MISSISSIPPI POWER & LIGHT COMPANY
Helping Build Mississippi
P. O. BOX 1640, JACKSON, MISSISSIPPI 39205

NUCLEAR PRODUCTION DEPARTMENT

June 8, 1982

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416 and 50-417
File 0260/L-814.2
SQRT - Additional Information Supporting Justification for Interim Operation
AECM-82/254

References:
1) AECM-82/128; April 5, 1982
2) AECM-82/173, April 19, 1982
3) AECM-82/190, April 16, 1982
4) AECM-82/218, May 24, 1982
5) AECM-82/229, May 24, 1982

Mississippi Power & Light Company (MP&L) met with the Equipment Qualification Branch - Seismic (EQB) on June 2, 1982, in Bethesda, Maryland to finalize MP&L's justification for interim operation for equipment at Grand Gulf Nuclear Station (GGNS) not qualified to the SQRT criteria.

During the June 2, 1982, meeting, certain information was hand delivered to the EQB and also certain information was requested by the EQB. The purpose of this letter is to provide that information.

The following information is provided:

A. Attachment No. 1

Attachment No. 1 provides a summary of the justification for interim operation for the GGNS equipment not qualified to the SQRT criteria.

B. Attachment No. 2 (RHR Heat Exchangers)

B001

Attachment No. 2 provides the natural frequency calculation for the RHR heat exchangers to confirm there are no natural frequencies below 6.0 Hz.

AE3M1

MISSISSIPPI POWER & LIGHT COMPANY

C. Attachment No. 3 (CRD Solenoid Valve)

Attachment No. 3 provides confirmation of the "g" loads for the GGNS CRD solenoid valve (C11-F009).

D. Attachment No. 4 (Conductivity Cell)

Attachment No. 4 provides Revision 2 of the conductivity cell qualification package. Revision 2 incorporates the shear stress calculation for the nipple that were performed during the June 2, 1982, meeting.

E. Attachment No. 5 (Air Operated Butterfly Valves)

Attachment No. 5 provides the valve and actuator acceleration data for P44-F118/F119/F120/F121. This information was not available until June 2, 1982.

F. Attachment No. 6 (Safety Relief Valves)

Attachment No. 6 provides explanation of why nozzle loads are not addressed and acceleration data for the RHR heat exchanger SRV's and the fuel oil system SRV's.

If you have any questions or require further information, please contact this office.

Yours truly,

L. F. Dale
Manager of Nuclear Services

RAB/SHH/JDR:lm

Attachments:
1) Summary of Justification for Interim Operation
2) RHR Heat Exchangers
3) CRD Solenoid Valve
4) Conductivity Cell
5) Air Operated Butterfly Valves
6) Safety Relief Valves

cc: (See Next Page)

AE3M2

cc: Mr. N. L. Stampley (w/o)
Mr. G. B. Taylor (w/o)
Mr. R. B. McGehee (w/o)
Mr. T. B. Conner (w/o)

Mr. Richard C. DeYoung, Director (w/o)
Office of Inspection & Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. J. P. O'Reilly, Regional Administrator (w/a)
Office of Inspection & Enforcement
U.S. Nuclear Regulatory Commission
Region II
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Atlanta, Georgia 30303

AE3M3

ATTACHMENT NO. 1

Grand Gulf SQRT Program
Justification for Interim Operation Summary

Component	Plant ID	Status
Pool Swell Loads - Required Response Spectrum		1. Bechtel to provide comparison of 15 psi 100 millisec curves to 11.4 psi 100 millisec curves to show "smearing" load has no effect. 2. Normal design review will be conducted. 3. HCU's will be re-evaluated. MP&L will either have qualification complete or justification for interim operation by full power.
Air Operated Butterfly Valves (M-257.0/258.0)	P44-F116, F117, F118 P44-F119, F120, F121 P44-F122, F123 G41-F019, F045	1. Justified; No further information required. 2. Qualified.
Safety Relief Valves (M-141.1)	E12-F055A, B P75-F026A, B	1. Justified; No further information required. 2. Provide NRC/EQB with confirmation when testing is completed. 3. Steam condensing mode of operation of RHR not to be used until SRV's are tested.
Main Steam Isolation Valve (MSIV)	B21-F022/F028	1. Justified; No further information required. 2. Provide copy of MSIV test specification.
RHR Heat Exchanger	E12-B001/B002	1. Justified; No further information required.
CRD Solenoid Valve	C11-F009	1. Justified; No further information required. 2. Qualified.

ATTACHMENT NO. 1 (Continued)

Grand Gulf SQRT Program
Justification for Interim Operation Summary

Component	Plant ID	Status
HPCS Valve Actuators	E22-F001/F010 E22-F011/F012/F015 E22-F023 E22-F004	1. Justified; No further information required.
HPCS Diesel Generator System	E22-S001/S002 E22-S003/S004	1. Justified; No further information required.
Pressure Indicators	B21-R005 (Barton 227)	1. Justified; No further information required. 2. Qualified.
	B21-R009A, B (Barton 227)	1. Justified; No further information required. 2. Identical to B21-R005. 3. Mounting verified. 4. Qualified.
Switches	C41A-S01 E12A-S03 E12A-S57, E21A-S07 E22A-S03, E21A-S06 E22B-S02/S07/S09 E22B-S10/S15/S16 E51A-S15 (Electroswitch)	1. Justified; No further information required.
Conductivity Cell	E12-N025A, B	1. Justified; No further information required.
Fuel Handling and Auxiliary Platforms	F11-E014 F15-E003/E005	1. Justified; No further information required.
In-Vessel Rack	F16-E006	1. Justified; No further information required.

ATTACHMENT NO. 1 (Continued)

Grand Gulf SQRT Program
Justification for Interim Operation Summary

Component	Plant ID	Status
Defective Fuel Storage Container	F16-E009	1. Justified; No further information required.
BOP/PGCC Panels	H13-P855/P856 H13-P864/P870/P871 H13-P872/P877/P878	1. Justified; No further information required.

AE3I3

ATTACHMENT NO. 2

RHR Heat Exchangers
(E12-B001/B002)

MPL-06-0207
Revision 0
File Number: 32.1206.0207

GRAND GULF NUCLEAR STATION

UNIT 1

SUPPORTING ANALYSIS REPORT ON THE JUSTIFICATION FOR INTERIM OPERATION OF THE RHR HEAT EXCHANGER

Prepared for:
Mississippi Power and Light Company

Prepared by:
NUTECH Engineers

Prepared by:

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Date: 5/28/82

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nutech
ENGINEERS

REVISION CONTROL SHEET

SUBJECT: Grand Gulf Nuclear Station Unit 1 Supporting Analysis Report on the Justification for Interim Operation of the RHR Heat Exchanger

REPORT NUMBER: MPL-06-0207

B. Fatemi/Engineer — BF
NAME/TITLE — INITIAL

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EFFECTIVE PAGE(S)	REV	PREPARED	ACCURACY CHECK	CRITERIA CHECK	EFFECTIVE PAGE(S)	REV	PREPARED	ACCURACY CHECK	CRITERIA CHECK
ii thru v	0	BF	RPM	RPM	App.A	0	BF	RPM	RPM
					B-1 thru B-7	0	BF	SO	SO
1 thru 8	0	BF	RPM	RPM	B-8 thru B-10	0	BF	RPM for MPV	RPM for MPV
					B-11 thru B-12	0	BF	RPM	RPM
					App.C	0	RPM for MPV	BF	BF
					App.D	0	BF	SO	SO
					App.E	0	N/A	N/A	N/A

QEP-001.1-00

nutech ENGINEERS

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Appendix A Calculation of the RHR Shell (Circumferential) Natural Frequencies

Appendix B Calculation of the Natural Frequencies Associated with the Beam Bending Modes of the RHR Heat Exchanger

Appendix C Local Stiffness (Flexibility) Calculation for the RHR Heat Exchanger Supports

Appendix D Input/Output for the Simplified Finite Element Model (PISTAR) Run

Appendix E Copy of the General Electric Report on the Justification for the Interim Operation of the RHR Heat Exchanger

PREFACE

This Supporting Analysis Report, Number MPL-06-0207, has been prepared for the Mississippi Power and Light Company (MP&L), representing Middle South Energy, Inc. and South Mississippi Electric Power Association by NUTECH Engineers (NUTECH) Inc. The purpose of this report is to support the justification for interim operation (JIO) by MP&L for the Residual Heat Removal (RHR) Heat Exchanger (Hx) installed in the Grand Gulf 1 Nuclear Power Station.

This report contains information proprietary in nature to NUTECH, and MP&L, for submission to appropriate regulatory agencies conducting the evaluation of the JIO. No other use, dissemination or distribution other than to those who require it for evaluation purposes is authorized.

1.0 INTRODUCTION

During the April 21, 1982 NRC review of the Justification for Interim Operation (JIO) for the RHR heat exchanger (Reference 1) the Staff requested additional confirmation that there are no natural frequencies exhibited by this equipment below six (6) Hz, thereby justifying the seismic coefficients used in the equivalent static analysis performed by General Electric Company. Acceptable methodologies were identified as finite element analysis techniques and/or testing. The purpose of this report is to respond to this NRC request.

The material presented utilizes both of the above methodologies to establish the lowest natural frequency of the Grand Gulf RHR heat exchangers. Finite element analyses were performed to determine the natural frequencies associated with beam bending of the heat exchanger shell. In-situ test results for another heat exchanger were reviewed to determine whether or not the lowest shell natural frequency is significantly lower than that of the internals.

The results of this work establish the lowest natural frequency of the Grand Gulf RHR heat exchanger to be 12.1 Hz, therefore, the seismic coefficients used in the JIO are justifiable.

2.0 PROCEDURES

In the calculation of the lowest natural frequency of the RHR heat exchanger, three major contributing areas are considered.

1. Natural frequencies associated with the circumferential shell vibration:

   These frequencies are calculated using a special purpose computer program which was written to solve the available equations for the natural frequencies of a simply supported cylindrical shell.

2. Natural frequencies associated with the beam bending modes of the RHR heat exchanger:

   These frequencies are calculated by making a simplified finite element model of the RHR heat exchanger and extracting modes using the PISTAR Computer program. PISTAR is a general purpose, NUTECH proprietary computer program which is capable of performing static and dynamic analyses of piping systems.

3. Natural frequencies associated with the internal structures:

   These frequencies are addressed by making a comparison between the Grand Gulf RHR heat exchanger and the Zimmer RHR heat exchanger.

This analysis calculates the natural frequencies associated with all of the above-mentioned areas, and shows that the calculated frequencies are all greater than 6 Hz.

3.0 ANALYSIS

The following are the three analyses required to determine the lowest natural frequency.

3.1 CIRCUMFERENTIAL SHELL FREQUENCIES

By using the equations for the natural frequencies of a simply supported cylindrical shell, the lowest shell natural frequency found for the ovalization mode, is 44.64 Hz. (The complete analyses is provided in Appendix A.) From this result it is concluded that the shell circumferential frequencies are high and a beam (pipe) model is appropriate for this analysis.

3.2 BEAM BENDING NATURAL FREQUENCIES

In order to calculate the beam bending natural frequency of the RHR heat exchanger, a simplified finite element model, utilizing pipe elements was generated. The use of pipe elements is justified since the circumferential shell frequencies are shown to be high (> 44 Hz). Included in the simplified finite element model are:

- Shell Local Flexibility (at support connections)
- Stiffness of the Mating Supports
- Flooded Weight
- Concentrated Weight of Flanges
- Effect of Connected Piping

After extracting modes, the lowest natural frequency associated with the beam bending was calculated to be 12.1 Hz. (The complete analysis is provided in Appendix B.)

3.3 INTERNAL STRUCTURES NATURAL FREQUENCIES

The data required to accurately calculate the lowest natural frequency of the internal structures was not available for this analysis. However, it is expected that the internal tubes would be the most flexible members of the internal structures.

The test conducted on the Zimmer RHR heat exchanger (Reference 2) showed the first natural frequency of the Zimmer RHR heat exchanger to be 14.65 Hz (associated with the beam rocking), and the internal tube natural frequency to be 57.33 Hz (the internal tube frequency is greater than the beam frequency). Since the Zimmer RHR heat exchanger is similar (but shorter) to the Grand Gulf RHR heat exchanger, it is expected that the internal tube natural frequency for the Grand Gulf heat exchanger is greater than the calculated beam natural frequency (12.1 Hz). Thus, the lowest natural frequency associated with the internal structures is greater than 12.1 Hz.

4.0 SUMMARY AND RESULTS

Based on the analytical and test data presented in the foregoing sections, which take into account the following:

- o Shell Local Flexibility (at support connections)
- o Stiffness of the Mating Supports
- o Flooded Weight
- o Concentrated Weight of the Flanges
- o Effect of Connected Piping
- o Shell Circumferential Natural Frequency
- o Internal Structures

It is shown that:

- o The shell lowest circumferential natural frequency is associated with the ovalization mode and is equal to 44.64 Hz.
- o The beam lowest natural frequency is 12.1 Hz.
- o The natural frequency of the internal structures is greater than 12.1 Hz.

Therefore, the lowest natural frequency of the RHR heat exchanger is 12.1 Hz.

5.0 CONCLUSIONS

The lowest natural frequency of the RHR heat exchanger was found to be 12.1 Hz. Consequently, the conclusions specified in the justification for interim operation of the RHR heat exchanger (Appendix E) are justifiable.

6.0 REFERENCES

1. "Grand Gulf RHR Heat Exchanger Interim Operation Justification", General Electric Report, performed by J. Mokri, dated April 16, 1982 (A copy of this report is provided in Appendix E for easy reference.)

2. Final Test Report, "In-situ Impedance Testing", Document Number TI-80029-04, William H. Zimmer Nuclear Power Station, Section 4.4, March 31, 1982

APPENDIX A

Calculation of The RHR Shell (circumferential)

Natural Frequencies

I. PURPOSE:

To calculate the RHR Shell natural frequencies, and show that the circumferential natural frequencies are high, so that a beam model can be justified.

II. CALCULATIONS:

The natural frequencies of a simply supported cylindrical shell without axial constraints (conservative assumption) can be calculated from the following: (Reference 1)

$$W_{ij} = \frac{\lambda_{ij}}{2\pi R}\left(\frac{E}{u(1-\upsilon^2)}\right)^{\frac{1}{2}}$$

where

(Radial - Axial Mode)

$$\lambda_{ij} = \frac{\left\{(1-\nu^2)\left(\frac{j\pi R}{L}\right)^4 + \left(\frac{h^2}{12R^2}\right)\left[i^2 + \left(\frac{j\pi R}{L}\right)^2\right]^4\right\}^{\frac{1}{2}}}{\left(\frac{j\pi R}{L}\right)^2 + i^2}$$

i = 2, 3, 4, ...
j = 1, 2, 3, ...

(Bending Mode)

$$\lambda_{ij} = \frac{j^2\pi^2(1-\nu^2)^{\frac{1}{2}}}{2^{\frac{1}{2}}} \quad \frac{R^2}{L^2}$$

i = 1
j = 1, 2, 3, ...
(for long cylinders, L/jR > 8)

(Breathing Mode)

$$\lambda_{ij} = 1$$

i = 0
j = 1, 2, 3, ...
(for long cylinders, L/jR > 8)

and

i = No. of circumferential waves
j = No. of axial half-waves
υ = Poisson ratio = .3 (steel)
R = Radius of the cylinder = 31" (Ref. 2)
u = density = .28 lb/in^3 (steel)
E = 2.65E7 psi (steel @ 480^{O}F) (Ref. 3)
L = length = 326.38" (Ref. 2)
h = thickness = 1" (Ref. 4)

These equations were programmed into the computer and the natural frequencies were calculated for the following: (See Pg. A-7)

$$\begin{cases} i = 0 \\ j = 1 \end{cases}$$

$$\begin{cases} i = 1 \\ j = 1 \end{cases}$$

$$\begin{cases} i = 2, 3, \ldots\ldots 9 \\ j = 1, 2, 3, \ldots 10 \end{cases}$$

No natural frequency was calculated for

$$\begin{cases} i = 0 \\ j = 2, 3, \ldots \end{cases}$$

$$\begin{cases} i = 1 \\ j = 2, 3, \ldots \end{cases}$$

This was due to the fact that the requirement for L/jR) > 8 only holds up to j = 1. However, an increase in j would only increase the corresponding natural frequencies of the cylinder. A listing of the computer program used to calculate the natural frequency and its output is presented on the next two pages.

Computer Program Listing

```
      PROGRAM NATFRE(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
      REAL LAM,MU,NU,L
      PI=3.141593
      NU=.3
      R=31.
      MU=.28
      E=2.65E7
      L=326.38
      H=1.
      DO 10,J=1,10
      DO 10,II=1,10
      I=II-1
      IF(((I.EQ.0).OR.(I.EQ.1)).AND.(J.GT.1))GO TO 10
      IF(I.EQ.0)GO TO 2
      IF(I.EQ.1)GO TO 3
      GO TO 4
    2 LAM=1.
      GO TO 8
    3 LAM=J**2*PI**2*(1.-NU**2)**.5/2.**.5*R**2/L**2
      GO TO 8
    4 TOP=((1.-NU**2)*(J*PI*R/L)**4+(H**2/12./R**2)*
     +(I**2+(J*PI*R/L)**2)**4)**.5
      BOT=(J*PI*R/L)**2+I**2
      LAM=TOP/BOT
    8 W=LAM/(2.*PI*R)*(E*386.4/MU/(1.-NU**2))**.5
      WRITE(5,100)J,I,W
  100 FORMAT(1H ,*J,I,W=*,2I4,F10.2)
   10 CONTINUE
      STOP
      END
```

Natural Frequencies

	J	I	W
J,I,W=	1	0	1029.20
J,I,W=	1	1	61.31
J,I,W=	1	2	44.64
J,I,W=	1	3	87.64
J,I,W=	1	4	154.29
J,I,W=	1	5	240.48
J,I,W=	1	6	345.89
J,I,W=	1	7	470.47
J,I,W=	1	8	614.23
J,I,W=	1	9	777.16
J,I,W=	2	2	90.48
J,I,W=	2	3	97.15
J,I,W=	2	4	158.21
J,I,W=	2	5	243.40
J,I,W=	2	6	348.57
J,I,W=	2	7	473.08
J,I,W=	2	8	616.81
J,I,W=	2	9	779.73
J,I,W=	3	2	170.20
J,I,W=	3	3	123.56
J,I,W=	3	4	167.70
J,I,W=	3	5	249.15
J,I,W=	3	6	353.35
J,I,W=	3	7	477.56
J,I,W=	3	8	621.18
J,I,W=	3	9	784.04
J,I,W=	4	2	263.03
J,I,W=	4	3	167.28
J,I,W=	4	4	185.29
J,I,W=	4	5	258.73
J,I,W=	4	6	360.62
J,I,W=	4	7	484.07
J,I,W=	4	8	627.40
J,I,W=	4	9	790.14
J,I,W=	5	2	356.05
J,I,W=	5	3	222.43
J,I,W=	5	4	211.87
J,I,W=	5	5	273.00
J,I,W=	5	6	370.79
J,I,W=	5	7	492.30
J,I,W=	5	8	635.57
J,I,W=	5	9	798.07
J,I,W=	6	2	442.19
J,I,W=	6	3	283.13
J,I,W=	6	4	246.44
J,I,W=	6	5	292.44
J,I,W=	6	6	334.22
J,I,W=	6	7	503.96
J,I,W=	6	8	645.80
J,I,W=	6	9	807.89
J,I,W=	7	2	518.43
J,I,W=	7	3	345.19
J,I,W=	7	4	286.94
J,I,W=	7	5	316.98
J,I,W=	7	6	401.13
J,I,W=	7	7	517.69
J,I,W=	7	8	658.18
J,I,W=	7	9	819.66
J,I,W=	8	2	584.31
J,I,W=	8	3	405.86
J,I,W=	8	4	331.25
J,I,W=	8	5	346.09
J,I,W=	8	6	421.56
J,I,W=	8	7	534.12
J,I,W=	8	8	672.80
J,I,W=	8	9	833.42
J,I,W=	9	2	640.61
J,I,W=	9	3	463.57
J,I,W=	9	4	377.55
J,I,W=	9	5	378.98
J,I,W=	9	6	445.38
J,I,W=	9	7	553.27
J,I,W=	9	8	689.70
J,I,W=	9	9	849.23
J,I,W=	10	2	688.65
J,I,W=	10	3	517.53
J,I,W=	10	4	424.48
J,I,W=	10	5	414.31
J,I,W=	10	6	472.34
J,I,W=	10	7	575.12
J,I,W=	10	8	708.93
J,I,W=	10	9	867.11

III. CONCLUSION:

The lowest calculated natural frequency for the shell of the RHR heat exchanger is 44.64 HZ which corresponds to the ovalization mode (for j = 1, and i = 2). It is then concluded that the shell circumferential frequencies are quite high (compared to 6 HZ), and a complete finite element shell model is not necessary. A beam model is sufficient.

IV. REFERENCE:

1) Robert D. Blevins, "Formulas for Natural Frequency and Mode Shape", Van Nostrand Reinhold Company.

2) General Electric, Drawing No. 762E987, sheet 1 of 2, "Interface Control Heat Exchanger", Rev. 6

3) ASME Section III Division I Appendices

4) Final Safety Analysis Report (FSAR), Grand Gulf Nuclear Station Units 1 and 2, Mississippi Power & Light Company, Amendment 53.

APPENDIX B

Calculation of the Natural Frequencies
Associated with the Beam Bending
Modes of the RHR Heat Exchanger

I. PURPOSE:

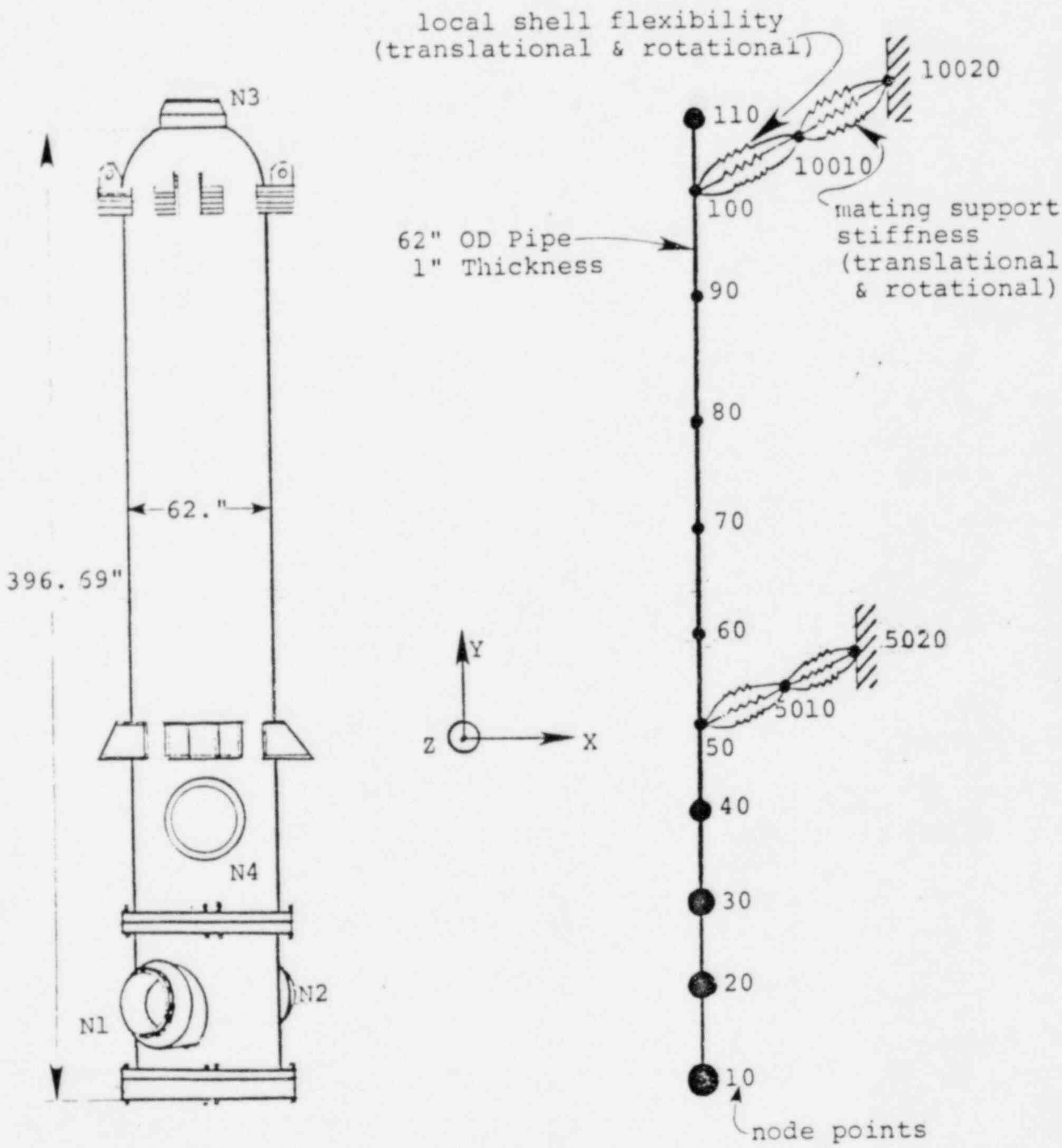
The objective of this analysis is to calculate the natural frequencies associated with the beam bending modes of the RHR heat exchanger.

