TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

April 21, 1982



Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Ms. Adensam:

In the Matter of the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

Enclosed for NRC review is information concerning the NRC Seismic Qualification Review Team (SQRT) audit of Watts Bar Nuclear Plant. This information includes specific details for equipment specified informally by the NRC. An advance copy of this information was provided to the NRC project manager and to EG&G of Idaho Falls by overnight mail service on April 19, 1982. We understand the audit will be conducted on April 27 through April 30, 1982 at the plant site.

If you have any questions concerning this matter, please get in touch with D. P. Ormsby at FTS 858-2682.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Licensing

Sworn to and subscribed before me
this 21st day of April 1982
Paulette H. White
Notary Public
My Commission Expires 9-5-84

Enclosure
cc: U.S. Nuclear Regulatory Commission
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

B001 Limited Dist

206

8204260

NRC's Seismic Qualification Review Team Audit of Selected Mechanical and Electrical Equipment

Item No.	Equipment	Scope
1	Electricl Penetrations, Conax Corporation	BOP
2	125V dc Vital Batteries	BOP
3	120V ac Vital Inverters	BOP
4	480V Motor Control Centers	BOP
5	Standby Power System, Diesel Generators	BOP
6	DG Control and Protection Relay Panels	BOP
7	Metalclad Switchgear	BOP
8	6900V Shutdown Board Logic Panels	BOP
9	480V Power Distribution Cabinet	BOP
	~~Transfer Switch Circuit Breaker Assemblies and Safety Switches~~	
10	Battery Rack	BOP
11	120V ac Vital Instrument Power Boards	BOP
12	BOP Power Supplies	BOP
13	Dual Alarm Units	BOP
14	Hi-Fi Relays	BOP
15	Main Steam Isolation Valves	BOP
16	Main Feedwater Isolation Valves	BOP
	~~Ice Condenser Doors and Passive Portions of System~~	
17	ERCW Pumps	BOP
18	Diesel ~~Starting~~ Combustion Air Intake Filters	BOP
19	Reactor Building Purge Valves	BOP
20	Control Building Ventilation, MCR Control Dampers	BOP

ID No	Equipment	Scope
21	480V Switchgear	BOP
22	Emergency Generator Starting and Control System-Contactor/Relay System-Barksdale Switch, E1HM90V	BOP
	Emergency Generator Starting and Control System-Contactor/Relay System-Square D Relays, Class 8501, Type KP	BOP
23	Ice Condenser-Doors and Passive Portions of System	NSSS
24	Reactor Trip and Bypass Breaker	NSSS
25	Reactor Protection System Output Relays	NSSS
26	Engineering Safeguards Test Cabinets	NSSS
27	RCS-Pressurizer Safety Valves	NSSS
28	CVCS-Centrifugal Charging Pumps and	NSSS
~~[illegible]~~	SIS-High Head SIS Pumps Breaker	NSSS
29 ~~[illegible]~~	CVCS-Boric Acid Transfer Pump and Filter	NSSS
30 ~~[illegible]~~	Neutron Detector	NSSS
31 ~~[illegible]~~	Control Rod Drive Mechanism	NSSS
32 ~~[illegible]~~	Spent Fuel Pit Bridge Crane 2	NSSS
33 ~~[illegible]~~	Control Room Panel	NSSS

Note: 1) Transfer Switch Circuit Breaker & Safety Switch Assembly was determined not to be required to perform any safety function during plant shutdown and was therefore deleted from the list.

2) Seismic Documentation For the spent fuel pit Bridge Crane was not retrievable. status will be discussed during the audit

GENERAL NOTES

ITEM V 6 FATIGUE EFFECTS

UNLESS OTHERWISE NOTED, THE ONLY FATIGUE EFFECT CONSIDERED IS THAT OF "SEISMIC AGING". SEISMIC TEST PROGRAMS INCLUDED TESTING TO A NUMBER OF OBE'S PRIOR TO FULL LEVEL SSE TEST.

NOTE: FOR WATTS BAR SITE, OBE LEVEL EARTHQUAKE HAS A RETURN PERIOD OF 300-500 YEARS. -- 84% CONSIDERATIONS

ITEM V 3 REQUIRED RESPONSE SPECTRA

IN ALL CASES, EQUIPMENT IS SEISMICALLY QUALIFIED TO THE SSE LEVELS. MANY OF THE ATTACHED RESPONSE SPECTRA REFLECT "1/2 SSE" LEVELS; THESE SPECTRA WOULD BE DOUBLED FOR THE CORRESPONDING SSE QUALIFICATION REQUIREMENT.

ITEM VI 7 FOR SEISMIC TEST PROGRAMS WHICH INCLUDED MANY TESTS (OBE'S, SSE'S, ORIENTATIONS) TYPICAL PLOTS OF TRS ENVELOPING RRS ARE ATTACHED; SPECIFICALLY SSE.

Attachment No. 3 ITEM 1 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: WESTINGHOUSE BWR
3. A/E: TVA Other

II. Component Name: ELECTRICAL PENETRATIONS 76K61-870164

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: VARIOUS* Quantity: 106
3. Size or Range: VARIOUS*
4. Vendor: CONAX CORPORATION
5. If the component is a cabinet or panel, name and model Number of the devices included: NA
6. Physical Description:
   a. Appearance: CYLINDRICAL
   b. Dimensions: VARIOUS
   c. Weight: VARIOUS
7. Location: Building: REACTOR BLDG
   Elevation: ALL
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [✓] Weld (Length ____)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   CANTILEVERED
10. a. System in which located: PENETRATIONS (302)
    b. Functional Description: PROVIDES ACCESS TO INSIDE CONTAINMENT FOR POWER CABLES WITHOUT VIOLATING CONTAINMENT INTEGRITY
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other

* SEE ATTACHMENT 1

11. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 2697 FOR FURNISHING AND DELIVERING ELECTRICAL PENETRATION ASSEMBLIES

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: E93-752 RevA; Design Qualification Report for

(No., Title and Date): Electric Penetration Assemblies for Watts Bar Nuclear Plant Units 1 & 2 1/21/81

Company that Prepared Report: Conax Corporation

Company that Reviewed Report: TVA

Where Report is filed or available: EEB 82 0115 315

Applicable Codes And/Or Standards:

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): attached 2

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

3/5

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direction:

[ ] ZPA [ ] Other _____ (specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = _____ F/B = _____ V = _____

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random
[ ] sine beat
[ ] _____

2. [ ] Single Axis [X] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 5 SSE 1 Other _____ (specify)

4. Frequency Range: Resonant Search 1-200 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
- See attached 3
S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[X] Yes (Attach TRS & RRS graphs) ATTACHMENT 4
[ ] No

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [X] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

see attached 5

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

CONAX CORPORATION
2300 Walden Ave., Buffalo, New York 14225

3.0 SUBJECT PENETRATIONS

3.1 The subject penetration assemblies of this report are Conax Penetration Assemblies 7429-10000 thru 7429-10004.

3.2 The Watts Bar Bill of Materials (Ref. 2.7) summarizes the subject penetration assemblies by Conax Part Number, Penetration Designation, Rated Voltage, Density per Feedthru Module/Wire Size, Number of Feedthru Modules, and Service Classification.

3.3 Tables 3.1, 3.2 and 3.3 briefly summarizes the physical configuration for the subject penetrations.

3.4 Table 3.4 briefly summarizes the required environmental and service parameters for the subject penetration assemblies and indicates the applicable reference section in this report.

TABLE 3.1

PHYSICAL CONFIGURATION - 7249-10000 (MVP)

Welded Header: 304 SST 18 inch dia. 3 inches thk.
Non-Canister
Penetration Length: 29.56 inches
No. of Ports: 6
Nozzle Size: 18 inch Sch 80
Conductor Insulation: Kerite
Ceramic Bushing: High Alumina/Viton "O" Ring Seal
Conductors: 6 750 MCM
1 #2/0 AWG
Conductor Seal: Cap and Ferrule

TABLE 3.2

PHYSICAL CONFIGURATION - 7429-10001 (LVP)

Weld Header: 304 SST 18 inch dia. 2.5 inch thk.
Non-Canister
Penetration Length: 27.56 inches
No. of Ports: 24/27/33
Nozzle Size: 18 inch Sch 80
Conductor Insulation: Kapton Polyimide
Feedthru Tube Material: 300 Series SST
Feedthru Module Seal: Cap & Ferrule SST
Module Conductor Sealant Material: Polysulfone
Wire Markers: Raychem RT-876, Type 1

CONAX CORPORATION
2300 Walden Ave., Buffalo, New York 14225

TABLE 3.3

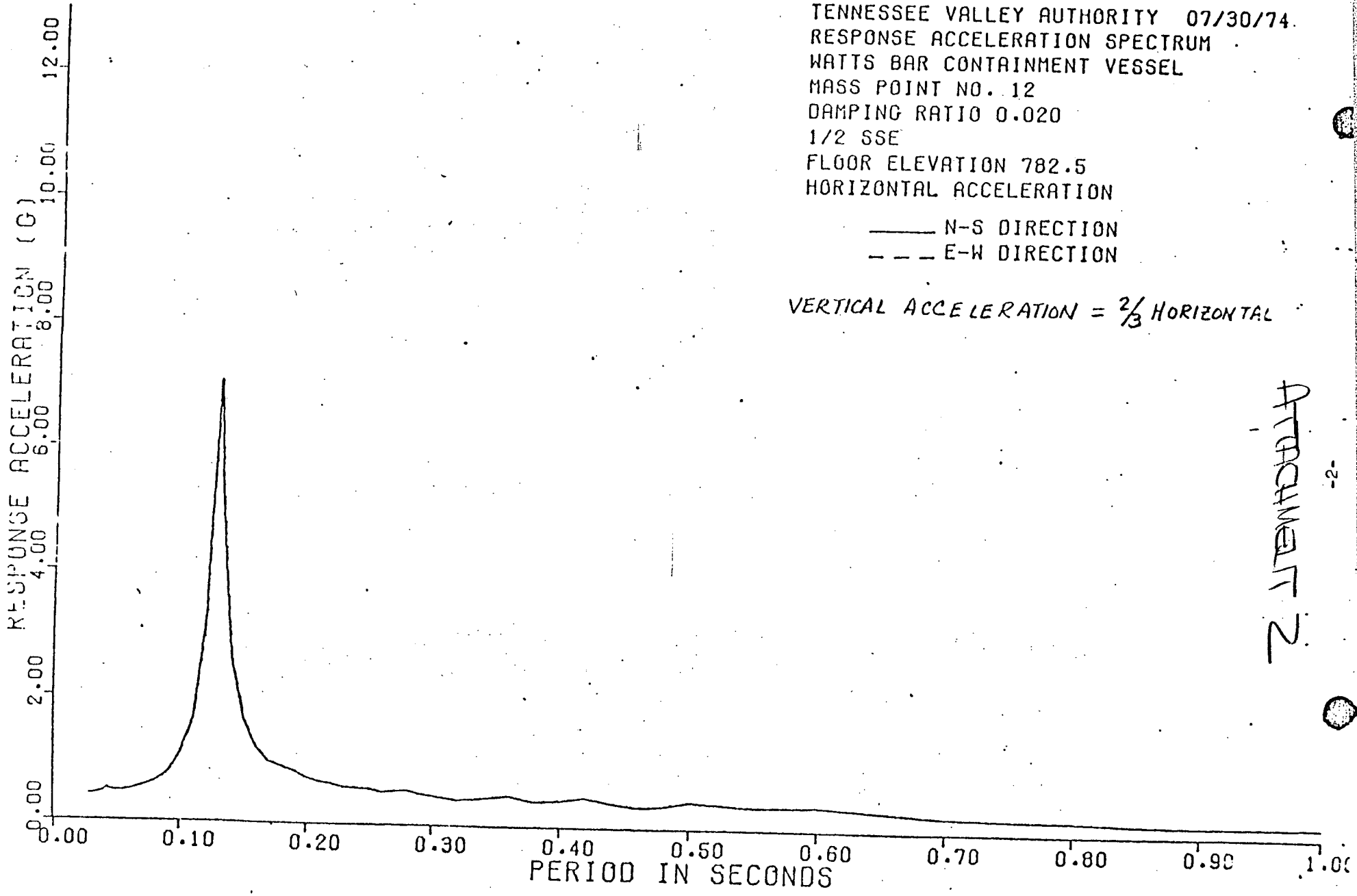
PHYSICAL CONFIGURATION - 7429-10002 (LVP) & 7429-10003 (LV1)

Welded Header: 304 SST 12.75 inch dia. 2.5 inch thk.
Non-Canister
Penetration Length: 27.56 inches
No. of Ports: 15/24/27/31
Nozzle Size: 12 inch Sch 80
Conductor Insulation: Kapton Polyimide
Feedthru Tube Material: 300 Series SST
Feedthru Module Seal: Cap & Ferrule SST
Module Conductor Sealant Material: Polysulfone
Wire Markers: Raychem RT-876, Type 1

TENNESSEE VALLEY AUTHORITY 07/30/74
RESPONSE ACCELERATION SPECTRUM
WATTS BAR CONTAINMENT VESSEL
MASS POINT NO. 12
DAMPING RATIO 0.020
1/2 SSE
FLOOR ELEVATION 782.5
HORIZONTAL ACCELERATION

——— N-S DIRECTION
– – – E-W DIRECTION

VERTICAL ACCELERATION = 2/3 HORIZONTAL



ATTACHMENT 2

5.12.2 For Test Data Bases One, Two, and Four a resonant frequency search was performed by inputing uniaxial sinusoidal excitation in each of the principal axes of the penetration in the frequency range of 1-200 Hertz (below 1 Hertz was beyond the limits of the test equipment). The excitation level was 0.1 g peak with a sweep rate of 1/2 octave per minute. The penetration response was monitored with an accelerometer located on the header. The cartesian coordinate system was defined as follows:

X Axis - Horizontal along the axis of the penetration.

Y Axis - Horizontal, perpendicular to the axis of the penetration.

Z Axis - Vertical

Resonances were recorded as follows: (Given in Hertz)

A. Test Data Base One

X Axis	Y Axis	Z Axis
14.9	17.2	31.1
75.1	60.0	43.2
114.0	83.5	78.2
161.0	161.0	157.0
	192.5	

B. Test Data Base Two

X Axis	Y Axis	Z Axis
18.3	16.0	74.1
113.5	24.7	104.5
130.0	95.3	125.3
	111.6	
	195.0	

C. Test Data Base Four

X Axis	Y Axis	Z Axis
95.0	26.0	61.5
126.5	46.0	82.5
74.0	193.0	165.0

ATTACHMENT 4

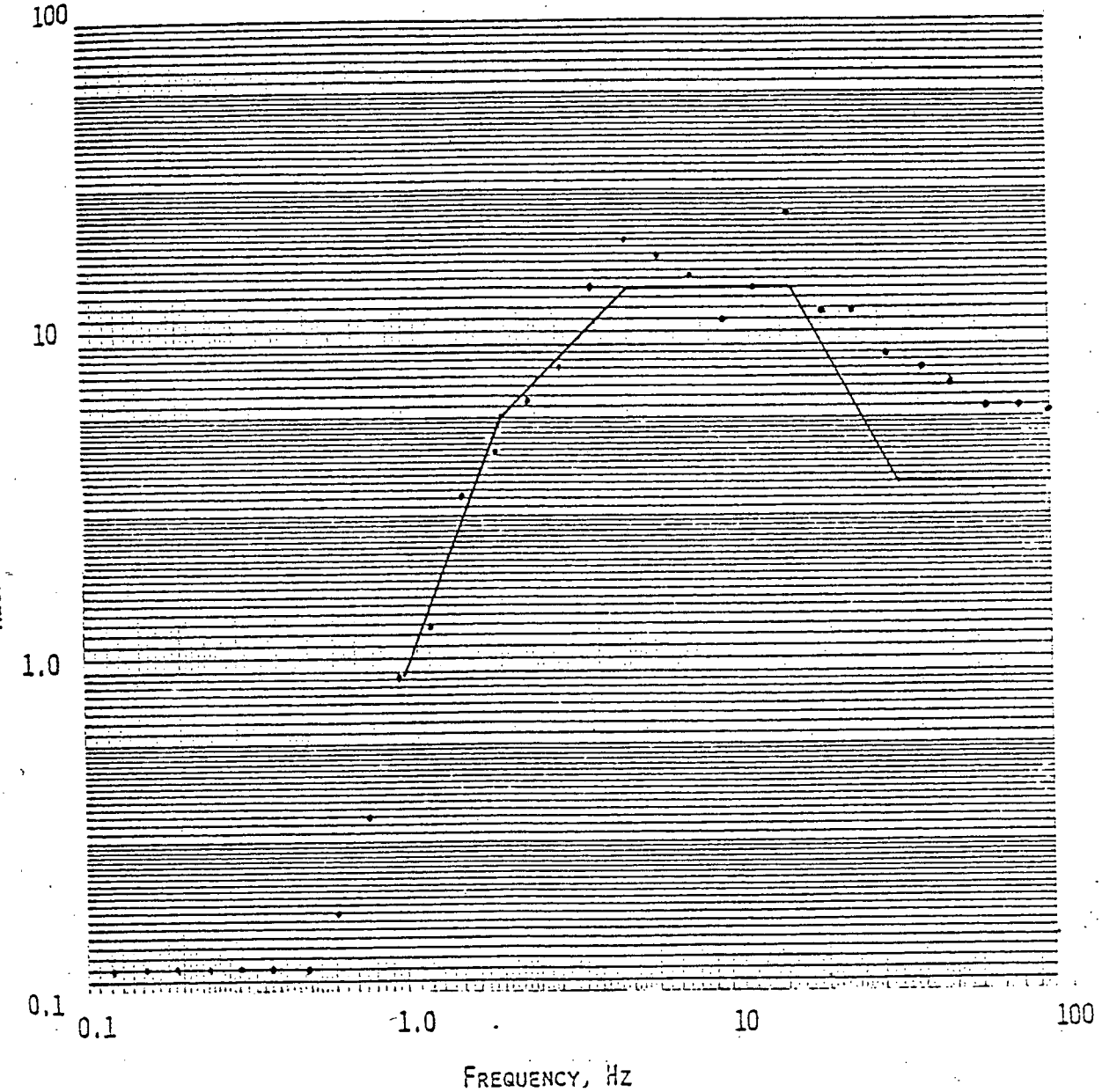


FIGURE 11.11 HORIZONTAL RESPONSE SPECTRUM, SSE NO.1, X-Z EXCITATION, RRS 2.0% Damping, TRS 2.5% Damping.

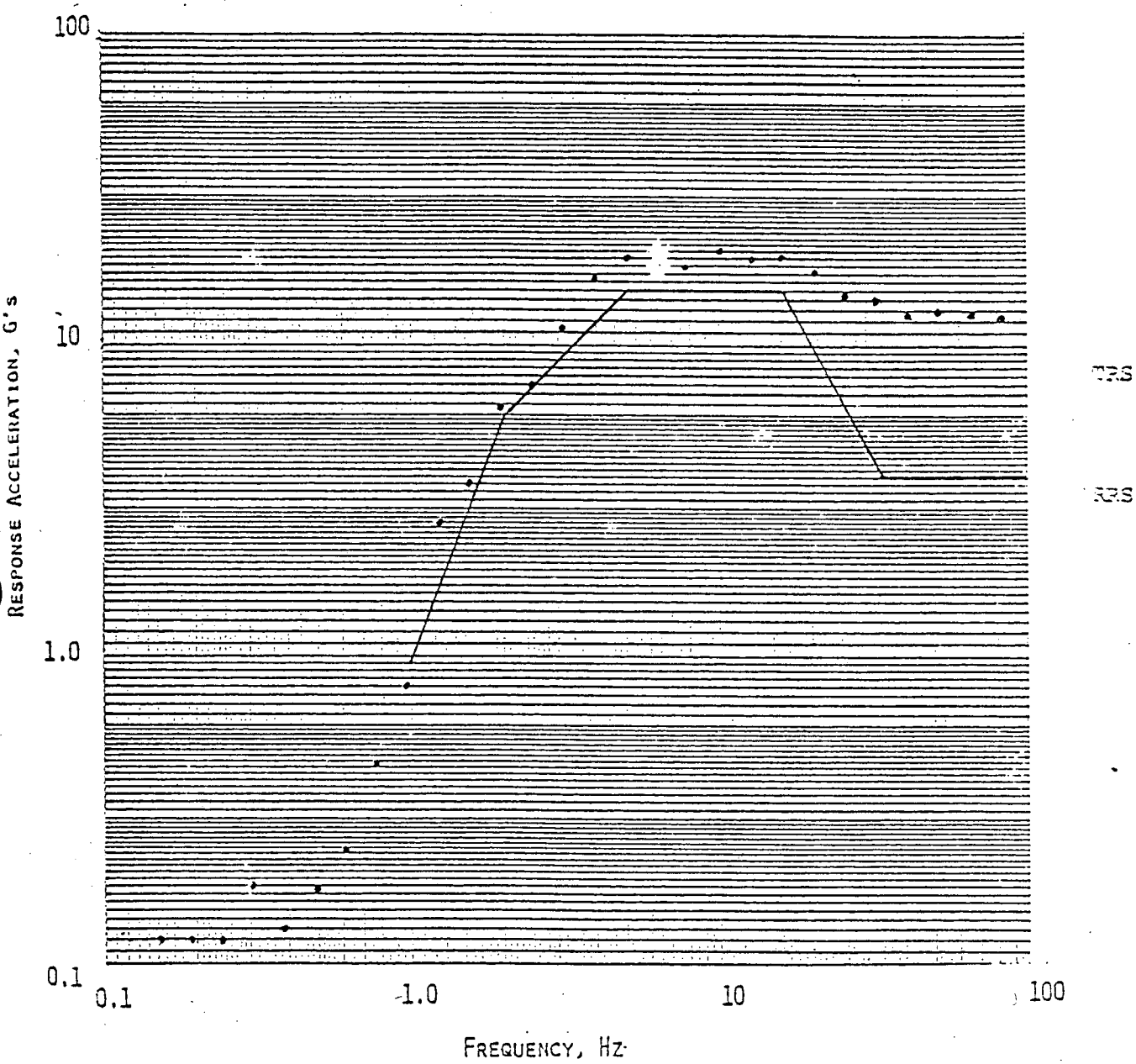


FIGURE 11.12 VERTICAL RESPONSE SPECTRUM, SSE NO.1, X-Z EXCITATION, RRS 2.0% Damping, TRS 2.5% Damping.

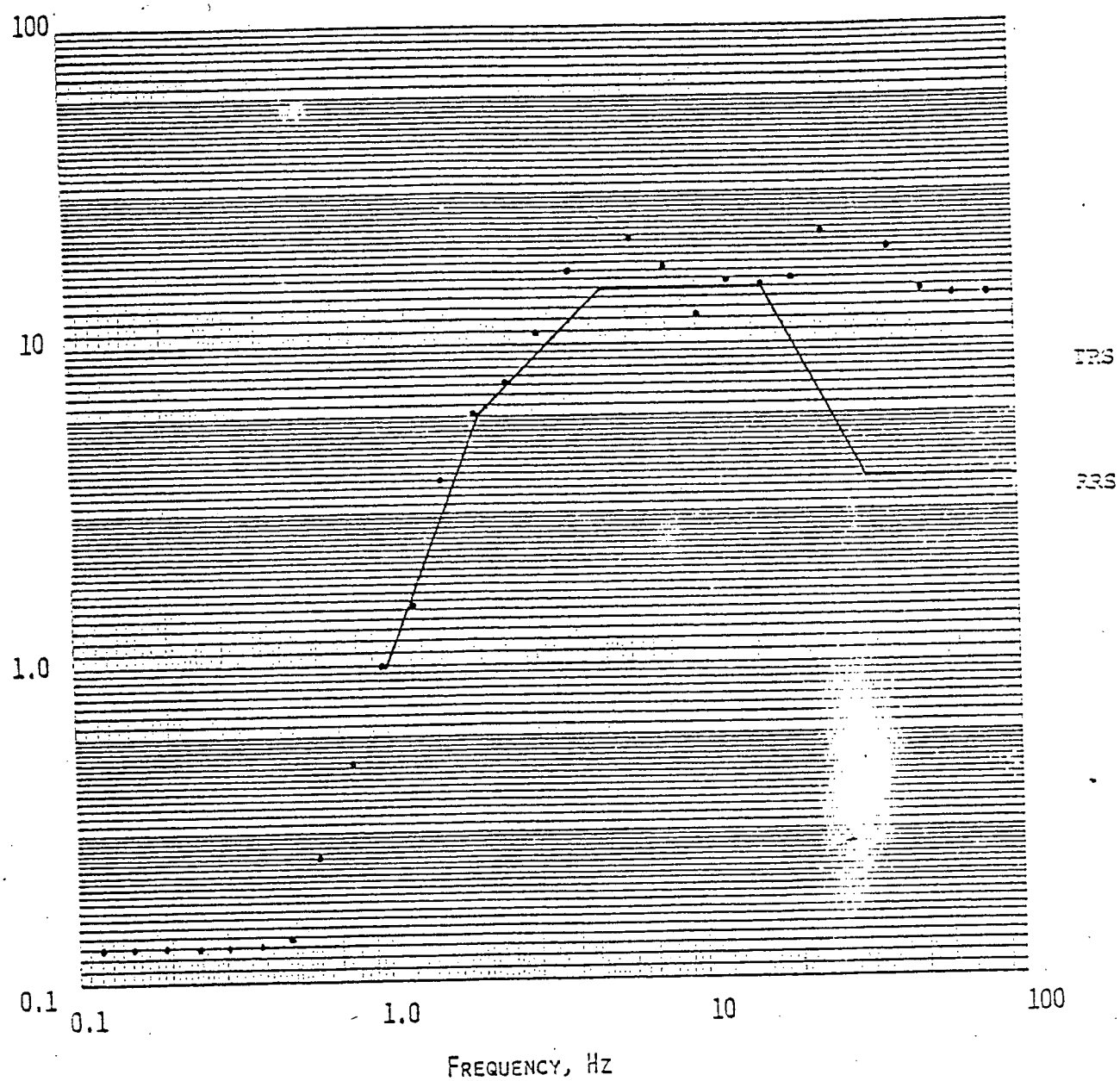


FIGURE 11. 23 HORIZONTAL RESPONSE SPECTRUM, SSE NO.1, Y-Z EXCITATION, RRS 2.0% Damping, TRS 2.5% Damping.

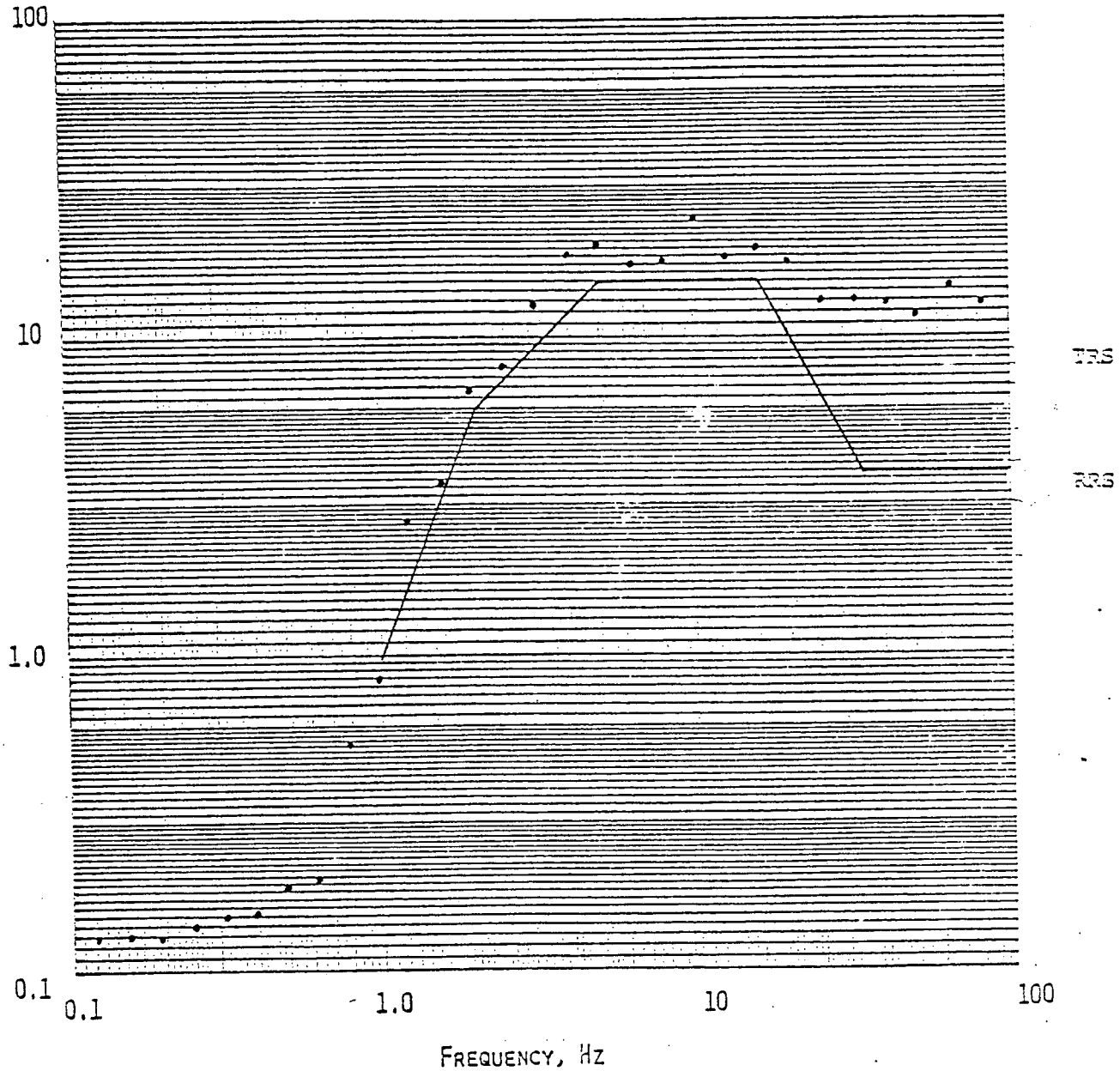


FIGURE 11.24 VERTICAL RESPONSE SPECTRUM, SSE NO.1, Y-Z EXCITATION, RRS 2.0% Damping, TRS 2.5% Damping.

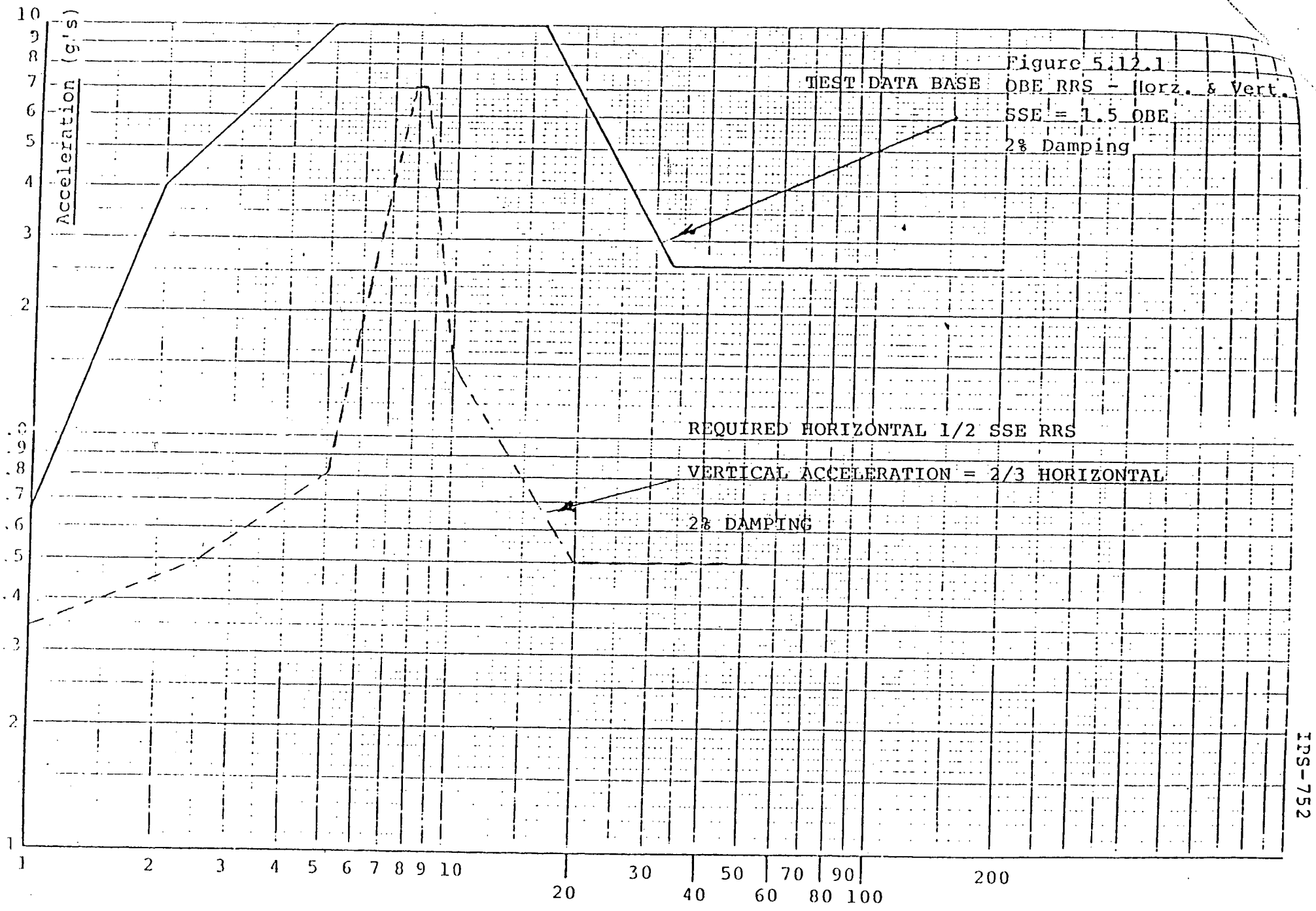


Figure 5.12.1

IPS-752

Table 4.5

Test Data Base Test Sequence

Type Test	Ref. Section IEEE 317-76	Ref. Section This Report	Data Base 1 Sequence	Data Base 2 Sequence	Data Base 3&4 Sequence
Gas Leak Rate	6.4.1	5.1	1	1	1
Pneumatic Pressure Test	6.4.2	5.2	2	2	2
Conductor Continuity Test	6.4.3	5.3	3	3	3
Dielectric Strength Test	6.4.4	5.4	4	4	4
Insulation Resistance Test	6.4.5	5.5	5	5	5
Partial Discharge (Corona) Test	6.4.6	5.6	N/A	6	N/A
Cycling & Aging Test	6.4.8	5.7	6	7	6
Basic Impulse Level (BIL) Test	RG1.63	5.8	N/A	9	N/A
Rated Continuous Current Test	6.4.7	5.9	7	10	N/A
Rated Short Time Overload Current Test	6.4.9	5.10	8	11	N/A
Short Circuit Current Test	6.4.10	5.11	9	12	N/A
Seismic Test	6.4.11	5.12	10	8	7
Repeat Rated Continuous Current	6.4.12	5.13	11	13	N/A
Design Basis Environmental Test	6.4.13	5.14	12	14	8
Rated Max. Dur. of Rated Short Circuit Current	6.4.14	5.15	13	15	N/A

Attachment No. 3 ITEM 2 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: 125V DC VITAL BATTERIES

1. Scope: [ ] NSSS [X] BOP [ ] Other 76K3-857763
2. Model Number: GOULD NCX-2250 Quantity: 4
3. Size or Range: 2250 AMPERE HOURS
4. Vendor: GOULD, INC. (NOW BROWN-BOVERI ELECTRIC)
5. If the component is a cabinet or panel, name and model Number of the devices included: NA
6. Physical Description:
   a. Appearance: ~~EACH BATTERY~~ COMPOSED OF 60 INDIVIDUAL CELLS
   b. Dimensions: ~~EACH CELL~~ 14 9/16" L, 14 1/2" W, 22 1/2" H
   c. Weight: ~~EACH CELL~~ 462 LB; 60 CELLS = 27,720 LBS/BATTERY
7. Location: Building: AUX-CONT BLDG
   Elevation: 772
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [X] ~~SEE BELOW~~
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   BATTERIES SET IN BATTERY RACKS
10. a. System in which located: 125V DC VITAL POWER SYS (249)
    b. Functional Description: ~~PROVIDES~~ CONTROL POWER VARIOUS ~~SAFETY-~~ RELATED DC POWERED EQUIPMENT
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other

11. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 1980

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WYLE LABORITORIES

(No., Title and Date): 43479-1

Company that Prepared Report:

Company that Reviewed Report: TVA

Where Report is filed or available:

Applicable Codes And/Or Standards:

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: LA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 5% SSE 5%

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other _____ (specify)

OBE S/S = .43 F/B = .43 V = .12

SSE S/S = .86 F/B = .86 V = .24

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGEING

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random [ ] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[X] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 5 SSE 1 Other _____ (specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 10 F/B = 15 V = 35

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[X] Yes (Attach TRS & RRS graphs) ATTACHED
[ ] No

6. Maximum Input g-level Test:

OBE S/S = 1.7 F/B = 2.0 V = .3

~~OBE~~ SSE S/S = 2.7 F/B = 3.2 V = .5

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] 3 BATT CELLS INSTALLED IN GOULD RACK--RACK WELDED TO TABLE

B. Orientation and Fixturing: 2 ORIENTATIONS SS/V, FB/V

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: NO PROBLEMS

12. Other tests performed (such as aging or fragility test, including results):

13. Failure Modes (If appropriate _____)

14. Margins Available: [X] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

TENNESSEE VALLEY AUTHORITY (49)
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 771.5
DAMPING RATIOS 0.050, 0.100, 0.150
½ SSE, N-S HORIZONTAL

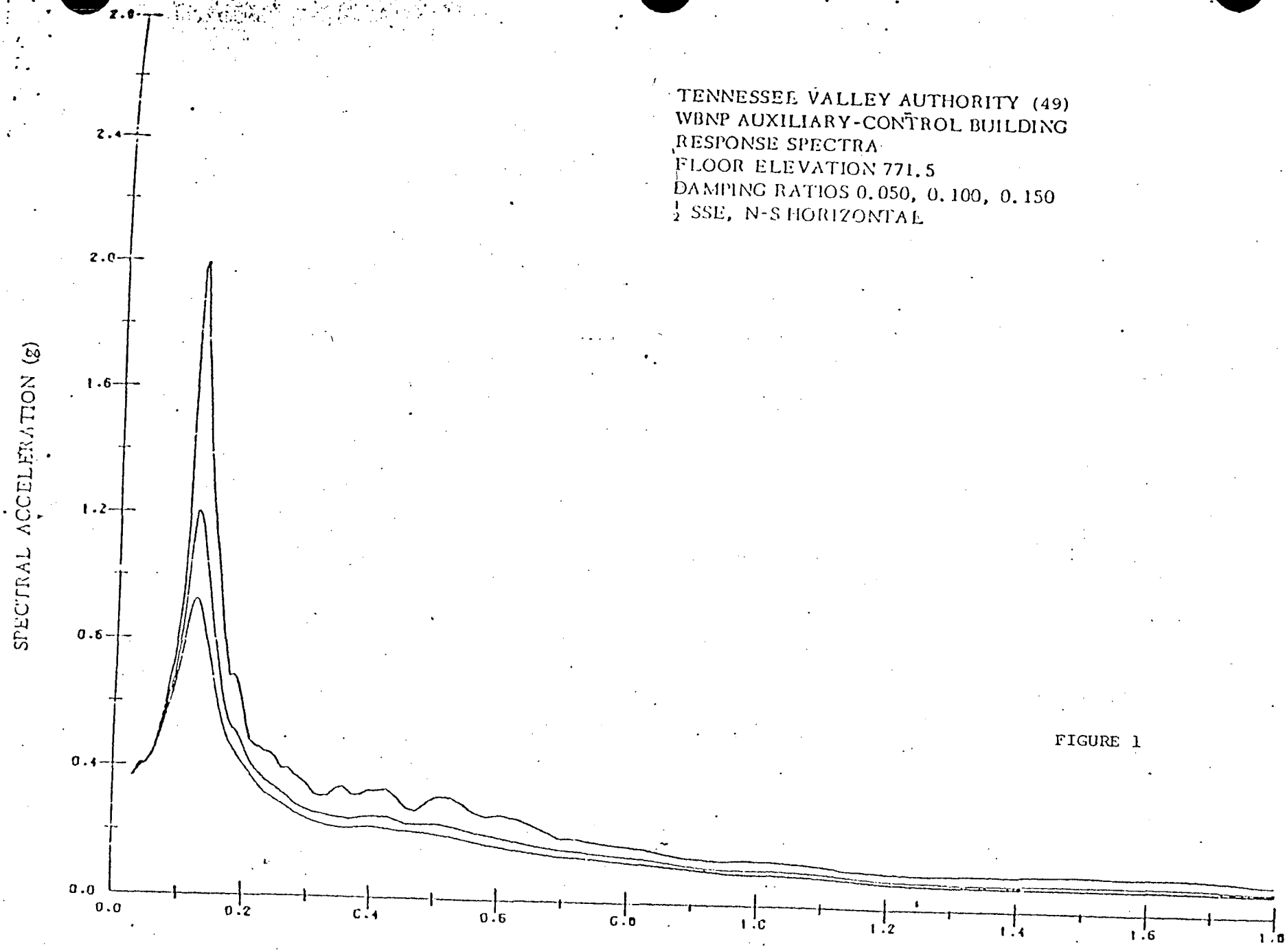


FIGURE 1

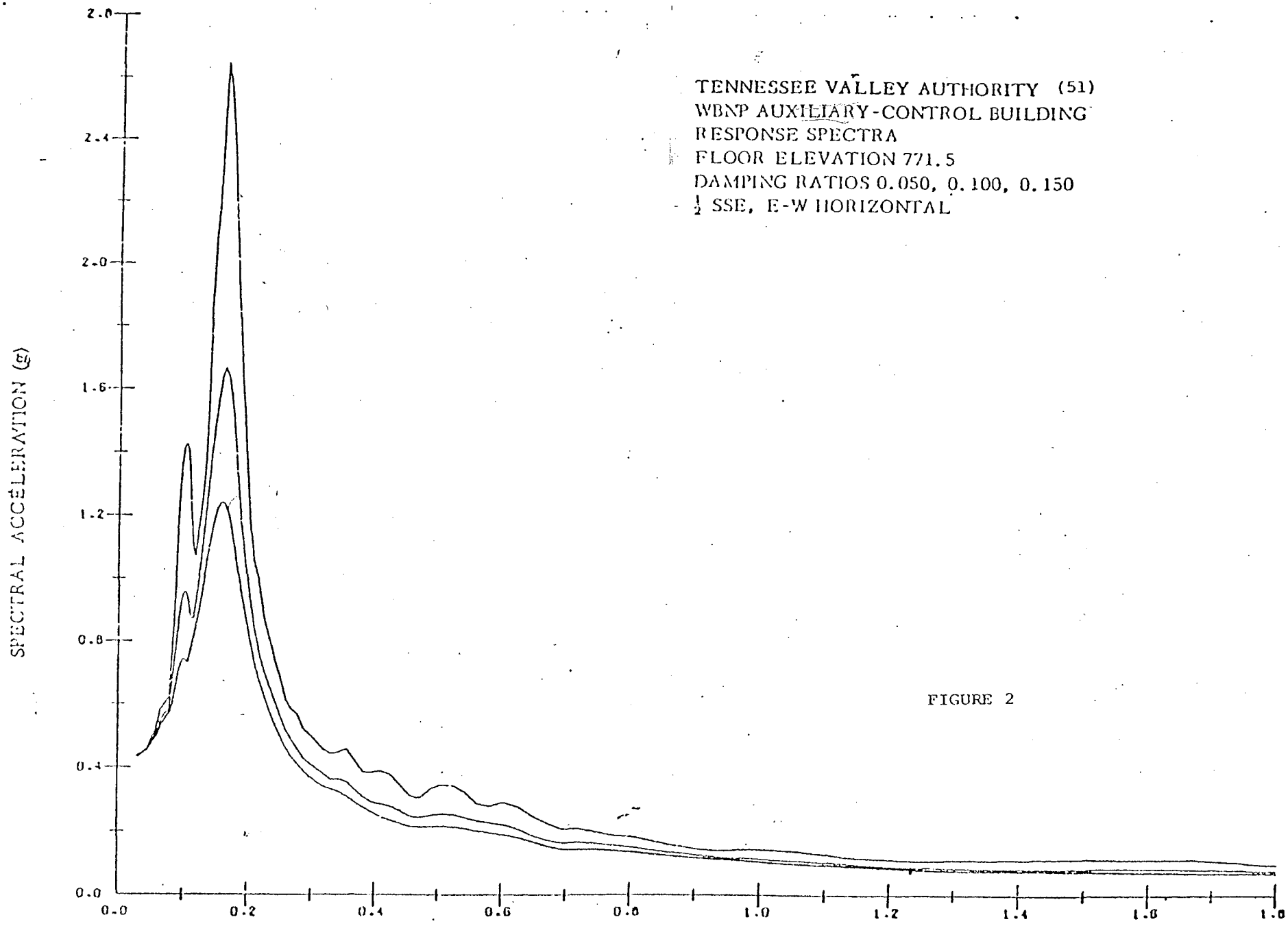


FIGURE 2

FIGURE 51

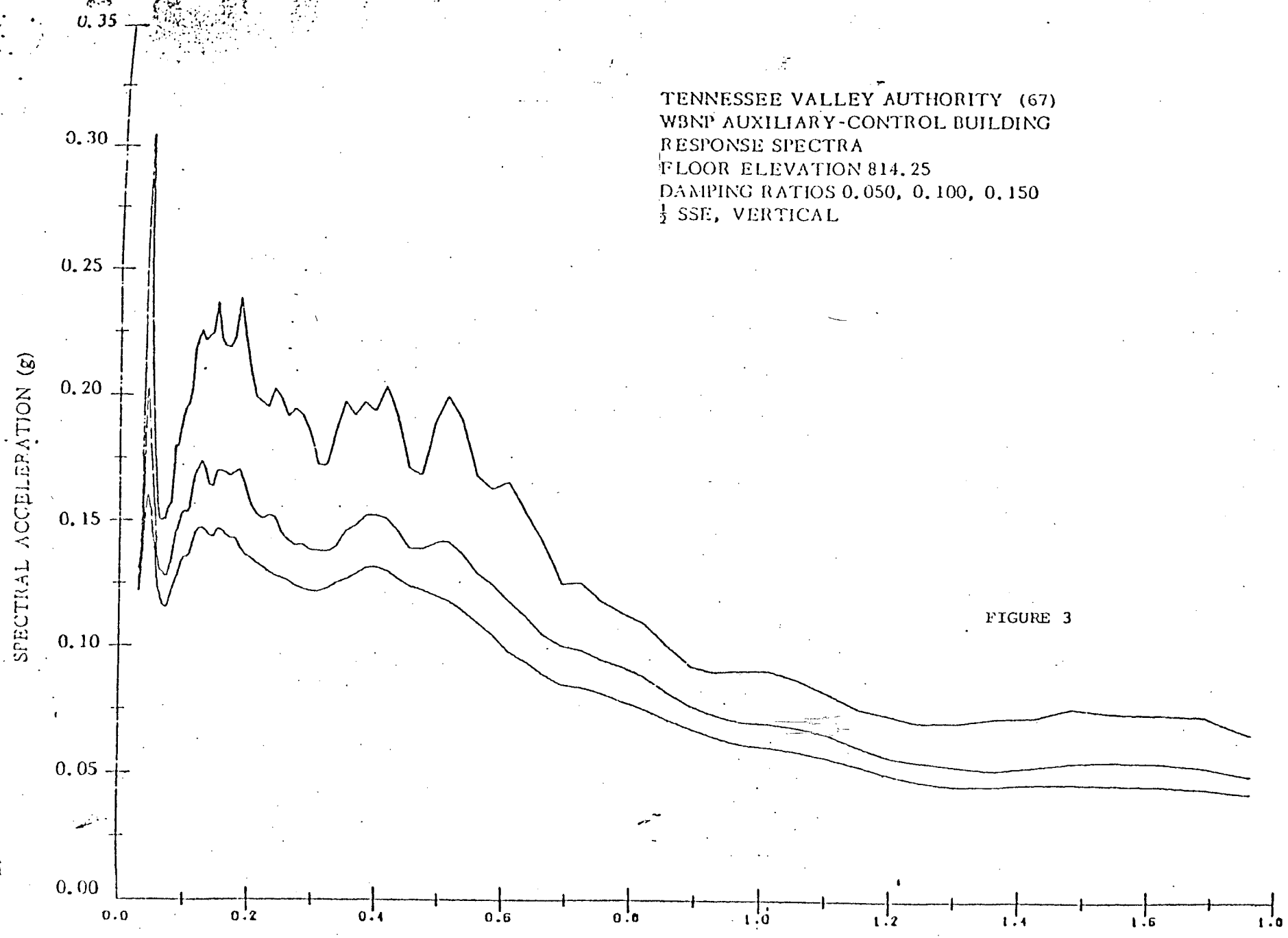


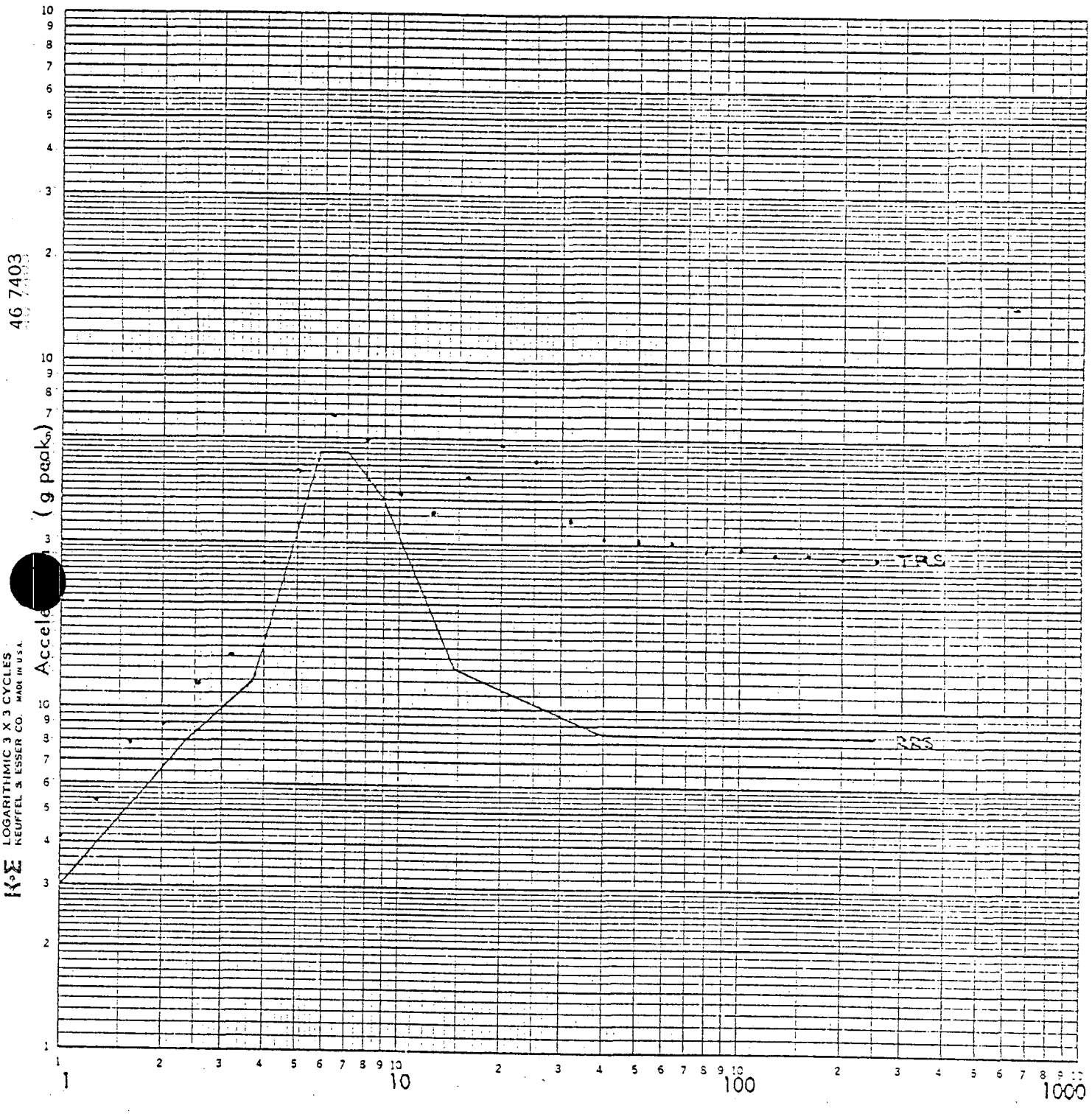
FIGURE 3

FIGURE 67

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 5 %



AXIS SS/V

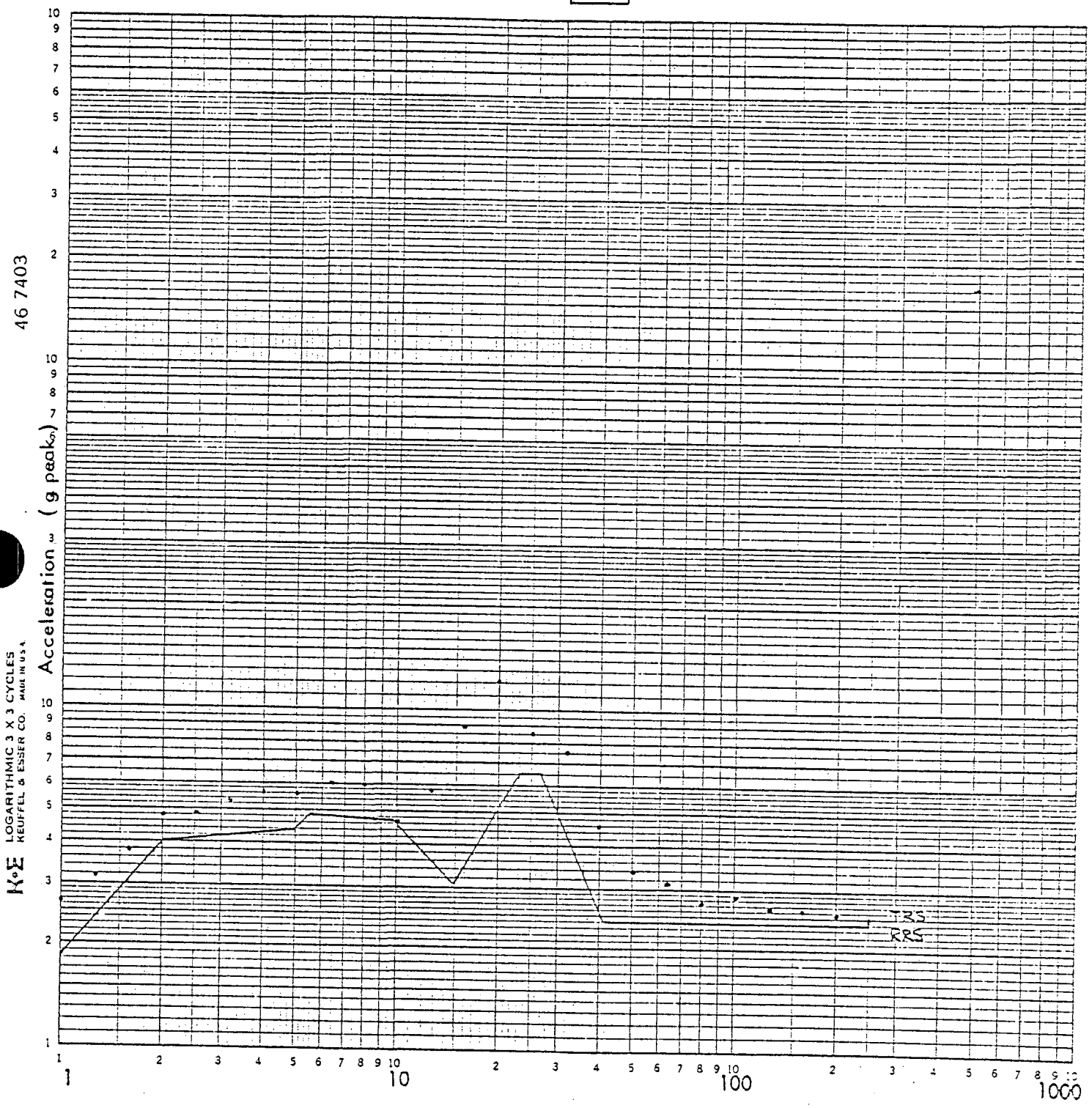
LOCATION NO. HCA

TEST RUN NO. 23

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 5%



AXIS SS/V

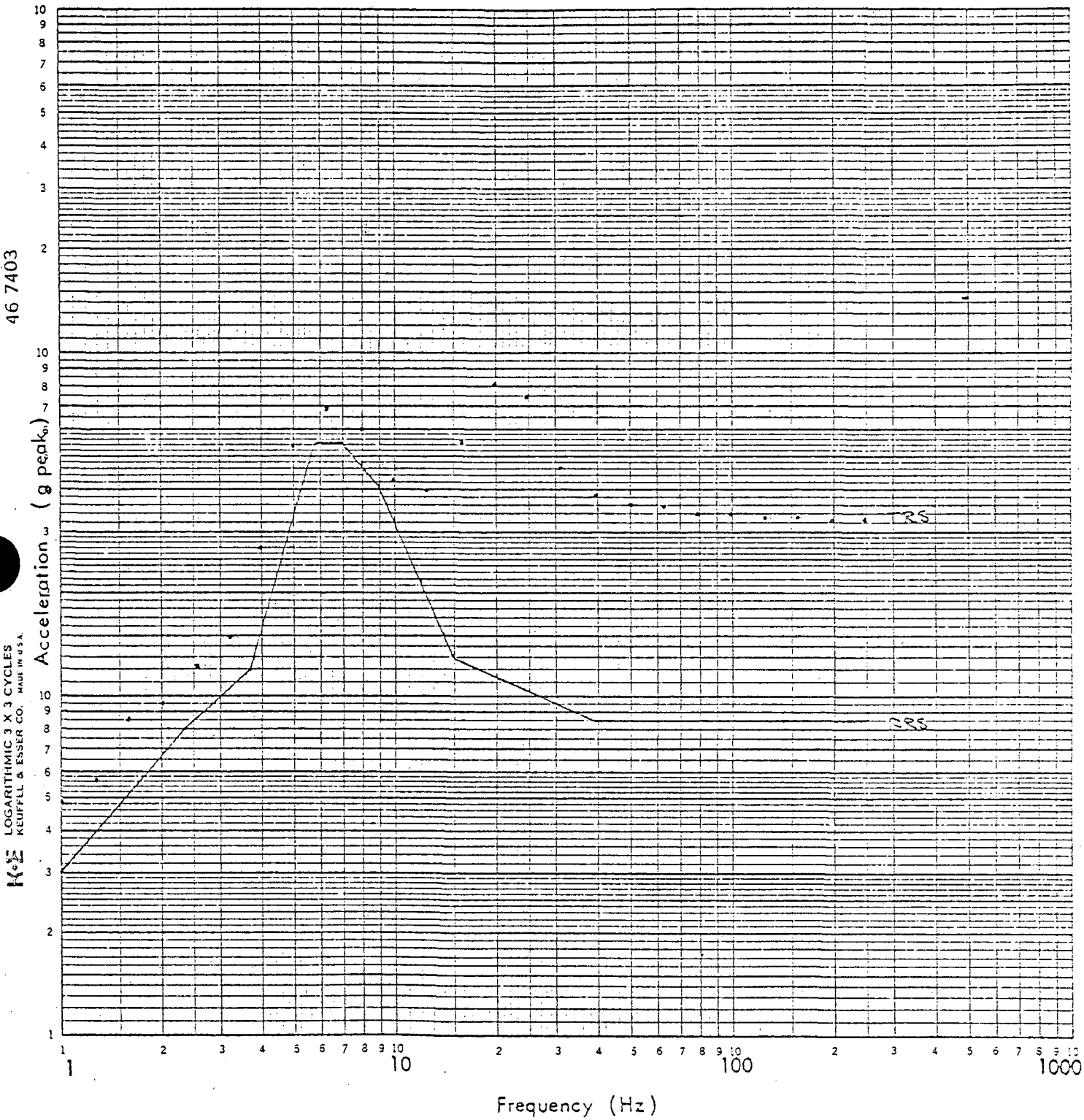
LOCATION NO. VCA

TEST RUN NO. 23

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 5%



AXIS FB/V

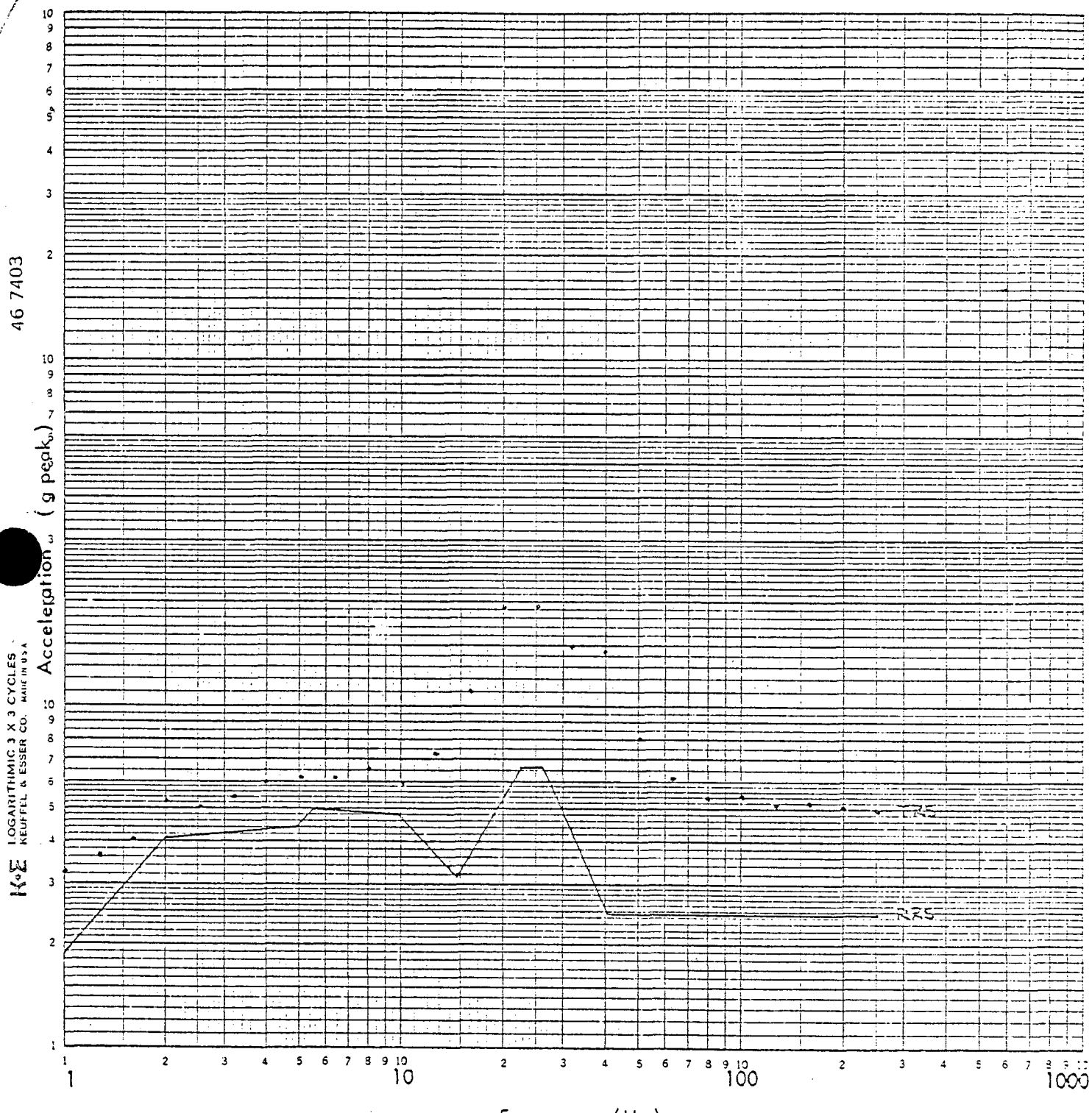
LOCATION NO. HCA

TEST RUN NO. 30

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 5 %



AXIS FB/V

LOCATION NO. VCA

TEST RUN NO. 30

Attachment No. 3 ITEM 3 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: 120 V AC VITAL INVERTER 74C8-826364

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: SCI SV12200/AC 3HR Quantity: 8
3. Size or Range: 20 KVA
4. Vendor: SOLIDSTATE CONTROLS, INC
5. If the component is a cabinet or panel, name and model Number of the devices included: N/A
6. Physical Description:
   a. Appearance: RECTANGULAR CABINET
   b. Dimensions: 56" X 36" X 94"
   c. Weight: 3600 LB
7. Location: Building: AUX-CONT BLDG
   Elevation: 772
8. Field Mounting Conditions [✓] Bolt (No. 10*, Size 1/2")
   [ ] Weld (Length)
   [ ] *10 BOLTS PER UNIT, 4 REQD
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR MOUNTED
10. a. System in which located: 120V AC VITAL POWER (250.1)
    b. Functional Description: CONVERTS 125 V DC TO 120 V AC POWER - BACKUP FOR 120 V AC VITAL INSTRUMENT POWER BOARDS
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
    [X] Both [ ] Neither [ ] Other

11. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 2094

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WYLE LABORATORIES

(No., Title and Date): #42854-1 MAY 5, 1975

Company that Prepared Report: _____

Company that Reviewed Report: TVA

Where Report is filed or available: _____

Applicable Codes And/Or Standards: _____

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other _____ (specify)

OBE S/S = .43 F/B = .43 V = .12

SSE S/S = .86 F/B = .86 V = .24

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGEING

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random [ ] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[X] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 5 SSE 1 Other _____ (specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 7, 17, 26 F/B = 12, 16, 25 V = —

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[X] Yes (Attach TRS & RRS graphs) ATTACHED
[ ] No

6. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

~~OBE~~ SSE S/S = 2.0 F/B = 1.9 V = 1.4

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[X] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: 2 ORIENTATIONS - F/B V, S/S V

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: CONTACT CHATTER DURING SEISMIC TESTS IN FAN ALARM CIRCUIT - NO PROBLEM

12. Other tests performed (such as aging or fragility test, including results):

ENVIRONMENTAL (TEMP, HUMIDITY) -- HIGH OUTPUT VOLTAGE RECORDED DURING ENVIRONMENTAL TESTS - NO PROBLEM

13. Failure Modes (If appropriate _____)

14. Margins Available: [X] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

FIGURE 43: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 771.5
DAMPING RATIOS 0.005, 0.010, 0.020
SSE, N-S HORIZONTAL

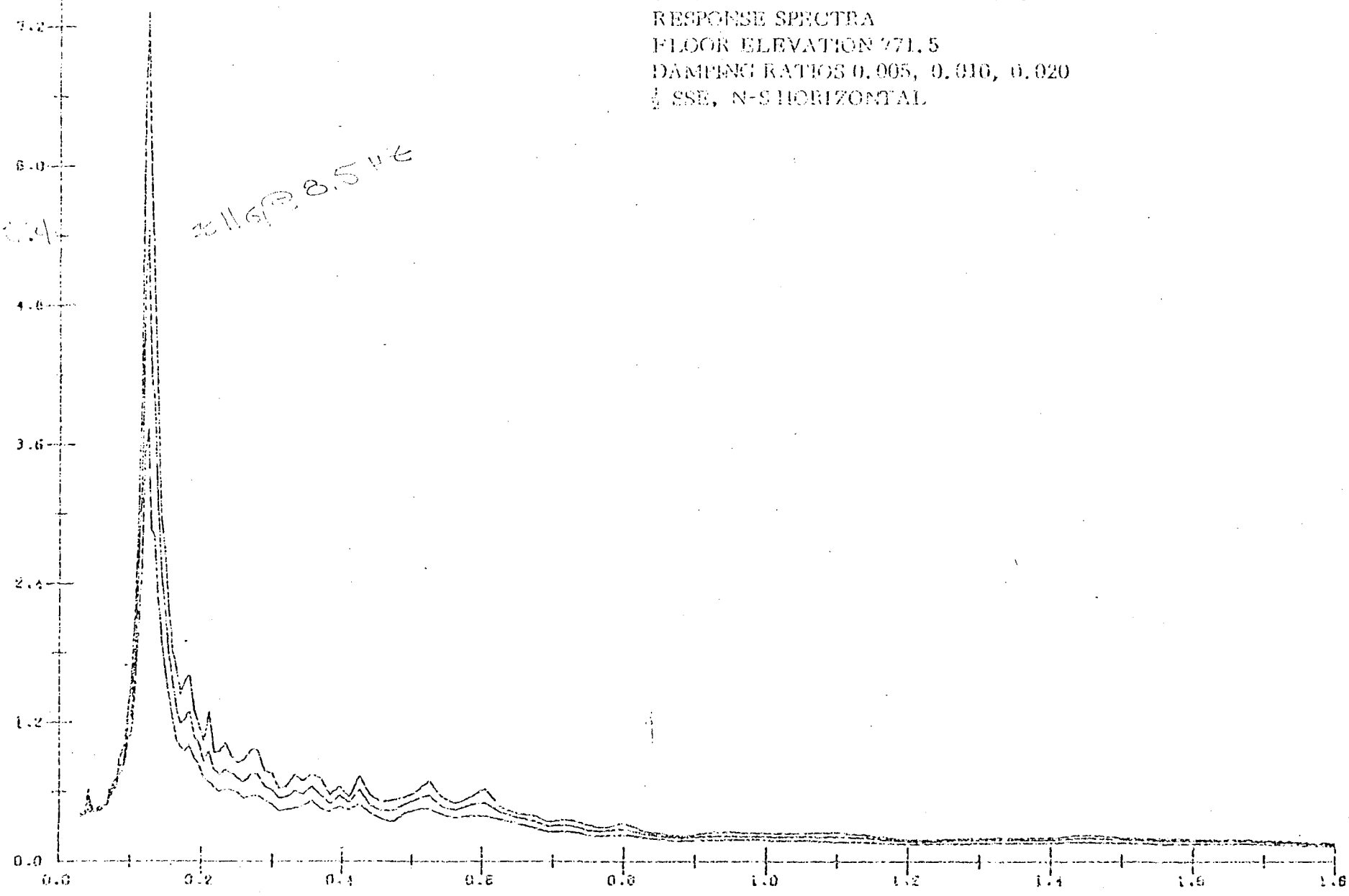
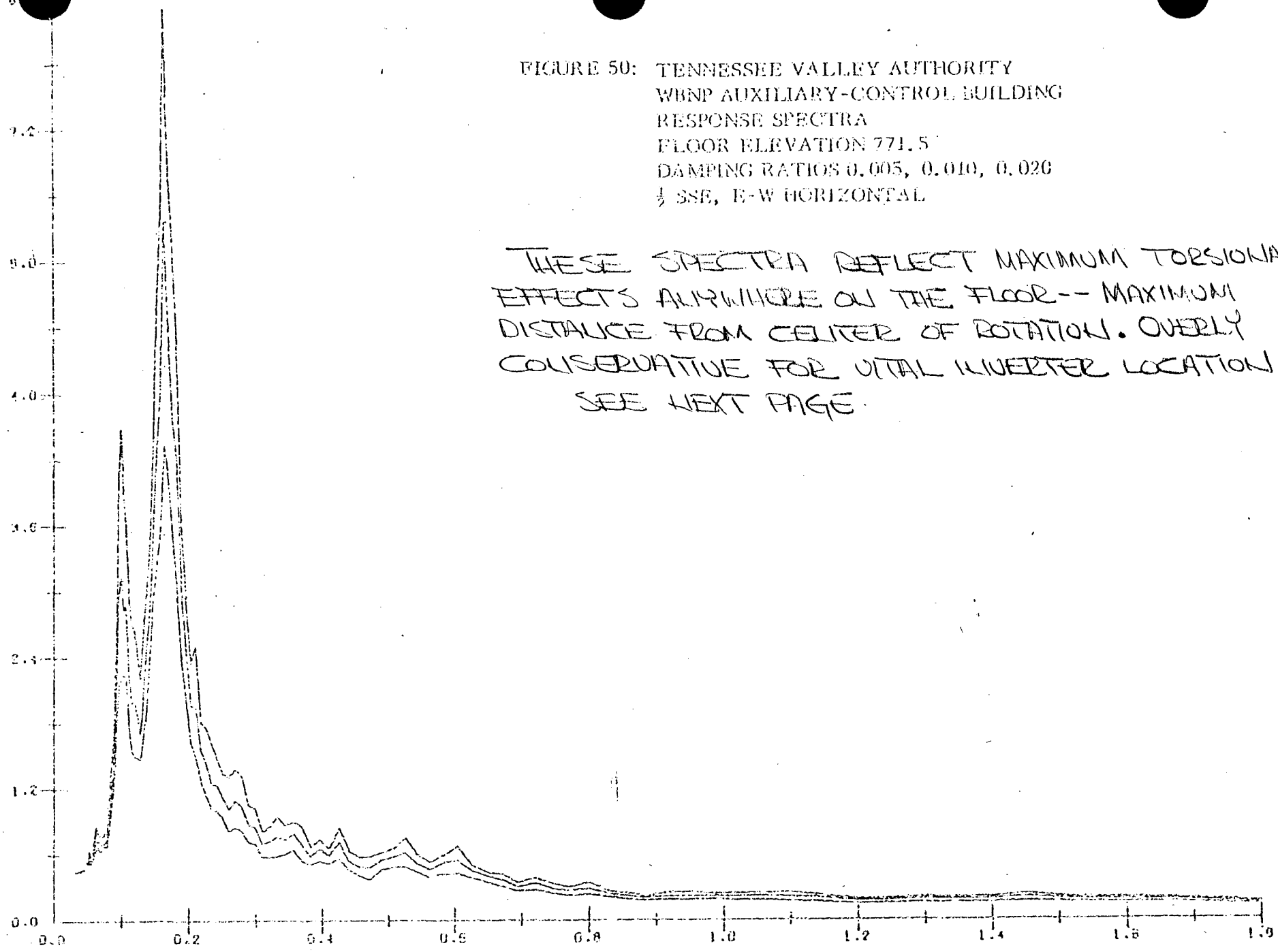


FIGURE 43

FIGURE 50: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 771.5
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, E-W HORIZONTAL

THESE SPECTRA REFLECT MAXIMUM TORSIONAL EFFECTS ANYWHERE ON THE FLOOR -- MAXIMUM DISTANCE FROM CENTER OF ROTATION. OVERLY CONSERVATIVE FOR VITAL INVERTER LOCATION.
SEE NEXT PAGE.



