UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

May 14, 1992

Docket Nos. 50-317
and 50-318

LICENSEE: Baltimore Gas and Electric Company (BG&E)

FACILITY: Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2

SUBJECT: MEETING MINUTES REGARDING THE MAY 5, 1992, MEETING TO DISCUSS THE SEISMIC ANALYSIS OF THE NEW EMERGENCY DIESEL GENERATOR BUILDINGS - CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2 (TAC NOS. M83222 AND M83223)

BACKGROUND:

On July 21, 1988, the Code of Federal Regulations 10 CFR Part 50, was amended to include a new Section 50.63, entitled, "Loss of All Alternating Current Power," referred to as the station blackout (SBO) rule. The SBO rule requires that each light-water cooled nuclear power plant be able to withstand and recover from an SBO of specified duration. The SBO rule also requires that information defined in the rule be provided to the staff for review.

BG&E responded to the requirements of the rule and the staff approved its response by letter dated February 12, 1992. The staff's approval included the addition of two new safety-related Class 1E emergency diesel generators (EDGs). A meeting was held on November 7, 1991, to discuss the design details and modifications associated with the installation of the new EDGs.

PURPOSE:

By letter dated April 24, 1992, BG&E requested the subject meeting. The requested meeting is the first of a series of meetings with the staff to discuss various technical issues associated with the addition of the EDGs. Some of the other topics to be discussed at future meetings include: American Society of Mechanical Engineers (ASME) Code requirements, mechanical and electrical design, instrumentation and controls design, and EDG surveillance requirements.

A list of attendees is attached as Enclosure 1 and the BG&E presentation is attached as Enclosure 2.

SUMMARY:

Representatives of BG&E and its architect/engineer, Bechtel Power Corporation, presented the design and seismic details provided in Enclosure 2, a description of the buildings being designed to house the EDGs, the seismic parameters being used, and the methods and procedures used in performing the seismic analysis was discussed.

Two separate buildings will be constructed to house the new EDGs including their associated diesel fuel tanks and cooling systems (radiators and fans). Provisions are being included in the initial design to add a third separate building at a future date. The seismic design parameters included discussions of the response spectra, time history, critical dumping factors, and the supporting media (soil). The discussion of the seismic analysis methods and procedures included details of the type (dynamic) of methods, natural frequencies, response loads being considered and the procedures used for modeling.

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Donald G. McDonald, Senior Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. List of Attendees
2. BG&E Presentation Handout

cc w/enclosures:
See next page

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Baltimore Gas & Electric Company

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Unit Nos. 1 and 2

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ATTENDANCE LIST

NAME	ORGANIZATION
Daniel G. McDonald	NRC/NRR/DRP
Robert A. Capra	NRC/NRR/DRP
Robert L. Rothman	NRC/NRR/ESGB
Sam Sae-Ung	Bechtel
James C. Cleinik	Bechtel
Eugene W. Thomas	Bechtel
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Wayne A. Smith	Bechtel
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Gary J. O'Connell	Baltimore Gas & Electric

SEISMIC ANALYSIS OF NEW DIESEL GENERATOR BUILDINGS AT CALVERT CLIFFS NUCLEAR POWER PLANT

PREPARED BY
BECHTEL POWER CORPORATION
FOR
BALTIMORE GAS AND ELECTRIC COMPANY

MAY 5, 1992

OUTLINE OF PRESENTATION

A. DESCRIPTION OF STRUCTURES

B. SEISMIC DESIGN PARAMETERS (SRP SECTION 3.7.1)

C. SEISMIC SYSTEM ANALYSIS (SRP SECTION 3.7.2)

D. SUMMARY

A. DESCRIPTION OF STRUCTURES

(SEE FIGURES 1 - 6)