II. ANALYSIS:

A simplified finite element model, utilizing pipe elements, is generated. The use of pipe elements is justified since the natural frequencies associated with the circumferential shell vibration are shown to be high (> 44 Hz) in Appendix A.

The effects of shell local flexibility (at support connections), stiffness of the mating supports, flooded weight, concentrated weight of the flanges, and connected piping are included in the finite element model.

The following simplifed geometry is used for the model.



nutech

San Jose, California

Project Grand Gulf Nuclear Station File No.

Owner Mississippi Power and Light Co.

Client Mississippi Power and Light Co.

The RHR heat exchanger is modeled as a 62" (OD) pipe with a thickness of 1". The concentrated weights of the flanges are lumped on nodes 10 and 30. The weight of the attached piping is lumped on nodes 20, 40 and 110. Conservatively, no credit is taken for the stiffness of the attached piping. Stiffnesses of the mating supports are considered, as are local shell flexibilities at the support connections.

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Checked By/Date	SO 5/27/82					

III. WEIGHT CALCULATION FOR THE FLANGES:

Flange 1:

ID = 62.5"-2" = 60.5" (Reference 1)

OD = 72.62" (Reference 1)

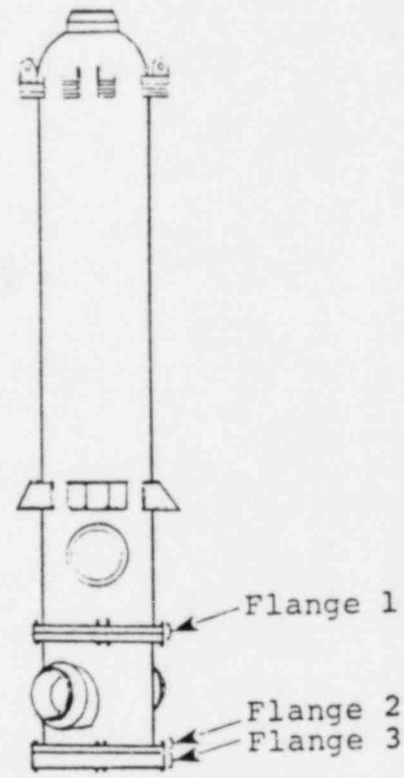
t = thickness = 11.4" (scaled from Reference 1)

ρ = density = 0.28 lb/in^3 (steel)

$$M_1 = \rho t \pi \left[\left(\frac{OD}{2}\right)^2 - \left(\frac{ID}{2}\right)^2 \right]$$

$$= 0.28*11.4\pi \left[\left(\frac{72.62}{2}\right)^2 - \left(\frac{60.5}{2}\right)^2 \right]$$

= 4,045 lbs.



Flange 2:

ID = 60.5" (Reference 1)

OD = 71.00" (Reference 1)

t = thickness = 5" (scaled from Reference 1)

ρ = density = 0.28 lb/in^3 (steel)

$$M_2 = 0.28*5*\pi \left[\left(\frac{71.00}{2}\right)^2 - \left(\frac{60.5}{2}\right)^2 \right]$$

= 1,518 lbs.

Flange 3:

M_3 = 10,000 lbs. (Given in Reference 1)

IV. WEIGHT PER UNIT LENGTH OF THE HEAT EXCHANGER

TOTAL FLOODED WEIGHT = 122,000 lbs.
(Given in Reference 2)

TOTAL WEIGHT OF FLANGES = 10,000 + 1,518 + 4,045
= 15,563 lbs.

$$\text{WEIGHT/UNIT LENGTH} = \frac{122000 - 15560}{396.69}$$

$$= 268.31 \text{ lb/in}$$

V. WEIGHT OF THE ATTACHED PIPING

Assume the span lenght for attached piping to be not greater than 20 ft.

Nozzles N_1 or N_2: (18" Sch 40) (Reference 1)

Weight/Ft = 104.75 + 97. = 201.75 lb/ft (Reference 2)

Total Wt = $\frac{20 * 201.75}{2}$ = 2017.5 lb (1/2 of the weight is transferred to the support, and only 1/2 is transferred to the nozzle)

Nozzles N_3 and N_4: (20" Sch 40) (Reference 1)

Weight/ft = 122.91 + 120.4 = 243.31 lb/ft (Reference 2)

Total wt = $\frac{20 * 243.31}{2}$ = 2433.1 lbs (1/2 of the weight is transferred to the support, and only 1/2 is transferred to the nozzle)

NOTE: A sensitivity study was performed on the effect of the length of the attached piping on the lowest natural frequency. Only 5% reduction for the lowest natural frequency was observed for adding 20 feet of pipe to each of the four nozzles. It was then concluded that knowing the actual length of the connected pipe is not a critical parameter.

VI. STIFFNESS OF THE MATING SUPPORTS

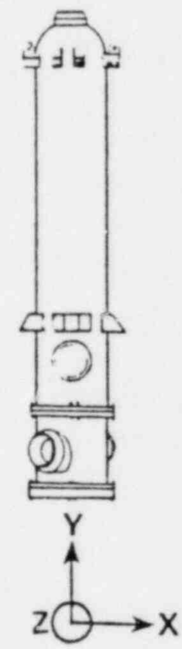
A) Upper Mating Support:

$K_{11} = K_{33} = 9.3$ E6 lb/in (Reference 1)

$K_{22} = 0$ (free to move)

$K_{44} = K_{66} = 1.$E4 in-lb/rad
(assume small rotation resistance)

$K_{55} = $ 1E 13 in-lb/rad
(assume large rotation resistance)



B) Lower Mating Support

$K_{11} = K_{33} = 9.3$ E6 lb/in
(Reference 1)

$K_{22} = 20$ E6 lb/in
(Reference 1)

$K_{44} = K_{66} = 1.$E4 in-lb/rad
(assume small rotation resistance)

$K_{55} = $ 1E 13 in-lb/rad
(assume large rotation resistance)

VII. LOCAL SHELL FLEXIBILITIES AT THE SUPPORT CONNECTIONS

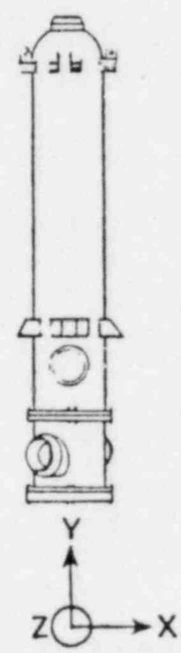
A) Upper Support

From the NUTSHELL computer run (see Appendix C for complete details) the local shell flexibilities of each upper support are calculated to be:

KPR = .31485E7
KML = .28668E10
KMC = .88921E8
KVL = .62869E8
KVC = .28845E8
KTQ = .69996E10

The total local shell flexibilities for the upper support can be calculated as follows:

$$K_{11} = K_{33} = 2KPR + 2\,KVC$$
$$= 2 * .31485E7 + 2 * .28845E8$$
$$= .63987E8 \text{ lb/in}$$



$$K_{22} = 4KVL$$
$$= 4 * .62869E8$$
$$= .25148E9 \text{ lb/in}$$

$$K_{44} = K_{66} = 2KTQ + 2KML$$
$$= 2 * .69996E10 + 2 * .28668E10$$
$$= .19733E11 \text{ in-lb/rad}$$

$$K_{55} = 4KMC$$
$$= 4 * .88921E8$$
$$= .35568E9 \text{ in-lb/rad}$$

B) Lower Support

From the NUTSHELL computer run (see Appendix C for complete details) the local shell flexibility of each lower support is calculated to be:

KPR = .24812E7
KML = .45474E10
KMC = .13010E9
KVL = .40049E8
KVC = .53732E7
KTQ = .15163E11

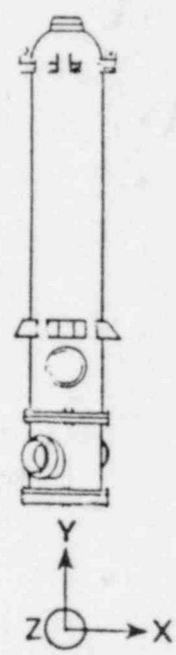
The total local shell flexibilities for the lower support can be calculated as follows:

$K_{11} = K_{33}$ = 2KPR + 2 KVC
= 2 * .24812E7 + 2 * .53732E7
= .15709E8 lb/in

K_{22} = 4KVL
= 4 * .40049E8
= .16020E9 lb/in

$K_{44} = K_{66}$ = 2KTQ + 2KML
= 2 * .15163E11 + 2 * .45474E10
= .39421E11 in-lb/rad

K_{55} = 4KMC
= 4 * .13010E9
= .5204E9 in-lb/rad



VIII. RESULTS

The PISTAR computer program was used to model the geometry explained in Section II. A modal extraction was performed. The lowest natural frequency calculated was 12.1 Hz. Copies of input and output are provided in Appendix D.

IX. REFERENCES

1. General Electric, Drawing Number 762E987, Sheet 1 of 2, "Interface Control Heat Exchanger", Revision 6

2. "Properties of Pipe Tables", Bergn-Paterson Pipe Supports Corporation, catalog 80

APPENDIX C

Local Stiffness (Flexibility) Calculation For the RHR Heat Exchanger Supports

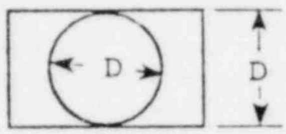
I. PURPOSE:

The purpose of this calculation is to determine the local shell stiffness at the upper and lower supports. The stiffnesses will be used for a modal analysis of the heat exchanger. All approximations are made such that the heat exchanger will be more flexible and thus have a lower natural frequency.

II. METHOD:

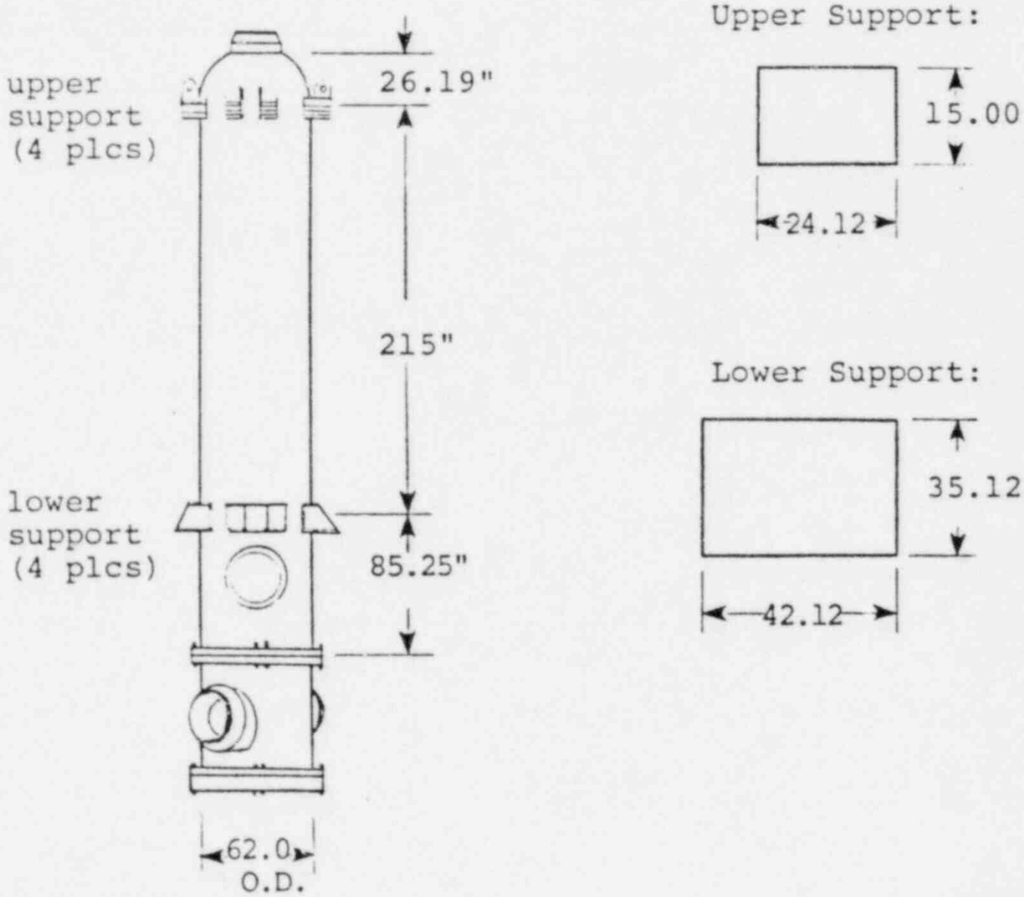
The program NUTSHELL (version 1.3.2) will be used to calculate stiffnesses. NUTSHELL is a general purpose, NUTECH proprietary computer program which is capable of calculating local stiffnesses of a cylindrical shell, and also calculating the stresses in the vicinity of a cylinder-to-cylinder penetration. Because NUTSHELL uses circular penetrations, an equivalent circular area will be calculated to model the rectangular supports. By inscribing a circle inside the rectrangular cross section of each support an area can be approximated which will result in weaker stiffness.

II. METHOD (Continued)



INSCRIBED CIRCLE

III. GEOMETRY (REF. 1)



IV. NUTSHELL INPUT

A. NUTSHELL Input, 1st Run - MPV06MX

1. Upper Support Minimum Stiffness

L_1 = 26.19" (Dist. From Nearest Upper Support)

L_2 = 215" (Dist. From Nearest Lower Support)

D = 61" (Mean Vessel Diameter)

d = 15" (Diameter of Support - Inscribed Circle)

2. Lower Support Minimum Stiffness

L_1 = 215" (Dist. From Nearest Upper Support)

L_2 = 85.25" (Dist. From Nearest Lower Support)

D = 61" (Mean Vessel Diameter)

d = 35.12" (Diameter of Support - Inscribed Circle)

3. Material Properties

υ = 0.3

E = $26.5\ (10)^6$ psi @ 480°F (Ref. 2)

VI. NUTSHELL INPUT

B. NUTSHELL Results From 1st Run - MVP06L4

1. Upper Support

NUTSHELL theory is based on having supports far enough away that the interaction from them is minimal. However, NUTSHELL will approximate the interaction; but not full interaction, therefore, making the resulting local stiffness weaker than the actual case.

2. Lower Support

A second run must be made using a smaller equivalent diameter. This will result in a smaller stiffness value than the actual.

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San Jose, California

Project Grand Gulf Nuclear Station File No.

Owner Mississippi Power and Light Co.

Client Mississippi Power and Light Co.

IV. NUTSHELL INPUT

C. NUTSHELL Input Final Run - MPV06MX

1. The largest value of d for which NUTSHELL will compute all stiffnesses is calculated as follows:

$$d \quad \lambda\sqrt{DT}$$

where λ_{max} = 3.0

D = Vessel Mean Diameter

T = Vessel Thickness

$$d = 3.0\sqrt{61.0\ (1.0)}$$

d = 23.4" (Max. Value For Lower Support)

All other input is the same as for the 1st run (MPV06L4)

Revision	0					Page C-6
Prepared By/Date	RPH for MPV 5/27/82					of 8
Checked By/Date	[illegible]					

V. RESULTS

NUTSHELL input was modified as discussed in Section IV, and the final run was made. The following results are obtained:

UPPER SUPPORT (Units - lbs/in & lbs/rad)

RADIAL LOAD	KPR = .31485 E7
LONG. MOMENT	KML = .28668 E10
CIRC. MOMENT	KMC = .88921 E8
LONG. LOAD	KVL = .62869 E8
CIRC. LOAD	KVC = .28845 E8
TORQUE	KTQ = .69996 E10

LOWER SUPPORT (Units - lbs/in & lbs/rad)

RADIAL LOAD	KPR = .24812 E7
LONG MOMENT	KML = .45474 E10
CIRC. MOMENT	KMC = .13010 E9
LONG LOAD	KVL = .40049 E8
CIRC. LOAD	KVC = .53732 E7
TORQUE	KTQ = .15163 E11

REFERENCES:

1. General Electric, Drawing No. 762E987, Sheet 1 of 2, "Interface Control Heat Exchanger", Revision 6

2. ASME Section III Division I Appendices

APPENDIX D

Input/Output For The Simplified Finite Element Model (PISTAR) Run

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San Jose, California

Project: Grand Gulf Nuclear Station — File No. ______

Owner: Mississippi Power and Light Co.

Client: Mississippi Power and Light Co.

```
PISTAR INPUT PROCESSOR (PASS 1)    -- VERSION 1.5.2 --    05/19/82       14.39.55.       PAGE  2

                                 INPUT DATA ECHO PRINT

     1         11         21         31         41         51         61         71         81
     :         :          :          :          :          :          :          :          :

   1 TITLE      RHR HEAT EXCHANGER
   2 ID         CLIENT=GRAND GULF NUCLEAR STATION
   3 ID         PROJECT NAME=EQUIPMENT QUALIFICATION
   4 ID         PROJECT NUMBER=MPL-0605
   5 ID         PREPARED BY=B. FATEMI
   6 ID         CHECKED BY=
   7 GEOMETRY   RHR HEAT EXCHANGER
   8 START      10                                     480.
   9 CLASS 2
  10 PIPE       10    20    0.0        35.16      0.0                  1    1
  11 PIPE       20    30    0.0        35.15      0.0                  1    1
  12 PIPE       30    40    0.0        33.85      0.0                  1    1
  13 PIPE       40    50    0.0        51.34      0.0                  1    1
  14 PIPE       50    60    0.0        43.00      0.0                  1    1
  15 PIPE       60    70    0.0        43.00      0.0                  1    1
  16 PIPE       70    80    0.0        43.00      0.0                  1    1
  17 PIPE       80    90    0.0        43.00      0.0                  1    1
  18 PIPE       90    100   0.0        43.00      0.0                  1    1
  19 PIPE       100   110   0.0        26.19      0.0                  1    1
  20 STIFFNESS 50    5010 1.0         0.0        0.0        DCOSINE   1
  21 STIFFNESS 5010  5020 1.0         0.0        0.0        DCOSINE   2
  22 STIFFNESS 100   100101.0         0.0        0.0        DCOSINE   3
  23 STIFFNESS 1001010020 1.0         0.0        0.0        DCOSINE   4
  24 MATRIX     1           K11  1.5709E7  K22  1.6020E8  K33  1.5709E7
  25 MATRIX     1           K44  3.9421E10 K55  5.204E8   K66  3.9421E10
  26 MATRIX     2           K11  9.3E6     K22  20 E6    K33  9.3E6
  27 MATRIX     2           K44  1.E4      K55  1.E13    K66  1.E4
  28 MATRIX     3           K11  6.3987E7  K22  2.5148E8  K33  6.3987E7
  29 MATRIX     3           K44  1.9733E10 K55  3.5568E8  K66  1.9733E11
  30 MATRIX     4           K11  9.3E6     K22  0.0      K33  9.3E6
  31 MATRIX     4           K44  1.E4      K55  1.E13    K66  1.E4
  32 ADD WEIGHT10           11518.     11518.     11518.
  33 ADD WEIGHT30           4045.      4045.      4045.
  34 ADD WEIGHT110          2433.1     2433.1     2433.1
  35 ADD WEIGHT40           2433.1     2433.1     2433.1
  36 ADD WEIGHT20           4035.      4035.      4035.
  37 ANCHOR     5020
  38 ANCHOR     10020
  39 PROPERTY   1           62.        1.0        268.31     MX         STEAM
  40 MATERIAL   1           2.65E7     .3         .788E-5    CARBON
  41 END GEOM
  42 LOADING    DEAD WEIGHT & MODAL EXTRACTION
  43 CASE       DW          DEAD WEIGHT ANALYSIS
  44 DEAD LOAD
  45 PRINT                  YES
  46 CASE       MX    MODAL EXTRACTION
  47 FREQUENCY              10         100.
  48 END LOADS

     :         :          :          :          :          :          :          :          :
     1         11         21         31         41         51         61         71         81
```

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Prepared By/Date	BF 5/27/82					of 3
Checked By/Date	SO 5/27/82					

nutech

San Jose, California

Project: Grand Gulf Nuclear Station — File No. ____

Owner: Mississippi Power and Light Co.

Client: Mississippi Power and Light Co.

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05/19/82                     N-U-T-E-C-H / P-I-S-T-A-R                    PAGE   22
                    F R E Q U E N C I E S   A N D   P E R I O D S
                              -- VERSION 1.5.2 --

