ATTACHMENT I

CONFIRMATORY ACTION LETTER

CAL-RIII-86-01

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, ILLINOIS 60137

JAN 31 1986

CAL-RIII-86-01

Docket No. 50-440
Docket No. 50-441

The Cleveland Electric Illuminating
Company
ATTN: Mr. Murray R. Edelman
Vice President
Nuclear Group
Post Office Box 5000
Cleveland, OH 44101

Gentlemen:

This letter confirms the telephone conversation between Dr. C. J. Paperiello of this office and yourself on January 31, 1986, related to the seismic event that occurred on January 31, 1986, in the vicinity of the Perry Nuclear Plant. It is our understanding, with regard to this matter, that you will:

1. Conduct a thorough review to determine if the earthquake was within the Design Basis of the plant (FSAR).

2. Identify any damage as a result of this seismic event; determine if that level of damage was as expected.

3. Determine that all equipment, including snubbers, that actuated during this event returned to normal operating conditions/positions; identify any anomalies.

4. Identify any actions required to complete licensing of the plant related to this event.

5. Maintain all affected equipment in the "as found" condition. Therefore, take no action such as removing, repairing or replacing equipment which would destroy or cause to be lost, any evidence which would be needed to investigate this event. Routine maintenance may be performed provided that no information related to the event is altered or destroyed.

6. Submit a formal report of your findings and conclusions to the NRC Region III Office within 30 days.

Please let us know immediately if your understanding differs from that set out above.

Sincerely,

James G. Keppler
Regional Administrator

cc w/enclosure:
J. J. Waldron, Manager, Perry Plant Technical Department
M. D. Lyster, Manager, Perry Plant Operations Department
L. O. Beck, General Supervising Engineer, Nuclear Licensing and Fuel Management Section
DCS/RSB (RIDS)
Licensing Fee Management Branch
Resident Inspector, RIII
Harold W. Kohn, Ohio EPA
Terry J. Lodge, Esq.
James W. Harris, State of Ohio
Robert H. Quillin, Ohio Department of Health

ATTACHMENT II

LETTER TO MR. HAROLD R. DENTON

February 12, 1986

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

P.O. BOX 5000 - CLEVELAND, OHIO 44101 - TELEPHONE (216) 622-9800 - ILLUMINATING BLDG. — 55 PUBLIC SQUARE

Serving The Best Location in the Nation

MURRAY R. EDELMAN
VICE PRESIDENT
NUCLEAR

February 12, 1986
PY-CEI/NRR-0437 L

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
Seismic Event Evaluation Report

Dear Mr. Denton:

My letter to you dated February 5, 1986, committed to provide a report on our response and activities related to the earthquake which occurred in the vicinity of the Perry Nuclear Power Plant. Enclosed is the Cleveland Electric Illuminating Company (CEI) report titled "January 31, 1986 Earthquake-Seismic Event Evaluation" for the Perry Nuclear Power Plant. This document has been prepared by CEI and our consultants following a thorough and detailed assessment of the plant response to the January 31, 1986 earthquake.

This report demonstrates the appropriateness of the seismic design for the Perry Nuclear Power Plant. Although this recent event provides an additional "data point" for historical seismic event activity, it will not alter any of the design criteria or licensing basis.

~~8602130193~~ 3pp.

FEB 20 1986

We believe that this report provides the information necessary to support the staff's review and we are available to meet with your staff as necessary. Should you or your staff have any questions please feel free to call.

Very truly yours,

Murray R Edelman

Murray R. Edelman
Vice President
Nuclear Group

MRE:L

cc: Jay Silberg, Esquire
John Stefano
J. Grobe
D. Eisenhut
R. Bernero
W. Butler
G. Lainas
J. Keppler
C. Norelius
C. Paperiello
R. Knop

ATTACHMENT III

CONFIRMATORY ACTION LETTER

CAL-RIII-86-01A

Paperiello
DRS

FEB 04 1986

Docket No. 50-440
Docket No. 50-441

The Cleveland Electric Illuminating
Company
ATTN: Mr. Murray R. Edelman
Vice President
Nuclear Group
Post Office Box 5000
Cleveland, OH 44101

Gentlemen:

This letter refers to our earlier Confirmatory Action Letter, CAL-RIII-86-01, dated January 31, 1986. Item 5 of that letter states that all affected equipment will be maintained in the "as found" condition but allowed routine maintenance to be performed. As a result of the inspections by our Augmented Investigation Team (AIT) and the subsequent conversations between the AIT leader, Dr. C. J. Paperiello, and Mr. M. D. Lyster, of your staff, we are amending and clarifying Item 5 as follows. It is our understanding, with regard to this matter, that you will:

1. Maintain all seismic monitoring instrumentation in the "as found" condition. Take no action such as removing, repairing, calibrating or replacing instrumentation which would destroy or cause to be lost, any evidence which would be needed to investigate the event. Maintenance, surveillance, and calibration will be performed only with the prior concurrence of NRC Region III management.

2. Resume all other activities including work such as, but not limited to, maintenance, training, surveillance, operations and calibrations under the following conditions:

   A. All off normal conditions identified during these activities will be documented in accordance with CEI's programs and procedures.

   B. Off normal conditions will be evaluated to determine if they were potentially earthquake related.

C. Equipment identified in an off normal condition will be maintained "as found" until evaluated. Equipment determined to be potentially earthquake affected will be maintained in an "as found" condition until released by the NRC.

D. The NRC will be notified of all off normal potentially earthquake related conditions within 24 hours.

3. Develop special procedures to implement Item 2.

Please let us know immediately if your understanding differs from that set out above.

Sincerely,

Original signed by
James G. Keppler

James G. Keppler
Regional Administrator

cc: J. J. Waldron, Manager, Perry Plant Technical Department
M. D. Lyster, Manager, Perry Plant Operations Department
L. O. Beck, General Supervising Fuel Management Section
DCS/RSB (RIDS)
Licensing Fee Management Branch
Resident Inspector, RIII
Harold W. Kohn, Ohio EPA
Terry J. Lodge, Esq.
James W. Harris, State of Ohio
Robert H. Quillin, Ohio Department of Health

RIII yes	RIII yes	RIII	RIII	RIII	RIII
RCK	RFW	CJP			
Knop/pd	Warnick	Paperiello	Norelius	Davis	Keppler
2/4/86	2/4/86	2/4/86	2/4/86	2/4/86	2/4/86

ATTACHMENT IV

CONDITION REPORT EVENT INVESTIGTATION

CR-86-0106

1216 259 3610

CONDITION REPORT
EVENT INVESTIGATION

CR-86-0106

Event Description

On Friday, January 31, 1986 at approximately 1148 hours, a step increase of approximately one and one half inches (1 1/2") was observed on both the Suppression Pool wide and narrow range level recorders, 1G43-R0093A/B and 1G43-R073B. Each instrument loop is totally independent in that they have separate power supplies, sensing and reference legs, and are mounted in different locations. This step change was therefore assumed to be related to the seismic event which was experienced at approximately the same time. In an attempt to ascertain the cause of the observed step change, as found data only was taken on the Suppression Pool level instruments by the performance of Surveillance Instructions G43-T1305 A thru F. This work was accomplished following prior approval from both plant management and the NRC resident inspector. The as found data indicated that there was a measurable positive zero shift of approximately three eights to three quarters of an inch (3/8" to 3/4") of pool level from the previous calibration data taken approximately two months prior.

Investigation of Potential Causes

The cause of the recorded level increase was investigated at first for possible sources of water being dumped or leaked into the suppression pool as a result of the seismic event. The step increase of 1 1/2 inch corresponds to approximately 5700 gallons of water. Prior to the event there had been indication of a small but continuous pool level increase of approximately 800 gallons per day due to a known source. Engineering evaluation after the event produced an extremely low probability that the level increase was due to an actual level increase in the suppression pool, as no potential source showed a corresponding loss of water inventory.

The measured instrument zero offset of 3/8" to 3/4" taken from the Surveillance Instruction data did not correspond directly with the recorded increase of 1 1/2 inch. As a result it was decided to investigate the following areas of potential cause:

Potential seismic damage to the Rosemount differential pressure transmitters

Installation of the level transmitters

Calibration procedure or technique

1 216 259 3610

Air entrapped in the variable sensing lines due to inadequate filling and venting after the recent suppression pool outage

Recorder pen sticking

To assist in the evaluation, ND&AS called in factory representatives from Rosemount, the manufacturer of the instrumentation. The overall investigation covers from January 31 to February 14,1986.