TWO SEPARATE DG BUILDINGS INITIALLY

THIRD SEPARATE DG BUILDING LATER

SEPARATED BY SEISMIC JOINTS

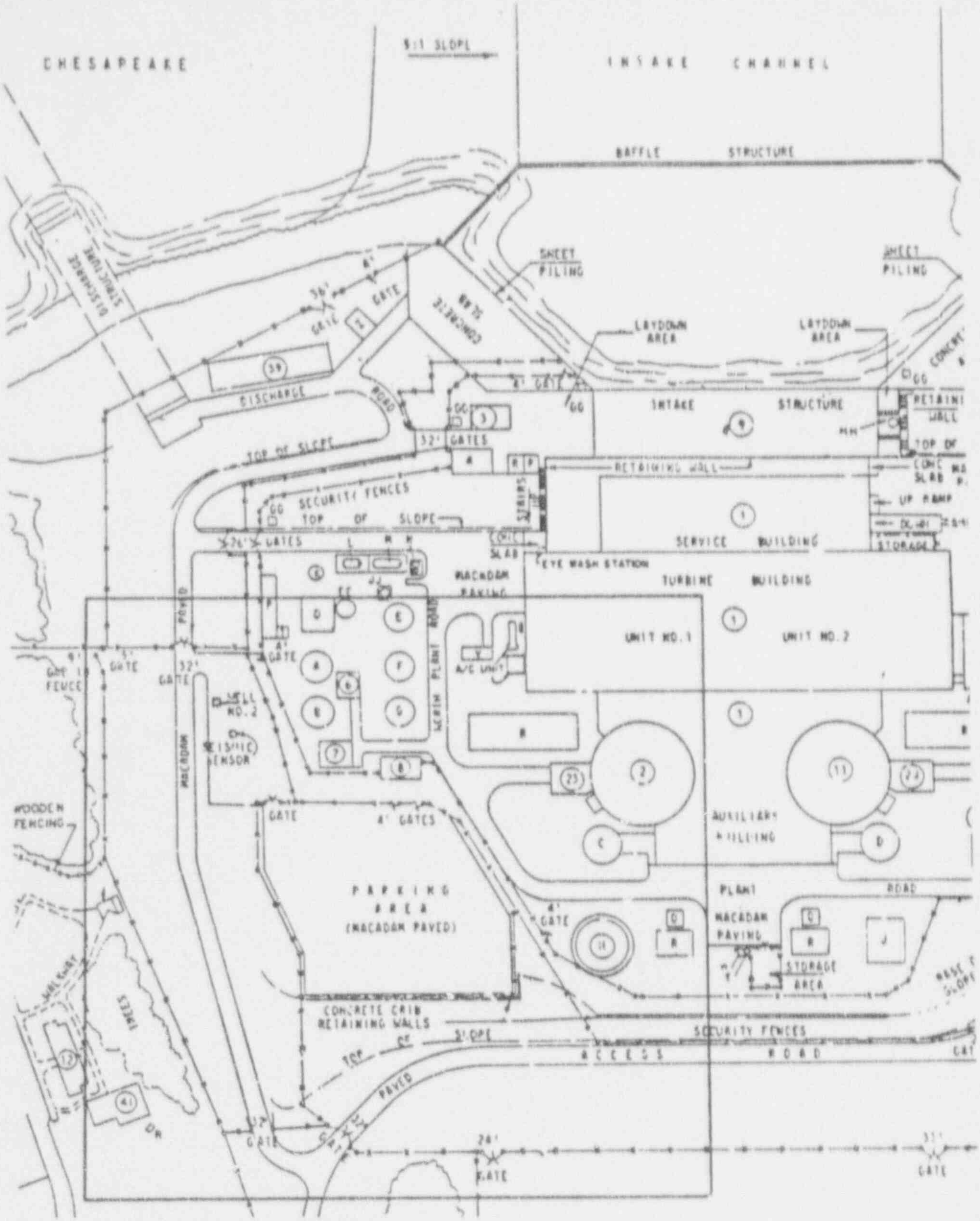

FIGURE 1: EXISTING PLANT LAYOUT

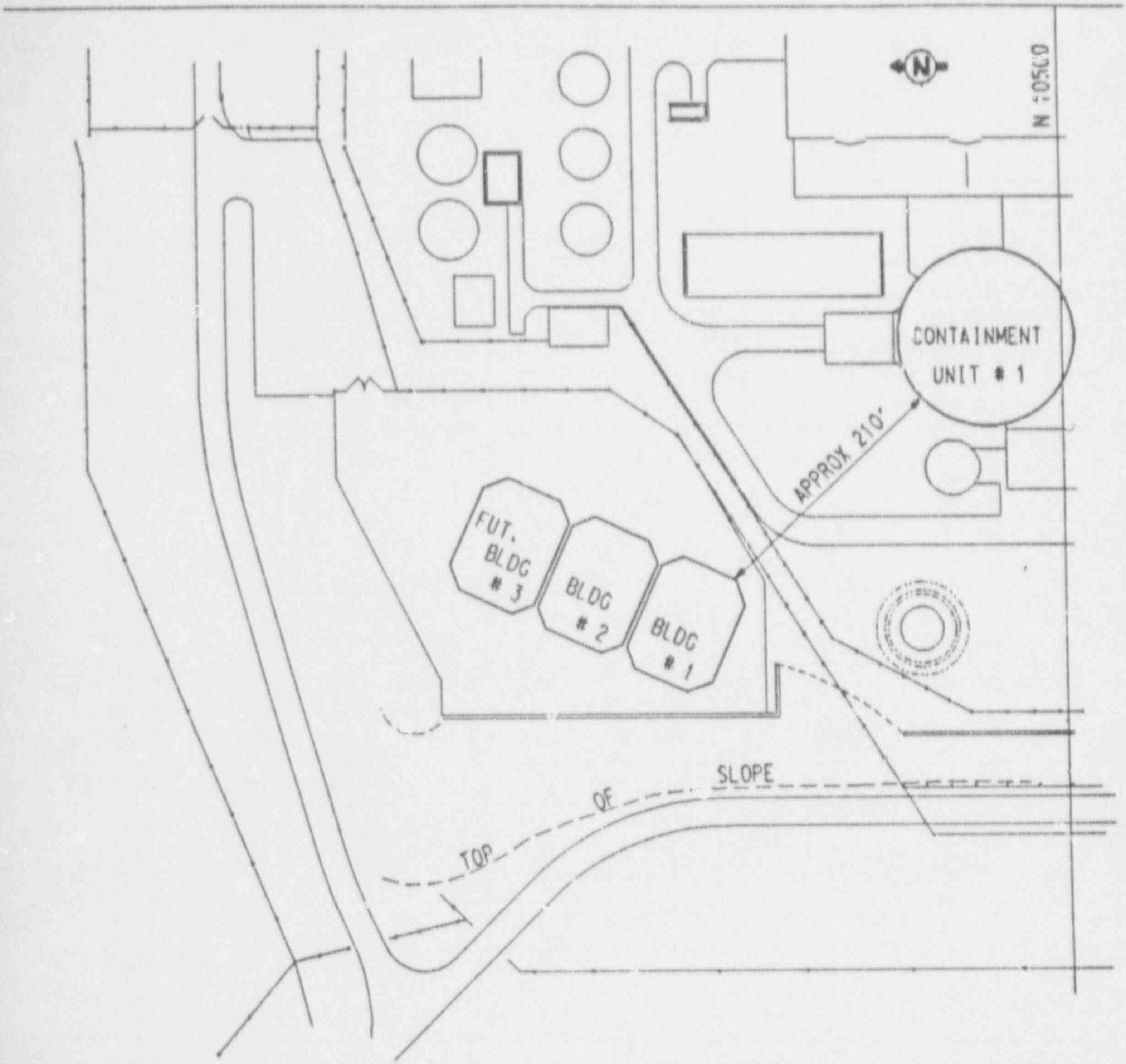

FIGURE 2: ENLARGED PLAN VIEW

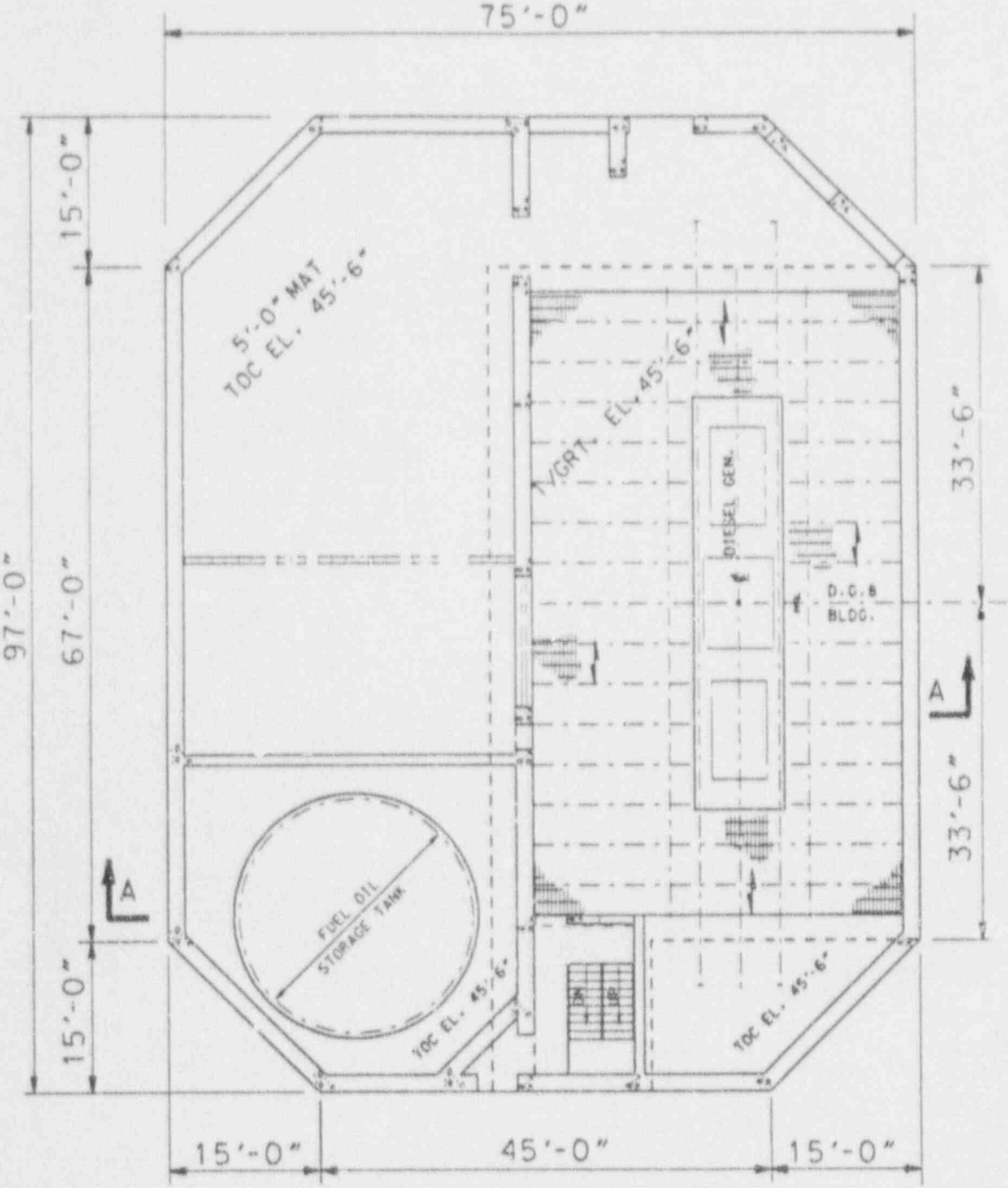

FIGURE 3: PLAN VIEW - EL. 45'- 6"

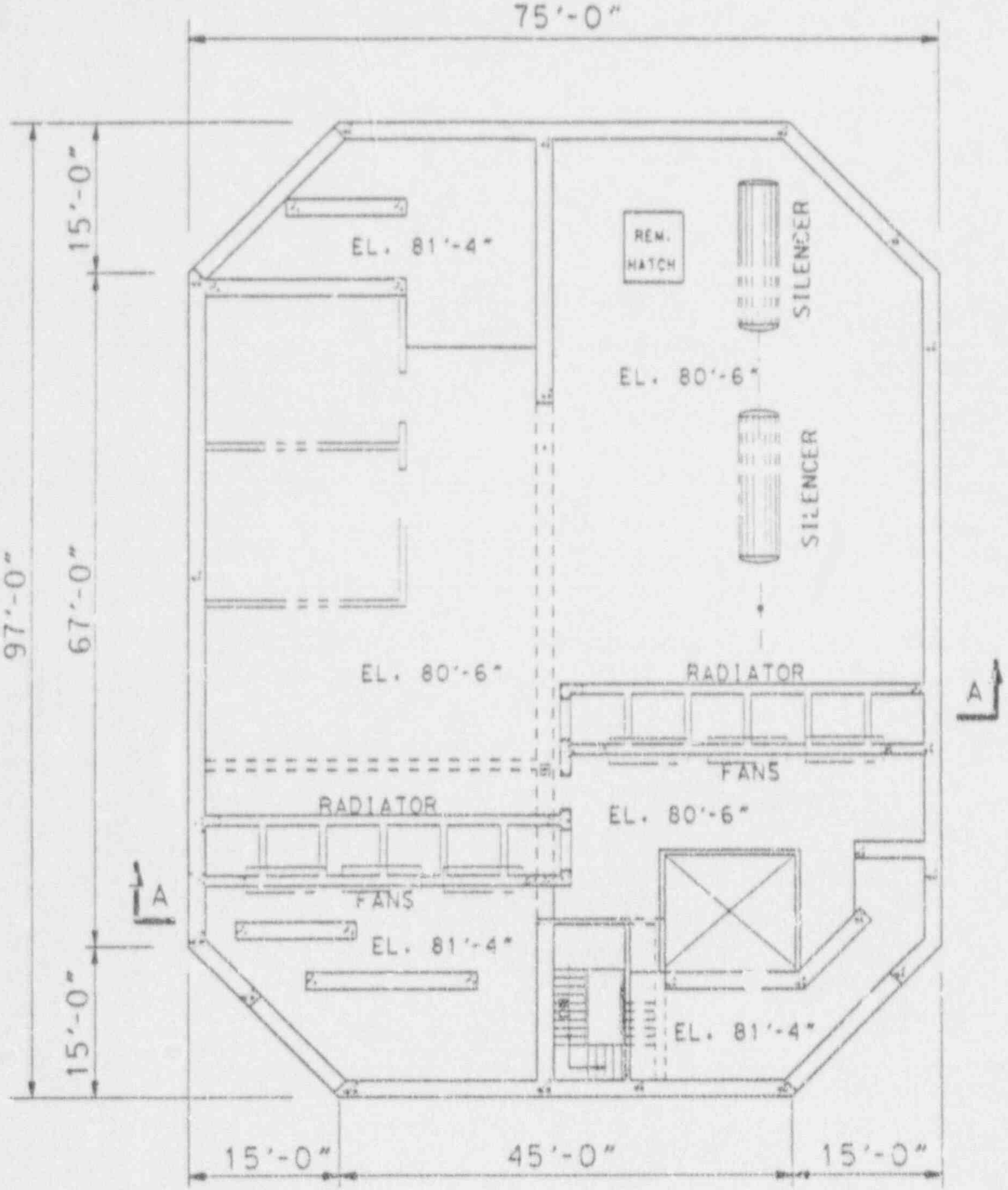

FIGURE 4: PLAN VIEW - EL. 80'- 6

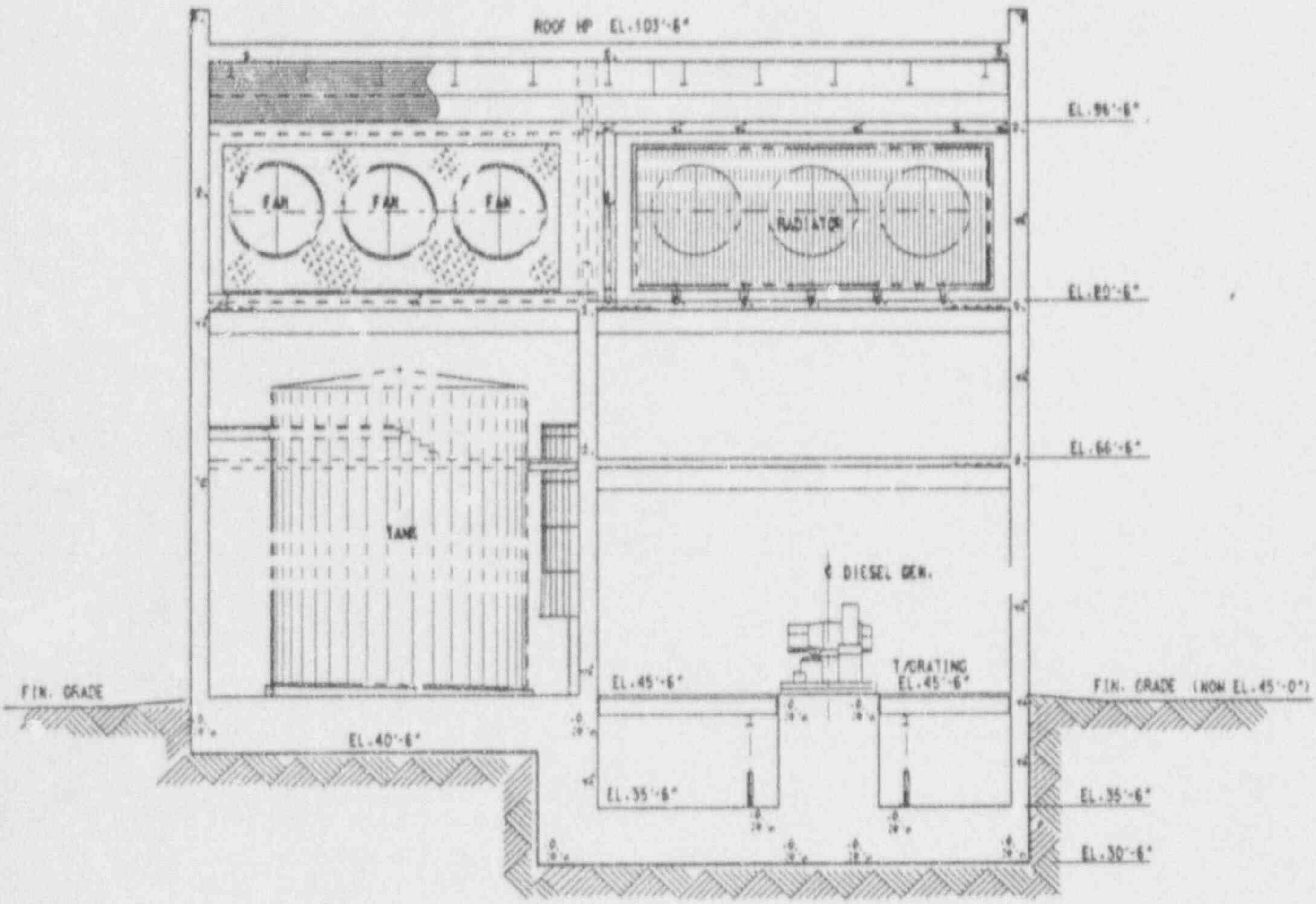

FIGURE 5: ELEVATION VIEW
(SECTION A-A)

