SDRC

Structural Dynamics Research Corporation

SDRC Report No. 11410-R1

# SEISMIC QUALIFICATION REPORT
# ON
# AN ITE SERIES 5600 MOTOR CONTROL CENTER

Prepared for
CINCINNATI GAS & ELECTRIC CO.
COLUMBUS & SOUTHERN OHIO ELECTRIC CO.
DAYTON POWER & LIGHT CO.
P. O. BOX 960
CINCINNATI, OHIO 45201

Prepared by
STRUCTURAL DYNAMICS RESEARCH CORPORATION
2000 EASTMAN DRIVE
MILFORD, OHIO 45150

AUGUST 29, 1982

**Contacts:**

CG&E (513) 553-2081
Mr. David Parker

S&L (312) 269-6762
Mr. Don Elias

SDRC (513) 576-2400
Mr. Gary Patrick
Mr. Anthony Wolfer
Mr. Thomas Zurmehly
Mrs. Kay Poynter

RECORD OF REVISION

| Rev. No. | Date | Pages Affected | By | Approvals Initials | | |
|---|---|---|---|---|---|---|
| | | | | Reviewed | Approved | QA Approved |
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| 1 | 10/7/82 | Table of Contents and Page 1 | ATW | | | |
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Rev. 1

# I. QUALIFICATION RESULTS CERTIFICATION AND SUMMARY

SDRC Report No. 11410 Volume 1 of 1 Revision Number 1 Date 10/7/82

SDRC Project No. 11410 Dates from 8/17/82 to _____

Customer: Cincinnati Gas & Electric
Nuclear Engineering Department

Customer P.O. Number XZC 023743

Address: P. O. Box 201
Moscow, Ohio 45153

Test Specimen(s) ITE Series 5600 Motor Control Center
See Table I.1 for component identification.

Manufacturer ITE/Gould Inc. Industrial Controls Division

Summary The test levels achieved met or exceeded the Required Response Spectra for all tests. The MCC provided essential power on command throughout all testing. No contact chatter was detected after normal change of state settling time before, during or after all seismic tests. The MCC met all structural acceptance criteria throughout the seismic testing except as noted in Record of Anomaly (see Record of Anomaly, following page). Rev. 1

Prepared by: Anthony Wolfer
Anthony Wolfer, Test Specialist

Reviewed by: Gary B. Patrick
Gary B. Patrick, Senior Project Manager

Reviewed by: Gary T. Post
Gary T. Post, Q.A. Engineer

Approved by: Edward L Peterson
Edward L. Peterson, PE, Technical Director–Testing

Certification of Results:

I hereby certify that the test specimen(s) have been qualified in full accordance with the Customers Purchase Order and is qualified to withstand without loss of those functions and/or structural integrity for the seismic condition provided in the Purchaser's Specification as presented to SDRC. The test has been supervised and reviewed by me.

Signature Edward L Peterson

Registration P.E. Number E041507
State of Ohio

Date 7-Oct-1982 P.E. Stamp

NAME AND LOCATION OF TEST FACILITY

STRUCTURAL DYNAMICS RESEARCH CORPORATION
2000 EASTMAN DRIVE
MILFORD, OHIO 45150
(513) 576-2400

SDRC
Structural Dynamics Research Corporation

2000 Eastman Drive
Milford, Ohio 45150

# RECORD OF ANOMALY

Date 8/17/82

Customer CG&E

SDRC Proposal No. 11410-R1

Description ITE 5600 Motor Control Center

Customer Item No. 61480 N.O.I.

Test Item No. 11410-R1-01-01-00

Engineer Wolfer

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## REQUIREMENTS:

The structural integrity of the test specimen must be demonstrated both during and after testing.

## DESCRIPTION OF ANOMALY:

The door latches rotated during the seismic aging tests so as to allow some doors to open. During the high level seismic tests the door latches rotated a small amount. (Not enough to allow any door to open).

## DISPOSITION:

Due to interlocking feature on the breakers, the doors could not open far enough to affect the safety-related function of the motor control center.
SDRC suggested disposition is "Use-As-Is".

## COMMENTS:

CC: SDRC Final Report
SDRC Q.A. Manager
SDRC Sales Department

Customer, Mr./~~Ms.~~ David A. Parker CG&E

Address P.O. Box 201
Moscow, Ohio 45153

SDRC
Structural Dynamics Research Corporation

2000 Eastman Drive
Milford, Ohio 45150
513-576-2400

## RECORD OF ANOMALY

Date: 8/17/82 Customer Item No.: 61480 N.O.I.

Customer: CG&E Test Item No.: 11410-R1-01-01-00

SDRC Proposal No.: 11410-R1 Engineer: Wolfer

Description: ITE 5600 Motor Control Center

---

REQUIREMENTS:

During the seismic testing the table control accelerometers must be analyzed by shock response software to determine the TRS.

DESCRIPTION OF ANOMALY:

During test no. 12 the control accelerometers overloaded and could not be analyzed.

DISPOSITION:

Rerun the test.

COMMENTS:

CC: SDRC Final Report
SDRC Q.A. Manager
SDRC Sales Department

Customer: Mr. David A. Parker – CG&E
Address: P.O. Box 201
Moscow, Ohio 45153

SDRC
Structural Dynamics Research Corporation

2000 Eastman Drive
Milford, Ohio 45150
513-576-2400

# RECORD OF ANOMALY

Date: 8/17/82 Customer Item No.: 61480 N.O.I.

Customer: CG&E Test Item No.: 11410-R1-01-01-00

SDRC Proposal No.: 11410-R1 Engineer: Wolfer

Description: ITE 5600 Motor Control Center

---

REQUIREMENTS:

During all seismic tests the motor control center must be monitored for chatter and operability.

DESCRIPTION OF ANOMALY:

During test no. 14 (3rd Emergency attempt) the SDRC monitoring system malfunctioned and did not record the electrical monitoring data for this test.

DISPOSITION:

Rerun the test.

COMMENTS:

CC: SDRC Final Report
SDRC Q.A. Manager
SDRC Sales Department

Customer: Mr. David A. Parker – CG&E
Address: P.O. Box 201
Moscow, Ohio 45153

TABLE 1.1

5600 MCC COMPONENT IDENTIFICATION

| Section | Description | Manufacturer | Identifying Numbers |
|---|---|---|---|
| 1B | Panel Board | ITE/Gould | CAT.#: UB30-14L/Series 8/ 20W29 |
| 1B | 30A Circuit Breaker | ITE/Gould | Issue LK-4441/BQ3-B030 |
| 1D | 3 Phase Insulated Transformers | Sorgel Electric | CAT.#: 15T02HPS P-2 KVA15 |
| 2A | Circuit Breaker | ITE/Gould | EF3-B030 |
| 2A | Size 1 Starter | ITE/Gould | CAT.#: AT03C |
| 2A | Size 1 Starter | ITE/Gould | CAT.#: AT03C |
| 2A | Control Transformer | ITE/Gould | .1KVA/CAT.2032-T3 |
| 2B | Adjustable Trip Breaker | ITE/Gould | CAT.#: EF3-A030Z |
| 2B | Size 1 Starter | ITE/Gould | CAT.#: A213C |
| 2B | Size 1 Starter | ITE/Gould | CAT.#: A213C |
| 2B | 4 Pole Contact Relay | ITE/Gould | J20A40 |
| 2B | Control Transformer | ITE/Gould | CAT.#: 2032-T3 |
| 2C | Circuit Breaker | ITE/Gould | EF3/480 Volt/CAT.# EF3B030 |
| 2C | Circuit Breaker | ITE/Gould | EF3/480 Volt/CAT.# EF3B030 |
| 2D | Circuit Breaker | ITE/Gould | CAT.#: EF3-B100 |
| 2D | Size 4 Starter | ITE/Gould | CAT.#: A203F |
| 2D | Control Transformer | ITE/Gould | CAT.#: 2030-T10/.25KVA |
| 2D | Aux Relays | ITE/Gould | CAT.#: 20A20/2 pole |
| 3A | Adjustable Trip Breaker | ITE/Gould | CAT.#: EF3-A030 |
| 3A | Size 2 Starter | ITE/Gould | A203D |
| 3A | Control Transformer | ITE/Gould | CAT.#: 2032-T3 |
| 3A rear | Double Block 4-Pole Relay | ITE/Gould | 2(J20A40) |
| 3A rear | 2 Pole Relay | ITE/Gould | CAT.#: J20A20/2 Pole |
| 3B | Circuit Breaker | ITE/Gould | CAT.#: EF3-B100 |
| 3B | Size 3 Starter | ITE/Gould | CAT.#: A203E |
| 3B | Relay | ITE/Gould | CAT.#: J20A20/2 pole |
| 3B | Control Transformer | ITE/Gould | CAT.#: 2032-T3 |
| 3B | Ground Fault Relay | Brown/Boveri | Type GRM-FC |
| 3B Rear | Relay | ITE/Gould | CAT.#: J20A20/2 Pole |
| 3C | Adjustable Circuit Breaker | ITE/Gould | CAT.#: EF3-A1002 |
| 3C | Size 3 Starter | ITE/Gould | CAT.#: A2030E |
| 3C | Contact | ITE/Gould | CAT.#: J2820 |
| 3C | Control Transformer | ITE/Gould | CAT.#: 2032-T3 |
| 3D | Circuit Breaker | ITE/Gould | CAT.#: EF3-B030 |
| 3D | Size 2 Starter | ITE/Gould | CAT.#: A203D |
| 3D | Control Transformer | ITE/Gould | CAT.#: 2032-T3 |
| 3D Rear | C-Relay | ITE/Gould | CAT.#: J20A40/4 Pole |

1. Name of item:

   ITE Series 5600 Motor Control Center (MCC)

2. Customer's part number:

   61480 N.O.I. (See Table I.1 for component identification)

3. Manufacturer's model number:

   84-78977

4. Manufacturer's model number:

   See Table I.1

5. Test dates:

   8/17/82

6. Specification number and source:

   Sargent & Lundy – Specification for Dynamic Testing of Seismic Category I ITE Series 5600 Motor Control Center – R2

7. Specification class or seismic category:

   Class I

8. Spectrum curves used (RRS's) and sources:

   See Section III.1

9. Number of orientations:

   1

10. Number of tests/orientations:

    SRV (total time of 700 seconds)
    SRV plus LOCA (total time duration of 300 seconds)
    5 Upset Tests
    2 Emergency Tests

11. Equipment is: stock ____ , or special ✓

12. Equipment qualified by: analysis____ , test ✓ , combination ____

13. Equipment is: mechanical ____ , electrical ✓ , other____ , instrumentation ____

14. Equipment is a: motor____ , pump____ , fan____ , panel ____ , switchgear____ , instrument____ , other (specify) motor control center

15. Schematic and photographs of test setup:

    See Section III.3

16. Equipment is located in the N/S* at elevation ___ , and is attached to the: floor____ , wall____ , ceiling ____ , other (Specify) _____

17. Summary of resonances located in equipment

    See Section IV.1

18. Damping values used in TRS calculation:

    SRV – 2%
    SRV + LOCA – 2%
    4 Upsets – 1%
    1 Upset – 1, 2, 5%
    1 Emergency – 2%
    1 Emergency – 2, 5, 10%

19. Justification of use of damping values other than as allowed in Item 6:

    N/A

*N/S – Not Specified

20. Description of the testing approach (such as biaxial, triaxial testing, simulated plant operation, testing frequency range, frequency interval, type of frequency wave from inputs, etc.):

    Triaxial random input 1 to 100 Hz

21. Method of monitoring and location of monitors:

    Survey accelerometers placed on the motor control center at locations specified by CG&E.

22. Statement of equipment function before and after tests:

    ITE Motor Control Center functioned as specified in the test plan before, during and after all seismic events.

23. Test levels shown to meet or exceed required response spectra:

    See Section IV.2

24. Mounting of test item as compared to actual mounting:

    See Section III.3

25. Test observers (representatives from customer and/or supplier):

    CG&E – Mr. Dan Harvey
    Mr. Roger Thoney
    Mr. Mark Angelo
    Mr. Mendo Jonovski
    Mr. Paul Bogen

26. Test logs:

    See Appendix VII.2

## II. INTRODUCTION

This report documents a full scale tri-axis seismic qualification test performed by Structural Dynamics Research Corporation for Cincinnati Gas & Electric Company. The item tested was an ITE Motor Control Center.

This test was conducted at the SDRC* testing laboratory in Milford, Ohio on August 17, 1982.

Participants in this project were:

CG&E

Mr. David Parker
Mr. Robert Johnson

S&L

Mr. Don Elias

SDRC

Mr. Gary Patrick
Mr. Anthony Wolfer
Mr. Thomas Zurmehly
Mrs. Kay Poynter

*SDRC is a service mark of Structural Dynamics Research Corporation.

# III. TEST DESCRIPTION

## III.1 Required Response Spectrum (RRS)

The response spectrum was provided by Sargent & Lundy. The horizontal and vertical SRV spectra are shown in Figures III.1 and III.2. The horizontal and vertical SRV plus LOCA spectra are shown in Figures III.3 and III.4. The horizontal and vertical Upset curves are shown in Figures III.5 and III.6. The horizontal and vertical Emergency spectra are shown in Figures III.7 and III.8.

## III.2 Test Signal Generation

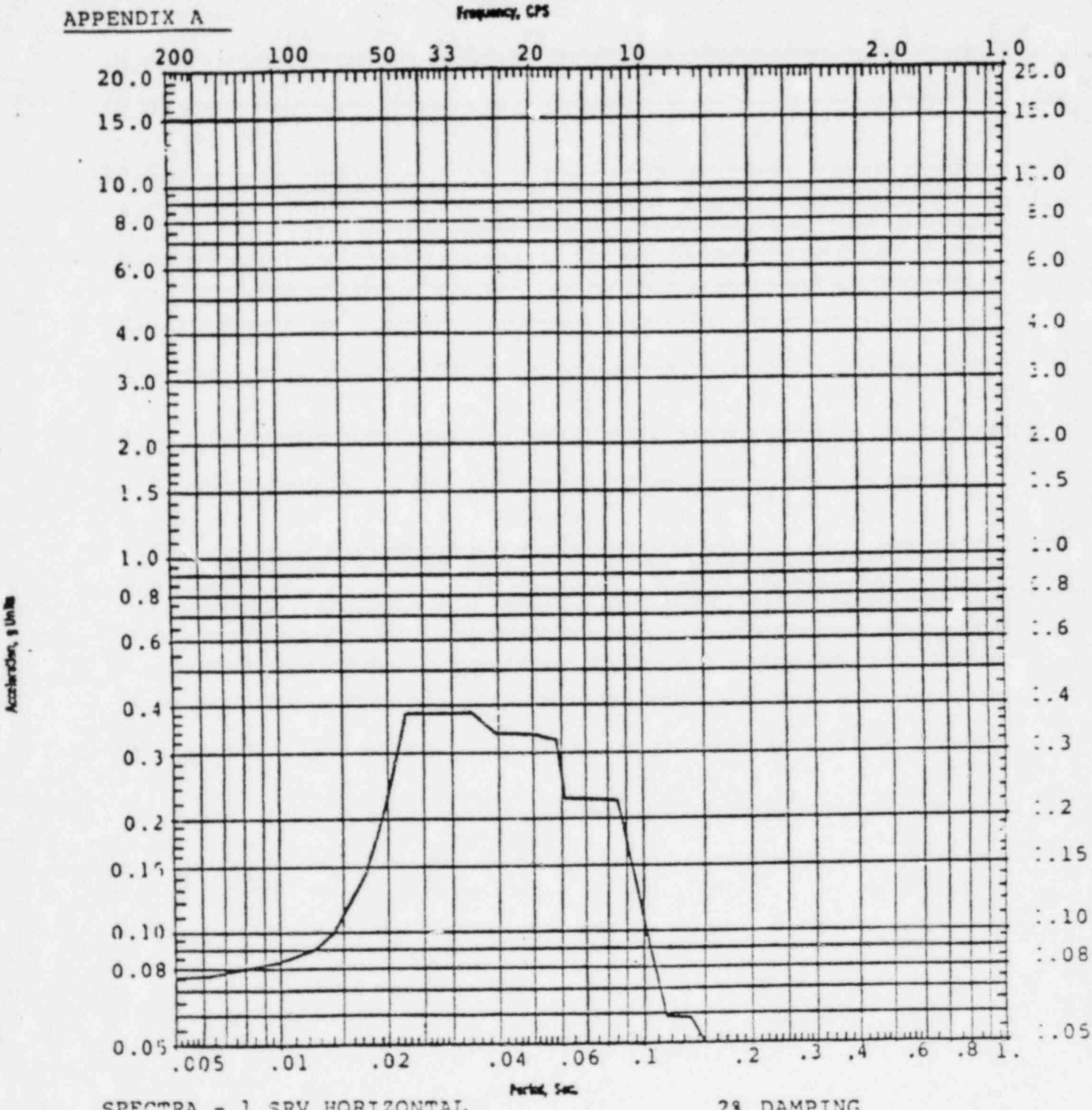
The horizontal and vertical input signals were generated by three random noise signals shaped by one third octave digital equalizers. The resulting signals are tape recorded for playback to the table. The signals are 30 seconds in duration. Figure III.9 shows approximately 5 seconds of the horizontal and vertical time signals.

SARGENT & LUNDY ENGINEERS

CLIENT CINCINNATI GAS & ELECTRIC COMPANY
PROJECT ZIMMER - 1 JOB NO. 4130-1[illegible]
DESIGN BY [illegible] DATE 6-29-82
CHECKED BY Nisar Alvi DATE 6-29-82 SHEET 1 OF [illegible]
FILE CQD-003243

| REV. NO. | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | | | | | | | |
| INITIALS | | | | | | | |

APPENDIX A




SPECTRA - 1 SRV HORIZONTAL

2% DAMPING
HORIZONTAL - N-S/E-W

Figure III.1

SARGENT & LUNDY ENGINEERS

CLIENT CINCINNATI GAS & ELECTRIC COMPANY
PROJECT ZIMMER - 1 JOB NO. 4130-15
DESIGN BY Donald E. Elsea DATE 6-24-82
CHECKED BY Nisar Alvi DATE 6-24-82 SHEET 2 OF 3
FILE CQD-003243

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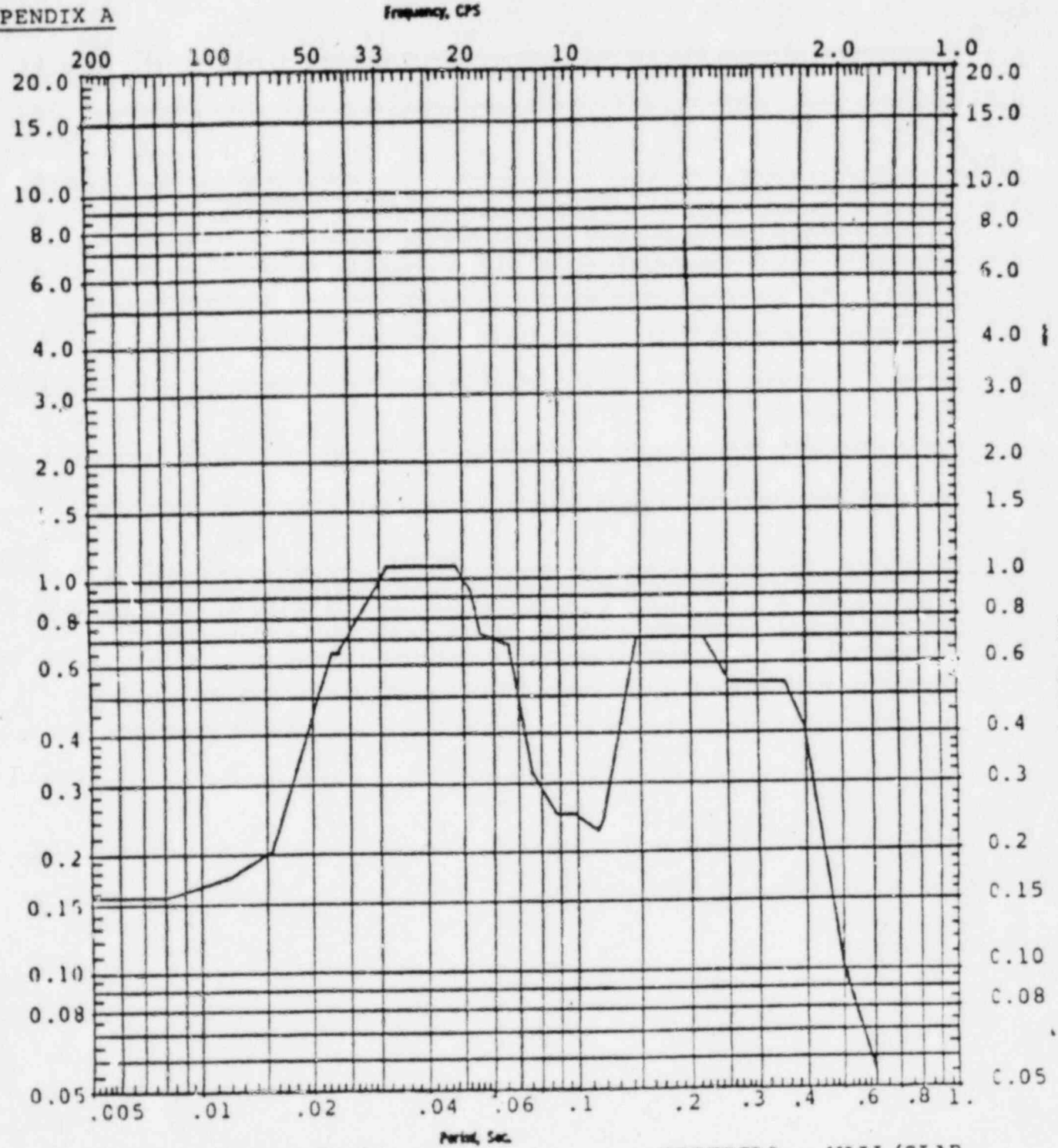


SPECTRA - 2 SRV VERTICAL

VERTICAL - WALL/SLAB
2% DAMPING

Figure III.2

SARGENT & LUNDY ENGINEERS

CLIENT CINCINNATI GAS & ELECTRIC COMPANY
PROJECT ZIMMER - 1 JOB NO. 4130-.9
DESIGN BY Donald E. Elsea DATE 6-29-82
CHECKED BY Nisar Ahmed DATE 6-29-8 SHEET 3 OF 8
FILE CQD-003243

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| INITIALS | | | | | | |

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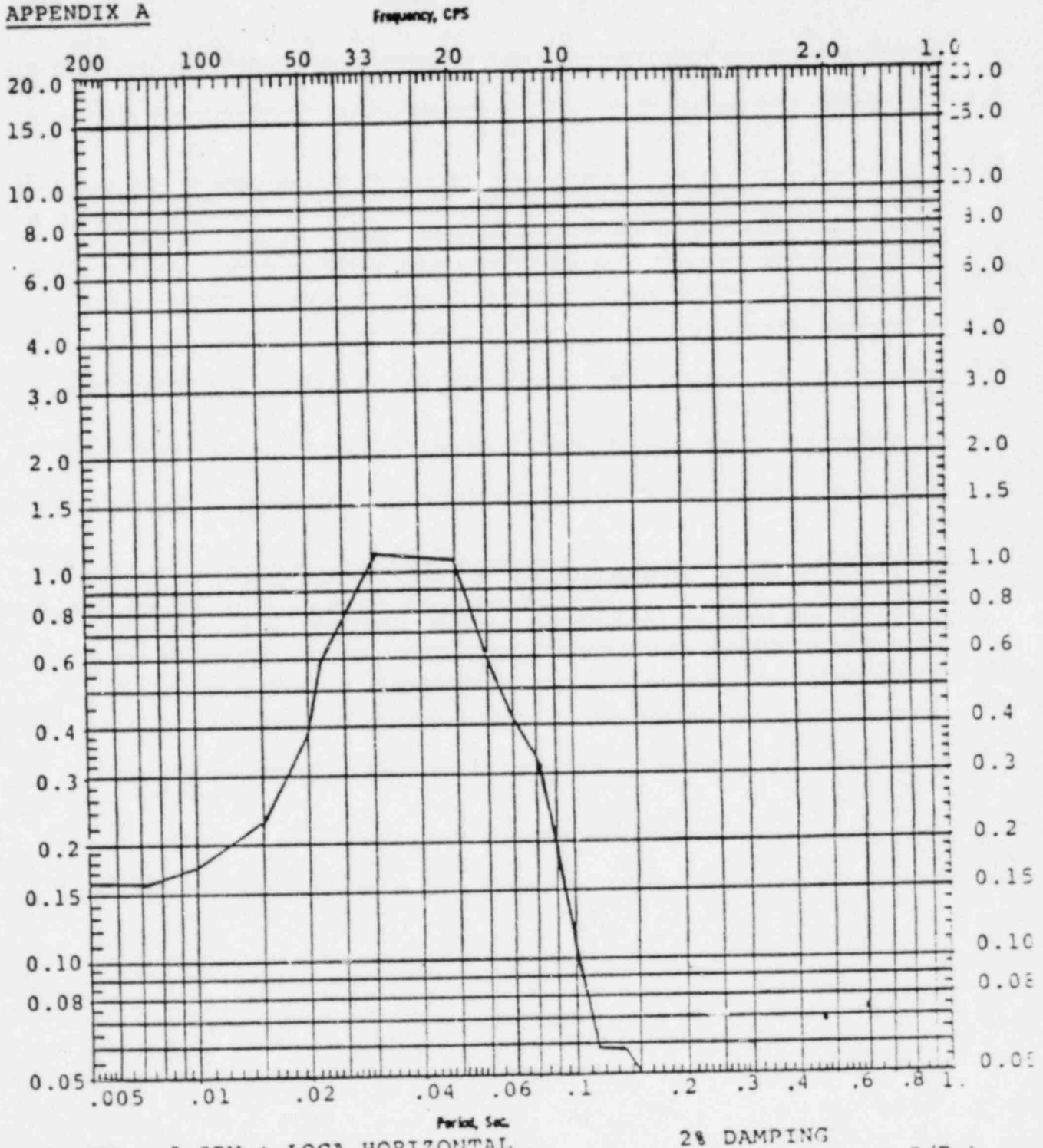


SPECTRA - 3 SRV + LOCA HORIZONTAL

2% DAMPING
HORIZONTAL - N-S/E-W

Figure III.3

SARGENT & LUNDY ENGINEERS

CLIENT CINGRP
PROJECT ZIMMER - 1 JOB NO. 4130-.5
DESIGN BY [signature] DATE 6-29-82
CHECKED BY [signature] DATE 6-29-82 SHEET 4 OF 9
FILE CQD-003243

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| DATE | | | | | | |
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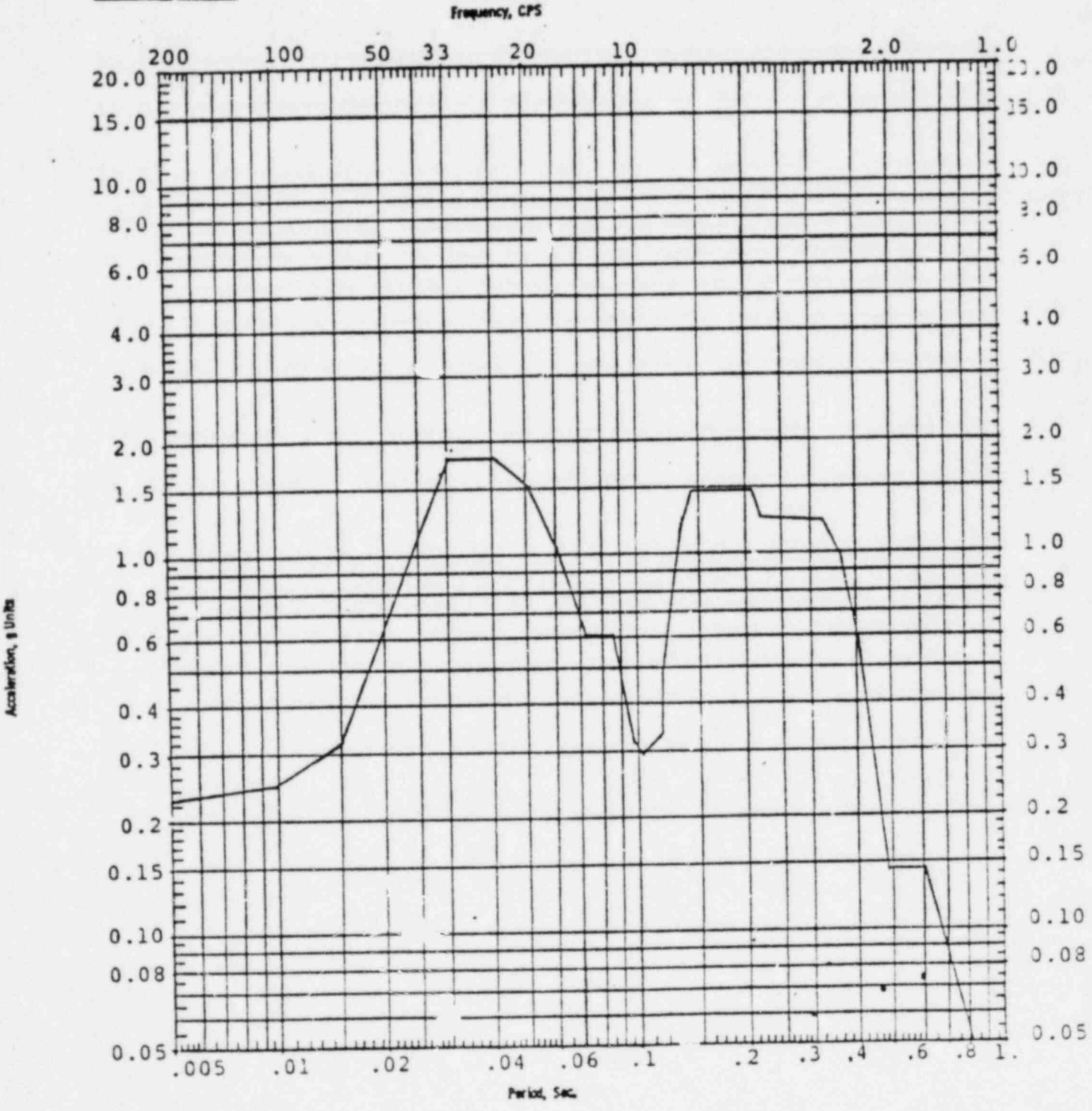


SPECTRA - 4 SRV + LOCA VERTICAL

VERTICAL - WALL/SLAB
2% DAMPING

Figure III.4

SARGENT & LUNDY ENGINEERS

CLIENT CINGRP
PROJECT ZIMMER-1 JOB NO. 4130-5
DESIGN BY Donald K Elliott DATE 6-11-82
CHECKED BY Nicholas Liu DATE 6-29-82 SHEET 5 OF 5
FILE CQD-003243

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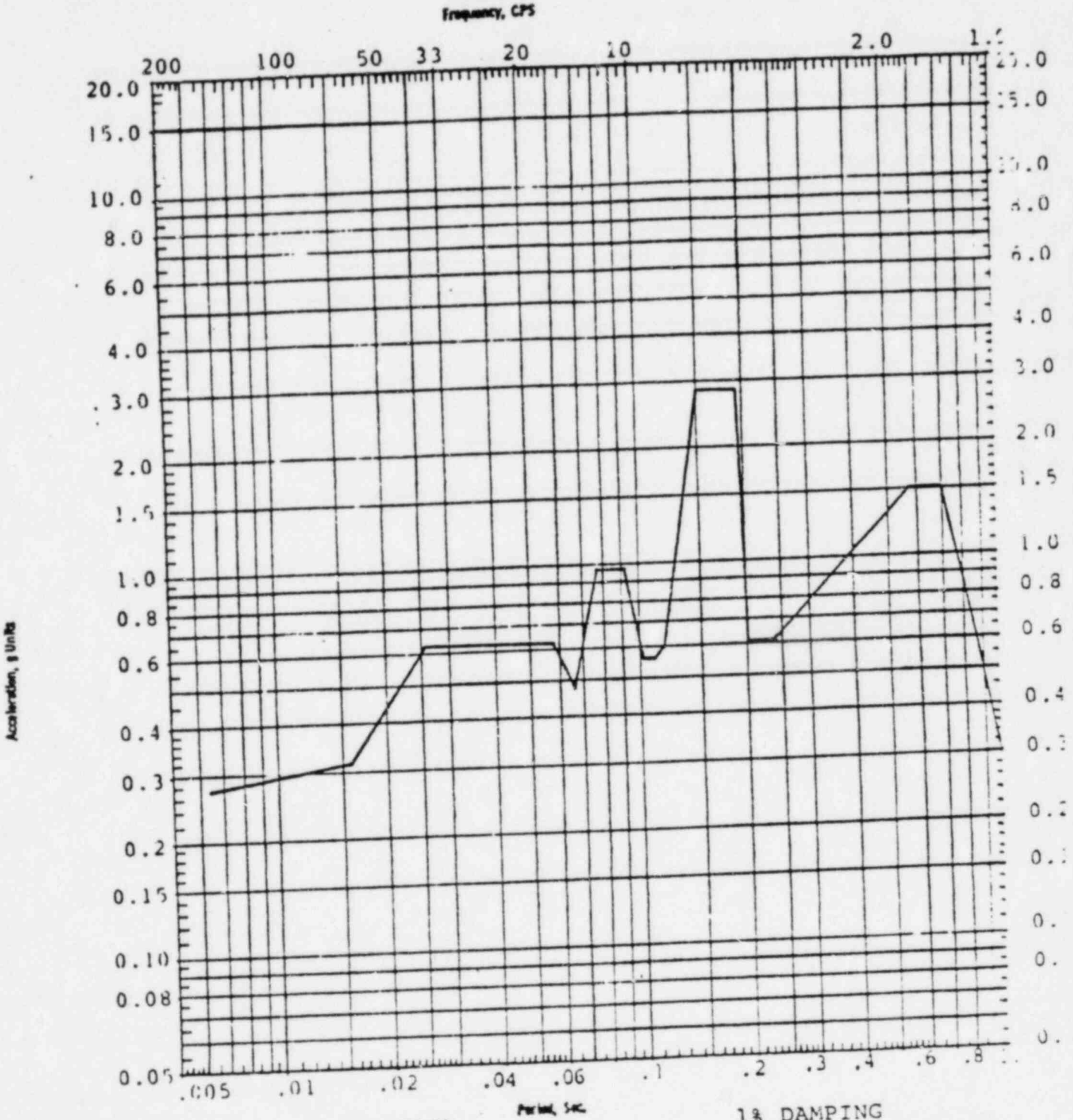


SPECTRA - 5 UPSET (OBE)
HORIZONTAL

1% DAMPING
HORIZONTAL - N-S/E-W

Figure III.5

SARGENT & LUNDY ENGINEERS

CLIENT CINGRP
PROJECT ZIMMER-1 JOB NO. 4136-5
DESIGN BY Donald K. Ghia DATE 6-11-82
CHECKED BY Nisar Ali DATE 6-29-82 SHEET 6 OF 8
FILE CQD-003243

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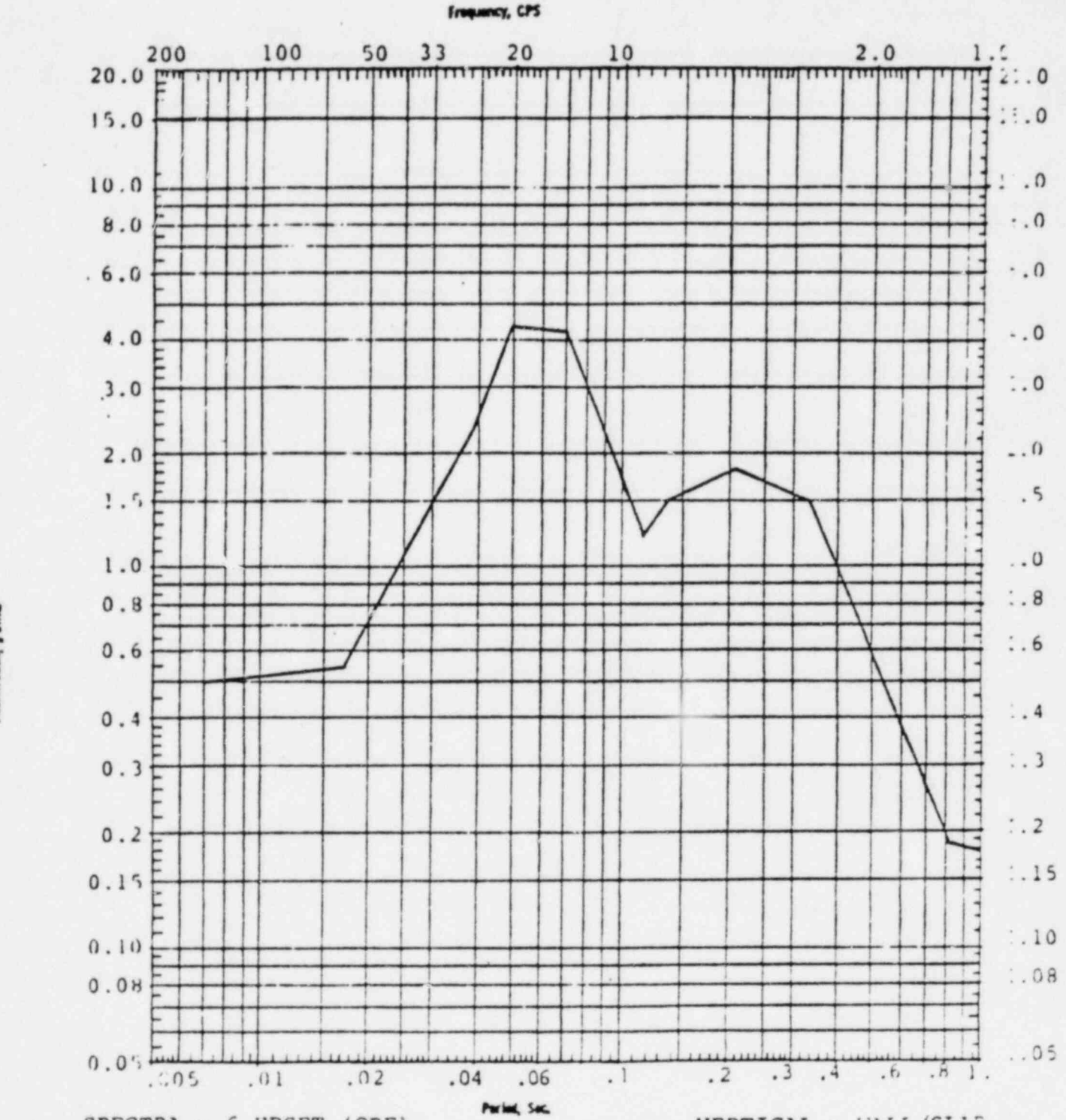


SPECTRA - 6 UPSET (OBE)
VERTICAL

VERTICAL - WALL/SLAB
1% DAMPING

Figure III.6

SARGENT & LUNDY ENGINEERS

CLIENT CINCINNATI GAS & ELECTRIC COMPANY
PROJECT ZIMMER - 1 JOB NO. 4130-15
DESIGN BY Ronald E. Ehrs DATE 6-29-82
CHECKED BY Nisar Ahmed DATE 6-29-82 SHEET 7 OF 7
FILE CQD-003243

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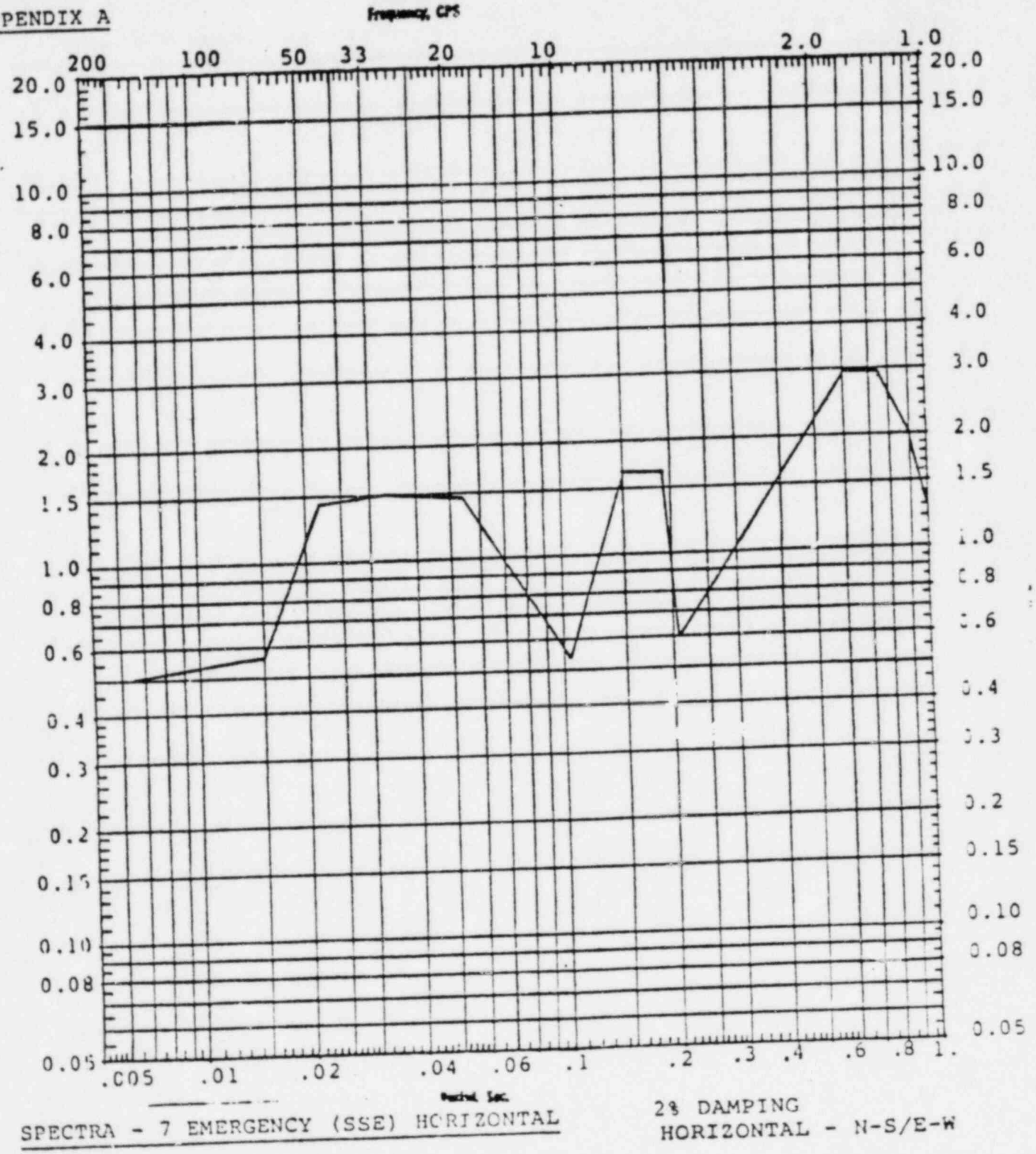


SPECTRA - 7 EMERGENCY (SSE) HORIZONTAL

2% DAMPING
HORIZONTAL - N-S/E-W

Figure III.7

SARGENT & LUNDY ENGINEERS

CLIENT CINGRP
PROJECT ZIMMER-1 JOB NO. 4130-.5
DESIGN BY Donald R Elsea DATE 6-11-92
CHECKED BY Nisar Ahmed DATE 6-29-92 SHEET 8 OF 8
FILE CQD-003243

| REV. NO. | | | | | | |
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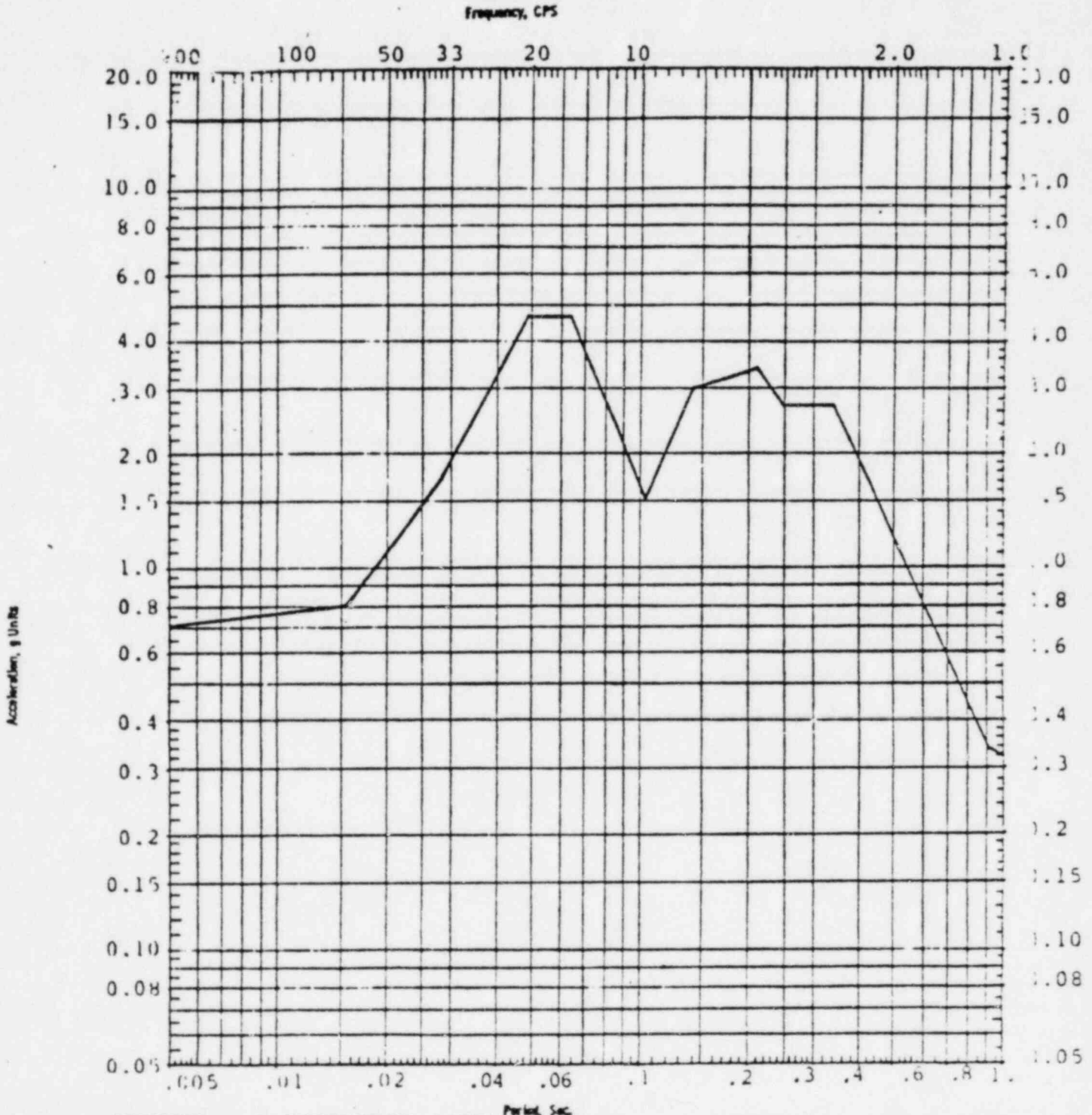
APPENDIX A




SPECTRA - 8 EMERGENCY (SSE)
VERTICAL

VERTICAL - WALL/SLAB
2% Damping

Figure III.8

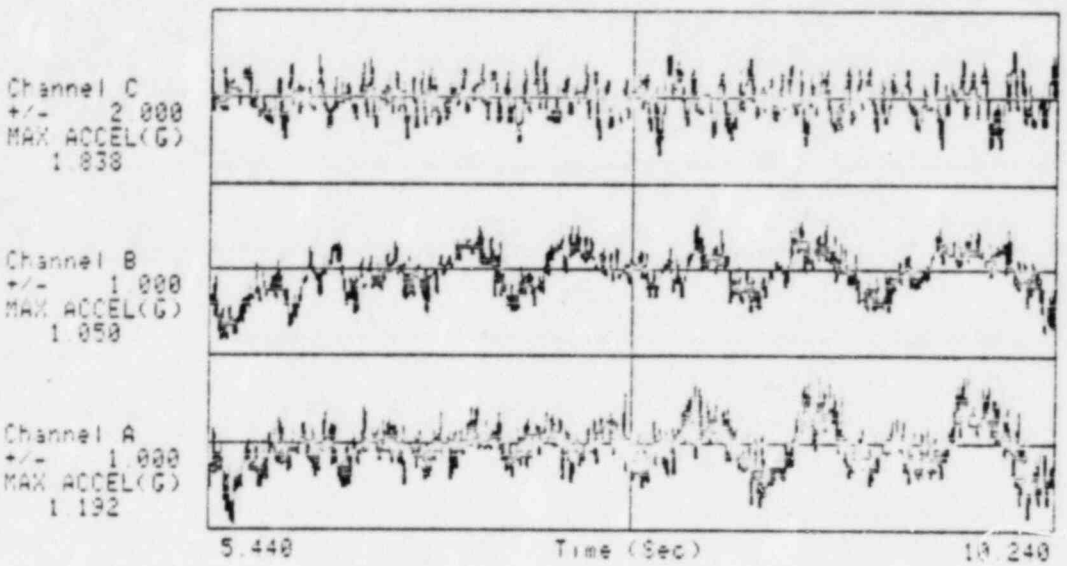



Figure III.9
Acceleration Time Histories
*Channel A – N-S
*Channel B – E-W
Channel C – Vertical

*The horizontal time histories include more low frequency random noise due to the higher level low frequency content of the horizontal RRS.

### III.3 Description and Mounting of Test Specimens

The mounting of the test specimen simulated the actual in-service mounting as closely as was practical. The specimen was mounted to the test table by welding it to a 1" thick plate which was bolted to the shake table. The welding pattern, which represents the as installed in-the-field condition, was 1 1/2 inch long, 3/16 inch leg fillet welds on 12 inch centers. Total number of welds was 12 (6 along front sill and 6 along rear sill). See Figures III.10 and III.11.

### III.4 Test Procedure

#### III.4.1 Test Sequence

Testing was performed in the following sequence:

1. Baseline Inspection
2. Operability Test
3. Resonance Search
4. SRV Aging Test
5. SRV + LOCA Aging Test
6. Baseline Inspection
7. Upset Condition Proof Test
8. First Emergency Condition Proof Test
9. Baseline Inspection
10. Second Emergency Condition Proof Test
11. Operability Test

(See VII.2 - Appendix B SDRC Log Sheet)

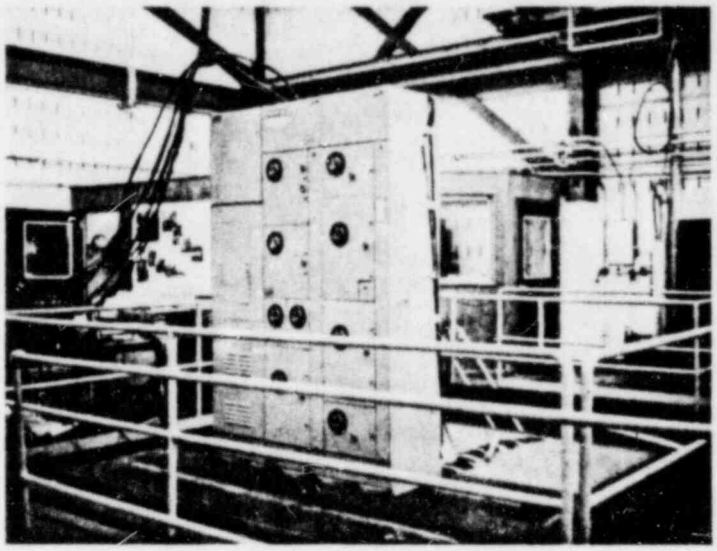



Figure III.10
Mounting of the Motor Control Center (MCC)
On the Triaxial Shake Table

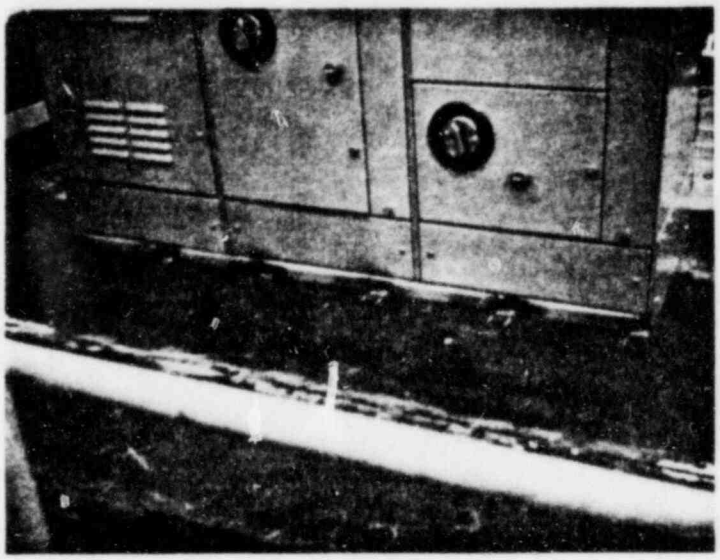


Figure III.11
Weld Pattern Used to Mount the
MCC to the Table

### III.4.2 Exploratory Test

The frequency search was conducted in each principal axis prior to the aging tests described in Section 3 below. This search was in the form of a single axis continuous frequency sweep using a sinusoidal steady state input at the lowest amplitude capable of determining resonance. This frequency search was conducted by developing transmissibility plots for point(s) on the test specimen. A transmissibility plot is defined as the ratio of motion of a point on the object divided by the input motion at the base of the item or the table on which the item is mounted. Peaks in the transmissibility plot represent the natural frequencies of the system. Phase angle of the output with respect to the input is also provided.

Transmissibility function(s) are calculated using Fourier analysis techniques on a GenRad test system. This technique ratio's the Fourier spectrum of the component response to the Fourier spectrum of the input motion.

The frequency of the input excitation was varied from 1.0 to 100 Hz.

The linear sweep rate was equivalent to two octaves per minute. The sine sweep was applied in the order of 0.2g to 0.4g.

Response accelerometers were mounted on the specimen as required to record natural frequencies up to 100 Hz.

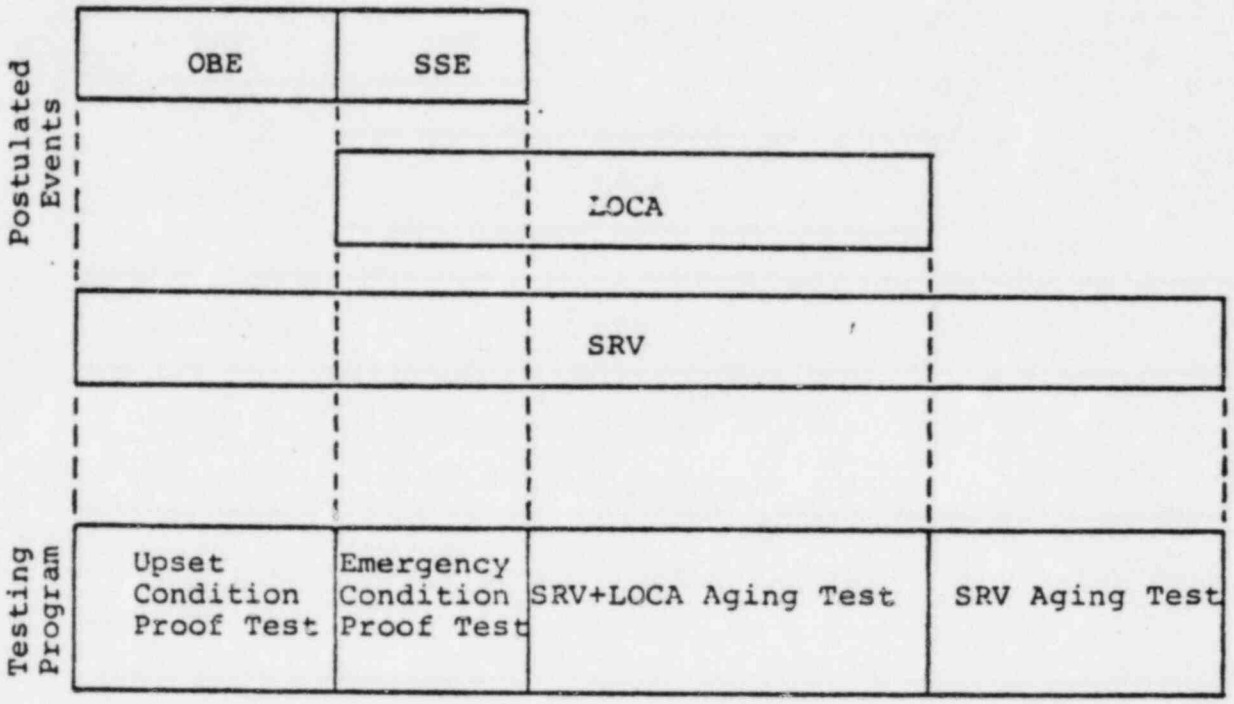
Natural frequencies were determined by the peaks and the phase angle in the transmissibility plot.

### III.4.3 Aging Tests

The purpose of the aging tests is to supplement the proof testing inassuring that the test specimens are subjected to the design life mechanical vibration resulting from all of the postulated dynamic events. The dynamic events postulated to occur are:

- Operating Basis Earthquake (OBE)
- Safe Shutdown Earthquake (SSE)
- Safety Relief Valve Acutation Events (SRV)
- Loss Of Coolent Accident (LOCA)

The following bar chart shows the sequencing of these events and how the testing program accounts for them:




*Aging Test Methodology*

a. The number of aging tests performed simultaneously in three directions prior to the full level qualification tests was one SRV aging sequence and one SRV plus LOCA aging sequence.

b. The specimen was subjected to a minimum test duration of 30 seconds for each time history in these sequences. The SRV sequence comprised a total test duration of 700 seconds. The SRV plus LOCA was a total test duration of 300 seconds.

c. The aging test consisted of simultaneous horizontal (N-S and E-W) and vertical inputs of continuous random waveform motion over the frequency range of 1.0 to 100 Hz.

d. The amplitude of each random waveform motion was independently adjusted at one-third octave frequency intervals in each axis until the TRS envelopes the RRS within the limitations of the test machine.

e. The resulting table motion was analyzed and plotted by a digital fourier analyzer using shock response software. This calculation was performed at the appropriate damping value and frequency interval:

Damping value(s): SRV – 2%
SRV plus LOCA – 2%

Octave frequency interval: 1/3

### III.4.4 Full Level Qualification Test

*Simultaneous Excitation Technique*

The seismic qualification for the subject equipment was performed by using an independent triaxial random motion simulator. Testing was performed with the test items' principal horizontal axis positioned parallel with the test table motion.

Thus, each horizontal axis was excited separately, but simultaneously with the vertical axis. The horizontal East-West, horizontal North-South, and vertical input accelerations were independent (incoherent) of each other during the multi-frequency test.

*Full Level Qualification Methodology*

a. The number of tests performed simultaneously in three directions was five Upset Condition Proof Test levels followed by two Emergency Condition Proof Tests.

b. The specimen was subjected to a minimum test duration of 30 seconds for each full level test.

c. The test consisted of simultaneous horizontal (N-S and E-W) and vertical inputs of continuous random waveform motion over the frequency range of 1.0 to 100 Hz.

d. The amplitude of each random waveform motion was independently adjusted at one-third octave frequency intervals in each axis until the TRS envelopes the RRS within the limitations of the test machine.

e. The resulting shake table motion was analyzed and plotted by a digital fourier analyzer using shock response software. This calculation was performed at the appropriate damping value and frequency interval:

Damping value(s): 4 Upset – 1%
1 Upset – 1%, 2%, 5%
1 Emergency – 2%
1 Emergency – 2%, 5%, 10%

Octave Frequency Interval: 1/3

### III.5 Monitoring Instrumentation

SDRC calibrates all test equipment and instrumentation used in this test program in accordance with SDRC Quality Assurance Manual Section 12.001. This procedure is in compliance with 10CFR50 Appendix B and ANSI/ASME N45.2–1977. Calibrations are traceable to the National Bureau of Standards.

#### III.5.1 Table Control

The three control accelerometers were mounted in the egg-crate designed shake table platform. These accelerometers are located in the approximate center of the horizontal planes and approximately 3 inches below the table top specimen interface plane.

The table control accelerometers were continuously monitored during the test using a brush recorder.

#### III.5.2 Survey Accelerometers

Transmissibility data was taken at eight accelerometer locations which were specified by CG&E. During the Aging and Full Level tests nine accelerometers were mounted at the three triaxial locations specified by CG&E. (See Section IV.1).

### III.5.3 Operability Tests

1. Operability Test (Pretest and Post-test)

The operational capability of the specimen was demonstrated and documented before and after the test sequence. A visual inspection for damage was performed. Equipment was operated under normal ambient environmental conditions to the extremes of performance and electrical characteristics specified as follows:

a. Contactors:

   1. Verify pick up at 85% of rated coil voltage.
   2. Verify that contactor does not drop out above 70% rated coil voltage.

b. Molded Case Circuit Breakers:

   1. Verify manual opening and closing .

c Distribution Transformer:

   1. Verify rated secondary voltage is present when rated voltage is applied to primary leads .
   2. Verify insulation strength by resistance measurements.

d. Auxiliary Relays:

   Same as for contactor .

e. Ground Fault Sensor/Relay:

   1. Verify operation.

2. Operability Verification (SRV)

The combination starters were initially in the de-energized state and were switched (i.e. change state) every 2 minutes. All other components were energized throughout the test.

3. Operability Verification (SRV + LOCA)

The combination starters were initially in the de-energized state and were switched every 2 minutes (i.e. change state). All other components were energized throughout the test.

4. Operability Verification (Upset)

The combination starters were initially in the de-energized state and were switched (i.e. change state) once during each test. All other components were energized throughout all tests.

5. Operability Verification (SSE 1)

The combination starters were initially in the de-energized state and were cycled (change state from de-energized to energized and back to de-energized) at least once during the test. All other components were energized throughout the test.

Operability Verification (SSE 2)

All components were de-energized to detect chatter in open contacts.

### III.5.4 Load Currents

The three load currents were as follows:

a. Load Current I – 30 Amps (No. 10 wire)

1. Enter point L2 cubicle 1B
2. Exit point T2 cubicle 3D

b. Load Current II – 30 Amps (No. 10 wire)

1. Enter point L2 cubicle 2A
2. Exit point T2 cubicle 2A

c. Load Current III – 100 Amps (No. 2 wire)

1. Enter point L2 cubicle 2D
2. Exit point T2 cubicle 3C

### III.5.5 Electrical Monitoring

Three (3) contacts were monitored on the MCC using a brush recorder and a D.C. power supply. This method was used for change of state verification for the Operability tests. Twenty-eight (28) channels of contact chatter monitor were used also during the seismic tests. Four (4) channels of the contact chatter were on the SDRC chatter monitor set to trip at 2 milliseconds. The remainder of the chatter monitoring was accomplished using a 10 V.D.C. power supply, 2 KΩ load resistors (to suppress unwanted noise) and two Honeywell 1858 Visicorders. (See Tables III.1 and III.2 for channel hook-up information).

Table III.1

| Brush | Chatter Monitor | Visicorder 1 | Visicorder 2 | Connected To | |
|---|---|---|---|---|---|
| | | | | TB 1 | TB 2 |
| CH 1 | | | | 18, 19 | |
| CH 2 | | | | | 32, 33 |
| CH 3 | | | | | 34, 35 |
| | CH 1 | | | 3, 4 | |
| | CH 2 | | | 20, 21 | |
| | CH 3 | | | 22, 24 | |
| | CH 4 | | | 23, 24 | |
| | | CH 1 | | 5, 27 | |
| | | CH 2 | | 6, 27 | |
| | | CH 3 | | 7, 27 | |
| | | CH 4 | | 8, 9 | |
| | | CH 5 | | 10, 11 | |
| | | CH 6 | | 14, 15 | |
| | | CH 7 | | 16, 17 | |
| | | CH 8 | | 25, 28 | |
| | | CH 9 | | 26, 28 | |
| | | CH 10 | | | 3, 9 |
| | | CH 11 | | | 4, 9 |
| | | CH 12 | | | 5, 6 |
| | | | CH 1 | | 7, 8 |
| | | | CH 2 | | 10, 11 |
| | | | CH 3 | | 12, 13 |
| | | | CH 4 | | 14, 15 |
| | | | CH 5 | | 16, 17 |
| | | | CH 6 | | 18, 36 |
| | | | CH 7 | | 19, 36 |
| | | | CH 8 | | 20, 21 |
| | | | CH 9 | | 22, 23 |
| | | | CH 10 | | 24, 25 |
| | | | CH 11 | | 28, 29 |
| | | | CH 12 | | 30, 31 |

TB1.

| POINT | DESCRIPTION (MCC POSITION) |
|---|---|
| 1 | 480VAC 1Ø Hot (Vertical 2) |
| 2 | 480VAC 1Ø Neutral (Vert. 2) |
| 3 | Breaker Monitor (1B) |
| 4 | Breaker Monitor (1B) |
| 5 | Breaker Monitor (2A) |
| 6 | Contactor Monitor (2A) |
| 7 | Contactor Monitor (2A) |
| 8 | NO Contact Monitor (2A) |
| 9 | NO Contact Monitor (2A) |
| 10 | NC Contact Monitor (2A) |
| 11 | NC Contact Monitor (2A) |
| 12 | 120VAC 1Ø Hot (2A) |
| 13 | 120VAC 1Ø Neutral (2A) |
| 14 | NO Contact Monitor (2A) |
| 15 | NO Contact Monitor (2A) |
| 16 | NC Contact Monitor (2A) |
| 17 | NC Contact Monitor (2A) |
| 18 | Starter Monitor (2B) |
| 19 | Starter Monitor (2B) |
| 20 | Breaker Monitor (2CL) |
| 21 | Breaker Monitor (2CL) |
| 22 | NO Contact Monitor (2CL) |
| 23 | NC Contact Monitor (2CL) |
| 24 | Common for 22 & 23 (2CL) |
| 25 | Breaker Monitor (2D) |
| 26 | Contactor Monitor (2D) |
| 27 | Common for 5,6, & 7 (2A) |
| 28 | Common for 25 & 26 (2D) |

TB2

| POINT | DESCRIPTION (MCC POSITION) |
|---|---|
| 1 | 480VAC 1Ø Hot (Vertical 3) |
| 2 | 480VAC 1Ø Neutral (Vert. 3) |
| 3 | Breaker Monitor (3A) |
| 4 | Contactor Monitor (3A) |
| 5 | NO Contact Monitor (3A) |
| 6 | NO Contact Monitor (3A) |
| 7 | NC Contact Monitor (3A) |
| 8 | NC Contact Monitor (3A) |
| 9 | Common for 3&4 (3A) |
| 10 | NC Contact Monitor (3A) |
| 11 | NC Contact Monitor (3A) |
| 12 | NO Contact Monitor (3A) |
| 13 | NO Contact Monitor (3A) |
| 14 | NO Contact Monitor (3A) |
| 15 | NO Contact Monitor (3A) |
| 16 | NC Contact Monitor (3A) |
| 17 | NC Contact Monitor (3A) |
| 18 | Breaker Monitor (3B) |
| 19 | Contactor Monitor (3B) |
| 20 | NO Contact Monitor (3B) |
| 21 | NO Contact Monitor (3B) |
| 22 | NO Contact Monitor (3B) |
| 23 | NO Contact Monitor (3B) |
| 24 | NC Contact Monitor (3B) |
| 25 | NC Contact Monitor (3B) |
| 26 | Ground Relay Trigger (3B |
| 27 | Ground Relay Trigger (3B) |
| 28 | NC Grd. Relay Monitor (3B) |
| 29 | NC Grd. Relay Monitor (3B) |
| 30 | NC Contact Monitor (3B) |
| 31 | NC Contact Monitor (3B) |
| 32 | Starter Monitor (3C) |
| 33 | Starter Monitor (3C) |
| 34 | Starter Monitor (3D) |
| 35 | Starter Monitor (3D) |
| 36 | Common for 18 & 19 (3B) |

## III.6 Criteria for Test Acceptance

The criteria for seismic acceptance or failure of devices will include the following characteristics as applicable during and after testing.

*Acceptance Criteria*

a. The maximum allowable chatter duration is 2 msec.

b. The structural integrity of the test specimen must be demonstrated both during and after testing.

c. The ability of the test specimen to provide essential power on command must be demonstrated both during and after testing.

d. A test failure shall be defined as the inability of the test specimen to provide essential power on command or as loss of essential power once energized.

e. A test anomaly shall be defined as:

   1. Contact chatter in excess of 2 msec.
   2. Any other abnormal event not affecting the specimen's safety-related function described above.

# IV. DATA PRESENTATION

## IV.1 Transmissibility

This section reports the results of the low level swept sine tests. Horizontal and vertical sweeps were run at .2g peak acceleration table input for the three orientations. The linear sweep rate was equivalent to 2 octaves/minute. Transmissibility plots are generated by comparing the output of an accelerometer mounted on a test item to the output of the table reference accelerometer of the same direction.

Table IV.1 lists transmissibility accelerometer locations, plot locations and resonant frequencies for the ITE Series 5600 motor control center. Survey accelerometer locations for the full level testing are listed Section IV.3.

SDRC documents significant resonances. Significant resonances are defined as those which have an amplification factor of 2 when the table motion is used as the reference.

Table IV.1

| Accelerometer Location | Accelerometer Number ① | Direction | Photo Fig. No. ② | Plot Fig. No. | Location Description | Summary of Major Resonances (Hz) ① |
|---|---|---|---|---|---|---|
| 1 | 1 | X (N-S) | IV.1 | V.1 | Breaker mounting | 7.3, 43.2, 58.2, 93.3 |
| 1 | | Y (E-W) | | V.2 | location | 8.5, 78.5, 91.2 |
| 1 | | Z (Vert) | | V.3 | Cubicle 1B | 32.1, 36.7, 47.4, 62.6, 83.9 |
| 2 | 2 | X (N-S) | IV.2 | V.4 | Equipment mounting | 7.4, 55.6, 60.3, 94.4 |
| 2 | | Y (E-W) | | V.5 | panel | 8.5 |
| 2 | | Z (Vert) | | V.6 | Inside Cubicle 2B | 35.1, 47.3 |
| 3 | 3 | X (N-S) | IV.3 | V.7 | Equipment mounting | 7.3, 68.4 |
| 3 | | Y (E-W) | | V.8 | panel | 8.5 |
| 3 | | Z (Vert) | | V.9 | Inside Cubicle 3B | 34.7, 47.3, 67.6 |
| 4 | 4 | X (N-S) | IV.4 | V.10 | Top of cabinet | 7.4, 12.7, 61.0 |
| 4 | | Y (E-W) | | V.11 | section 1 | 8.5, 35.9 |
| 4 | | Z (Vert) | | V.12 | (towards outside edge) | 31.6, 36.7, 47.3, 56.9, 84.1 |
| 5 | 5 | X (N-S) | IV.5 | V.13 | Top of cabinet | 7.2, 7.7 |
| 5 | | Y (E-W) | | V.14 | near section 2 to | 8.5, 31.3, 35.5, 44.2, 81.3 |
| 5 | | Z (Vert) | | V.15 | 3 junction | 35.1, 46.8, 84.1 |
| 6 | 6 | X (N-S) | IV.6 | V.16 | Top of cabinet | 7.4, 60.3, 94.4 |
| 6 | | Y (E-W) | | V.17 | section 3 | 8.4, 30.9, 35.5, 44.7, 79.4 |
| 6 | | Z (Vert) | | V.18 | (towards outside edge) | 34.7, 47.3, 84.1 |
| 7 | 7 | X (N-S) | IV.7 | V.19 | Right side of | 7.3 |
| 7 | | Y (E-W) | | V.20 | section 3 | 8.4 |
| 7 | | Z (Vert) | | V.21 | (halfway up) | 35.1, 47.9, 86 |
| 8 | 8 | X (N-S) | IV.8 | V.22 | Front right | 7.3 |
| 8 | | Y (E-W) | | V.23 | outside | 8.5, 35.1 |
| 8 | | Z (Vert) | | V.24 | Cubicle 1B | 47.9, 61.0, 85.1 |

① These frequencies are cursored approximations at the equipment's resonant frequencies.

② The accelerometer at each location was rotated for each transmissibility test to collect data in the corresponding direction.

