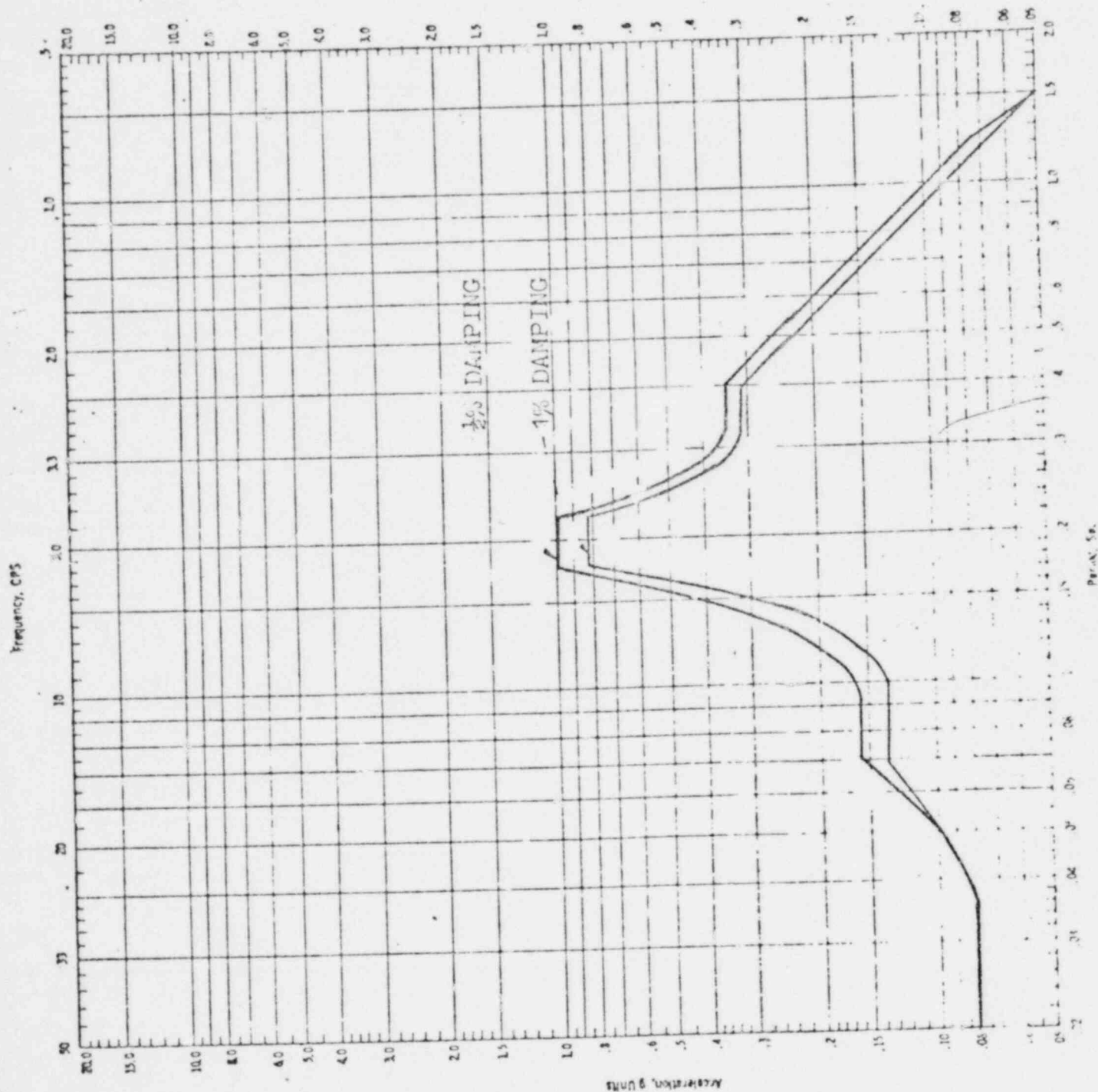


FIGURE B-19
HORIZONTAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE DRYWELL CONTAINMENT
6'-0" BELOW RPV INVERT NORTH-SOUTH COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON
PROJECT ENRICO FERMI JOB NO. 3988
DESIGN BY SGM DATE April 18, 1972
CHECKED BY HHS DATE 4/18/72 SHEET OF