TENNESSEE VALLEY AUTHORITY 03/13/75
RESPONSE ACCELERATION SPECTRUM
WBNP AUXILIARY-CONTROL BUILDING
MASS POINT NO. 9 EL 771.5
DAMPING RATIO 0.010
SPECTRUM PLOTTED AT SHEAR CENTER
1/2 SAFE SHUTDOWN EARTHQUAKE
EAST-WEST MOTION

THIS SPECTRUM REFLECTS TORSIONAL EFFECTS APPROPRIATE TO THE VITAL INVERTER LOCATION

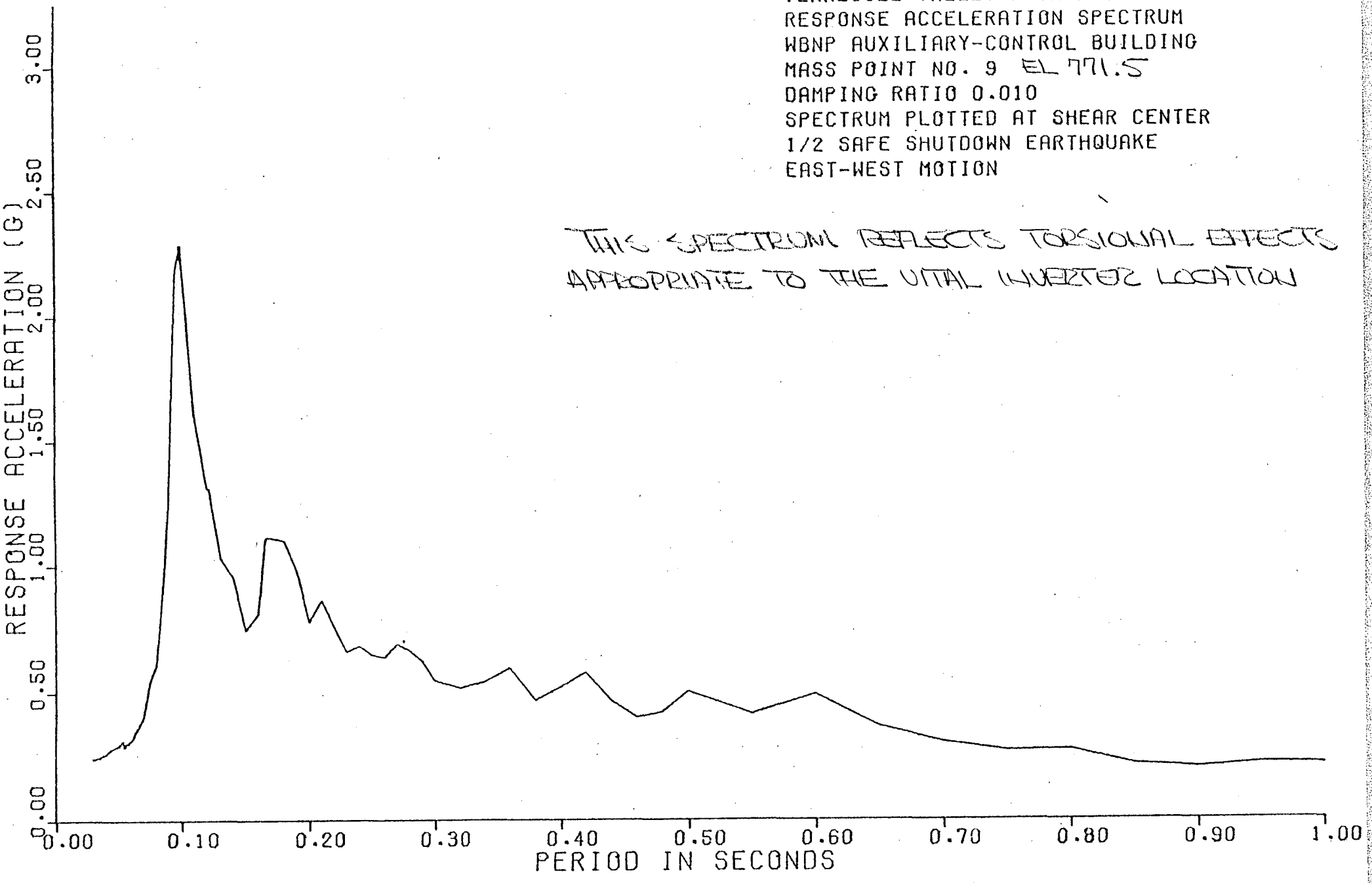
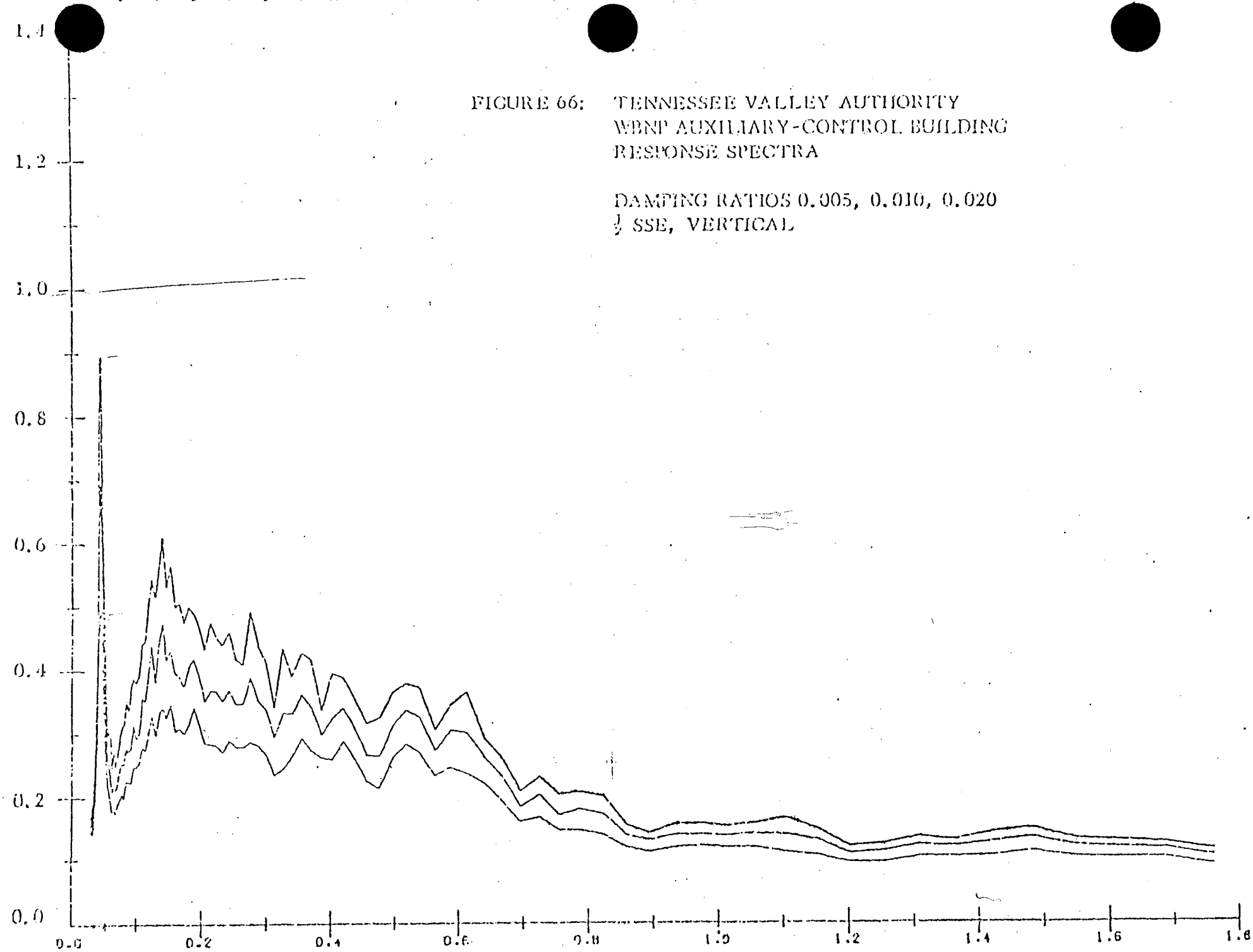


FIGURE 66: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA

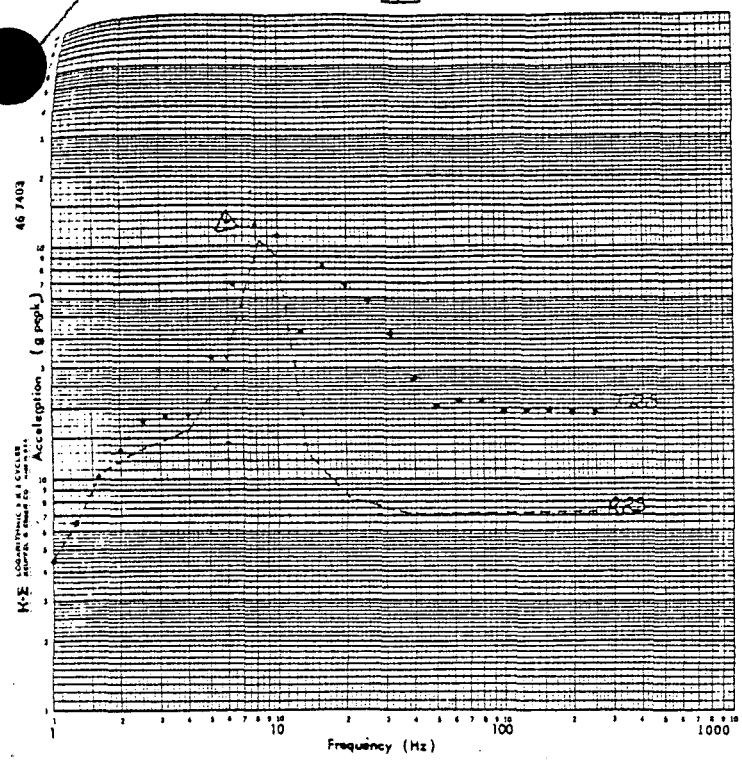
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, VERTICAL



FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1%



AXIS FB/V

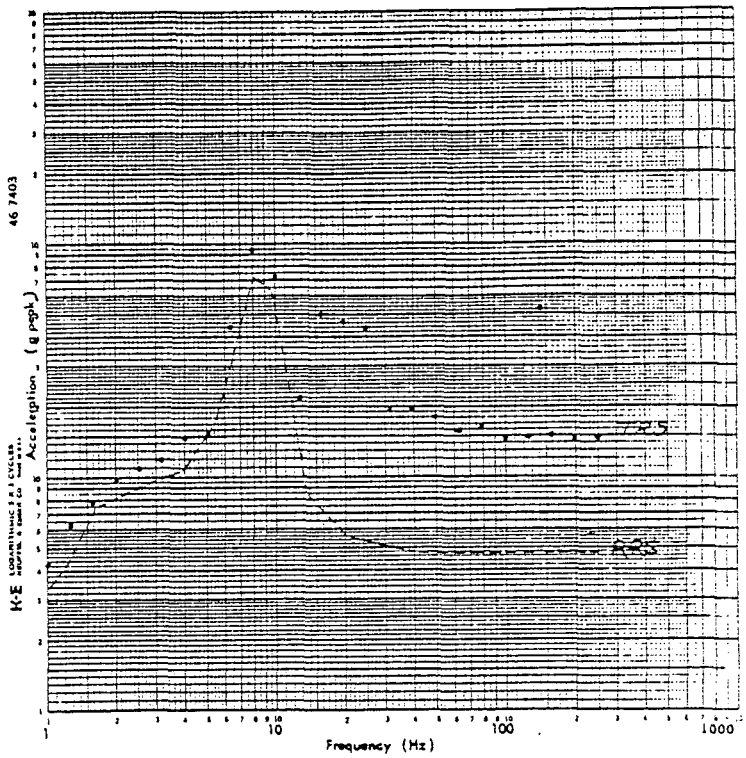
LOCATION NO. 4CA

TEST RUN NO. 8

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1%



AXIS FB/V

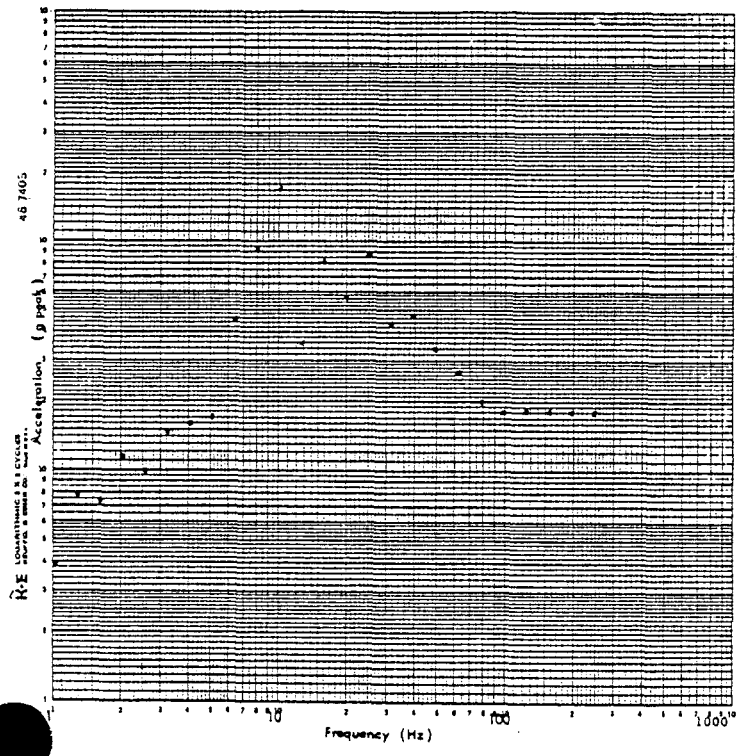
LOCATION NO. VCA

TEST RUN NO. 8

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1%



AXIS FB/V

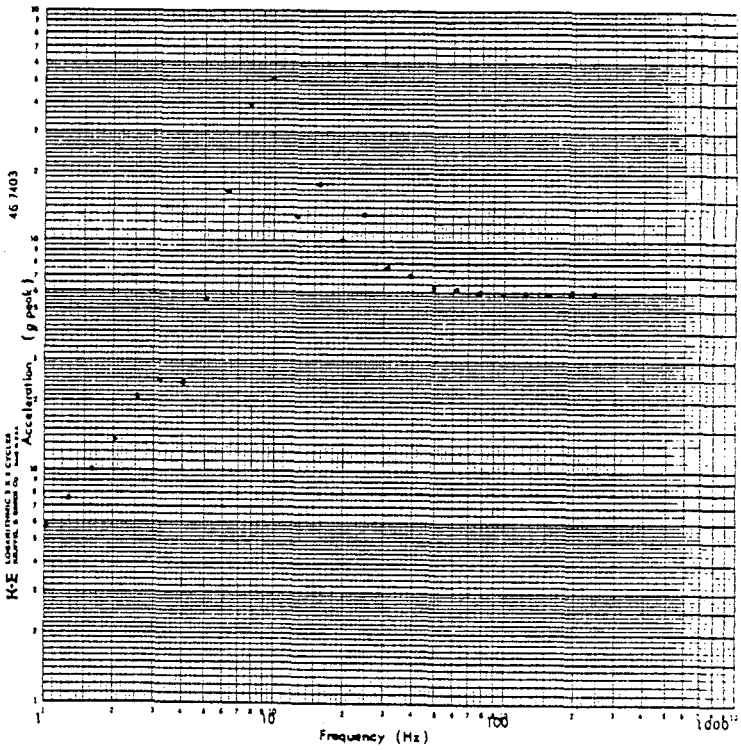
LOCATION NO. 1V

TEST RUN NO. 8

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1%



AXIS FB/V

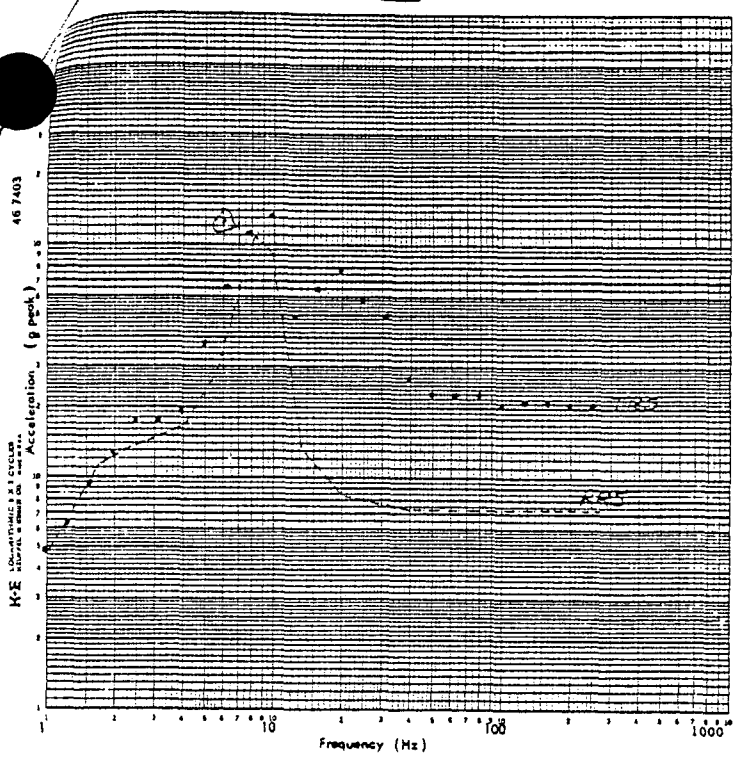
LOCATION NO. 2FB

TEST RUN NO. 8

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 7%



AXIS SS/V

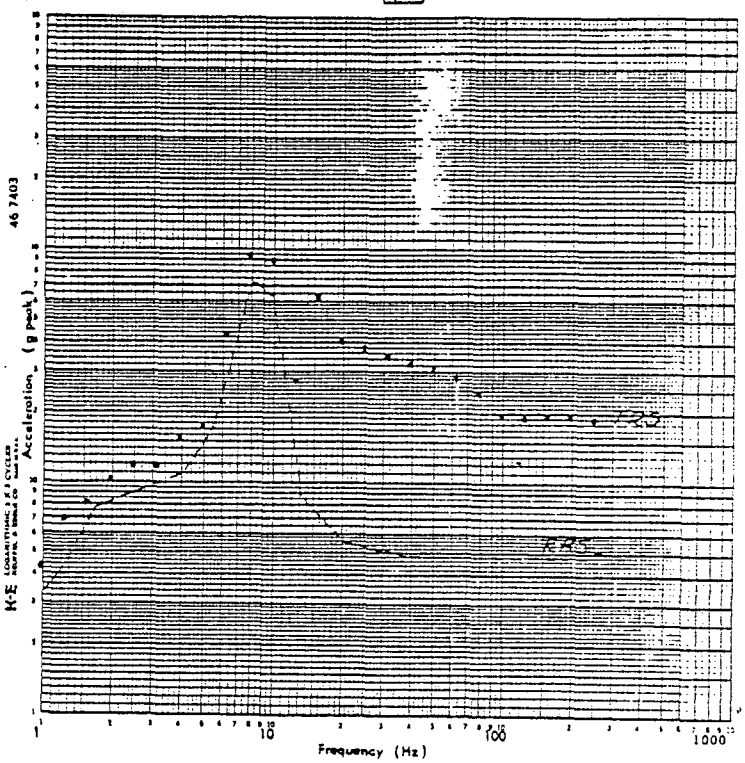
LOCATION NO. VCA

TEST RUN NO. 17

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 7%



AXIS SS/V

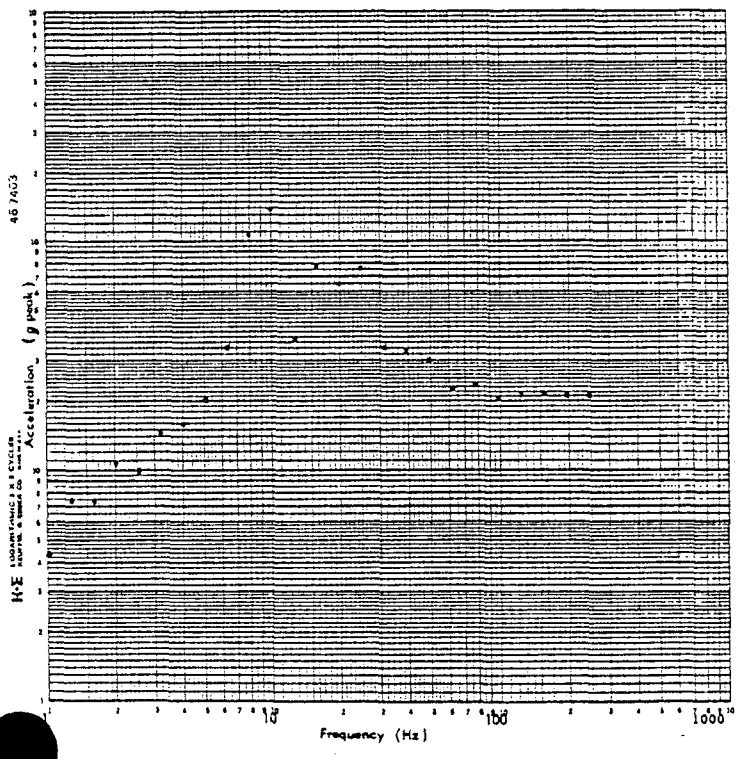
LOCATION NO. VCA

TEST RUN NO. 17

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 7%



AXIS SS/V

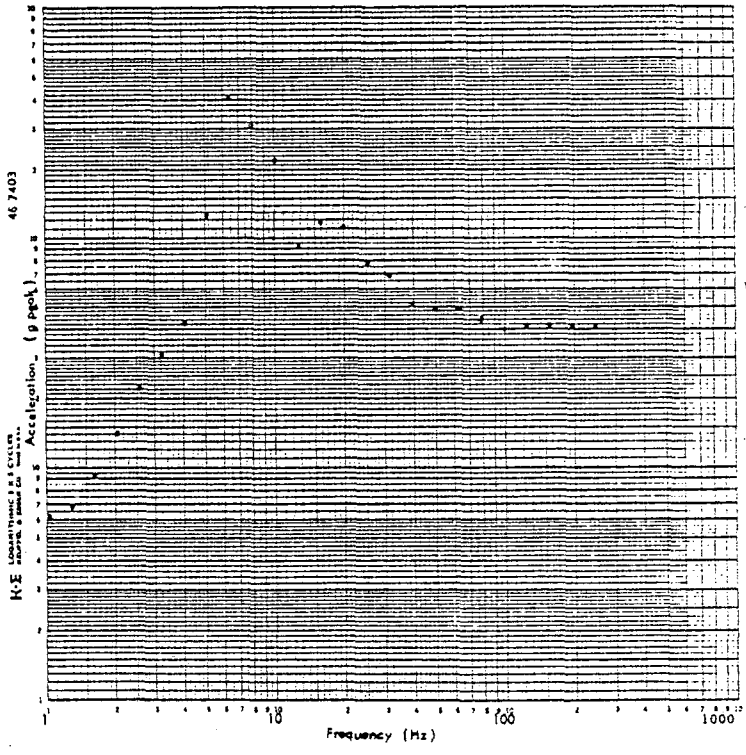
LOCATION NO. IV

TEST RUN NO. 17

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 7%



AXIS SS/V

LOCATION NO. 2SS

TEST RUN NO. 17

Attachment No. 3 ITEM 4 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: 480 V MOTOR CONTROL CENTERS 7HC5-846A6

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: ITE 5600 Quantity: 36
3. Size or Range: 480 V
4. Vendor: ITE IMPERIAL CORP
5. If the component is a cabinet or panel, name and model Number of the devices included: NA
6. Physical Description:
   a. Appearance: SWGR TYPE MOTOR CONTROL CENTERS
   b. Dimensions: 36' x 8' x 2' ~~EACH~~
   c. Weight: ≈ 5500 LB ~~EACH~~
7. Location: Building: AUX-CONT BLDG { DG BLDG
   Elevation: VARIOUS UP TO 772 { 760.5
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [✓] Weld (Length ~~957.32~~)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR MOUNTED
10. a. System in which located: VARIOUS SYSTEMS
    b. Functional Description: SUPPLIES POWER TO VARIOUS 480V VALVE MOTORS
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other

11. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC. 1844

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WYLE LABORATORIES

(No., Title and Date): #42926-1 ; APRIL 15, 1975

Company that Prepared Report: _____

Company that Reviewed Report: TVA

Where Report is filed or available: _____

Applicable Codes And/Or Standards: _____

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other _____ (specify)

OBE S/S = .68 F/B = .68 V = .46

SSE S/S = 1.37 F/B = 1.37 V = .91

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGEING

VI. If Qualification by Test, then Complete:

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [X] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[ ] Independent axis [X] In-phase motions & OUT OF PHASE

3. Number of Qualifications Tests:

OBE 4 SSE 1 Other _____ (specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 10 F/B = 8.5 V = —

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test NA

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = .82 F/B = .88 V = .82

~~OBE~~ SSE S/S = 1.55 F/B = 1.6 V = 1.42

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[X] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: 2 ORIENTATIONS F/B, S/S (TESTED IN PHASE AND OUT OF PHASE EACH ORIENTATION)

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: MINOR CONTACT CHATTER, NO PROBLEM TO SAFETY FUNCTION

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

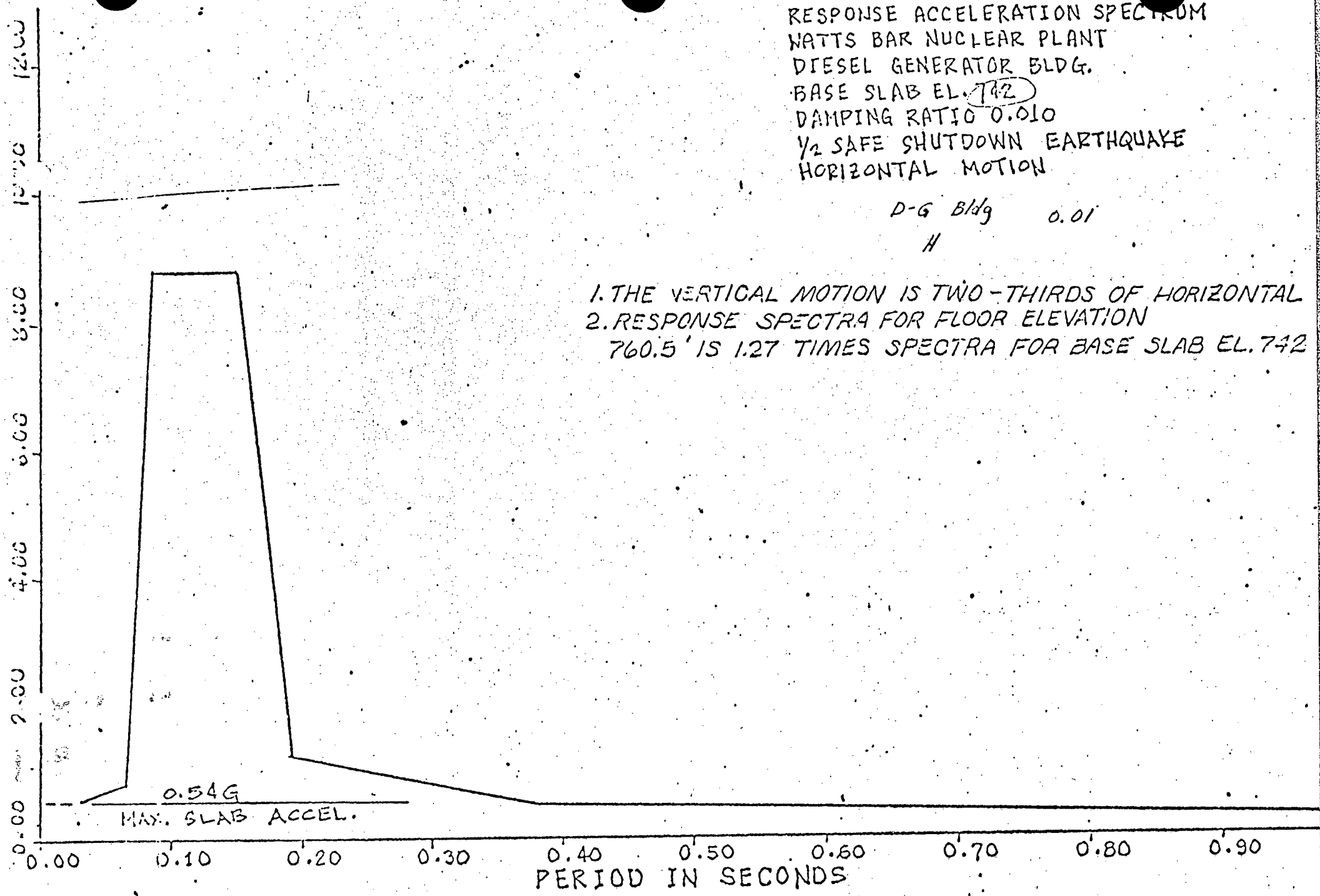
9. Failure Modes: _____

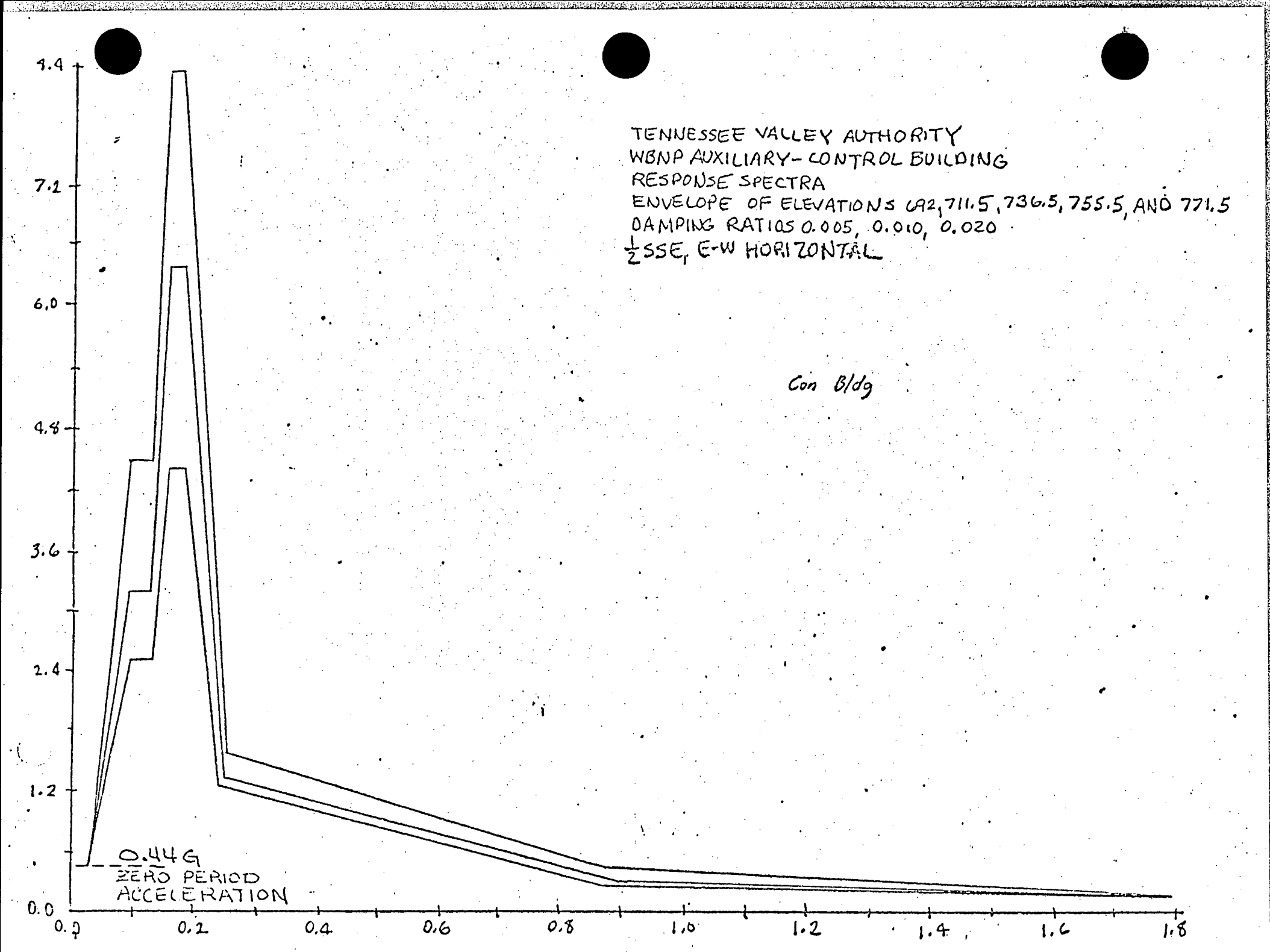
10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

TENNESSEE VALLEY AUTHORITY 6/28/74
RESPONSE ACCELERATION SPECTRUM
WATTS BAR NUCLEAR PLANT
DIESEL GENERATOR BLDG.
BASE SLAB EL. 742
DAMPING RATIO 0.010
½ SAFE SHUTDOWN EARTHQUAKE
HORIZONTAL MOTION

D-G Bldg 0.01
H

1. THE VERTICAL MOTION IS TWO-THIRDS OF HORIZONTAL
2. RESPONSE SPECTRA FOR FLOOR ELEVATION 760.5' IS 1.27 TIMES SPECTRA FOR BASE SLAB EL. 742




TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
ENVELOPE OF ELEVATIONS 692, 711.5, 736.5, 755.5, AND 771.5
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, E-W HORIZONTAL
Con Bldg
8.4
7.2
6.0
4.8
3.6
2.4
1.2
0.0
0.44G
ZERO PERIOD
ACCELERATION
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8

TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA 772
ENVELOPE OF ELEVATIONS 692, 711.5, 736.5, 755.5, AND 77
DAMPING RATIOS 0.005, 0.010, 0.020
½SSE N-S HORIZONTAL

Aux Bldg
H

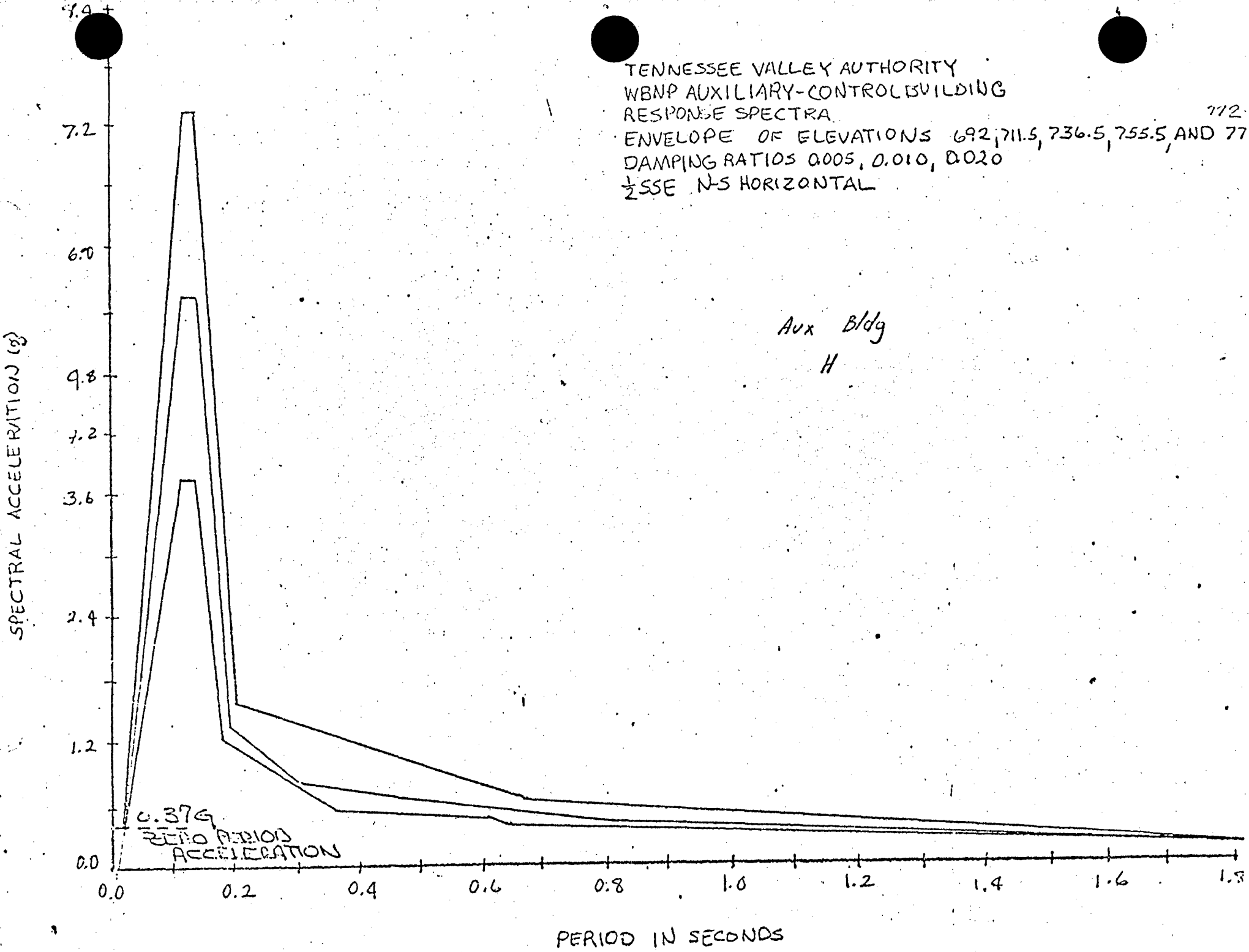
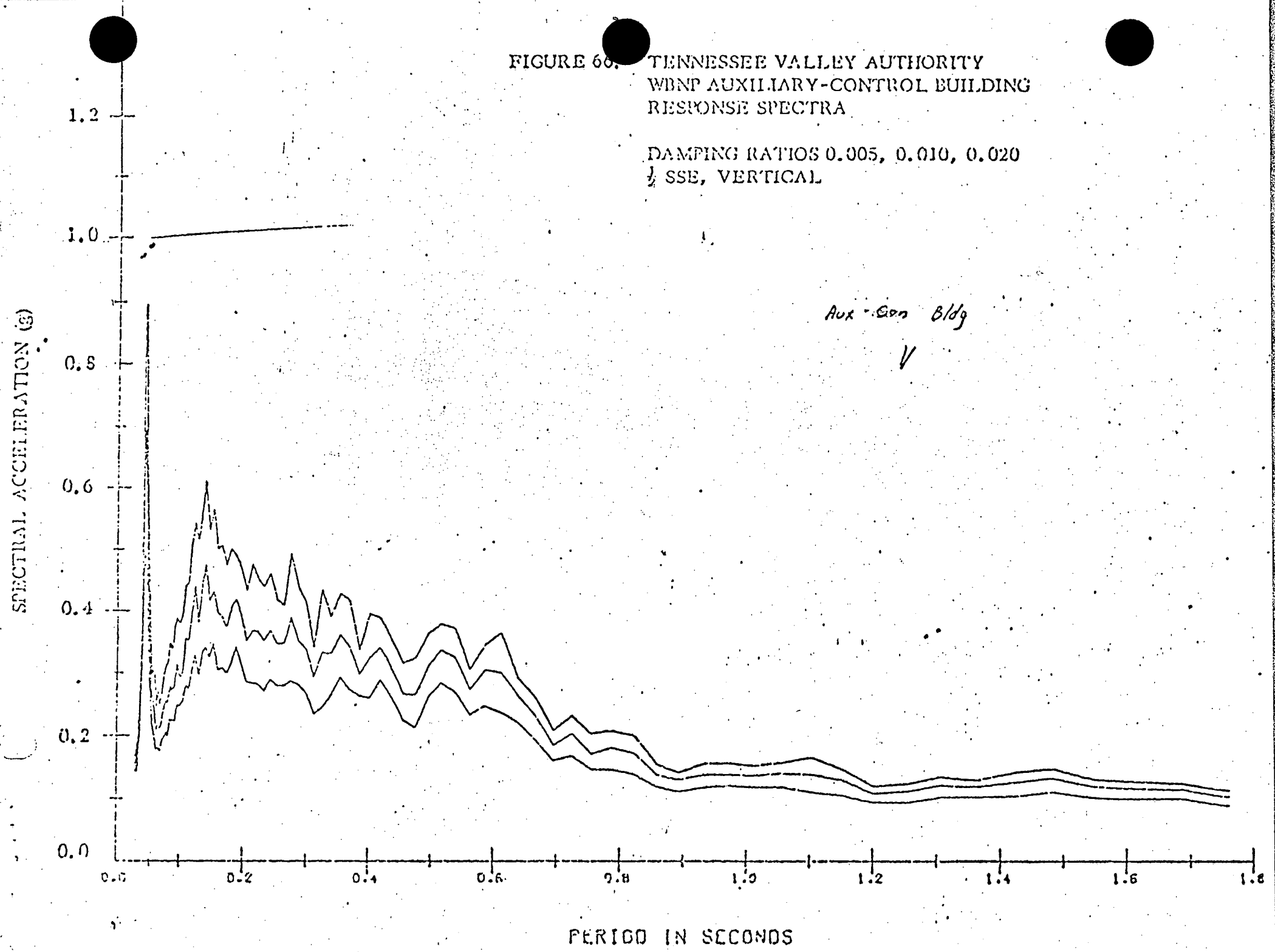


FIGURE 66. TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA

DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, VERTICAL



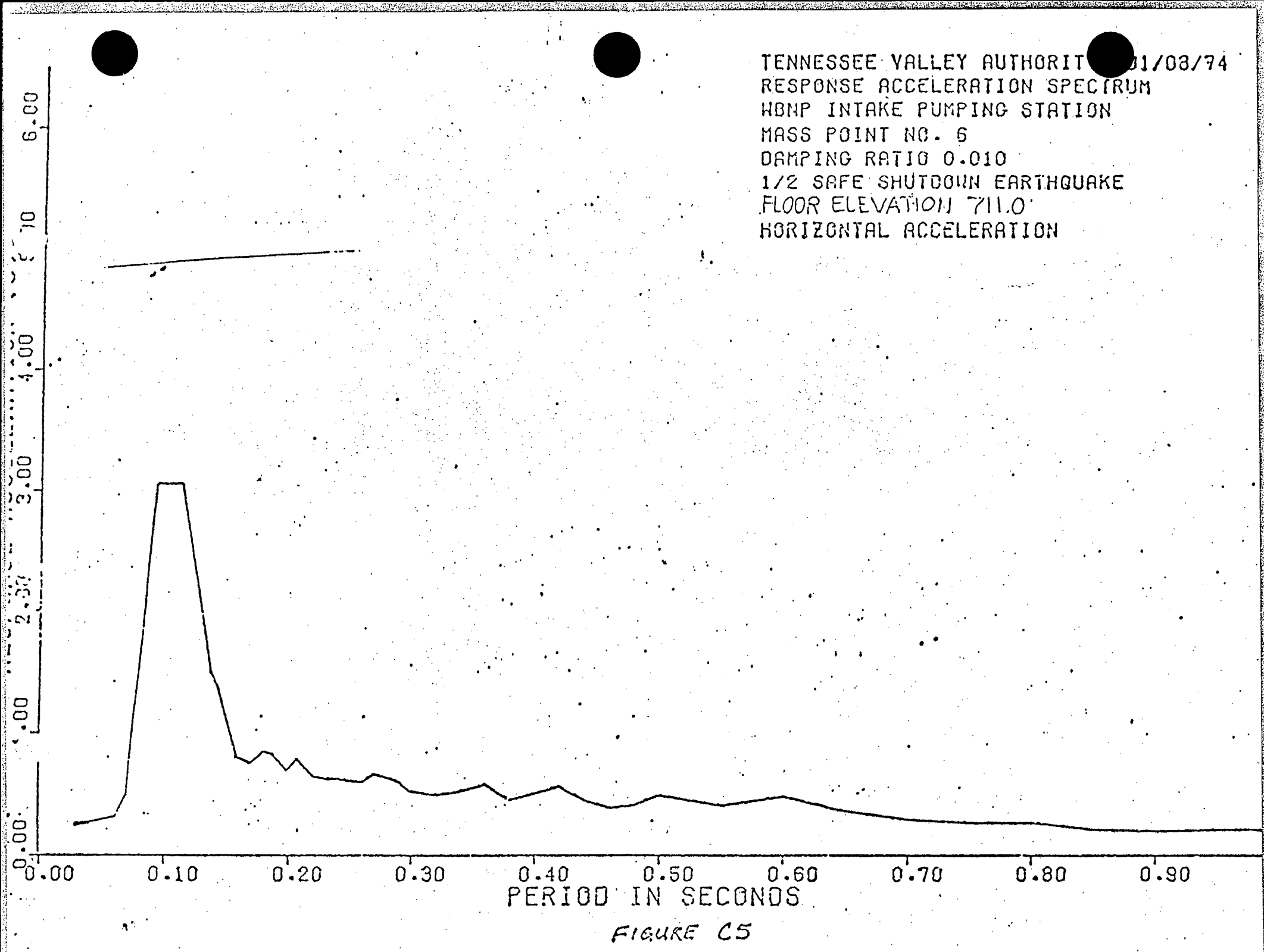

TENNESSEE VALLEY AUTHORIT 01/08/74
RESPONSE ACCELERATION SPECTRUM
HBNP INTAKE PUMPING STATION
MASS POINT NO. 6
DAMPING RATIO 0.010
1/2 SAFE SHUTDOWN EARTHQUAKE
FLOOR ELEVATION 711.0
HORIZONTAL ACCELERATION
6.00
4.00
3.00
.00
0.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
PERIOD IN SECONDS

FIGURE C5

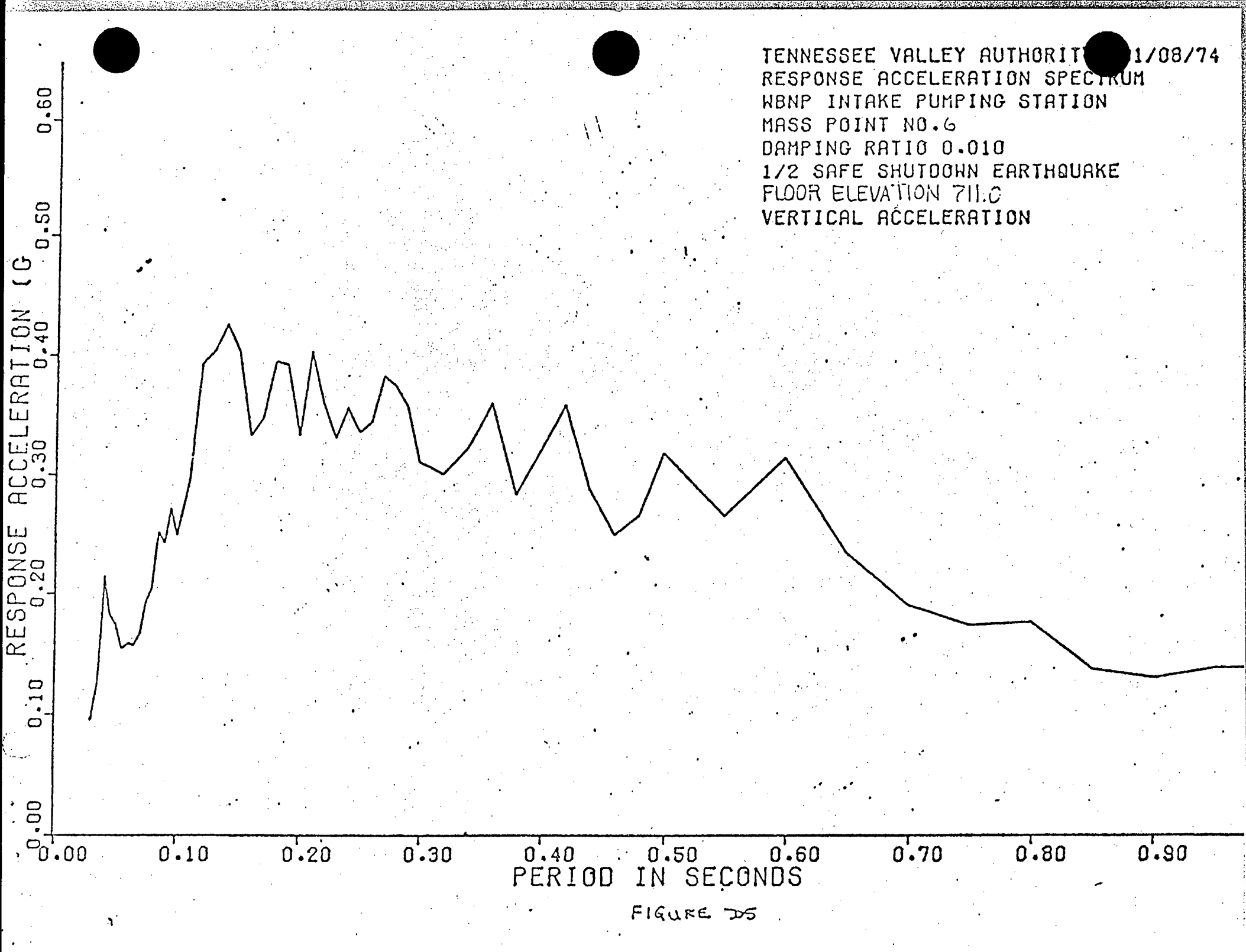

TENNESSEE VALLEY AUTHORITY 1/08/74
RESPONSE ACCELERATION SPECTRUM
WBNP INTAKE PUMPING STATION
MASS POINT NO.6
DAMPING RATIO 0.010
1/2 SAFE SHUTDOWN EARTHQUAKE
FLOOR ELEVATION 711.0
VERTICAL ACCELERATION
RESPONSE ACCELERATION (G
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
PERIOD IN SECONDS

FIGURE 25

Attachment No. 3 ITEM 5 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: W BWR
3. A/E: TVA Other

II. Component Name: STANDBY POWER SYSTEM (3500 KVA SYNCHRONOUS GENERATOR) 74C63-83090

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: 5500 KVA - 900RPM Quantity:
3. Size or Range: #140 AC GENERATOR
4. Vendor: ELECTRIC PRODUCTS DIV, PORTEC, INC.
5. If the component is a cabinet or panel, name and model Number of the devices included: NA
6. Physical Description:
   a. Appearance:
   b. Dimensions: 68" DIA x 41" LG
   c. Weight:
7. Location: Building: D-G BLDG
   Elevation: 742
8. Field Mounting Conditions [X] Bolt (No. 4, Size ____)
   [ ] Weld (Length ____)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR SKID
10. a. System in which located: STANDBY DIESEL GENERATORS (82)
    b. Functional Description: PROVIDES EMERGENCY AC POWER FOR THE PLANT UPON LOSS OF OFF SITE POWER
    c. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
       [ ] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC. 2072

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: STATIC ANALYSIS OF 5500 KVA - 900 RPM

(No., Title and Date): SYNCHRONOUS GENERATOR

Company that Prepared Report: ELECTRIC PRODUCTS DIV., PORTEC, INC.

Company that Reviewed Report: TVA

Where Report is filed or available: TVA

Applicable Codes And/Or Standards: IEEE 344-75

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [X] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [X] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): NA

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: NA OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [ ] Other _____ (specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = 2.7g F/B = 2.7g V = 1.8g

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

_____

_____

VI. If Qualification by Test, then Complete: NA

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] _____

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [X] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ROTOR/STATOR 41Hz / 68.84Hz F/B = 22Hz ROTOR V = —

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [X] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: 4 STATOR
2 ROTOR 1st 41 Hz 2nd 164 Hz

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[X] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping: NA

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.0078"	ROTOR	0.45"

9. Failure Modes: ROTOR RUB

10. Margins Available: [ ] Input Spectrum [X] Stress or Deflection

$\frac{.45}{.0078} = 50+$

Attachment No. 3 ITEM 6 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: DG CONTROL & PROTECTION RELAY PANEL (GENERATOR CONTROL BOARD) -85329

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: VARIOUS Quantity: 4
3. Size or Range: 480V
4. Vendor: DELTA SWITCHBOARD CO
5. If the component is a cabinet or panel, name and model Number of the devices included: ATTACHMENT 1
6. Physical Description:
   a. Appearance: RECTANGULAR CABLET
   b. Dimensions: 30" x 91 1/2" x 32" EACH
   c. Weight: 2500 LB EACH
7. Location: Building: DG BLDG
   Elevation: 742
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [✓] Weld (Length 5')
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR MOUNTED
10. a. System in which located: STANDBY DIESEL GENERATORS (82)
    b. Functional Description: DICTATE CONTROL SIGNALS AND GIVE VOLTAGE DEVIATION PROTECTION
    c. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
       [ ] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 2122

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WYLE LABORATORIES

(No., Title and Date): 54064 ; 13 JAN. 1975

Company that Prepared Report:

Company that Reviewed Report: TVA

Where Report is filed or available:

Applicable Codes And/Or Standards:

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: SA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHMENT 2

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other _____ (specify)

OBE S/S = .54 F/B = .54 V = .36

SSE S/S = 1.1 F/B = 1.1 V = .72

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGEING -- NATURE OF TEST PROCEDURE WAS SUCH THAT THE EQUIPMENT WAS SUBJECTED TO MANY LOADING CYCLES OF VARYING DEGREES OF EFFECTIVITY SEVERITY

VI. If Qualification by Test, then Complete:

1. [X] Single Frequency SERIES OF [ ] Multi-Frequency: [ ] random [X] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[ ] Independent axis [X] In-phase motions & OUT OF PHASE

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 17.5 (LONG) F/B = 14, 25, 30 (LAT) V = —

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test NA

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test: ATTACHMENT 3

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [X] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: 4 ORIENTATIONS F/B, S-S IN PHASE & 180° OUT OF PHASE

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: MINOR CHATTER NOTED IN ONE MONITORED CIRCUIT -- NO PROBLEM

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

CONSERVATISM OF TEST METHOD

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

...LAYS PER PANEL. (4 PANELS REQUIRED) ALL PROTE... RELAYS TO BE SURFACE MOUNTED. ATTACHMENT 4

ITEM NO.	QUAN.	DESCRIPTION	MFG	CATALOG NO	PURCHASE ORDER
1	1	59 OVERVOLTAGE RELAY, GENERATOR NEUTRAL	WESTING-HOUSE	TYPE CV-5 1875512	45714
2	1	46 PHASE BALANCE CURRENT RELAY FT-11	"	TYPE CM 2908A60A21	"
3	1	32 POWER DIRECTION RELAY FT-31	"	TYPE CRM-1 2908038A09	"
4	1	87 DIFFERENTIAL RELAY, THREE PHASE	"	TYPE SA-1 2908325A10	"
5	1	50 OVERCURRENT RELAY, THREE PHASE FT-32	"	TYPE SC 1878394	"
6	3	51V OVERCURRENT RELAY FT-21	"	TYPE COV-8 1876244	"
7	1	51 OVERCURRENT RELAY FT-11	"	TYPE CO-8 1875360	"
8	1	64 GROUND DETECTION RELAY, FIELD FT-21	"	TYPE DOF 1976039	"
9	1	86-3 LOCKOUT RELAY, 125 VDC COIL, 16-N/O & 16-N/C CONTACTS	ELECTRO SWITCH	SERIES 24 7808E	45715
10	1	86-2 LOCKOUT RELAY, 125 VDC COIL, 10-N/O & 10-N/C	"	SERIES 24 7805E	"
11	1	86-1 LOCKOUT RELAY, 125 VDC COIL, 6-N/O & 6-N/C CONTACTS	"	SERIES 24 7803E	"
12	12	AUXILIARY RELAY, 125 VDC COIL, 2-N/O & 2-N/C CONTACTS	GENERAL ELECTRIC	TYPE HGA 12HGA12B52	45734
13	16	AUXILIARY RELAY, 125 VDC COIL, 3-N/O & 3-N/C CONTACTS	WESTING-HOUSE	TYPE MG-6 2908355A20	45714
14	1	ACV AC VOLTMETER, 0-9000V SCALE, 150V MOVEMENT	GENERAL ELECTRIC	TYPE AB-40 50-103021 P2UY	45734
15	3	ACA AC AMMETER, 0-600A SCALE, TRANSFORMER RATED	"	TYPE AB-40 50-103031 LSSJ	"
16	1	WM AC WATTMETER, 0-7500 KW SCALE, FOR USE WITH 7200/120 PT'S & 600/5 CT'S	"	TYPE AB-40 50-103221A	"
17	1	VAR VARMETER, 3000-0-3000 KVAR SCALE, FOR USE WITH 7200/120 PT'S & 600/5 CT'S	"	TYPE AB-40 50-103322A	"
18	1	WHM WATTHOUR METER, 4-DIAL FRI. REGISTERS, FOR USE WITH 7200/120 PT'S & 600/5 CT'S	WESTING-HOUSE	TYPE D4S-2F 246C715C04	45714
19	1	RECORDER, MULTIPOINT TEMPERATURES, 24-POINT, 120 VAC	LEEDS & NORTHRUP	524-104-551-6-601 038-016-302-030	45738
20	1	PUSHBUTTON, BLACK, 1-N/O & 1-N/C CONTACT	GENERAL ELECTRIC	CR2940UA202B	45734
21	1	VOLTMETER SELECTOR SWITCH, "OFF-AB-BC-CA"	WESTING-HOUSE	TYPE W-2 505A702G04	45714
22	1	TEST BLOCK, 6 POLES, WITH SHORTING BARS FOR USE WITH CT'S	GENERAL ELECTRIC	TYPE PK-2 642212-G4	45734

24	[illegible]	[illegible], [illegible] TYPE, [illegible] [illegible]	"	CR151-B2	"
25	[illegible]	PHASE SHIFTING TRANSFORMER FOR US[illegible] ITEM 17	"	TYPE MC-6[illegible] 8603K92001	"
26	3	FLUORESCENT LIGHT FIXTURE, COMPLETE WITH SINGLE LAMP, AND STYRENE LENSE COVER	ACME	591 SERIES 591-20TS-L	45739
27	3	LIGHT SWITCH, 10A, 250V	HUBBLE	1101	"
28	3	DUPLEX RECEPTACLE, 10A, 250V	"	5362	"
29	3	3-POINT VAULT HANDLE, CHROME FINISH, TEE	CORBIN	1001	45740
30	3	4 X 4 HANDY BOX COMBINATION COVER PLATE	HUBBLE	94532	45739
31	1	RED PILOT LIGHT, 120 VOLT DC	RUNDEL	PR1-L120-CR1	STOCK
	1 LOT	ACCESSORIES FOR ITEM 19	LEEDS & NORTHRUP		45738
	10	INSTRUCTION MANUALS (TOTAL)			

CUSTOMER: TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PROJECT

CUST. P.O.: 78C-8-85329

MATERIAL SUMMARY

SHEET 1 OF 1

DRAWN BY	DATE
JH	4-19-74

JOB NO.	REVISED	DATE
B-47495-1	1 (AS BUILT)	3-28-75

Post Office Box 1995
Stockton, California 95201

Solid State Switchboard

TENNESSEE VALLEY AUTHORITY 00[illegible]74
RESPONSE ACCELERATION SPECTRUM
WATTS BAR NUCLEAR PLANT
DIESEL GENERATOR BLDG.
BASE SLAB EL. 742
DAMPING RATIO 0.020
1/2 SAFE SHUTDOWN EARTHQUAKE
HORIZONTAL MOTION

VERTICAL SPECTRUM = 2/3 HORIZONTAL

ATTACHMENT 2

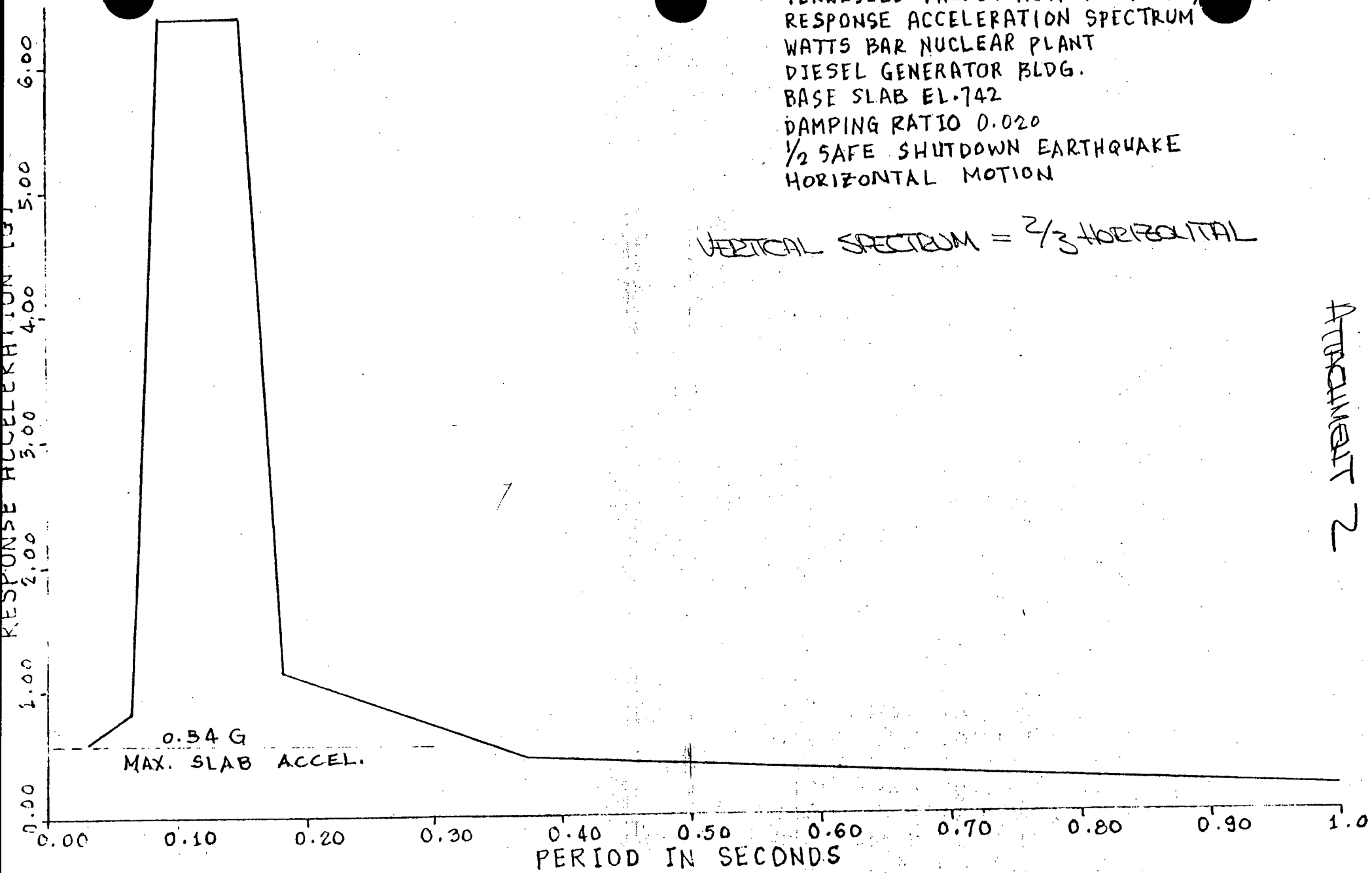


FIGURE 12

LABORATORIES

DATA SHEET

ATTACHMENT 3

CUSTOMER DELTA SWITCH BOARD
Test Title: Sine Beat

Specimen GENERATOR CONTROL BOARD
Part No. SEE SEC INSP

Job No. 54064
S/N SEE SEC INSP
Date 1-8-25

Date	Time	Axis	Freq (Hz)	Vert. Level	Horiz. Level	Phase	COMMENTS
1975	NOTES	VERT LONG	NOTES	#	#	IN Ø	# LEVELS REQUIRED: .72 G's VERT; 1.08 G's HORIZ.
1-6	1430	VERT LONG	1	.45	.5	"	FIXED FREQUENCY
1-6	1435	VERT LONG	1.5	.72	1.08	"	FIXED FREQUENCY
1-6	1438	VERT LONG	2	.72	1.1	"	FIXED FREQUENCY
1-6	1440	VERT LONG	3	.8	1.1	"	FIXED FREQUENCY
1-6	1447	VERT LONG	4	.35	1.08	"	FIXED FREQUENCY
1-6	1450	VERT LONG	6	.8	1.2	"	FIXED FREQUENCY
1-6	1455	VERT LONG	8	.8	1.1	"	FIXED FREQUENCY
1-6	1458	VERT LONG	12	.72	1.1	"	FIXED FREQUENCY
1-6	1503	VERT LONG	16	1.0	1.2	"	FIXED FREQUENCY CHATTER ON #4
1-6	1505	VERT LONG	16	.75	1.1	"	FIXED FREQUENCY CHATTER ON #4
1-6	1508	VERT LONG	16	.75	1.1	"	FIXED FREQUENCY
1-6	1510	VERT LONG	17.5	.9	1.1	"	RESONANCE FREQUENCY CHATTER ON #4
1-6	1511	VERT LONG	17.5	.8	1.1	"	RESONANCE FREQUENCY
1-6	1516	VERT LONG	24	.8	1.1	"	FIXED FREQUENCY
1-6	1520	VERT LONG	32	.8	1.1	"	FIXED FREQUENCY

FURTHER TESTING

W 5148

QC Form Approved

LABORATORIES

DATA SHEET

CUSTOMER: DELTA SWITCH BOARD
Test Title: Sine Beat
Specimen: GENERATOR CONTROL BOARD
Part No.: SEE REC INSP
Job No.: 54064-1
S/N: SEE REC INSP
Date: 1-8-75

Date	Time	Axis	Freq (Hz)	Vert. Level	Horiz Level	Phase	COMMENTS
1975	NOTED	VERT LONG	NOTED	*	*	OUT Ø	* LEVELS REQUIRED: .72 Gs VERT; 1.08 Gs HORIZ
1-6	1631	VERT LONG	1	.5	.5	"	FIXED FREQUENCY
1-6	1626	VERT LONG	1.5	.72	1.08	"	FIXED FREQUENCY
1-6	1622	VERT LONG	2	.72	1.08	"	FIXED FREQUENCY
1-6	1618	VERT LONG	3	.72	1.08	"	FIXED FREQUENCY
1-6	1614	VERT LONG	4	.72	1.1	"	FIXED FREQUENCY
1-6	1610	VERT LONG	6	.8	1.2	"	FIXED FREQUENCY
1-6	1607	VERT LONG	8	.72	1.08	"	FIXED FREQUENCY
1-6	1604	VERT LONG	12	.72	1.08	"	FIXED FREQUENCY
1-6	1557	VERT LONG	16	.8	1.2	"	FIXED FREQUENCY
1-6	1554	VERT LONG	17.5	.72	1.1	"	RESONANCE FREQUENCY
1-6	1548	VERT LONG	24	.8	1.1		FIXED FREQUENCY
1-6	1543	VERT LONG	32	.8	1.1		FIXED FREQUENCY

Robert Hurst

LABORATORIES

Report No. 54064
Page No. 16

DATA SHEET

CUSTOMER DELTA SWITCH BOARD
Test Title: Sine Beat

Specimen GENERATOR CONTROL BOARD
Part No. SEE REC INSP

Job No. 54064
S/N SEE REC INSP
Date 1-8-75

Date	Time	Axis	Freq (Hz)	Vert. Level	Horiz Level	Phase	COMMENTS
1975	NOTED	VERT LAT	NOTED	#	#	IN Ø	#LEVELS REQUIRED: .726's VERT: 1.086's HORIZ
1-7	1422	VERT LAT	1	.4	.5	"	FIXED FREQUENCY
1-7	1427	VERT LAT	1.5	.72	1.1	"	FIXED FREQUENCY
1-7	1511	VERT LAT	2	.72	1.1	"	FIXED FREQUENCY
1-7	1513	VERT LAT	3	.35	1.1	"	FIXED FREQUENCY
1-7	1515	VERT LAT	4	.9	1.1	"	FIXED FREQUENCY
1-7	1518	VERT LAT	6	.9	1.1	"	FIXED FREQUENCY
1-7	1522	VERT LAT	8	.8	1.25	"	FIXED FREQUENCY
1-7	1530	VERT LAT	12	1.0	1.1	"	FIXED FREQUENCY
1-7	1533	VERT LAT	14	.8	1.1	"	RESONANCE FREQUENCY
1-7	1538	VERT LAT	16	.75	1.1	"	FIXED FREQUENCY
1-7	1540	VERT LAT	24	.72	1.1	"	FIXED FREQUENCY
1-7	1542	VERT LAT	25	.8	1.1	"	RESONANCE FREQUENCY
1-7	1545	VERT LAT	30	.85	1.1	"	RESONANCE FREQUENCY
1-7	1548	VERT LAT	32	.85	1.1	"	FIXED FREQUENCY

W 614 B

QC Form Approved

SHEET ____ OF ____

LABORATORIES

Report No. 54064
Page No. 17

DATA SHEET

CUSTOMER DELTA SWITCH BOARD
Test Title: Sine Beat

Specimen GENERATOR CONTROL BOARD
Part No. SEE REC INSP

Job No. 54064
S/N SEE REC INSP
Date 1-8-75

Date	Time	Axis	Freq (Hz)	Vert. Level	Horiz. Level	Phase	COMMENTS
1975	NOTED	VERT LAT	NOTED	#	#	OUT Φ	#LEVELS REQUIRED: .72G's VERT; 1.08G's HORIZ
1-7	1709	VERT LAT	1	.5	.5	"	FIXED FREQUENCY
1-7	1707	VERT LAT	1.5	.72	1.1	"	FIXED FREQUENCY
1-7	1705	VERT LAT	2	.72	1.1	"	FIXED FREQUENCY
1-7	1658	VERT LAT	3	.72	1.1	"	FIXED FREQUENCY
1-7	1654	VERT LAT	4	.72	1.1	"	FIXED FREQUENCY
1-7	1648	VERT LAT	6	.9	1.1	"	FIXED FREQUENCY
1-7	1637	VERT LAT	8	.8	1.1	"	FIXED FREQUENCY CHATTER = 4G
1-7	1630	VERT LAT	12	.8	1.1	"	FIXED FREQUENCY
1-7	1625	VERT LAT	14	.72	1.1	"	RESONANCE FREQUENCY
1-7	1621	VERT LAT	16	.72	1.2	"	FIXED FREQUENCY CHATTER = 4G
1-7	1622	VERT LAT	16	.72	1.2	"	FIXED FREQUENCY
1-7	1614	VERT LAT	24	.9	1.1	"	FIXED FREQUENCY
1-7	1612	VERT LAT	25	.9	1.1	"	RESONANCE FREQUENCY
1-7	1608	VERT LAT	30	.72	1.2	"	RESONANCE FREQUENCY
1-7	1605	VERT LAT	32	1.1	1.2	"	FIXED FREQUENCY

Attachment No. 3 ITEM 7 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: METAL CLAD SWITCHGEAR - 6900 V (SHUTDOWN BOARDS) 74C2-843T6

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: 7.2 KV METAL CLAD SWGR Quantity: 4
3. Size or Range: 6.9 KV
4. Vendor: GE
5. If the component is a cabinet or panel, name and model Number of the devices included: NA
6. Physical Description:
   a. Appearance: METAL CLAD SWGR
   b. Dimensions: 66' x 7'3½" x 8'4"
   c. Weight: ≈ 91,900 LB ~~EACH~~
7. Location: Building: AUX CONT BLDG
   Elevation: 757
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [X] Weld (Length 396')
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR MOUNTED
10. a. System in which located: VARIOUS ELECTRICAL SYSTEMS
    b. Functional Description: HELPS TO PROVIDE POWER TO ENTIRE PLANT
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other ____

11. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 1765

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WYLE LABORATORIES

(No., Title and Date): #42868-1 ; DEC 16, 1974

Company that Prepared Report:

Company that Reviewed Report: TVA

Where Report is filed or available:

Applicable Codes And/Or Standards:

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: TVA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other _____ (specify)

OBE S/S = .4 F/B = .4 V = .14

SSE S/S = .8 F/B = .8 V = .28

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGING

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random [ ] sine beat [ ] _____

SSE TESTS -- SINE BEATS SUPERIMPOSED ON RANDOM

2. [ ] Single Axis [X] Multi-Axis
[X] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ≥ 5 SSE ≥ 1 Other _____ (specify)

X - FB
X - S/S
X - VERT

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 3.2*, 5.7 F/B = 5.3, 9, 10* V = —

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[X] Yes (Attach TRS & RRS graphs) ATTACHED
[ ] No

8. Maximum Input g-level Test:

OBE S/S = 1.2 F/B = 1.55 V = .32

~~OBE~~ SSE S/S = 1.85 F/B = 1.55 V = .55

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ___

B. Orientation and Fixturing: 2 ORIENTATIONS F/B, S/S

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: MINOR STRUCTURAL PROBLEMS -- CHATTER IN CERTAIN RELAYS - NO SAFETY PROBLEMS PER GE TEST RESULTS REPORT

12. Other tests performed (such as aging or fragility test, including results):

13. Failure Modes (If appropriate ___)

14. Margins Available: [X] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ___ F/B = ___ V = ___

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ___

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

FIGURE 44: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 755.5
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, N-S HORIZONTAL

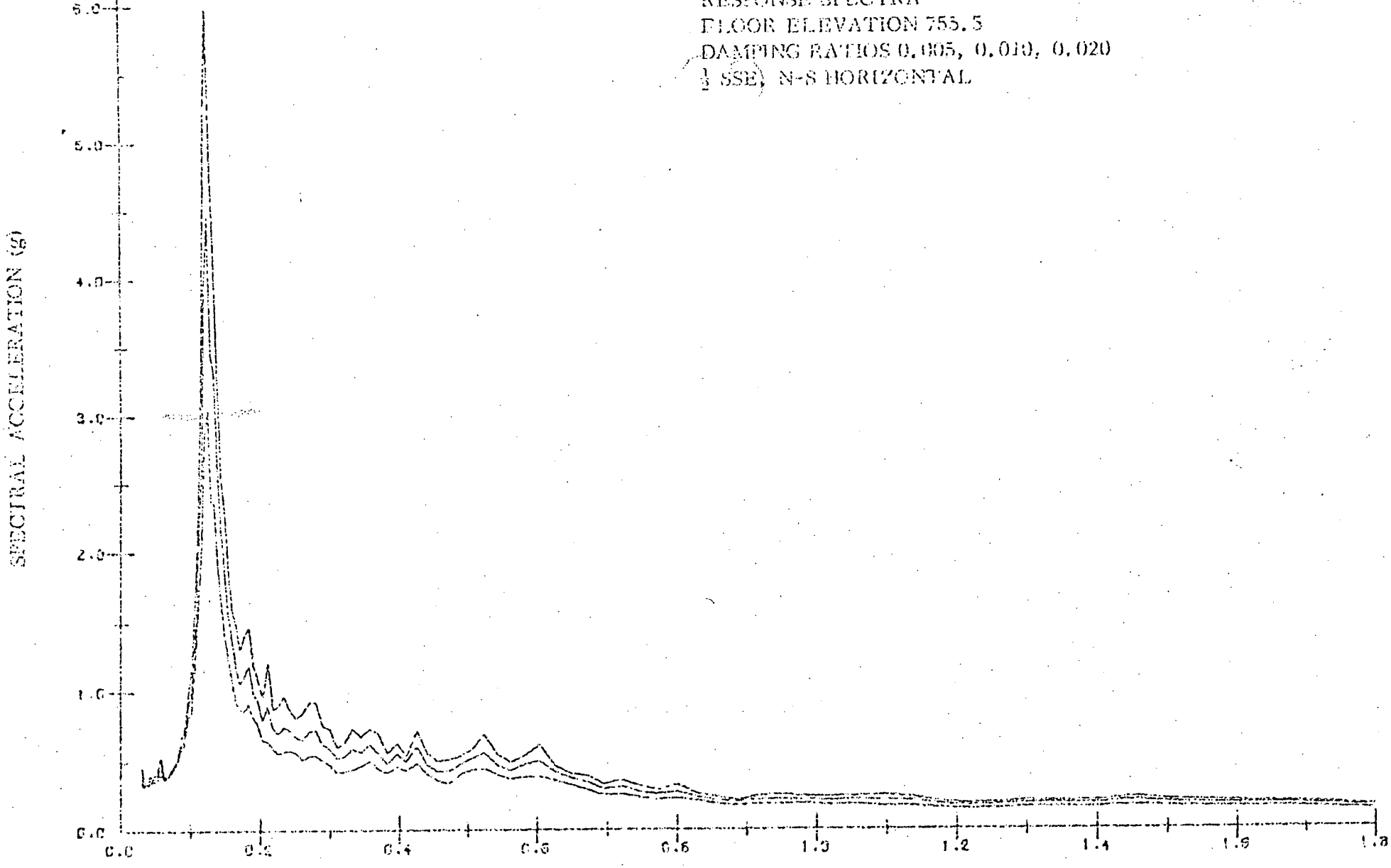


FIGURE 46: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 755.5 — FOR 759 ELEV
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, E W HORIZONTAL

THESE SPECTRA REFLECT MAXIMUM TORSIONAL EFFECTS FOR ANY LOCATION AT THIS ELEVATION -- MAXIMUM DISTANCE FROM CENTER OF ROTATION. OVERLY CONSERVATIVE FOR 6900 V SWITCHGEAR LOCATION.