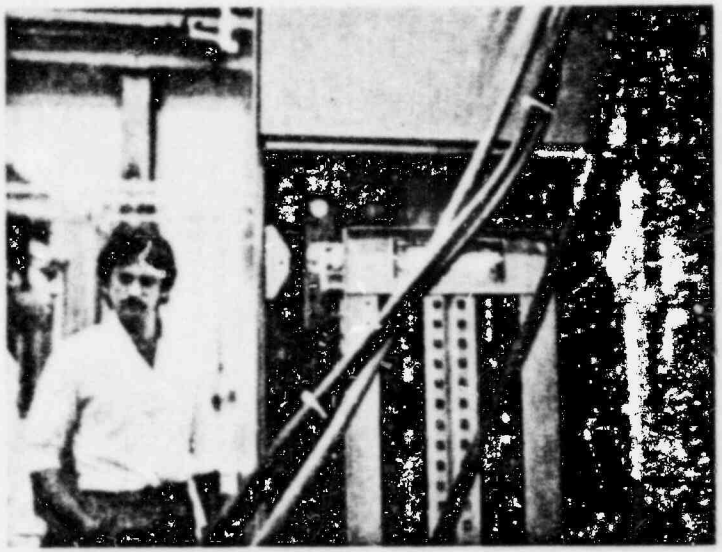


Figure IV.1
Accelerometer Location No. 1

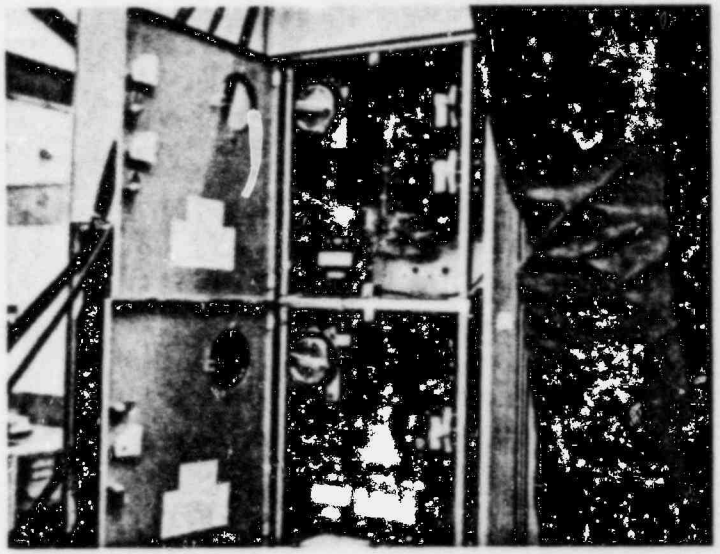


Figure IV.2
Accelerometer Location No. 2

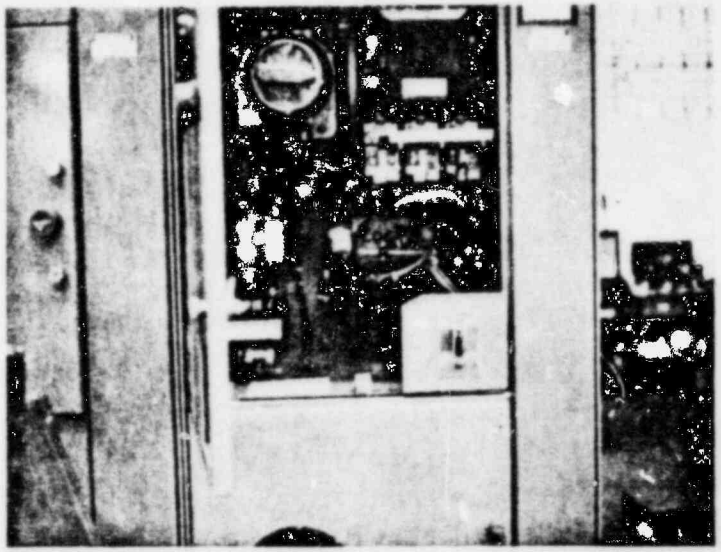


Figure IV.3
Accelerometer Location No. 3

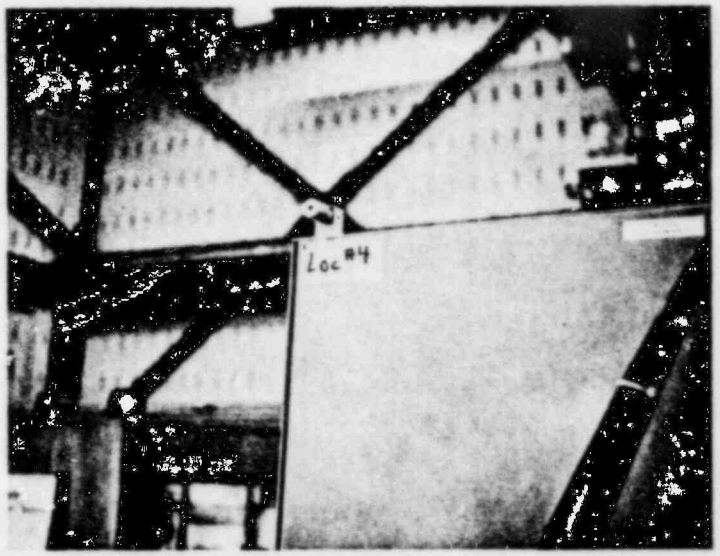



Figure IV.4
Accelerometer Location No. 4

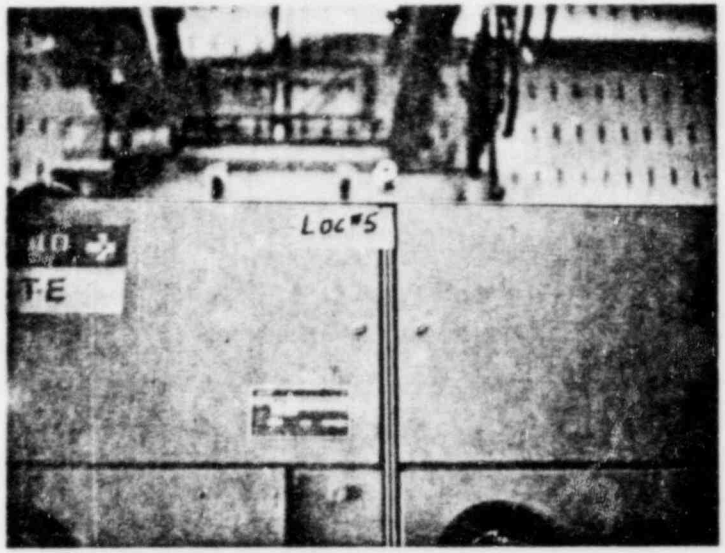



Figure IV.5
Accelerometer Location No. 5

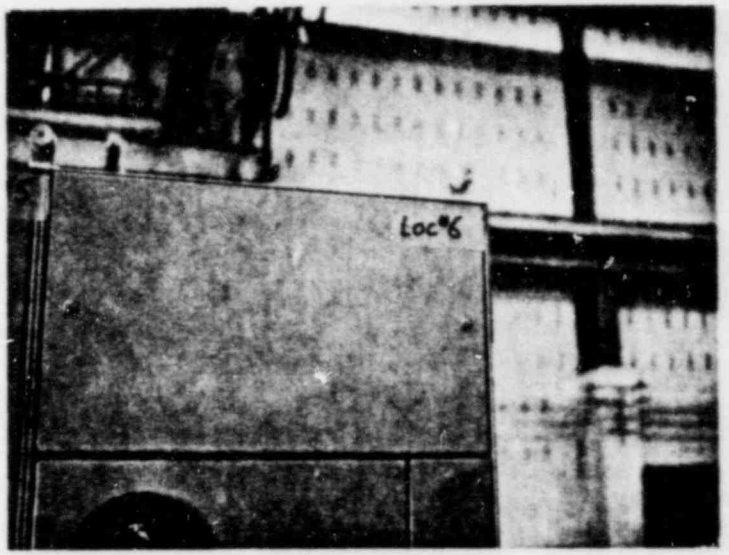



Figure IV.6
Accelerometer Location No. 6

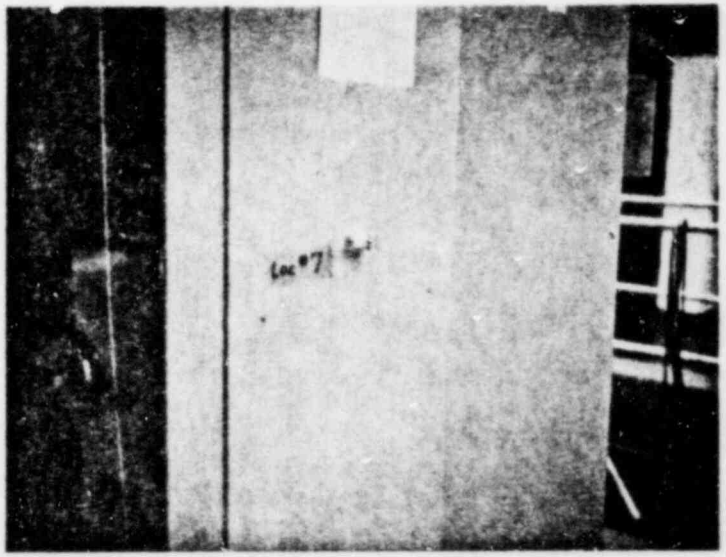


Figure IV.7
Accelerometer Location No. 7

Figure IV.8
Accelerometer Location No. 8

## IV.2 Test Response Spectra (TRS)

The test response spectra for the various OBE levels and SSE levels are presented in Section VI.1.

Test No. 4 TRS enveloped the SRV RRS in all three axes. Test No. 5 TRS enveloped the SRV plus LOCA RRS in all three axes. Test No. 6 (1st Upset) TRS did not envelope in the Y axis. Tests Nos. 7 through 11 (5 Upsets) TRS enveloped the Upset RRS for all three axes. Test No. 12 data (1st Emergency) overloaded and could not be analyzed (see Record of Anomaly page no. 3). Test No. 13 (2nd Emergency) did not envelope in the Y axis. Test No. 14 (3rd Emergency) enveloped the RRS but was not an accepted test because of a malfunction in the SDRC relay monitoring system (see Record of Anomaly page no. 4). Test No. 15 (4th Emergency) and Test No. 16 (5th Emergency) TRS enveloped the Emergency RRS in all three axes.

A representative TRS plot is provided in Figure VI.1 as a reference.

## IV.3 Survey Response Spectra

The survey accelerometers were placed on the motor control center at locations determined by CG&E for the full level testing. Table IV.2 listed the survey accelerometer locations, orientations and photo figures for the full level testing. The survey TRS are presented in Section VI.2.

Table IV.2

| Accelerometer | | Direction | Photo Fig. No. | Location Description |
|---|---|---|---|---|
| Location | Number | | | |
| 1 | 1 X | N-S (F–B) | IV.9 | Breaker mounting |
| 1 | 2 Y | E-W (S–S) | IV.9 | location |
| 1 | 3 Z | Vertical | IV.9 | Cubicle 1B |
| 2 | 4 X | N-S (F–B) | IV.10 | Equipment mounting |
| 2 | 5 Y | E-W (S–S) | IV.10 | panel inside |
| 2 | 6 Z | Vertical | IV.10 | Cubicle 2B |
| 3 | 7 X | N-S (F–B) | IV.11 | Equipment mounting |
| 3 | 8 Y | E-W (S–S) | IV.11 | panel inside |
| 3 | 9 Z | Vertical | IV.11 | Cubicle 3B |

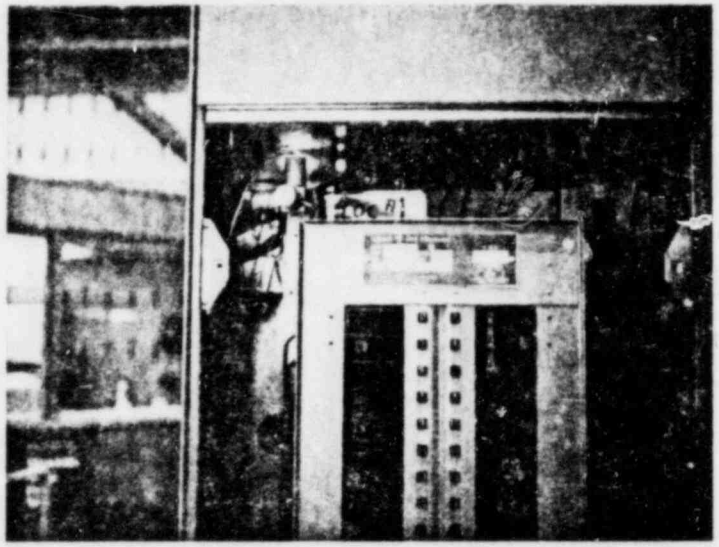


Figure IV.9
Accelerometer Location No. 1
During Full Level Testing

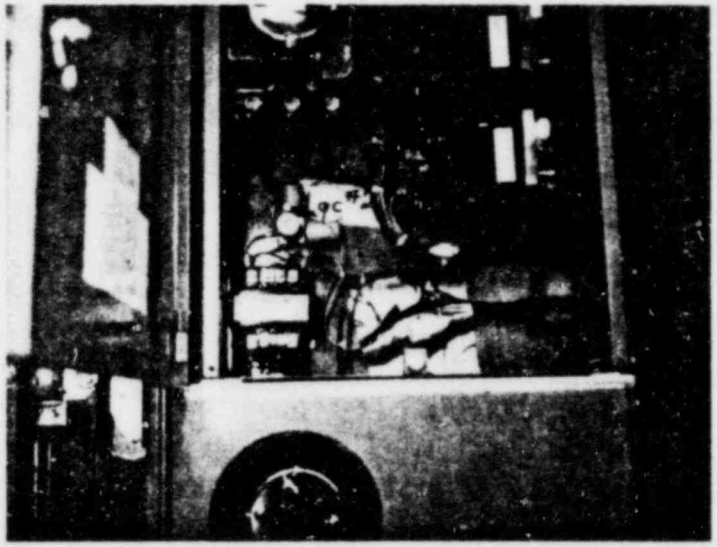


Figure IV.10
Accelerometer Location No. 2
During Full Level Testing

Figure IV.11
Accelerometer Location No. 2
During Full Level Testing

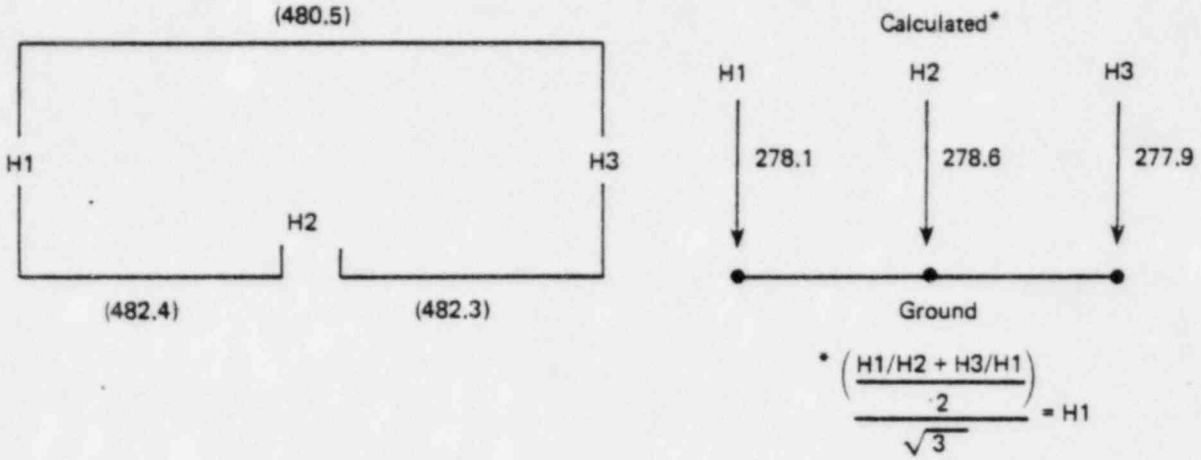
## IV.4 Functional and Operability Tests

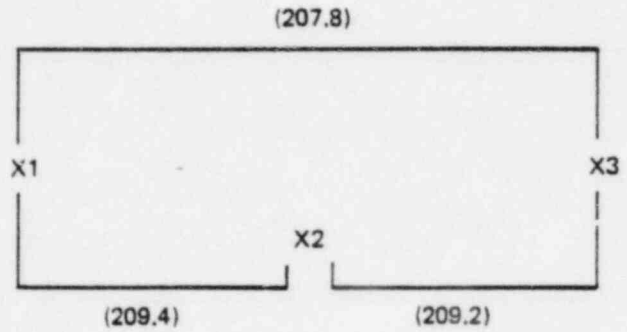
The results of the functional monitoring are presented in this section.

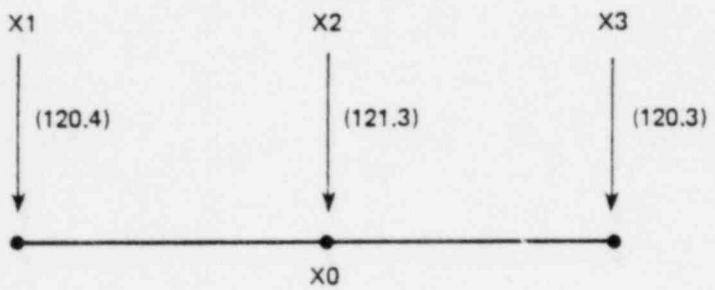
Figures IV.12 and IV.13 are the voltage values of the Distribution Transformer pre-test and post-test, respectively. The pre and post-test megger results are shown in Table IV.3.

The pre-test and post test operability checks are listed in Tables IV.4 and IV.5.

Figures IV.14, IV.15 and IV.16 are representative sections of the contact and operability monitoring recordings. (See VII.4 - Appendix D – Gould verification of normal contact settling times.)

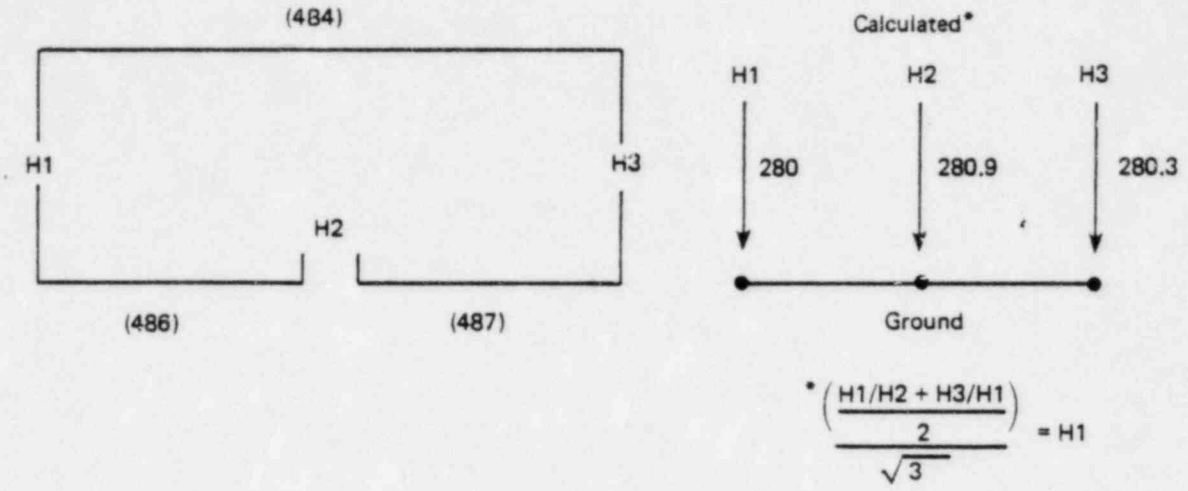


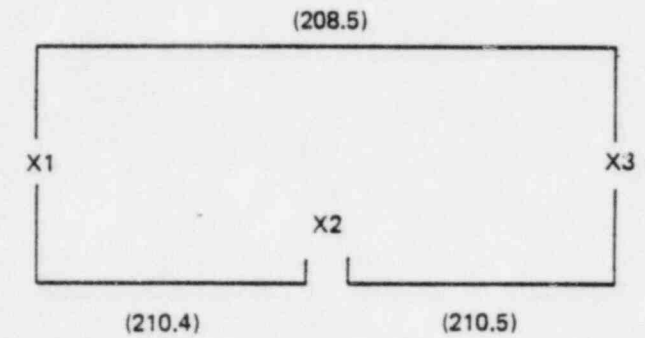



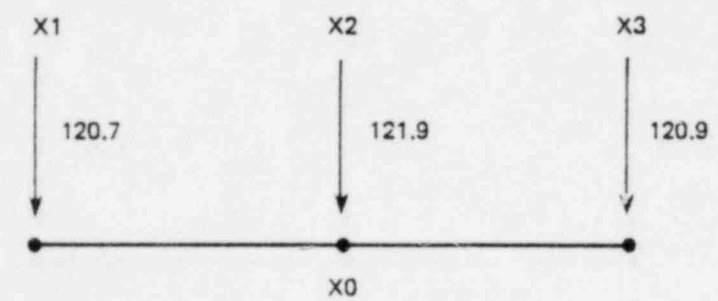




| 0 to 0 Ratios | | | 0 to Ground Ratios | | |
|---|---|---|---|---|---|
| H1–H2/X1–X2 | H2–H3/X2–X3 | H3–H1/X3–X1 | H1/X1 | H2/X2 | H3/X3 |
| 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |

Figure IV.12
Pre-Test Distribution Transformer




| 0 to 0 Ratios | | | 0 to Ground Ratios | | |
|---|---|---|---|---|---|
| H1–H2/X1–X2 | H2–H3/X2–X3 | H3–H1/X3–X1 | H1/X1 | H2/X2 | H3/X3 |
| 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 |

Figure IV.13
Post-Test Distribution Transformer

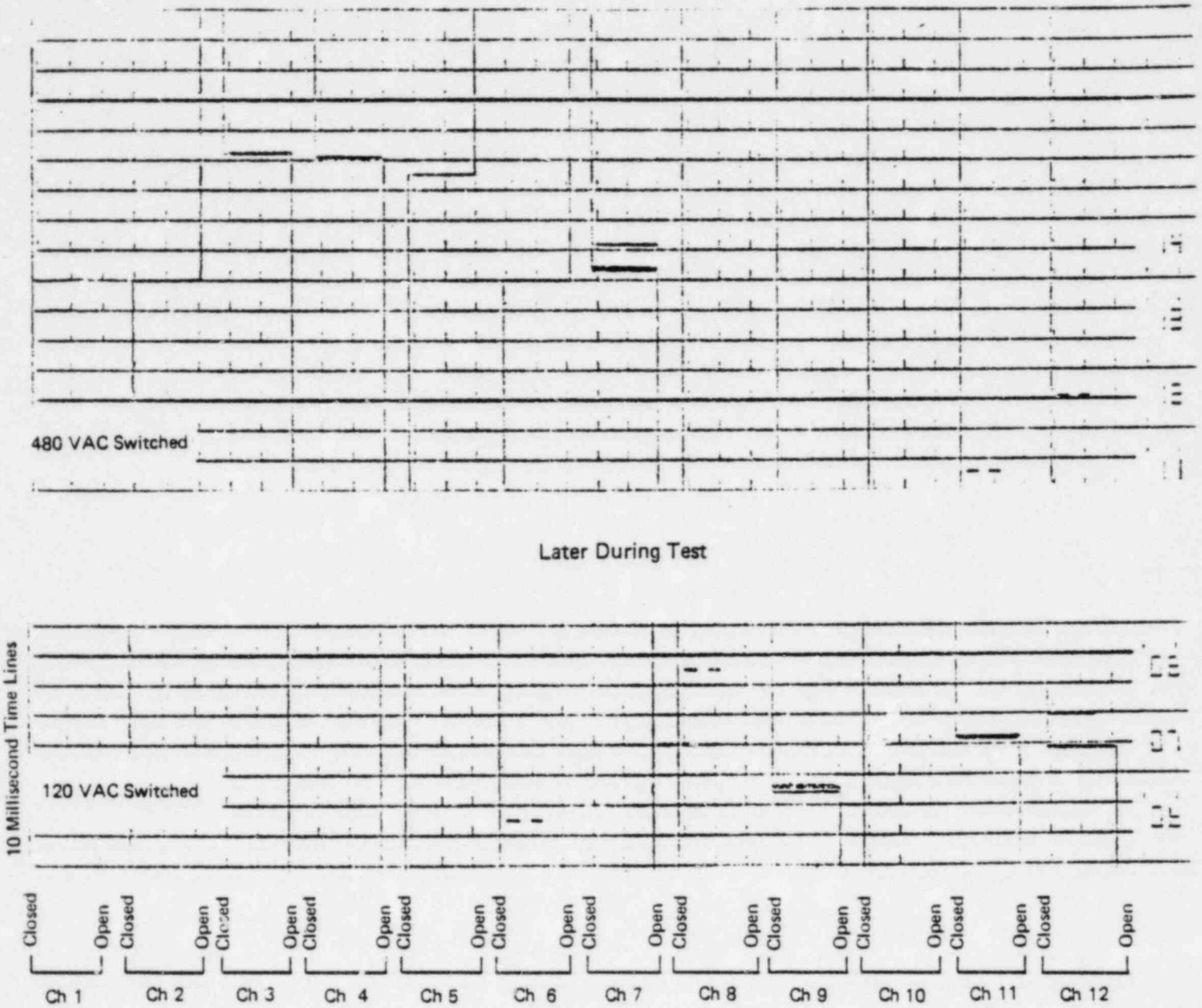



Figure IV.14
Visicorder No. 1 Representative Operation Taken from
Emergency Test (see Section III.5.5 for Channel Identification)

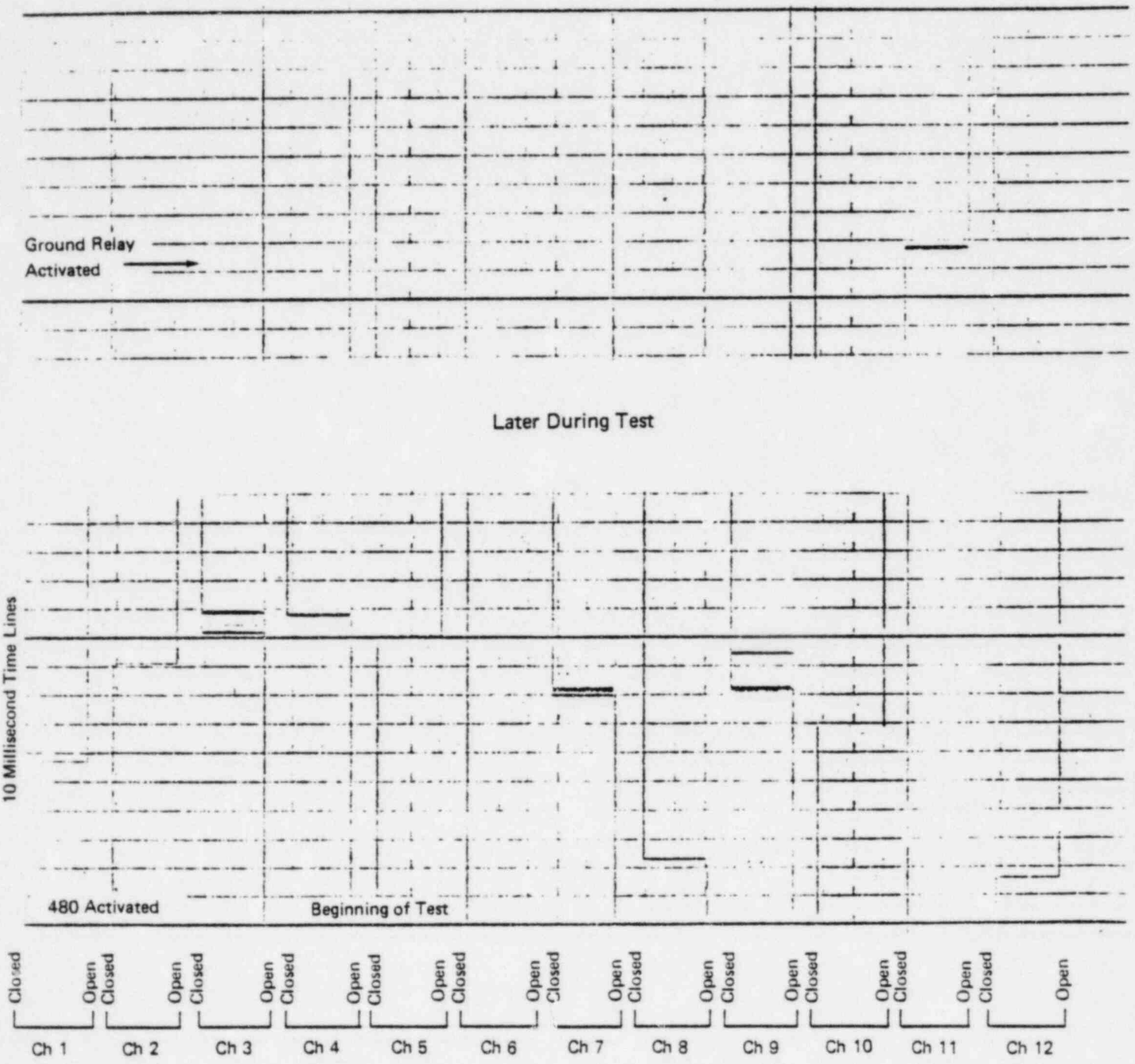



Figure IV.15
Visicorder No. 2 During Emergency Test
(see Section III.5.5 for Channel Identification)

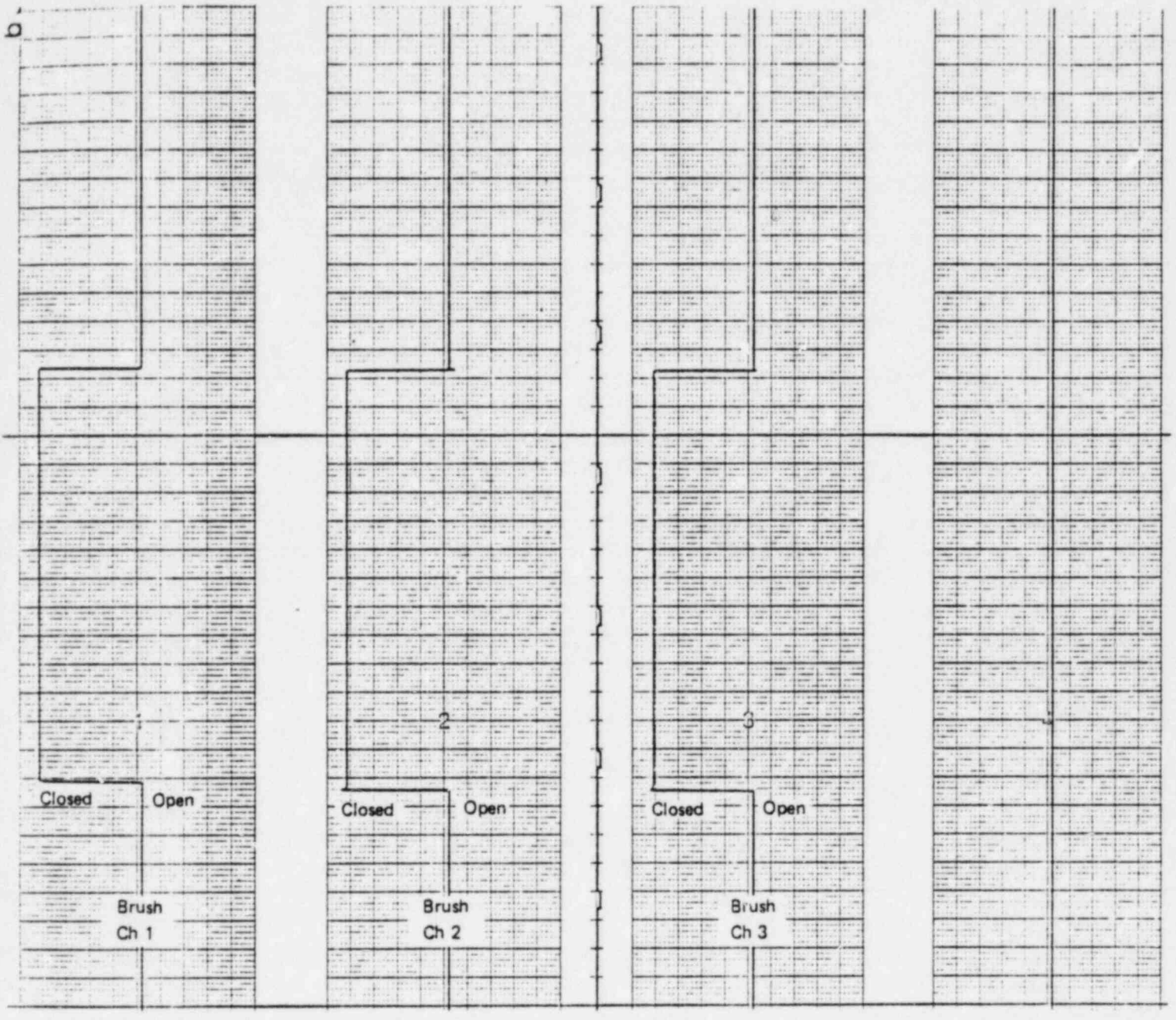



Figure IV.16
Operability As Recorded on the Brush Recorder
During the Emergency Test
(see Section III.5.5 for Channel Description)

Table IV.3
Megger Results

| Pre-Test Input | Reference* | MΩ |
|---|---|---|
| H 1 | | |
| H 2 | Ground | > 10,000 |
| H 3 | | |
| X 1 | | |
| X 2 | Ground | > 10,000 |

| Post-Test | | |
|---|---|---|
| H 1 | | |
| H 2 | Ground | > 10,000 |
| H 3 | | |
| X 1 | | |
| X 2 | Ground | > 10,000 |
| X 3 | | |

*When H was meggered, X was ground
When X was meggered, H was ground

Table IV.4

Time: 16:00
Date: 8/17/82

## Operability Test – Pretest

| | | Initials |
|---|---|---|
| **Contactors** | | |
| 1. | Verify pickup at 85% of rated voltage | aTw |
| 2. | Verify that contactor does not drop out above 70% of rated voltage | aTw |
| **Molded Case Circuit Breakers** | | |
| 1. | Verify manual open and close | aTw |
| **Distribution XFormer** | | |
| 1. | Verify rated secondary voltage is present with rated input | aTw |
| 2. | Megger | aTw |
| **Auxiliary Relays** | | |
| 1. | Verify pickup at 85% of rated voltage | aTw |
| 2. | Verify that relay does not drop out above 70% of rated voltage | aTw |
| **Ground Fault Sensor** | | |
| 1. | Verify operation | aTw |

Table IV.5

Time: 23:54
Date: 8/17/82

## Operability Test – Pretest

| | | Initials |
|---|---|---|
| **Contactors** | | |
| 1. | Verify pickup at 85% of rated voltage | qTw |
| 2. | Verify that contactor does not drop out above 70% of rated voltage | qTw |
| **Molded Case Circuit Breakers** | | |
| 1. | Verify manual open and close | qTw |
| **Distribution XFormer** | | |
| 1. | Verify rated secondary voltage is present with rated input | qTw |
| 2. | Megger | qTw |
| **Auxiliary Relays** | | |
| 1. | Verify pickup at 85% of rated voltage | qTw |
| 2. | Verify that relay does not drop out above 70% of rated voltage | qTw |
| **Ground Fault Sensor** | | |
| 1. | Verify operation | qTw |

# V. TRANSMISSIBILITY DATA

The data presented in this section is from the resonance search. See Section IV.1 for details.

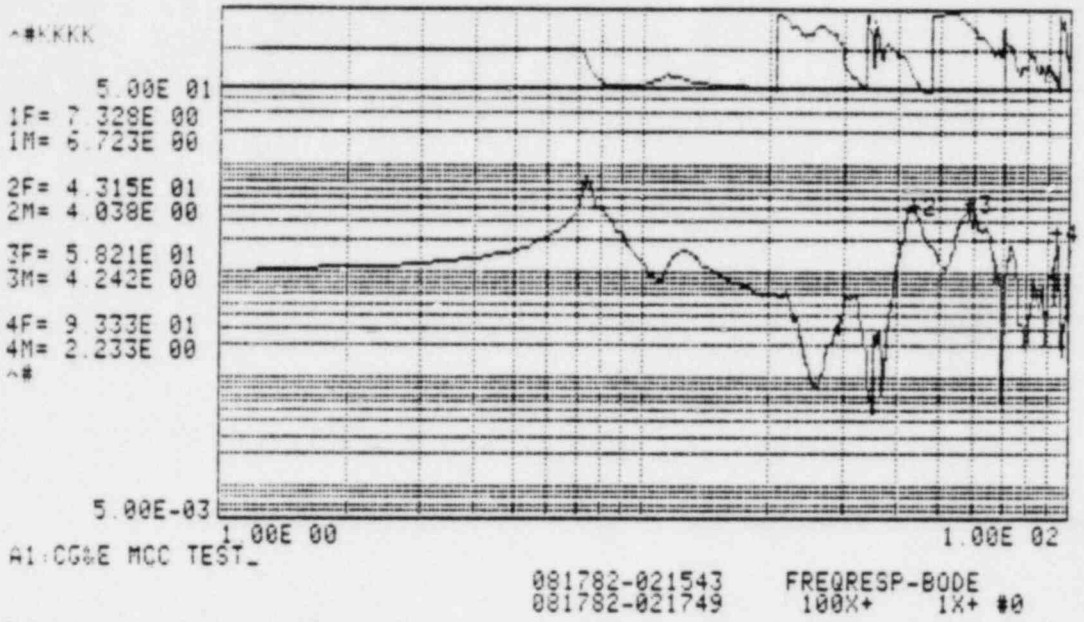



Figure V.1

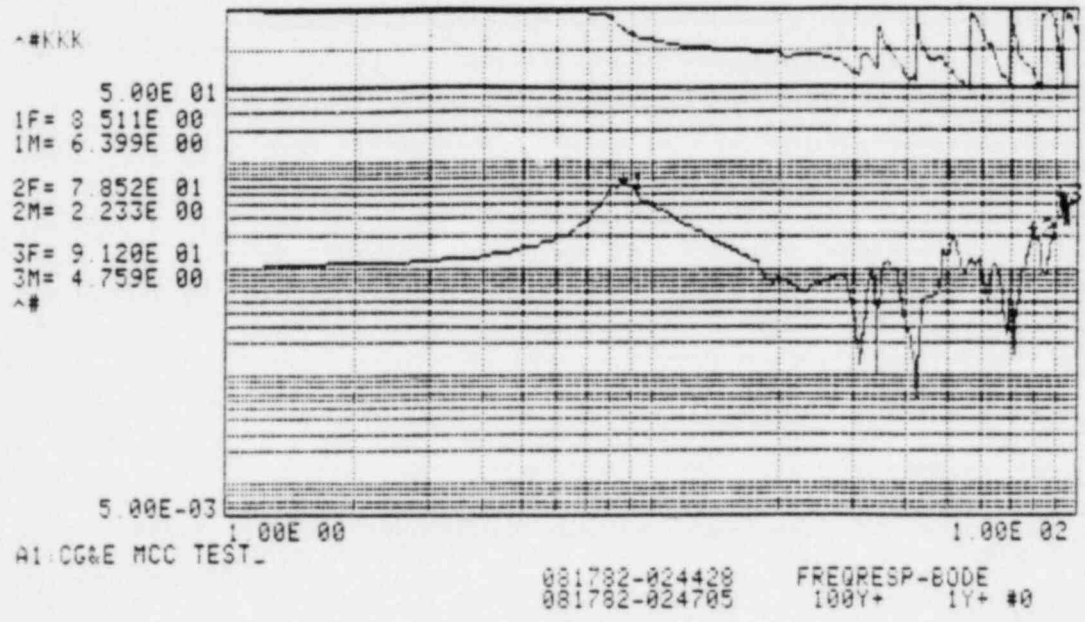



Figure V.2

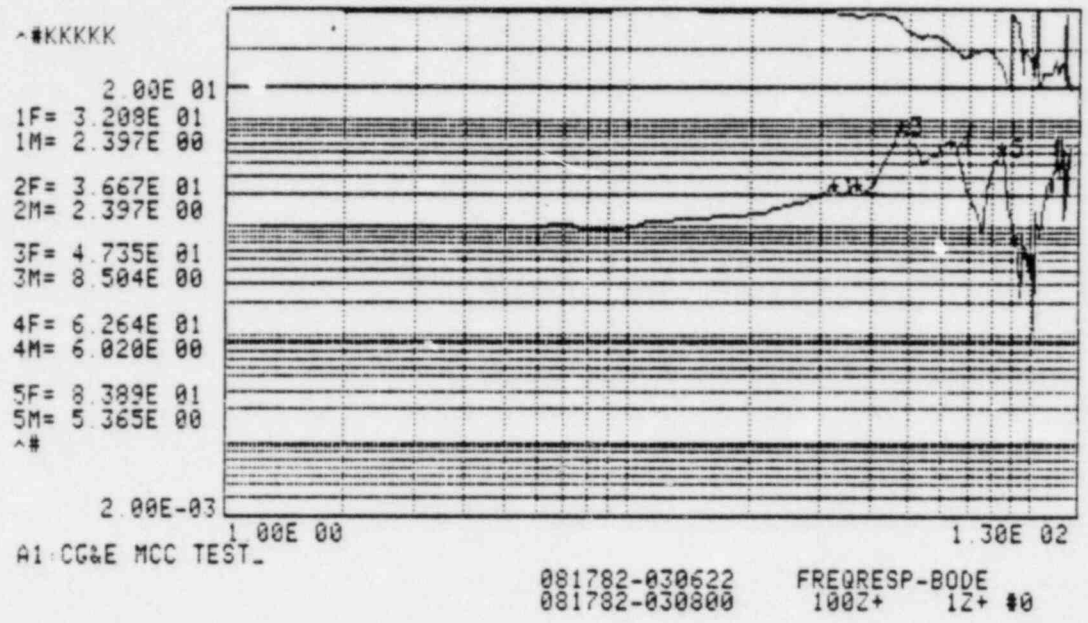



Figure V.3

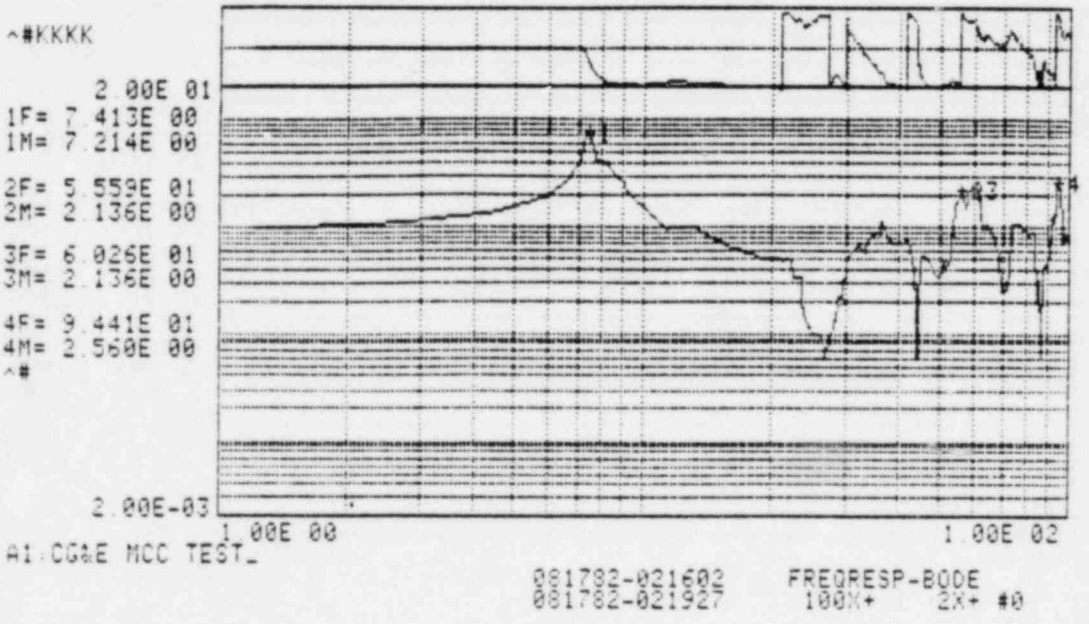



Figure V.4

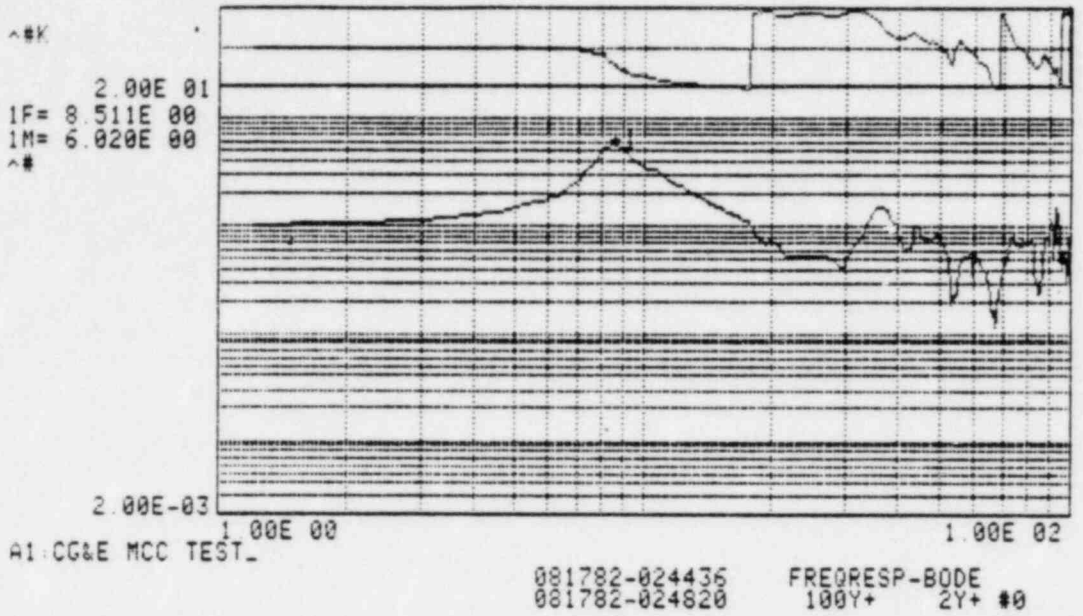



Figure V.5

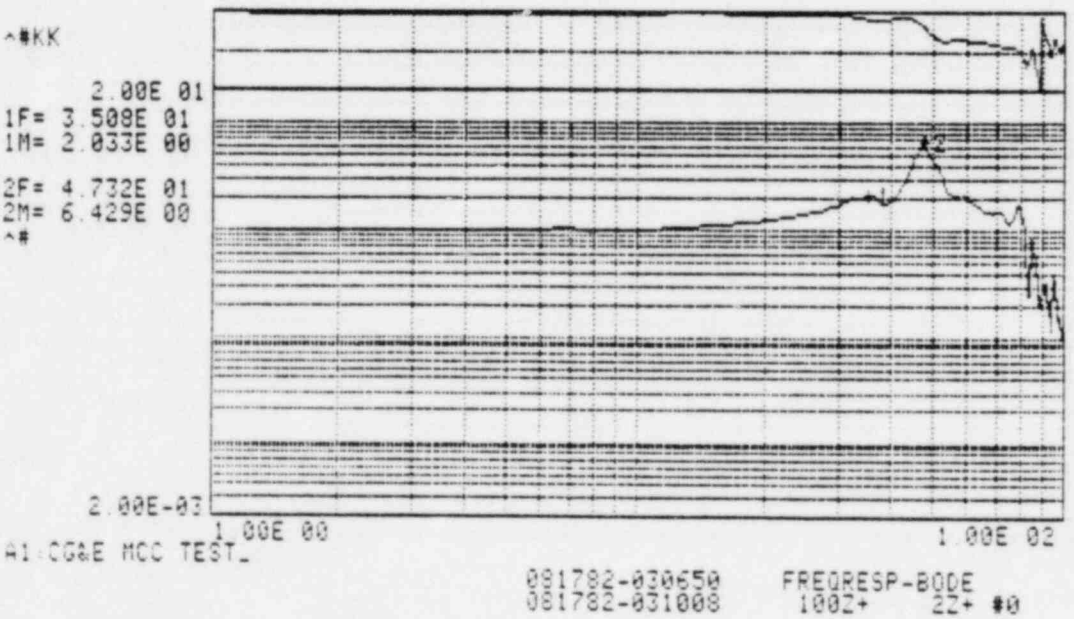



Figure V.6

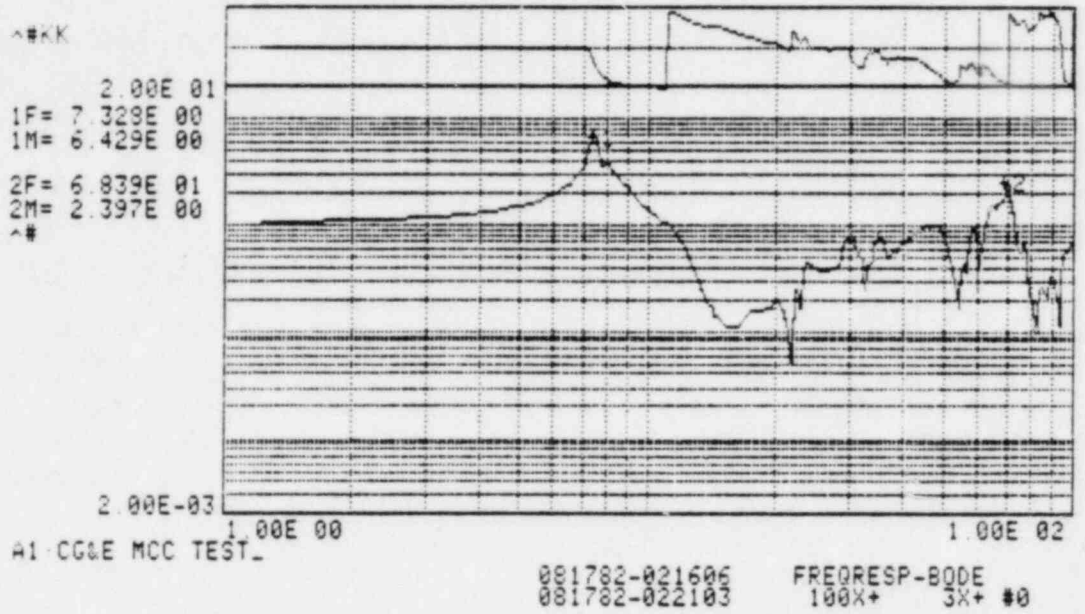



Figure V.7

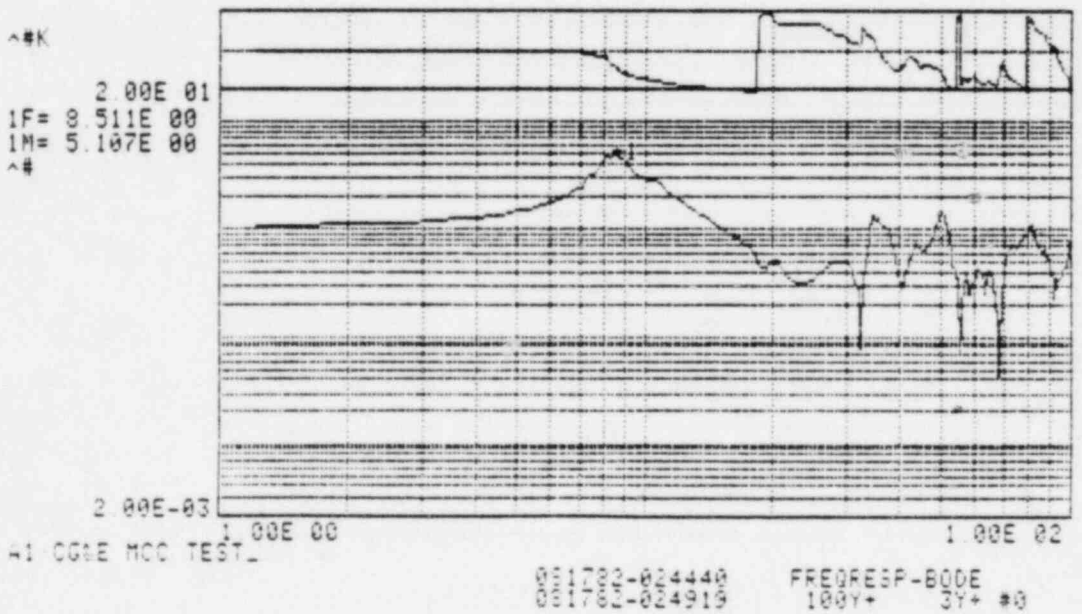



Figure V.8

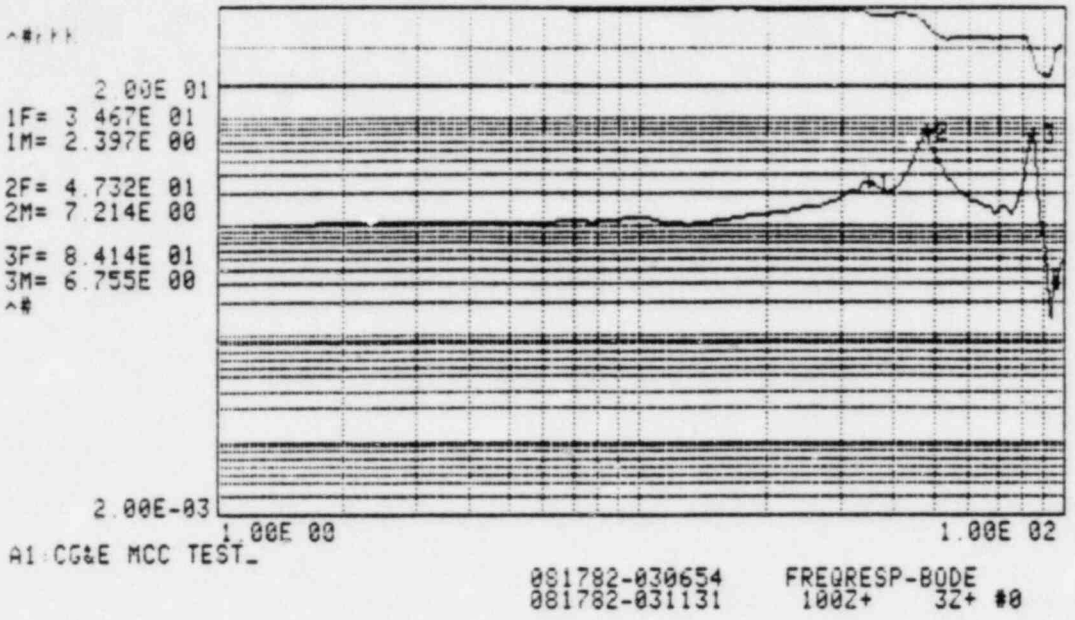



Figure V.9

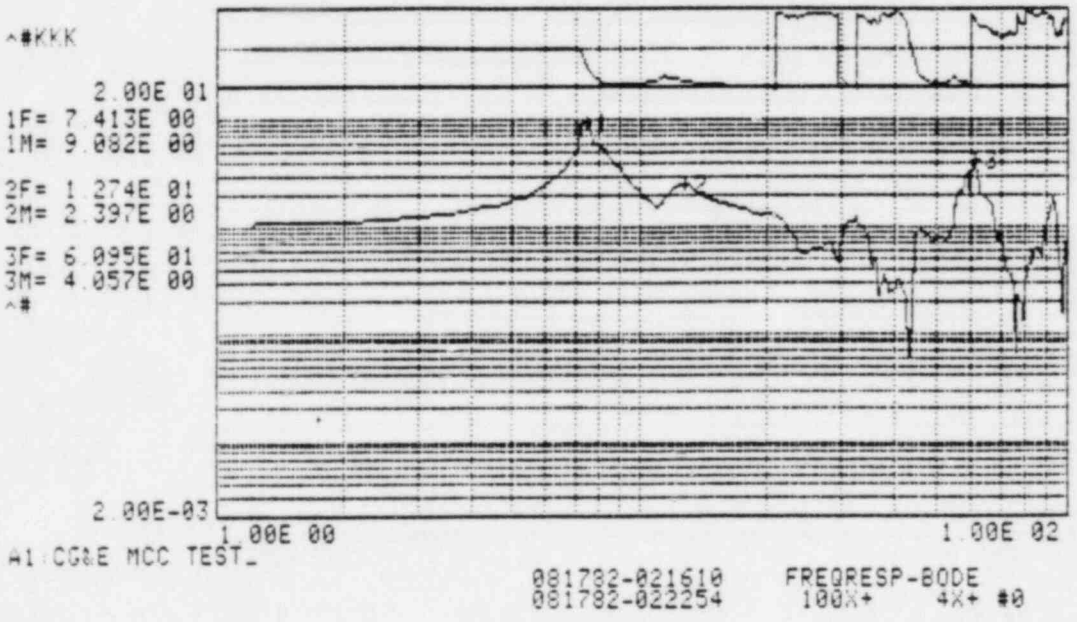



Figure V.10

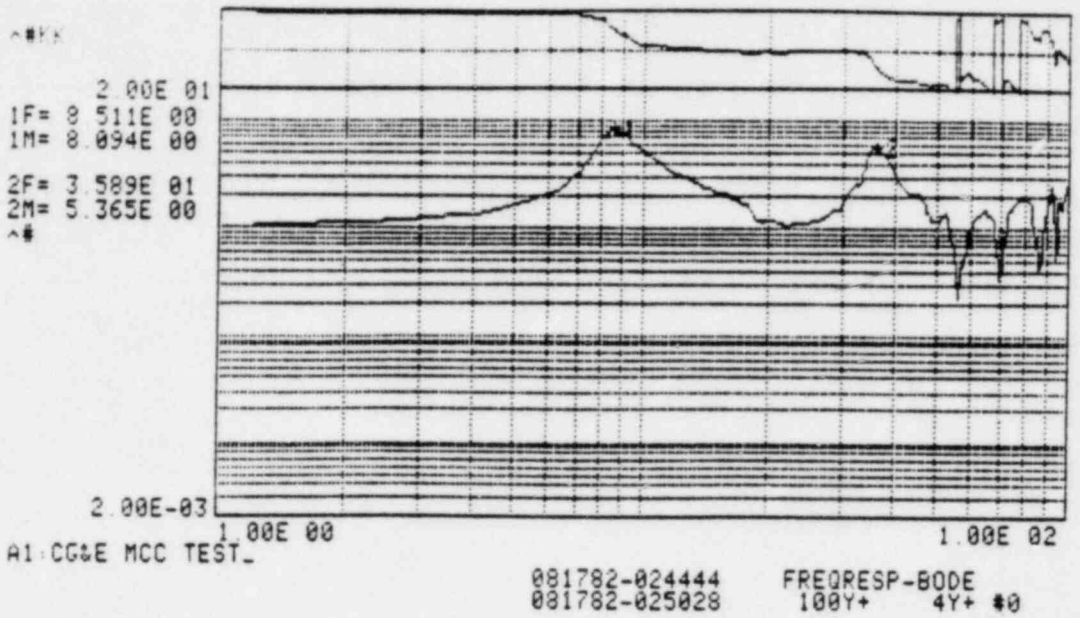



Figure V.11

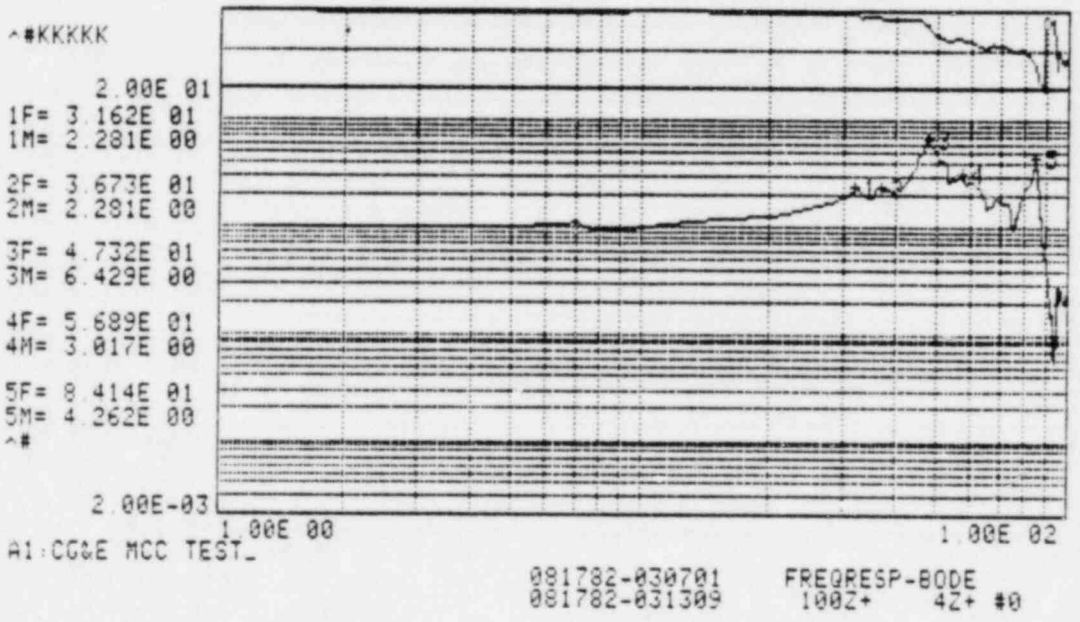



Figure V.12

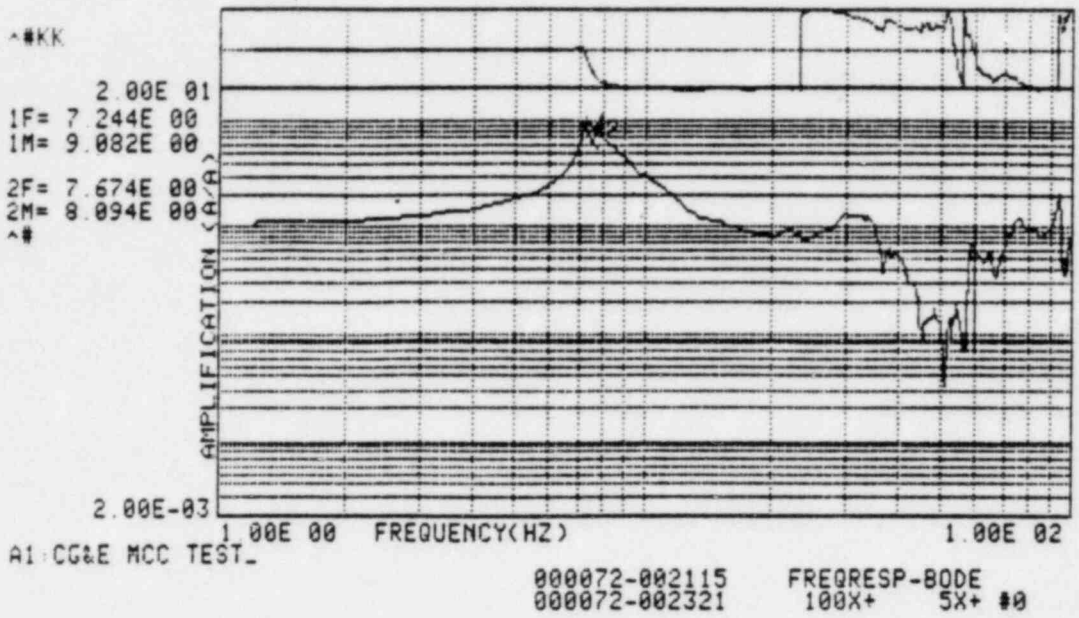



Figure V.13

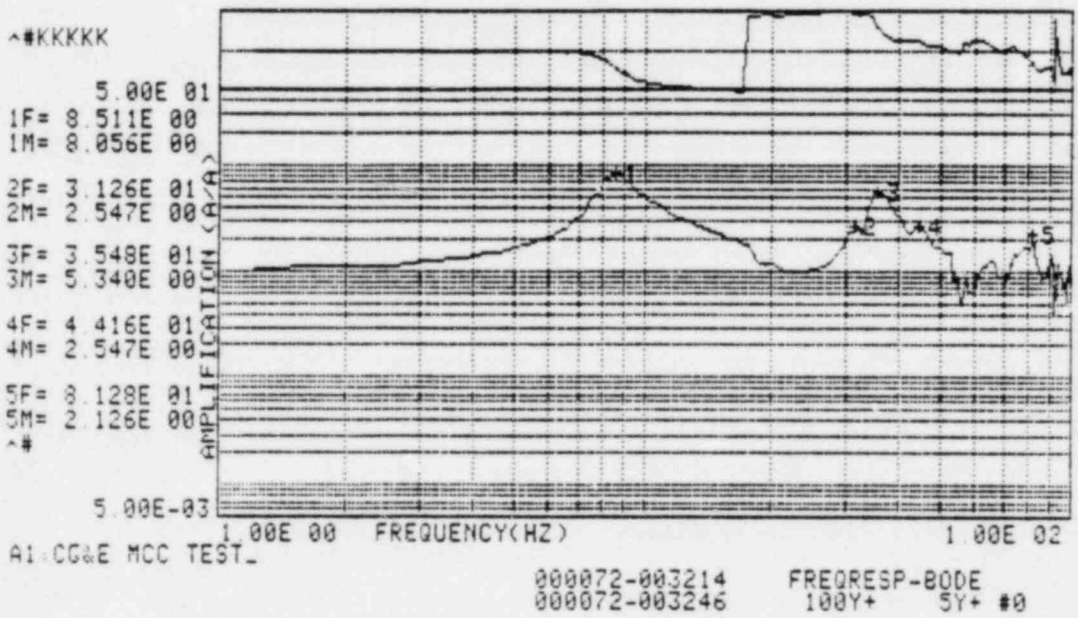



Figure V.14

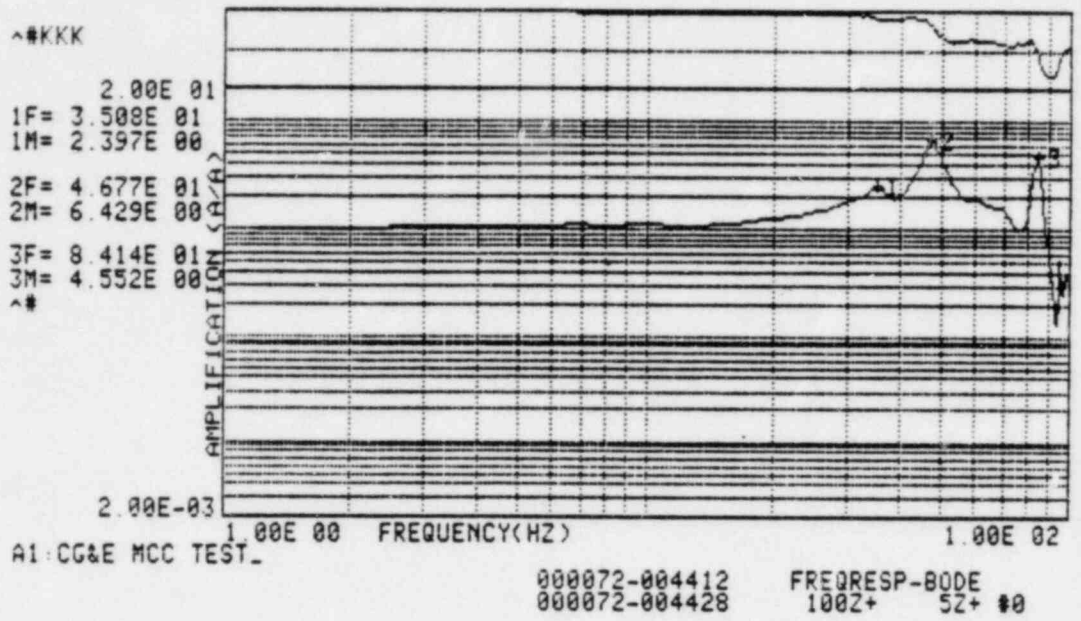



Figure V.15

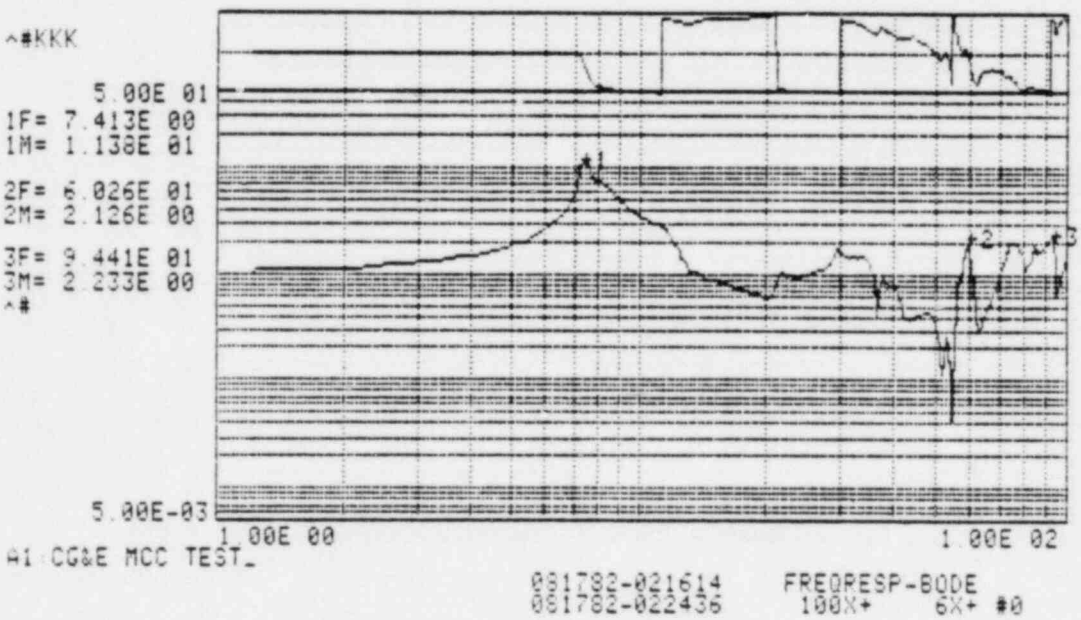



Figure V.16

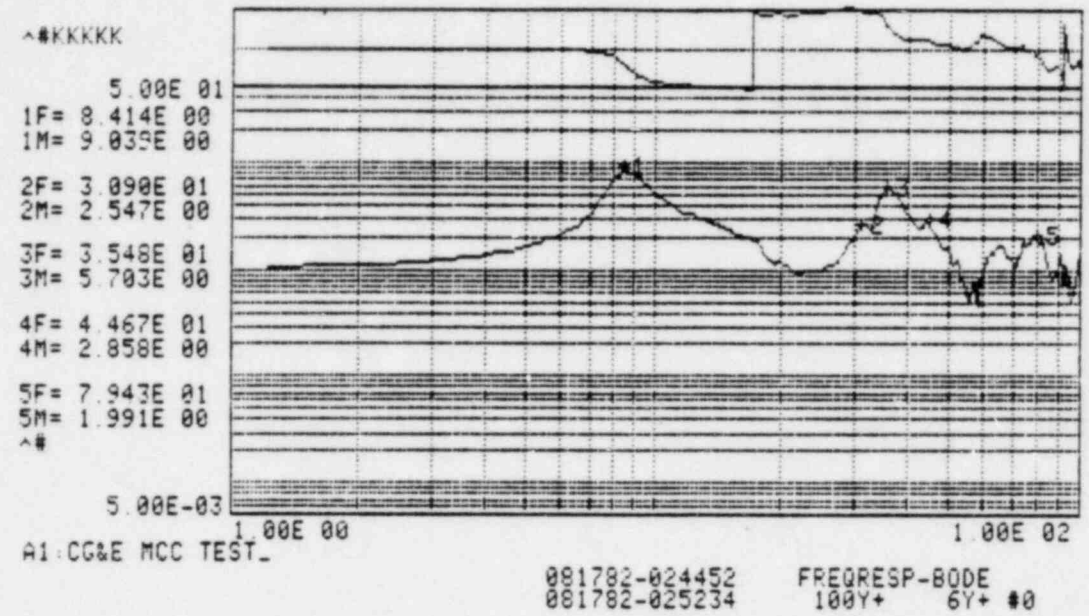



Figure V.17

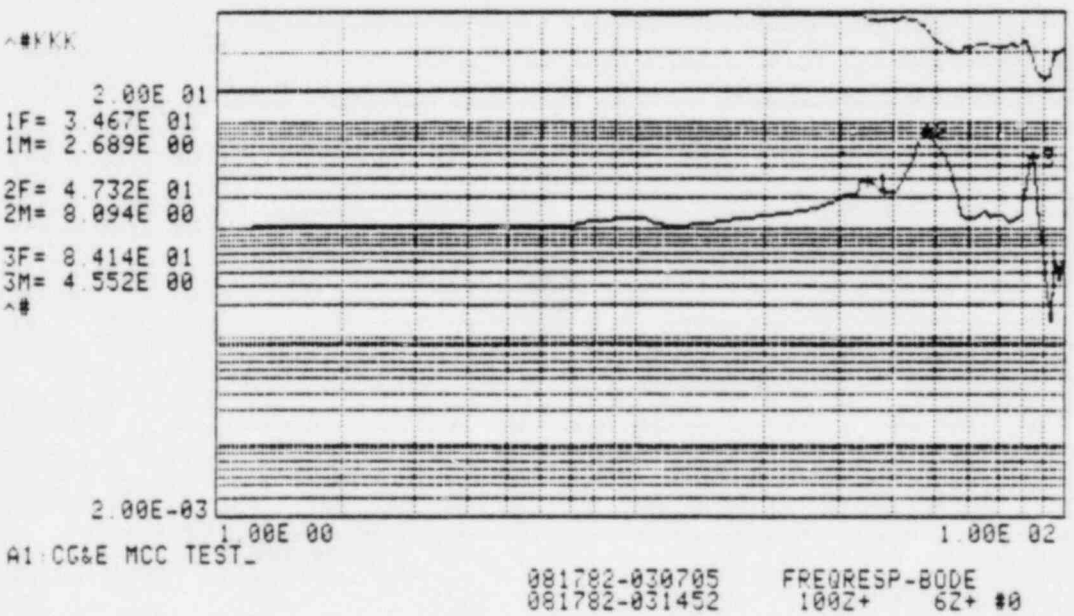



Figure V.18

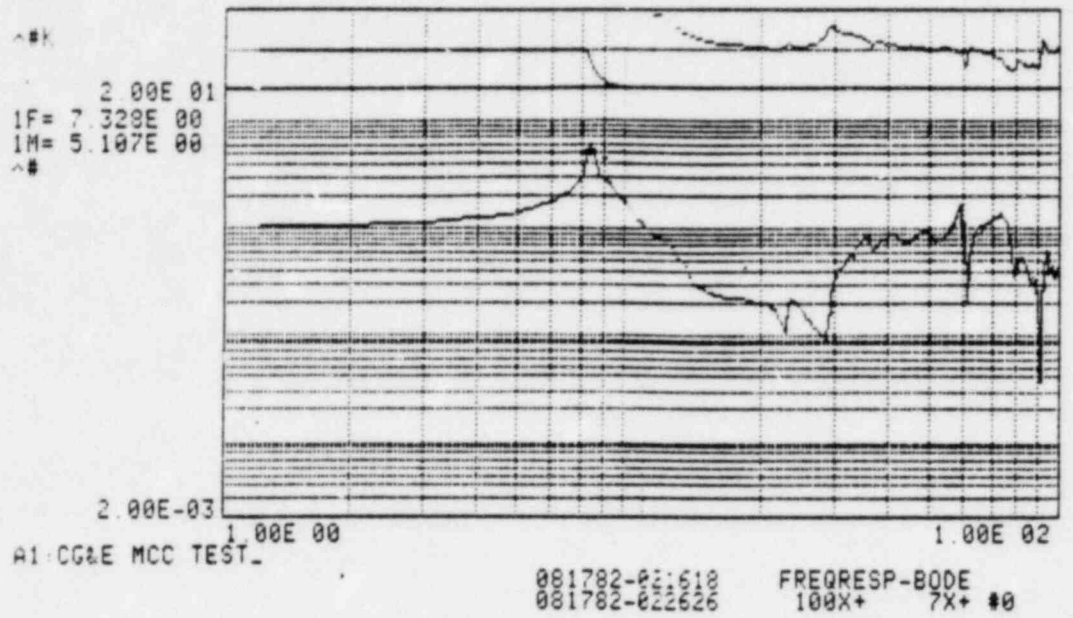



Figure V.19

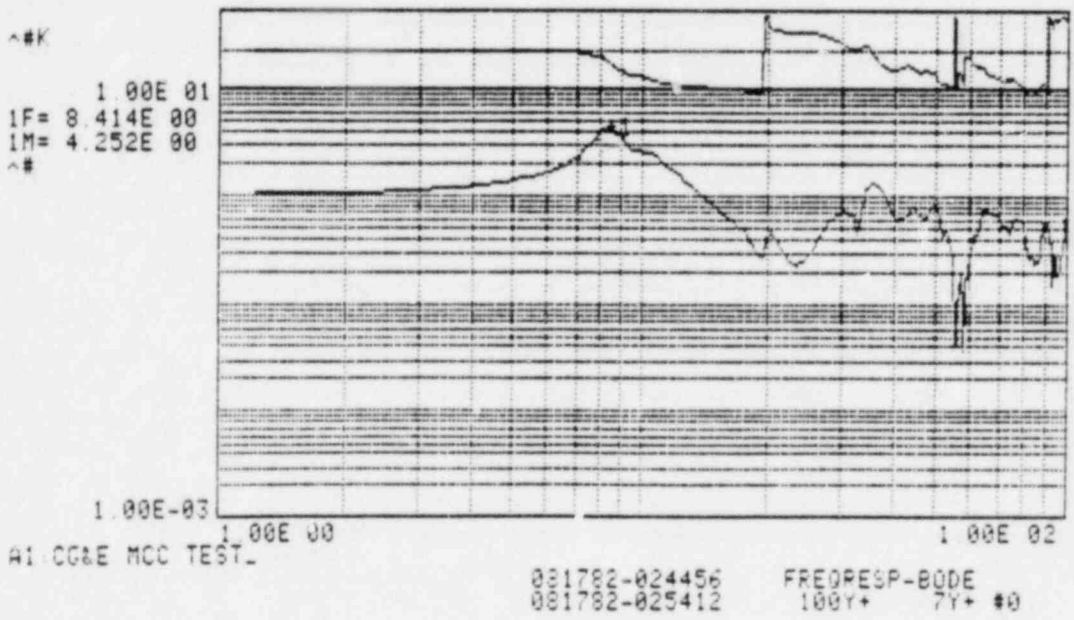



Figure V.20

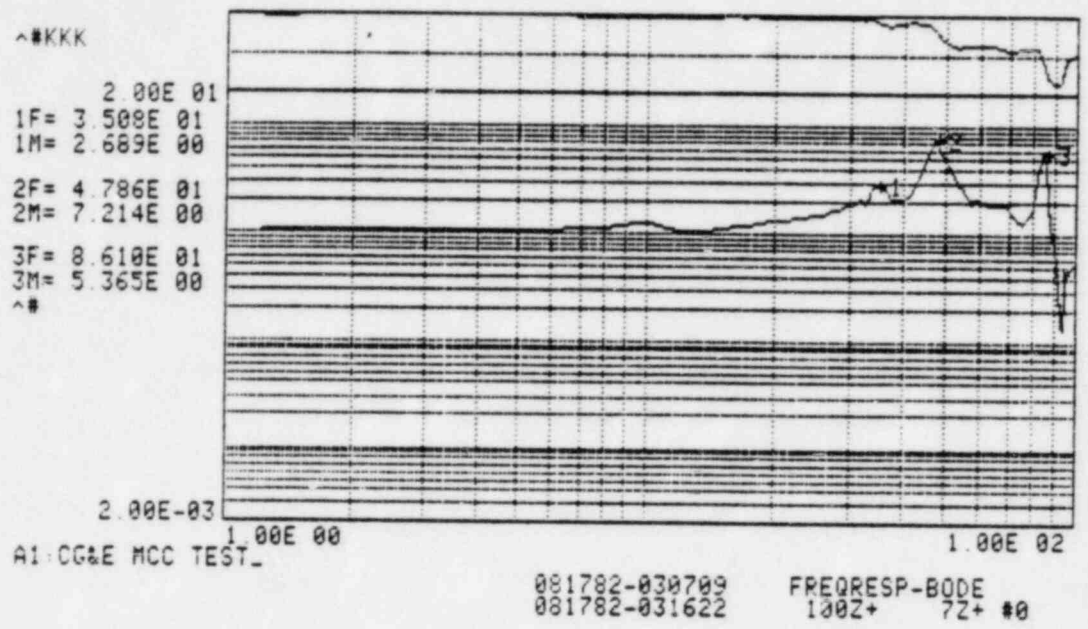



Figure V.21

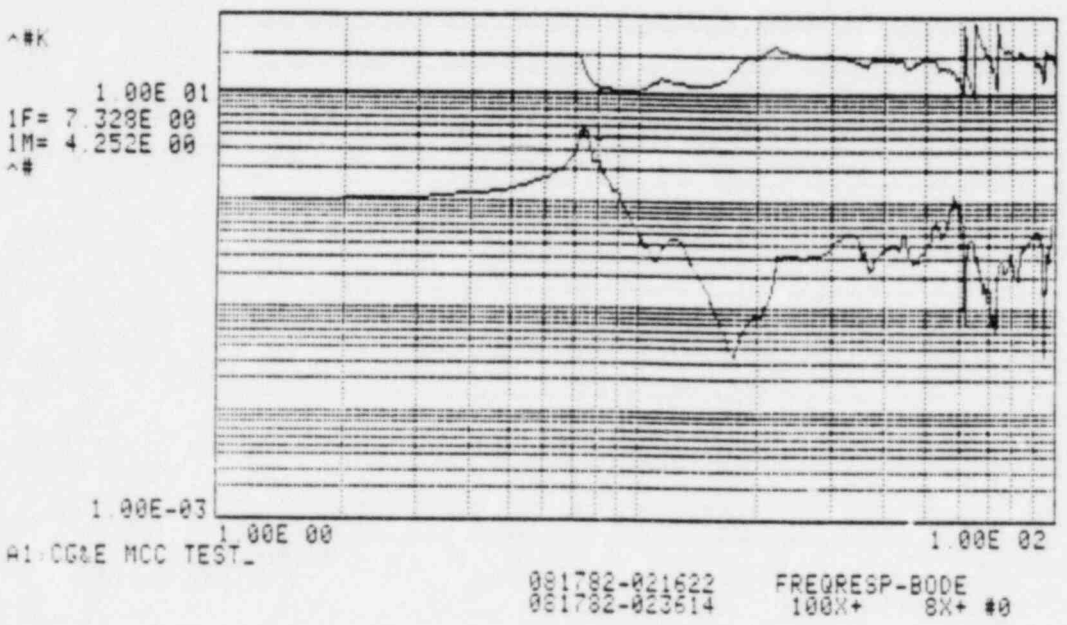



Figure V.22

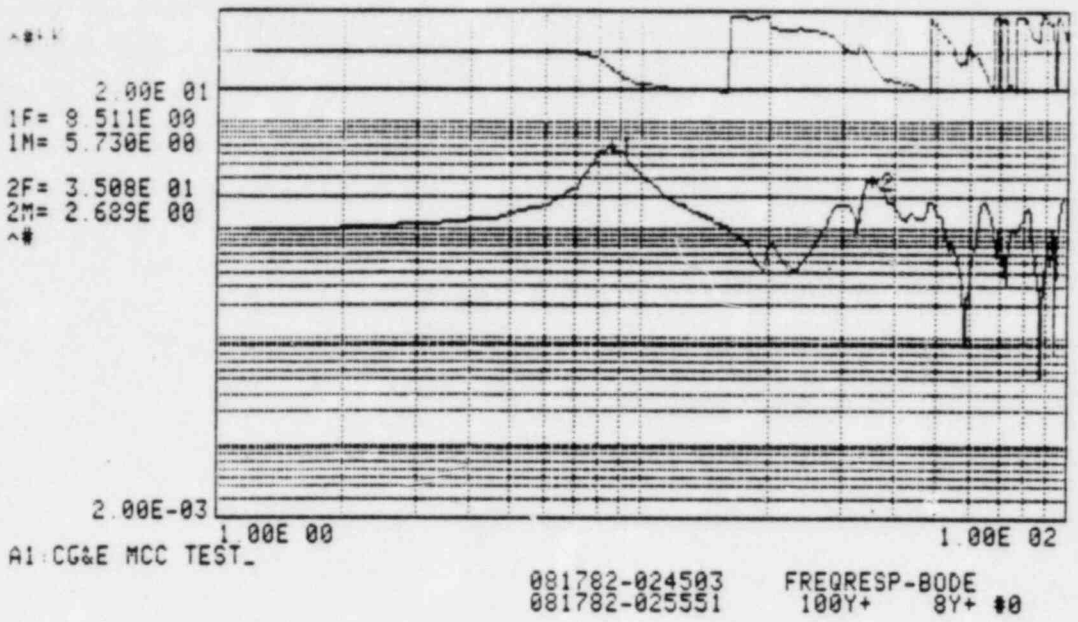



Figure V.23

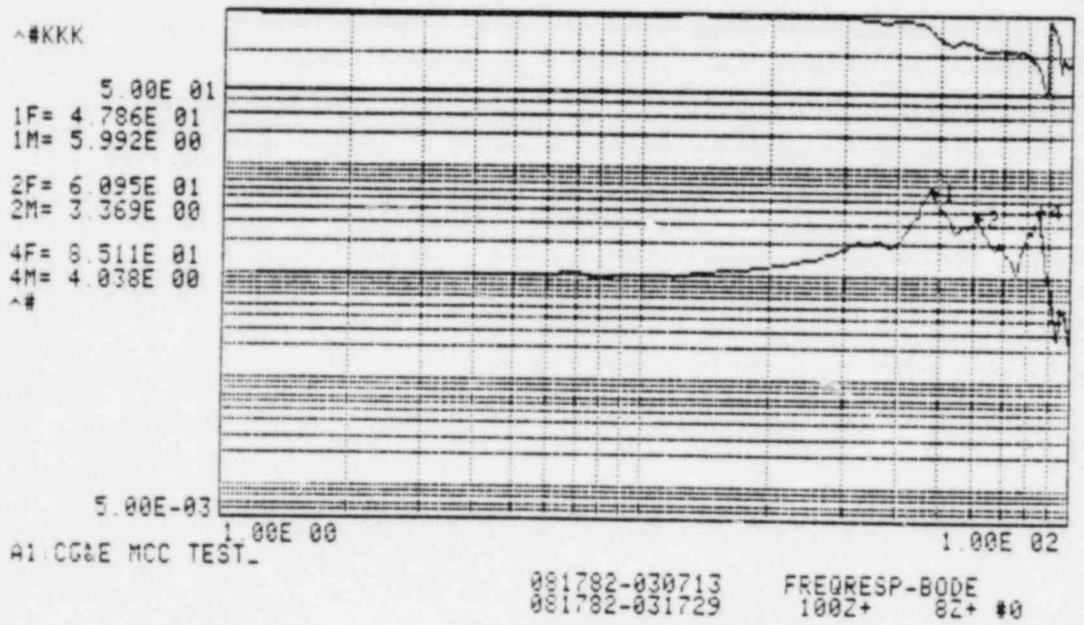


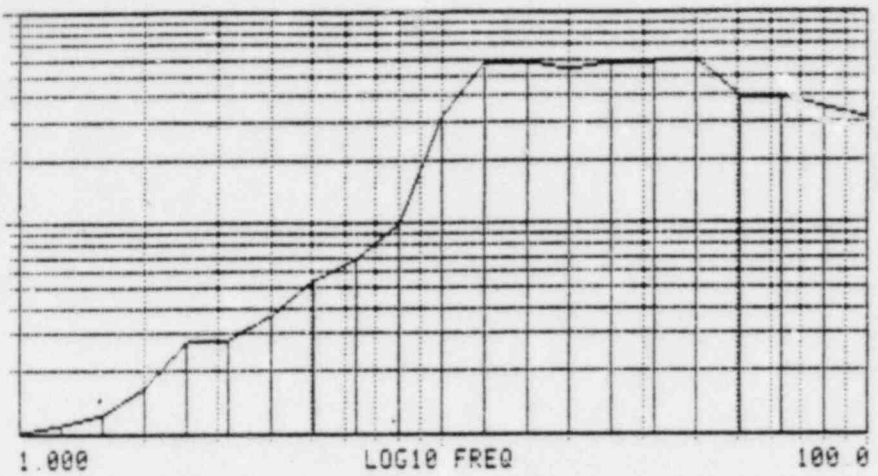

Figure V.24

# VI. TEST RESPONSE SPECTRA PLOTS

## VI.1 Table Controls

The table control TRS are presented as follows:

CHANNEL - A ZPA= 0.19GPK



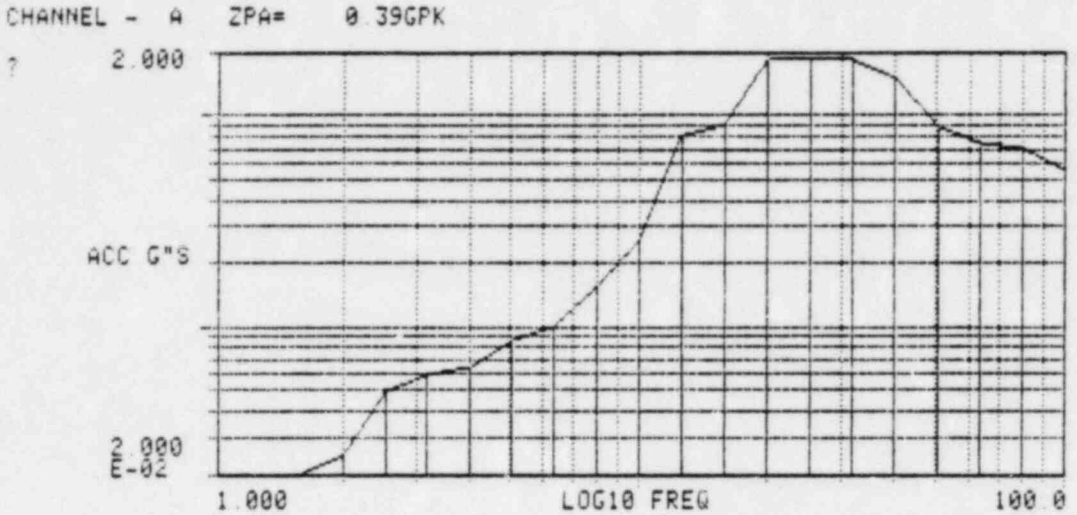

17-AUG-82
18:21:50

SHOCK RESPONSE
CG&E SRV - TEST #4

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.01 | 5.01 | 0.05 | 25.12 | 0.57 |
| 1.26 | 0.01 | 6.31 | 0.07 | 31.62 | 0.58 |
| 1.58 | 0.01 | 7.94 | 0.10 | 39.81 | 0.60 |
| 2.00 | 0.02 | 10.00 | 0.32 | 50.12 | 0.39 |
| 2.51 | 0.03 | 12.59 | 0.57 | 63.10 | 0.38 |
| 3.16 | 0.03 | 15.85 | 0.57 | 79.43 | 0.35 |
| 3.98 | 0.04 | 19.95 | 0.52 | 100.00 | 0.31 |

ACCELEROMETER # X DAMPING 2
DIRECTION N-S LOCATION _____
TEST# 4(SRV) OBE___ SSE___ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY ___ ____




17-AUG-82
19:02:30

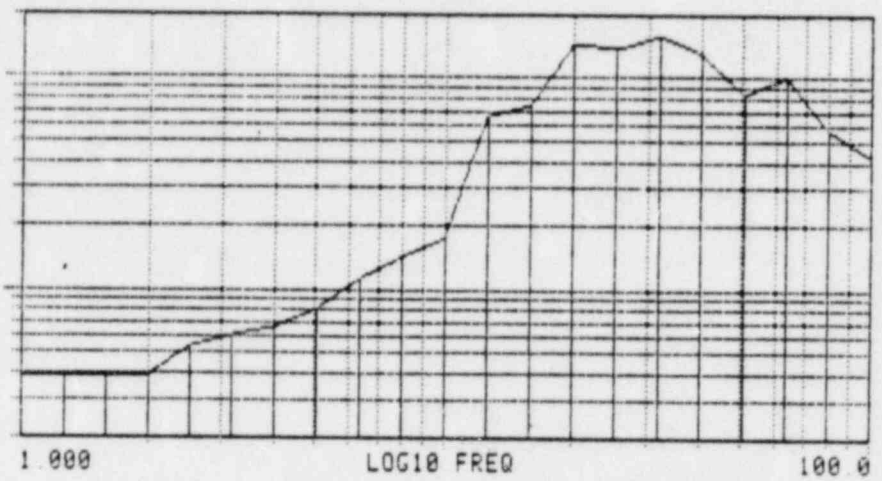
SHOCK RESPONSE
CG&E SRV+LOCA TEST #5

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.01 | 5.01 | 0.09 | 25.12 | 1.87 |
| 1.26 | 0.01 | 6.31 | 0.10 | 31.62 | 1.84 |
| 1.58 | 0.02 | 7.94 | 0.16 | 39.81 | 1.48 |
| 2.00 | 0.02 | 10.00 | 0.26 | 50.12 | 0.88 |
| 2.51 | 0.05 | 12.59 | 0.81 | 63.10 | 0.74 |
| 3.16 | 0.06 | 15.85 | 0.91 | 79.43 | 0.70 |
| 3.98 | 0.06 | 19.95 | 1.84 | 100.00 | 0.56 |

ACCELEROMETER # X DAMPING 2
DIRECTION N-S LOCATION _____
TEST# 5 (SRV+LOCA) SSE___ FRAG%___
TRIAX ___ N-S ___ E-W ___ TRIAX ✓
CONTROL ✓ SURVEY ____

CHANNEL - B ZPA= 0.28GPK




17-AUG-82
19:04:50

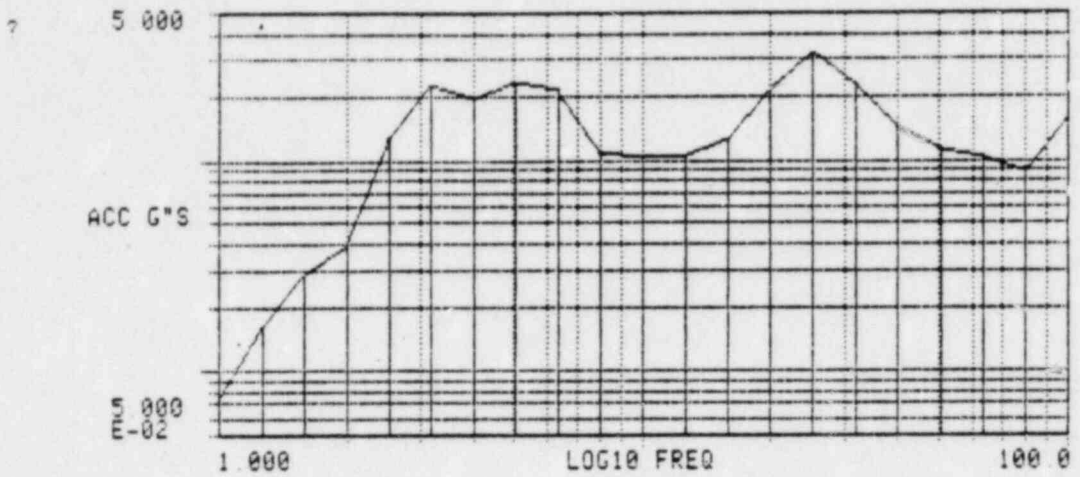
SHOCK RESPONSE
CG&E SRV+LOCA TEST #5

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.04 | 5.01 | 0.08 | 25.12 | 1.39 |
| 1.26 | 0.04 | 6.31 | 0.11 | 31.62 | 1.60 |
| 1.58 | 0.04 | 7.94 | 0.14 | 39.81 | 1.30 |
| 2.00 | 0.04 | 10.00 | 0.17 | 50.12 | 0.82 |
| 2.51 | 0.05 | 12.59 | 0.66 | 63.10 | 1.03 |
| 3.16 | 0.06 | 15.85 | 0.74 | 79.43 | 0.57 |
| 3.98 | 0.07 | 19.95 | 1.46 | 100.00 | 0.42 |

ACCELEROMETER # Y DAMPING 2
DIRECTION E-W LOCATION _____
TEST # 5 (SRV+LOCA) SSE___ FRAG%___
RTAX___ N-S___ E-W___ TRIAX ✓
CONTROL ✓ SURVEY ___

CHANNEL - C ZPA= 0.70GPK




17-AUG-82
19:14:50

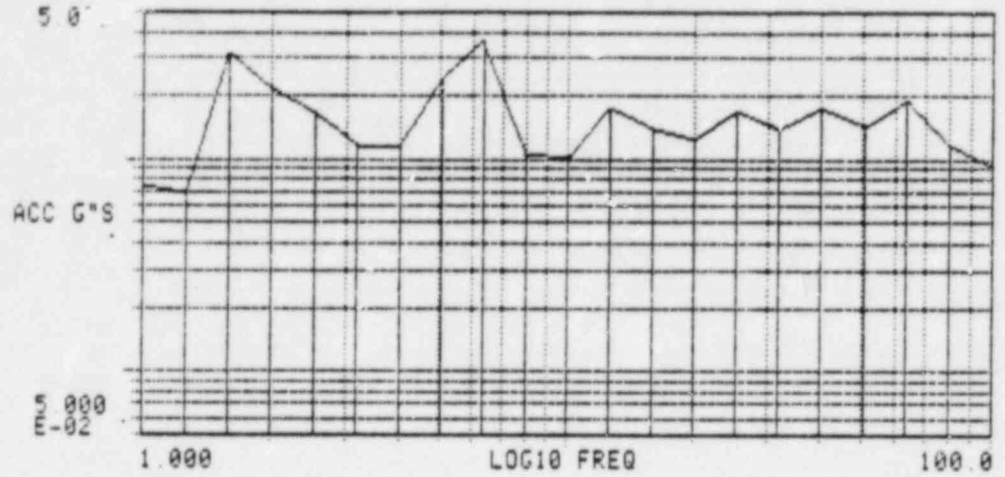
SHOCK RESPONSE
CG&E SRV+LOCA TEST #5

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.07 | 5.01 | 2.29 | 25.12 | 3.22 |
| 1.26 | 0.16 | 6.31 | 2.14 | 31.62 | 2.25 |
| 1.58 | 0.28 | 7.94 | 1.08 | 39.81 | 1.39 |
| 2.00 | 0.39 | 10.00 | 1.03 | 50.12 | 1.11 |
| 2.51 | 1.27 | 12.59 | 1.05 | 63.10 | 1.03 |
| 3.16 | 2.26 | 15.85 | 1.26 | 79.43 | 0.88 |
| 3.98 | 1.92 | 19.95 | 2.11 | 100.00 | 1.59 |

ACCELEROMETER # 3 DAMPING 2
DIRECTION Vertical LOCATION _____
TEST# 5 (SRV+LOCA) BSE___ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL ____✓____ SURVEY __ ____

CHANNEL - B ZPA= 0.61GPK




17-AUG-82
20:18:00

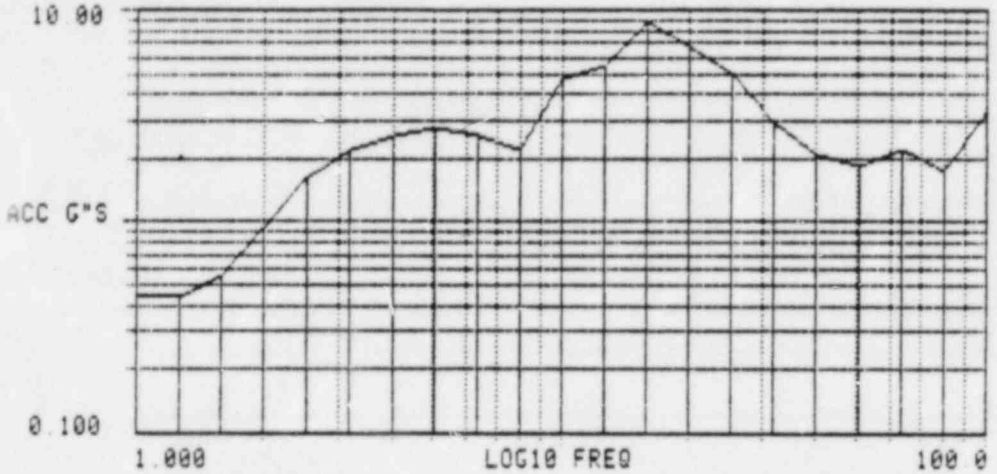
SHOCK RESPONSE
CG&E UPSET#1 TEST #6

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.75 | 5.01 | 2.37 | 25.12 | 1.70 |
| 1.26 | 0.68 | 6.31 | 3.58 | 31.62 | 1.37 |
| 1.58 | 3.13 | 7.94 | 1.06 | 39.81 | 1.76 |
| 2.00 | 2.15 | 10.00 | 1.01 | 50.12 | 1.40 |
| 2.51 | 1.61 | 12.59 | 1.76 | 63.10 | 1.91 |
| 3.16 | 1.14 | 15.85 | 1.35 | 79.43 | 1.16 |
| 3.98 | 1.15 | 19.95 | 1.20 | 100.00 | 0.92 |

ACCELEROMETER # Y DAMPING 1
DIRECTION E-W LOCATION _____
TEST# 6 OBE ✓ SSE___ FRAG%___
RIAX____ N-S____ E-W____ TRIAX ✓
CONTROL ✓ SURVEY _____

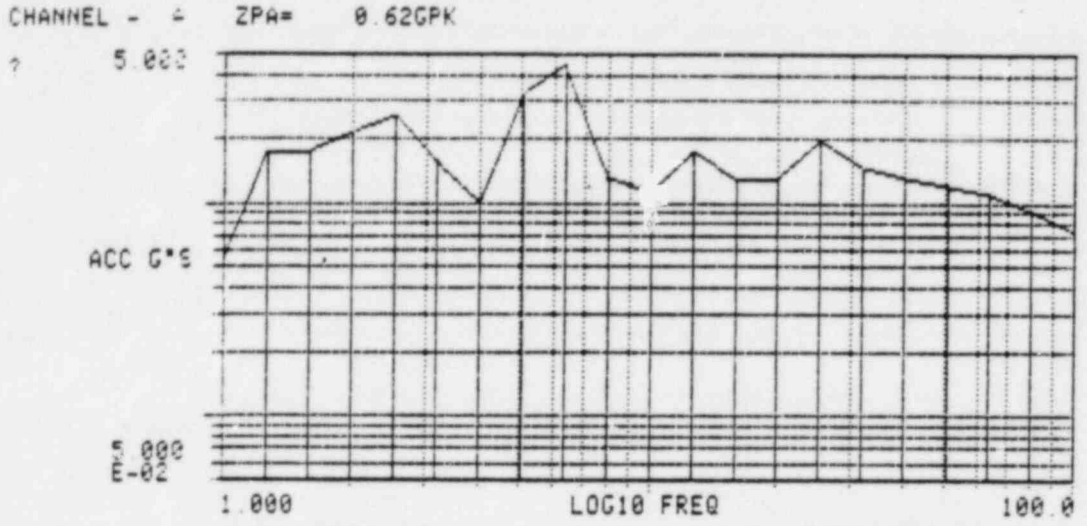
CHANNEL - C ZPA= 1.28GPK




17-AUG-82 20:21:00
SHOCK RESPONSE
CG&E UPSET#1 TEST #6
1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

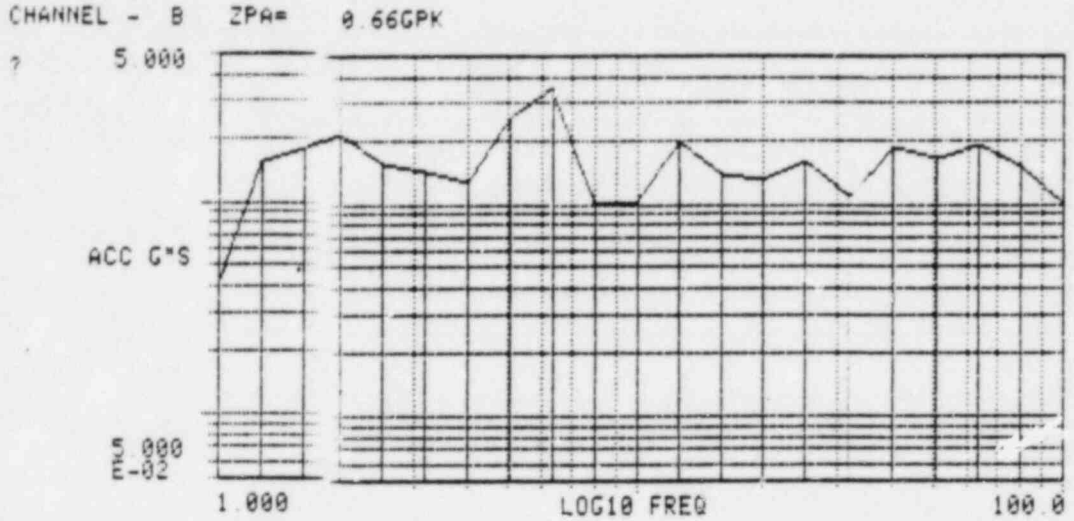
| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.44 | 5.01 | 2.74 | 25.12 | 4.95 |
| 1.26 | 0.44 | 6.31 | 2.54 | 31.62 | 2.90 |
| 1.58 | 0.55 | 7.94 | 2.20 | 39.81 | 2.06 |
| 2.00 | 0.92 | 10.00 | 4.71 | 50.12 | 1.79 |
| 2.51 | 1.61 | 12.59 | 5.32 | 63.10 | 2.20 |
| 3.16 | 2.16 | 15.85 | 8.59 | 79.43 | 1.74 |
| 3.98 | 2.51 | 19.95 | 6.72 | 100.00 | 3.30 |

ACCELEROMETER # 3 DAMPING 1
DIRECTION Vertical LOCATION _____
TEST# 6 OBE ✓ SSE___ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY _____




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.55 | 5.01 | 3.26 | 25.12 | 1.95 |
| 1.26 | 1.73 | 6.31 | 4.49 | 31.62 | 1.46 |
| 1.58 | 1.72 | 7.94 | 1.28 | 39.81 | 1.28 |
| 2.00 | 2.14 | 10.00 | 1.12 | 50.12 | 1.19 |
| 2.51 | 2.55 | 12.59 | 1.72 | 63.10 | 1.09 |
| 3.16 | 1.52 | 15.85 | 1.25 | 79.43 | 0.90 |
| 3.98 | 0.99 | 19.95 | 1.31 | 100.00 | 0.72 |

ACCELEROMETER # X DAMPING 1
DIRECTION N-S LOCATION _____
TEST# 7 OBE ✓ SSE___ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL ✓ SURVEY _____




17-AUG-82
20:31:40

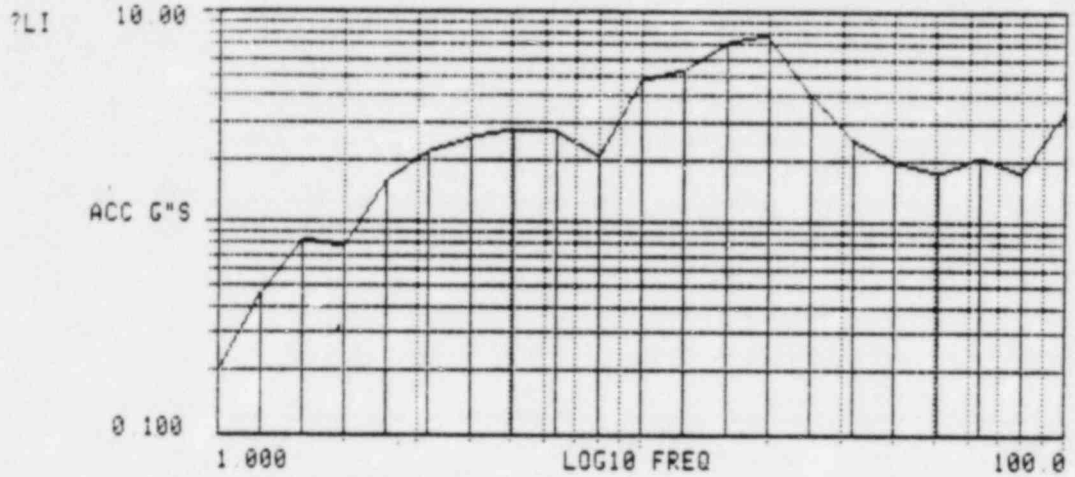
SHOCK RESPONSE
CG&E UPSET#2 TEST #7

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.40 | 5.01 | 2.55 | 25.12 | 1.58 |
| 1.26 | 1.55 | 6.31 | 3.48 | 31.62 | 1.10 |
| 1.58 | 1.81 | 7.94 | 1.01 | 39.81 | 1.81 |
| 2.00 | 2.14 | 10.00 | 1.01 | 50.12 | 1.65 |
| 2.51 | 1.55 | 12.59 | 1.93 | 63.10 | 1.89 |
| 3.16 | 1.42 | 15.85 | 1.37 | 79.43 | 1.50 |
| 3.98 | 1.25 | 19.95 | 1.31 | 100.00 | 1.00 |

ACCELEROMETER # X DAMPING 1
DIRECTION E-W LOCATION _____
TEST# 2 OBE ✓ SSE___ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL ___✓_____ SURVEY _____

CHANNEL - C ZPA= 1.06GPK




17-AUG-82
20:36:10

SHOCK RESPONSE
CG&E UPSET#2 TEST #7

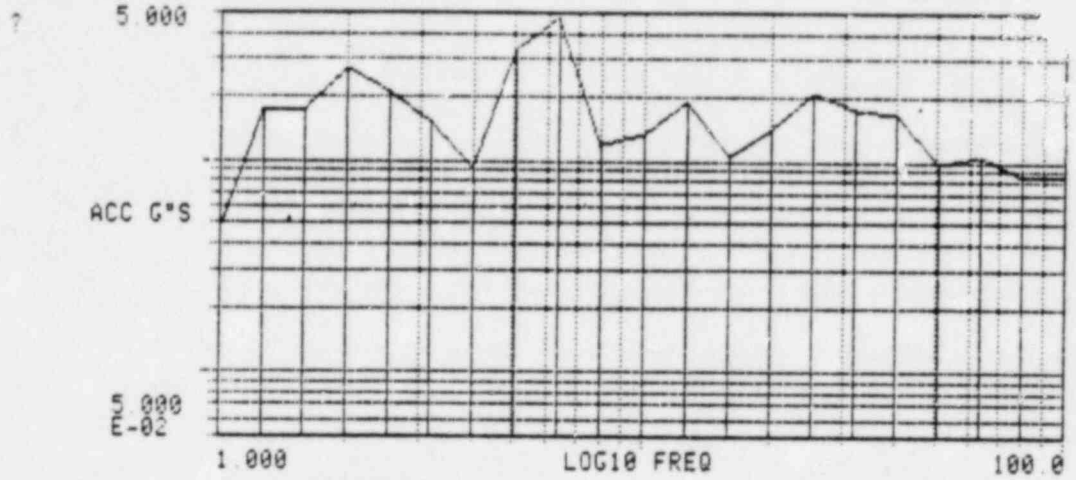
1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.19 | 5.01 | 2.72 | 25.12 | 4.04 |
| 1.26 | 0.45 | 6.31 | 2.67 | 31.62 | 2.48 |
| 1.58 | 0.83 | 7.94 | 2.05 | 39.81 | 1.92 |
| 2.00 | 0.75 | 10.00 | 4.63 | 50.12 | 1.70 |
| 2.51 | 1.56 | 12.59 | 5.25 | 63.10 | 2.06 |
| 3.16 | 2.16 | 15.85 | 7.07 | 79.43 | 1.71 |
| 3.98 | 2.49 | 19.95 | 7.64 | 100.00 | 3.36 |

?

ACCELEROMETER # 2 DAMPING 1
DIRECTION Vertical LOCATION _____
TEST# 7 OBE ✓ SSE___ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY _____

CHANNEL - A ZPA= 0.69GPK




17-AUG-82
20:44:20

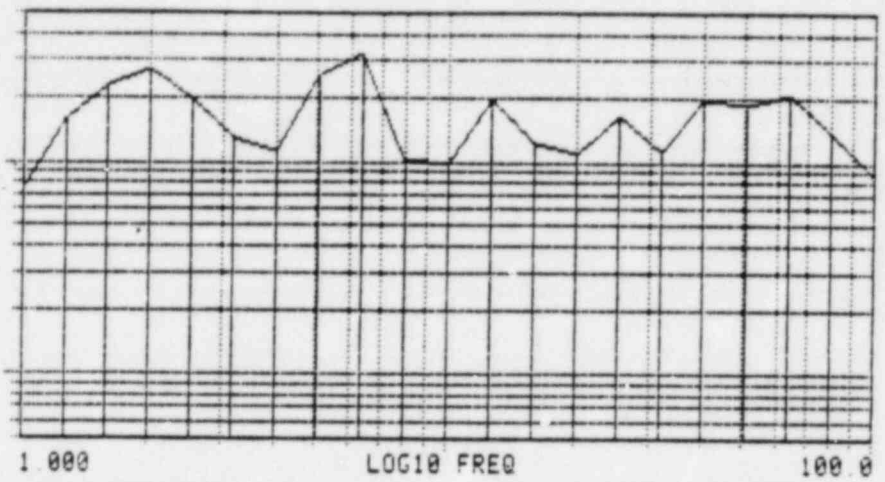
SHOCK RESPONSE
CG&E UPSET#3 TEST #8

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.46 | 5.01 | 3.34 | 25.12 | 2.10 |
| 1.26 | 1.71 | 6.31 | 4.73 | 31.62 | 1.75 |
| 1.58 | 1.74 | 7.94 | 1.19 | 39.81 | 1.63 |
| 2.00 | 2.72 | 10.00 | 1.32 | 50.12 | 0.96 |
| 2.51 | 2.10 | 12.59 | 1.90 | 63.10 | 1.05 |
| 3.16 | 1.50 | 15.85 | 1.06 | 79.43 | 0.83 |
| 3.98 | 0.92 | 19.95 | 1.42 | 100.00 | 0.84 |

ACCELEROMETER # X DAMPING 1
DIRECTION N-S LOCATION _____
TEST# 8 OBE ✓ SSE ___ FRAG% ___
BIAX ___ N-S ___ E-W ___ TRIAX ✓
CONTROL ✓ SURVEY _____

CHANNEL - B ZPA= 0 63GPK




17-AUG-82
20:46:40

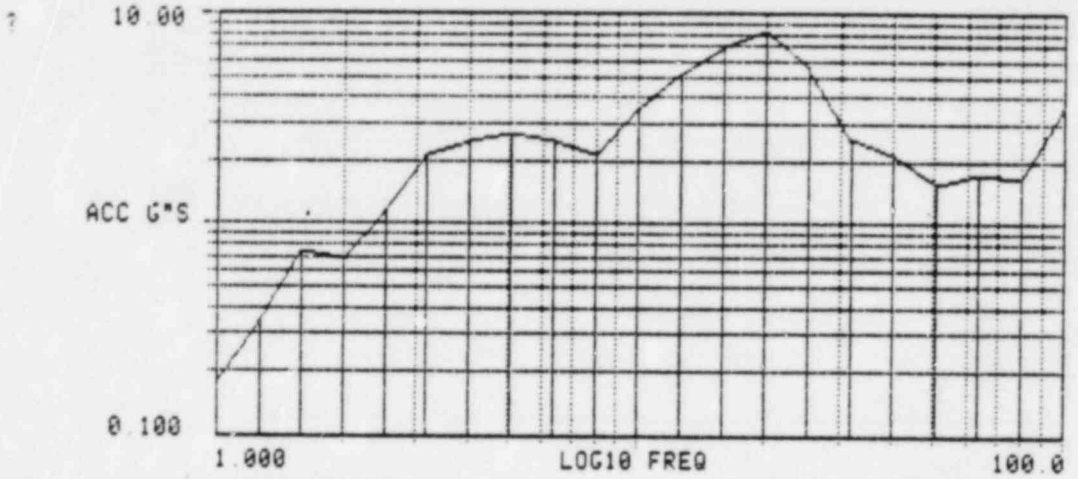
SHOCK RESPONSE
CG&E UPSET#3 TEST #8

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.75 | 5.01 | 2.51 | 25.12 | 1.62 |
| 1.26 | 1.59 | 6.31 | 3.23 | 31.62 | 1.11 |
| 1.58 | 2.26 | 7.94 | 1.02 | 39.81 | 1.94 |
| 2.00 | 2.68 | 10.00 | 0.95 | 50.12 | 1.82 |
| 2.51 | 1.98 | 12.59 | 1.92 | 63.10 | 2.04 |
| 3.16 | 1.29 | 15.85 | 1.23 | 79.43 | 1.39 |
| 3.98 | 1.11 | 19.95 | 1.09 | 100.00 | 0.85 |

ACCELEROMETER # Y DAMPING 1
DIRECTION E-W LOCATION _____
TEST# 8 OBE ✓ SSE___ FRAG%___
RTAX____ N-S____ E-W____ TRIAX ✓
CONTROL ___✓_____ SURVEY _____

CHANNEL - C ZPA= 1.18GPK



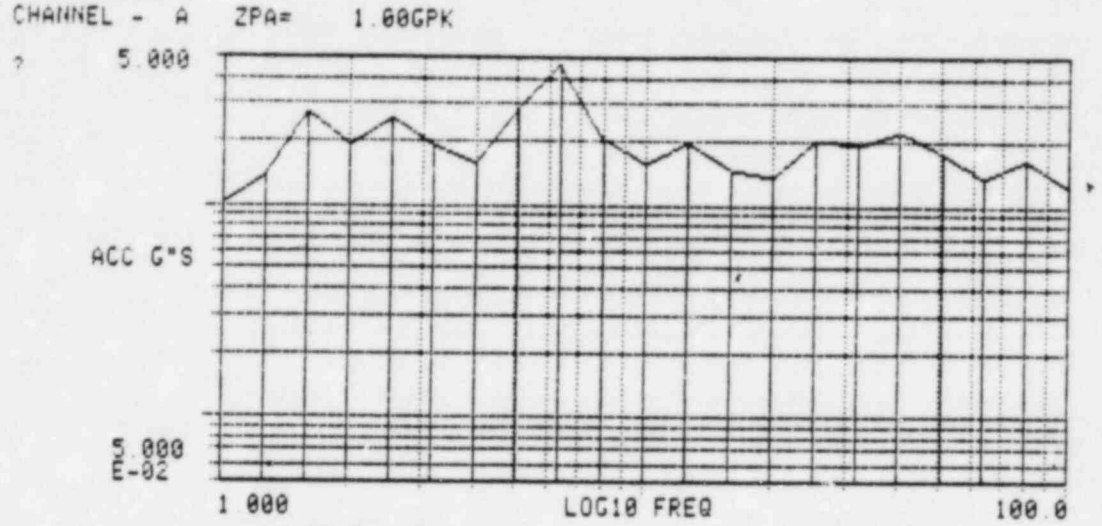

17-AUG-82
20:49:00

SHOCK RESPONSE
CG&E UPSET#3 TEST #8

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.17 | 5.01 | 2.67 | 25.12 | 5.35 |
| 1.26 | 0.34 | 6.31 | 2.44 | 31.62 | 2.51 |
| 1.58 | 0.74 | 7.94 | 2.12 | 39.81 | 2.12 |
| 2.00 | 0.67 | 10.00 | 3.48 | 50.12 | 1.55 |
| 2.51 | 1.12 | 12.59 | 5.05 | 63.10 | 1.70 |
| 3.16 | 2.13 | 15.85 | 6.91 | 79.43 | 1.64 |
| 3.98 | 2.45 | 19.95 | 8.09 | 100.00 | 3.59 |

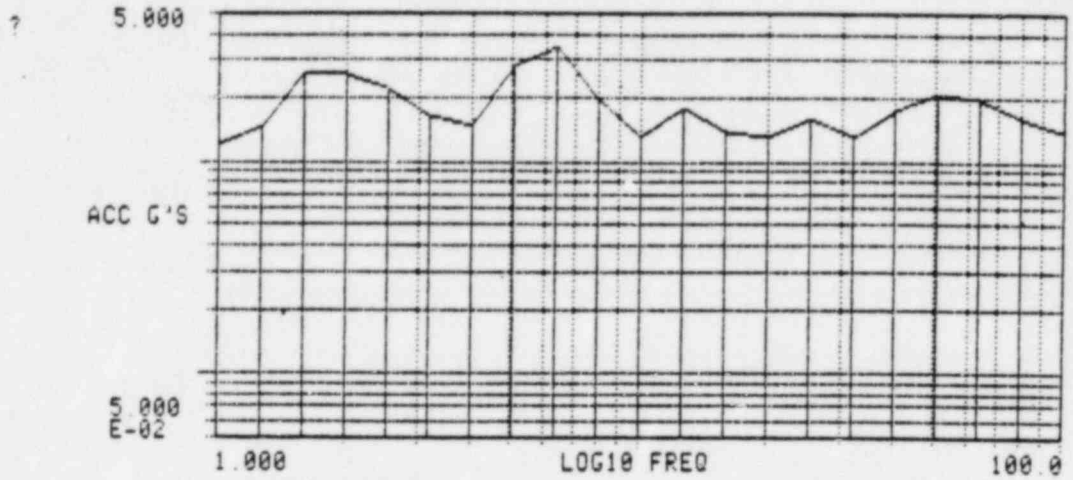
ACCELEROMETER # 5 DAMPING .1
DIRECTION Vertical LOCATION _____
TEST# 8 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ✓ SURVEY _____




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.02 | 5.01 | 2.90 | 25.12 | 1.99 |
| 1.26 | 1.39 | 6.31 | 4.65 | 31.62 | 1.90 |
| 1.58 | 2.66 | 7.94 | 2.00 | 39.81 | 2.22 |
| 2.00 | 1.88 | 10.00 | 1.54 | 50.12 | 1.72 |
| 2.51 | 2.54 | 12.59 | 1.92 | 63.10 | 1.32 |
| 3.16 | 1.89 | 15.85 | 1.45 | 79.43 | 1.63 |
| 3.98 | 1.55 | 19.95 | 1.34 | 100.00 | 1.20 |

ACCELEROMETER # X DAMPING 1
DIRECTION N-S LOCATION _____
TEST# 9 OBE ✓ SSE ___ FRAG% ___
RIAX ___ N-S ___ E-W ___ TRIAX ✓
CONTROL ✓ SURVEY _____

CHANNEL - B ZPA= 0.95GPK




17-AUG-82
20:58:00

SHOCK RESPONSE
CG&E UPSET#4 TEST#9

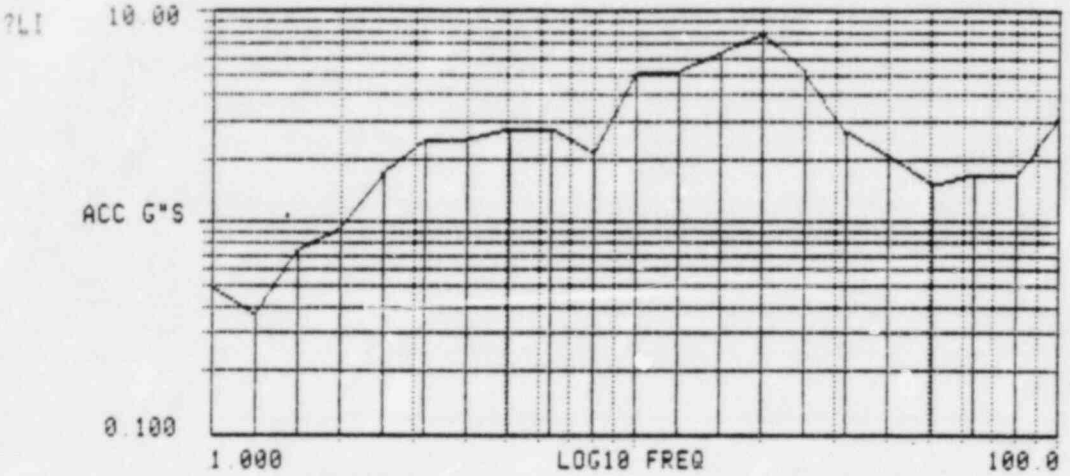
1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.20 | 5.01 | 2.76 | 25.12 | 1.59 |
| 1.26 | 1.47 | 6.31 | 3.44 | 31.62 | 1.30 |
| 1.58 | 2.59 | 7.94 | 1.97 | 39.81 | 1.74 |
| 2.00 | 2.52 | 10.00 | 1.29 | 50.12 | 2.04 |
| 2.51 | 2.16 | 12.59 | 1.81 | 63.10 | 1.96 |
| 3.16 | 1.61 | 15.85 | 1.39 | 79.43 | 1.60 |
| 3.98 | 1.43 | 19.95 | 1.31 | 100.00 | 1.38 |

?

ACCELEROMETER # Y DAMPING 1
DIRECTION E-W LOCATION _____
TEST# 9 OBE ✓ SSE___ FRAG%___
MAX___ N-S___ E-W___ TRIAX ✓
CONTROL ✓ SURVEY _____

CHANNEL - C ZPA= 1.19GPK




17-AUG-82
21:00:30

SHOCK RESPONSE
CG&E UPSET#4 TEST#9

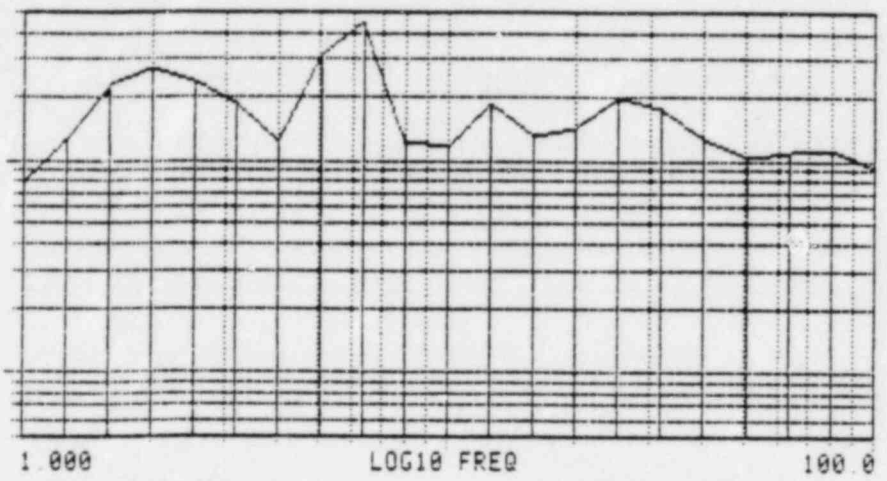
1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

?

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.49 | 5.01 | 2.72 | 25.12 | 5.17 |
| 1.26 | 0.36 | 6.31 | 2.78 | 31.62 | 2.67 |
| 1.58 | 0.72 | 7.94 | 2.10 | 39.81 | 2.07 |
| 2.00 | 0.92 | 10.00 | 4.86 | 50.12 | 1.49 |
| 2.51 | 1.73 | 12.59 | 5.11 | 63.10 | 1.69 |
| 3.16 | 2.44 | 15.85 | 6.30 | 79.43 | 1.64 |
| 3.98 | 2.45 | 19.95 | 7.66 | 100.00 | 3.09 |

ACCELEROMETER # 2 DAMPING 1
DIRECTION Vertical LOCATION _____
TEST# 9 OBE ✓ SSE ___ FRAG% ___ ✓
BIAX ___ N-S ___ E-W ___ TRIAX ✓
CONTROL ___ ✓ ___ SURVEY _____

CHANNEL - A ZPA= 0.72GPK




17-AUG-82
21:09:20

SHOCK RESPONSE
CG&E UPSET #5 TEST #10

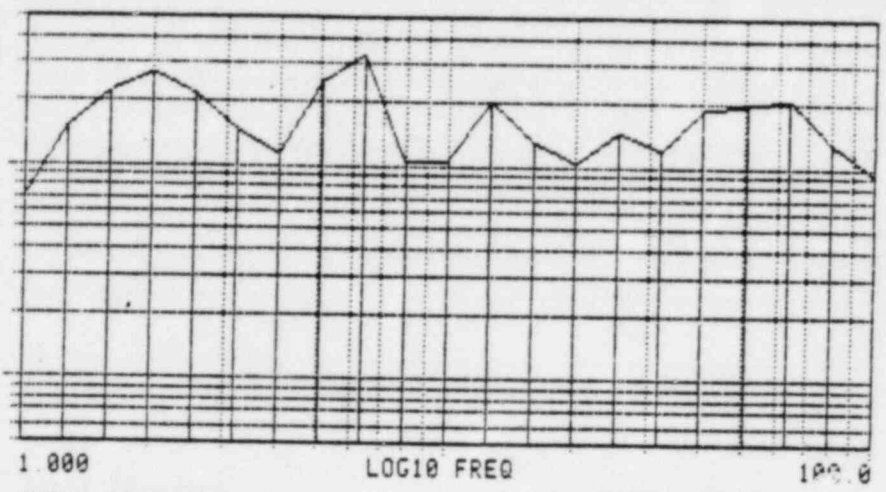
1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.79 | 5.01 | 3.16 | 25.12 | 1.96 |
| 1.26 | 1.25 | 6.31 | 4.49 | 31.62 | 1.73 |
| 1.58 | 2.28 | 7.94 | 1.23 | 39.81 | 1.26 |
| 2.00 | 2.66 | 10.00 | 1.17 | 50.12 | 1.02 |
| 2.51 | 2.30 | 12.59 | 1.82 | 63.10 | 1.08 |
| 3.16 | 1.85 | 15.85 | 1.27 | 79.43 | 1.11 |
| 3.98 | 1.22 | 19.95 | 1.41 | 100.00 | 0.90 |

?

ACCELEROMETER # X DAMPING 1
DIRECTION N-S LOCATION _____
TEST# 10 OBE ✓ SSE___ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___ ✓ ___ SURVEY _____

CHANNEL - B ZPA= 0.56GPK




17-AUG-82
21:11:30

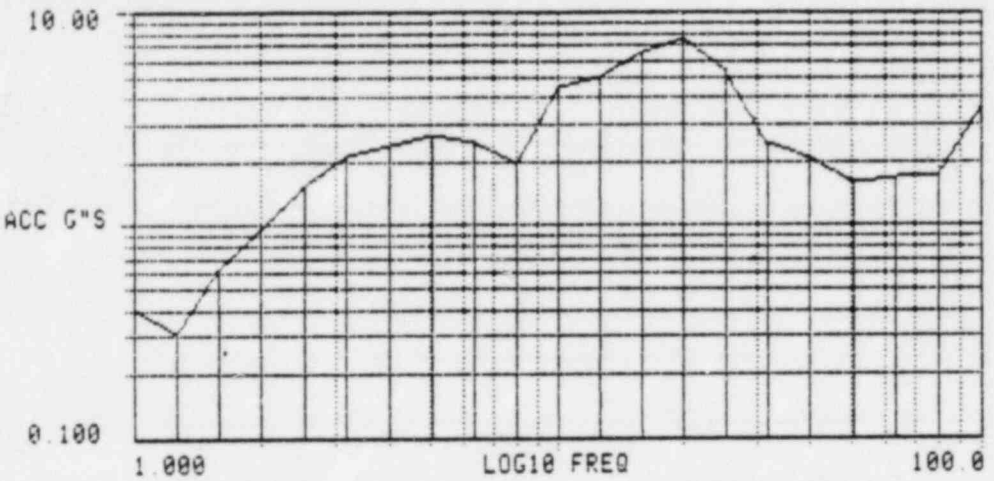
SHOCK RESPONSE
CG&E UPSET #5 TEST #10

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.70 | 5.01 | 2.44 | 25.12 | 1.45 |
| 1.26 | 1.50 | 6.31 | 3.32 | 31.62 | 1.18 |
| 1.58 | 2.21 | 7.94 | 1.04 | 39.81 | 1.84 |
| 2.00 | 2.70 | 10.00 | 1.06 | 50.12 | 1.95 |
| 2.51 | 2.12 | 12.59 | 2.00 | 63.10 | 2.10 |
| 3.16 | 1.48 | 15.85 | 1.31 | 79.43 | 1.28 |
| 3.98 | 1.12 | 19.95 | 1.04 | 100.00 | 0.90 |

ACCELEROMETER # Y DAMPING 1
DIRECTION E-W LOCATION _____
TEST# 10 OBE ✓ BSE___ FRAG%___
TRAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY _____

CHANNEL - C ZPA= 1.15GPK



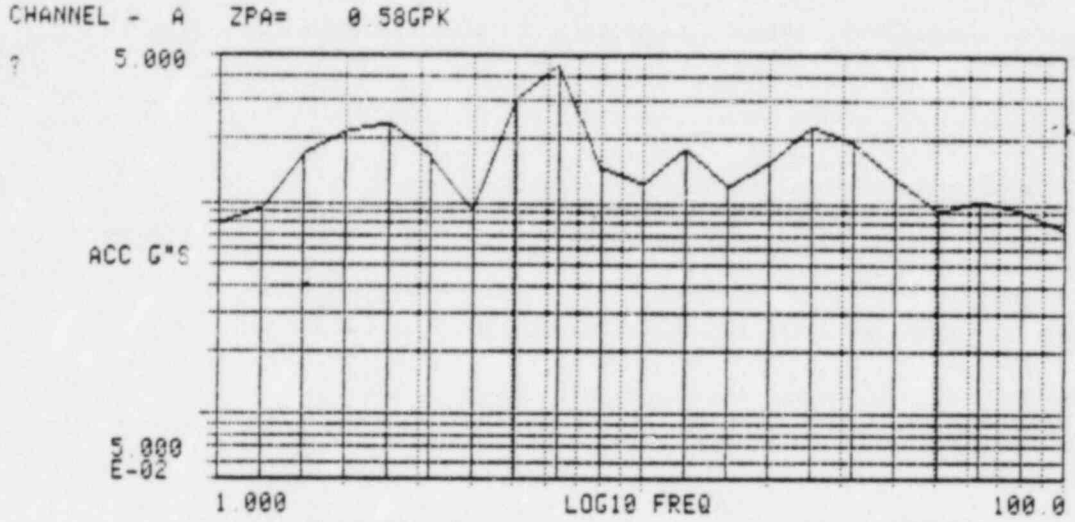

17-AUG-82
21:31:20

SHOCK RESPONSE
CG&E UPSET #5 TEST #10

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.39 | 5.01 | 2.64 | 25.12 | 5.24 |
| 1.26 | 0.30 | 6.31 | 2.47 | 31.62 | 2.44 |
| 1.58 | 0.62 | 7.94 | 1.90 | 39.81 | 2.05 |
| 2.00 | 0.96 | 10.00 | 4.39 | 50.12 | 1.58 |
| 2.51 | 1.50 | 12.59 | 4.87 | 63.10 | 1.67 |
| 3.16 | 2.12 | 15.85 | 6.45 | 79.43 | 1.72 |
| 3.98 | 2.40 | 19.95 | 7.39 | 100.00 | 3.58 |

ACCELEROMETER # Z DAMPING .1
DIRECTION Vertical LOCATION _____
TEST# 10 OBE ✓ SSE___ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY _____




17-AUG-82
21:48:40

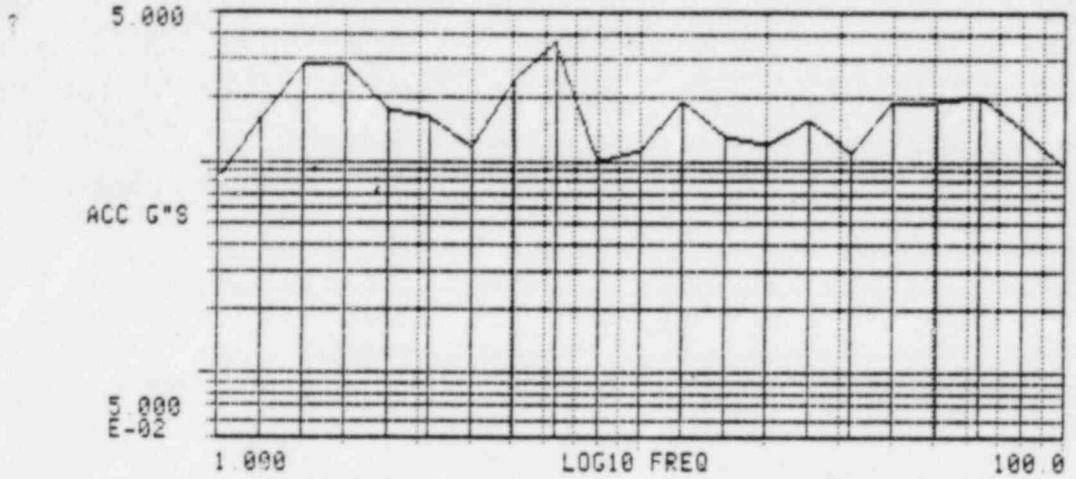
SHOCK RESPONSE
CG&E UPSET#6 TEST #11

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.79 | 5.01 | 3.01 | 25.12 | 2.23 |
| 1.26 | 0.93 | 6.31 | 4.46 | 31.62 | 1.88 |
| 1.58 | 1.69 | 7.94 | 1.44 | 39.81 | 1.29 |
| 2.00 | 2.14 | 10.00 | 1.23 | 50.12 | 0.92 |
| 2.51 | 2.34 | 12.59 | 1.80 | 63.10 | 1.04 |
| 3.16 | 1.66 | 15.85 | 1.17 | 79.43 | 0.90 |
| 3.98 | 0.92 | 19.95 | 1.52 | 100.00 | 0.74 |

ACCELEROMETER # X DAMPING 1
DIRECTION N-S LOCATION _____
TEST# 11 OBE ✓ SSE___ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY _____

CHANNEL - B ZPA= 0 62GPK




17-AUG-82
21:51:20

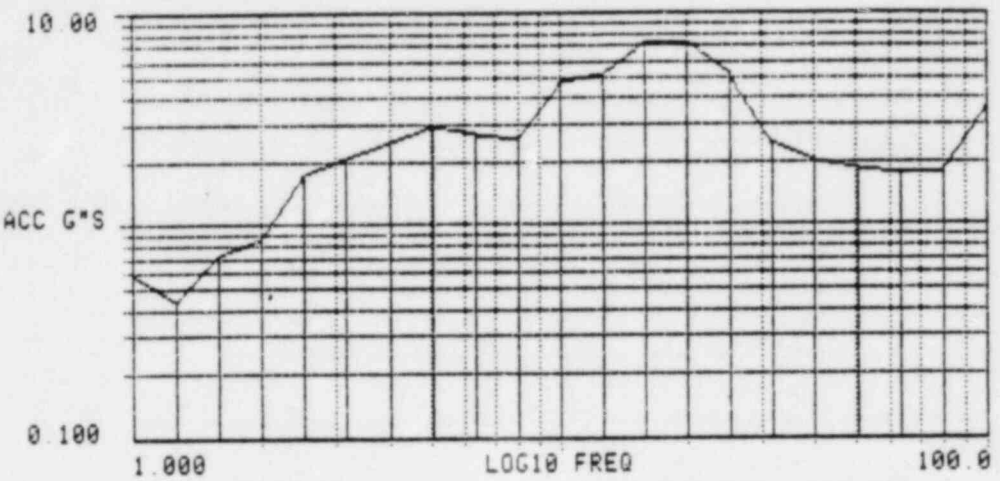
SHOCK RESPONSE
CG&E UPSET#6 TEST #11

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.82 | 5.01 | 2.38 | 25.12 | 1.55 |
| 1.26 | 1.59 | 6.31 | 3.59 | 31.62 | 1.08 |
| 1.58 | 2.90 | 7.94 | 0.99 | 39.81 | 1.90 |
| 2.00 | 2.77 | 10.00 | 1.11 | 50.12 | 1.87 |
| 2.51 | 1.76 | 12.59 | 1.88 | 63.10 | 2.02 |
| 3.16 | 1.59 | 15.85 | 1.28 | 79.43 | 1.40 |
| 3.98 | 1.13 | 19.95 | 1.17 | 100.00 | 0.93 |

ACCELEROMETER # Y DAMPING .1
DIRECTION E-W LOCATION _____
TEST# 11 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ✓ SURVEY _____

CHANNEL - C ZPA= 1.23GPK



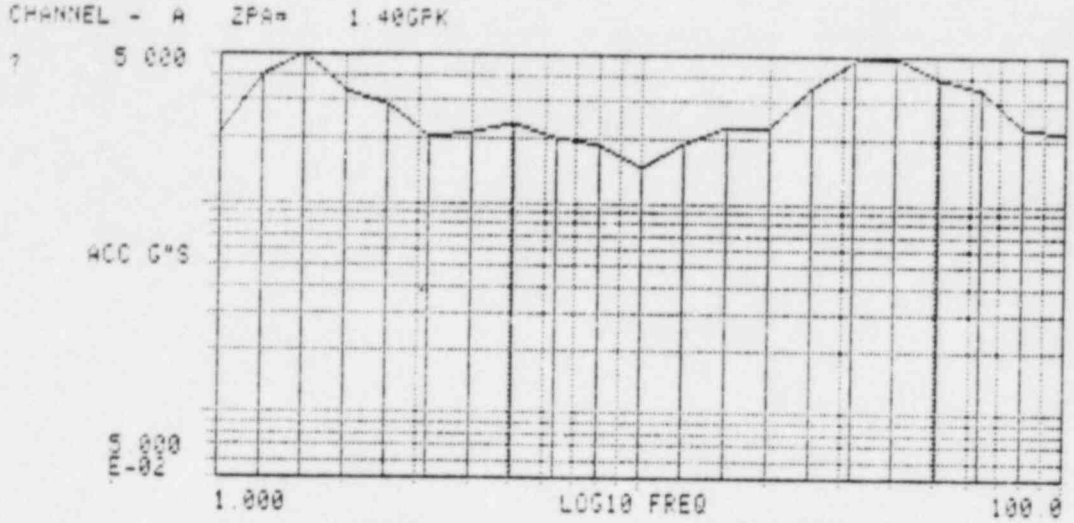

17-AUG-82
21:53:50

SHOCK RESPONSE
CG&E UPSET#6 TEST #11

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.59 | 5.01 | 2.93 | 25.12 | 5.13 |
| 1.26 | 0.44 | 6.31 | 2.69 | 31.62 | 2.41 |
| 1.58 | 0.71 | 7.94 | 2.53 | 39.81 | 1.97 |
| 2.00 | 0.85 | 10.00 | 4.61 | 50.12 | 1.84 |
| 2.51 | 1.69 | 12.59 | 5.10 | 63.10 | 1.73 |
| 3.16 | 2.06 | 15.85 | 7.15 | 79.43 | 1.77 |
| 3.98 | 2.41 | 19.95 | 7.24 | 100.00 | 3.54 |

ACCELEROMETER # Z DAMPING 1
DIRECTION Vertical LOCATION _____
TEST# 11 OBE ✓ BSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓_____ SURVEY _____



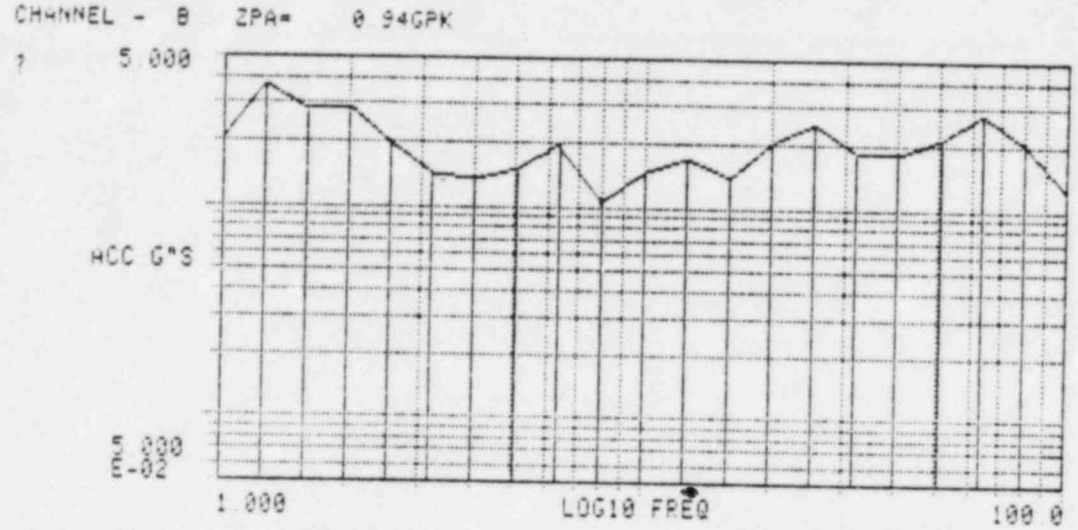

27-AUG-82
12:24:30

SHOCK RESPONSE
CG&E EMERGENCY#2 TEST # 13

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

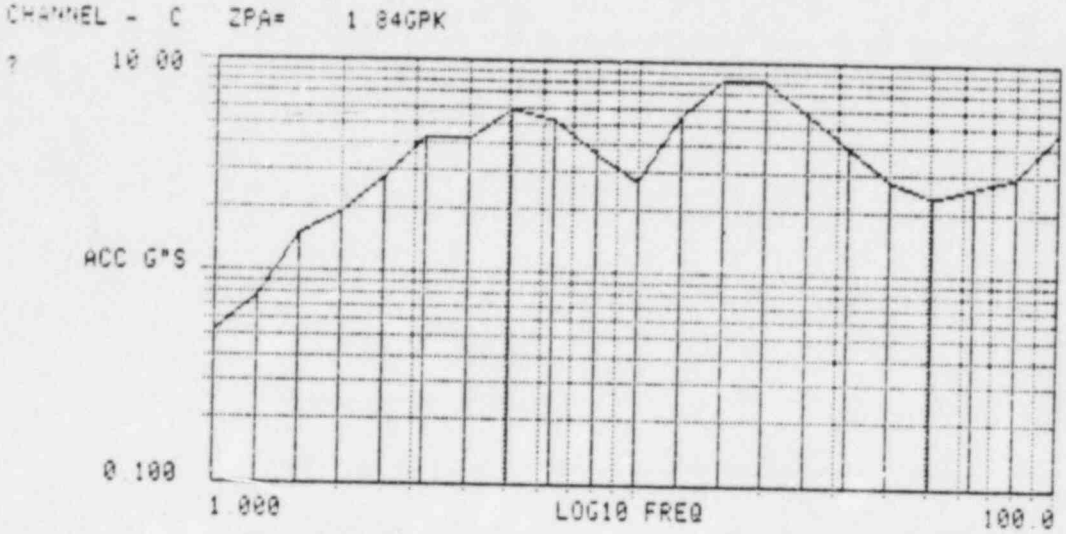
| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 2.05 | 5.01 | 2.33 | 25.12 | 3.54 |
| 1.26 | 3.92 | 6.31 | 2.02 | 31.62 | 4.75 |
| 1.58 | 5.02 | 7.94 | 1.81 | 39.81 | 4.79 |
| 2.00 | 3.35 | 10.00 | 1.45 | 50.12 | 3.87 |
| 2.51 | 2.82 | 12.59 | 1.88 | 63.10 | 3.41 |
| 3.16 | 2.01 | 16.85 | 2.23 | 79.43 | 2.28 |
| 3.98 | 2.11 | 19.95 | 2.26 | 100.00 | 2.15 |

ACCELEROMETER # X DAMPING 2
DIRECTION N-S LOCATION _____
TEST# 13 OBE___ SSE ✓ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ✓ SURVEY _____



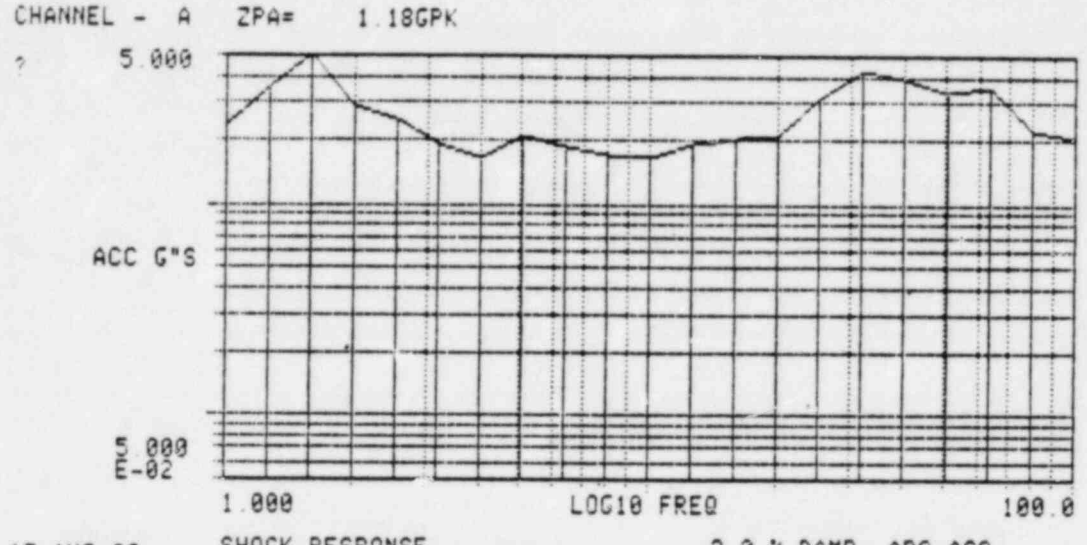

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 2.05 | 5.01 | 1.49 | 25.12 | 2.46 |
| 1.26 | 3.66 | 6.31 | 1.96 | 31.62 | 1.83 |
| 1.58 | 2.76 | 7.94 | 1.05 | 39.81 | 1.76 |
| 2.00 | 2.90 | 10.00 | 1.48 | 50.12 | 2.13 |
| 2.51 | 1.93 | 12.59 | 1.70 | 63.10 | 2.81 |
| 3.16 | 1.40 | 15.85 | 1.37 | 79.43 | 3.00 |
| 3.98 | 1.34 | 19.95 | 2.03 | 100.00 | 1.24 |

ACCELEROMETER # Y DAMPING 2
DIRECTION E-W LOCATION _____
TEST# 13 OBE___ SSE✓ FRAG%___
RLAY___ N-S___ E-W___ TRIAX✓
CONTROL ___✓___ SURVEY _____




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.52 | 5.01 | 5.69 | 25.12 | 5.62 |
| 1.26 | 0.75 | 6.31 | 5.16 | 31.62 | 3.94 |
| 1.58 | 1.48 | 7.94 | 3.56 | 39.81 | 2.71 |
| 2.00 | 1.88 | 10.00 | 2.67 | 50.12 | 2.32 |
| 2.51 | 2.71 | 12.59 | 5.49 | 63.10 | 2.61 |
| 3.16 | 4.20 | 15.85 | 8.03 | 79.43 | 2.87 |
| 3.98 | 4.07 | 19.95 | 7.87 | 100.00 | 4.70 |

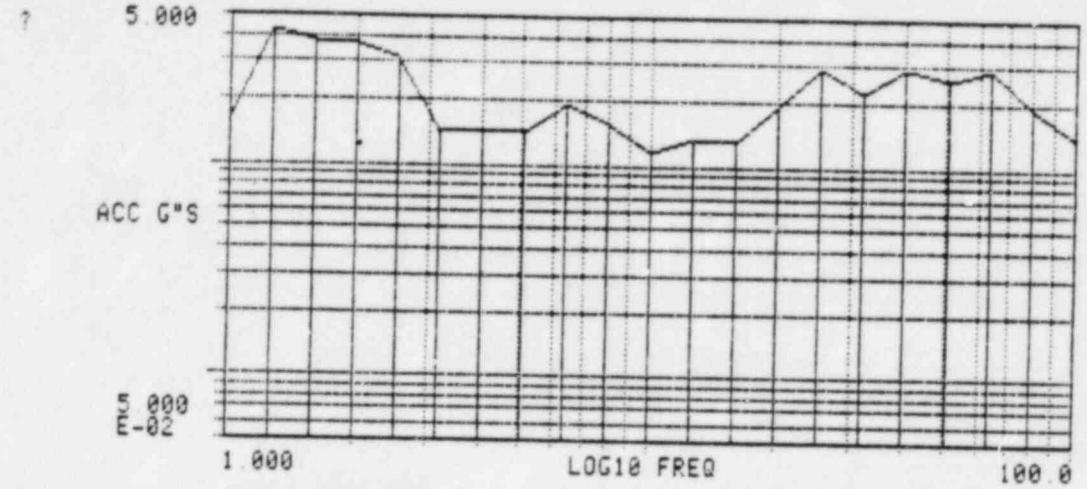
ACCELEROMETER # Z DAMPING 2
DIRECTION VERT. LOCATION _____
TEST# 13 OBE ___ SSE ✓ FRAG% ___
BIAX ___ N-S ___ E-W ___ TRIAX ✓
CONTROL ___ ✓ ___ SURVEY _____