EIGENVALUE PROBLEM           MODAL EXTRACTION              LOADING CONDITION MX
```

MODE NUMBER	CIRCULAR FREQUENCY (RAD/SEC)	FREQUENCY (CYCLES/SEC)	PERIOD (SEC)
1	.7600E+02	.1210E+02	.8268E-01
2	.7600E+02	.1210E+02	.8268E-01
3	.2109E+03	.3356E+02	.2980E-01
4	.2109E+03	.3356E+02	.2980E-01
5	.2150E+03	.3422E+02	.2922E-01
6	.3642E+03	.5797E+02	.1725E-01
7	.3642E+03	.5797E+02	.1725E-01
8	.4911E+03	.7815E+02	.1280E-01
9	.4911E+03	.7815E+02	.1280E-01
10	.5739E+03	.9134E+02	.1095E-01

Revision	0				
Prepared By/Date	BF/5/27/82				
Checked By/Date	SO 5/27/82				

APPENDIX E

Copy of the General Electric

Report on the Justification for the

Interim Operation of the RHR

Heat Exchanger

JUSTIFICATION FOR INTERIM OPERATION

NAME: RHR Heat Exchanger

MPL: E12-B001/B002

SAFETY FUNCTION:

To remove decay heat from the reactor.

FAILURE MODES:

Fail Open	____
Fail Closed	____
Loss of Power	____
Loss of Air	____
Loss of Pressure Integrity	____
Loss of Structural Integrity	____
Distortion of Mounting	X

FAILURE EFFECT:

A. Effect on Primary Use

Support structure could yield, under excessive seismic loads, causing heat exchanger nozzles to pick up additional load. If nozzles pick up additional load, they too might yield. However, pressure integrity and heat removal capability would be unimpaired.

B. Secondary Effect

None

DISCUSSION AND CONCLUSION:

An analysis of the RHR heat exchanger shows that the fundamental frequency is greater than 6 hertz. A static analysis of the heat exchanger, using a static coefficient greater than 1.5 times the peak of the faulted response spectra for all frequencies greater than 6 hertz, shows that stresses imposed on the heat exchanger are all less than allowable. Therefore, interim operation with the Grand Gulf RHR heat exchanger does not pose a safety hazard.

NUMBER ________ DATE ________
SUBJECT ________ BY Jim Motari 4/16/82 SHEET 1 OF 11

GRAND GULF RHR HEAT EXCHANGER

INTERIM OPERATION

JUSTIFICATION

I GRAND GULF RHR HEAT EXCHANGER DESIGN

II. ESTIMATED HEAT EXCHANGER AND SUPPORT SYSTEM NATURAL FREQUENCY.
1.) HAND CALCULATED VALUE
2.) COMPARISON WITH OTHER PLANTS

III. STATIC COEFFICIENT ANALYSIS
1.) ACCELERATION VALUE FROM RESPONSE SPECTRA CURVES.
2.) DISCUSSION OF STATIC COEFFICIENT
3.) DESCRIPTION OF ANALYSIS METHOD
4.) STRESS SUMMARY TABLE.

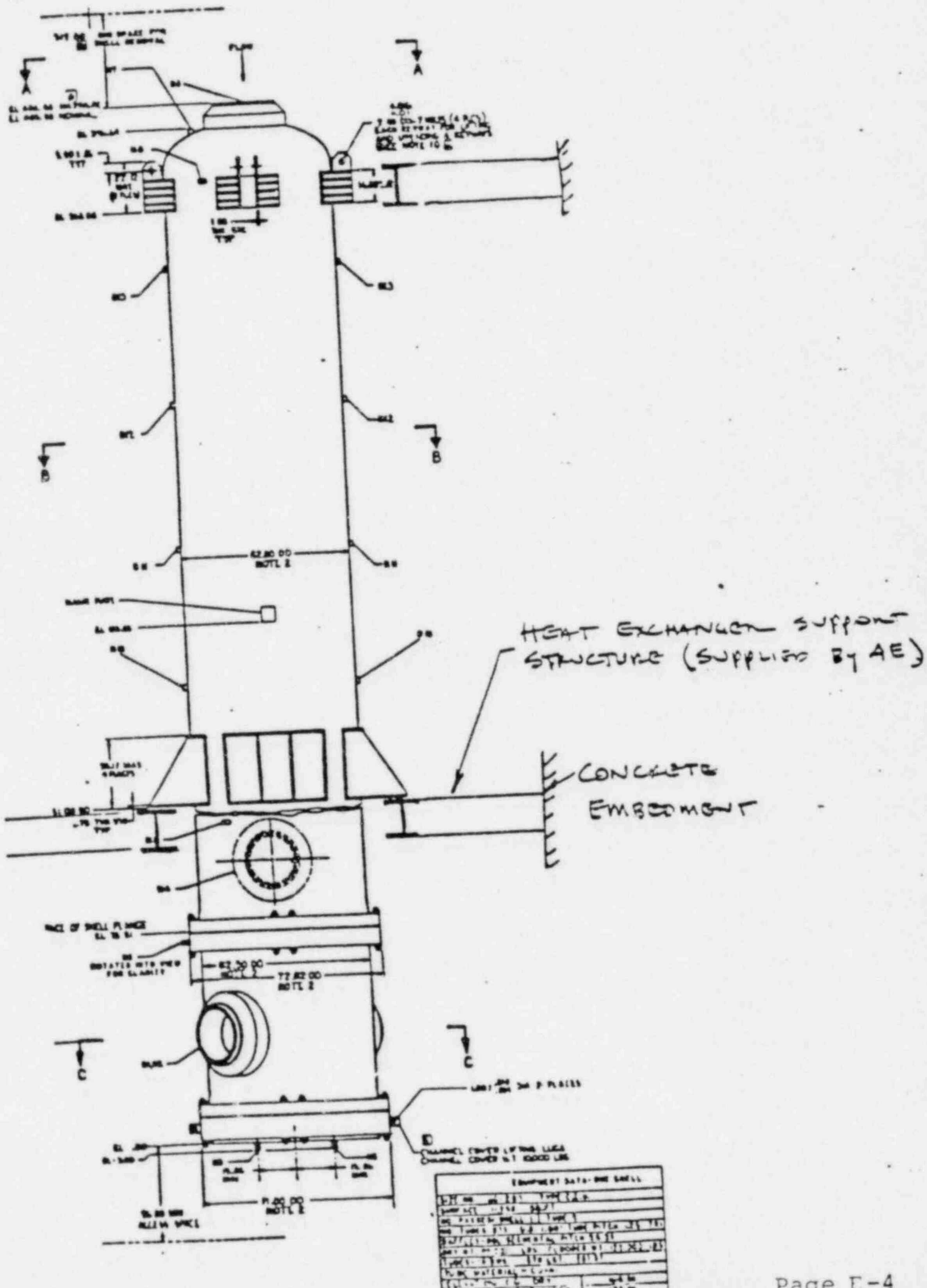
IV. CONCLUSION.

ENGINEERING CALCULATION SHEET

NUMBER ______ DATE ______

SUBJECT ______ BY ______ SHEET 2 OF 11

I GRAND GULF RHR HEAT EXCHANGER DESIGN:



II. ESTIMATION OF HEAT EXCHANGER AND SUPPORT SYSTEM NATURAL FREQUENCY.

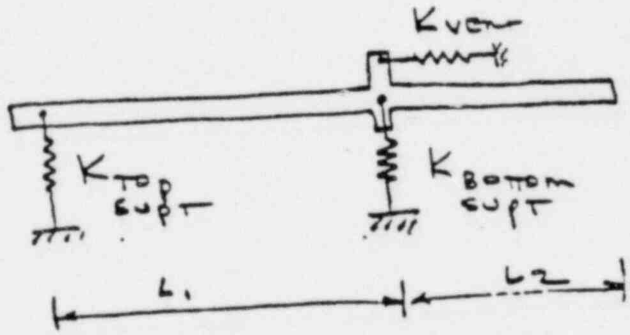
1.) HAND CALCULATED VALUE:

THE GRAND GULF RHR HEAT EXCHANGER HORIZONTAL NATURAL FREQUENCY WAS DETERMINED USING A SIMPLIFIED BEAM AND SUPPORT STIFFNESS MODEL FOR USE IN THE ORIGINAL SEISMIC CALCULATION. SEVERAL SIMPLIFYING ASSUMPTIONS WERE USED:

A.) MASS DISTRIBUTION WAS ASSUMED UNIFORM OVER THE HEAT EXCHANGER LENGTH

B) SUPPORT STRUCTURE WAS REPRESENTED BY SINGLE SPRINGS AT THE UPPER AND LOWER SUPPORT LOCATIONS.

C) BEAM MODEL IS SHOWN BELOW:



D.) MASS AND SECTION PROPERTIES WERE CALCULATED FROM THE HEAT EXCHANGER SHELL DIMENSIONS.

E.) MINIMUM REQUIRED SUPPORT STIFFNESS VALUES (K_{TOP}, K_{BOTTOM}) WERE SPECIFIED ON THE EQUIPMENT INTERFACE CONTROL DRAWING (ICD). TO THE PLANT AE.

RESULTS OF THE FREQUENCY ANALYSIS:

$fn_H = 18$ HZ (HORIZONTAL)

$fn_V > 30$ HZ (VERTICAL)

2) COMPARISON WITH OTHER PLANTS

SINCE THE PREVIOUS CALCULATIONAL METHOD FOR SYSTEM FREQUENCY INCLUDED SEVERAL SIMPLIFYING ASSUMPTIONS, IT IS PRUDENT TO COMPARE THE RESULTS OF FINITE ELEMENT MODE AND FREQUENCY ANALYSES FOR OTHER PLANTS, USING SIMILAR HEAT EXCHANGERS TO THE GRAND GULF RESULTS.

GRAND GULF RHR HEAT EXCHANGER:

- HAND CALCULATED FREQUENCY = 18 HZ
- SHELL ID = 60"
- SHELL THICKNESS = 1"
- ELEVATION = 370" (TOP SUPPORT) 156" (BOTTOM SUPPORT)
- SUPPORT STIFFNESS REQUIREMENT ON ICD = 9.3×10^6 LB/IN

SUSQUEHANNA RHR HEAT EXCHANGER

- HAND CALCULATED FREQUENCY = 15 HZ
- SHELL ID = 63"
- SHELL THICKNESS = 1"
- ELEVATION = 347" (TOP SUPPORT) 184 (BOTTOM SUPPORT)
- SUPPORT STIFFNESS REQUIREMENT ON ICD = 10×10^6 LB/IN
- SAP4 FINITE ELEMENT ANALYSIS RESULT = 7.5 HZ

KUO SHENG RHR HEAT EXCHANGER

- HAND CALCULATED FREQUENCY = 18 HZ
- SHELL ID = 52"
- SHELL THICKNESS ~ .9"
- ELEVATION = 306" (TOP SUPPORT) 131" (BOTTOM SUPPORT)
- SUPPORT STIFFNESS REQUIREMENT ON ICD = 4.5×10^6 LB/IN
- SAP4 FINITE ELEMENT ANALYSIS RESULTS = 12 HZ

BASED ON THE ABOVE COMPARISON BETWEEN HAND CALCULATED FREQUENCY, AND SAP4 FINITE ELEMENT FREQUENCY FOR SIMILAR HEAT EXCHANGERS,

IT IS EXPECTED THAT THE GRAND GULF RHR HX HORIZONTAL FREQUENCY WOULD BE GREATER THAN 7.5 HZ.

ALSO, FREQUENCIES DETERMINED FROM FINITE ELEMENT ANALYSES, ON RHR HEAT EXCHANGERS FROM EIGHT REPRESENTATIVE BWR PLANTS HAVE ALL BEEN GREATER THAN THE 7.5 HZ VALUE FOR SUSQUEHANNA. THEREFORE, SINCE THE GRAND GULF HEAT EXCHANGER IS EXPECTED TO BE GREATER THAN 7.5 HZ, USE OF 7.5 HZ IS CONSERVATIVE

III. STATIC COEFFICIENT ANALYSES –

1.) THE PLANT SPECIFIC SSE RESPONSE SPECTRA CURVES FOR THE RHR HEAT EXCHANGER (ATTACHED) HAVE A MAXIMUM ACCELERATION VALUE IN THE HORIZONTAL DIRECTIONS OF 0.65g AND IN THE VERTICAL DIRECTION OF 0.194g, USING 3% DAMPING. (FREQUENCIES AS LOW AS 6 HZ WILL STILL RESULT IN $S_H \doteq .65g$)

2.) THE USE OF A STATIC COEFFICIENT MULTIPLIER FOR INCREASING SPECTRA ACCELERATIONS IS ACCEPTABLE AS AN ALTERNATE TO DYNAMIC ANALYSIS. AN ACCEPTED VALUE FOR SIMPLE BEAM AND FRAME STRUCTURES IS 1.5. DEPENDING ON THE COMPLEXITY OF THE EQUIPMENT THE FACTOR CAN BE SLIGHTLY HIGHER THAN 1.5 BUT IT NEVER EXCEEDS 2.0 FOR STRUCTURES SIMILAR TO THE GRAND GULF RHR HEAT EXCHANGER. THEREFORE, FOR CONSERVATISM A 2.0 FACTOR CAN BE USED.

THE STATIC COEFFICIENT ACCELERATION IS:

$$S_H = (2.0)(.65) = 1.3g$$
$$S_V = (2.0)(.194) = .39g$$

3.) DESCRIPTION OF ANALYSIS METHOD

A STATIC COEFFICIENT ANALYSIS OF THE RHR HEAT EXCHANGER USING S_H = 1.5g AND S_V = 1.75 g (INCLUDING STATIC WEIGHT) WAS PERFORMED USING STANDARD ENGINEERING METH... . THE ACCELERATION VALUE WAS APPLIED TO THE DISTRIBUTED WEIGHT, FORCES AND MOMENTS CALCULATED, NORMAL PRESSURE AND WEIGHT WAS INCLUDED, STRESSES CALCULATED, AND STRESSES WERE COMPARED TO ASME CODE ALLOWABLES. STATIC ACCELERATION WAS APPLIED SIMULTANEOUSLY IN THREE DIRECTIONS. NOZZLE LOADS WERE ASSUMED EQUAL TO MAXIMUM VALUES ON ICD.

4.) STRESS SUMMARY TABLE.

ATTACHED IS A COMPARISON OF CALCULATED TO ALLOWABLE STRESSES

IV CONCLUSION

BASED ON THE CONSERVATIVE APPROXIMATION OF FREQUENCY, THE CONSERVATIVE 2.0 STATIC FACTOR, THE MARGIN BETWEEN THE 1.3g AND 1.5g ACCELERATIONS, AND THE MARGIN BETWEEN CALCULATED AND ALLOWABLE STRESSES, THE EQUIPMENT IS CAPABLE OF WITHSTANDING GRAND GULF SEISMIC LOADS. IN CONJUNCTION WITH ALL PLANT NORMAL LOADS.

Bechtel Power Corporation

Engineers—Constructors

15740 Shady Grove Road
Gaithersburg, Maryland 20760
301-948-2700

July 30, 1980

Grand Gulf 1 & 2 ________
Date Received E-
Assigned To N/A
Answered ________

Mr. A. R. Smith, Project Manager
General Electric Company (M/C-392)
175 Curtner Avenue
San Jose, California 95114

Dear Mr. Smith:

Nuclear QA Is Not Applicable
Middle South Energy, Inc.
Grand Gulf Nuclear Station
Bechtel Job No. 9645
File: 0265/6410/M-001.0
Seismic Response Spectra
GEB-80/0216

In response to the request of your Mr. C. Morris for the seismic response spectra applicable to the RHR heat exchangers location, enclosed are the following spectra for floor elevation 119'-0" of the auxiliary building:

N213
N214
E213
E214
V213
V214

Very truly yours,

R. S. Trick
for A. Zaccaria
Project Engineer

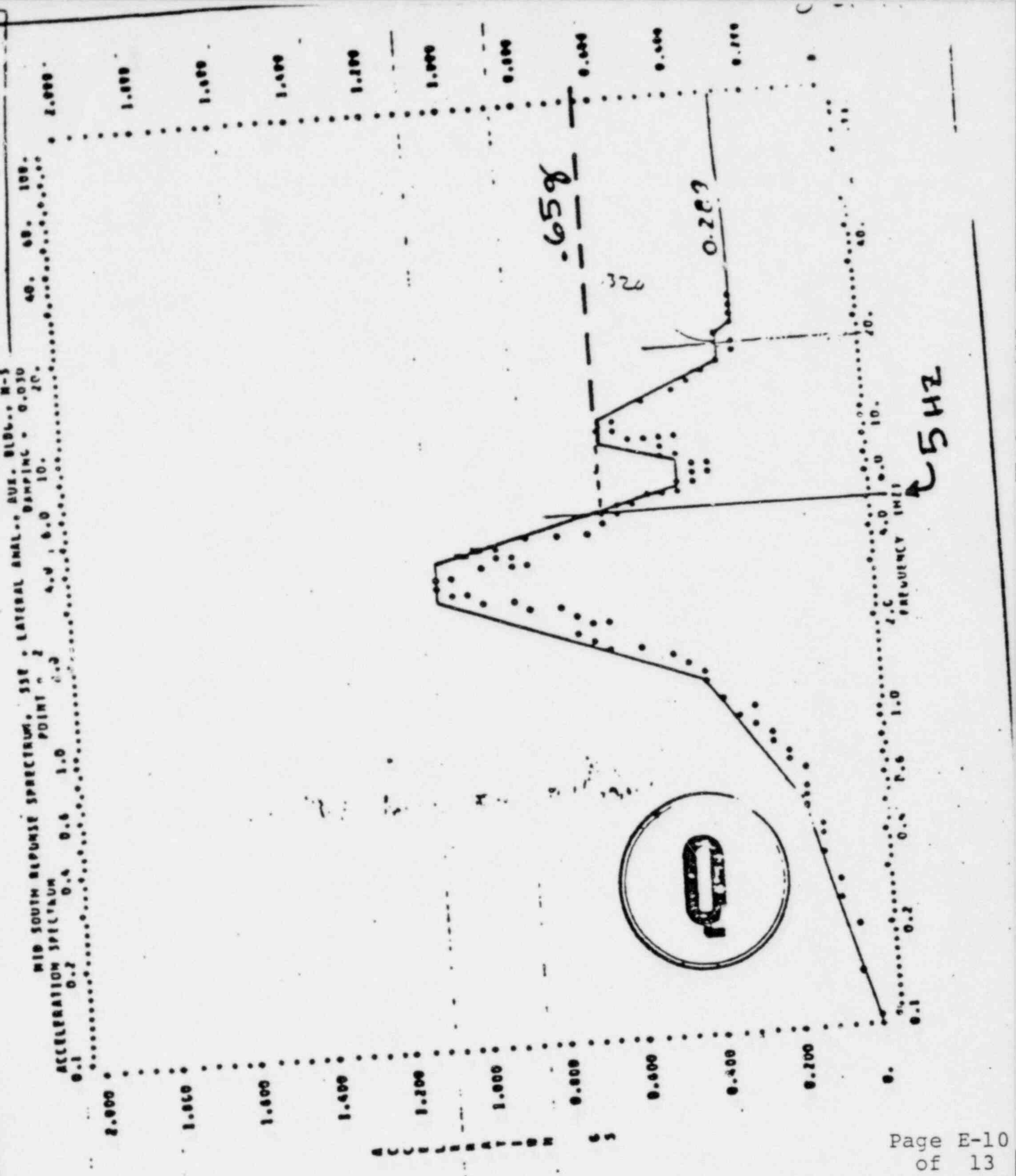
RCG:jgt

Enclosures: Seismic Response Spectra (6 sheets)

cc: J. P. McGaughy, Jr., w/1
L. F. Dale, 2/2
C. K. McCoy, w/1
T. H. Cloninger, w/1
T. E. Reaves, w/1
Dr. D. C. Gibbs, w/1
W. A. Shanks, w/1 (GE Res. Site Mngr.)
D. M. Lake, w/1
H. H. Weber, w/1
R. L. Scott, w/1

RECE[illegible]D
AUG 7 1980
A. R. SMITH

Calc. No. C.H0041, Rev. 0

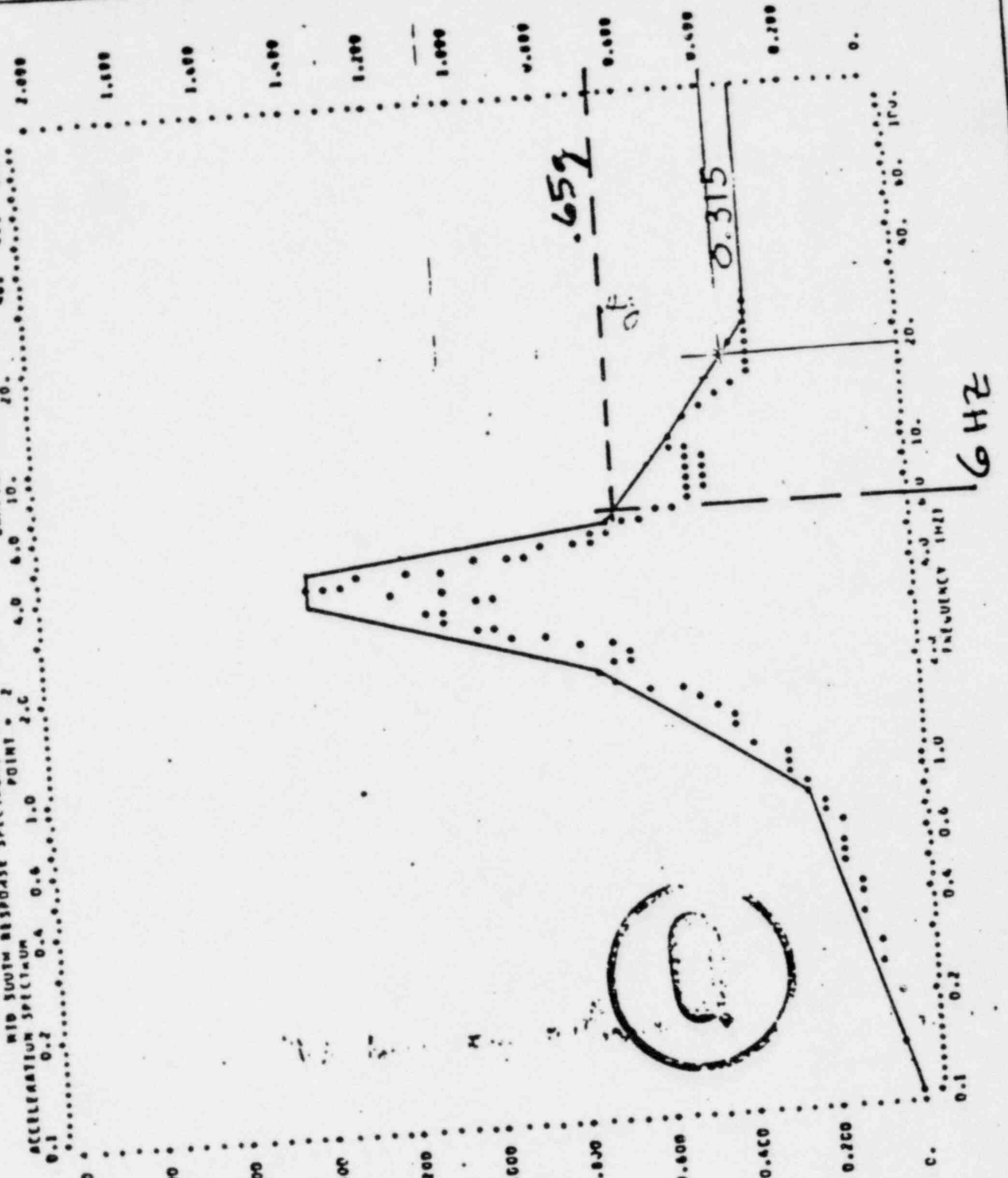


No	DATE	REVISIONS	BY	CHK
2	6/11/73	ISSUED FOR USE		

AUX. BLDG. FLOOR SPECTRUM
SSE, N-S, EL. 119'-0", 3%
GRAND GULF NUCLEAR STATION UNITS 1&2

SHEET 5 OF 12

C-11008.A 0



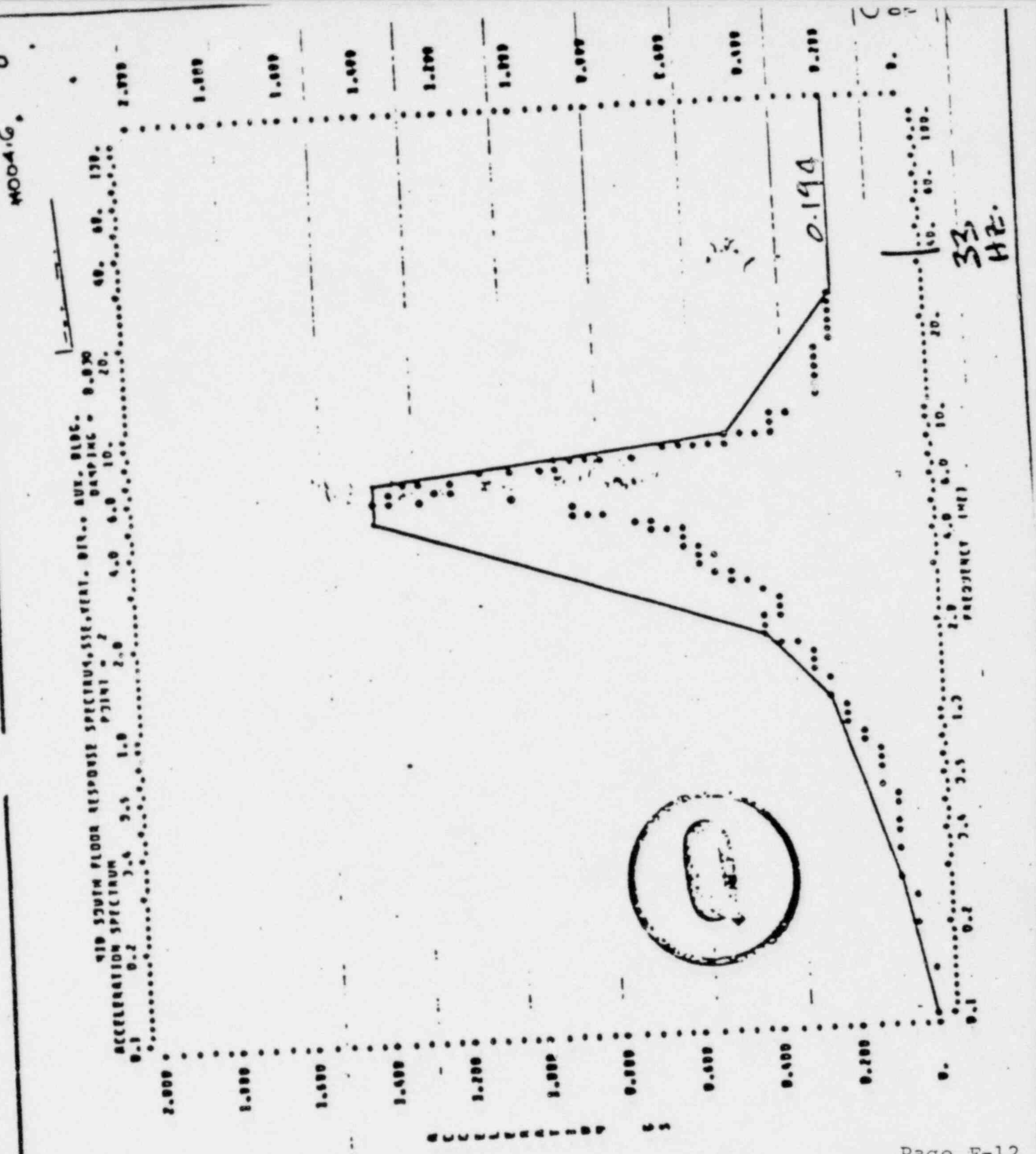
0	6/11/73	ISSUED FOR USE	[illegible]	T&H
No.	DATE	REVISIONS	BY	CH'K

JOB No. 9645

E 214

AUX. BLDG. FLOOR SPECTRUM
SSE, E-W, EL. 119'-0", 3%
... STATION UNITS 1&2

SHEET 2 OF 12



No.	DATE	REVISIONS	BY	CH'K	AP
0	6/11/73	ISSUED FOR USE			

JOB No 9645

V212

AUX. BLDG. FLOOR SPECTRUM
SSE, VERT., EL. 119'-0", 3%
GRAND GULF NUCLEAR STATION UNITS 1&2

SHEET 8 OF 32

ENGINEERING CALCULATION SHEET

NUMBER GRAND GULF 1&2 - RHR HEAT EXCHANGERS DATE 4/7/82

SUBJECT STRESSES IN SHELL AND SUPPORT BY A.R. SCHICK SHEET 1 OF 1

REFERENCE:

(a) GE DWG. 762E987, Rev.6 - "GRAND GULF 1&2 RHR HEAT EXCHANGER INTERFACE CONTROL DWG".

THE CRITICAL STRESSES IN THE SHELLS AND SUPPORTS OF THE GRAND GULF 1&2 RHR HEAT EXCHANGERS FOR THE SUPPORT LOADS* TABULATED IN NOTE 4 OF REF. (a) ARE LISTED BELOW:

STRESS LOCATION	UPSET		FAULTED	
	STRESS, psi	ALLOWABLE STRESS, PSI	STRESS, psi	ALLOWABLE STRESS, PSI
LONGITUDINAL STRESS IN THE SHELL JUST BELOW THE LOWER SUPPORTS	13,019	17,500	14,173	35,000
UPPER SUPPORTS				
MAX. STRESS IN SHELL-BIJLAARD ANALYSIS	17,666	26,250	18,028	42,000
PAD-TO-SHELL ATTACHMENT WELD:				
SHEAR STRESS	1,070	8,575	1,451	17,150
BENDING STRESS	850	16,078	1,152	32,156
LOWER SUPPORTS				
MAX. STRESS IN SHELL-BIJLAARD ANALYSIS	21,675	26,250	22,810	42,000
PAD-TO-SHELL ATTACHMENT WELD:				
SHEAR STRESS	4,099	8,575	5,367	17,150
BENDING STRESS	4,110	16,078	5,268	32,156
SHELL FLANGE: BOLT STRESS	27,899	37,500	28,906	50,000
HUB STRESS	38,279	39,375	39,769	52,500
FLANGE STRESS	24,637	26,250	25,594	35,000
LOWER SUPPORT ANCHOR BOLTS:				
SHEAR STRESS	—	—	4,985	10,000
TENSION STRESS	—	—	4,537	10,000

* THE LOADS OF NOTE 4 WERE CALCULATED ON THE BASIS OF THE FOLLOWING SEISMIC COEFFICIENTS:

DIRECTION	UPSET	FAULTED
HORIZONTAL	1.0g	1.5g
VERTICAL	0.5g	0.75g

ATTACHMENT NO. 3

CRD Solenoid Valve
(C11-F009)

AE3I5

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-06

EQUIPMENT NAME: Control Rod Drive
CRD Solenoid Valve

SPEC. NO:

EQUIPMENT NO: C11-F009

LOCATION: Reactor Building, El. 135'-4"

EQUIPMENT CLASSIFICATION: [X] ACTIVE [ ] PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

"Vibration Test of ASCO Solenoid Valve 8323 for William H. Zimmer and La Salle County Nuclear Power Stations", October 16, 1981, SwRI Project Number 02-6056-007

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: GPChew
G.P. Chew

APPROVED: for C. Narayanan
V.J. Brocato

DATE: 4/20/82

REVISION 1, 5/26/82

PREPARED: GPChew

APPROVED: C. Narayanan for V.J. Brocato

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name CRD Solenoid Valve

2. Equipment No. MPL - Number C11-F009

3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
1.	SwRI Project No. 02-6056-007	Oct. 16, 1981	Vibration Test of ASCO Solenoid Valve 8323

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
NUTECH File #32.1206.0065	4/30/82 (D.G. Bost Telecopy)	File includes: 1. Telecopy from D.G. Bost (MP&L) to D.E. Forney (Bechtel
	5/21/32 (Bechtel Letter)	2. Bechtel letter with attached analysis for solenoid valve loads.
NUTECH File #32.1206.0206	5/25/82	Calculations: "CRD Solenoid Valve Accelerations"

EQUIPMENT NO. C11-F009

4. Functional Requirements

This valve is required to be operable during and after a seismic event.

5. Demonstration Capability

An identical valve was subjected biaxial random vibration at levels greater than those predicted for Grand Gulf Unit 1. The specimen functioned properly during after the simulated seismic event. In addition, the specimen functioned properly after fragility testing with a 30 second, 50 Hz dwell, at an acceleration level of 12g.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

Specimen operability was demonstrated during and after seismic testing at loads greater than those required for Grand Gulf, and following fragility testing at 12g. Based on this test data the ASCO HT8323A22 dual solenoid valve is acceptable for its use in the Grand Gulf plant.