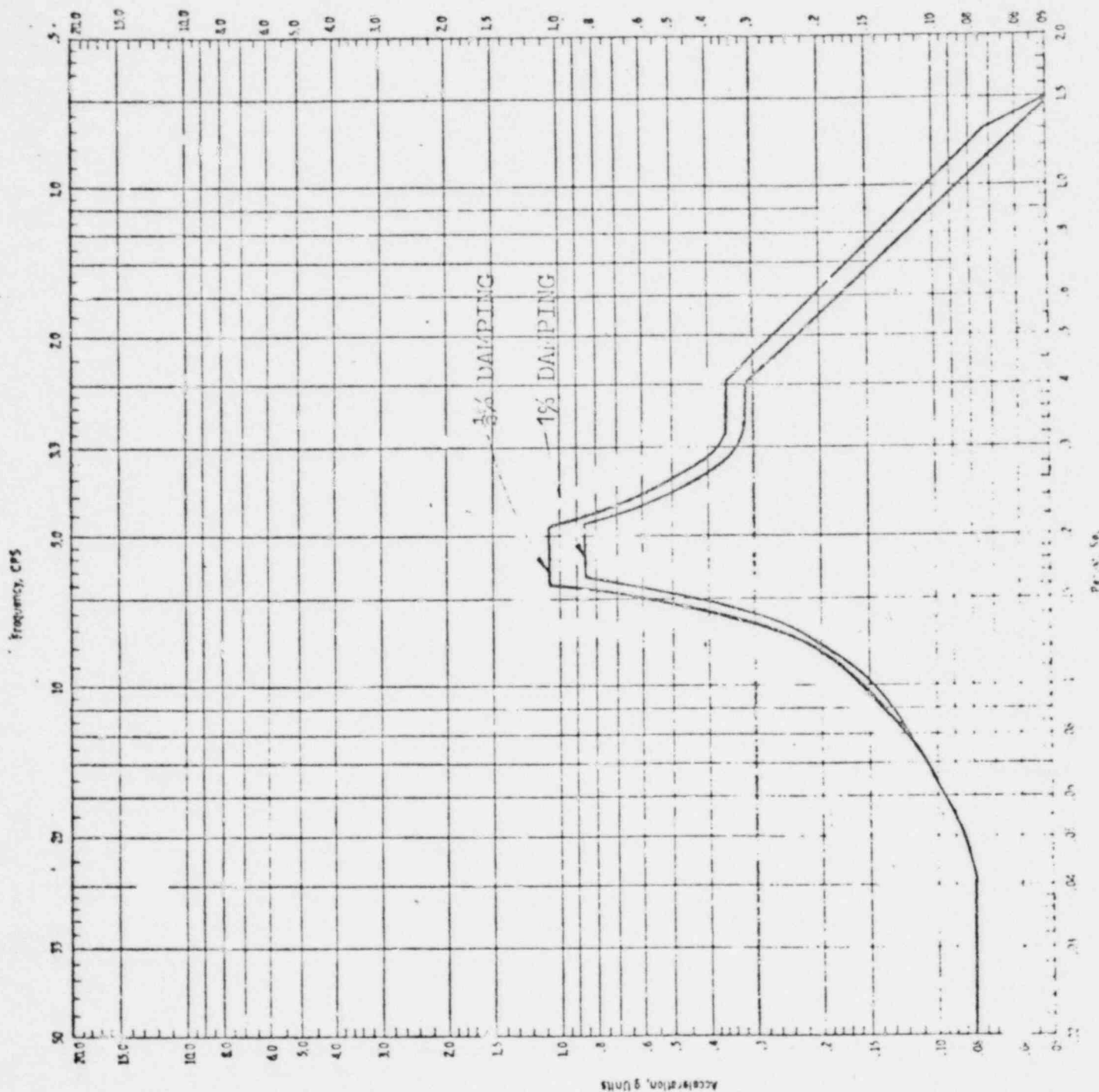


FIGURE B-20
HORIZONTAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE DRYWELL CONTAINMENT
6'-0" BELOW RPV INVERT EAST-WEST COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SGM