SEE NEXT PAGE

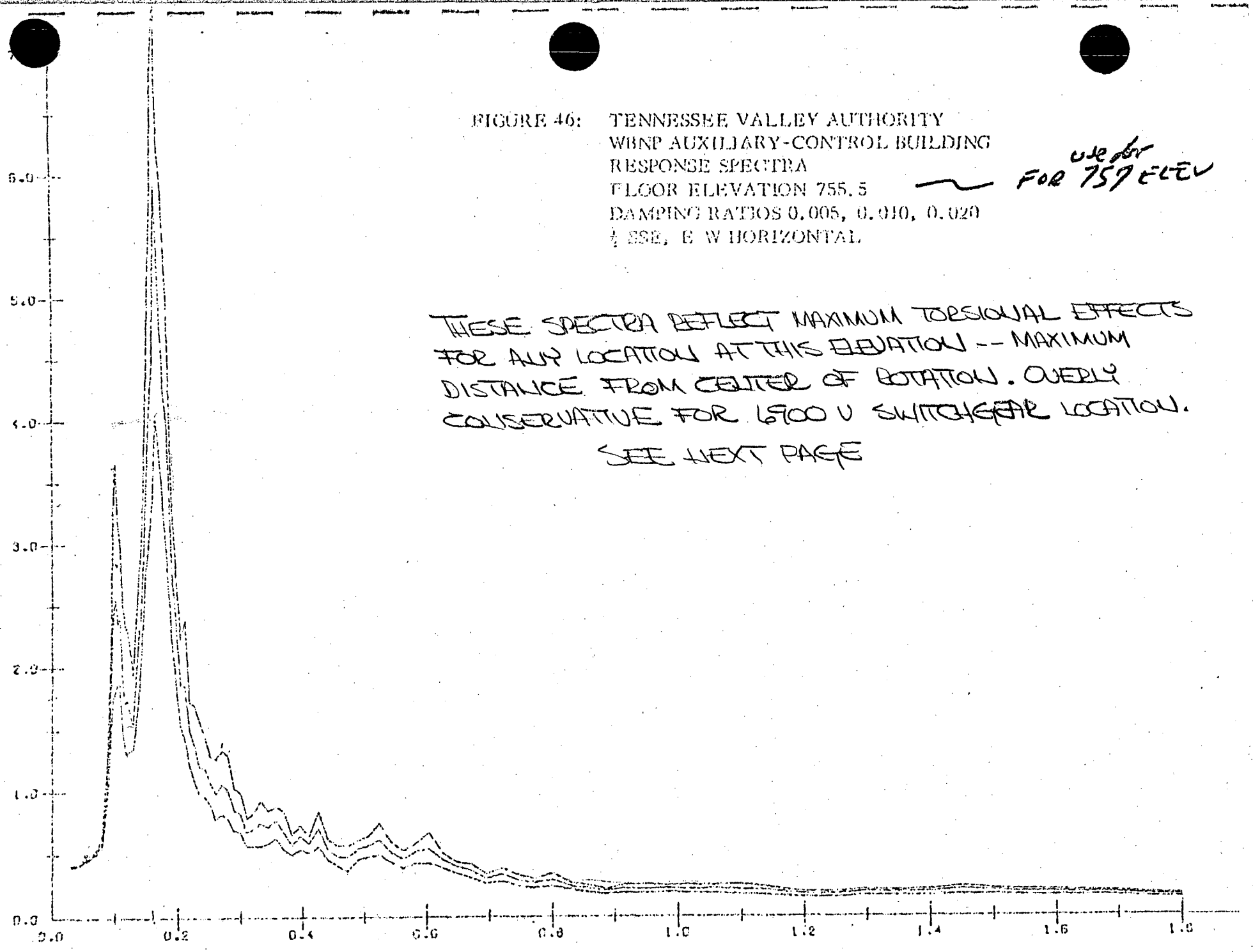


FIGURE 46

TENNESSEE VALLEY AUTHORITY 03/13/75
RESPONSE ACCELERATION SPECTRUM
WBNP AUXILIARY-CONTROL BUILDING
MASS POINT NO. 8 EL 755.5
DAMPING RATIO 0.010
SPECTRUM PLOTTED AT SHEAR CENTER
1/2 SAFE SHUTDOWN EARTHQUAKE
EAST-WEST MOTION

THIS SPECTRUM REFLECTS TORSIONAL EFFECTS APPROPRIATE TO THE 6900 V SWITCHGEAR LOCATION

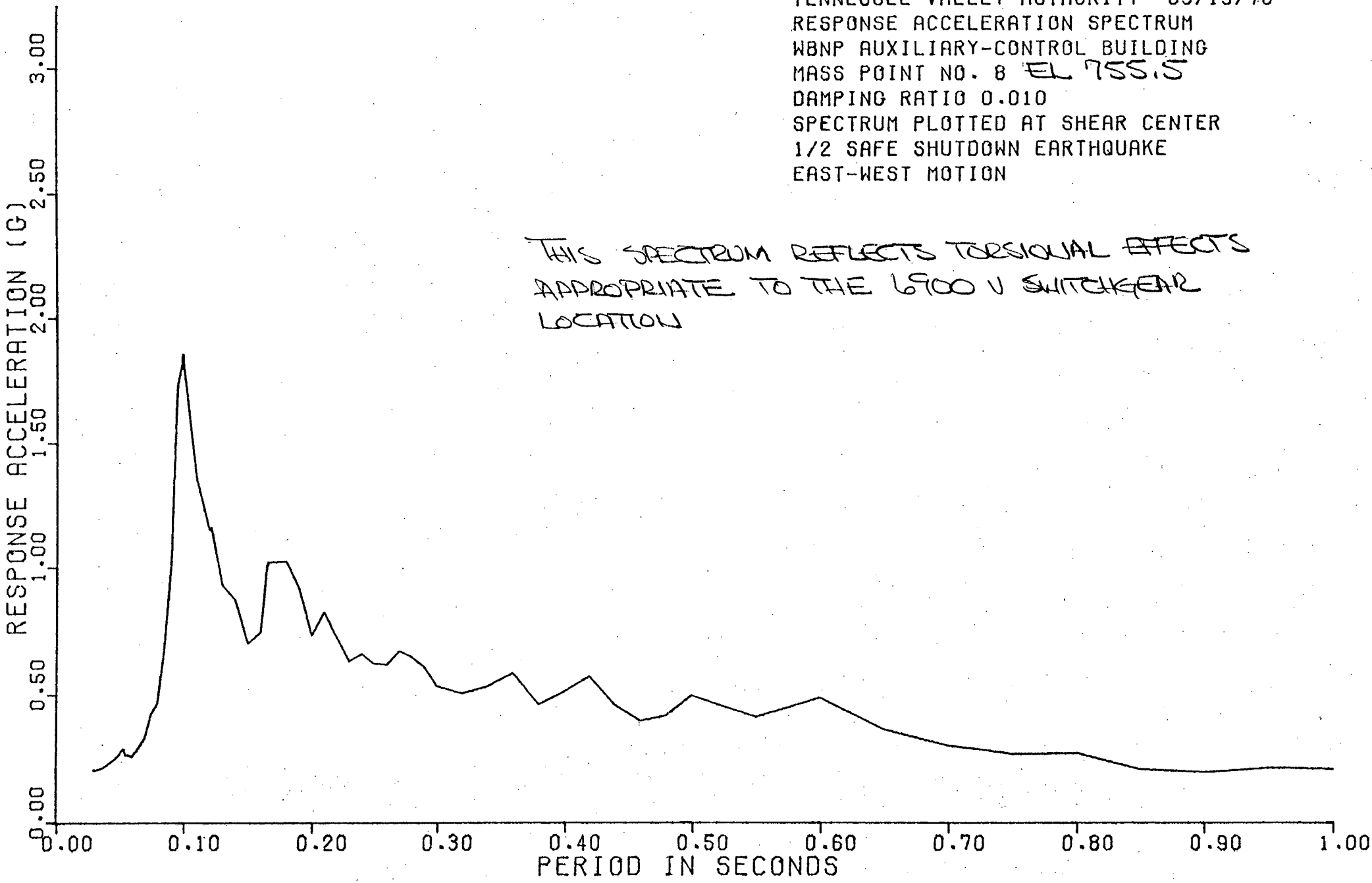
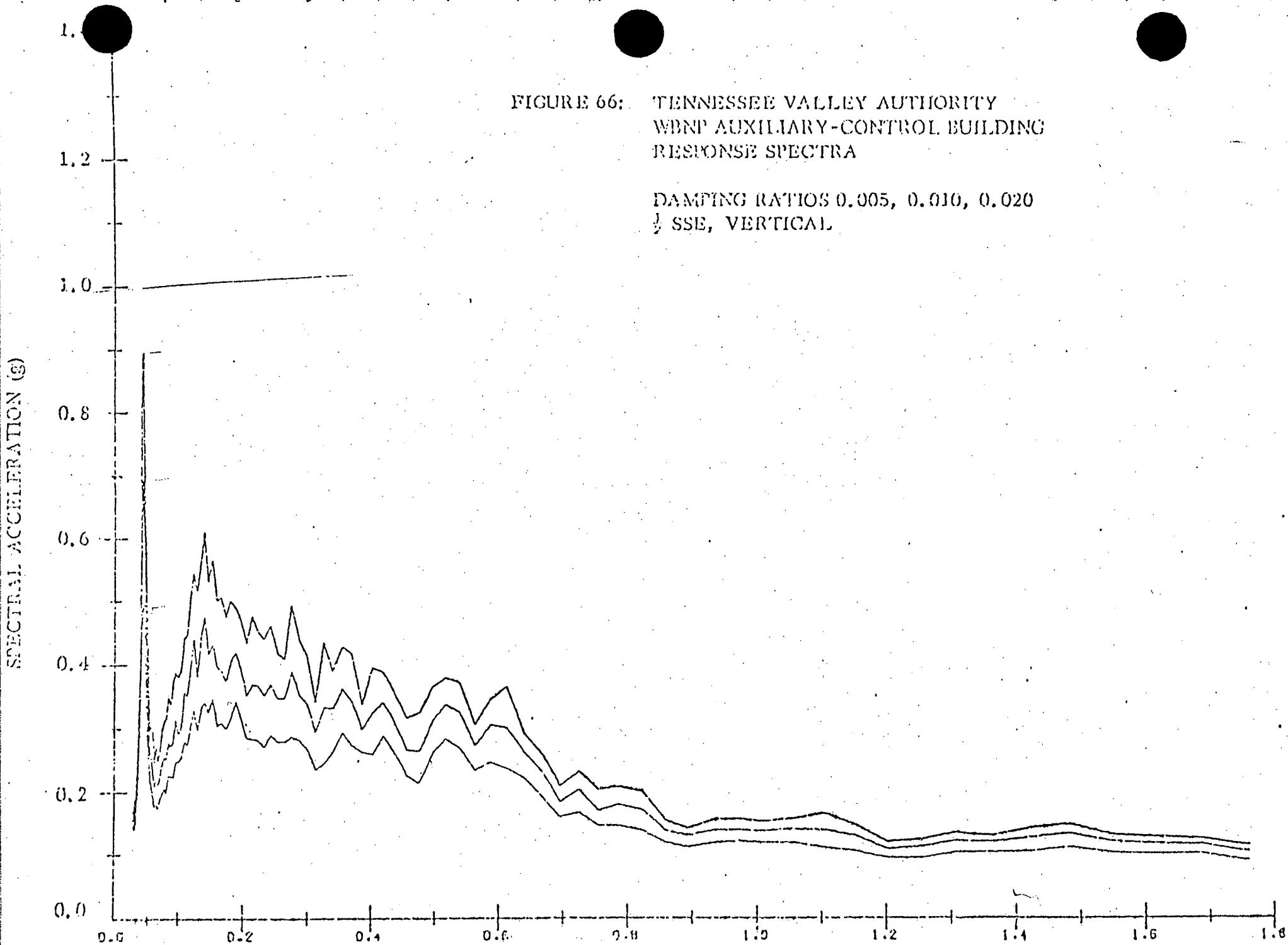


FIGURE 66: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA

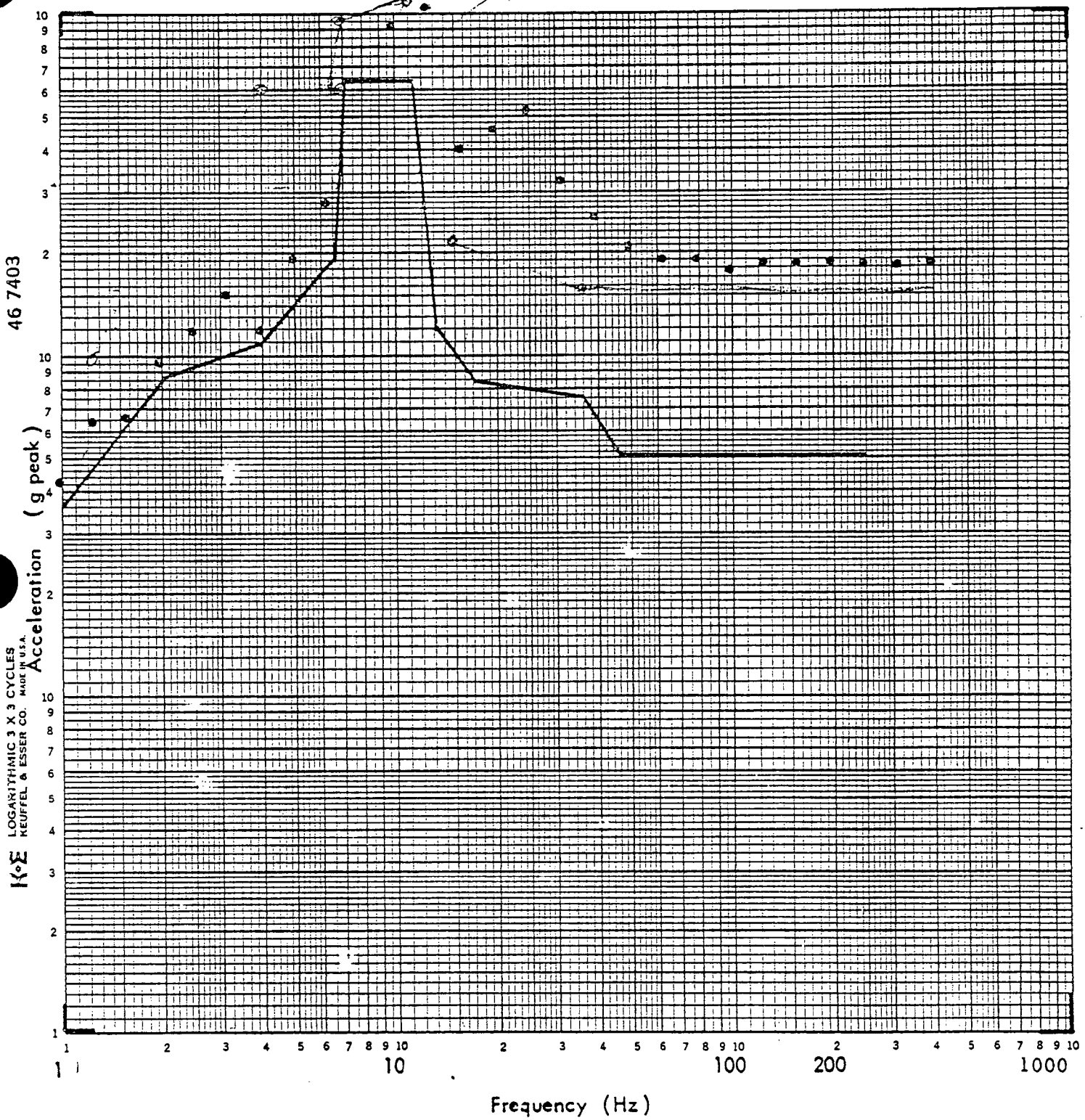
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, VERTICAL



FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

DAMPING 2%



CUSTOMER _____ AXIS ZY

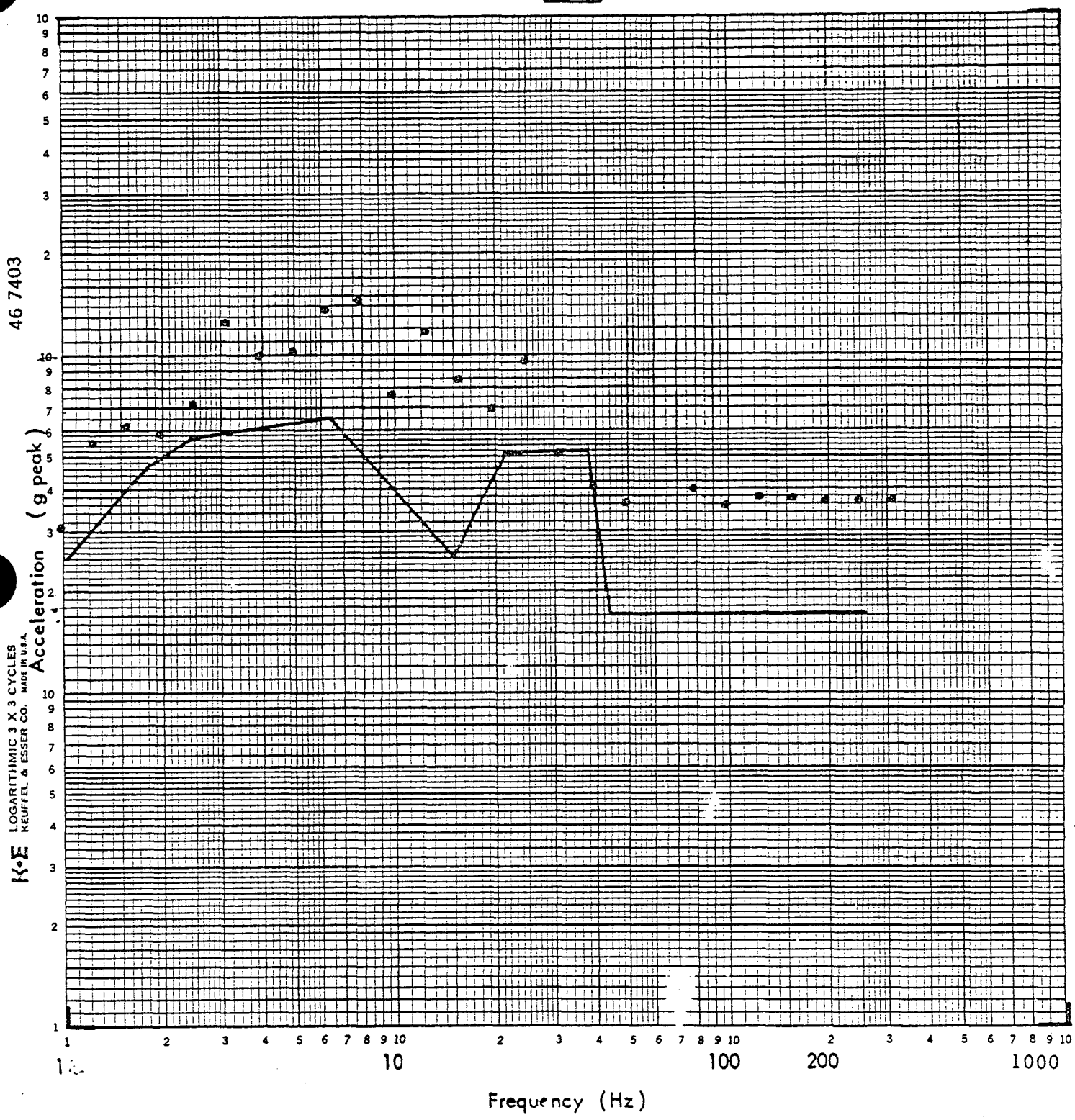
SPECIMEN _____ LOCATION NO. HCA

S/N _____ TEST RUN NO. 99

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

DAMPING 2%



CUSTOMER _____ AXIS ZY

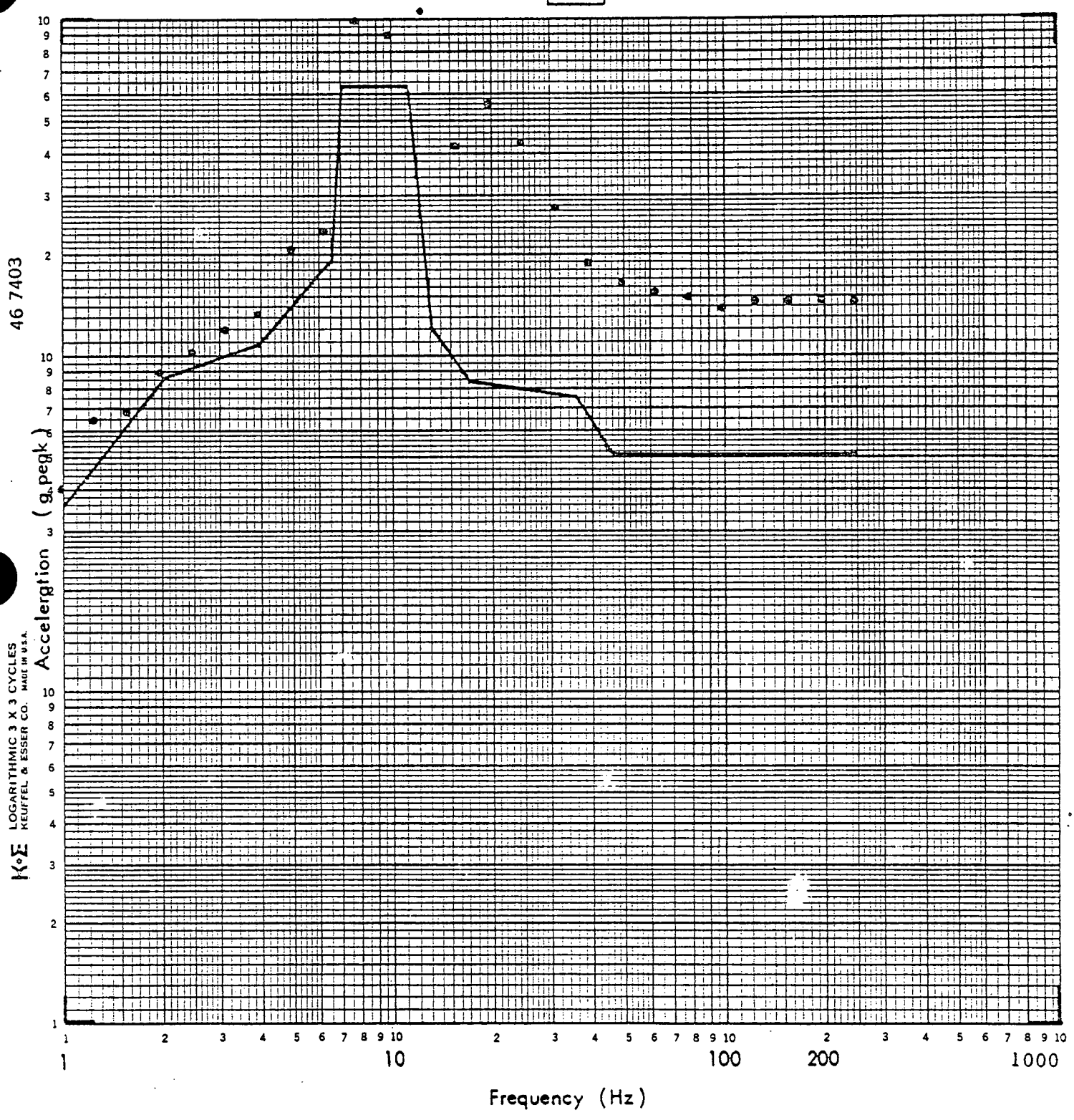
SPECIMEN _____ LOCATION NO. VCA

S/N _____ TEST RUN NO. 9?

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

DAMPING 2%



CUSTOMER _____ AXIS XY

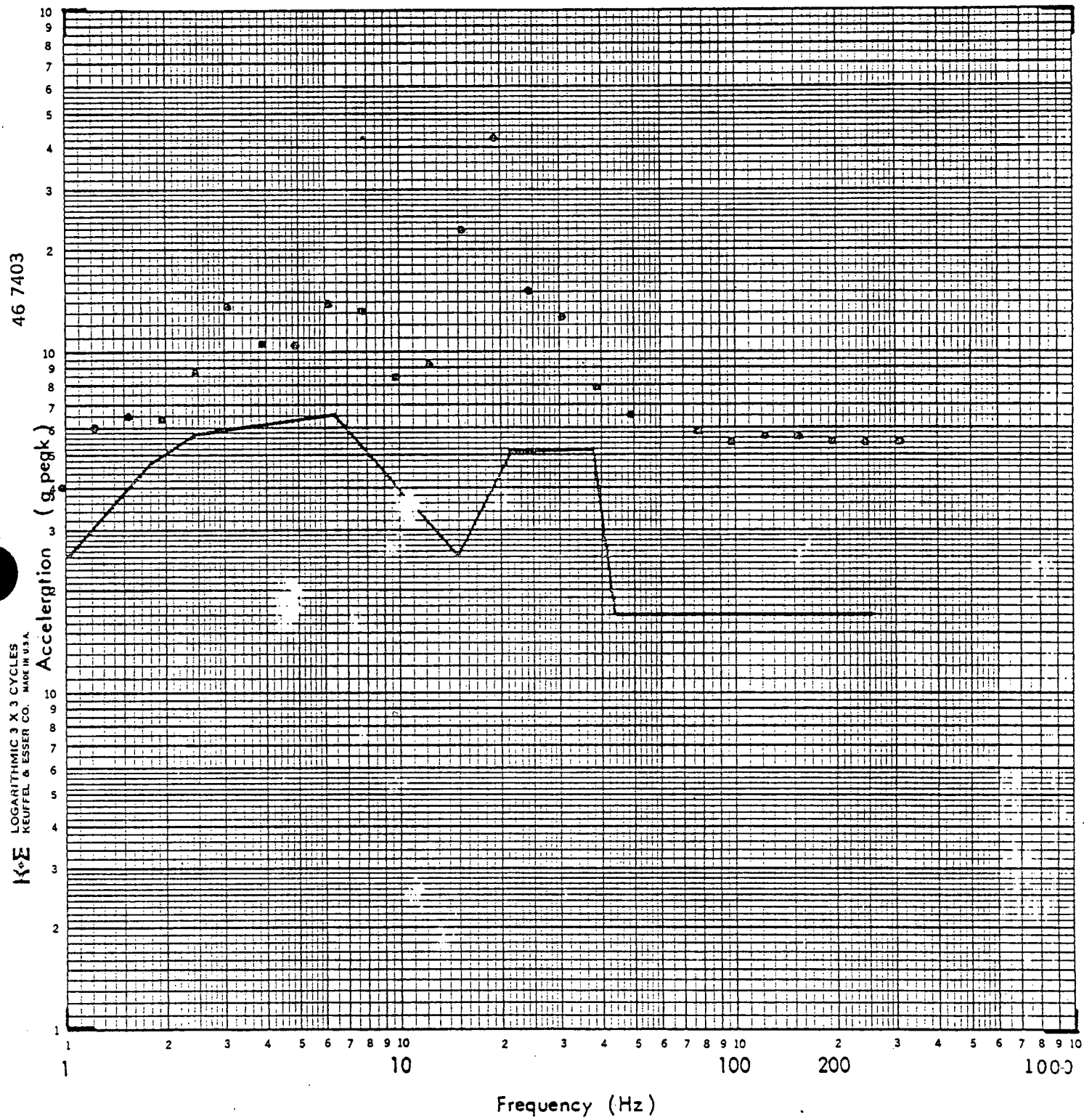
SPECIMEN _____ LOCATION NO. HCA

S/N _____ TEST RUN NO. 23

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

DAMPING 2%



CUSTOMER _____ AXIS XY

SPECIMEN _____ LOCATION NO. VCA

S/N _____ TEST RUN NO. 23

2

Attachment No. 3 ITEM 8 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: 6900 V SHUTDOWN BOARD LOGIC PANEL 75K2-85354

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: UA Quantity: 4
3. Size or Range: 6.9 KV
4. Vendor: H.K. PORTER CO
5. If the component is a cabinet or panel, name and model Number of the devices included: ASEA RELAYS TYPE RRMH2, RRMUB2, RRME1, AND AGASTAT RELAYS
6. Physical Description:
   a. Appearance:
   b. Dimensions: 10'x7'x4'
   c. Weight: ≈ 8300 LB EACH
7. Location: Building: AUX-CONT BLDG
   Elevation: 757
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [X] Weld (Length 27'9")
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR MOUNTED
10. a. System in which located: 6.9KV SHUTDOWN BDS & LOGIC RELAY PANELS (211)
    b. Functional Description: GIVES LOAD SHED AND PICK-UP SIGNAL DURING AN EMERGENCY
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 2135

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WYLE LABORATORIES

(No., Title and Date): #43137-1 ; JAN 26, 1976

Company that Prepared Report:

Company that Reviewed Report: TVA

Where Report is filed or available:

Applicable Codes And/Or Standards:

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other _____ (specify)

OBE S/S = .4 F/B = .4 V = .14

SSE S/S = .8 F/B = .8 V = .28

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGEING

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random [ ] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[X] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 5 SSE 1 Other _____ (specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 14 F/B = 13*, 25, 29 V = — * PRIMARY

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[X] Yes (Attach TRS & RRS graphs) ATTACHED
[ ] No

8. Maximum Input g-level Test:

OBE S/S = .87 F/B = .87 V = .36

~~SSE~~ S/S = 1.9 F/B = 1.85 V = 1.05

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[X] Weld (Length ___) [ ] ___

B. Orientation and Fixturing: 2 ORIENTATIONS - F/B, S/S

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ELECTRICAL CHATTER OBSERVED DURING SEISMIC TESTS (SIP-UVX RELAY) - NO PROBLEM

12. Other tests performed (such as aging or fragility test, including results):

___

___

13. Failure Modes (If appropriate ___)

14. Margins Available: [X] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ___ F/B = ___ V = ___

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ___

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

FIGURE 44: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 755.5
DAMPING RATIOS 0.005, 0.010, 0.020
$\frac{1}{2}$ SSE, N-S HORIZONTAL

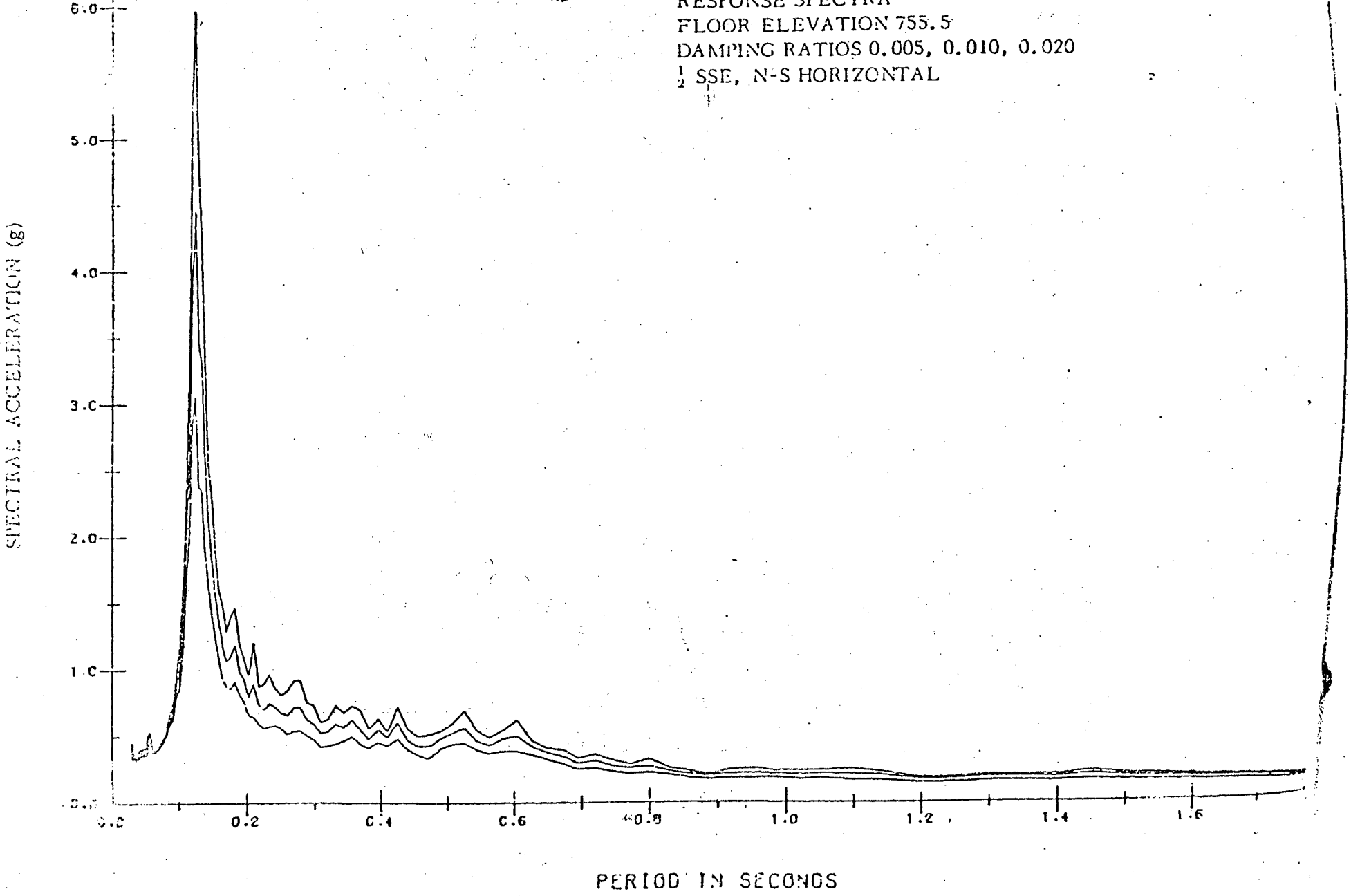


FIGURE 46: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 755.5
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, E-W HORIZONTAL

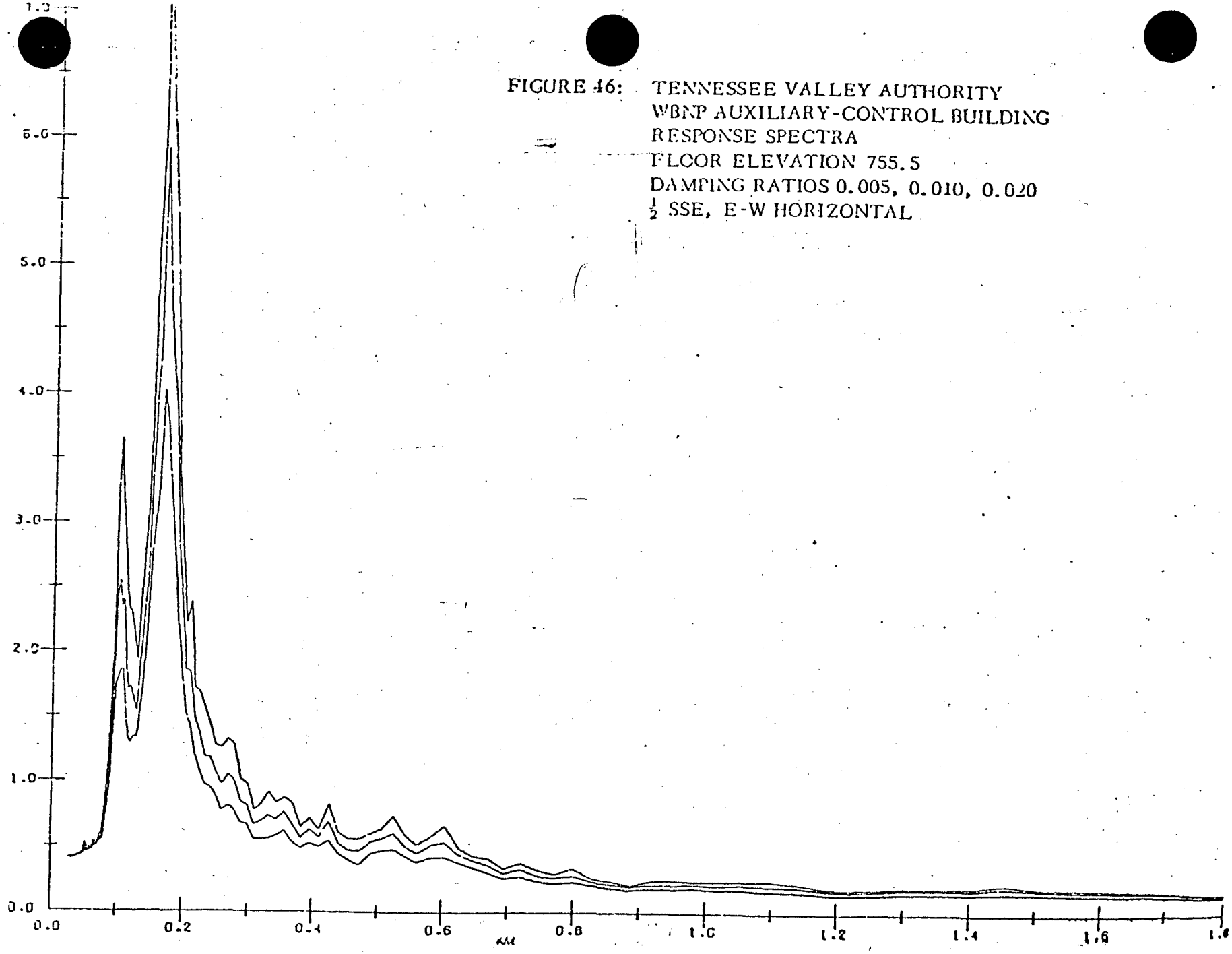
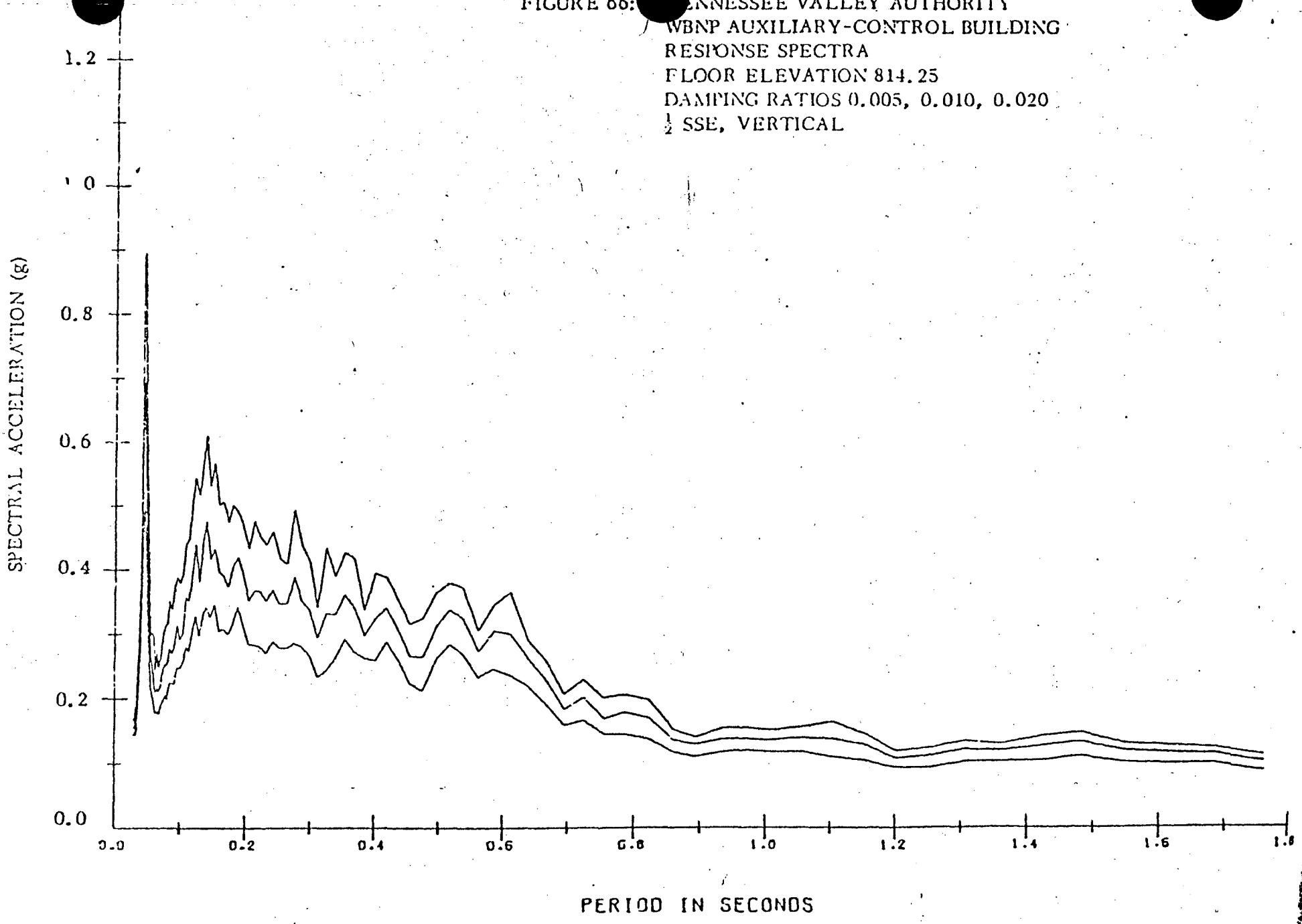


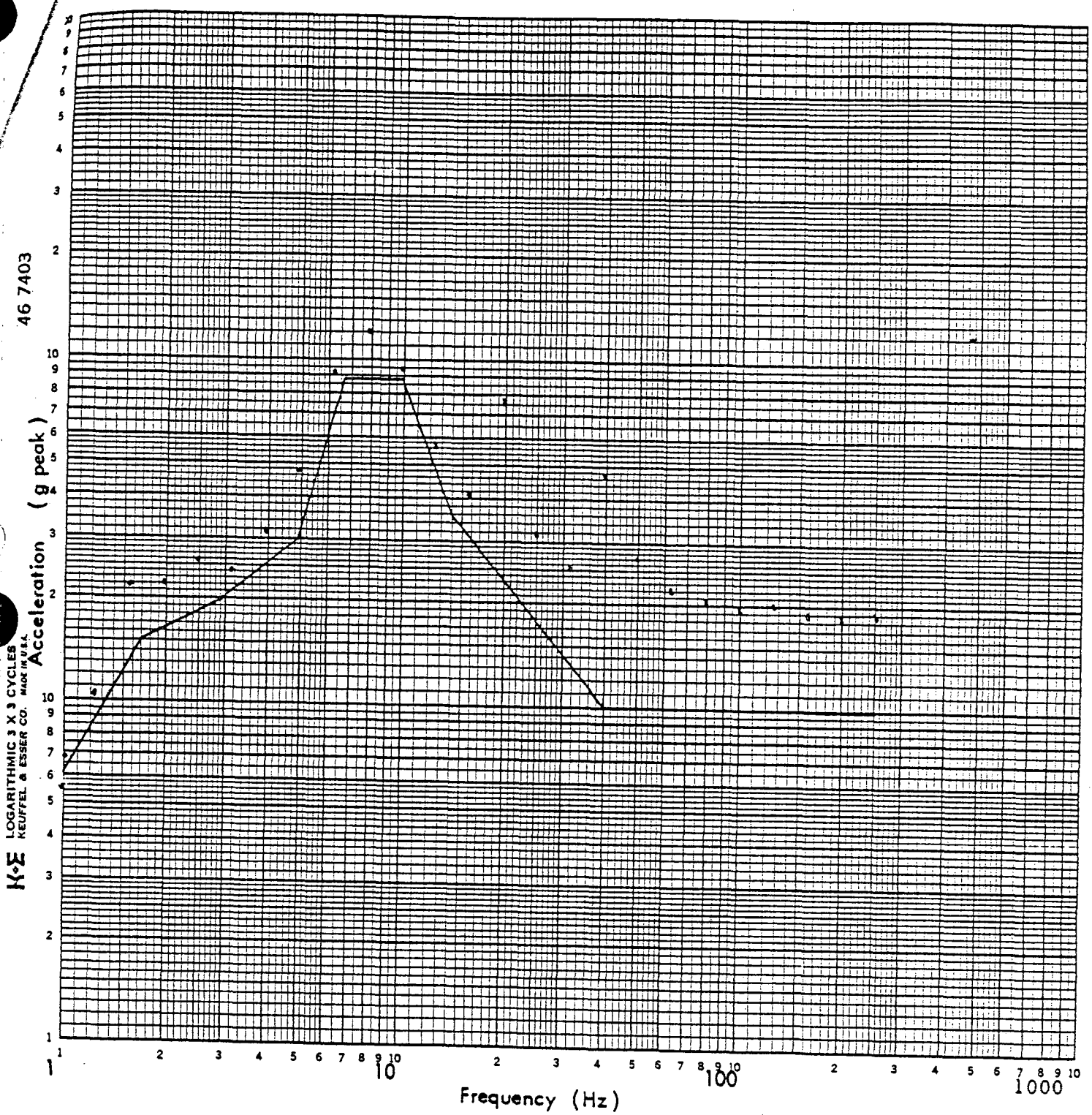
FIGURE 66: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 814.25
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, VERTICAL



FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



AXIS S-5 ϕV

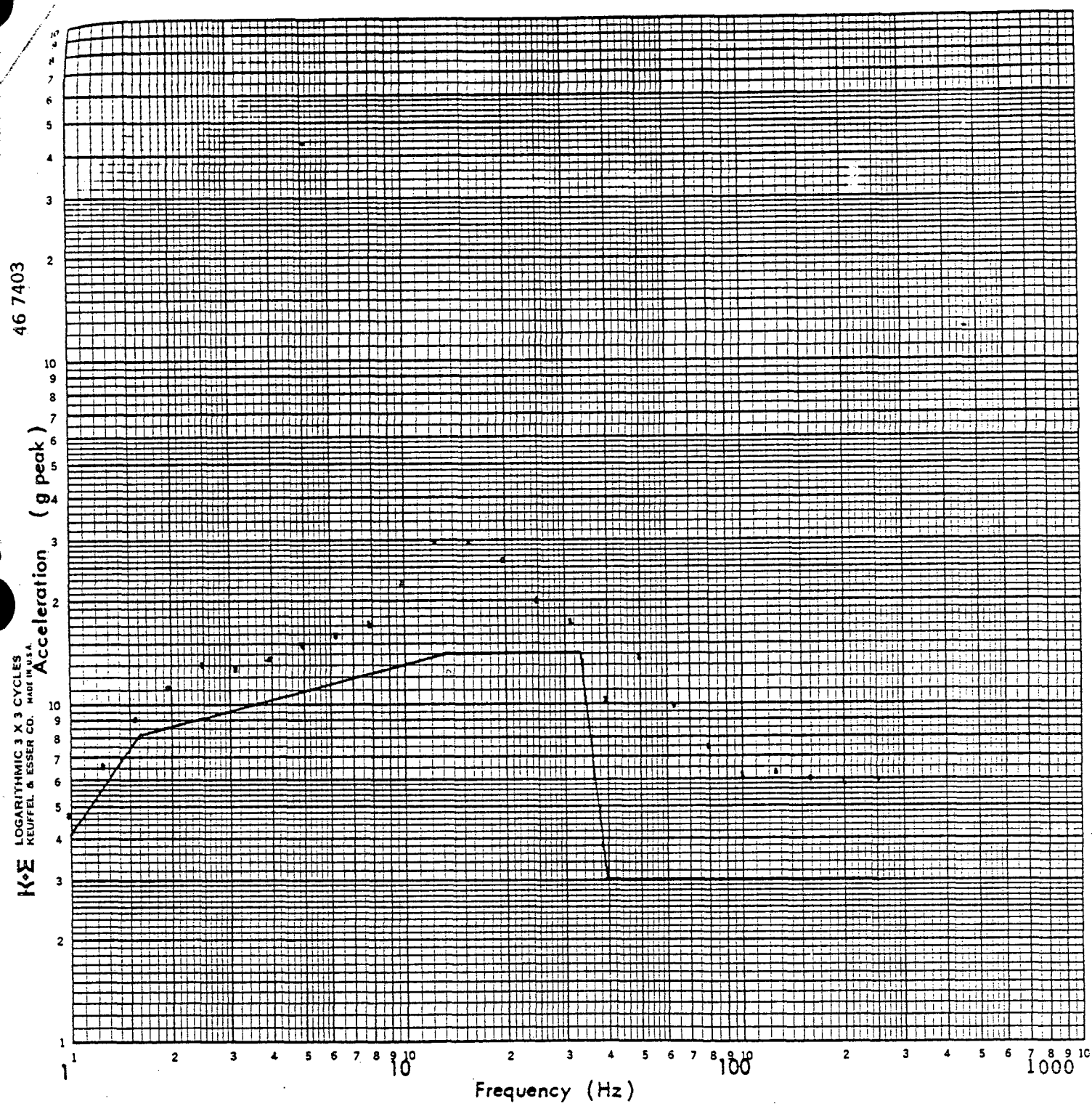
LOCATION NO. HCA

TEST RUN NO. 13

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



AXIS S-S & V

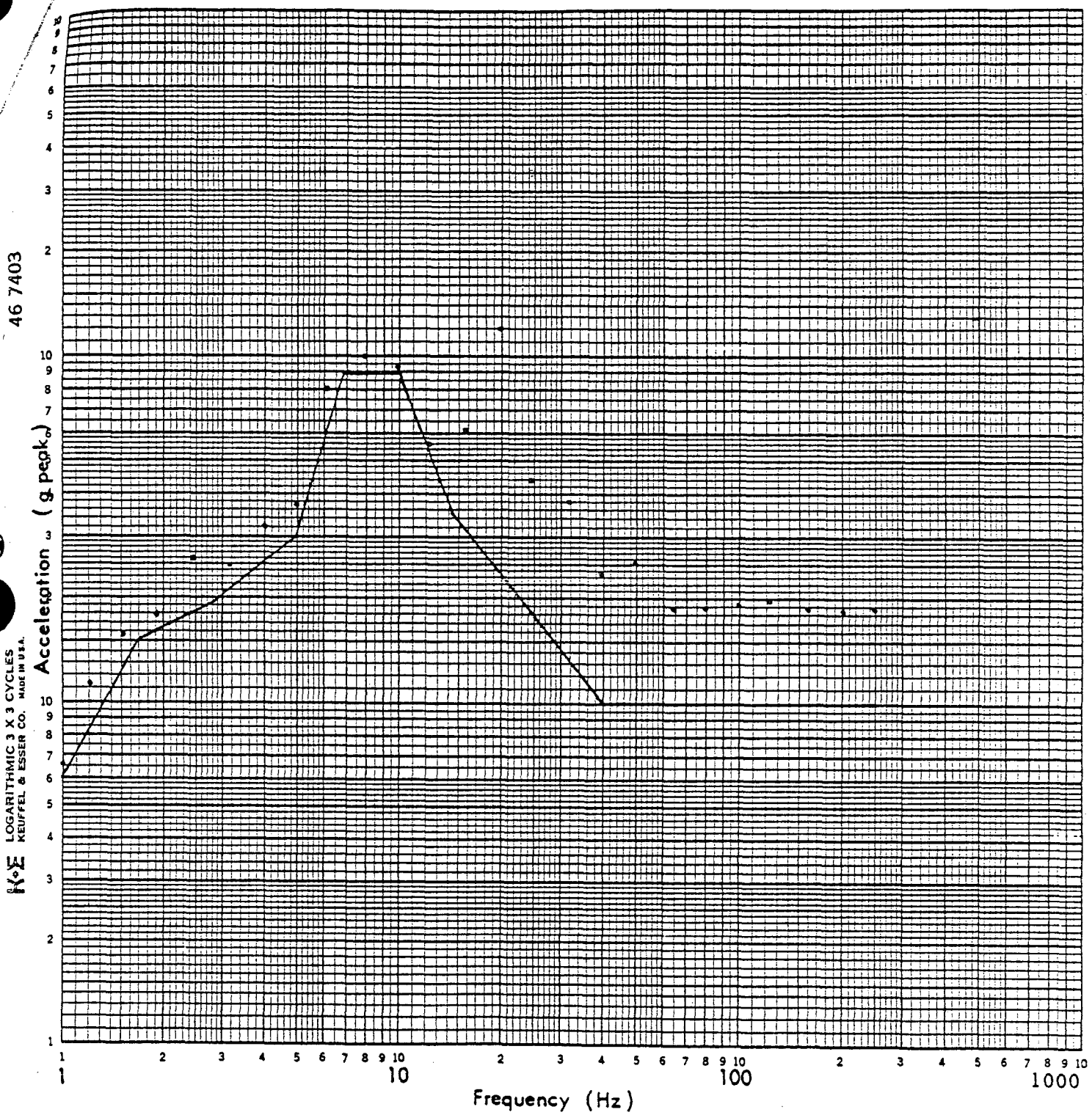
LOCATION NO. VCA

TEST RUN NO. 13

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



AXIS E-B & V

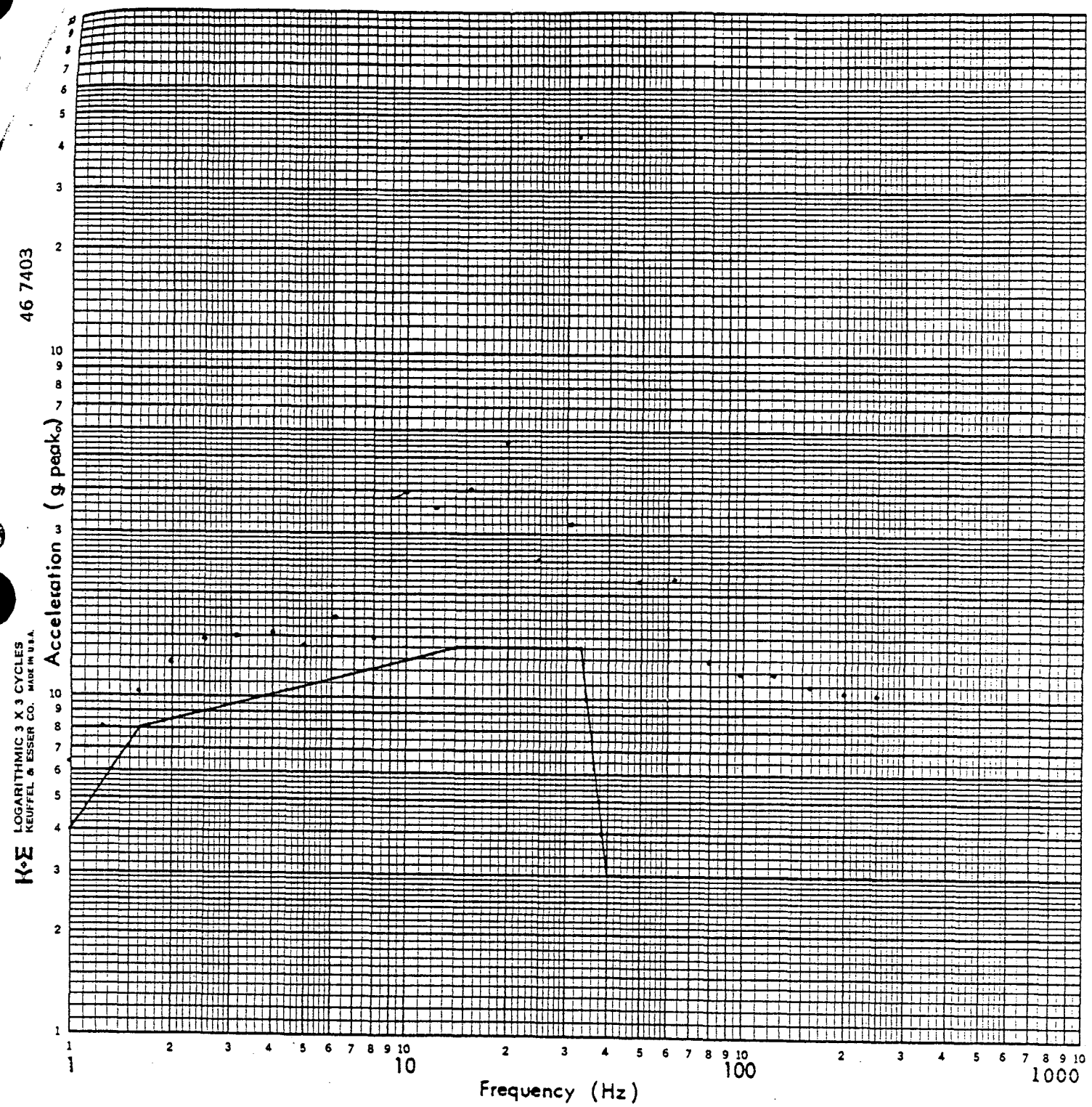
LOCATION NO. HCA

TEST RUN NO. 24

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



AXIS _____

LOCATION NO. VCB

TEST RUN NO. 24

Attachment No. 3 ITEM 9 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: 480V POWER DISTRIBUTION PANEL 75K3-864476

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: NA Quantity: 8
3. Size or Range: 480V 800 AMPS
4. Vendor: EL-TEX INDUSTRIES
5. If the component is a cabinet or panel, name and model Number of the devices included: NEMA 1 ENCLOSURE CONTAINING FPE TYPE XJL FUSEMATIC BREAKERS
6. Physical Description:
   a. Appearance: RECTANGULAR CABINET
   b. Dimensions: 64" x 44" x 10"
   c. Weight: 500 LB EACH
7. Location: Building: AUX-CONT BLD
   Elevation: 781.5
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   WALL MOUNTED
10. a. System in which located: VARIOUS ELECTRICAL SYSTEMS
    b. Functional Description: PROVIDES 480 V. POWER FOR VARIOUS PLANT LOADS
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
    [X] Both [ ] Neither [ ] Other

11. Pertinent Reference Design Specifications for Qualification Requirements: _____

_____

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WYLE LABORATORIES

(No., Title and Date): 43039-1 ; OCT 20 1975

Company that Prepared Report: _____

Company that Reviewed Report: TVA

Where Report is filed or available: _____

Applicable Codes And/Or Standards: _____

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

3/5

4. Damping Corresponding to RRS: OBE 5% SSE 5%

5. Required Acceleration in Each Direction:

[✓] ZPA [ ] Other _____ (specify)

OBE S/S = .43 F/B = .43 V = .12

SSE S/S = .86 F/B = .86 V = .24

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGEING

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random [ ] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[X] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 5 SSE 1 Other _____ (specify)

4. Frequency Range: 1-33

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 20, 33 F/B = 23*, 28 V = _____ *PRIMARY

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test ATTACHED

[X] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = 1.6 F/B = 1.4 V = 1.25

~~OBE~~ SSE S/S = 1.4 F/B = 2.1 V = 1.75

9. Laboratory Mounting:

A. [X] Bolt (No. ___, Size ___)

[ ] Weld (Length ____) [ ] PANEL ATTACHED TO WALL MOUNTING FIXTURE, ALL ATTACHED TO TEST TABLE.

B. Orientation and Fixturing: 2 ORIENTATIONS F-B/V, S-S/V

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: NO PROBLEMS

12. Other tests performed (such as aging or fragility test, including results):

13. Failure Modes (If appropriate _____)

14. Margins Available: [X] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

   Frequency Range and No. of modes considered: _____

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

   [ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

   OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

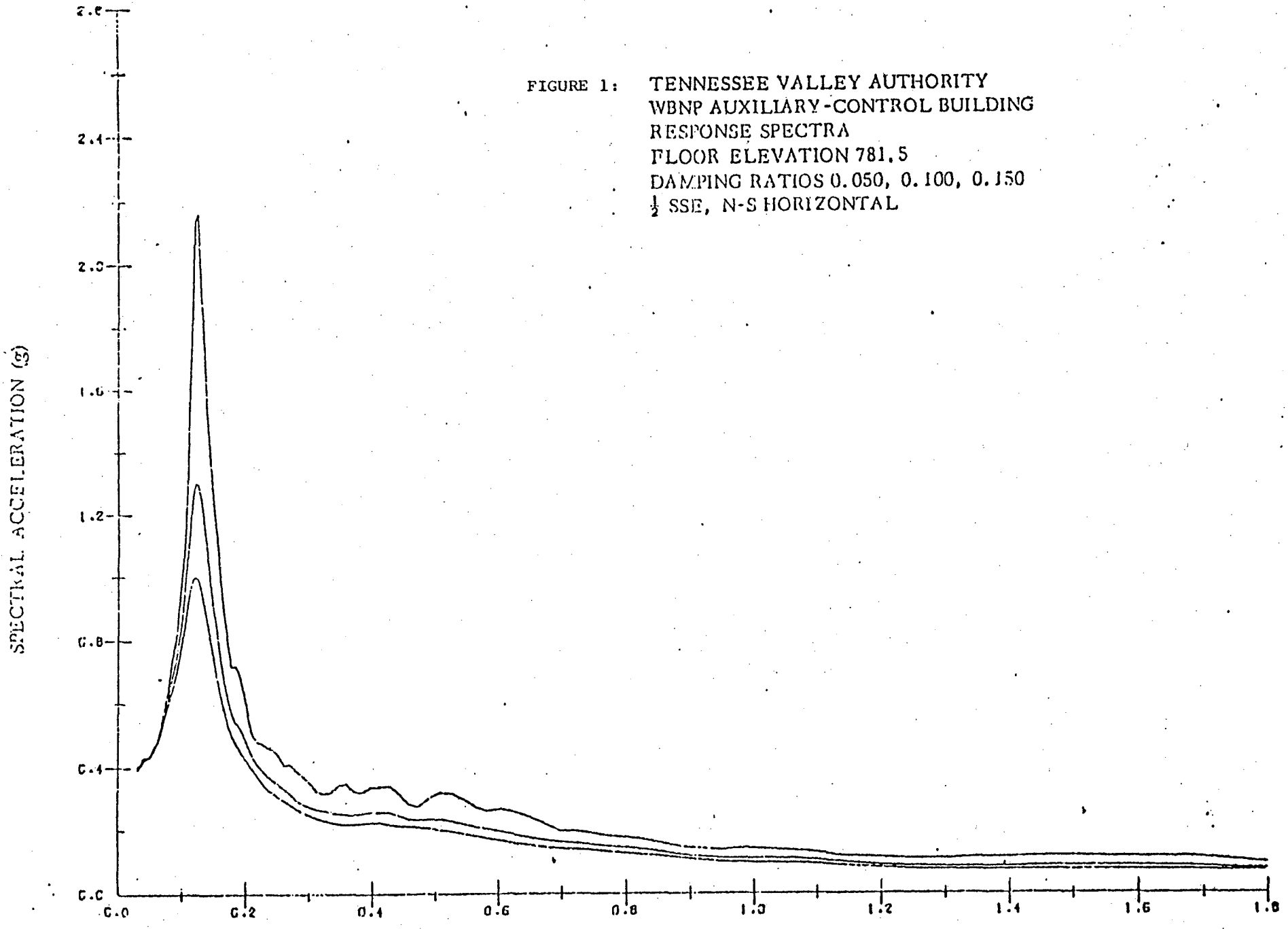
B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

FIGURE 1: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 781.5
DAMPING RATIOS 0.050, 0.100, 0.150
½ SSE, N-S HORIZONTAL



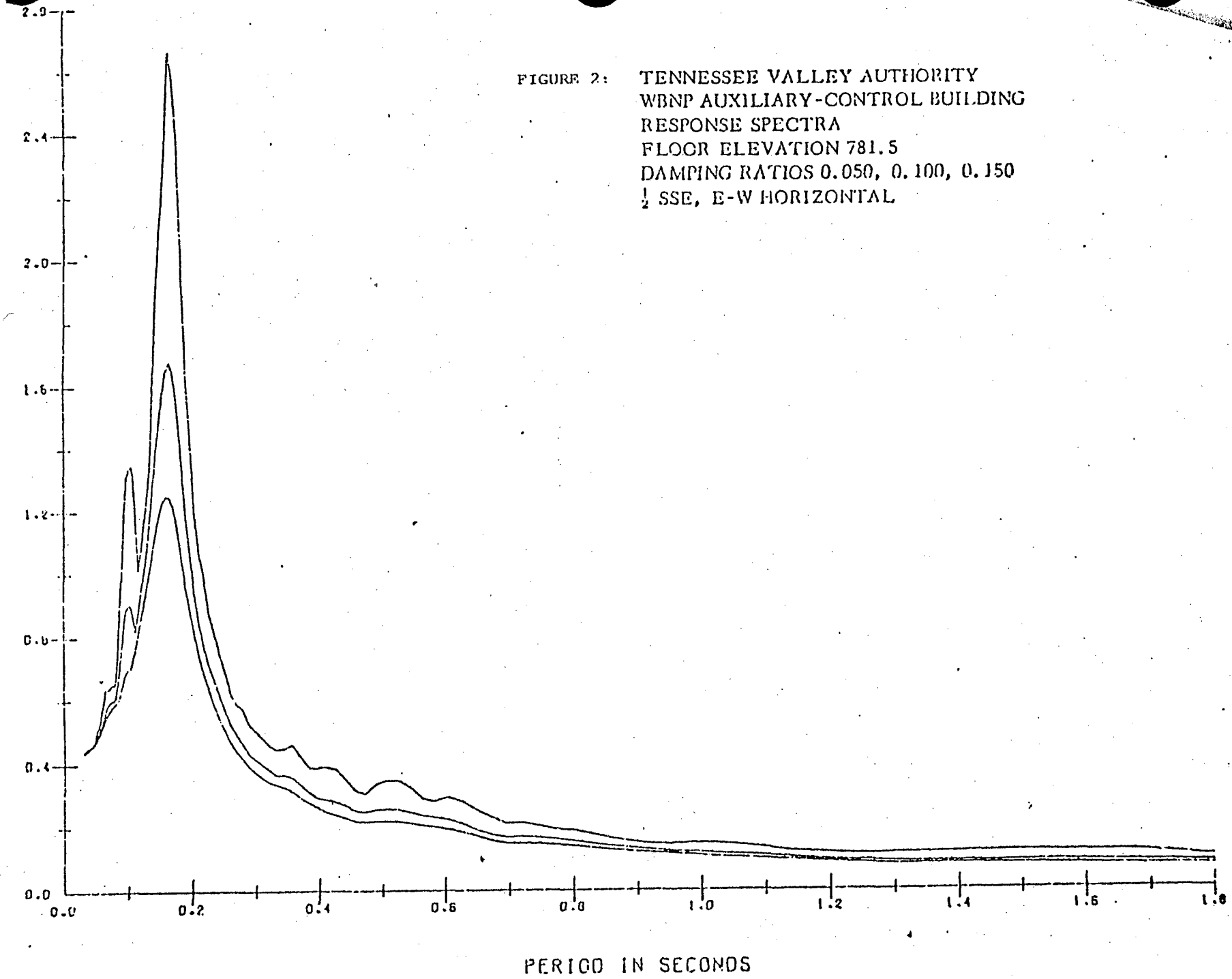


FIGURE 2: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 781.5
DAMPING RATIOS 0.050, 0.100, 0.150
½ SSE, E-W HORIZONTAL

FIGURE 55

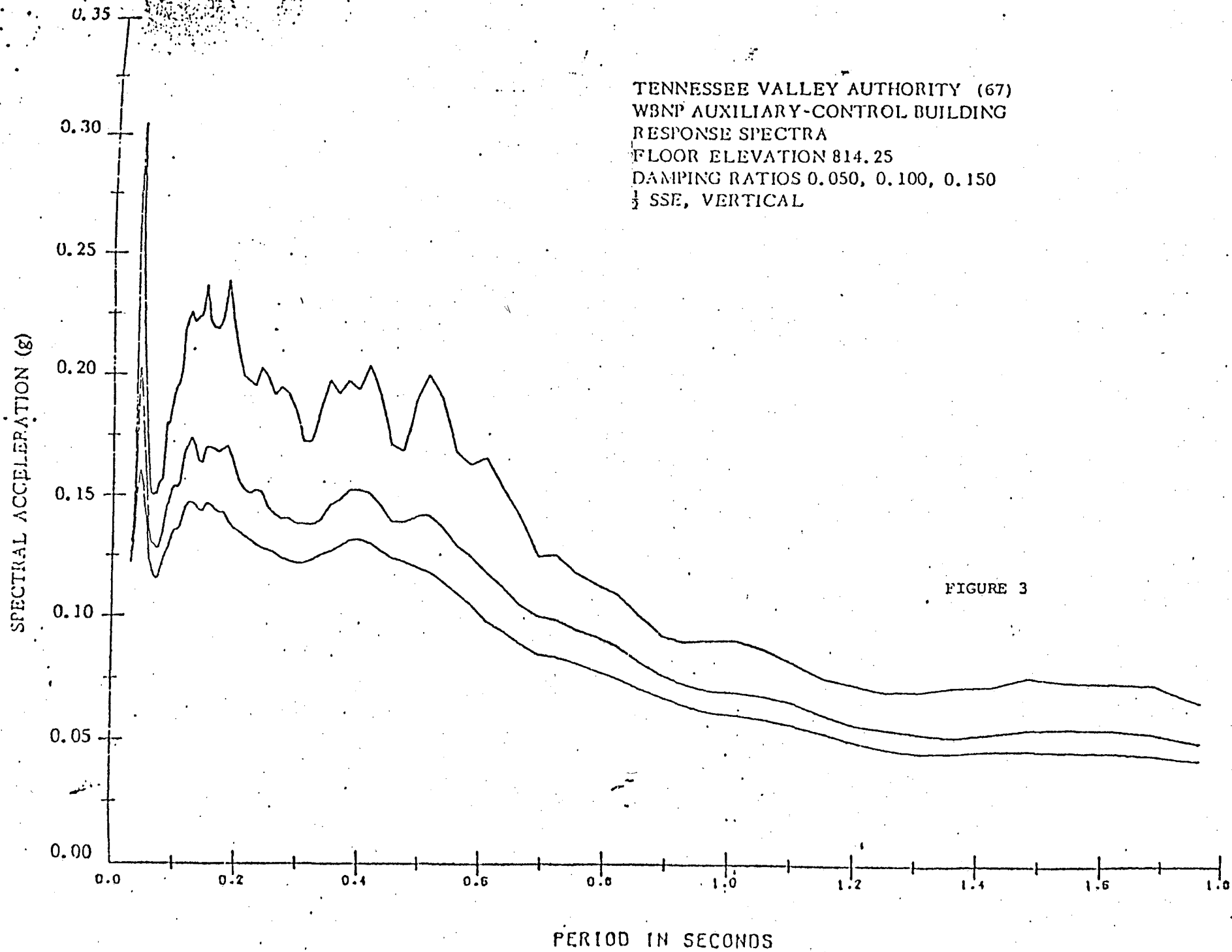


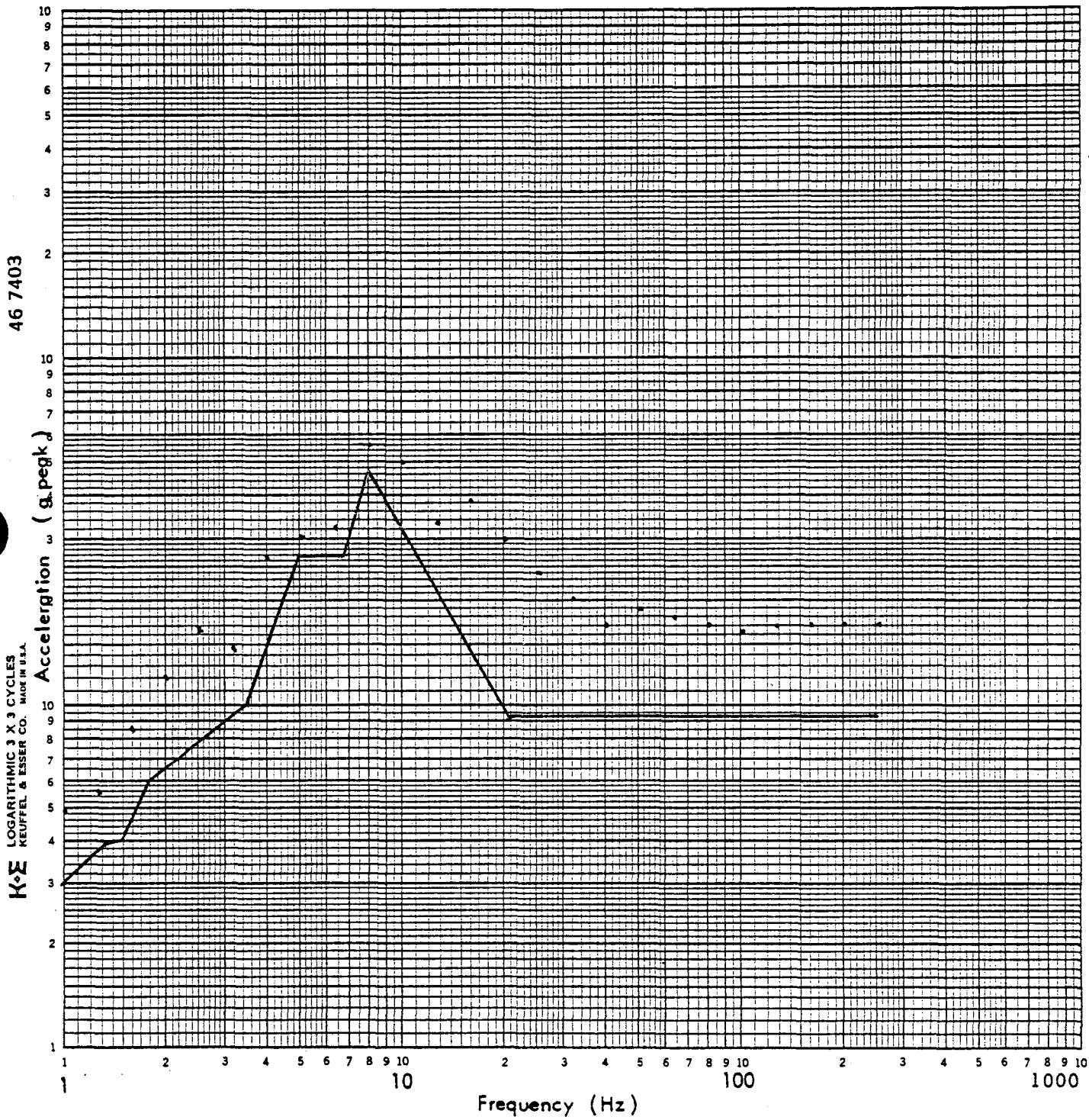
FIGURE 3

FIGURE 67

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 5 %



AXIS FB/VERTICAL

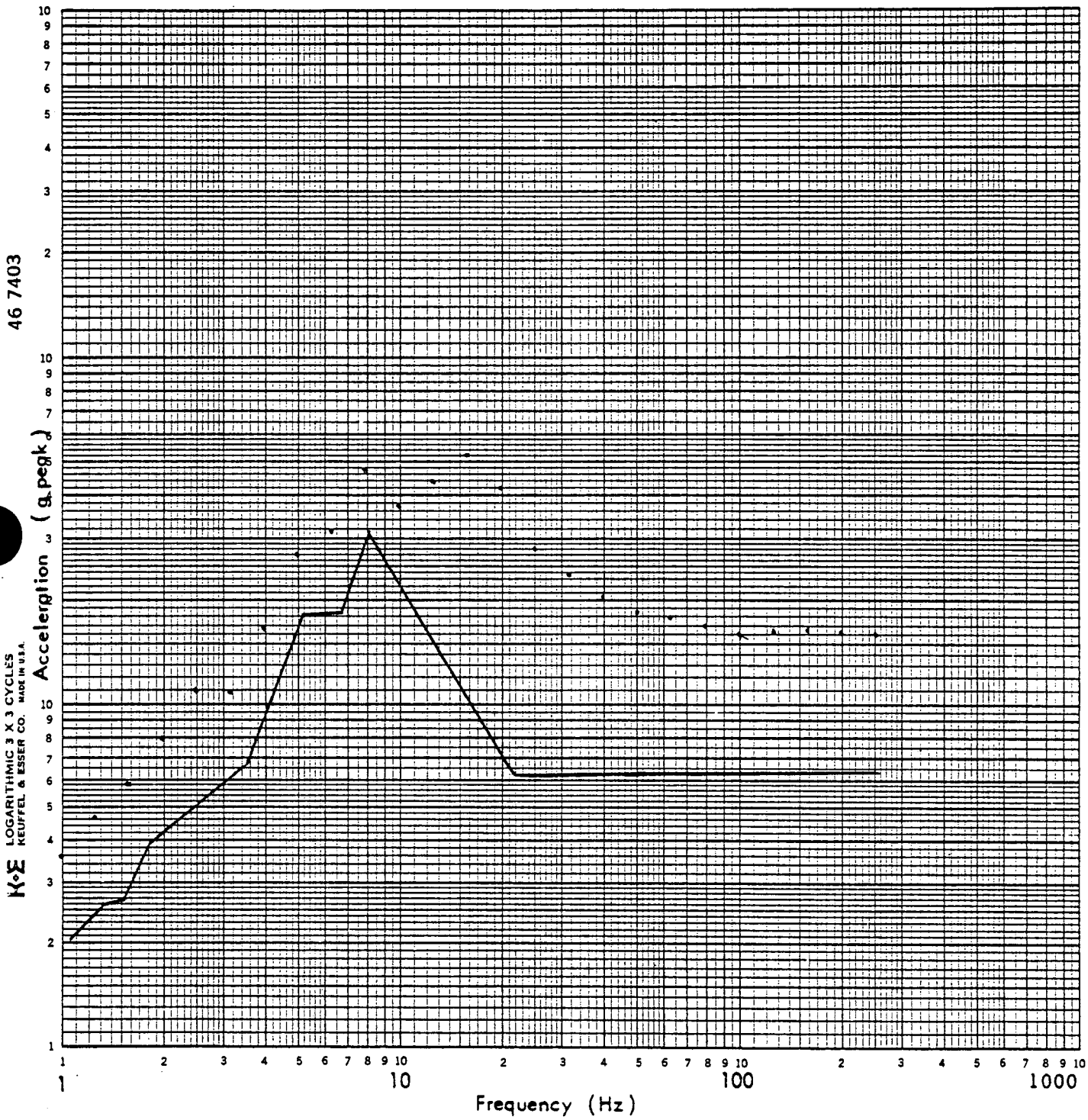
LOCATION NO. HCA

TEST RUN NO. 12

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 5%



AXIS FB/VERTICAL

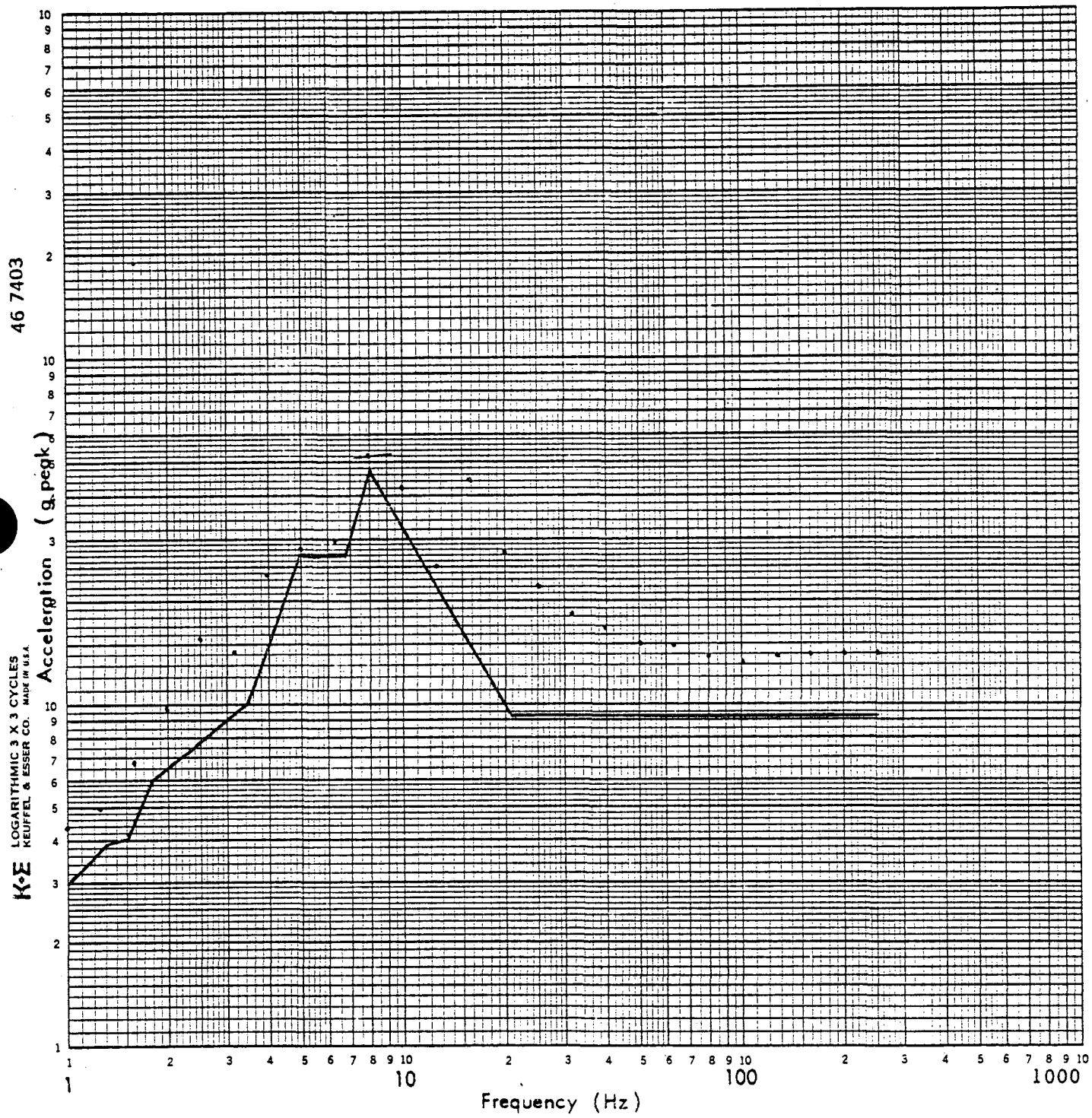
LOCATION NO. VCA

TEST RUN NO. 12

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 5 %



AXIS SS/VERTICAL

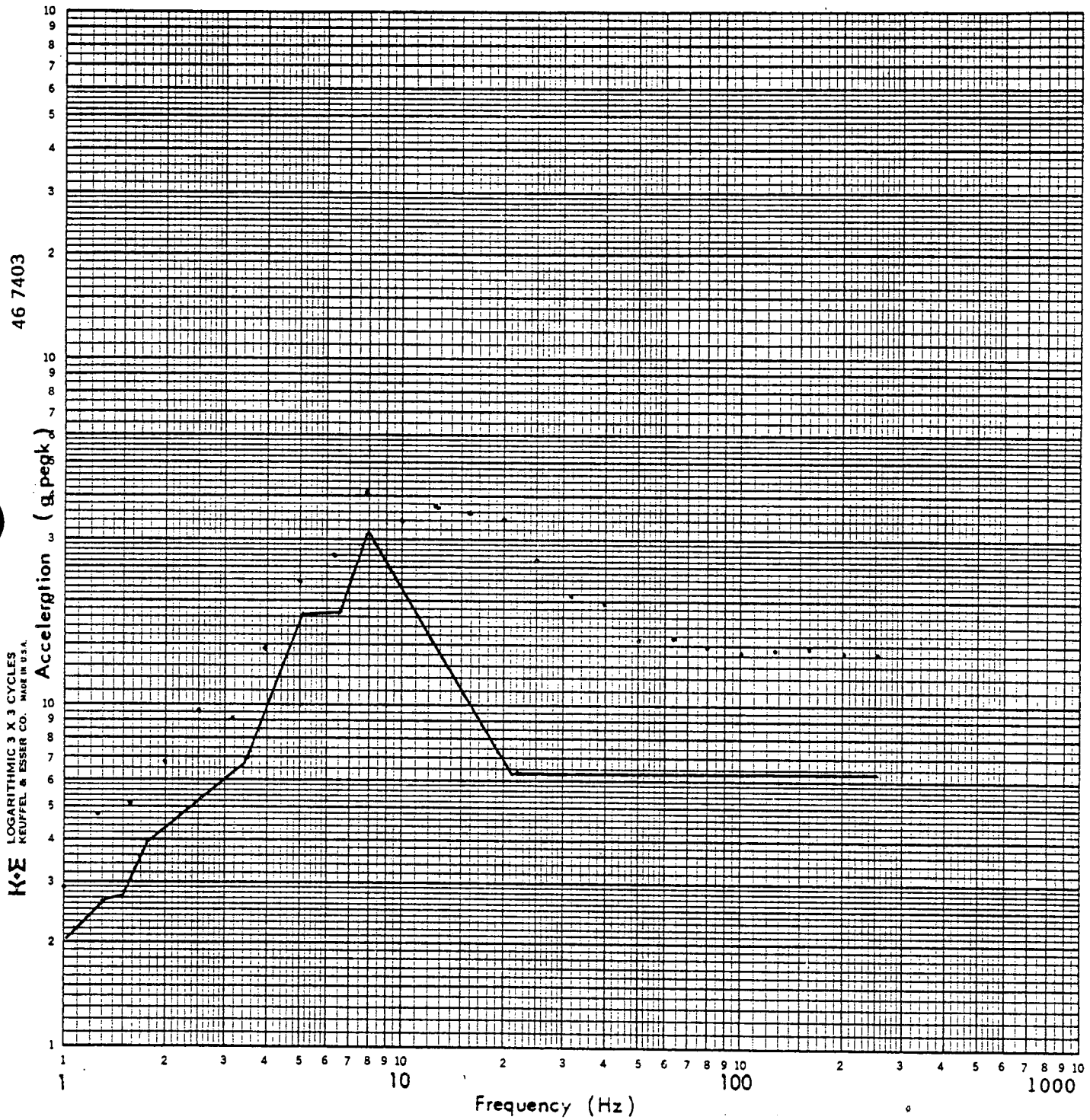
LOCATION NO. HCA

TEST RUN NO. 19

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 5%



AXIS SS / VERTICAL

LOCATION NO. VCA

TEST RUN NO. 19

Attachment No. 3 ITEM 10 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: BATTERY RACK 76K3-85763

1. Scope: [ ] NSSS [✓] BOP [ ] Other
2. Model Number: 507-07526-806 -816 Quantity: 12 RACKS
3. Size or Range: TOTAL OF THREE 13 FT RACKS PER BATTERY
4. Vendor: GOULD, INC (NOW BROWN BOVERI ELECTRIC)
5. If the component is a cabinet or panel, name and model Number of the devices included: NA
6. Physical Description:
   a. Appearance: TWO-STEP RACKS
   b. Dimensions: 13'L x 37 7/8" H EACH RACK
   c. Weight: 1650 LB x 3 RACKS = 4950 LB/BATTERY
7. Location: Building: AUX CONT BLDG
   Elevation: 772
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [✓] Weld (Length 60')
   [ ] 60' PER UNIT, 4 UNITS REQD
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR MOUNTED
10. a. System in which located: VARIOUS BATTERY SYSTEMS
    b. Functional Description: PROVIDES SEISMIC SUPPORT FOR BATTERIES IN PLANT
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 1980

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: _____

(No., Title and Date): _____

Company that Prepared Report: GOULD, INC

Company that Reviewed Report: TVA

Where Report is filed or available: _____

Applicable Codes And/Or Standards: _____

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE _____ SSE _____

5.* Required Acceleration in Each Direction:

[ ] ZPA [ ] Other _____ (specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = _____ F/B = _____ V = _____

6. Were fatigue effects considered?

[ ] Yes [ ] No

If yes, describe how they were treated in overall qualification program: _____

_____

_____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] _____

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

*CRITICAL ACCEL FOR RACK ANALYSIS IS THE MAX ACCEL RESPONSE LEVEL OF THE BATTERIES. RACK LOADS ANALYSIS REFLECTS ACCEL LOAD FACTORS OF 3.75G HORIZ/.3G VERT; THESE VALUES ARE CONSISTENT WITH BATTERY RESPONSE LEVELS ESTABLISHED FROM TEST DATA.

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [X] Equivalent Static LOADS Analysis

[X] Dynamic Analysis: [ ] Time-History [X] Response Spectrum

2. * Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = — F/B = — V = —

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [X] Beam

[ ] Closed Form Solution [ ] Other _____

* CONSERVATIVE (~~FLEXIBLE~~) ~~FREQUENCY~~ ANALYSIS SHOWS LOWEST NATURAL ~~FREQUENCY~~ OF LOADED RACK TO BE 27 HZ -- RACK IS CONSIDERED TO BE RIGID.

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[X] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads: NA

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping: NA (SEE NOTE, ITEM II 5

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A. Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
VERTICAL TUBES REACTING HORIZONTAL LOADS		21327 PSI	—	23760 PSI

B. Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
NOT DEFLECTION CRITICAL		

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

ANALYSIS REFLECTS CONSIDERABLE DEGREE OF CONSERVATISM.