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit I

Type:

1. Utility: Mississippi Power and Light Co.

PWR ______

2. NSSS: G.E. 3. A/E: Bechtel Power Corp.

BWR 6, Mark III

II. Component Name: CRD Solenoid Valve (MPL #C11-F009)

1. Scope: [X] NSSS [ ] BOP
2. Model Number: HT8323A22 Quantity: 1
3. Vendor: Automatic Switch
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance ______

   b. Dimensions $7\frac{1}{16}$" H x $3\frac{7}{16}$" W x $2\frac{3}{4}$" D

   c. Weight 3.1 lbs.
6. Location: Building: Reactor Building

   Elevation: 135'-4"
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)

   [ ] Weld (Length____)

   [X] Clamped on Piping
8. a. System in which located: CRD

   b. Functional Description: Actuates CRD Vent and Drain Valves

   c. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown

   [ ] Both [ ] Neither
9. Pertinent Reference Design Specifications: ______

Prepared by: G.F. Chan 5/26/82

Verified by: R.F. Morton 5/26/82

12/80

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

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

Qualification Report*: SwRI Project No. 02-6256-0007

(No., Title and Date) Vibration Test-ASCO Solenoid Valve 8323,10/16/82

Company that Prepared Report: Southwest Research Institute for NUTECH

Company that Reviewed Report: NUTECH

V. Vibration Input:

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [x] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [ ] ______ (other, specify)

3. Required Response Spectra (attach the graphs): ______

4. Damping Corresponding to RRS: OBE ______ SSE ______

5. Required Acceleration in Each Direction: [ ] ZPA [ ] Other ______ (specify)

OBE	S/S =	F/B =	V =	
SSE	S/S = 2.38	F/B = 2.38	V = .81	

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency   [x] Multi-Frequency: [X] random / [ ] sine beat / [ ] ______

2. [ ] Single Axis   [X] Multi-Axis

3. No. of Qualification Tests: OBE 4 SSE 1 Other ______ (specify)

4. Frequency Range: 1 - 100 Hz

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

S/S = >100 F/B = 85 V = >100

6. Method of Determining Natural Frequencies

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

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs
[ ] No

8. Input g-level Test: OBE S/S = 5.0 F/B = 6.1 V = 6.2

SSE S/S = 8.8 F/B = 8.6 V = 8.1

9. Laboratory Mounting: See Note 1

1. [ ] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Specimen functioned satisfactorily. No modifications required.

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

Fragility tests: 12g, 50 Hz Sine dwell for 30 seconds each axis. Specimen functioned satisfactorily.

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Specimen was clamped in manner similar to that of the unit installed in Grand Gulf Unit 1.

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

1. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

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

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

   S/S = ________ F/B = ________ V = ________

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

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ________

   Frequency Range and No. of modes considered: ________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: ________ (specify)

6. Damping: OBE ____ SSE ____ Basis for the damping used: ________

7. Support Considerations in the model: ________

8. Critical Structural Elements:

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

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

Project Grand Gulf Nuclear Station File No. 32.1206.02
Owner Mississippi Power and Light Co.
Client Mississippi Power and Light Co.

CRD Solenoid Valve Accelerations

Reference: 1. Telecopy From D.G. Bost (4/30/82) & Bechtel Letter (5/21/82) with attached analysis for Solenoid Valve Loads, Nutech File # 32.1206.0065

2. "Vibration Test of ASCO Solenoid Valve 8323", SWRI Project No. 02-6056-007, 10/16/81

f_n = 85 Hz (fundamental frequency per Ref 2, page 24)

The following table is generated from spectra in Ref 1

Elevation	Event	Direction	g Level	
117.33'	SSE	Vert.	.14	V
"	"	NS	.20	
"	"	EW	.25	
142.33'	"	Vert.	.14	
"	"	NS	.32	H
"	"	EW	.32	
120.83'	LOCA DBA/Var.PS	Vert.	.55	V
"	"	Radial	1.76	H
147.58	"	Vert.	.40	
"	"	Radial	.82	
120.83	SRVA	Vert.	.10	
"	"	Horiz.	.30	H
147.58	"	Vert.	.12	V
"	"	Horiz.	.20	

Combinations

SSE + LOCA + SRV = .14 + .55 + .12 = .81 g's ← Vertical

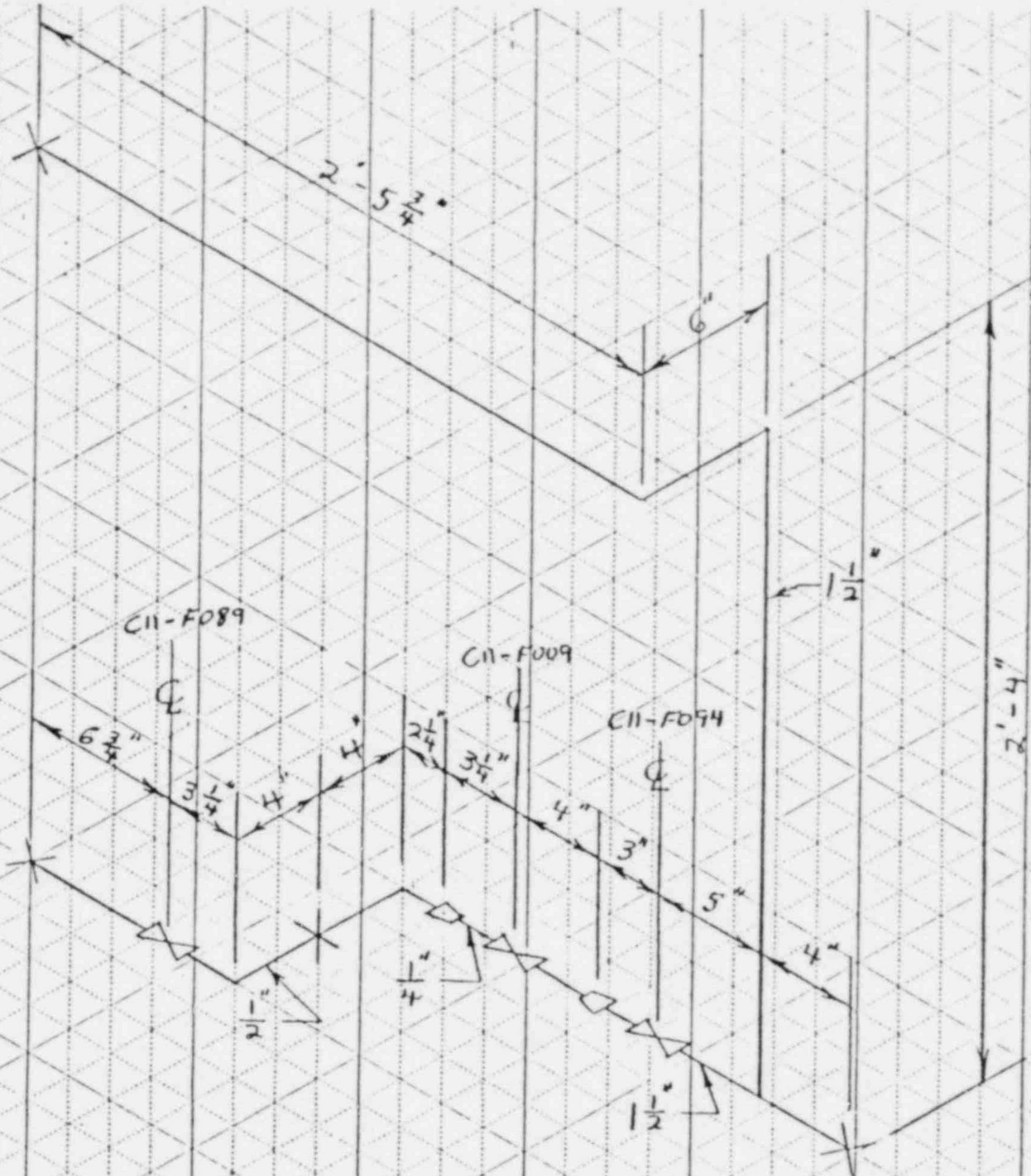
SSE + LOCA + SRV = .32 + 1.76 + .30 = 2.38 g's ← Horizontal

Revision	0					Page 1
Prepared By/Date	RDW 5/25/82					of 1
Checked By/Date						

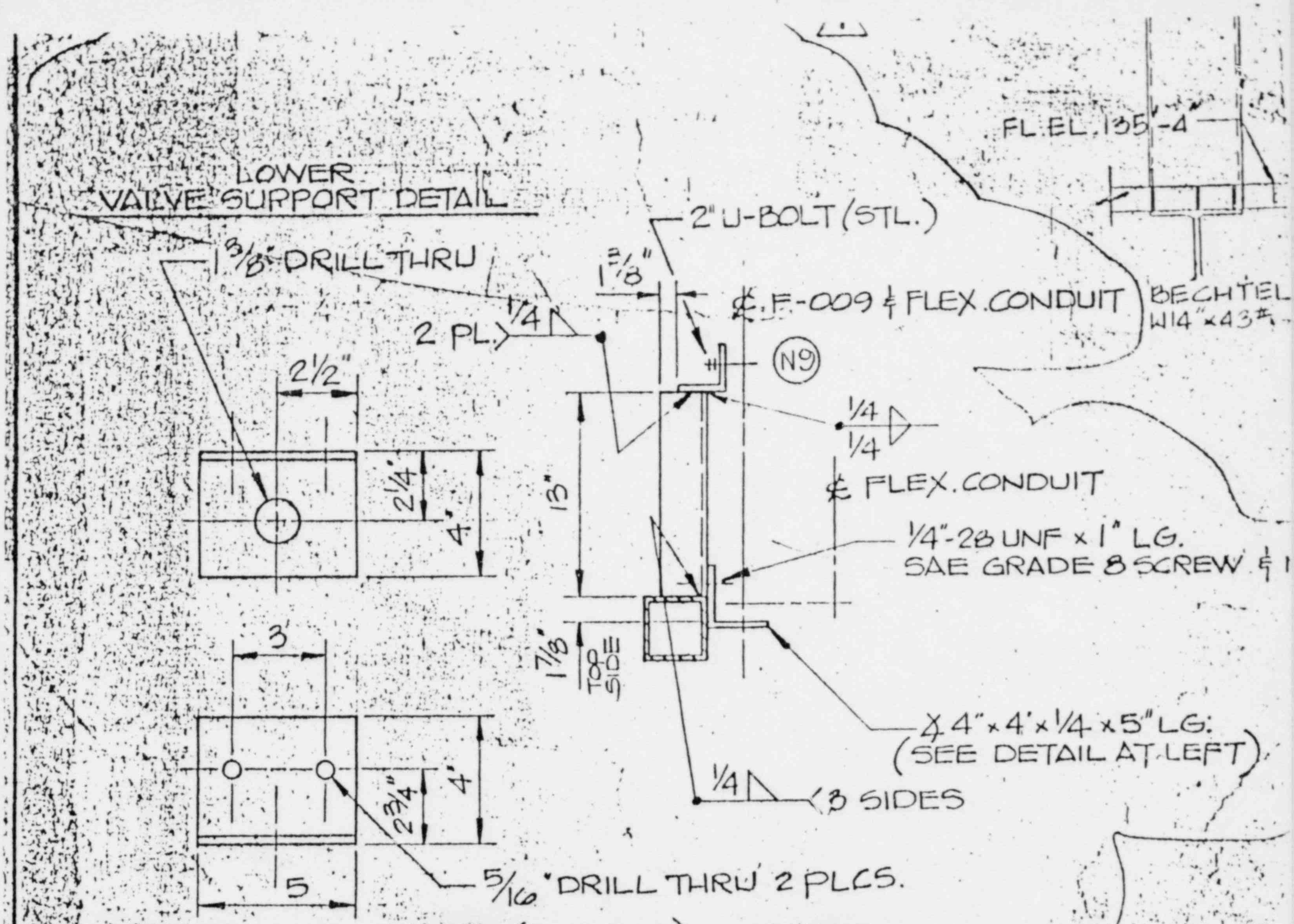
32.1206.0065

TELECOPY TO : D.E. FORNEY
FROM : D.G. BOST
DATE : 4/30/82

PER OUR DISCUSSION, HERE IS THE INFORMATION ON THE CRD SOLENOID VALVE (C11-F009). THE EXISTING FIELD CONFIGURATION HAS BEEN DUPLICATED ON THE ATTACHED ISOMETRIC DRAWING. ALL SUPPORTS ARE DESIGNATED BY AN "x". THE VALIDITY OF THE ASSUMPTION THAT THE U-BOLTS WERE 3-D SUPPORTS HAS BEEN RESOLVED AS RECENT FIELD MODIFICATIONS HAVE ADDED SPACERS. ALL SUPPORTS SHOWN MAY BE ASSUMED TO BE 3-D. A 6½" LONG CONDULET EXTENDS HORIZONTAL FROM C11-F009. FLEX CONDUIT RUNS FROM THIS TO RIGID STEEL CONDUIT LOCATED APPROXIMATELY 5' ABOVE THE VALVE. THE R.S. CONDUIT IS SUPPORTED AT THIS POINT. A 9½" LONG CONDULET EXTENDS VERTICAL FROM C11-F009 AND IS SUPPORTED BY A 3-D CLAMP. THIS SUPPORT IS NOT SHOWN ON THE ISOMETRIC DRAWING BUT SHOULD BE TAKEN INTO ACCOUNT DURING YOUR ANALYSIS. A DETAIL OF THIS SUPPORT STRUCTURE IS ALSO ATTACHED. I WILL CONTACT YOU MONDAY MORNING TO DISCUSS THIS INFORMATION. IF THIS CONFLICTS WITH YOUR SCHEDULE, PLEASE CONTACT ME AT X 2873.



2'-5 3/4"
6"
1 1/2"
2'-4"
C11-F089
C11-F009
C11-F094
6 3/4"
3 1/4"
4"
4"
2 1/4"
3 1/4"
4"
3"
5"
4"
1/2"
1/4"
1 1/2"



DETAIL 4 (H-6, C-5) TOWARDS DRYWELL

Bechtel Power Corporation
Engineers — Constructors

15740 Shady Grove Road
Gaithersburg, Maryland 20877
301—258-3000

May 21, 1982

Mr. J. F. Pinto, Manager
Nuclear Plant Engineering
Grand Gulf Nuclear Station
Mississippi Power & Light Company
Post Office Box 756
Port Gibson, Mississippi 39150

Dear Mr. Pinto:

Nuclear QA Is Not Applicable
Middle South Energy, Inc.
Grand Gulf Nuclear Station
Bechtel Job No. 9645
File: 0262/10750
Solenoid Valve 1C11-SV-F009
MPB-82/0297

In response to a request from D. Bost of NPE, Project Engineering performed a stress calculation on the R.C.I. tubing run for solenoid valve 1C11-SV-F009. This calculation was done using Bechtel computer program ME 101 and was to determine the "G" (acceleration) forces on the valve for Mr. Bost's use in evaluating seismic qualification of the solenoid valve.

The information used to do this calculation was either provided by D. Bost or compiled by D. Forney, of Bechtel. Attached with this letter is a copy of the calculation showing the input information, with all sources and assumptions shown, and the output showing the "G" forces calculated.

This valve installation, which was apparently designed by RCI, differs greatly from what we have used in a similar application (see Drawing J0134S). The J0134S installation clearly shows the valve rigidly supported in two directions. However, the geometry of the 1C11-SV-F009 installation is not so well defined. Therefore, your evaluation should closely examine the assumption that the valve is restrained in two directions.

We are also sending you copies of the response spectra necessary for you to evaluate the seismic qualification of the solenoid valve. This consists of SSE, SRVA and LOCA-DBA envelopes which include the new variable pool swell response spectra which may be implemented on the project in the near future.

It should be understood that Project Engineering is submitting this for information only and is neither qualifying the installation nor the solenoid valve.

If you have any questions, please contact us.

Very truly yours,

R. S. Trickovic
Project Engineer

DEF/jgt
Enclosures: Calculation C11-1, Response spectra envelopes
Applicable Systems: C11
cc: J. P. McGaughy, Jr., w/1
L. F. Dale, 2w/2
T. H. Cloninger, w/1
T. E. Reaves, w/1
C. K. McCoy, w/1
J. N. Ward, w/o
M. D. Archdeacon, w/o
L. E. Ruhland, w/o
C. D. Wood, w/1
J. F. Hudson, w/1
D. E. Stewart, w/1

QUALITY ASSURANCE PROGRAM
CALCULATION COVER SHEET
GRAND GULF NUCLEAR STATION UNITS NO. 1 and 2

CALC. NO. C11-1

NO. OF SHEETS 17

JOB NO. 9645

DISCIPLINE CONTROL SYSTEMS

TITLE

MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION UNITS 1 & 2

SUBJECT

RCI Tubing Run (1C11-SV-F009)

STATEMENT OF PROBLEM

To determine the G (acceleration) forces on the solenoid valve 1C11-SV-F009

SAR CHECKED [XX] SAR CHANGE REQ'D [ ] SAR CHANGE NOTICE INITIATED [ ]

SOURCES OF DATA

ASME section III, subsection NA
Marks Standard Handbook of Mechanical Engineers, 8th Edition
Telecon dated 4/30/82 from D.Bost to D.Forney

SOURCES OF FORMULAE & REFERENCES

Computer Program Used: ME101

Approved for submittal to MP&L

Chief CS Engineer W. [signature] 21 May 82

Manager of Engineering ~~W N Adams~~ [signature] for 5-21-82

*PRELIMINARY CALC [ ] FINAL CALC [XX] SUPERSEDES CALC NO. N/A

REV. NO.	DATE	DESCRIPTION	CALC. BY	**CHECKED BY	DATE	APPROVED BY	DATE
0	5/20/82	ISSUED PER CLIENT REQUEST	[signature]	M. Dove	5/20/82	John C [signature]	5-21-82

*Preliminary calcs checked only at Group Supervisors Request
**Considers PSAR Codes & Standards, Redundancy & Separation, Operability, Maintainability & Technical adequacy & clarity.

GPD-1369 Rev. 6/79 (Form QG-7)

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR Dale E Forney DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 1

PURPOSE

TO DETERMINE THE "G" (ACCELERATION) FORCES ON SOLENOID VALVE 1C11-SV-F009 USING BECHTEL COMPUTER PROGRAM ME-101.

INPUT DATA

LISTED BELOW IS ALL THE INFORMATION THAT MUST BE PROVIDED TO THE COMPUTER WITH THE SOURCE LISTED BESIDE IT.

1) TUBE O.D. - TAKEN FROM ISOMETRIC SKETCH PROVIDED BY D. BOST
2) TUBE WALL THICKNESS - USED THICKNESS OF STANDARD BECHTEL COPPER TUBE OF THAT O.D.
3) TUBE WEIGHT - DETERMINED BY CALCULATING VOLUME OF TUBE AND MULTIPLING BY DENSITY OF COPPER.
4) ALLOWABLE HOT & COLD STRESS VALUES FOR COPPER - TAKEN FROM TABLE I-8.4 IN APPENDIX I OF ASME SECTION III SUBSECTION NA BASED ON ANNEALED COPPER TUBE AT 100°F COLD AND 150°F HOT.
5) MODULUS OF ELASTICITY - TAKEN FROM TABLE I-6.0 IN APPENDIX I OF ASME SECTION III SUBSECTION NA BASED ON 200°F
6) PRESSURE, DESIGN PRESSURE & PEAK PRESSURE - USED HIGHEST SHOWN ON SFD-1067 SHEET 3 REVISION 4.
7) THERMAL EXPANSION FACTOR - CALCULATED FROM THE FORMULA $l = l_0\left[1 + a\left(\frac{t-32}{1000}\right) + b\left(\frac{t-32}{1000}\right)^2\right]$ AND TABLE 10 ON PG. 4-7 OF MARKS' STANDARD HANDBOOK OF MECHANICAL ENGINEER 8TH EDITION.
8) TUBING RUN LAYOUT - TAKEN FROM ISOMETRIC SKETCH PROVIDED BY D. BOST
9) WEIGHTS OF VALVES & FITTING - ALL ARE ASSUMED BASED ON CONVERSATIONS BETWEEN D. FORNEY AND D. BOST

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR [signature] DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 2

OTHER INPUT DATA

ONE ASSUMPTION MADE WAS THAT THE SOLENOID VALVE WAS RESTRAINED IN TWO DIRECTIONS. THIS ASSUMPTION WAS BASED ON CONVERSATIONS WITH D. BOST, OF NPE. HE EXPLAINED THAT THE SOLENOID IS ATTACHED TO TWO CONDULETS, ONE VERTICALLY AND ONE HORIZONTALLY, WHICH ARE RIGIDLY SUPPORTED AND THEREFORE WOULD ACT AS A TWO DIRECTIONAL SUPPORT.

ATTACHMENT 1 IS A COPY OF THE ISOMETRIC SKETCH PROVIDED BY D. BOST.

RESULTS

THE RESULTS SHOW ZERO ACCELERATION ON THE VALVE. THIS MEANS THAT VALVE MOVES WITH THE SUPPORT STEEL WHICH IS ASSUMED TO BE RIGIDLY ATTACHED TO THE FLOOR STEEL, WHICH MOVES WITH THE FLOOR. THEREFORE THE VALVE WILL ONLY SEE THE ACCELERATIONS THAT THE FLOOR WILL SEE.

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR [signature] DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 3

COMPUTER INPUT