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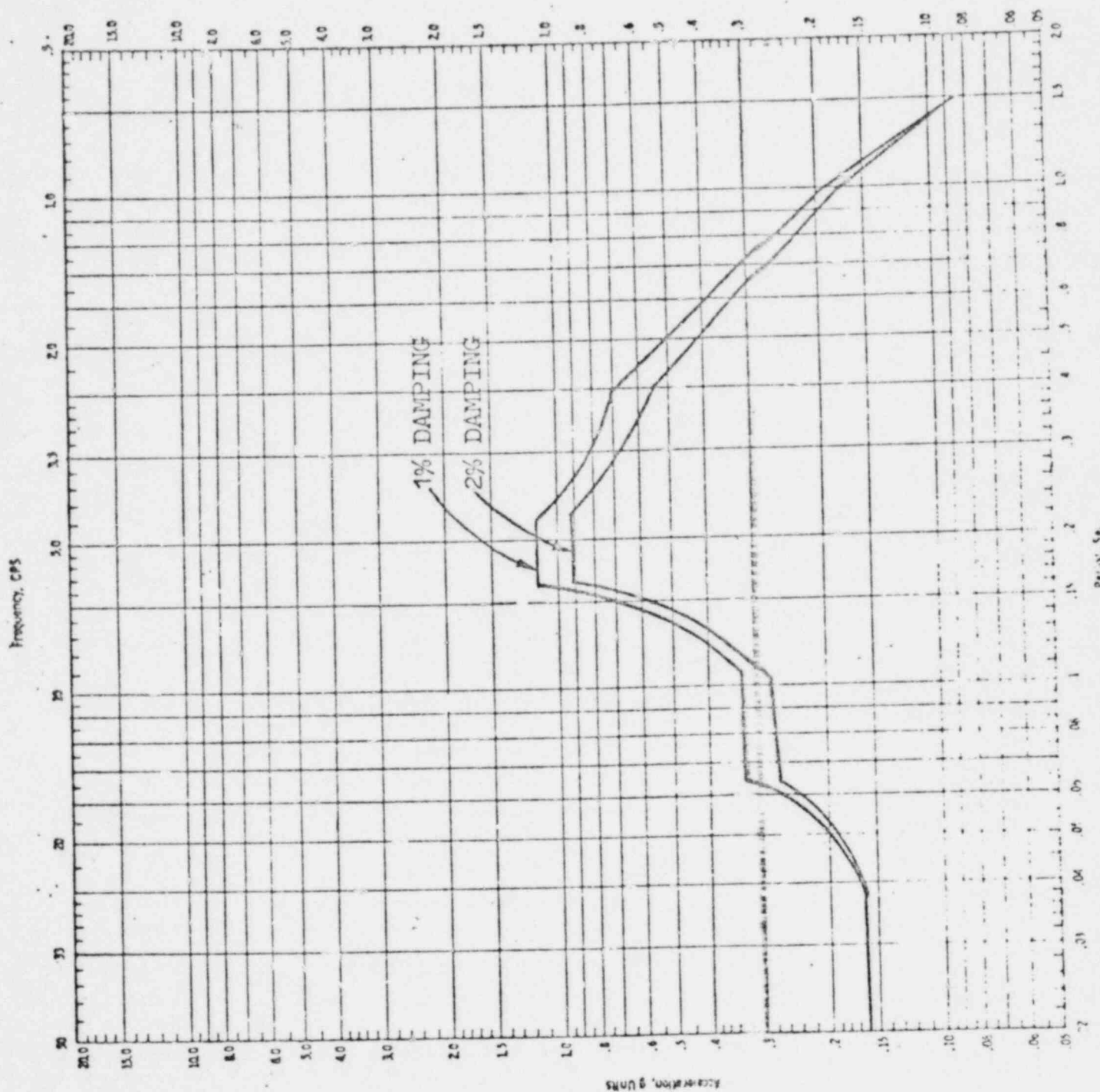


FIGURE B-43
HORIZONTAL RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE DRYWELL CONTAINMENT 6'-0"
BELOW RPV INVERT NORTH-SOUTH COMPONENT