Analysis

Several possible causes of the observed anomaly were considered, however only those discussed below display a reasonable degree of probability or collaborating evidence:

Potential Seismic Damage - At first, it was assumed that there could have possibly been some damage to the Rosemount differential transmitter resulting from the seismic event. ND&AS has researched the environmental qualification of the transmitter as compared with the actual seismic event data, and report that the test response spectra of the Rosemount transmitter enveloped the seismic event. In a further attempt to confirm potential seismic damage, three similar differential pressure instruments, listed below, were tested by taking as found data only using the corresponding Surveillance Instruction. All of the selected instruments had been previously calibrated in a time frame similar to that of the suppression pool level transmitters. The results of the data taken from these instruments showed no measurable offset, and the as found data compared favorably with the as left data from the previous calibration.

Instrument Number	Surveillance Number
1E12-N053A	E12-T1193
1E12-N053B	E12-T1195A
1E12-N053C	E12-T1195B

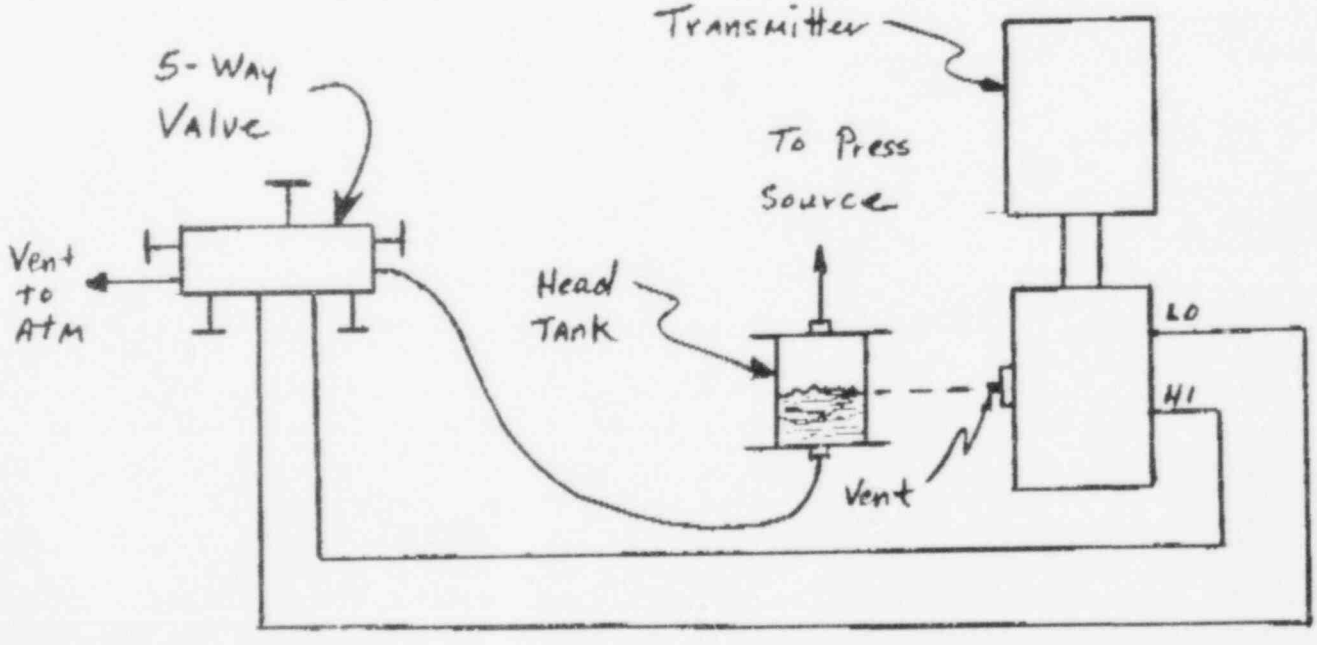
Close observation of the suppression pool level transmitter zero offset showed that if the value of the zero shift was subtracted from the data points taken, that all values would then fall within the leave-as-is zone for the loop calibration. This observation eliminated all other loop components except the level transmitter as a potential source of deviation. It was then necessary to take a closer look at the transmitter installation.