```
                          I N P U T   C A R D   I M A G E S

   1         11        21        31        41        51        61        71       80
 . +         +         +         +         +         +         +         +         +
 . RUN                                               LDCASE=WT1(1),
 . RUN                                               LDCASE=THRM1(1),
 . RUN                                               LDCASE=SEIS1(1),
 . RUN                                               LDCASE=SEIS2(1),
 . RUN                                               LDCASE=SEIS3(1),
 . RUN                                               LDCASE=SEIS4(1),
 . RUN                                               LDCASE=SEIS5(1),
 . RUN                                               LDCASE=SEIS6(1),
 . RUN                                               LDCASE=SEIS7(1),
 . RUN                                               LDCASE=SEIS8(1),
 . HED                                               PROJNO=9645,USER=DOVE,
 .                                                   UNITS=2,
 .                                                   PERIOD=0.008,MODES=6,
 .                                                   TITLE=RCI TUBING SPAN,
 . ANC       5                                       OD=.5,LBS/FT=.27,THICK=.049,
 .                                                   SC=6000,SH=5100,E=15.6E6,
 .                                                   PPRESS=160,PRESS=160,
 .                                                   DPRESS=160,
 .                                                   EXP=.011476,CODE=SC374,
 .                                                   CLASS=2,
 .           10                      -0-4      0-1.5
 .           15 0-4.25                               SIF=1.5,ADDWT=.25,
 .                                                   OD=.25,LBS/FT=.25,THICK=.035,
 .           20 0-3.25                               SIF=1.5,ADDWT=1.0,
 . RAD       20        1.0
 . RAD       20                  1.0
 .           25 0-4                                  SIF=1.5,ADDWT=1.25,
 .                                                   OD=1.5,LBS/FT=1.43,
 .                                                   THICK=.083,
 .           30 0-3                                  SIF=1.5,ADDWT=4.5,
 .           35 0-5                                  TEE=BRANCH,SIF=1.5,
 .           40 0-4
 . ANC       40
 .        35 45        2-4                 0-1.5
 .           50                  0-6       0-1.5
 .           55 -2-5.75
 . ANC       55
 . CMB                                               SEIS10=SEIS3&SEIS5,
 . CMB                                               SEIS11=SEIS1+SEIS10,
 . CMB                                               SEIS13=SEIS2+SEIS10,
 . CMB                                               SEIS14=SEIS2+SEIS4+SEIS6,
 . CMB                                               SEIS15=SEIS2+SEIS7+SEIS8,
 . CMB                                               SEIS16=SEIS13&SEIS14&SEIS15,
 . TEA                                               INCLUD=THRM1,
 . SLA                                               INCLUD=WT1,
 . OLA                                               LEVEL=B,INCLUD=SEIS11+WT1,
 . OLA                                               LEVEL=D,INCLUD=SEIS16+WT1,
 . RLS                                               LIST=WT1+THRM1+SEIS16,
 . END
```

CALCULATION SHEET

BECHTEL

CALC NO. C11-1 REV. NO. 0

ORIGINATOR [signature] DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 4

EFFECTIVE ACCELERATIONS ME101/12

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS1

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

	DATA PT	EFFECTIVE ACCELERATIONS (G'S) GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
	5	.000	.000	.000	.000
	10 B	.000	.000	.000	.000
	10 E	.000	.000	.000	.000
	15	.000	.000	.000	.000
VALVE →	20	.000	.000	.000	.000
	25	.000	.001	.000	.001
	30	.000	.001	.001	.001
	35	.000	.001	.000	.001
	40	.000	.000	.000	.000
	45 B	.057	.001	.288	.294
	45 E	.048	.016	.306	.310
	50 B	.017	.044	.306	.309
	50 E	.000	.053	.287	.292
	55	.000	.000	.000	.000

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR Dale E. Forman DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 5

EFFECTIVE ACCELERATIONS ME101/12

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS2

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

EFFECTIVE ACCELERATIONS (G'S)

	DATA FT	GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
	5	.000	.000	.000	.000
	10 B	.000	.000	.000	.000
	10 E	.000	.000	.000	.000
	15	.000	.000	.000	.000
VALVE →	20	.000	.000	.000	.000
	25	.000	.002	.001	.002
	30	.000	.002	.001	.002
	35	.000	.001	.000	.001
	40	.000	.000	.000	.000
	45 B	.097	.001	.490	.500
	45 E	.081	.027	.520	.527
	50 B	.030	.075	.520	.527
	50 E	.000	.090	.466	.456
	55	.000	.000	.000	.000

BECHTEL

CALCULATION SHEET

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR [signature] DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 6

EFFECTIVE ACCELERATIONS ME101/12

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS3

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

	DATA PT	EFFECTIVE ACCELERATIONS (G'S) GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
	5	.000	.000	.000	.000
	10 E	.000	.001	.000	.001
	10 F	.000	.001	.000	.001
	15	.000	.001	.001	.001
VALVE →	20	.000	.000	.000	.000
	25	.000	.006	.003	.007
	30	.000	.009	.005	.010
	35	.000	.004	.000	.004
	40	.000	.000	.000	.000
	45 B	.404	.004	2.046	2.085
	45 E	.339	.112	2.171	2.200
	50 B	.124	.314	2.171	2.197
	50 E	.000	.375	2.037	2.071
	55	.000	.000	.000	.000

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR [signature] DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 7

EFFECTIVE ACCELERATIONS ME101/12

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS4

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

	DATA PT	GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
			EFFECTIVE ACCELERATIONS (G'S)		
	5	.000	.000	.000	.000
	10 B	.000	.001	.000	.001
	10 E	.000	.001	.000	.001
	15	.000	.001	.001	.001
VALVE →	20	.000	.000	.000	.000
	25	.000	.005	.003	.006
	30	.000	.007	.003	.008
	35	.000	.003	.000	.003
	40	.000	.000	.000	.000
	45 B	.313	.003	1.585	1.616
	45 E	.263	.087	1.682	1.704
	50 B	.096	.243	1.682	1.702
	50 E	.000	.290	1.578	1.605
	55	.000	.000	.000	.000

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR [signature] DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 8

EFFECTIVE ACCELERATIONS ME101/12

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS5

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

	DATA PT	EFFECTIVE ACCELERATIONS (G'S) GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
	5	.000	.000	.000	.000
	10 B	.000	.001	.000	.001
	10 E	.000	.002	.000	.002
	15	.000	.001	.001	.002
VALVE →	20	.000	.000	.000	.000
	25	.000	.010	.005	.011
	30	.000	.014	.007	.015
	35	.000	.007	.001	.007
	40	.000	.000	.000	.000
	45 B	.615	.006	3.116	3.176
	45 E	.517	.170	3.307	3.351
	50 B	.189	.479	3.307	3.346
	50 E	.006	.571	3.103	3.155
	55	.000	.000	.000	.000

EFFECTIVE ACCELERATIONS ME101/12

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS6

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

EFFECTIVE ACCELERATIONS (G'S)

	DATA FT	GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
	5	.000	.000	.000	.000
	10 B	.000	.000	.000	.000
	10 E	.000	.001	.000	.001
	15	.000	.000	.000	.001
VALVE →	20	.000	.000	.000	.000
	25	.000	.004	.002	.005
	30	.000	.006	.003	.007
	35	.000	.003	.000	.003
	40	.000	.000	.000	.000
	45 B	.267	.003	1.352	1.378
	45 E	.224	.074	1.434	1.454
	50 B	.082	.208	1.424	1.452
	50 E	.000	.248	1.346	1.368
	55	.000	.000	.000	.000

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR [signature] DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 10

EFFECTIVE ACCELERATIONS ME101/12

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS7

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

	DATA PT	EFFECTIVE ACCELERATIONS (G'S) GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
	5	.000	.000	.000	.000
	10 B	.000	.002	.000	.002
	10 E	.000	.004	.000	.004
	15	.000	.002	.002	.003
VALVE →	20	.000	.000	.000	.000
	25	.000	.017	.009	.019
	30	.000	.024	.012	.027
	35	.000	.012	.001	.012
	40	.000	.000	.000	.000
	45 B	1.077	.011	5.457	5.563
	45 E	.905	.299	5.751	5.865
	50 B	.331	.838	5.751	5.861
	50 E	.000	1.000	5.434	5.525
	55	.000	.000	.000	.000

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR [signature] DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 11

EFFECTIVE ACCELERATIONS FE101/I2

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEISB

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

	DATA PT	EFFECTIVE ACCELERATIONS (G'S) GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
	5	.000	.000	.000	.000
	10 B	.000	.000	.000	.000
	10 E	.000	.001	.000	.001
	15	.000	.000	.000	.001
VALVE →	20	.000	.000	.000	.000
	25	.000	.003	.002	.004
	30	.000	.005	.002	.005
	35	.000	.002	.000	.002
	40	.000	.000	.000	.000
	45 B	.209	.002	1.059	1.079
	45 E	.176	.058	1.123	1.138
	50 B	.064	.163	1.123	1.137
	50 E	.000	.194	1.054	1.072
	55	.000	.000	.000	.000

EFFECTIVE ACCELERATIONS ME101/I2

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS10

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

	DATA PT	GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
		EFFECTIVE ACCELERATIONS (G'S)			
	5	.000	.000	.000	.000
	10 B	.000	.001	.000	.001
	10 E	.000	.002	.000	.002
	15	.000	.001	.001	.002
VALVE →	20	.000	.006	.010	.0[illegible]
	25	.000	.010	.005	.011
	30	.000	.014	.007	.015
	35	.000	.007	.001	.007
	40	.000	.000	.000	.000
	45 B	.615	.006	3.116	3.176
	45 E	.517	.170	3.307	3.351
	50 B	.189	.479	3.307	3.346
	50 E	.000	.571	3.103	3.155
	55	.000	.000	.000	.000

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR [signature] DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 13

EFFECTIVE ACCELERATIONS ME101/12

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS11

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

	DATA FT	EFFECTIVE ACCELERATIONS (G'S) GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
	5	.000	.000	.000	.000
	10 B	.000	.001	.000	.001
	10 E	.000	.002	.000	.002
	15	.000	.001	.001	.002
VALVE →	20	.000	.000	.000	.000
	25	.000	.011	.006	.012
	30	.000	.015	.008	.017
	35	.000	.007	.001	.007
	40	.000	.000	.000	.000
	45 B	.672	.007	3.404	3.470
	45 F	.565	.186	3.612	3.661
	50 B	.207	.023	3.612	3.656
	50 E	.000	.024	3.350	3.447
	55	.000	.000	.000	.000

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR [signature] DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 14

EFFECTIVE ACCELERATIONS ME101/12

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS13

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

	DATA PT	EFFECTIVE ACCELERATIONS (G'S) GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
	5	.000	.000	.000	.000
	10 B	.000	.001	.000	.001
	10 E	.000	.002	.000	.002
	15	.000	.001	.001	.002