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 2.34 | 5.01 | 2.08 | 25.12 | 3.12 |
| 1.26 | 3.56 | 6.31 | 1.82 | 31.62 | 4.18 |
| 1.58 | 4.94 | 7.94 | 1.69 | 39.81 | 3.83 |
| 2.00 | 2.86 | 10.00 | 1.64 | 50.12 | 3.28 |
| 2.51 | 2.45 | 12.59 | 1.91 | 63.10 | 3.51 |
| 3.16 | 1.91 | 15.85 | 2.02 | 79.43 | 2.22 |
| 3.98 | 1.62 | 19.95 | 2.10 | 100.00 | 2.03 |

ACCELEROMETER # X DAMPING 2
DIRECTION N-S LOCATION _____
TEST# 14 OBE___ BSE ✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY _____

CHANNEL - B ZPHW 0.93GPK




17-AUG-82
23:02:40

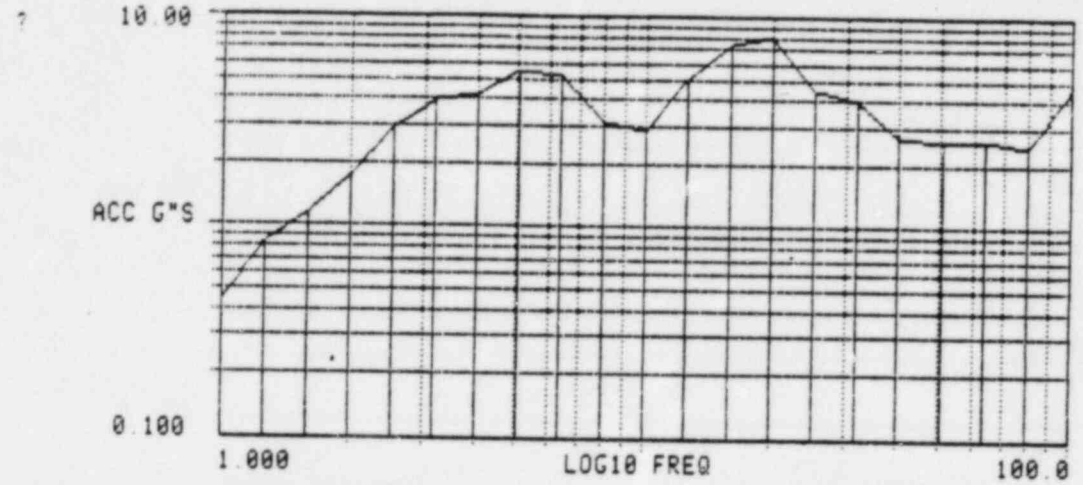
SHOCK RESPONSE
CG&E EMERGENCY#3 TEST #14

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.57 | 5.01 | 1.41 | 25.12 | 2.87 |
| 1.26 | 4.18 | 6.31 | 1.90 | 31.62 | 2.20 |
| 1.58 | 3.74 | 7.94 | 1.56 | 39.81 | 2.84 |
| 2.00 | 3.63 | 10.00 | 1.16 | 50.12 | 2.52 |
| 2.51 | 3.16 | 12.59 | 1.33 | 63.10 | 2.85 |
| 3.16 | 1.46 | 15.85 | 1.31 | 79.43 | 1.92 |
| 3.98 | 1.48 | 19.95 | 1.90 | 100.00 | 1.36 |

ACCELEROMETER A Y DAMPING 2
DIRECTION E-W LOCATION _____
TEST# 14 OBE___ SSE✓ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX✓
CONTROL ✓ SURVEY _____

CHANNEL - C ZPA= 2.04GPK



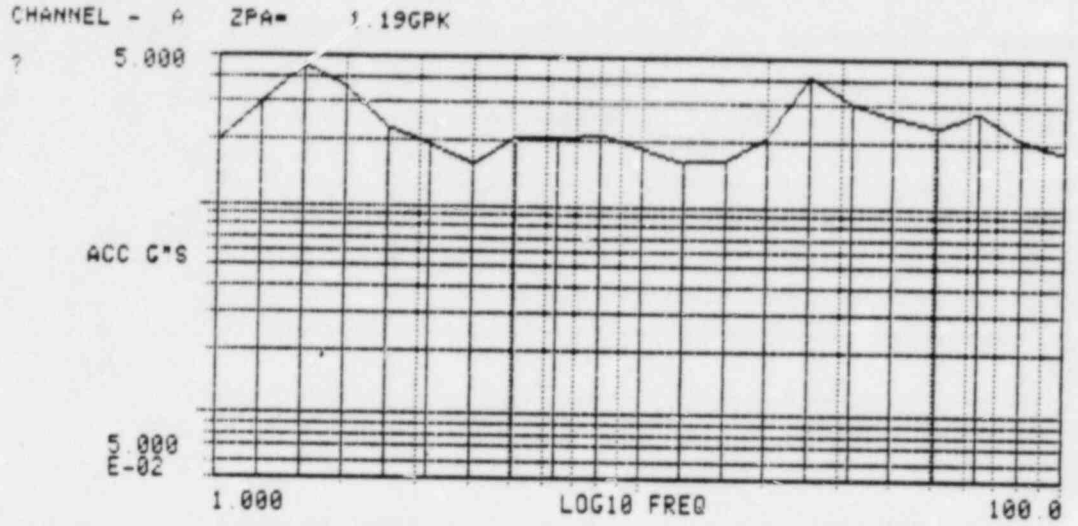

17-AUG-82
23:08:40

SHOCK RESPONSE
CG&E EMERGENCY#3 TEST #14

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.44 | 5.01 | 5.47 | 25.12 | 4.36 |
| 1.26 | 0.81 | 6.31 | 5.02 | 31.62 | 3.85 |
| 1.58 | 1.14 | 7.94 | 3.08 | 39.81 | 2.64 |
| 2.00 | 1.70 | 10.00 | 2.82 | 50.12 | 2.52 |
| 2.51 | 2.90 | 12.59 | 4.98 | 63.10 | 2.58 |
| 3.16 | 3.87 | 15.85 | 7.15 | 79.43 | 2.36 |
| 3.98 | 4.09 | 19.95 | 7.82 | 100.00 | 4.51 |

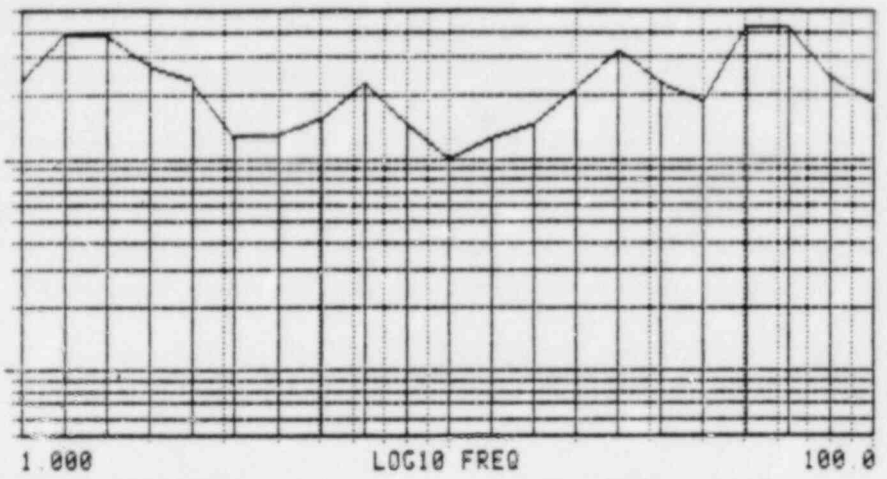
ACCELEROMETER # 3 DAMPING 2
DIRECTION Vertical LOCATION _____
TEST# 14 OBE___ SSE✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX✓
CONTROL ✓ SURVEY _____




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.95 | 5.01 | 2.04 | 25.12 | 4.08 |
| 1.26 | 2.93 | 6.31 | 2.02 | 31.62 | 3.01 |
| 1.58 | 4.40 | 7.94 | 2.12 | 39.81 | 2.65 |
| 2.00 | 3.51 | 10.00 | 1.86 | 50.12 | 2.29 |
| 2.51 | 2.27 | 12.59 | 1.61 | 63.10 | 2.79 |
| 3.16 | 1.89 | 15.85 | 1.62 | 79.43 | 2.05 |
| 3.98 | 1.53 | 19.95 | 2.09 | 100.00 | 1.79 |

ACCELEROMETER 1 X DAMPING 2
DIRECTION N-S LOCATION _____
TEST# 15 OBE___ SSE✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX✓__
CONTROL ____✓____ SURVEY _____

CHANNEL - B ZPA= 1.05GPK




17-AUG-82
23:24:50

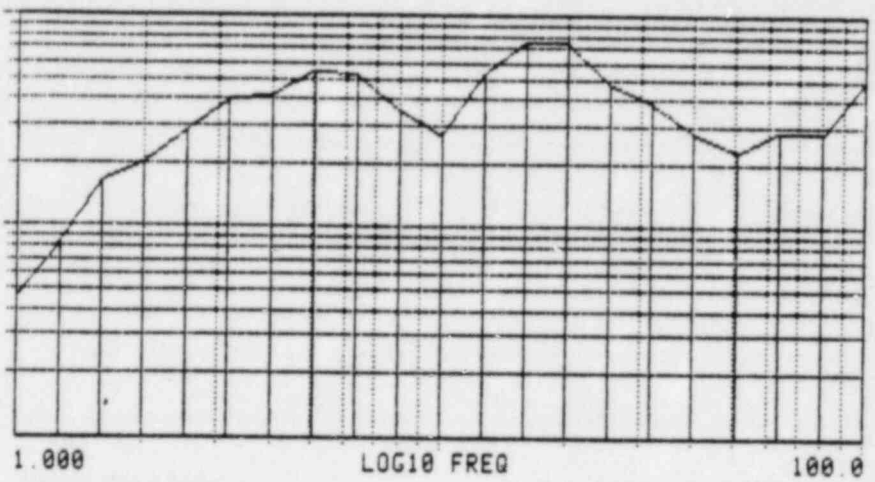
SHOCK RESPONSE
CG&E EMERGENCY#4 TEST #15

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 2.32 | 5.01 | 1.52 | 25.12 | 3.18 |
| 1.26 | 3.90 | 6.31 | 2.23 | 31.62 | 2.24 |
| 1.58 | 3.70 | 7.94 | 1.45 | 39.81 | 1.86 |
| 2.00 | 2.73 | 10.00 | 0.99 | 50.12 | 4.20 |
| 2.51 | 2.30 | 12.59 | 1.27 | 63.10 | 4.07 |
| 3.16 | 1.26 | 15.85 | 1.45 | 79.43 | 2.41 |
| 3.98 | 1.31 | 19.95 | 2.12 | 100.00 | 1.85 |

ACCELEROMETER # Y DAMPING 2
DIRECTION E-W LOCATION _____
TEST# 15 OBE___ SSE ✓ FRAG%___
RTAX____ N-S____ E-W____ TRIAX ✓
CONTROL ___ ✓ ____ SURVEY _____

CHANNEL - C ZPA= 1.84GPK




17-AUG-82
23:27:10

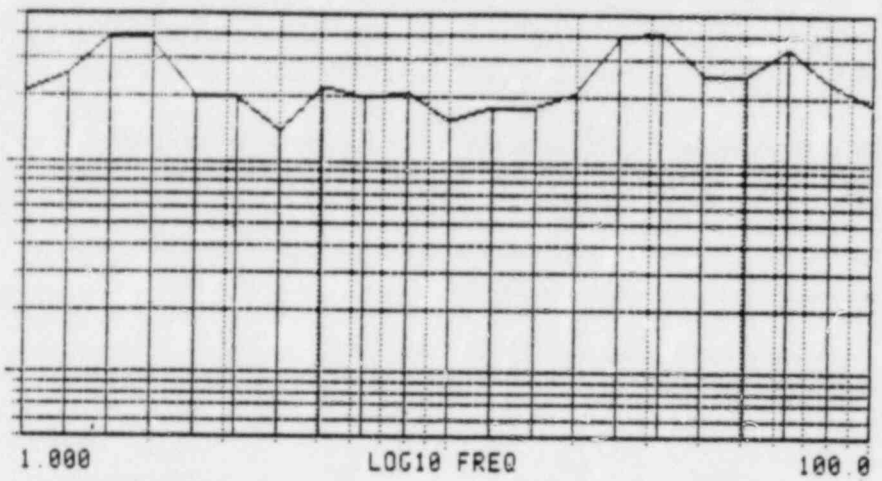
SHOCK RESPONSE
CG&E EMERGENCY#4 TEST #15

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.44 | 5.01 | 5.46 | 25.12 | 4.61 |
| 1.26 | 0.83 | 6.31 | 5.13 | 31.62 | 3.81 |
| 1.58 | 1.61 | 7.94 | 3.44 | 39.81 | 2.73 |
| 2.00 | 1.98 | 10.00 | 2.65 | 50.12 | 2.24 |
| 2.51 | 2.82 | 12.59 | 5.28 | 63.10 | 2.80 |
| 3.16 | 3.93 | 15.85 | 7.41 | 79.43 | 2.78 |
| 3.98 | 4.17 | 19.95 | 7.18 | 100.00 | 4.75 |

ACCELEROMETER # Z DAMPING 2
DIRECTION Vertical LOCATION _____
TEST# 15 OBE___ SSE ✓ FRAG%___
RTAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY _____

CHANNEL - A ZPA= 1.16GPK




17-AUG-82
23:39:40

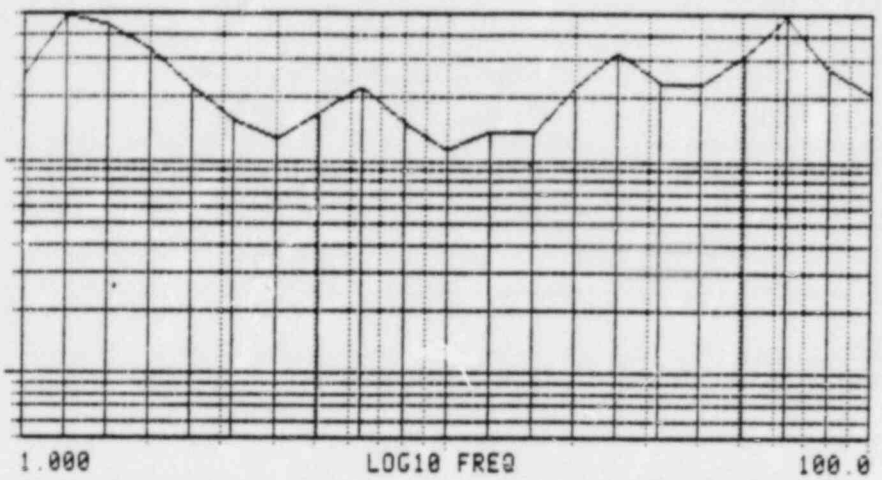
SHOCK RESPONSE
CG&E EMERGENCY#5 TEST #16

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 2.09 | 5.01 | 2.16 | 25.12 | 3.85 |
| 1.26 | 2.58 | 6.31 | 1.95 | 31.62 | 4.07 |
| 1.58 | 3.88 | 7.94 | 2.10 | 39.81 | 2.54 |
| 2.00 | 3.69 | 10.00 | 1.55 | 50.12 | 2.58 |
| 2.51 | 2.01 | 12.59 | 1.80 | 63.10 | 3.38 |
| 3.16 | 1.92 | 15.85 | 1.77 | 79.43 | 2.33 |
| 3.98 | 1.38 | 19.95 | 2.08 | 100.00 | 1.86 |

ACCELEROMETER # X DAMPING 2
DIRECTION N-S LOCATION _____
TEST # 16 OBE ___ SSE ✓ FRAG% ___
TRIAX ___ N-S ___ E-W ___ TRIAX ✓
CONTROL ✓ SURVEY _____

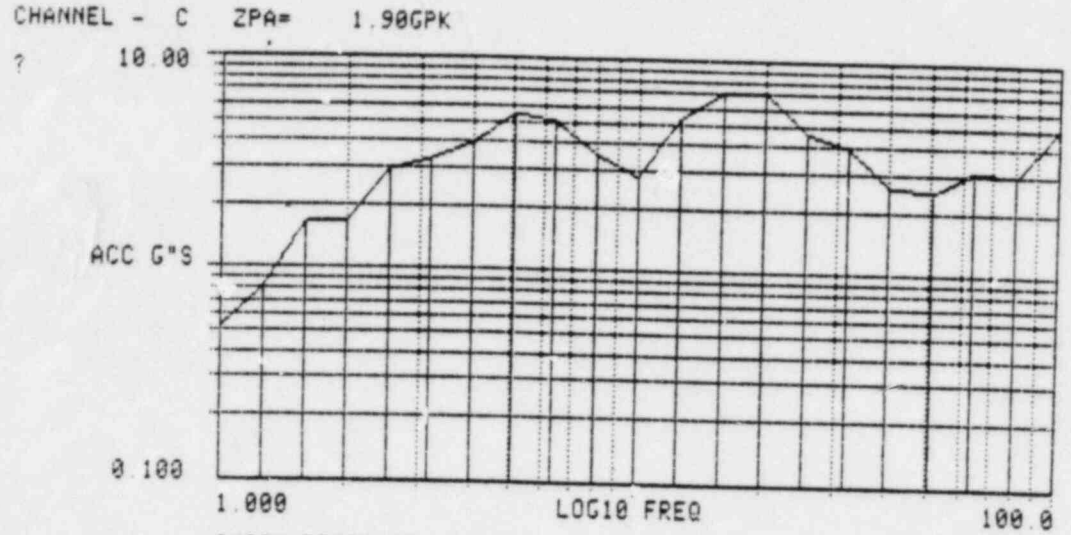
CHANNEL - B ZPA= 1.29GPK




17-AUG-82
23:42:30
SHOCK RESPONSE
CG&E EMERGENCY#5 TEST #16
2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 2.48 | 5.01 | 1.69 | 25.12 | 3.18 |
| 1.26 | 4.89 | 6.31 | 2.19 | 31.62 | 2.35 |
| 1.58 | 4.27 | 7.94 | 1.48 | 39.81 | 2.28 |
| 2.00 | 3.31 | 10.00 | 1.12 | 50.12 | 3.13 |
| 2.51 | 2.18 | 12.59 | 1.37 | 63.10 | 4.90 |
| 3.16 | 1.56 | 15.85 | 1.32 | 79.43 | 2.70 |
| 3.98 | 1.24 | 19.95 | 2.22 | 100.00 | 2.09 |

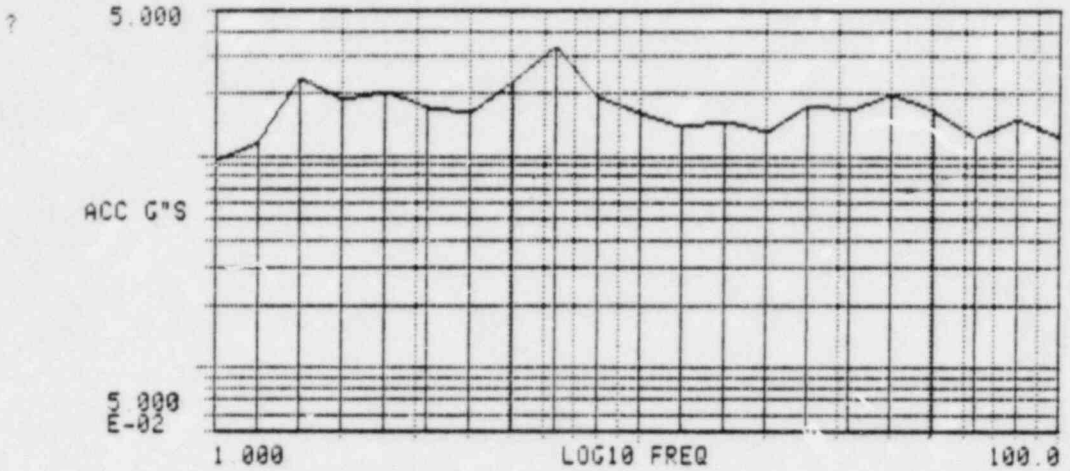
ACCELEROMETER # Y DAMPING 2
DIRECTION E-W LOCATION _____
TEST# 16 ORE___ SSE ✓ FRAG%___
RIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ✓ SURVEY _____




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.51 | 5.01 | 5.42 | 25.12 | 4.54 |
| 1.26 | 0.79 | 6.31 | 4.93 | 31.62 | 3.87 |
| 1.58 | 1.62 | 7.94 | 3.43 | 39.81 | 2.56 |
| 2.00 | 1.65 | 10.00 | 2.74 | 50.12 | 2.44 |
| 2.51 | 2.90 | 12.59 | 5.20 | 63.10 | 3.04 |
| 3.16 | 3.25 | 15.85 | 7.06 | 79.43 | 2.94 |
| 3.98 | 3.91 | 19.95 | 7.00 | 100.00 | 4.95 |

ACCELEROMETER # 2 DAMPING 2
DIRECTION Vertical LOCATION _____
TEST# 16 OBE___ SSE ✓ FRAG%___
PEAK___ N-S___ E-W___ TRIAX ✓
CONTROL ✓ SURVEY _____

CHANNEL - A ZPA= 1.00GPK




18-AUG-82
15:05:50

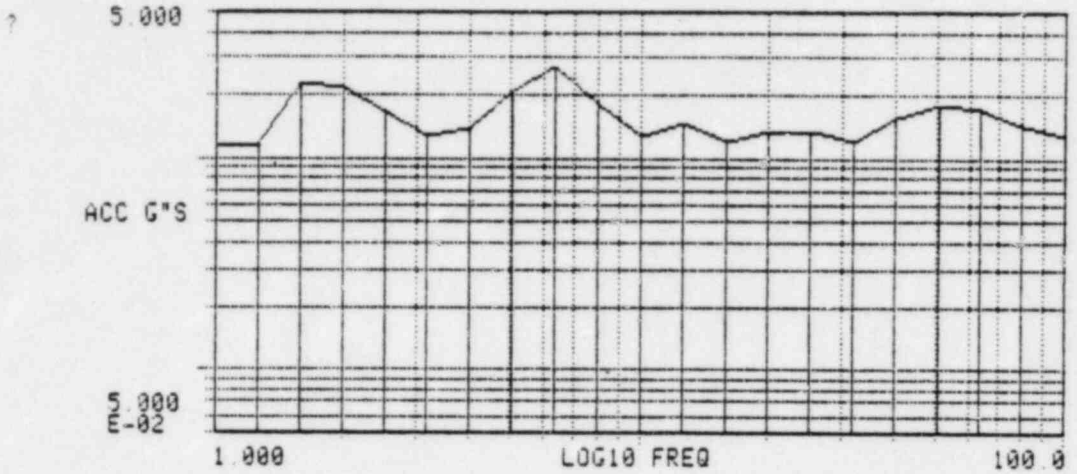
SHOCK RESPONSE
CG&E UPSET#4 TEST#9

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.93 | 5.01 | 2.28 | 25.12 | 1.73 |
| 1.26 | 1.16 | 6.31 | 3.30 | 31.62 | 1.65 |
| 1.58 | 2.36 | 7.94 | 1.88 | 39.81 | 1.97 |
| 2.00 | 1.82 | 10.00 | 1.60 | 50.12 | 1.63 |
| 2.51 | 2.01 | 12.59 | 1.39 | 63.10 | 1.23 |
| 3.16 | 1.66 | 15.85 | 1.46 | 79.43 | 1.49 |
| 3.98 | 1.59 | 19.95 | 1.28 | 100.00 | 1.22 |

ACCELEROMETER # X DAMPING 2
DIRECTION N-S LOCATION _____
TEST# 9 OBE ✓ SSE___ FREQ%___
RIAX____ N-S____ E-W____ TRIAX ✓
CONTROL ✓ SURVEY _____

CHANNEL - B ZPA= 0.95GPK




18-AUG-82
15:08:20

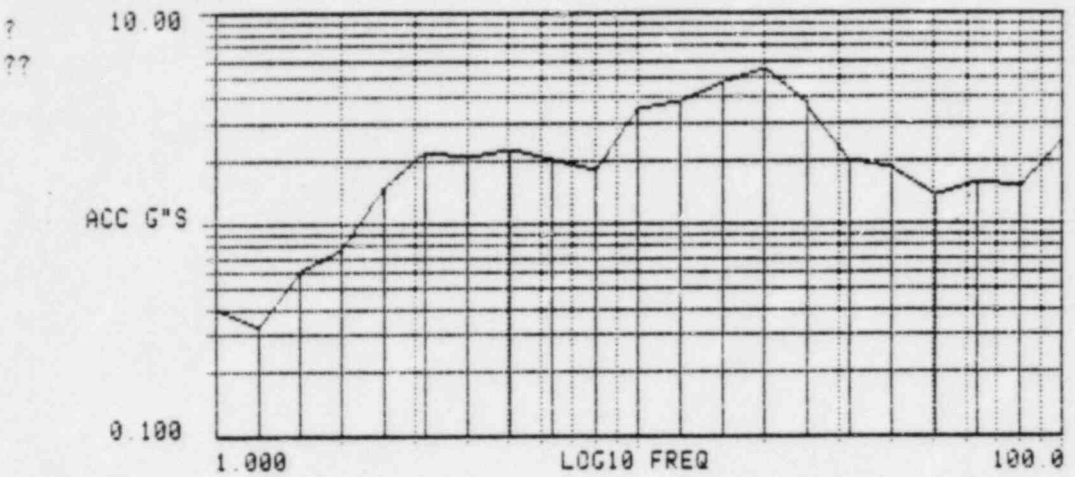
SHOCK RESPONSE
CG&E UPSET#4 TEST#9

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.11 | 5.01 | 2.09 | 25.12 | 1.35 |
| 1.26 | 1.15 | 6.31 | 2.70 | 31.62 | 1.19 |
| 1.58 | 2.25 | 7.94 | 1.79 | 39.81 | 1.56 |
| 2.00 | 2.11 | 10.00 | 1.25 | 50.12 | 1.80 |
| 2.51 | 1.61 | 12.59 | 1.46 | 63.10 | 1.69 |
| 3.16 | 1.26 | 15.85 | 1.18 | 79.43 | 1.41 |
| 3.98 | 1.38 | 19.95 | 1.33 | 100.00 | 1.26 |

ACCELEROMETER # Y DAMPING 2
DIRECTION E-W LOCATION _____
TEST# 9 OBE ✓ SSE___ FRAG%___
RIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY _____

CHANNEL - C ZPA= 1.19GPK




18-AUG-82
15:10:40

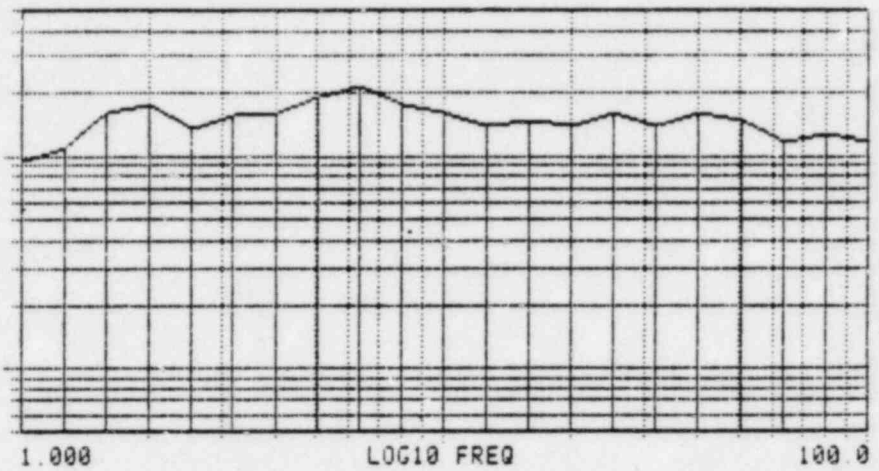
SHOCK RESPONSE
CG&E UPSET#4 TEST#9

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.39 | 5.01 | 2.22 | 25.12 | 3.69 |
| 1.26 | 0.32 | 6.31 | 1.99 | 31.62 | 1.97 |
| 1.58 | 0.60 | 7.94 | 1.77 | 39.81 | 1.81 |
| 2.00 | 0.75 | 10.00 | 3.49 | 50.12 | 1.38 |
| 2.51 | 1.50 | 12.59 | 3.75 | 63.10 | 1.57 |
| 3.16 | 2.18 | 15.85 | 4.57 | 79.43 | 1.47 |
| 3.98 | 2.08 | 19.95 | 5.35 | 100.00 | 2.47 |

ACCELEROMETER # 2 DAMPING 2
DIRECTION Vertical LOCATION _____
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY _____

CHANNEL - A ZPA= 1.00GPK




18-AUG-82
15:13:30

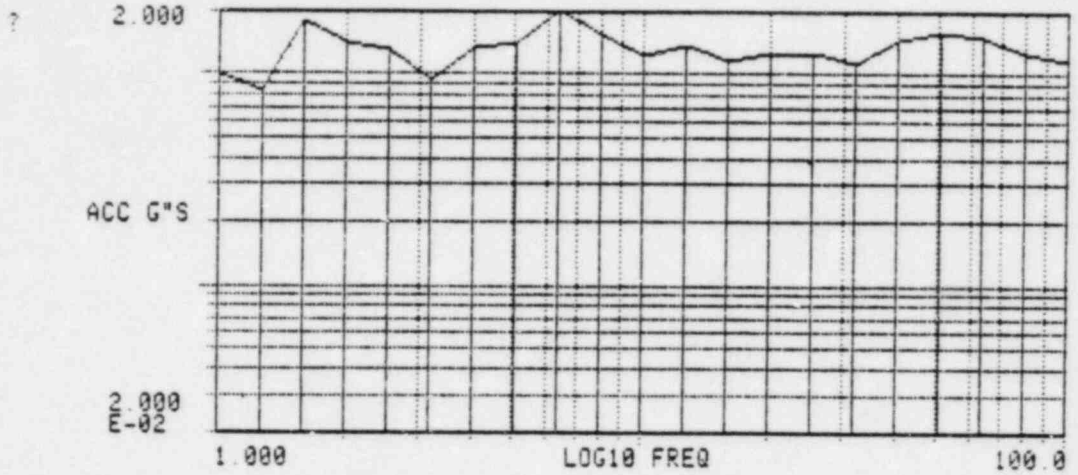
SHOCK RESPONSE
CG&E UPSET#4 TEST#9

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| | Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|---|
| | 1.00 | 0.95 | 5.01 | 1.88 | 25.12 | 1.57 |
| | 1.26 | 1.09 | 6.31 | 2.10 | 31.62 | 1.37 |
| | 1.58 | 1.57 | 7.94 | 1.75 | 39.81 | 1.59 |
| ? | 2.00 | 1.75 | 10.00 | 1.58 | 50.12 | 1.48 |
| ?? | 2.51 | 1.32 | 12.59 | 1.39 | 63.10 | 1.16 |
| | 3.16 | 1.56 | 15.85 | 1.45 | 79.43 | 1.25 |
| | 3.98 | 1.57 | 19.95 | 1.36 | 100.00 | 1.16 |

ACCELEROMETER # X DAMPING 5
DIRECTION N-S LOCATION _____
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY _____

CHANNEL - B ZPA= 0.35GPK




18-AUG-82
15:16:30

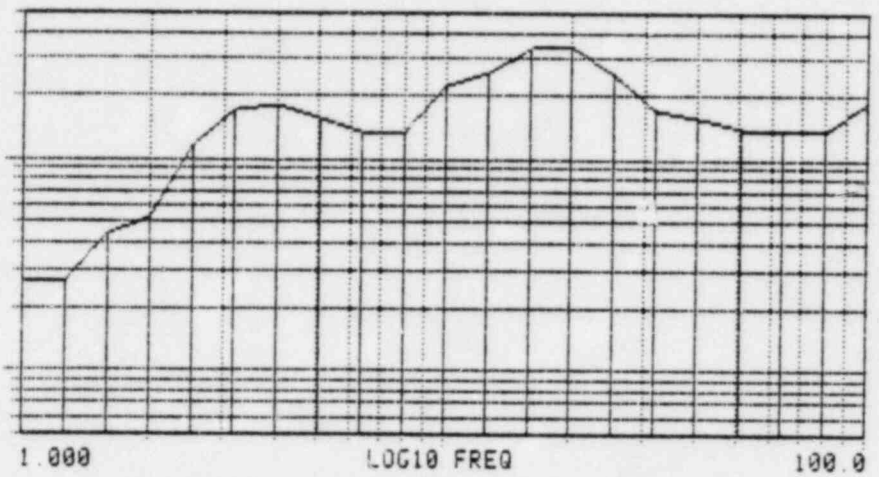
SHOCK RESPONSE
CG&E UPSET#4 TEST#9

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.99 | 5.01 | 1.40 | 25.12 | 1.24 |
| 1.26 | 0.84 | 6.31 | 2.00 | 31.62 | 1.11 |
| 1.58 | 1.76 | 7.94 | 1.55 | 39.81 | 1.45 |
| 2.00 | 1.42 | 10.00 | 1.22 | 50.12 | 1.57 |
| 2.51 | 1.28 | 12.59 | 1.37 | 63.10 | 1.49 |
| 3.16 | 0.94 | 15.85 | 1.13 | 79.43 | 1.27 |
| 3.98 | 1.32 | 19.95 | 1.26 | 100.00 | 1.16 |

ACCELEROMETER # Y DAMPING 5
DIRECTION E-W LOCATION _____
TEST# 9 OBE ✓ SSE___ FRAG%___
RTAY____ N-S____ E-W____ TRIAX ✓
CONTROL ___✓____ SURVEY _____

CHANNEL - C ZPA= 1.19GPK




18-AUG-82
15:18:40

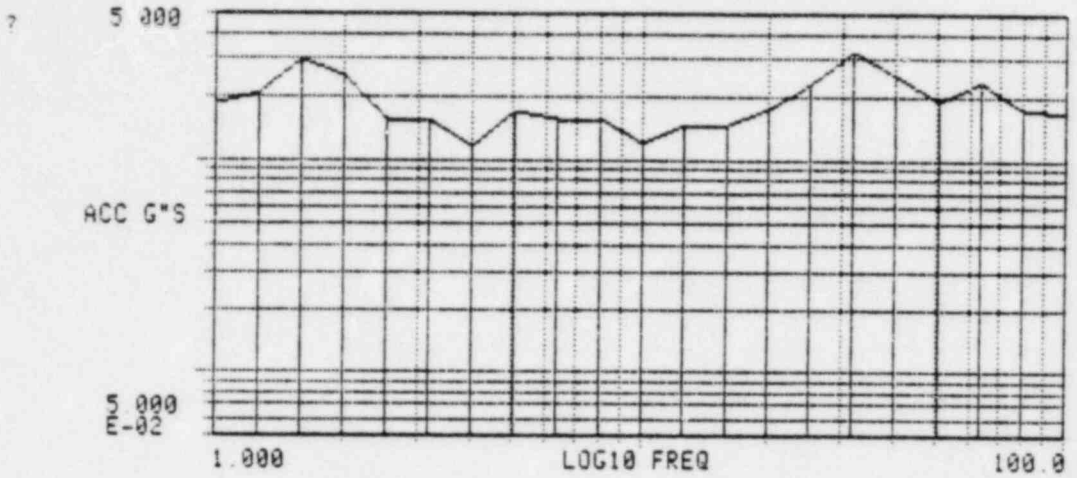
SHOCK RESPONSE
CG&E UPSET#4 TEST#9

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.27 | 5.01 | 1.52 | 25.12 | 2.44 |
| 1.26 | 0.27 | 6.31 | 1.33 | 31.62 | 1.69 |
| 1.58 | 0.43 | 7.94 | 1.33 | 39.81 | 1.52 |
| 2.00 | 0.53 | 10.00 | 2.17 | 50.12 | 1.38 |
| 2.51 | 1.16 | 12.59 | 2.57 | 63.10 | 1.37 |
| 3.16 | 1.67 | 15.85 | 3.29 | 79.43 | 1.34 |
| 3.98 | 1.77 | 19.95 | 3.39 | 100.00 | 1.83 |

ACCELEROMETER # Z DAMPING 5
DIRECTION Vertical LOCATION _____
TEST# 9 ORE ✓ SSE___ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___✓___ SURVEY _____

CHANNEL - A ZPA= 1.16GPK




18-AUG-82
15:22:00

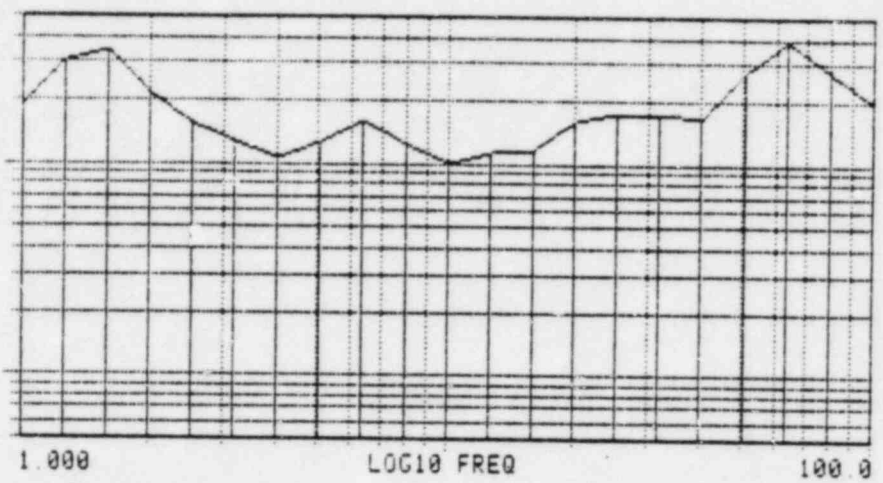
SHOCK RESPONSE
CG&E EMERGENCY#5 TEST #16

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.83 | 5.01 | 1.68 | 25.12 | 2.25 |
| 1.26 | 2.05 | 6.31 | 1.53 | 31.62 | 3.26 |
| 1.58 | 2.94 | 7.94 | 1.56 | 39.81 | 2.49 |
| 2.00 | 2.48 | 10.00 | 1.19 | 50.12 | 1.87 |
| 2.51 | 1.54 | 12.59 | 1.45 | 63.10 | 2.29 |
| 3.16 | 1.57 | 15.85 | 1.45 | 79.43 | 1.73 |
| 3.98 | 1.17 | 19.95 | 1.73 | 100.00 | 1.64 |

ACCELEROMETER # X DAMPING 5
DIRECTION N-S LOCATION _____
TEST# 16 OBE___ SSE ✓ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___ ✓ ___ SURVEY _____

CHANNEL - 8 ZPA= 1.29GPK



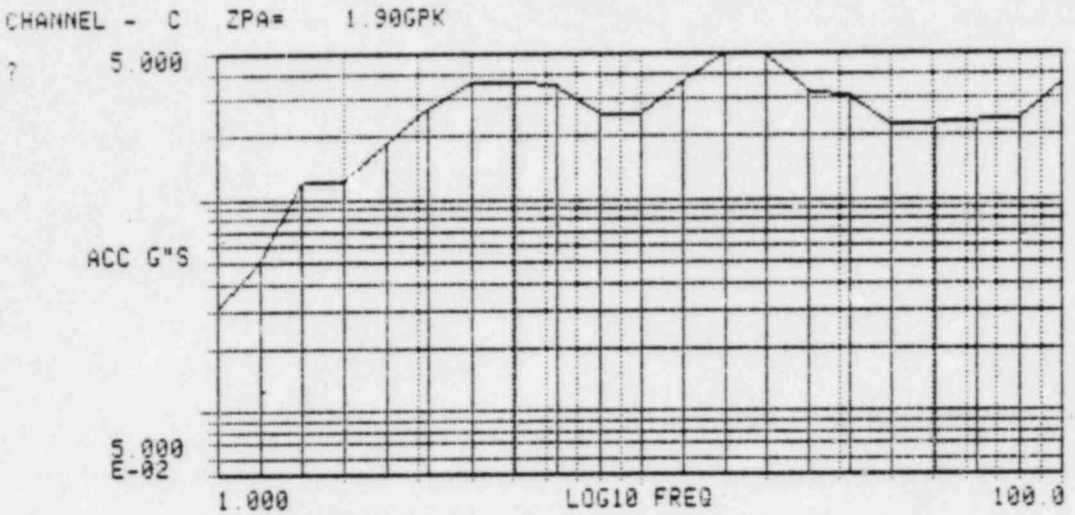

18-AUG-82
15:26:40

SHOCK RESPONSE
CG&E EMERGENCY#5 TEST #16

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.89 | 5.01 | 1.24 | 25.12 | 1.74 |
| 1.26 | 2.99 | 6.31 | 1.60 | 31.62 | 1.76 |
| 1.58 | 3.46 | 7.94 | 1.24 | 39.81 | 1.63 |
| 2.00 | 2.10 | 10.00 | 0.99 | 50.12 | 2.71 |
| 2.51 | 1.53 | 12.59 | 1.11 | 63.10 | 3.87 |
| 3.16 | 1.26 | 15.85 | 1.16 | 79.43 | 2.66 |
| 3.98 | 1.06 | 19.95 | 1.59 | 100.00 | 1.97 |

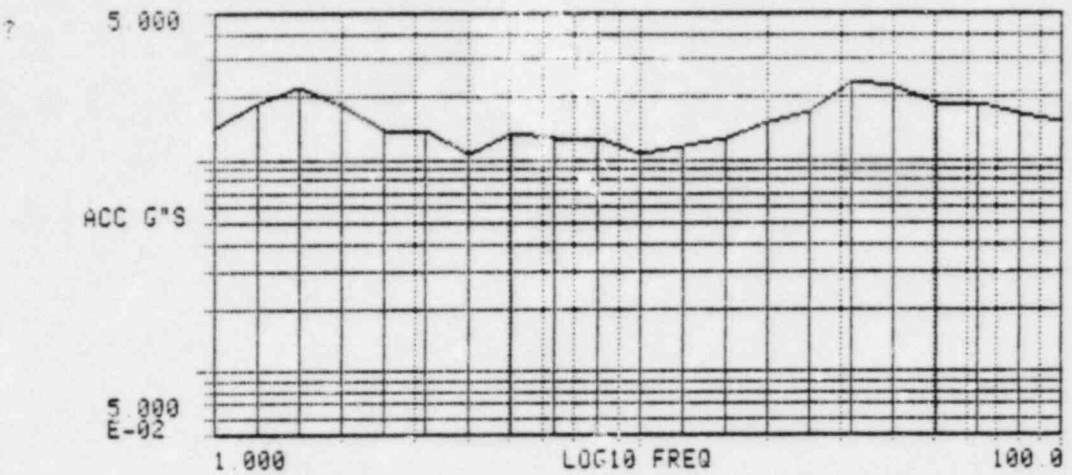
ACCELEROMETER # Y DAMPING 5
DIRECTION E-W LOCATION _____
TEST# 16 OBE___ SSE✓ FRAC%___
MAX___ N-S___ E-W___ TRIAX✓
CONTROL ✓ SURVEY _____




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.30 | 5.01 | 3.60 | 25.12 | 3.20 |
| 1.26 | 0.50 | 6.31 | 3.42 | 31.62 | 2.99 |
| 1.58 | 1.17 | 7.94 | 2.55 | 39.81 | 2.22 |
| 2.00 | 1.22 | 10.00 | 2.53 | 50.12 | 2.27 |
| 2.51 | 1.86 | 12.59 | 3.67 | 63.10 | 2.33 |
| 3.16 | 2.72 | 15.85 | 5.00 | 79.43 | 2.39 |
| 3.98 | 3.58 | 19.95 | 4.80 | 100.00 | 3.50 |

ACCELEROMETER # 2 DAMPING 5
DIRECTION Vertical LOCATION _____
TEST# 16 OBE___ SSE ✓ FRAG%___
RTAX___ N-S___ E-W___ TRIAX___
CONTROL ___✓_____ SURVEY _____

CHANNEL - A ZPA= 1.16GPK




18-AUG-82
15:32:00

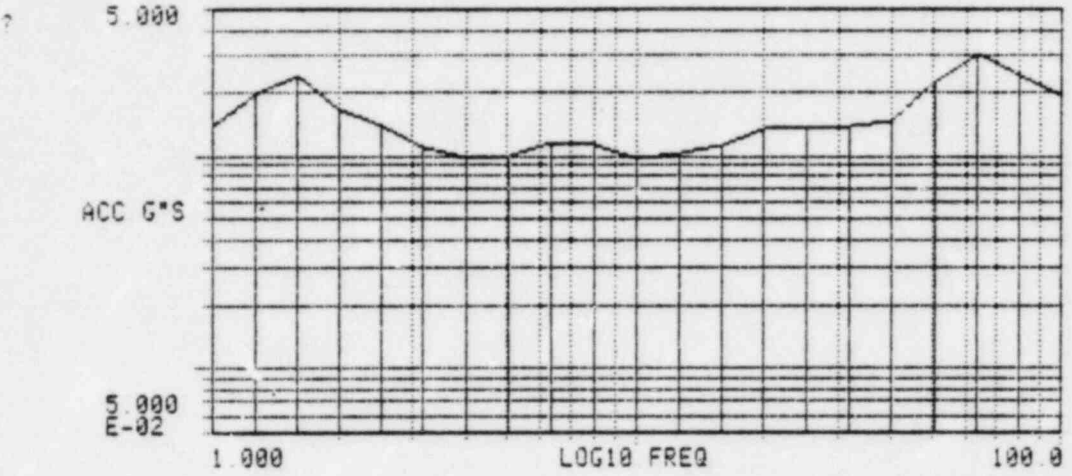
SHOCK RESPONSE
CG&E EMERGENCY#5 TEST #16

10.0% DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.42 | 5.01 | 1.32 | 25.12 | 1.70 |
| 1.26 | 1.85 | 6.31 | 1.26 | 31.62 | 2.36 |
| 1.58 | 2.22 | 7.94 | 1.25 | 39.81 | 2.22 |
| 2.00 | 1.78 | 10.00 | 1.04 | 50.12 | 1.86 |
| 2.51 | 1.36 | 12.59 | 1.13 | 63.10 | 1.84 |
| 3.16 | 1.36 | 15.85 | 1.25 | 79.43 | 1.63 |
| 3.98 | 1.05 | 19.95 | 1.51 | 100.00 | 1.50 |

ACCELEROMETER # X DAMPING 10
DIRECTION N-S LOCATION _____
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL ___✓_____ SURVEY _____

CHANNEL - B ZPA= 1.29GPK




18-AUG-82
15:34:00

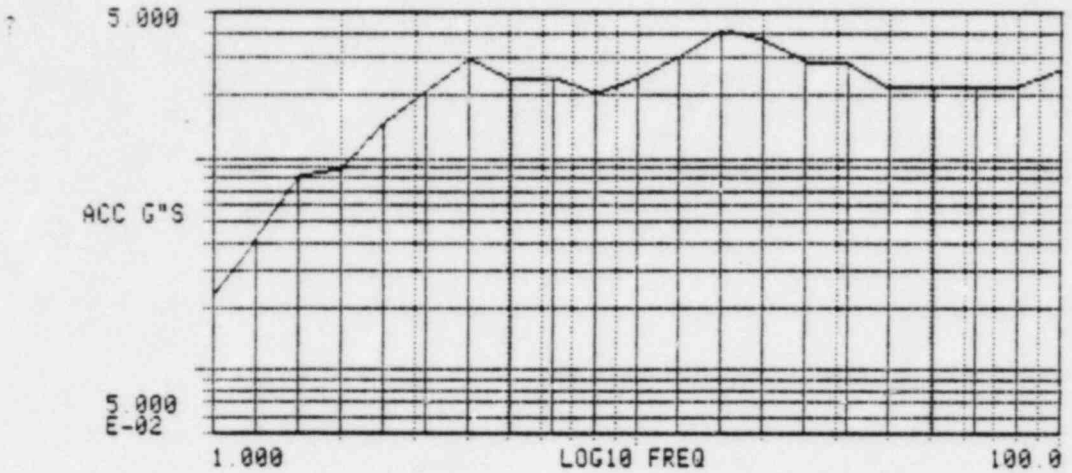
SHOCK RESPONSE
CG&E EMERGENCY#5 TEST #16

10.0% DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.36 | 5.01 | 0.98 | 25.12 | 1.35 |
| 1.26 | 1.93 | 6.31 | 1.14 | 31.62 | 1.38 |
| 1.58 | 2.39 | 7.94 | 1.10 | 39.81 | 1.43 |
| 2.00 | 1.63 | 10.00 | 0.98 | 50.12 | 2.25 |
| 2.51 | 1.37 | 12.59 | 1.03 | 63.10 | 3.07 |
| 3.16 | 1.10 | 15.85 | 1.11 | 79.43 | 2.40 |
| 3.98 | 0.97 | 19.95 | 1.33 | 100.00 | 1.87 |

ACCELEROMETER # X DAMPING 10
DIRECTION E-W LOCATION _____
TEST# 16 OBE___ BSE ✓ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL ___ ✓ ___ SURVEY _____

CHANNEL - C ZPA= 1.90GPK




18-AUG-82
15:54:30

SHOCK RESPONSE
CG&E EMERGENCY#5 TEST #16

10.0% DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.22 | 5.01 | 2.35 | 25.12 | 2.89 |
| 1.26 | 0.41 | 6.31 | 2.38 | 31.62 | 2.76 |
| 1.58 | 0.82 | 7.94 | 2.02 | 39.81 | 2.11 |
| 2.00 | 0.88 | 10.00 | 2.38 | 50.12 | 2.18 |
| 2.51 | 1.46 | 12.59 | 3.07 | 63.10 | 2.19 |
| 3.16 | 2.09 | 15.85 | 4.02 | 79.43 | 2.18 |
| 3.98 | 2.98 | 19.95 | 3.63 | 100.00 | 2.62 |

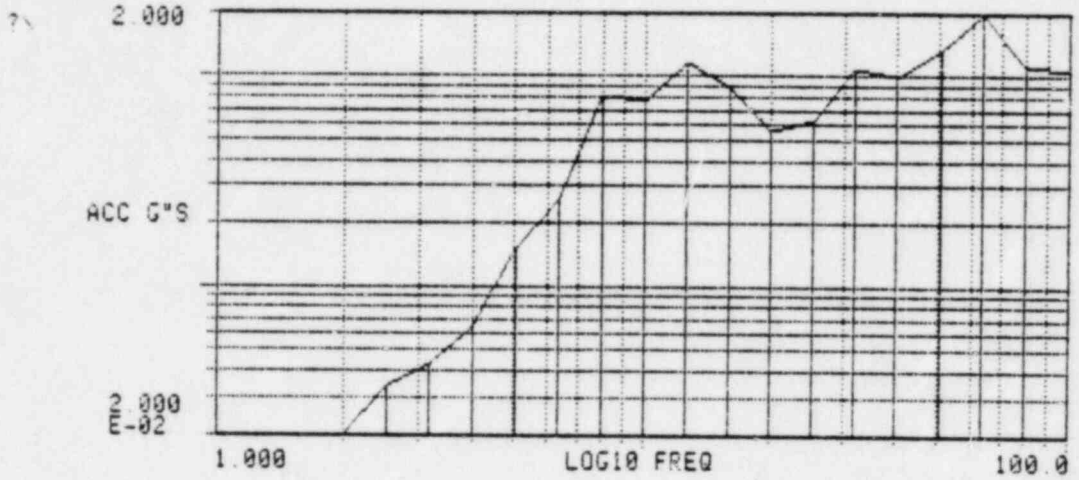
ACCELEROMETER # 2 DAMPING 10
DIRECTION Vertical LOCATION _____
TEST# 16 OBE___ SSE✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX✓
CONTROL ___✓_____ SURVEY _____

## VI.2 Survey Accelerometers

The TRS for the survey accelerometers are presented as follows:

| Test | Description | Pages |
|---|---|---|
| 4 | SRV – 2% | 111 – 119 |
| 5 | SRV plus LOCA – 2% | 120 – 128 |
| 9 | Upset – 1% | 129 – 137 |
| 9 | Upset – 2% | 138 – 146 |
| 9 | Upset – 5% | 147 – 155 |
| 16 | Emergency – 2% | 156 – 164 |
| 16 | Emergency – 5% | 165 – 173 |
| 16 | Emergency – 10% | 174 – 182 |

CHANNEL - A ZPA= 0.34GPK



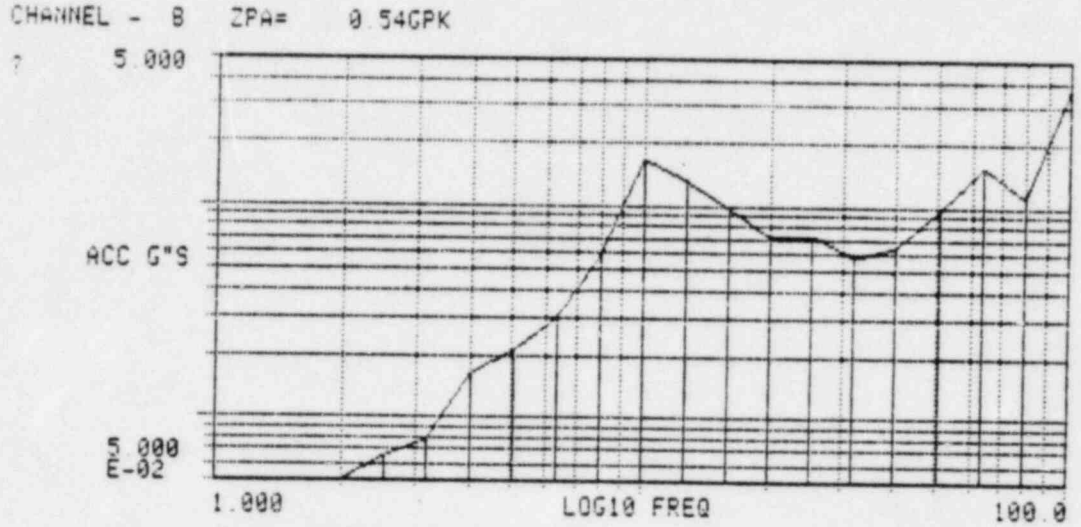

19-AUG-82
09:07:00

SHOCK RESPONSE
CG&E SRV SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.01 | 5.01 | 0.15 | 25.12 | 0.61 |
| 1.26 | 0.01 | 6.31 | 0.25 | 31.62 | 1.08 |
| 1.58 | 0.01 | 7.94 | 0.80 | 39.81 | 0.98 |
| 2.00 | 0.02 | 10.00 | 0.75 | 50.12 | 1.33 |
| 2.51 | 0.03 | 12.59 | 1.15 | 63.10 | 1.93 |
| 3.16 | 0.04 | 15.85 | 0.87 | 79.43 | 1.11 |
| 3.98 | 0.07 | 19.95 | 0.54 | 100.00 | 1.04 |

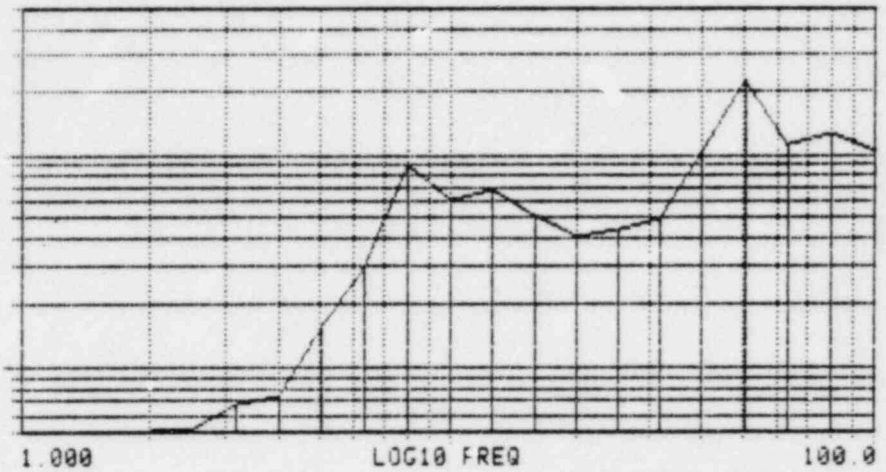
ACCELEROMETER # 1X DAMPING 2
DIRECTION N-S LOCATION 1
TEST # 4 OBE___ SSE___ FRAG%___
MAX____ N-S____ E-W____ TRIAX ✓
CONTROL _____ SURVEY ✓




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.03 | 5.01 | 0.21 | 25.12 | 0.73 |
| 1.26 | 0.03 | 6.31 | 0.30 | 31.62 | 0.57 |
| 1.58 | 0.03 | 7.94 | 0.59 | 39.81 | 0.65 |
| 2.00 | 0.03 | 10.00 | 1.65 | 50.12 | 0.97 |
| 2.51 | 0.07 | 12.59 | 1.31 | 63.10 | 1.53 |
| 3.16 | 0.08 | 15.85 | 0.95 | 79.43 | 1.08 |
| 3.98 | 0.16 | 19.95 | 0.69 | 100.00 | 3.56 |

ACCELEROMETER # 2Y DAMPING 2
DIRECTION E-W LOCATION 1
TEST# 4 OBE___ SSE___ FRAG%___
RTAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 0.29GPK




19-AUG-82
09:17:30

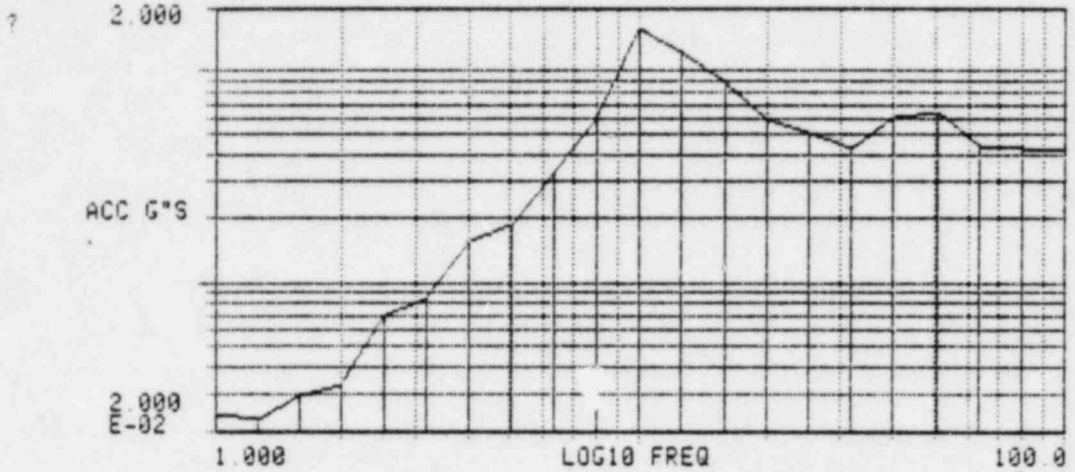
SHOCK RESPONSE
CG&E SRV SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.04 | 5.01 | 0.15 | 25.12 | 0.43 |
| 1.26 | 0.04 | 6.31 | 0.29 | 31.62 | 0.48 |
| 1.58 | 0.04 | 7.94 | 0.89 | 39.81 | 1.02 |
| 2.00 | 0.05 | 10.00 | 0.60 | 50.12 | 2.28 |
| 2.51 | 0.05 | 12.59 | 0.68 | 63.10 | 1.13 |
| 3.16 | 0.07 | 15.85 | 0.50 | 79.43 | 1.25 |
| 3.98 | 0.07 | 19.95 | 0.40 | 100.00 | 1.04 |

ACCELEROMETER # 4X DAMPING 2
DIRECTION N-S LOCATION 2
TEST# 4 OBE___ BSE___ FRAG%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 0.25GPK




19-AUG-82
09:27:20

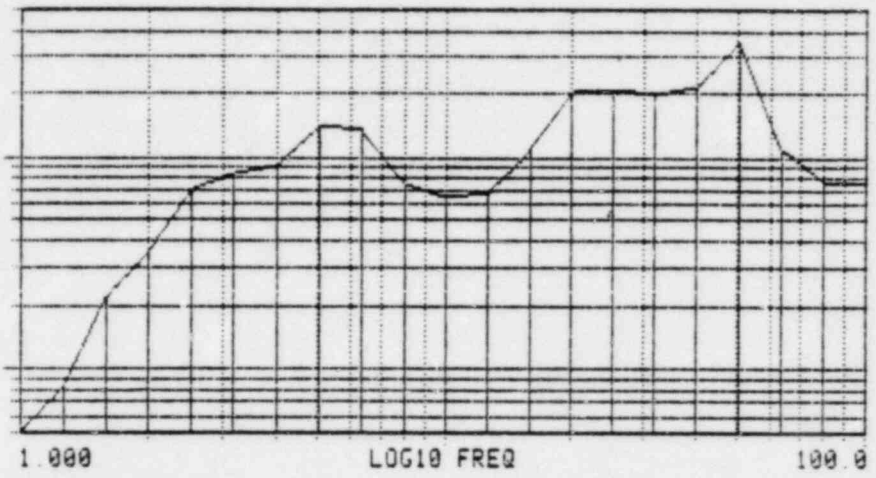
SHOCK RESPONSE
CG&E SRV SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.02 | 5.01 | 0.18 | 25.12 | 0.50 |
| 1.26 | 0.02 | 6.31 | 0.32 | 31.62 | 0.43 |
| 1.58 | 0.03 | 7.94 | 0.60 | 39.81 | 0.60 |
| 2.00 | 0.03 | 10.00 | 1.57 | 50.12 | 0.63 |
| 2.51 | 0.07 | 12.59 | 1.23 | 63.10 | 0.44 |
| 3.16 | 0.08 | 15.85 | 0.88 | 79.43 | 0.43 |
| 3.98 | 0.16 | 19.95 | 0.57 | 100.00 | 0.42 |

ACCELEROMETER # 5Y DAMPING 2
DIRECTION E-W LOCATION 2
TEST# 4 OBE___ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 0.53GPK



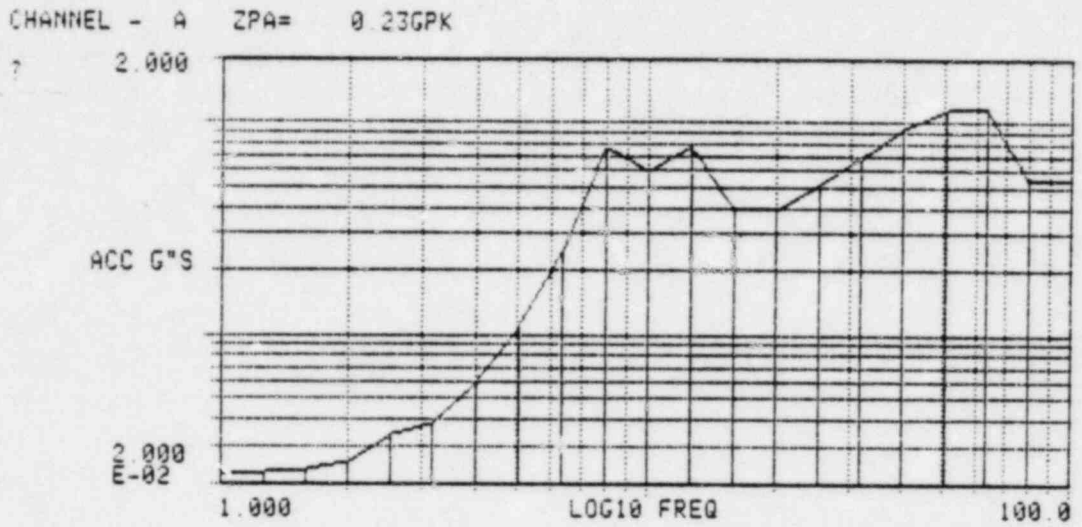

19-AUG-82
09:29:40

SHOCK RESPONSE
CG&E SRV SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.04 | 5.01 | 1.39 | 25.12 | 2.08 |
| 1.26 | 0.08 | 6.31 | 1.34 | 31.62 | 1.98 |
| 1.58 | 0.21 | 7.94 | 0.74 | 39.81 | 2.14 |
| 2.00 | 0.34 | 10.00 | 0.65 | 50.12 | 3.50 |
| 2.51 | 0.71 | 12.59 | 0.67 | 63.10 | 1.07 |
| 3.16 | 0.82 | 15.85 | 1.09 | 79.43 | 0.77 |
| 3.98 | 0.91 | 19.95 | 1.99 | 100.00 | 0.74 |

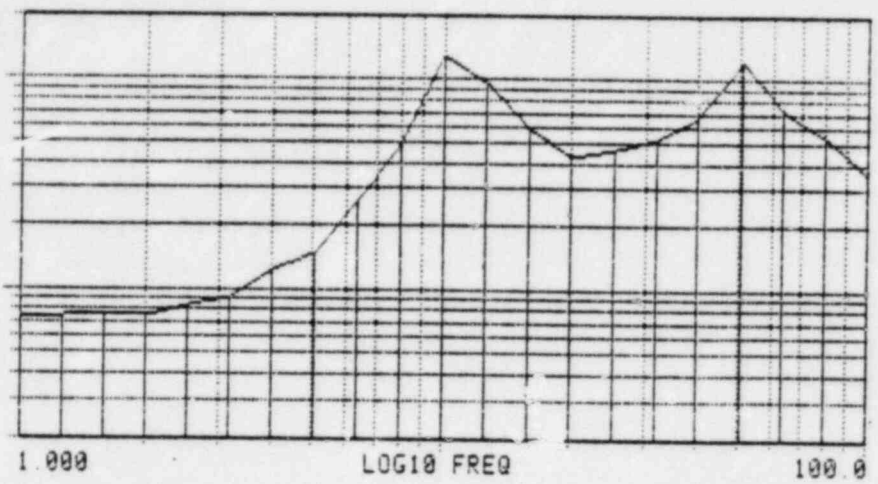
ACCELEROMETER # 62 DAMPING 2
DIRECTION Vertical LOCATION 2
TEST# 4 OBE___ BSE___ FREQ%___
TRIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.02 | 5.01 | 0.11 | 25.12 | 0.52 |
| 1.26 | 0.02 | 6.31 | 0.24 | 31.62 | 0.67 |
| 1.58 | 0.02 | 7.94 | 0.76 | 39.81 | 0.92 |
| 2.00 | 0.03 | 10.00 | 0.58 | 50.12 | 1.15 |
| 2.51 | 0.03 | 12.59 | 0.79 | 63.10 | 1.19 |
| 3.16 | 0.04 | 15.85 | 0.39 | 79.43 | 0.54 |
| 3.98 | 0.06 | 19.95 | 0.39 | 100.00 | 0.54 |

ACCELEROMETER NO. 7X DAMPING 2
DIRECTION N-S LOCATION 3
TEST NO. 4 OBE_____ SSE_____
BIAX____ N-S____ E-W___ TRIAX ✓
CONTROL ____ SURVEY ✓

CHANNEL - 8 ZPA= 0.24GPK




19-AUG-82
09:36:10

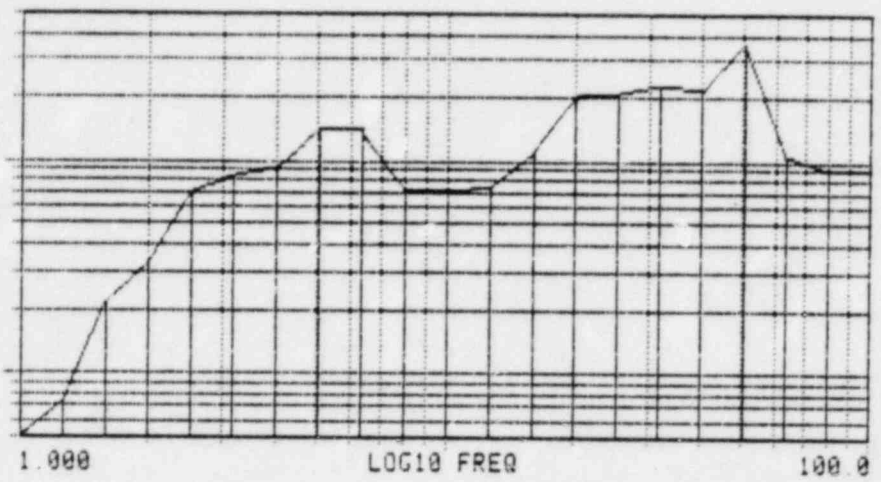
SHOCK RESPONSE
CG&E SRV SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.07 | 5.01 | 0.15 | 25.12 | 0.47 |
| 1.26 | 0.07 | 6.31 | 0.26 | 31.62 | 0.53 |
| 1.58 | 0.08 | 7.94 | 0.49 | 39.81 | 0.66 |
| 2.00 | 0.07 | 10.00 | 1.28 | 50.12 | 1.21 |
| 2.51 | 0.08 | 12.59 | 0.96 | 63.10 | 0.71 |
| 3.16 | 0.09 | 15.85 | 0.58 | 79.43 | 0.53 |
| 3.98 | 0.12 | 19.95 | 0.42 | 100.00 | 0.35 |

ACCELEROMETER NO. 8Y DAMPING 2
DIRECTION E-W LOCATION 3
TEST NO. 4 OBE_____ SSE_____
BIAX____ N-S____ E-W___ TRIAX ✓
CONTROL ____ SURVEY ✓

CHANNEL - C ZPA= 0.56GPK




19-AUG-82
09:38:40

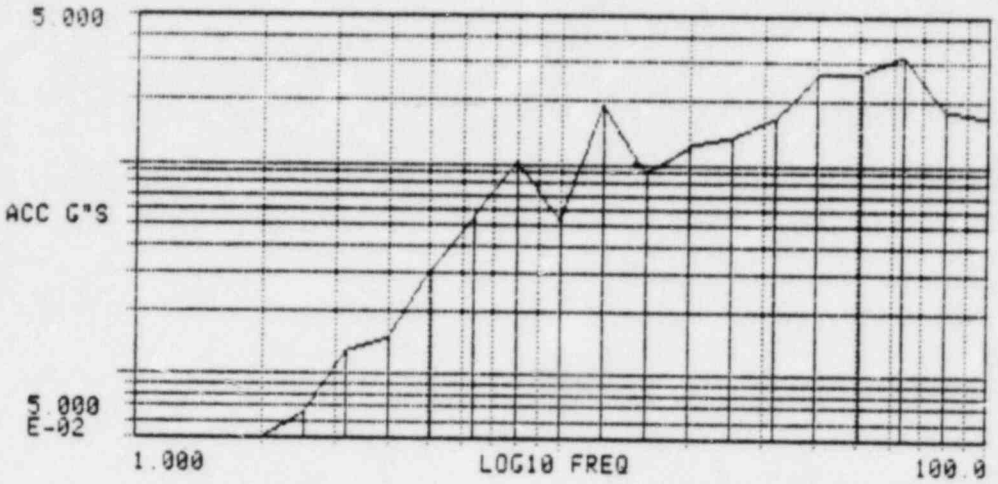
SHOCK RESPONSE
CG&E SRU SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.03 | 5.01 | 1.40 | 25.12 | 2.10 |
| 1.26 | 0.07 | 6.31 | 1.36 | 31.62 | 2.25 |
| 1.58 | 0.22 | 7.94 | 0.72 | 39.81 | 2.13 |
| 2.00 | 0.33 | 10.00 | 0.69 | 50.12 | 3.64 |
| 2.51 | 0.70 | 12.59 | 0.74 | 63.10 | 1.06 |
| 3.16 | 0.84 | 15.85 | 1.08 | 79.43 | 0.87 |
| 3.98 | 0.90 | 19.95 | 1.98 | 100.00 | 0.90 |

ACCELEROMETER NO. 9Z DAMPING 2
DIRECTION Vertical LOCATION 3
TEST NO. 4 OBE_____ SSE_____
BIAX_____ N-S_____ E-W_____ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 0.58GPK




19-AUG-82
09:41:10

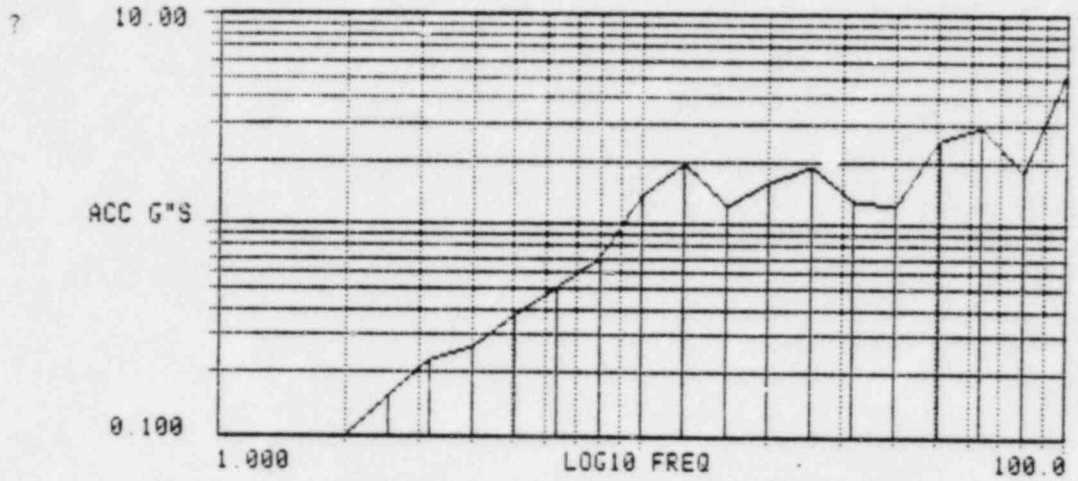
SHOCK RESPONSE
CG&E SRV+LOCA SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.03 | 5.01 | 0.30 | 25.12 | 1.34 |
| 1.26 | 0.04 | 6.31 | 0.56 | 31.62 | 1.64 |
| 1.58 | 0.04 | 7.94 | 1.04 | 39.81 | 2.60 |
| 2.00 | 0.04 | 10.00 | 0.54 | 50.12 | 2.73 |
| 2.51 | 0.07 | 12.59 | 1.90 | 63.10 | 3.20 |
| 3.16 | 0.13 | 15.85 | 0.90 | 79.43 | 1.80 |
| 3.98 | 0.15 | 19.95 | 1.23 | 100.00 | 1.63 |

ACCELEROMETER NO. 1X DAMPING 2
DIRECTION N-S LOCATION 1
TEST NO. 5 OBE_____ SSE_____
BIAX____ N-S____ E-W___ TRIAX ✓
CONTROL ____ SURVEY ✓