SARGENT & LUNDY

ENGINEERS

CLIENT DETROIT EDISON

PROJECT ENRICO FERMI

JOB NO. 3988

DESIGN BY SGM

DATE April 18, 1972

CHECKED BY HHS

DATE 4/10/72 SHEET OF

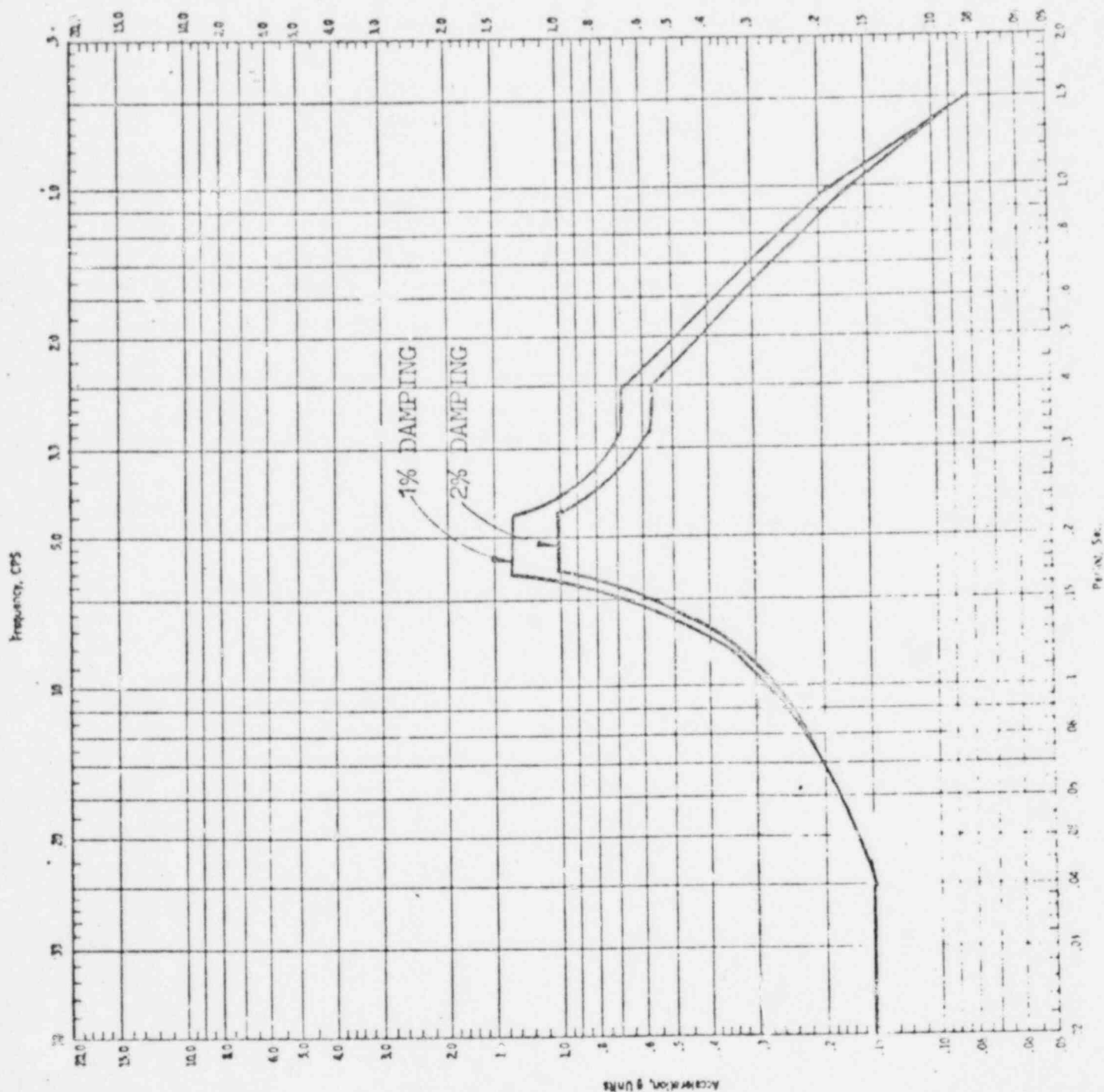


FIGURE B-44

HORIZONTAL RESPONSE SPECTRA

DESIGN BASIS EARTHQUAKE DRYWELL CONTAINMENT 6'-0"