VALVE →	20	.000	.000	.000	.000
	25	.000	.011	.006	.013
	30	.000	.016	.008?	.018?
	35	.000	.008?	.001	.008?
	40	.000	.000	.000	.000
	45 B	.712	.007	3.667?	3.676
	45 E	.598	.197	3.827	3.879
	50 B	.219	.554	3.827	3.873
	50 E	.000	.661	3.591	3.651
	55	.000	.000	.000	.000

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR [signature] DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 15

EFFECTIVE ACCELERATIONS ME101/12

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS14

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

		EFFECTIVE ACCELERATIONS (G'S)		
DATA PT	GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
5	.000	.000	.000	.000
10 B	.000	.001	.000	.001
10 E	.000	.002	.000	.002
15	.000	.001	.001	.002
VALVE → 20	.000	.000	.000	.000
25	.000	.011	.006	.012
30	.000	.015	.008	.017
35	.000	.007	.001	.007
40	.000	.000	.000	.000
45 B	.676	.007	3.427	3.493
45 E	.569	.187	3.637	3.665
50 B	.208	.526	3.636	3.680
50 E	.000	.028	3.412	3.409
55	.000	.000	.000	.000

CALCULATION SHEET

BECHTEL

CALC. NO. C11-1 REV. NO. 0

ORIGINATOR Dale E. Forrest DATE 5/20/82 CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 16

EFFECTIVE ACCELERATIONS ME101/I2

TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEISIS

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

	DATA PT	EFFECTIVE ACCELERATIONS (G'S) GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESULTANT
	5	.000	.000	.000	.000
	10 B	.000	.002	.000	.002
	10 E	.000	.005	.000	.005
	15	.000	.003	.003	.004
VALVE →	20	.000	.000	.000	.000
	25	.000	.022	.012	.025
	30	.000	.031	.015	.035
	35	.000	.015	.001	.015
	40	.000	.000	.000	.000
	45 B	1.383	.015	7.016	7.142
	45 E	1.162	.383	7.434	7.535
	50 B	.425	1.076	7.434	7.524
	50 E	.000	1.282	6.976	7.093
	55	.000	.000	.000	.000

CALCULATION SHEET

BECHTEL

ORIGINATOR [signature] DATE 5/20/82 CALC. NO. C11-1 REV. NO. 0

CHECKED M. Dove DATE 5/20/82

PROJECT Mississippi Power & Light Company Grand Gulf Nuclear Station Unit 1 & 2 JOB NO. 9645

SUBJECT RCI TUBING (1C11-SV-F009) SHEET NO. 17

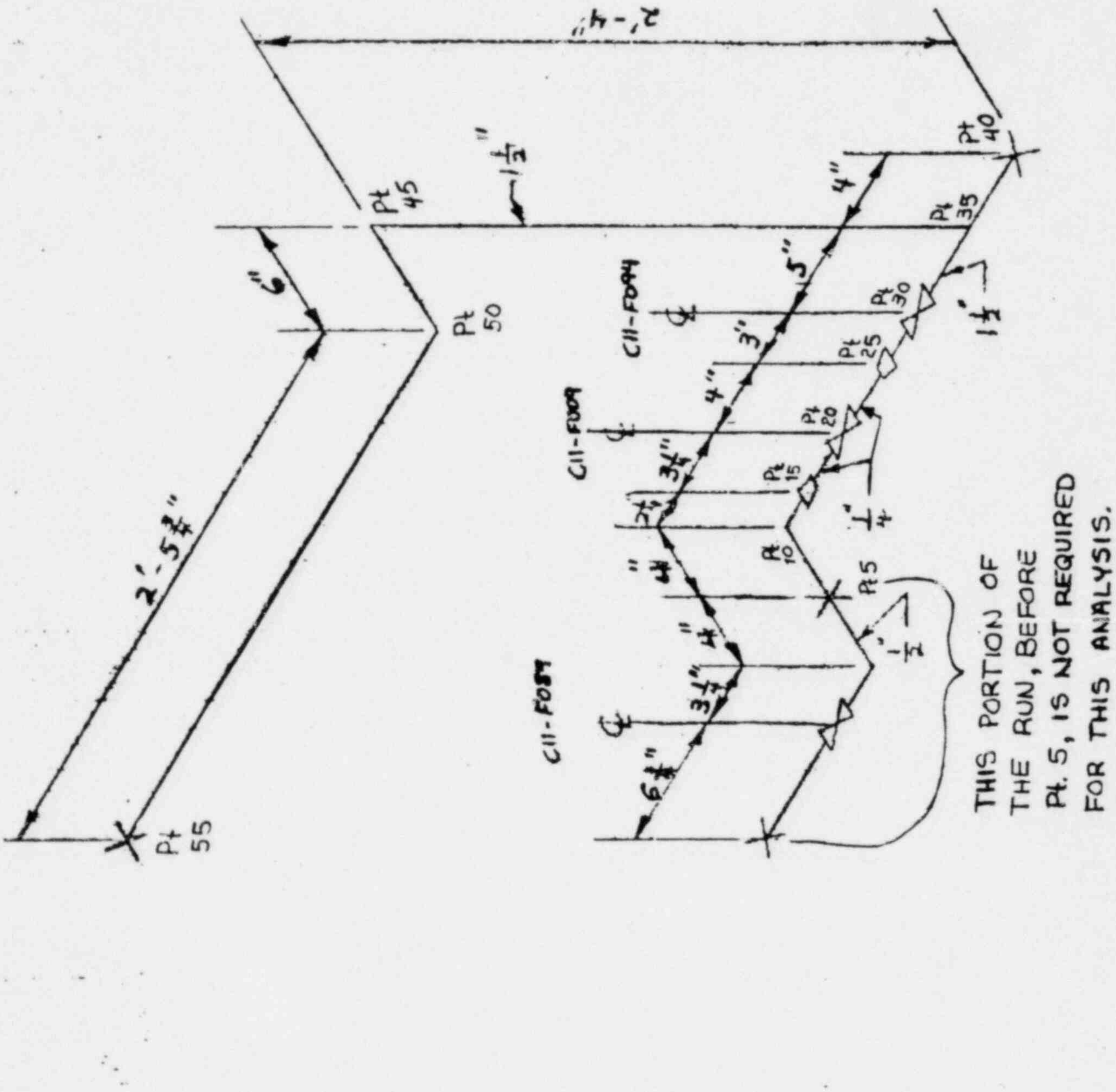
EFFECTIVE ACCELERATIONS ME101/I2

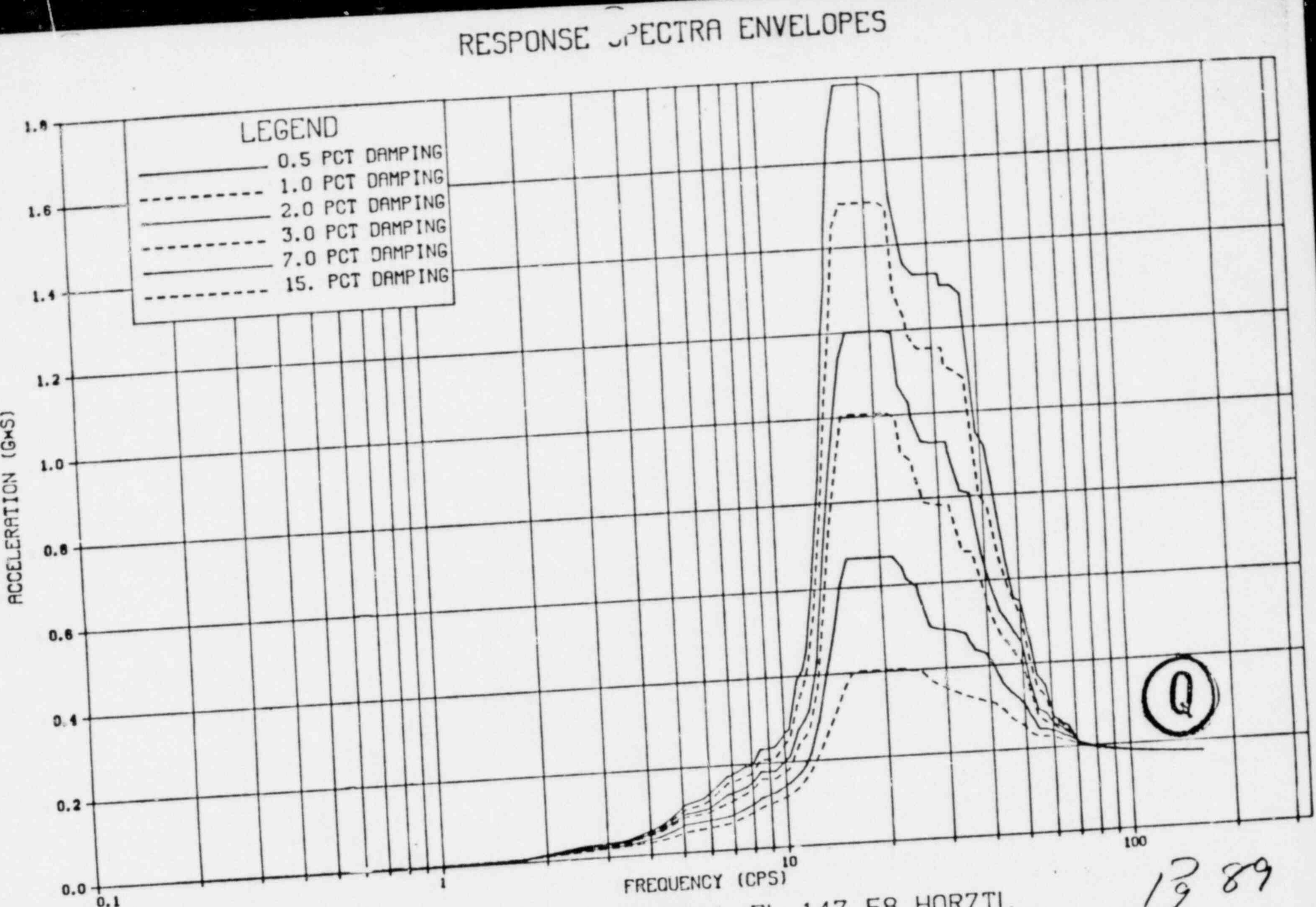
TITLE : RCI TUBING SPAN
PROJECT NUMBER : 9645
PROBLEM NUMBER :
USER : DOVE
LOAD CASE : SEIS16

EARTHQUAKE COMPONENT : X+Y+Z
RESULTS OF MODAL SYNTHESIS

DATA PT	GLOBAL-X	EFFECTIVE ACCELERATIONS (G'S) GLOBAL-Y	GLOBAL-Z	RESULTANT
5	.000	.000	.000	.000
10 B	.000	.002	.000	.002
10 E	.000	.005	.000	.005
15	.000	.003	.003	.004
VALVE → 20	.000	.000	.000	.000
25	.000	.022	.012	.025
30	.000	.031	.015	.035
35	.000	.015	.001	.015
40	.000	.000	.000	.000
45 B	1.383	.015	7.006	7.142
45 E	1.162	.383	7.434	7.53[illegible]
50 B	.425	1.076	7.434	7.524
50 E	.000	1.283	6.976	7.093
55	.000	.000	.000	.000

ATTACHMENT 1 TO CALC. C11-1



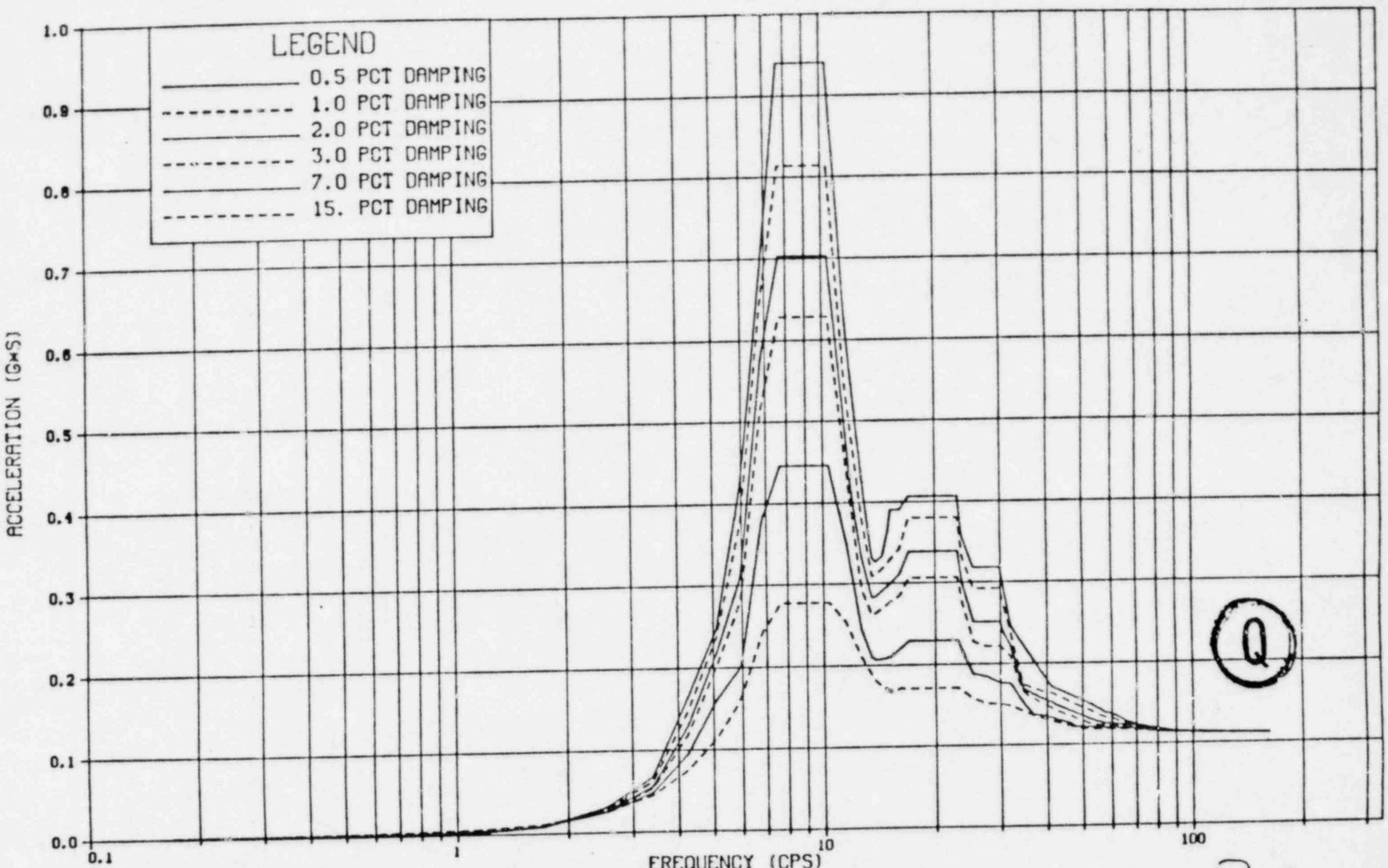


SPECTRA NODE30 DRYWELL EL. 147.58 HORZTL
SRVA ALL SRVA LOAD CASES SCALE FACTOR - .65

13 89

Calc. No.: C-6879.0. Rev. 0

RESPONSE SPECTRA ENVELOPES



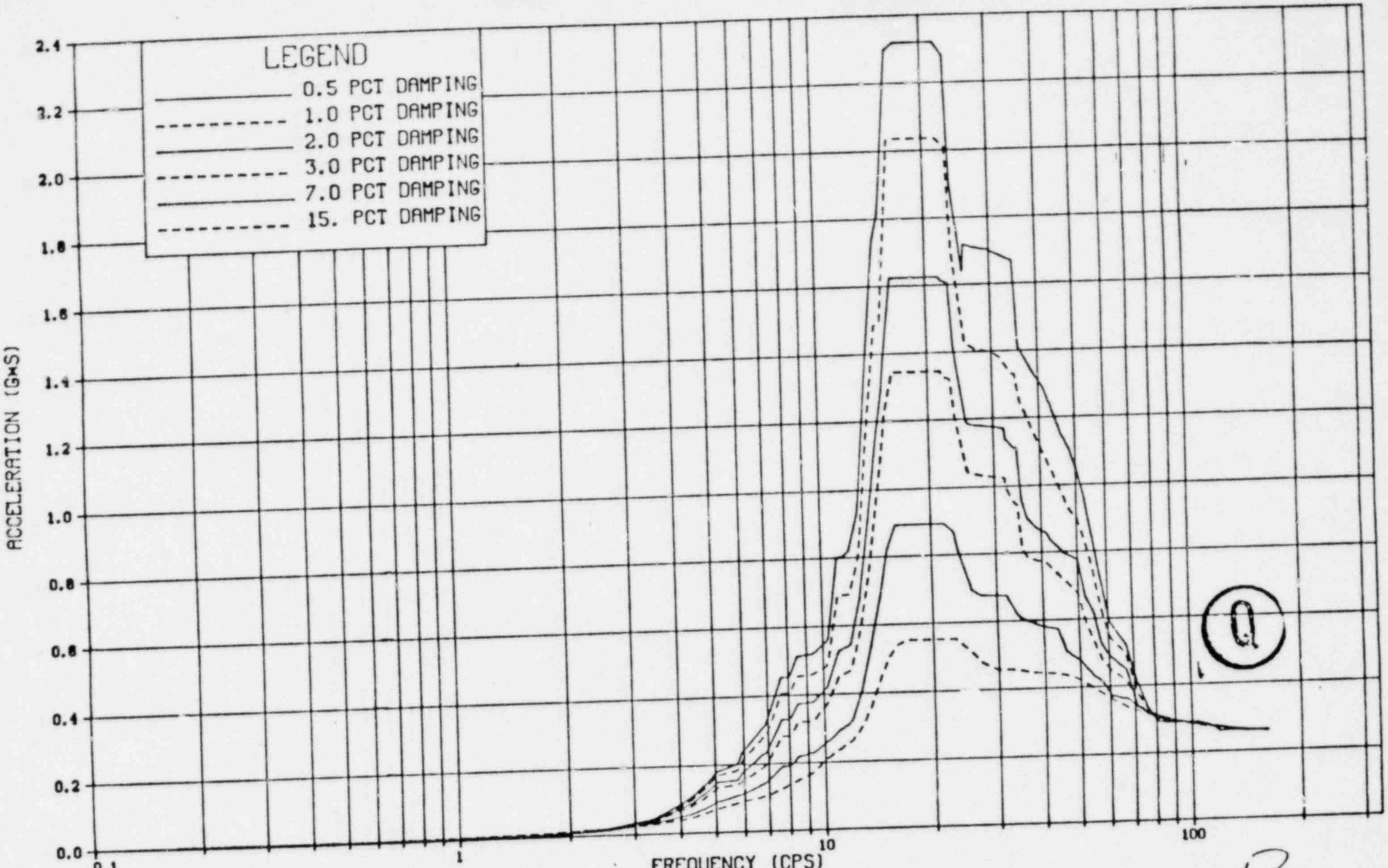
SPECTRA NODE30 DRYWELL EL.147.58 VERTCL
SRVA ALL SRVA LOAD CASES SCALE FACTOR - .65

Pg 90

Calc. No.: C-6879.Q Rev. 0

PLOT 14 09.08.42 TUES 3 JUL, 1979 JOB-RAJDE30 . CYBERNET SCOPE3.1 DISSPLA VER 7.5

RESPONSE S :CTRA ENVELOPES



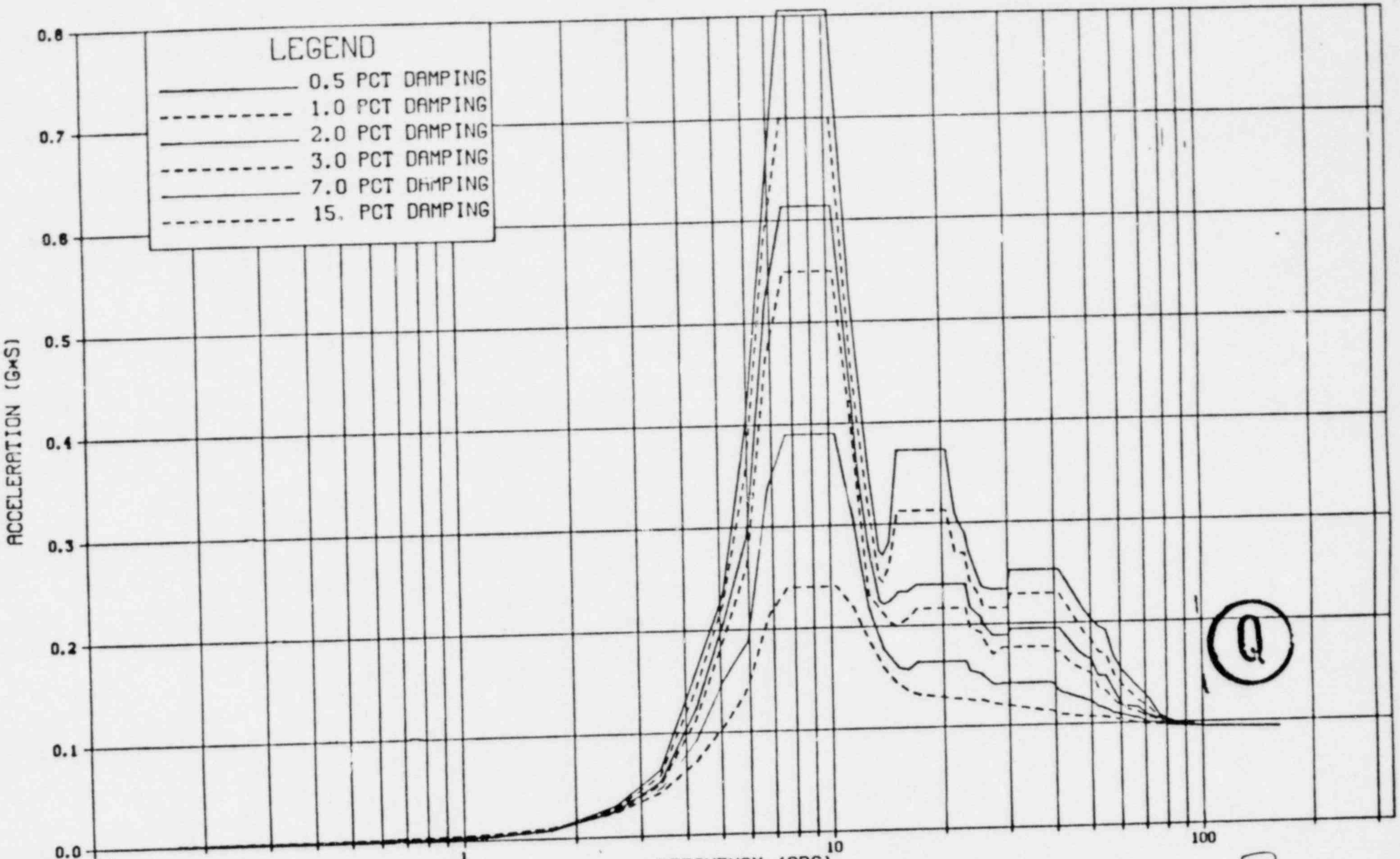
SPECTRA NODE48 DRYWELL EL.120.83 HORZTL
SRVA ALL SRVA LOAD CASES SCALE FACTOR - .65

Pg 109

Calc. No.: C-G8??.0, Rev. 0

JT 33 09.13.12 TUES 3 JUL, 1979 JOB-RAJDE30 . CYBERNET SCOPE3.4 DISSPLA VER

RESPONSE SPECTRA ENVELOPES



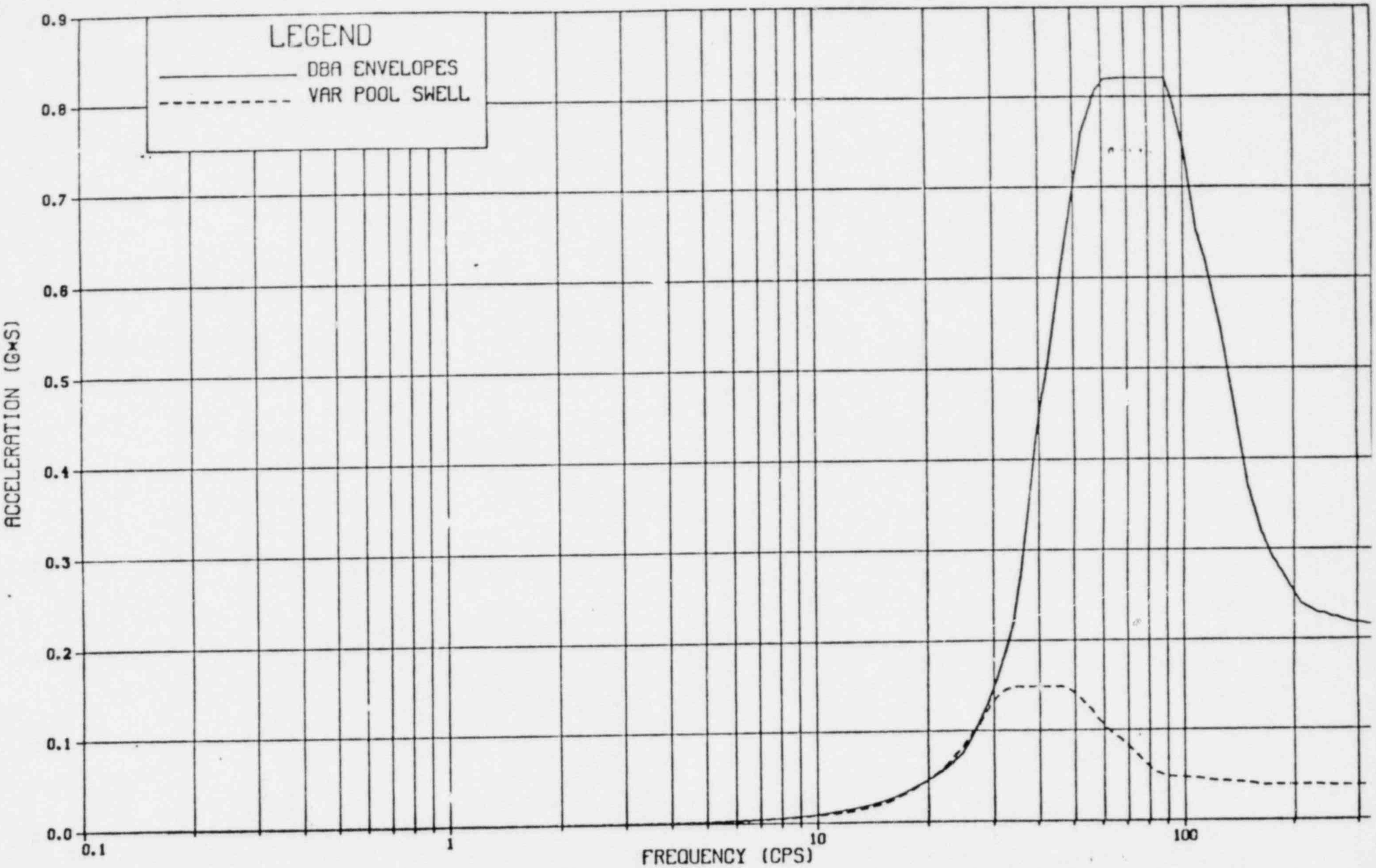
SPECTRA NODE48 DRYWELL EL.120.83 VERTCL
SRVA ALL SRVA LOAD CASES SCALE FACTOR - .65

Pg 110

Calc. No.: C-6879.0, Rev. 0

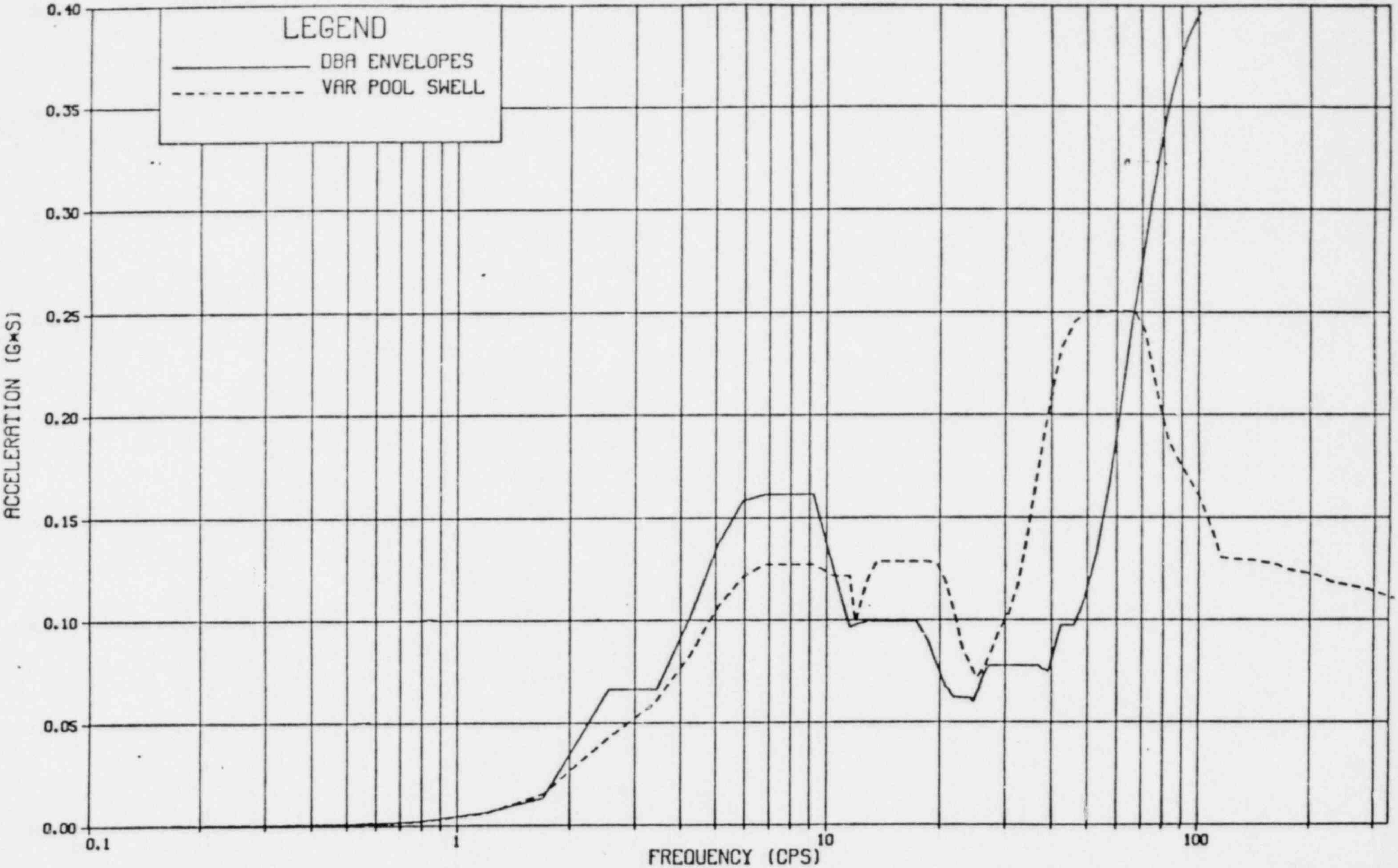
T 34 09.13.14 TUES 3 JUL, 1979 JOB-RAJDE30 . CYBERNET SCOPE3.4 DISSPLA VER 7.5

RESPONSE SPECTRA COMPARISON



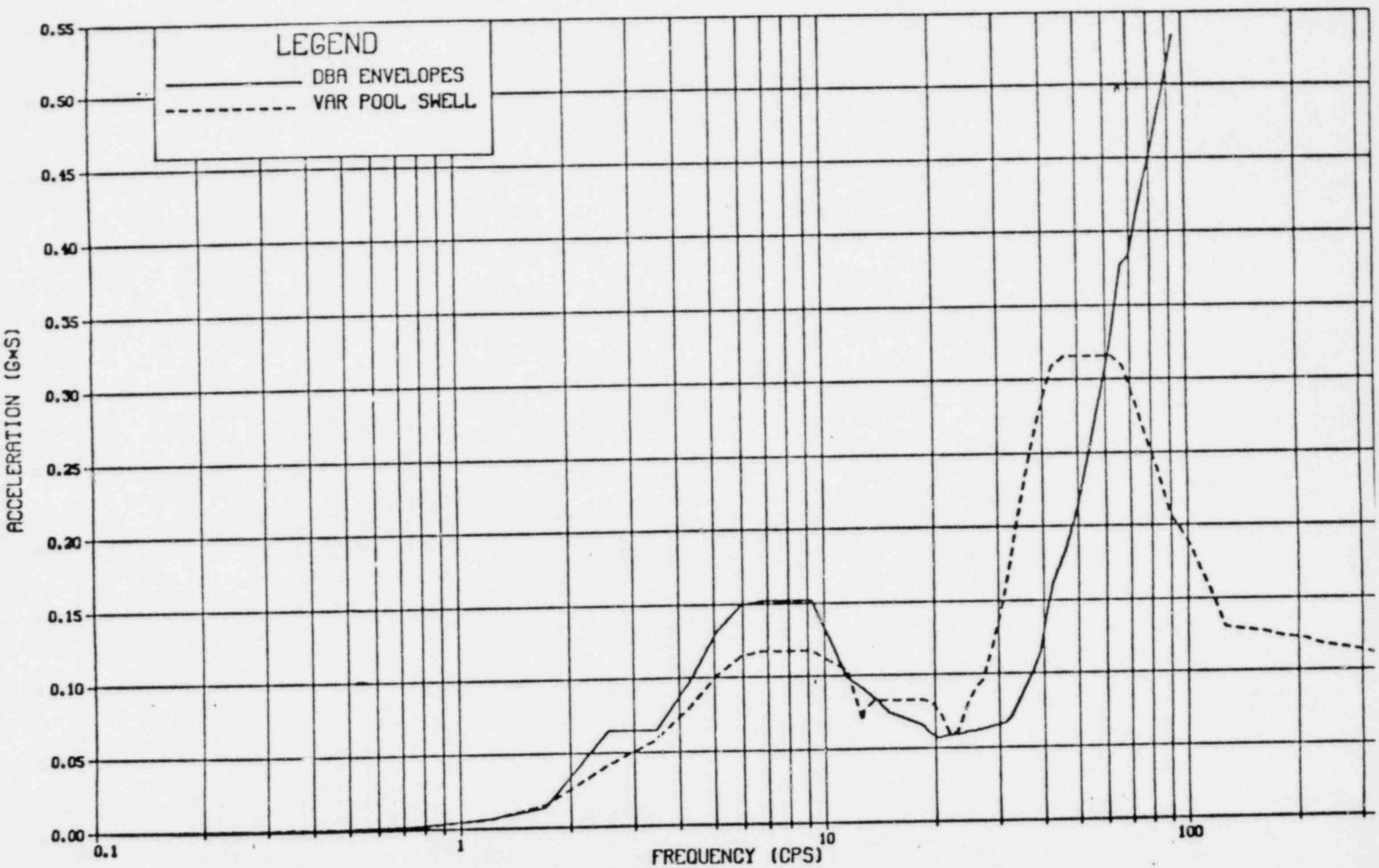
SPECTRA NODE30 DRYWELL EL.147.58 RADIAL
LOCA DBA VS VARIABLE POOL SWELL DAMPING- 2.000

RESPONSE SPECTRA COMPARISON



SPECTRA NODE30 DRYWELL EL.147.58 VERTCL
LOCA DBA VS VARIABLE POOL SWELL DAMPING- 2.000

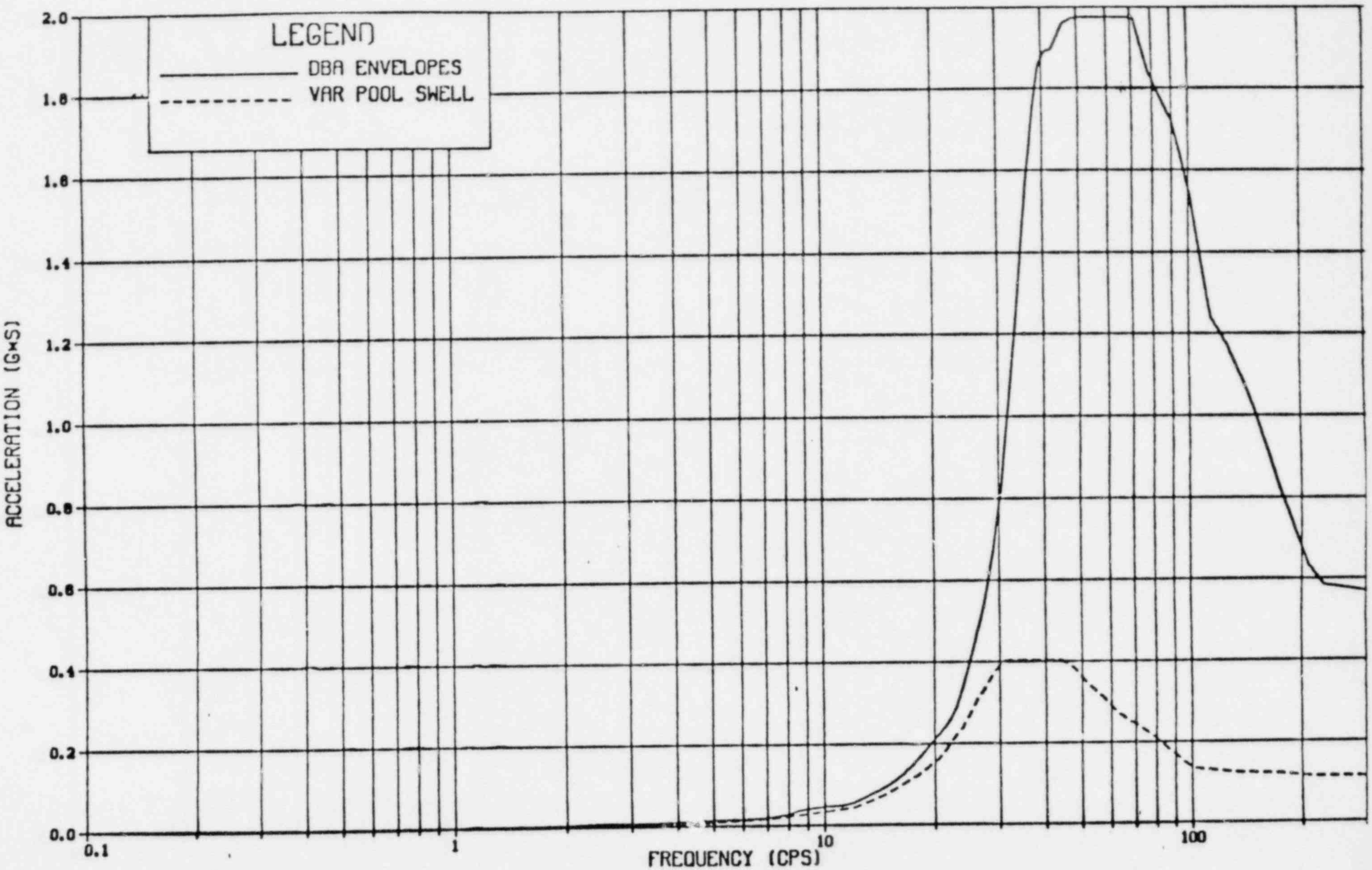
RESPONSE SPECTRA COMPARISON



SPECTRA NODE48 DRYWELL EL.120.83 VERTCL
LOCA DBA VS VARIABLE POOL SWELL DAMPING- 2.000

08.42.36' FRI 30 APR, 1982 JOB-RACDE12 , CYBERNET SCOPE3.4 DISSPLA VER 8.2

RESPONSE SPECTRA COMPARISON

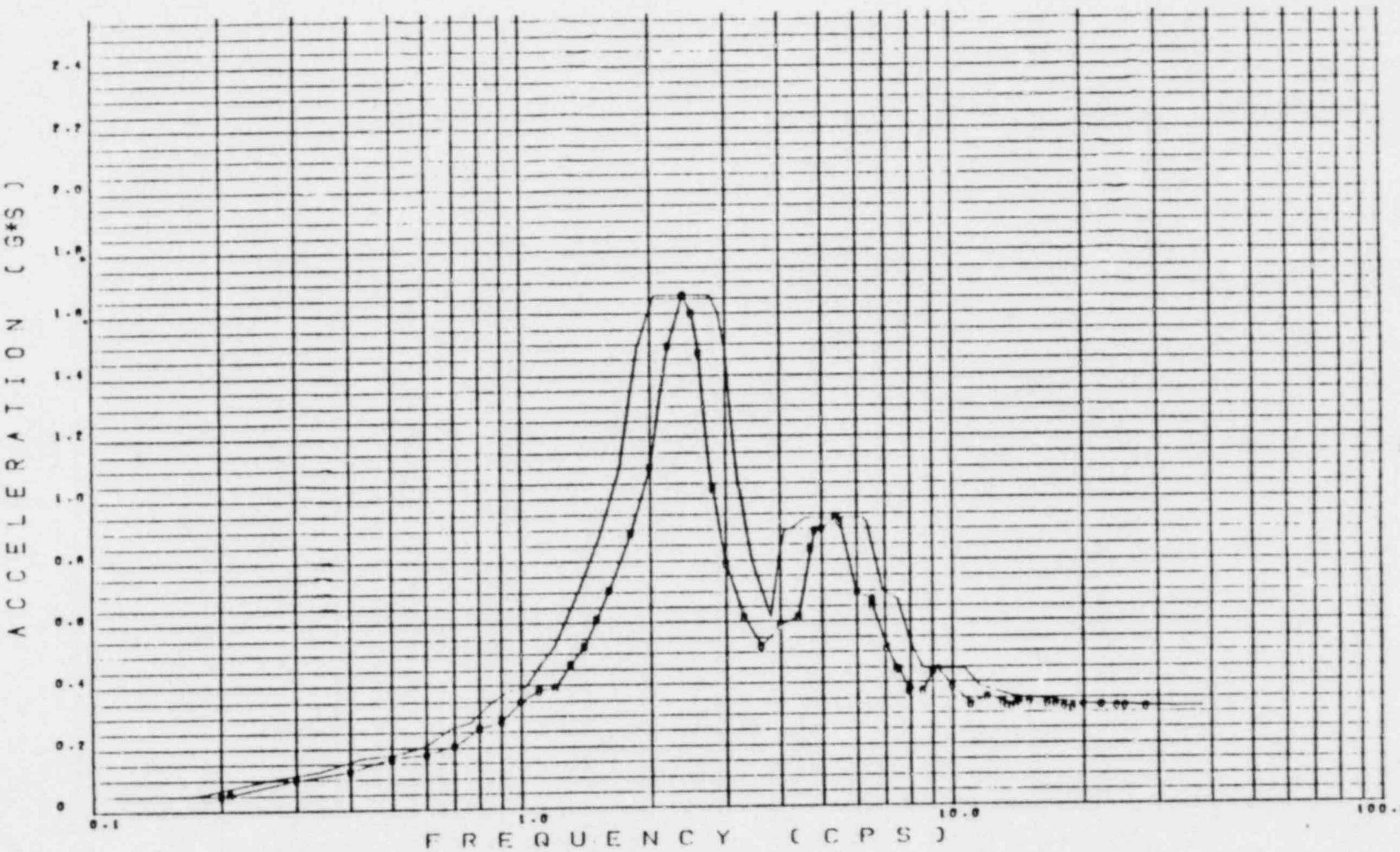


SPECTRA NODE48 DRYWELL EL.120.83 RADIAL
LOCA DBA VS VARIABLE POOL SWELL DAMPING- 2.000

08.42.27 . FRI 30 APR, 1982 JOB-RNODE12 , CTEERNET SCOPE3.4 DISSPLA VER 8.2

DAMPING = .0200

BECHTEL CORPORATION



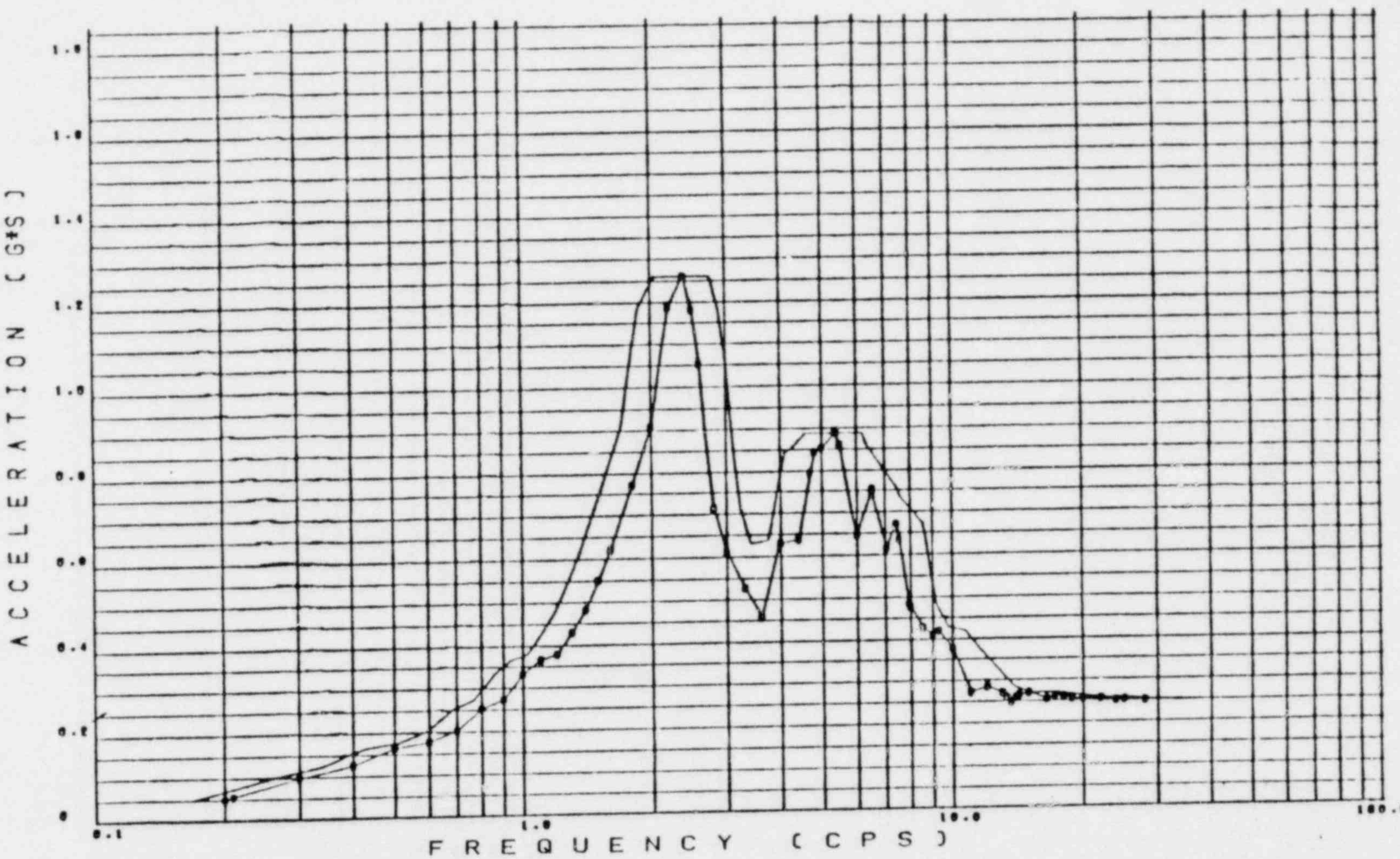
SPECTRA NODE 14 DRYWELL EL. 142.33

SSE E-W

E113

DAMPING = .0200

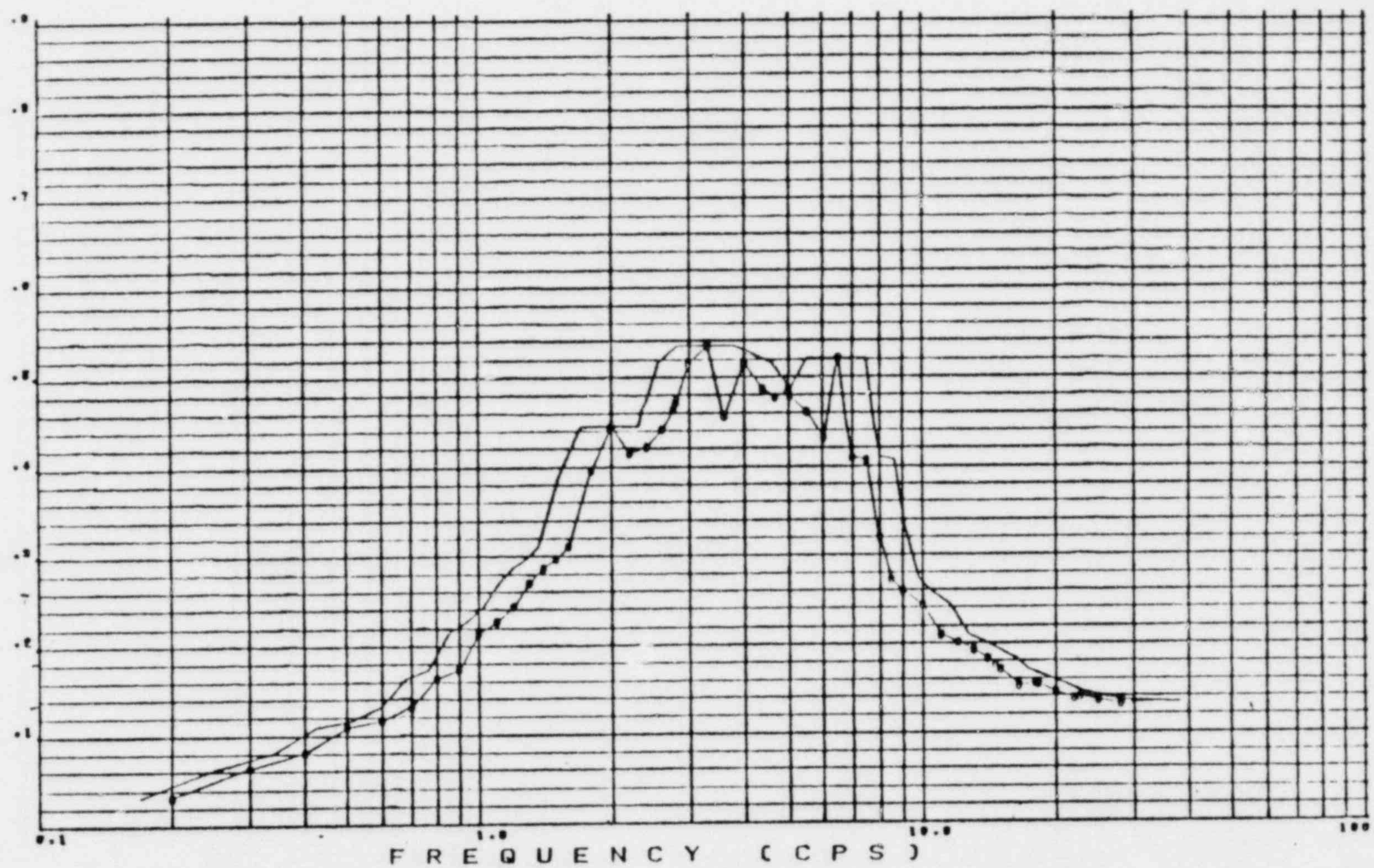
BECHTEL CORPORATION



SPECTRA NODE 13 DRYWELL EL. 117.33
SSE E-W

E1013

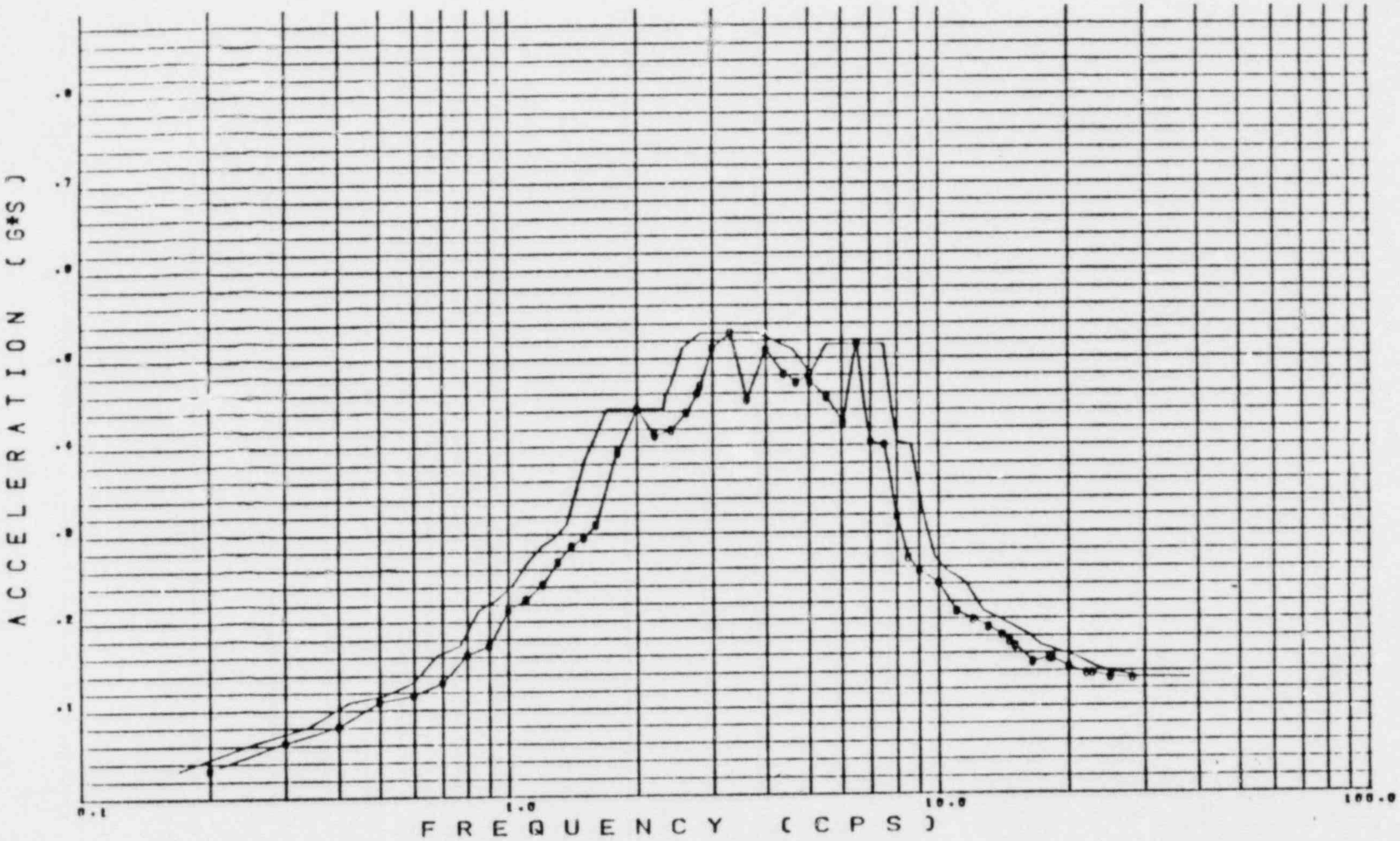
DAMPING = .0200 BECHTEL CORPORATION



SPECTRA NODE 14 DRYWELL EL. 142.33
SSE VERTICAL

DAMPING = .0200

BECHTEL CORPORATION

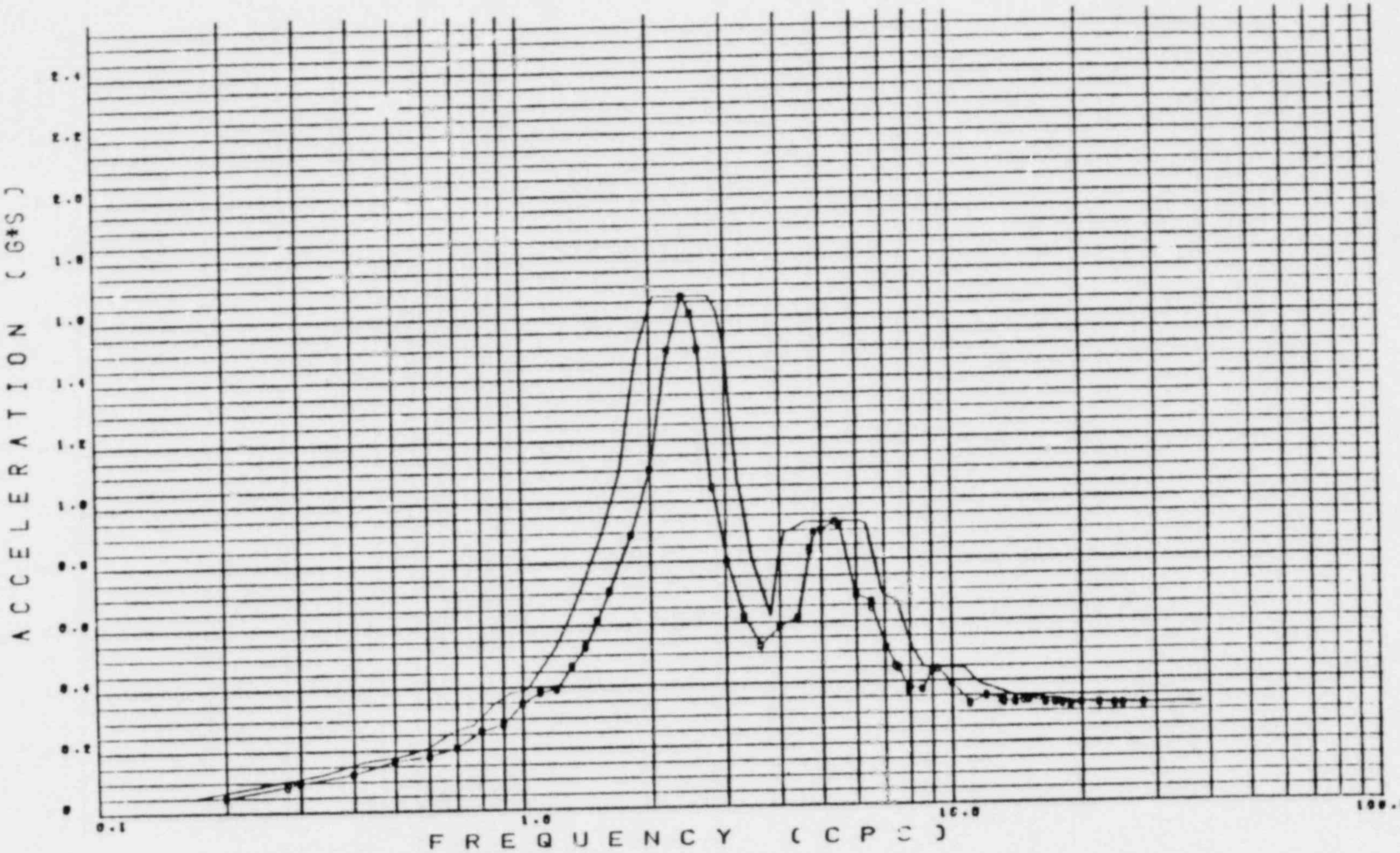


SPECTRA NODE 13 DRYWELL EL. 117.33
SSE VERTICAL

V1013

DAMPING = .0200

BECHTEL CORPORATION

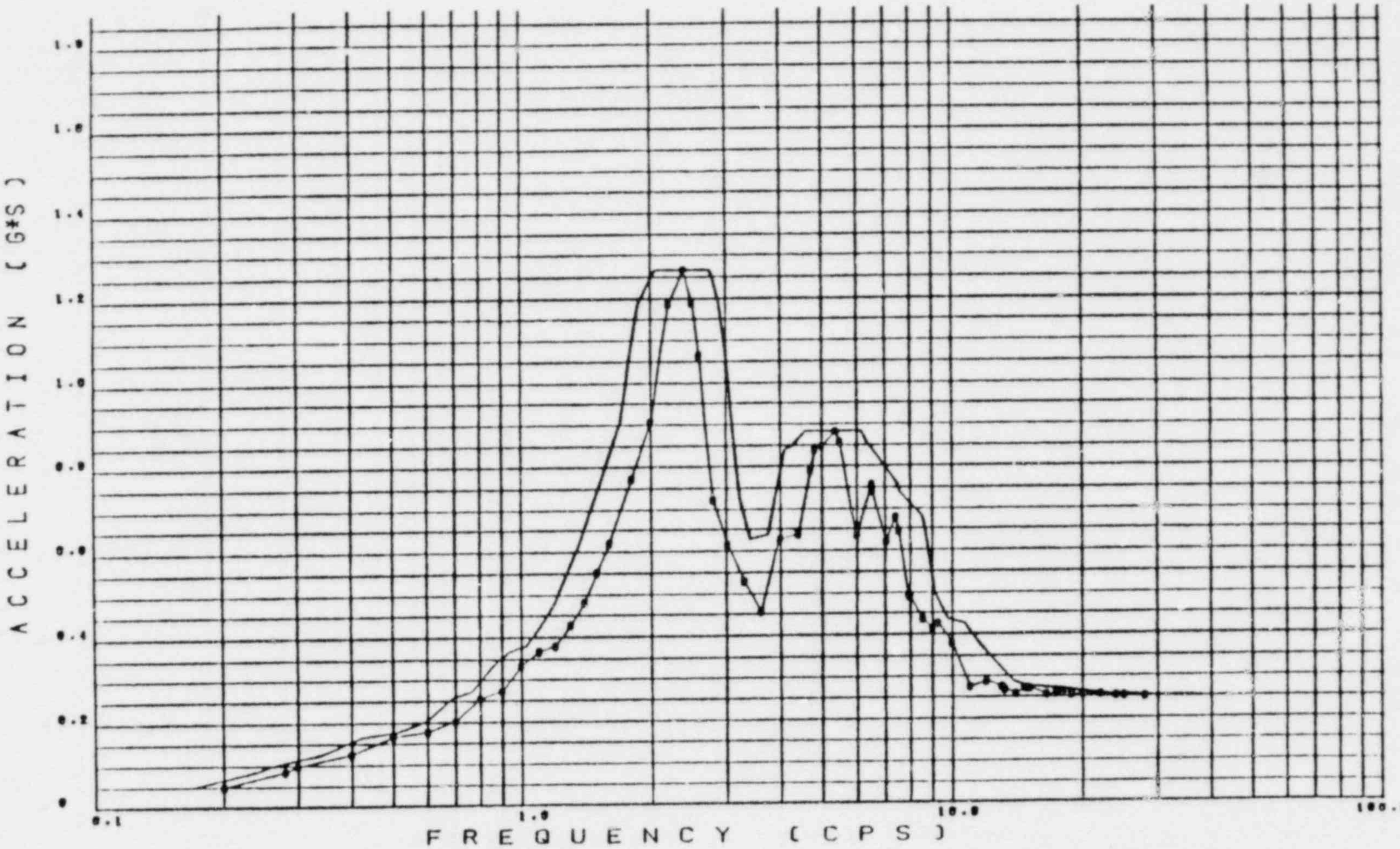


SPECTRA NODE 14 DRYWELL EL. 142.33
SSE N-S

N1113

DAMPING = .0200

BECHTEL CORPORATION



SPECTRA NODE 13 DRYWELL EL. 117.33
SSE N-S

N1013

QUALIFICATION OF THE CRD SOLENOID VALVE (MPL NO. C11-F009)

The valve name plate data identified the Grand Gulf Unit 1 CRD Solenoid Valve as an Automatic Switch Company (ASCO) Model 8323A22 dual solenoid valve (See attached Communication Record dated 3/31/82 between D. Bost and C. Nakayama). The ASCO Model 8323A22 was tested as part of the Zimmer/La Salle seismic requalification program conducted by NUTECH. The tests included resonance searchs from 1 to 100 Hz, biaxial random vibration seismic simulation, and fragility. The specimen functioned satisfactorily throughout testing. Peak loads were 8.6g horizontal and 8.1g vertical during seismic simulation and 12g during fragility testing with a 50 Hz sine wave input.

The test fixture simulated the mounting conditions of the Zimmer and La Salle installations.

The test exceeds the requirements for Grand Gulf Unit 1.

NUTECH COMMUNICATION RECORD

Persons Involved: D. Bost	Date/Time: 3/31/82 9:43 AM
Company: MP&L	Recorded By: CEN
☑ Telecon/Ph. No. (601) 437-5260 x2873	Copy To: GC, PD.
☐ Meeting/Location	Route To:
File:	Page 1 of 1

SUBJECT: JIO Information

Denny relayed the following information on the ASCO model solenoid valve:

Catalog No.: HT8323A22
Ser #: 626402
Orifice: 3/32
pipe: 1/4
electrical: 9 watts
50 hz
110 V.

Air: Air / 110.

I requested ~~pre-opns +~~ a teleconference between his preopns engineers on the B-21 sys and P. Donnelly today. Denny will be tracking them down, and will call us back in 1-2 hrs to arrange the conference.

He will be sending us the acceptance letter for Dynamic Testing & Analyses + JIO work end of this week; we will need to follow up with a work order.

Denny will be expecting us to Federal Express our write ups today.

ATTACHMENT NO. 4

Conductivity Cell
(E12-N025A, B)

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-06

EQUIPMENT NAME: Conductivity Cell

SPEC. NO: 163C1544P012

EQUIPMENT NO: E12-N025A, B

LOCATION: Auxiliary Building, 93'-0"

EQUIPMENT CLASSIFICATION: ☐ ACTIVE ☒ PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: R.P. Morton
R.P. Morton

APPROVED: for C E Nakayama
V.J. Brocato

DATE: 4/29/82

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name Conductivity Cell

2. Equipment No. E12-N025A, B

3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   The conductivity cell assembly is qualified for combinations of dead weight, internal pressure, thermal expansion and seismic loads for ASME Code class 2 service levels A through D.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
1	Spec. 9645-M-220.0	Rev. 13	Design Specification for Nuclear Piping System for Mississipp Power & Light Compan Grand Gulf Nuclear Station, Units 1 and 2, Grand Gulf, Mississippi

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
NUTECH File Number 32.1206.0200	Rev. 1	Seismic Qualification Analysis for the Conductivity Cell (1" Valve Connected to the RHR Line) See Attached

4. Functional Requirements

The conductivity cell must maintain its pressure retaining capability during and after a seismic event. Operability is not required.

5. Demonstration Capability

Calculations demonstrate that the attachment nipple is capable of withstanding a seismic event of greater than 6g's multiplied by a calculated DLF.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

The most critical component affecting the pressure integrity of the conductivity cell is the 1" attachment nipple. Nipple stress was determined for combinations of dead weight, internal pressure, thermal expansion and seismic loads for ASME code class 2 service levels A through D. In no case were the calculated stresses greater than 60 percent of the allowable stresses.

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit I — Type:

1. Utility: Mississippi Power and Light Co. — PWR ____________

2. NSSS: G.E. — 3. A/E: Bechtel Power Corp. — BWR 6, Mark III

II. Component Name: Conductivity Cell

1. Scope: [X] NSSS   [ ] BOP

2. Model Number: GV1-2-N/910-.1T-1HN   Quantity: 2

3. Vendor: Balsbaugh (Division of Foxboro Corp.)

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

5. Physical Description a. Appearance 1" Valve with 1" NPT Nipple & 1" NPS Attached Pipe

   b. Dimensions 10" Maximum with nipple and 1" NPS pipe

   c. Weight Valve (10 lbs.) + pipe & Nipple = 12 lbs.

6. Location: Building: Auxiliary Building

   Elevation: 93'-0"

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [ ] Weld (Length____)
   [x] 1" NPT nipple

8. a. System in which located: Residual Heat Removal

   b. Functional Description: Monitor water quality during a line flush prior to activating system

   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

   [x] Both [ ] Neither

9. Pertinent Reference Design Specifications: G.E. Purchase Part Drawing 163C1544P012

Prepared by: R. P. Morton 4/29/82

Verified by: Babram Fatemi 4/29/82

12/80

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

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

Qualification Report*: Seismic Qualification for the Conductivity Cell

(No., Title and Date) (1" Valve Connected to the RHR Line) 4/16/82
NUTECH File: 32.1206.0200

Company that Prepared Report: NUTECH

Company that Reviewed Report: NUTECH

V. Vibration Input:

1. Loads considered: a. [x] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] N/A (other, specify)

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

4. Damping Corresponding to RRS: OBE ______ SSE N/A

5. Required Acceleration in Each Direction: [ ] ZPA [x] Other per Bechtel Spec. (specify)

OBE	S/S =	F/B =	V =	
SSE	S/S = 6.0g	F/B = 6.0g	V = 6.0g	