CHANNEL - B ZPA= 0.70GPK




19-AUG-82
09:46:50

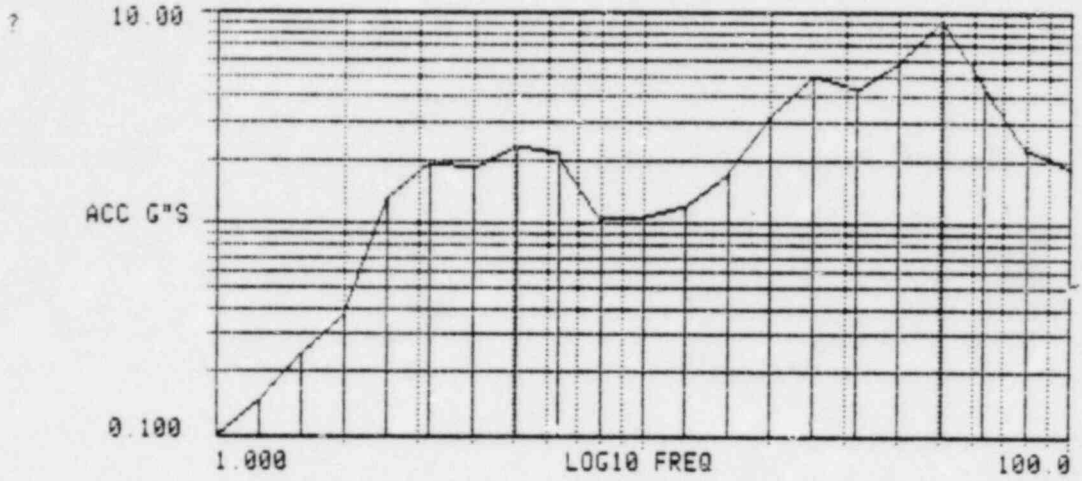
SHOCK RESPONSE
CG&E SRV+LOCA SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.08 | 5.01 | 0.37 | 25.12 | 1.89 |
| 1.26 | 0.08 | 6.31 | 0.50 | 31.62 | 1.30 |
| 1.58 | 0.08 | 7.94 | 0.68 | 39.81 | 1.21 |
| 2.00 | 0.08 | 10.00 | 1.34 | 50.12 | 2.49 |
| 2.51 | 0.15 | 12.59 | 1.90 | 63.10 | 2.87 |
| 3.16 | 0.23 | 15.85 | 1.22 | 79.43 | 1.78 |
| 3.98 | 0.26 | 19.95 | 1.57 | 100.00 | 5.13 |

ACCELEROMETER NO. 2Y DAMPING 2
DIRECTION E-W LOCATION L
TEST NO. 5 OBE_____ SSE_____
BIAX____ N-S____ E-W___ TRIAX ✓
CONTROL ____ SURVEY ✓

CHANNEL - C ZPA= 1.12GPK




19-AUG-82
09:53:40

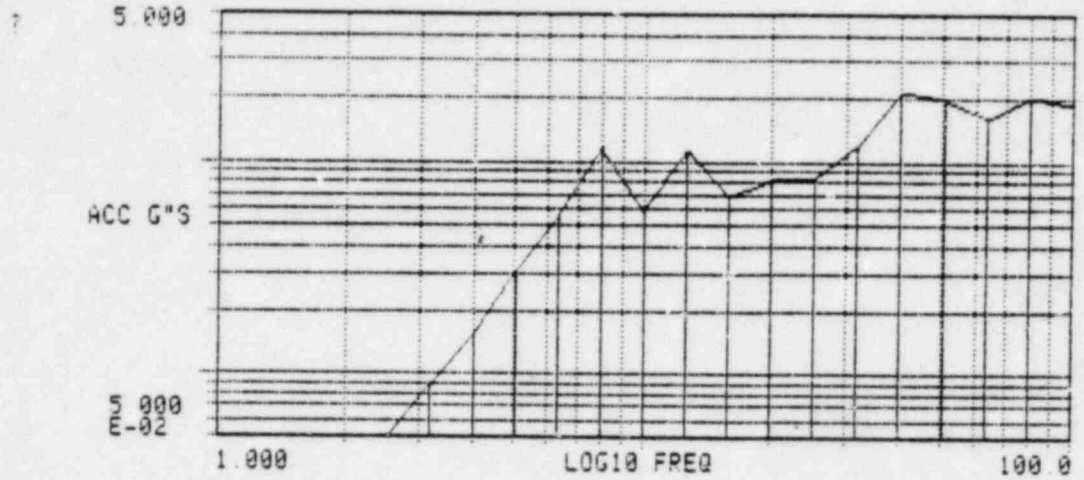
SHOCK RESPONSE
CG&E SRV+LOCA SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.08 | 5.01 | 2.33 | 25.12 | 4.90 |
| 1.26 | 0.14 | 6.31 | 2.11 | 31.62 | 4.25 |
| 1.58 | 0.24 | 7.94 | 1.03 | 39.81 | 5.68 |
| 2.00 | 0.38 | 10.00 | 1.06 | 50.12 | 9.04 |
| 2.51 | 1.31 | 12.59 | 1.20 | 63.10 | 4.48 |
| 3.16 | 1.94 | 15.85 | 1.72 | 79.43 | 2.21 |
| 3.98 | 1.83 | 19.95 | 3.15 | 100.00 | 1.79 |

ACCELEROMETER NO. 3Z DAMPING 2
DIRECTION Vertical LOCATION 1
TEST NO. 5 OBE_____ SSE_____
BIAX____ N-S____ E-W___ TRIAX ✓
CONTROL ____ SURVEY ✓

CHANNEL - A ZPA= 0.45GPK




13-AUG-82
09:59:40

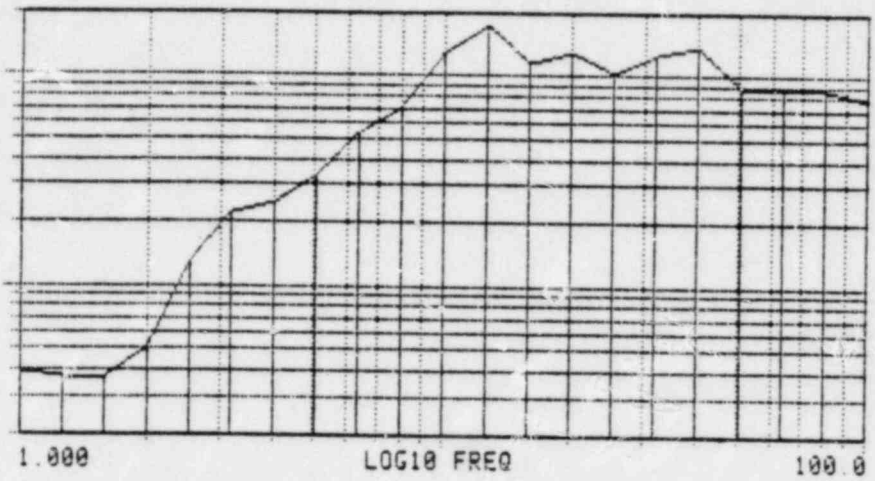
SHOCK RESPONSE
CG&E SRV+LOCA SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.03 | 5.01 | 0.30 | 25.12 | 0.83 |
| 1.26 | 0.03 | 6.31 | 0.55 | 31.62 | 1.17 |
| 1.58 | 0.03 | 7.94 | 1.15 | 39.81 | 2.12 |
| 2.00 | 0.03 | 10.00 | 0.58 | 50.12 | 1.97 |
| 2.51 | 0.05 | 12.59 | 1.11 | 63.10 | 1.60 |
| 3.16 | 0.09 | 15.85 | 0.67 | 79.43 | 2.02 |
| 3.98 | 0.15 | 19.95 | 0.80 | 100.00 | 1.85 |

ACCELEROMETER NO. 4X DAMPING 2
DIRECTION N-S LOCATION 2
TEST NO. 5 OBE_____ SSE_____
BIAX____ N-S____ E-W___ TRIAX V
CONTROL ____ SURVEY V

CHANNEL - 8 ZPA= 0.33GPK



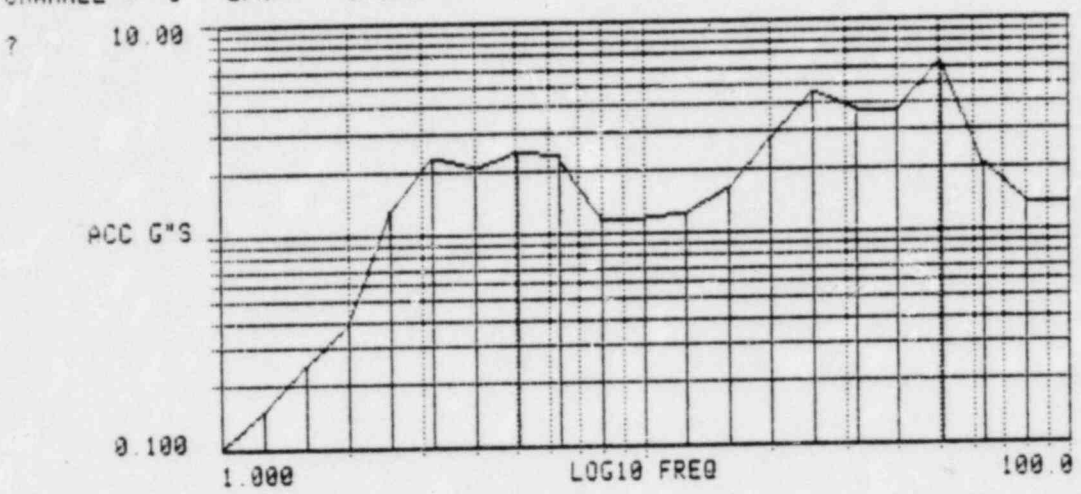

19-AUG-82 SHOCK RESPONSE 2.0 % DAMP ABS ACC
10:02:00 CG&E SRV+LOCA SURVEY 1/3 OCTAVE MAXI-MAX

?R

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.04 | 5.01 | 0.33 | 25.12 | 1.02 |
| 1.26 | 0.04 | 6.31 | 0.54 | 31.62 | 1.26 |
| 1.58 | 0.04 | 7.94 | 0.69 | 39.81 | 1.36 |
| 2.00 | 0.05 | 10.00 | 1.28 | 50.12 | 0.37 |
| 2.51 | 0.13 | 12.59 | 1.75 | 63.10 | 0.88 |
| 3.16 | 0.22 | 15.85 | 1.17 | 79.43 | 0.86 |
| 3.98 | 0.25 | 19.95 | 1.29 | 100.00 | 0.76 |

ACCELEROMETER NO. 5Y DAMPING 2
DIRECTION E-W LOCATION 2
TEST NO. 5 OBE_____ SSE ✓
BIAX____ N-S____ E-W___ TRIAX ✓
CONTROL ____ SURVEY ✓

CHANNEL - C ZPA= 0.87GPK



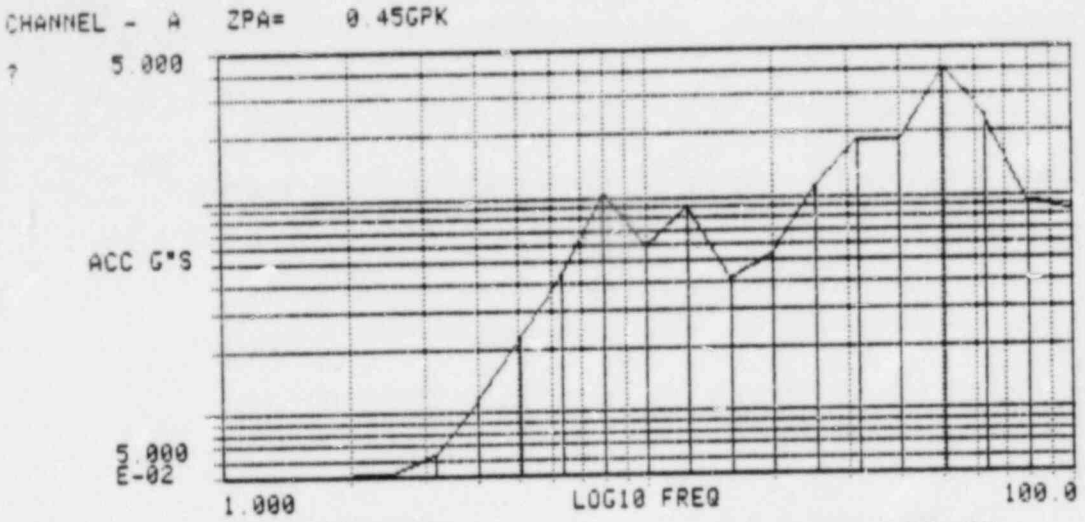

19-AUG-82
10:11:30

SHOCK RESPONSE
CG&E SRV+LOCA SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.07 | 5.01 | 2.44 | 25.12 | 4.48 |
| 1.26 | 0.15 | 6.31 | 2.28 | 31.62 | 3.65 |
| 1.58 | 0.25 | 7.94 | 1.19 | 39.81 | 3.69 |
| 2.00 | 0.38 | | 1.15 | 50.12 | 6.33 |
| 2.51 | 1.33 | | 1.25 | 63.10 | 2.07 |
| 3.16 | 2.29 | 12.85 | 1.61 | 79.43 | 1.35 |
| 3.98 | 2.05 | 15.85 | 2.75 | 100.00 | 1.33 |

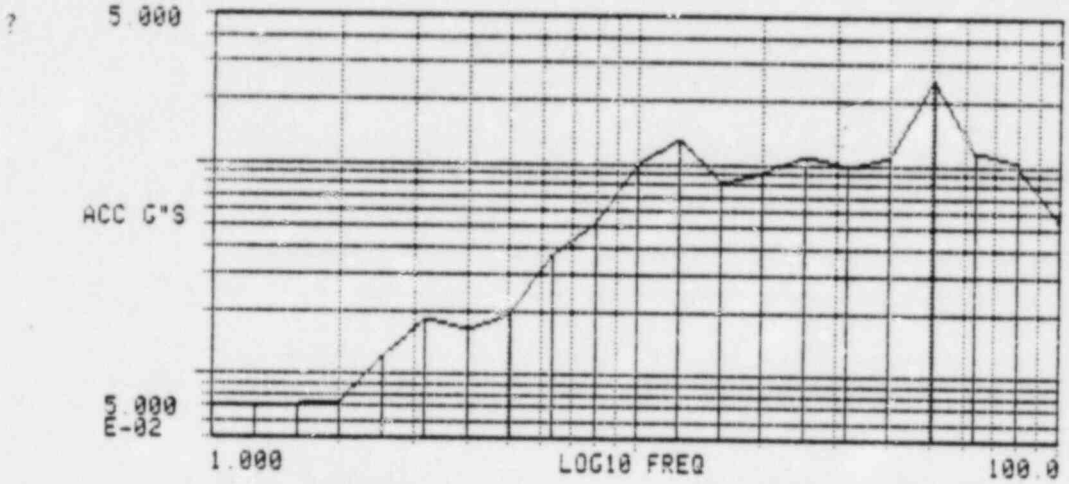
ACCELEROMETER #62 DAMPING 2
DIRECTION Vertical LOCATION 2
TEST# 5 OBE___ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.05 | 5.01 | 0.22 | 25.12 | 1.12 |
| 1.26 | 0.05 | 6.31 | 0.44 | 31.62 | 1.83 |
| 1.58 | 0.05 | 7.94 | 1.01 | 39.81 | 1.77 |
| 2.00 | 0.04 | 10.00 | 0.53 | 50.12 | 4.00 |
| 2.51 | 0.05 | 12.59 | 0.90 | 63.10 | 2.31 |
| 3.16 | 0.06 | 15.85 | 0.41 | 79.43 | 0.95 |
| 3.98 | 0.11 | 19.95 | 0.54 | 100.00 | 0.84 |

ACCELEROMETER # 7X DAMPING 2
DIRECTION N-S LOCATION 3
TEST# 5 OBE___ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 0.36GPK




19-AUG-82
10:18:00

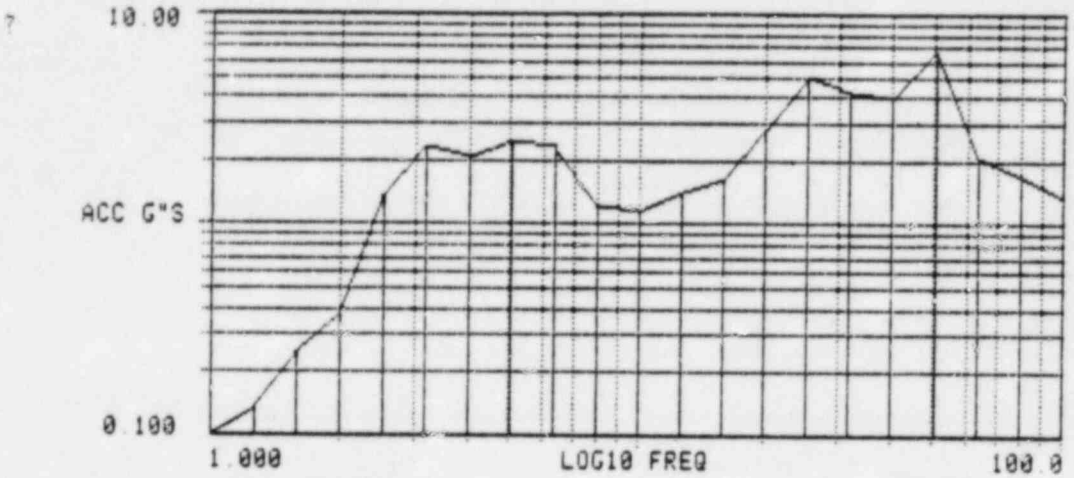
SHOCK RESPONSE
CG&E SRV+LOCA SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.07 | 5.01 | 0.19 | 25.12 | 1.07 |
| 1.26 | 0.07 | 6.31 | 0.37 | 31.62 | 0.95 |
| 1.58 | 0.07 | 7.94 | 0.52 | 39.81 | 1.07 |
| 2.00 | 0.07 | 10.00 | 0.98 | 50.12 | 2.55 |
| 2.51 | 0.12 | 12.59 | 1.28 | 63.10 | 1.13 |
| 3.16 | 0.18 | 15.85 | 0.82 | 79.43 | 1.04 |
| 3.98 | 0.16 | 19.95 | 0.90 | 100.00 | 0.56 |

ACCELEROMETER # 8Y DAMPING 2
DIRECTION E-W LOCATION 3
TEST# 5 OBE___ SSE___ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 0.90GPK




19-AUG-82
10:22:20

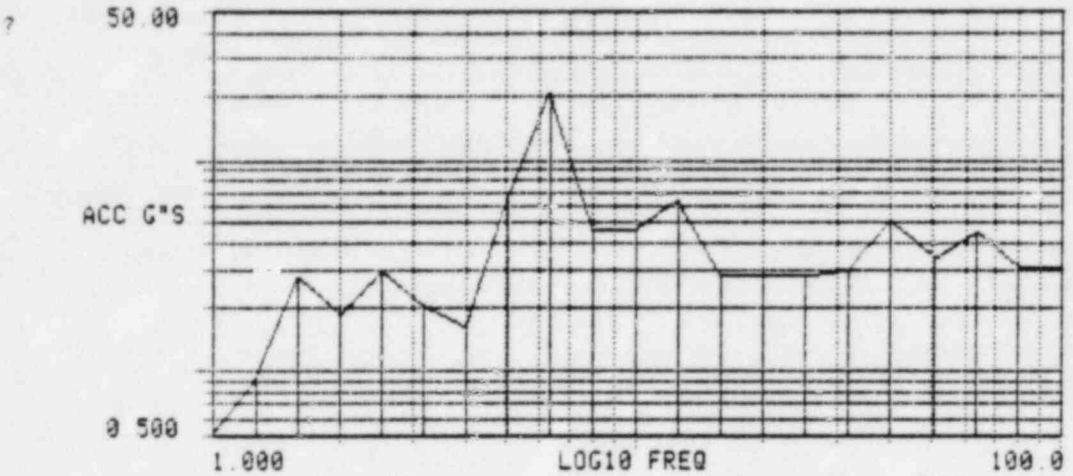
SHOCK RESPONSE
CG&E SRV+LOCA SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.07 | 5.01 | 2.46 | 25.12 | 4.87 |
| 1.26 | 0.13 | 6.31 | 2.32 | 31.62 | 4.18 |
| 1.58 | 0.24 | 7.94 | 1.21 | 39.81 | 3.96 |
| 2.00 | 0.37 | 10.00 | 1.13 | 50.12 | 6.60 |
| 2.51 | 1.34 | 12.59 | 1.39 | 63.10 | 2.04 |
| 3.16 | 2.34 | 15.85 | 1.63 | 79.43 | 1.67 |
| 3.98 | 2.04 | 19.95 | 2.78 | 100.00 | 1.32 |

ACCELEROMETER #92 DAMPING 2
DIRECTION Vertical LOCATION 3
TEST# 5 OBE___ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ___✓___

CHANNEL - A ZPA= 1.79GPK




19-AUG-82
10:41:00

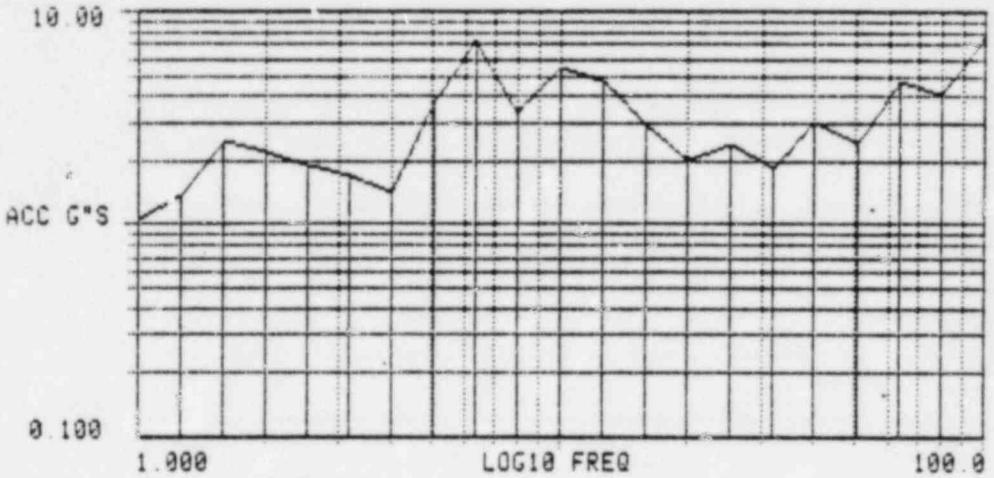
SHOCK RESPONSE
CG&E UPSET #4 TEST #9 SURVEY

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.50 | 5.01 | 6.66 | 25.12 | 2.76 |
| 1.26 | 0.92 | 6.31 | 20.42 | 31.62 | 3.01 |
| 1.58 | 2.74 | 7.94 | 4.59 | 39.81 | 5.07 |
| 2.00 | 1.79 | 10.00 | 4.69 | 50.12 | 3.32 |
| 2.51 | 2.90 | 12.59 | 6.47 | 63.10 | 4.44 |
| 3.16 | 1.98 | 15.85 | 2.81 | 79.43 | 3.09 |
| 3.98 | 1.57 | 19.95 | 2.81 | 100.00 | 3.01 |

ACCELEROMETER # 1X DAMPING 1
DIRECTION N-S LOCATION 1
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 1.30GPK




19-AUG-82
10:43:00

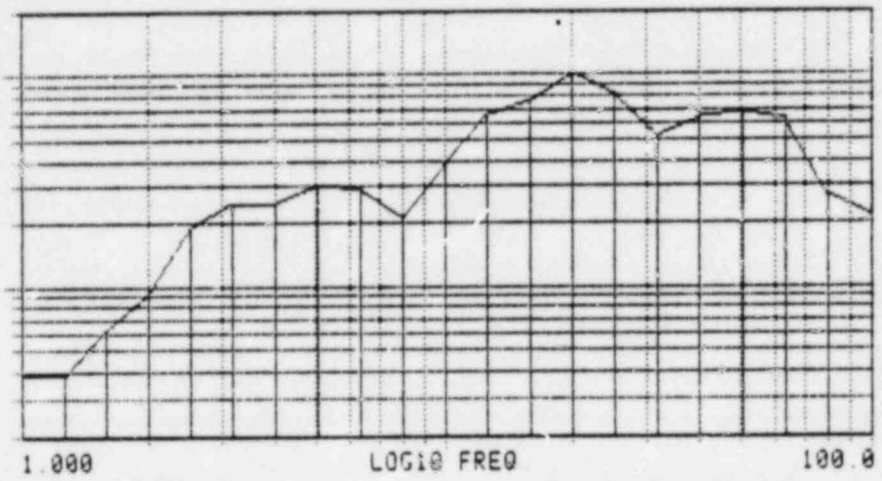
SHOCK RESPONSE
CG&E UPSET #4 TEST #9 SURVEY

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.03 | 5.01 | 3.73 | 25.12 | 2.37 |
| 1.26 | 1.34 | 6.31 | 7.18 | 31.62 | 1.81 |
| 1.58 | 2.47 | 7.94 | 3.37 | 39.81 | 3.02 |
| 2.00 | 2.18 | 10.00 | 5.37 | 50.12 | 2.35 |
| 2.51 | 1.88 | 12.59 | 4.67 | 63.10 | 4.61 |
| 3.16 | 1.67 | 15.85 | 2.89 | 79.43 | 4.03 |
| 3.98 | 1.39 | 19.95 | 1.97 | 100.00 | 7.51 |

ACCELEROMETER # 2Y DAMPING 1
DIRECTION E-W LOCATION 1
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 1.45GPK




19-AUG-82
10:45:50

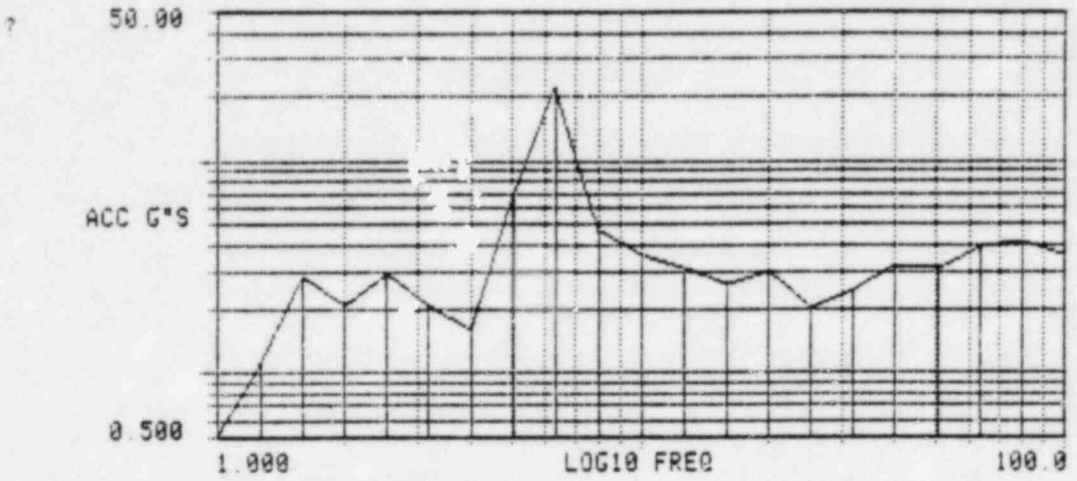
SHOCK RESPONSE
CG&E UPSET #4 TEST #9 SURVEY

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.38 | 5.01 | 3.02 | 25.12 | 8.12 |
| 1.26 | 0.38 | 6.31 | 2.92 | 31.62 | 5.17 |
| 1.58 | 0.62 | 7.94 | 2.06 | 39.81 | 6.35 |
| 2.00 | 0.93 | 10.00 | 3.80 | 50.12 | 6.70 |
| 2.51 | 1.90 | 12.59 | 6.59 | 63.10 | 6.12 |
| 3.16 | 2.45 | 15.85 | 7.59 | 79.43 | 2.67 |
| 3.98 | 2.46 | 19.95 | 10.13 | 100.00 | 2.14 |

ACCELEROMETER # 32 DAMPING 1
DIRECTION Vertical LOCATION 1
TEST# 9 OBE ✓ SSE ___ FRAG% ___
BIAX ___ N-S ___ E-W ___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 1.87GPK




19-AUG-82
11:15:20

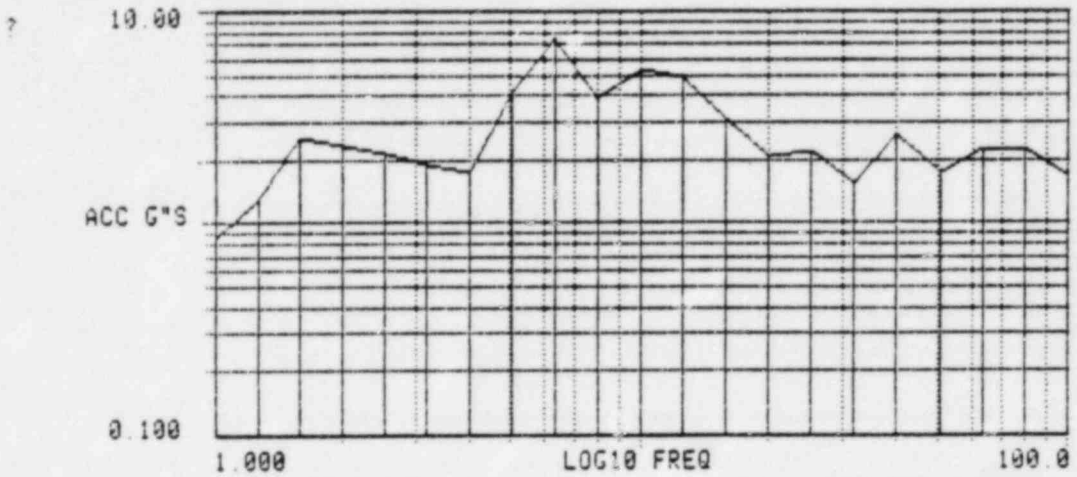
SHOCK RESPONSE
CG&E UPSET #4 TEST#_ SURVEY

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.42 | 5.01 | 7.05 | 25.12 | 1.97 |
| 1.26 | 1.09 | 6.31 | 21.79 | 31.62 | 2.43 |
| 1.58 | 2.81 | 7.94 | 4.62 | 39.81 | 3.14 |
| 2.00 | 2.02 | 10.00 | 3.51 | 50.12 | 3.04 |
| 2.51 | 2.93 | 12.59 | 3.11 | 63.10 | 3.89 |
| 3.16 | 2.06 | 15.85 | 2.54 | 79.43 | 4.07 |
| 3.98 | 1.58 | 19.95 | 2.96 | 100.00 | 3.55 |

ACCELEROMETER # 4X DAMPING 1
DIRECTION N-S LOCATION 2
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 1.20GPK




19-AUG-82
11:17:30

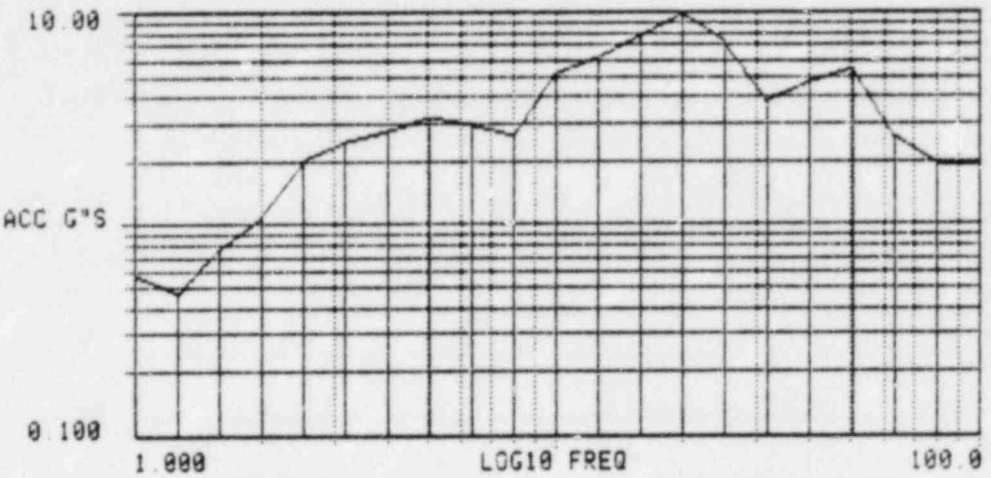
SHOCK RESPONSE
CG&E UPSET #4 TEST#9 SURVEY

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.84 | 5.01 | 4.01 | 25.12 | 2.15 |
| 1.26 | 1.29 | 6.31 | 7.47 | 31.62 | 1.50 |
| 1.58 | 2.54 | 7.94 | 3.92 | 39.81 | 2.58 |
| 2.00 | 2.33 | 10.00 | 5.24 | 50.12 | 1.69 |
| 2.51 | 2.10 | 12.59 | 4.73 | 63.10 | 2.23 |
| 3.16 | 1.89 | 15.85 | 3.14 | 79.43 | 2.21 |
| 3.98 | 1.74 | 19.95 | 2.03 | 100.00 | 1.69 |

ACCELEROMETER # 5Y DAMPING 1
DIRECTION E-W LOCATION 2
TEST# 2 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 1.48GPK




19-AUG-82
11:19:30

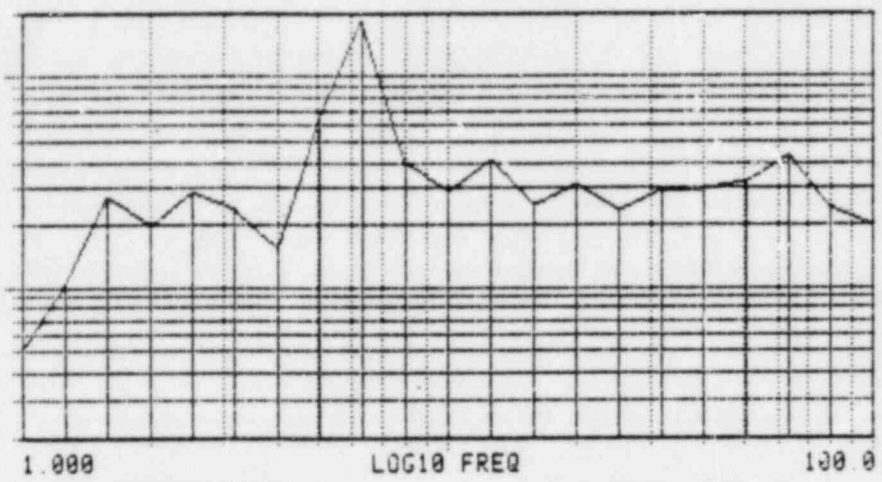
SHOCK RESPONSE
CG&E UPSET #4 TEST#9 SURVEY

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.56 | 5.01 | 3.15 | 25.12 | 7.34 |
| 1.26 | 0.46 | 6.31 | 2.89 | 31.62 | 3.83 |
| 1.58 | 0.76 | 7.94 | 2.55 | 39.81 | 4.67 |
| 2.00 | 1.06 | 10.00 | 5.02 | 50.12 | 5.38 |
| 2.51 | 1.98 | 12.59 | 6.01 | 63.10 | 2.62 |
| 3.16 | 2.40 | 15.85 | 7.59 | 79.43 | 1.96 |
| 3.98 | 2.71 | 19.95 | 9.77 | 100.00 | 1.95 |

ACCELEROMETER #62 DAMPING 1
DIRECTION Vertical LOCATION 2
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 1.53GPK




19-AUG-82
12:45:20

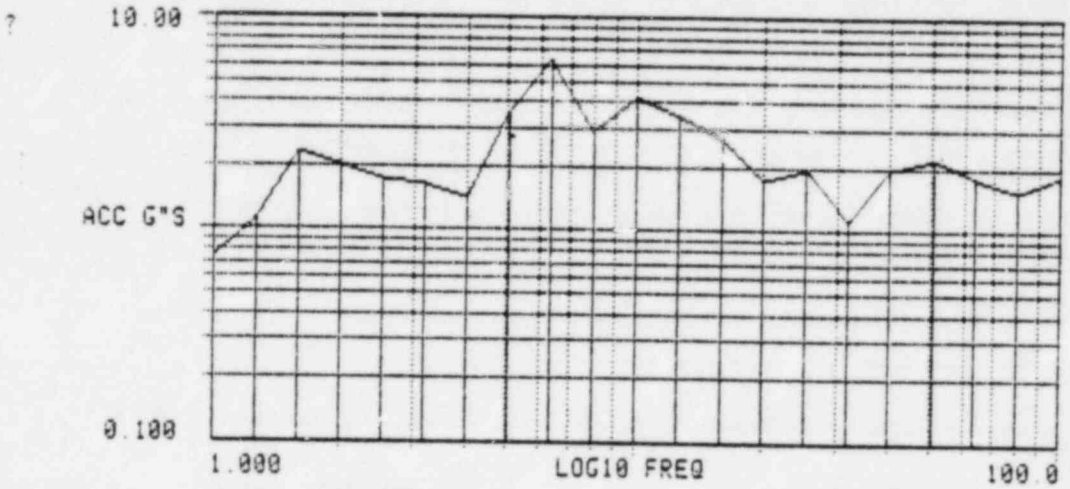
SHOCK RESPONSE
CG&E UPSET #4 TEST 9 SURVEY

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.51 | 5.01 | 6.29 | 25.12 | 2.33 |
| 1.26 | 1.04 | 6.31 | 18.53 | 31.62 | 2.94 |
| 1.58 | 2.60 | 7.94 | 4.00 | 39.81 | 2.98 |
| 2.00 | 1.96 | 10.00 | 2.92 | 50.12 | 3.22 |
| 2.51 | 2.86 | 12.59 | 4.05 | 63.10 | 4.34 |
| 3.16 | 2.35 | 15.85 | 2.47 | 79.43 | 2.43 |
| 3.98 | 1.50 | 19.95 | 3.15 | 100.00 | 1.98 |

ACCELEROMETER # 7X DAMPING 1
DIRECTION N-S LOCATION 3
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - 8 ZPA= 0.93GPK




19-AUG-82
12:48:00

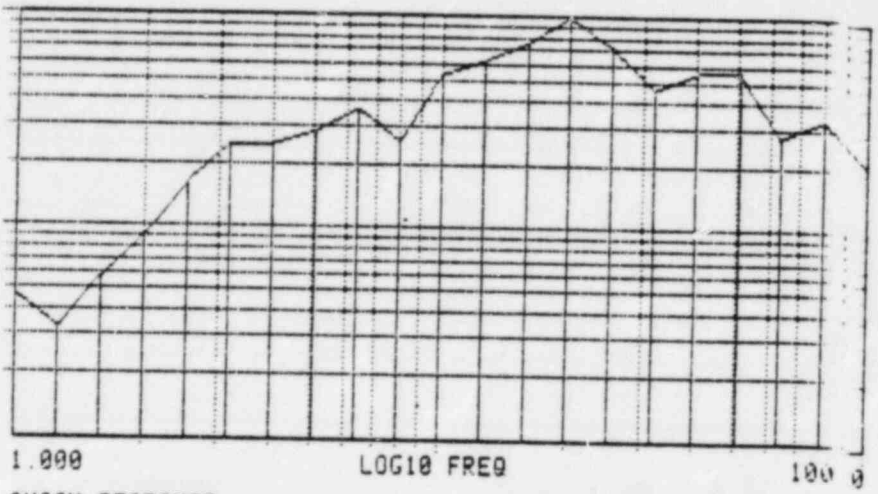
SHOCK RESPONSE
CG&E UPSET #4 TEST 9 SURVEY

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.74 | 5.01 | 3.55 | 25.12 | 1.93 |
| 1.26 | 1.09 | 6.31 | 6.19 | 31.62 | 1.11 |
| 1.58 | 2.31 | 7.94 | 2.90 | 39.81 | 1.90 |
| 2.00 | 2.00 | 10.00 | 4.12 | 50.12 | 2.15 |
| 2.51 | 1.72 | 12.59 | 3.37 | 63.10 | 1.76 |
| 3.16 | 1.61 | 15.85 | 2.63 | 79.43 | 1.53 |
| 3.98 | 1.41 | 19.95 | 1.73 | 100.00 | 1.83 |

ACCELEROMETER # δY DAMPING L
DIRECTION E-W LOCATION 3
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 1.43GPK




19-AUG-82
12:50:10

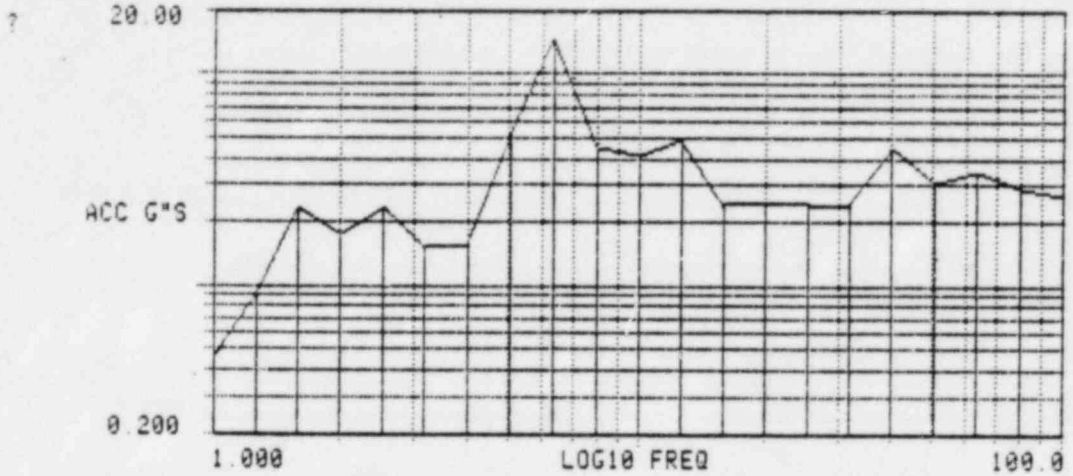
SHOCK RESPONSE
CG&E UPSET #4 TEST 9 SURVEY

1.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.45 | 5.01 | 2.83 | 25.12 | 7.04 |
| 1.26 | 0.32 | 6.31 | 3.58 | 31.62 | 4.51 |
| 1.58 | 0.56 | 7.94 | 2.52 | 39.81 | 5.40 |
| 2.00 | 0.89 | 10.00 | 5.30 | 50.12 | 5.52 |
| 2.51 | 1.63 | 12.59 | 6.15 | 63.10 | 2.72 |
| 3.16 | 2.43 | 15.85 | 7.51 | 79.43 | 3.23 |
| 3.98 | 2.45 | 19.95 | 9.56 | 100.00 | 2.13 |

ACCELEROMETER #92 DAMPING 1
DIRECTION Vertical LOCATION 3
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 1.79GPK



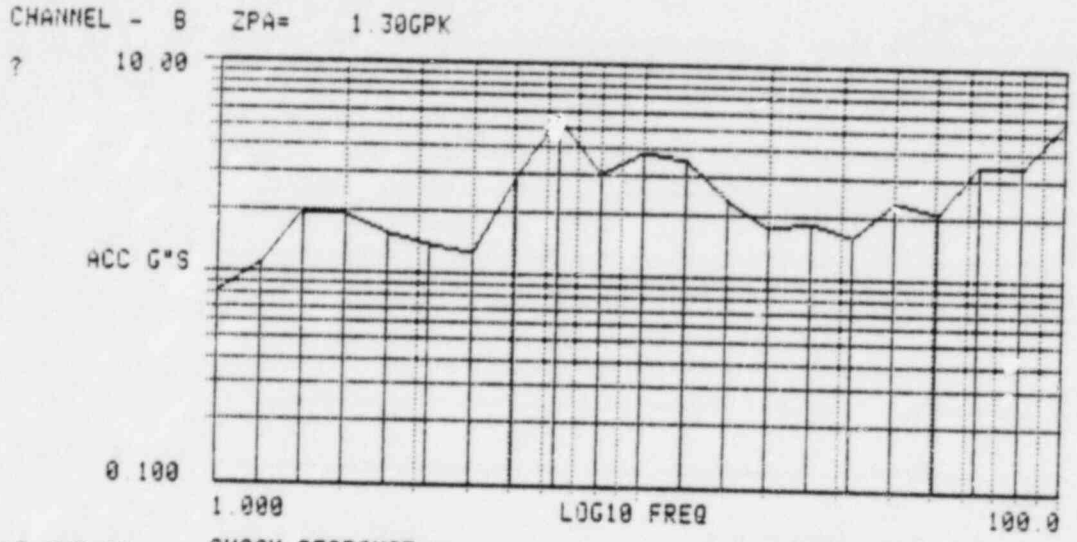

19-AUG-82
10:25:50

SHOCK RESPONSE
CG&E UPSET #4 TEST #9 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.45 | 5.01 | 5.24 | 25.12 | 2.39 |
| 1.26 | 0.90 | 6.31 | 14.28 | 31.62 | 2.39 |
| 1.58 | 2.34 | 7.94 | 4.44 | 39.81 | 4.47 |
| 2.00 | 1.73 | 10.00 | 4.13 | 50.12 | 3.04 |
| 2.51 | 2.33 | 12.59 | 4.95 | 63.10 | 3.49 |
| 3.16 | 1.51 | 15.85 | 2.41 | 79.43 | 2.90 |
| 3.98 | 1.54 | 19.95 | 2.46 | 100.00 | 2.64 |

ACCELEROMETER # 1X DAMPING 2
DIRECTION N-S LOCATION 1
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓




19-AUG-82
10:28:40

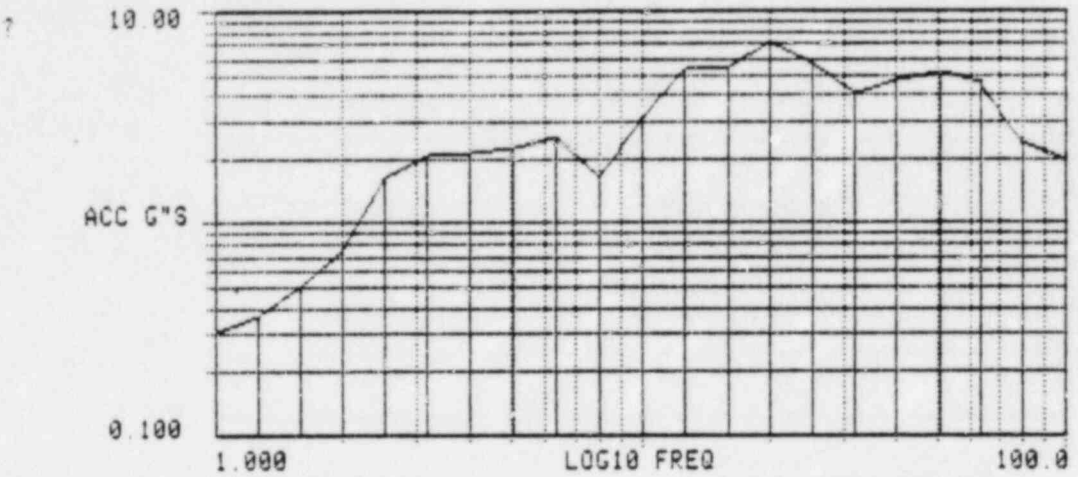
SHOCK RESPONSE
CG&E UPSET #4 TEST #9 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.79 | 5.01 | 2.82 | 25.12 | 1.80 |
| 1.26 | 1.09 | 6.31 | 5.56 | 31.62 | 1.56 |
| 1.58 | 1.95 | 7.94 | 3.02 | 39.81 | 2.33 |
| 2.00 | 1.88 | 10.00 | 3.80 | 50.12 | 2.05 |
| 2.51 | 1.53 | 12.59 | 3.44 | 63.10 | 3.51 |
| 3.16 | 1.36 | 15.85 | 2.29 | 79.43 | 3.41 |
| 3.98 | 1.23 | 19.95 | 1.72 | 100.00 | 5.63 |

ACCELEROMETER # 2Y DAMPING 2
DIRECTION E-W LOCATION 1
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 1.45GPK




19-AUG-82
10:35:40

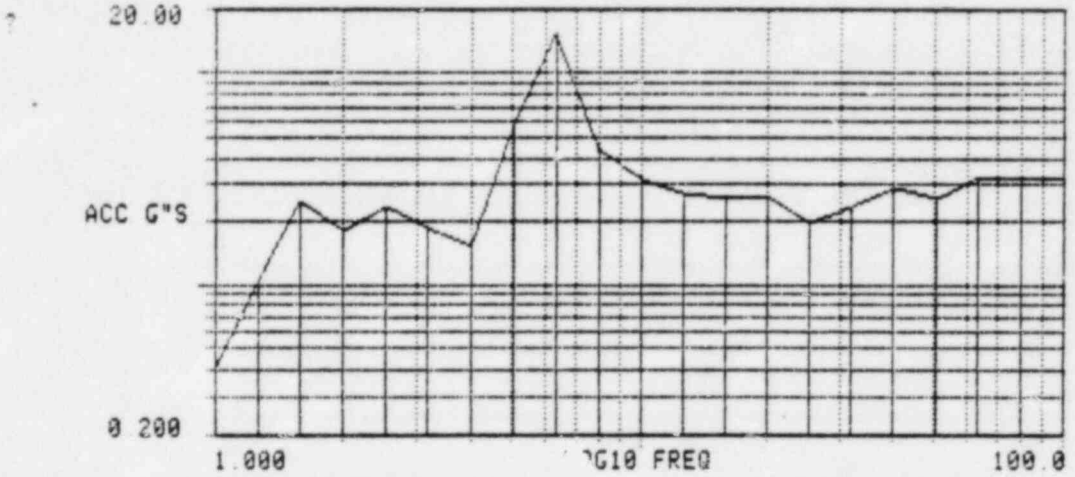
SHOCK RESPONSE
CG&E UPSET #4 TEST #9 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.30 | 5.01 | 2.23 | 25.12 | 5.53 |
| 1.26 | 0.36 | 6.31 | 2.48 | 31.62 | 4.02 |
| 1.58 | 0.50 | 7.94 | 1.63 | 39.81 | 4.71 |
| 2.00 | 0.73 | 10.00 | 3.12 | 50.12 | 5.03 |
| 2.51 | 1.64 | 12.59 | 5.22 | 63.10 | 4.48 |
| 3.16 | 2.03 | 15.85 | 5.44 | 79.43 | 2.36 |
| 3.98 | 2.08 | 19.95 | 7.12 | 100.00 | 1.95 |

ACCELEROMETER #3Z DAMPING 2
DIRECTION Vertical LOCATION 1
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPR= 1.87GPK




19-AUG-82
11:08:40

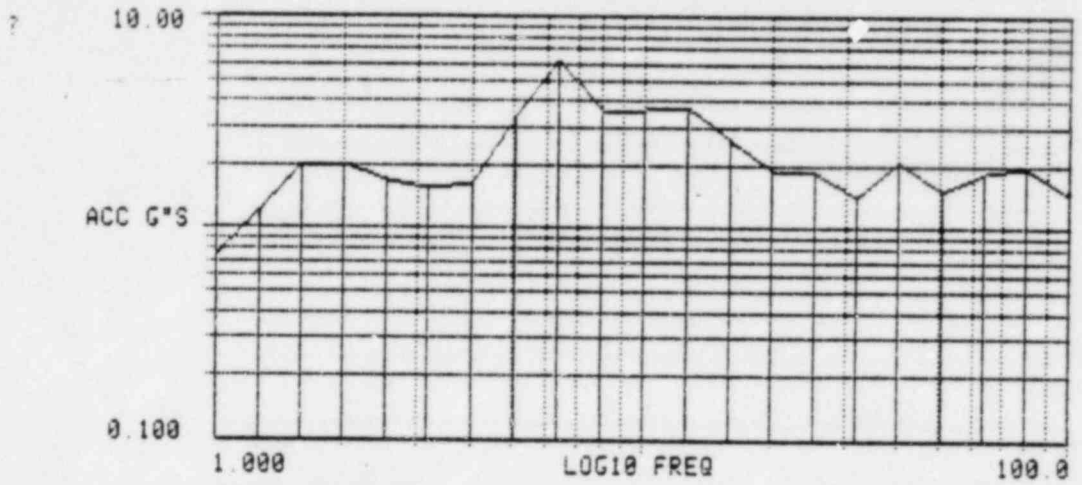
SHOCK RESPONSE
CG&E UPSET #4 TEST#9 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.40 | 5.01 | 5.58 | 25.12 | 1.94 |
| 1.26 | 1.03 | 6.31 | 15.50 | 31.62 | 2.32 |
| 1.58 | 2.46 | 7.94 | 4.31 | 39.81 | 2.92 |
| 2.00 | 1.79 | 10.00 | 3.16 | 50.12 | 2.55 |
| 2.51 | 2.30 | 12.59 | 2.75 | 63.10 | 3.26 |
| 3.16 | 1.65 | 15.85 | 2.58 | 79.43 | 3.19 |
| 3.98 | 1.51 | 19.95 | 2.60 | 100.00 | 3.19 |

ACCELEROMETER # 4X DAMPING 2
DIRECTION N-S LOCATION 2
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 1.20GPK




19-AUG-82
11:10:48

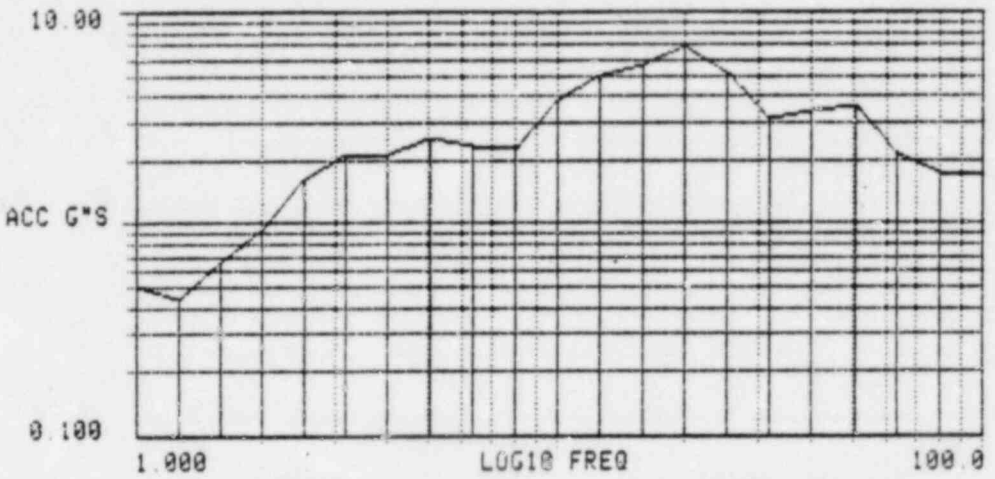
SHOCK RESPONSE
CG&E UPSET #4 TEST#9 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.73 | 5.01 | 3.24 | 25.12 | 1.82 |
| 1.26 | 1.20 | 6.31 | 6.04 | 31.62 | 1.41 |
| 1.58 | 1.97 | 7.94 | 3.54 | 39.81 | 2.04 |
| 2.00 | 1.97 | 10.00 | 3.56 | 50.12 | 1.48 |
| 2.51 | 1.66 | 12.59 | 3.71 | 63.10 | 1.80 |
| 3.16 | 1.51 | 15.85 | 2.59 | 79.43 | 1.91 |
| 3.98 | 1.60 | 19.95 | 1.86 | 100.00 | 1.42 |

ACCELEROMETER # 5Y DAMPING 2
DIRECTION E-W LOCATION 2
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 1.48GPK



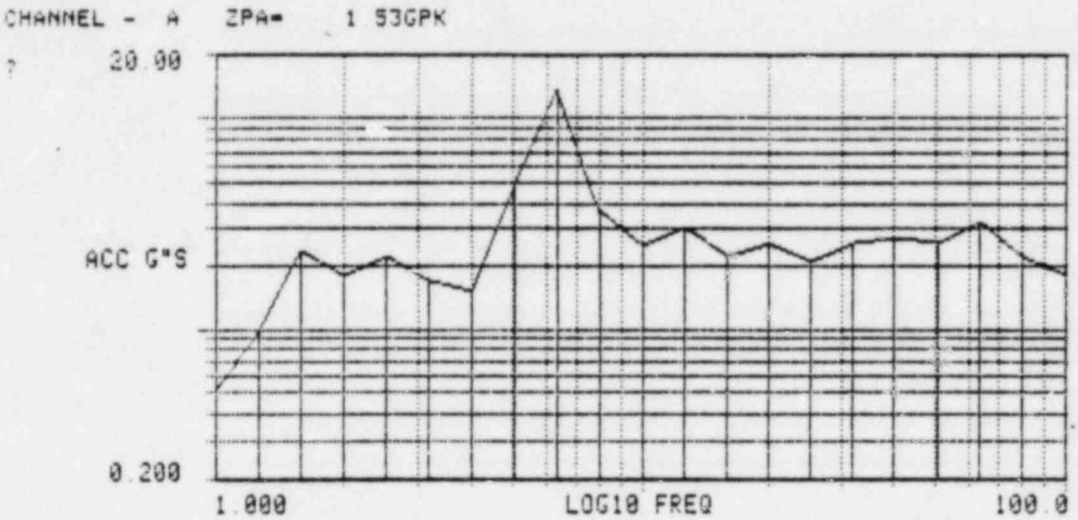

19-AUG-82
11:12:50

SHOCK RESPONSE
CG&E UPSET #4 TEST#9 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.50 | 5.01 | 2.51 | 25.12 | 5.02 |
| 1.26 | 0.42 | 6.31 | 2.27 | 31.62 | 3.03 |
| 1.58 | 0.65 | 7.94 | 2.24 | 39.81 | 3.35 |
| 2.00 | 0.92 | 10.00 | 3.79 | 50.12 | 3.54 |
| 2.51 | 1.63 | 12.59 | 4.97 | 63.10 | 2.13 |
| 3.16 | 2.12 | 15.85 | 5.52 | 79.43 | 1.71 |
| 3.98 | 2.11 | 19.95 | 6.91 | 100.00 | 1.69 |

ACCELEROMETER #6Z DAMPING 2
DIRECTION Vertical LOCATION 2
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓




19-AUG-82
11:32:40

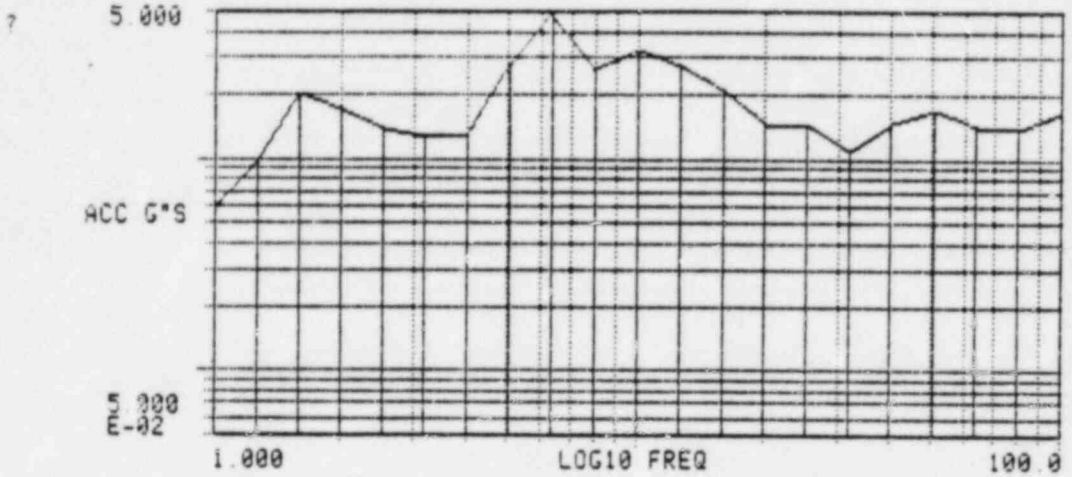
SHOCK RESPONSE
CG&E UPSET #4 TEST 9 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.50 | 5.01 | 4.93 | 25.12 | 2.05 |
| 1.26 | 0.97 | 6.31 | 13.44 | 31.62 | 2.54 |
| 1.58 | 2.36 | 7.94 | 3.62 | 39.81 | 2.68 |
| 2.00 | 1.77 | 10.00 | 2.52 | 50.12 | 2.53 |
| 2.51 | 2.19 | 12.59 | 3.08 | 63.10 | 3.28 |
| 3.16 | 1.69 | 15.85 | 2.17 | 79.43 | 2.21 |
| 3.98 | 1.52 | 19.95 | 2.57 | 100.00 | 1.78 |

ACCELEROMETER #7X DAMPING 2
DIRECTION N-S LOCATION 3
TEST# 2 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 0.93GPK




19-AUG-82
11:35:10

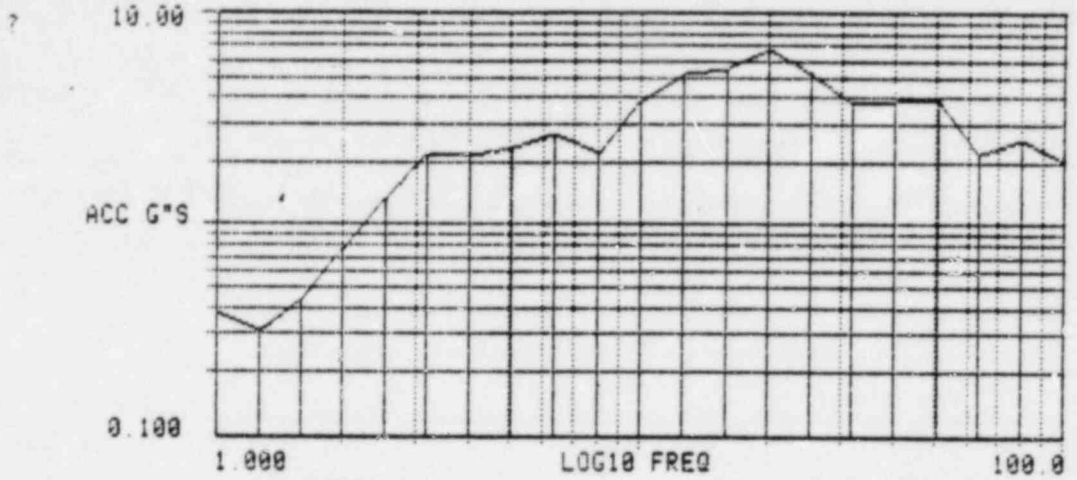
SHOCK RESPONSE
CG&E UPSET #4 TEST 9 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.58 | 5.01 | 2.78 | 25.12 | 1.45 |
| 1.26 | 0.97 | 6.31 | 4.91 | 31.62 | 1.07 |
| 1.58 | 1.99 | 7.94 | 2.62 | 39.81 | 1.46 |
| 2.00 | 1.70 | 10.00 | 3.18 | 50.12 | 1.69 |
| 2.51 | 1.36 | 12.59 | 2.72 | 63.10 | 1.40 |
| 3.16 | 1.24 | 15.85 | 2.10 | 79.43 | 1.36 |
| 3.98 | 1.30 | 19.95 | 1.43 | 100.00 | 1.61 |

ACCELEROMETER # 8Y DAMPING 2
DIRECTION E-W LOCATION 3
TEST# 2 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 1.43GPK




19-AUG-82
11:40:50

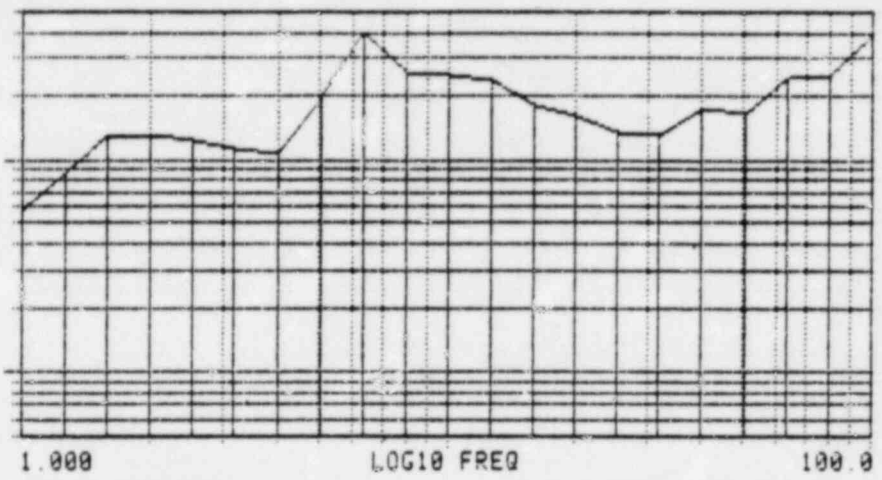
SHOCK RESPONSE
CG&E UPSET #4 TEST 9 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.37 | 5.01 | 2.27 | 25.12 | 5.07 |
| 1.26 | 0.30 | 6.31 | 2.68 | 31.62 | 3.68 |
| 1.58 | 0.43 | 7.94 | 2.17 | 39.81 | 3.79 |
| 2.00 | 0.76 | 10.00 | 3.82 | 50.12 | 3.87 |
| 2.51 | 1.33 | 12.59 | 5.07 | 63.10 | 2.14 |
| 3.16 | 2.14 | 15.85 | 5.46 | 79.43 | 2.49 |
| 3.98 | 2.13 | 19.95 | 6.68 | 100.00 | 1.99 |

ACCELEROMETER # 92 DAMPING 2
DIRECTION Vertical LOCATION 3
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 1.30GPK




19-AUG-82
10:51:20

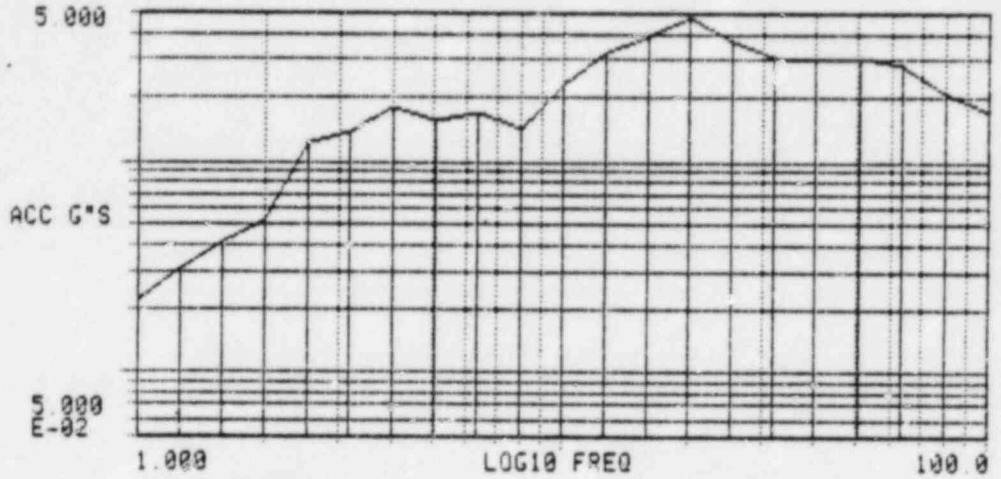
SHOCK RESPONSE
CG&E UPSET #4 TEST #9 SURVEY

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.57 | 5.01 | 1.92 | 25.12 | 1.32 |
| 1.26 | 0.86 | 6.31 | 3.99 | 31.62 | 1.29 |
| 1.58 | 1.30 | 7.94 | 2.52 | 39.81 | 1.72 |
| 2.00 | 1.31 | 10.00 | 2.50 | 50.12 | 1.62 |
| 2.51 | 1.23 | 12.59 | 2.35 | 63.10 | 2.41 |
| 3.16 | 1.12 | 15.85 | 1.78 | 79.43 | 2.46 |
| 3.98 | 1.04 | 19.95 | 1.60 | 100.00 | 3.84 |

ACCELEROMETER # 2,4 DAMPING 5
DIRECTION E-W LOCATION 1
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 1.45GPK




19-AUG-82
10:53:30

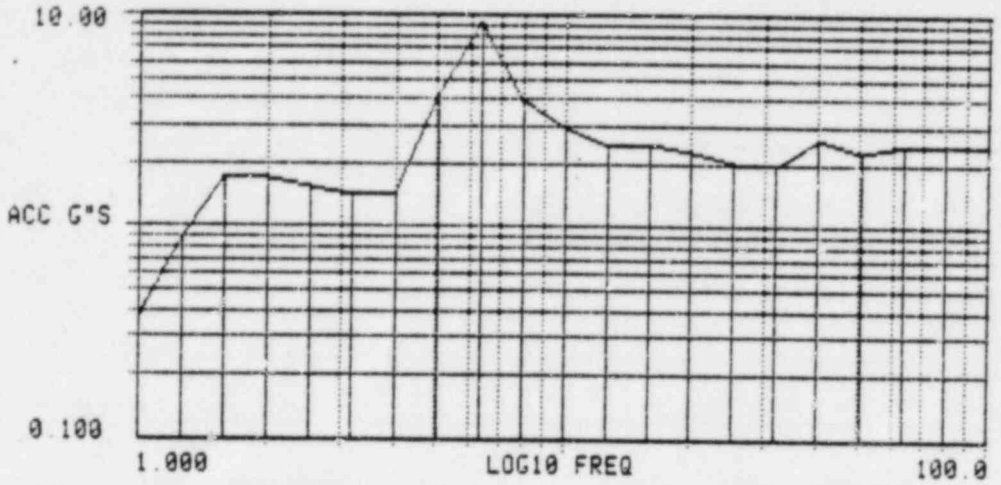
SHOCK RESPONSE
CG&E UPSET #4 TEST #9 SURVEY

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.22 | 5.01 | 1.54 | 25.12 | 3.59 |
| 1.26 | 0.31 | 6.31 | 1.68 | 31.62 | 3.04 |
| 1.58 | 0.41 | 7.94 | 1.42 | 39.81 | 3.00 |
| 2.00 | 0.51 | 10.00 | 2.28 | 50.12 | 3.06 |
| 2.51 | 1.24 | 12.59 | 3.20 | 63.10 | 2.81 |
| 3.16 | 1.35 | 15.85 | 3.90 | 79.43 | 2.08 |
| 3.98 | 1.77 | 19.95 | 4.73 | 100.00 | 1.67 |

ACCELEROMETER #3Z DAMPING 2
DIRECTION Vertical LOCATION 1
TEST# 9 OBE ✓ SSE ___ FRAG% ___
BIAX ___ N-S ___ E-W ___ TRIAX ✓
CONTROL ___ SURVEY ✓

CHANNEL - A ZPA= 1.87GPK




19-AUG-82
11:22:20

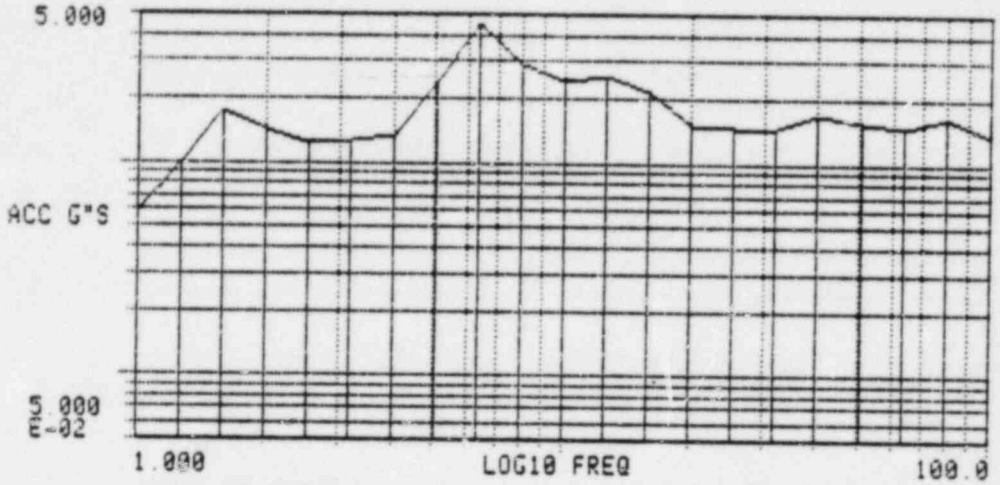
SHOCK RESPONSE
CG&E UPSET #4 TEST#9 SURVEY

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.36 | 5.01 | 4.08 | 25.12 | 1.97 |
| 1.26 | 0.87 | 6.31 | 9.30 | 31.62 | 1.95 |
| 1.58 | 1.70 | 7.94 | 3.96 | 39.81 | 2.62 |
| 2.00 | 1.67 | 10.00 | 2.91 | 50.12 | 2.26 |
| 2.51 | 1.51 | 12.59 | 2.38 | 63.10 | 2.48 |
| 3.16 | 1.40 | 15.85 | 2.40 | 79.43 | 2.46 |
| 3.98 | 1.43 | 19.95 | 2.26 | 100.00 | 2.41 |

ACCELEROMETER # 4X DAMPING 5
DIRECTION N-S LOCATION 2
TEST# 9 OBE ✓ SSE ___ FRAG% ___
BIAX ___ N-S ___ E-W ___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 1.20GPK




19-AUG-82
11:25:50

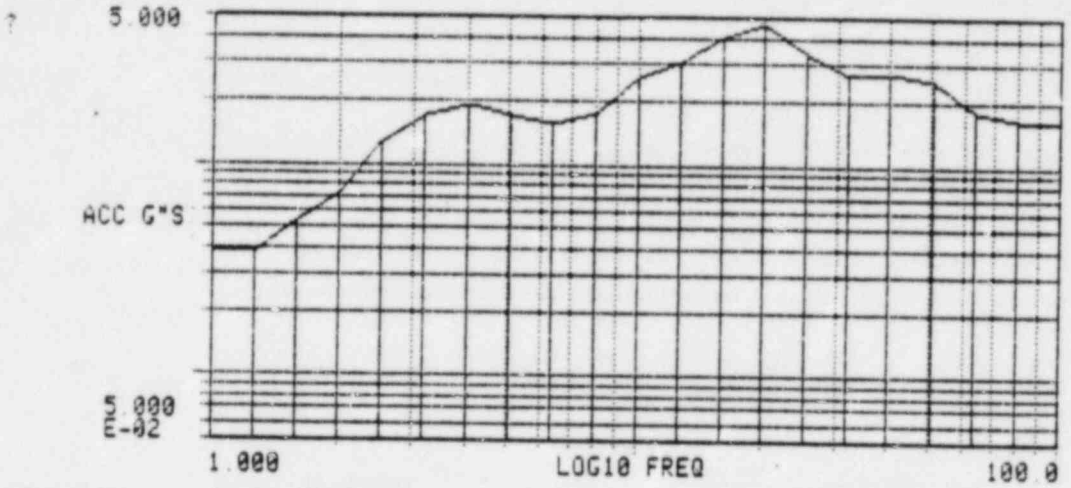
SHOCK RESPONSE
CG&E UPSET #4 TEST#9 SURVEY

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.59 | 5.01 | 2.29 | 25.12 | 1.46 |
| 1.26 | 0.99 | 6.31 | 4.50 | 31.62 | 1.43 |
| 1.58 | 1.75 | 7.94 | 2.83 | 39.81 | 1.68 |
| 2.00 | 1.40 | 10.00 | 2.42 | 50.12 | 1.52 |
| 2.51 | 1.20 | 12.59 | 2.56 | 63.10 | 1.46 |
| 3.16 | 1.27 | 15.85 | 2.14 | 79.43 | 1.65 |
| 3.98 | 1.32 | 19.95 | 1.51 | 100.00 | 1.32 |