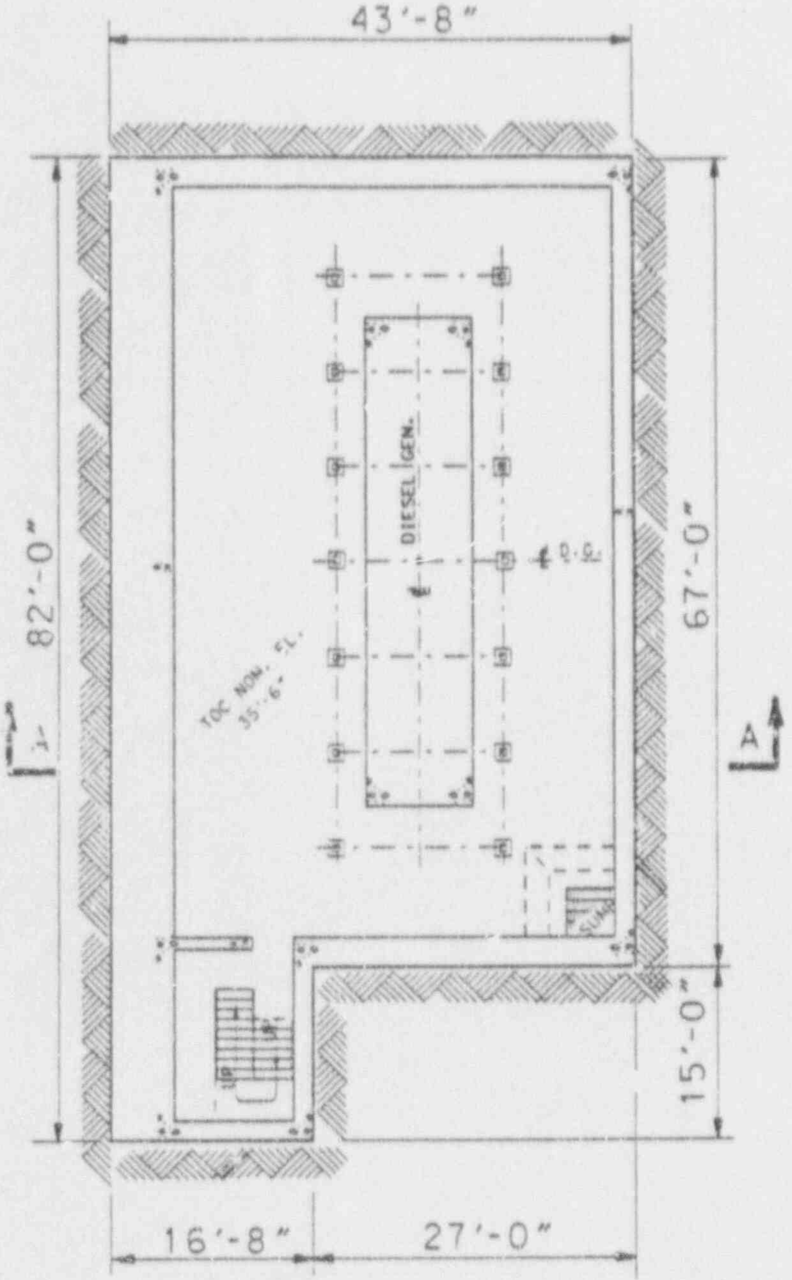

FIGURE 6: PLAN VIEW - EL. 35'- 6"

B. SEISMIC DESIGN PARAMETERS (SRP SECTION 3.7.1, REV. 2)

1. DESIGN GROUND MOTION

   a. DESIGN RESPONSE SPECTRA

      1.) REGULATORY GUIDE 1.60

      2.) MAXIMUM GROUND ACCELERATIONS:

QUAKE	DIRECTION	
	HOR.	VERT.
SSE	0.15 g	0.10 g
OBE	0.08 g	0.053 g

      3.) CONTROL MOTIONS DEFINED AT BOTTOM OF EFFECTIVE BASE SLAB (EL. 35'- 6")

b. DESIGN TIME HISTORY

1.) THREE TIME HISTORIES APPLIED IN ORTHOGONAL DIRECTIONS (SEE FIGURES 7 - 9)

2.) SPECTRA ENVELOPING (SEE FIGURES 10 - 12)

3.) POWER SPECTRAL DENSITY (SEE FIGURES 13 - 15)

4.) TOTAL DURATION (SEE FIGURES 7 - 9)

5.) STRONG MOTION DURATION (SEE FIGURES 16 - 18)

6.) STATISTICAL INDEPENDENCE (SEE FIGURES 19 - 21)