BELOW RPV INVERT EAST-WEST COMPONENT

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ENGINEERS

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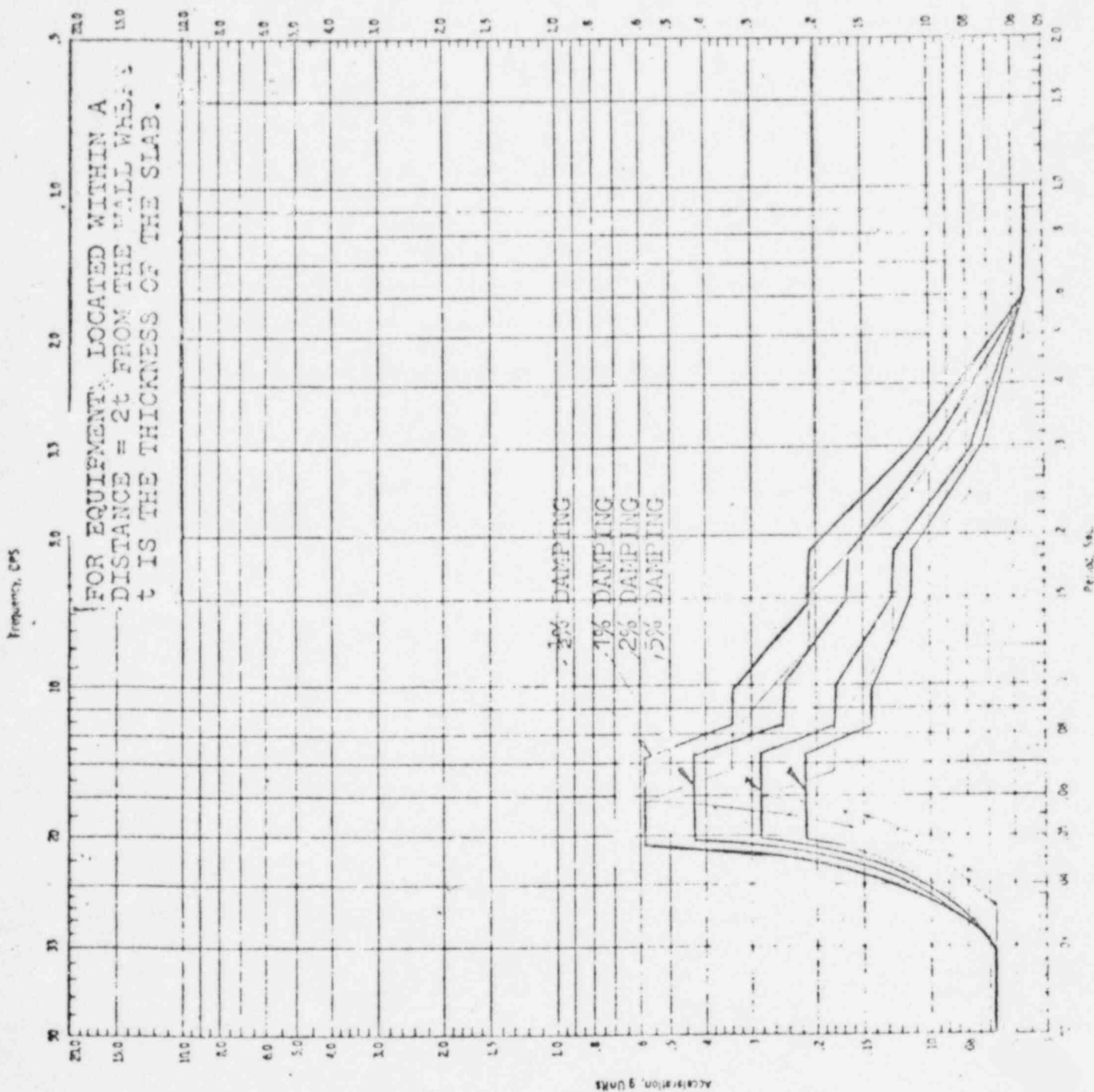


FIGURE C-2
VERTICAL RESPONSE SPECTRA
OPERATING BASIS EARTHQUAKE
REACTOR CONT. SHIELD EL. 583'-6", 613'-6"