ACCELEROMETER #5Y DAMPING 5
DIRECTION E-W LOCATION 2
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 1.48GPK

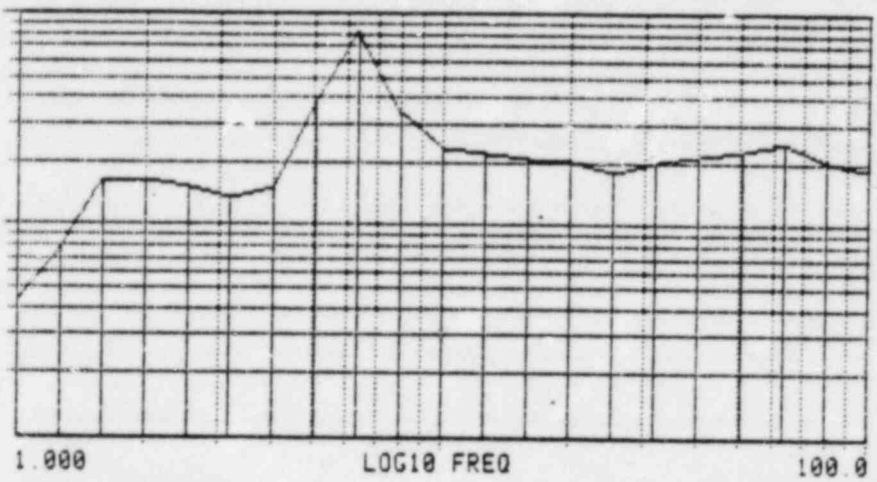



19-AUG-82 11:28:40
SHOCK RESPONSE
CG&E UPSET #4 TEST#9 SURVEY
5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.39 | 5.01 | 1.68 | 25.12 | 3.32 |
| 1.26 | 0.37 | 6.31 | 1.54 | 31.62 | 2.65 |
| 1.58 | 0.53 | 7.94 | 1.72 | 39.81 | 2.68 |
| 2.00 | 0.71 | 10.00 | 2.57 | 50.12 | 2.46 |
| 2.51 | 1.25 | 12.59 | 3.06 | 63.10 | 1.77 |
| 3.16 | 1.70 | 15.85 | 3.98 | 79.43 | 1.66 |
| 3.98 | 1.90 | 19.95 | 4.59 | 100.00 | 1.63 |

ACCELEROMETER # 62 DAMPING 5
DIRECTION Vertical LOCATION 2
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 1.53GPK

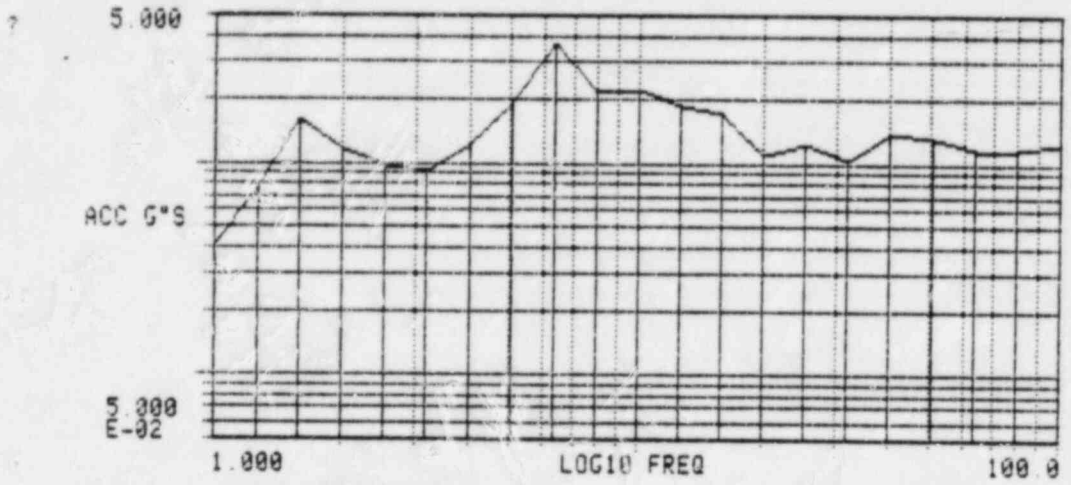



19-AUG-82 12:53:20
SHOCK RESPONSE
CG&E UPSET #4 TEST 9 SURVEY
5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.42 | 5.01 | 3.77 | 25.12 | 1.73 |
| 1.26 | 0.78 | 6.31 | 8.24 | 31.62 | 2.00 |
| 1.58 | 1.62 | 7.94 | 3.34 | 39.81 | 2.08 |
| 2.00 | 1.64 | 10.00 | 2.30 | 50.12 | 2.26 |
| 2.51 | 1.49 | 12.59 | 2.20 | 63.10 | 2.47 |
| 3.16 | 1.32 | 15.85 | 2.05 | 79.43 | 1.98 |
| 3.98 | 1.47 | 19.95 | 2.00 | 100.00 | 1.79 |

ACCELEROMETER # 7X DAMPING 5
DIRECTION N-S LOCATION 3
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 0.93GPK




19-AUG-82
12:55:30

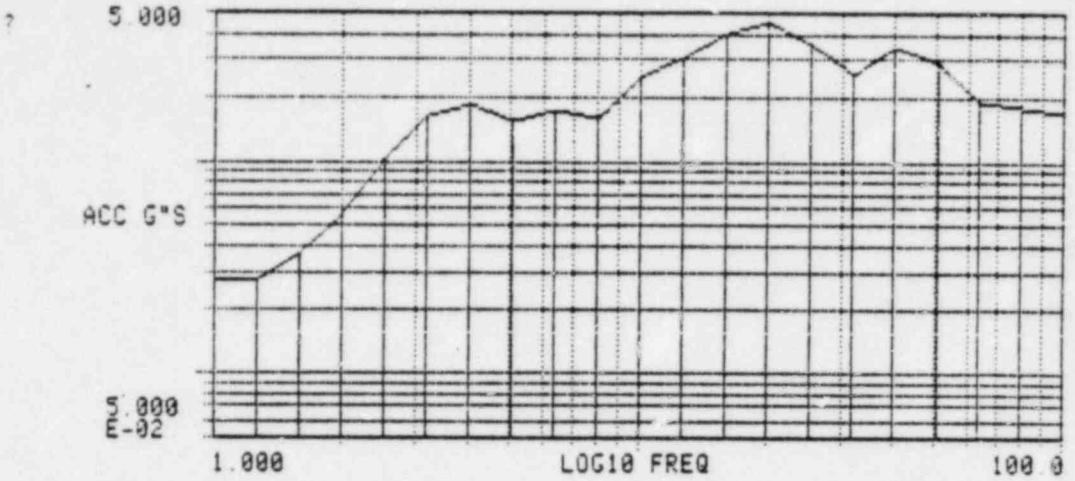
SHOCK RESPONSE
CG&E UPSET #4 TEST 9 SURVEY

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.40 | 5.01 | 1.87 | 25.12 | 1.21 |
| 1.26 | 0.76 | 6.31 | 3.63 | 31.62 | 1.03 |
| 1.58 | 1.60 | 7.94 | 2.14 | 39.81 | 1.36 |
| 2.00 | 1.16 | 10.00 | 2.16 | 50.12 | 1.31 |
| 2.51 | 0.98 | 12.59 | 1.85 | 63.10 | 1.16 |
| 3.16 | 0.90 | 15.85 | 1.67 | 79.43 | 1.16 |
| 3.98 | 1.21 | 19.95 | 1.88 | 100.00 | 1.23 |

ACCELEROMETER # 8Y DAMPING 5
DIRECTION E-W LOCATION 3
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 1.43GPK




19-AUG-82
12:57:40

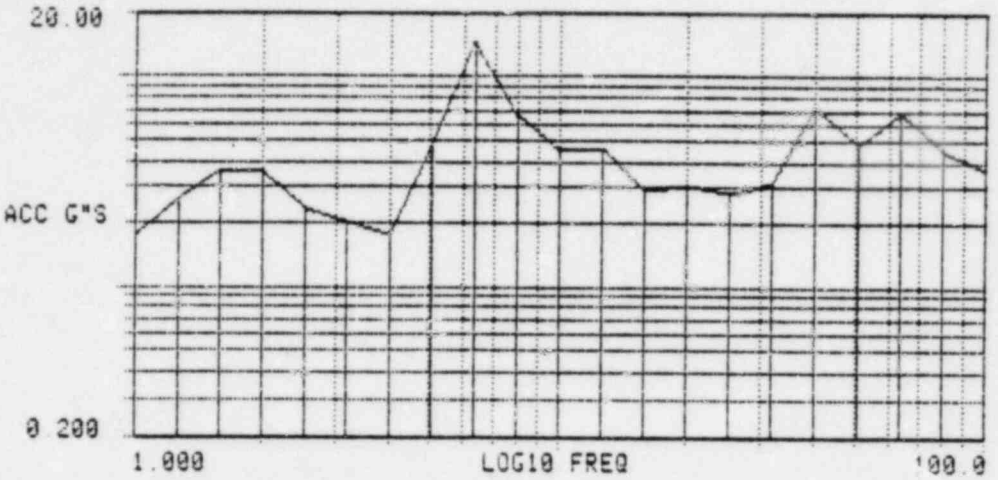
SHOCK RESPONSE
CG&E UPSET #4 TEST 9 SURVEY

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.26 | 5.01 | 1.54 | 25.12 | 3.47 |
| 1.26 | 0.27 | 6.31 | 1.71 | 31.62 | 2.54 |
| 1.58 | 0.37 | 7.94 | 1.58 | 39.81 | 3.37 |
| 2.00 | 0.55 | 10.00 | 2.48 | 50.12 | 2.87 |
| 2.51 | 1.04 | 12.59 | 3.06 | 63.10 | 1.88 |
| 3.16 | 1.63 | 15.85 | 3.95 | 79.43 | 1.77 |
| 3.98 | 1.82 | 19.95 | 4.49 | 100.00 | 1.69 |

ACCELEROMETER # 92 DAMPING 5
DIRECTION Vertical LOCATION 3
TEST# 9 OBE ✓ SSE___ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 2.33GPK




19-AUG-82
13:03:00

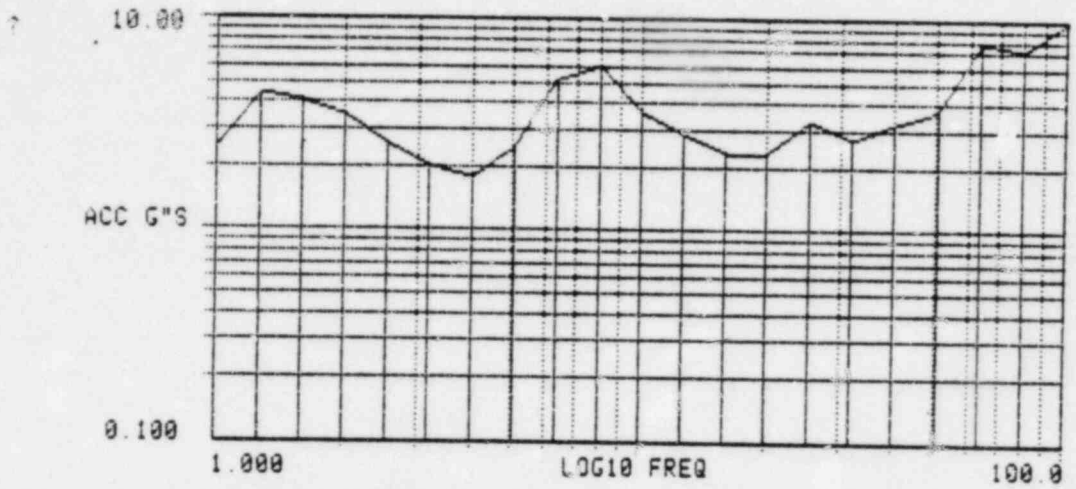
SHOCK RESPONSE
CG&E SURVEY EMERGENCY#5

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.72 | 5.01 | 4.73 | 25.12 | 2.76 |
| 1.26 | 2.64 | 6.31 | 14.26 | 31.62 | 3.13 |
| 1.58 | 3.65 | 7.94 | 6.44 | 39.81 | 7.07 |
| 2.00 | 3.57 | 10.00 | 4.45 | 50.12 | 4.75 |
| 2.51 | 2.31 | 12.59 | 4.54 | 63.10 | 6.82 |
| 3.16 | 2.03 | 15.85 | 2.91 | 79.43 | 4.49 |
| 3.98 | 1.73 | 19.95 | 3.06 | 100.00 | 3.61 |

ACCELEROMETER # 1X DAMPING 2
DIRECTION N-S LOCATION 1
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - 8 ZPA= 2.18GPK



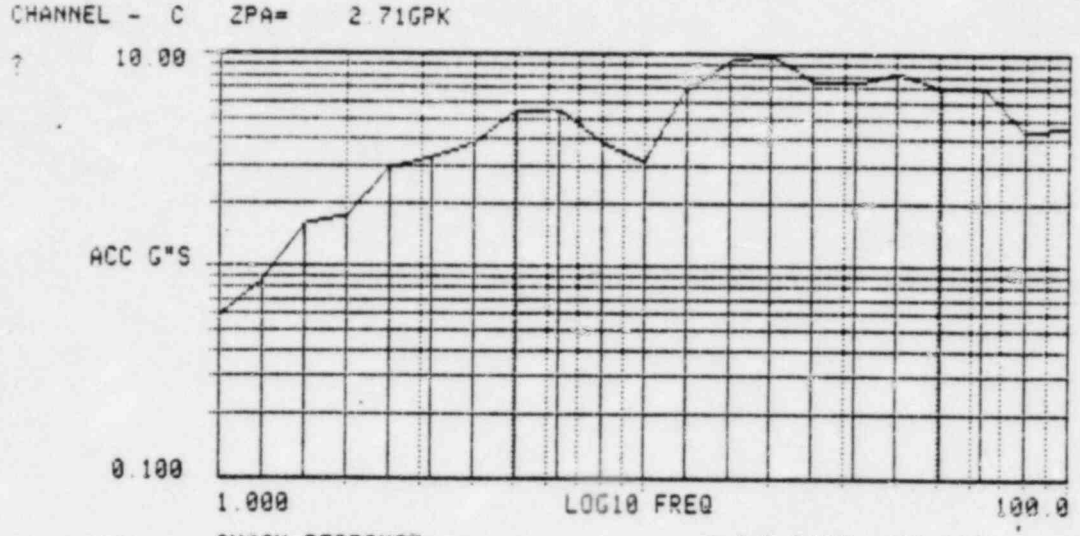

19-AUG-82
13:05:20

SHOCK RESPONSE
CG&E SURVEY EMERGENCY#5

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 2.44 | 5.01 | 2.45 | 25.12 | 3.27 |
| 1.26 | 4.43 | 6.31 | 5.11 | 31.62 | 2.68 |
| 1.59 | 4.05 | 7.94 | 5.97 | 39.81 | 3.15 |
| 2.00 | 3.50 | 10.00 | 3.56 | 50.12 | 3.62 |
| 2.51 | 2.50 | 12.59 | 2.80 | 63.10 | 7.66 |
| 3.16 | 1.97 | 15.85 | 2.31 | 79.43 | 7.06 |
| 3.98 | 1.78 | 19.95 | 2.33 | 100.00 | 9.81 |

ACCELEROMETER # 2Y DAMPING 2
DIRECTION E-W LOCATION 1
TEST# 16 OBE___ SSE✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX✓
CONTROL _____ SURVEY ✓




19-AUG-82
13:07:30

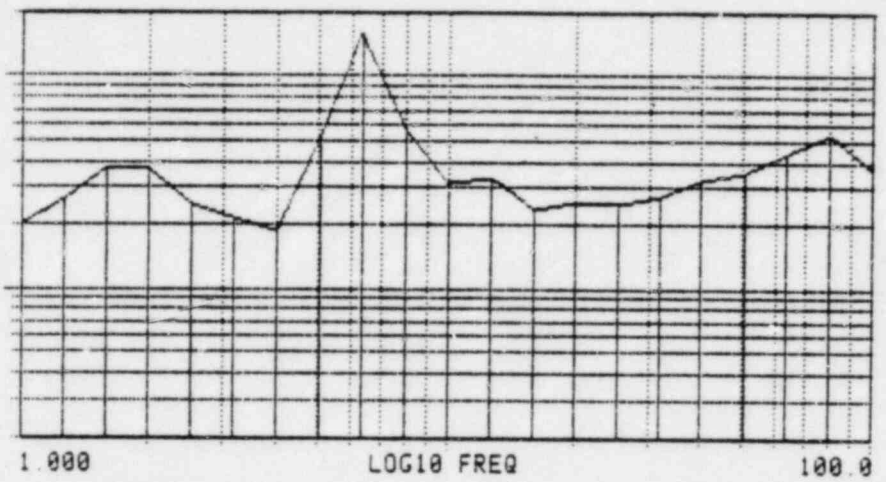
SHOCK RESPONSE
CG&E SURVEY EMERGENCY#5

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.57 | 5.01 | 5.36 | 25.12 | 7.43 |
| 1.26 | 0.84 | 6.31 | 5.38 | 31.62 | 7.34 |
| 1.58 | 1.56 | 7.94 | 3.78 | 39.81 | 8.07 |
| 2.00 | 1.72 | 10.00 | 3.09 | 50.12 | 6.90 |
| 2.51 | 2.87 | 12.59 | 6.83 | 63.10 | 6.96 |
| 3.16 | 3.30 | 15.85 | 9.08 | 79.43 | 4.29 |
| 3.98 | 3.77 | 19.95 | 9.87 | 100.00 | 4.57 |

ACCELEROMETER #3Z DAMPING 2
DIRECTION Vertical LOCATION 1
TEST#16 OBE___ SSE ✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 2.49GPK




19-AUG-82
13:48:00

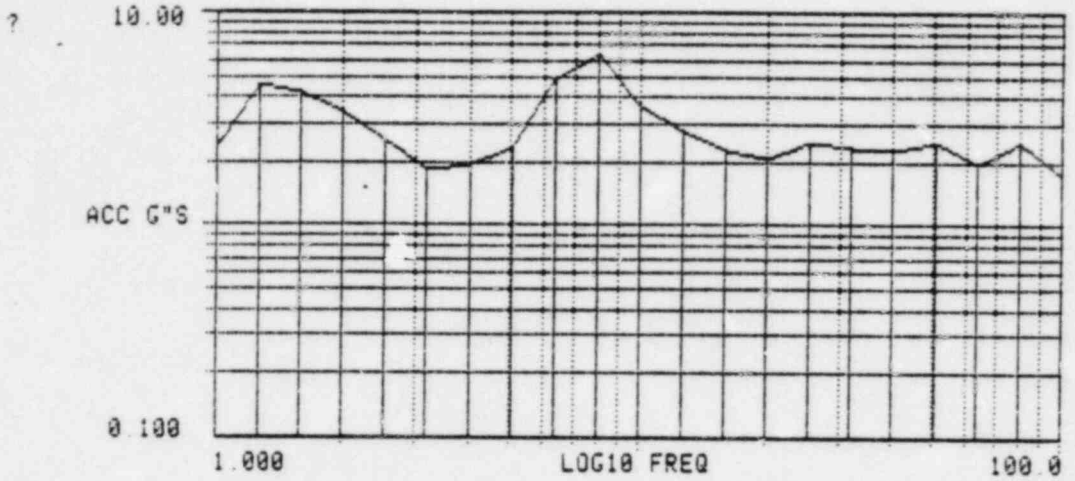
SHOCK RESPONSE
CG&E EMERGENCY#5 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 2.00 | 5.01 | 5.12 | 25.12 | 2.46 |
| 1.26 | 2.62 | 6.31 | 15.91 | 31.62 | 2.67 |
| 1.58 | 3.70 | 7.94 | 5.87 | 39.81 | 3.23 |
| 2.00 | 3.62 | 10.00 | 3.13 | 50.12 | 3.55 |
| 2.51 | 2.50 | 12.59 | 3.35 | 63.10 | 4.32 |
| 3.16 | 2.15 | 15.85 | 2.32 | 79.43 | 5.38 |
| 3.98 | 1.84 | 19.95 | 2.53 | 100.00 | 3.60 |

ACCELEROMETER # 4X DAMPING 2
DIRECTION N-S LOCATION 2
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - 8 ZPA= 1.32GPK




19-AUG-82
13:50:20

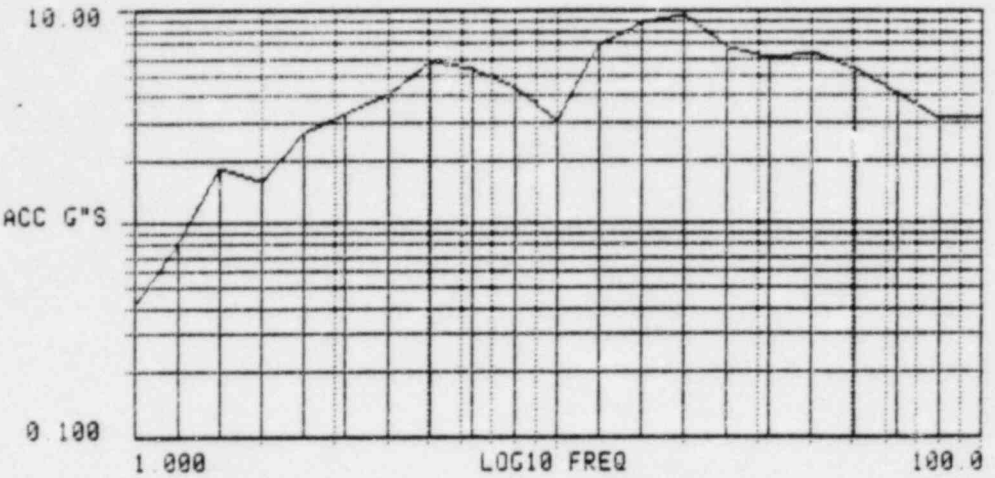
SHOCK RESPONSE
CG&E EMERGENCY#5 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 2.34 | 5.01 | 2.30 | 25.12 | 2.47 |
| 1.26 | 4.56 | 6.31 | 4.84 | 31.62 | 2.28 |
| 1.58 | 4.13 | 7.94 | 6.26 | 39.81 | 2.25 |
| 2.00 | 3.39 | 10.00 | 3.56 | 50.12 | 2.40 |
| 2.51 | 2.51 | 12.59 | 2.72 | 63.10 | 1.96 |
| 3.16 | 1.83 | 15.85 | 2.25 | 79.43 | 2.42 |
| 3.98 | 1.91 | 19.95 | 2.02 | 100.00 | 1.74 |

ACCELEROMETER #5Y DAMPING 2
DIRECTION E-W LOCATION 2
TEST#16 ORE___ SSE✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 2.39GPK




19-AUG-82
13:52:50

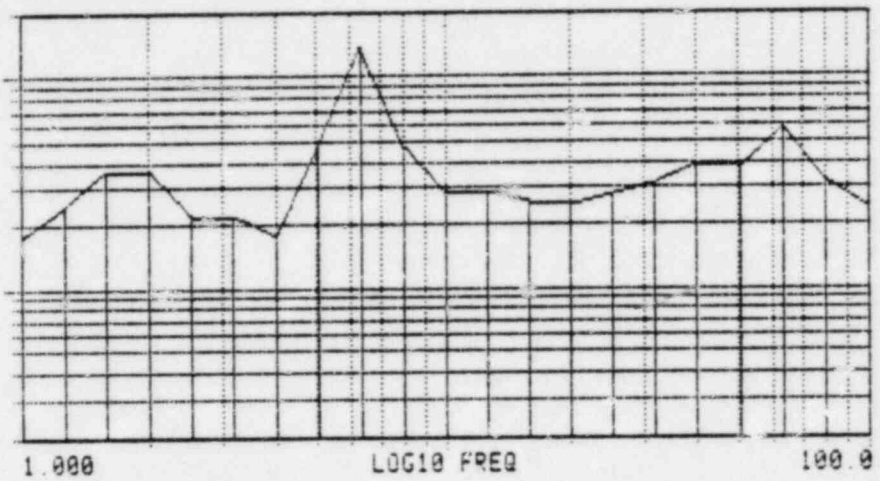
SHOCK RESPONSE
CG&E EMERGENCY#5 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.40 | 5.01 | 5.76 | 25.12 | 6.50 |
| 1.26 | 0.79 | 6.31 | 5.26 | 31.62 | 5.97 |
| 1.58 | 1.79 | 7.94 | 4.23 | 39.81 | 6.28 |
| 2.00 | 1.56 | 10.00 | 3.00 | 50.12 | 5.29 |
| 2.51 | 2.64 | 12.59 | 6.76 | 63.10 | 4.01 |
| 3.15 | 3.24 | 15.85 | 8.57 | 79.43 | 3.06 |
| 3.98 | 3.97 | 19.95 | 9.43 | 100.00 | 3.19 |

ACCELEROMETER #62 DAMPING 2
DIRECTION Vertical LOCATION 2
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 1.92GPK



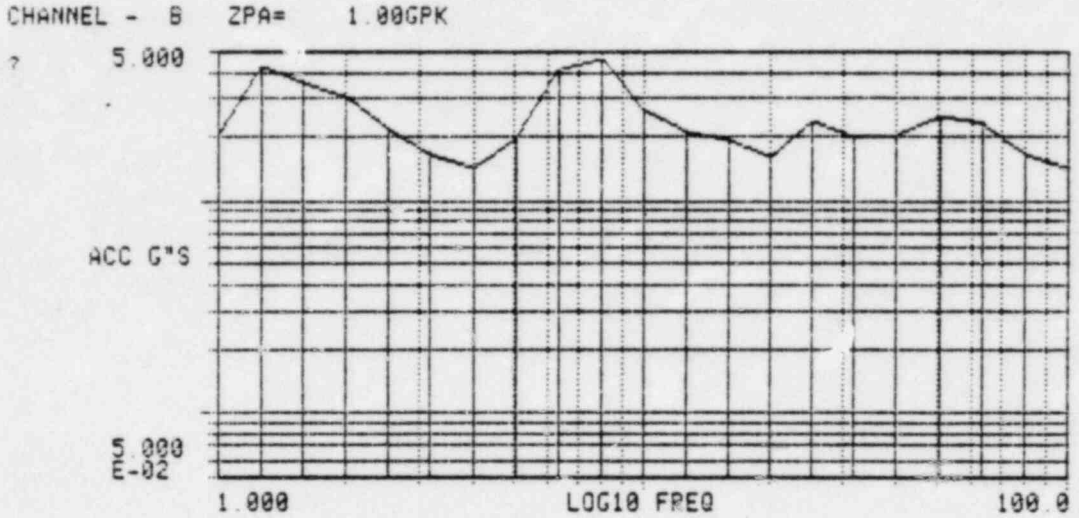

19-AUG-82
14:13:00

SHOCK RESPONSE
CG&E EMERGENCY #5 SURVEY

2.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

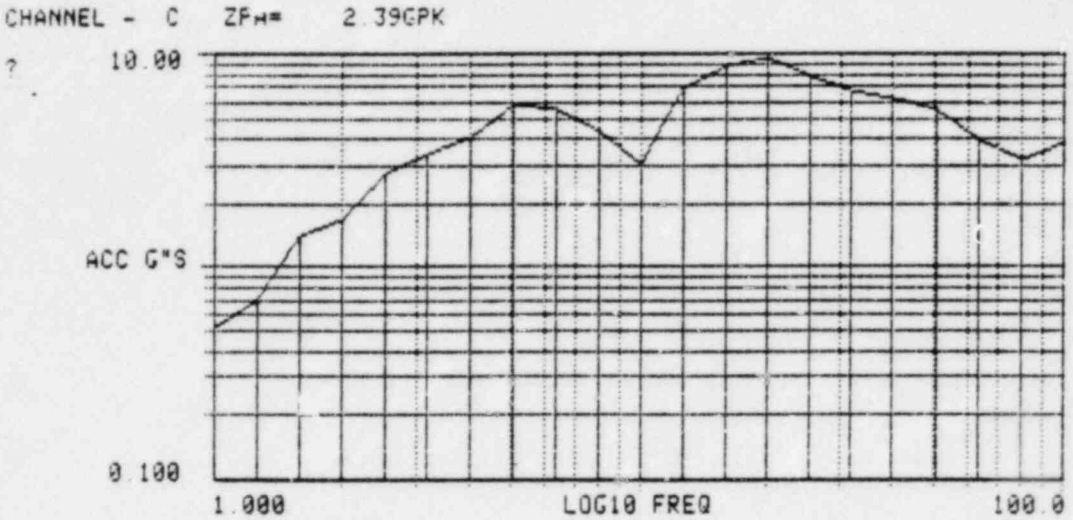
| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.72 | 5.01 | 4.70 | 25.12 | 2.80 |
| 1.26 | 2.44 | 6.31 | 13.87 | 31.62 | 3.18 |
| 1.58 | 3.67 | 7.94 | 4.74 | 39.81 | 3.87 |
| 2.00 | 3.68 | 10.00 | 2.79 | 50.12 | 3.70 |
| 2.51 | 2.17 | 12.59 | 2.90 | 63.10 | 5.80 |
| 3.16 | 2.18 | 15.85 | 2.58 | 79.43 | 3.24 |
| 3.98 | 1.72 | 19.95 | 2.47 | 100.00 | 2.39 |

ACCELEROMETER # 7X DAMPING 2
DIRECTION N-S LOCATION 3
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL _____ SURVEY ____✓___




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 2.03 | 5.01 | 1.96 | 25.12 | 2.30 |
| 1.26 | 4.20 | 6.31 | 4.05 | 31.62 | 1.92 |
| 1.59 | 3.50 | 7.94 | 4.66 | 39.81 | 2.03 |
| 2.00 | 3.07 | 10.00 | 2.64 | 50.12 | 2.49 |
| 2.51 | 2.13 | 12.59 | 2.08 | 63.10 | 2.25 |
| 3.16 | 1.62 | 15.85 | 1.90 | 79.43 | 1.62 |
| 3.98 | 1.40 | 19.95 | 1.60 | 100.00 | 1.41 |

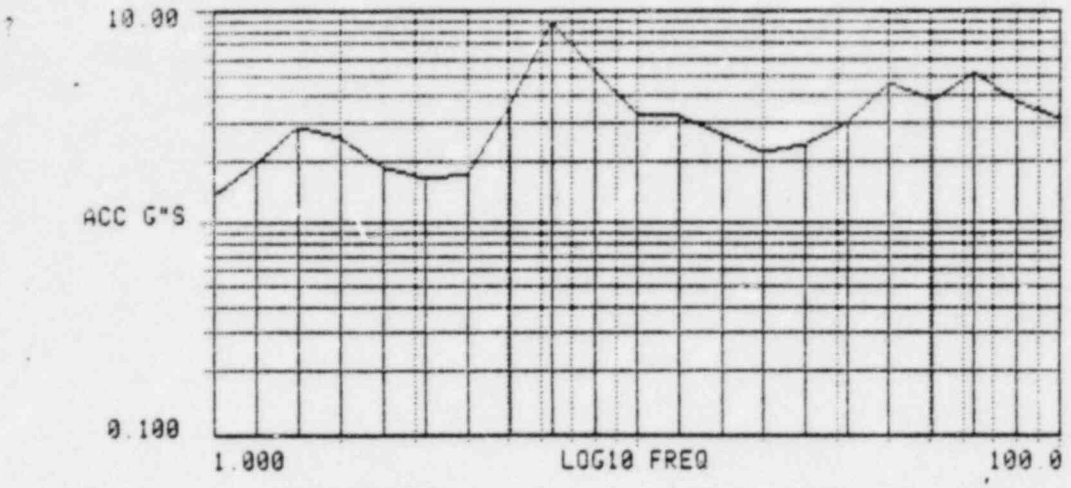
ACCELEROMETER # 8Y DAMPING 2.
DIRECTION E-W LOCATION 3
TEST# 16 OBE___ SSE✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX✓
CONTROL _____ SURVEY ✓




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.52 | 5.01 | 5.67 | 25.12 | 7.64 |
| 1.26 | 0.69 | 6.31 | 5.46 | 31.62 | 6.65 |
| 1.58 | 1.40 | 7.94 | 4.22 | 39.81 | 6.16 |
| 2.00 | 1.65 | 10.00 | 2.99 | 50.12 | 5.43 |
| 2.51 | 2.73 | 12.59 | 6.75 | 63.10 | 3.90 |
| 3.16 | 3.34 | 15.85 | 8.55 | 79.43 | 3.18 |
| 3.98 | 4.00 | 19.95 | 9.38 | 100.00 | 3.81 |

ACCELEROMETER #92 DAMPING 2
DIRECTION Vertical LOCATION 3
TEST#16 OBE___ SSE✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 2.33GPK




19-AUG-82
13:10:40

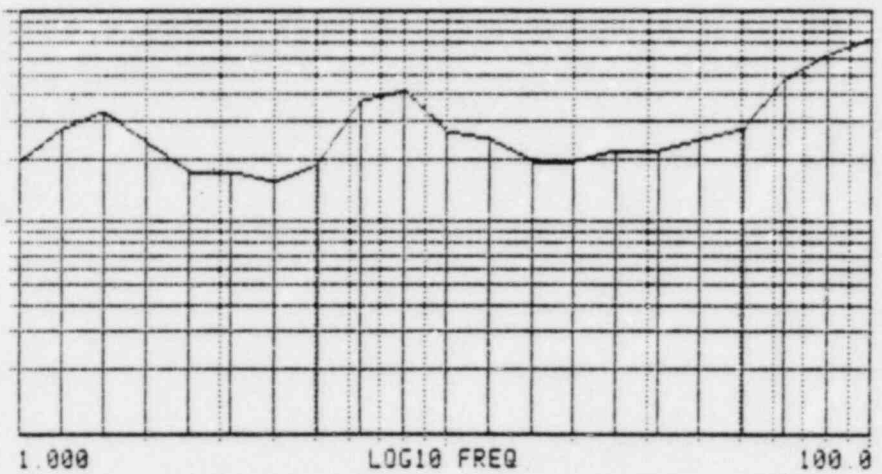
SHOCK RESPONSE
CG&E SURVEY EMERGENCY#5

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.35 | 5.01 | 3.57 | 25.12 | 2.36 |
| 1.26 | 1.93 | 6.31 | 8.69 | 31.62 | 3.00 |
| 1.58 | 2.06 | 7.94 | 5.12 | 39.81 | 4.48 |
| 2.00 | 2.58 | 10.00 | 3.27 | 50.12 | 3.79 |
| 2.51 | 1.80 | 12.59 | 3.18 | 63.10 | 5.05 |
| 3.16 | 1.61 | 15.85 | 2.57 | 79.43 | 3.73 |
| 3.98 | 1.69 | 19.95 | 2.18 | 100.00 | 3.07 |

ACCELEROMETER # 1X DAMPING 5
DIRECTION N-S LOCATION 1
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 2.18GPK




19-AUG-82
13:20:30

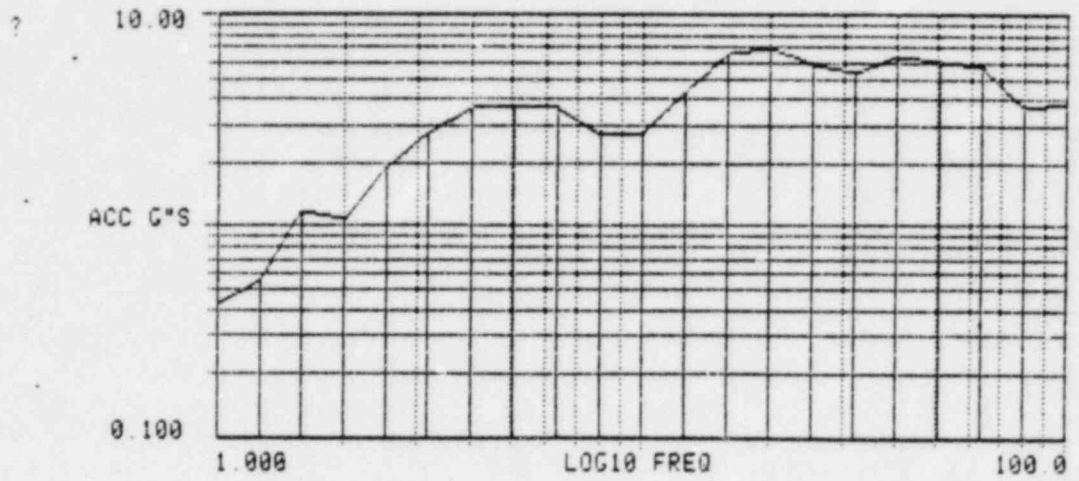
SHOCK RESPONSE
CG&E SURVEY EMERGENCY#5

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.90 | 5.01 | 1.88 | 25.12 | 2.18 |
| 1.26 | 2.79 | 6.31 | 3.66 | 31.62 | 2.19 |
| 1.58 | 3.31 | 7.94 | 4.12 | 39.81 | 2.44 |
| 2.00 | 2.39 | 10.00 | 2.64 | 50.12 | 2.77 |
| 2.51 | 1.74 | 12.59 | 2.45 | 63.10 | 4.65 |
| 3.16 | 1.70 | 15.85 | 1.94 | 79.43 | 6.13 |
| 3.98 | 1.50 | 19.95 | 1.91 | 100.00 | 7.23 |

ACCELEROMETER # 2Y DAMPING 5
DIRECTION E-W LOCATION 1
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 2.71GPK




19-AUG-82
13:22:50

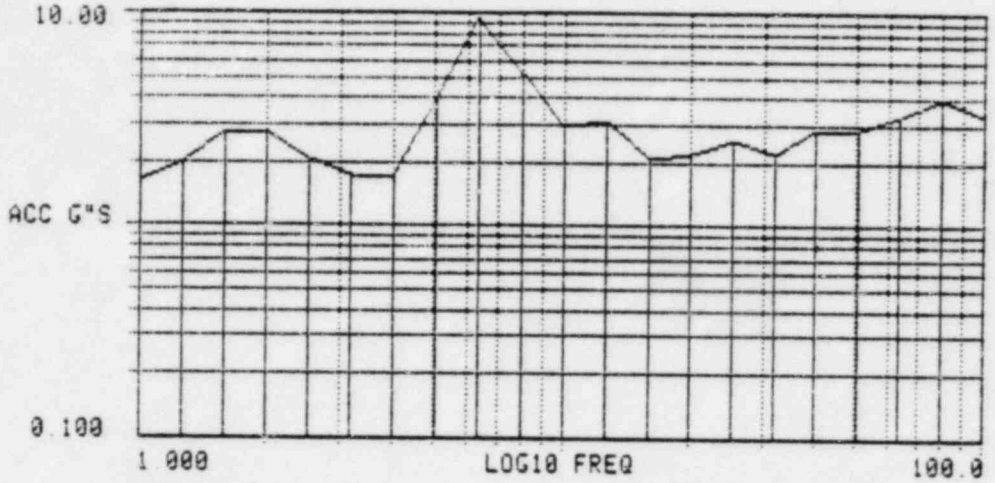
SHOCK RESPONSE
CG&E SURVEY EMERGENCY#5

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.42 | 5.01 | 3.63 | 25.12 | 5.76 |
| 1.26 | 0.55 | 6.31 | 3.59 | 31.62 | 5.22 |
| 1.58 | 1.15 | 7.94 | 2.63 | 39.81 | 6.26 |
| 2.00 | 1.06 | 10.00 | 2.77 | 50.12 | 5.97 |
| 2.51 | 1.86 | 12.59 | 4.31 | 63.10 | 5.58 |
| 3.16 | 2.75 | 15.85 | 6.40 | 79.43 | 3.58 |
| 3.98 | 3.55 | 19.95 | 6.31 | 100.00 | 3.79 |

ACCELEROMETER #3 Z DAMPING 5
DIRECTION Vertical LOCATION 1
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 2.49GPK




19-AUG-82
13:57:50

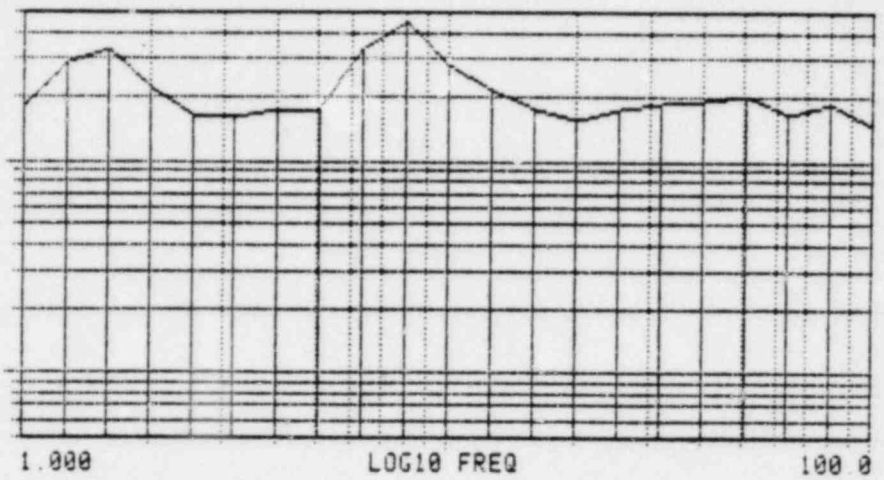
SHOCK RESPONSE
CG&E EMERGENCY#5 SURVEY

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.64 | 5.01 | 3.92 | 25.12 | 2.52 |
| 1.26 | 2.01 | 6.31 | 9.42 | 31.62 | 2.20 |
| 1.58 | 2.74 | 7.94 | 5.18 | 39.81 | 2.83 |
| 2.00 | 2.74 | 10.00 | 2.95 | 50.12 | 2.83 |
| 2.51 | 2.02 | 12.59 | 3.04 | 63.10 | 3.30 |
| 3.16 | 1.69 | 15.85 | 2.07 | 79.43 | 3.88 |
| 3.98 | 1.69 | 19.95 | 2.19 | 100.00 | 3.25 |

ACCELEROMETER # 4X DAMPING 5
DIRECTION N-S LOCATION 2
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - 8 ZPA= 1.32GPK




19-AUG-82
14:00:00

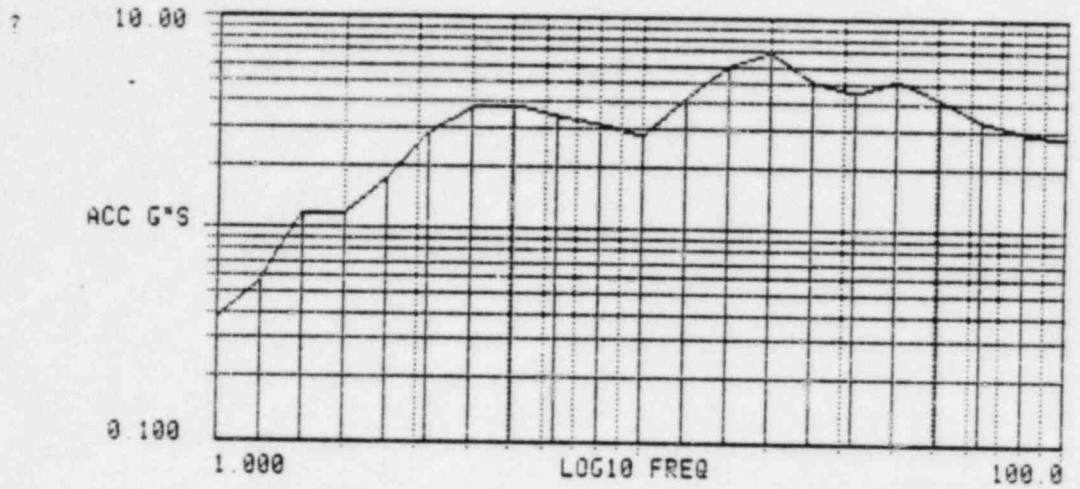
SHOCK RESPONSE
CG&E EMERGENCY#5 SURVEY

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.78 | 5.01 | 1.73 | 25.12 | 1.71 |
| 1.26 | 2.84 | 6.31 | 3.31 | 31.62 | 1.85 |
| 1.58 | 3.28 | 7.94 | 4.40 | 39.81 | 1.91 |
| 2.00 | 2.13 | 10.00 | 2.78 | 50.12 | 2.02 |
| 2.51 | 1.62 | 12.59 | 2.15 | 63.10 | 1.61 |
| 3.16 | 1.59 | 15.85 | 1.76 | 79.43 | 1.83 |
| 3.98 | 1.72 | 19.95 | 1.57 | 100.00 | 1.48 |

ACCELEROMETER # 5Y DAMPING 5
DIRECTION E-W LOCATION 2
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL _____ SURVEY ____✓____

CHANNEL - C ZPA= 2.39GPK



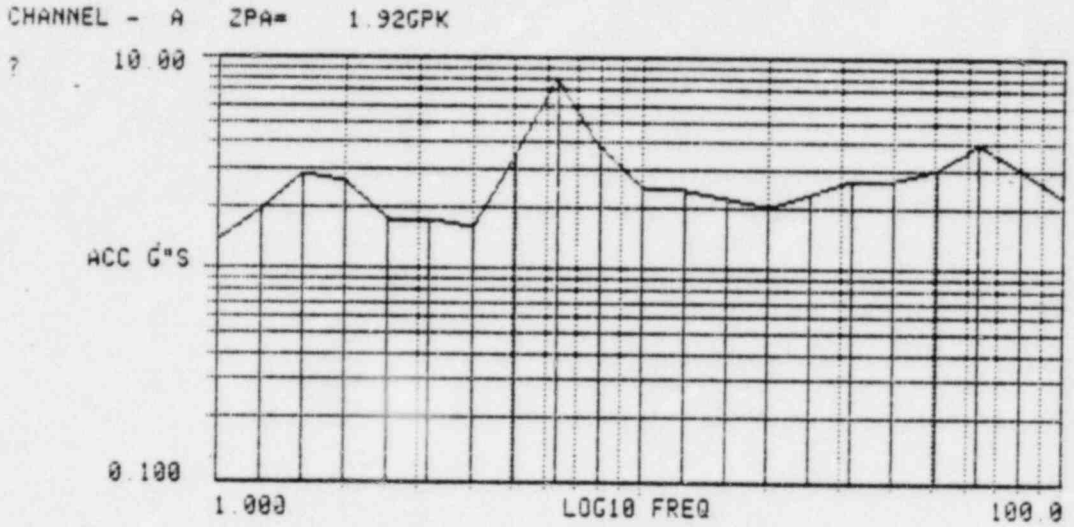

19-AUG-82
14:02:20

SHOCK RESPONSE
CG&E EMERGENCY#5 SURVEY

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.37 | 5.01 | 3.78 | 25.12 | 4.94 |
| 1.26 | 0.57 | 6.31 | 3.34 | 31.62 | 4.41 |
| 1.58 | 1.15 | 7.94 | 3.08 | 39.81 | 5.12 |
| 2.00 | 1.18 | 10.00 | 2.77 | 50.12 | 4.12 |
| 2.51 | 1.73 | 12.59 | 4.10 | 63.10 | 3.30 |
| 3.16 | 2.79 | 15.85 | 3.94 | 79.43 | 2.92 |
| 3.98 | 3.70 | 19.95 | 6.81 | 100.00 | 2.79 |

ACCELEROMETER # 6Z DAMPING 5
DIRECTION Vertical LOCATION 1
TEST# 16 OBE___ SSE✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX✓
CONTROL _____ SURVEY ✓




13-AUG-82
14:25:30

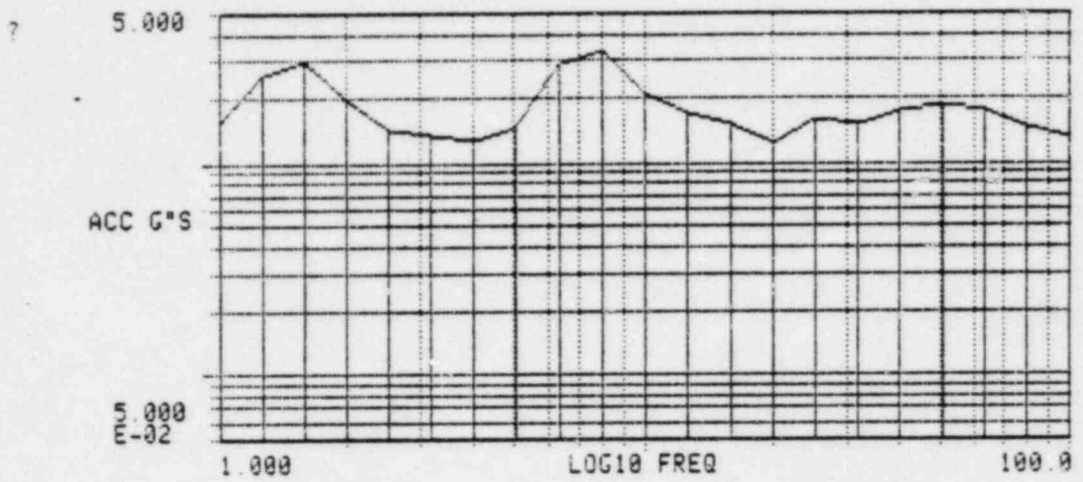
SHOCK RESPONSE
CG&E EMERGENCY #5 SURVEY

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.37 | 5.01 | 3.51 | 25.12 | 2.29 |
| 1.26 | 1.96 | 6.31 | 7.95 | 31.62 | 2.66 |
| 1.58 | 2.83 | 7.94 | 3.79 | 39.81 | 2.68 |
| 2.00 | 2.60 | 10.00 | 2.42 | 50.12 | 3.02 |
| 2.51 | 1.71 | 12.59 | 2.38 | 63.10 | 3.87 |
| 3.16 | 1.72 | 15.85 | 2.20 | 79.43 | 2.99 |
| 3.98 | 1.55 | 19.95 | 1.99 | 100.00 | 2.24 |

ACCELEROMETER #7X DAMPING 5
DIRECTION N-S LOCATION 3
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - 8 ZPA= 1.00GPK



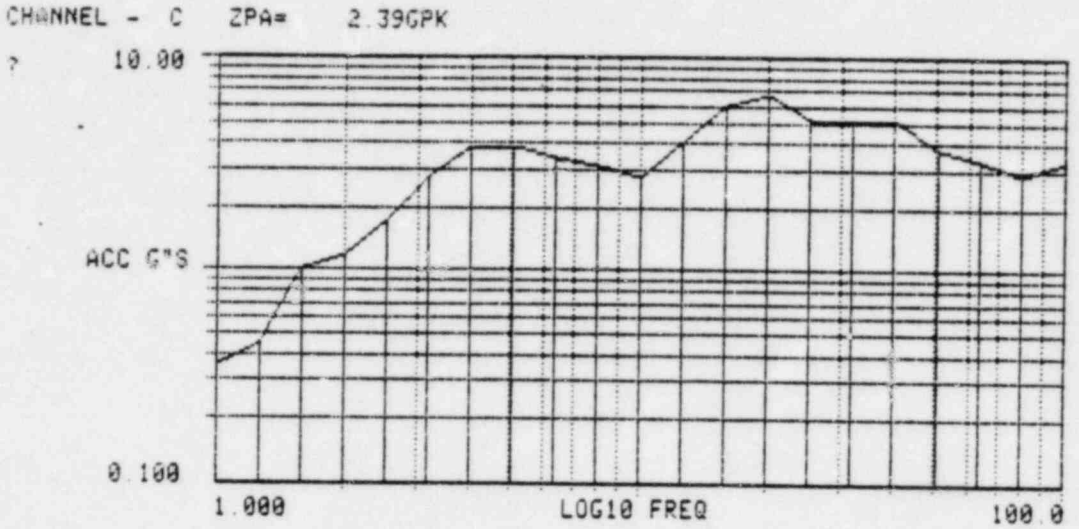

19-AUG-82
14:31:10

SHOCK RESPONSE
CG&E EMERGENCY #5 SURVEY

5.0 % DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.53 | 5.01 | 1.44 | 25.12 | 1.57 |
| 1.26 | 2.55 | 6.31 | 2.83 | 31.62 | 1.49 |
| 1.58 | 2.95 | 7.94 | 3.28 | 39.81 | 1.72 |
| 2.00 | 1.95 | 10.00 | 2.06 | 50.12 | 1.85 |
| 2.51 | 1.42 | 12.59 | 1.67 | 63.10 | 1.73 |
| 3.16 | 1.33 | 15.85 | 1.50 | 79.43 | 1.46 |
| 3.98 | 1.24 | 19.95 | 1.21 | 100.00 | 1.29 |

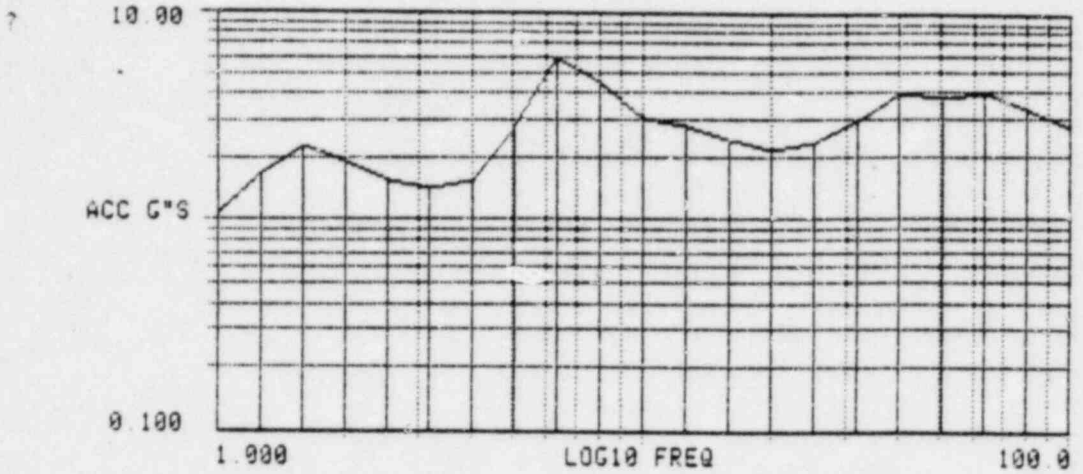
ACCELEROMETER # 8Y DAMPING 5
DIRECTION E-W LOCATION 3
TEST# 16 OBE___ SSE✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX✓
CONTROL _____ SURVEY ✓




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.35 | 5.01 | 3.75 | 25.12 | 5.13 |
| 1.26 | 0.44 | 6.31 | 3.40 | 31.62 | 5.01 |
| 1.58 | 1.00 | 7.94 | 3.08 | 39.81 | 5.13 |
| 2.00 | 1.16 | 10.00 | 2.73 | 50.12 | 3.72 |
| 2.51 | 1.74 | 12.59 | 4.03 | 63.10 | 3.28 |
| 3.16 | 2.74 | 15.85 | 5.86 | 79.43 | 2.86 |
| 3.98 | 3.74 | 19.95 | 6.63 | 100.00 | 3.29 |

ACCELEROMETER #9Z DAMPING 5
DIRECTION Vertical LOCATION 3
TEST#16 OBE___ SSE✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 2.33GPK




19-AUG-82
13:39:10

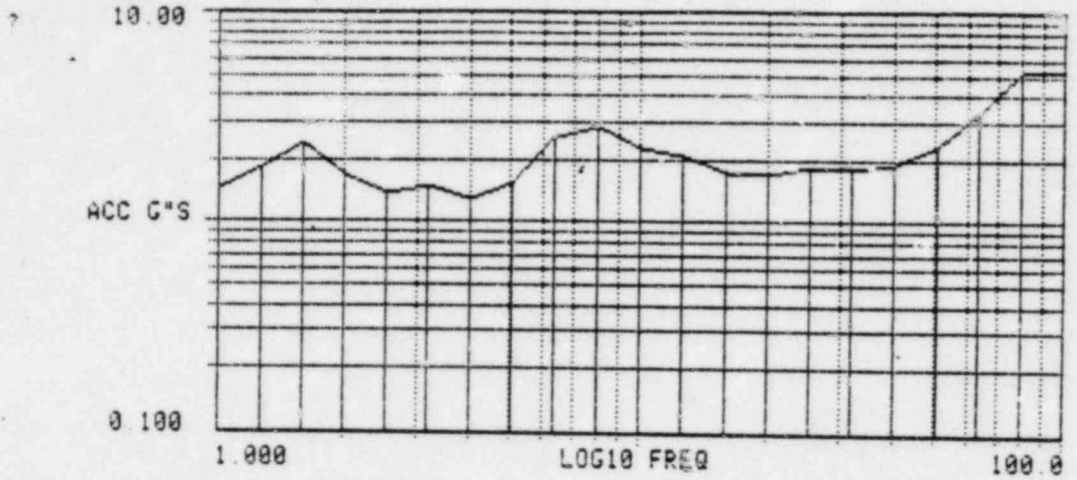
SHOCK RESPONSE
CG&E SURVEY EMERGENCY#5

10.0% DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.07 | 5.01 | 2.73 | 25.12 | 2.33 |
| 1.26 | 1.69 | 6.31 | 5.71 | 31.62 | 2.92 |
| 1.58 | 2.22 | 7.94 | 4.42 | 39.81 | 3.89 |
| 2.00 | 1.85 | 10.00 | 2.97 | 50.12 | 3.63 |
| 2.51 | 1.50 | 12.59 | 2.78 | 63.10 | 3.93 |
| 3.16 | 1.39 | 15.85 | 2.36 | 79.43 | 3.24 |
| 3.98 | 1.54 | 19.95 | 2.11 | 100.00 | 2.67 |

ACCELEROMETER #1X DAMPING 10
DIRECTION N-S LOCATION 1
TEST#16 OBE___ SSE✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 2.1SGPK



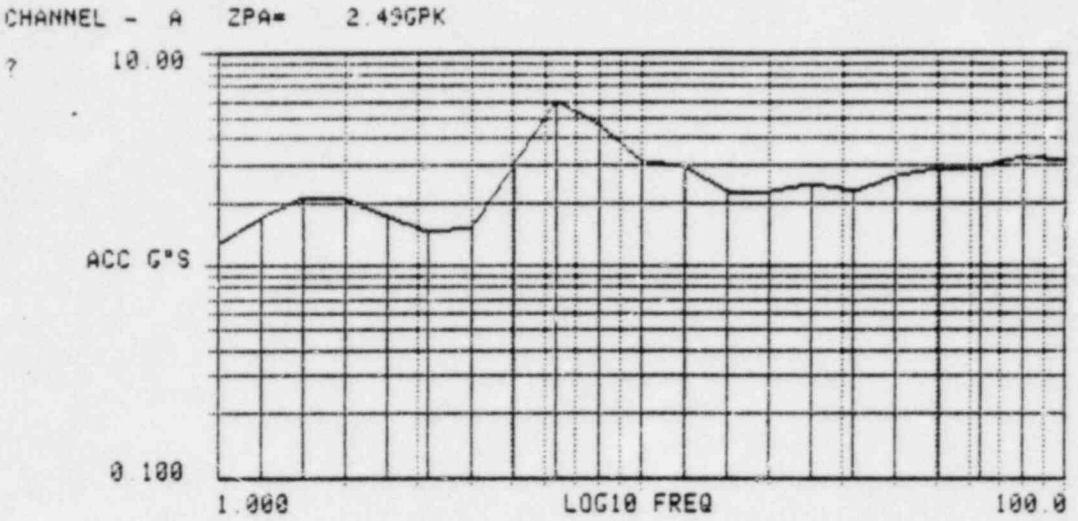

19-AUG-82
13:41:30

SHOCK RESPONSE
CG&E SURVEY EMERGENCY#5

10.0% DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.42 | 5.01 | 1.55 | 25.12 | 1.79 |
| 1.26 | 1.82 | 6.31 | 2.52 | 31.62 | 1.78 |
| 1.58 | 2.37 | 7.94 | 2.83 | 39.81 | 1.89 |
| 2.00 | 1.68 | 10.00 | 2.23 | 50.12 | 2.30 |
| 2.51 | 1.34 | 12.59 | 2.04 | 63.10 | 3.29 |
| 3.16 | 1.50 | 15.85 | 1.70 | 79.43 | 5.06 |
| 3.98 | 1.28 | 19.95 | 1.66 | 100.00 | 5.30 |

ACCELEROMETER #2Y DAMPING 10
DIRECTION E-W LOCATION 1
TEST#16 OBE___ SSE✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX✓
CONTROL _____ SURVEY ✓




19-AUG-82
14:05:20

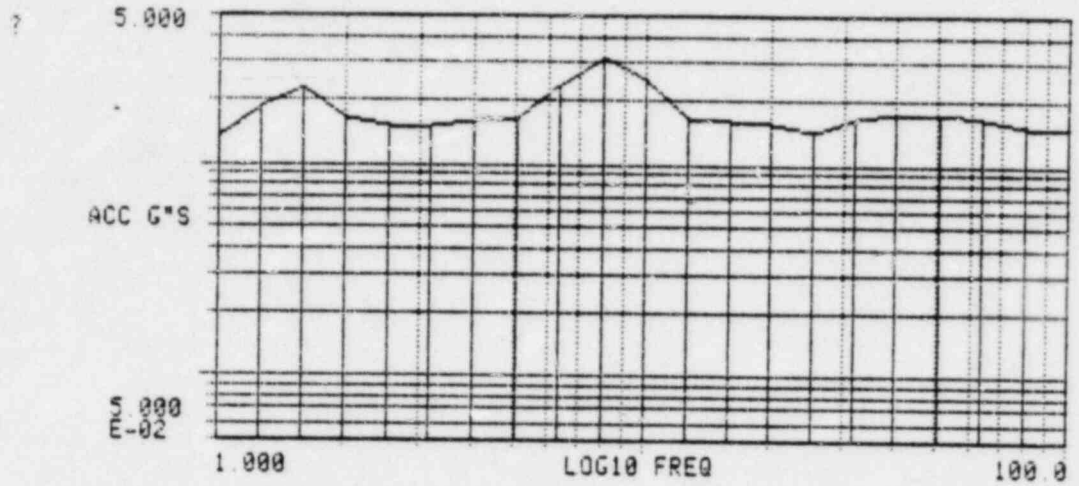
SHOCK RESPONSE
CG&E EMERGENCY#5 SURVEY

10.0% DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.28 | 5.01 | 2.99 | 25.12 | 2.47 |
| 1.26 | 1.70 | 6.31 | 5.95 | 31.62 | 2.24 |
| 1.58 | 2.11 | 7.94 | 4.53 | 39.81 | 2.66 |
| 2.00 | 2.03 | 10.00 | 3.08 | 50.12 | 2.88 |
| 2.51 | 1.74 | 12.59 | 2.87 | 63.10 | 2.92 |
| 3.16 | 1.46 | 15.85 | 2.26 | 79.43 | 3.23 |
| 3.98 | 1.51 | 19.95 | 2.24 | 100.00 | 3.09 |

ACCELEROMETER # 4X DAMPING 10
DIRECTION N-S LOCATION 1
TEST# 16 OBE___ SSE ✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX ✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 1.32GPK




19-AUG-82
14:07:40

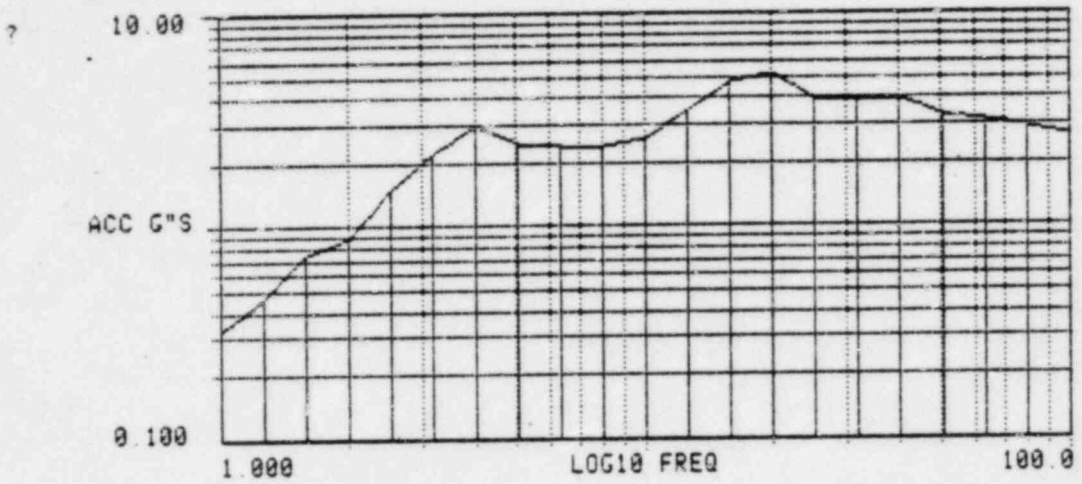
SHOCK RESPONSE
CG&E EMERGENCY#5 SURVEY

10.0% DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.32 | 5.01 | 1.63 | 25.12 | 1.42 |
| 1.26 | 1.84 | 6.31 | 2.29 | 31.62 | 1.63 |
| 1.58 | 2.28 | 7.94 | 3.10 | 39.81 | 1.75 |
| 2.00 | 1.65 | 10.00 | 2.44 | 50.12 | 1.75 |
| 2.51 | 1.48 | 12.59 | 1.66 | 63.10 | 1.62 |
| 3.16 | 1.48 | 15.85 | 1.60 | 79.43 | 1.50 |
| 3.98 | 1.59 | 19.95 | 1.56 | 100.00 | 1.48 |

ACCELEROMETER #5Y DAMPING 10
DIRECTION E-W LOCATION 2
TEST#16 OBE___ SSE✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX✓
CONTROL _____ SURVEY ✓

CHANNEL - C ZPA= 2.39GPK




19-AUG-82
14:09:50

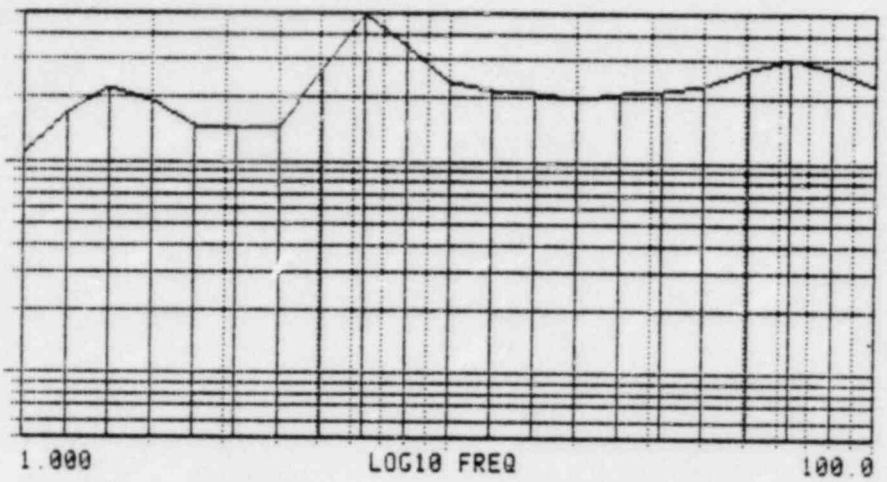
SHOCK RESPONSE
CG&E EMERGENCY#5 SURVEY

10.0% DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.33 | 5.01 | 2.46 | 25.12 | 3.90 |
| 1.26 | 0.46 | 6.31 | 2.35 | 31.62 | 3.90 |
| 1.58 | 0.73 | 7.94 | 2.36 | 39.81 | 3.97 |
| 2.00 | 0.88 | 10.00 | 2.58 | 50.12 | 3.29 |
| 2.51 | 1.50 | 12.59 | 3.44 | 63.10 | 3.03 |
| 3.16 | 2.13 | 15.85 | 4.59 | 79.43 | 2.87 |
| 3.98 | 3.02 | 19.95 | 5.10 | 100.00 | 2.68 |

ACCELEROMETER #6Z DAMPING 10
DIRECTION Vertical LOCATION 2
TEST# 16 OBE___ SSE✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX✓
CONTROL _____ SURVEY ✓

CHANNEL - A ZPA= 1.92GPK




19-AUG-82
14:39:00

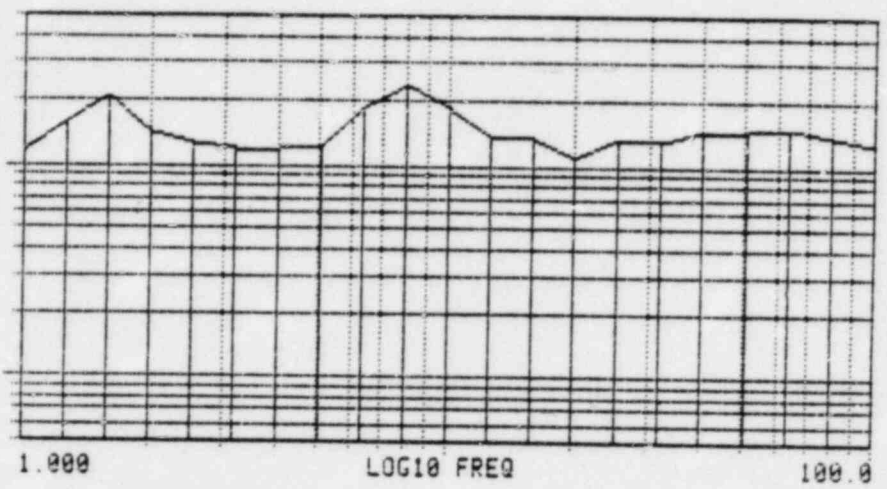
SHOCK RESPONSE
CG&E EMERGENCY #5 SURVEY

10.0% DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.10 | 5.01 | 2.67 | 25.12 | 2.07 |
| 1.26 | 1.69 | 6.31 | 4.87 | 31.62 | 2.15 |
| 1.58 | 2.18 | 7.94 | 3.42 | 39.81 | 2.24 |
| 2.00 | 1.87 | 10.00 | 2.32 | 50.12 | 2.66 |
| 2.51 | 1.47 | 12.59 | 2.12 | 63.10 | 3.01 |
| 3.16 | 1.46 | 15.85 | 2.04 | 79.43 | 2.68 |
| 3.98 | 1.43 | 19.95 | 1.93 | 100.00 | 2.24 |

ACCELEROMETER #7X DAMPING 10
DIRECTION N-S LOCATION 3
TEST# 16 OBE___ SSE✓ FRAG%___
BIAX____ N-S____ E-W____ TRIAX✓
CONTROL _____ SURVEY ✓

CHANNEL - B ZPA= 1.00GPK



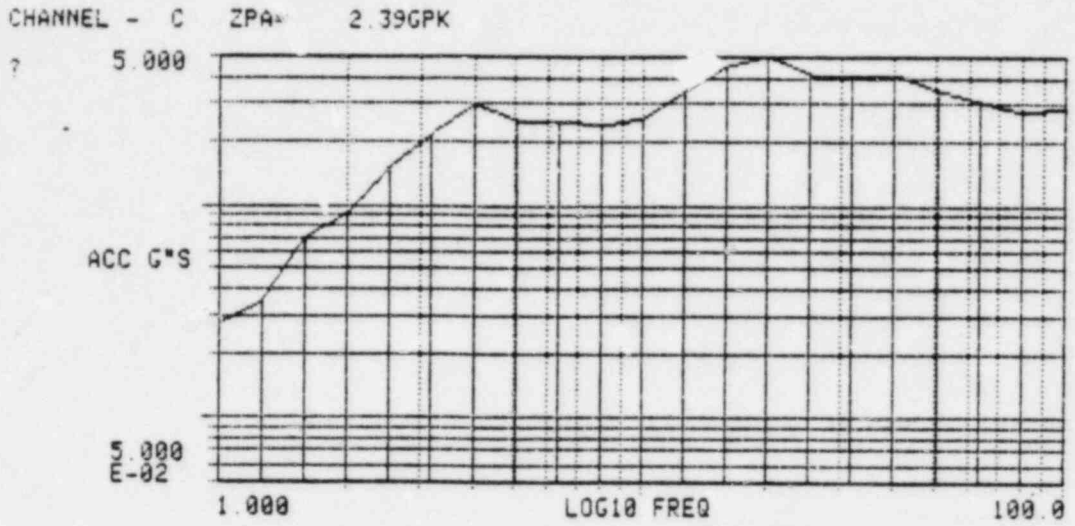

19-AUG-82
14:41:40

SHOCK RESPONSE
CG&E EMERGENCY #5 SURVEY

10.0% DAMP ABS ACC
1/3 OCTAVE MAXI-MAX

| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 1.15 | 5.01 | 1.24 | 25.12 | 1.34 |
| 1.26 | 1.61 | 6.31 | 1.82 | 31.62 | 1.31 |
| 1.59 | 2.04 | 7.94 | 2.32 | 39.81 | 1.47 |
| 2.00 | 1.41 | 10.00 | 1.82 | 50.12 | 1.45 |
| 2.51 | 1.27 | 12.59 | 1.39 | 63.10 | 1.49 |
| 3.16 | 1.16 | 15.85 | 1.32 | 79.43 | 1.35 |
| 3.98 | 1.19 | 19.95 | 1.10 | 100.00 | 1.25 |

ACCELEROMETER # 8Y DAMPING 10
DIRECTION E-W LOCATION 3
TEST# 16 OBE___ SSE_✓_ FRAG%___
BIAX____ N-S____ E-W____ TRIAX_✓_
CONTROL _____ SURVEY ___✓____




| Freq | Ampl | Freq | Ampl | Freq | Ampl |
|---|---|---|---|---|---|
| 1.00 | 0.27 | 5.01 | 2.45 | 25.12 | 4.06 |
| 1.26 | 0.34 | 6.31 | 2.48 | 31.62 | 4.00 |
| 1.58 | 0.70 | 7.94 | 2.34 | 39.81 | 4.05 |
| 2.00 | 0.91 | 10.00 | 2.55 | 50.12 | 3.36 |
| 2.51 | 1.51 | 12.59 | 3.37 | 63.10 | 3.05 |
| 3.16 | 2.12 | 15.85 | 4.47 | 79.43 | 2.69 |
| 3.98 | 2.98 | 19.95 | 4.98 | 100.00 | 2.90 |

ACCELEROMETER # 97 DAMPING 10
DIRECTION Vertical LOCATION 3
TEST# 16 OBE___ SSE✓ FRAG%___
BIAX___ N-S___ E-W___ TRIAX✓
CONTROL _____ SURVEY ✓

THIS ORDER NO MUST APPEAR ON ALL INVOICES PACKAGES CORRESPONDENCE AND SHIPPING PAPERS

XZC 023743

DATE OF ORDER 7/19/82

DELIVERY REQUIRED 7/08/83

INVOICE TO: THE CINCINNATI GAS & ELECTRIC COMPANY
THE DAYTON POWER AND LIGHT COMPANY
COLUMBUS AND SOUTHERN OHIO ELECTRIC COMPANY
P.O. BOX 960 CINCINNATI, OHIO 45201

# PURCHASE ORDER

STRUCTURAL DYNAMICS RESEARCH CORP.
2000 EASTMAN DRIVE

MILFORD OH 45150

STREET AS INSTRUCTED BELOW
IN DESCRIPTION. OR SEE
STATE FOB TERMS OR SHIP VIA OH 45202
ON D.A. PARKER

WK HKG

SHIP VIA BEST AVAILABLE

IMPORTANT

FAILURE TO COMPLY WITH INVOICING REQUIREMENTS WILL RESULT IN RETURN OF INVOICE TO VENDOR

**INVOICING REQUIREMENTS**

1. SUBMIT FIVE(5) COPIES OF INVOICE.
2. SHOW COMPANY NAME(S) OF THE PURCHASER(S) AS SHOWN ABOVE.
3. SHOW OUR PURCHASE ORDER AND LINE ITEM NUMBERS.
4. MAIL TO P.O. BOX 960 ATTN: ACCOUNTS PAYABLE CINCINNATI, OHIO 45201

ALL BILLS OF LADING, CORRESPONDENCE AND OTHER PAPERS MUST ALSO BE MAILED TO ABOVE ADDRESS.

| OUR STOCK NUMBER OR VENDOR CATALOG NUMBER | QUANTITY | UNIT | ARTICLE/DESCRIPTION | UNIT PRICE | LINE ITEM TOTAL |
|---|---|---|---|---|---|
| | | | ********** IMPORTANT ********** * PLEASE SIGN AND RETURN THE * * ATTACHED ACKNOWLEDGEMENT * * IMMEDIATELY UPON RECEIPT * * OF THIS PURCHASE ORDER * * MAIL TO THE ABOVE ADDRESS * * ATTN: PURCHASING DIVISION * ********** CONFIRMING PURCHASE ORDER PLACED 08-11-82 WITH YOUR COMPANY ESSENTIAL DYNAMIC TESTING-480 VAC MCC'S B/M 51000 JOB E-5590 ITEM M-170 SHEET(S) A-D SPONSOR: D.A. PARKER FURNISH MATERIAL IN ACCORDANCE WITH THE ABOVE B/M (COPY ATTACHED) SHIP DATE SHOWN IS TO SATISFY COMPUTER REQUIREMENTS AND DOES NOT REFLECT NEGOTIATED DATE. | | .0 |

8/23/82
#11410
Q. Patrick
Attached
Mendicks
Req
Rec'd
Ramos

APPROVED
SDRC Q.A.
Gary T. Rapp 8/23/82
TITLE DATE

TOTAL COST

FURNISH THE ABOVE AS INDICATED SUBJECT TO THE PROVISIONS HEREOF INCLUDING THE TERMS AND CONDITIONS SHOWN ON REVERSE

NET 30 DAYS
SHIPPING POINT

THE CINCINNATI GAS & ELECTRIC COMPANY
THE DAYTON POWER AND LIGHT COMPANY
COLUMBUS AND SOUTHERN OHIO ELECTRIC COMPANY

BY D. C. Funke
D.C. FUNKE, Purchasing Agent for Cincinnati & Subsidiary Companies

AND (WITH POWER OF ATTORNEY) FOR COLUMBU AND DAYTON. (SUCH PURCHASING AGENT HAS EXECUTED THIS PURCHASE ORDER SEPARATELY ON BEHALF OF EACH COMPANY).