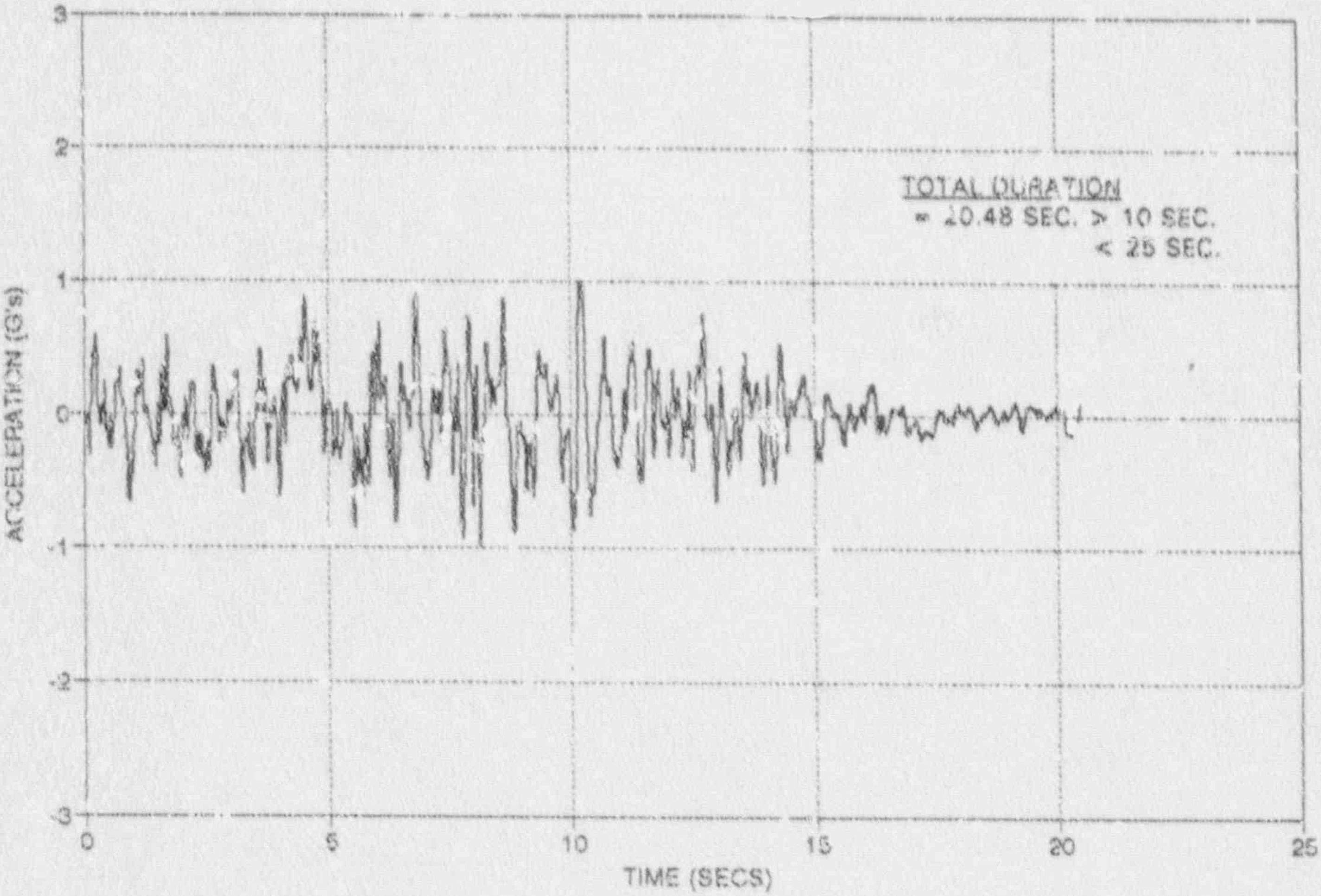

FIGURE 7: HORIZONTAL
TIME HISTORY H1

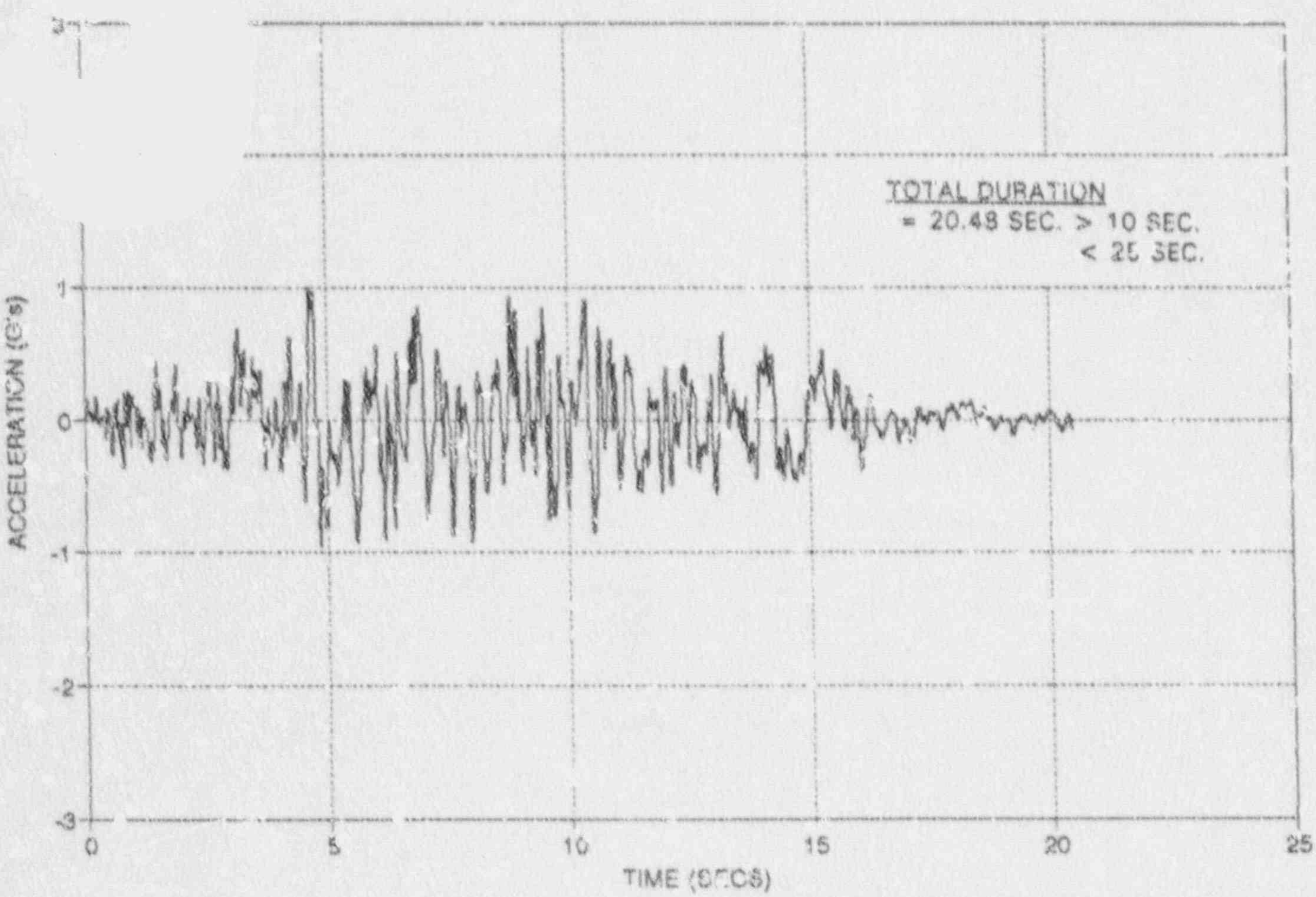

FIGURE 8: HORIZONTAL
TIME HISTORY H2

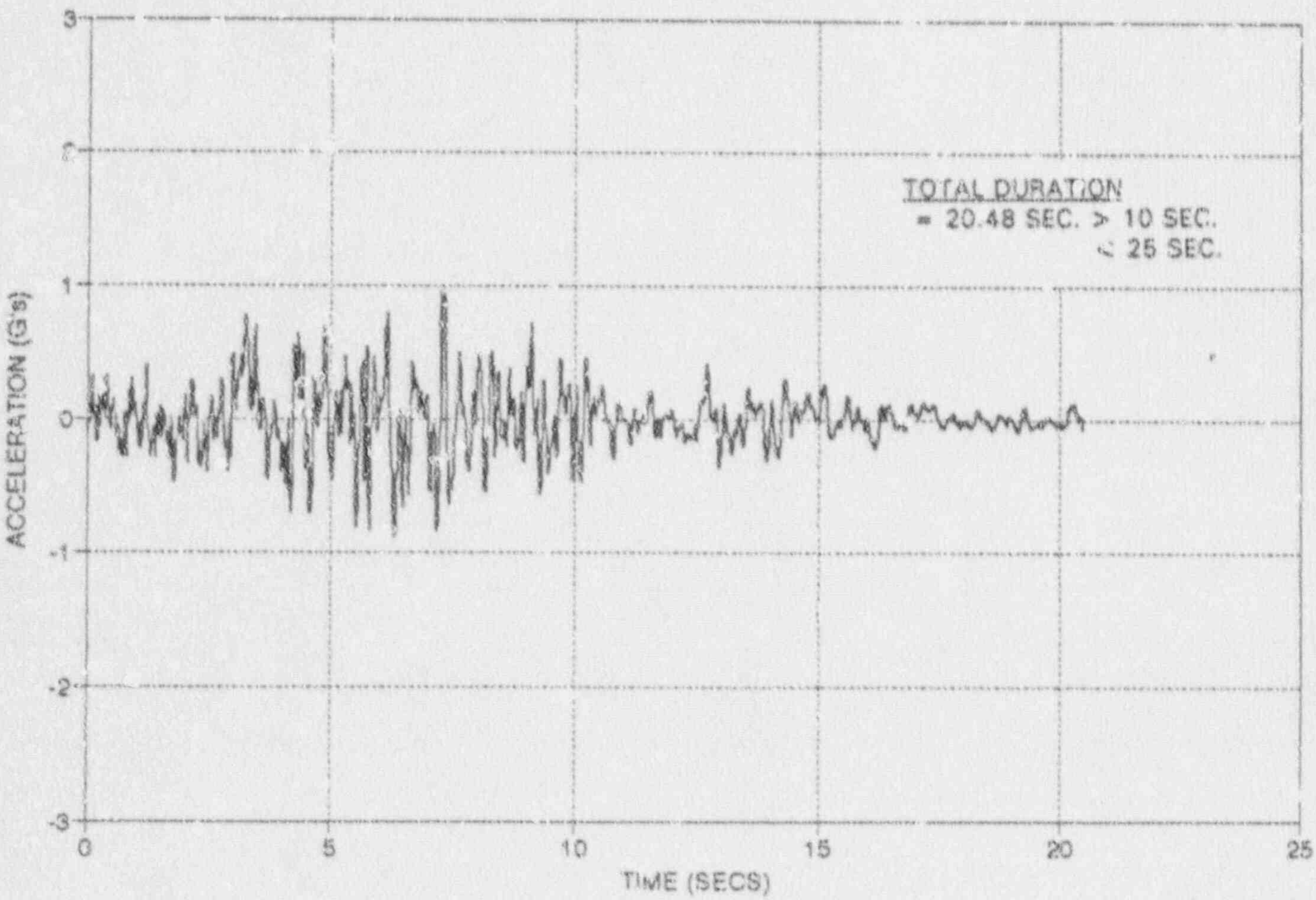

FIGURE 9: VERTICAL TIME HISTORY

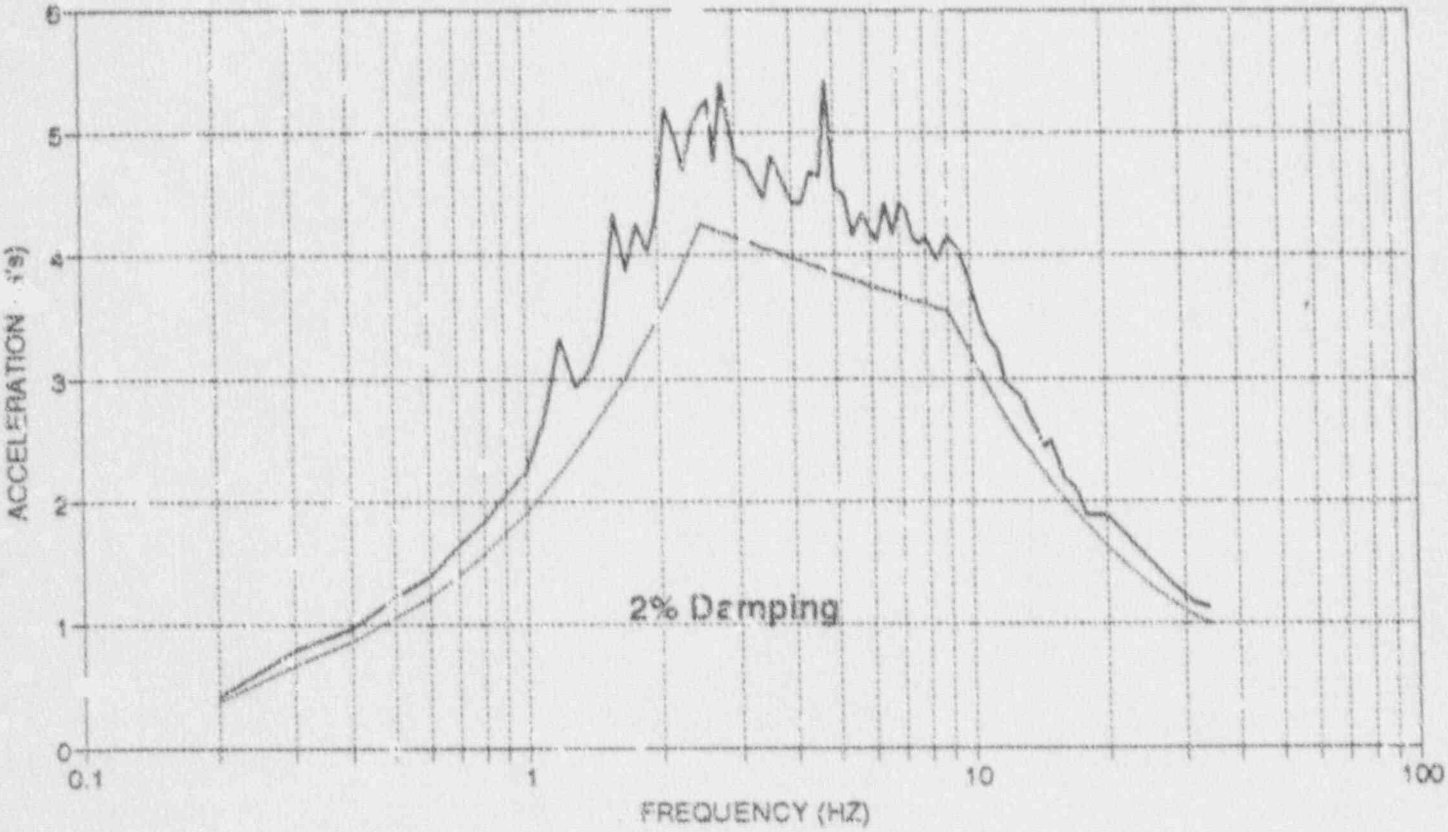

FIGURE 10: SPECTRA ENVELOPING HOR. TIME HISTORY H1

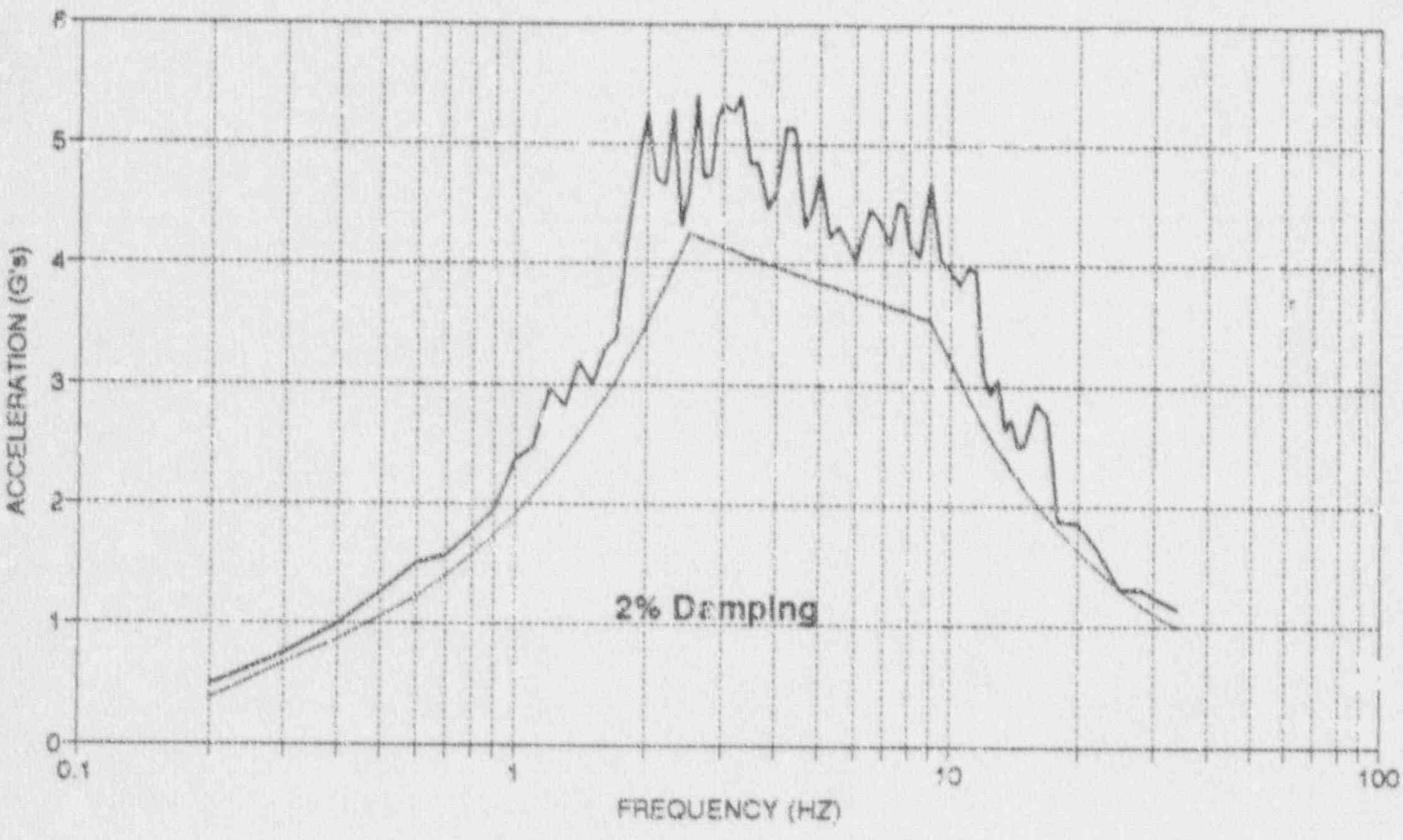

FIGURE 11: SPECTRA ENVELOPING
HOR. TIME HISTORY H2

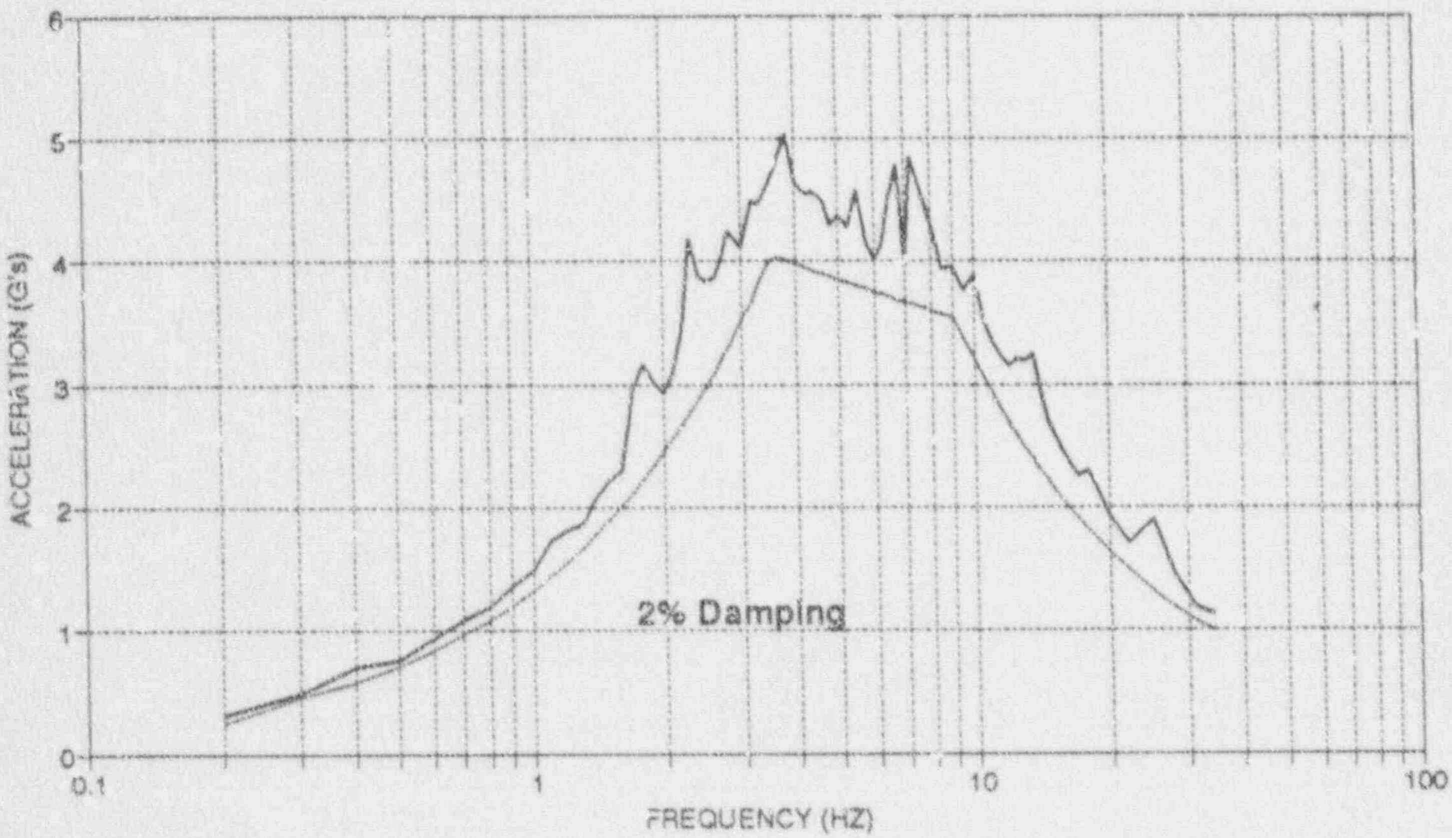