Transmitter Installation - The Rosemount factory representatives could find no problems with the installation of the transmitter that could potentially cause a zero offset or step change in transmitter output. A review of each instrument's history file showed some previous occurrence of zero offset as a result of

changing mounting hardware, but not evident on all transmitters. A trend analysis shows that after the observed shift, subsequent recalibration showed no trend of zero offset, nor any common cause could be identified for the offset. The factory representatives did offer some observations with respect to the calibration technique used and installation of the sensing lines.

Calibration Technique - The suppression pool level instruments are designed such that they have a "dry" reference leg, vented to containment atmosphere, and a wet variable leg sensing pool level. This configuration requires the use of a "head tank" on only the variable side. A head tank is used to allow the instrument to be calibrated with water. It is crucial that the head tank be at the same elevation each time the calibration is performed. The methods to accomplish this are for the most part left up to the technician with the probable result being that the reproducibility of the calibration is questionable. Dry calibration techniques cannot be used because not all water can be removed from the instrument, and as a result, an offset would be experienced. An additional problem occurs in that if the instrument bypass valve is opened, water would be admitted to the reference leg. Water in the reference leg would result in a positive offset. During the taking of as found data, no water was observed in the reference leg. Additionally, it is relatively impossible to cause water to enter both reference legs at the same time, unless the containment is flooded to above the 674.0 foot elevation.

When calibrating with one head tank, extreme care must be observed when adjusting the elevation of the tank. The current procedure is to match the elevation of the head tank with the center of the vent screw on the transmitter. If the tank is above the center line, a negative offset will occur, and below the center will result in a positive offset. It should be noted that there is no mounting mechanism currently provided to align and hold the position of the head tank assembly during calibration.



Sensing Line Installation - The sensing lines for the narrow range transmitters are extremely long as compared with the wide range. There are several high points that have installed. There are at least three high points in common with both narrow and wide range transmitters, but only one of these points is vented. The suppression pool transmitters had been filled and vented after the suppression pool outage, approximately two weeks prior to the event. Our current program does not require a formal procedure for filling and venting every instrument in the plant. There are however, generic Instrument Maintenance Instructions (IMI's) providing methodology for the filling and venting of various types of instruments.

It was previously observed that the filling and venting of the suppression pool lines was difficult due to the short section of three quarter inch pipe followed by a long section of small instrument line. The method used was to open the instrument vent lines, and allow the water to flow until the variable line no longer showed signs of air. The other high points would be vented in a similar manner. This method does appear to be inadequate in that it remains uncertain that the variable sensing line may not be fully vented of all entrapped air due to the low mass flow rate of the water through the instrument lines and vent valves. The geometry of the sensing lines is such that the amount of residual entrapped air would be roughly equal in both loops in the section upstream of the narrow range tap.

Recorder Pen Movement - It has been observed that when a recorder pen receives little or no movement, the pen may tend to "stick" in place until a force, such as a shake or tap, causes the pen drivers to overcome the slidewire resistance (friction). At first, it was assumed that this may have been a major contributing cause of the observed step increase. The momentary shake, combined with the actual momentary change in pool level could have contributed to the discontinuity of the chart trace. Further investigation shows that no other active chart recorders showed a similar pen movement at the time of the event. Additionally, the expected step change would be much less than observed at the current gain setting of the recorder amplifier. It may then be surmised that the observed change in level was not a result of a "stuck" recorder pen.