FOR MORE INFORMATION CONTACT BUYER

C. BRINKMANN 513-553-2107

ORIGINAL

PAGE 1

A-1148 GEN. ENG.

# THE CINCINNATI GAS AND ELECTRIC CO.

## GENERAL ENGINEERING DEPT.

**BILL OF MATERIAL** ESSENTIAL

ITEM M-170 August 5, 1982

Provide laboratory testing services for the dynamic (seismic) testing of one (1) three section motor control center to be furnished by the purchaser. All testing shall be performed in accordance with the Sargent & Lundy Test Specification titled "Specification For Dynamic Testing of Seismic Category I ITE Series 5600 Motor Control Centers" Rev. 2. Testing services shall be furnished in accordance with SDRC's Proposal No. 11410 Revision No. 1 dated August 5, 1982.

QA AUDIT BY J.F. Wiemeyer 6/14/82

QUALITY ASSURANCE/DOCUMENTATION:

All work performed under this Bill of Material shall be completed in accordance with the applicable requirements of 10CFR50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants". This program sets forth the Quality Assurance requirements to be applied to the design, fabrication, construction, and testing of the essential structures, systems and components.

Contractor shall submit with the proposal one (1) copy to the Quality Assurance Manager, H.R. Sager, The Cincinnati Gas & Electric Company, and one (1) copy to the Head Quality Control Division, M.J. Schuster, Jr., Sargent & Lundy Engineers, of the Quality Assurance Program which shall apply to the design, fabrication, construction and testing of the equipment covered by this B/M. The Program shall include the following:

a. The Contractor's organization showing the reporting and relationship between the Quality Control personnel and top management.

b. The responsibilities of the Quality Control personnel and the degree of authority granted them to carry out their responsibilites.

c. The policy and porcedures for insuring quality reviews and designs and procurement documents; for drawing and design, change controls; for nonconforming material control; for receiving inspection, shop inspection, storage; subvendor surveillance; corrective action, documentation, qualifications of welding; nondestructive testing, material identification and traceability plans and internal audits.

d. The equipment and facilities available for performing the Quality Control functions.

e. The procedures for in-process and final inspections, for protection of stored material and equipment, and for shipping.

THE CINCINNATI GAS & ELECTRIC COMPANY
COLUMBUS & SOUTHERN OHIO ELECTRIC CO.
THE DAYTON POWER & LIGHT COMPANY

Company ____ W.O. 57300 Item No. 955-6 T.R. 70

Location WM. H. ZIMMER NUCLEAR POWER STATION UNIT 1 Job No. E-5590

Engineer D.A. Parker Prepared by Sargent & Lundy Engineers P.O. No. XZC-023743

Checked DAP Project No. ____ Date ____

Approved ____ Spec. No. ____ B/M No. 51000

Engineer ____ Date ____

Sheet No. M170A Dept. No. 84-7

A-1148 GEN. ENG.

# THE CINCINNATI GAS AND ELECTRIC CO.

## GENERAL ENGINEERING DEPT.

BILL OF MATERIAL

ESSENTIAL

ITEM M-170 Continued

NOTE: The Cincinnati Gas & Electric Company's Quality Assurance Department has reviewed Structural Dynamics Research Corporation's Quality Assurance Manual and has determined that it complies with the requirements of 10CFR50, Appendix B for performing seismic tests on safety related equipment (HRS-81-166)

Contractor shall ensure that The Cincinnati Gas & Electric Company has the most up-to-date copies of the Contractors Quality Assurance Manual for the duration of this program.

Conformance with 10CFR Part 21

The work indicated in this specification and/or on the drawings as Nuclear Safety-Related requires the application of the provisions of Title 10, Chapter 1, Code of Federal Regulations, Part 21, Reporting of Defects and Non-compoiance (loCFR Part 21). It is the responsibility of the Contractor to implement the provisions of 10CFR Part 21 insofar as they are applicable to the Contractor's work under this specification.

The purchasers and/or their designated representative shall have full access to Contractor'sand Subcontractor's shops for reviewing progress and determining acceptability of Quality Control work and program.

Quality Assurance records of compliance which are not transmitted to the purchaser shall be retained by supplier for the life of the plant.

PROPRIETARY INFORMATION:

All test reports produced under this purchase order shall be stamped "CG&E/GOULD PROPRIETARY" - UNDER NO CIRCUMSTANCES SHOULD ANY COPIES OF THIS TEST REPORT BE GIVEN OUT WITHOUT WRITTEN CONSENT OF CG&E!

VENDOR

Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Test Reports

Three (3) copies of a draft report for comment shall be distributed as follows:

Company THE CINCINNATI GAS & ELECTRIC COMPANY
COLUMBUS & SOUTHERN OHIO ELECTRIC CO.
THE DAYTON POWER & LIGHT COMPANY W.O. 57300 Item No. 955-6 T.R. 70

Location WM. H. ZIMMER NUCLEAR POWER STATION UNIT 1 Job No. E-5590

Engineer D.A. Parker Prepared by Sargent & Lundy Engineers P.O. No. XZC-023743

Checked DAP Project No. Date

Spec. No. B/M No. 51000

Approved Engineer Date

Sheet No. M170B Dept. No. 84-7

# THE CINCINNATI GAS AND ELECTRIC CO.



GENERAL ENGINEERING DEPT.

BILL OF MATERIAL

ESSENTIAL

ITEM M-170 August 5, 1982 Continued

One (1) Copy Each

Wm. H. Zimmer Nuclear Power Station
The Cincinnati Gas & Electric Company
U.S. Rt. # 52
Moscow, Ohio 45153-0201

ATTN: Mr. D.J. Frederick
84-7

Gould, Inc.
2002 Bethel Road
Finksburg, Maryland 21048

ATTN: Mr. P.W. Higgins

Sargent & Lundy Engineers
55 E. Monroe Street
Chicago, Illinois 60603

ATTN: Mr. R.M. Tjernlund

QA Audit
by J.G. Wisenburg
5/11/82

After incorporating comments five (5) copies of the final report shall be distributed as follows:

CG&E - ATTN: D.J. Frederick (3)
Gould - ATTN: P.W. Higgins (1)
S&L - ATTN: R.M. Tjernlund (1)

Price:

- S&L Spec. Rev. # 1
- 2 Additional Monitoring Channels S&L Spec. Rev. # 2
- 3 Draft Reports
- Total Firm Price *

* Freight charges for shipment of test unit from Gould in Finksburg, Maryland to SDRC in Milford, Ohio are not included in this price and will be added once shipment is made.

Terms of Payment: 30 days of receipt of invoice.

THE CINCINNATI GAS & ELECTRIC COMPANY
COLUMBUS & SOUTHERN OHIO ELECTRIC CO.
THE DAYTON POWER & LIGHT COMPANY

Company _____ W.O. 57300 Item No. 955-6 T.R. 70

Location WM. H. ZIMMER NUCLEAR POWER STATION UNIT 1 Job No. E-5590

Engineer D.A. Parker Prepared by Sargent & Lundy Engineers P.O. No. XZC-023743

Checked DAP Project No. _____ Date _____

Approved _____ Spec. No. _____ B/M No. 51000

Engineer _____

Sheet No. M170C Date 84-7

A-1370

# THE CINCINNATI GAS AND ELECTRIC CO.

## NUCLEAR ENGINEERING DEPT.

**BILL OF MATERIAL** ESSENTIAL

ITEM M-170 August 5, 1982 Continued

Billing Address:

The Cincinnati Gas & Electric Company
Columbus & Southern Ohio Electric Company
The Dayton Power & Light Company
P.O. Box 960
Cincinnati, Ohio 45201

On All Invoices Please Include The Following:

B/M No. 51000, Job E-5590, Item M-170
Sponsor: D.A. Parker (NED 84-7)

Q. A. AUDIT
BY P. Weinantz
DATE 8/11/82

APPROVED
SDRC Q. A.
Q A-D
Harry T. Poppe 8/23/82
NAME DATE

THE CINCINNATI GAS & ELECTRIC COMPANY
COLUMBUS & SOUTHERN OHIO ELECTRIC CO.
THE DAYTON POWER & LIGHT COMPANY

Company _____ W.O. 57300 Item No. 955-6 T.R. 70

Location WM. H. ZIMMER NUCLEAR POWER STATION UNIT 1 Job No. E-5590

Engineer D.A. Parker Prepared by Sargent & Lundy Engineers P.O. No. XZC-023743

Checked _____ Project No. _____ Date _____

Approved _____ Spec. No. _____ B/M No. 51000

Engineer _____ Date _____

Sheet No. M170D Dept. No. 84-7

SDRC PROPOSAL NUMBER 11410

PROPOSAL

FOR

# SEISMIC TRI-AXIAL TEST QUALIFICATION PLAN OF ITE SERIES 5600 MOTOR CONTROL CENTERS

Prepared

for

CINCINNATI GAS & ELECTRIC COMPANY
NUCLEAR ENERGY GROUP
P.O. BOX 201
MOSCOW, OHIO 45153

Submitted

by

SDRC-INC.
wholly owned subsidiary
of

STRUCTURAL DYNAMICS RESEARCH CORPORATION
2000 EASTMAN DRIVE
MILFORD, OHIO 45150

AUGUST 5, 1982

Approved by: John R Hendricks
John R. Hendricks, P.E.
Quality Assurance Manager

Prepared by: Gary T. Popp
Gary Popp
Seismic Sales

Customer Contact: David Parker

Reviewed by: Gary B Patrick
Gary Patrick
Manager, Seismic Testing Service

Phone number: (513) 553-2081

**REVISIONS**

| REV. NO. | DATE | PAGES AFFECTED | BY | APP'L. | DESCRIPTION OF CHANGES |
|---|---|---|---|---|---|
| 1 | 8/5/82 | ——— | GBP | GTP | Added SDRC Test Plan which is based on the attached C.G. & E. Test Specification |
| | | | | | |
| | | | | | |
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| | | | | | |

TABLE OF CONTENTS

## 1.0: TEST PLAN

This plan is for the seismic qualification of ITE Series 5600 Motor Control Centers.

The test specimen is defined in Table 1.

The test specimen will be qualified by seismic testing using the Tri-Axis Seismic Simulator Shake Table described in Figure 1. This table is located at the Structural Dynamics Research Corporation Laboratory in Milford, Ohio, a suburb of Cincinnati. Figure 2 is a description of the laboratory.

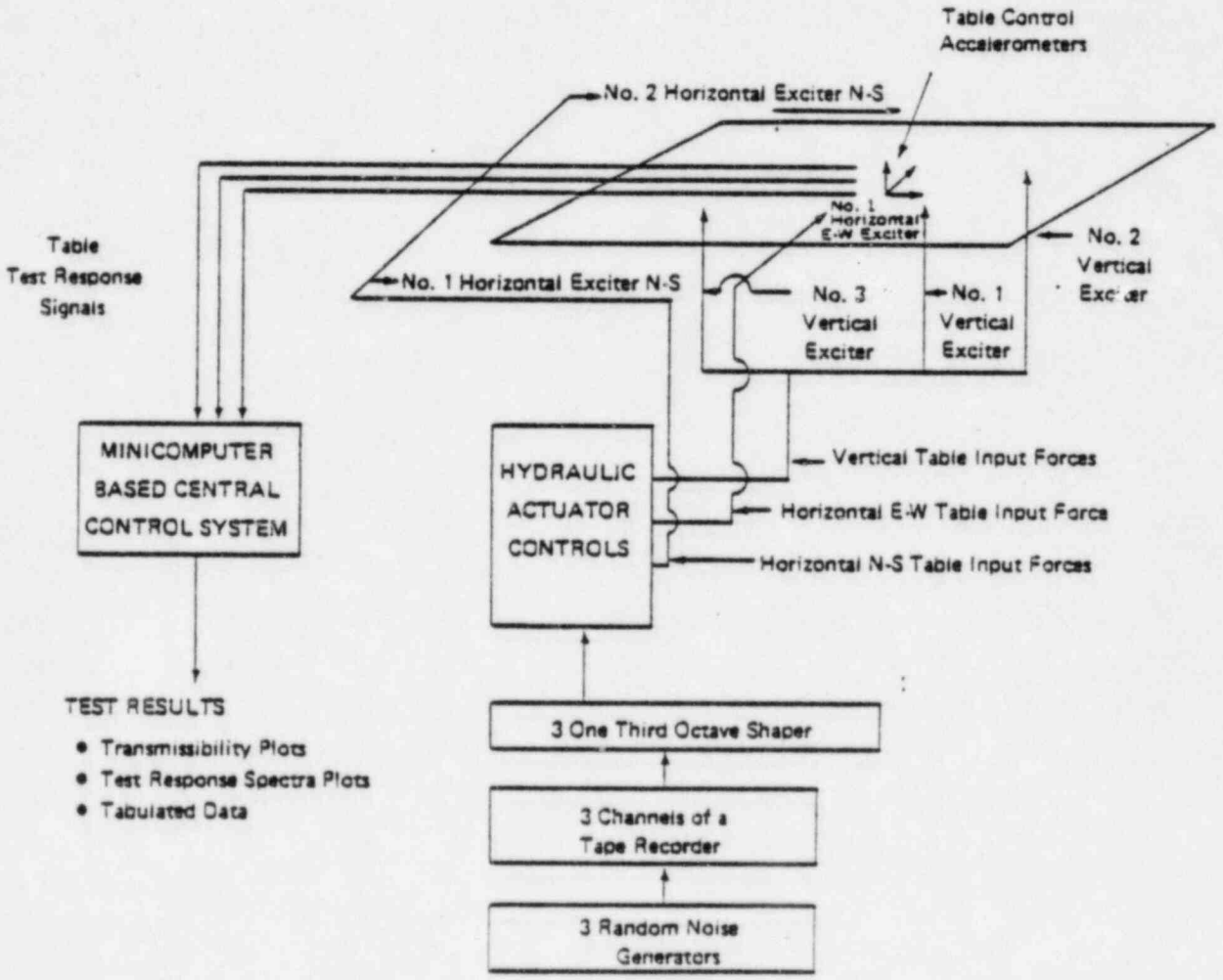
The control system for each of the six (3 vertical, 2 horizontal N-S and 1 horizontal E-W) actuators is made up of a dual loop analog controller. The controller provides a dynamic drive signal proportional to the command for force. This proportional system controls directly the variable of interest (acceleration). Conventional integral systems must process and track control data through two system orders (displacement and velocity), thereby making system stability much more difficult. The table's geometric design inherently has less table rocking because of the longer ram-actuator system which provides less pivot angle. The mechanical constraints eliminate the need for cross axis control feedback loops that typically compensate for test specimen shake table dynamic interaction, and out of necessity simultaneously reduce system response.

TABLE 1

Test Specimen Description

| |
|---|
| Three 5600 Series NEMA Class 1, Type A vertical sections joined to form one assembly. Overall dimensions 60 inches wide, 20 inches deep, by 91½ inches. |

Figure 1
Description of Test Equipment
Schematic Diagram of the Test Instrumentation



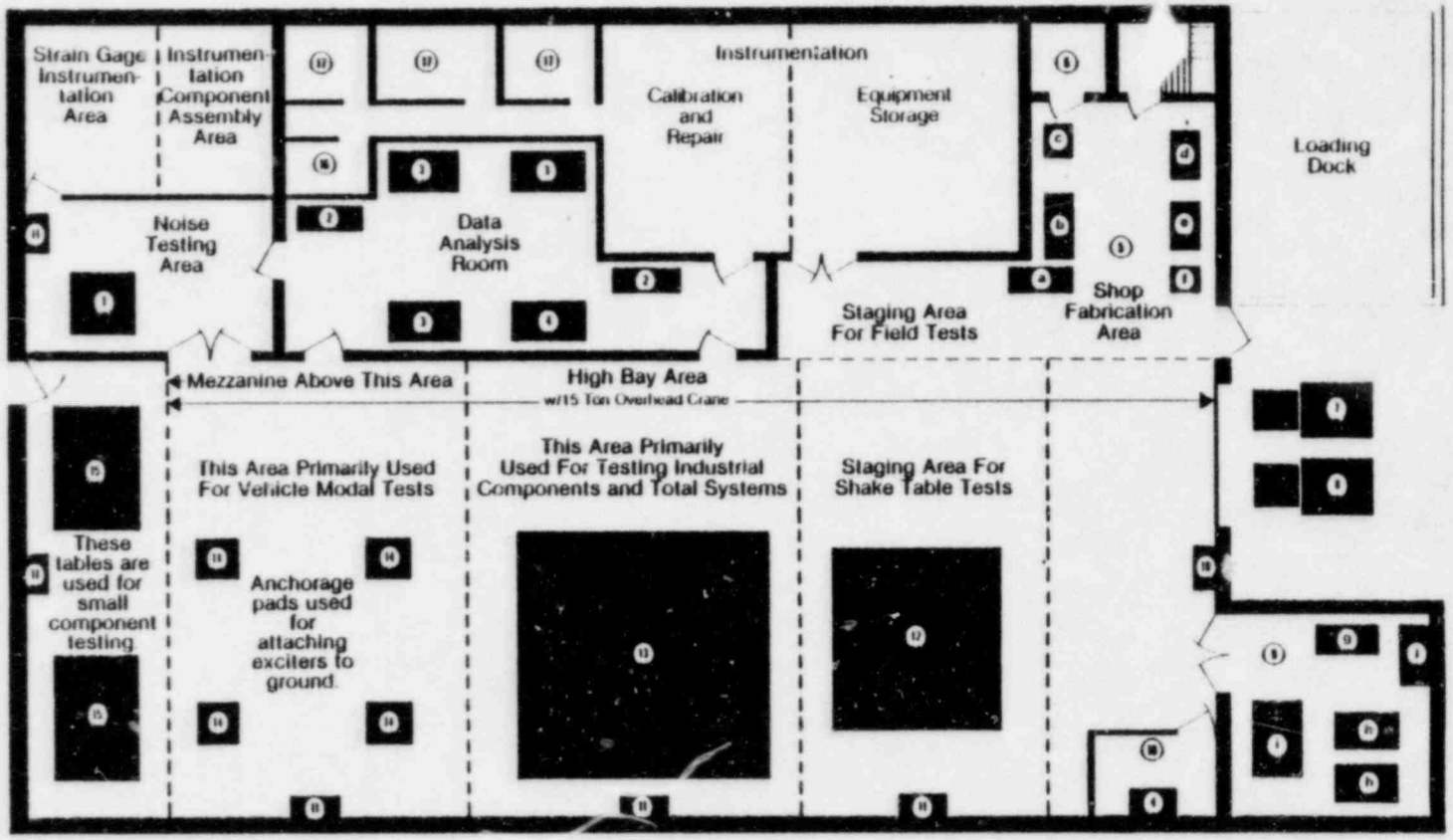
# SDRC Cincinnati Testing Services

Structural Dynamics Research Corporation, Milford, Ohio, offers sophisticated electromechanical testing capabilities for the study of complex mechanical and structural problems. These Testing Services are provided through the SDRC home office and several branch offices for problem solving in the following general areas:

- Telemetry transmitters and recievers for measurements on moving or rotating systems.
- A ten foot triaxial shaker table.
- Numerous recorders, transducers and amplifiers for the measurement of acceleration, strain, velocity, displacement, rotary motion and force.
- Fast Fourier Analyzers Minicomputer based signal processing and modal testing systems.
- Hydraulic and electromechanical exciter systems.
- Real time analyzers for single channel or dual channel spectrum analysis.

**Total Lab Area**
**11,280 Sq. Ft.**

**High Bay Area**
**5,760 Sq. Ft. x 20 Ft. Height**




1. Sub-Zero & High Temperature Chamber
2. Real Time Analyzer
3. GenRad PDP 11/34 Minicomputer
4. HP 2100s Minicomputer
5. Shop Fabrication Area
   a. Kalamazoo Band Saw
   b. Boice Crane Band Saw
   c. Clausing Drill Press
   d. 18" LeBlond Regal Lathe
   e. Bridgeport Mill
   f. Miller Constant Welder
6. Telemetry Storage Area
7. Test Van No. 1
8. Test Van No. 2
9. Hydraulic Pump Room
   g. 10 GPM @ 3000 PSI
   h. 45 GPM @ 3000 PSI
   i. 90 GPM @ 3000 PSI
   j. 20 SCFM @ 100 PSI Air Compressor
10. Shake Table Control Room
11. Hydraulic Outlet
12. Shake Table
    Three axes simultaneously
    30,000 lbs. Force Vertical
    20,000 lbs. Force Horizontal
    20,000 lbs. Force Lateral
    Table 10'x10'
    Max. Spec. 15'x15'x12" High
    Max. Payload 10,000 lbs. @ 2 g's
    Max. Disp. 8" P.P all directions
    Max. Freq. 400 Hertz
13. Isolation Pad with Tie Down Inserts
    Used for testing components which need to be tied to ground or isolated from external vibrations. 30'x30'x3' Reinforced Concrete.
14. Anchorage Pad
15. "T" Slot Table
16. PCB Board Design and Fabrication
17. Office
18. Electric Outlets
    100 AMP 480V 3φ 60 Hz
    28 AMP 0-560V 3φ 60 Hz

## 2.0: TEST PROCEDURE

### 2.1: Specimen Mounting

2.1.1: The mounting of the test specimen will simulate the actual in-service mounting as closely as practical.

2.1.2: A visual inspection of the specimen will be made prior to, during, and after the test. Any failure or abnormalities in the structural integrity of the specimen or mounting will be recorded.

2.1.3: The specimen will be welded to a steel plate per the customers welding instructions. Herein, this fixtured specimen is referred to as the specimen. This fixture will inturn be bolted to the shake table.

2.1.4: The specimen will be subjected to baseline and operability tests per the attached C.G. & E. Specification.

2.2: Exploratory Test

2.2.1: The frequency search is conducted in each principal axis prior to the full level qualification described in Section 2.3 below. This search is in the form of a single axis continuous frequency sweep using a sinusoidal steady-state input at the lowest possible amplitude capable of determining resonance. This frequency search is conducted by developing transmissibility plots for point(s) on the test specimen. A transmissibility plot is defined as the ratio of motion of a point on the object divided by the input motion at the base of the item or the table on which the item is mounted. Peaks in the transmissibility plot as well as a corresponding phase shift represent the natural frequency of the structure.

2.2.2: Transmissibility function(s)are calculated using Digital Fourier Analysis techniques which employ Digital Signal Processing Theory. This technique ratio's the Fourier spectrum of the component response to the Fourier spectrum of the input motion.

2.2.3: The frequency of the input excitation shall vary from 1.0 to 100 Hz.

2.2.4: The sweep rate shall be linear with the rate not to exceed two octaves per minute. The sine sweep shall be applied in the order of 0.2 g to 0.4 g.

2.2.5: Response accelerometers will be mounted on the specimen as required to record any natural frequencies. In addition to the three accelerometer locations in the C.C. & E. Specification, SDRC will place accelerometers at three other locations. These locations will provide information about the overall structure rather than specific device locations. Preliminary locations would be 1) the top right front corner (Unit 1) 2) the top left rear corner (Unit 3) and 3) elevation 45 inches between Units 1 and 2 (front face). Actual locations will be determined by the Test Engineer at the start of the test.

2.2.6: It should be noted that due to either the complexity or the inaccessibility of critical parts (sealed relays, etc.), the exploratory test may not ascertain all the critical frequencies. Also because of nonlinearities the resonant response at high acceleration levels may differ in frequency and damping from that at low acceleration levels. Further, resonant response may not be excited at all low acceleration levels. Therefore, a low level exploratory test may not be conclusive as an indication of either equipment dynamic response or lack of resonances. Generally speaking higher accelerations,such as the SSE time signal, will shift the resonance frequencies lower than the indicated values from a .2 to .4 "g" acceleration sweep level.

Thus, it is recommended that the results of a low level exploratory search be used for an approximate determination of resonances and not be used for dwell tests, etc.

## 2.3: Full Level Qualification Test

### 2.3.1: Simultaneous Excitation Technique

The seismic qualification for the subject equipment will be performed by using an independent tri-axial random motion simulator. Testing will be performed with the test items' principal horizontal axes positioned parallel with the test table motion.

Thus, each horizontal axis will be excited separately, but simultaneously with the vertical axis. The Horizontal East-West, Horizontal North-South; and Vertical input accelerations will be independent (incoherent) of each other during the multi-frequency test.

2.3.2: Full Level Qualification Methodology

2.3.2.1: The SRV load will be applied per the attached Specification.

2.3.2.2: The SRV plus LOCA load per the attached Specification

2.3.2.3: Thereafter, the number of the tests performed simultaneously in three directions will be five operating basis earthquake (OBE') [1] levels followed by two safe shutdown earthquake (SSE') [2]. In addition to these required tests there may be a need for additional tests, if the test response spectra (TRS) does not envelope the required response spectra (RRS).

2.3.2.4 The specimen will be subjected to a minimum test duration of 30 seconds for each OBE and for each SSE.

2.3.2.5: The test will consist of simultaneous horizontals (N-S and E-W) and vertical inputs of a continuous random motion over the frequency range of 1.0 to 100 Hz.

2.3.2.6: The amplitude of each random waveform motion will be independently adjusted at one-third octave frequency intervals in each axis until the TRS envelops the RRS within the limitations of the test machine.

2.3.2.7: The resulting shake table motion is analyzed and plotted by a Digital Fourier analyzer using shock response software. This calculation is performed at the appropriate damping value and frequency interval:

damping value(s) See Section 3.1
minimum octave frequency interval: 1/3

The zero period acceleration (ZPA) of the RRS will be exceeded to meet the spectra peaks.

2.3.2.8: The required response spectra provided by the customer is attached, as well as the approximate broadband shake table limits.

NOTES:

(1) OBE' refers to a absolute summation of the attached envelope of OBE, SRV, etc., response spectra, see attachment, if not provided by the customer.

(2) SSE' refers to a absolute summation of the attached envelope of SSE, SRV, LOCA, etc., response spectra if not provided by the customer.

## 3.0: MONITORING INSTRUMENTATION

SDRC calibrates all test equipment and instrumentation used in this test program in accordance with SDRC Quality Assurance Manual. This procedure is in compliance with 10CFR50 Appendix B, and ANSI/ASME N45.2-1977. Calibrations are traceable to the National Bureau of Standards.

### 3.1: Table Control

The three control accelerometers are mounted in the egg-crate designed shake table platform. These accelerometers are located in the approximate center of the horizontal planes and approximately 3 inches below the table top specimen interface plane.

The table control accelerometers are brushed recorded. The control accelerometers are calculated for the TRS at the following damping values: SRV 2%, SRV + LOCA 2%, OBE 1%,[1] SSE 2%[2]

### 3.2: Specimen

Specimen mounted uniaxial piezo-electric accelerometers will be located on the test specimen per the customer's direction.

The specimen accelerometers will have their Resonance Search calculated and plotted.

The specimen accelerometers will have their TRS calculated at damping values specified by the customer.

- Number of specimen accelerometers: 9
- TRS calculated: SRV, SRV + LOCA, one OBE and ~~one SSE~~
- Damping values are: SRV 2%
  ~~SRV + LOCA 2%~~
  OBE 1, 2, and 5%
  SSE 2, 5 and 10%

### 3.3: Power

The following power is normally available:

| | |
|---|---|
| 480 Volt, 60 Hz. 3-phase, | 80 amp. |
| 480 Volt, 60 Hz. 3-phase, | 30 amp. |
| 208 Volt, | 50 amp. |
| 125 Volt, D.C. | 50 amp. |
| 250 Volt, D.C. | 25 amp. |
| 0-560 Volt, 3-phase | 28 amp. |
| 0-560 Volt, 3-phase | 4 amp. |
| 0-140 Volt, single phase at | 10, 20, & 30 amp |

NOTES: [1]One OBE will be calculated at 1%, 2% and 5%.
[2]One SSE will be calculated at 2%, 5% and 10%.

3.4: Electric

Electric monitoring will be used to monitor electric continuity, contact chatter, etc., before, during and after the seismic event.

- Number of Monitoring Channels: See attached specification

## 4.0: ACCEPTANCE CRITERIA

See attached Specification.

## 5.0: FINAL REPORT

SDRC will certify that the testing was done in accordance with the accepted test program, IEEE-344-1975, the customer specification provided to SDRC.etc. This report contains:

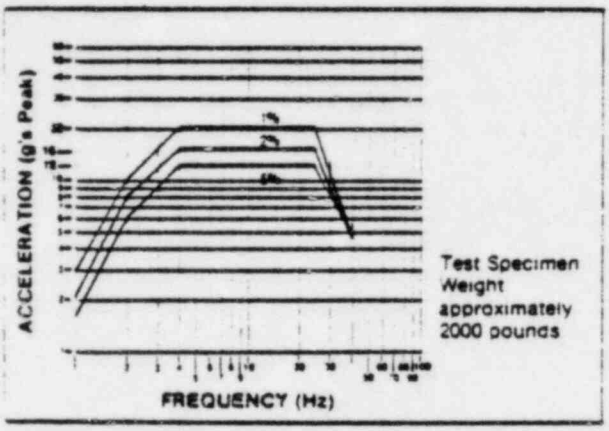
- QUALIFICATION RESULTS CERTIFICATION AND SUMMARY
- INTRODUCTION
- TEST DESCRIPTION
  - III.1: Required Response Spectrum (RRS)
  - III.2: Test Signal Generation
  - III.3: Description and Mounting of Test Specimens, including photographs
  - III.4: Test Procedure
  - III.5: Monitoring of Specimen Response
  - III.6: Criteria for Test Acceptance
- DATA PRESENTATION
  - IV.1: Transmissibility
  - IV.2: Test
- APPENDICES
  - V.1: Appendix A - Seismic Test Plan
  - V.2: Appendix B - SDRC Log Sheet
  - V.3: Appendix C - Calibration Records of Test Equipment

SDRC will provide 3 copies of the final report draft for comments. SDRC will provide 5 copies of the final report after corrections and comments.

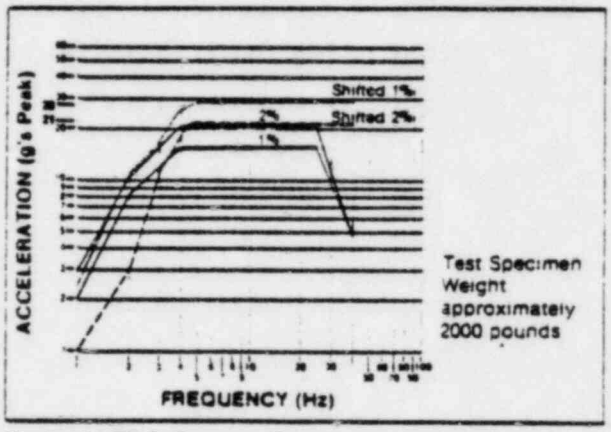
# ATTACHMENTS

## Customer's Requirement

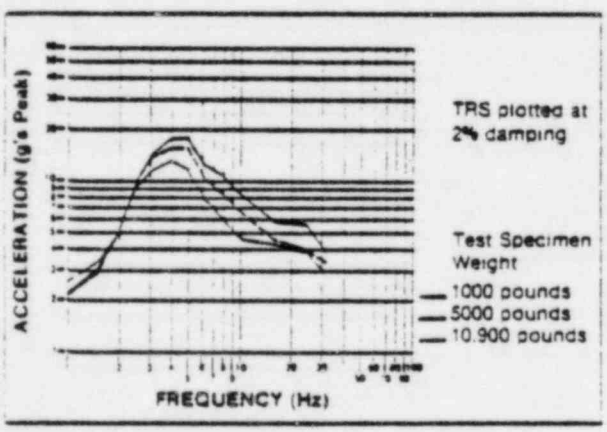
SDRC Broadband and shifted shake table limits; etc., using random noise as the signal source follows:



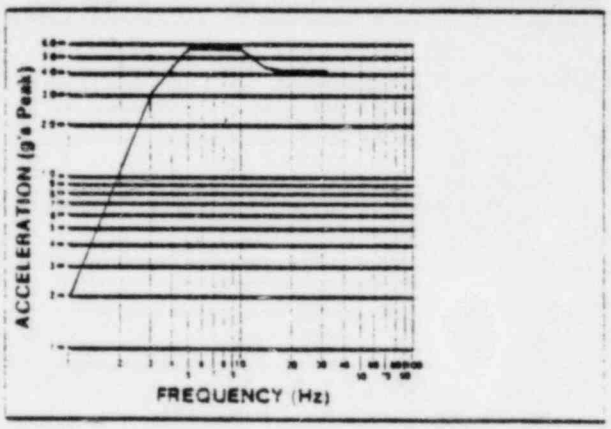

**Approximate Broadband Limits Horizontal E-W.** The horizontal N-S and vertical TRS are greater than the horizontal E-W.
(1, 2, & 5% damping is presented)




**Variable TRS Curves.** Can be obtained by modifying the test signal energy content at the 1/3 octave frequencies. Note the significantly increased TRS at 1 and 2% damping above 4 Hz by lowering the test signal energy below 4 Hz. This data is from two different qualifications tests.




**Test Specimen Weight Effects On System Performance.** Note the parallel TRS shifting with identical input signals. This shows the shake table controls are independent of the test article mounted on the table. RRS curves for larger items are enveloped merely by increasing system gain.




**Maximum Acceleration in g's for the Horizontal E-W.** The maximum g's for the horizontal N-S and vertical are equal to or greater than the horizontal E-W.

ATTACHMENTS

# SPECIFICATION FOR DYNAMIC TESTING
# OF
# SEISMIC CATEGORY I

## ITE SERIES 5600
## MOTOR CONTROL CENTERS

FOR

WM. H. ZIMMER
NUCLEAR POWER STATION

Prepared By
SARGENT & LUNDY
ENGINEERS

ISSUE SUMMARY

| REV. | REASON FOR REVISION | |
|---|---|---|
| 00 | For Client Comment | Preparer _____ Date _____<br>Reviewer _____ Date _____<br>Approver _____ Date _____ |
| 01 | Client Request | Preparer Donald R. Elvis Date 6-14-82<br>Reviewer _____ Date _____<br>Approver _____ Date _____ |
| 02 | Per Client Comment | Preparer Donald R. Elvis Date 8-13-82<br>Reviewer F. M. Austin Date 8-13-82<br>Approver H. Hasselbacher Date 8-13-82 |
| | | |

# TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this specification is to define the technical and documentation requirements for dynamic testing of the Seismic Category I ITE Series 5600 Motor Control Centers for the Wm. H. Zimmer Nuclear Power Station. A representative sample motor control center has been assembled to test, this representative sample shall hereafter be referred to as the "Test Specimen."

2.0 DESCRIPTION OF TEST SPECIMEN

The specimen shall consist of three 5600 Series NEMA Class I Type A vertical sections joined to form one assembly. Capable of handling up to six combination starter units, the vertical sections shall be of the basic structural design for 20-inch deep front-of-board mounting with standard 20-inch width. Unit overall dimensions will be approximately 60 inches wide, 20 inches deep, by 91-1/2 inches high (including 1-1/2 x 3 inch mounting sills). Each vertical section is defined below and shown on Figure 1:

Section 1 - Shall consist of four compartments with internal equipment as follows:

Compartment 1A - Test Lab Connections
(See Drawing SM, Test E-1, Appendix B)

Compartment 1B - 30 Circuit Panel Board
(See Drawing SM, Test E-1, Appendix B)

Compartment 1C - Filler Panel

Compartment 1D - 480-120V 15 KVA Distribution Transformer
(See Drawing SM, Test E-1, Appendix B)

Section 2 - Per Figure 1 shall consist of four compartments with internal equipment as follows:

Compartment 2A - FVT Starter, NEMA Size 1
(See Drawing SM, Test E-2, Appendix B)

Compartment 2B - FVR Starter, NEMA Size 1
(See Drawing SM, Test E-2, Appendix B)

Compartment 2C - Left and Right Branch Feeder, Left Branch with 'a' and 'b' Auxiliary Switch
(See Drawing SM, Test E-2, Appendix B)

Compartment 2D - FVNR Starter, NEMA Size 4 with Interposing Relay
(See Drawing SM, Test E-2, Appendix B)

Section 3 - Per Figure 1 shall consist of four compartments with internal equipment as follows:

Compartment 3A - FVNR Starter, NEMA Size 2 with Control Relay
(See Drawing SM, Test E-3, Appendix B)

Compartment 3B - FVNR Starter, NEMA Size 3 with Ground Fault Protection and Interposing Relay
(See Drawing SM, Test E-3, Appendix B)

MCC SEISMIC TEST UNIT

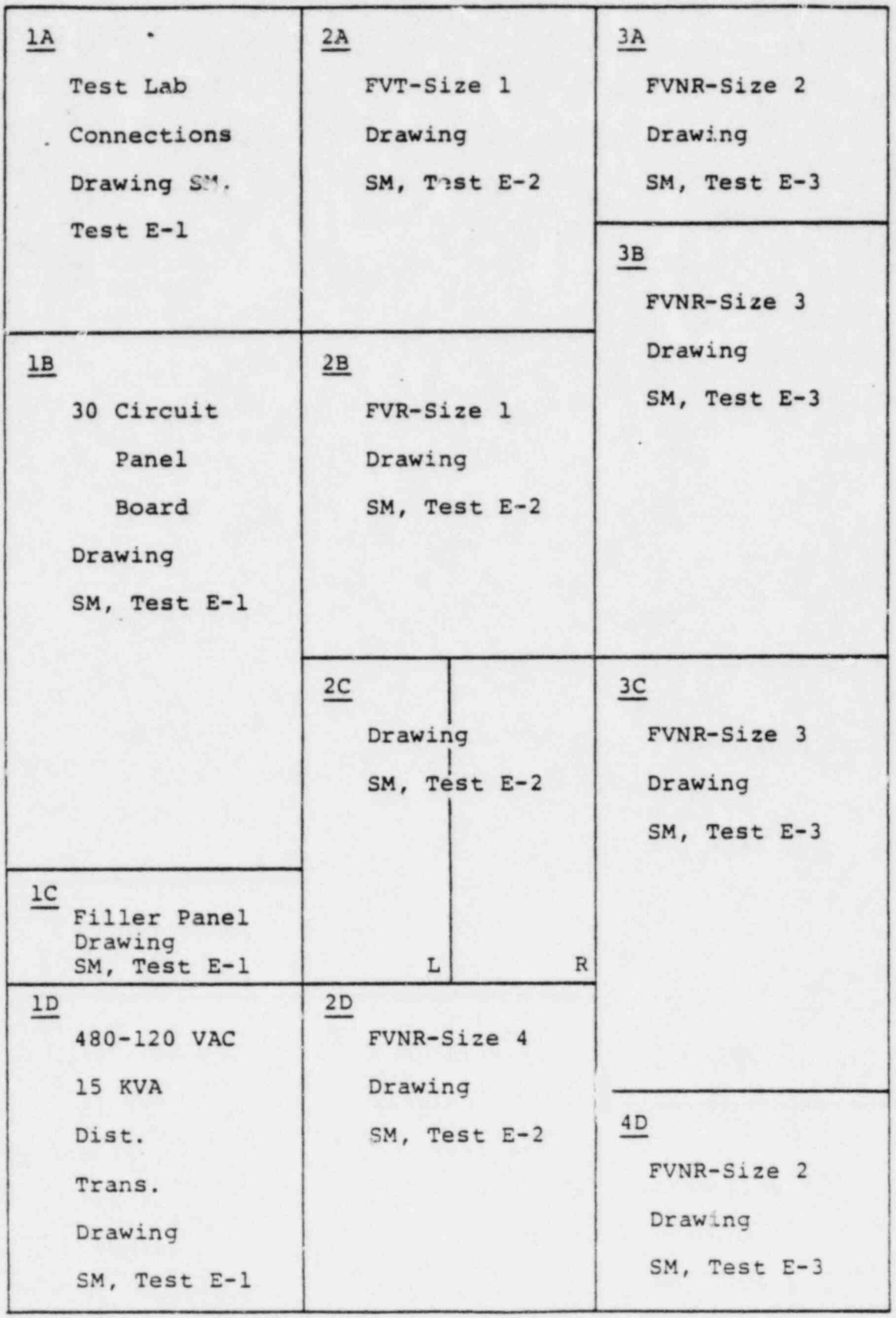



FIGURE 1 - FRONT ELEVATION

Compartment 3C - FVNR Starter, NEMA Size 3 with Interposing Relay
(See Drawing SM, Test E-3, Appendix B)

Compartment 3D - FVNR Starter, NEMA Size 2 with Control Relay
(See Drawing SM, Test E-3, Appendix B)

## 3.0 RESPONSIBILITIES

3.1 The purchaser shall be responsible for:

-providing the test specimen with all appendages

3.2 The test lab shall be responsible for:

-making available 480 V AC single phase power

-making available 120 V AC single phase power

-making available four independent current sources:

Load Current I - 30 Amps

Load Current II - 30 Amps

Load Current III - 100 Amps

Ground Relay Trigger

-providing the equipment required to monitor the test specimen in accordance with the requirements of Section 6.0

-preparing a test plan, describing the procedures to be used. This test plan shall be submitted to the Purchaser for review and acceptance prior to testing

-providing the dynamic testing equipment

-providing qualified test personnel

-conducting the test and providing test documentation in accordance with the requirements of this specification.

4.0 SPECIMEN MOUNTING

The specimen shall be mounted to the test table by welding. The welding pattern, which represents the as installed in-the-field condition, shall be 1-1/2 inch long, 3/16 inch leg fillet welds on 12 inch centers. Total number of welds shall be 12 (6 along front sill and 6 along rear sill).

5.0 SET-UP REQUIREMENTS

5.1 The test specimen shall be energized with the appropriate voltages and currents to allow all components to be tested at their rated load.

5.2 The control circuit of the combination starters shall be wired in a manner to allow simulation of operability during testing (i.e. to provide the capability to change state from de-energized to energized and energized to de-energized). This will require some external wiring and switches which are to be provided by the Test Lab.

5.3 Wiring diagrams for all components are identified in Figure 1 and are provided in Appendix B.

5.4 The control circuits of the combination starters shall be energized to 85% of their rated voltage (120 V AC). This is to demonstrate operability of the units during a potential power dip.

5.5 Locations of response accelerometers during the Resonance Search Test shall be per Section 10.6.

5.6 In addition to using response accelerometers to determine the structural modes of the cabinet (via Resonance Search Test), triaxial response accelerometers shall be used during the aging and proof tests to determine the input to two combination starters and to the circuit panel board. This is to provide RRS for these devices should additional testing for these devices be required in the future. These triaxial accelerometers one set per combination starter and one set for the circuit panel board, shall be located on the sub-panel as close as practical to the devices. The two combination starters selected are:

1. FVNR Size 3 combination starter located in compartment 3B
2. FVT Size 1 combination starter located in compartment 2A

6.0 MONITORING REQUIREMENTS

6.1 All monitoring and power connections shall be made in accordance with Table 1 to the two terminal blocks in the rear of compartment 1A with the exception of the three load currents.

6.2 The following terminal block points shall be monitored for change of state:

| TB1 | TB2 |
|---|---|
| 18,19 | 32,33 |
| | 34,35 |

6.3 The following terminal block points shall be monitored for contact chatter:

| TB1 | | TB2 | | |
|---|---|---|---|---|
| 3,4 | 14,15 | 3,4,9 | 12,13 | 20,21 |
| 5,6,7,27 | 16,17 | 5,6 | 14,15 | 22,23 |
| 8,9 | 20,21 | 7,8 | 16,17 | 24,25 |
| 10,11 | 22,23,24 | 10,11 | 18,19,36 | 28,29 |
| 25,26,28 | | | | 30,31 |

TABLE I

| TB1. | | TB2 | |
|---|---|---|---|
| POINT | DESCRIPTION (MCC POSITION) | POINT | DESCRIPTION (MCC POSITION) |
| 1 | 480VAC 1Ø Hot (Vertical 2) | 1 | 480VAC 1Ø Hot (Vertical 3) |
| 2 | 480VAC 1Ø Neutral (Vert. 2) | 2 | 480VAC 1Ø Neutral (Vert. 3) |
| 3 | Breaker Monitor (1B) | 3 | Breaker Monitor (3A) |
| 4 | Breaker Monitor (1B) | 4 | Contactor Monitor (3A) |
| 5 | Breaker Monitor (2A) | 5 | NO Contact Monitor (3A) |
| 6 | Contactor Monitor (2A) | 6 | NO Contact Monitor (3A) |
| 7 | Contactor Monitor (2A) | 7 | NC Contact Monitor (3A) |
| 8 | NO Contact Monitor (2A) | 8 | NC Contact Monitor (3A) |
| 9 | NO Contact Monitor (2A) | 9 | Common for 3&4 (3A) |
| 10 | NC Contact Monitor (2A) | 10 | NC Contact Monitor (3A) |
| 11 | NC Contact Monitor (2A) | 11 | NC Contact Monitor (3A) |
| 12 | 120VAC 1Ø Hot (2A) | 12 | NO Contact Monitor (3A) |
| 13 | 120VAC 1Ø Neutral (2A) | 13 | NO Contact Monitor (3A) |
| 14 | NO Contact Monitor (2A) | 14 | NO Contact Monitor (3A) |
| 15 | NO Contact Monitor (2A) | 15 | NO Contact Monitor (3A) |
| 16 | NC Contact Monitor (2A) | 16 | NC Contact Monitor (3A) |
| 17 | NC Contact Monitor (2A) | 17 | NC Contact Monitor (3A) |
| 18 | Starter Monitor (2B) | 18 | Breaker Monitor (3B) |
| 19 | Starter Monitor (2B) | 19 | Contactor Monitor (3B) |
| 20 | Starter Monitor (2CL) | 20 | NO Contact Monitor (3B) |
| 21 | Starter Monitor (2CL) | 21 | NO Contact Monitor (3B) |
| 22 | NO Contact Monitor (2CL) | 22 | NO Contact Monitor (3B) |
| 23 | NC Contact Monitor (2CL) | 23 | NO Contact Monitor (3B) |
| 24 | Common for 22 & 23 (2CL) | 24 | NC Contact Monitor (3B) |
| 25 | Breaker Monitor (2D) | 25 | NC Contact Monitor (3B) |
| 26 | Contactor Monitor (2D) | 26 | Ground Relay Trigger (3B |
| 27 | Common for 5,6, & 7 (2A) | 27 | Ground Relay Trigger (3B |
| 28 | Common for 25 & 26 (2D) | 28 | NC Grd. Relay Monitor (3B) |
| | | 29 | NC Grd. Relay Monitor (3B) |
| | | 30 | NC Contact Monitor (3B) |
| | | 31 | NC Contact Monitor (3B) |
| | | 32 | Starter Monitor (3C) |
| | | 33 | Starter Monitor (3C) |
| | | 34 | Starter Monitor (3D) |
| | | 35 | Starter Monitor (3D) |
| | | 36 | Common for 18 & 19 (3B) |

6.4 The three load currents shall be connected as follows:

a. Load Current I - 30 Amps (#10 wire)

1. Enter point L2 cubicle 1B

2. Exit point T2 cubicle 3D

b. Load Current II - 30 Amps (#10 wire)

1. Enter point L2 cubicle 2A

2. Exit point T2 cubicle 2A

c. Load Current III - 100 Amps (#2 wire)

1. Enter point L2 cubicle 2D

2. Exit point T2 cubicle 3C

6.5 Should contact chatter occur in excess of the limit defined in the acceptance criteria, suitable monitoring equipment shall be provided to determine the duration of such chatter. The purpose of this is to determine the maximum allowable chatter before the contactors drop out.

7.0 TEST SEQUENCE

Testing shall be performed in the following sequence:

1. Baseline Inspection
2. Operability Test
3. Resonance Search
4. SRV Aging Test
5. SRV + LOCA Aging Test
6. Baseline Inspection
7. Upset Condition Proof Test
8. First Emergency Condition Proof Test

9. Baseline Inspection
10. Second Emergency Condition Proof Test
11. Operability Test

## 8.0 BASELINE INSPECTION

8.1 The test specimen shall be visually inspected for damage.

8.2 All mounting hardware shall be inspected and tightened as required to insure that all components are securely mounted. If tightening is required it shall be noted in the test report.

## 9.0 OPERABILITY TEST

The operational capability of the specimen shall be demonstrated and documented. A visual inspection for damage shall be performed. Equipment shall be operated under normal ambient environmental conditions to the extremes of performance and electrical characteristics specified as follows:

9.1 Contactors:

1. Verify pick up at 85% of rated coil voltage
2. Verify that contactor does not drop out above 70% rated coil voltage

9.2 Molded Case Circuit Breakers:

Verify manual opening and closing.

9.3 Distribution Transformer:

1. Verify rated secondary voltage is present when rated voltage is applied to primary leads
2. Verify insulation strength by resistance measurements

9.4 Auxiliary Relays:

Same as for contactor

9.5 Ground Fault Sensor/Relay:

Verify operation

10.0 RESONANCE SEARCH TEST

The purpose of the Resonance Search Test is to determine the structural modes of the motor control center cabinet. The test method shall be single axis sine sweep, however other methods proposed by the Test Lab may be acceptable provided approval is obtained from the Purchaser. The requirements for this test are:

10.1 Test Method: Single axis sine sweep

10.2 Frequency Range: 1 - 100 hz.

10.3 Input Acceleration: 0.2 g minimum

10.4 Sweep Rate: 2 octaves per minute maximum

10.5 Number of Tests: 3, one in each orthogonal axis

10.6 Response Accelerometer Locations: To be determined by the Test Lab and approved by the Purchaser

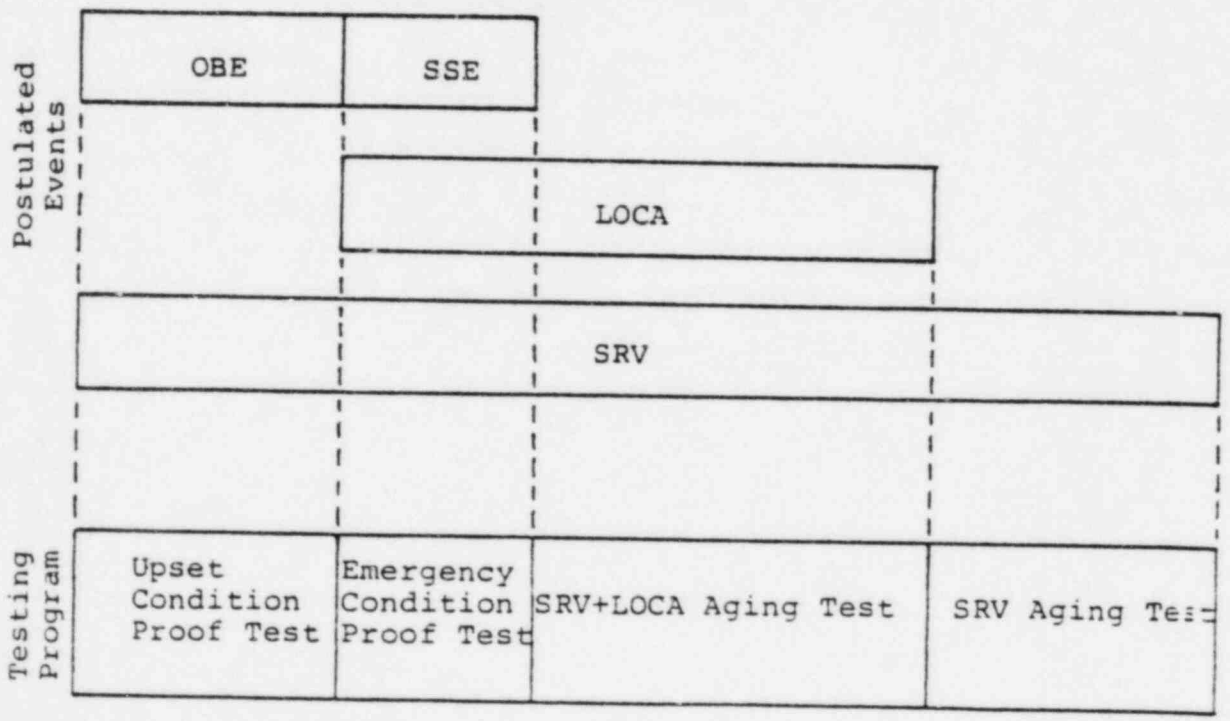
10.7 Documentation: Transmissibility Plots and Bode Plots (phase angle vs. frequency)

## 11.0 AGING TESTS

The purpose of the aging tests is to supplement the proof testing in assuring that the test specimens are subjected to the design life mechanical vibration resulting from all of the postulated dynamic events. The dynamic events postulated to occur are:

- operating basis earthquake (OBE)
- safe shutdown earthquake (SSE)
- safety relief valve actuation events (SRV)
- loss of coolant accident (LOCA)

The following bar chart shows the sequencing of these events and how the testing program accounts for them:



11.1 SRV Aging Test

11.1.1 Test Method: independent triaxial random motion

11.1.2 Test Input: simultaneous independent horizontal and vertical random waveform motion consisting of frequency bandwidths spaced a maximum of one-third octave apart

11.1.3 Frequency Range: 1 to 100 Hz

11.1.4 Duration Individual Time History: 30 sec.

11.1.5 Total Test Duration: 700 sec.

11.1.6 Operability Verification: the combination starters shall initially be in the de-energized state and shall be switched (i.e. change state) every 2 minutes. All other components shall be energized throughout the test.

11.1.7 Specimen Orientations: for triaxial testing only one specimen orientation is required

11.1.8 Required Response Spectra: Appendix A - Spectra 1 and 2

11.1.9 Damping: 2%

11.2 SRV + LOCA Aging Test

11.2.1 Test Method: independent triaxial random motion

11.2.2 Test Input: simultaneous independent horizontal and vertical random waveform motion consisting of frequency bandwidths spaced a maximum of one-third octave apart

11.2.3 Frequency Range: 1 to 100 Hz

11.2.4 Duration Individual Time History: 30 sec.

11.2.5 Total Test Duration: 300 sec.

11.2.6 Operability Verification: the combination starters shall initially be in the de-energized state and shall be switched every 2 minutes (i.e. change state). All other components shall be energized throughout the test.

11.2.7 Specimen Orientations: for triaxial testing only one specimen orientation is required

11.2.8 Required Response Spectra: Appendix A - Spectra 3 and 4

11.2.9 Damping: 2%

## 12.0 PROOF TESTING

### 12.1 Upset Condition (OBE) Proof Tests

12.1.1 Test Method: independent triaxial random motion

12.1.2 Test Input: simultaneous independent horizontal and vertical random waveform motion consisting of frequency bandwidths spaced a maximum of one-third octave apart

12.1.3 Number of Tests: five

12.1.4 Test Duration: 30 seconds per test

12.1.5 Specimen Orientations: for triaxial testing only one specimen orientation is required

12.1.6 Operability Verification: the combination starters shall initially be in the de-energized state and shall be switched (i.e. change state) once during each test. All other components shall be energized throughout all tests.

12.1.7 Required Response Spectra: Appendix A - Spectra 5 and 6

12.1.8 Damping: 1%

### 12.2 Emergency Condition (SSE) Proof Test

12.2.1 Test Method: independent triaxial random motion

12:2.2 Test Input: simultaneous independent horizontal and vertical random waveform motion consisting of frequency bandwidths spaced a maximum of one-third octave apart.

12.2.3 Number of Tests: Two

12.2.4 Test Duration: 30 seconds

12.2.5 Specimen Orientations: for triaxial testing only one specimen orientation is required

12.2.6a Operability Verification, SSE 1

The combination starters shall initially be in the de-energized state and shall be cycled (change state from de-energized to energized and back to de-energized) at least once during the test. All other components shall be energized throughout the test.

12.2.6b Operability Verification, SSE 2

All components shall be de-energized to detect chatter in open contacts

12.2.7 Required Reponse Spectra: Appendix A - Spectra 7 and 8

12.2.8 Damping: 2%

## 13.0 ACCEPTANCE CRITERIA

13.1 The maximum allowable chatter duration is 2 msec.

13.2 The structural integrity of the test specimen must be demonstrated both during and after testing.

13.3 The ability of the test specimen to provide essential power on command must be demonstrated both during and after testing.

13.4 A test failure shall be defined as the inability of the test specimen to provide essential power on command or as loss of essential power once energized.

13.5 A test anomaly shall be defined as:

a. Contact chatter in excess of 2 msec.

b. Any other abnormal event not affecting the specimen's safety-related function described above in Section 13.3.

## 14.0 DOCUMENTATION

A test report shall be prepared and certified by a registered professional engineer. This report shall contain:

14.1 Test specification

14.2 Test plan

14.3 Identification of test specimens:

a. Motor Control Center: manufacturer, model number, and serial number

b. Internal devices: manufacturer, model number, serial number, and location within specimen (MCC)

14.4 Description of test set up, including:

a. Photographs or sketches of specimen

b. Description of mounting to shake table

c. Description of monitoring techniques

d. Location of response accelerometers

e. Identification of all test equipment and instrumentation, including calibration certification

14.5 Test log

14.6 Identification of test personnel and witnesses

14.7 Test results including:

a. Results of each baseline inspection

b. Results of each operability tests

c. Description of any failures or anomalies

14.8 Identification of the structural frequencies as determined by the Resonance Test, including transmissibility and Bode plots

14.9 Test Response Spectra:

a. One per control accelerometer for:

- SRV Aging Test plotted at 2% damping
- SRV + LOCA Aging Test plotted at 2% damping
- Each of the 5 Upset condition proof tests plotted at 1% damping and one representative Upset condition test also plotted at 2%, & 5% damping
- the first Emergency condition proof test plotted at 2% damping and the second plotted at 2%, 5% & 10% damping

b. One per response accelerometer, identified in Section 5.6, for

- SRV Aging Test plotted at 2% damping
- SRV + LOCA Aging Test plotted at 2% damping
- one representative Upset condition proof test plotted at 1%, 2%, & 5% damping
- one representative Emergency condition proof test plotted at 2%, 5%, & 10% damping

## 15.0 REFERENCES

15.1 IEEE-323-1974 "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."

15.2 IEEE-344-1975 "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations."

15.3 IEEE-649-1980 "IEEE Standard for Qualifying Class 1E Motor Control Centers for Nuclear Power Generating Stations."

15.4 NUREG-0588, Rev. 1, "Interim Staff Position on Environmental Qualification of Electrical Equipment."

15.5 NUREG-0800, July 1981, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" Section 3.9.2, Rev. 2, Section 3.10, Rev. 2.

15.6 U.S. NRC Regulatory Guide 1.89, November 1974, "Qualification of Class 1E Equipment for Nuclear Power Plants."

15.7 U.S. NRC Regulatory Guide 1.100, Rev. 1, August 1977 "Seismic Qualification of Electric Equipment for Nuclear Power Stations."

15.8 Form MSS-6.2C "Sargent & Lundy Standard Specification for Seismic Qualification Criteria for Nuclear Safety-Related Equipment."

SARGENT & LUNDY ENGINEERS

CLIENT CINCINNATI GAS & ELECTRIC COMPANY

PROJECT ZIMMER - 1 JOB NO. 4130-15

DESIGN BY Donald R. Elsea DATE 6-29-82

CHECKED BY Nisar Alvi DATE 6-29-82 SHEET 1 OF 5

FILE CQD-003243

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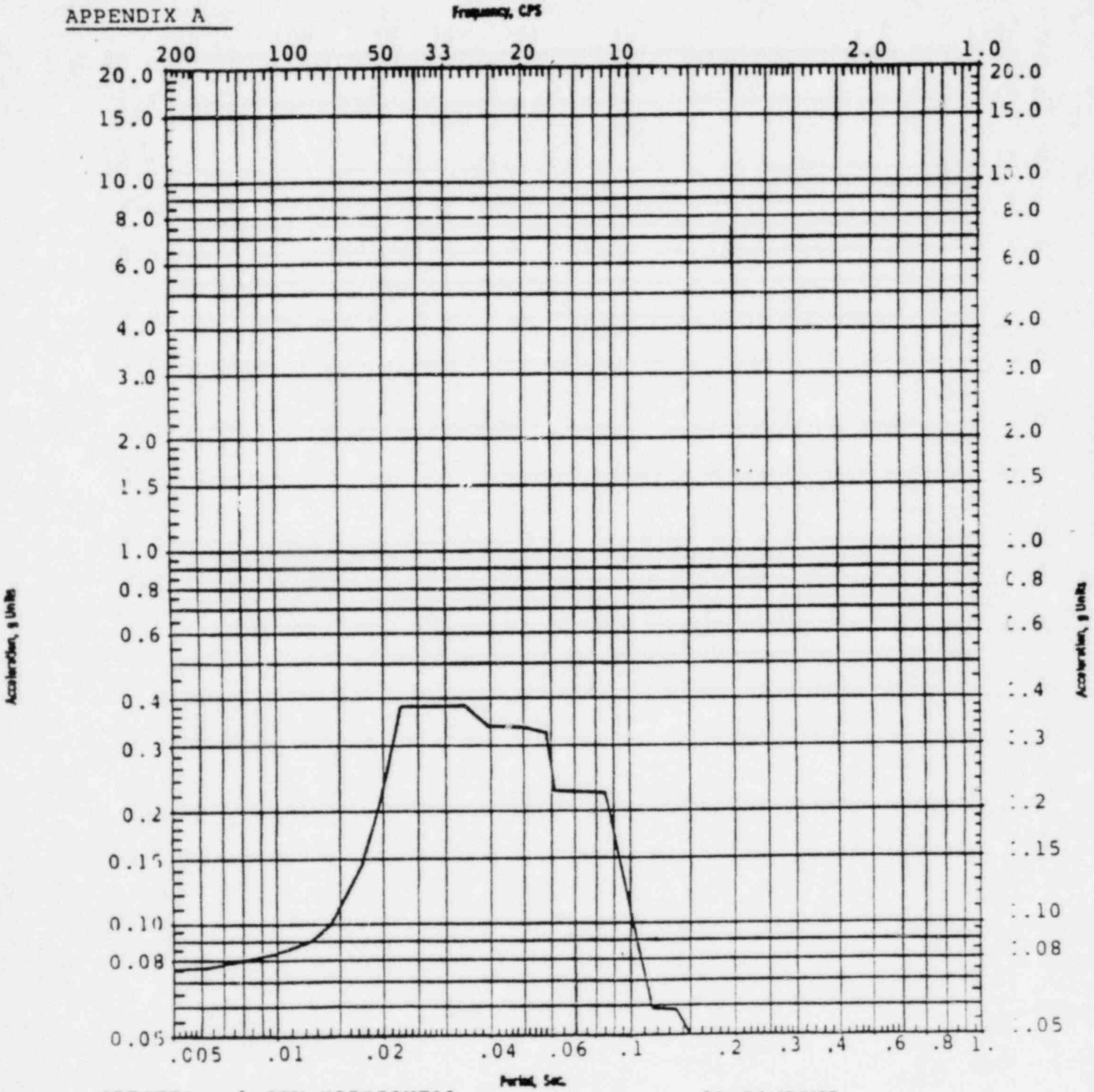
APPENDIX A




SPECTRA - 1 SRV HORIZONTAL

2% DAMPING
HORIZONTAL - N-S/E-W

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CLIENT CINCINNATI GAS & ELECTRIC COMPANY
PROJECT ZIMMER - 1 JOB NO. 4130-15
DESIGN BY Donald E. Elsea DATE 6-27-82
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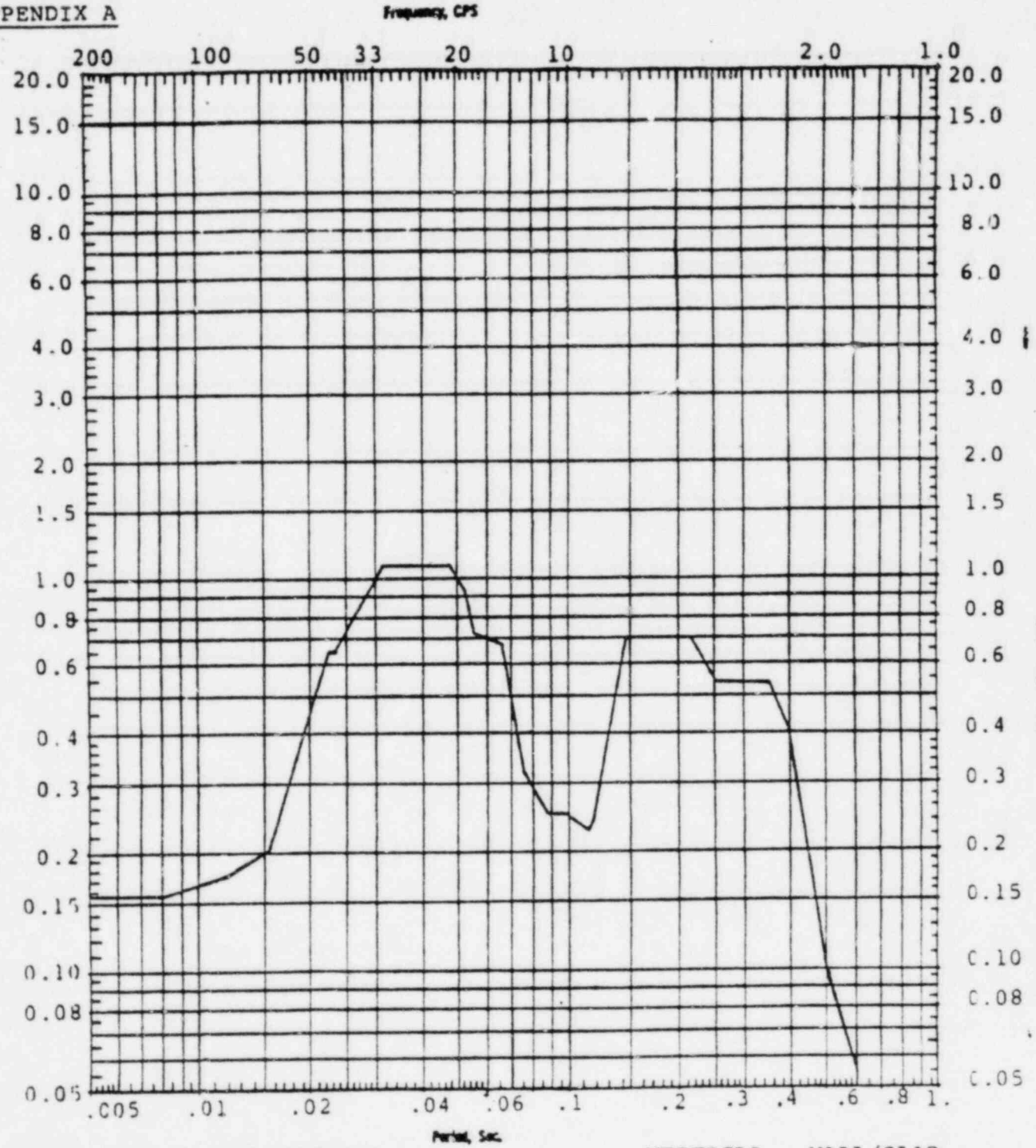


SPECTRA - 2 SRV VERTICAL

VERTICAL - WALL/SLAB
2% DAMPING

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DESIGN BY Donald E. Elsea DATE 6-29-82
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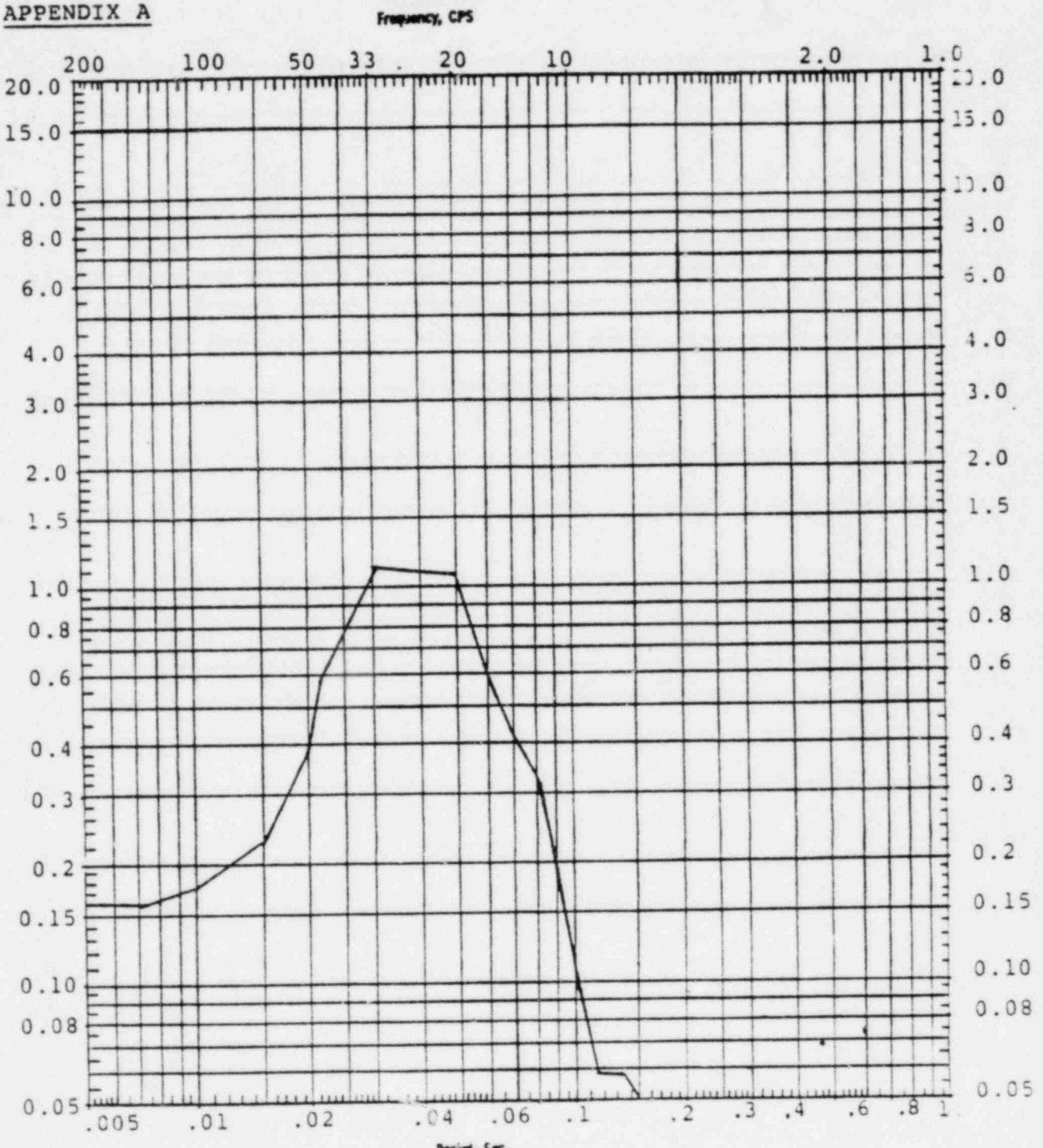
APPENDIX A




SPECTRA - 3 SRV + LOCA HORIZONTAL

2% DAMPING
HORIZONTAL - N-S/E-W

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DESIGN BY Donald P. Rich DATE 6-29-82
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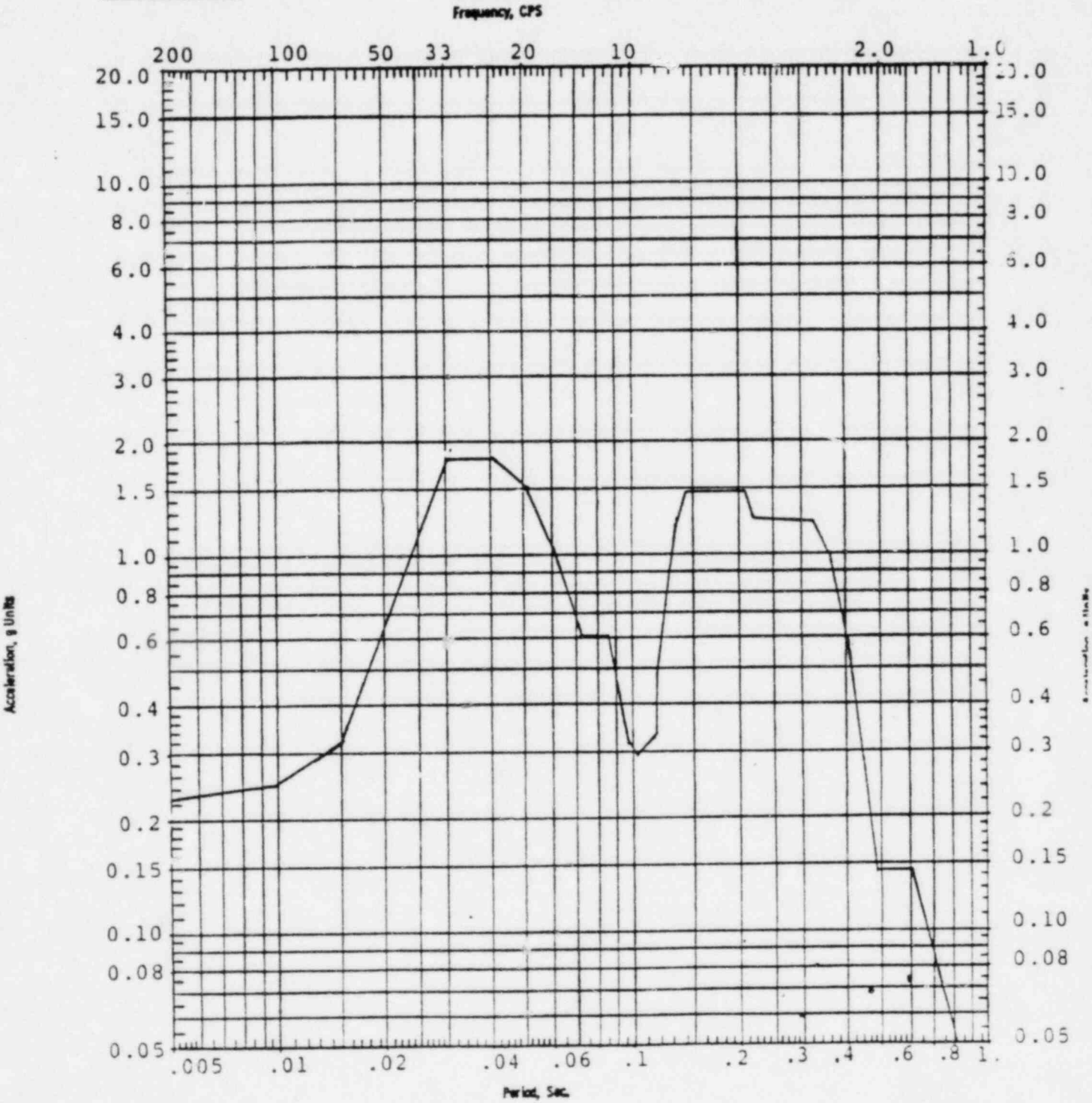