FIGURE 12: SPECTRA ENVELOPING VERT. TIME HISTORY

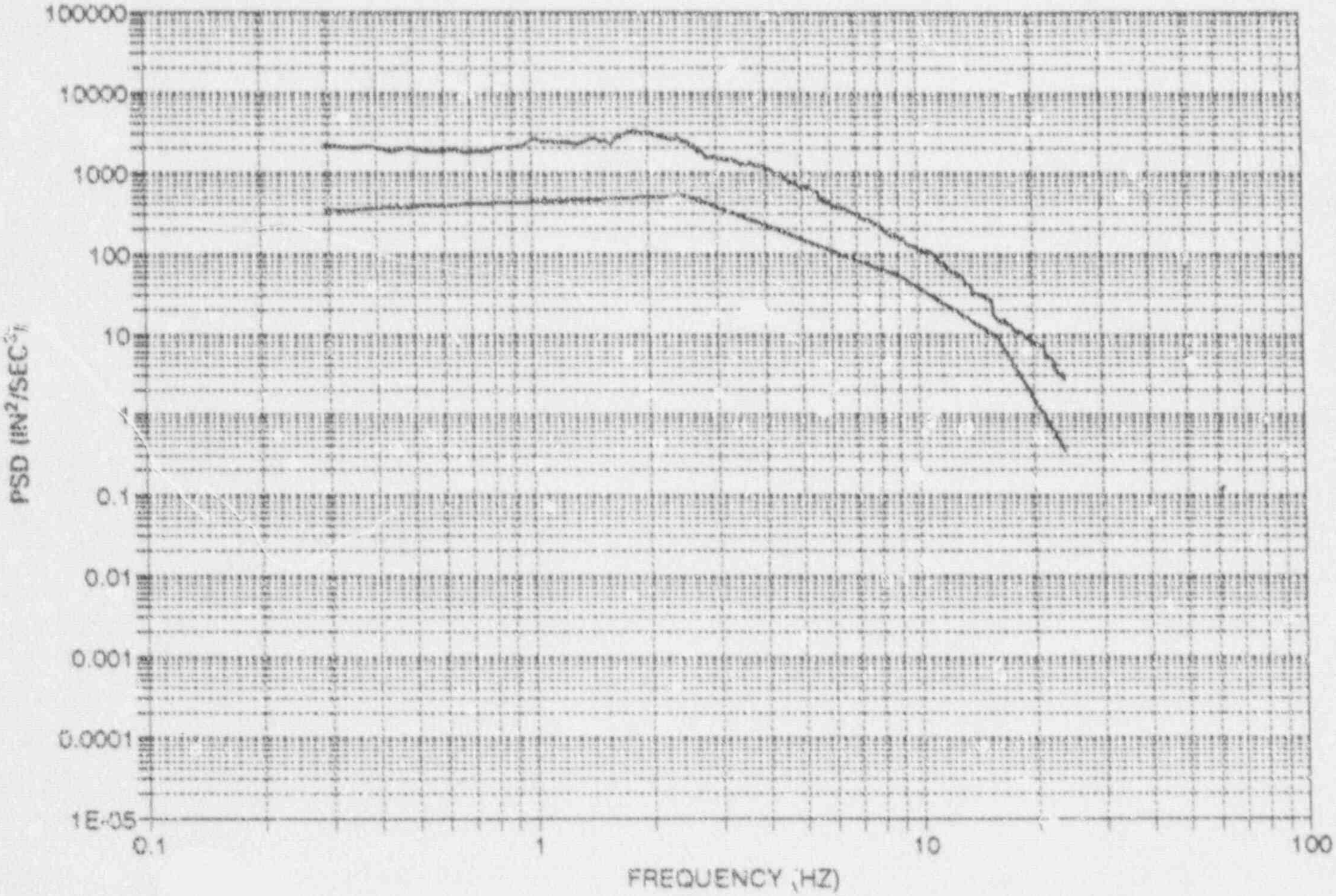

FIGURE 13: POWER SPECTRAL DENSITY - HOR. TIME HISTORY H1

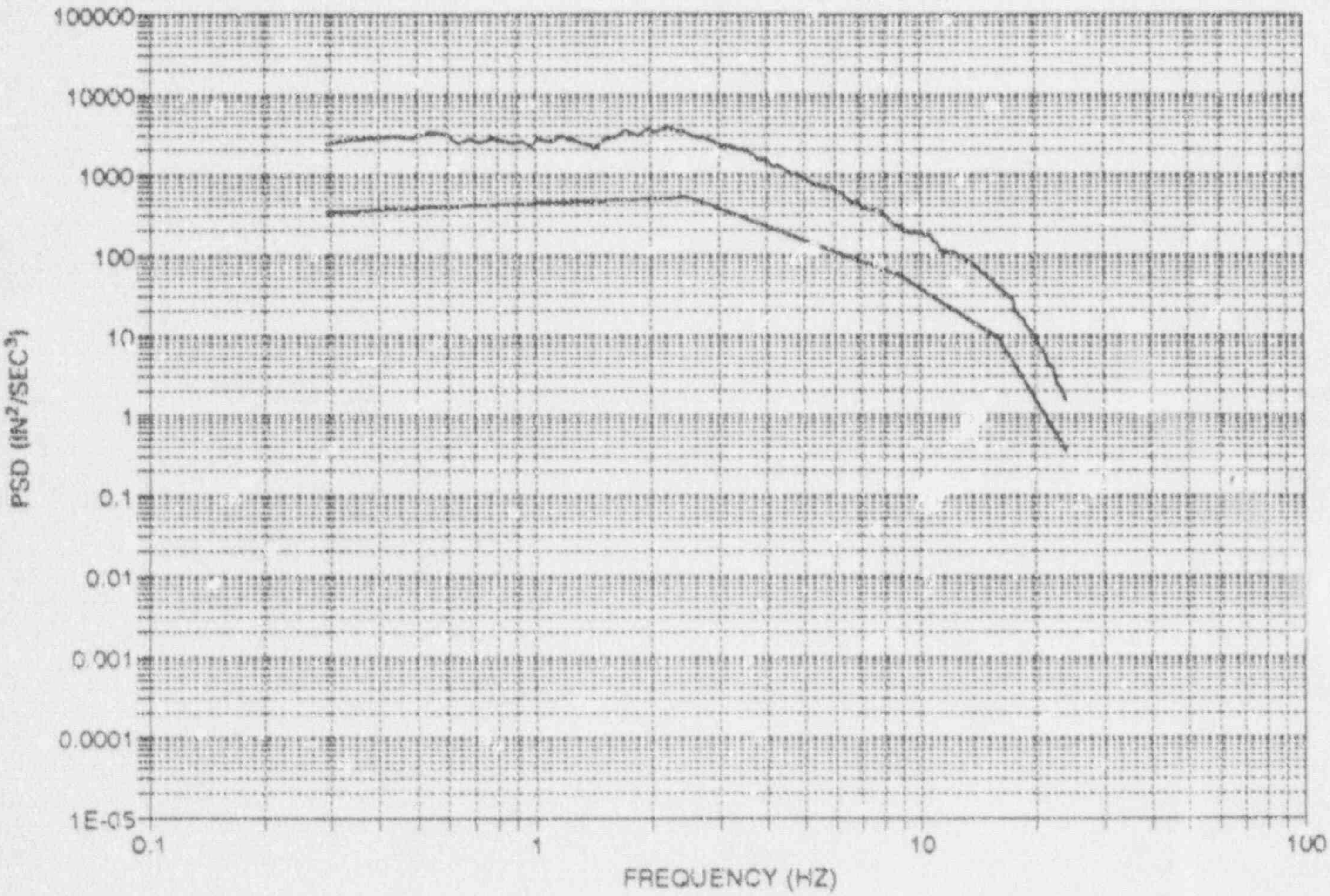

FIGURE 14: POWER SPECTRAL DENSITY - HOR. TIME HISTORY H2

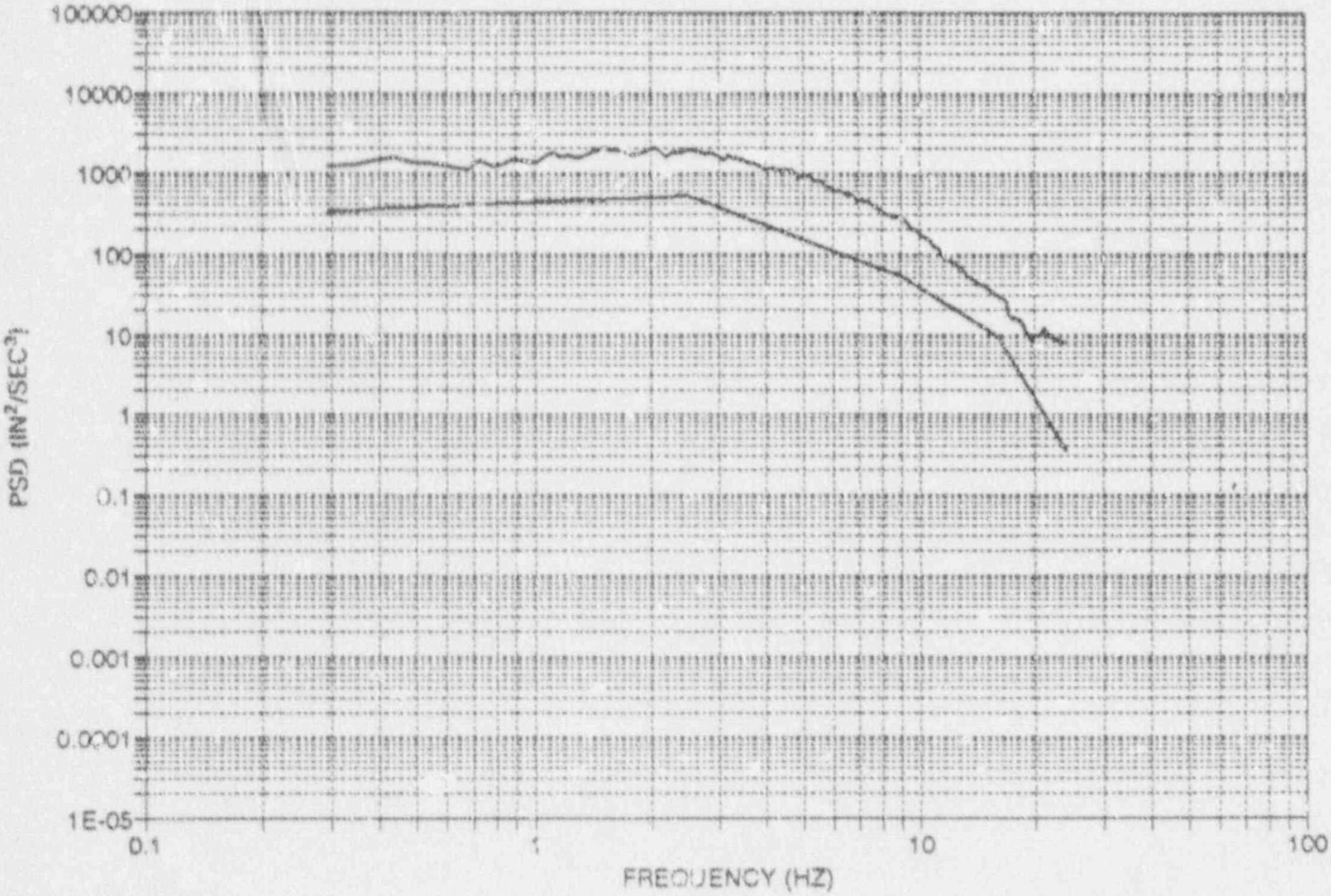

FIGURE 15: POWER SPECTRAL DENSITY - VERT. TIME HISTORY

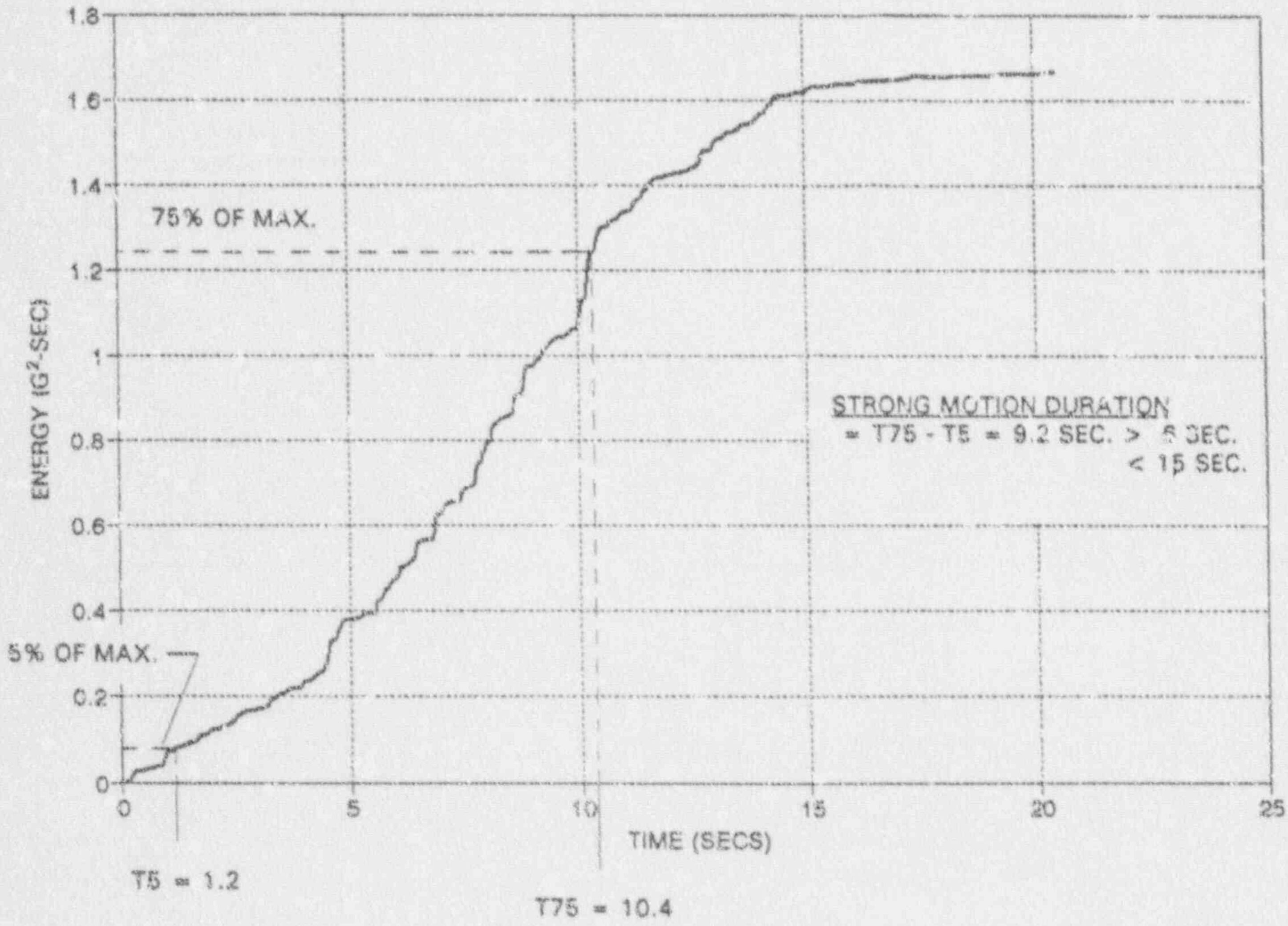

FIGURE 16: STRONG MOTION DURATION - HOR. TIME HISTORY H1