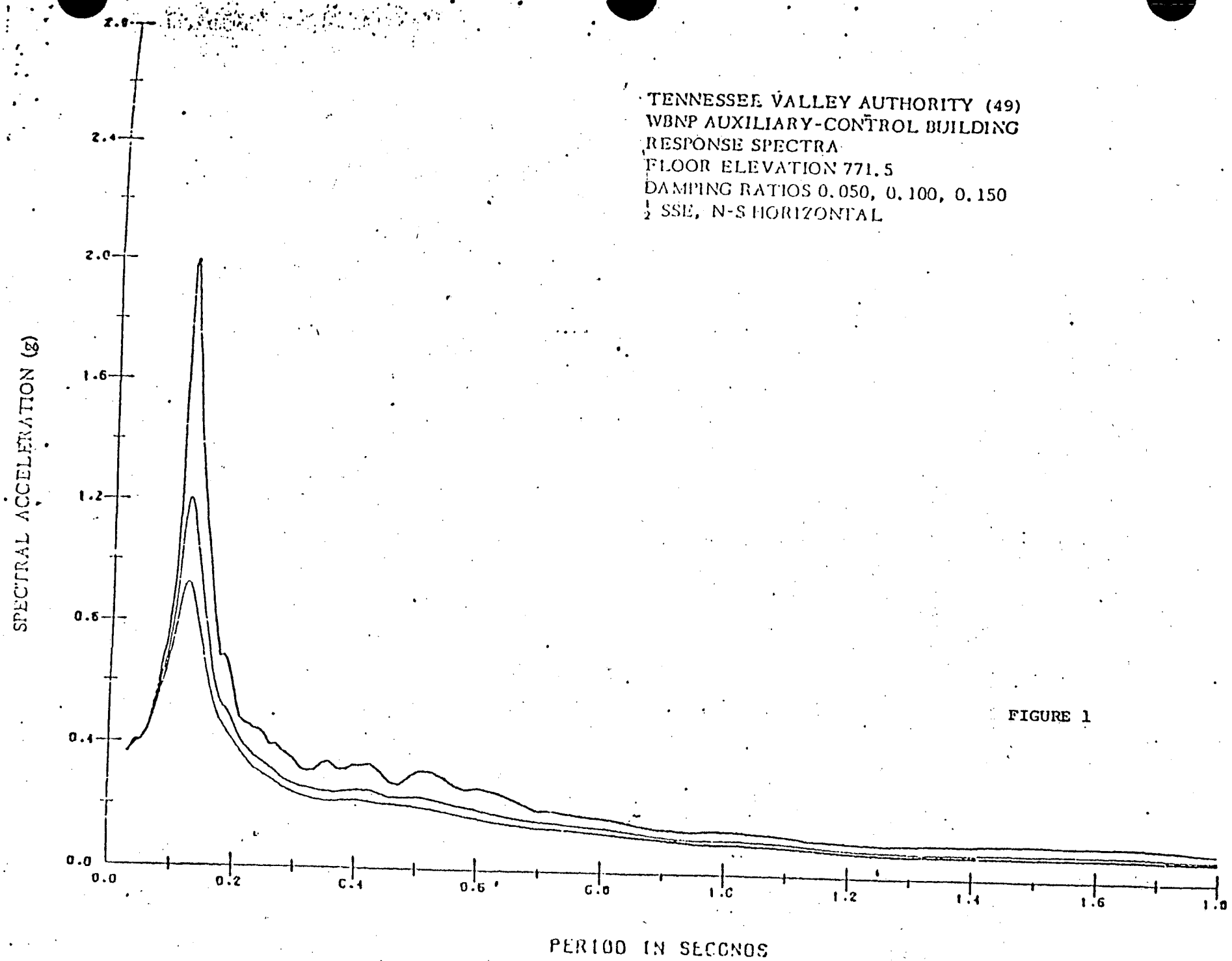

TENNESSEE VALLEY AUTHORITY (49)
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 771.5
DAMPING RATIOS 0.050, 0.100, 0.150
½ SSE, N-S HORIZONTAL
SPECTRAL ACCELERATION (g)
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
PERIOD IN SECONDS

FIGURE 1

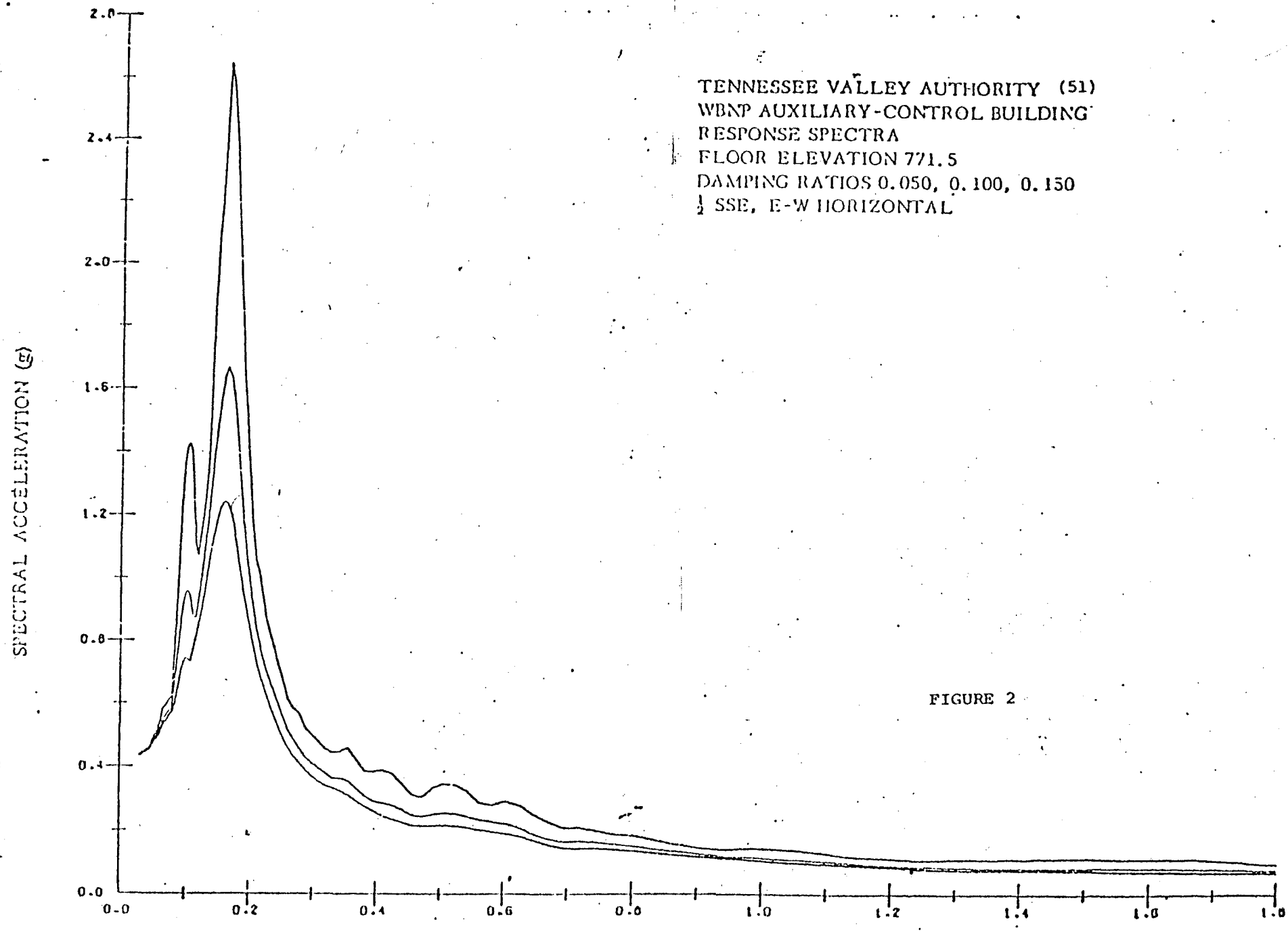


FIGURE 2

FIGURE S1

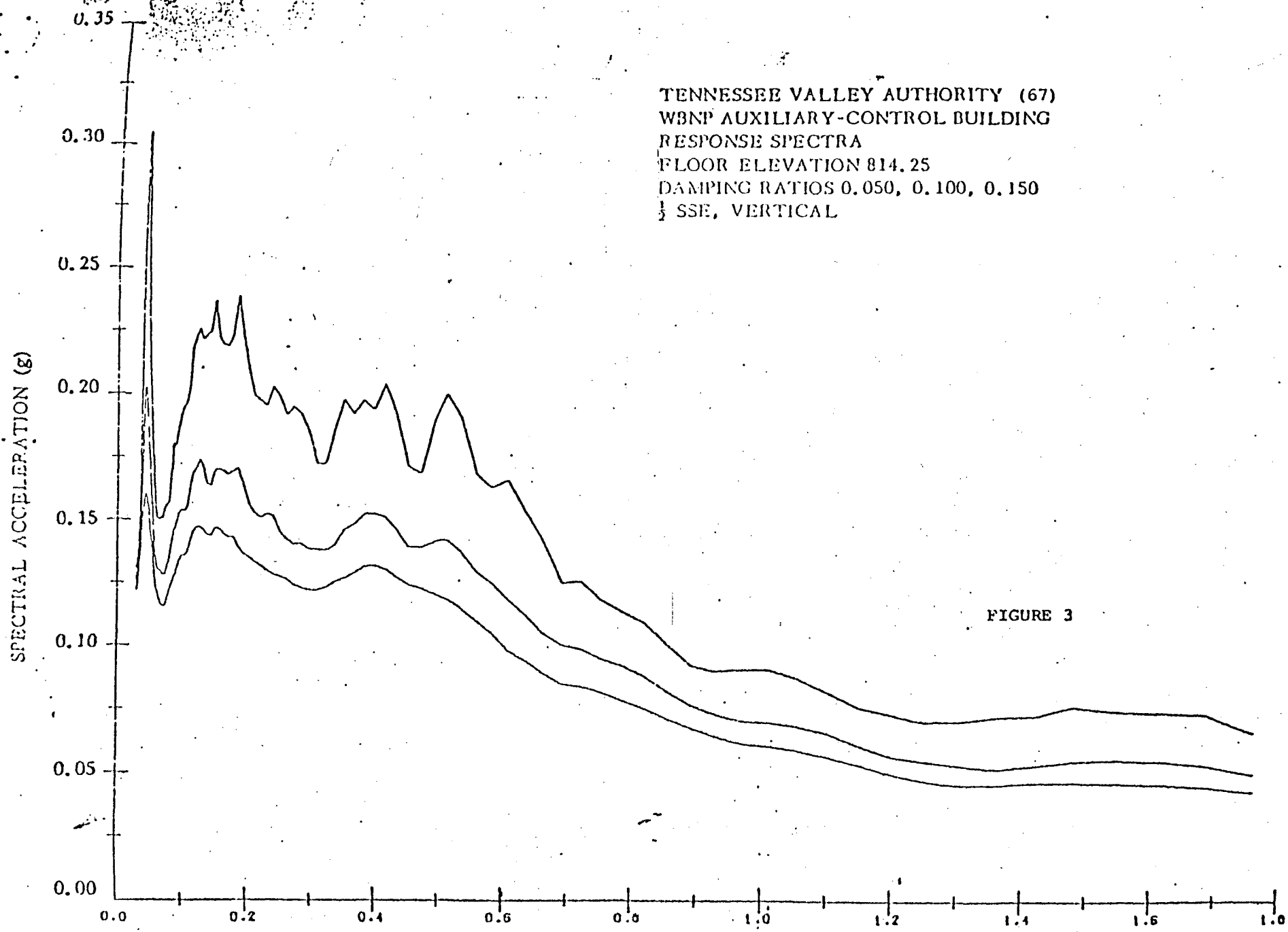


FIGURE 3

FIGURE 67

Attachment No. 3 ITEM 11 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: 120 V AC VITAL INSTRUMENT POWER BOARDS

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: — Quantity: 4
3. Size or Range: 120 V AC
4. Vendor: WESTINGHOUSE
5. If the component is a cabinet or panel, name and model Number of the devices included: BILL OF MATERIAL - ITEMS 1 THROUGH 21 ATTACHED
6. Physical Description:
   a. Appearance: POWER BDS - RECTANGULAR PRISM
   b. Dimensions: 78"x24"x91½"
   c. Weight: 2200 LB EACH
7. Location: Building: AUX CONT BLDG
   Elevation: 757
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [X] Weld (Length 6'6")
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR MOUNTED
10. a. System in which located: 120V AC VITAL INSTRUMENT POWER (250.2)
    b. Functional Description: SUPPLIES 120V AC TO VARIOUS VITAL COMPONENTS INSIDE PLANT
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other

11. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC. 2073

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations.
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*:

(No., Title and Date): WEST. G.O. CO-32659-MKE & CO-33419-MKE SHOP ORDER NO 49672 & 50573; 12-16-74

Company that Prepared Report: WESTINGHOUSE / SYSTEMS CONTROL CORP.

Company that Reviewed Report: TVA

Where Report is filed or available:

Applicable Codes And/Or Standards:

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other _____ (specify)

OBE S/S = .4 F/B = .4 V = .14

SSE S/S = .8 F/B = .8 V = .28

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGEING

VI. If Qualification by Test, then Complete:

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [X] sine beat (10 CPB) [ ] _____

SERIES OF

2. [ ] Single Axis [X] Multi-Axis
[ ] Independent axis [X] In-phase motions

3. *Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 12, 24, 27 F/B = 12, 16, 23 V = 12, 16, 27

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test NA

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

*ALTHOUGH NOT IDENTIFIED AS A SPECIFIC NUMBER OF OBE'S AND SSE'S, THE SERIES OF SINGLE FREQUENCY TESTS PROCEDURE INCLUDED MANY LOAD CYCLES OF VARYING EFFECTIVE SEVERITY.

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

~~OBE~~ SSE S/S = ATTACHED F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: 4 ORIENTATIONS

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: NO PROBLEMS

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

CONSERVATISM OF TEST INPUT MOTION

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE, WIS. 53233

Tennessee Valley Authority 120 V.A.C. Vital Instrument Power Boards Watts Bar Nuclear Plant	Bill of Material
7107-10073 | CO-33419-MKE-BM	REV. 0 | SHEET NO. 1

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP. BY: DATE
1	8	Type KA-241 Voltmeter	7148461A10	
		Scale 0-140, 60 HZ with		
		Suppressed Zero Expanded Portion		
		of Scale App. 100-140 (VM)		
2	8	Type JA Disconnect Switch	459D988G15	
		225 Amp, 2 Poles (DS)		
3	8	OEM Type N Transfer Switch	NN20025921	
		600V., 200A. Continuous, 1200A.		
		Interrupting Cap. (TS)		
4	16	Type EZC Indicating Lights	449D187G54	
		with Amber Lens, 120V., 60 HZ		
		3200 Ohm Resistor		
5	382	Heineman ACB-15 Amp	CF-2-15-240-3	
		Frame Series CF 240V., 60 HZ		
		15A., 2 Pole with Aux. Switch		
		1 N.O. & 1 N.C. (E)		

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE, WIS. 53233

7107-10073	CO-33419-MKE-BM	REV. 0	SHEET NO. 2

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP BY: DATE
6	2	Heineman ACB-15 Amp	CF-2-15-240-1	
		Frame Series CF 240V., 60 HZ		
		15A., 2 Pole with Aux. Switch		
		1 N.O. & 1 N.C. (E)		
7	4	Type EZC Indicating Lights	449D187G64	
		with Clear Lens, 120V., 60 HZ		
		3200 Ohm Resistor		
8		Not Used		
9	8	Type SG Relay, 120V., 60 HZ	293B254A26	
		DPDT		
10	136	General Electric EB-5, 12 Pt.		
		Terminal Blocks, 600V., 30A.		
11	36	Bussman Type KWN10 Fuse	KWN10	
		250 V.D.C., 10 Amp		
11A	18	General Electric Fuse Block, 240V.	G.E. 8421-3	
		30A., 2 Pole for Item 11		

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE, WIS. 53233

7107-10073 | CO-33419-MKE-BM | REV. 0 | SHEET NO. 3

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP. BY: DATE
12	32	Bussman Limitron Fuse	KTN70	
		250V., 60 HZ, 70 Amp		
		Interrupting Capacity 200,000A.		
13	32	Bussman Type KAZ Activator	KAZ	
14	32	Bussman Fuse Block for		
		Item 12 & 13		
15	2	Type MTA Isolation Trans.	IF1690	
		230/460 - 115/230, 3000VA.		
		60 HZ		
16	8	Lithonia C Series	C-220	
		Lamp Fixture, 40 Watt with		
		(2) 20 Watt Lamps and Guard		
17	8	Bryant Single Pole	4801-I	
		Toggle Switch, 15A., 277V.		
17A	8	Bryant Receptacle, Duplex	808	
		15A., 125V.		

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE, WIS. 53233

7107-10073	CO-33419-MKE-BM	REV. Ø 1	SHEET NO. 4

ITEM	QTY.	DESCRIPTION	STYLE NO.	FINAL INSP. BY: DATE
17B	8	General Electric EB-5, 4 Pt.	642248264	
		Terminal Block, 600V., 30A.		
17C	8	National Lock Co. 3 Pt. Latching Lock	68-0340T	
17D	1	Lot General Electric	S.I.S. #14	
		Control Wire S.I.S. #14		
17E	1	Lot General Electric	S.I.S. #10	
		Control Wire S.I.S. #10		
17F	1	Lot General Electric	4/o THW-MTW	
		4/o Cable Type THW-MTW		
17G	1	Lot Copper Bus $1\frac{1}{4}$" x $\frac{1}{4}$		
17H	1	Lot 3M Scotchtite 105C	30244478	
		Heat Reactive Bus Bar		
		Insulation $1\frac{1}{2}$"		

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE. WIS. 53233

7107-10073	CO-33419-MKE-BM	REV. Ø 1	SHEET NO. 5

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP. BY: DATE
18	32	Bussman Fuse Type KTN	KTN70	
		70A. (Shipped Loose & Unmounted)		
19	32	Bussman Type KAZ	KAZ	
		Actuator (Shipped Loose & Unmounted)		
20	20	Bussman Type KWN Fuse	KWN10	
		(Shipped Loose & Unmounted)		
21	8	West. Type EZC Indicating	449D187G44	
		Lite, 120 VAC with Blue		
		Lens, 120V., 60 HZ		
		3200 Ohm Resistor		

FIGURE 44: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 755.5
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE) N-S HORIZONTAL

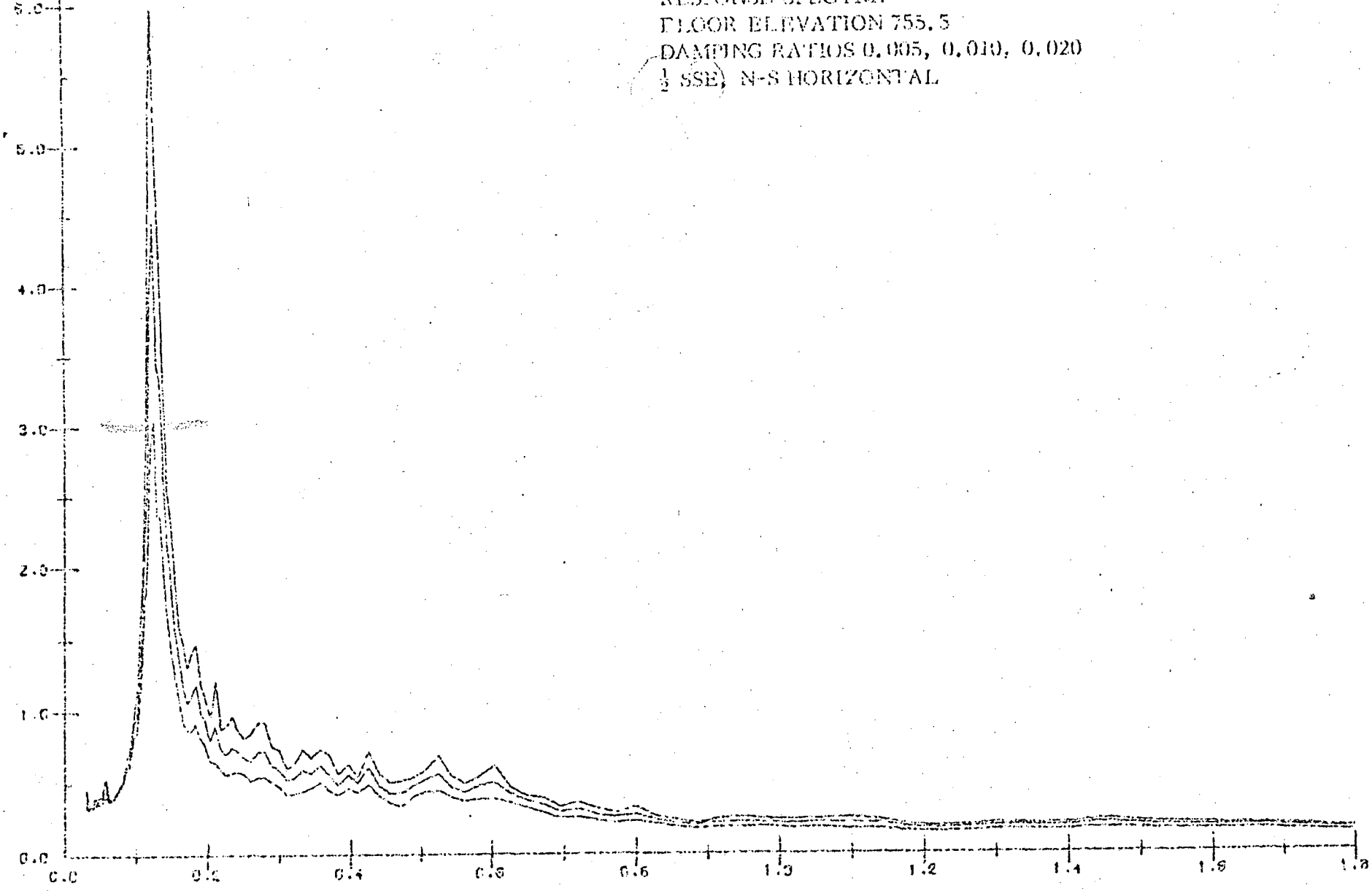


FIGURE 46: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 755.5
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, E W HORIZONTAL

use for 757 elev

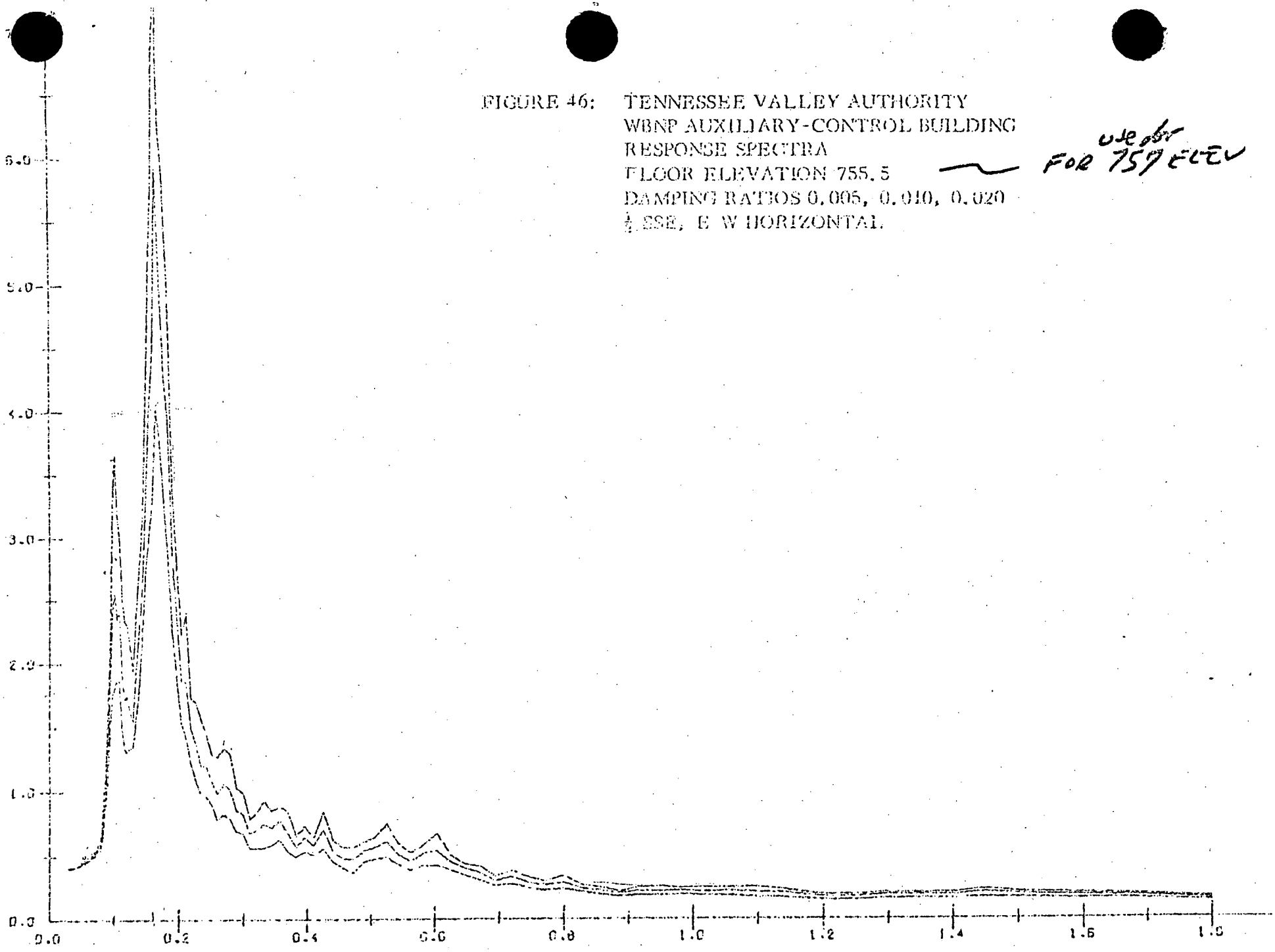
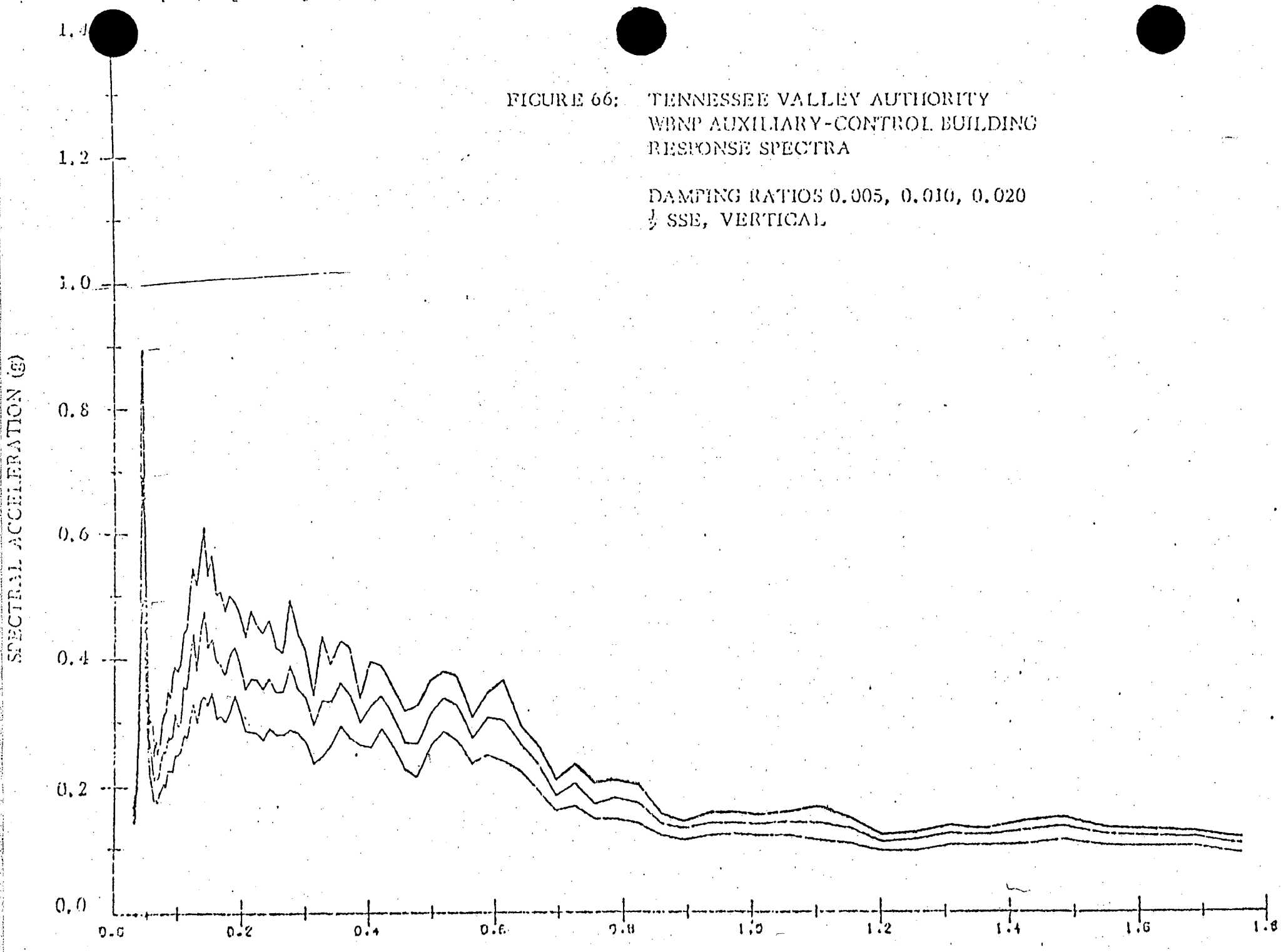


FIGURE 46

FIGURE 66: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA

DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, VERTICAL



TYPE OF TEST — BEAT TEST
PNL. — 120VAC VITAL INSTRUMENT POWER BOARD
PER. FIG. — 1 ~~FRONT-BACK~~ VERTICAL

FREQ.	ACCELERATION IN G's					
	ACCEL. NO. 1	ACCEL NO. 2	ACCEL. NO. 3	ACCEL. NO. 4	ACCEL. NO. 5	ACCEL NO.
1	1.28	1.16	1.10	.90	.68	.22
1.5	1.10	1.12	1.14	.84	.86	.22
2	1.14	1.20	1.12	.92	.84	.26
3	1.24	1.24	1.20	.96	.86	.30
4	1.20	1.32	1.28	1.00	.98	.24
6	3.40	1.10	1.60	.94	1.20	.22
8	3.98	1.64	1.62	.96	1.22	.36
12	5.30	2.30	1.94	.78	1.28	.48
16	5.30	1.80	1.14	1.76	.78	.70
23	5.10	.60	.48	.70	.10	.54
24	5.20	.56	.40	.70	.11	.60
27	5.30	.76	1.02	.70	.50	.68
32	5.36	.76	.64	.55	.36	.60
33	5.20	.58	.60	.55	.24	.64

ACCEL. NO. 1 — Z ROOF
ACCEL. NO. 2 — X TOP MIDDLE RIGHT FACE
ACCEL. NO. 3 — X CENTER LEFT FACE
ACCEL. NO. 4 — X IN — ~~HORIZ~~ INPUT
ACCEL. NO. 5 — X INSIDE BARRIER
ACCEL. NO. 6 — Z IN - VERT INPUT

FOR - Ⓦ , TVA.

SPEC. NO. — 73C2-83010
7404-85215

WEST. GO. — CO-32699 & 33419

SYSTEMS CONTROL CORP. NO. — 49672 & 10073

TABLE 2

TYPE OF TEST — BEAT TEST

PNL. — 120VAC VITAL INSTRUMENT POWER BOARD

PER. FIG. — 2 SIDE-SIDE/VERTICAL

FREQ.	ACCELERATION IN G's					
	ACCEL. NO. 1	ACCEL. NO. 2	ACCEL. NO. 3	ACCEL. NO. 4	ACCEL. NO. 5	ACCEL. NO.
1	3.16	1.32	1.56	1.16	1.22	.34
1.5	2.10	1.04	1.36	.96	.88	.32
2	3.00	1.14	1.32	1.18	.94	.26
3	2.24	1.34	1.42	1.26	1.02	.28
4	2.86	.98	1.40	1.22	.84	.22
6	2.46	1.36	1.60	1.20	1.12	.27
8	4.00	2.02	1.21	.98	1.24	.36
12	3.02	1.26	1.00	1.12	.88	.32
13	5.00	1.02	.92	1.16	.66	.30
16	5.76	.86	.76	.98	.56	.30
24	6.60	.76	.64	.76	.70	.30
32	7.44	1.00	.90	.84	.80	.64
33	7.30	1.06	.96	.84	.86	.72

ACCEL. NO. 1 — Z ROOF
ACCEL. NO. 2 — Y TOP MIDDLE RIGHT FACE
ACCEL. NO. 3 — Y CENTER LEFT FACE
ACCEL. NO. 4 — Y IN - HORIZ WPOT
ACCEL. NO. 5 — Y INSIDE BARRIER
ACCEL. NO. 6 — Z IN - VERT WPOT

FOR - Ⓦ , TVA.

SPEC. NO. — 7302-83010
7404-85216

WEST. GO. — CO-32699 & 33419

SYSTEMS CONTROL CORP. NO. — 49672 & 10073

TABLE 3

TYPE OF TEST — BEAT TEST
PNL. — 120VAC VITAL INSTRUMENT POWER BOARD
PER. FIG. — 3 F-B/N - ROTATED 180°

FREQ.	ACCELLERATION IN G's					
	ACCEL. NO. 1	ACCEL. NO. 2	ACCEL. NO. 3	ACCEL. NO. 4	ACCEL. NO. 5	ACCEL. NO.
1	3.00	1.20	1.00	1.02	.84	.22
1.5	2.26	1.13	1.02	1.02	.92	.22
2	3.20	1.23	1.22	1.22	1.06	.22
3	3.10	1.30	1.46	1.40	1.16	.24
4	3.10	1.30	1.64	1.38	1.12	.24
6	3.16	1.30	1.50	1.36	1.08	.26
8	3.20	1.12	1.66	1.30	1.12	.26
12	4.00	1.62	1.76	.90	1.20	.24
15	4.20	1.60	1.06	1.00	.56	.24
16	4.56	1.16	.96	.86	.50	.24
17	4.12	1.24	.50	.78	.40	.36
24	1.96	1.00	.80	.80	.42	.76
29	5.36	.90	.90	.70	.42	.70
32	5.44	.62	.46	.62	.32	.76
33	4.60	.64	.56	.52	.24	.68

ACCEL. NO. 1 — Z ROOF
ACCEL. NO. 2 — X TOP MIDDLE RIGHT FACE
ACCEL. NO. 3 — X CENTER LEFT FACE
ACCEL. NO. 4 — X IN-HORZ INPUT
ACCEL. NO. 5 — X INSIDE BARRIER
ACCEL. NO. 6 — Z IN-VERT INPUT

FOR- Ⓦ , TVA.

SPEC. NO. — 7302-83010
7404-85215
WEST. G.O. — CO-32699 & 33419
SYSTEMS CONTROL CORP. NO. — 49672 & 10073

TABLE 4

TYPE OF TEST — BEAT TEST
PNL. — 120VAC VITAL INSTRUMENT POWER BOARD
PER. FIG. — 4 S-S/N ROTATED 180°

FREQ.	ACCELLERATION IN G's					
	ACCEL. NO. 1	ACCEL. NO. 2	ACCEL. NO. 3	ACCEL. NO. 4	ACCEL. NO. 5	ACCEL. NO
1	1.00	1.13	1.14	.76	.96	.36
1.5	1.30	1.04	1.14	.76	.90	.26
2	1.18	1.26	1.30	.84	1.02	.30
3	.98	1.30	1.40	.84	1.06	.26
4	.90	1.26	1.38	.92	1.02	.28
6	2.28	1.50	1.66	.80	1.40	.26
8	3.60	3.42	2.72	.74	1.74	.38
12	3.52	1.30	1.00	.80	.80	.38
16	4.46	.80	.52	1.70	.46	.40
24	3.20	.48	.60	.70	.60	.80
27	4.38	.94	.92	.70	.88	.72
32	5.24	.46	.60	.60	.80	.76
33	5.46	.62	.62	.60	.96	.76

ACCEL. NO. 1 — Z ROOF
ACCEL. NO. 2 — Y TOP MIDLLE RIGHT FACE
ACCEL. NO. 3 — Y CENTER LEFT FACE
ACCEL. NO. 4 — Y IN - HORZ INPUT
ACCEL. NO. 5 — Y INSIDE BARRIER
ACCEL. NO. 6 — Z IN - VERT INPUT

FOR - Ⓦ , TVA.

SPEC. NO. — 73C2-83010
74C4-85215
WEST. GO. — CO-32699 & 33419
SYSTEMS CONTROL CORP. NO. — 43672 & 10073

Attachment No. 3 ITEM 12 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: BOP POWER SUPPLIES (125 V DC VITAL BATTERY BOARDS) 75CC-85281

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: VARIOUS Quantity: 4
3. Size or Range: 125 V
4. Vendor: WESTINGHOUSE
5. If the component is a cabinet or panel, name and model Number of the devices included: BILL OF MATERIAL ATTACHED
6. Physical Description:
   a. Appearance: RECTANGULAR CABINETS
   b. Dimensions: 30" X 45" X 90" EACH PANEL
   c. Weight: 28,000 LB FOR 4 PANELS
7. Location: Building: AUX CONT BLDG
   Elevation: 757
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [X] Weld (Length 4'-4")
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR MOUNTED
10. a. System in which located: VARIOUS ELECTRICAL SYSTEMS
    b. Functional Description: SUPPLIES SAFETY-RELATED POWER TO NON-NSSS SYSTEMS IN PLANT
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
    [X] Both [ ] Neither [ ] Other ____

11. Pertinent Reference Design Specifications for Qualification Requirements: IUA SPEC 2091

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations.
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

* [X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*:

(No., Title and Date): WESTINGHOUSE #CO-33679-MKE SHOP ORDER #1773 12/29/76

Company that Prepared Report: WESTINGHOUSE/SYSTEMS CONTROL CORP

Company that Reviewed Report: IUA

Where Report is filed or available:

Applicable Codes And/Or Standards:

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: IUA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

* VENDOR QUALIFICATION REPORT INCLUDED TEST DATA AND ANALYSIS. HOWEVER, TEST DATA ALONE WAS SUFFICIENT FOR SEISMIC QUALIFICATION; ANALYSIS WAS NOT NEEDED OR USED.

3/5

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other _____ (specify)

OBE S/S = .32 F/B = .32 V = .12

SSE S/S = .64 F/B = .64 V = .24

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGEING -- TEST PROGRAM WAS SUCH THAT EQUIPMENT WAS SUBJECTED TO MANY LOAD CYCLES OF VARYING DEGREES OF EFFECTIVE SEVERITY

VI. If Qualification by Test, then Complete: PANELS 1 & 2

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [X] sine beat [ ] _____
SERIES OF

2. [ ] Single Axis [X] Multi-Axis
[ ] Independent axis [X] In-phase motions & OUT OF PHASE

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S (Y) = 8,12 F/B (X) = 11,12 V (Z) = —

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test NA

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test: ATTACHED TABLES

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [X] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: NO PROBLEMS

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

CONSERVATISM OF TEST METHOD

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

3/5

4. Damping Corresponding to RRS: OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [ ] Other _____ (specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = _____ F/B = _____ V = _____

6. Were fatigue effects considered?

[ ] Yes [ ] No

If yes, describe how they were treated in overall qualification program: _____

_____

_____

VI. If Qualification by Test, then Complete: PANELS 3 & 4 SERIES OF

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [X] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[ ] Independent axis [X] In-phase motions & ~~OUT OF PHASE~~

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 10 F/B = 12, V = —

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test ~~N/A~~

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test: ATTACHED TABLES

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [X] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: NO PROBLEMS

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

CONSERVATISM OF TEST METHOD

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE, WIS. 53233

Tennessee Valley Authority 125 Volt DC Vital Battery Boards Watts Bar Nuclear Plant	Bill of Material

7107-17773	CO-33697-MKE-BM	REV. 0 1	SHEET NO. 1

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP. BY: DATE
1	4	Cutler Hammer Push Light	10250T471-	
		120V.	1026M36	
		Escutcheon - ALARM - RESET		
		Lens - White		
		Contacts 1 N.O. & 1 N.C.		
2	12	Westinghouse Type KX-241 Voltmeter	714B450A13	
		150 VDC Element, 0-150V. Scale		
		Self-contained, Suppressed		
		Zero Expanded Scale 100-150V.		
		(VM)		
3	4	General Electric Type 195		
		Meter, Element 100 MV D.C.,		
		Scale 400-0-800A. D.C.		
		with Shunt 100MV, 800A.		
		Double Set Points, with		
		Remote Mtg. Kit &	1012K10701	
		Shunt 800A. (AM)		
4	4	Westinghouse Type KX-241 Meter	691B671A10	
		Element 100 MV D.C., Scale 0-600A.		
		(AM)		

APPROVED WITH CORRECTION AS NOTED

This approval does not relieve the contractor from any responsibility he may have for the correctness of designs, details and dimensions. Drawings corrected as noted hereon, are released for construction.

TENNESSEE VALLEY AUTHORITY

Date JUN 11 1975 L. CHANDLER

TVA MAY 9 1975
WATTS BAR NP
CONTRACT NO. 75-85281
TITLE: Instr
CHECKED:

FILE

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE. WIS. 53233

7107-17773	CO-33697-MKE-BM	REV. 0 1	SHEET NO. 2

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP BY: DATE
5	4	General Electric Type 195		
		Meter, Element 15-0-15 MA		
		Scale 150-0-150 V.D.C.		
		Double Set Point with, (2) 10K, 5 Watt, 2%		
		Resistors & Remote Mtg. Kit (VM)	1012K10701	
6	4	Westinghouse Type SS-851 Shunt for Item 4	563872	
		100MV, 600A.		
6a	4	Westinghouse Type SS-851 Shunt, 100MV, 800A	563873	
7	40	Potter & Brumfield Type MDR	MDR5058	
		125 VDC Relay, 2 N.O. & 2 N.C.		
8	4	Agastat Time Delay Relay	7022ADGZ	
		120 VAC Delay on Dropout		
		5-50 Sec., DPDT, With Auxiliary Sw.		
9	4	General Electric Type NGV	12NGV17A2	
		Relay, 125 V.D.C., Range 100-140V.		
		1 N.O. 7 1 N.C. (27)		

FILE

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE. WIS. 53233

7107-17773	CO-33697-MKE-BM	REV. Ø 1	SHEET NO. 3

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP. BY: DATE
10	4	Westinghouse EZC Indicating		
		Lite With White Lens, 120VAC., 60 HZ		
		3200 Ohm Resistor		
11	8	General Electric Air Circuit Breaker		
		600V., Frame 1600, 2 Pole		
		1000A. with,		
		Series Trip Device,	EC-1	
		Adjustable Long Time Delay		
		Curve 1A & Instantaneous		
		4X to 10X, & Curve 2C Short Delay Unit		
		Normally Open Trip Alarm		
		Switch		

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE, WIS. 53233

7107-17773	CO-33697-MKE-BM	REV. 6	SHEET NO. 4

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP. BY: DATE
12	64	Type HFB Air Circuit Breaker	Sim. to 4976D04G18	
		250 V.D.C., 2 Pole, Frame 150A.		
		Trip 15A., 20,000A. Interrupting		
		Capacity with Normally		
		Open Trip Alarm Switch		
13	8	Type HFB Air Circuit Breaker	Sim. to 4976D04G19	
		250 V.D.C., 2 Pole, Frame 150A.,		
		Trip 20A., 20,000A. Interrupting		
		Capacity with Normally		
		Open Trip Alarm Switch		
14	92	Type HFB Air Circuit Breaker	Sim. to 4976D04G21	
		250 V.D.C., 2 Pole, Frame 150A.		
		Trip 30A., 20,000A. Interrupting		
		Capacity with Normally Open		
		Trip Alarm Switch		
15	4	Type HFB Air Circuit Breaker	Sim. to 4976D04G23	
		250 V.D.C., 2 Pole, Frame 150A.		
		Trip 40A., 20,000A. Interrupting		
		Capacity with Normally		
		Open Trip Alarm Switch		

FILE

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE, WIS. 53233

7107-17773	CO-33697-MKE-BM	REV. 0 1	SHEET NO. 5

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP BY: DATE
16	2	Type HFB Air Circuit Breaker	Sim. to 4976D04G24	
		250 V.D.C., 2 Pole, Frame 150A.		
		Trip 50A., 20,000A. Interrupting		
		Capacity with Normally		
		Open Trip Alarm Switch		
17	1	Type HFB Air Circuit Breaker	Sim. to 4976D04G25	
		250 V.D.C., 2 Pole, Frame 150A.		
		Trip 60A., 20,000A. Interrupting		
		Capacity with Normally		
		Open Trip Alarm Switch		
18	1	Type HFB Air Circuit Breaker	Sim. to 4976D04G28	
		250 V.D.C., 2 Pole, Frame 150A.		
		Trip 100A., 20,000A. Interrupting		
		Capacity with Normally		
		Open Trip Alarm Switch		
19	4	Type HLB Air Circuit Breaker	Sim. to 5680D03G09	
		250 V.D.C., 2 Pole, Frame 400A.		
		Trip 125A., 20,000A. Interrupting		
		Capacity with Normally		
		Open Trip Alarm Switch		

FILE

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE, WIS. 53233

7107-17773 | CO-33697-MKE-BM | REV. 0 1 | SHEET NO. 6

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP BY: DATE
20	20	Type HLB Air Circuit Breaker	Sim. to 5680D03G09	
		250 V.D.C., 2 Pole, Frame 400A.		
		Trip 300A., 20,000A. Interrupting		
		Capacity with Normally		
		Open Trip Alarm Switch		
21	4	Type 5HT Resistor, 125 V.D.C.	5HJ7500	
		50 Watts, 7500 Ohms		
22	8	Sprague, Capacitor, 600V.	CP72B1EG105K1 1Mfd, 1000V.	
		Mfd. 1.0 (equal to Mallory, 1 μF, Cat no. EWF610)		
23	8	Mallory, Capacitor 250V.	CGL32T250E1	
		Mfd. .300		
24	4	Curtis Instruments, Battery	926AP	
		Charger Indicator,		
		Supply 125 V.A.C., Scale 800A.,		
		use with 800A-100MV Shunt		
		2 Alarm Contacts @ 75 & 90%		
		with Power Conditioner Model		
		H.O. & Reset Option; to Monitor		
		1800A-HR - 105 to 140V.		

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE, WIS. 53233

7107-17773	CO-33697-MKE-BM	REV. 6 1	SHEET NO. 7

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP. BY: DATE
25	120	Bussman Type KAZ Actuator	KAZ	
		Complete with 10A., 250V.,		
		30,000A. Interrupting		
		Capacity, Indicator		
		Fuse & Fuse Holder Type		
		2778		
	2000	Bussman Type KAZ Ind. Fuse	KAZ	
		Rated 10A., 250V., 30,000A.		
27	500	Bussman Signal Fuse Block	2828	
		4 Pole, 250V. for Item 26		
		above		
28	16	Lithonia Series C	C220	
		Fluorescent Lamp		
		Fixture with Guard		
		& F20T Lamps		
	28	General Electric Type	6422494G12	
		EB-5 Terminal Block		
		12 pt. with Cover		

FILE

WESTINGHOUSE ELECTRIC CORPORATION

MILWAUKEE ENGINEERING SERVICE DIVISION

1701 W. WISCONSIN AVE.
MILWAUKEE, WIS. 53233

7107-17773	CO-33697-MKE-BM	REV. Ø 1	SHEET NO. 8

ITEM	QTY	DESCRIPTION	STYLE NO.	FINAL INSP. BY: DATE
30		Bussman Type FRN		
		Fuse, 250V.		
30a	8	200A.	FRN200	
b	16	150A.	FRN150	
c	24	100A.	FRN100	
d	24	60A.	FRN60	
e	40	400A.	FRN400	
		Not Used		
32	8	Chase-Shawmut Type 55	A4BY1600	
		Amp-Trap Fuse, 600V.		
		1600A., Complete with		
		Mounting Hardware		

FIGURE 44: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 755.5
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, N-S HORIZONTAL

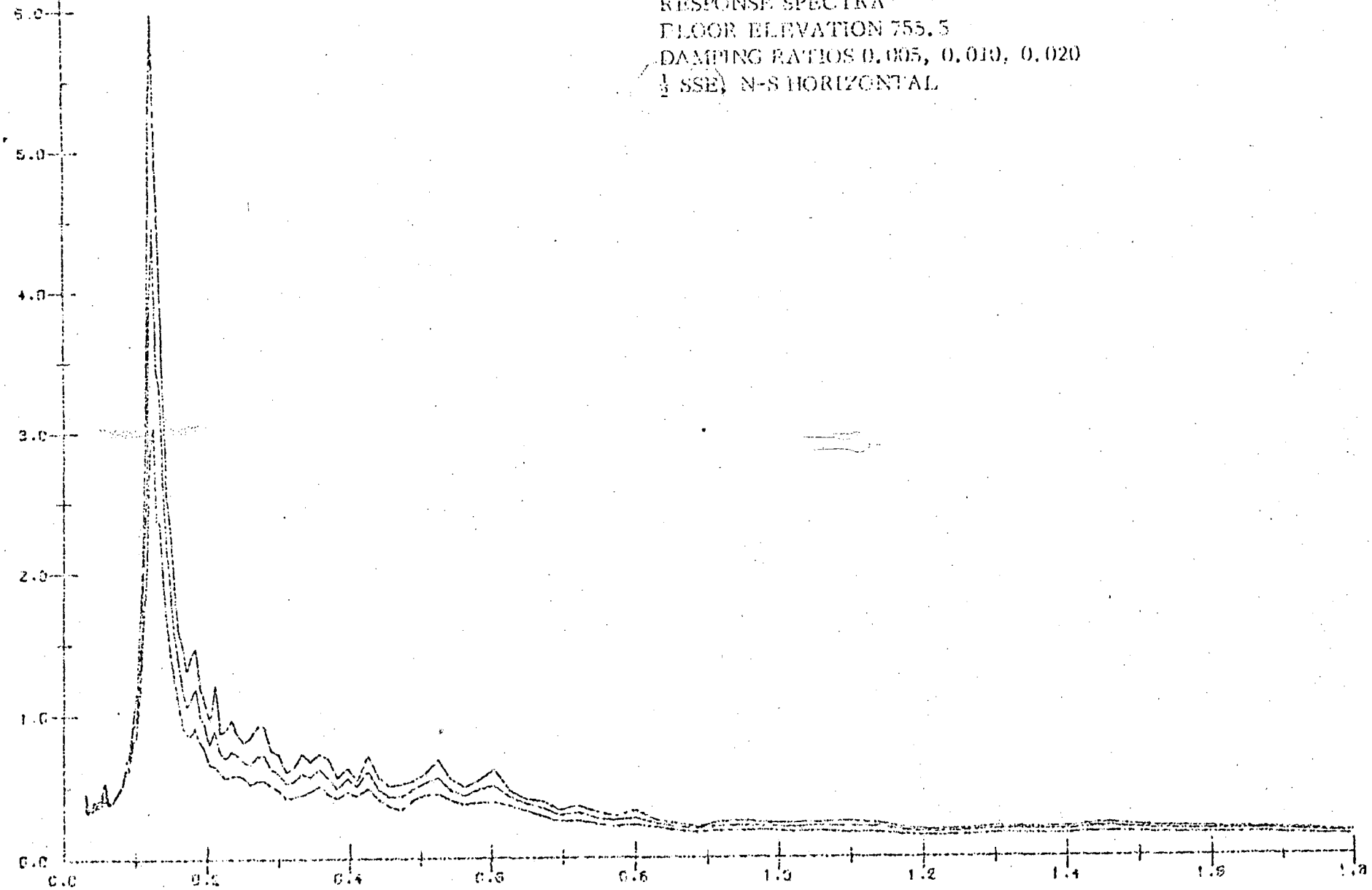


FIGURE 46: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 755.5 — USED FOR 757 ELEV
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, E W HORIZONTAL

THESE SPECTRA REFLECT MAXIMUM TORSIONAL EFFECTS FOR ANY LOCATION AT THIS ELEVATION -- MAXIMUM DISTANCE FROM CENTER OF ROTATION. OVERLY CONSERVATIVE FOR BATTERY BOARDS LOCATION.

SEE NEXT PAGE

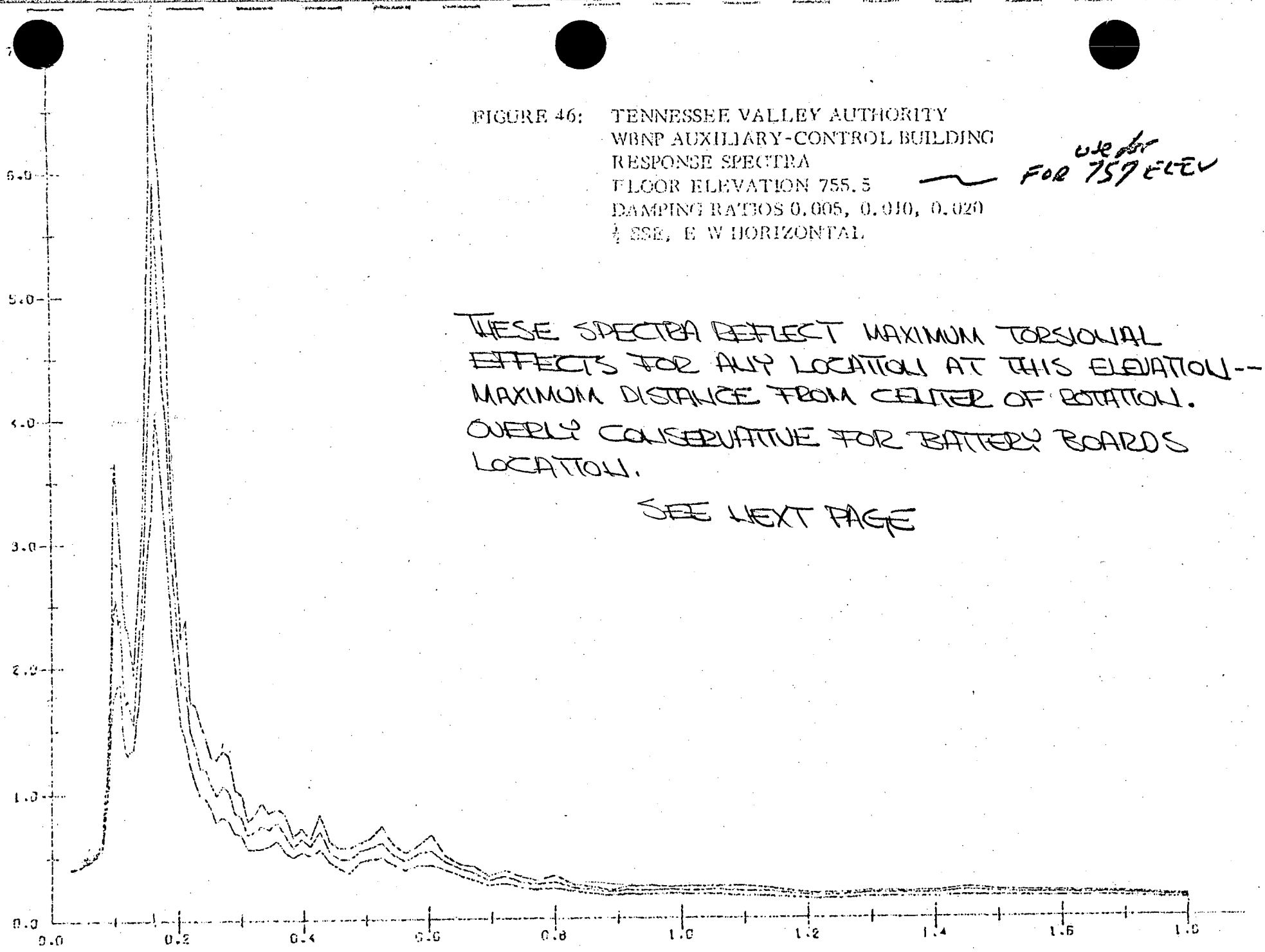


FIGURE 2.46

TENNESSEE VALLEY AUTHORITY 03/13/75
RESPONSE ACCELERATION SPECTRUM
WBNP AUXILIARY-CONTROL BUILDING
MASS POINT NO. 8 EL 755.5
DAMPING RATIO 0.010
SPECTRUM PLOTTED AT CENTER OF MASS
1/2 SAFE SHUTDOWN EARTHQUAKE
EAST-WEST MOTION

THIS SPECTRUM REFLECTS TORSIONAL EFFECTS APPROPRIATE TO THE 125V DC VITAL BATTERY BOARDS.

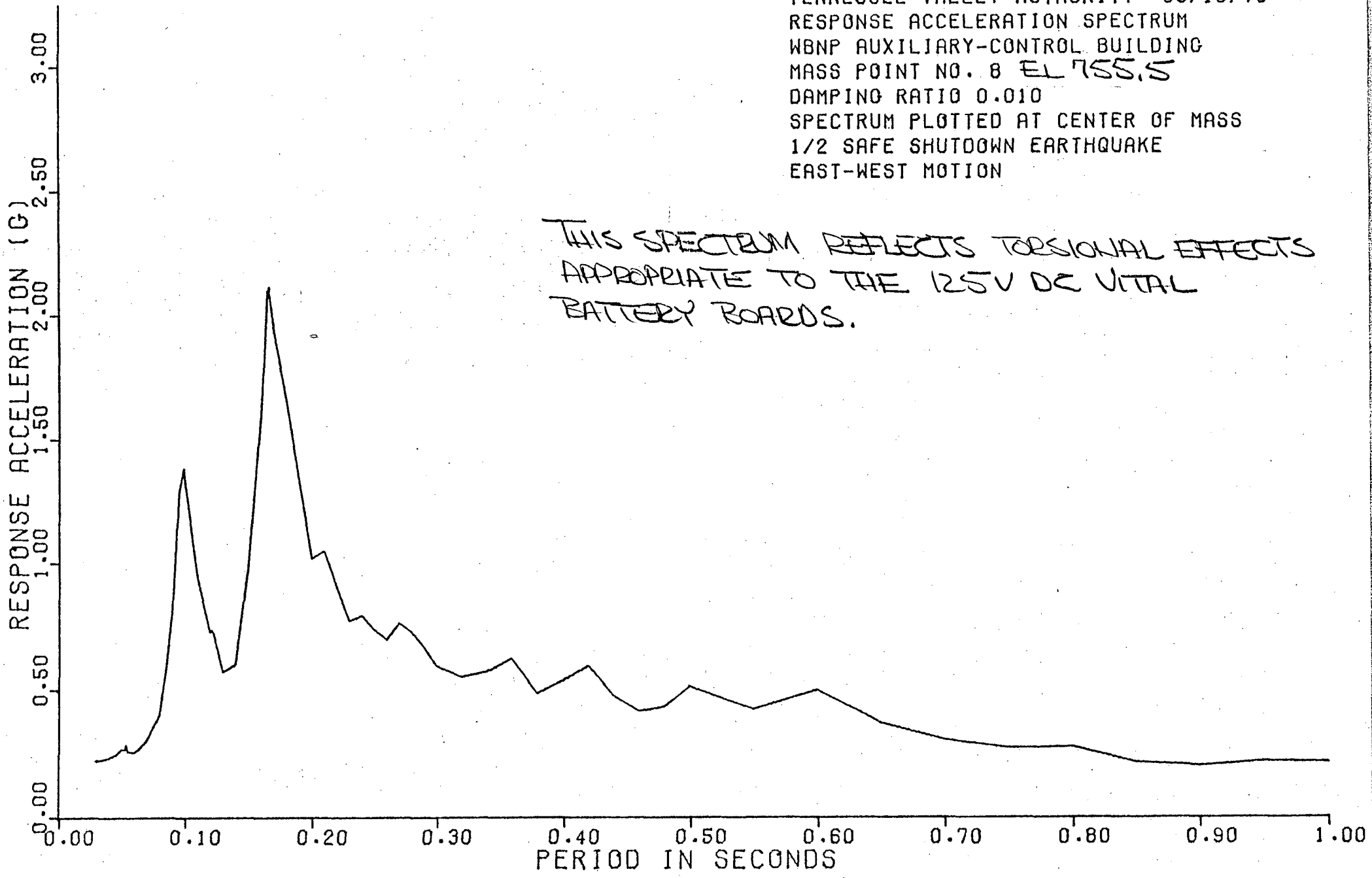
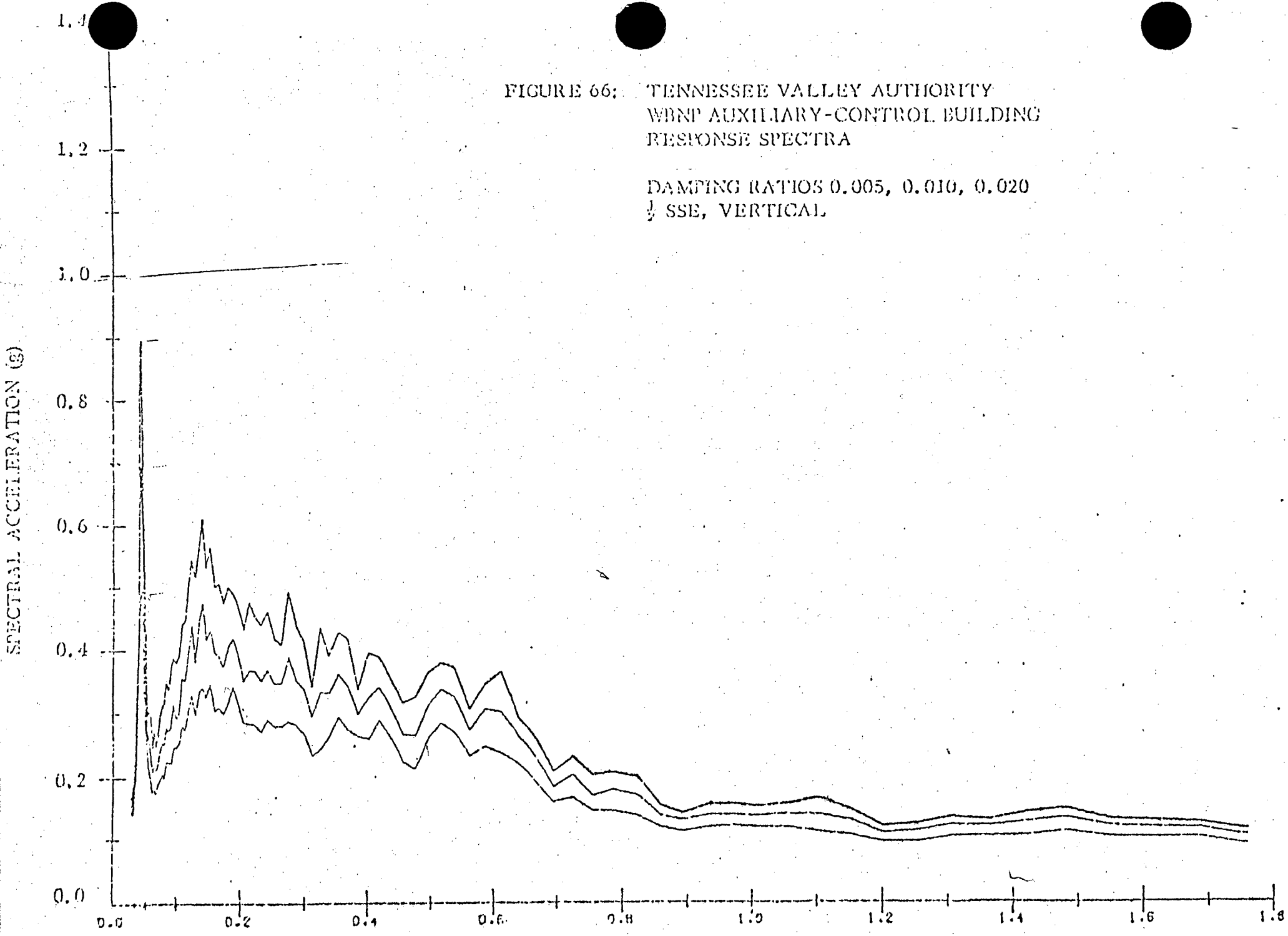


FIGURE 66: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA

DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, VERTICAL



PANELS 1 & 2

TABLE

TYPE OF TEST-1/2 SSE BEAT TEST

PER FIG. 1 FRONT-BACK/VERTICAL

FREQ.	ACCELERATION IN G'S			
	ACCEL. NO. 1	ACCEL. NO. 2	ACCEL. NO. 3	ACCEL. NO. 4
1	.14	.36	.35	.39
2	.15	.36	.36	.41
3	.15	.48	.37	.51
4	.20	.49	.46	.60
6	.18	.55	.41	.63
8	.21	.86	.50	.94
11	.42	1.34	.35	1.47
12	.52	1.30	.40	1.32
16	.41	.47	.43	.54
24	.35	.18	.40	.46
32	.35	.21	.41	.40

ACCEL. NO. 1 -Z -VERT. IN
ACCEL. NO. 3 -X -HORZ. IN
ACCEL. NO. 2 -X -HORZ. OUT H1
ACCEL. NO. 4 -X -HORZ. OUT H2

TVA #75C2-85281
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP. #17773

PANELS 1 & 2

TYPE OF TEST - SSE BEAT TEST
PER FIG. 1 FRONT-BACK/VERTICAL

FREQ.	ACCELERATION IN G'S			
	ACCEL. NO. 1	ACCEL. NO. 2	ACCEL. NO. 3	ACCEL. NO. 4
1	.18	.35	.35	.37
2	.23	.64	.50	.67
3	.38	.80	.70	.94
4	.42	.81	.75	.85
6	.50	1.24	.98	1.90
8	.94	2.38	1.30	2.70
11	.90	1.50	.78	1.73
12	.89	1.28	.77	1.49
16	.81	.55	.80	.59
24	.57	.44	.70	.44
32	.58	.35	.56	1.07

ACCEL. NO. 1 - Z - VERT. IN
ACCEL. NO. 3 - X - HORZ. IN
ACCEL. NO. 2 - X - HORZ. OUT H1
ACCEL. NO. 4 - X - HORZ. OUT H2

TVA #75C2-85281
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP. #17773

PANELS 1 & 2

TABLE

TYPE OF TEST-1/2 SSE BEAT TEST
PER FIG.2 F-B/V ROTATED 180°

FREQ.	ACCELERATION IN G'S			
	ACCEL. NO.1	ACCEL. NO.2	ACCEL. NO.3	ACCEL. NO.4
1	.13	.12	.35	.45
2	.15	.15	.41	.54
3	.14	.14	.37	.50
4	.18	.14	.40	.47
6	.15	.18	.39	.55
8	.13	.11	.35	.81
12	.44	.22	.37	1.75
13	.47	.22	.39	1.70
14	.50	.18	.40	1.35
16	.48	.12	.41	.92
24	.27	.07	.38	.35
32	.29	.14	.35	.37

ACCEL. NO.1 -Z- VERT. IN
ACCEL. NO.2 -Z- VERT. OUT
ACCEL. NO.3 -X- HORZ. IN
ACCEL. NO.4 -X- HORZ. OUT HI

TVA #75C2-85281
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP. #17773

PANELS 1 & 2

TABLE

TYPE OF TEST-SSE BEAT TEST
PER FIG 2 F-B/V ROTATED 180°

FREQ.	ACCELERATION IN G'S			
	ACCEL. NO. 1	ACCEL. NO. 2	ACCEL. NO. 3	ACCEL. NO. 4
1	.17	.15	.36	.40
2	.25	.24	.49	.69
3	.40	.31	.70	1.00
4	.50	.39	.84	.85
6	.35	.40	.79	1.08
8	.26	.37	.78	2.33
12	1.10	.55	.80	2.38
13	.95	.45	.79	1.97
14	.97	.45	.75	1.80
16	.93	.35	.71	1.15
24	.45	.21	.56	.34
32	.34	.14	.37	.44

ACCEL. NO. 1 -Z- VERT. IN
ACCEL. NO. 2 -Z- VERT. OUT
ACCEL. NO. 3 -X- HORZ. IN
ACCEL. NO. 4 -X- HORZ. OUT HI

TVA #75C2-85281
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP. #17773

PANELS 1 & 2

TYPE OF TEST-1/8 SSE BEAT TEST
PER FIG. 3 SIDE-SIDE/VERTICAL

FREQ.	ACCELERATION IN G'S			
	ACCEL. NO.1	ACCEL. NO. 2	ACCEL. NO.3	ACCEL. NO.4
1	.36	.11	.14	.41
2	.35	.11	.15	.41
3	.41	.15	.20	.55
4	.36	.15	.19	.39
6	.40	.15	.20	.58
8	.41	.11	.17	.96
11	.39	.26	.68	1.30
12	.47	.30	.69	1.17
16	.45	.18	.56	.59
24	.37	.13	.50	.45
32	.35	.14	.59	.40

ACCEL. NO.3 - Z - VERT. IN
ACCEL. NO.1 - Y - HORZ. IN
ACCEL. NO.2 - Y - HORZ. OUT H1
ACCEL. NO.4 - Y - HORZ. OUT H2

TVA #75C2-8581
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP. #17773

PANELS 1 & 2

TYPE OF TEST-SSE BEAT TEST
PER FIG. 3 SIDE-SIDE/VERTICAL

FREQ.	ACCELERATION IN G'S			
	ACCEL NO.1	ACCEL NO.2	ACCEL NO.3	ACCEL NO.4
1	.37	.15	.22	.43
2	.48	.22	.26	.65
3	.77	.38	.52	.88
4	.79	.30	.46	.79
6	.77	.40	.60	1.55
8	.70	.38	.77	1.50
11	.75	.46	.76	.91
12	.86	.53	1.05	.96
16	.79	.50	1.15	.81
24	.85	.20	.72	.86
32	.54	.33	.80	.56

ACCEL. NO.3 - Z - VERT. IN
ACCEL. NO.1 - Y - HORZ. IN
ACCEL. NO.2 - Y - HORZ. OUT H1
ACCEL. NO.4 - Y - HORZ. OUT H2

TVA #75C2-8581
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP #17773

PANELS 1 & 2

TABLE

TYPE OF TEST 1/2 SSE BEAT TEST
PER FIG. 4 S-S/V ROTATED 180°

FREQ.	ACCELERATION IN GS			
	ACCEL. NO.1	ACCEL. NO.2	ACCEL. NO.3	ACCEL. NO.4
1	.16	.15	.36	.40
2	.15	.13	.36	.45
3	.16	.15	.35	.40
4	.22	.25	.42	.55
6	.19	.19	.36	.65
8	.40	.47	.35	1.04
12	.41	.37	.35	.44
16	.35	.37	.35	.39
24	.36	.37	.36	.35
32	.32	.12	.32	.34

ACCEL. NO.1 - Z - VERT. IN
ACCEL. NO.2 - Z - VERT. OUT
ACCEL. NO.3 - Y - HORZ. IN
ACCEL. NO.4 - Y - HORZ. OUT HI

TVA #75C2-8581
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP. #17773

PANELS 1 & 2

TABLE C

TYPE OF TEST SSE BEAT TEST
PER FIG.4 S-S/N ROTATED 180°

FREQ.	ACCELERATION IN G'S			
	ACCEL. NO.1	ACCEL. NO.2	ACCEL. NO.3	ACCEL. NO.4
1	.17	.15	.36	.40
2	.26	.22	.54	.70
3	.50	.42	.89	.89
4	.52	.56	.75	1.36
6	.67	.62	.85	1.84
8	.75	.80	.70	1.44
12	1.36	1.10	1.34	.97
16	.76	.66	.85	.40
24	.66	.55	.89	.61
32	.56	.26	.49	.48

ACCEL. NO.1 - Z - VERT. IN
ACCEL. NO.2 - Z - VERT. OUT
ACCEL. NO.3 - Y - HORZ. IN
ACCEL. NO.4 - Y - HORZ. OUT HI

TVA# 75C2-8581
WESTINGHOUSE # CO-33697
SYSTEMS CONTROL CORP# 17773

PANELS 3 & 4

TABLE

TYPE OF TEST-1/2 SSE BEAT TEST
PER FIG.5 FRONT-BACK/VERTICAL

FREQ.	ACCELERATION IN G'S			
	ACCEL NO.1	ACCEL NO. 2	ACCEL NO. 3	ACCEL NO. 4
1	.13	.14	.36	.43
2	.15	.15	.44	.78
3	.18	.16	.40	.58
4	.21	.21	.41	.51
6	.14	.15	.40	.59
8	.17	.18	.46	1.08
12	.36	.27	.45	2.70
16	.36	.36	.40	.57
24	.52	.56	.45	.59
28	.70	.97	.39	1.27
32	.48	.68	.35	.45

ACCEL NO.1 -Z-VERT IN
ACCEL NO.2 -Z-VERT OUT
ACCEL NO.3 -X-HORZ IN
ACCEL NO.4 -X-HORZ OUT HI

TVA #75C2-85281
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP #17773

PANELS 3 & 4

TYPE OF TEST - SSE BEAT TEST
PER FIG. 5 FRONT-BACK/VERTICAL

FREQ.	ACCELERATION IN G'S			
	ACCEL NO.1	ACCEL NO. 2	ACCEL NO.3	ACCEL NO. 4
1	.47	.49	.86	1.37
2	.56	.56	.98	1.84
3	.42	.41	.76	.94
4	.49	.50	.83	.96
6	.54	.54	.99	1.56
8	.42	.46	.86	2.07
12	1.10	1.03	.83	3.04
16	.79	.80	.81	1.15
24	.87	1.07	.75	.60
28	1.00	1.75	.81	1.14
32	.79	.79	.90	.48

ACCEL NO.1 -Z-VERT IN
ACCEL NO.2 -Z-VERT OUT
ACCEL NO.3 -X-HORZ IN
ACCEL NO.4 -X-HORZ OUT HE

TVA #75C2-85281
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP #17773

PANELS 3 & 4

TABLE

TYPE OF TEST - 1/2 SSE BEAT TEST
PER. FIG. 6 F-B/V ROTATED 180°

FREQ.	ACCELERATION IN G'S			
	ACCEL NO.1	ACCEL NO.2	ACCEL NO.3	ACCEL NO.4
1	.18	.18	.40	.43
2	.17	.17	.37	.48
3	.20	.18	.41	.51
4	.19	.19	.38	.45
6	.19	.19	.38	.56
8	.20	.21	.37	.76
12	.30	.33	.40	3.09
16	.31	.29	.38	.68
24	.32	.34	.39	.44
28	.49	.58	.40	.72
32	.45	.34	.47	.42

ACCEL NO. 1 - Z - VERT. IN
ACCEL NO. 2 - Z - VERT. OUT
ACCEL NO. 3 - X - HORZ. IN
ACCEL NO. 4 - X - HORZ. OUT HI

TVA #75C2-85281
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP #17773

PANELS 3 & 4

TABLE

TYPE OF TEST-SSE BEAT TEST
PER FIG. 6 F-R/V ROTATED 180°

FREQ.	ACCELERATION IN G'S			
	ACCEL NO.1	ACCEL NO.2	ACCEL NO.3	ACCEL NO.4
1	.33	.33	.74	.80
2	.36	.40	.82	1.49
3	.44	.39	.90	1.32
4	.43	.47	.95	1.08
6	.41	.48	.91	1.45
8	.36	.46	.86	1.90
12	.71	.57	.82	4.40
16	.60	.77	.87	1.69
24	.92	.87	.81	1.45
28	.95	1.02	.95	1.39
32	.80	.65	.98	.71

ACCEL NO. 1 -Z-VERT. IN
ACCEL NO. 2 -Z-VERT. OUT
ACCEL NO. 3 -X-HORZ. IN
ACCEL NO. 4 -X-HORZ. OUT HI

TVA #75C2-85281
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP #17773

PANELS 3 & 4

TABLE

TYPE OF TEST - 1/2 SSE BEAT TEST

FIG NO. 7 SIDE-SIDE / VERTICAL

FREQ.	ACCELERATION IN G'S			
	ACCEL NO.1	ACCEL NO.2	ACCEL NO.3	ACCEL NO.4
1	.19	.19	.42	.42
2	.18	.19	.37	.45
3	.19	.20	.39	.44
4	.21	.22	.44	.48
6	.22	.22	.45	.55
8	.23	.23	.45	.70
10	.47	.45	.62	2.06
12	.15	.17	.37	.82
16	.14	.24	.42	.42
24	.14	.25	.42	.67
32	.31	.20	.41	.46

ACCEL NO.1 - Z - VERT. IN
ACCEL NO. 2 - Z - VERT. OUT
ACCEL NO. 3 - X - HORZ. IN
ACCEL NO. 4 - X - HORZ. OUT HI

TVA #75C2-85281
WESTINGHOUSE #CO-3697
SYSTEMS CONTROL CORP. #17773

TABLE

TYPE OF TEST-SSE BEAT TEST FIG NO. 7 SIDE-SIDE/VERTICAL

PANELS 3 & 4

FREQ.	ACCELERATION IN G'S			
	ACCEL NO.1	ACCEL NO.2	ACCEL NO.3	ACCEL NO.4
1	.35	.35	.75	.77
2	.41	.40	.83	1.17
3	.43	.43	.88	.91
4	.46	.46	1.00	1.06
6	.41	.46	.93	1.25
8	.47	.61	.82	2.08
10	.73	.63	.90	2.55
12	.39	.46	.74	1.33
16	.26	.48	.88	.84
24	.33	.69	.84	1.60
32	.96	.26	.87	1.33

ACCEL NO.1 - Z - VERT. IN
ACCEL NO. 2 - Z - VERT. OUT
ACCEL NO. 3 - X - HORZ. IN
ACCEL NO. 4 - X - HORZ. OUT HI

TVA #7502-85281
WESTINGHOUSE #CO-3697
SYSTEMS CONTROL CORP #17773

PANELS 3 & 4

TABLE

TYPE OF TEST - 1/2 SSE BEAT TEST

FIG. NO. 8 S-S/J ROTATED 180°

FREQ.	ACCELERATION IN G'S			
	ACCEL. NO.1	ACCEL. NO.2	ACCEL. NO.3	ACCEL. NO.4
1	.19	.19	.38	.39
2	.19	.19	.37	.46
3	.20	.20	.42	.45
4	.23	.23	.49	.53
6	.20	.20	.43	.51
8	.20	.19	.43	.64
10	.34	.49	.38	1.54
12	.28	.70	.52	1.05
16	.20	.53	.40	.37
22	.12	.55	.38	.66
24	.13	.44	.38	.57
27	.18	.47	.38	.66
32	.31	.33	.39	.42

ACCEL. NO.1 - Z - VERT. IN
ACCEL. NO.2 - Z - VERT. OUT
ACCEL. NO.3 - X - HORZ. IN
ACCEL. NO.4 - X - HORZ. OUT HI

TVA # 75C2-85281
WESTINGHOUSE # CO-33697
SYSTEMS CONTROL CORP # 17773

PANELS 3 & 4

FIG NO.8 S-S/N ROTATED 180°

FREQ.	ACCELERATION IN G'S			
	ACCEL. NO.1	ACCEL. NO.2	ACCEL. NO.3	ACCEL. NO.4
1	.35	.38	.78	.82
2	.51	.68	1.07	1.56
3	.46	.53	.99	.99
4	.39	.42	.85	.86
6	.41	.39	.90	1.14
8	.41	.49	.86	1.51
10	1.17	1.18	.85	2.14
12	.45	1.11	.81	1.43
16	.36	1.20	.86	.89
22	.23	1.11	.79	1.44
24	.25	1.18	.77	1.45
27	.43	1.26	.78	1.25
32	.80	.47	.90	.66

ACCEL. NO.1 - Z - VERT. IN
ACCEL. NO.2 - Z - VERT. OUT
ACCEL. NO.3 - X - HORZ. IN
ACCEL. NO.4 - X - HORZ. OUT HI

TVA #75C2-85281
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP. #17773

PANELS 3 & 4

FIG. NO.8 S-S/N ROTATED 180°

FREQ.	ACCELERATION IN G'S			
	ACCEL. NO.1	ACCEL. NO.2	ACCEL. NO.3	ACCEL. NO.4
1	.35	.38	.78	.82
2	.61	.68	1.07	1.56
3	.46	.53	.99	.99
4	.39	.42	.85	.86
6	.41	.39	.90	1.14
8	.41	.49	.86	1.51
10	1.17	1.18	.85	2.14
12	.45	1.11	.81	1.43
16	.36	1.20	.86	.89
22	.23	1.11	.79	1.44
24	.25	1.18	.77	1.45
27	.43	1.26	.78	1.25
32	.80	.47	.90	.66

ACCEL. NO.1 - Z - VERT. IN
ACCEL. NO.2 - Z - VERT. OUT
ACCEL. NO.3 - X - HORZ. IN
ACCEL. NO.4 - X - HORZ. OUT HI

TVA #75C2-85281
WESTINGHOUSE #CO-33697
SYSTEMS CONTROL CORP. #17773

Attachment No. 3 ITEM 13/14 1 of 3 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: CONTROL SYSTEM CABINET -87352

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: Quantity:
3. Size or Range:
4. Vendor: ROBERTSHAW CONTROLS CO.
5. If the component is a cabinet or panel, name and model Number of the devices included: SEPARATE SQRT FORMS PROVIDED
6. Physical Description:
   a. Appearance: RECTANGULAR CABINET
   b. Dimensions:
   c. Weight:
7. Location: Building: AUX CONT BLDG
   Elevation: 708
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [ ]
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR MOUNTED
10. a. System in which located:
    b. Functional Description: CABINET IN WHICH ALARM UNITS & RELAYS ARE INSTALLED
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
    [X] Both [ ] Neither [ ] Other

11. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 2782

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations.
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WYLE LABORATORIES

(No., Title and Date): # 43675-1; JULY 28, 1977

Company that Prepared Report:

Company that Reviewed Report: TVA

Where Report is filed or available:

Applicable Codes And/Or Standards:

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 5% SSE 5%

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other _____ (specify)

OBE S/S = .2 F/B = .2 V = .12

SSE S/S = .4 F/B = .4 V = .24

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGING

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random [ ] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[X] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 5 SSE 1 Other _____ (specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 20,23 HZ F/B = 25 HZ V = RIGID

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test ATTACHED

[X] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = .44 F/B = .44 V = .26

~~OBE~~ SSE S/S = .8 F/B = .65 V = .26

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[X] Weld (Length 2" EACH WAY AT EACH CORNER) [ ] _____

B. Orientation and Fixturing: 2 ORIENTATIONS - SS/V, FB/V

10. Functional operability verified:

[ ] Yes [X] No [ ] Not Applicable

11. Test Results including modifications made: NO PROBLEMS

12. Other tests performed (such as aging or fragility test, including results):

13. Failure Modes (If appropriate _____)

14. Margins Available: [X] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 711.5
DAMPING RATIOS 0.050, 0.100, 0.150
SSE, N-S HORIZONTAL