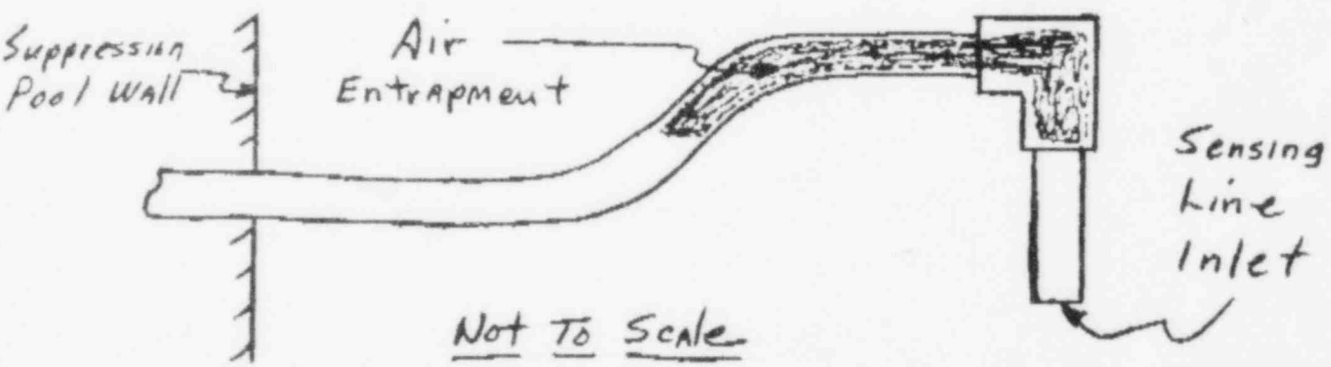
Probable Cause

ND&AS has performed an analysis of the earthquake and how it should have affected the Rosemount differential transmitters. They have found that the event was within the environmental qualification of the instrument, and that they responded as expected. This evaluation is substantiated in that there were no other instruments other than the suppression pool level that showed an abnormal indication during or after the event. No other recorders or differential pressure instruments were observed to

exhibit similar or any other anomalies.

The actual level of the suppression pool was surveyed, and the results show that all of the instruments are currently indicating approximately thirteen sixteenths inch (13/16") lower than actual level. The instruments do have a 3/8-3/4 inch positive zero offset which make the instruments sensing actually about an inch to inch and one half (1 - 1/2") lower than actual level. This difference is most likely due to some amount of air still being entrapped in the sensing lines. The air entrapment is due to the inability to completely fill and vent the existing lines from the sensing tap to the instrument.

As mentioned earlier, there currently exists three points in the sensing line, between the sensing tap and the tee where the narrow range instrument line taps off, where the high points cannot be vented. Two of these points are in the three quarter inch line, where a high mass flow rate would be required in order to completely remove any entrapped air. Most important to note is that the sensing line inside the suppression pool has an elevated offset just prior to the elbow which directs the sensing line down towards the pool floor (see sketch below). The opening is directed towards the floor to minimize the turbulent effects when RHR is running, as both the RHR suction line and the level sensing line share the same penetration.



This offset can, and is expected to still contain some entrapped air. Entrapped air in this location will have equal effect on both the wide and narrow range level channels. Both the A and B instrument loops are installed on a similar manner.

Assuming that the sensing line contained air in the location described, prior to the event all of the suppression pool level instruments may have been indicating about two and one half inches (2 1/2") lower than actual pool level. At the time of the earthquake, the pool was upset, causing a "wave" effect. This upset can be clearly seen on the suppression pool level recorder charts. When the level went momentarily low at the sensing tap, there was a momentary vacuum sensed at the end of the pipe tap. This low pressure caused some of the entrapped air to be pulled out the end of the pipe, resulting in a restoration of about 1 1/2

inch of level. As mentioned before, it is expected that there still may be as much as one inch of air still entrapped in the sensing lines. This phenomena occurred at both sensing taps in nearly equal magnitude, and almost simultaneously.

It is not expected that the zero shift had anything to do with the observed step change in level, but existed prior to the event, and was due to the improper elevation of the water head tank during calibration. Similar zero shifts were observed prior to the event on the suppression pool level channels and the condensate storage tank level instruments which utilize a similar installation of both a wet and a dry sensing line.

At this time, the spontaneous venting of some entrapped air in both of the suppression pool level instrument sensing lines is the only suspected cause for the observed pool level change at the time of the seismic event. Several corrective actions are therefore recommended.

Proposed Corrective Actions

Sensing Line Filling and Venting - The facilities currently installed are inadequate to provide complete filling and venting of the sensing lines. Additionally, due to the complex nature of the process being measured and the difficulty in assuring the proper and repeatable venting and filling, the following actions will be taken:

Installation of Sensing Lines - An EDCR has been prepared to provide at least two additional high point vents. One of the vents shall be in the three quarter inch line upstream of the containment isolation valve to assure adequate flow rate through the unventable high point inside the suppression pool. Installation of the high point vents should be completed prior to entering Operational Mode 3

CA-86-106-01 To approve EDCR, Instrument & Controls Section. Due date March 1, 1986

Filling and Venting Procedure - A detailed Instrument Maintenance Instruction will be prepared to provide step by step instruction to assure the adequate and repeatable filling and venting of the sensing lines. The I&C supervisors will assure that personnel who are assigned the task of filling and venting the suppression pool level sensing lines will have been properly trained in this activity prior to starting.