SPECTRA - 4 SRV + LOCA VERTICAL

VERTICAL - WALL/SLAB
2% DAMPING

SARGENT & LUNDY ENGINEERS

CLIENT CINGRP
PROJECT ZIMMER-1 JOB NO. 4130-.5
DESIGN BY Donald R Ebar DATE 6-11-82
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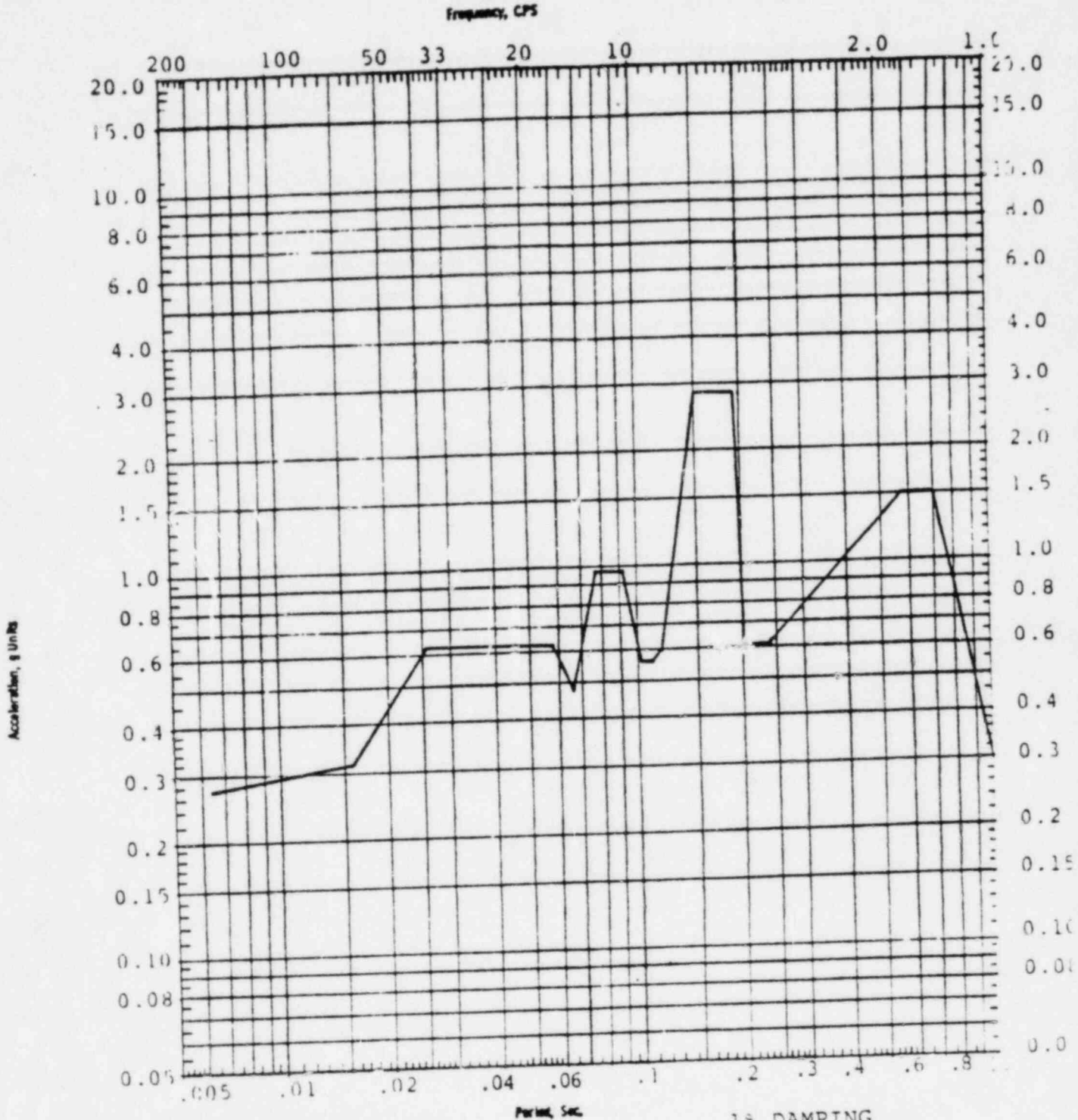


SPECTRA - 5 UPSET (OBE)
HORIZONTAL

1% DAMPING
HORIZONTAL - N-S/E-W

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PROJECT ZIMMER-1 JOB NO. 4130-5
DESIGN BY Donald P. Ellis DATE 6-11-82
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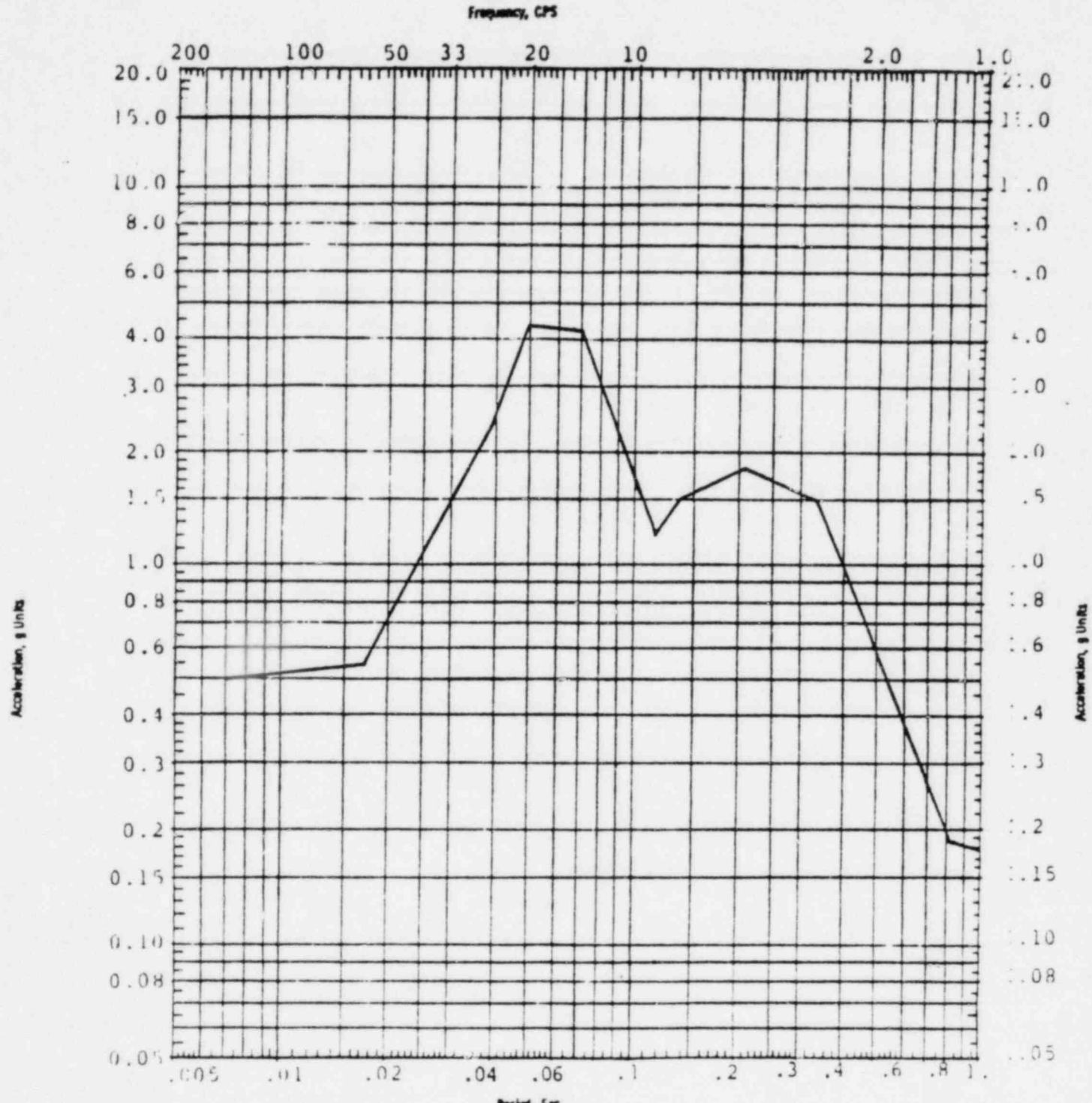


SPECTRA - 6 UPSET (OBE)
VERTICAL

VERTICAL - WALL/SLAB
1% DAMPING

SARGENT & LUNDY ENGINEERS

CLIENT CINCINNATI GAS & ELECTRIC COMPANY
PROJECT ZIMMER - 1 JOB NO. 4130-15
DESIGN BY [illegible] DATE 6-29-82
CHECKED BY Nisar Ali DATE 6-29-82 SHEET 7 OF [illegible]
FILE CQD-003243

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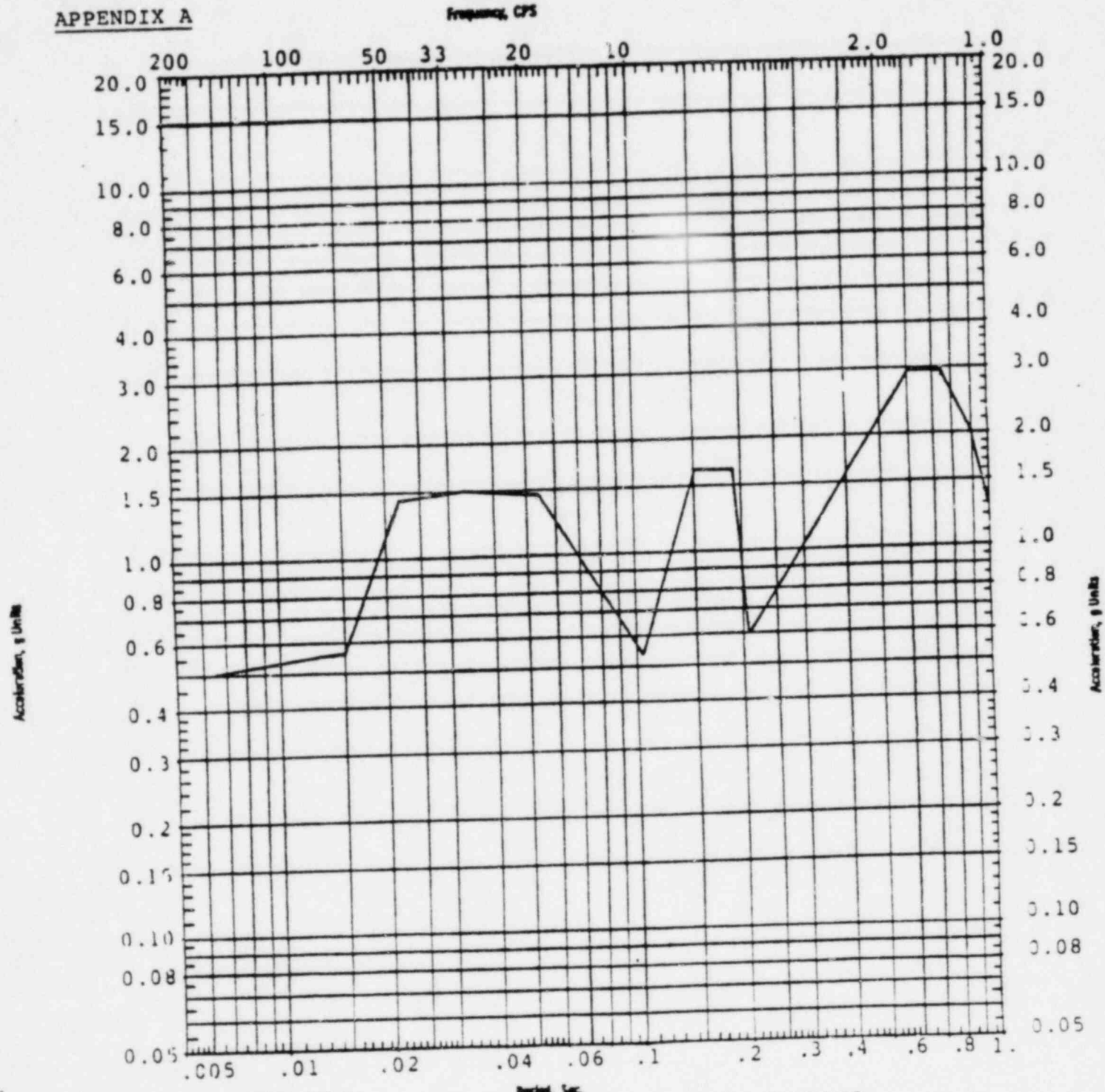
|---|---|---|---|---|---|---|---|
| DATE | | | | | | | |
| INITIALS | | | | | | | |

APPENDIX A




SPECTRA - 7 EMERGENCY (SSE) HORIZONTAL

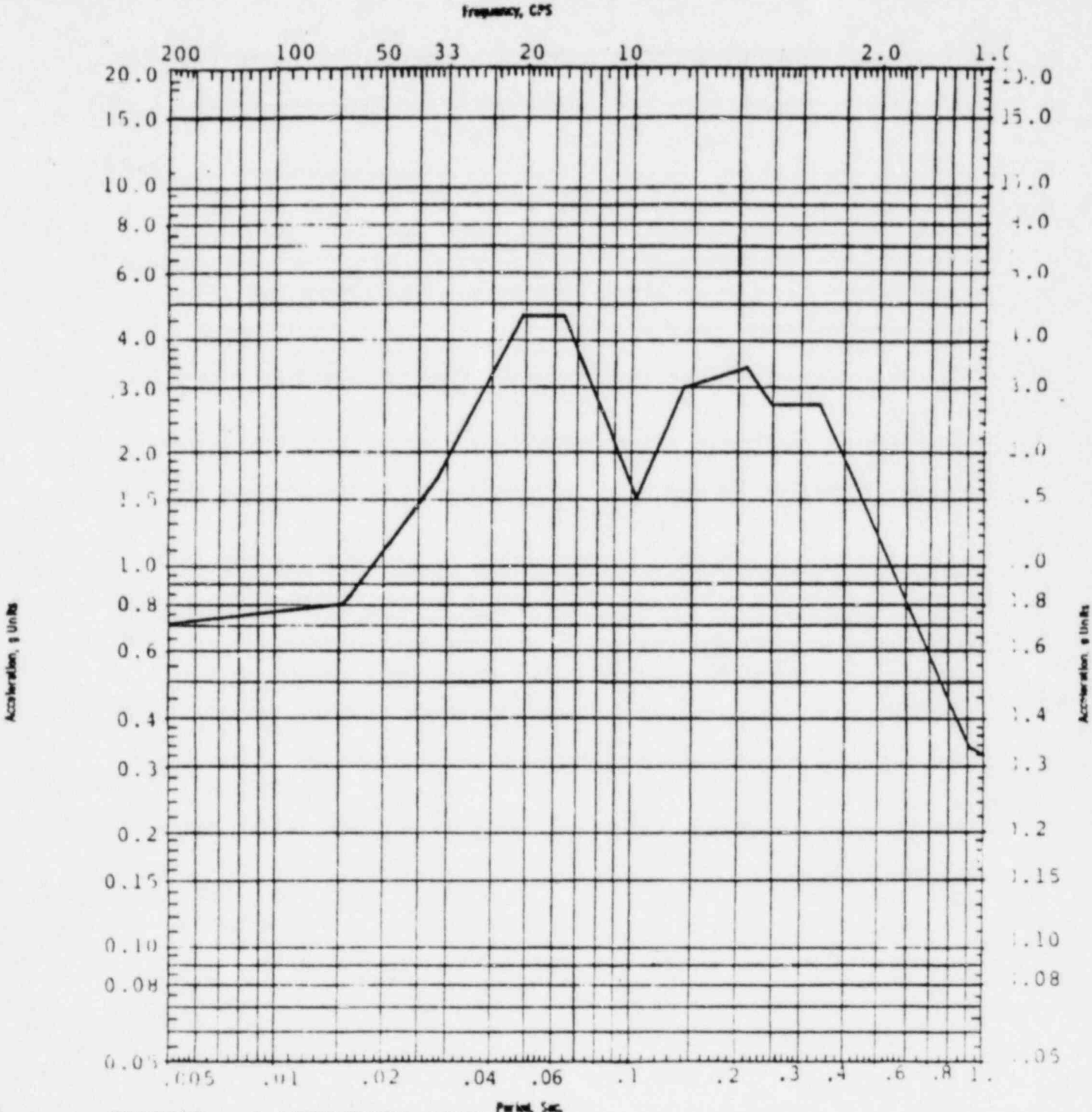
2% DAMPING
HORIZONTAL - N-S/E-W

SARGENT & LUNDY ENGINEERS

CLIENT CINGRP
PROJECT ZIMMER-1 JOB NO. 4130-.5
DESIGN BY Donald E Elias DATE 6-11-82
CHECKED BY Nisar A Ansari DATE 6-29-82 SHEET 8 OF 8
FILE CQD-003243

| REV. NO. | | | | | | |
|---|---|---|---|---|---|---|
| DATE | | | | | | |
| INITIALS | | | | | | |

APPENDIX A




SPECTRA - 8 EMERGENCY (SSE)
VERTICAL

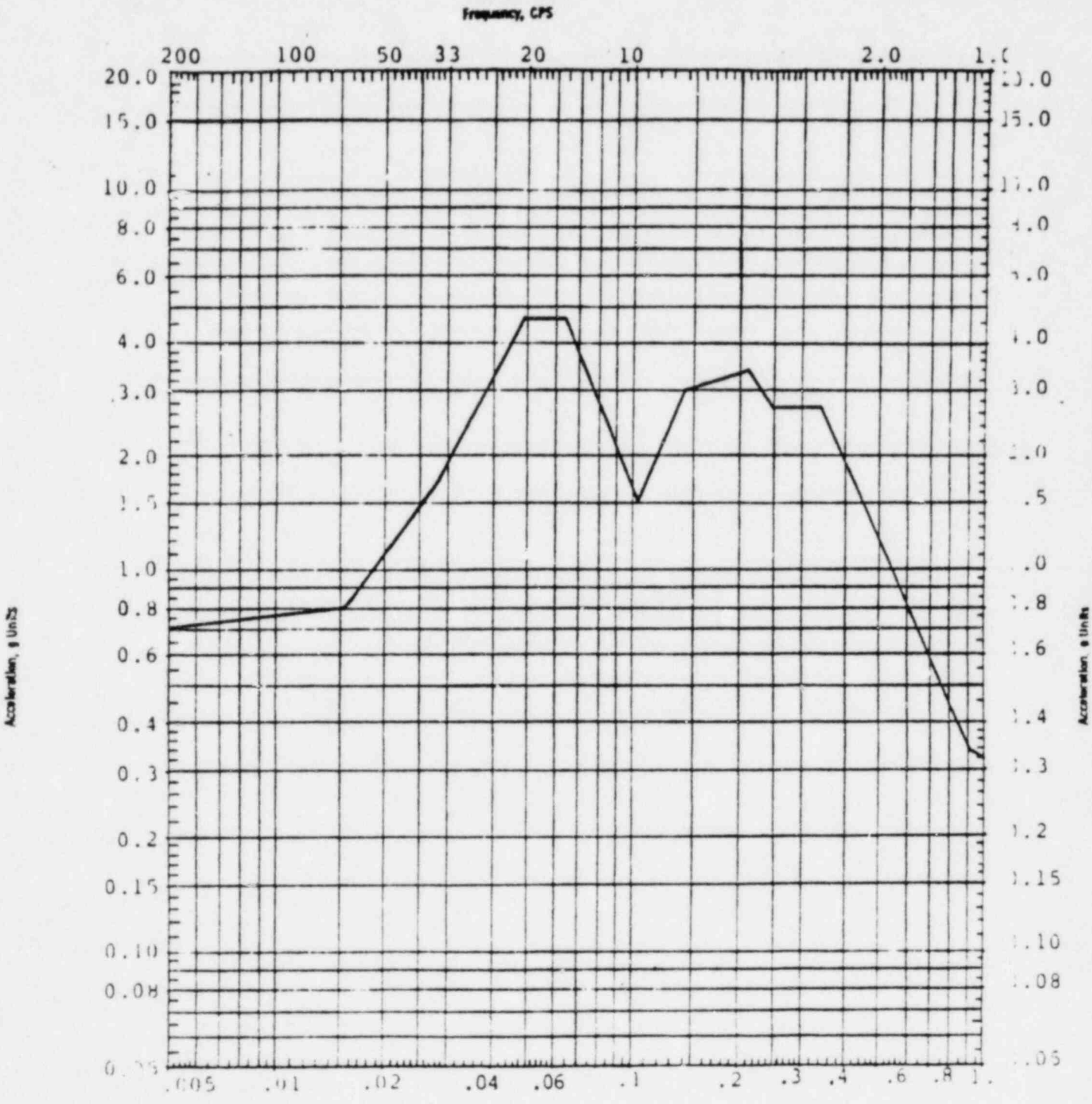
VERTICAL - WALL/SLAB
2% Damping

SARGENT & LUNDY ENGINEERS

CLIENT CINGRP
PROJECT ZIMMER-1 JOB NO. 4130-.5
DESIGN BY Donald E Elsea DATE 6-11-82
CHECKED BY Nisar A Lui DATE 6-29-82 SHEET 8 OF 8
FILE CQD-003243

| REV. NO. | | | | | | |
|---|---|---|---|---|---|---|
| DATE | | | | | | |
| INITIALS | | | | | | |

APPENDIX A

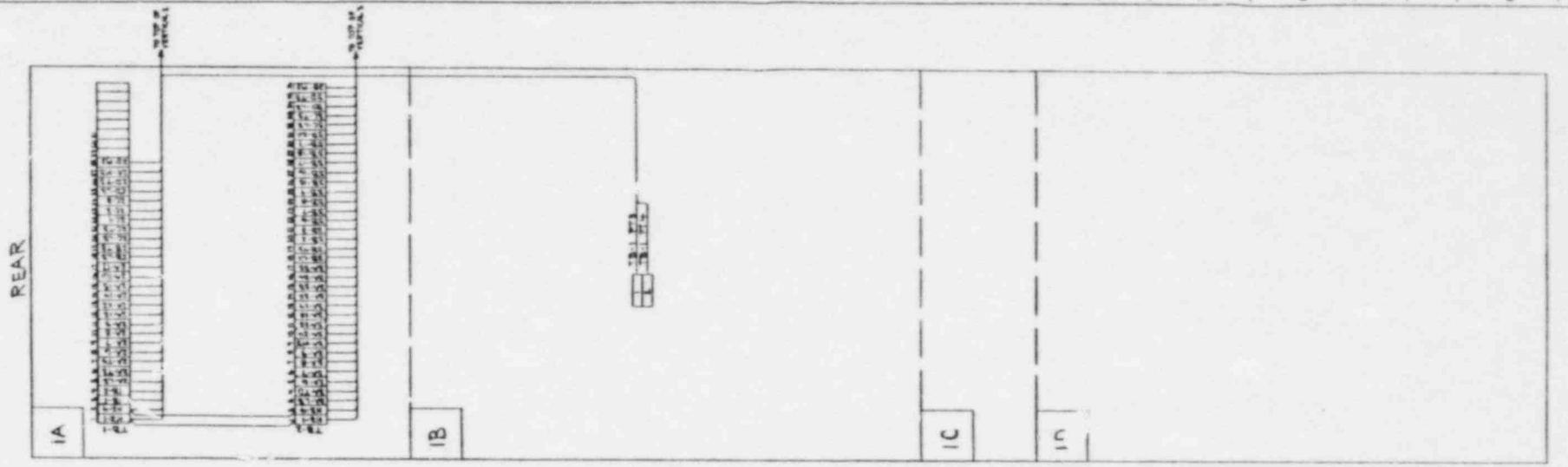


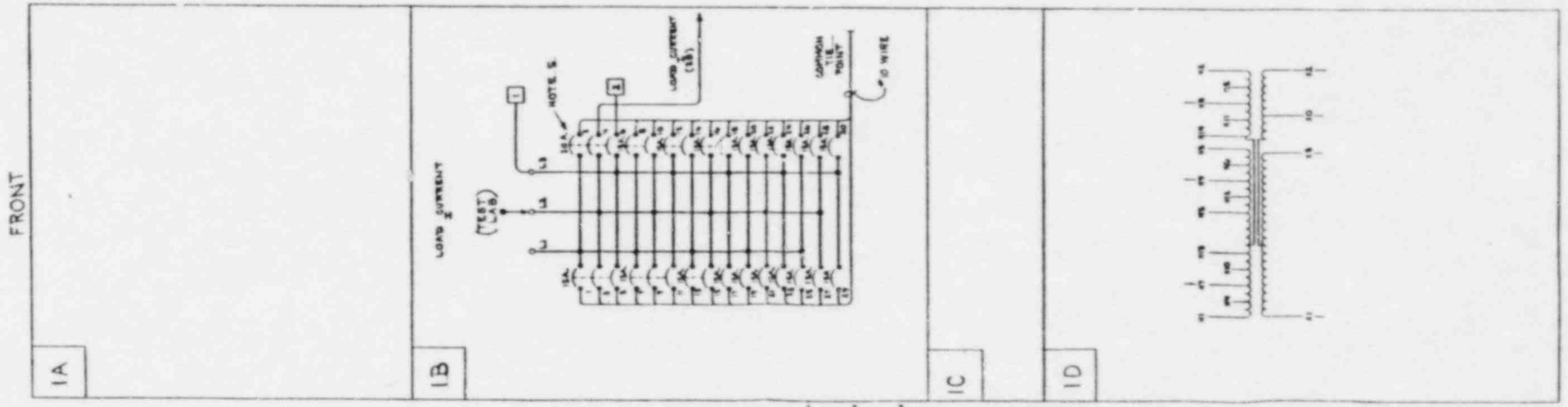

SPECTRA - 8 EMERGENCY (SSE)
VERTICAL

VERTICAL - WALL/SLAB
2% Damping

RECORD OF REVISION

| Date | Drawing(s) Affected | Revision | Approved By |
|---|---|---|---|
| 8/16/82 | Drawing No. SM Test – E2 | FVR Starter 2B. Moved jumper between 1 and 3 to 1 and 5 to enable reversing contactor which was being monitored to operate. (Prior to test). | D A Parker COLE |
| | Drawing No. SM Test – E3 | FVNR Starter 3A. Connected wires 22 and 23 going to C coil to 14 and 15 in parallel with C2 coil. (Prior to test). | D A Parker COLE |




NOTES:

1. LOAD CURRENT I = 30 AMPS., #10 GA. WIRE
   II = 50 " #10 " "
   III = 100 " #6 " "
2. USE #14GA. FOR CONTROL & MONITORING WIRE.
3. ONLY CIRCUIT BKR. TO BE CLOSED DURING TESTING.
4. TERMINAL BLOCK LOCATED IN 1B.

▣ INDICATES TERMINAL BLOCK CONNECTION

HEATER LEGEND

| STARTER SIZE | HEATER SIZE |
|---|---|
| | |
| | |
| | |
| | |

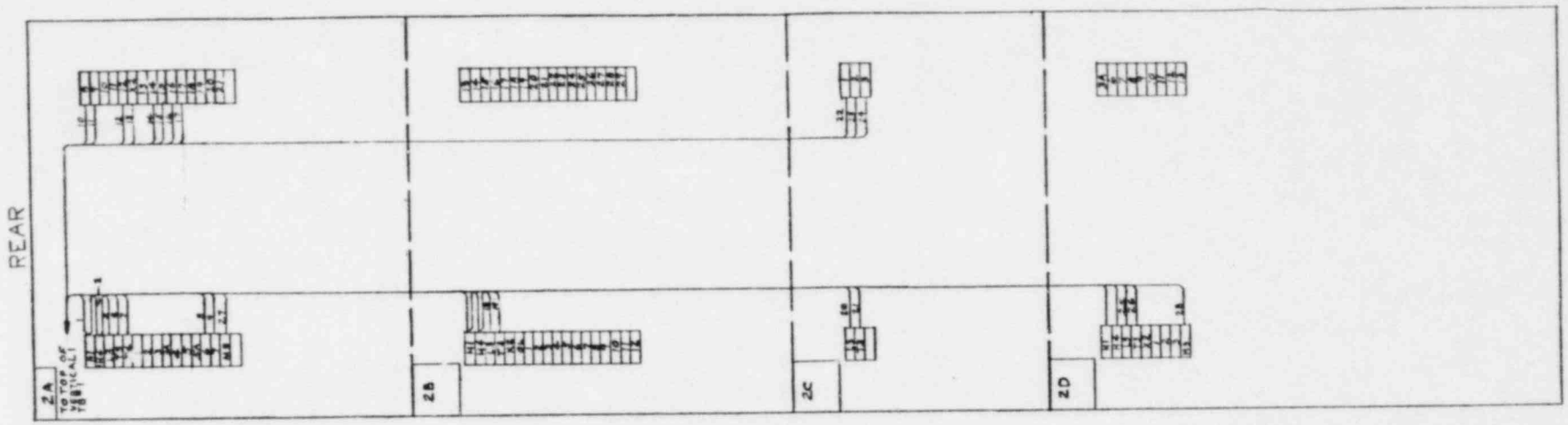
480 VAC MCC SEISMIC TEST UNIT

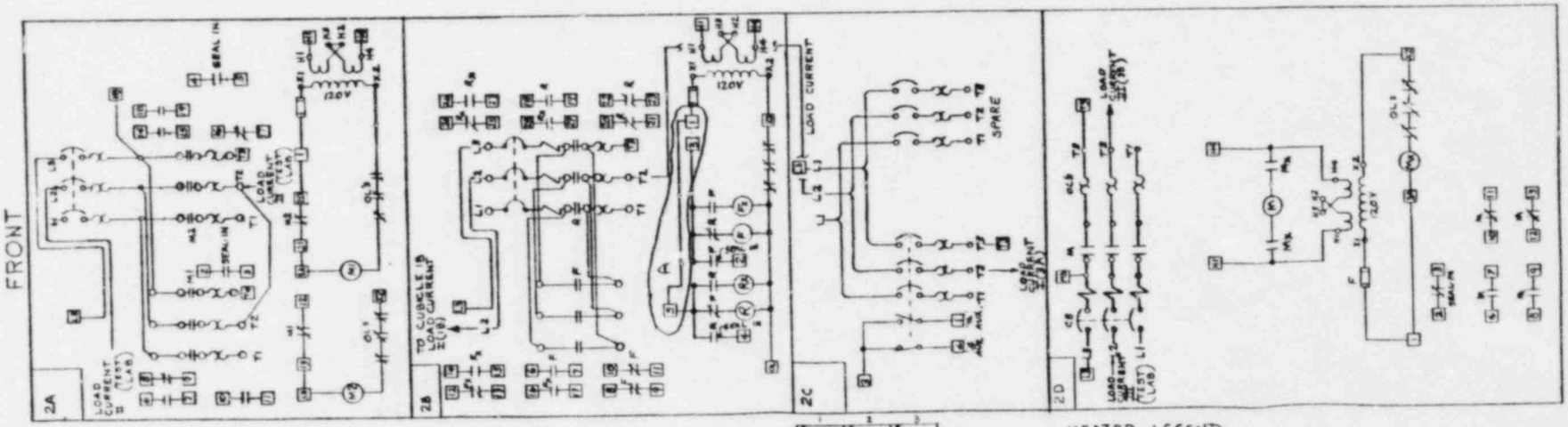
WM. H. ZIMMER NUCLEAR PWR. U#1

THE CINCINNATI GAS & ELECTRIC COMPANY

GENERAL ENGINEERING DEPARTMENT

M-TEST-E1




NOTES:

1. LOAD CURRENT I = 30 AMPS; #10 CU WIRE
2. " " II = 30 " #10 CU WIRE
3. " " III = 100 " #2 CU WIRE
4. USE BIAGA FOR CONTROL & MONITORING WIRE.
5. TERMINAL BLOCKS LOCATED IN REAR
6. WIRE TERMINAL BLOCKS H1 & H4 IN PARALLEL

[F] INDICATES TERMINAL BLOCK CONNECTION

| | | | |
|---|---|---|---|
| A INCOMING | A FVNR SIZE 1 | A FVNR SIZE 2 | |
| B 50 CKT PANEL | B FVNR SIZE 1 | B FVNR SIZE 3 | |
| | C CF | C FF | C FVNR SIZE 3 |
| D 15 KVA 3Ø | D FVNR SIZE 4 | D FVNR SIZE 2 | |

HEATER LEGEND

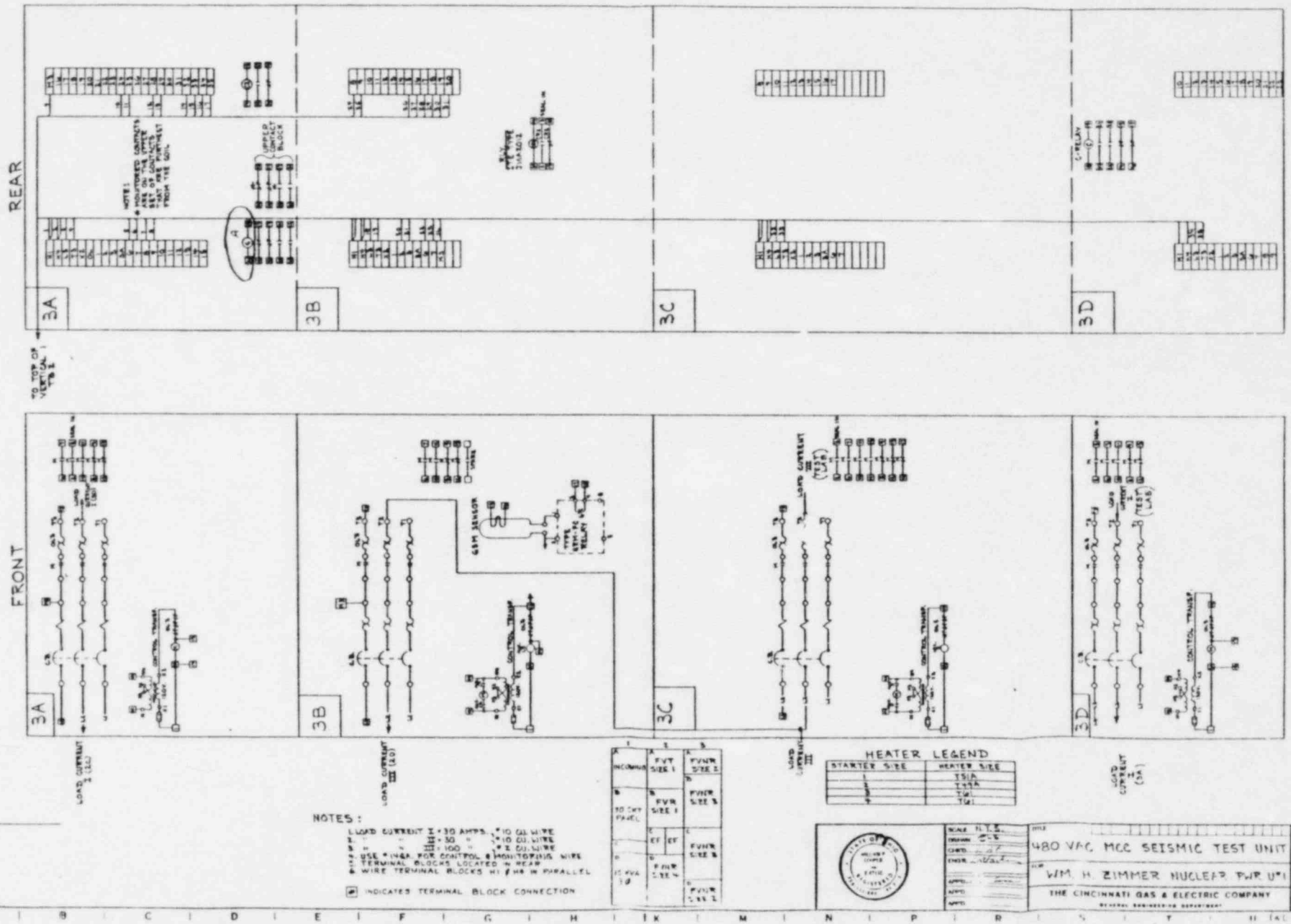
| STARTER SIZE | HEATER SIZE |
|---|---|
| 1 | T-21 |
| 2 | T-24 |
| 3 | T-28 |
| 4 | T-31 |

480 V[illegible] MCC SEISMIC TEST UNIT

WM. H. ZIMMER NUCLEAR PWR. U#1

THE CINCINNATI GAS & ELECTRIC COMPANY

M-TEST-12


REAR
FRONT
3A
3B
3C
3D
HEATER LEGEND
STARTER SIZE
HEATER SIZE
NOTES :
480 VAC. MCC SEISMIC TEST UNIT
WM. H. ZIMMER NUCLEAR PWR U°1
THE CINCINNATI GAS & ELECTRIC COMPANY
SM TEST-E3

## VII.2 Appendix B – SDRC Log Sheet

## SDRC SEISMIC TEST LOG

Customer: CGoE

P.O. No.: XEC-023743

Project No.: 1140-R1

Log Page 1 of 2

Engineer: G. Patrick

| DATE | TIME | TEST NO. | TEST DESCRIPTION | COMMENTS |
|---|---|---|---|---|
| 8/17 | 16:15 | 1 | X Transmissibility | Test # 1 |
| 8/17 | 16:44 | 2 | Y Transmissibility | Test # 2 |
| 8/17 | 17:05 | 3 | Z Transmissibility | Test # 3 |
| 8/17 | 18:03 | 4 | SRV Aging | Test # 4 |
| 8/17 | 19:00 | 5 | SRV + LOCA | Test # 5 |
| 8/17 | 20:10 | 6 | OBE - Upset - 1st | Test # 6 Low Y axis |
| 8/17 | 20:28 | 7 | OBE - Upset - 2nd | Test # 7 |
| 8/17 | 20:42 | 8 | OBE - Upset - 3rd | Test # 8 |
| 8/17 | 20:52 | 9 | OBE - Upset - 4th | Test # 9 |
| 8/17 | 21:06 | 10 | OBE - Upset - 5th | Test # 10 |
| 8/17 | 21:44 | 11 | OBE - Upset - 6th | Test # 11 |
| 8/17 | 21:58 | 12 | SSE - Emergency, 1st | Test # 12 Low |
| 8/17 | 22:38 | 13 | SSE - Emergency 2nd | Test # 13 Low Y axis |

## SDRC SEISMIC TEST LOG

Customer: CG&E

P.O. No.: XEC-023743

Project No.: 11410-R1

Log Page 2 of 2

Engineer: G. Patrick

| DATE | TIME | TEST NO. | TEST DESCRIPTION | COMMENTS |
|---|---|---|---|---|
| 8/17 | 22:58 | 14 | SSE - 3rd - Emergency | Paper kicked out power supply Test #14 |
| 8/17 | 23:15 | 15 | SSE - 4th - Emergency | Test #15 |
| 8/17 | 23:30 | 16 | SSE - 5th - Emergency | Test #16 |
| | | | | |
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## VII.3 Appendix C – Calibration Records of Test Equipment

# MINICOMPUTER BASED CENTRAL CONTROL SYSTEM

SDRC
Structural Dynamics Research Corporation

Cert. No. 000814
Date 8-13-82
Due 11-13-82

# Certificate of Calibration

Manufacturer ~~GenRad~~ Model (2503)2501-3007 ADS
Asset No: E0132 S/N 008

This is to certify that the ~~ADS Unit~~ described above has been calibrated by SDRC Instrumentation Services per procedure ~~GenRad ADS Autom~~ using the references listed below and has been found to be within the tolerance specified.

| Certified References Used | Last Cal Date |
|---|---|
| SDRC PC-2 S/N 005 | 1-29-82 |
| DATA PRECISION 936 S/N 2551 | 3-19-82 |
| | |

| Channel | Frequency | Ref. Input | Output | % Error |
|---|---|---|---|---|
| ~~A~~ | ~~D.C.~~ | ~~+.1201~~ | +.1201 | 0 |
| | | ~~-.1201~~ | -.1198 | .25 |
| | | ~~+1.8~~ | +1.802 | .11 |
| | | ~~1.8~~ | -1.799 | .06 |
| ~~B~~ | | ~~+.1201~~ | +.1201 | 0 |
| | | ~~-.1201~~ | -.1198 | .25 |
| | | ~~+1.8~~ | +1.803 | .17 |
| | | ~~-1.8~~ | -1.799 | .06 |
| ~~C~~ | | ~~+.1201~~ | +.1202 | .08 |
| | | ~~.1201~~ | -.1201 | 0 |
| | | ~~+1.8~~ | +1.803 | .17 |
| | | ~~-1.8~~ | -1.799 | .06 |
| ~~D~~ | | ~~+.1201~~ | +.1198 | .25 |
| | | ~~-.1201~~ | -.1201 | 0 |
| | | ~~+1.8~~ | +1.798 | .11 |
| | | 1.8 | -1.801 | .06 |

Comments WITHIN SPEC

SDRC
Structural Dynamic Research Corporation
2000 Eastman Drive
Milford Ohio 45150

Calibrated By Terry E Frye

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 009313
Date 8-13-82
Due 11-13-82

# Certificate of Calibration

Manufacturer GenRad Model 2501-3007 ADS
Asset No: _____ S/N 0042

This is to certify that the ADS Unit described above has been calibrated by SDRC Instrumentation Services per procedure GenRad ADS Align using the references listed below and has been found to be within the tolerance specified.

| Certified References Used | Last Cal Date |
|---|---|
| SDRC PC-2 S/N 005 | 1-29-82 |
| DATA PRECISION 936 S/N 2551 | 3-19-82 |
| | |

| Channel | Frequency | Ref. Input | Output | % Error |
|---|---|---|---|---|
| A | D.C. | +.1201 | +.1200 | .08 |
| | | -.1201 | -.1200 | .08 |
| | | +1.8 | +1.803 | .17 |
| | | -1.8 | -1.798 | .11 |
| B | | +.1201 | +.1200 | .08 |
| | | -.1201 | -.1200 | .08 |
| | | +1.8 | +1.799 | .06 |
| | | -1.8 | -1.797 | .17 |
| C | | +.1201 | +.1200 | .08 |
| | | -.1201 | -.1199 | .17 |
| | | +1.8 | +1.797 | .17 |
| | | -1.8 | -1.798 | .11 |
| D | | +.1201 | +.1198 | .25 |
| | | -.1201 | -.1203 | .17 |
| | | +1.8 | +1.801 | .06 |
| | | -1.8 | -1.798 | .11 |

Comments WITHIN SPEC.

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford Ohio 45150

Calibrated By Terry E Fryer

TABLE CONTROL ACCELEROMETERS AND AMPLIFIER

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000239
Date 6-15-82
Due 12-15-82

# Certificate of Calibration

Manufacturer PCB Model 308B
Asset No: _____ S/N 2780

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure ATCPCB06 using the references listed below and has been found to be within the tolerance specified. Dedicated to Shaketable Xaxis

| Certified References Used | | Last Cal Date |
|---|---|---|
| 394MC4 | PCB Accel. Standard | 5-11-82 |
| 5520A | Fluke DMM | 4-13-82 |
| | | |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV/g | | mV/g | % |
| | | | | | |
| | 15 | 100.0 | | 99.5 | -0.40 |
| | 30 | ↓ | | 100.2 | 0.30 |
| | 50 | | | 99.9 | 0.00 |
| | 100 | | | 100.0 | 0.10 |
| | 300 | | | 100.1 | 0.20 |
| | 500 | | | 100.2 | 0.30 |
| | 1K | | | 100.4 | 0.50 |
| | 2K | ↓ | | 100.2 | 0.30 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments Sensitivity = 99.9 mV/g

Calibrated By [signature]

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000240
Date 6-15-82
Due 12-15-82

# Certificate of Calibration

Manufacturer PCB Model 308B
Asset No: S/N 5378

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure ~~CP3~~ ACCPCB06 using the references listed below and has been found to be within the tolerance specified. Dedicated to Shaker table - Y axis

| Certified References Used | | Last Cal Date |
|---|---|---|
| 394M04 | PCB Accel Standard | 5-11-82 |
| 8520A | Fluke DVM | 4-13-82 |
| | | |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV/g | | mV/g | % |
| | | | | | |
| | 15 | 100.0 | | 99.7 | 0.50 |
| | 30 | ↓ | | 100.1 | 0.90 |
| | 50 | ↓ | | 100.2 | 1.00 |
| | 100 | ↓ | | 100.2 | 1.00 |
| | 300 | ↓ | | 100.3 | 1.10 |
| | 500 | ↓ | | 100.4 | 1.20 |
| | 1K | ↓ | | 100.6 | 1.41 |
| | 2K | ↓ | | 104.0 | 4.83 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments Sensitivity = 99.2 mV/g

Calibrated By [signature]

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000241
Date 6-15-82
Due 12-15-82

# Certificate of Calibration

Manufacturer PCB Model 308B
Asset No: S/N 5327

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure ACLPCB06 using the references listed below and has been found to be within the tolerance specified. Dedicated to Shaketable - Z axis

| Certified References Used | | Last Cal Date |
|---|---|---|
| 394 M04 | Accel Standard | 5-11-82 |
| 8520A | Fluke DVM | 4-13-82 |
| | | |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV/g | | mV/g | % |
| | | | | | |
| | 15 | 100.0 | | 100.3 | 0.19 |
| | 30 | | | 100.7 | 0.59 |
| | 50 | | | 100.9 | 0.79 |
| | 100 | | | 101.0 | 0.89 |
| | 300 | | | 101.2 | 1.09 |
| | 500 | | | 101.3 | 1.19 |
| | 1k | | | 101.4 | 1.29 |
| | 2k | | | 103.0 | 2.89 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments Sensitivity = 100.1

Calibrated By

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000238
Date 6-15-82
Due 12-15-82

# Certificate of Calibration

Manufacturer PCB Model 483M33
Asset No: S/N 316

This is to certify that the Amplifier described above has been calibrated by SDRC Instrumentation Services per procedure AMPPCB33 using the references listed below and has been found to be within the tolerance specified.

| Certified References Used | Last Cal Date |
|---|---|
| 3520A Fluke DVM | 4-13-82 |
| 5100A Calibrator | 5-24-82 |
| | |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV | | mV | % |
| | | | | X1 | |
| | | | | | |
| 1 | 100 | 50 | | 50.00 | 0.00 |
| 2 | " | " | | 50.03 | 0.06 |
| 3 | " | " | | 50.04 | 0.08 |
| 4 | " | " | | 50.04 | 0.08 |
| 5 | " | " | | 50.05 | 0.10 |
| 6 | " | " | | 50.06 | 0.12 |
| 7 | " | " | | 50.06 | 0.12 |
| 8 | " | " | | 50.07 | 0.14 |
| 9 | " | " | | 50.08 | 0.16 |
| X | " | " | | 50.09 | 0.18 |
| Y | " | " | | 50.09 | 0.18 |
| Z | " | " | | 50.09 | 0.18 |

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments within spec.

Calibrated By [signature]

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000238
Date 6-15-82
Due 12-15-82

# Certificate of Calibration

Manufacturer PCB Model 483M33
Asset No: _____ S/N 316

This is to certify that the Amplifier described above has been calibrated by SDRC Instrumentation Services per procedure AMPPCB33 using the references listed below and has been found to be within the tolerance specified.

| Certified References Used | Last Cal Date |
|---|---|
| 8520A Fluke DVM | 4-13-82 |
| 5100A Fluke Calibrator | 5-24-82 |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV | | mV | % |
| | | | | X10 | |
| | | | | As Found / As Left | |
| 1 | 100 | 50 | | 500.30 / 500.00 | 0.06 |
| 2 | ↓ | ↓ | | 500.03 / 500.00 | 0.01 |
| 3 | | | | 500.32 / 500.00 | 0.06 |
| 4 | | | | 500.13 / 500.00 | 0.02 |
| 5 | | | | 500.15 / 500.00 | 0.03 |
| 6 | | | | 500.40 / 500.00 | 0.08 |
| 7 | | | | 500.13 / 500.00 | 0.02 |
| 8 | | | | 500.78 / 500.00 | 0.15 |
| 9 | | | | 500.80 / 500.00 | 0.16 |
| X | | | | 500.27 / 500.00 | 0.05 |
| Y | | | | 500.11 / 500.00 | 0.02 |
| Z | | | | 500.33 / 500.00 | 0.04 |

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments within Spec.

Calibrated By [signature]

000238

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. _____
Date 6-15-82
Due 12-15-82

# Certificate of Calibration

Manufacturer PCB Model 483M33
Asset No: _____ S/N 316

This is to certify that the Amplifier described above has been calibrated by SDRC Instrumentation Services per procedure AMPPCB33 using the references listed below and has been found to be within the tolerance specified.

| Certified References Used | Last Cal Date |
|---|---|
| 8920A Fluke DVM | 4-13-82 |
| 5100A Fluke Calibrator | 5-24-82 |
| | |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV | | mV | % |
| | | | | X100 | |
| | | | | As Found / After Cal | |
| 1 | 100 | 5 | | 5.0003 / 5.0000 | 0.01 |
| 2 | | | | 5.0072 / 5.0000 | 0.10 |
| 3 | | | | 5.0008 / 5.0000 | 0.01 |
| 4 | | | | 5.0013 / 5.0000 | 0.02 |
| 5 | | | | 4.9997 / 5.0000 | 0.00 |
| 6 | | | | 5.0032 / 5.0000 | 0.04 |
| 7 | | | | 5.0002 / 5.0000 | 0.00 |
| 8 | | | | 4.9810 / 4.9816 | -0.36 |
| 9 | | | | 5.0009 / 5.0000 | 0.01 |
| X | | | | 5.0031 / 5.0000 | 0.10 |
| Y | | | | 5.0031 / 5.0000 | 0.10 |
| Z | | | | 5.0075 / 5.0000 | 0.15 |

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments within Spec.

Calibrated By Harold A Roberts

SURVEY ACCELEROMETERS

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

000242

Cert. No. _____
Date 6-15-82
Due 12-15-82

# Certificate of Calibration

Manufacturer PCB Model 308M81
Asset No: _____ S/N 3441

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure ACCPCB06 using the references listed below and has been found to be within the tolerance specified. Dedicated to Shaketable #1

| Certified References Used | Last Cal Date |
|---|---|
| 394M04 PCB Accel Standard | 5-11-82 |
| 8520A Fluke DVM | 4-13-82 |
| | |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV/g | | mV/g | % |
| | | | | | |
| | 15 | 100.0 | | 100.5 | 0.90 |
| | 30 | ↓ | | 100.9 | 1.30 |
| | 50 | | | 100.5 | 0.90 |
| | 100 | | | 100.7 | 1.10 |
| | 300 | | | 100.9 | 1.30 |
| | 500 | | | 101.0 | 1.40 |
| | 1K | | | 101.3 | 1.70 |
| | 2K | ↓ | | 102.5 | 2.91 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments Sensitivity = 99.6 mV/g

Calibrated By [signature]

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000198
Date 6-1-82
Due 12-1-82

# Certificate of Calibration

Manufacturer PCB Model 308B
Asset No: S/N 2768

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure ACCPCB06 using the references listed below and has been found to be within the tolerance specified. Dedicated To Shake Table #2

| Certified References Used | | Last Cal Date |
|---|---|---|
| 2941N04 | PCB Accel Standard | 5-11-82 |
| 9520A | Fluke DVM | 4-13-82 |
| | | |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV/g | | mV/g | % |
| | 10 | 100.0 | | 100.0 | 0.30 |
| | 30 | ↓ | | 100.2 | 0.50 |
| | 50 | ↓ | | 100.4 | 0.70 |
| | 100 | ↓ | | 100.4 | 0.70 |
| | 300 | ↓ | | 100.6 | 0.90 |
| | 500 | ↓ | | 100.6 | 0.90 |
| | 1K | ↓ | | 100.7 | 1.00 |
| | 2K | ↓ | | 100.5 | 0.80 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments Sensitivity = 99.7 mV/g

Calibrated By Malcolm H. Ruley

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000199
Date 6-1-82
Due 12-1-82

# Certificate of Calibration

Manufacturer PCB Model 308B
Asset No: S/N 2769

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure ACCPCB06 using the references listed below and has been found to be within the tolerance specified. Dedicated To Shake Table #3

| Certified References Used | | Last Cal Date |
|---|---|---|
| 394M04 | PCB Accel Standard | 5-11-82 |
| 5530A | Fluke DVM | 4-13-82 |
| | | |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV/g | | mV/g | % |
| | | | | | |
| | 10 | 100.0 | | 99.7 | -0.39 |
| | 30 | | | 101.1 | 0.49 |
| | 50 | | | 101.4 | 0.79 |
| | 100 | | | 101.6 | 0.99 |
| | 300 | | | 101.5 | 0.89 |
| | 500 | | | 101.4 | 0.79 |
| | 1K | | | 101.7 | 1.09 |
| | 2K | ↓ | | 101.5 | 0.89 |
| | | | | | |
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SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments Sensitivity = 100.6mV/g

Calibrated By [signature]

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000241
Date 6-15-82
Due 12-15-82

# Certificate of Calibration

Manufacturer PCB Model 308M81
Asset No: S/N 3442

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure ACC PCB06 using the references listed below and has been found to be within the tolerance specified. No. Pictured is Shaketable #4

| Certified References Used | Last Cal Date |
|---|---|
| 394A11 4 PCB Accel. Standard | 5-11-82 |
| 952A Fluke DVM | 4-13-82 |
| | |

| Channel | Frequency | Ref. Input | Output | % Error |
|---|---|---|---|---|
| | Hz | mV/g | mV/g | % |
| | | | | |
| | 15 | 100.0 | 100.4 | 0.80 |
| | 30 | " | 101.5 | 1.90 |
| | 50 | " | 101.0 | 1.40 |
| | 100 | " | 101.1 | 1.50 |
| | 300 | " | 101.3 | 1.70 |
| | 500 | " | 101.5 | 1.90 |
| | 1K | " | 101.6 | 2.00 |
| | 2K | " | 103.5 | 3.91 |
| | | | | |
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SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments Sensitivity = 99.6 mV/g

Calibrated By Sheldon A Bailey

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000243
Date 6-15-82
Due 12-15-82

# Certificate of Calibration

Manufacturer PCB Model 308M81
Asset No: S/N 3445

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure AECPCB06 using the references listed below and has been found to be within the tolerance specified. Dedicated to Shake Table #5

| Certified References Used | | Last Cal Date |
|---|---|---|
| 394M04 | PCB Accel. Standard | 5-11-82 |
| 8520A | Fluke DVM | 4-13-82 |
| | | |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV/g | | mV/g | % |
| | | | | | |
| | 15 | 100.0 | | 100.4 | 0.09 |
| | 30 | ↓ | | 101.3 | 0.00 |
| | 50 | | | 101.0 | 0.69 |
| | 100 | | | 101.0 | 0.69 |
| | 300 | | | 101.3 | 0.99 |
| | 500 | | | 101.3 | 0.99 |
| | 1K | | | 101.6 | 1.29 |
| | 2K | | | 102.3 | 1.99 |
| | | | | | |
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SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments Sensitivity = 100.3 mV/g

Calibrated By [signature]

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

000192

Cert. No. _____
Date 6-2-82
Due 12-2-82

# Certificate of Calibration

Manufacturer PCB Model 308B
Asset No: _____ S/N 2781

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure ACC PCB 006 using the references listed below and has been found to be within the tolerance specified. Dedicated to Shaketable #6

| Certified References Used | Last Cal Date |
|---|---|
| 394 MCH Accel Standard | 5-11-82 |
| 8520A Fluke DVM | ~~4-13-82~~ |

| Channel | Frequency | Ref. Input | Output | % Error |
|---|---|---|---|---|
| | Hz | mV/g | mV/g | % |
| | | | | |
| | 10 | 100.0 | 99.5 | -1.19 |
| | 30 | | 101.1 | 0.39 |
| | 50 | | 101.2 | 0.49 |
| | 100 | | 101.1 | 0.39 |
| | 300 | | 101.2 | 0.49 |
| | 500 | | 101.0 | 0.29 |
| | 1K | | 101.3 | 0.59 |
| | 2K | | 102.9 | 2.18 |
| | | | | |
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SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments sensitivity = 100.7 mV/g

Calibrated By _____

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000235
Date 6-14-82
Due 12-14-82

# Certificate of Calibration

Manufacturer PCB Model 308 m 81
Asset No: S/N 3444

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure PACCPCB06 using the references listed below and has been found to be within the tolerance specified. Dedicated To Shaketable #7

| Certified References Used | | Last Cal Date |
|---|---|---|
| 394M04 | PCB Accel Standard | 5-11-82 |
| 8500A | Fluke DVM | 4-13-82 |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV/g | | mV/g | % |
| | 15 | 100.0 | | 101.2 | 0.99 |
| | 30 | ↓ | | 101.3 | 1.09 |
| | 50 | | | 101.1 | 0.89 |
| | 100 | | | 101.4 | 1.19 |
| | 300 | | | 101.3 | 1.09 |
| | 500 | | | 101.5 | 1.29 |
| | 1K | | | 101.6 | 1.39 |
| | 2K | ↓ | | 103.4 | 3.19 |
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SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments sensitivity = 100.2 mV/g

Calibrated By [signature]

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000201
Date 6-1-92
Due 12-1-92

# Certificate of Calibration

Manufacturer PCB Model 308B
Asset No: S/N 2774

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure ACLPCB.06 using the references listed below and has been found to be within the tolerance specified. Dedicated To Shake Table #8

| Certified References Used | | Last Cal Date |
|---|---|---|
| 394A04 | PCB Accel Standard | 5-11-92 |
| 9520A | Fluke DVM | 4-13-92 |
| | | |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV/g | | mV/g | % |
| | | | | | |
| | 10 | 100.0 | | 98.0 | -2.29 |
| | 30 | ↓ | | 99.4 | -0.99 |
| | 50 | ↓ | | 100.0 | -0.29 |
| | 100 | ↓ | | 100.5 | 0.19 |
| | 300 | ↓ | | 100.7 | 0.39 |
| | 500 | ↓ | | 100.3 | 0.49 |
| | 1K | ↓ | | 101.1 | 0.79 |
| | 2K | ↓ | | 101.8 | 1.49 |
| | | | | | |
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| | | | | | |

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford Ohio 45150

Comments Sensitivity = 100.3 mV/g

Calibrated By [signature]

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000202
Date 6-1-92
Due 12-1-92

# Certificate of Calibration

Manufacturer PCB Model 308B
Asset No: S/N 5381

This is to certify that the Accelerometer described above has been calibrated by SDRC Instrumentation Services per procedure ACCPCB06 using the references listed below and has been found to be within the tolerance specified. Dedicated To Shake Table #9

| Certified References Used | | Last Cal Date |
|---|---|---|
| 374M04 | PCB Accel Standard | 5-11-92 |
| 8520A | Fluke DVM | 4-13-92 |
| | | |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | Hz | mV/g | | mV/g | % |
| | | | | | |
| | 10 | 100.0 | | 99.5 | -0.69 |
| | 30 | ↓ | | 101.2 | 0.99 |
| | 50 | | | 101.7 | 1.49 |
| | 100 | | | 101.8 | 1.59 |
| | 300 | | | 102.0 | 1.79 |
| | 500 | | | 102.1 | 1.89 |
| | 1K | | | 102.3 | 2.09 |
| | 2K | | | 104.3 | 4.09 |
| | | | | | |
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SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford Ohio 45150

Comments Sensitivity = 100.2 mV/g

Calibrated By [signature]

TAPE RECORDER, BRUSH RECORDERS, VISICORDERS

SDRC
Structural Dynamics Research Corporation

Cert. No. 000049
Date 11-21-81
Due 11-21-82

# Certificate of Calibration

Manufacturer AMPEX Model PR2200
Asset No: _____ S/N 6140363

This is to certify that the RECORDER described above has been calibrated by SDRC Instrumentation Services per procedure RECOR AMPEX PR2200 using the references listed below and has been found to be within the tolerance specified.

| Certified References Used | Last Cal Date |
|---|---|
| FLUKE 5100A S/N 2096008 | 4-29-81 |
| FLUKE 8600A S/N 0800225 | 7-17-81 |
| FLUKE 1953A S/N 2315063 | 5-6-81 |

0% DEV. FULL SCALE

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| | CARRIER (KHz) | $V_{out}$ (mV) | CARRIER (KHz) | $V_{out}$ (VOLTS) | |
| 1 | 108.025 | -0.30 | 151.280 | 1.414 | |
| 2 | .012 | +0.15 | .257 | " | |
| 3 | .015 | +0.20 | .230 | " | |
| 4 | .013 | +0.08 | .242 | " | |
| 5 | .001 | -0.05 | .233 | " | |
| 6 | .050 | -0.04 | .255 | " | |
| 7 | .048 | +0.30 | .232 | " | |
| 8 | .025 | +0.10 | .290 | " | |
| 9 | .030 | +0.04 | .236 | " | |
| 10 | .037 | -0.20 | .213 | " | |
| 11 | .029 | +0.20 | .203 | " | |
| 12 | .016 | +0.60 | .210 | " | |
| 13 | .050 | +0.20 | .241 | " | |
| 14 | .012 | -0.30 | .246 | " | |

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford, Ohio 45150

Comments SPEED = 3 3/4 IPS, 14x14, 2.828 IN
1.414 OUT. COPY OF ORIGINAL DATA
BY PAT GRIFFITHS.

Calibrated By VIA Bill Ramsey

SDRC
Structural Dynamics Research Corporation

Cert. No. 000182
Date 82/05/12
Due - 83/05/12

# Certificate of Calibration

Manufacturer Gould Model MK 260
Asset No: S/N 4107

This is to certify that the Brush Recorder described above has been calibrated by SDRC Instrumentation Services per procedure Record Brush MK 260 using the references listed below and has been found to be within the tolerance specified.

| Certified References Used | Last Cal Date |
|---|---|
| Fluke 5100A Calibrator | 12/7/81 |
| Krohn-Hite 5400B Generator | |

| Channel | Frequency | Ref. Input | Output | % Error |
|---|---|---|---|---|
| Channels 1-6 calibrated as follows: | | | | |
| ICO BAL adjusted for minimum pen movement. | | | | |
| ZERO adjusted to center pen. | | | | |
| PEN POSITION control adjusted to center pen. | | | | |
| Preamplifier BALANCE adjusted for zero pen deflection when SENSITIVITY X1 control is rotated. | | | | |
| SPAN adjusted for exactly 25 divisions when ±2.5 V.d-c applied to input terminals. | | | | |
| DAMPING control adjusted for sine-wave 25 divisions p-p when 1 Hz signal applied to input terminals. | | | | |
| Amplitude response checked at 10 divisions (10-100Hz) and 50 divisions (4-40Hz) | | | | |
| RT and LEFT LIMITS adjusted to 2 divisions outside chart edge when ±3V.d-c applied to input terminals. | | | | |
| | | | | |

Speed = 5 mm/sec
Sensitivity = 100 mV/div.

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Structural Dynamics Research Corporation
2000 Eastman Drive
Milford Ohio 45150

Calibrated By Marlon Robey

Instrumentation Services

SDRC
Structural Dynamics Research Corporation

Cert. No. 000065
Date 10-9-81
Due 10-9-82

# Certificate of Calibration

Manufacturer GOULD Model 260
Asset No: S/N 3977

This is to certify that the BRUSH RECORDER described above has been calibrated by SDRC Instrumentation Services per procedure REPAIR BRUSH MK260 using the references listed below and has been found to be within the tolerance specified.

| Certified References Used | Last Cal. Date |
|---|---|
| FLUKE 5100A CALIBRATOR | 4/29/81 |
| | |
| | |

| Channel | Frequency | Ref. Input | Output | % Error |
|---|---|---|---|---|
| Channels 1-6 calibrated as follows: | | | | |
| ICO BAL adjusted for minimum pen movement. | | | | |
| ZERO adjusted to center pen. | | | | |
| PEN POSITION control adjusted to center pen. | | | | |
| Preamplifier BALANCE adjusted for zero pen deflection when SENSITIVITY X1 control is rotated. | | | | |
| SPAN adjusted for exactly 25 divisions when ±2.5 V.d-c applied to input terminals. | | | | |
| DAMPING control adjusted for sine-wave 25 divisions p-p when 1 Hz signal applied to input terminals. | | | | |
| Amplitude response checked at 10 divisions (10-100Hz) and 50 divisions (4-40Hz) | | | | |
| RT and LEFT LIMITS adjusted to 2 divisions outside chart edge when ±3V.d-c applied to input terminals. | | | | |
| | | | | |

SPEED = 5mm/sec.
SENSITIVITY = 500 mv/div.

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford Ohio 45150

Calibrated By Pat Griffith

SDRC
Structural Dynamics Research Corporation

Instrumentation Services

000067

Cert. No.
Date 10-14-81
Due 10-14-82

# Certificate of Calibration

Manufacturer HONEYWELL Model 1858 VISICORDER
Asset No: S/N 6895 PJ81

This is to certify that the RECORDER described above has been calibrated by SDRC Instrumentation Services per procedure RECOR HONEY 1858 using the references listed below and has been found to be within the tolerance specified.

| Certified References Used | Last Cal Date |
|---|---|
| FLUKE 5100A S/N 2096008 | |
| | |
| | |

| Channel | Frequency | Ref. Input | Output | % Error |
|---|---|---|---|---|
| VISICORDER RECEIVED NEW FROM FACTORY ON 10-14-81. ALL CHANNELS CHECKED FOR CORRECT GRIDLINE SPACING. ADJUSTED IF NECESSARY WITH CAL POT. | | | | |
| RESISTOR PAK OPTION INSTALLED ON PINS J3, J4, J5, J7 OF ALL 18 CHANNELS. | | | | |
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SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford Ohio 45150

Calibrated By Pat Griffiths

ElectroRent

# Certificate of Calibration

We certify that the equipment listed below was duly tested and inspected prior to shipment and met physical and operating specifications published by the manufacturer(s).

Electro Rent's primary and secondary standards are traceable to the National Bureau of Standards.

8/12/82
DATE

| MANUFACTURER | MODEL | SERIAL NO. | REPORT NUMBER | DUE DATE |
|---|---|---|---|---|
| HON | 1858 | 44949 | M3638 | 8/12/83 |

MEGGER, VOLTMETER

# INTER-DEPARTMENT CORRESPONDENCE



TO: N. L. Kaestle DATE: 8/12/82

FROM: R. J. Eyer

SUBJECT: INSTRUMENT ACCURACY

DESCRIPTION: Megger 500 Volt

MANUFACTURER: J. G. Biddle

MODEL: Meg Type

SERIAL NO.: C 1554526

TEST PROCEDURE USED ET 1

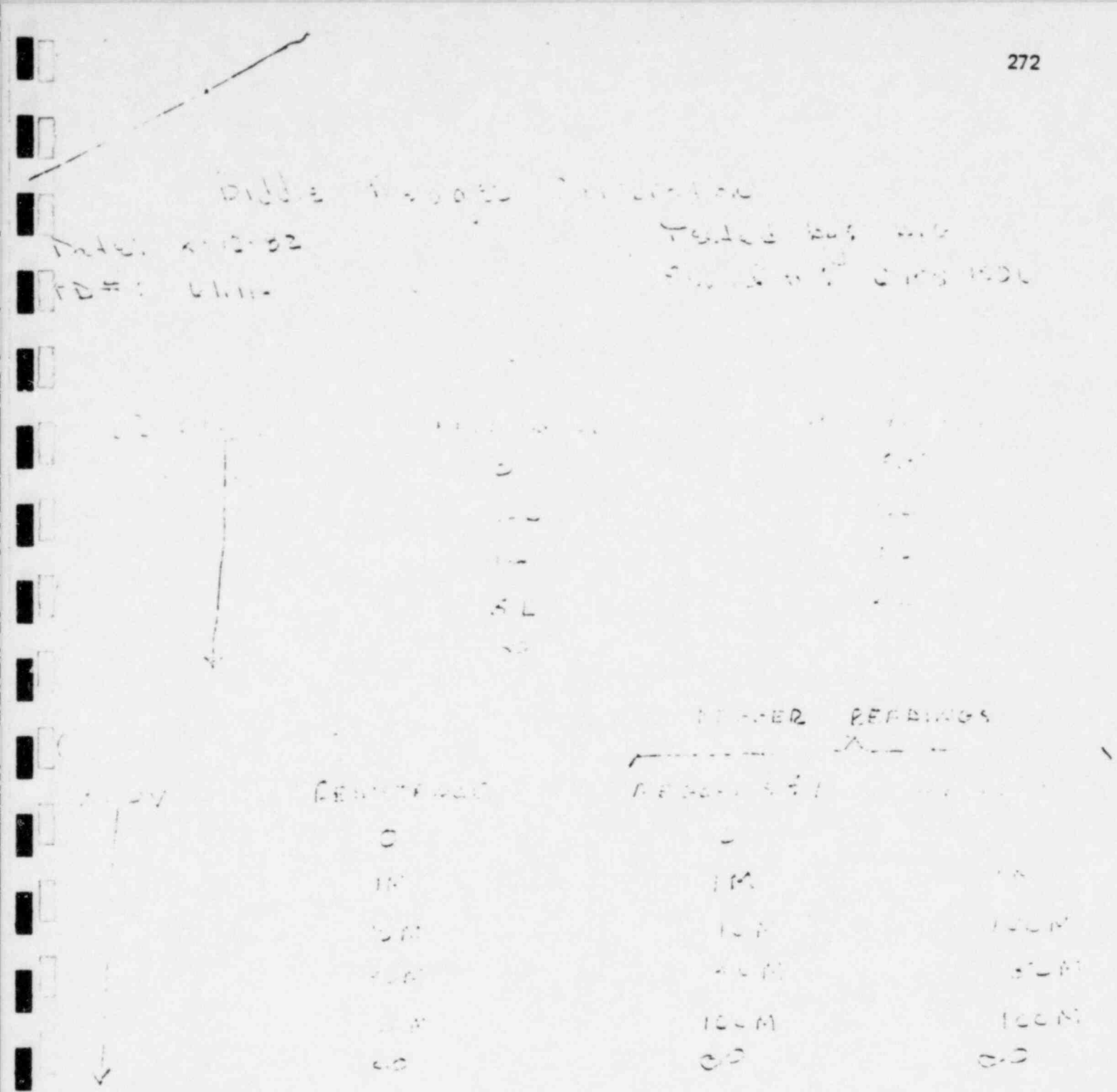
ELECTRIC OPERATING TEST DEPT.
IDENTIFICATION NO.: T.D. 61.11

RATED ACCURACY: 1% of scale legnth

This is to certify that:

The accuracy of this instrument has been verified under the conditions stated above with standards traceable to the National Bureau of Standards. Evidence of traceability is on file at our Laboratory.

TESTED BY: R. J. Eyer



SDRC
Structural Dynamics Research Corporation

Instrumentation Services

000099

Cert. No. _____
Date 3/11/82
Due 3/11/83

# Certificate of Calibration

Manufacturer FLUKE Model 8050A
Asset No: _____ S/N 2576068

This is to certify that the DIGITAL VOLT METER described above has been calibrated by SDRC Instrumentation Services per procedure _____ using the references listed below and has been found to be within the tolerance specified.

| Certified References Used | Last Cal Date |
|---|---|
| FLUKE 5100A S/N 2096008 NBS# 32792 | 12/7/81 |

| Channel | Frequency | Ref. Input | | Output | % Error |
|---|---|---|---|---|---|
| ACV | 100Hz | 100mV | | 100.07mV | +.07 |
| | 100 | 10V | | 10.008V | +.08 |
| | 400 | 500V | | 500.6V | +.12 |
| DCV | | 100mV | | 100.02mV | +.02 |
| | | 10V | | 10.001V | +.01 |
| | | 1000V | | 1000.1V | +.01 |
| KΩ | | 100Ω | resistive on | 100.33Ω | +.33 |
| | | 10KΩ | | 10.001KΩ | +.01 |
| | | 1MΩ | | 1000.1KΩ | +.01 |
| DCA | | 100μA | | 100.06μA | +.06 |
| | | 100mA | | 100.02mA | +.02 |
| | | 1A | | 1.0015A | +.15 |
| ACA | 100Hz | 100μA | | 100.12μA | +.12 |
| | 100 | 100mA | | 100.07mA | +.07 |
| | 100 | 1A | | 1002.1A | +.21 |

SDRC
Structural Dynamics Research Corporation
2000 Eastman Drive
Milford Ohio 45150

Comments within spec.

Calibrated By _____

## VII.4 Appendix D – Contact Settling Time

August 19, 1982

Mr. David Parker
Nuclear Engineering Department
Cincinaati Gas & Electric
U.S. Route 52, P.O. Box 201
Moscow, Ohio 45153

Subject: Cincinnati Gas & Electric Testing of 5600 Motor Control Centers

Dear Mr. Parker:

I am happy to hear that the testing was successful and went as well as it did. I am looking forward to receiving the draft test report for Gould's comments and review. In our phone conversation we discussed the chatter during transition, i.e., change from de-energized to energized conditions. With any electromechanical device there will be a substantial amount of bounce. This is described as primary and secondary bounce on contactors. When one monitors the contactors with a low voltage DC source, as the contacts close there is an impact and impulse condition. This causes the contactors to bounce; hence, an interruption of the DC monitoring circuit. Immediately thereafter the armature closes and the same phenomena will be repeated and an interruption of the DC circuit. The duration of this bounce depends on the size, dynamics, etc. It is not uncommon to see bounce times in the neighborhood of 3, 5, 10, and 15 milliseconds. In addition, since a low voltage DC source is being used, i.e., ten volts or lower, there is an additional condition. This condition is the overcoming of the resistive film on the silver contacts. The point being, eventhough the contacts are closed there is not sufficient voltage to break down the resistive film for conducting. This condition occurs on new contacts mostly or used contacts sitting at rest for some time. Both the aforementioned conditions, bounce and resistive film, can cause contact chatter simulation during a seismic test. Please note that in actual operation at full voltage, e.g., 480 volts AC, this condition goes away or is reduced substantially. Please understand that this situation is not an adnomalty, but a normal occurance to motor control equipment.

This, I believe, should answer your questions and Gould will be looking forward to receiving the test report draft.

Very truly yours,

G. Erich Heberlein, Jr.
Manager, Engineering Systems

GEH/nm

cc: P. W. Higgins, Gould

SDRC
Structural Dynamics Research Corporation

2000 Eastman Drive
Milford, Ohio 45150
513-576-2400

# ATTACHMENT