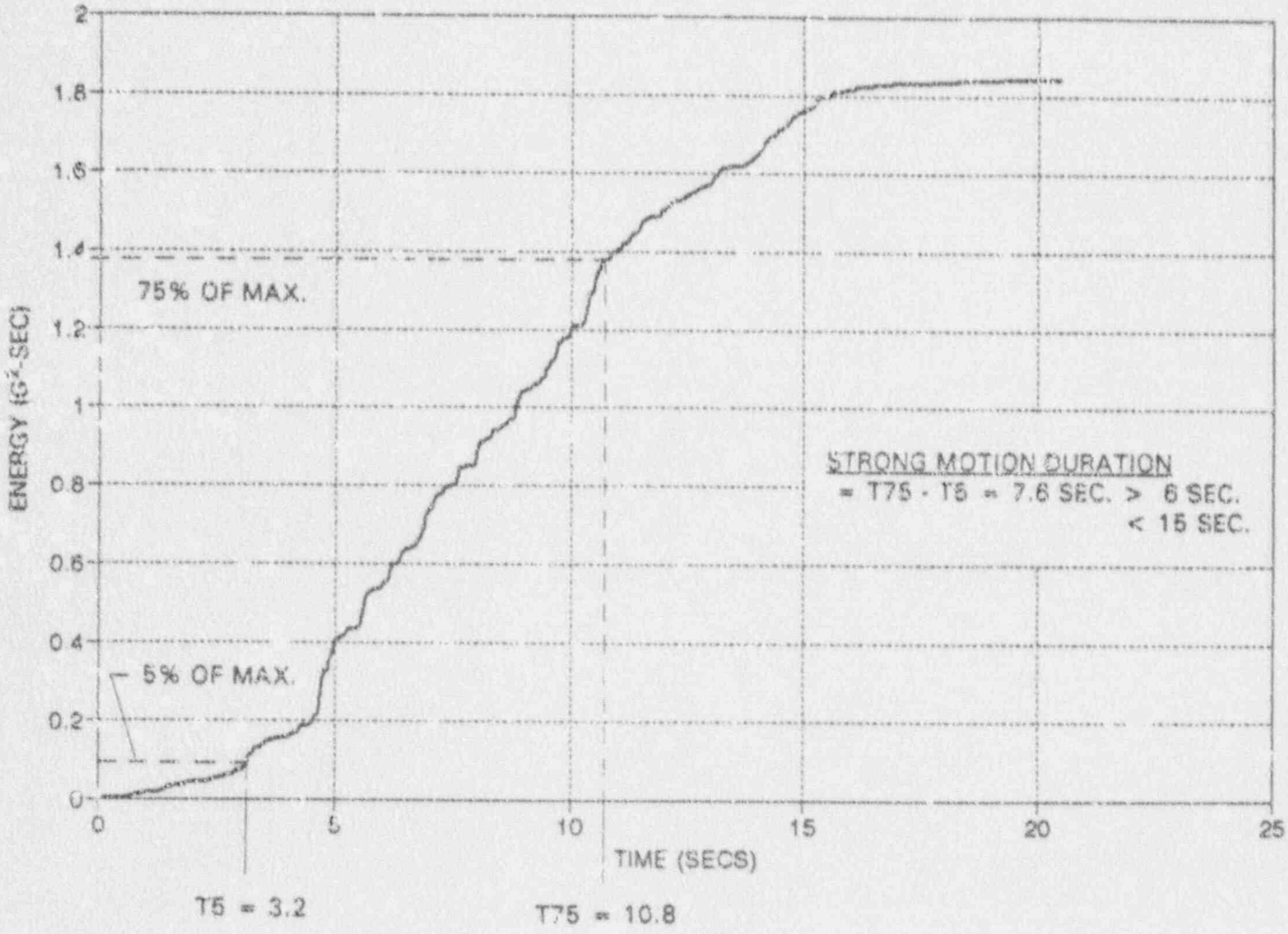

FIGURE 17: STRONG MOTION DURATION - HOR. TIME HISTORY H2

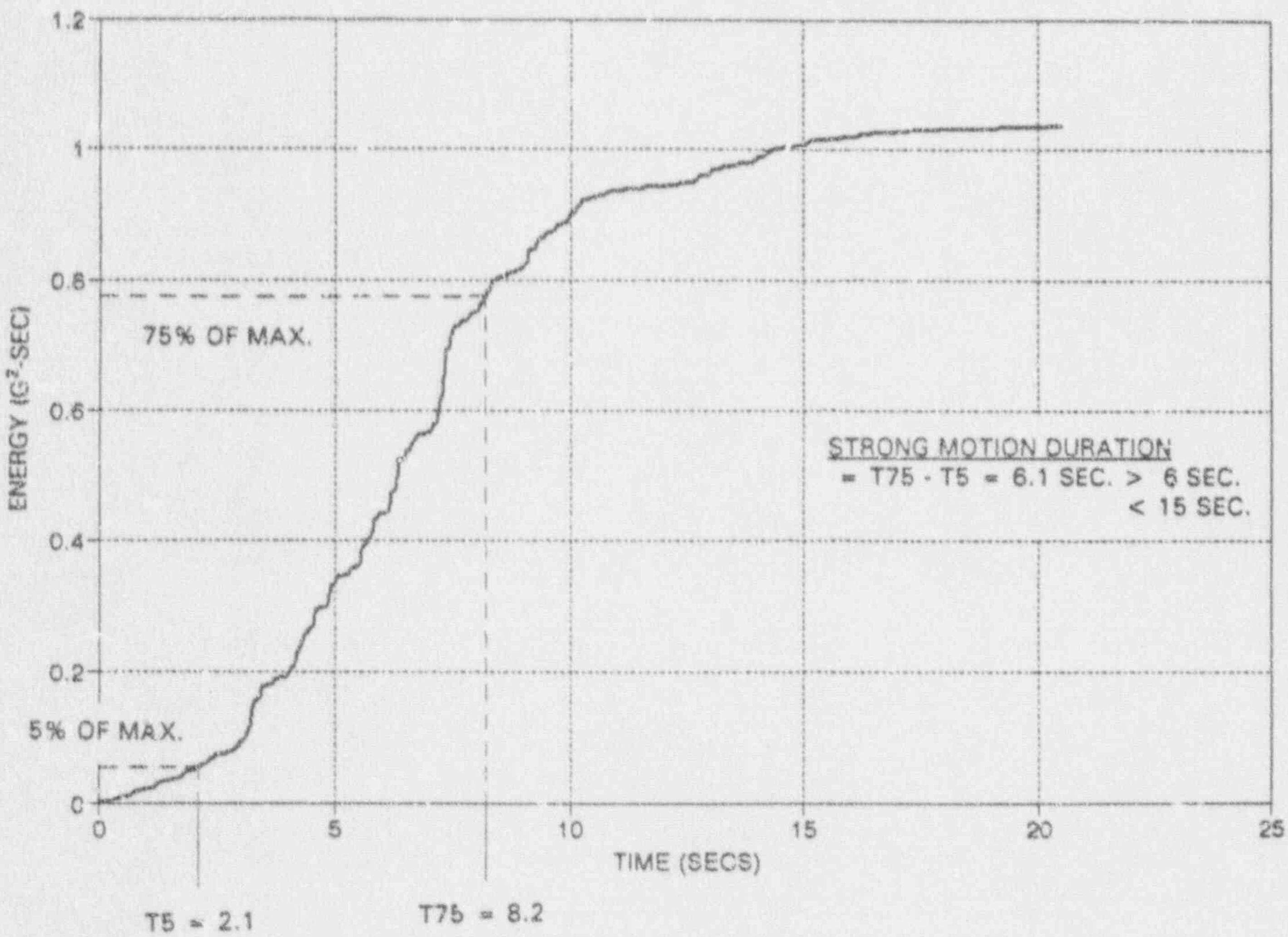

FIGURE 18: STRONG MOTION DURATION - VERT. TIME HISTORY

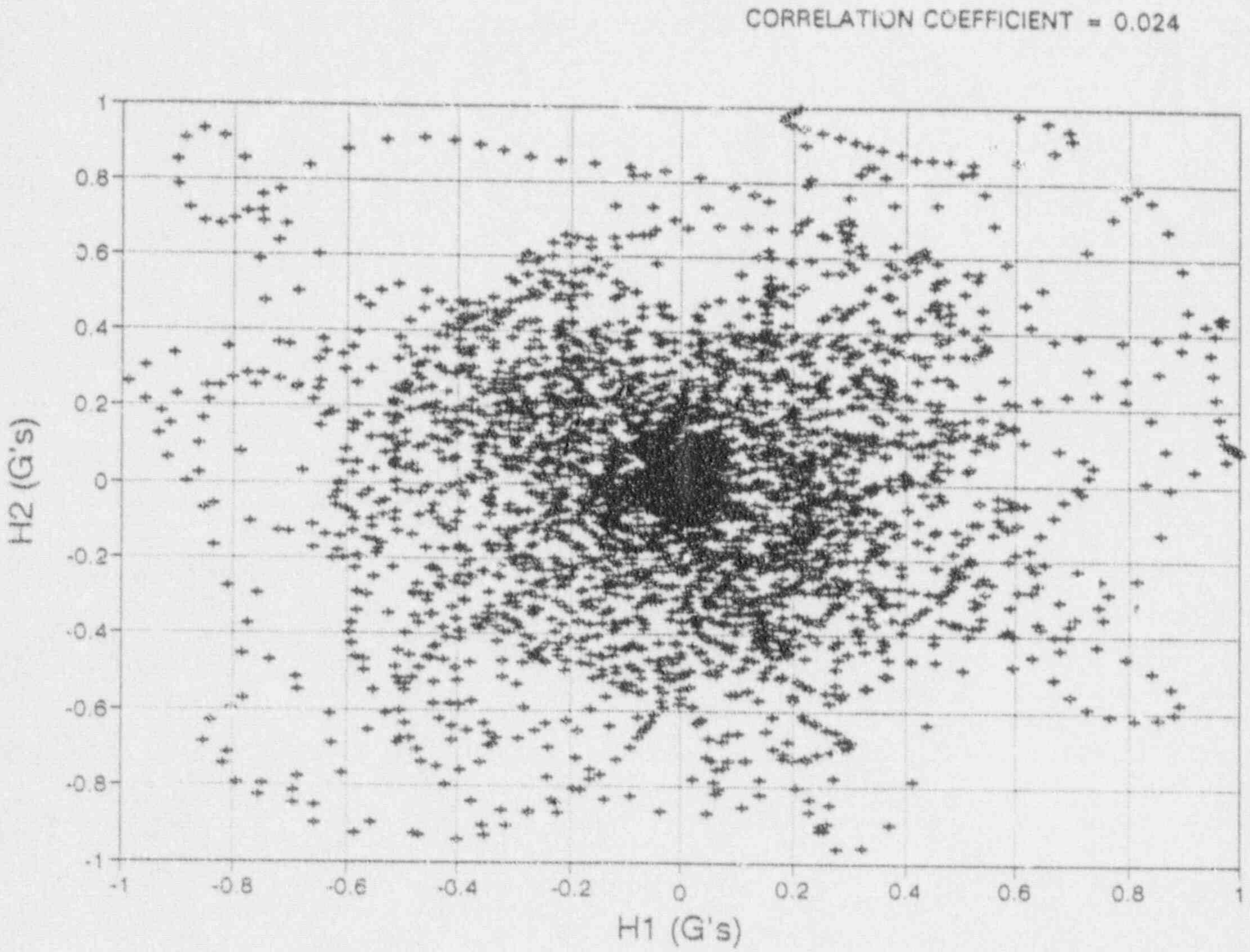

FIGURE 19: STATISTICAL INDEPENDENCE - HOR. TIME HISTORY H1 VS. HOR. TIME HISTORY H2

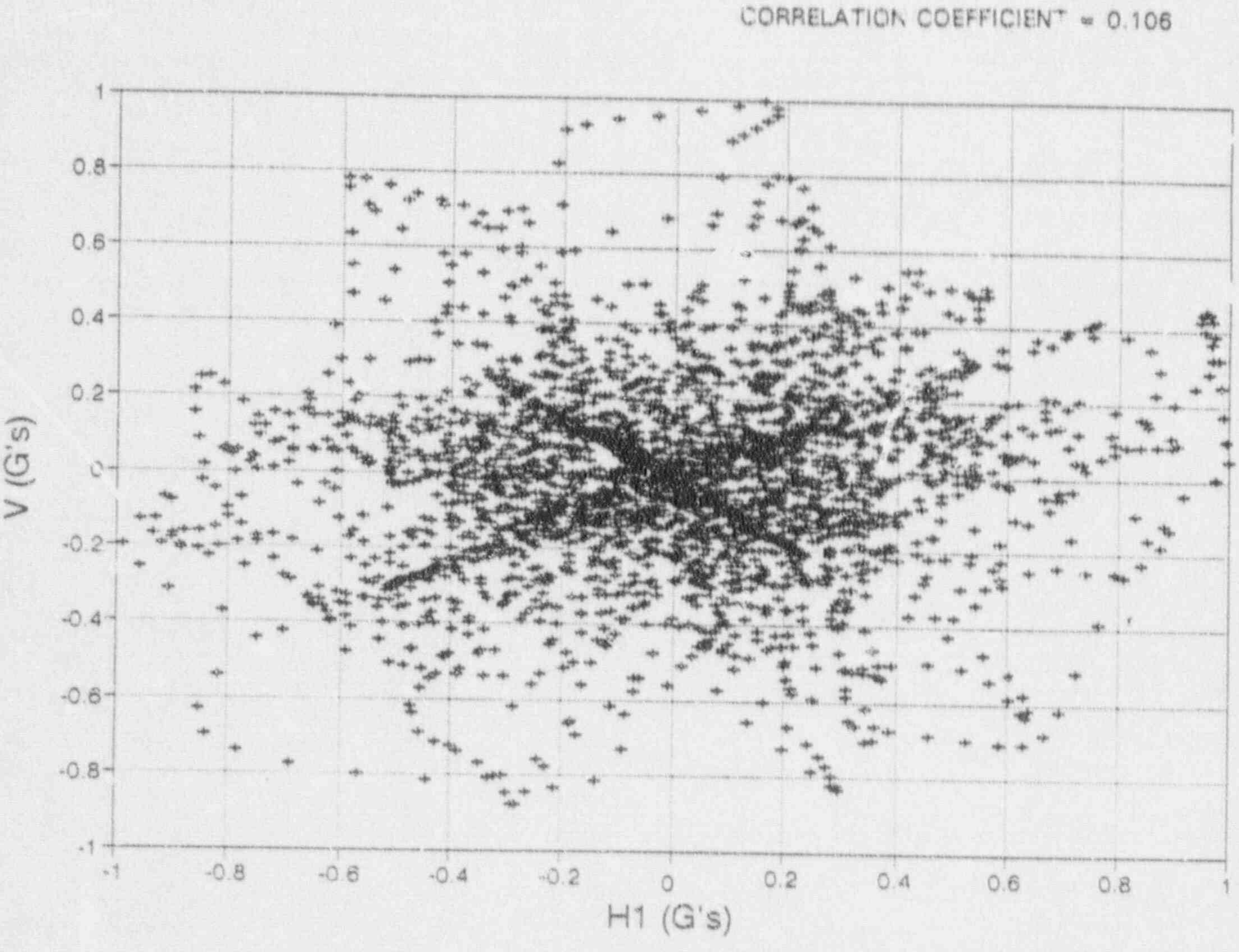

FIGURE 20: STATISTICAL INDEPENDENCE - HOR. TIME HISTORY H1 VS. VERT. TIME HISTORY