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PROJECT ENRICO FERMI

100-0-3983-00

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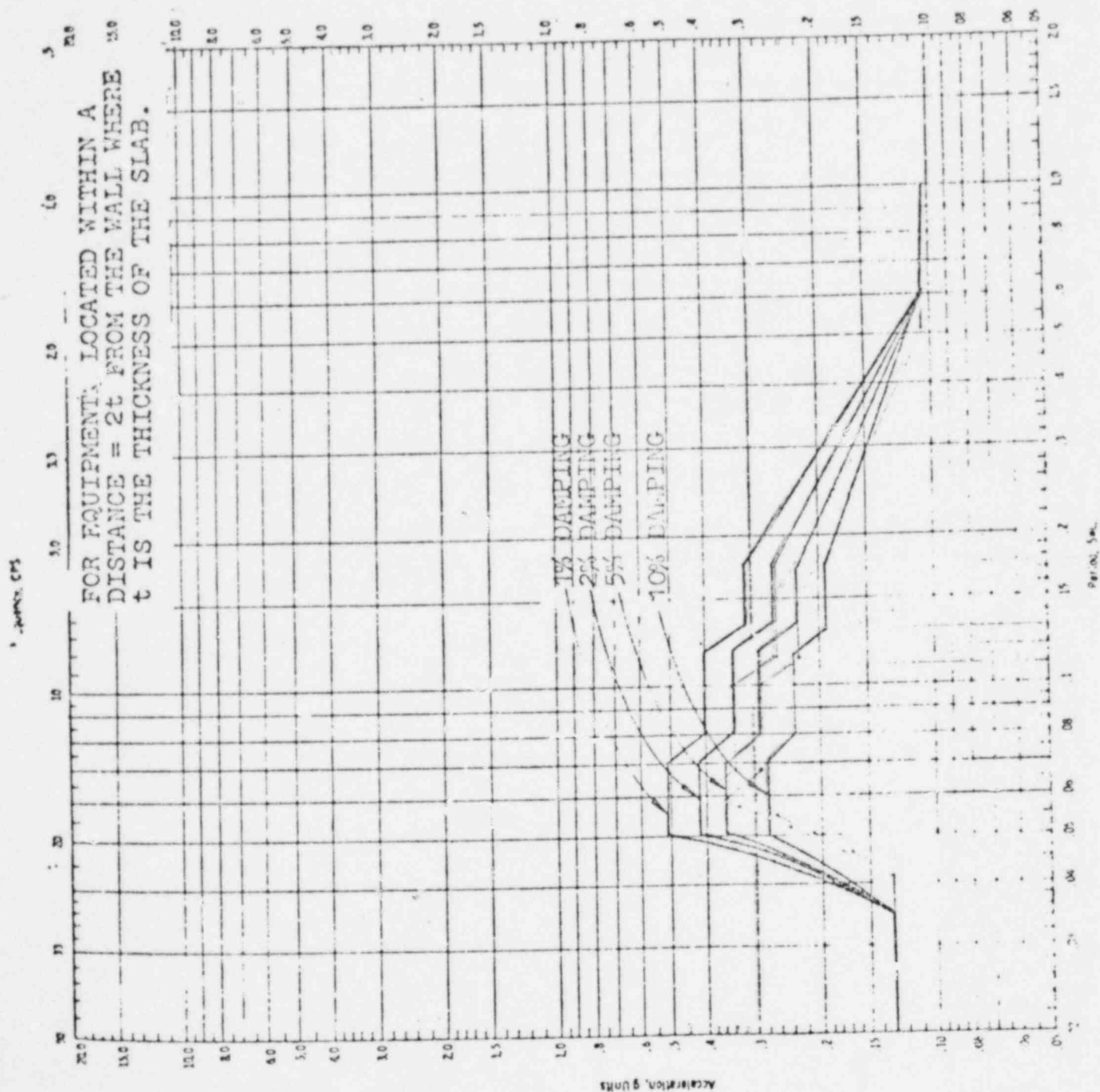


FIGURE C-12
VERTICAL RESPONSE SPECTRA
DESIGN BASIS EARTHQUAKE REACTOR
CONT. SHIELD EL. 583'-6", 613'-6"