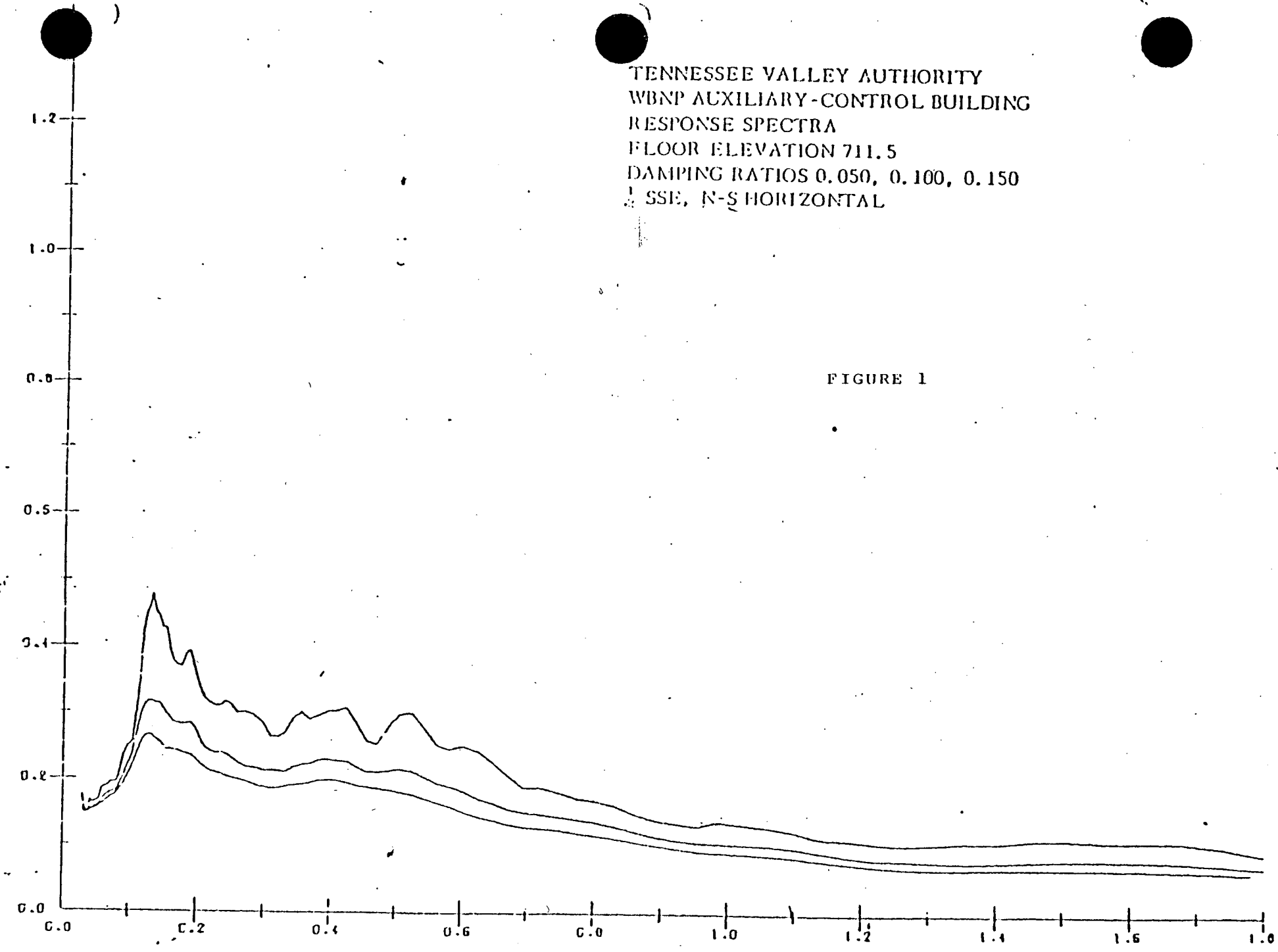
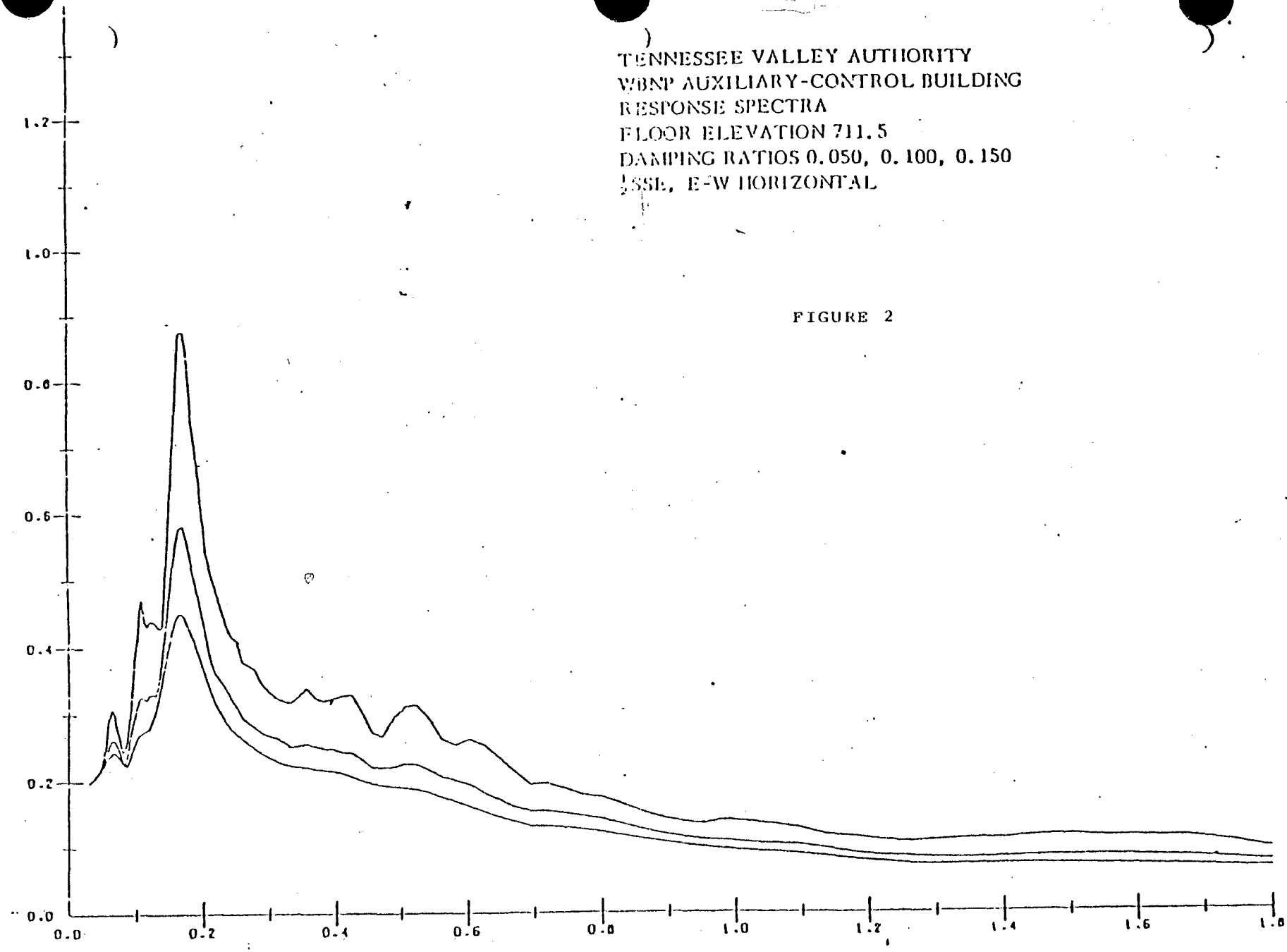


FIGURE 1

TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 711.5
DAMPING RATIOS 0.050, 0.100, 0.150
SSE, E-W HORIZONTAL

FIGURE 2



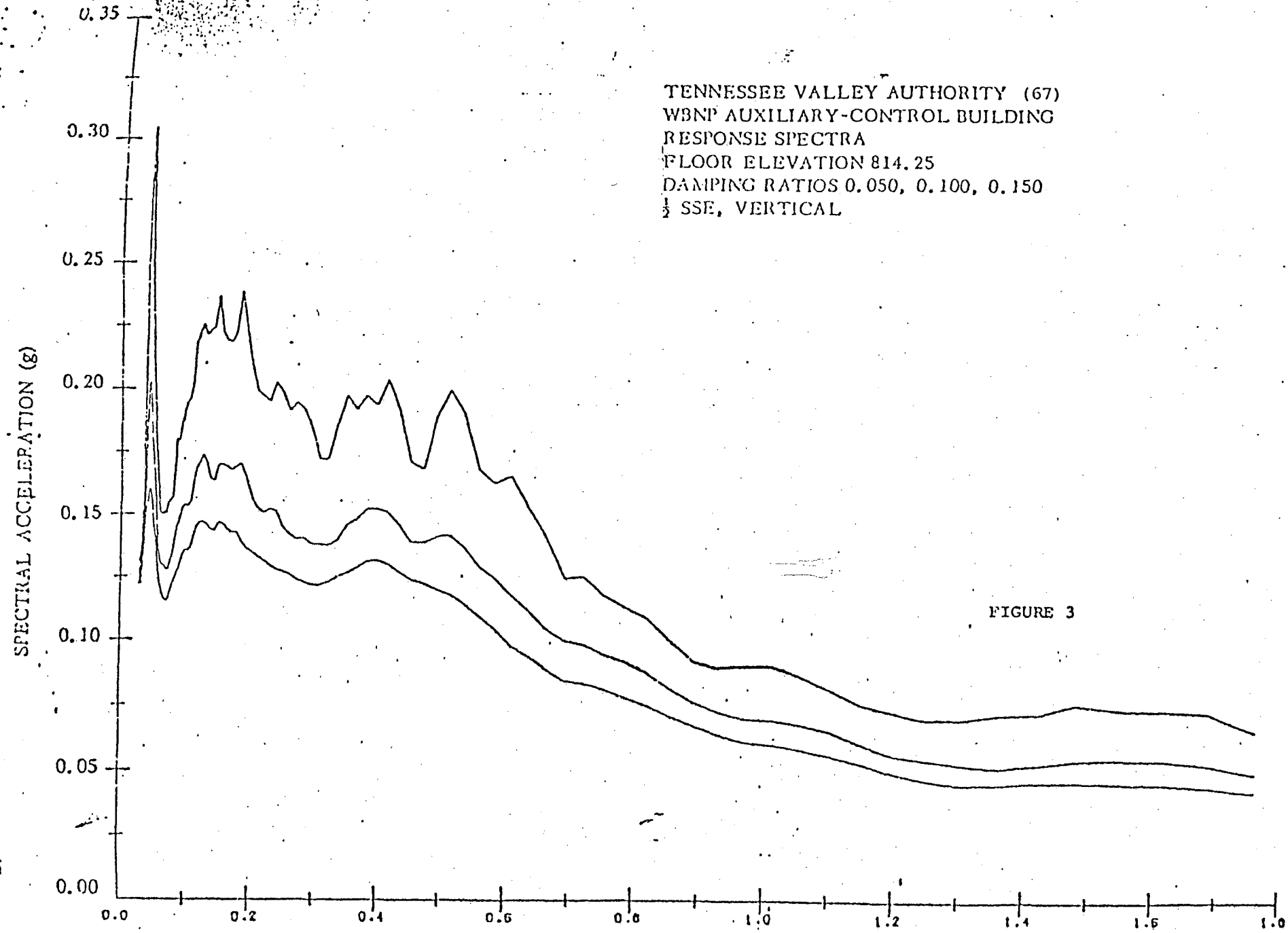


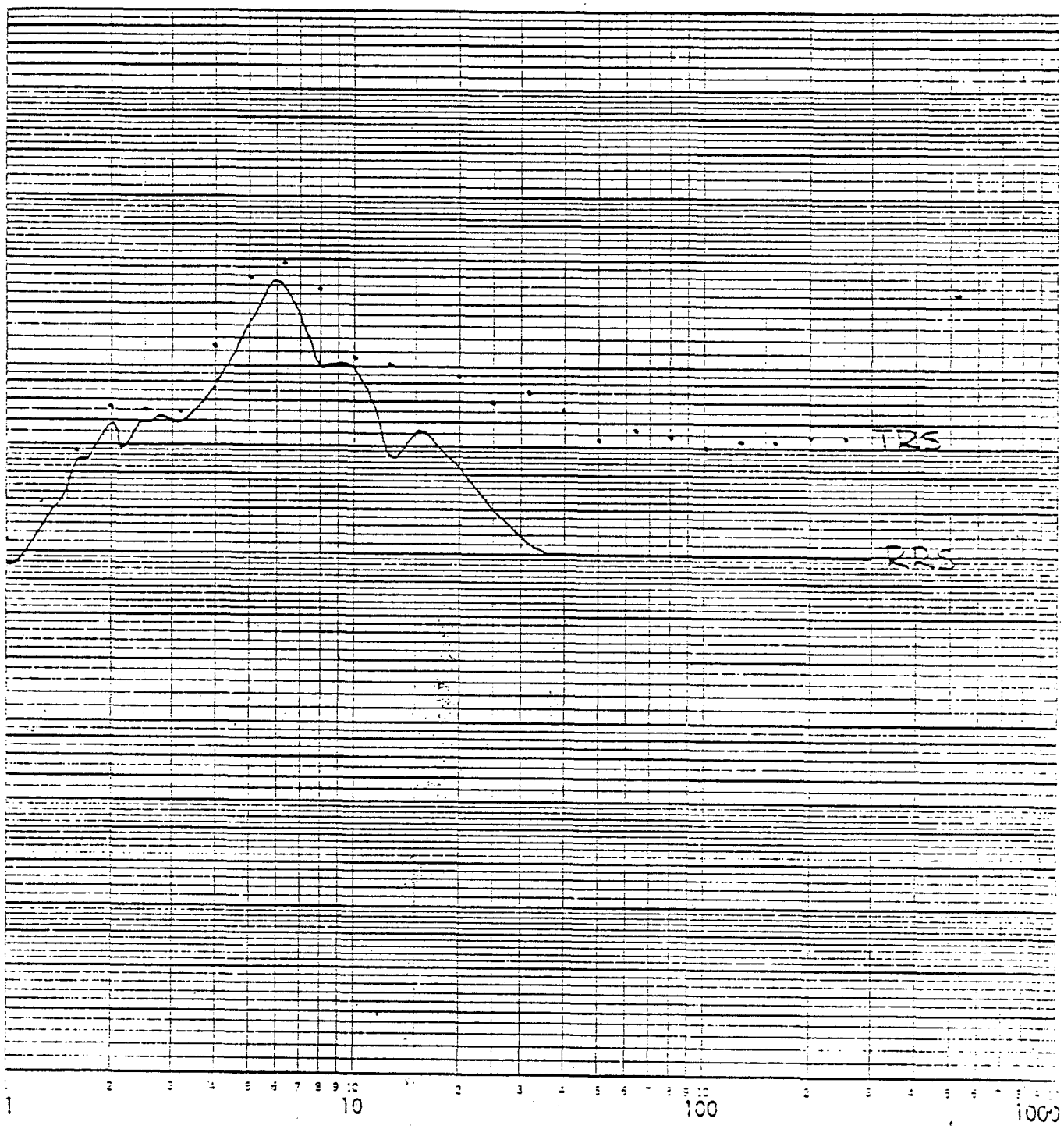
FIGURE 3

FIGURE 67

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

DAMPING 5%



AXIS F-B/VERT

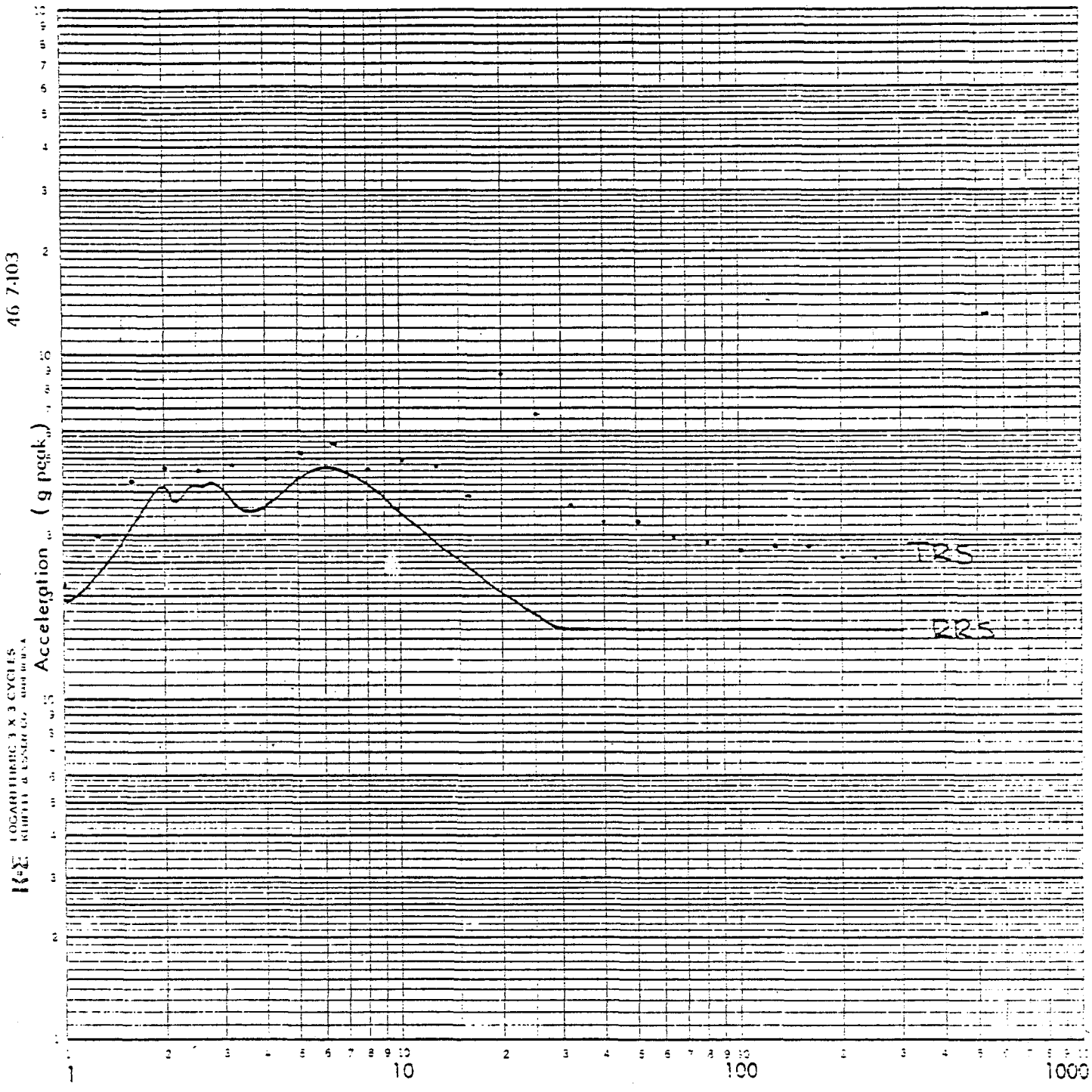
LOCATION NO. HCA

TEST RUN NO. 10

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

DAMPING 5 %



AXIS E-W/VERT

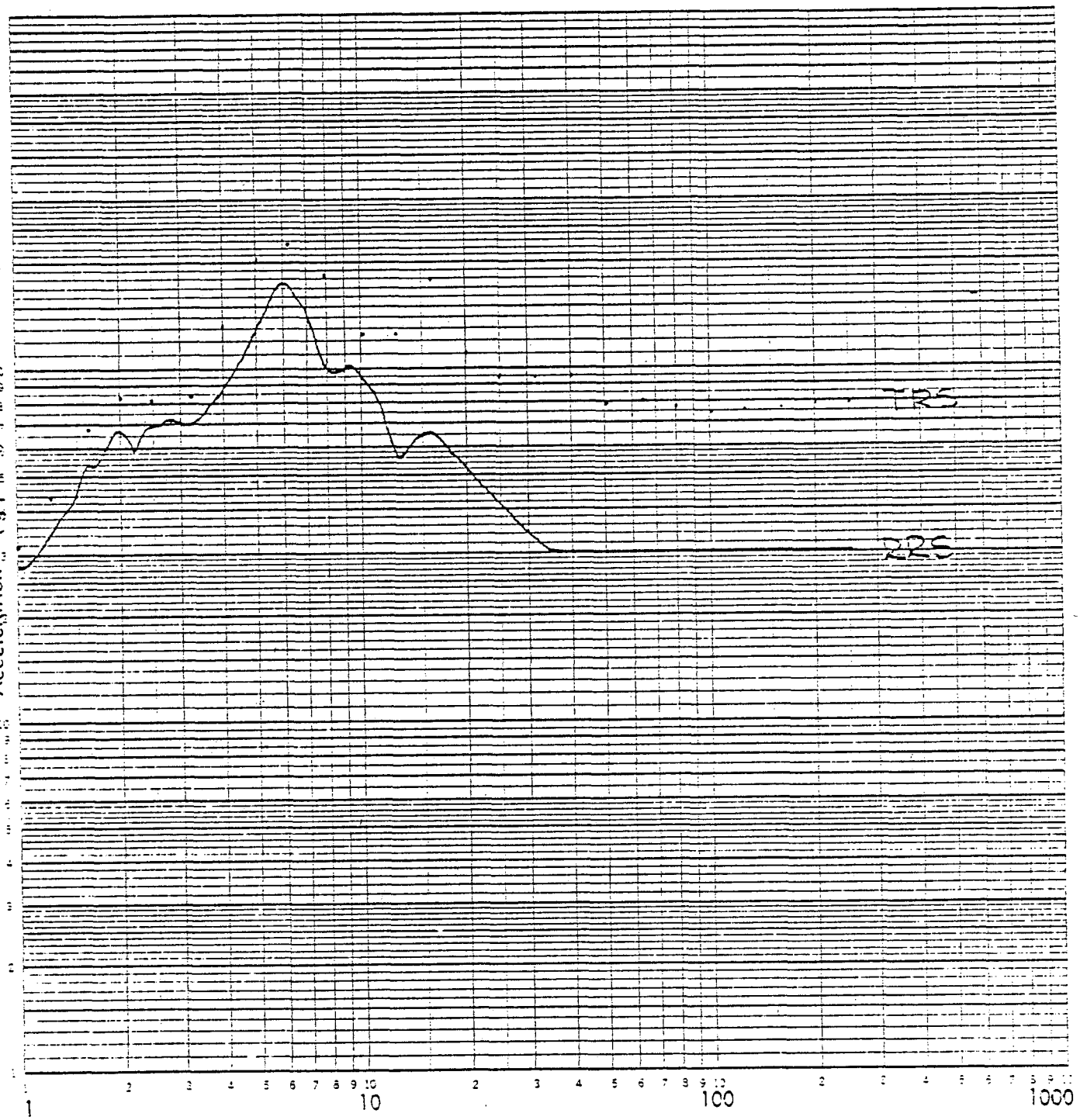
LOCATION NO. VCA

TEST RUN NO. 10

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

DAMPING 5%



AXIS S-S/VERT

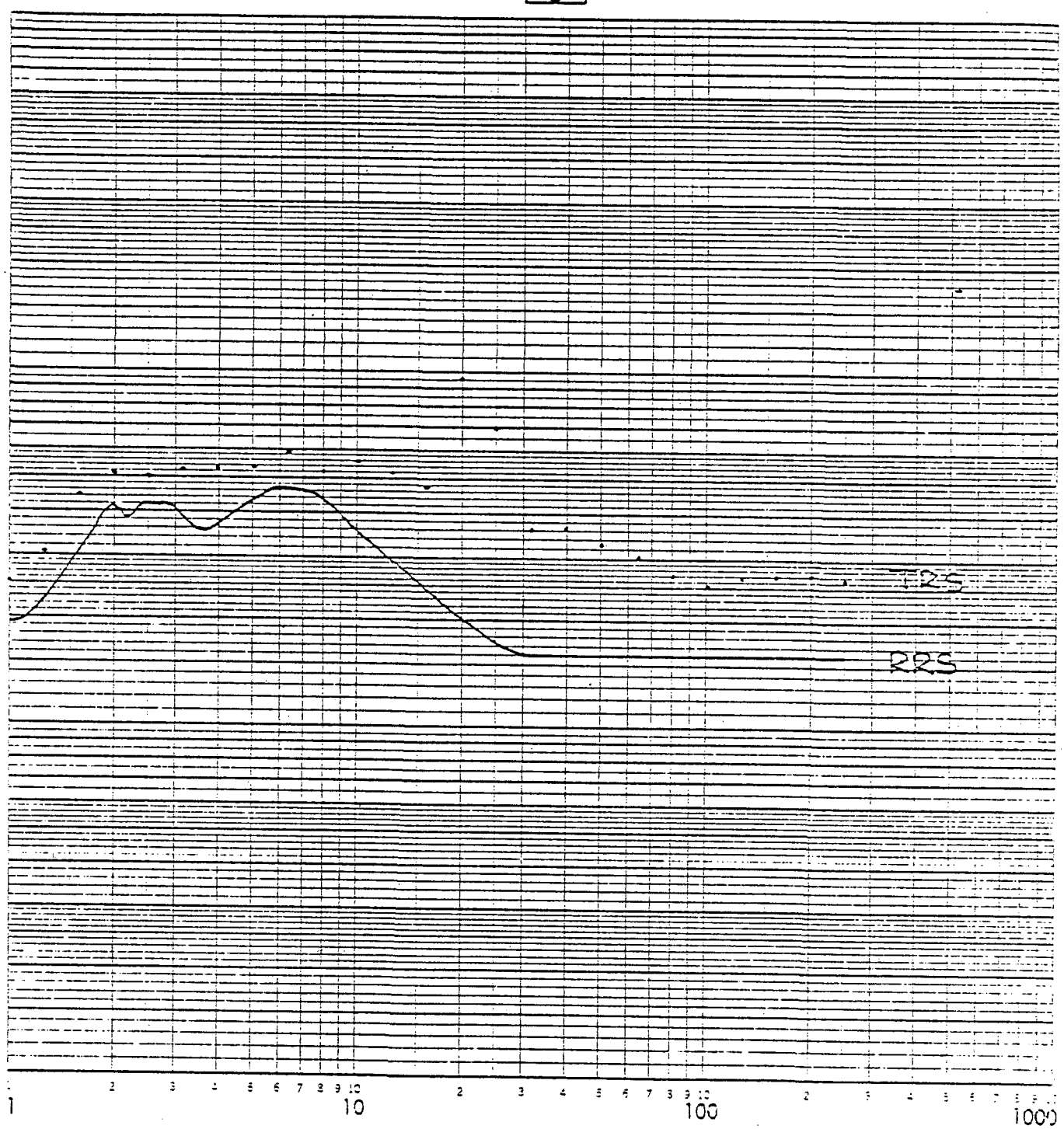
LOCATION NO. HCA

TEST RUN NO. 18

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☒ 100 ☐ 1000 ☐

DAMPING 5%



AXIS S-S/VERT

LOCATION NO. VCA

TEST RUN NO. 18

Attachment No. 3

ITEM 13/14 2 OF 3

1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR

Type:

1. Utility: TVA — PWR ✓
2. NSSS: (W) — BWR
3. A/E: TVA — Other

II. Component Name: DUPLEX ALARM RELAY / SUM & DIFFERENCE AMPLIFIER

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: 553 Quantity: NUMEROUS
3. Size or Range: —
4. Vendor: ROBERTSHAW CONTROLS CO
5. If the component is a cabinet or panel, name and model Number of the devices included: —
6. Physical Description:
   a. Appearance:
   b. Dimensions: 7.5" x 3" x 8"
   c. Weight: 4 LB
7. Location: Building: AUX CONT BLDG
   Elevation: 708
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   INSTALLED IN FLOOR MOUNTED PANEL
10. a. System in which located: VARIOUS BOP SYSTEMS
    b. Functional Description: ANNUNCIATE ALARMS AND GIVE LOGIC SIGNALS FOR VARIOUS ~~SAFETY~~ RELATED SYSTEMS
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other

11. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 2782

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WYLE LABORATORIES

(No., Title and Date): # 42934-1 ; APRIL 29, 1975

Company that Prepared Report:

Company that Reviewed Report: TVA

Where Report is filed or available:

Applicable Codes And/Or Standards:

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): SERIES OF SINE BEAT (10 CPS) TESTS -- TEST FREQS: 4.5, 6, 9, 12, 18, 24, 29, 33 42 - 5 BEATS/FREQ

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: NA OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [X] Other 3G HORIZ (2 AXES) / 2G VERT
(specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = _____ F/B = _____ V = _____

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGING

VI. If Qualification by Test, then Complete:

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [X] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[ ] Independent axis [X] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE 2 Other _____
(specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = NONE F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test NA

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = 3G F/B = 3G V = 3G

9. Laboratory Mounting:

A. [X] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: 45° TO INPUT MOTION -- 4 ORIENTATIONS

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: NO PROBLEMS

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

CONSERVATISM OF TEST OVER REQUIREMENT FOR CABINET INSTALLATION

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

Attachment No. 3

ITEM 13/14 3 OF 3

1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: ALARM RELAY / POWER SUPPLY

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: 554 Quantity: NUMEROUS
3. Size or Range: —
4. Vendor: ROBERTSHAW CONTROLS
5. If the component is a cabinet or panel, name and model Number of the devices included: —
6. Physical Description:
   a. Appearance:
   b. Dimensions: 7.62" x 3" x 8"
   c. Weight: 4 LB
7. Location: Building: AUX CONT BLDG
   Elevation: 708
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   INSTALLED IN FLOOR MOUNTED PANEL
10. a. System in which located: VARIOUS ROP SYSTEMS
    b. Functional Description: ANNUNCIATE ALARMS AND GIVE LOGIC SIGNALS FOR SAFETY-RELATED SYSTEMS
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other

11. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 2782

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WYLE LABORATORIES

(No., Title and Date): 43280-2 ; JULY 19, 1976

Company that Prepared Report: _____

Company that Reviewed Report: TVA

Where Report is filed or available: _____

Applicable Codes And/Or Standards: _____

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): _____

SERIES OF SINE BEAT (10 CPB) TESTS -- TEST FREQ @ 1/3 OCT INCREMENTS 1-35 HZ - 5 BEATS/FREQ

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: NA OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [ ] Other 3G HORZ (2 AXES) / 2G VERT
(specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = _____ F/B = _____ V = _____

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGEING

VI. If Qualification by Test, then Complete:

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [X] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[ ] Independent axis [X] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE 2 Other _____
(specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = LOWE _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test NA

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

~~OBE~~ SSE S/S = 3G F/B = 3G V = 3G

9. Laboratory Mounting:

A. [X] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: 45° TO INPUT MOTION - 4 ORIENTATIONS

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: NO PROBLEM AT QUALIFICATION LEVELS

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate ELECTRICAL MISFUNCTION - FRAGILITY LIMITS

14. Margins Available: [ ] Input Spectrum [X] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

Seismic and Dynamic Qualification Summary of Equipment MSIV - VALVE

ITEM 15 1 OF 3

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: W BWR
3. A/E: TVA Other

II. Component Name: MAIN STEAM ISOLATION VALVE 76K38-83080

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: N/A Quantity: 8
3. Size or Range: 32"
4. Vendor: Atwood & Morrill (76K38-83080)
5. If the component is a cabinet or panel, name and model Number of the devices included: N/A
6. Physical Description:
   a. Appearance: Main Steam Isolation Valves, bidirectional, Air-operated
   b. Dimensions: See dwg 1382401-H sheets 1-3 Rev 5 166X117"
   c. Weight: 27,250 lbs
7. Location: Building:
   Elevation:
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [X] Weld (Length ____)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   PIPE MOUNTED
10. a. System in which located: MAIN STEAM
    b. Functional Description: PREVENTS EXCESSIVE COOLING & DEPRESSURIZATION OF PRIMARY SIDE AFTER MAIN STEAM LINE BREAK
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements:

WBNP-DS-3835-2020-R1

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations.
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 32" MSIV STRESS ANALYSIS

(No., Title and Date): 501-13824-00 9/9/76

Company that Prepared Report: ATWOOD & MORRILL CO

Company that Reviewed Report: TVA

Where Report is filed or available: TVA

Applicable Codes And/Or Standards: ASME SEC III CL 2

V. Vibration Input:

1. Loads considered:
   a. [x] Seismic only
   b. [X] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): N/A

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: NA OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [ ] Other _____ (specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = 3g F/B = 3g V = 2g

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] _____

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [X] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 58.2 Hz F/B = 58.2 Hz V = NA

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [X] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[X] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[X] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping: NA

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: FIXED

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

1.23

BODY - General Pri Memb. Stress Inten = $\frac{17.5}{15.2} = 1.15$

BONNET FLANGE - Long Hub Stress = $\frac{26.25}{15.14} = 1.73$

Attachment No. 3

CONTROL PANEL
OPERATOR
VALVE

ITEM 15 1/5
2 OF 3

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: W BWR
3. A/E: TVA Other

II. Component Name: CONTROL PANEL FOR MSIV

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: NA Quantity: 8
3. Size or Range:
4. Vendor: ATWOOD & MORRILL
5. If the component is a cabinet or panel, name and model Number of the devices included:
6. Physical Description:
   a. Appearance:
   b. Dimensions:
   c. Weight:
7. Location: Building:
   Elevation:
8. Field Mounting Conditions NA [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [ ]
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   CONTROL PANEL ATTACHED TO MSIV EXTENDED STRUCTURE (TOPWORKS)
10. a. System in which located:
    b. Functional Description:
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [ ] Both [ ] Neither [ ] Other

11. Pertinent Reference Design Specifications for Qualification Requirements: _____

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: A&M S.O. 13824 - TVA ORDER - 76K38-83080

(No., Title and Date): SEIS QUAL TEST RPT 32" MSIV CONTROL PANEL

Company that Prepared Report: ENVIRONMENTAL TEST LAB - AYCO SYS DIV

Company that Reviewed Report: A&M

Where Report is filed or available: TVA

Applicable Codes And/Or Standards: IEEE 344-75

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [X] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [X] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): 6g horz / 4g vertical

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: *NA* OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[*3*] ZPA [ ] Other _____ (specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = _____ F/B = _____ V = _____

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete:

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] _____

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [X] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: *0-35Hz*

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = *> 50 Hz* F/B = *> 50 Hz* V = *> 50 Hz*

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test *NA*

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test: 6g

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [X] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: SATISFIES ALL STRUCTURAL AND OPERABILITY REQUIREMENTS

12. Other tests performed (such as aging or fragility test, including results):

NA

13. Failure Modes (If appropriate NA)

14. Margins Available: [X] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete: NA

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

Attachment No. 3 MSIV OPERATOR 1/5

ITEM 15
3 OF 3

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: W BWR
3. A/E: TVA Other

II. Component Name: AIR SPRING ACTUATOR FOR MSIV

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: Quantity:
3. Size or Range:
4. Vendor:
5. If the component is a cabinet or panel, name and model Number of the devices included:
6. Physical Description:
   a. Appearance:
   b. Dimensions:
   c. Weight: 3200#
7. Location: Building:
   Elevation:
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [ ]
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   VALVE MOUNTED
10. a. System in which located:
    b. Functional Description:
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [ ] Both [ ] Neither [ ] Other

11. Pertinent Reference Design Specifications for Qualification Requirements: _____

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: NUCLEAR QUALIFICATION TEST REPORT ON

(No., Title and Date): MSIV AIR SPRING ACTUATOR -STR-060578-1 10/23/78

Company that Prepared Report: AMERICAN ENVIRONMENTAL CO

Company that Reviewed Report: ATWOOD MORRILL CO.

Where Report is filed or available: TVA

Applicable Codes And/Or Standards: IEEE 323, 344 & 382

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[ ] Absolute Sum [ ] SRSS [ ] NA (other, specify)

3. Required Response Spectra** (attach the graphs): _____

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [ ] Other _____ (specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = 3g F/B = 3g V = 2g

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: Extensive number and level of tests.

VI. If Qualification by Test, then Complete:

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[ ] Independent axis [X] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE 4 Other _____ (specify)

4. Frequency Range: 1-35Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
Several noted depending on position of valve and opening.
S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test NA

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

~~OBE~~ SSE S/S = 12g F/B = 12g V = 8g

9. Laboratory Mounting:

A. [ ] Bolt (No. 10, Size 2¼)- 8UN

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: NORMAL IN SERVICE

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: SUCCESSFULLY COMPLETED ALL PHASES.

12. Other tests performed (such as aging or fragility test, including results):

MECHANICAL LIFE, RADIATION SOAK, THERMO CYCLIC AGING, RESONANT FREQ. SEARCH, STATIC BEND, AND ABNORMAL AMBIENT SIMULATION (LOCA) TESTS.

13. Failure Modes (If appropriate NA)

14. Margins Available: [X] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete: NA

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

Attachment No. 3

MAIN FEEDWATER ISOLATION VALVE 1/5

ITEM 16

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: W BWR
3. A/E: TVA Other

II. Component Name: MAIN FEEDWATER ISOLATION VALVE

1. Scope: [ ] NSSS [X] BOP [ ] Other 74C38-83015
2. Model Number: N5232 WE A-12819-M-1 Quantity: 8
3. Size or Range: 16" 600#
4. Vendor: WALWORTH CO.
5. If the component is a cabinet or panel, name and model Number of the devices included: NA
6. Physical Description:
   a. Appearance: 16" 600# GATE VALVE / LIMITORQUE SB-4-30
   b. Dimensions: 40 x 95"
   c. Weight: 6875#
7. Location: Building: REACTOR BLDG
   Elevation: ≈ 731
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [X] Weld (Length 16" ϕ)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   PIPE MOUNTED
10. a. System in which located: MAIN FEEDWATER (3)
    b. Functional Description: PREVENT OVERCOOLING OF THE PRIMARY SIDE, AND PREVENT LOSS OF FEEDWATER FROM STEAM GENERATOR
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
    [X] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements: _____

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [X] Combination of Test and Analysis

Qualification Report*: SEISMIC QUALIFICATION ACTIVE BOLTED BONNET

(No., Title and Date): GATE VALVE G-5 REV. 1

Company that Prepared Report: WALWORTH

Company that Reviewed Report: TVA

Where Report is filed or available: TVA

Applicable Codes And/Or Standards: ASME SEC III CL 2 ACTIVE

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): NA

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [ ] Other _____ (specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = 3g F/B = 3g V = 2g

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[X] STATIC LOAD STROKE

2. [X] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: NA

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 66 Hz F/B = 37 Hz V = _____

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test NA

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

~~OBE~~ SSE S/S = 3g F/B = 3g V = 2g

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: NO IMPAIRMENT OF OPERABILITY.

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

Attachment No. 3 ITEM 17 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: ERCW PUMP 76K31-83158

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: 32BXL - 2 STAGE Quantity: 8
3. Size or Range: 11,800 GPM @ 210' TDH, 800 HORSEPOWER
4. Vendor: BORG-WARNER CORP / BYRON-JACKSON PUMP DIV
5. If the component is a cabinet or panel, name and model Number of the devices included: NA
6. Physical Description:
   a. Appearance: VERTICAL TURBINE PUMP
   b. Dimensions: 4'6" DIAM x 93'6" TALL
   c. Weight: 31,785 LB (PUMP & MOTOR, DRY)
7. Location: Building:
   Elevation:
8. Field Mounting Conditions [X] Bolt (No. 8, Size 1½"ϕ)
   [ ] Weld (Length)
   [ ]
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR MOUNTED
10. a. System in which located: ERCW SYSTEM
    b. Functional Description: PROVIDE COOLING FOR VITAL COMPONENTS IN PLANT
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other

2/5

11. Pertinent Reference Design Specifications for Qualification Requirements: WBNP-DS-1925-2260-00 plus Appendix C

Design Criteria for Seismic Qualification of Category I Fluid System Components and Electrical or Mechanical Equipment 7/15/

(a) Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations.
d. Service Conditions
e. Qualified Life
(f) Wind

III. Is Equipment Available for Inspection in the Plant:

[✓] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [✓] Analysis [ ] Combination of Test and Analysis

Qualification Report*: Seismic Stress Analysis

(No., Title and Date): ME-274, Seismic - Stress Analysis 12/12/75 Addendum 3 3/17/77

Company that Prepared Report: McDonald Engr. Analysis Co

Company that Reviewed Report: TVA

Where Report is filed or available: TVA

Applicable Codes And/Or Standards: ASME Section III Class 3 Pumps

V. Vibration Input: [✓] Seismic + Wind

1. Loads considered:
   a. [ ] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[✓] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): Figs. C15 & D9 ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

3/5

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direction:

[✓] ZPA [ ] Other _____ (specify)

OBE S/S = .33g req'd / .375g used F/B = .33g req'd / .375g used V = .1

SSE S/S = .66g req'd / .750g used F/B = .66g req'd / .750g used V = .2

6. Were fatigue effects considered?

[ ] Yes [✓] No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] _____

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[✓] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 33 Hz F/B = 34 Hz V = 16 Hz

3. Model Type: [✓] 3D [ ] 2D [ ] 1D

[✓] Finite Element [✓] Beam

[ ] Closed Form Solution [ ] Other _____

4. [✓] Computer Codes: ICES - STRUDL

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[✓] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE 2% SSE 2% Basis for the damping used: Table 3.1-1

7. Support Considerations in the model: Anchor bolts in concrete

8. Critical Structural Elements: Anchor Bolts & Nozzle

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Anchor Bolts	Seismic + Wind (Upset)	S- 15 041 psi V- 3752 psi		20 000 10 000
Nozzle	Normal Nozzle Loads		14 921	15 000

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.02 inches	Shaft	.08 inches

9. Failure Modes: Anchor Failure

10. Margins Available: [✓] Input Spectrum [ ] Stress or Deflection

1.3 (Nozzle Loads Dominate)

TENNESSEE VALLEY AUTHORITY 01/08/74
RESPONSE ACCELERATION SPECTRUM
WBNP INTAKE PUMPING STATION
MASS POINT NO. 10
DAMPING RATIO 0.020
1/2 SAFE SHUTDOWN EARTHQUAKE
FLOOR ELEVATION 741.0
HORIZONTAL ACCELERATION

Doubled for SSE

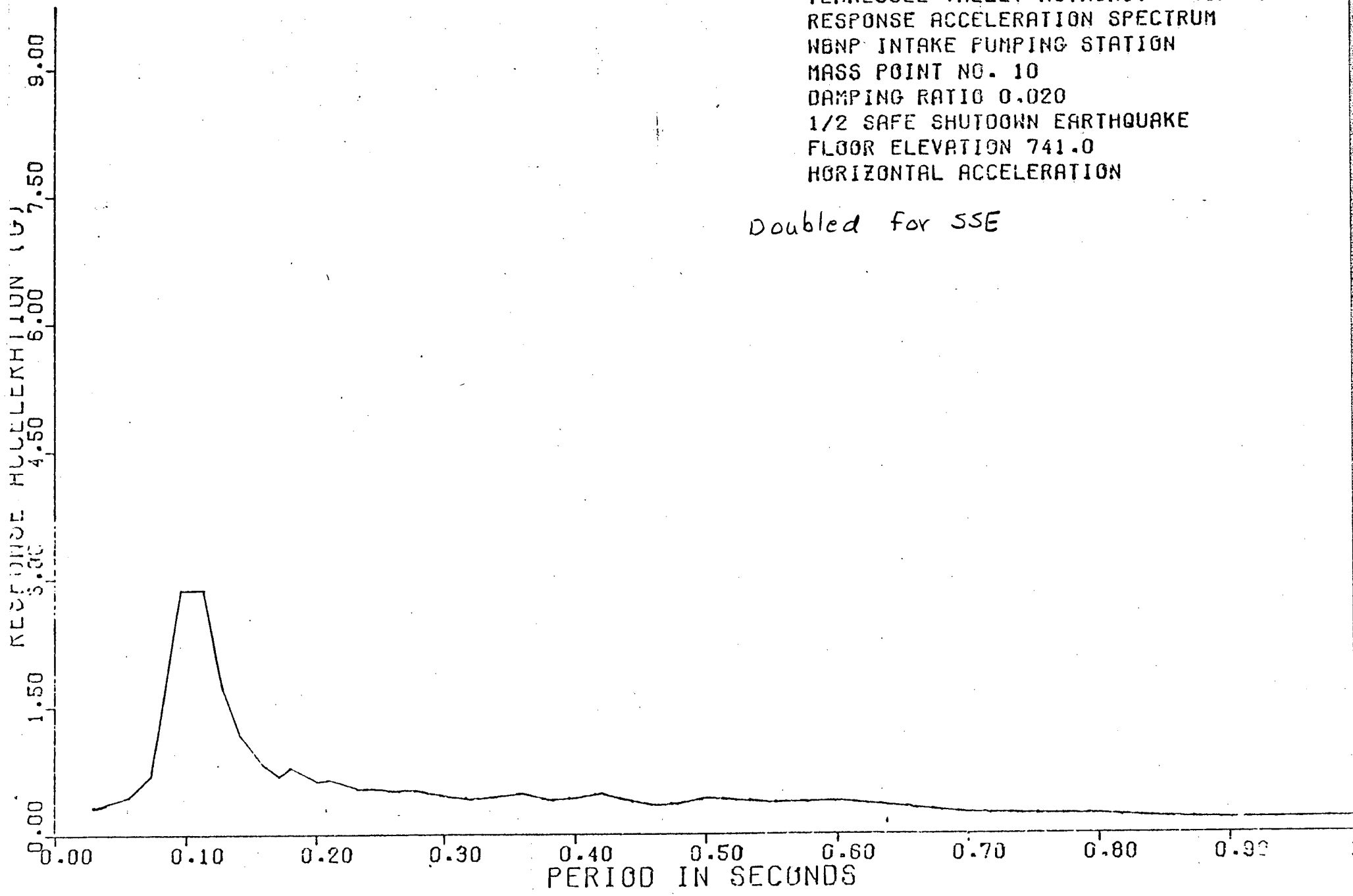


FIGURE C15

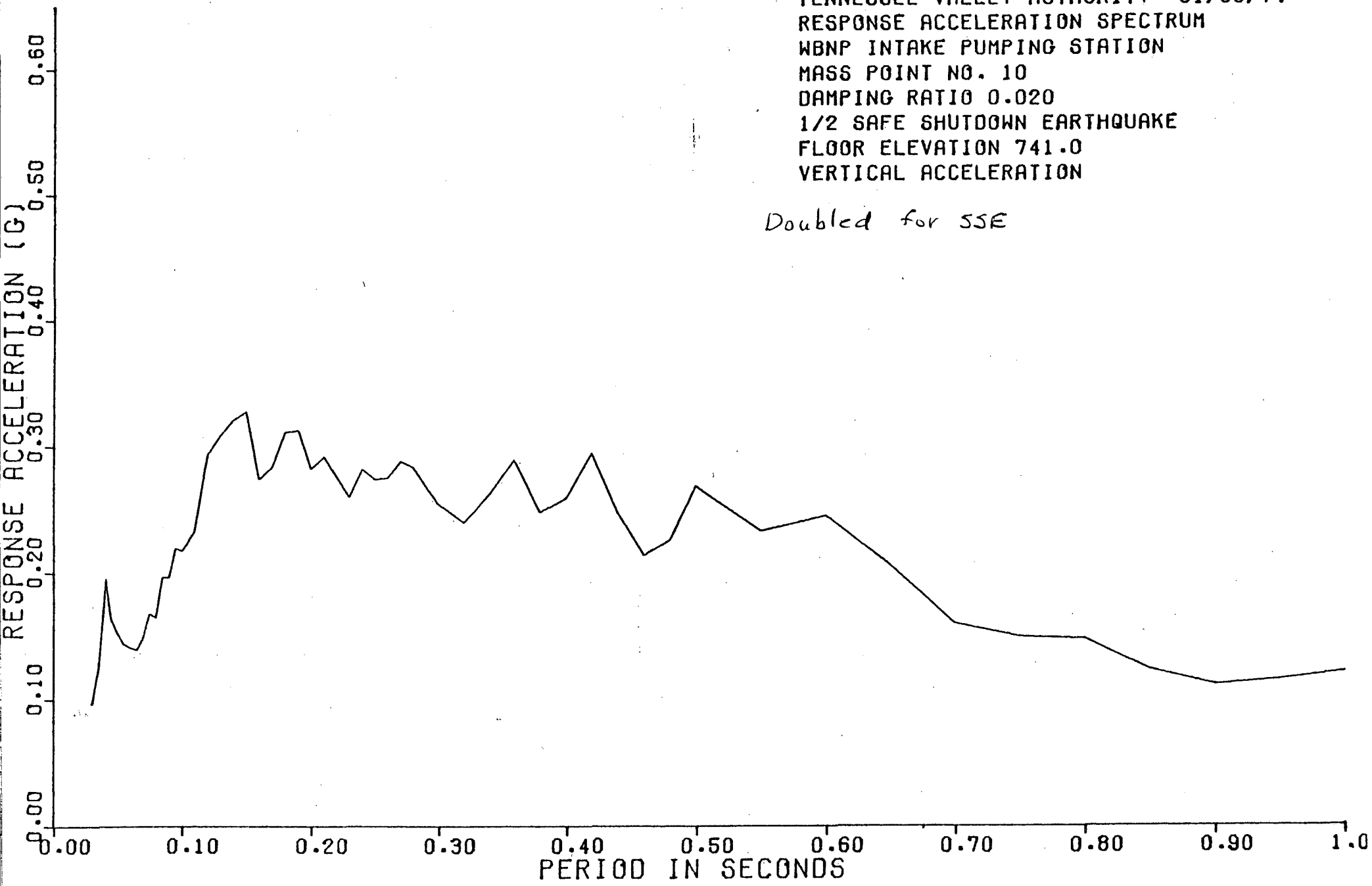

TENNESSEE VALLEY AUTHORITY 01/08/74
RESPONSE ACCELERATION SPECTRUM
WBNP INTAKE PUMPING STATION
MASS POINT NO. 10
DAMPING RATIO 0.020
1/2 SAFE SHUTDOWN EARTHQUAKE
FLOOR ELEVATION 741.0
VERTICAL ACCELERATION
Doubled for SSE
RESPONSE ACCELERATION (G)
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.0
PERIOD IN SECONDS

FIGURE D9

Attachment No. 3 ITEM 18 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: W BWR
3. A/E: TVA Other

II. Component Name: DIESEL COMBUSTION AIR INTAKE FILTER AT MOUNTING BRACKET 74C63-83090

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: NA Quantity:
3. Size or Range:
4. Vendor: POWER SYSTEMS DIVISION - MORRISON-KNUDSEN CO., INC
5. If the component is a cabinet or panel, name and model Number of the devices included: NA
6. Physical Description:
   a. Appearance:
   b. Dimensions:
   c. Weight: 250#
7. Location: Building: DIESEL GENERATOR
   Elevation: 742
8. Field Mounting Conditions [X] Bolt (No. ____, Size 1/2)
   [ ] Weld (Length ____)
   [ ]
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   SKID
10. a. System in which located: STANDBY DIESEL GENERATORS (82)
    b. Functional Description: PROVIDES CLEAN AIR FOR DIESELS
    c. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
    [ ] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 2042

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations.
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: DIESEL EMERGENCY GENERATOR

(No., Title and Date): SEISMIC ANALYSIS CCL REPORT NUMBER A-27-74 11/22/74

Company that Prepared Report: CORPORATE CONSULTING AND DEVELOPMENT CO, LTD

Company that Reviewed Report: POWER SYSTEMS DIVISION MORRISON-KNUDSEN CO, INC

Where Report is filed or available: TVA

Applicable Codes And/Or Standards: AISC

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

3/5

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direction:

[ ] ZPA [ ] Other _____ (specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = 3g F/B = 3g V = 2g

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete: NA

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] _____

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

SSE
OBE S/S = 3g F/B = 3g V = 2g

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [X] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = >33 Hz F/B = >33Hz V = >33Hz

3. Model Type: [X] 3D [ ] 2D [ ] 1D

[ ] Finite Element [X] Beam

[ ] Closed Form Solution [ ] Other _____

4. [X] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[X] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE 1% SSE 1% Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A. Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
BOLTS	SSE	≈ 2200psi 307#		GRADE 5 BOLTS

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

>500%

TENNESSEE VALLEY AUTHORITY 0[illegible]8/74
RESPONSE ACCELERATION SPECTRUM
WATTS BAR NUCLEAR PLANT
DIESEL GENERATOR BLDG.
BASE SLAB EL. 742
DAMPING RATIO 0.010
½ SAFE SHUTDOWN EARTHQUAKE
HORIZONTAL MOTION

VERTICAL SPECTRUM = 2/3 HORIZ

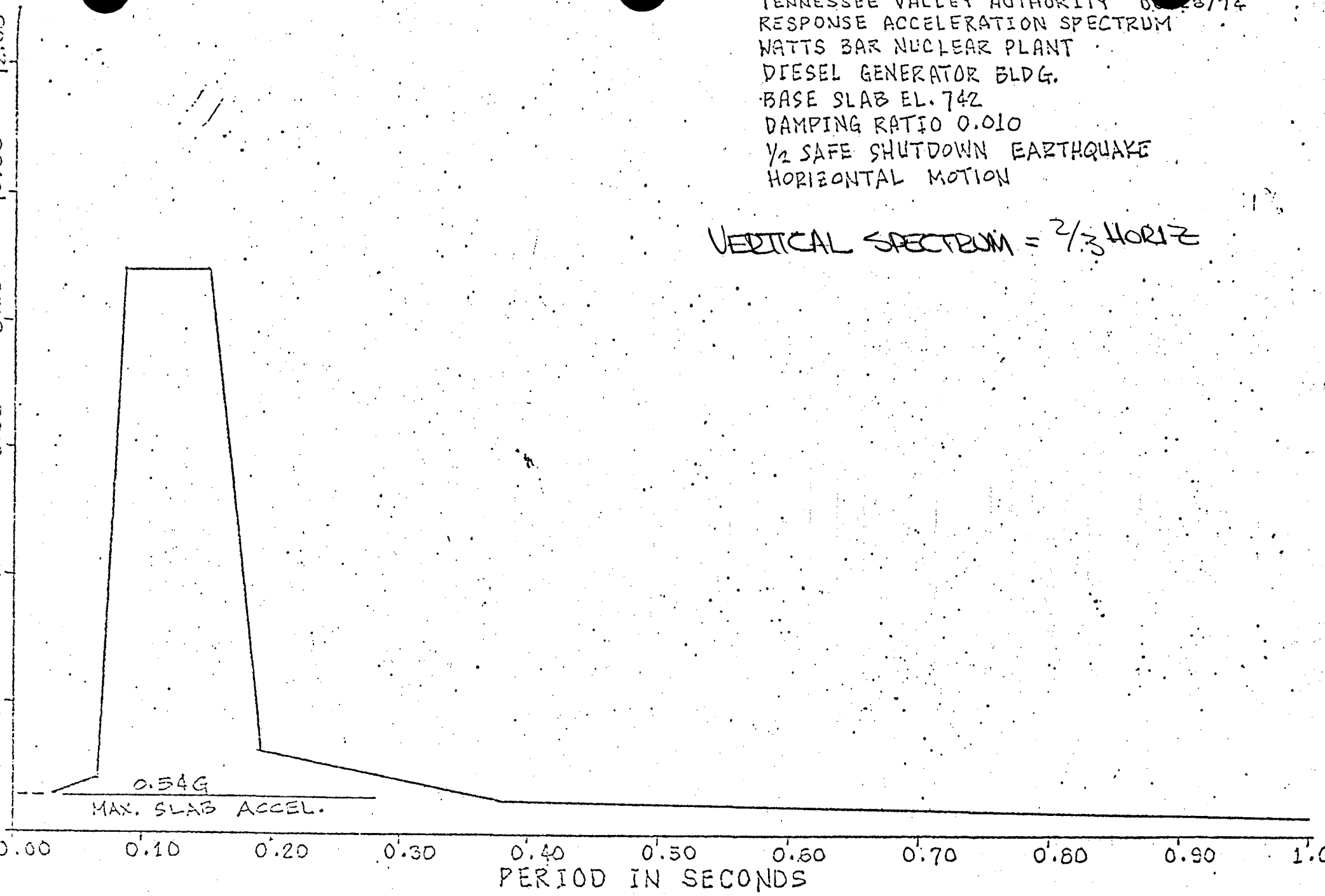


FIGURE 11

Attachment No. 3 ITEM 19 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR NUCLEAR PLANT Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: REACTOR BLDG PURGE VALVES (CONTAINMENT ISOLATION VALVES) 76K51-83264-2

1. Scope: [ ] NSSS [✓] BOP [ ] Other
2. Model Number: BIF 0652 Quantity: 6-24"
3. Size or Range: 24INCH
4. Vendor: BIF
5. If the component is a cabinet or panel, name and model Number of the devices included: NA
6. Physical Description:
   a. Appearance: AIR-CYLINDER OPERATED BUTTERFLY VALVE
   b. Dimensions:
   c. Weight: 1680 LBS (ASSEMBLY)
7. Location: Building: REACTOR BLDG.
   Elevation: VARIOUS
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [X] BOLTED BETWEEN FLANGES
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   VERTICAL MOUNTED IN PIPELINE
10. a. System in which located: CONTAINMENT ISOLATION (88)
    b. Functional Description: ENSURES CONTAINMENT INTEGRITY THROUGH CONTAINMENT ISOLATION
    c. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
       [ ] Both [ ] Neither [ ] Other

11. Pertinent Reference Design Specifications for Qualification Requirements: WBNP-DS-1935-2774R1 (APPENDIX I OR WB-DC-40-31.12),

(a) Seismic Input
(d) Service Conditions
b. Hydrodynamic Load Input
e. Qualified Life
c. Fatigue Considerations.

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [X] Combination of Test and Analysis

Qualification Report*: REPORT #1572, "SEISMIC ANALYSIS OF BUTTERFLY

(No., Title and Date): VALVE," DATED 3/3/77.

Company that Prepared Report: DYNATECH R/D COMPANY

Company that Reviewed Report: BIF & TVA

Where Report is filed or available: TVA

Applicable Codes And/Or Standards: ASME, AISC

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only - SEE SECTION VI.
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): NA

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [X] Other SEE SECTION VI
(specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = 3G F/B = 3G V = 2G

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

_____

_____

▲ VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
▲ [X] STATIC SEISMIC LOAD APPLIED DURING OPERABILITY TESTING.

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

2 CYCLES of SEIS. STATIC LOADS, (0-4036 LBS-0) PLUS ONE CYCLE AFTER W/O SEIS. LOADS,

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____
(specify)

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [X] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

▲ QUALIFICATION PARTIALLY BY STATIC DEFLECTION/OPERABILITY TESTING. SEISMIC STATIC LOAD APPLIED AT C.G. OF VALVE EXTENDED STRUCTURES = 4036 LBS (EQUIVALENT TO: 5.72g x WEIGHT OF EXTENDED STRUCTURES/OPERATOR).

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: VALVE ASSY MOUNTED IN TEST STAND FOR STATIC DEFLECTION/OPERABILITY TESTING. (SEE SECTION VI).

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: OPERABILITY DEMONSTRATED BY ABOVE DESCRIBED TESTING & REPORT.

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[X] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

↖ SEE NEXT PAGE, ITEM 4!

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

▲ QUALIFICATION PARTIALLY BY ANLYSIS — { a. Natural Frequency
b. Component Stresses due to required load conditions.

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: f_N = 104 Hz (MINIMUM) TORSIONAL MODE

[X] Hand Calculations & f_N = 180 Hz (BENDING MODES)

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: CANTILEVER SUPPORTED

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
CYLINDER TRUNNION PINS	OPERATING TORQUE PLUS SEISMIC,	5,000 PSI	8923 PSI	10,320 PSI (SHEAR)

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
NONE DETERMINED		

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [✓] (Stress) or Deflection

+16% (ELASTIC), ITEM 8A ABOVE!

$\frac{10,320}{8923} - 1 = .16$

Attachment No. 3 ITEM 20 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR NUCLEAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: CONTROL DAMPER, MOTOR OPERATED (MAIN CONTROL ROOM)

1. Scope: [ ] NSSS [✓] BOP [ ] Other
2. Model Number: CD82AF-276 Quantity: 4 (ITEM 47 of 77X34-820197-1) SCH VII
3. Size or Range: SEE 6b BELOW
4. Vendor: RUSKIN MFG. CO., GRANDVIEW, MO. 64030
5. If the component is a cabinet or panel, name and model Number of the devices included:
6. Physical Description:
   a. Appearance: RECTANGULAR (A x B)
   b. Dimensions: 34" x 34"
   c. Weight: ~ 100 lbs
7. Location: Building: AUX. CONTROL BLDG
   Elevation: 755
8. Field Mounting Conditions [X] Bolt (No. ____, Size ____) PER MFGR SPEC
   [ ] Weld (Length ____)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   MOUNTED IN WALL, DUCT
10. a. System in which located: HVAC
    b. Functional Description: ENSURES PROPER CONTROL ROOM ENVIRON-MENT DURING NORMAL & EMERGENCY OPERATION
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
       [X] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements:

WB-DC-40-31.2 REV 1 (SEISMIC)

(a.) Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations.

(d.) Service Conditions

e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[✓] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [✓] Combination of Test and Analysis

Qualification Report*: SEISMIC ANALYSIS OF RUSKIN CD82AF4 TORNADO DAMPER

(No., Title and Date): DATED JULY 1977 WITH ATTACHED WYLE LAB TEST REPORT # 43516-1 (FOR DAMPER MOTORS)

Company that Prepared Report: RUSKIN MFG CO.

Company that Reviewed Report: RUSKIN/TVA

Where Report is filed or available: TVA

Applicable Codes And/Or Standards: AISC,

V. Vibration Input:

1. Loads considered:

a. [ ] Seismic only

b. [ ] Hydrodynamic only

c. [ ] Vibration from normal operation

d. [X] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): NA

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [X] Other CONSERVATIVE ENVELOPE FOR GENERAL (specify) DUCT MOUNTED INSTALLATION

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = 3G F/B = 3G V = 2G

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [X] sine beat [ ] _____

2. [ ] Single Axis [X] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 5 SSE 1 Other PERFORMED AT 5, 8, 13, 30, 33 Hz AND AT ANY RESONANT FREQUENCIES DETERMINED FROM PRIOR EXPLORATORY TESTS, (specify)

4. Frequency Range: 1 thru 35 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [X] Analysis SEE VII, 4.

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

SEISMIC QUALIFICATION PARTIALLY BY TEST, I.E., MOTOR, ABOVE ITEM IV WYLE TEST REPORT

THE INPUT ACCELERATIONS WERE 3.0g HORIZ AND VERTICALLY THRU-OUT 1-35 Hz RANGE.

6. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

~~OBE~~ SSE S/S = 3G F/B = 3G V = 3G

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: BI-AXIAL SHAKE TABLE

10. Functional operability verified:

[✓] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[X] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
SEE FOLLOWING ITEM 4.

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

SEISMIC QUALIFICATION PARTIALLY BY ANALYSIS (EXCEPT MOTOR).

a. SEISMIC = 3 g'S HORIZ + 2 g'S VERTICAL + DEADWEIGHT.
4

+

b. MAX PRESSURE DIFFERENTIAL (ΔP) ACROSS BLADES = 3PSI

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: $f_N = 69$ HZ (MINIMUM) BENDING FOR BLADE

[X] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A. Identification Location	Governing Load or Response Combination	Seismic Stress (PSI)	Total Stress (PSI)	Stress Allowable (PSI)
BLADE	SEISMIC G'S PLUS ΔP (SEE ABOVE VII)		732. – SHEAR	14,400
			13,834. – BENDING	21,600.

B. Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
0.0936	BLADE MID-SPAN	0.0972 INCH

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [X] Stress or Deflection

SEE ABOVE BLADE BENDING STRESS = 13834 PSI

$F.S = \frac{21,600}{13834} = 1.56$

Attachment No. 3 ITEM 21 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (W) BWR
3. A/E: TVA Other

II. Component Name: 480 V SWITCHGEAR (SHUTDOWN BOARDS)

1. Scope: [ ] NSSS [X] BOP [ ] Other 74C2-8x647
2. Model Number: (W) TYPE DS Quantity: 8
3. Size or Range: 480 V
4. Vendor: WESTINGHOUSE
5. If the component is a cabinet or panel, name and model Number of the devices included: (W) DS-206, DS-416, & DS-632 BREAKERS
6. Physical Description:
   a. Appearance: NEMA 1 LOW VOLTAGE SWITCHGEAR
   b. Dimensions: 19' x 8' x 6' EACH
   c. Weight: ≈ 19,203 LB EACH
7. Location: Building: AUX CONT BLDG { INTAKE PUMP STA
   Elevation: 772, 782 { 711
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [X] Weld (Length 14')
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   FLOOR MOUNTED
10. a. System in which located: VARIOUS SYSTEMS
    b. Functional Description: PROVIDES 480 V POWER TO VARIOUS SAFETY-RELATED PLANT LOADS
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
    [X] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements: _____

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WESTINGHOUSE ASTRONUCLEAR LABORATORY

(No., Title and Date): #EL-453, FEB 1975, REVISED APRIL 10, 1975

Company that Prepared Report: _____

Company that Reviewed Report: TVA

Where Report is filed or available: _____

Applicable Codes And/Or Standards: _____

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 5% SSE 5%

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other _____ (specify)

OBE S/S = .43 F/B = .43 V = .12

SSE S/S = .86 F/B = .86 V = .24

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGEING

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency: [ ] random [ ] sine beat [X] SUMMATION OF DECAYING SINUSOIDS

2. [ ] Single Axis [X] Multi-Axis
[ ] Independent axis [X] In-phase motions

3. Number of Qualifications Tests:

OBE >5 SSE >1 Other _____ (specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

APPROXIMATE S/S = 7, 10, 17, 23 F/B = 10 V = —

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test ATTACHED

[X] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test: MUCH LARGER THAN RRS ZPA

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [X] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: PRINCIPAL HORIZ AXES OF EQUIP @ 45° TO HORIZ INPUT COMPONENT -- RESULTANT INPUT VECTOR @ 26° BELOW HORIZ PLANE -- TESTED @ 4 ORIENTATIONS

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: MAJOR STRUCTURAL DAMAGE AND ELECTRICAL MISFUNCTION -- NO SAFETY CONCERN

REF: (W) POST TEST REPORT DATED MAY 75

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

FIGURE 49: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 771.5
DAMPING RATIOS 0.050, 0.100, 0.150
½ SSE, N-S HORIZONTAL

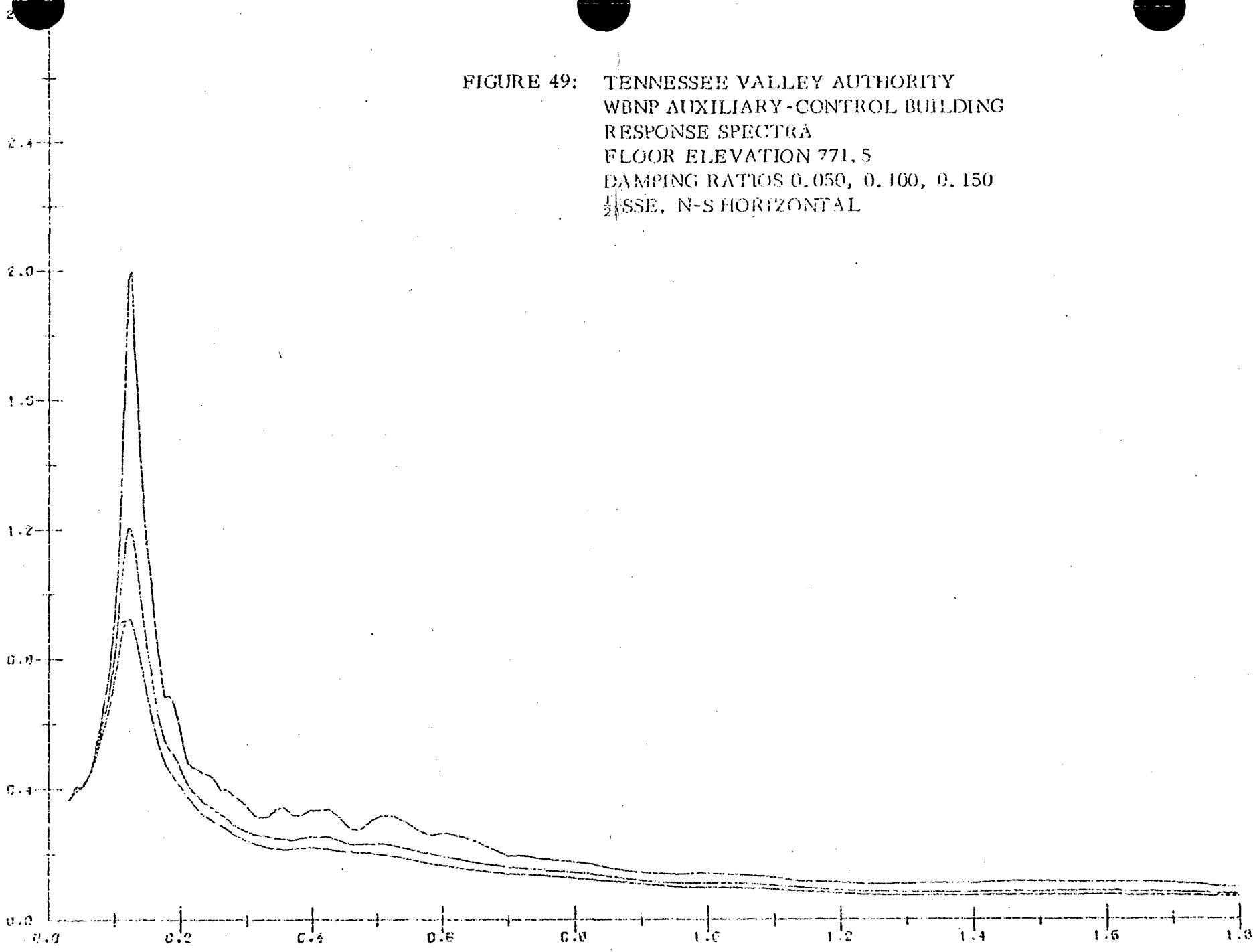


FIGURE 51: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 771.5
DAMPING RATIOS 0.050, 0.100, 0.150
½ SSE, E-W HORIZONTAL

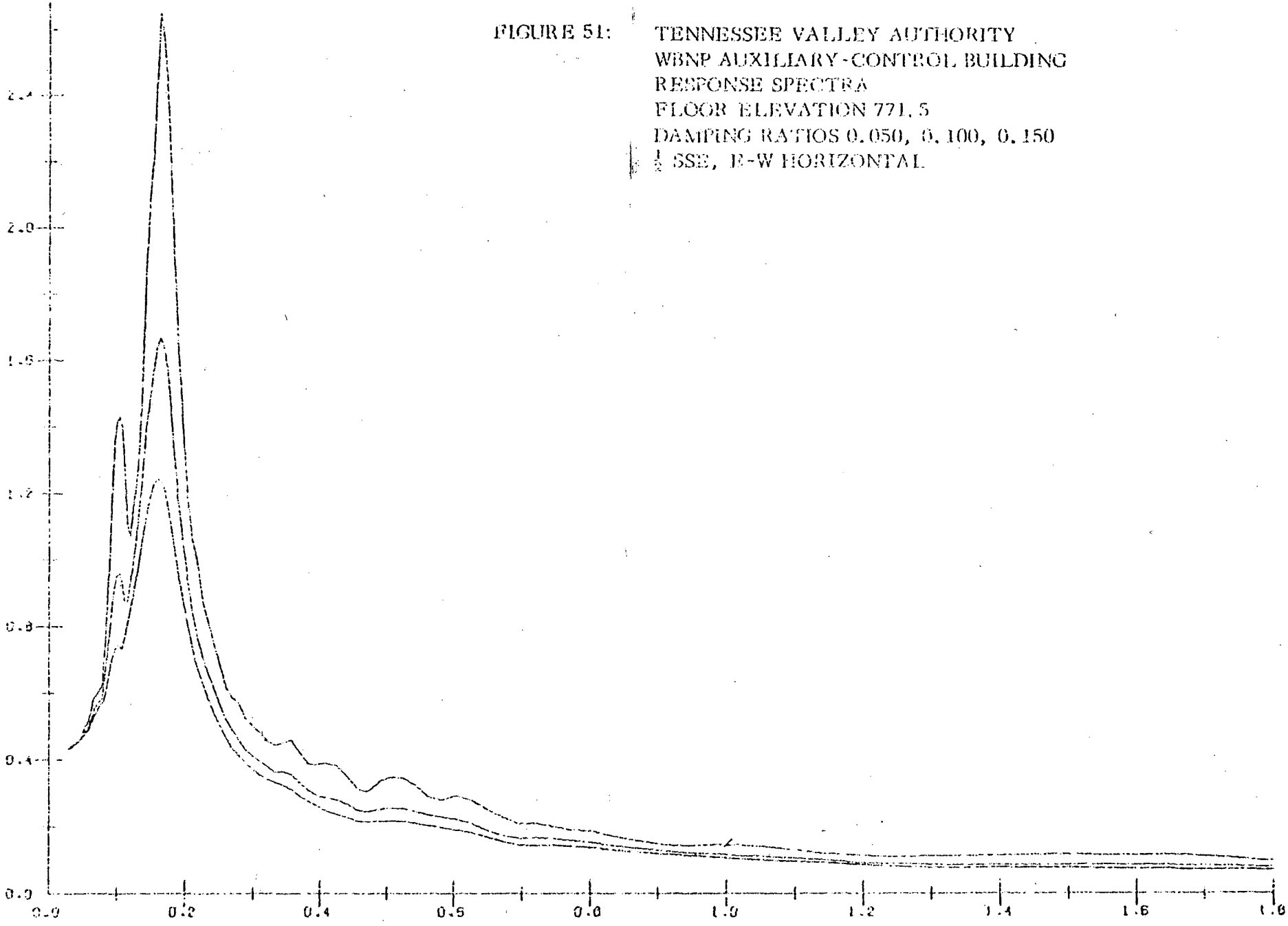


FIGURE 53: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 781.5
DAMPING RATIOS 0.050, 0.100, 0.150
$\frac{1}{2}$ SSE, N-S HORIZONTAL

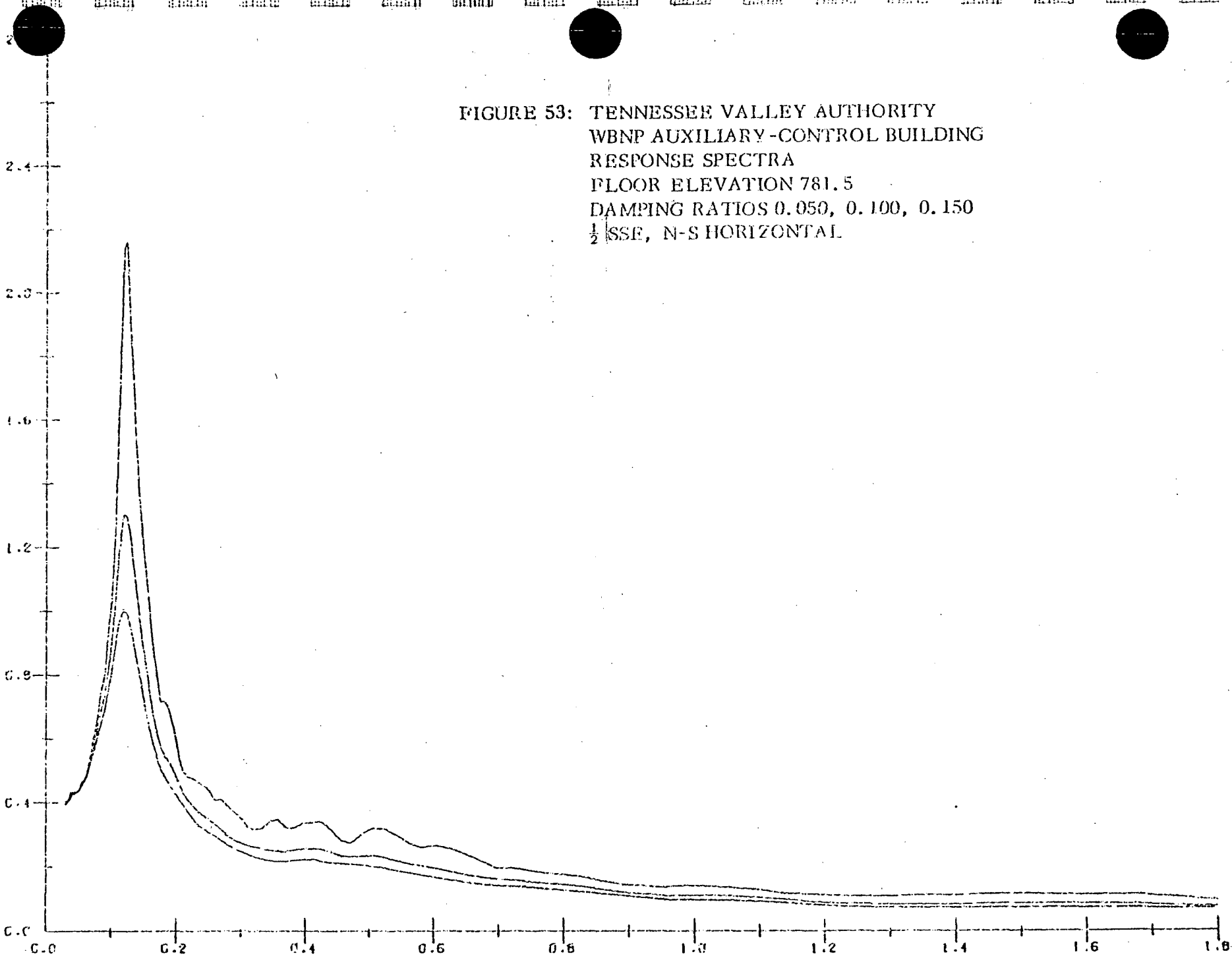


FIGURE 55: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY - CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 781.5
DAMPING RATIOS 0.050, 0.100, 0.150
½ SSE, E-W HORIZONTAL