CA-86-106-02 To prepare and apporve IMI for filling and venting sensing lines, Instrument & Control Section. Due date March 15, 1986.

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Inatrument Calibration - The methodology used for the calibration of differential pressure instruments with one wet and one dry sensing line is difficult to implement. Portable test equipment is difficult to adjust to assure proper repeatable positioning of the head tank assembly. The following corrective actions will be taken to assure future calibrations do not introduce zero offset errors:

Head Tank Assemblies - An EDCR has been submitted to provide for the installation of permanently head tank assemblies on all instruments which have one wet and one dry sensing line. This will include the suppression pool and condensate storage tank level transmitters. Use of permanently installed head tanks will assure repeatable results due to the accurate positioning of the test equipment. The head tank assemblies should be installed prior to the end of the first refueling outage.

CA-86-106-03 To approve EDCR for head tank assemblies, Instrument & Control Section. Due date March 1, 1986.

Instrument Calibration Instructions - The Surveillance Instruction for the suppression pool level channel calibration will be revised to incorporate appropriate changes to the calibration methodology so as to assure proper positioning and use of portable head tanks until permanent tanks are installed. When permanent tanks are installed, the procedure will be revised accordingly as part of the DCP process. Additionally, a generic Instrument Calibration Instruction will be written to provide specifically for transmitter calibration when there are dissimilar fluid sensing lines.

CA-86-106-04 To prepare and approve TCN for Surveillance Instructions, Technical Section. Due date February 26, 1986.

CA-86-106-05 To prepare and approve ICI for transmitter calibration, Instrument & Control Section. Due date April 1, 1986.

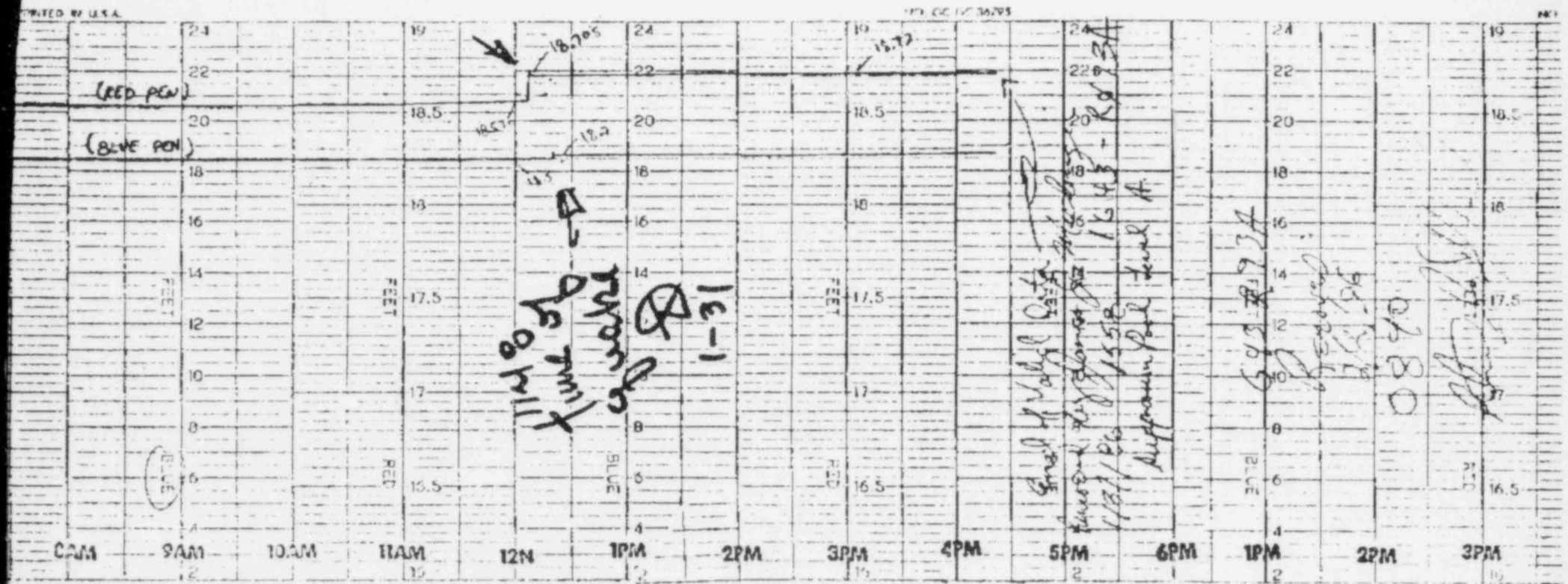
Instrument Calibration Frequency - The Technical Specifications require that the suppression pool level instruments be calibrated on a frequency of once per 18 months (ref. 4.3.7.4 Table 4.3.7.4-1 & 4.3.7.5 Table 4.3.7.5-1). As a conservative measure, the frequency for Surveillance Instructions G43-T1305 A thru F will be accelerated to once per 90 days until such time as three consecutive as-found data measurements are within the currently established leave-as-is zone. At that time the Lead Engineer E/I&C may relax the frequency concurrent with technical specifications.