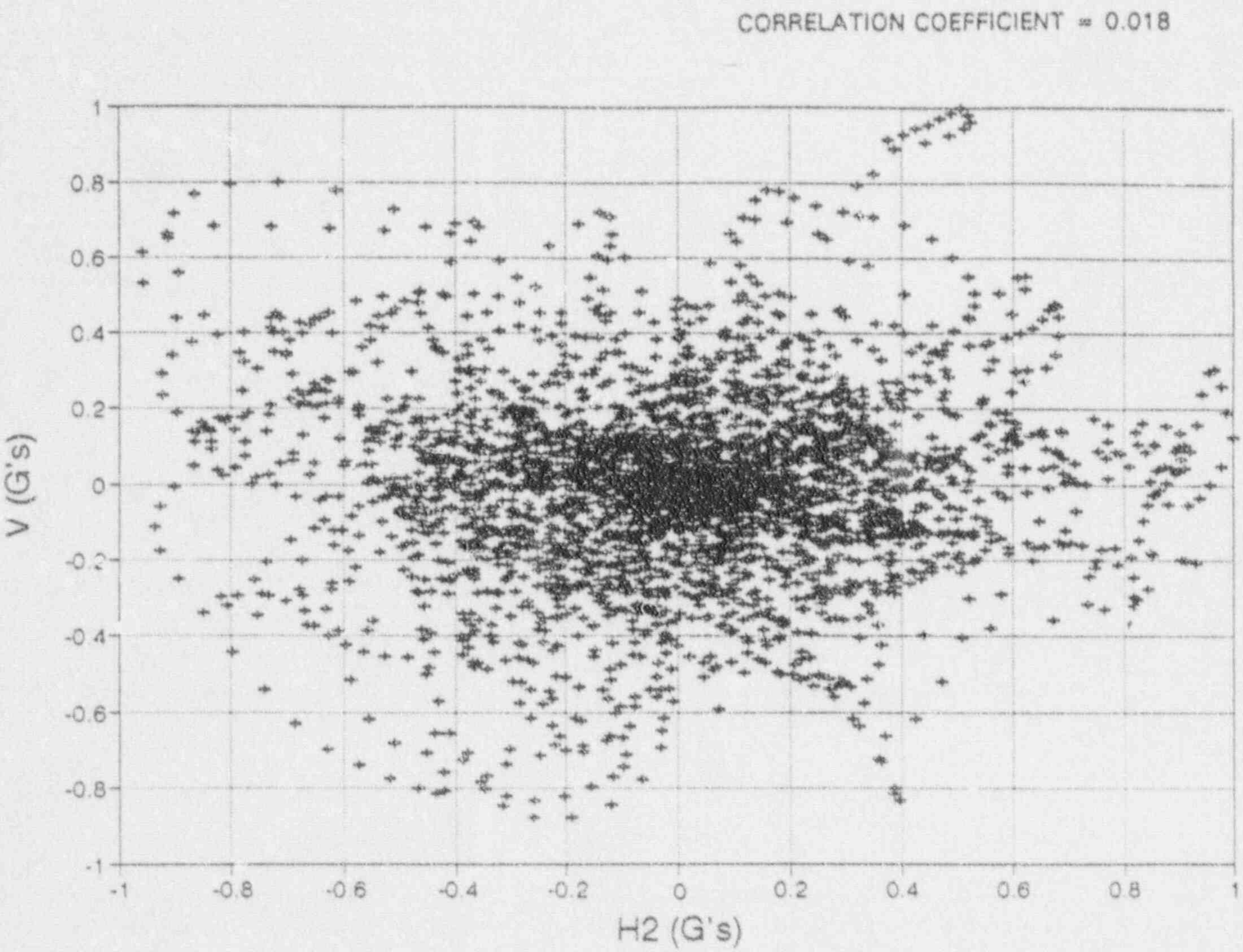

FIGURE 21: STATISTICAL INDEPENDENCE - HOR. TIME HISTORY H2 VS. VERT. TIME HISTORY

2. PERCENT OF CRITICAL DAMPING VALUES

a. REGULATORY GUIDE 1.61 DAMPING

b. RACEWAY DAMPING VALUES BASED ON BECHTEL/ANCO TESTS

c. CORRELATION BETWEEN STRESS LEVELS AND DAMPING VALUES

d. GROUND WATER EFFECTS ON SOIL DAMPING

3. SUPPORTING MEDIA FOR CATEGORY I STRUCTURES

a. FOUNDATION EMBEDMENT DEPTH (SEE FIGURE 5)

MIN. = 4.5 ft.