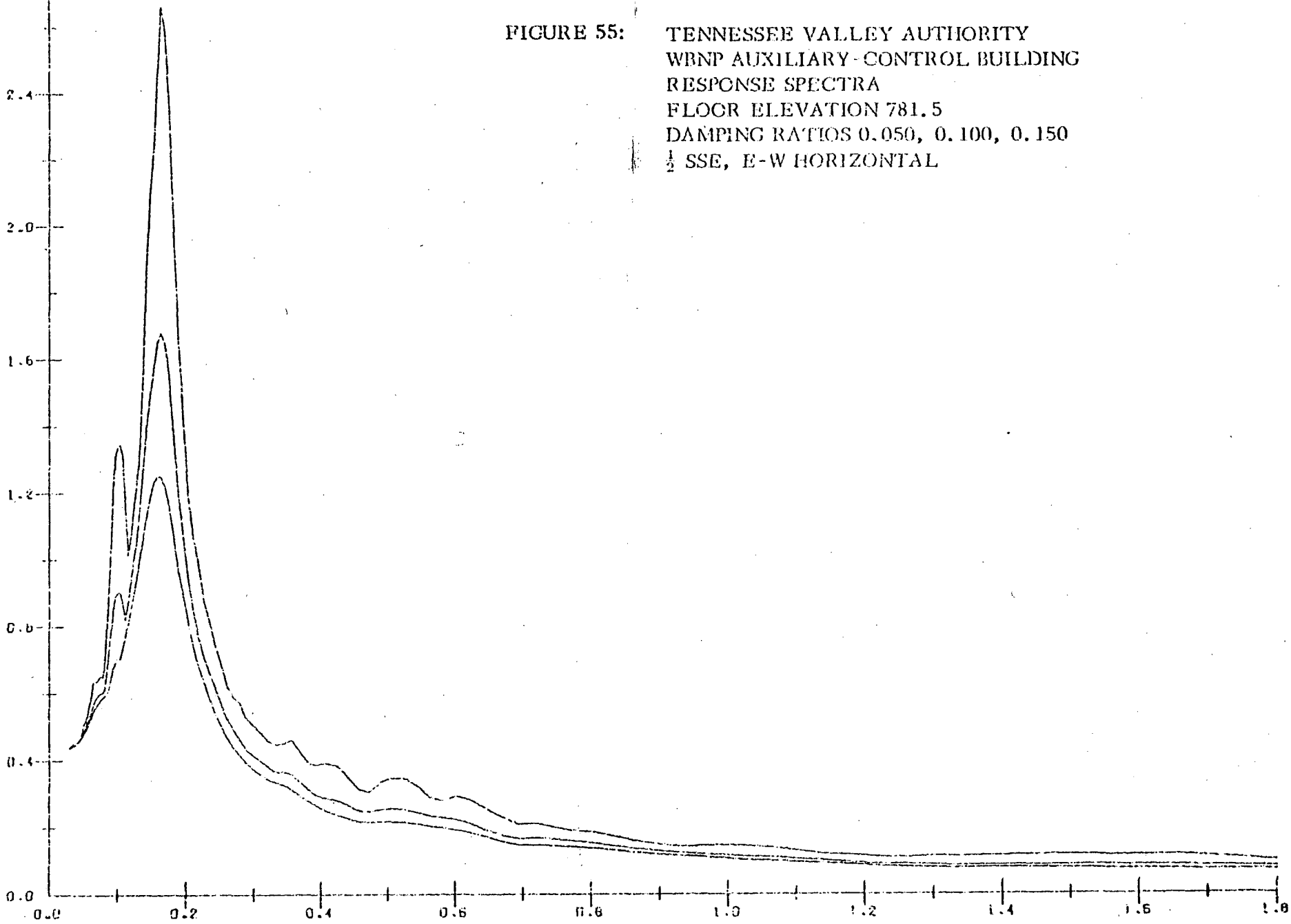


FIGURE 55

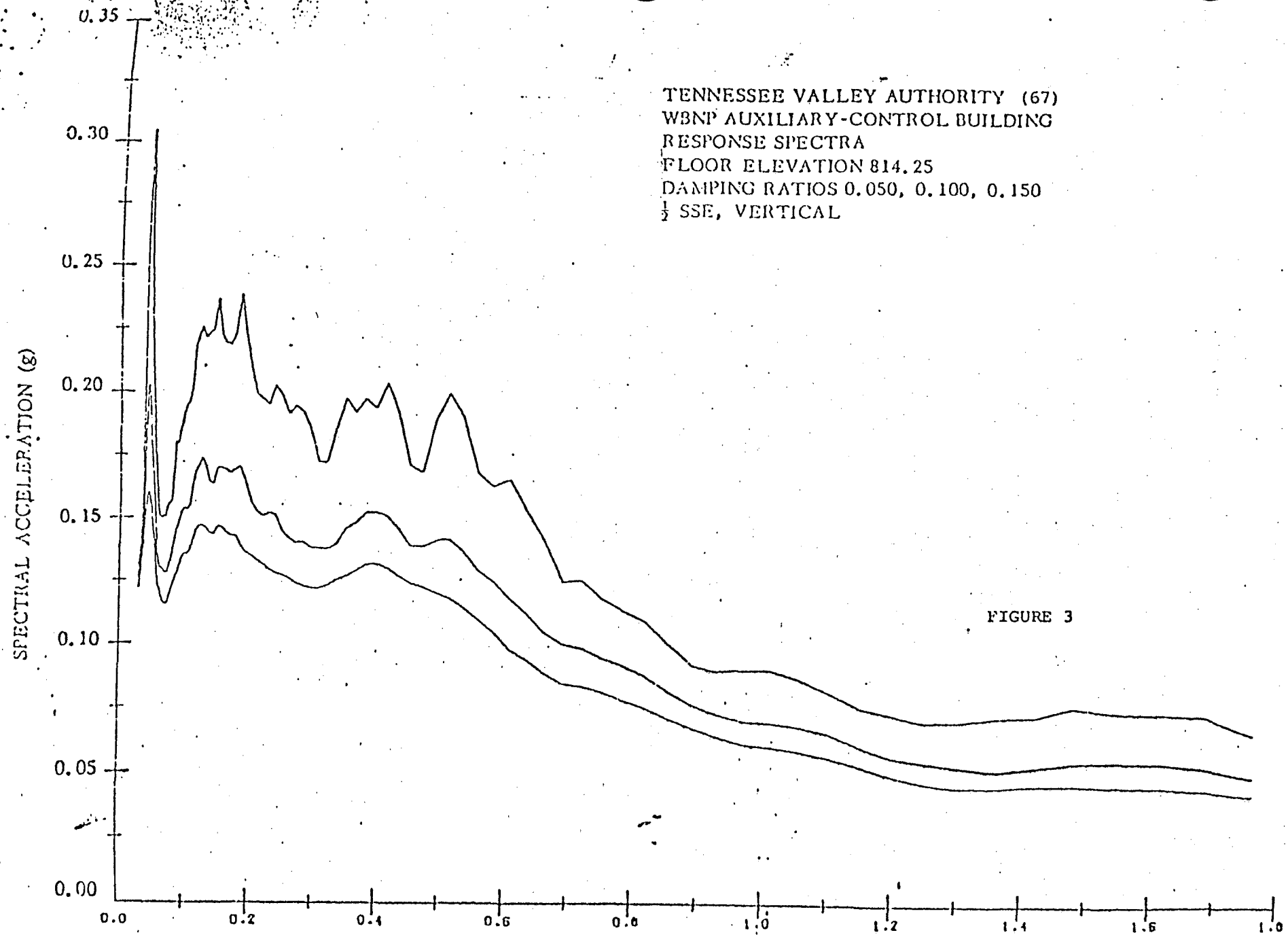


FIGURE 3

FIGURE 67

TENNESSEE VALLEY AUTHORITY 01/08/74
RESPONSE ACCELERATION SPECTRUM
WBNP INTAKE PUMPING STATION
MASS POINT NO. 6
DAMPING RATIO 0.020
1/2 SAFE SHUTDOWN EARTHQUAKE
FLOOR ELEVATION 711.0
HORIZONTAL ACCELERATION

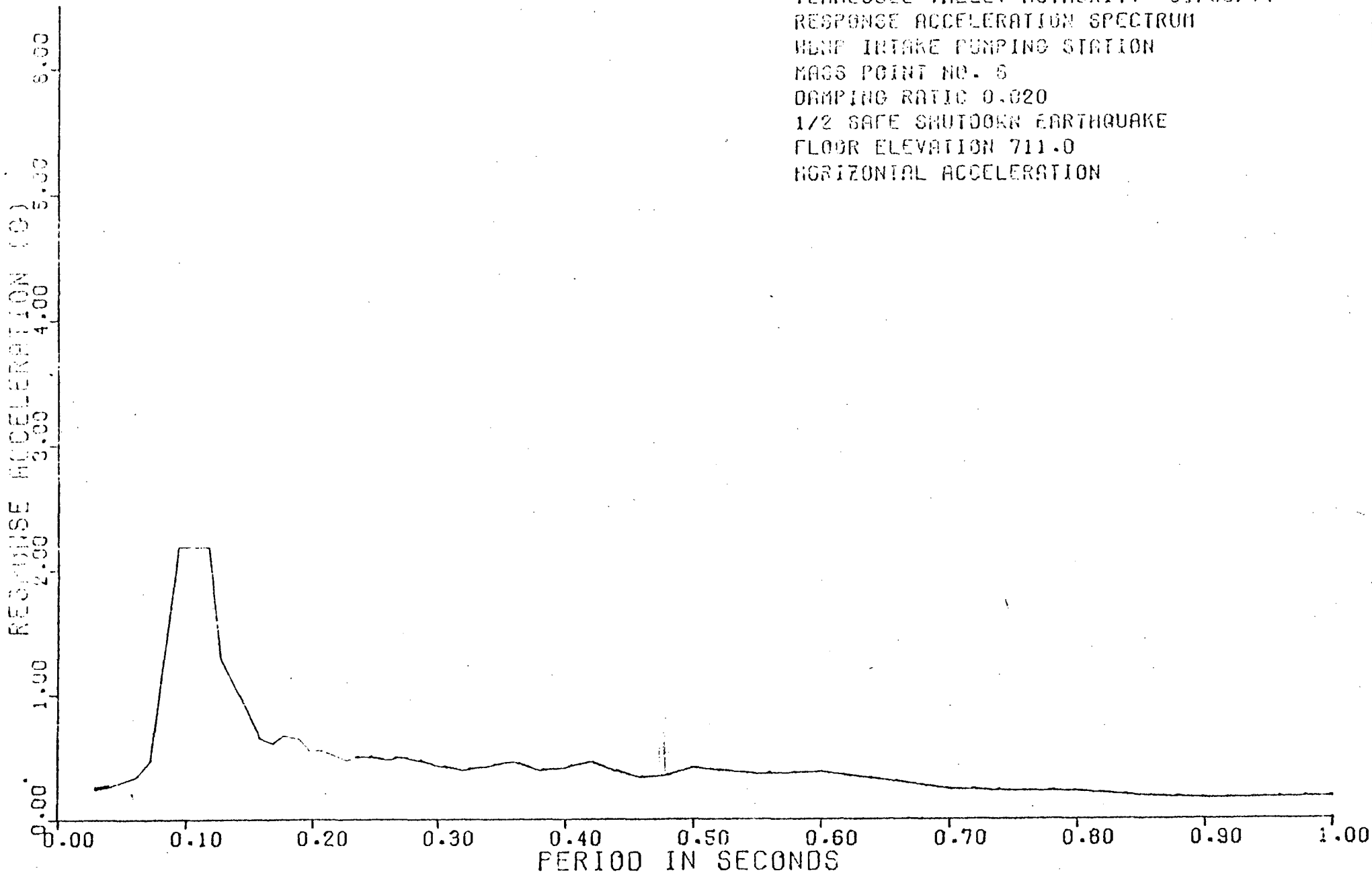


FIGURE 66

TENNESSEE VALLEY AUTHORITY 03/23/72
RESPONSE ACCELERATION SPECTRUM
WATTS BAR NUCLEAR PLANT

DAMPING RATIO 0.020
1/2 SAFE SHUTDOWN EARTHQUAKE
GROUND ACCELERATION SPECTRUM
HORIZONTAL ACCELERATION

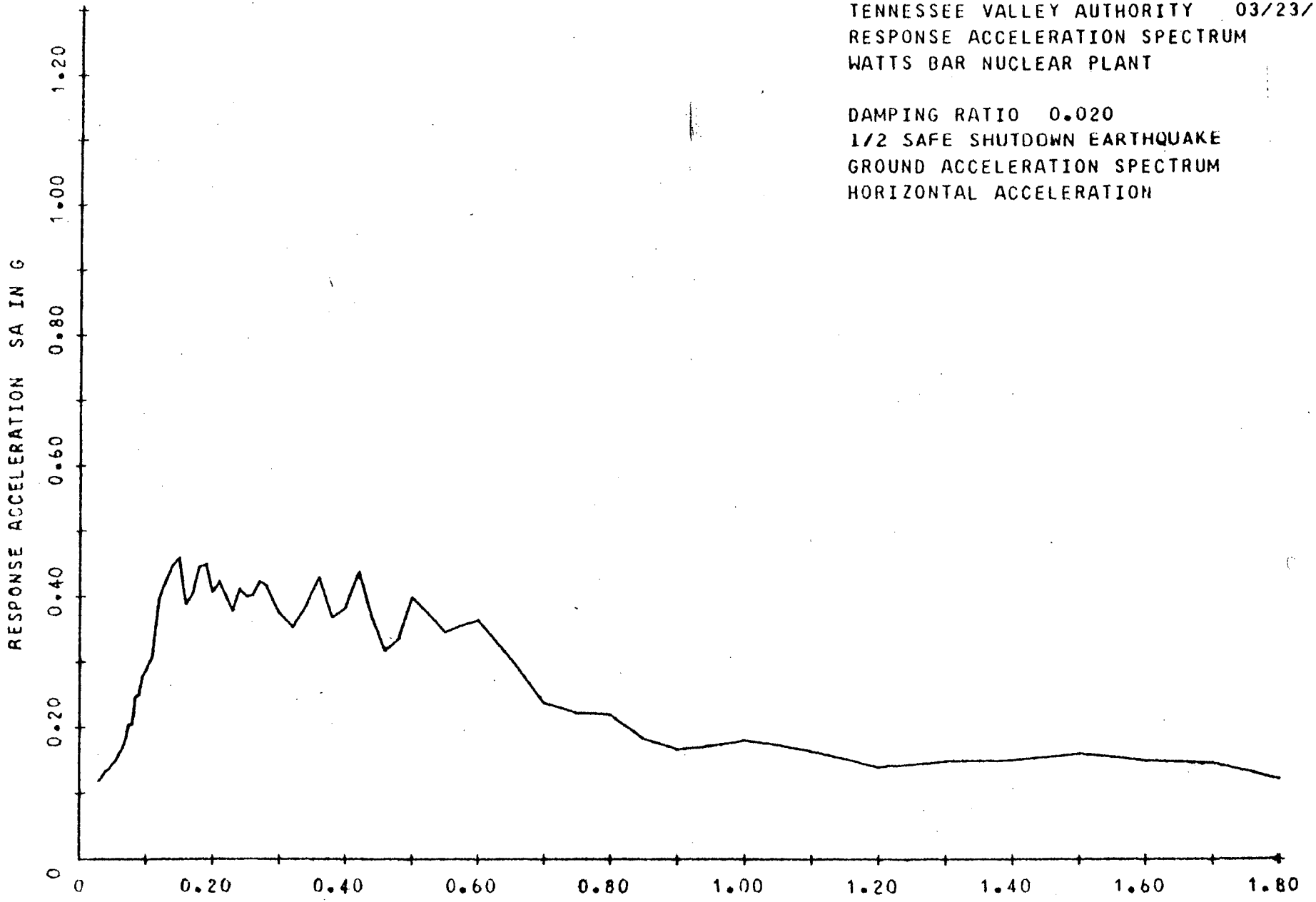


FIGURE C3

X .26/√2

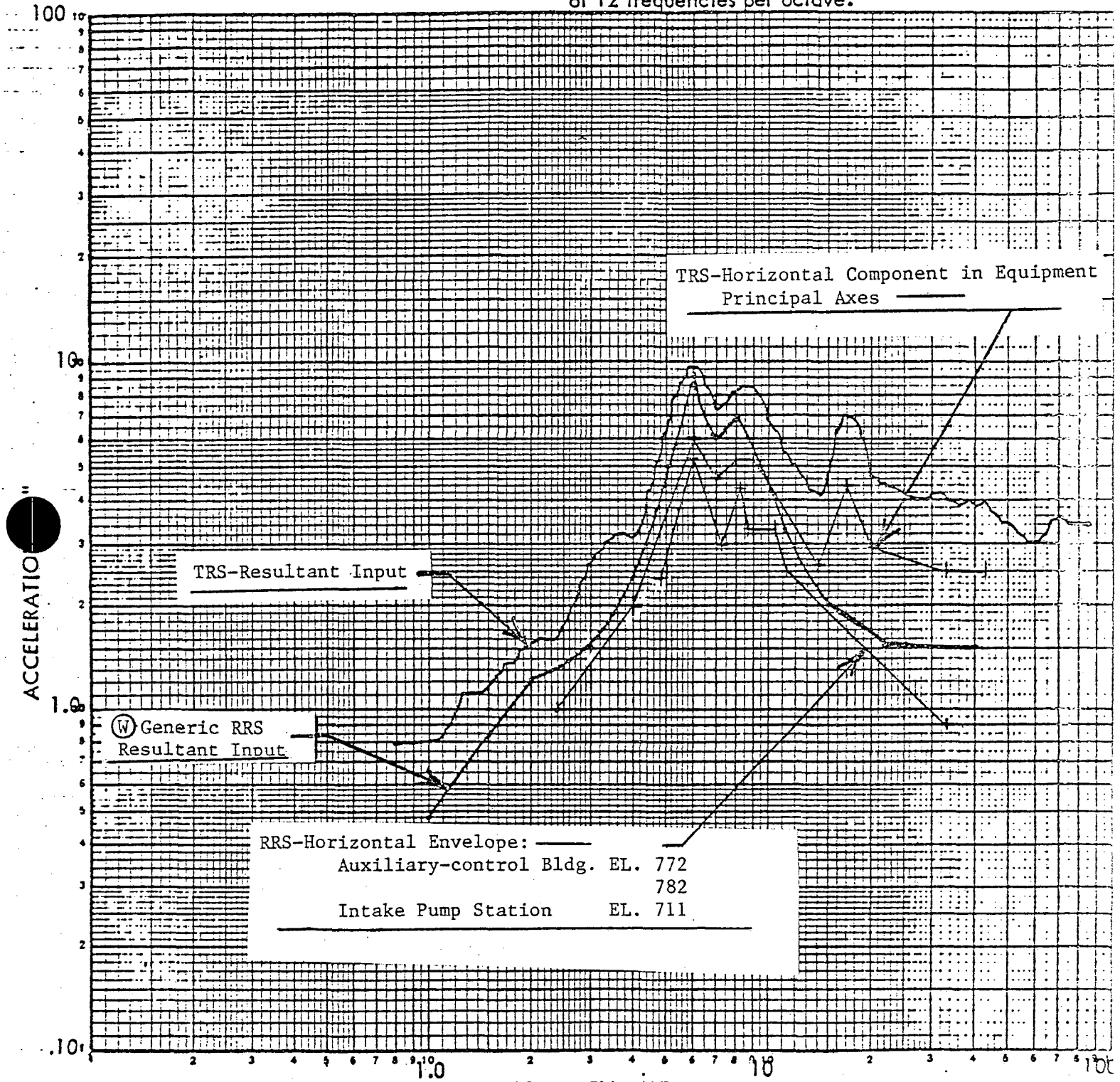
TITLE DS LOW VOLTAGE SWITCHGEAR

CUSTOMER WESTINGHOUSE EAST PITTSBURGH

SERIES 1 TEST 1 RUN 2M

OPERATOR ACCELEROMETER A2

CONTRACT NO. XAL 71706 ANALYSIS METHOD Seismic Shock Response Spectrum analysis at 5% of critical damping with a resolution of 12 frequencies per octave.



TRS envelopse RRS for SSE

Figure 36

TYPICAL

Attachment No. 3 ITEM 22 . 1/5

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS BAR Type:

1. Utility: TVA PWR ✓
2. NSSS: (N) BWR
3. A/E: TVA Other

II. Component Name: (A) BARKSDALE PRESSURE SWITCH / (B) SQUARE D RELAYS (COMPONENTS IN CONTACTOR/RELAY SYSTEM ASSEMBLY) 7HC63-83090

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: * Quantity: —
3. Size or Range: *
4. Vendor: POWER SYSTEMS - A HARRISON - KLUDSEN DU
5. If the component is a cabinet or panel, name and model Number of the devices included: NA
6. Physical Description:
   a. Appearance: *
   b. Dimensions: *
   c. Weight: —
7. Location: Building: DG BLDG
   Elevation: 742
8. Field Mounting Conditions [X] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   A) SWITCH MOUNTED ON DG AIR COMPRESSOR, COMPRESSOR FLOOR MOUNTED
   B) RELAYS MOUNTED IN PANEL, PANEL FLOOR MOUNTED **
10. a. System in which located: STANDBY DIESEL GENERATORS (82)
    b. Functional Description: A) SWITCH CONTROLS DIESEL AIR STARTING SYSTEM
    B) RELAYS PROVIDE CONTROL FOR DIESELS
    c. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
    [ ] Both [ ] Neither [ ] Other

* SEE ATTACHED CATALOG DATA

** SEPARATE TEST OF RELAYS NOT REQUIRED FOR QUALIFICATION, ENGINE CONTROL PANEL ASSY (WITH RELAYS) WAS QUALIFIED AS A TOTAL FUNCTIONAL ASSY IN SAME TEST PROGRAM.

II. Pertinent Reference Design Specifications for Qualification Requirements: TVA SPEC 2042

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WYLE LABORATORIES

(No., Title and Date): #42749-1 ; JUNE 24, 1974

Company that Prepared Report:

Company that Reviewed Report: TVA

Where Report is filed or available:

Applicable Codes And/Or Standards:

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: NA

   [ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): ATTACHED

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [X] Other TEST REQMTS -- CONSERVATIVE ENVELOPE OF INSTALLATION REQMTS
(specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = 3G*/1.5G** F/B = 3G*/1.5G** V = 1G*/1.5G*
(OR LIMITS OF TEST MACHINE)

6. Were fatigue effects considered?

* SINGLE AXIS TESTS
** BI-AXIAL TESTS

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program: SEISMIC AGEING - TEST PROCEDURE WAS SUCH THAT EQUIPMENT WAS SUBJECTED TO MANY LOADING CYCLES OF VARYING EFFECTIVE SEVERITY

VI. If Qualification by Test, then Complete:

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [X] sine beat [ ] _____

2. [X] Single Axis AND [X] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____
(specify)

4. Frequency Range: 1-33 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
NONE BELOW 33 HZ
S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test N/A

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test: ATTACHED TABLES

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [X] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: NO PROBLEMS

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

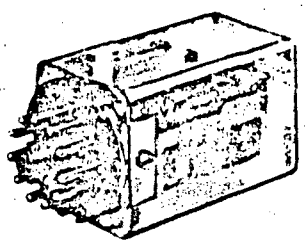
9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

NEW SHEET

TYPE K GENERAL PURPOSE RELAY
TUBE TYPE

Tube type relays feature an industry standard wiring and pin arrangement. The basic relay is the same as the Type KS (combination terminal) with the exception of pin termination.



Type KP and KPD

CONTACTS: 10 AMP. RESISTIVE — 150 VOLTS MAX.●

Coil	Mounting Method	Termination	Poles	Dust Cover Enclosed Type	Dust Cover Enclosed Price ‡
AC (240 V. max.) 50/60 Hz.	Socket	8 Pin	2 PDT	KP12	$ 8.20
		11 Pin	3 PDT	KP13	10.25
DC (110 V. max.) ▲	Socket	8 Pin	2 PDT	KPD12	8.20
		11 Pin	3 PDT	KPD13	10.25

▲220 volt operation possible by using 5W, 6,800 ohm wire-wound resistor in series with 110 volt coil.

‡Prices listed apply to maximum coil voltages of 120 volts ac and 24 volts dc. Above 120 volts ac add $0.50. Above 24 volts dc add $0.65.

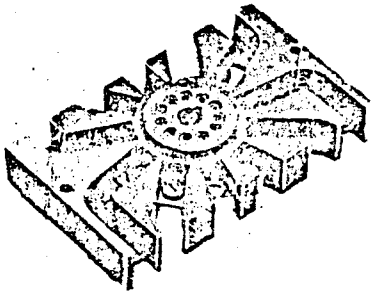
●See Page 107 for detailed ratings.



Type NR1



Type NR3 and NR4



Type NR2

SOCKETS

Termination	Mounting	Amp. Rating	Pins	Poles	Type	Price
Screw	Front or Back Panel	5	8	2 PDT	NR1❶	$1.75
		10	11	3 PDT	NR2❷	4.05
Solder	Front Panel	3	8	2 PDT	NR3❸	.25
		3	11	3 PDT	NR4❹	.35

❶Amphenol Type 146-103
❷Amphenol Type 146-817
❸Amphenol Type 77-M1P-8
❹Amphenol Type 77-M1P-11

SPECIAL FEATURE

Feature	Function	Form	Additions Price
Pilot Light	Indicates Power to Coil	P14	$1.20



Cut-away of Relay with Pilot Light (Form P14)

ORDERING INFORMATION REQUIRED

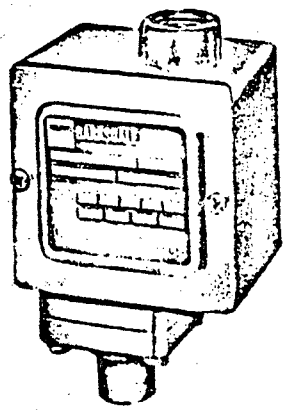
1—Class and type number.

2—Coil voltage and whether ac or dc.

3—If pilot light is desired, add "Form P14" to Class and Type of relay, e.g. Class 8501 Type KP12 Form P14 — 120 Volts, 50/60 Hz.

ECON-O-TROL Dia-Seal Piston Models
Water-Tight Housing (NEMA 4)

PRESSURE SWITCHES
E1H Single Setting
VACUUM SWITCHES
E1H-H-VAC Single Setting



OPERATING CHARACTERISTICS • ORDERING DATA

PRESSURE SWITCHES — All values given in P.S.I. (Gauge)

Proof (Test) Press	Adjustable Range				Approx.* Actuation Value (Differential)	Catalog Number ¼" npt Internal (No Ext. Thread)	Catalog Number ⅛" npt Internal ½" npt External
	Decreasing		Increasing				
	Min.	Max.	Min.	Max.			
1000	.5	14.2	.6	15.0	.1 to .8	E1H-H15	E1H-H15-P6†
1000	3.0	82.0	3.5	90.0	.5 to 8.0	E1H-H90	E1H-H90-P6†
1000	10.0	230.0	11.0	250.0	1.0 to 20.0	E1H-H250	E1H-H250-P6†
1000	25.0	472.0	29.0	500.0	4.0 to 28.0	E1H-H500	E1H-H500-P6

*Fixed at any pressure setting, varies as shown from lowest to highest setting.

VACUUM SWITCHES — All values given in inches of mercury (Gauge)

Proof (Test) Vacuum	Proof (Test) Press	Adjustable Range				Approx.* Actuation Value (Differential)	Catalog Number ⅛" npt Internal & ½" npt Ext. Thread
		Decreasing		Increasing			
		Min.	Max.	Min.	Max.		
30	30 PSI	.5	29.0	2.2	30.0	.3 to 1.7	E1H-H-VAC-P6

*Actuation value depends on Actuation Point (Set Point). Maximum actuation value is at .5 inches HG Set Point. Minimum actuation value is at 30 inches HG Set Point.

Models tabled have Aluminum fitting and Buna "N" diaphragm. Aluminum fittings are not recommended for water service. Use Polysulfone fittings, suffix -PLS, or Nickel Plated fittings, suffix -F2.

Approximate shipping weight 1.5 lbs.

DETAIL DATA

ELECTRICAL CHARACTERISTICS (Pressure and Vacuum Switches): All models incorporate Underwriters' Laboratories, Inc. listed single pole double throw snap-action switching elements. Electrical rating (continuous inductive) 10 amps 125 or 250 volts AC, 3 amps 480 volts AC. Automatically reset by snap-action of switch.

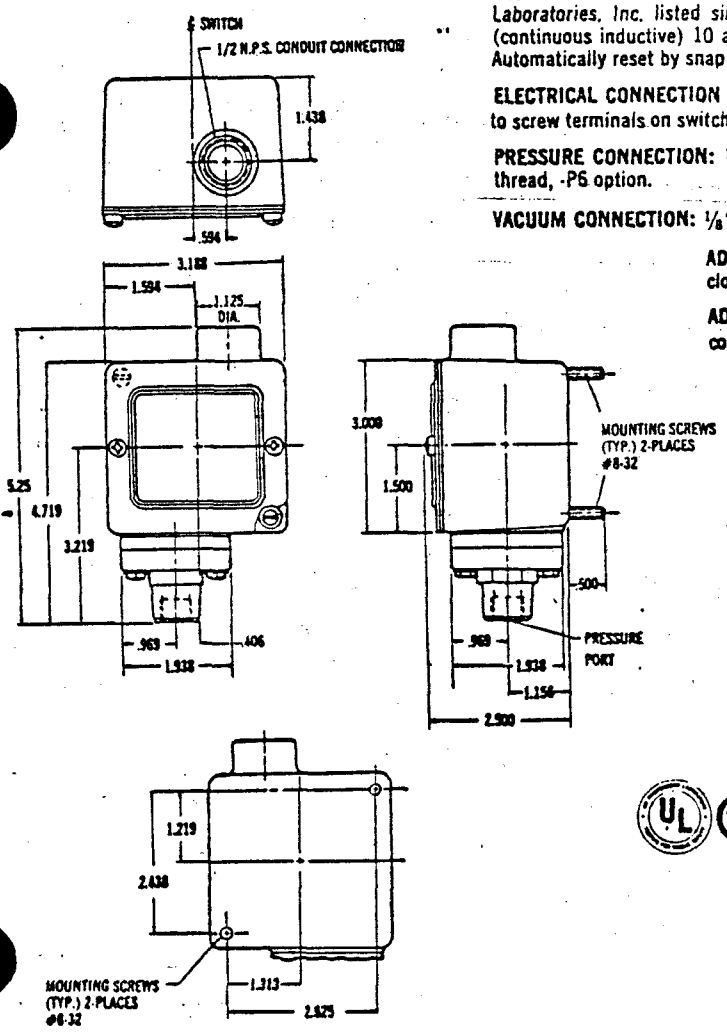
ELECTRICAL CONNECTION (Pressure and Vacuum Switches): Through ½" NPS Conduit Connection to screw terminals on switch. May be wired Normally Open or Normally Closed.

PRESSURE CONNECTION: ¼" npt internal thread, standard. ⅛" npt internal and ½" npt external thread, -P6 option.

VACUUM CONNECTION: ⅛" npt internal and ½" npt external thread, standard.

ADJUSTMENT INSTRUCTIONS (Pressure): Turn self locking adjustment nut clockwise to raise and counterclockwise to lower the actuation point.

ADJUSTMENT INSTRUCTIONS (Vacuum): Turn self locking adjustment nut counterclockwise to adjust the actuation point toward 30 inches HG.



OPTIONAL MODIFICATIONS (Pressure Switches)
Field adjustable Actuation Value (Differential). See Bulletin #690804 for range of actuation values available and electrical rating. See price list for pricing.

Diaphragms: These models can be supplied with Viton or Teflon diaphragms to special order. To specify add suffix -V or -T to switch number and consult plant for delivery. *See price list for price adjustment.*

† Polysulfone 40% glass filled pressure fitting with ⅛" NPT internal connection and ½" NPT external connection. Proof pressure 400 P.S.I. Add suffix -PLS to tabled units with †. For higher pressures consult factory. Note: For chemical resistance refer to chart (Bulletin No. 680406).

Class J switch element with elastomer boot around actuator and sealed to prevent moisture and foreign matter from affecting contacts. See price list for price adjustment. See pages 28 thru 30 for more details.

OPTIONAL MODIFICATIONS (Vacuum Switches)
Field Adjustable Actuation Value (Differential).
Class J switch element with elastomer boot around actuator and sealed to prevent moisture and foreign matter from affecting contacts. See price list for price adjustment.

All models and modifications shown (except Field Adjustable Actuation Value models and -F2 Nickel Plated fittings) *are Underwriters' Laboratories listed* in the Recognized Components Index, Guide NKPZ2: "Motor Controllers, Float and Pressure Operated", and Canadian Standards Association listed under Guide #380-W-1.16.

TABLE I

SINE BEAT ACCELERATION LEVELS (PEAK G'S)
UNFILTERED DATA

Specimen		Frequency					
Series 3 (Vertical)	Accel. No.	26 Hz	27 Hz	28 Hz	29 Hz	30 Hz	31 Hz
	Control	1.05	1.10	1.10	1.10	1.10	1.10
Switchgear	1 F-R	3.00	3.48	3.52	3.56	3.28	3.20
	2 S-S	0.55	0.83	0.88	0.86	0.76	0.63
	3 V	1.15	1.25	1.33	1.30	1.46	1.50
	4 F-R	0.24	0.30	0.35	0.37	0.40	0.40
Series 2 (Vertical)		6 Hz	13 Hz	16 Hz	28 Hz	33 Hz	
	Control	1.70	1.10	1.00	1.10	1.17	
Anode Transformer	1 V	2.40	1.68	1.20	1.76	2.00	
	2 S-S	2.40	4.20	1.20	1.36	1.32	
	3 V	2.88	3.20	1.60	1.80	2.24	
	4 F-R	1.40	1.84	0.80	1.20	1.44	
Engine Control Panel	5 F-R	1.72	1.20	1.00	2.80	2.76	
(Relays Energized)	6 S-S	1.20	1.20	1.60	1.20	1.52	
	7 V	3.04	2.08	1.68	2.40	3.60	
	8 F-R	1.32	0.88	1.20	0.96	1.48	
Series 2 (Vertical)		6 Hz	13 Hz	16 Hz	28 Hz	33 Hz	
	Control	1.75	1.10	1.00	1.00	1.05	
Anode Transformer	1 V	2.32	1.56	1.52	1.60	1.84	
	2 S-S	2.40	3.60	1.20	1.20	1.68	
	3 V	2.84	2.80	1.60	1.60	2.00	
	4 F-R	1.20	1.44	0.80	1.00	1.20	
Engine Control Panel	5 F-R	1.40	0.88	1.04	2.84	2.68	
(Relays De-energized)	6 S-S	0.80	0.80	1.28	0.60	0.92	
	7 V	3.20	2.00	1.96	2.24	2.96	
	8 F-R	1.60	0.80	1.04	0.80	1.24	
Series 1 (Vertical) (Side-to-Side Mounted)		5 Hz	27 Hz				
	Control	1.70	1.00				
Fuel Oil Pump	1 V	2.12	1.28				
	3 S-S	1.60	0.80				
Battery	2 F-R	0.46	0.66				
	5 V	2.40	1.76				
Soak Back Oil Pump	4 V	2.40	1.60				
	6 S-S	0.36	0.54				
Battery Charger	7 F-R	2.40	2.44				
	8 V	1.96	1.44				
	9 S-S	2.40	3.84				
Contactor/Relay System	10 V	0.50	1.20				
	11 F-R	0.24	0.22				
	12 V	2.32	1.60				
Series 1 (Horizontal, S-S)		5 Hz	27 Hz				
	Control	2.92	2.96				
Fuel Oil Pump	1 V	0.48	1.84				
	3 S-S	4.00	4.40				
Battery	2 F-R	0.80	1.70				
	5 V	0.80	2.48				
Soak Back Oil Pump	4 V	0.40	2.00				
	6 S-S	3.00	3.00				
Battery Charger	7 F-R	2.08	4.80				
	8 V	1.00	4.00				
	9 S-S	4.60	5.20				
Contactor/Relay System	10 F-R	0.40	0.60				
	11 S-S	3.00	2.50				
	12 V	0.48	2.28				

TABLE I (Continued)

SINE BEAT ACCELERATION LEVELS (PEAK G'S)
UNFILTERED DATA

Specimen		Frequency					
Series 1 (Combined V & S-S)	Accel No.	5 Hz	27 Hz				
	Control H	2.40	1.80				
	Control V	3.20	1.66				
Fuel Oil Pump	1 V	3.20	2.10				
	3 S-S	3.00	3.50				
Battery	2 F-R	0.06	0.20				
	5 V	5.00	3.50				
Soak Back Oil Pump	4 V	4.00	3.10				
	6 S-S	2.00	2.00				
Battery Charger	7 F-R	3.00	4.00				
	8 V	4.80	4.00				
	9 S-S	3.10	5.50				
Contactor/Relay System	10 F-R	2.00	2.50				
	11 S-S	2.20	1.80				
	12 V	4.60	2.80				
Series 1 ~~(V & F-R Mounting)~~		7 Hz	12 Hz	33 Hz			
VERTICAL (F-R MOUNTED)	Control	2.00	1.15	1.15			
Fuel Oil Pump	1 V	1.40	1.00	0.64			
	3 S-S	2.60	2.40	2.00			
Battery	2 F-R	1.20	0.46	0.20			
	5 V	1.80	1.32	1.60			
Soak Back Oil Pump	4 V	1.56	1.04	1.20			
	6 S-S	1.16	0.40	0.20			
Battery Charger	7 F-R	2.30	1.80	1.60			
	8 V	2.20	1.40	1.60			
	9 S-S	2.50	1.88	0.52			
Contactor/Relay System	10 F-R	0.40	0.24	0.24			
	11 S-S	0.88	0.26	0.06			
	12 V	2.00	1.02	1.40			
Series 1 (Horizontal F-R)		7 Hz	33 Hz				
	Control	1.58	2.88				
Fuel Oil Pump	1 V	0.50	1.24				
	3 S-S	0.68	0.88				
Battery	2 F-R	1.02	0.80				
	5 V	1.80	2.20				
Soak Back Oil Pump	4 V	1.20	2.00				
	6 S-S	0.60	1.00				
Battery Charger	7 F-R	1.86	2.60				
	8 V	1.20	2.40				
	9 S-S	0.92	1.20				
Contactor/Relay System	10 F-R	0.74	0.60				
	11 S-S	0.26	0.20				
	12 V	0.40	1.82				
Series 1 (Combined V & F-R)		7 Hz	12 Hz	33 Hz			
	Control H	2.10	1.70	1.80			
	Control V	2.40	1.84	1.80			
Fuel Oil Pump	1 V	2.04	1.60	1.20			
	3 S-S	2.24	1.44	0.80			
Battery	2 F-R	3.30	4.00	3.90			
	5 V	3.52	3.60	4.30			
Soak Back Oil Pump	4 V	2.40	1.60	2.24			
	6 S-S	1.48	0.60	0.60			
Battery Charger	7 F-R	4.00	4.00	1.88			
	8 V	3.04	2.40	4.00			
	9 S-S	3.36	2.40	1.00			
Contactor/Relay System	10 F-R	2.50	2.00	2.50			
	11 S-S	0.80	0.24	0.16			
	12 V	2.48	0.20	2.80			

TENNESSEE VALLEY AUTHORITY 8/74
RESPONSE ACCELERATION SPECTRUM
WATTS BAR NUCLEAR PLANT
DIESEL GENERATOR BLDG.
BASE SLAB EL. 742
DAMPING RATIO 0.010
½ SAFE SHUTDOWN EARTHQUAKE
HORIZONTAL MOTION

VERTICAL SPECTRUM = 2/3 HORIZ

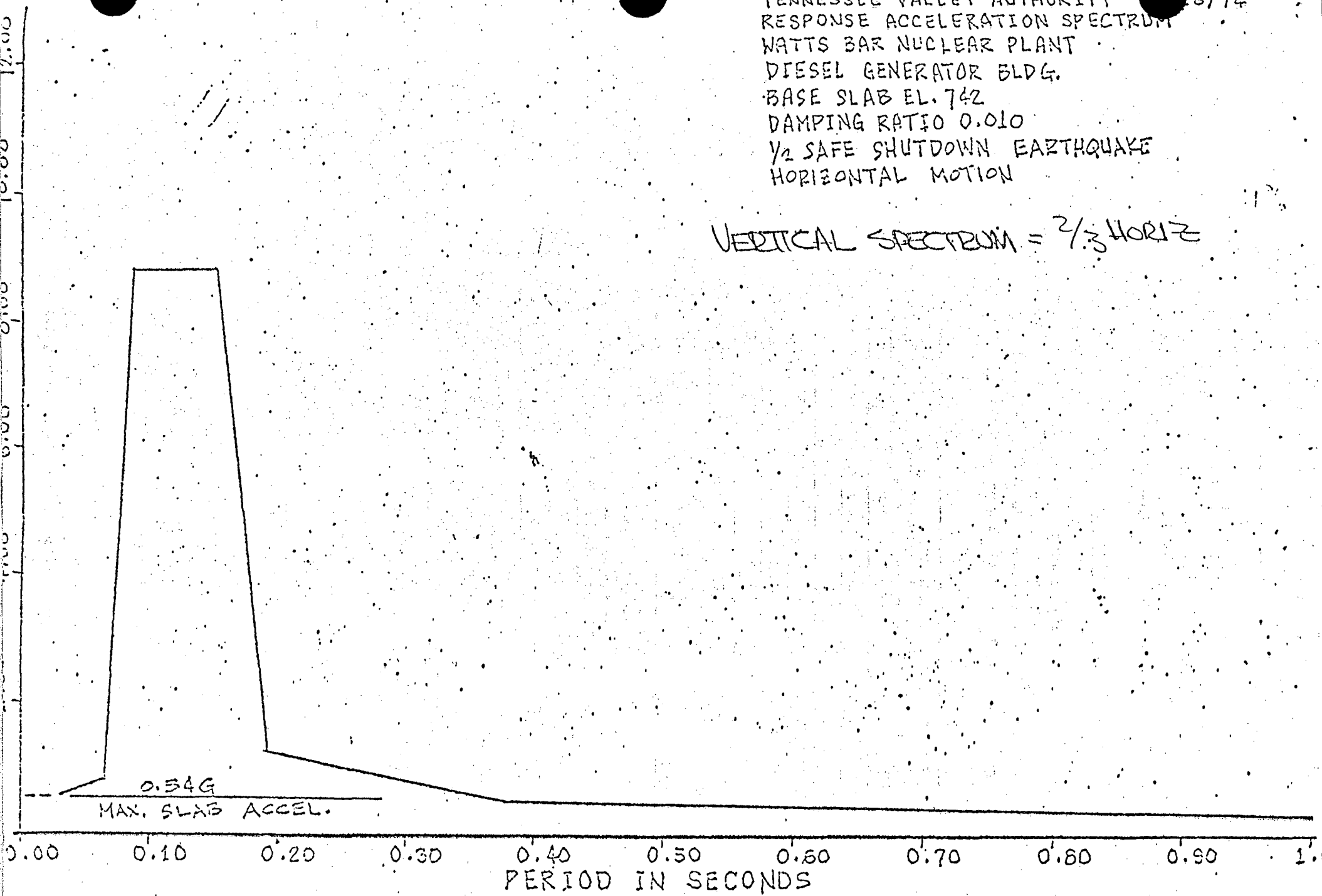


FIGURE 11

Seismic and Dynamic Qualification Summary of Equipment

EM-STA-275

I. Plant Name: Watts Bar — Type:

1. Utility: TVA — PWR ✓
2. NSSS: WENES — BWR
3. A/E: TVA — Other

II. Component Name: Solid State Protection System

1. Scope: [✓] NSSS [ ] BOP [ ] Other
2. Model Number: 1057E57 — Quantity: 2 (Train A & B)
3. Size or Range:
4. Vendor: Westinghouse (WIO)
5. If the component is a cabinet or panel, name and model Number of the devices included: Reference drawing 1057E57, Rev. K
6. Physical Description:
   a. Appearance: Three-Bay Vertical Cabinet
   b. Dimensions: 90" x 30" x 91.31"
   c. Weight: Approximately 2300 lbs
7. Location: Building: Control
   Elevation: 708 Ft
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [✓] Weld (Length 12 ft)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   floor mounted
10. a. System in which located: Reactor Protection System
    b. Functional Description: provides reactor trip & safeguards actuation
    c. Is the equipment required for [✓] Hot Standby [✓] Cold Shutdown
    [✓] Both [ ] Neither [ ] Other

EM-SIA-202/

II. Pertinent Reference Design Specifications for Qualification Requirements: E-SPEC. 952152 REV 1

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations.
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[✓] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[✓] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WCAP 7817 Seismic Testing of Electrical and Control Equipment

(No., Title and Date): WCAP 7817 Supplement 2 Seismic Testing of Electrical and Control Equipment (low Seismic Pk

Company that Prepared Report: Westinghouse

Company that Reviewed Report: Westinghouse

Where Report is filed or available: W Monroeville Nuclear Center - Nuclear Safety Dept.

Applicable Codes And/Or Standards: IEEE-344-1971

V. Vibration Input:

1. Loads considered:
   a. [✓] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[✓] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): See Attached Figure 1 & 2

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE N/A SSE 5%

5. Required Acceleration in Each Direction:

[I ZPA [I Other _____ (specify)

OBE S/S = N/A F/B = N/A V = N/A

SSE S/S = N/A F/B = N/A V = N/A

6. Were fatigue effects considered?

[I Yes [✓ I No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete:

1. [✓ I Single Frequency [I Multi-Frequency: [I random [✓ I sine beat (10cpb) @ ambient frequency [ ] _____ 5 beats

2. [✓ I Single Axis [I Multi-Axis
[I Independent axis [I In-phase motions

3. Number of Qualifications Tests: FRONT-TO-BACK SIDE-TO-SIDE VERTICAL

OBE _____ SSE 3 Other _____ (specify)

4. Frequency Range: 1-5 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 8.0 F/B = 15-25 V = > 33 Hz

6. Method of Determing Natural Frequencies

[✓ I Lab Test [I In-Situ Test [I Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[I Yes (Attach TRS & RRS graphs)
[✓ I No

8. Maximum Input g-level Test: See Attached Figures 3 & 4

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [X] Bolt (No. 12, Size 3/4")

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Test results were Acceptable. Number of Bolts used to fasten the three-rack structure to rack base was increased from 12 to 24.

12. Other tests performed (such as aging or fragility test, including results):

NONE

13. Failure Modes (If appropriate NONE)

14. Margins Available: [X] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

II. Pertinent Reference Design Specifications for Qualification Requirements:

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations.
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WCAP 7817 Seismic Testing of Electrical and Control Equipment

(No., Title and Date): WCAP 7817 Supplement 3 Seismic Testing of Electrical and Control Equipment (W SSPS) Low Seismic

Company that Prepared Report: Westinghouse

Company that Reviewed Report: Westinghouse

Where Report is filed or available: W Monroeville Nuclear Center

Applicable Codes And/Or Standards: IEEE-344-1971

V. Vibration Input:

1. Loads considered:
   a. [✓] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[✓] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): See Attached Figure

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE N/A SSE 5 %

5. Required Acceleration in Each Direction:

[I ZPA [I Other _____ (specify)

OBE S/S = N/A F/B = N/A V = N/A

SSE S/S = _____ F/B = _____ V = _____

6. Were fatigue effects considered?

[I Yes [I No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete:

1. [✓] Single Frequency [I Multi-Frequency: [I random [✓] sine beat (5 BEATS 10 cps @ each test freq) [ ] _____

2. [✓] Single Axis [I Multi-Axis
[I Independent axis [I In-phase motions

3. Number of Qualifications Tests: (FRONT-TO-BACK SIDE-TO-SIDE VERTICAL)

OBE _____ SSE 3 Other _____ (specify)

4. Frequency Range: 5-35 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 8.0 Hz F/B = 15-25 Hz V = >33 Hz

6. Method of Determing Natural Frequencies

[✓] Lab Test [I In-Situ Test [I Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[I Yes (Attach TRS & RRS graphs)
[✓] No

8. Maximum Input g-level Test: See Attached figures 3+4

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [✓] Bolt (No. 12, Size 3/4")

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[✓] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Test results were acceptable. number of bolts used to fasten the three-rack structure to the rack base was increased from 12 to 24

12. Other tests performed (such as aging or fragility test, including results):

None

13. Failure Modes (If appropriate None)

14. Margins Available: [✓] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other: _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations N/A

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A. Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

FIGURE 33; TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 711.5
DAMPING RATIOS 0.050, 0.100, 0.150
½ SSE, N-S HORIZONTAL

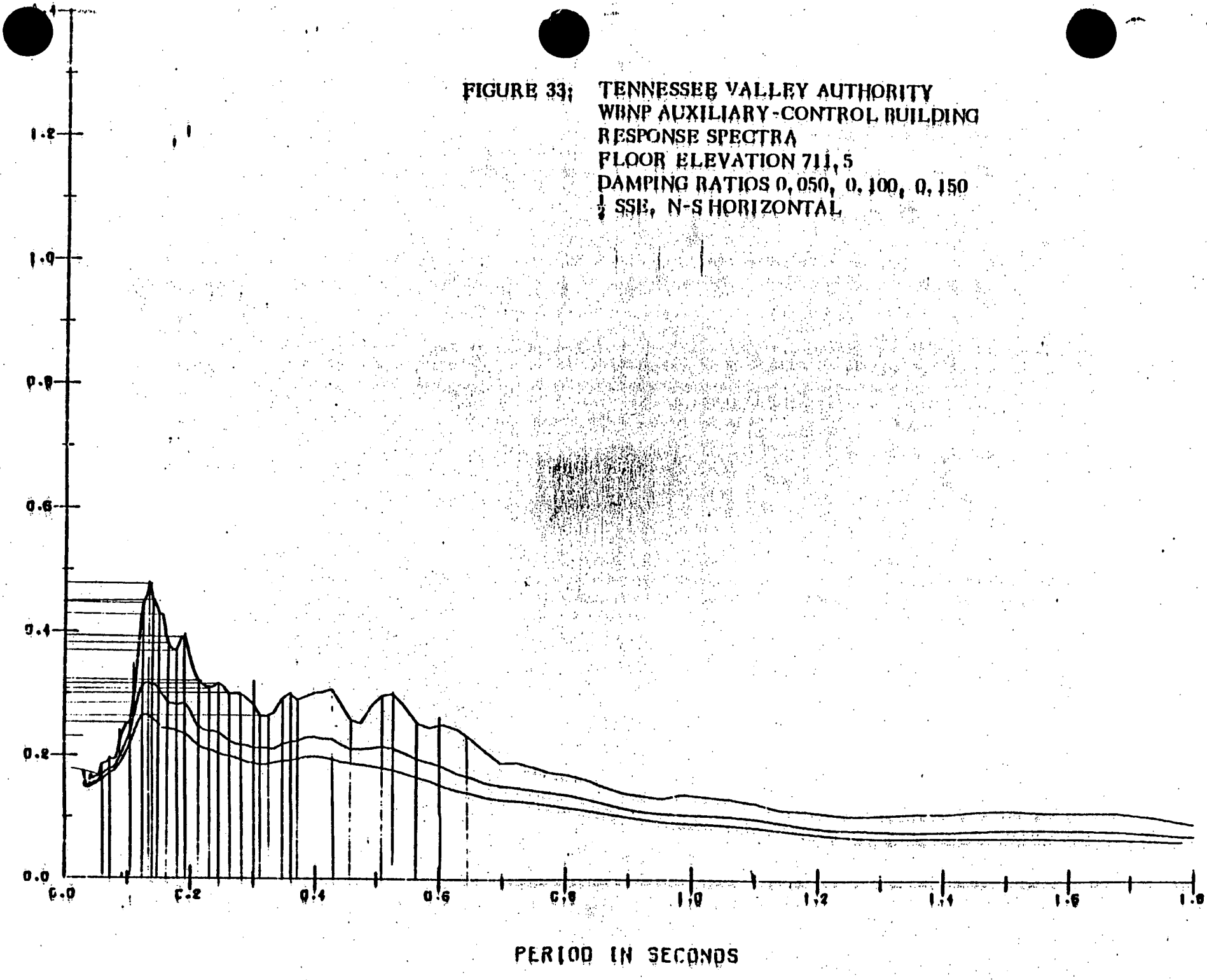


Figure 1

EM-STA-275

FIGURE 33

FIGURE 35; TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 711.5
DAMPING RATIOS 0.050, 0.100, 0.150
½SSE, E-W HORIZONTAL

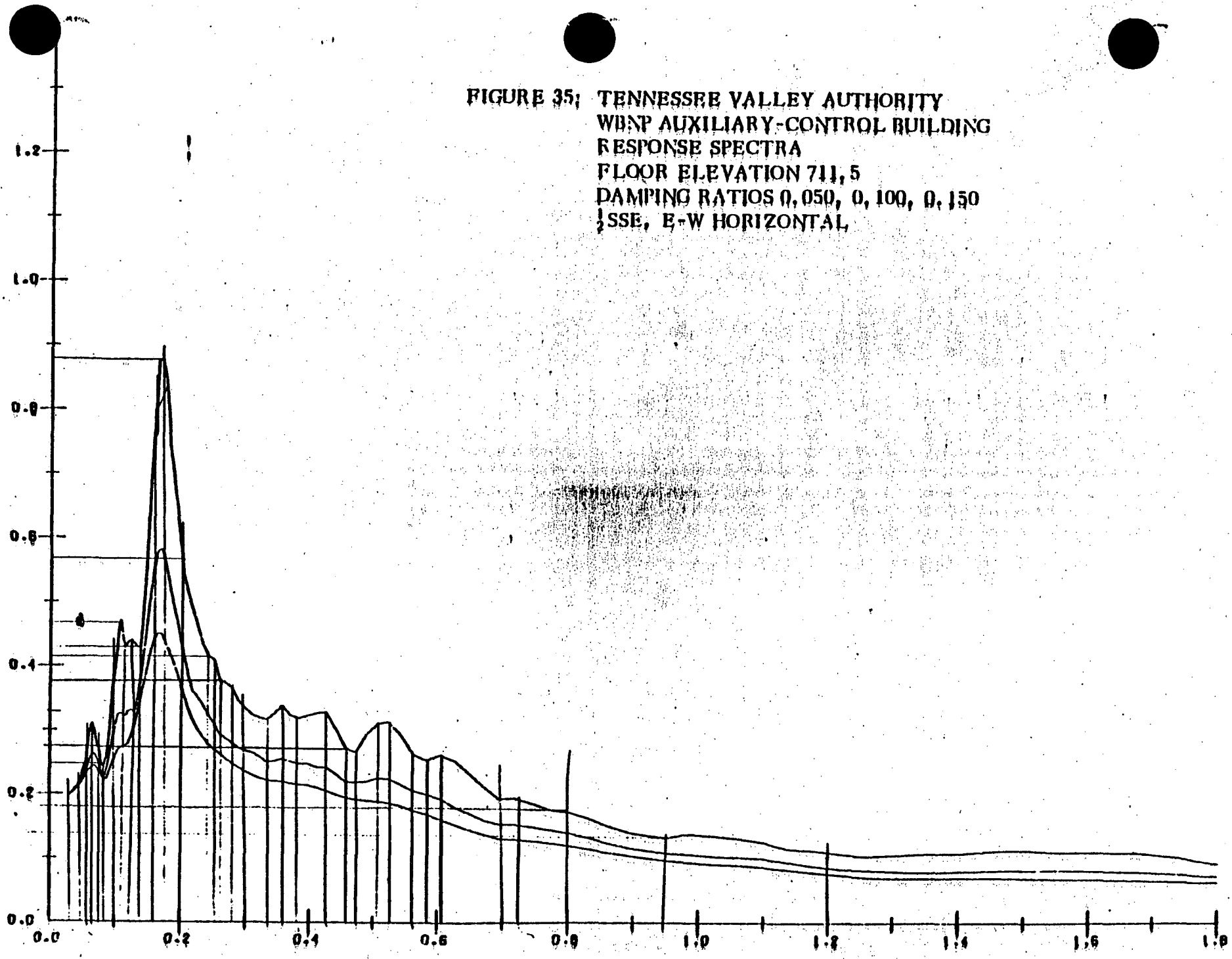


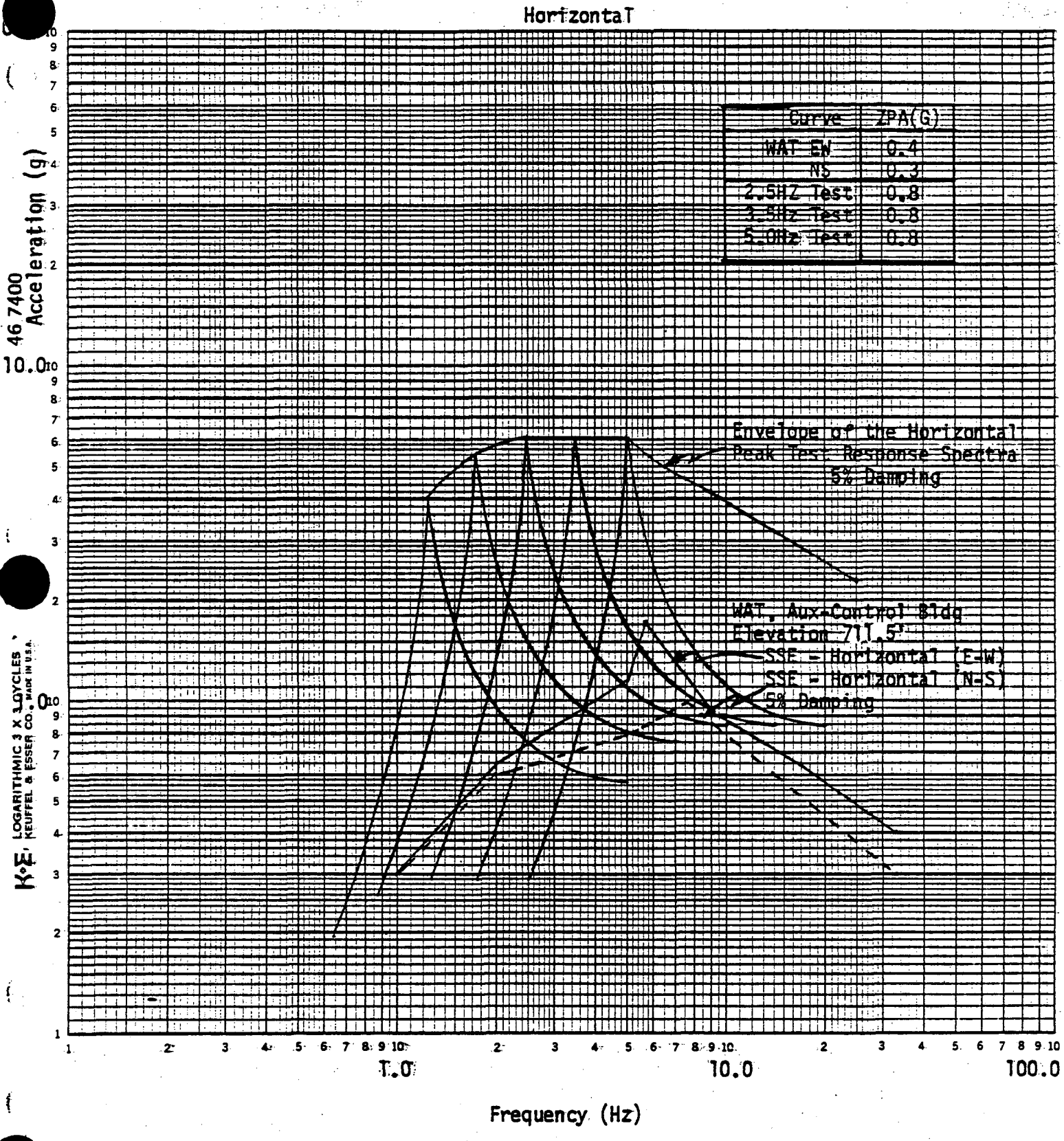
Figure 2

EM-STA-275

Figure 3

Equipment: Solid State Protection System (3-Bay)
and Safeguards Test Cabinet (1-Bay)

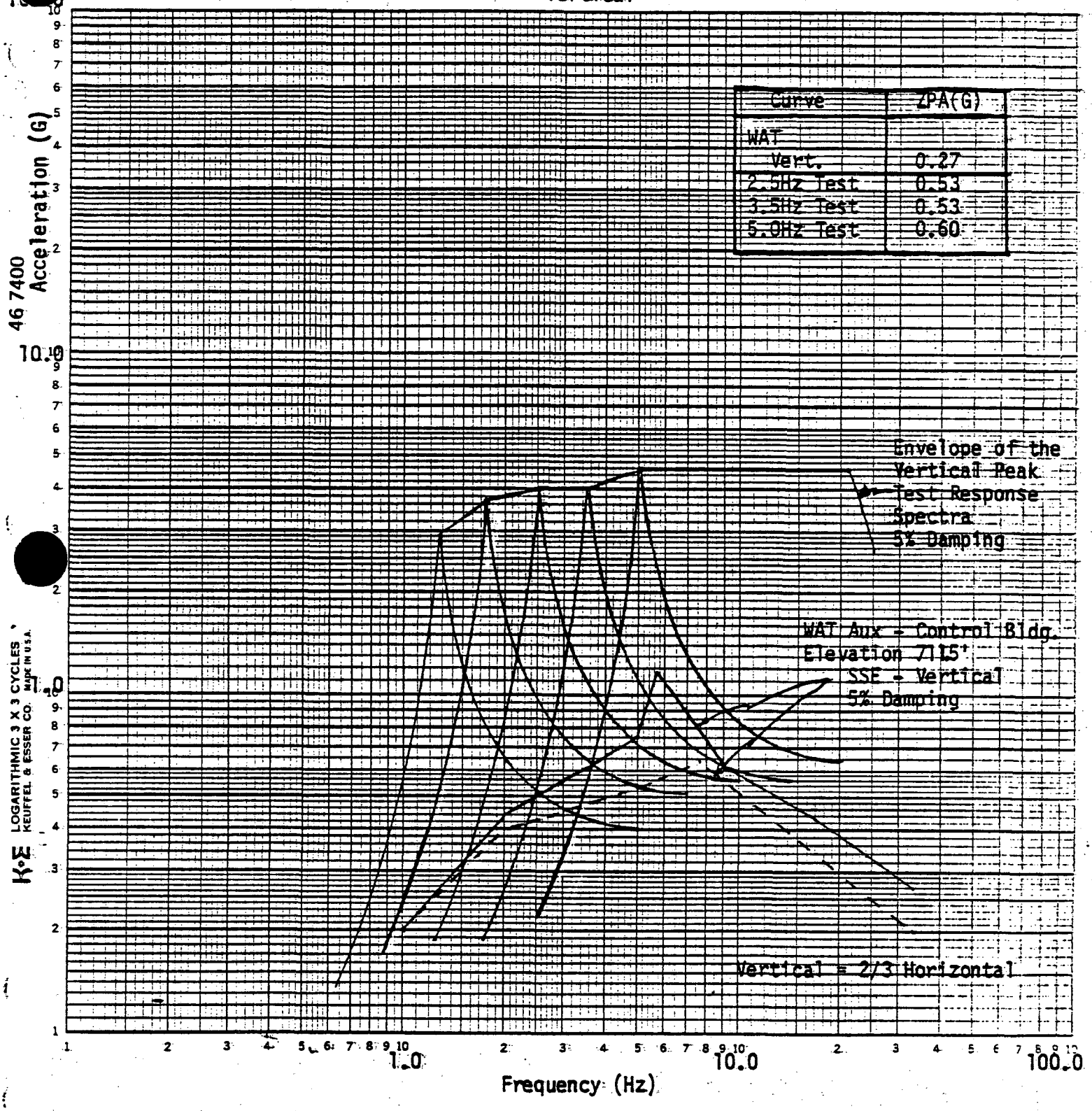
EM-STA-275



EM-STA-275

Figure 4

Equipment: Solid State Protection System (3-Bay)
and Safeguards Test Cabinet (1-Bay)



Seismic and Dynamic Qualification Summary of Equipment

EM-STA-275

I. Plant Name: Watts Bar Type:

1. Utility: TVA PWR ✓
2. NSSS: WNES BWR
3. A/E: TVA Other

II. Component Name: Safeguards Test Cabinet

1. Scope: [✓] NSSS [ ] BOP [ ] Other
2. Model Number: 1060D36 Quantity: two (Train A & B)
3. Size or Range:
4. Vendor: Westinghouse (WID)
5. If the component is a cabinet or panel, name and model Number of the devices included: Reference drawing 1060D36, Rev. -
6. Physical Description:
   a. Appearance: One Bay Vertical Cabinet
   b. Dimensions: 30" x 30" x 91.31"
   c. Weight: Approximately 1500 lbs
7. Location: Building: CONTROL BUILDING
   Elevation: 708ft
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [✓] Weld (Length 4ft)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   floor mounted
10. a. System in which located: Reactor Protection System
    b. Functional Description: Provides at-power test capability
    c. Is the equipment required for [✓] Hot Standby [✓] Cold Shutdown
    [✓] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements: E-SPEC, 95215Z REV 1 EM-ST 2/

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[✓] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[✓] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WCAP 7817 SEISMIC TESTING OF ELECTRICAL & CONTROL EQUIPMENT

(No., Title and Date): WCAP7817 Supplement 7 SEISMIC TESTING OF ELECTRICAL AND CONTROL EQUIPMENT FOR LOW SEISMIC PLANTS

Company that Prepared Report: Westinghouse

Company that Reviewed Report: Westinghouse

Where Report is filed or available: W Monroeville Nuclear Center – Nuclear Safety Dept.

Applicable Codes And/Or Standards: IEEE-344-1971

V. Vibration Input:

1. Loads considered:
   a. [✓] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[✓] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): See Attached figure 1 of 2

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE N/A SSE 5%

5. Required Acceleration in Each Direction:

[I ZPA [I Other _____ (specify)

OBE S/S = N/A F/B = N/A V = N/A

SSE S/S = N/A F/B = N/A V = N/A

6. Were fatigue effects considered?

[I Yes [✓ I No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete:

1. [✓ I Single Frequency [I Multi-Frequency: [ ] random 5 Beats
[✓ I sine beat (10 cpb) @ each test Cy
[ ] _____

2. [✓ I Single Axis [I Multi-Axis
[I Independent axis [I In-phase motions

3. Number of Qualifications Tests: FRONT-TO-BACK SIDE-TO-SIDE VERTICAL

OBE _____ SSE 3 Other _____ (specify)

4. Frequency Range: 1Hz to 35 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 9.5-13 F/B = 19-20 V = > 33 Hz

6. Method of Determing Natural Frequencies

[✓ I Lab Test [I In-Situ Test [I Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[I Yes (Attach TRS & RRS graphs)
[✓ I No

8. Maximum Input g-level Test: See Attached Figures 3&4

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [✓] Bolt (No. 4, Size 3/4)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: Floor Mounted

10. Functional operability verified:

[✓] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Test results were acceptable and structural integrity demonstrated. No modifications to the equipment were made

12. Other tests performed (such as aging or fragility test, including results):

NONE

13. Failure Modes (If appropriate: NONE)

14. Margins Available: [✓] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: EM-STA-275

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A. Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

N/A

FIGURE 33: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 711.5
DAMPING RATIOS 0.050, 0.100, 0.150
½ SSE, N-S HORIZONTAL

Figure 1

EM-STA-275

FIGURE 33

FIGURE 35; TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 711.5
DAMPING RATIOS 0.050, 0.100, 0.150
½SSE, E-W HORIZONTAL

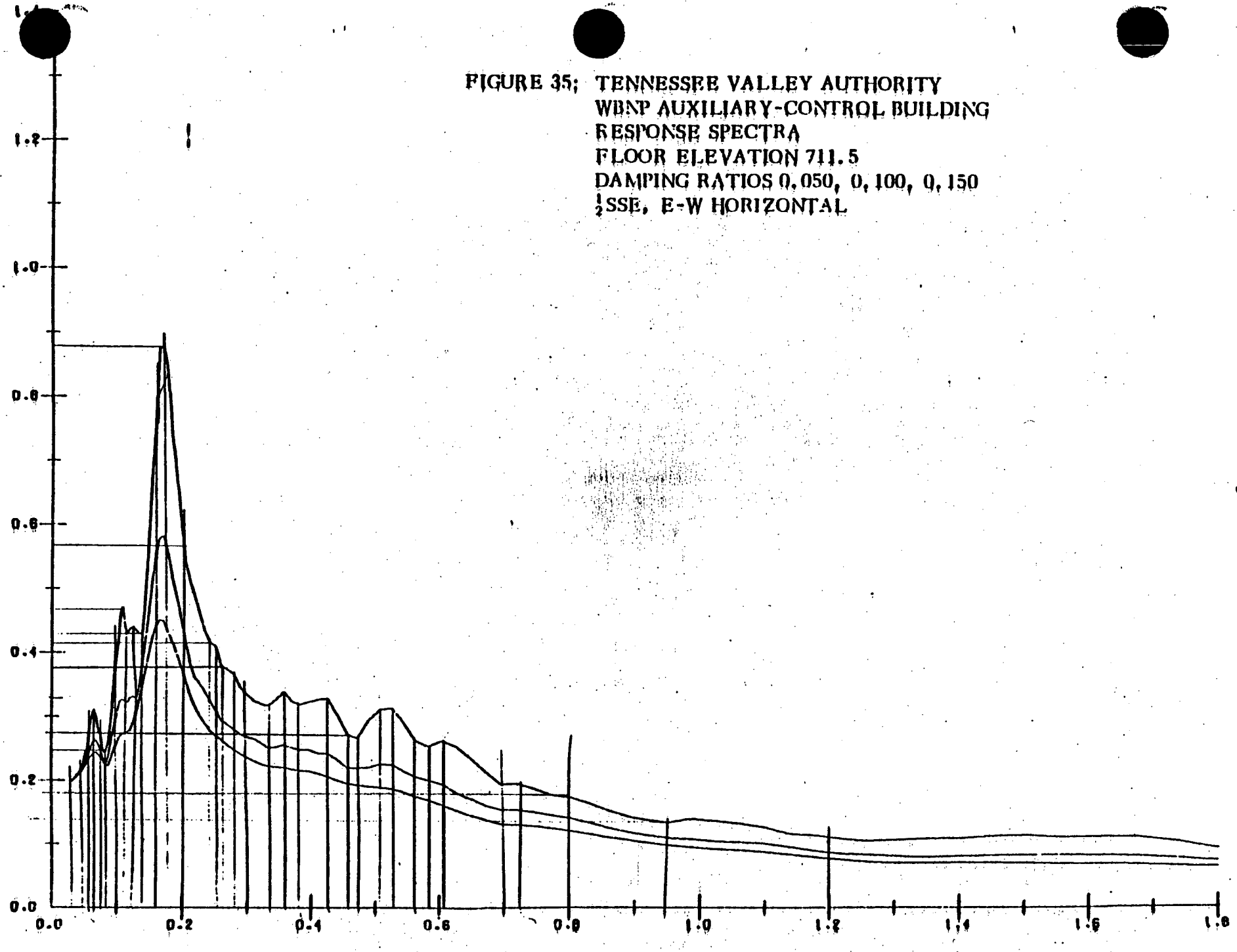


Figure 2

EM-STA-275

Figure 3

Equipment: Solid State Protection System (3-Bay)
and Safeguards Test Cabinet (T-Bay)

EM-STA-275

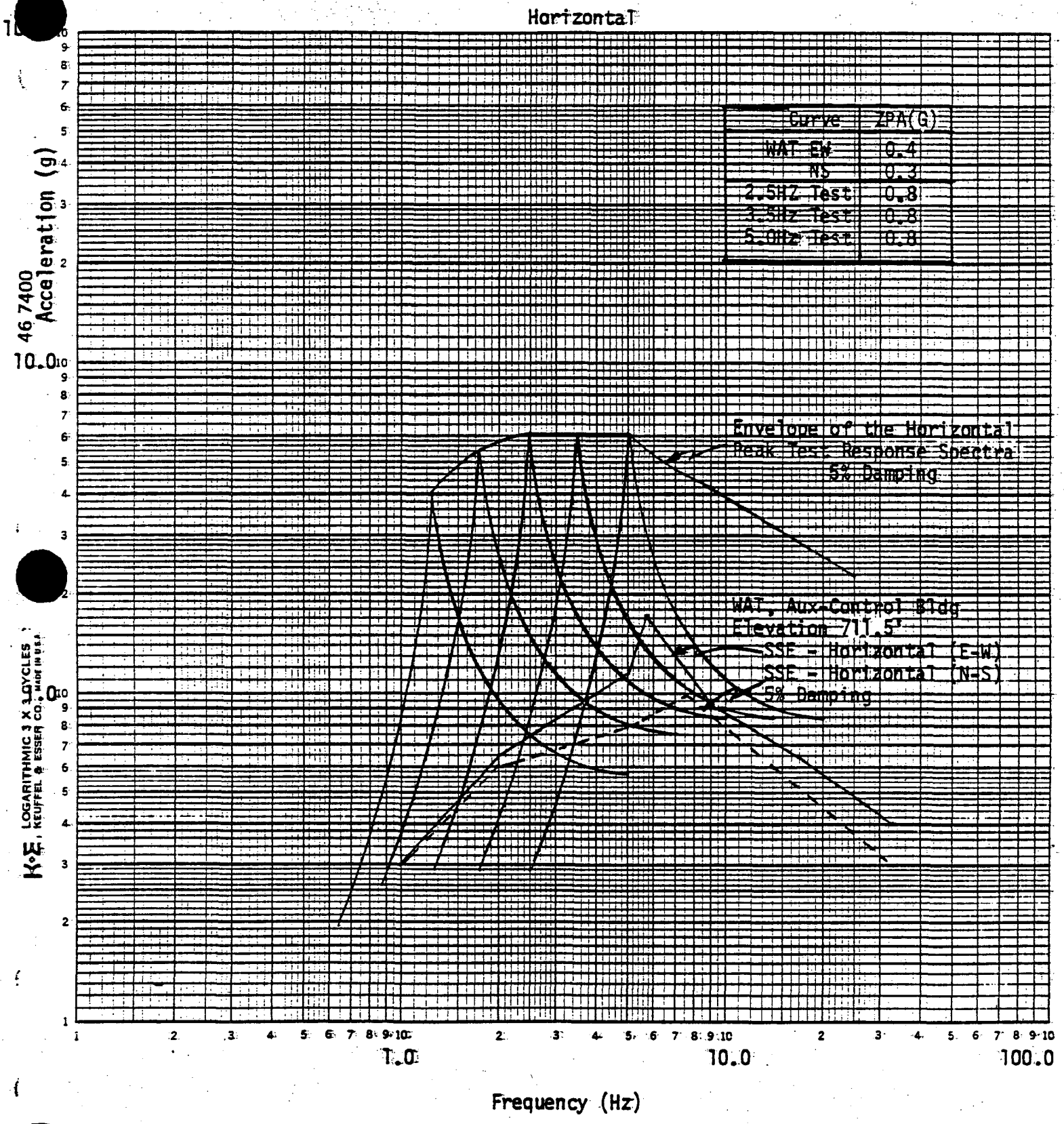
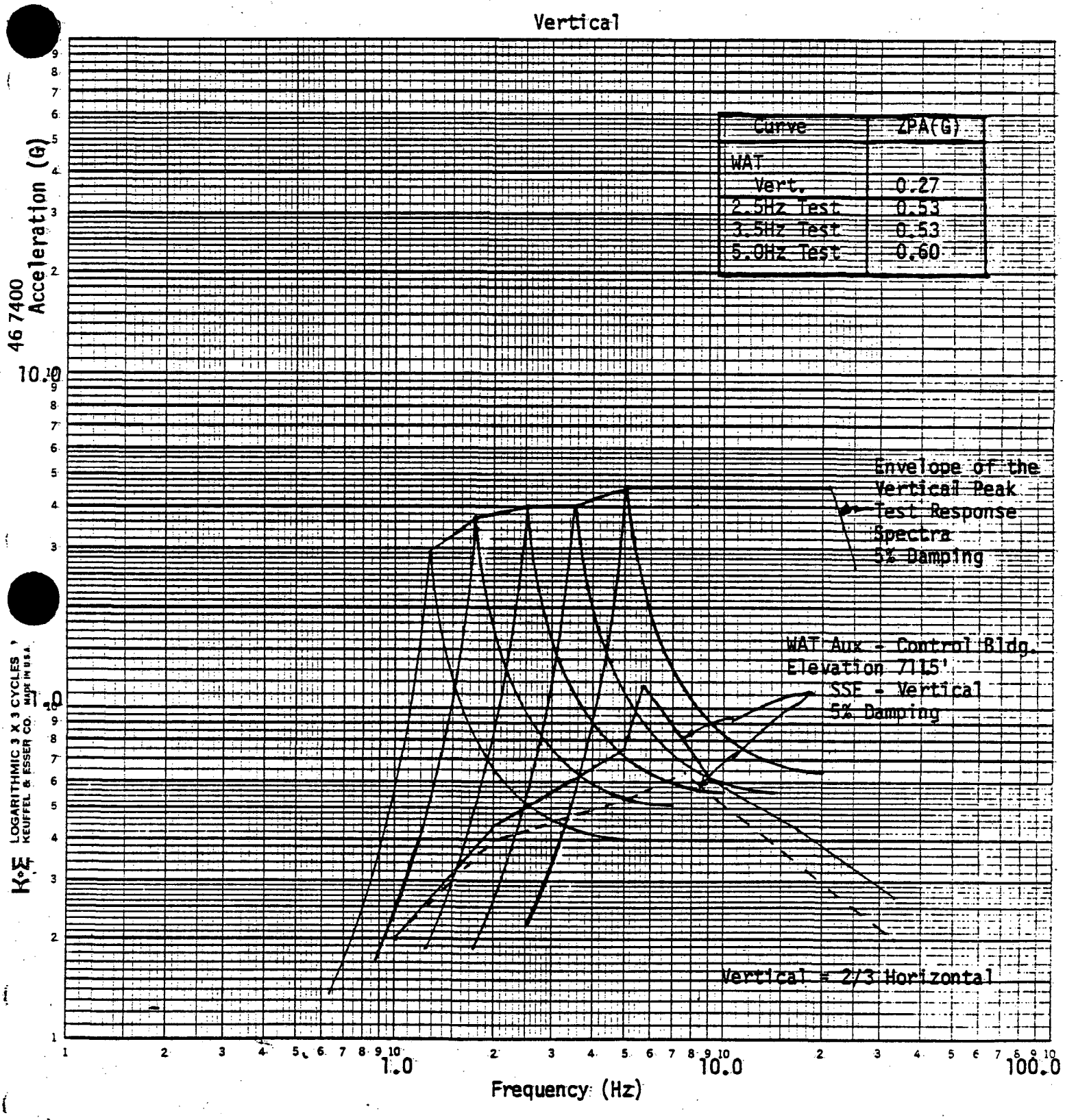


Figure 4

Equipment: Solid State Protection System (3-Bay) and Safeguards Test Cabinet (1-Bay)

EM-STA-275



Seismic and Dynamic Qualification Summary of Equipment

EM-STA-275

I. Plant Name: Watts Bar Type:

1. Utility: TVA PWR ✓
2. NSSS: WNES BWR
3. A/E: TVA Other

II. Component Name: Power Range Neutron Detector

1. Scope: [✓] NSSS [ ] BOP [ ] Other
2. Model Number: WL-23686 Quantity: Four
3. Size or Range:
4. Vendor: Westinghouse (WIGTD)
5. If the component is a cabinet or panel, name and model Number of the devices included: N/A
6. Physical Description:
   a. Appearance: Long cylinder with 3 triaxial cables
   b. Dimensions: 3.125" x 126.82" with three 168" cables
   c. Weight: Approximately 60 lbs.
7. Location: Building: Containment
   Elevation: 701.84 ft.
8. Field Mounting Conditions* [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [✓] Free standing in W Positioning Tube

* 4 units are mounted around the reactor core with their respective positions of 45°, 135°, 225°, and 315° to the core.

9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.] Supported by Positioning Tube Wheel axel at bottom. ⅛" clearance contact between detector side and tube wall
10. a. System in which located: Reactor Protection System
    b. Functional Description: Neutron Detector for neutron flux power measurements
    c. Is the equipment required for [✓] Hot Standby [✓] Cold Shutdown
    [✓] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements: Power Range Specification Sheets EM-STA-27
18-A1 Rev. 2 & 18-A2 Rev. 2

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[✓] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[✓] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: Seismic Testing of the Nuclear Instrumentation System Power Range Detector for the WATTS BAR PLANT

(No., Title and Date): ST-STA-32, dated 3/17/1981

Company that Prepared Report: Westinghouse

Company that Reviewed Report: - Westinghouse

Where Report is filed or available: Westinghouse Nuclear Safety Dept. Monroeville, Pa.

Applicable Codes And/Or Standards: IEEE-344-1975

V. Vibration Input:

1. Loads considered:
   a. [✓] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[X] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): See Attached Figure

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE N/A SSE 2%

5. Required Acceleration in Each Direction:

EM-STA-275

[I ZPA [I Other _____ (specify)

OBE S/S = N/A F/B = N/A V = N/A

SSE S/S = N/A F/B = N/A V = N/A

6. Were fatigue effects considered?

[✓] Yes [ ] No

If yes, describe how they were treated in overall qualification program: Four(4) T-rigidity tests of ascending input levels were performed, each lasted 20 seconds. These 3 lower level Test cycles constituted fatigue effects.

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [✓] Multi-Frequency: [ ] random [✓] sine beat [ ] _____

2. [ ] Single Axis [✓] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other 4 (See Figure 2) (specify)

4. Frequency Range: 1 Hz. to 33 Hz.

5. Natural Frequencies ~~in Each Direction (Side/Side, Front/Back, Vertical):~~
Radial 22 ~ 30 Hz.
~~S/S =~~ _____ ~~F/B =~~ _____ ~~V =~~ _____

6. Method of Determing Natural Frequencies

[✓] Lab Test (Shock Tests) [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[✓] Yes (Attach TRS & RRS graphs) FIGURE 2
[ ] No

8. Maximum Input g-level Test:

OBE S/S = N/A F/B = N/A V = N/A

OBE S/S = N/A F/B = N/A V = N/A (free standing)

9. Laboratory Mounting: Test article was loaded inside the ^ with ¼" clearance w/ positioning device around the circumference.

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length ____) [X] ____

B. Orientation and Fixturing: Test Fixture simulated in plant condition and is oriented 45° to the horizontal input actuator.

10. Functional operability verified:

[✓] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: No modifications were made.