1 216 259 3610

CA-86-106-06 To revise the frequency of SVI G43-T1305 A thru F to once per 90 days, Technical Section. Due date March 1, 1986. 2 TEC 2-27-86

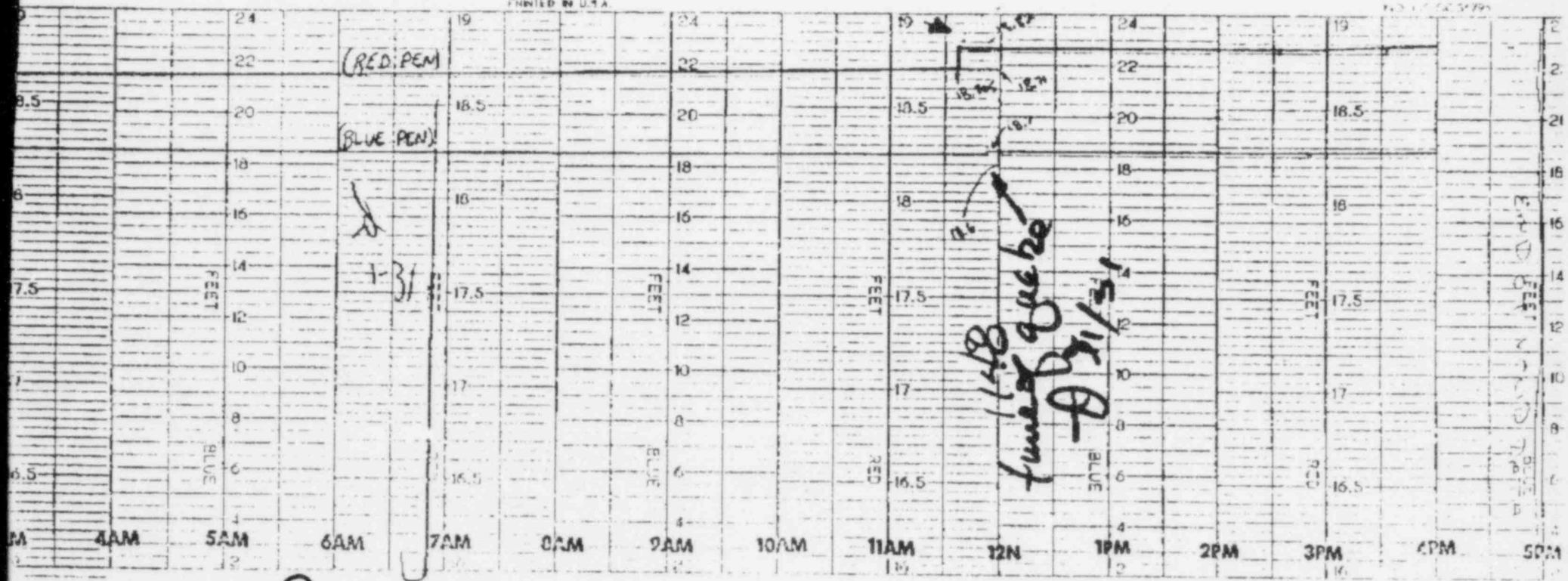
ATTACHMENTS

1643R093A



1 216 259 3610

1643-R093B



1216 259 3610

PNPP No. 6584 Rev. 5/85

ENGINEERING DESIGN CHANGE REQUEST

1216 259 3610

Operating Phase

1. SYSTEM NO. 043 2. DATE INITIATED 2-18-86 3. EDCR NO. _____

4. SYSTEM TITLE SUPPR POOL MAKE-UP 5. Priority 7

6. SUBJECT ADDITION OF HIGH POINT VENTS FOR COMPLETE VENTING OF LINE

7. ORIGINATOR BOB RUND 8. SUPERVISOR _____

9. REFERENCE DOCUMENTS

CR-86-0104 INVESTIGATION RESPONSE
B14-727 INSTRUMENTATION LOOP A
B14-728 INSTRUMENTATION LOOP B

10. JUSTIFICATION

THE HIGH POINT VENTS WILL MAKE IT EASIER TO FILL/VENT THE LONG RUNNING SENSING LINES AND PREVENT THE OCCURENCE OF TRAPPED AIR IN THE LINES WHICH WAS DISCOVERED BY OBSERVING A STEP CHANGE IN THE RECORDER TRACINGS FOR SUPPR POOL LEVEL DURING THE 1-31-86 EARTHQUAKE.

11. PROPOSED DESIGN CHANGE

ADD TWO HIGH VENT POINTS EACH TO LOOPS A AND B. ONE BEFORE AND ONE AFTER THE CONTAINMENT ISOLATION VALVE. THESE VENT POINTS SHALL BE INSTALLED PRIOR TO OPERATIONAL MODE 3.

12. WORK SCOPE

ADD VENT POINTS, FILL/VENT LINES AND CALIBRATE LEVEL TRANSMITTERS 1643N060, 70, 90 & 100 - AEB; 1E51-N036 A, B, E, F; 1E22N055 C&G; 1E22N054 C&G; 1E51-N035A EE

13. PPOD/PPTO RESPONSE ☐ ACCEPTED ☐ REJECTED - REASON:

RPG 2/20/86 _____ Plant Manager _____ Date

14. ENGINEERING RESPONSE