MAX. = 14.5 ft.

b. DEPTH OF SOIL OVER BEDROCK

APPROX. 2500 ft.

c. SOIL LAYERING CHARACTERISTICS

(SEE TABLE 1)

DEPTH	SOIL DESCRIPTION	SHEAR WAVE VEL. (ft/sec)	SHEAR MOD. (ksf)	DEN. (pcf)	POISSON'S RATIO
0 - 18	MEDIUM STIFF TO STIFF SILTY CLAY	850	2500	110	0.47
18 - 33	MEDIUM DENSE TO DENSE SILTY FINE SAND, TRACE TO SOME SHELL FRAGMENTS, OCCASIONAL CEMENTATION	1250	5800	120	0.34
33 - 50	LOOSE TO MEDIUM DENSE SILTY FINE SAND	1050	4100	120	0.39
50 - 100	MEDIUM DENSE TO DENSE SILTY FINE SAND	1350	7000	125	0.35
BELOW 100	DENSE SILTY FINE SAND TO SANDY SILT	1600	9500	120	0.35
-	CRUSHED STONE	1300	6800	130	0.4

TABLE 1: SOIL LAYERING CHARACTERISTICS AND PROPERTIES

d. DESIGN GROUNDWATER ELEVATION

25 ft. BELOW GRADE
(EL. 20'- 0")

e. DIMENSIONS OF THE STRUCTURAL FOUNDATION

(SEE FIGURES 3 AND 6)

f. TOTAL STRUCTURAL HEIGHT

58.5 ft. ABOVE GRADE
(SEE FIGURE 5)

g. SOIL PROPERTIES AS A FUNCTION OF DEPTH (SEE TABLE 1)

EXISTING SOIL ABOVE EL. 27'- 0" REPLACED WITH CRUSHED STONE

C. SEISMIC SYSTEM ANALYSIS (SRP SECTION 3.7.2, REV.2)

1. SEISMIC ANALYSIS METHODS (DYNAMIC ANALYSIS)

   a. CLASSI
      ELASTIC HALF-SPACE
      GREEN'S FUNCTION

   b. SOIL-STRUCTURE INTERACTION
      (SEE TABLE 1 FOR SOIL LAYERING)

   c. 3D MODEL
      TORSIONAL, ROCKING AND TRANSLATIONAL RESPONSES
      (SEE FIGURE 22)

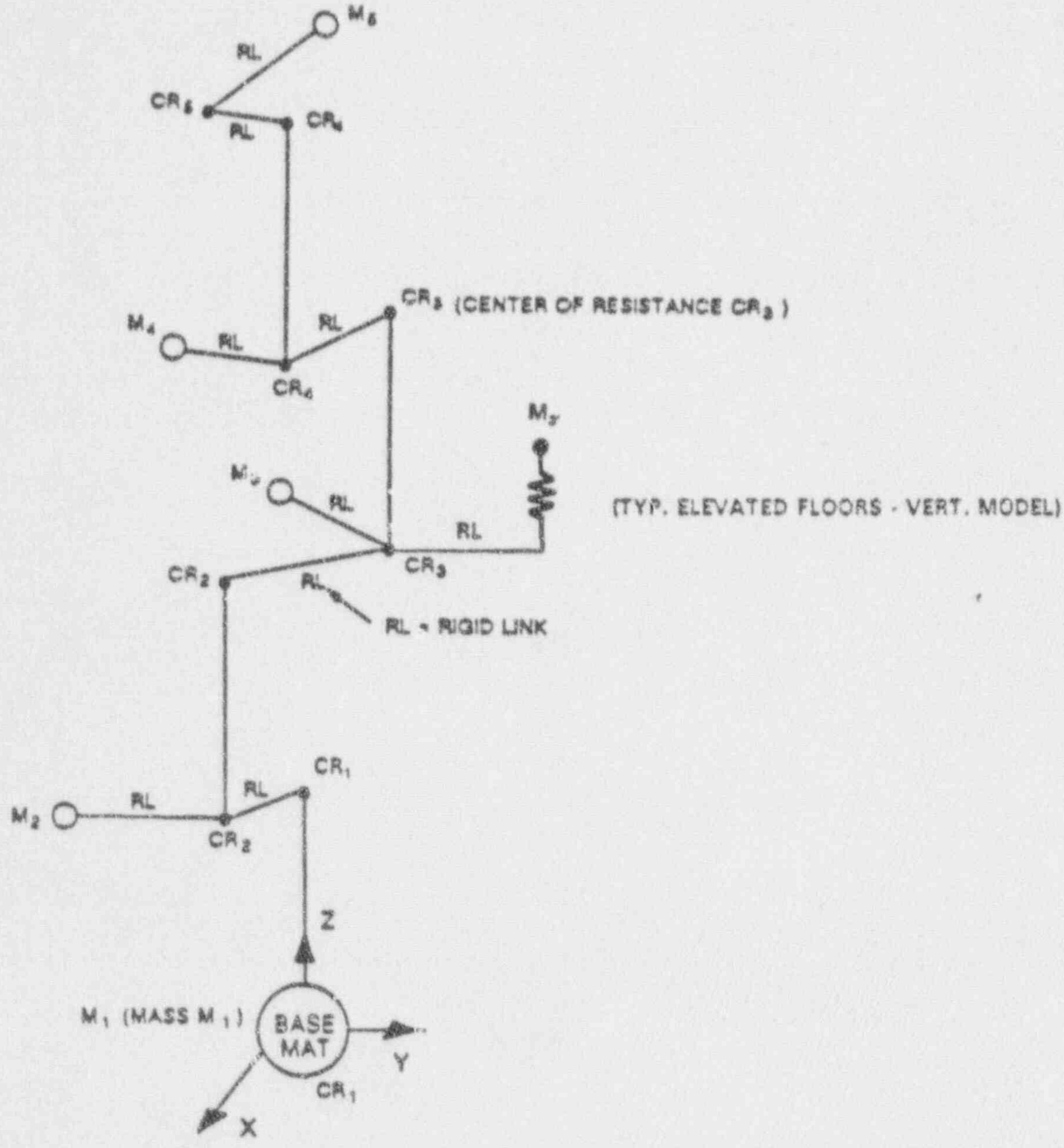

FIGURE 22: PROPOSED 3-D STRUCTURAL MODEL

d. NUMBER OF MASSES/DEGREES OF FREEDOM

e. MODAL MASS

f. RELATIVE DISPLACEMENTS BETWEEN BUILDINGS

2. NATURAL FREQUENCIES AND RESPONSE LOADS

LATER

3. PROCEDURES USED FOR ANALYTICAL MODELING

a. DECOUPLING CRITERIA

   1.) RADIATORS

   2.) FUEL OIL TANK

   3.) DIESEL GENERATOR

b. FLOOR FLEXIBILITY WILL BE ACCOUNTED FOR IN THE VERTICAL DIRECTION

4. SOIL-STRUCTURE INTERACTION

a. CLASSI

b. EMBEDMENT EFFECTS

c. EQUIVALENT LINEAR SOIL PROPERTIES - SHAKE

d. THREE SETS OF SOIL PROPERTIES

   1.) AVERAGE (BEST ESTIMATE)

   2.) TWICE AVERAGE

   3.) HALF AVERAGE

e. CONTROL MOTIONS DEFINED AT BOTTOM OF EFFECTIVE BASE SLAB (EL. 35'- 6")

f. GROUNDWATER EFFECTS NOT SIGNIFICANT FOR DAMPING

g. STRUCTURE-TO-STRUCTURE INTERACTION NOT SIGNIFICANT

5. DEVELOPMENT OF FLOOR RESPONSE SPECTRA (FRS)

   a. FLOOR TIME HISTORIES FROM CLASSI

   b. REGULATORY GUIDE 1.122 BROADENING

   c. ENVELOPE OF 3 SETS OF SOIL PROPERTIES

6. THREE COMPONENTS OF EARTHQUAKE MOTION

MAXIMUM DIRECTIONAL RESPONSES COMBINED BY SRSS (OR THE MORE CONSERVATIVE 100-40-40 PERCENT RULE)

7. COMBINATION OF MODAL RESPONSES

NOT APPLICABLE TO TIME HISTORY ANALYSIS

8. INTERACTION OF NON CATEGORY I STRUCTURES WITH CATEGORY I STRUCTURES

NOT APPLICABLE

9. EFFECTS OF PARAMETER VARIATIONS ON FLOOR RESPONSE SPECTRA (FRS)

FRS BROADENED IN ACCORDANCE WITH REGULATORY GUIDE 1.122

10. USE OF EQUIVALENT VERTICAL STATIC FACTORS

NOT APPLICABLE

11. METHODS USED TO ACCOUNT FOR TORSIONAL EFFECTS

TORSIONAL DEGREES OF FREEDOM INCORPORATED INTO MODEL

12. COMPARISON OF RESPONSES (RESPONSE SPECTRUM VS. TIME HISTORY)

NOT APPLICABLE

13. ANALYSIS PROCEDURE FOR DAMPING

NOT APPLICABLE

14. DETERMINATION OF CATEGORY I STRUCTURES OVERTURNING MOMENTS

BASED ON 100-40-40 PERCENT RULE FOR THREE COMPONENTS OF SEISMIC RESPONSE

D. SUMMARY

1. MAX. HOR. OBE & SSE GROUND ACCELERATIONS
   - 0.08 G & 0.15 G, RESPECTIVELY

   VERT. = 2/3 HOR.

2. REG. GUIDE 1.60 DESIGN SPECTRA

3. USE THREE SINGLE TIME HISTORIES FOR ANALYSIS

4. USE CLASSI FOR SEISMIC ANALYSIS

   MAJOR POINTS

   - 3D ANALYSIS
   - SOIL LAYERING

D. SUMMARY (CONTINUED)

- VARIATION OF SOIL PROPERTIES
- PARAMETRIC STUDIES TO ADDRESS FOUNDATION CONDITIONS
- DECOUPLING CRITERIA
- SPECTRA BROADENING PER REG. GUIDE 1.122

Two separate buildings will be constructed to house the new EDGs including their associated diesel fuel tanks and cooling systems (radiators and fans). Provisions are being included in the initial design to add a third separate building at a future date. The seismic design parameters included discussions of the response spectra, time history, critical dumping factors, and the supporting media (soil). The discussion of the seismic analysis methods and procedures included details of the type (dynamic) of methods, natural frequencies, response loads being considered and the procedures used for modeling.

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DATE	5/14/92	05/14/92	5/14/92	/ /92	/ /92

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