12. Other tests performed (such as aging or fragility test, including results):

NONE

13. Failure Modes (If appropriate N/A)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete: Not Applicable

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ____ F/B = ____ V = ____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A. Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

Equipment: Power Range Neutron Detector

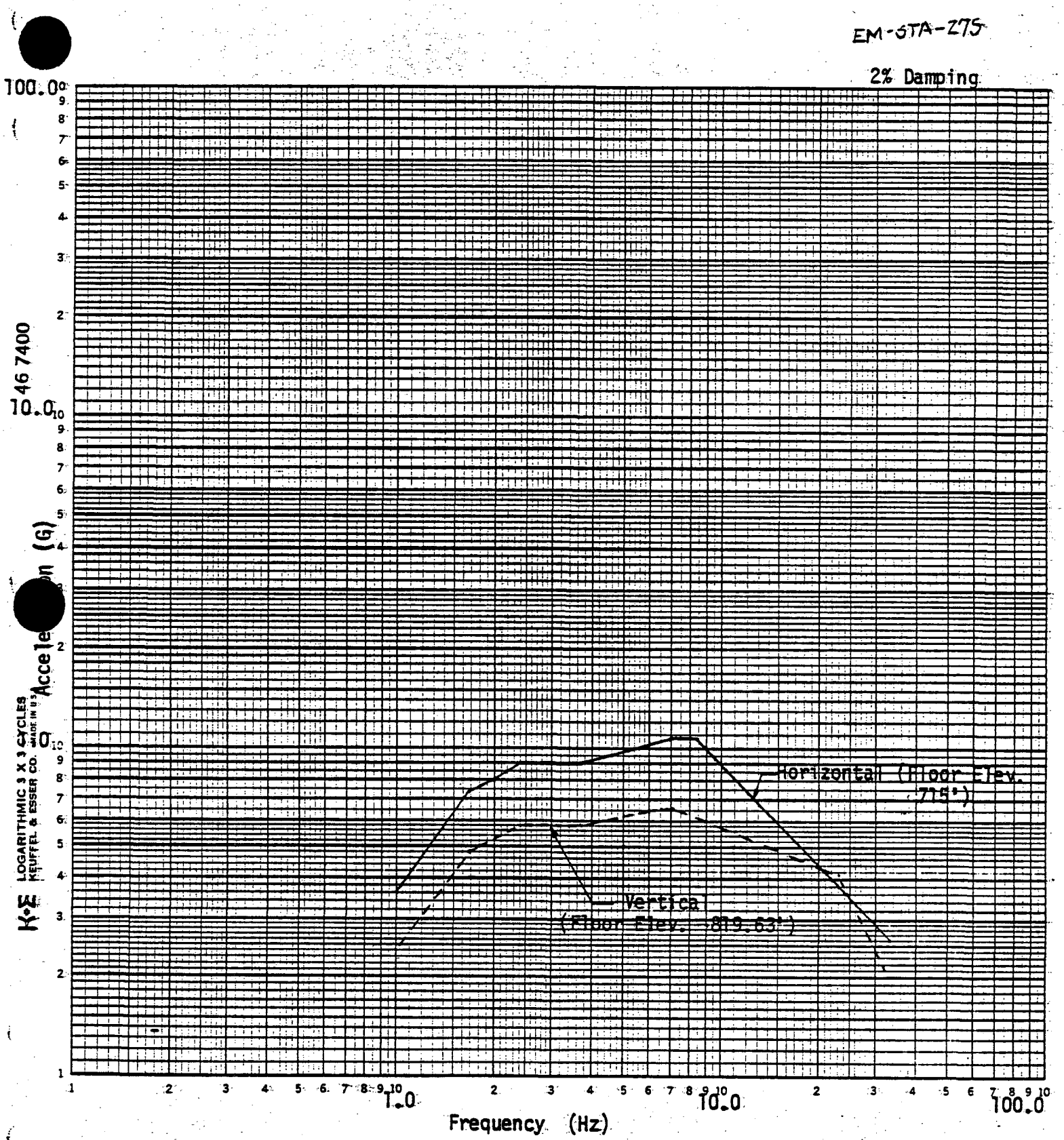


Figure 1: Watts Bar Required Response Spectra

Equipment: Power Range Neutron Detector

EM-STA-275

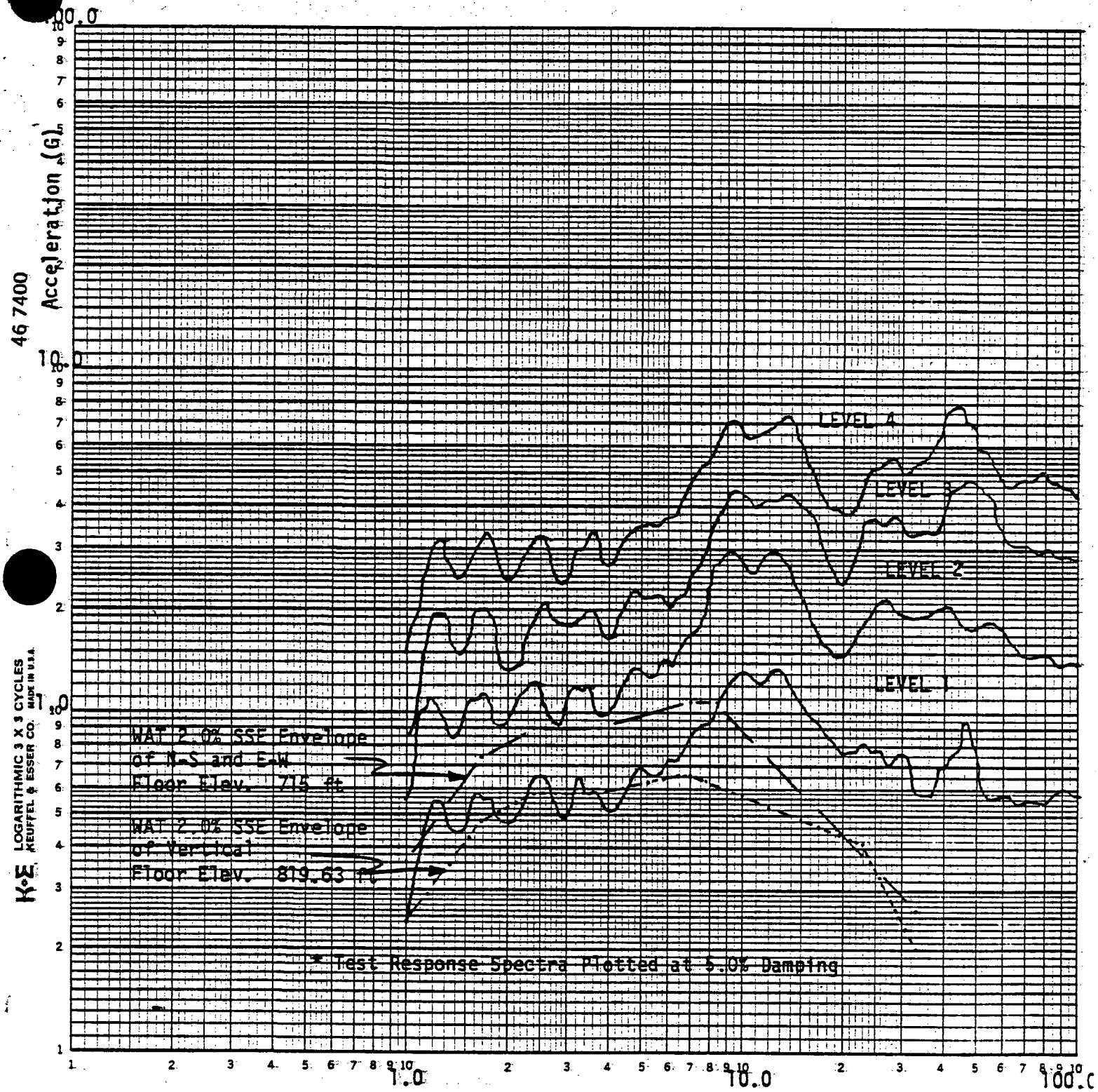


Figure 2: Comparison of Test Response Spectra*to WAT Required Response Spectra

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Watts Bar Type:

1. Utility: TVA PWR ✓
2. NSSS: WNES BWR
3. A/E: TVA Other

II. Component Name: Reactor Trip Switchgear (Reactor trip And bypass breakers)

1. Scope: [✓] NSSS [ ] BOP [ ] Other
2. Model Number: 9125D23 Quantity: One
3. Size or Range:
4. Vendor: Westinghouse (Swgr. Div)
5. If the component is a cabinet or panel, name and model Number of the devices included: Reference drawing 9125D23, Rev. 3
6. Physical Description:
   a. Appearance: Two-Bay Vertical Cabinet
   b. Dimensions: 42.18" x 73.25" x 92.00"
   c. Weight: Approximately 3400 lbs.
7. Location: Building: Auxiliary Building
   Elevation: 782 ft
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [✓] Weld (Length 21 ft)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   Floor mounted
10. a. System in which located: Reactor Protection System
    b. Functional Description: provides reactor trip function
    c. Is the equipment required for [✓] Hot Standby [✓] Cold Shutdown
    [✓] Both [ ] Neither [ ] Other

EM-STA-275 2/

II. Pertinent Reference Design Specifications for Qualification Requirements: E-SPEC. 952080 REV. 2

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[✓] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[✓] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: WCAP-8687 Supplement 2-E20B Rev. 1 - EQUIPMENT QUALIFICATION TEST REPORT

(No., Title and Date): Reactor Trip Switchgear, July 1981

Company that Prepared Report: Westinghouse

Company that Reviewed Report: Westinghouse

Where Report is filed or available: W. Monmouville Nuclear Center

Applicable Codes And/Or Standards: IEEE-344-1975, IEEE-323-1974

V. Vibration Input:

1. Loads considered:
   a. [✓] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[✓] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): See Attached Figure 1 + 2

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 5% SSE 5%

5. Required Acceleration in Each Direction:

[I ZPA [I Other _____ (specify)

OBE S/S = N/A F/B = N/A V = N/A

SSE S/S = N/A F/B = N/A V = N/A

6. Were fatigue effects considered?

[✓I Yes [I No

If yes, describe how they were treated in overall qualification program: 5 OBE cycles for fatigue effects

OBE = 1/2 SSE

VI. If Qualification by Test, then Complete:

1. [I Single Frequency [✓] Multi-Frequency: [I random [✓] sine beat [I _____

2. [I Single Axis [✓] Multi-Axis
[I Independent axis [✓] In-phase motions

3. Number of Qualifications Tests:

OBE 5 SSE 4 Other _____ (specify)

4. Frequency Range: 1 Hz to 33 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 5-7 Hz F/B = 10-12.5 Hz V = >33 Hz

6. Method of Determing Natural Frequencies

[✓I Lab Test [I In-Situ Test [I Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[✓I Yes (Attach TRS & RRS graphs) See Attached Figure 3
[I No

8. Maximum Input g-level Test:

OBE S/S = N/A F/B = N/A V = N/A

~~OBE~~ SSE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [✓] Bolt (No. 12, Size 3/8")

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: Floor Mounted

10. Functional operability verified:

[✓] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Test results were acceptable and structural integrity demonstrated. No modifications to the equipment were made

12. Other tests performed (such as aging or fragility test, including results):

NONE

13. Failure Modes (If appropriate NONE)

14. Margins Available: [✓] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Consfderations in the model: _____

8. Critical Structural Elements:

A. Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

N/A

FIGURE 53; TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 781.5
DAMPING RATIOS 0.050, 0.100, 0.150
½ SSE, N-S HORIZONTAL

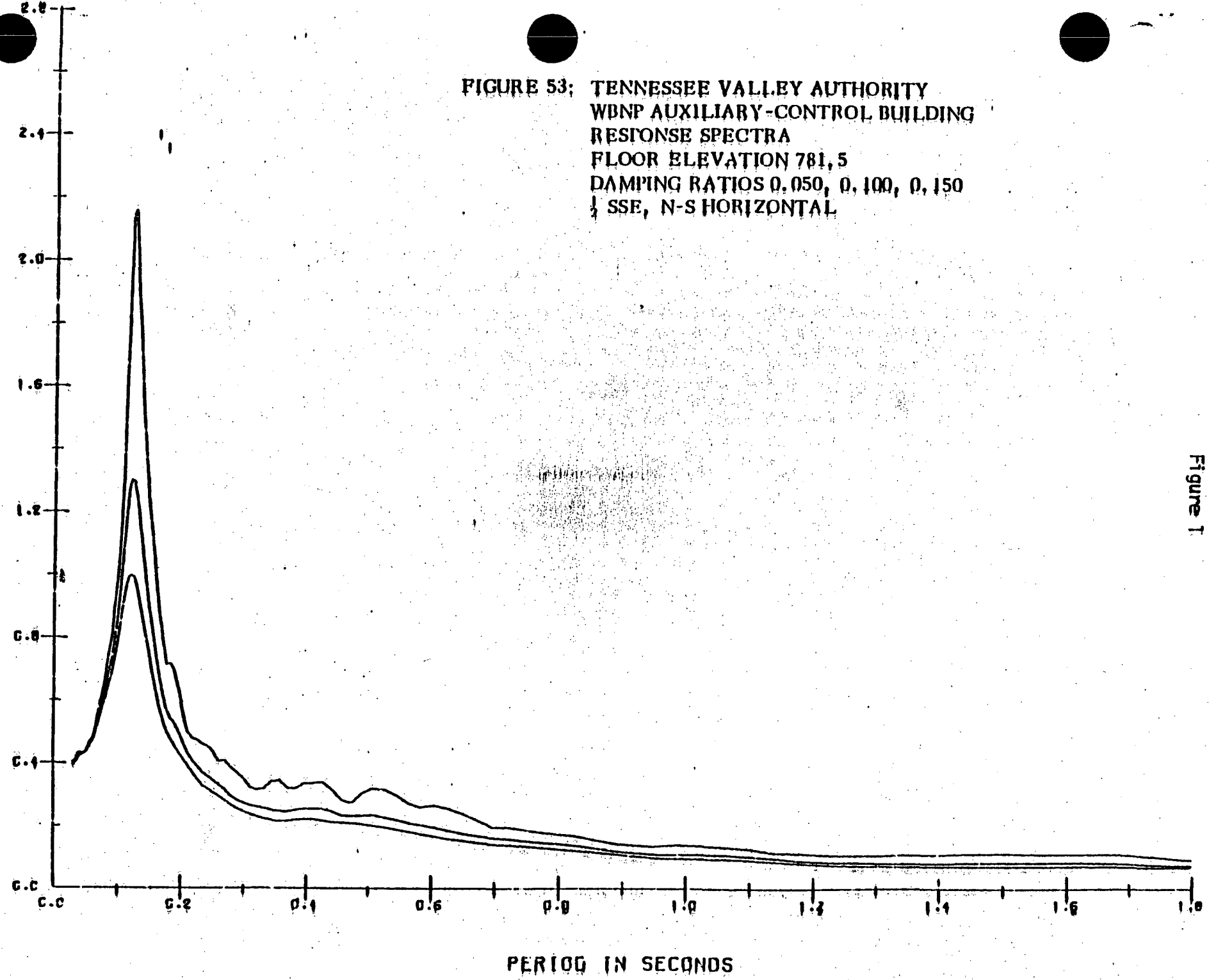


FIGURE 53

Figure 1

EMSTA-275

Figure 2

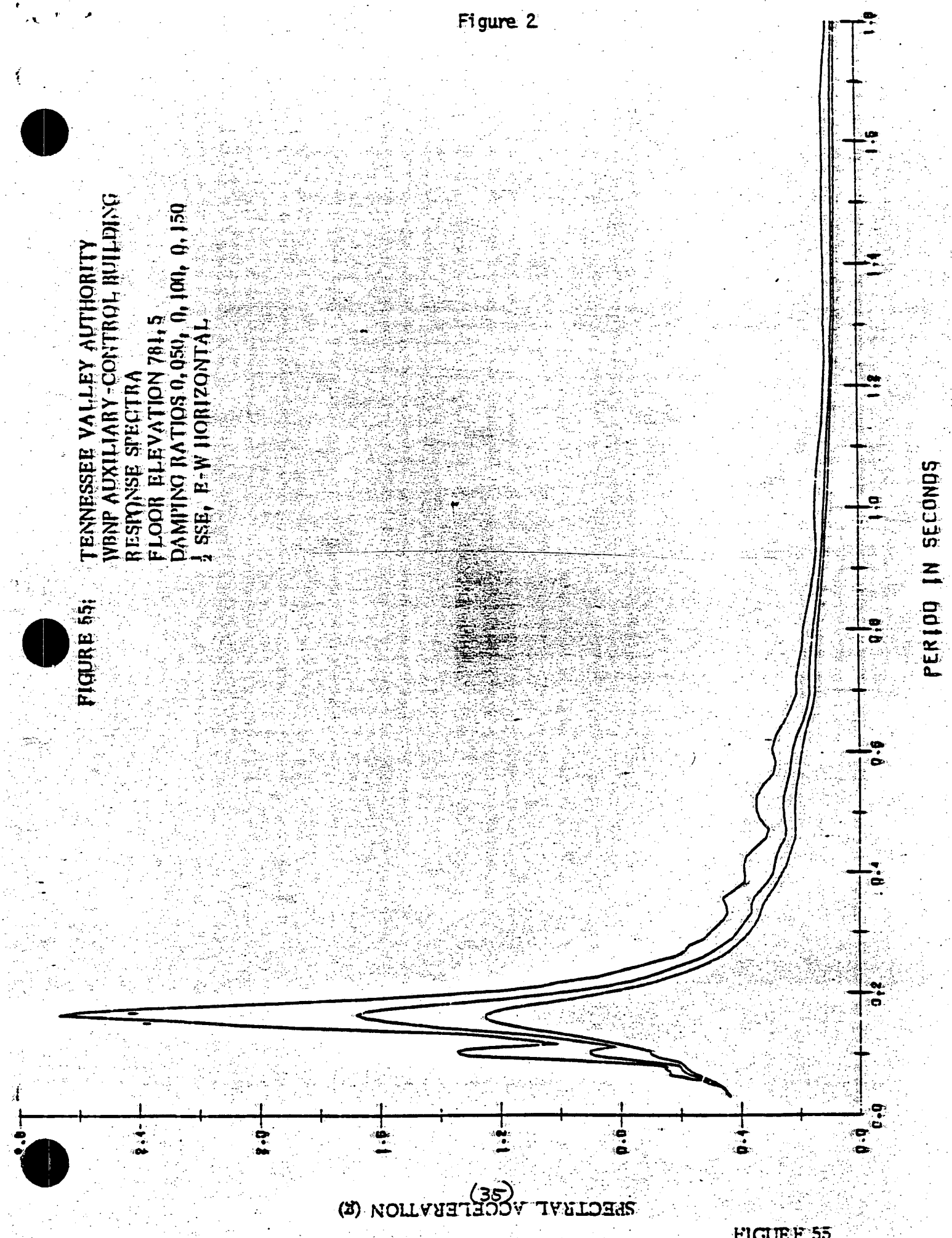
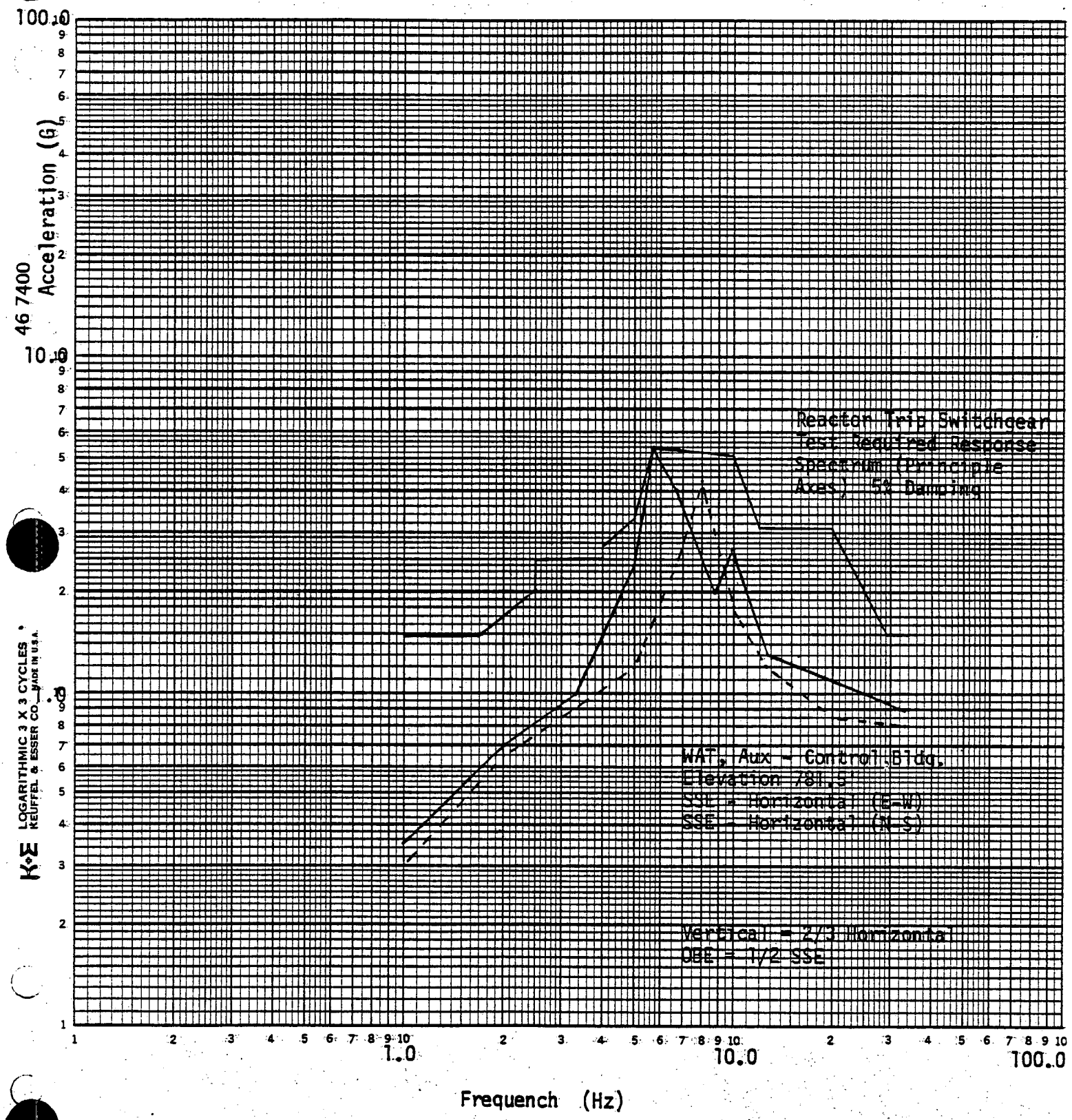


FIGURE 55

EM-STA-275

Figure 3

Equipment: Reactor Trip Switchgear



Seismic and Dynamic Qualification Summary of Equipment EM-STA-275

I. Plant Name: Watts Bar Type:

1. Utility: TVA PWR ✓
2. NSSS: W-NES BWR
3. A/E: TVA Other

II. Component Name: Main Control Board

1. Scope: [✓] NSSS [ ] BOP [ ] Other
2. Model Number: 1142E62 Quantity: 1
3. Size or Range:
4. Vendor: Westinghouse (WID)
5. If the component is a cabinet or panel, name and model Number of the devices included: Ref Table C-1 of WCAP 8540
6. Physical Description:
   a. Appearance: Five (5) individual panel sections - U shape
   b. Dimensions: Height 98.5", Depth 71.6", Length (section) 114" → 1
   c. Weight: 4200 lbs to 9800 lbs
7. Location: Building: Auxilliary Control Building
   Elevation: 755.5" (main control room)
8. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [✓] Weld (Length ____) 259'/MCB
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   floor
10. a. System in which located: Reactor control and protection
    b. Functional Description:
    c. Is the equipment required for [✓] Hot Standby [✓] Cold Shutdown
       [✓] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements: F-SPEC 952367 REV 2

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[✓] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [X] Combination of Test and Analysis

Qualification Report*: WCAP 8501 "Correlation Study of a Full Size MCB Section"

(No., Title and Date): WCAP 8540: Seismic Qual. of the Full Size MCB for Sequoyah and Watts Bar NPP

Company that Prepared Report: Westinghouse

Company that Reviewed Report: Westinghouse

Where Report is filed or available: Westinghouse

Applicable Codes And/Or Standards: IEEE-344-1971

V. Vibration Input:

1. Loads considered:
   a. [✓] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[✓] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): attached Fig 46

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direction:

[I ZPA [I Other _____ (specify)

OBE S/S = NA F/B = NA V = NA

SSE S/S = _____ F/B = _____ V = _____

6. Were fatigue effects considered?

[✓] Yes [ ] No

If yes, describe how they were treated in overall qualification program: Several sine beat tests were conducted. Three sequences at increasing levels, each sequence was repeated in each principal direction.

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [✓] Multi-Frequency: [ ] random [✓] sine beat [ ] _____

2. [✓] Single Axis [ ] Multi-Axis
[ ] Independent axis [✓] In-phase motions

3. Number of Qualifications Tests:

OBE 12 SSE _____ Other sine sweeps (specify)

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical): (WCAP 9501)

S/S = 14.2 Hz F/B = 21.1 Hz V = >33 Hz

6. Method of Determing Natural Frequencies

[✓] Lab Test [ ] In-Situ Test [✓] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[✓] No

8. Maximum Input g-level Test: (RRS)

OBE S/S = _____ F/B = _____ V = _____

~~OBE~~ SSE S/S = 2 F/B = 2 V = 1.5

9. Laboratory Mounting:

A. [✓] Bolt (No. 4, Size 0.5")

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[✓] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Structural adequacy of device operability verified; test data obtained for analysis correlation

12. Other tests performed (such as aging or fragility test, including results):

sine sweep

13. Failure Modes (If appropriate None)

14. Margins Available: [ ] Input Spectrum [✓] Fragility

VII. If Qualification by Analysis, then complete: (WCAP 8540)

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[✓] Dynamic Analysis: [✓] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

5 Section S/S = 17.71 F/B = 14.3 V = >33 Hz

3. Model Type: [✓] 3D [ ] 2D [ ] 1D

[✓] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other: _____

4. [✓] Computer Codes: NASTRAN

Frequency Range and No. of modes considered: 750 Hz

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[✓] Absolute Sum [ ] SRSS [ ] Other: AISC (specify)

✓ 6. Damping:

OBE _____ SSE 2 Basis for the damping used: _____

7. Support Considerations in the model: Fixed base

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Normalized Seismic Stress	Normalized Total Stress	Normalized Stress Allowable
Section MA	F/B	.49	.535	1 (AISC

See Appendix A of WCAP 8540

Allowable is 36.0 KS

B.

Max. Critical ~~Deflection~~ Acc.	Location	Maximum Allowable Deflection to Assure Functional Operability
3.12g	IM4 F/B	3.12g

9. Failure Modes: None

10. Margins Available: [ ] Input Spectrum [✓] Stress or Deflection

Note: Comparison of analysis and required response spectrum in Figure 2-1 (attached)

TABLE C-1

LOCATION AND DESCRIPTION OF ELECTRICAL EQUIPMENT TESTED*

Item No.	Description
M-4-003	W 252 Vertical Indicator
M-4-004	International 1151 Ver. Ind.
M-4-005	W 252 Vertical Indicator
M-4-006	International 1251 Ver. Ind.
M-4-007	W 252 Vertical Indicator
M-4-008	International 1151 Vertical Indicator
M-4-017	W 252 Vertical Indicator
M-4-018	International 1251 Vertical Indicator
M-4-021	W 252 Vertical Indicator
M-4-022	International 1151 Vertical Indicator
M-4-036	W 252 Vertical Indicator
M-4-037	International 1251 Vertical Indicator
M-4-076	RPI Module
M-4-0101	MWO-2T Switch Module
M-4-0102	Joystick Switch Module
M-4-0103	MW3 Switch Module
M-4-0108	M00 Switch Module
M-4-0109	M00 Switch Module
M-4-0116	MW0 Switch Module
M-4-0117	MW0 Switch Module
M-4-0134	Special Switch Module
M-4-0135	Special Switch Module
M-4-0136	GEMCO Switch Module
M-4-0137	GEMCO Switch Module
M-4-0138	MW3 Switch Module
M-4-0144	MW0 Switch Module
M-4-0169	MW0-2T Switch Module
M-4-0170	MW0-2T Switch Module
M-4-0179	MW0 Switch Module

*Reference — B/M For TVA-M4

TABLE C-1 (cont)

LOCATION AND DESCRIPTION OF ELECTRICAL EQUIPMENT TESTED

Item No.	Description
M-4-0181	GEMCO Switch Module
M-4-0182	GEMCO Switch Module
M-4-0189	M00 Switch Module
M-4-0190	M00 Switch Module
M-4-0208	Special Switch Module
M-4-0209	Special Switch Module
M-4-0233	Annunciator Window Box

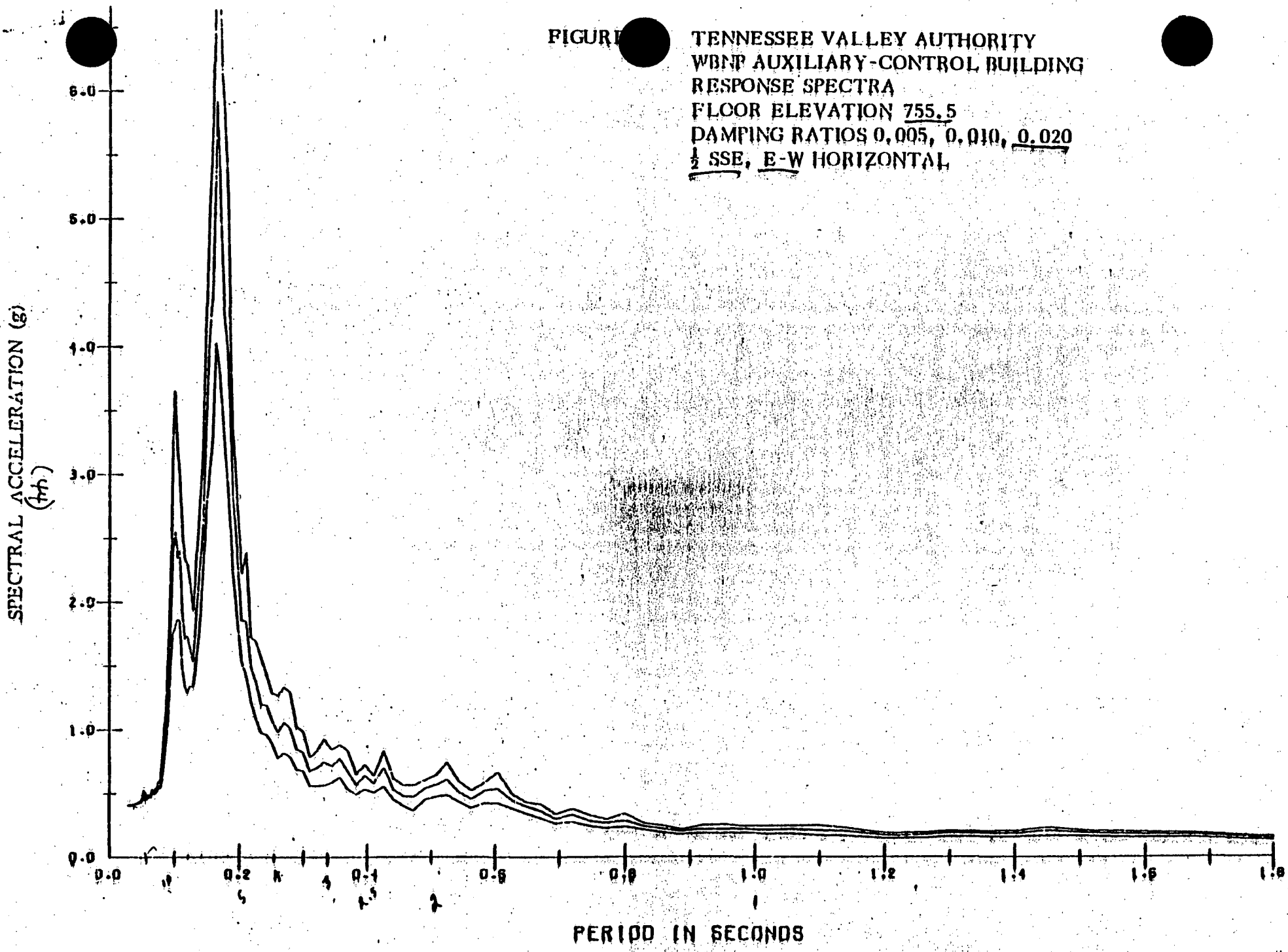
TABLE C-2

Accelerometer Locations for Testing (i.e., Vertical, Horizontal; front to back, and side to side.)

A1 — Input Acceleration
A2 — Top Left Side-near Item 234
A3 — Top Right Between Items 233 and 235
A4 — Between Items 38, 39, 64 and 65
A5 — Middle Center Between Items 75 and 86
A6 — Middle Right Between Items 45 and 100
A7 — Bottom Left Below Item 143
A8 — Bottom middle between Items 148 and 149
A9 — Bottom right below Items 172 and 173
A10 — Middle Center Between Items 16 and 17
A11 — Top Frame Circuit Breaker Panel

FIGURE

TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 755.5
DAMPING RATIOS 0.005, 0.010, 0.020
½ SSE, E-W HORIZONTAL



EM-STA-275

8590-38

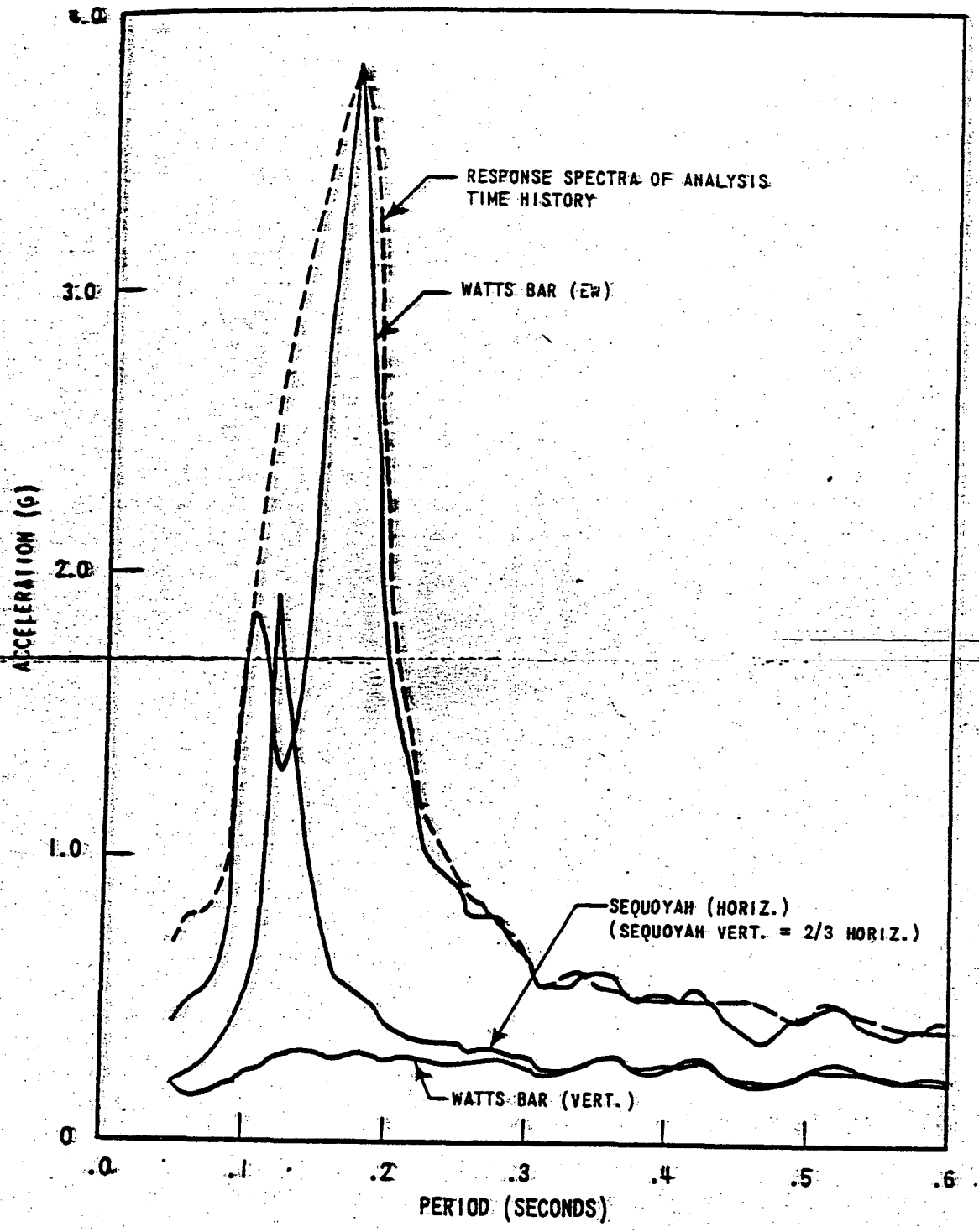


Figure 2-1. Response Spectra (OBE) (Main Control Board)

NOTE: Time-history input was amplified by a factor of 2.0 in analyses to reach SSE levels.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS Bar

Type:

1. Utility: Tennessee Valley Authority — PWR X
2. NSSS: Westinghouse Electric Corp. — BWR
3. A/E: Tennessee Valley Authority — Other

II. Component Name: Boric Acid Transfer Pump

1. Scope: [X] NSSS [ ] BOP [ ] Other
2. Model Number: 3196 MT Quantity: Four
3. Size or Range: 75 gallons per minute
4. Vendor: Goulds Pump Inc.
5. If the component is a cabinet or panel, name and model Number of the devices included:
6. Physical Description:
   a. Appearance: horizontal single stage pump
   b. Dimensions: 52" by 15" by 21" high
   c. Weight: 580 lbs
7. Location: Building: Auxiliary Building
   Elevation: 713 feet
8. Field Mounting Conditions [X] Bolt (No. 4, Size 5/8")
   [ ] Weld (Length)
   [ ]
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   grouted and bolted to the floor
10. a. System in which located: Chem. & Volume Control
    b. Functional Description: Pump Boric Acid
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
    [ ] Both [ ] Neither [ ] Other

Requirements: 678910 Rev. 0 679140 Rev. 5

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [x] Analysis [ ] Combination of Test and Analysis

Qualification Report*:

(No., Title and Date): Static Seismic Analysis #717672, 3/30/76

Company that Prepared Report: Goulds Pump Inc.

Company that Reviewed Report: Westinghouse Electric Corporation

Where Report is filed or available: Westinghouse Electric Corporation

Applicable Codes And/Or Standards: ASME Code Section III, AISC Code

V. Vibration Input:

1. Loads considered:
   a. [ ] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [X] Combination of (a), (b),

2. Method of Combining RRS:

[ ] Absolute Sum [ ] SRSS [X] Static analysis (other, specify)

3. Required Response Spectra** (attach the graphs):

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE .005 SSE .005

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other _____ (specify)

OBE S/S = 1g F/B = 1g V = .5g

SSE S/S = 2g F/B = 2g V = 1g

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] _____

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[✓] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = > 35Hz F/B = > 35Hz V = > 35Hz

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[X] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[x] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[x] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE .005 SSE .005 Basis for the damping used: _____

7. Support Considerations in the model: assumed to be rigidly attached to the flo

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

will probably be hold down bolts

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

FIGURE

TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 728.25
DAMPING RATIOS 0.005, 0.010, 0.020
1/3 SSE, E-W HORIZONTAL

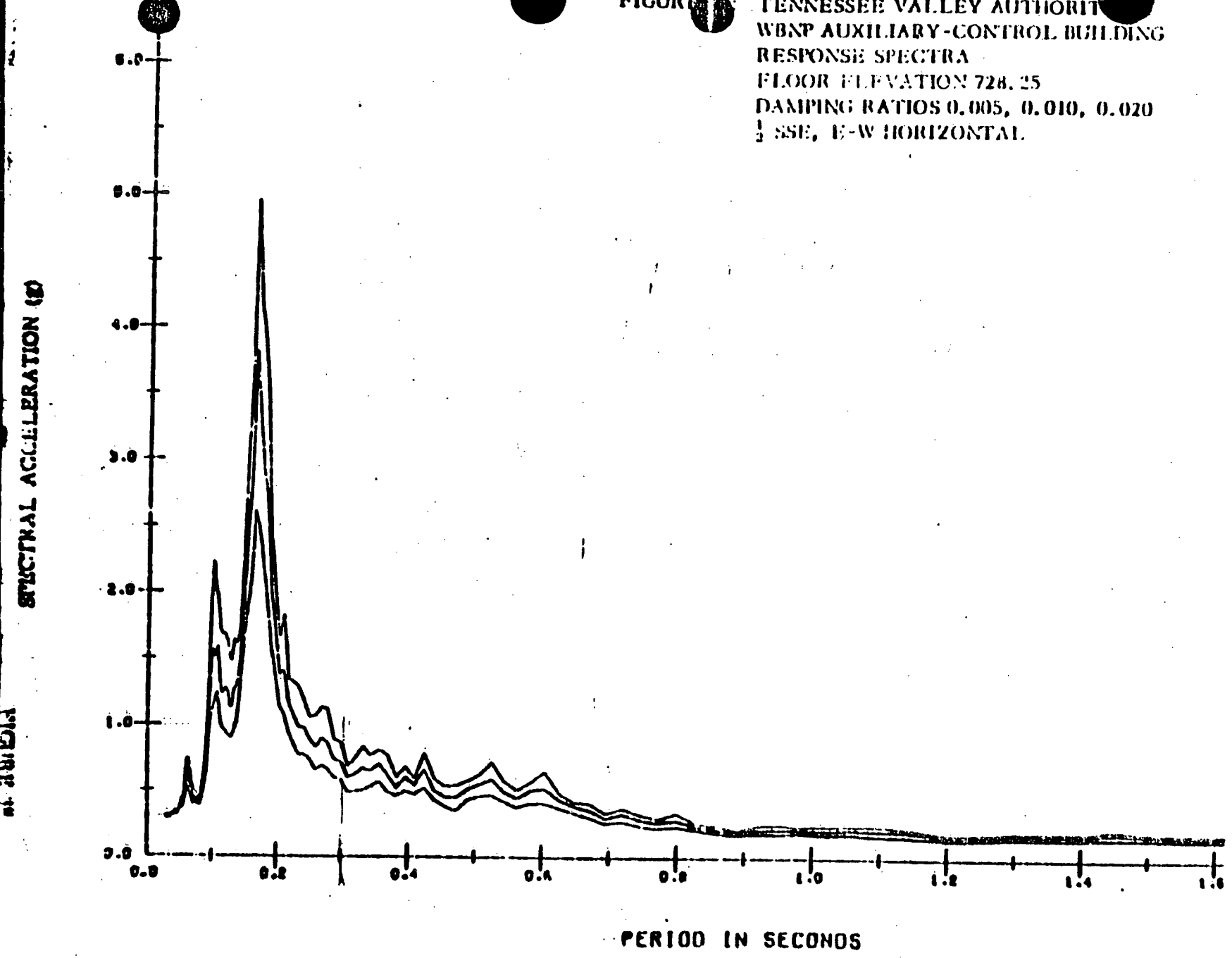


FIGURE 37: TENNESSEE VALLEY AUTHORITY
WBN AUXILIARY CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 728.25
DAMPING RATIOS 0.050, 0.100, 0.150,
& SSE, N-S HORIZONTAL

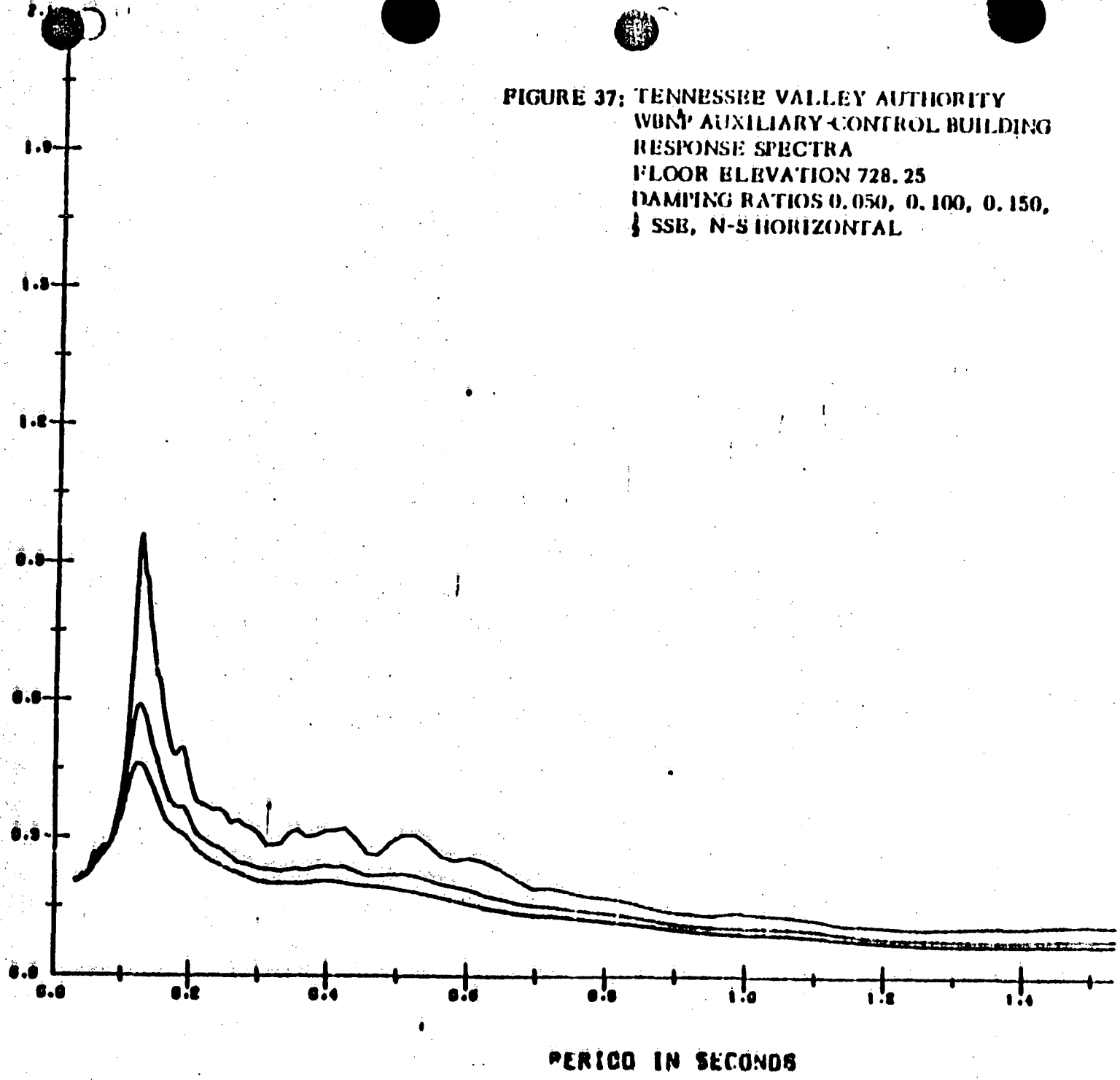
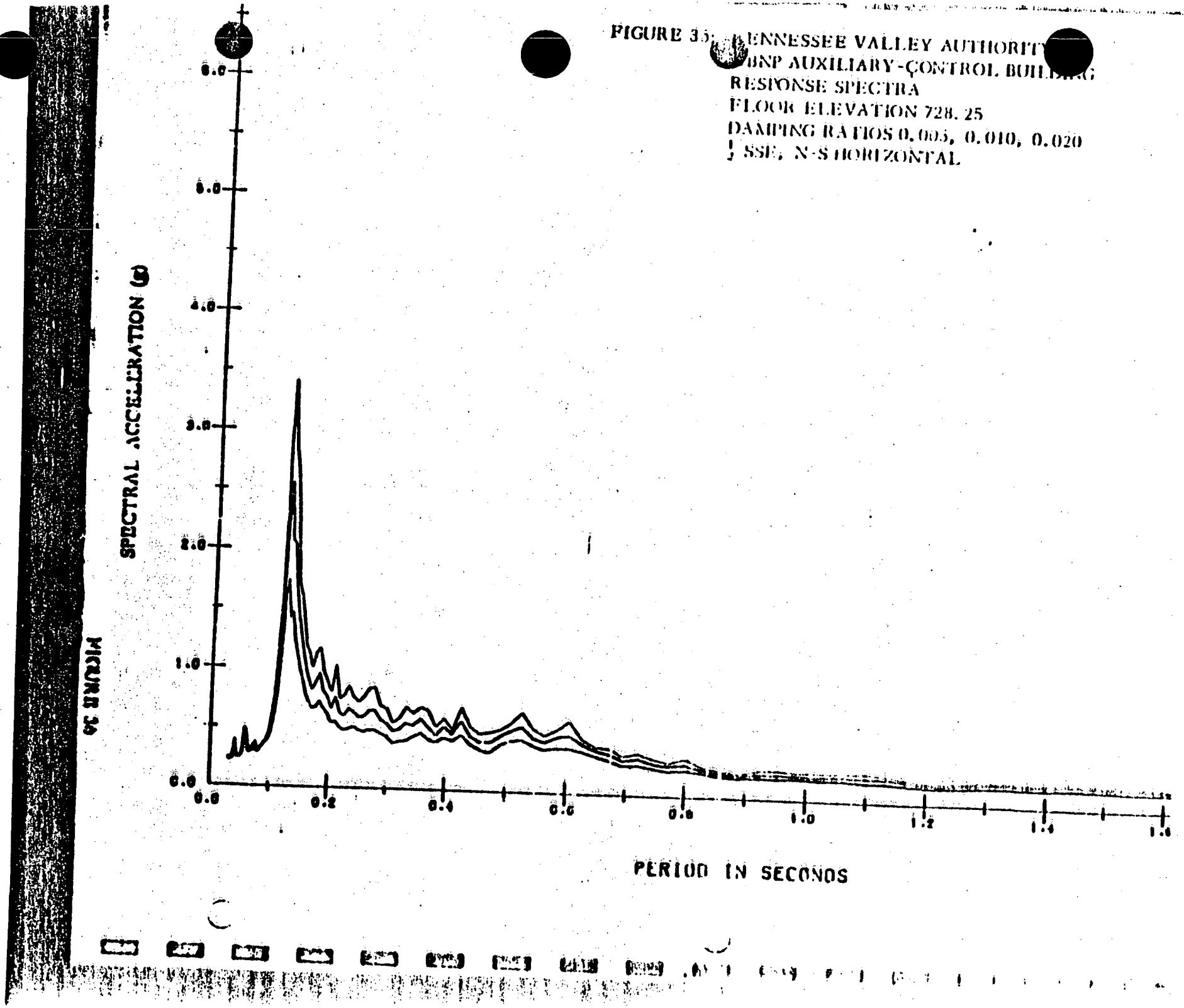


FIGURE 37

FIGURE 35 TENNESSEE VALLEY AUTHORITY
BNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 728.25
DAMPING RATIOS 0.005, 0.010, 0.020
SSE, N-S HORIZONTAL



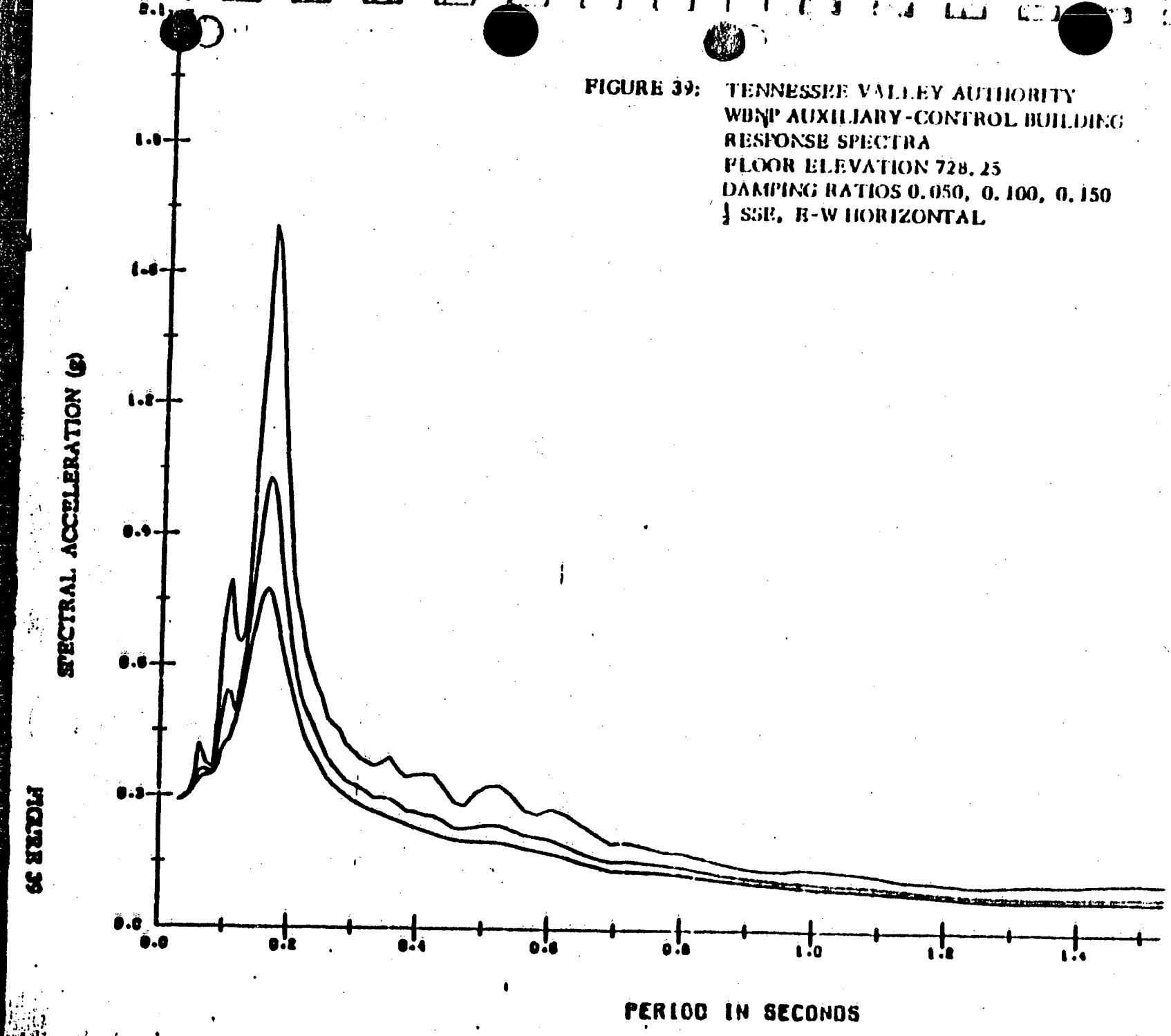


FIGURE 39: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 728.25
DAMPING RATIOS 0.050, 0.100, 0.150
½ SSE, E-W HORIZONTAL

FIGURE 66: TENNESSEE VALLEY AUTHORITY
BNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 814.25
DAMPING RATIOS 0.005, 0.010, 0.020
SSE, VERTICAL

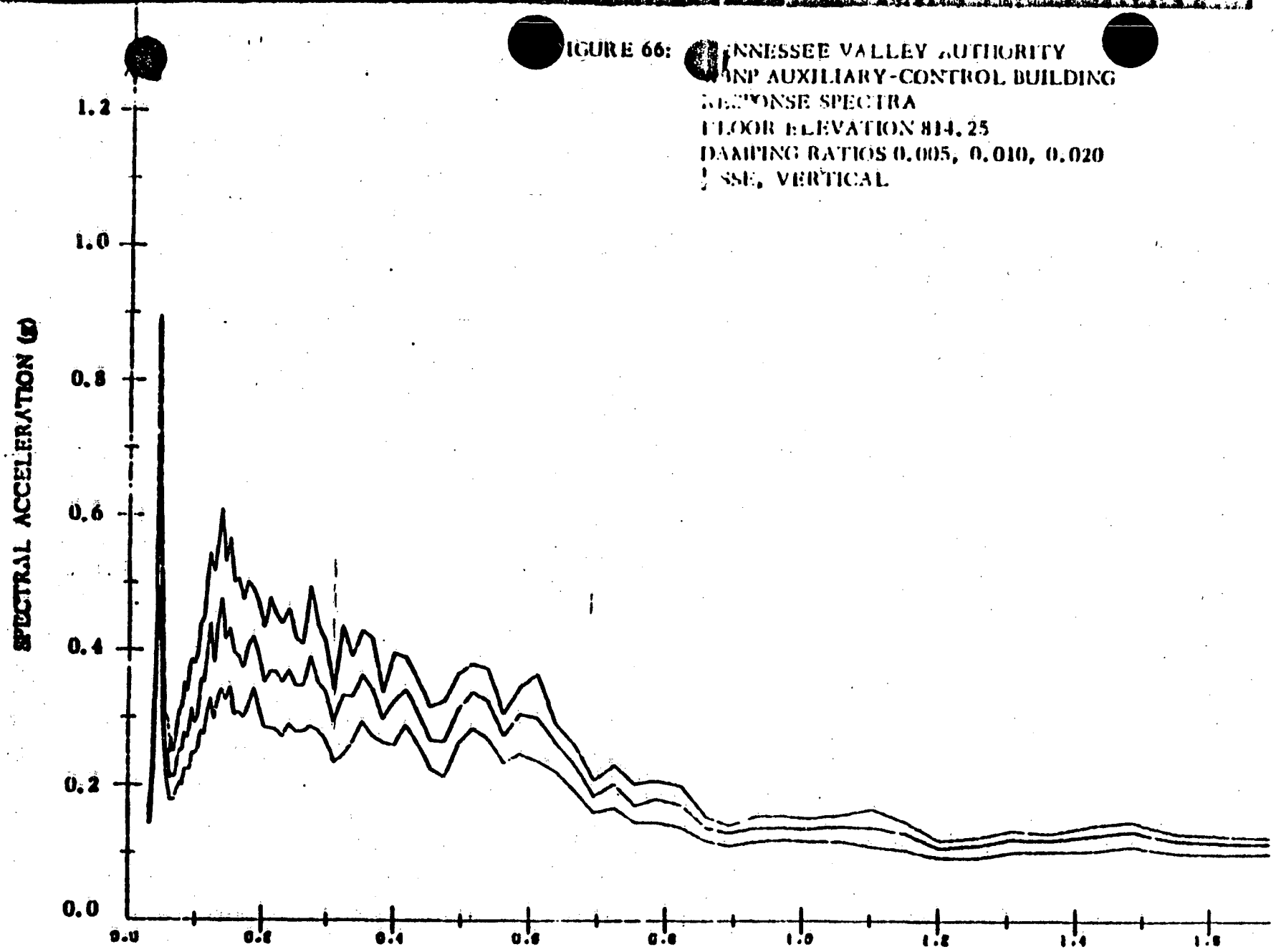
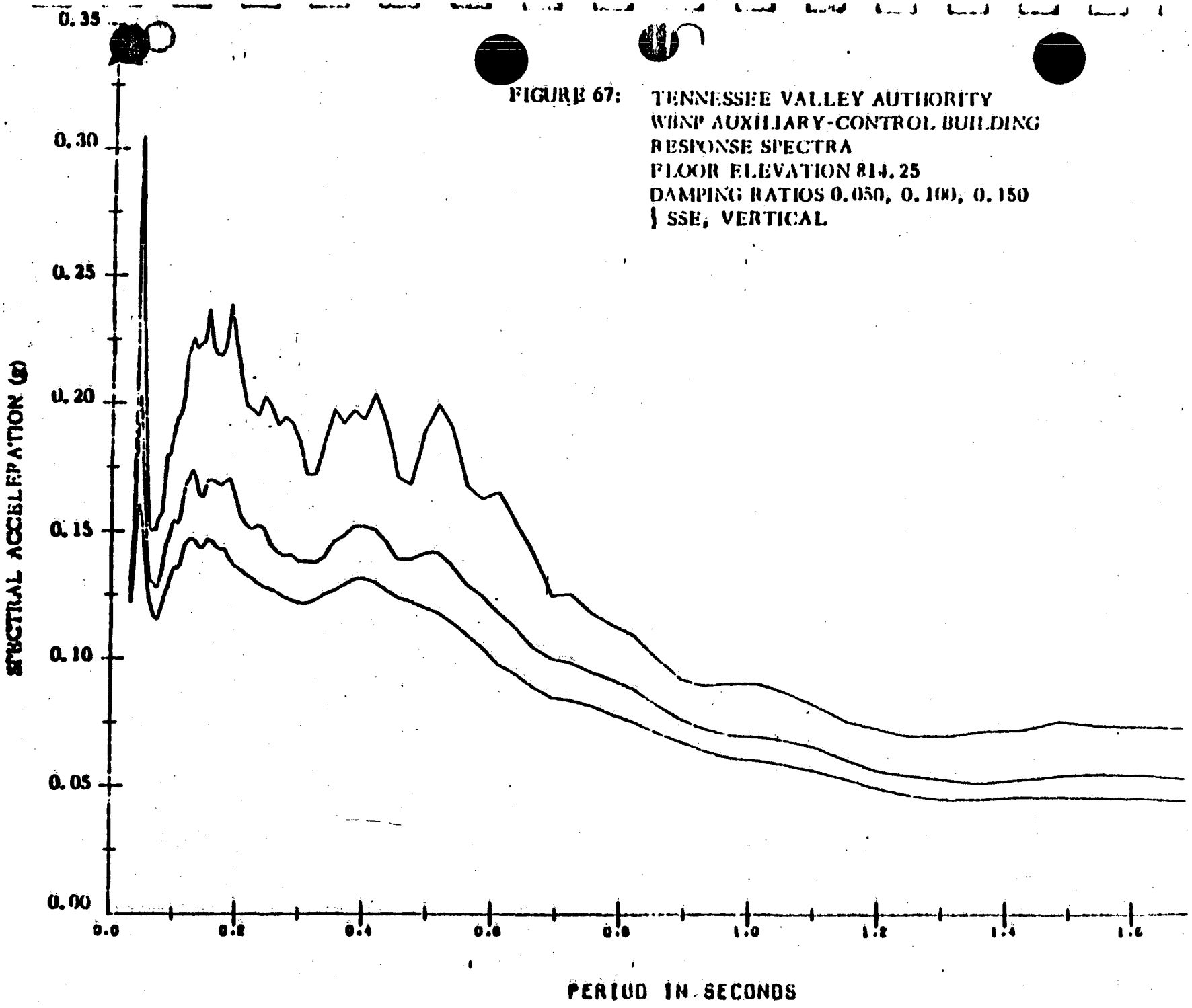


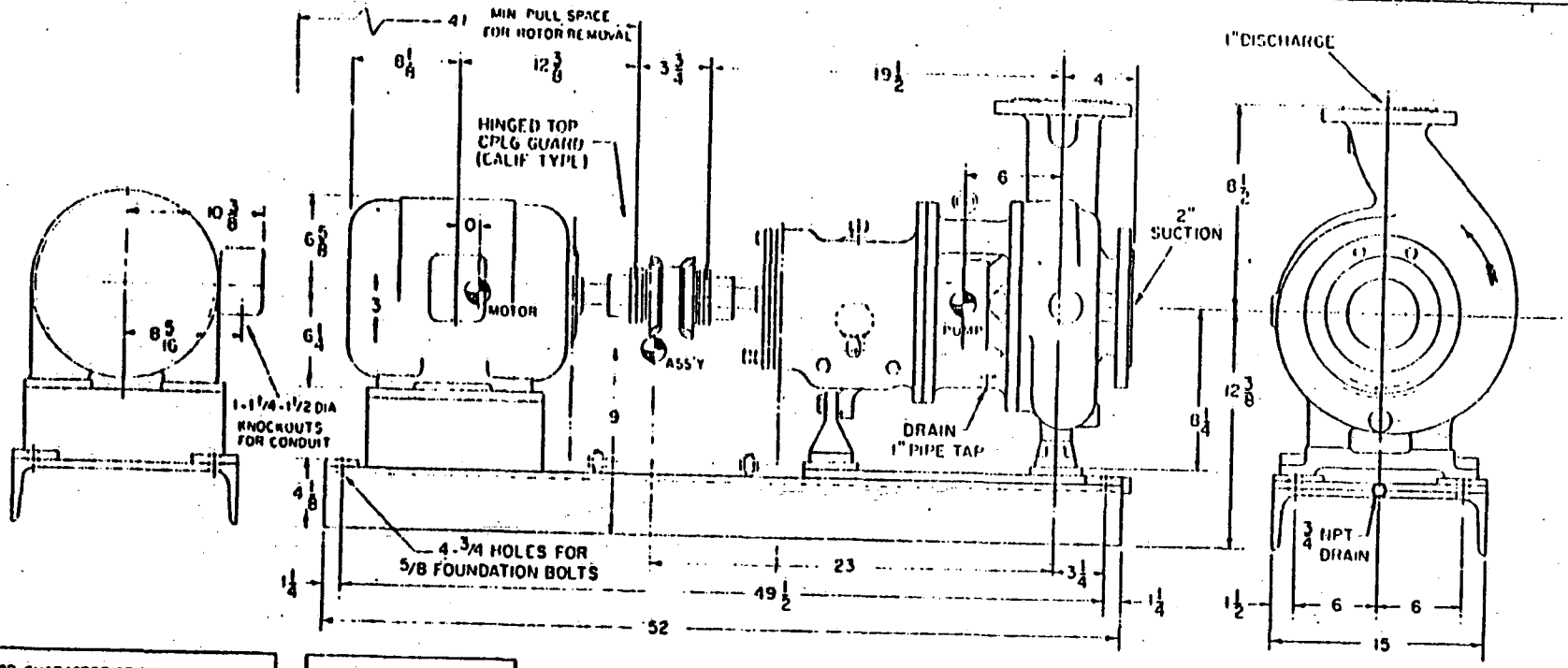
FIGURE 67: TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 814.25
DAMPING RATIOS 0.050, 0.100, 0.150
SSE, VERTICAL



GOULDS PUMPS, INC.
SENECA FALLS, N.Y., U.S.A

MODEL 3196 MT, SIZE 1 X 2 - 8
W/150 LB. RAISED FACE FLANGES

FAB. STEEL BEDPLATE W/DRIP BASIN AND DRAIN ON PUMP END



MOTOR CHARACTERISTICS
WESTINGHOUSE FR. 254 T O.D.P.
7 1/2/15 H.P. 1750/3500 RPM
3 PHASE, 60 HERTZ, 230/460 VOLTS

MECHANICAL SEAL IS CRANE
TYPE 1, CODE O$_{40}$ DIDI
W/PLAIN GLAND

COUPLING IS THOMAS
TYPE DBZ-C W/SS DISCS
SIZE 163 W/3 1/2" SPACER

PUMP CHARACTERISTICS
DESIGN FLOW = 75 GPM
DESIGN HEAD = 235 FT.
DESIGN TEMP. 250 °F
DESIGN PRESS = 150 PSI
CURVE NO. CDS 1580-3

APPROX WEIGHTS (LBS)	
PUMP	190
MOTOR	200
BEDPLATE	190
TOTAL	580

REVISIONS

1	Design Weights 9/24/73 CAV		

NOTES:
PULL SPACE FOR PUMP-NO AVAILABLE SPACE REQUIRED - INHERENT IN DESIGN.
INSTALL FOUNDATION BOLTS IN PIPE SLEEVE. ALLOW FROM 3/4 TO 1 1/2 FOR GROUTING SEE INSTRUCTION BOOK FOR DETAIL.
PUMP FLANGE DRILLING CONFORMS TO 150 LB. ANSI DIMENSIONS. FLANGES ARE RAISED FACE.
DIMENSIONS ARE IN INCHES.
DRAWING IS NOT TO SCALE.
⊕ INDICATES APPROX. CENTER OF GRAVITY

GOULDS SERIAL NO. N717B672-1, 2
CUSTOMER WESTINGHOUSE ELECTRIC CORP.
W N E S P.O. NO. 546-CAV-181951-BN
SPIN NO. WAT-CSAPBA-01, WAT-CSAPBA-02
SERVICE BORIC ACID TRANSFER PUMPS
ITEM NO. 001, 002

DRN BY: PAD
DATE: 1-9-73

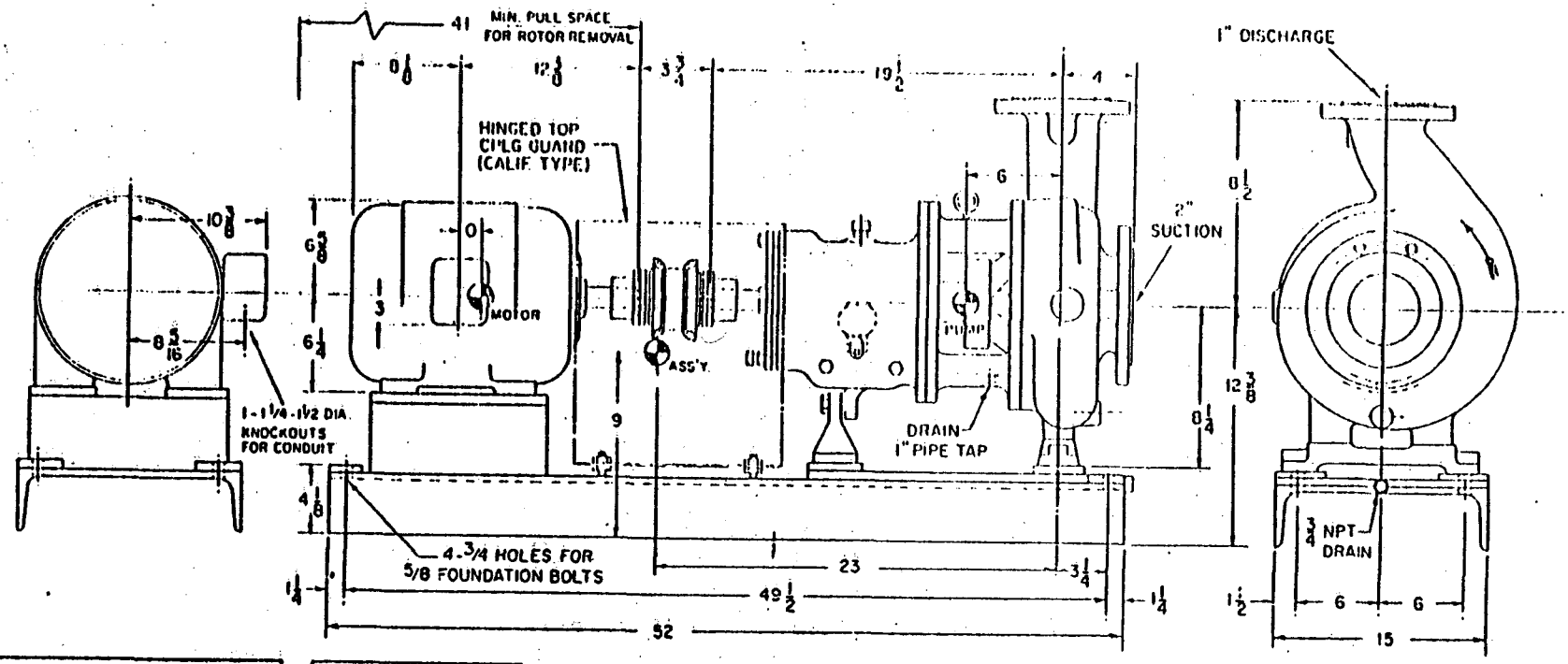
DWG NO. N717672 #1

REV 1

GOULDS PUMPS, INC.
SENECA FALLS, N.Y., USA

MODEL 3196 MT, SIZE 1 X 2 - 8
W/150 LB. RAISED FACE FLANGES

FAB. STEEL BEDPLATE W/DRIP BASIN AND DRAIN ON PUMP END



MOTOR CHARACTERISTICS
WESTINGHOUSE FR. 254 T O.D.P.
7½/10 H.P. 1750/3500 RPM
3 PHASE, 60 HERTZ, 230/460 VOLTS

MECHANICAL SEAL IS CRANE
TYPE 1, CODE O40 DIDI
W/PLAIN GLAND

COUPLING IS THOMAS
TYPE DDZ-C W/SS DISCS
SIZE 163 W/3½" SPACER

PUMP CHARACTERISTICS
DESIGN FLOW = 75 GPM
DESIGN HEAD = 235 FT.
DESIGN TEMP. = 250 °F
DESIGN PRESS. = 150 PSI
CURVE NO. CDS 1580-3

APPROX. WEIGHTS (LBS.)

PUMP	190
MOTOR	200
BEDPLATE	190
TOTAL	580

NOTES:
1. PULL SPACE FOR PUMP-NO AVAILABLE SPACE REQUIRED - INHERENT IN DESIGN.
2. INSTALL FOUNDATION BOLTS IN PIPE SLEEVE. ALLOW FROM 3/4 TO 1 1/2 FOR GROUTING. SEE INSTRUCTION BOOK FOR DETAIL.
3. PUMP FLANGE DRILLING CONFORMS TO 150 LB. ANSI DIMENSIONS. FLANGES ARE RAISED FACE.
4. DIMENSIONS ARE IN INCHES.
5. DRAWING IS NOT TO SCALE.
6. ⊕ INDICATES APPROX. CENTER OF GRAVITY.

REVISIONS

1	DRAWN & APPROVED SEE SHT. 2	

GOULDS SERIAL NO. N717B689 -1, -2
CUSTOMER WESTINGHOUSE ELECTRIC CORP.
W.N.E.S. P.O. NO. 546 - CAV - 181952 - 0N
SPIN NO. WBT - CSAPBA - 01, WBT - CSAPBA - 02
SERVICE BORIC ACID TRANSFER PUMPS
ITEM NO. 001, 002

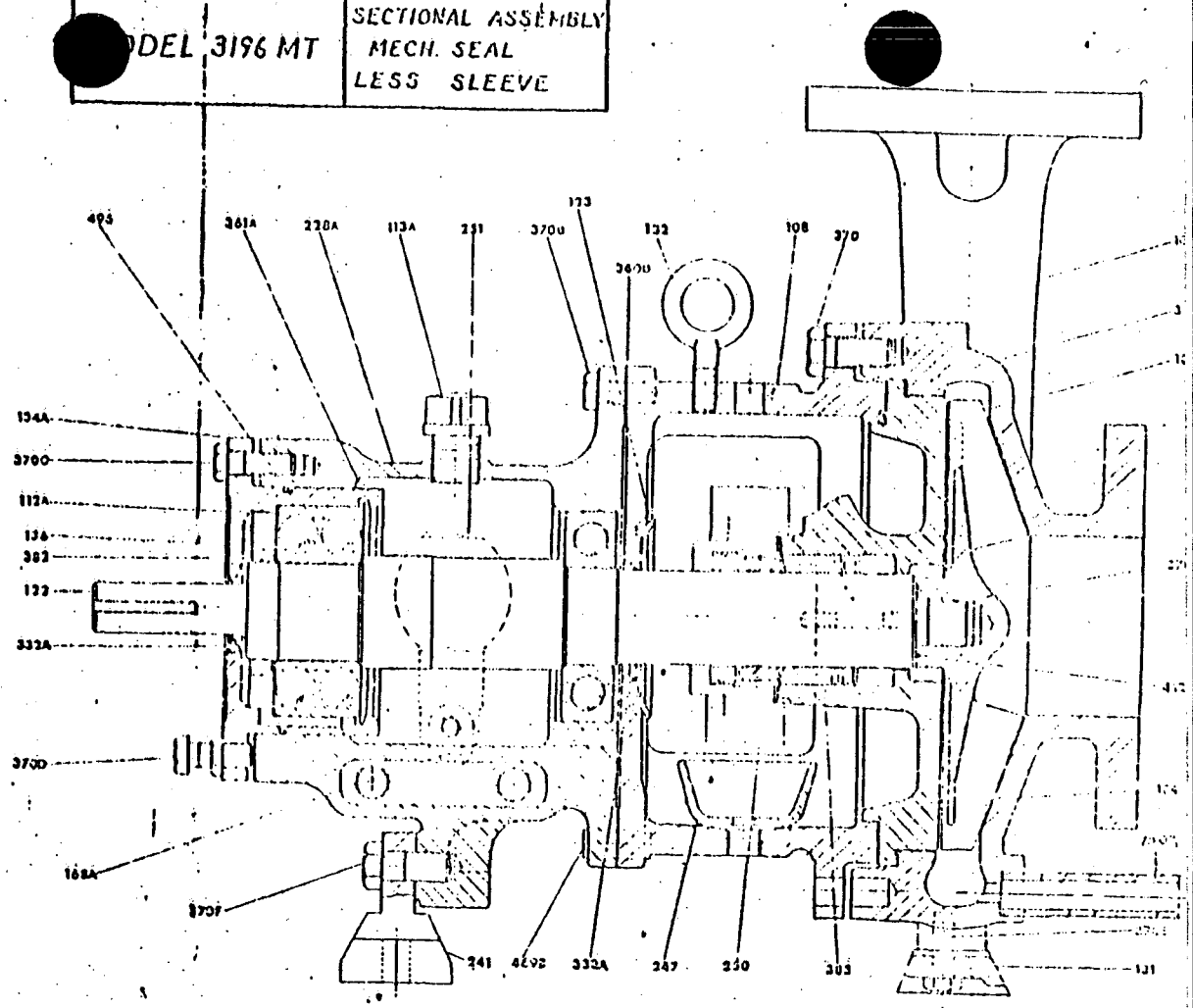
DWN BY: PAD
DATE: 1-9-73

DWG. NO. N717689 #1

REV. 1

[redacted] The quotation includes manufacturing the following (e) pressure
[redacted] to the rules of the ASME Boiler and Pressure Vessel Code,
III, Edition 7-1-77 Addenda thru Summer of 1978
[redacted] these rules extended to other items, kindly indicate them
drawing and return so that a revised quotation can be submitted.

[redacted] DEL 3196 MT | SECTIONAL ASSEMBLY MECH. SEAL LESS SLEEVE



BILL OF MATERIALS

ITEM NO	NO PER PUMP	PART NAME	MATERIAL	ASME NO OR ASTM NO
[redacted]	*1	CASING	316SS	SA351 CF8M
[redacted]	1	IMPELLER	316SS	A296 CF8M
[redacted]	*1	FRAME ADAPTER	CARBON STL	SA 216 WCB
[redacted]	1	BALL BRG OTBD	STEEL	
[redacted]	1	BREATHER	STEEL	
[redacted]	1	SHAFT	316SS	A276 TP316
[redacted]	1	DEFLECTOR	GL & NYL	
[redacted]	1	PUMP FOOT	DUCT IRON	A536
[redacted]	1	EYEBOLT	STEEL	
[redacted]	1	BRG HOUSING	DUCT IRON	A536
[redacted]	1	BRG LK NUT	STEEL	
[redacted]	1	BALL BRG INBD	STEEL	
[redacted]	*1	STUFF BOX COVER	316SS	SA351 CF8M
[redacted]	1	FRAME	DUCT IRON	A536
[redacted]	1	FRAME FOOT	DUCT IRON	A536
[redacted]	1	DRIP BASIN	316SS	A296 CF-8M
[redacted]	*1	GLAND, MECH SEAL	316SS	SA351 CF8M
[redacted]	1	SIGHT OILER	GL & STL	
[redacted]	1	OIL SEAL OTBD	BUNA-RBR	
[redacted]	1	OIL SEAL INBD	BUNA-RBR	
[redacted]	1	GASKET CASING	AFR-ASB	
[redacted]	*4	STUD, GLAND	316SS	SA193 B8
[redacted]	*4	NUT GLAND STUD	304SS	SA194 8M
[redacted]	1	GASKET, FR-ADPTR	VELLUMOID	
[redacted]	1	GASKET GLAND	BLUE-ASB	
[redacted]	1	RTNG RG, BRG HSG	STEEL	
[redacted]	*8	H CAP SCREW, CASE	STEEL	SA193 B8
[redacted]	4	H CAP SCREW, ADPTR-FR	STEEL	A307 GR B
[redacted]	3	H TAP BOLT, BRG HSG	STEEL	A307 GR B
[redacted]	3	H TAP BOLT, IMPLR ADJ	STEEL	A307 GR B
[redacted]	2	H CAP SCREW, FOOT	STEEL	A307 GR B
[redacted]	1	STUD BOLT, FR-FOOT	STEEL	
[redacted]	2	STUD, COV-ADPTR	304SS	A276 TP304
[redacted]	1	BRG LK WASHER	STEEL	
[redacted]	1	MECH SEAL		
[redacted]	1	O-RING, IMPLR	TEFLON	
[redacted]	2	MECH ALNR, FR-ADPTR	STEEL	
[redacted]	1	NIPPLE-CASING DRAIN	316SS	SA312 TP316
[redacted]	1	O-RING, BRG HSG	BUNA-N	

GOULDS SERIAL N7178672-1-2
CUSTOMER [redacted]
CUSTOMER P.O. [redacted]
EQUIP. OF ITEM [redacted]
SERVICE [redacted]
MAT-CSA20A-D.

REV.	
1	ADDED NIPPLE 135A 5-21-79

GOULDS PUMPS, INC.

DRAWN	CHECKED	APPROVED	DATE
D.E.R.	D.E.R.		1-26-7

MODEL 3196 MT

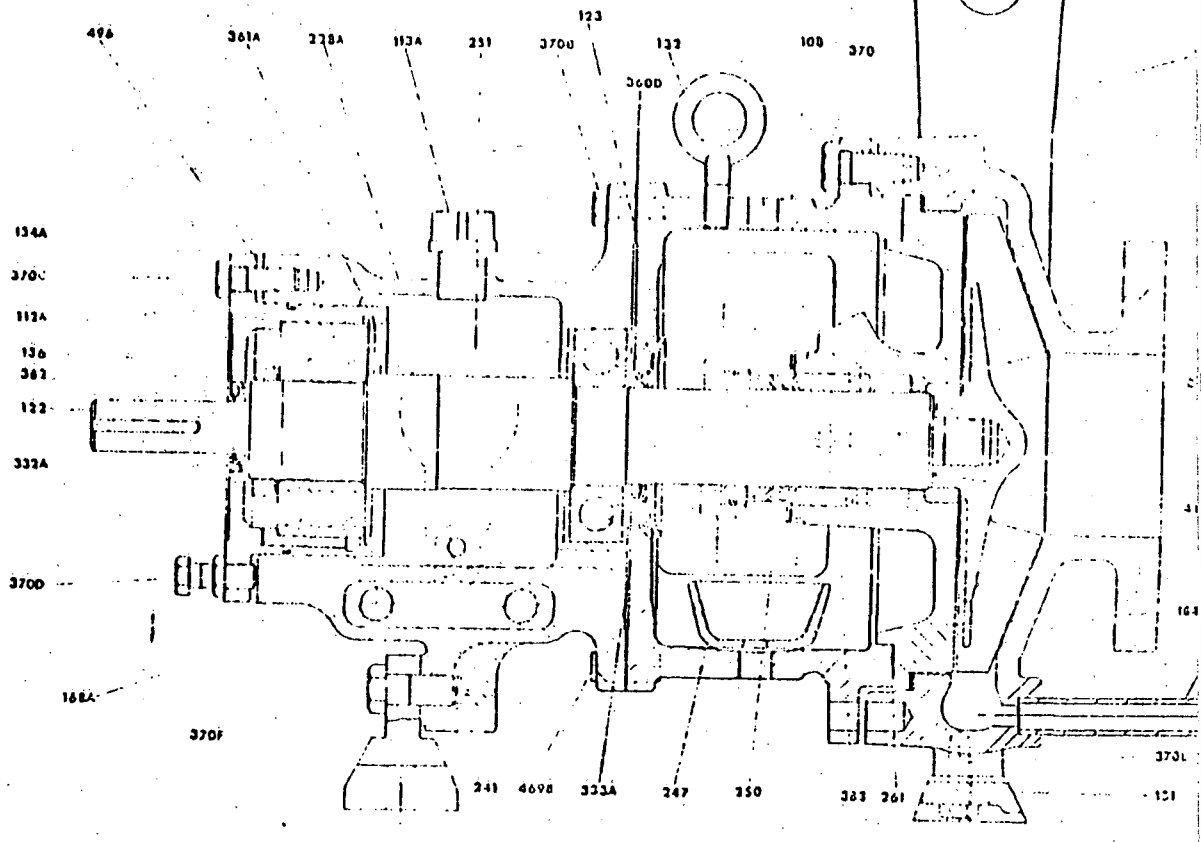
DRAWING N7178672

The quotation includes manufacturing the following (*) pressure containing items to the rules of the ASME Boiler and Pressure Vessel Code, Section III, Edition 7-1-77 Addenda Thru Summer of 1978. Should you wish these rules extended to other items, kindly indicate them on the drawing and return so that a revised quotation can be submitted.