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

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

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

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ________ SSE ________ Other ________ (specify)

4. Frequency Range: ________________________

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

   S/S = ____________ F/B = ____________ V = ____________

6. Method of Determining Natural Frequencies

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

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs
   [ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

   SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

   1. [ ] Bolt (No.____, Size____) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ________________________

    ____

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

    ____

    ____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis   [x] Equivalent Static Analysis

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

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

   S/S = 182.   F/B = 182.   V = 182.

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

   [ ] Finite Element   [X] Beam   [ ] Closed Form Solution

4. [ ] Computer Codes: PISTAR

   Frequency Range and No. of modes considered: 182. Hz to 771. Hz, 4 modes

   [X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [X] Other: SRSS moments in three directions (absolute sum in each direction)

6. Damping: OBE 1%   SSE 1%   Basis for the damping used: Reg. Guide 1.61

7. Support Considerations in the model: Valve cantilevered at nipple.

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable	ASME Code Class 2
Bending + Axial	Valve Nipple	Seismic + DL + Int. Pressure + Thermal	8.5ksi 17.0ksi	10.8ksi 19.3ksi	21.1ksi 31.9ksi	(level B) (level C)

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
N/A		

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Project: Grand Gulf Nuclear Station — File No. 32.1206.0200
Owner: Mississippi Power and Light Co.
Client: Mississippi Power and Light Co.

SEISMIC QUALIFICATION ANALYSIS

FOR THE CONDUCTIVITY CELL

(1" VALVE CONNECT TO

THE RHR LINE)

*Addendum added for calculations of shear stress in nipple threads.

Revision	0	1	2*		
Prepared By/Date	BF/4-16-82	BF/4-28-82	RPM 6/3/82		

Contents

		Page
I.	Purpose	3
II.	Conductivity Cell Environment	3
III.	Method of Analysis	3
VI.	Dimensions and Properties	4
V.	Calculation of the Section Modulus and the Cross-Sectional Area of the Nipple	5
VI.	Stress Calculation Due to Dead Weight	7
VII.	Stress Calculation Due to Thermal Expansion	7
VIII.	Stress Calculation Due to Internal Pressure	8
IX.	Stress Calculation Due to Seismic Loads	8
X.	Stress Summary and Code Evaluation	11
XI.	Conclusion	12
	References	13

Rev.1

I. Purpose

Evaluate (based on seismic category 1, and ASME Class 2 equipment) the pressure integrity of the conductivity cell when subjected to combined operating and seismic loading.

II. Conductivity Cell Environment

Design Condition (Reference 1)

Temperature = 350° F
Pressure = 500 psi

Operating Condition (Reference 1)

Temperature = 250° F
Pressure = 310 psi

Seismic Loads (Reference 2)

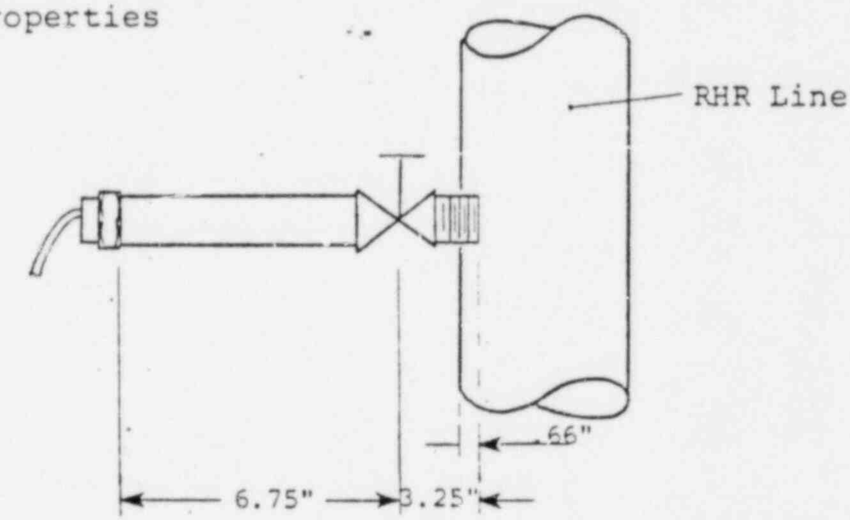
Peak excitation acceleration = 6g

III. Method of Analysis

The most critical component affecting the pressure integrity of the conductivity cell is the 1" nipple. (Which connects the 1" valve to the RHR line.) The stress in the 1" nipple is estimated according to dead weight, thermal expansion, and seismic loads.

The seismic response is calculated with the conservative assumption that the excitation is the harmonic force with a frequency to which the conductivity cell responds most critically.

IV. Dimensions and Properties



Properties:

Nipple:

Size = 1" N.P.T. schedule 80	(3)	
O.D. = 1.315"	(4)	
I.D. = .957"	(4)	
Wall Thickness = .179"	(4)	
Height of Thread = .06957"	(5)	
Engagement Length = .66"	(5)	
Material = 316 SS	(6)	
Damping = ξ = 1% (small pipe)	(8)	Rev. 1
SIF = .75*2.3= 1.725 S_C = 18.7 ksi (@100 ^oF) S_H = 17.7 ksi (@350 ^oF) S_A = 1.25*18.7 + .25*17.7 = 27.8 ksi	(7)	Rev. 1

Valve:

Material = Stainless Steel ASTM A351
CF - 8M
CF - 3M (3)

Weight = 10 pounds (6)

Assumption

- The 6.75" pipe is made of the same material that the 1" nipple is made of (316 SS)

  Weight of the 6.75" pipe = $\frac{6.75}{12} * 2.172 = 1.22$ lb

- The weight of the nut and the assembly at the end of the 1" pipe is conservatively estimated to be 2.5 lbs. | Rev. 1

V. Calculation of the section modulus and the cross-sectional area of the nipple.

Assume the weakest point is the bottom of the thread.

$$z_N = \frac{I}{C}$$ | Rev. 1

Where

$$I = \frac{\pi}{64}\left[(OD_{min})^4 - ID^4 \right]$$

$$= \frac{\pi}{64}\left[(1.315 - 2* .06957)^4 - .957^4 \right]$$

$$= .05267 \ in^4$$

and

$$C = OD/2 - \text{Thread Height}$$
$$= 1.315/2 - .06957$$
$$= .5879 \ in$$

Substituting the values for I and C into equation (1), the section modulus of the nipple can be calculated

$$z_N = .05267/.5879$$

Rev. 1

$$= .0896 \ in^3$$

$$A_N = \frac{\pi}{4}\left[(OD_{min})^2 - ID^2 \right]$$

$$= \frac{\pi}{4}\left[(1.315 - 2* .06957)^2 - .957^2 \right]$$

$$= .367 \ in^2$$

VI. Stress Calculation Due to Dead Weight

The whole assembly is mounted vertically. Let the mass center of the valve be d = 6" off-center. (conservative estimation reached by scaling from reference 1)

$$\sigma_{DW} = \left(\frac{M}{Z_N}\right) * SIF$$

$$= \left(\frac{10 * 6}{.0896}\right) * 1.725$$

$$= 1,155 \text{ psi}$$

Rev. 1

VII. Stress Calculation Due to Thermal Expansion

Since one side of the 1" pipe is connected to a flexible wire, then the entire assembly can grow without any

restriction. Consequently, the stress due to thermal expansion is zero.

$$\sigma_{TH} = 0$$

VIII. Stress Calculation Due to Internal Pressure

$$\sigma_P = \frac{Pr}{2t}$$

$$= \frac{500\ (.957/2)}{2(.179 - .06957)}$$

$$= 1{,}093 \text{ psi}$$

Rev. 1

IX. Stress Calculation Due to Seismic Loads

A simple finite element model of the entire assembly is set up (for details see Appendix A). Natural frequencies for the entire assembly are then obtained.

First natural frequency = W_N = 182. Hz

Rev. 1

The dynamic magnification factor can now be calculated from the following equation (9)

$$DLF = \frac{1}{\sqrt{\left[1 - \left(\frac{W}{W_N}\right)^2\right]^2 + \left[2\,\xi\left(\frac{W}{W_N}\right)\right]^2}}$$

(harmonic excitation, Conservative)

using

$W_N = 182.$ Hz

W = 33 Hz (highest frequency content of an earthquake)

One can calculate the DLF to be

$$DLF = \frac{1}{\sqrt{\left[1 - \left(\frac{33}{182}\right)^2\right]^2 + \left[2 * .01 \left(\frac{33}{182}\right)\right]^2}}$$

= 1.03 (The assembly responds almost statically to earthquakes) Rev. 1

Responds acceleration = 6*1.03 = 6.2 g

A. Bending moment due to horizontal excitation: The bending moment at the base of the 1" nipple due to horizontal excitation can be calculated by multiplying the inertia forces (F = ma) by the appropriate moment arms.

M_H = 10* 6.2 * (3.25 - .66) + 1.22*6.2*(6.75/2 + 3.25 - .66)

+ 2.5 * 6.2 * (6.75 + 3.25 - .66)

= 350 in-lb (acting in two directions)

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Owner: Mississippi Power and Light Co.

Client: Mississippi Power and Light Co.

B. Bending Moment due to vertical excitation: The bending moment at the base of the 1" nipple due to vertical excitation can be calculated by multiplying the inertia force (F = ma) by the appropriate moment arm.

$$M_V = 10 * 6.2 * 6$$

$$= 372 \text{ in-lb}$$

Rev. 1

C. Torque: The torque created due the off-centeredness of the mass of the valve can be calculated as follows:

$$M_T = 10 * 6.2 * 6$$

$$= 372 \text{ in-lb}$$

And finally the seismic moment can be calculated as follows:

$$M_{seismic} = M_S = \sqrt{(M_H + M_V)^2 + (M_H)^2 + (M_T)^2}$$

$$= 884 \text{ in-lb}$$

$$\sigma_{SSE} = \left(\frac{M_S}{Z_N}\right) * SIF$$

$$= \left(\frac{884}{.0896}\right) * 1.725$$

$$= 17{,}019 \text{ psi} \quad \text{(for SSE)}$$

$$\sigma_{OBE} = 8{,}510 \text{ psi} \quad \text{(for OBE)}$$

Revision		1				Page 10
Prepared By/Date		BK 4-28-82				of 13
Checked By/Date		[illegible] 4/29/82				

X. Stress Summary and Code Evaluation

The following is a summary of the stress calculated for the conductivity cell.

Event	Stress (psi)
Dead Weight	1,155
Thermal Expansion	0
Internal Pressure	1,093
Seismic (SSE)	17,019
Seismic (OBE)	8,510

The following is the code evaluation table:

Rev. 1

Service Level	Code Requirement (equation)	Calculated Stress (psi)	Allowable Stress (psi)	Pass/fail
A	$\sigma_{TH} \leq 1.S_A$	0	27,800	pass
A	$\sigma_P + \sigma_{DW} \leq 1.S_H$ (8)	2,248	17,700	pass
B	$\sigma_P + \sigma_{DW} + \sigma_{OBE} \leq 1.2S_H$ (9)	10,753	21,240	pass
C	$\sigma_P + \sigma_{DW} + \sigma_{SSE} \leq 1.8S_H$ (9)	19,267	31,860	pass
D	$\sigma_P + \sigma_{DW} + \sigma_{SSE} \leq 2.4S_H$ (9)	19,267	42,480	pass
TEST	$1.25\sigma_P + \sigma_{DW} \leq 1.S_H$	2,521	17,700	pass

XI. Conclusion

Since all the calculated stresses (for all service levels) are below allowable stress limits, it is then concluded that the 1" nipple (which is the weakest point) and consequently the entire assembly for the conductivity cell, will meet the requirements of the ASME Boiler and Pressure Vessel Code, 1980 Edition. Rev. 1

This qualifies the conductivity cell to be Safe to operate in the environments explained in Section II of this report.

References

1. General Electric DWG 163C1544 SH No.2, "Purchased Part Conductivity Cell", Rev. 4.

2. Bechtel Spec. No 9645-M-220.0, "Design Specifiction for Nuclear Piping Systems for MP&L, Grand Gulf Nuclear Station, Units No. 1 and 2, Grand Gulf Mississippi", Page 15, Paragraph 7.12.B., Rev. 13, 12-23-81. Rev.1

3. General Electric DWG 163C1544 SH No. 1, "Purchased Part Conductivity Cell", Rev. 4.

4. Properties of Pipe Table, Bergen-Paterson catalog.

5. Machinery's Handbook, 18th Edition, Industrial Press, Southeast.

6. NUTECH Communication Record, Telephone Conversation between Steven Hicks (from Foxboro Corp.) and R. Morton, File 32.1206.0001, 4-9-82.

7. ASME Boiler and Pressure Vessel Code, 1980, Section III, Division 1. Rev.1

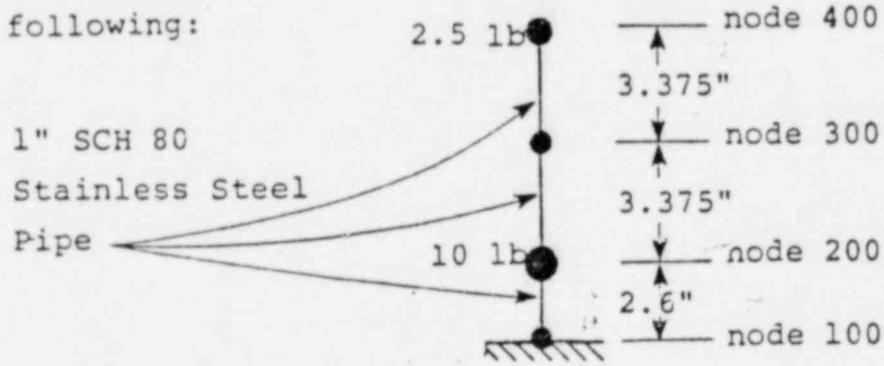
8. U.S. Atomic Energy Commission, Regulatory Guide 1.61, "Damping Values for Seismic Design of Nuclear Power Plants."

9. William T. Thomson, "Theory of Vibration With Applications", 2nd Edition, Prentice Hall, 1981.

APPENDIX A

Simple Finite Element Model of the Entire Assemble of the Conductivity Cell:

PISTAR computer program is used to build a finite element model for the following: Rev. 1



Natural frequencies are calculated from a PISTAR model extraction run (Run ID = BOF32AC). The next two pages are copies of inputs and outputs extracted from the referenced PISTAR model computer run.

Rev. 1

INPUT DATA ECHO PRINT