MODEL 3196 MT | SECTIONAL ASSEMBLY MECH. SEAL LESS SLEEVE

BILL OF MATERIALS

ITEM NO	NO PER PUMP	PART NAME	MATERIAL	ASME NO OR ASTM NO
100	*1	CASING	316 SS	SA351 CF8M
101	1	IMPELLER	316 SS	SA743 CF8M
108	*1	FRAME ADAPTER	CARBON STL	SA216 WCB
112A	1	BALL BRG OUTBD	STEEL	
113A	1	BREATHER	STEEL	
122	1	SHAFT	316SS	A276 TP316
123	1	DEFLECTOR	GL & NYL	
131	1	PUMP FOOT	DI	A536
134A	1	EYEBOLT	STEEL	
136	1	BRG HOUSING	DI	A536
168	1	BRG LK NUT	STEEL	
168A	1	BALL BRG INBD	STEEL	
178	*1	STUFF BOX COVER	316 SS	SA351 CF8M
228A	1	FRAME		
231	1	FRAME FOOT	DI	A536
241	1	DRIP BASIN	DI	A536
332A	*1	GLAND, MECH SEAL	316SS	SA351 CF8M
333A	1	SIGHT OILER	GL & STL	
351A	1	GASKET, ADPTR-COVER	MNL PAPER	
360A	1	OIL SEAL OUTBD	BUNA-RBR	
360B	1	OIL SEAL INBD	BUNA-RBR	
361A	1	GASKET CASING	AFR-ASB	
370	*2	STUD, GLAND	316SS	SA193 B8
370C	*4	NUT GLAND STUD	304SS	SA194 8M
370D	1	GASKET, FR-ADPTR	VELLUMOID	
370F	1	GASKET GLAND	BLUE-ASB	
372	1	RTNG RG, BRG HSG	STEEL	
374	*8	H CAP SCREW, CASE	STEEL	SA193 B8
375	4	H CAP SCREW, ADPTR-FR	STEEL	A307 GR B
376	3	H TAP BOLT, BRG HSG	STEEL	A307 GR B
377	3	H TAP BOLT, IMPLR ADJ	STEEL	A307 GR B
378	2	H CAP SCREW, FOOT	STEEL	A307 GR B
379F	1	DOWEL BOLT, FR-FOOT	STEEL	
387	2	STUD, COV-ADPTR	304SS	A276 TP304
393	1	BRG LK WASHER	STEEL	
412	1	MECH SEAL		
412A	1	O-RING, IMPLR	TEFLON	
433	2	BACK PLATE FR-ADPTR	STEEL	
733	1	NIPPLE-CASING DRAIN	316 SS	SA312 TP316
412B	1	O-RING, BRG HSG	BUNA-N	



GOULDS SERIAL N7178689
CUSTOMER Westinghouse Elec Corp
CUSTOMER P.O. SK-CQ-181352-BN
EQUIP. OF ITEM 001 Pump
SERVICE Boric Acid Transfer Pump
Specific Wgt. 1.0 Viscosity 1.0 Vapor Pressure

REV.

GOULDS PUMPS, INC.

DR BY	CKD BY	APPROVED	DATE
D.E.R.	D.E.R.		1-26

MODEL 3196 MT | DRAWING N7178689

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Watts Bar

1. Utility: TVA
2. NSSS: Westinghouse
3. A/E: TVA

Type:

PWR X

BWR

Other

II. Component Name: Ice Condenser Intermediate Deck Doors & Passive Components

1. Scope: [ ] NSSS [X] BOP [ ] Other
2. Model Number: 1193E14G01 and G02 Quantity: 24 and 24 each
3. Size or Range:
4. Vendor: Dayco Industries Inc (door panels), Stahl Rider (hinges & frames)
5. If the component is a cabinet or panel, name and model Number of the devices included: N/A
6. Physical Description:
   a. Appearance: 4 horizontal door panels mounted on a steel frame
   b. Dimensions: 13' x 5½' (4 door panel assembly)
   c. Weight: 425# (4 door panel assembly)
7. Location: Building: containment building
   Elevation: 804'
8. Field Mounting Conditions [X] Bolt (No. 8/8, Size 5/8"/3/8"
   [ ] Weld (Length)
   [ ]
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   Suspended horizontally across ice condenser 13' annulus, mounted to tops of the lattice frame vertical columns
10. a. System in which located: ice condenser
    b. Functional Description: Normally closed horizontally hinged doors form an insulation barrier for top of ice storage area. Door open under LOCA conditions to allow air & steam to flow into upper containment
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
    [ ] Both [ ] Neither [X] Other LOCA & steam line break

Requirements: General Ice Condenser Design Criteria, Rev. 0, and Ice Component Design Criteria for Top Deck Structure, Rev. 1

	a. Seismic Input	d.	Service Conditions
XX	b. Hydrodynamic Load Input	e.	Qualified Life
	c. Fatigue Considerations		

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [X] Combination of Test and Analysis

Qualification Report*: WCAP-8110, Supplement 3, and Calculation 009.

(No., Title and Date): Test plans & results for the ice condenser system, 7/8/73
Structural analysis of the intermediate deck doors, 12/21

Company that Prepared Report: Westinghouse

Company that Reviewed Report: Westinghouse

Where Report is filed or available: Westinghouse Monroeville Nuclear Center

Applicable Codes And/Or Standards: AISC Code

Vibration Input: (See Discussion on Page 6)

Considered: a. [ ] Seismic only

b. [X] Hydrodynamic only

c. [ ] Vibration from normal operation

d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[ ] Absolute Sum [ ] SRSS [ ] See Below*** (other, specify)

3. Required Response Spectra** (attach the graphs):

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

***Seismic input was considered to be negligible and not combined with DBA loads. Watts Bar response spectras at floor elevation 807.82 is attached.

g corresponding to RRS: OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [ ] Other _____ (specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = _____ F/B = _____ V = _____

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

_____

_____

VI. If Qualification by Test, then Complete: (See Discussion on Page 6)

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [x] hydrodyanic test

2. [ ] Single Axis [ ] Multi-Axis [ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies (not determined)

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[ ] Yes [ ] No [X] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete: (See Discussion on Page 6)

1. Method of Analysis:

[ ] Static Analysis [X] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

Frequency Range and No. of modes considered: _____

[X] Hand Calculations Calculation #009

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [X] Other: Seismic loads were considered negligible and only DBA loads were considered.
(specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: _____

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

INTERMEDIATE DECK DOOR AND FRAME QUALIFICATION

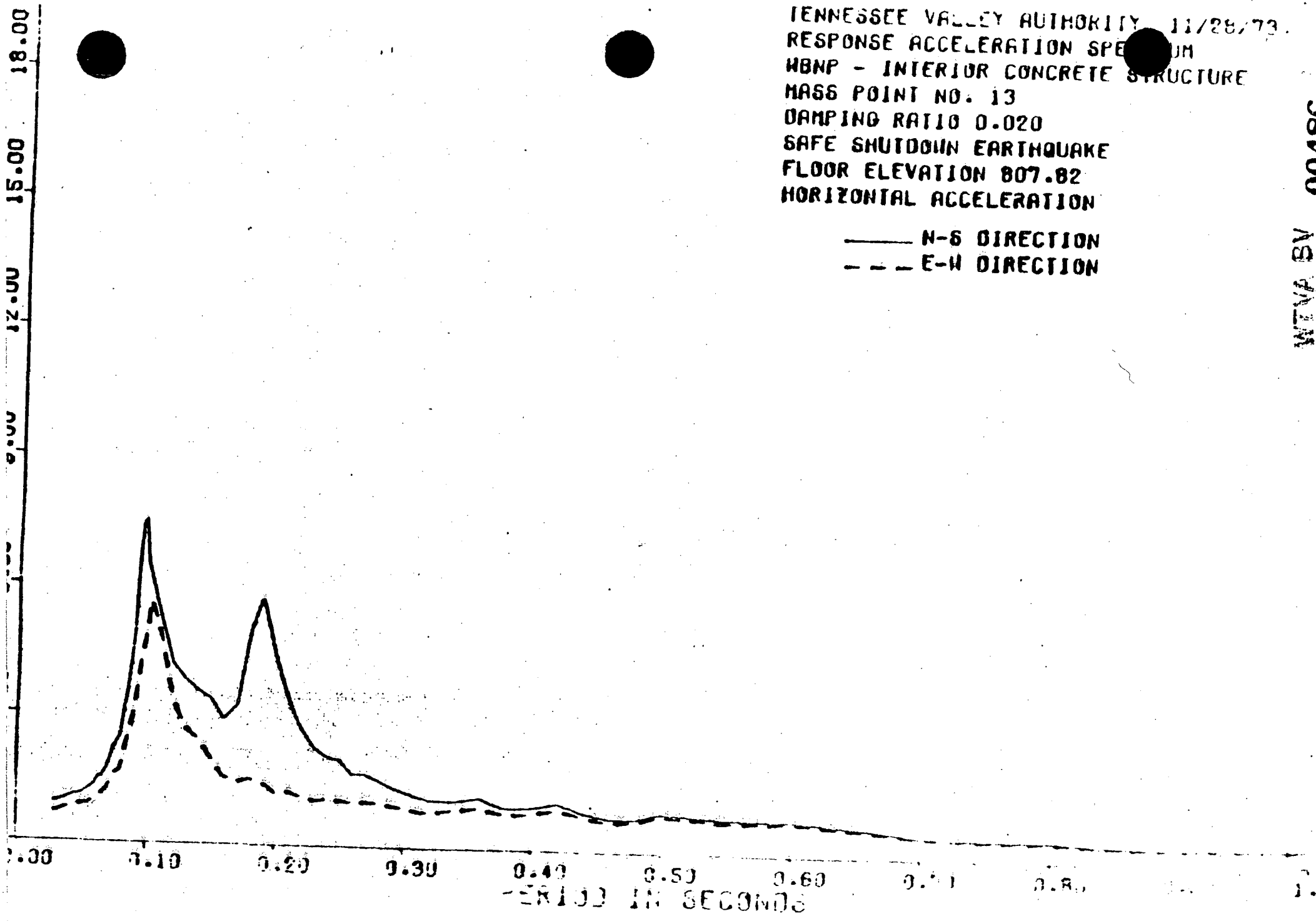
The intermediate deck doors, frames and beams have been qualified to withstand LOCA or DBA loads. The door panels were subjected to full scale blowdown tests which simulated forces and flow rates, up to 140%, of maximum design conditions (ref. WCAP-8110, Supplement 3). These full scale tests qualified the door panel design and also verified the Westinghouse computer program "DOOR" which was used to calculate the reaction forces on the door hinges, frames and beams. The hinges, frames and beams were then qualified by structural analysis (ref. Calc #009).

Seismic loads (OBE and SSE) on the intermediate deck doors, frames and beams were considered to be negligible when compared to the DBA loads imposed. As an example, Calculation #009, Section J, identifies the seismic door hinges loads on the TVA Sequoyah and AEP Cook plants to be less than 30 lbs. By comparison, the DBA reaction loads on the door hinges were calculated to be in excess of 9000 lbs, so the seismic input would be approximately 0.3 percent of the DBA input. It should also be pointed out that the DBA loads used were for the 140 percent design case and that an additional load factor of 1.3 was imposed on DBA loads for calculating stresses.

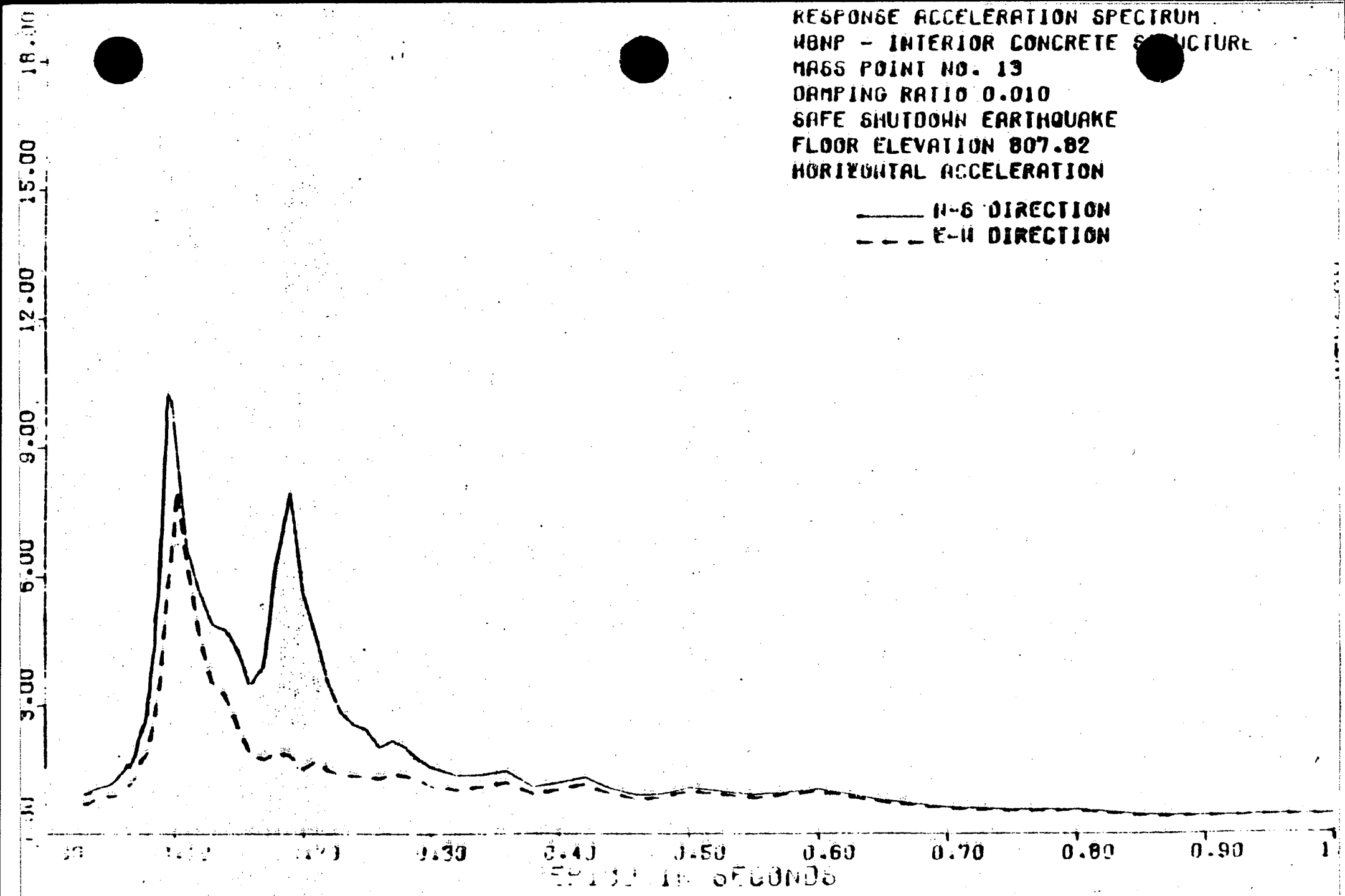
A comparison of the seismic design loads for the intermediate deck door frame for the TVA Sequoyah and Watts Bar plants shows the Watts Bar SSE horizontal loads are at most 2.2 times those for the Sequoyah plant. Again, if we correlate this to hinges loads, as was done before, a 66 lbs hinge load (22 x 30) would only be approximately 0.7 percent of the DBA hinge loads, and still considered negligible. A review of Calculation #009 shows that all stresses on the intermediate deck door, frames and beams to be well within the allowable stress limits.

TENNESSEE VALLEY AUTHORITY 11/28/73.
RESPONSE ACCELERATION SPECTRUM
WBNP - INTERIOR CONCRETE STRUCTURE
MASS POINT NO. 13
DAMPING RATIO 0.020
SAFE SHUTDOWN EARTHQUAKE
FLOOR ELEVATION 807.82
HORIZONTAL ACCELERATION

——— N-S DIRECTION
– – – E-W DIRECTION

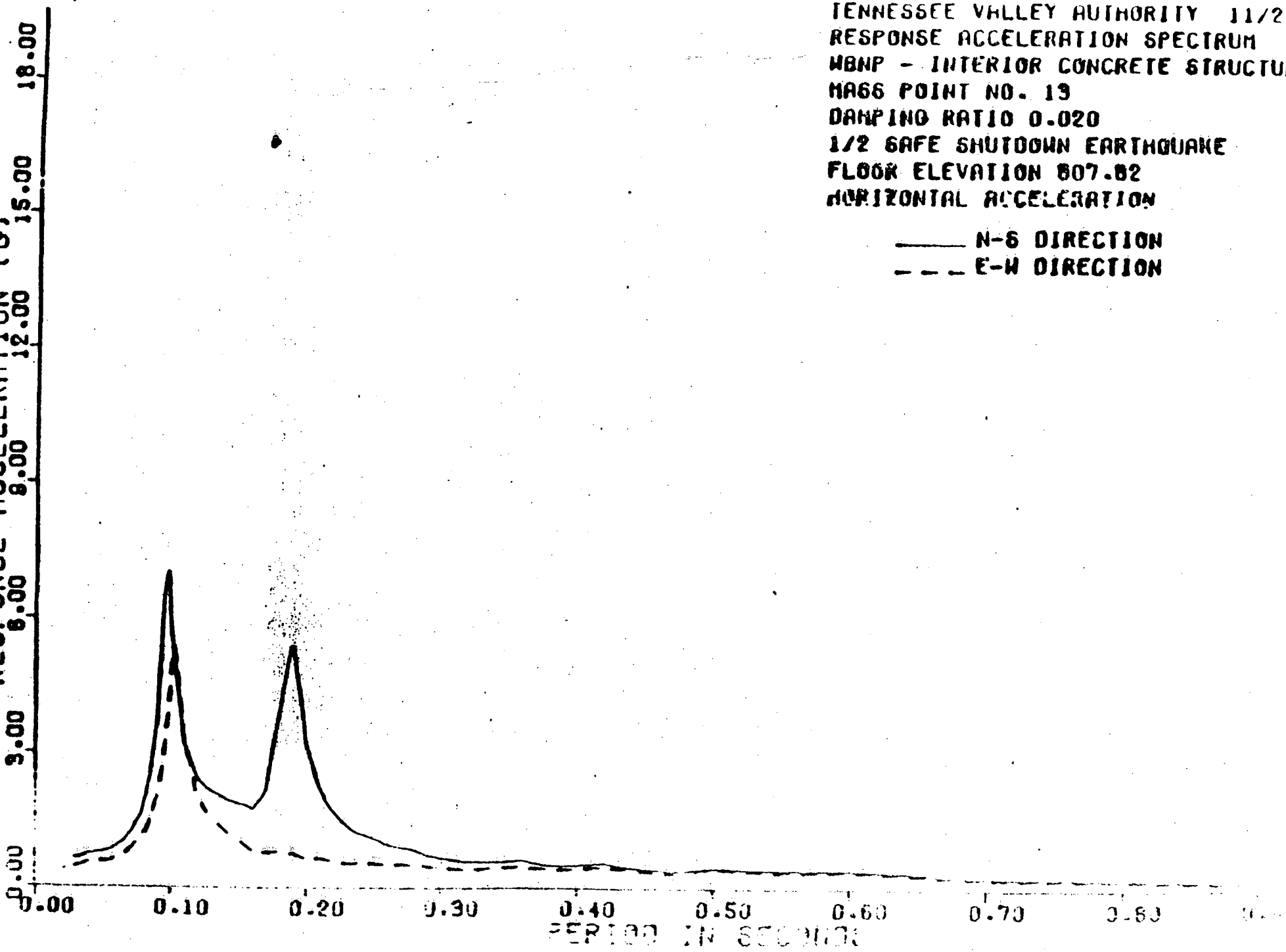


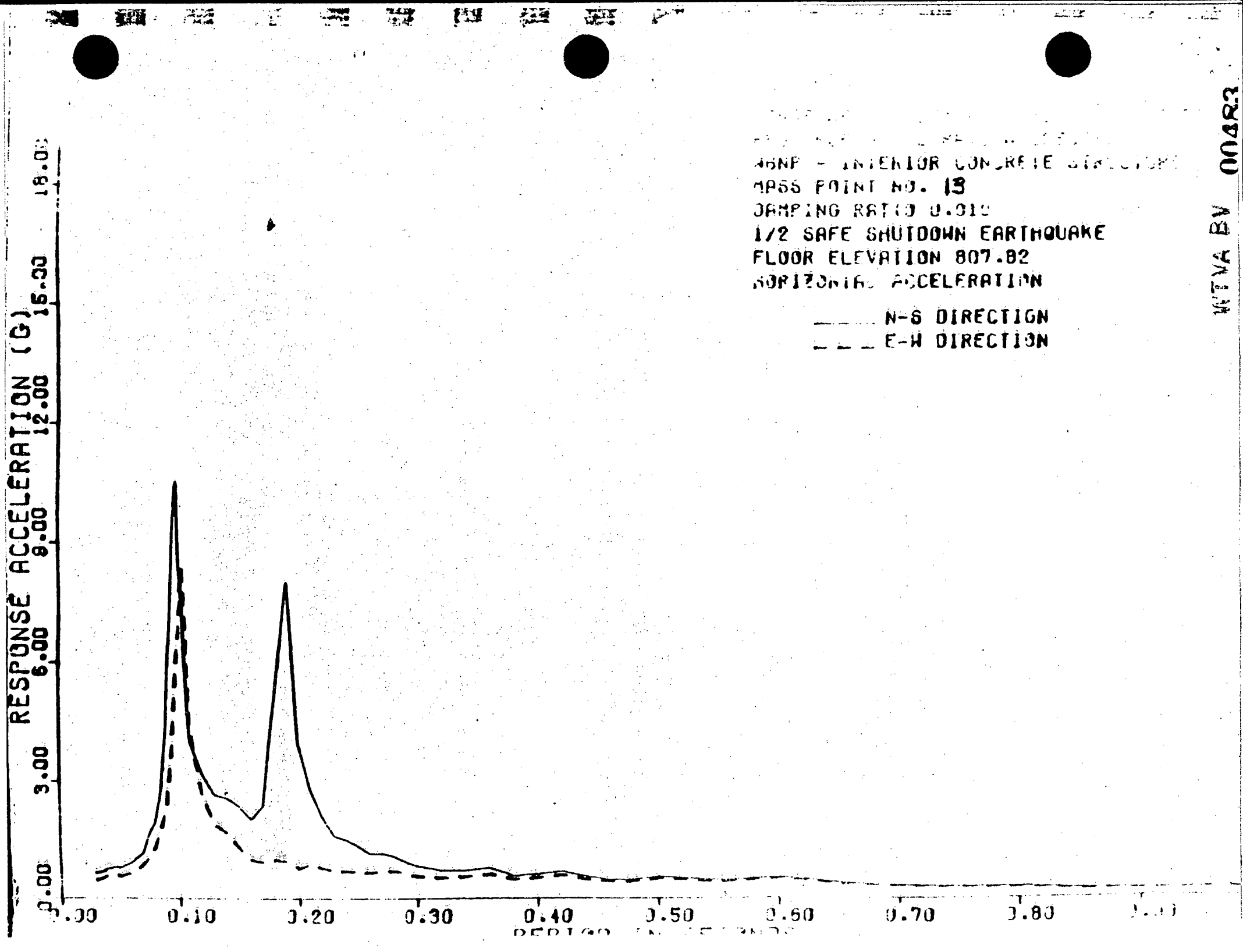
WBNP SV 00486


RESPONSE ACCELERATION SPECTRUM
HBNP - INTERIOR CONCRETE STRUCTURE
MASS POINT NO. 13
DAMPING RATIO 0.010
SAFE SHUTDOWN EARTHQUAKE
FLOOR ELEVATION 807.82
HORIZONTAL ACCELERATION
N-S DIRECTION
E-W DIRECTION
15.00
12.00
9.00
6.00
3.00
0.30
0.40
0.50
0.60
0.70
0.80
0.90
SECONDS

TENNESSEE VALLEY AUTHORITY 11/28/73
RESPONSE ACCELERATION SPECTRUM
WBNP - INTERIOR CONCRETE STRUCTURE
MA66 POINT NO. 19
DAMPING RATIO 0.020
1/2 SAFE SHUTDOWN EARTHQUAKE
FLOOR ELEVATION 807.82
HORIZONTAL ACCELERATION

——— N-S DIRECTION
– – – E-W DIRECTION




46NF - INTERIOR CONCRETE STRUCTURE
MASS POINT NO. 13
DAMPING RATIO 0.01
1/2 SAFE SHUTDOWN EARTHQUAKE
FLOOR ELEVATION 807.82
HORIZONTAL ACCELERATION
N-S DIRECTION
E-W DIRECTION
RESPONSE ACCELERATION (G)
18.00
15.00
12.00
9.00
6.00
3.00
0.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
WTVA BV 00483

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Watts Bar

Type:

1. Utility: TVA — PWR x
2. NSSS: Westinghouse — BWR
3. A/E: TVA — Other

II. Component Name: Boric Acid Filter

1. Scope: [X] NSSS [ ] BOP [ ] Other
2. Model Number: 5EHD 10702-032-EG32 Quantity: 1
3. Size or Range: 150 GPM
4. Vendor: Pall Trinity Micro Corp
5. If the component is a cabinet or panel, name and model Number of the devices included: N/A
6. Physical Description:
   a. Appearance: Vertical vessel with cylin. Shell, flatheads, and leg supports welded to a baseplate.
   b. Dimensions: Length = 29", shell dia = 6 5/8", baseplate 15"x15"
   c. Weight: 120 lbs.
7. Location: Building: Auxiliary
   Elevation: 713 ft.
8. Field Mounting Conditions
   [x] Bolt (No. 4, Size 5/8")
   [ ] Weld (Length)
   [ ]
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   Floor
10. a. System in which located: CVCS
    b. Functional Description: To retain particles which may have entered the system during boric acid batching operations.
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
    [ ] Both [x] Neither [ ] Other

Requirements: E spec - 952427 R/1

EDS FL 029 R/2

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[x] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [x] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 150 GPM filter stress report

(No., Title and Date): Dynamic analysis #49-5-4 (2/5/76)
Report No. 501-39 (2/22/74)

Company that Prepared Report: Westinghouse/Pall Trinity Micro Corp.

Company that Reviewed Report: Westinghouse

Where Report is filed or available: Westinghouse MNC

Applicable Codes And/Or Standards: ASME Sec. VIII Div. 1 and AISC Code

V. Vibration Input:

1. Considered:
   a. [x] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[ ] Absolute Sum [x] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): See attachment 1

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 1.0% SSE 2.0%

5. Required Acceleration in Each Direction:

[x] ZPA [ ] Other _____ (specify)

OBE S/S = Rigid F/B = Rigid V = Rigid

SSE S/S = Rigid F/B = Rigid V = Rigid

6. Were fatigue effects considered?

[ ] Yes [x] No

If yes, describe how they were treated in overall qualification program: N/A

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] _____

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (spec

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[x] Static Analysis [ ] Equivalent Static Analysis

[x] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 166.7 HZ F/B = 166.7 HZ V = 647.9 HZ

3. Model Type: [x] 3D [ ] 2D [ ] 1D

[x] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

[x] computer codes: WEUAN

[x] Computer Codes: WECAN

Frequency Range and No. of modes considered: Rigid (1 mode)

[x] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: N/A (specify)

6. Damping:

OBE 1.0% SSE 2.0% Basis for the damping used: FSAR

7. Support Considerations in the model: 4 leg supports fixed at base

8. Critical Structural Elements:

A.

Identification Location		Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Base at leg	Pt. B	SSE	Combined axial and bending	.863	1.0

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
		N/A

9. Failure Modes: N/A

10. Margins Available: [ ] Input Spectrum [x] Stress or Deflection

86.3% of allowable

ATTACHMENT #1

TENNESSEE VALLEY AUTHORITY
KNOXVILLE, TENNESSEE 37902

204 Union Building (DLW)
July 11, 1974

Westinghouse Electric Corporation
Post Office Box 355
Pittsburgh, Pennsylvania 15230

Gentlemen: Attention: Mr. J. E. Werle

WATTS BAR NUCLEAR PLANT
NUCLEAR STEAM SUPPLY SYSTEMS
CONTRACT 71C62-54114-1
LETTER NO. W-984

SEISMIC ANALYSIS OF AUXILIARY CONTROL BUILDING - UNITS 1 AND 2 - WBN-2-12 AND WBN-2-50

A copy of the seismic analysis of the auxiliary control building is enclosed. This report includes the structural response and floor response spectra. In order to use the floor response spectra to find the acceleration experienced by a piece of equipment, the period, damping ratio, and location (elevation) of the item in question must be known. Using the appropriate spectrum, find the largest acceleration in a band of ±10 percent of the period of the item and use that value as its acceleration. The seismic analysis was performed by EDS Nuclear and reviewed by TVA.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

D. R. Patterson, Chief
Mechanical Engineering Branch

Enclosure
CC: Mr. R. E. Lyman

RECEIVED
JUL 1
TENN.

Approved 8/17/74

An Equal Opportunity Employer

TENNESSEE VALLEY AUTHORITY

SEISMIC ANALYSES OF THE AUXILIARY-CONTROL BUILDING WATTS BAR NUCLEAR PLANT, UNITS 1 & 2

NSM-2-12
NSM-2-50
TVA JUL 3 '75
PROJECT: WATTS BAR
CONTRACT NO: 75C65-64856
NSRS
USER
CHECKED

eds
EDS NUCLEAR
220 MONTGOMERY ST. • SAN FRANCISCO, CALIFORNIA 94104 • (415) 421-5066

TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN
CIVIL ENGINEERING BRANCH

WATTS BAR NUCLEAR PLANT

SEISMIC ANALYSES OF THE AUXILIARY CONTROL BUILDING

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2

June 19, 1974

Prepared by	EDS Nuclear Incorporated
Checked by	EDS Nuclear Incorporated
Reviewed by	
Submitted	
Recommended	
Approved	

Revisions

No. ____ Prepd ____ Ckd ____ Rev ____ Subm ____ Recm ____

Appd _____ Date _____ Pages Revised _____

EDS NUCLEAR
220 MONTGOMERY ST. • SAN FRANCISCO, CALIFORNIA 94104 • (415) 421-5056

May 17, 1974
TVA File No. NZM-15-A
0600250-007

Mr. R. G. Domer
Chief Civil Engineer
Tennessee Valley Authority
104 Union Building
Knoxville, Tennessee 37902

ATTENTION: Mr. W. A. English

SUBJECT: Watts Bar Nuclear Plant, Units 1 & 2
Dynamic Analyses of the Auxiliary-Control Building
Personal Service Contract No. TV38685A

Gentlemen:

Please find enclosed six (6) copies of our final report on the subject analyses. We understand that this report will supersede the TVA report entitled, "Dynamic Earthquake Analysis of the Auxiliary-Control Building and Response Spectra for Attached Equipment", dated June 30, 1972, as the current analyses include the effects of revised concrete elastic properties and modifications to the structural design. We believe that this completes the scope of work outlined in our proposal No. 06-4, dated October 22, 1973.

We have enjoyed working with you on this project, and look forward to the possibility of providing assistance to you on future work.

If you have any questions or comments on the enclosed, please contact the undersigned.

Very truly yours,

EDS NUCLEAR INC.

LFS

Leonard F. Swee, Jr.
Supervising Engineer
Advanced Engineering Division

LFS/lpj
cc: Mr. R. C. Giordano (w/ encls.)
Mr. E. Douglas Myninger

COPY

TENNESSEE VALLEY AUTHORITY

SEISMIC ANALYSES OF THE AUXILIARY-CONTROL BUILDING WATTS BAR NUCLEAR PLANT, UNITS 1 & 2

Prepared for: Tennessee Valley Authority

Prepared by: EDS Nuclear Inc.
May, 1974

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3.0	METHODS OF ANALYSIS	3
4.0	DISCUSSION OF ANALYSES	4
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1.0 INTRODUCTION

This report, prepared by EDS Nuclear Inc., (EDS), for the Tennessee Valley Authority, (TVA), describes the analyses performed to determine the effects of seismic excitation on the Auxiliary-Control Building of the Watts Bar Nuclear Plant, Units 1 & 2, and to develop the associated floor response spectra for seismic analyses of attached equipment.

The purpose of these studies was to evaluate the maximum dynamic response displacements, accelerations and member forces expected in the structure under seismic loading, including torsional effects due to structural eccentricities, and to develop floor response spectra which include the "worst case" torsional contributions to response.

Both response spectrum analyses and dynamic time history analyses were performed on a mathematical model of the Auxiliary-Control Building, and its response to seismic excitation determined. The model was constructed to properly account for torsional effects resulting from eccentricities between the centers of mass and centers of rigidity at each floor level.

The results of the analyses indicate that the structure responds as a "shear building", with negligible floor rotations about the horizontal axes. Torsion contributes significantly to the translational motion under east-west seismic excitation, but for a north-south earthquake component, the symmetry of the structure precludes the development of significant torsional effects. The analysis results presented in this report include plots of the maximum displacements, accelerations, floor rotations, shears, moments, torques and axial forces, as well as response spectra at all floor levels for each direction of seismic response.

2.0 DESCRIPTION OF STRUCTURE

The Auxiliary-Control Building is a reinforced concrete "shear" structure, consisting of poured-in-place shear walls and floor slabs. The structure houses the common spent fuel pit and other radioactive waste treatment facilities, and the control equipment for Units One and Two of the Watts Bar Nuclear Plant. The structure is located between the Units One and Two Shield Buildings, and is approximately "T" shaped. The structure is nearly symmetrical about the north-south centerline of the plant.

The building is founded on competent rock, with the bottom elevation of the foundation mat varying from 659 feet to 683 feet. The top of bedrock is located at Elevation 692 feet, and the portion of the structure below this elevation is effectively rigid. Expansion joints between the foundation mats of the Auxiliary-Control Building and the adjacent Reactor Buildings and Turbine Building, permit differential movement between structures with negligible load transmission.

The structure extends approximately 335 feet in the north-south direction and approximately 320 feet in the east-west direction. Major floor levels are located at Elevations 692, 713, 737, 757 and 786 feet, with the roof slab at Elevation 814 feet.

The north end of the structure is partially embedded in engineered backfill, with rib walls extending outward into the backfill material between Elevations 692 feet and 727 feet. These walls comprise the support structure for two, symmetrically-located Auxiliary Equipment Buildings attached to the Auxiliary-Control Building.

3.0 METHODS OF ANALYSIS

The effects of seismic loading on the Auxiliary-Control Building were evaluated by performing both response spectrum and dynamic time history analyses, using EDS Program EDSGAP, originally developed by Wilson (Reference 3.01), and modified extensively by EDS. The program may be used to analyze large , three-dimensional structural systems of arbitrary geometry, subjected to static or dynamic loading.

The Auxiliary-Control Building was idealized as a mathematical model consisting of lumped masses connected by massless elastic members. Masses were located at all floor levels of the building and intermediate elevations associated with a change of wall configuration, in order to adequately represent the dynamic and elastic characteristics of the structure. The elastic properties included the effects of bending, shear, axial and torsional structural characteristics.

Seismic analyses were performed for independent vertical and horizontal earthquake components, with the seismic excitation represented by base mat input response spectra for use in the response spectrum analyses, and by a set of four artificially-generated accelerograms for use in the time history analyses. Maximum displacements, accelerations and member forces were determined from the response spectrum analyses by calculating the natural frequencies and modes of vibration of the structure, determining modal response maxima, and combining these by the square-root-of-the-sum-of-the-squares (SRSS) technique. Time histories of floor acceleration and the associated floor response spectra were obtained by the normal-mode time history technique, in which individual modal response time histories were superimposed to form the total time history response of the system.

4.0 DISCUSSION OF ANALYSES

The seismic response of the structure was computed for a 1/2 Safe Shutdown Earthquake (SSE) case, having a maximum horizontal acceleration of 0.09g. The vertical earthquake component was assumed to have a magnitude equal to 2/3 of the horizontal components. A value of five percent structural damping was considered appropriate for the analyses, as the Auxiliary-Control Building is a concrete structure, and the stresses for such seismic loadings were expected to remain well below yield. It should be noted that no analyses were performed for the SSE case. Instead, the results for an SSE excitation are assumed to be twice the 1/2 SSE response. This assumption will result in a conservative estimate of SSE response, as the stress levels and extent of concrete cracking for such loadings will be higher than for the 1/2 SSE, with correspondingly higher structural damping. With such increased damping characteristics, the response of the structure to SSE excitation will be less than twice the response for a 1/2 SSE base motion.

Discussions of the mathematical model and analyses performed are presented in separate sections below.

4.1 Mathematical Model

The mathematical model of the Auxiliary-Control Building is shown schematically in Figure 1. Figures 2 through 14 indicate the arrangements of structural walls at the elevations of selected mass points. The elastic characteristics of the structure are based only on the active structural walls shown in Figures 2 through 14. However, the mass properties of the building include the weights of all structural components and equipment. Wall dimensions, floor slab thicknesses and equipment weights were obtained from References 1.01.01 through 1.01.15.

Torsion was considered in the analyses by including the effects of eccentricities between centers of mass and centers of rigidity. In addition, the maximum eccentricities of points in the structure farthest from the centers of rigidity were included in the mathematical model to facilitate evaluation of floor response spectra at the extreme eccentricities.

The elastic structural properties are shown in Table I. Equivalent cross section properties were calculated for bending, shear, axial and torsional characteristics, and an elastic modulus for concrete of 4.1×10^6 psi was assumed in the analyses. (Reference 1.02.01). Shear areas were computed as the sum of the

contributing shear areas of the active structural walls parallel to the direction of seismic excitation. Torsion constants were calculated according to the procedures of Reference 4.01, considering all major active structural walls. Centers of rigidity were computer for the structural walls above and below each floor level according to the procedures of Reference 5.01. At each floor level, the average location for the center of rigidity was computed as the arithmetic average of the locations of the centers of rigidity above and below the floor.

The mass properties of the structure are presented in Table II. Masses and mass moments of inertia were computed for each floor level by considering the weights of floor slabs and tributary weights of all walls above and below each floor. Locations of the centers of mass were computed by averaging the centers of mass of the floor slab and tributary masses of walls above and below each floor. Weights of major equipment at each floor level were included as additional lumped masses. Eccentricities for torsional effects were computed using the locations of the centers of mass and centers of rigidity shown in Table III.

As the lower elevations of the Auxiliary-Control Building are embedded in competent rock below Elevation 692 feet, the structure will be effectively rigid below this elevation. A fixed base was assumed at Elevation 692, and hence no structural properties were computed for the portion of the building below this elevation. Between Elevations 692 feet and 727 feet, the structure is partially embedded in engineered backfill, and it was assumed that the region of backfill surrounding the external rib walls at the north end of the building will contribute an additional mass to the structure during seismic response. It was assumed that the backfill mass active during a particular direction of horizontal seismic motion is that material enclosed by the rib walls perpendicular to the direction of motion. For vertical excitation, the full mass of backfill material in this region was assumed to be active. Backfill masses were computed assuming a unit weight of 135 pounds per cubic foot, and were distributed to the mass points of the mathematical model between Elevations 692 feet and 727 feet.

4.2 Analyses Performed

Seismic analyses were performed for three independent components of earthquake motion, using both the response spectrum and normal-mode time history techniques. The seismic input criteria for the 1/2 SSE case are as shown in Figure 15. As discussed in Section 4.0, above, analyses were performed for the 1/2 SSE case only, and the response of the structure to SSE motion is conservatively assumed to be twice the 1/2 SSE response.

Floor response spectra were generated from four separate time history analyses for each earthquake component. Time history analyses were performed for each of four artificially-generated acceleration time history input motions, in which the accelerograms were scaled such that the associated response spectra envelop the criteria spectra of Figure 15. Floor spectra were calculated for each input motion at all of the major floor levels. Final floor response spectra were obtained as the arithmetic average of four spectra at each mass point for each component of motion. In addition, the torsional effects caused by mass eccentricities for east-west motion of the structure were included in the floor spectra by obtaining the envelope response spectra at the maximum positive and negative eccentricities with respect to the centers of rigidity.

5.0 DISCUSSION OF RESULTS

Response maxima and time histories were obtained for the 1/2 SSE input motion. The natural frequencies of vibration for each component of seismic excitation are presented in Table IV, and it was assumed that all frequencies up to 33 Hz contribute to the dynamic response. As the structure is essentially symmetric about the north-south centerline, it was assumed for purposes of analysis that the north-south and east-west responses of the building are uncoupled.

It should be noted that the dynamic behavior of the structure is essentially that of a "shear building". Comparisons of the dynamic response were made for the cases of restrained and unrestrained floor rotations about the horizontal axes. The response maxima and selected floor response spectra differed by less than five percent for the two cases.

Maximum floor accelerations, displacements and rotations, and maximum shears, moments, torques and axial forces are presented in Figures 16 through 29. The maximum response values were obtained by combining the modal response maxima by the SRSS technique. The shears, moments, torques and rotations are shown for the centers of rigidity, while the accelerations and displacements are shown for the centers of mass.

Floor response spectra associated with the three components of earthquake are presented in Figures 30 through 67. It should be noted that the vertical response spectra are presented only for the base mat and the highest elevation in the structure. The vertical response spectra at other elevations in the structure may be obtained by linear interpolation. As discussed in Section 4.2, above, the east-west spectra are presented for the points in the structure which experience the maximum torsional contribution to translational response. From a review of the natural modes of vibration and the dynamic response under east-west excitation, it was found that torsion contributed significantly to the total dynamic response. The first mode consists of a combination of shear translation and torsion, resulting from the relatively large mass eccentricities in the structure. In the case of north-south response, the symmetry of the structure precludes the development of torsional motion.

FIGURE 32 TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 711.5
DAMPING RATIOS 0.005, 0.010, 0.020
SSE, N-S HORIZONTAL

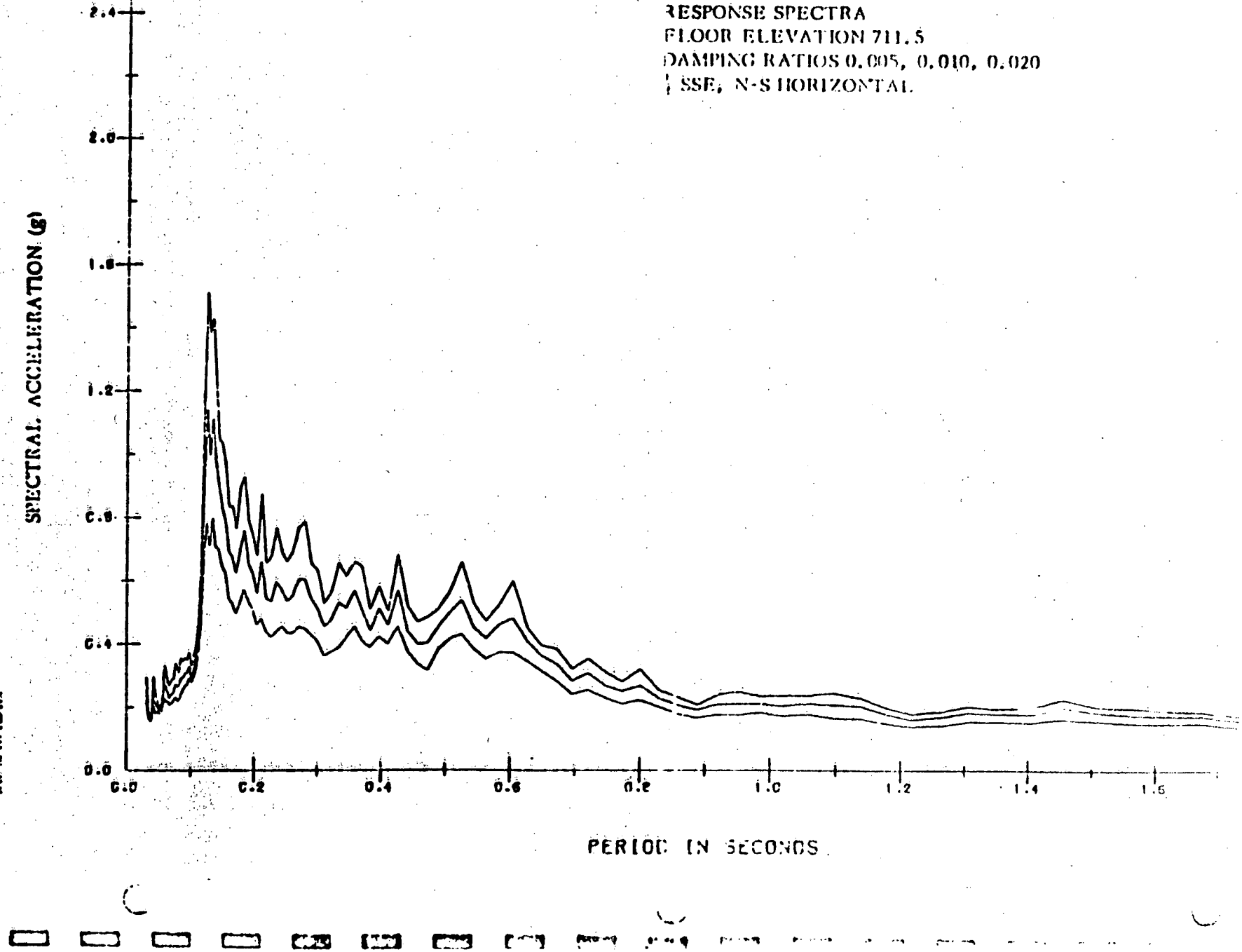
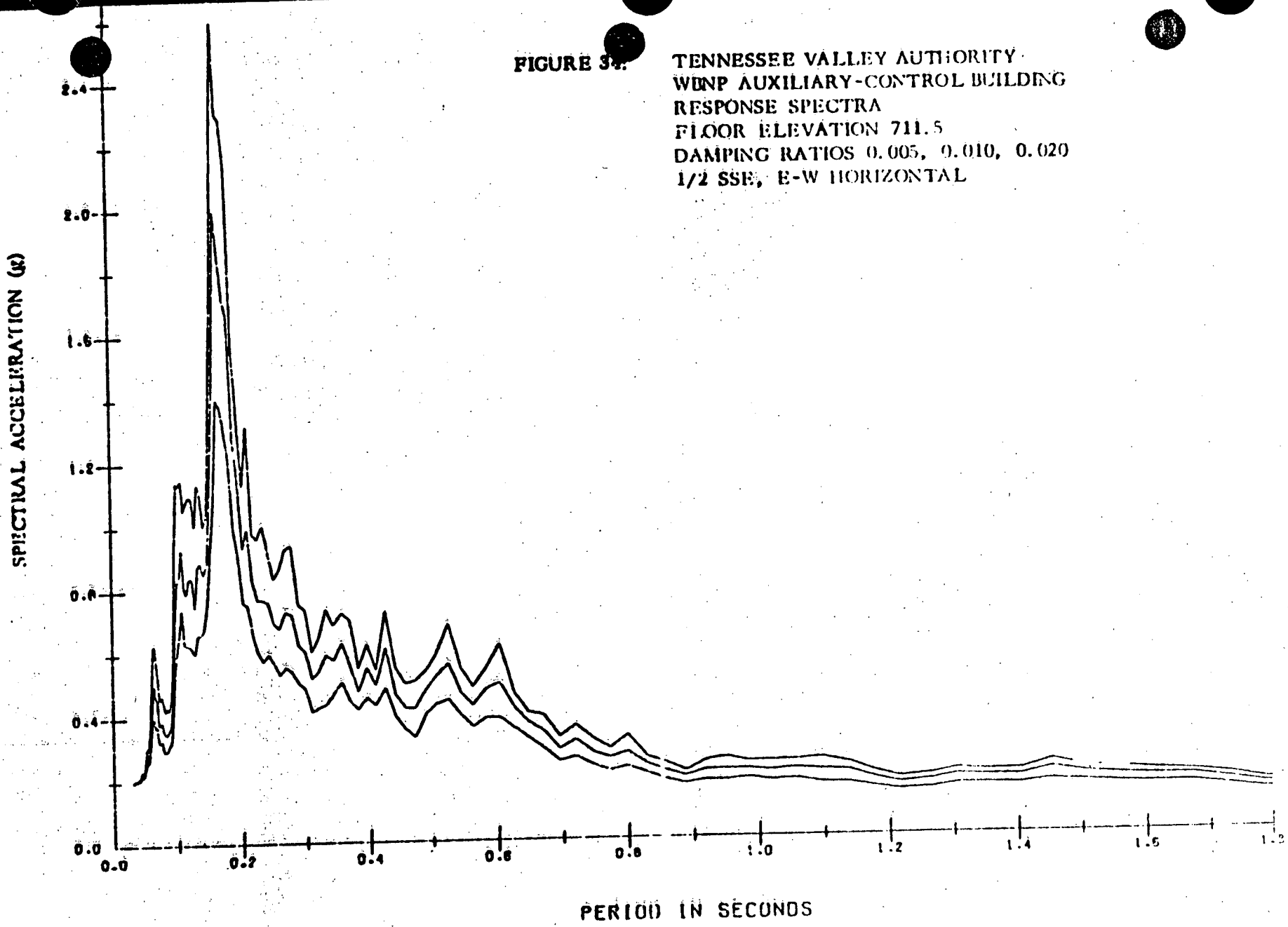


FIGURE 32

FIGURE 34

TENNESSEE VALLEY AUTHORITY
WBNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 711.5
DAMPING RATIOS 0.005, 0.010, 0.020
1/2 SSE, E-W HORIZONTAL



FIGURE

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT
RESPONSE SPECTRA
DAMPING RATIOS 0.005, 0.010, 0.020
SSE, VERTICAL GROUND ACCELERATION

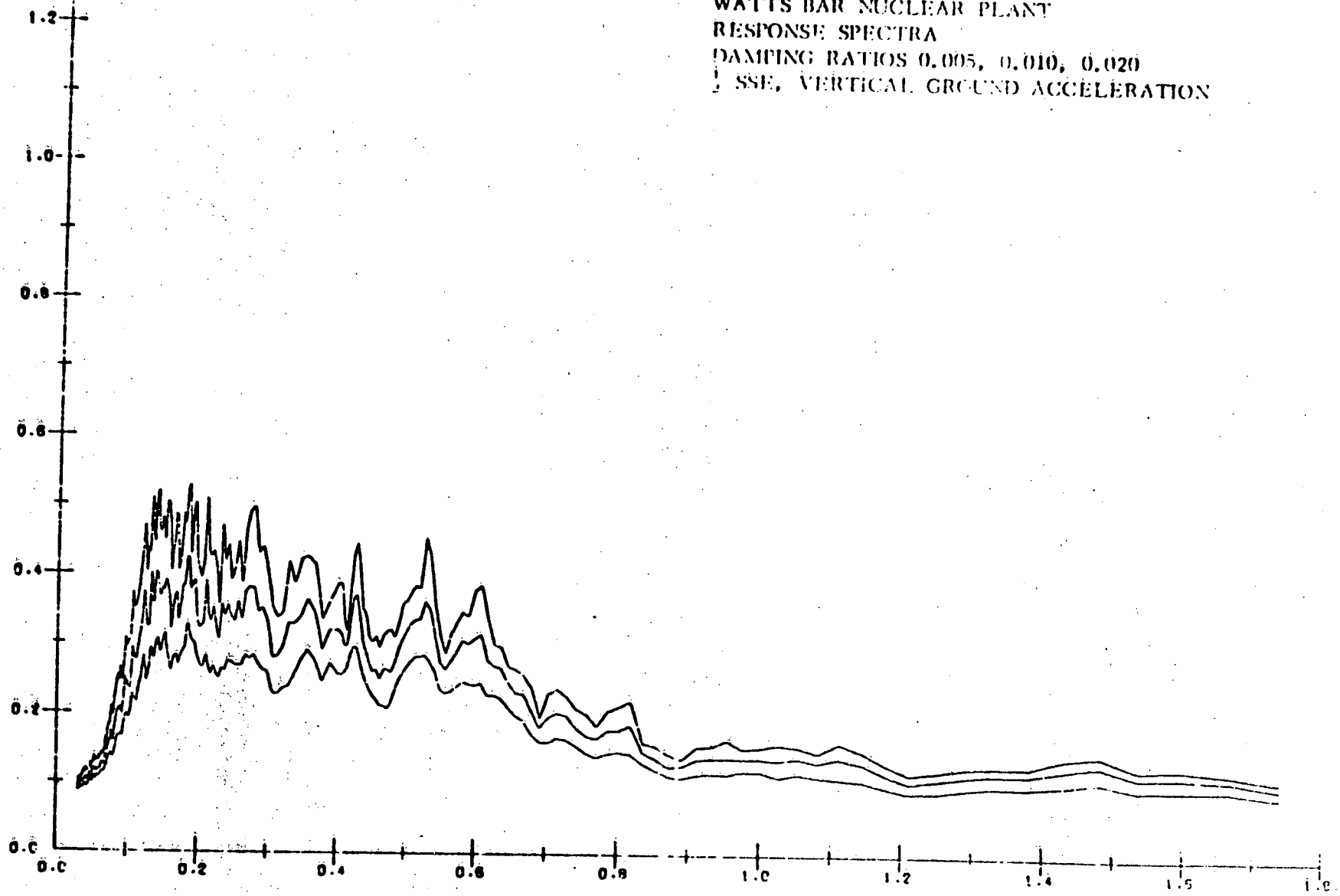


FIGURE 66: TENNESSEE VALLEY AUTHORITY
WNP AUXILIARY-CONTROL BUILDING
RESPONSE SPECTRA
FLOOR ELEVATION 814.25
DAMPING RATIOS 0.005, 0.010, 0.020
SSE, VERTICAL

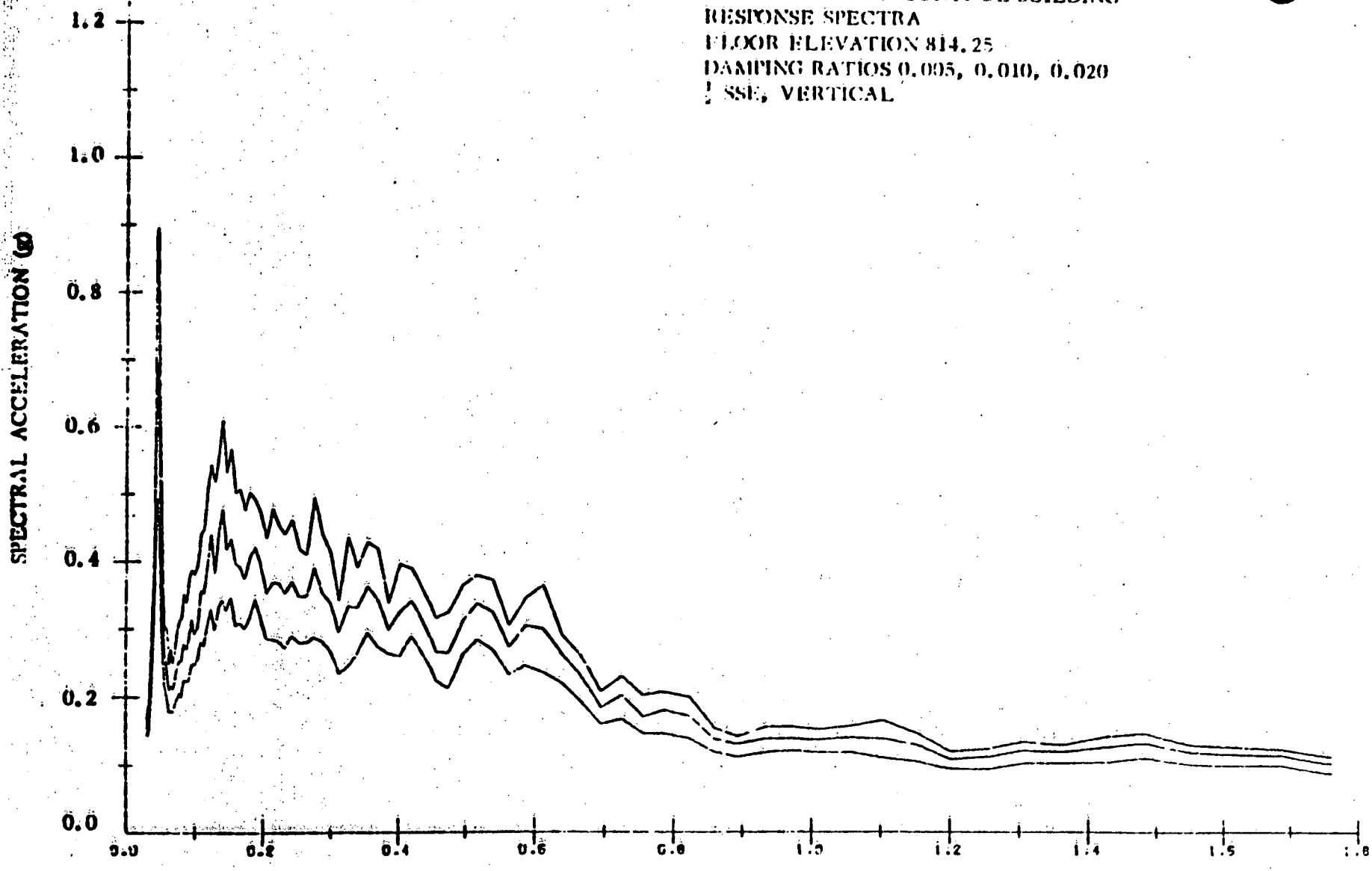


FIGURE 66

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS Bar Nuclear Plant Type:

1. Utility: Tennessee Valley Authority PWR X
2. NSSS: Westinghouse Electric Corp. BWR
3. A/E: T.V.A. Other

II. Component Name: Pressurizer Safety Valve

1. Scope: [X] NSSS [ ] BOP [ ] Other
2. Model Number: HB-BP-86 Type E Quantity: 3
3. Size or Range: 6M6 Valve I.D. 6RV88MSB
4. Vendor: Crosby Valve and Gage Company
5. If the component is a cabinet or panel, name and model Number of the devices included:
6. Physical Description:
   a. Appearance: Valve
   b. Dimensions: 44 3/4 high - 33 diameter
   c. Weight: 900 lb.
7. Location: Building: Inside Containment Building
   Elevation: 779' - 10 3/16" AZ 108°
8. Field Mounting Conditions [X] Bolt (No. 12, Size 12 1 3/8 inlet 1 outlet)
   [ ] Weld (Length)
   [ ]
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   Mounted Vertical in the Piping above the Pressurizer
10. a. System in which located: Reactor Coolant System
    b. Functional Description: Pressure Relief
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
    [ ] Both [ ] Neither [X] Other All operating conditions

Pertinent Reference Design Specifications for Qualification Requirements: 678972 Rev. 3 and 678838 Rev. 2

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations .
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: EC-155 Rev. 1

(No., Title and Date): Stress Report EC-155 Rev. 1-10/1/75

Company that Prepared Report: Crosby Valve and Gage Company

Company that Reviewed Report: Westinghouse Electric Corporation

Where Report is filed or available: Westinghouse Electric Corporation

Applicable Codes And/Or Standards: ASME Code with Addenda thru Winter 1972 and Specification ~~G-678838 Rev. 0~~

V. Vibration Input: (For Analysis)

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

? [X] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): (static analysis)

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: N/A OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [X] Other 3 Horizontal 2 Vertical
(specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = 3 F/B = _____ V = 2

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] _____

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____
(specify)

Frequency Range: _____

4. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [X] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

6. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[X] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 116 F/B = _____ V = _____

3. Model Type: [ ] 3D [X] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other Manual Calculation

4. [ ] Computer Codes: _____

Frequency Range and No. of modes considered: _____

[X] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[X] Absolute Sum [ ] SRSS [X] Other: ASME Boiler Code Section III; NB3500 and NB3570 (Draft 12/16/7 (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: _____

7. Support Considerations in the model: Rigid mounting at Inlet Flange

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

we need to fill this in

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

Attachment No. 3

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: WATTS Bar No. 1&2 Type:

1. Utility: Tennessee Valley Authority PWR 4 Loop
2. NSSS: Westinghouse Electric Corp. BWR
3. A/E: Tennessee Valley Authority Other

II. Component Name: Charging/Safety Injection Pumps

1. Scope: [X] NSSS [ ] BOP [ ] Other
2. Model Number: type 2½ RLIJ, 11 Stages Quantity: 2 per plant
3. Size or Range: Centrifugal Horizontal Pump
4. Vendor: Pacific Pumps
5. If the component is a cabinet or panel, name and model Number of the devices included: N/A
6. Physical Description:
   a. Appearance: Horizontal Pump, Motor & Gear Drive on a Common Base
   b. Dimensions: Overall Size: Lgth: 226", Width = 52 3/4", Ht = 55"
   c. Weight: Total = 21,330 lbs.
7. Location: Building: Auxiliary Building
   Elevation: 692.0 Ft
8. Field Mounting Conditions [X] Bolt (No. 16, Size 1"dia)
   [ ] Weld (Length)
   [ ]
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   On Floor
10. a. System in which located: Charging & Safety Injection
    b. Functional Description: Charging & Safety Injection Flow
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
    [X] Both [ ] Neither [ ] Other Charging

II. Pertinent Reference Design Specifications for Qualification Requirements: E-Spec 678815 Rev. 2 & Addendum E-Spec 952484 Rev. 4

(a.) Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: (No., Title and Date):	Pump Seismic 9-25-78 K-318-1, Rev. 5	Gear Seismic S.O. 75R40761	Motor Seismic S.O. 74-F-31186
Company that Prepared Report:	Pacific Pumps	W MM&G	W LMD
Company that Reviewed Report:	Pacific Pumps	W MNC	W LMD
Where Report is filed or available:	W MNC	W MNC	W MNC
Applicable Codes And/Or Standards:			

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [ ] N/A (other, specify)

3. Required Response Spectra** (attach the graphs): N/A

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE _____ SSE _____

5. Required Acceleration in Each Direction:

[ ] ZPA [ ] Other _____ (specify)

OBE S/S = 1.5g F/B = 1.5g V = 1.0g

SSE S/S = 3.0g F/B = 3.0g V = 2g

6. Were fatigue effects considered?

[ ] Yes [ ] No

If yes, describe how they were treated in overall qualification program: _____

VI. If Qualification by Test, then Complete: NOT APPLICABLE

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] _____

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

Frequency Range: _____

4. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[X] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = >35Hz F/B = > 35Hz V = >35Hz

3. Model Type: [ ] 3D [X] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other _____

4. [ ] Computer Codes: N/A

Frequency Range and No. of modes considered: N/A

[X] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [X] SRSS [ ] Other: _____ (specify)

6. Damping:

OBE _____ SSE _____ Basis for the damping used: N/A

7. Support Considerations in the model: Assumed rigid attachment to building

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: _____

10. Margins Available: [ ] Input Spectrum [X] Stress or Deflection

Attachment No. 2

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Watts Bar No. 1 Type:

1. Utility: Tennessee Valley Authority PWR 412 - NSSS
2. NSSS: Westinghouse BWR
3. A/E: Tennessee Valley Authority Other

II. Component Name: Control Rod Drive Mechanisms

EMD S10	Serial Nos.	Description	General Assembly
M 323	1 - 53	Full - Length Control Rod Drive Mechanisms.	115E238G03
M 323	54 - 57	L-106A CRDM Full-Length Converted Capped L.Hsg (For Information Capped Latch Housing General Assy. 934D129G01 1 through 4).	1168E80G01

REQUIREMENTS: Pressure Retaining Components designed to Section III ASME B & PV Code Class 1 Components.

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations . EM 4531
d. Service Conditions EM 4531
e. Qualified Life. EM 4531

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [X] Partial or limited availability

IV. Equipment Qualification Method: Generic Stress Report

[ ] Test [X] EMD Analysis [ ] Combination of Test and Analysis

Qualification Report*: EM 4531 inc. Revisions 1 and 2

(No., Title and Date): Stress and Thermal Report of Type L-106A and L-106B CRDM EM 4531 1/31/74 R/1 8/19/75 R/2 4/12/76.

Company that Prepared Report: Westinghouse Electro-Mechanical Division

Company that Reviewed Report: Manf. Cert. by EMD
Owners Cert. by W PWR Division

Where Report is filed or available: Westinghouse Electro-Mechanical Division

Applicable Codes And/Or Standards: R/01/2 W'71 E-Spec 677470 Rev. 1

V. Vibration Input: Not Applicable

1. Loads considered:
   a. [ ] Seismic only
   b. [ ] Hydrodynamic
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[ ] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): _____

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

REQUIREMENTS: _____

_____

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations.
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method: Specific Plant Stress Report

[ ] Test [XX] Analysis [ ] Combination of Test and Analysis

Qualification Report*: EM 4941 and EM 4941 Addendum 1

(No., Title and Date): EM 4941 L-106A Full-Length Control Rod Drive Mechanism and Capped Latch Housing Assembly Pressure Boundary Component Summary Report.

Company that Prepared Report: EM 4941 Add 1 Same Title as above plus capped catch housing replacement Westinghouse Electro-Mechanical

Company that Reviewed Report: Manf.-Cert. by EMD Owners Cert. by W PWR Division

Where Report is filed or available: Westinghouse Electro-Mechanical Division

Applicable Codes And/Or Standards: W '72 E-Specs 952356 Rev. 1 and 677470 Rev. 1

V. Vibration Input: Not applicable based upon paragraph 3.1.5 Seismic of E-Spec 677470 Rev. 1

1. Loads considered:
   a. [XX] Seismic Only***
   b. [ ] Hydrodynamic Only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [XX] Absolute Sum [ ] SRSS [ ] _____ (other, specify)

3. Required Response Spectra** (attach the graphs): _____

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

***Letter AM-SSD-08

4. Damping Corresponding to RRS: OBE 5% / 1% SSE 5% / 2%

5. Required Acceleration in Each Direction: CRDM/Structure

[ ] ZPA [ ] Other N/A (specify)

OBE S/S = _____ F/B = _____ V = _____

SSE S/S = _____ F/B = _____ V = _____

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: _____

_____

_____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] _____

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE _____ SSE _____ Other _____ (specify)

4. Frequency Range: _____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = _____ F/B = _____ V = _____

6. Method of Determing Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = _____ F/B = _____ V = _____

OBE S/S = _____ F/B = _____ V = _____

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length _____) [ ] _____

B. Orientation and Fixturing: _____

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _____

_____

12. Other tests performed (such as aging or fragility test, including results):

_____

_____

13. Failure Modes (If appropriate _____)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[X] Static Analysis [ ] Equivalent Static Analysis

* [X] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 4.3 5.9 5.0 6.8 hz 5.6 F/B = Same as S/S V = Above 100 hz

3. Model Type: [X] 3D [X] 2D [ ] 1D

[X] Finite Element [X] Beam

[ ] Closed Form Solution [ ] Other _____

Static Analysis - FEASS-6 EM 4531, Rev. 2, Page i Axi-Symmetric

*Letter AM-SSD-08

4. [X] Computer Codes: WECAN

Frequency Range and No. of modes considered: 0-80 hz, 66 modes (these are total system modes).

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[X] Absolute Sum [ ] SRSS [ ] Other: _____ (specify)

6. Damping: CRDM/Support Structure

OBE 5% / 1% SSE 5% / 2% Basis for the damping used: Tests

7. Support Considerations in the model: System Supports (actual)

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
rod travel housing/latch housing joint canopy weld.	OBE Moment 75,000 in-lb	20.9 KSI	NA	24.15 KSI

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
NA		

9. Failure Modes: NA

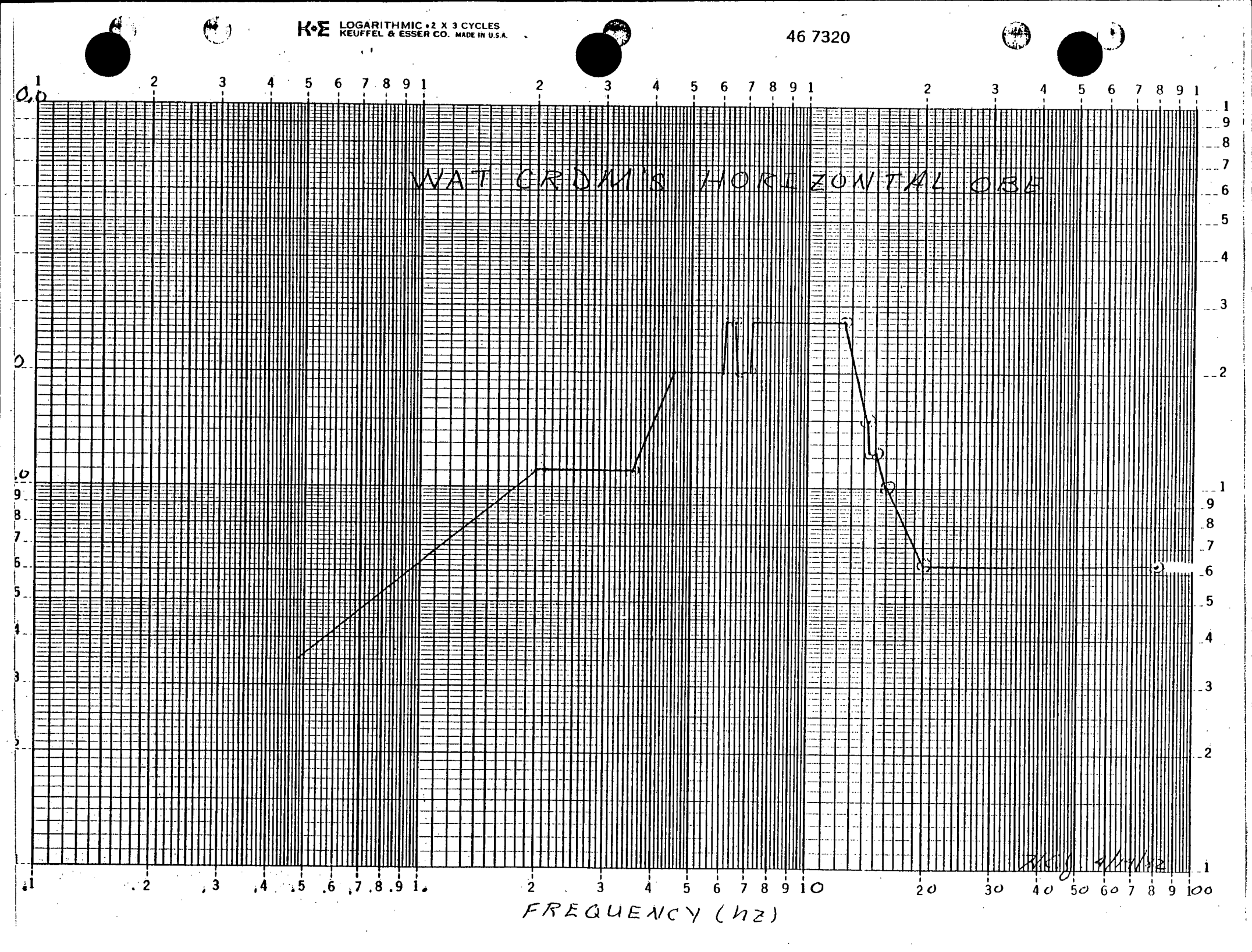
10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

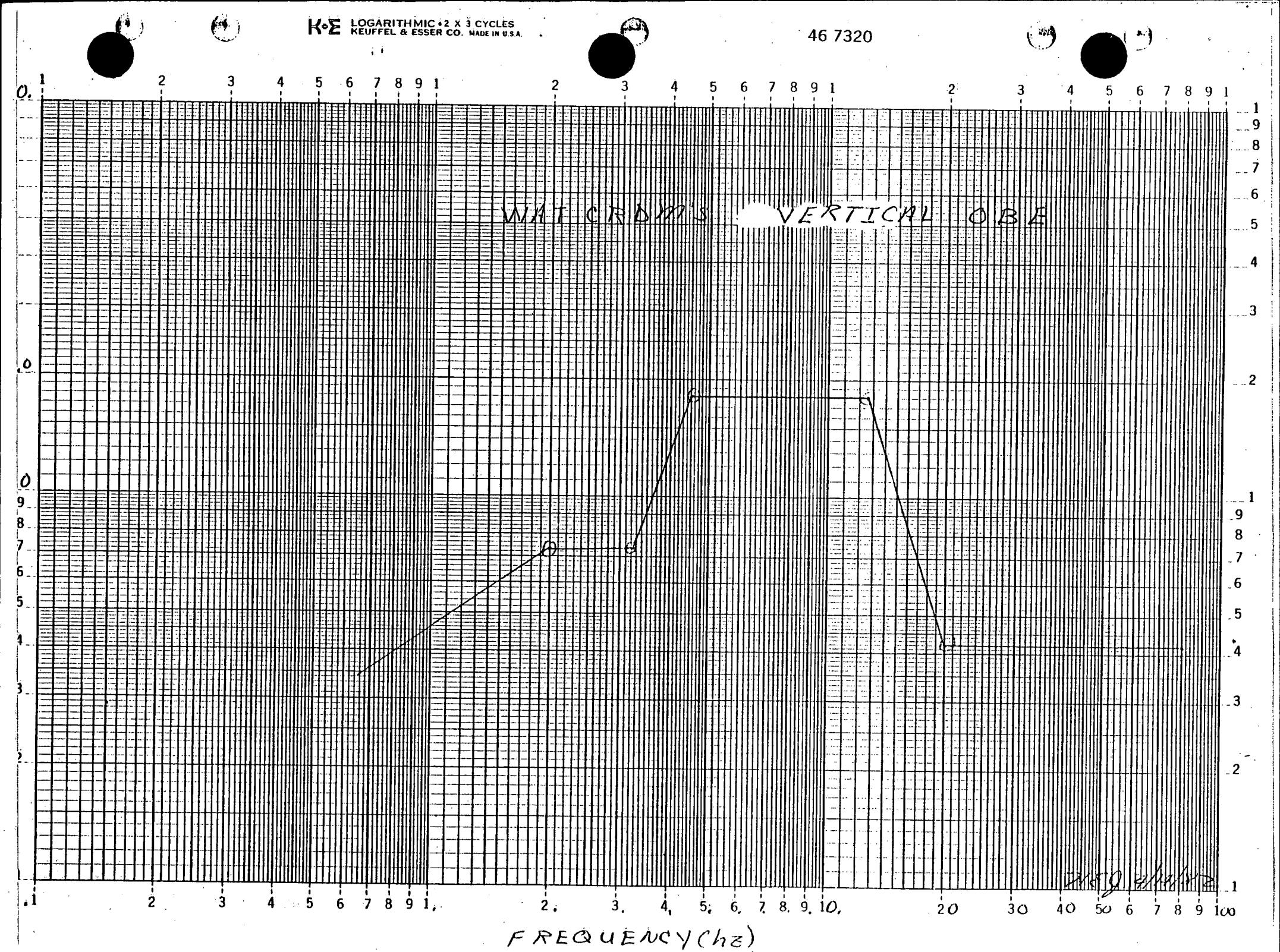
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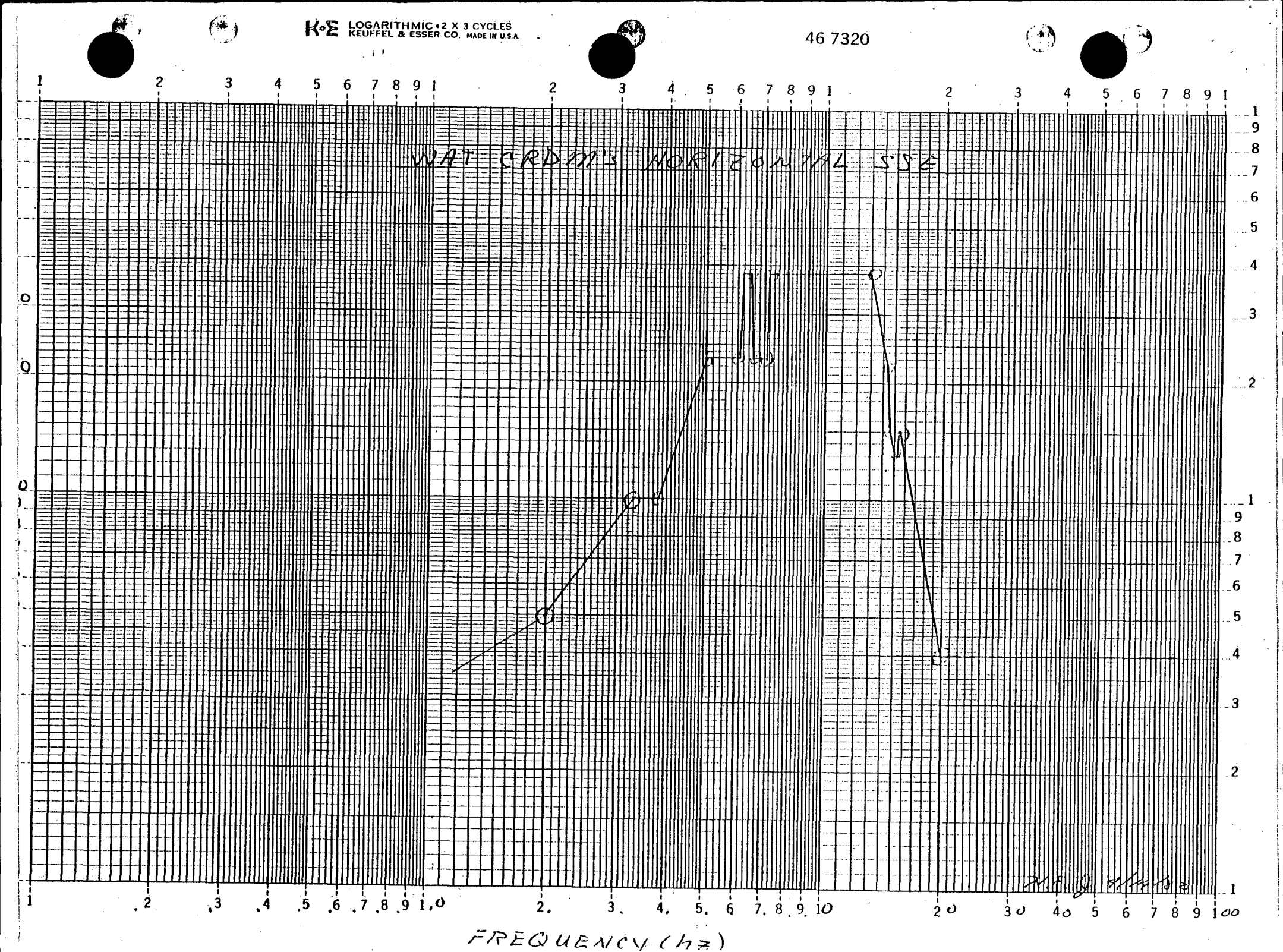
*Letter AM-SSD-08, February 24, 1981, J. S. VanKirk

1. Obermeyer, F. D., "Effective Structural Damping of the KEP L105 Control Rod Drive Mechanism", WCAP-7427, January 1970. (Westinghouse Proprietary).
2. Obermeyer, F. D., WCAP-7427, Addendum 1 to reference (1) above, December 1970. (Westinghouse Proprietary).
3. "CRDM Vibration Test Report", Mitsubishi Atomic Power Industries, Inc., CD-CRDM-2-1, (Preliminary), November 1974.
4. "A study of Vibration Characteristics of Control Rod Drive Mechanism of PWR (Part 2)", (Preliminary) Mitsubishi Atomic Power Industries, Co., December 1974.
5. E-Spec 677470 Rev. 1 EM 4531 Page 212
6. SSDC No. 1.3 Rev. 1, dated 4/2/71 Hot Leg Transients Analyzed.
7. W '71 ASME Code.

The attached graphs are composite response spectras. That is, the horizontal spectras take the damping differences between the CRDM's and their support structure into account. (CRDM's 5% and structure 1% critical damping for OBE; CRDM's 5% and structure 2% damping for SSE). The spectra's have also been peak broadened 15%. A linear-linear interpolation is used between given points. Note that the given horizontal spectra envelopes the N-S and E-W spectras that was transmitted to Westinghouse by the A/E.


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