```
    1         11        21        31        41        51        61        71        81
    :         :         :         :         :         :         :         :         :

 1 TITLE     CONDUCTIVITY CELL
 2 ID        CLIENT=GRAND GULF NUCLEAR STATION
 3 ID        PROJECT NAME=EQUIPMENT QUALIFICATION
 4 ID        PROJECT NUMBER=MPL-0607
 5 ID        PREPARED BY=B. FATEMI
 6 ID        CHECKED BY=
 7 GEOMETRY  CONDUCTIVITY CELL
 8 START     100
 9 CLASS 2
10 PIPE      100  200  0.0       2.6       0.0                 1    1
11 PIPE      200  300  0.0       3.375     0.0                 1    1
12 PIPE      300  400  0.0       3.375     0.0                 1    1
13 ADD WEIGHT200       10.0      10.0      10.0
14 ADD WEIGHT400       2.50      2.50      2.50
15 PROPERTY  1                                       1.00SCH80 WATER
16 MATERIAL  1                                       STAINLESS
17 ANCHOR    100
18 END GEOM
19 LOADING   DW,MOD. EXT.
20 CASE      DW
21 DEAD LOAD
22 PRINT               YES
23 CASE      MX
24 FREQUENCY           10        1000.
25 END LOADS

    :         :         :         :         :         :         :         :         :
    1         11        21        31        41        51        61        71        81
```

Rev. 1

Revision 1

Prepared by/date BF/4-28-82

Checked by/date [signature] 4/29/82

File: 32.1206.0200

F R E Q U E N C I E S   A N D   P E R I O D S

-- VERSION 1.5.2 --

EIGENVALUE PROBLEM LOADING CONDITION MX

MODE NUMBER	CIRCULAR FREQUENCY (RAD/SEC)	FREQUENCY (CYCLES/SEC)	PERIOD (SEC)
1	.1142E+04	.1817E+03	.5503E-02
2	.1142E+04	.1817E+03	.5503E-02
3	.4847E+04	.7714E+03	.1296E-02
4	.4847E+04	.7714E+03	.1296E-02

Rev. 1

Revision 1
Prepared by/date BF/4-28-82
Checked by/date AJ 4/29/82

File: 32.1206.0200

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San Jose, California

Project Grand Gulf Nuclear Station File No. 32.1206.020

Owner Mississippi Power and Light Co.

Client Mississippi Power and Light Co.

Addendum to
Seismic Qualification Analysis for the
Conductivity Cell Rev. 1 April 1982

Shear Stress Calculation:

Pressure load;

$F = PA$

Where $A = \pi r_m^2 = 0.719$ in.^{2}

and P = 500 PSI

Therefore F = 500 x 0.719 = 359.5 lbs.

Seismic load;

$F = m\ a$

Where $m = \frac{W}{g}$ = mass $\frac{\text{lb-sec}^2}{\text{in}}$

and a = 6 g acceleration $\frac{\text{in}}{\text{sec}^2}$

Therefore, $F = \frac{12.5}{g}$ x 6g x 1.03 = 77.25 lbs.

F_T = Press. load + Seismic load

F_T = 359.5 + 77.25 = 436.75 lbs.

Revision	1					Page 1 of 2
Prepared By/Date	[illegible] 6/2/82					

Min. Root Diameter = 1.17"

Pitch = 0.08696 in

$A = \pi\ 1.17 \times 0.08696 = 0.3196 \ \frac{in^2}{\text{one thread ring}}$

no. of threads engaged = 6 ASME Code

$A_T = 6 \times 0.3196 = 1.92\ in^2$

$= \frac{Ft}{A} = \frac{436.76}{1.92} = 227.5$ psi

9,660 psi (allowable) $\gg$ 227.5 psi

ATTACHMENT NO. 5

Air Operated Butterfly Valves
(M-257.0/258.0)

Valve Acceleration Data

Valve No.	Valve Acceleration (g's)	Actuator Acceleration (g's)
P44-F116	1.6380	1.4440
P44-F117	1.6380	1.6680
P44-F118	0.1070	0.2510
P44-F119	0.0320	0.0370
P44-F120	0.0410	0.0390
P44-F121	0.0580	0.0530
P44-F122	0.4485	0.4899
P44-F123	0.0920	0.0920
G41-F019	0.7380	0.8040
G41-F045	1.3240	1.4640

ATTACHMENT NO. 6

Safety Relief Valve
(M-141.1)

Question a: Nozzle loads not addressed.

Response a: Subsections NC/ND 3500 of ASME Section III, 1974 Edition including addenda through Winter 1975, which governs the design and procurement of these valves, does not require evaluation of nozzle loads for Class 2 and Class 3 valves.

Question b: Need verification that the 6.0g loads used in testing will not be exceeded.

Response b: The actual accelerations for the SRV's in question are as follows:

E12F055A	2.014g (SSE)
E12F055B	1.281g (SSE)
E75F026A	2.933g (SSE)
E75F026B	5.025g (SSE)