☐ ACCEPTED Design Engineer/Project Coordinator _____

☐ REJECTED - REASON:

_____ Lead Engineer _____ Date

_____ Senior Project Engineer _____ Date

15. DOCUMENT(S) TO DEVELOP EDCR

PNPP NO. 6684 Rev. 5/85

ENGINEERING DESIGN CHANGE REQUEST

1216 269 3610

Operating Phase

1. SYSTEM NO. G43 2. DATE INITIATED 2-18-86 3. EDCR NO. 11

4. SYSTEM TITLE SUPPR POOL MAKE-UP 5. Priority

6. SUBJECT INSTALLATION OF PERMANENT HEAD TANK ASSEMBLIES

7. ORIGINATOR BOB RUND 8. SUPERVISOR

9. REFERENCE DOCUMENTS

CR-86-0106 INVESTIGATION RESPONSE
CALIBRATION VOLUME CHAMBER LITERATURE (CVC)
~~B14-727 INSTRUMENTATION LOOP A~~
~~B14-728 INSTRUMENTATION LOOP B~~

10. JUSTIFICATION

PERMANENT HEAD TANKS WILL ASSURE REPEATABLE POSITIONING OF THE TEST EQUIPMENT FOR ACCURATE CALIBRATIONS AND REDUCE THE INTRODUCTION OF ZERO OFFSET ERRORS.

11. PROPOSED DESIGN CHANGE

PERMANENTLY INSTALL HEAD TANKS ON ALL INSTRUMENTS THAT HAVE ONE WET AND ONE DRY SENSING LINE. INSTALLATION TO BE COMPLETE PRIOR TO COMPLETION OF 1/4 FUEL OUTAGE.

12. WORK SCOPE

ADD HEAD TANKS, FILL/VENT SENSING LINES AND CALIBRATE TRANSMITTERS 1G43N060, 70, 90 & 100 AEB; 1E51-N036 AEE; 1E22N055 CEG; 1E51-N035 AEE; 1E22N054 CEG

13. PPOD/PPTD RESPONSE ☐ ACCEPTED ☐ REJECTED - REASON:

SRB 2/20/86 Plant Manager Date

14. ENGINEERING RESPONSE

☐ ACCEPTED Design Engineer/Project Coordinator

☐ REJECTED - REASON:

Lead Engineer Date

Senior Project Engineer Date

15. DOCUMENT(S) TO DEVELOP EDCR

ATTACHMENT V

PRELIMINARY REPORT ON KINEMETRICS DATA

TELECOPY REQUEST

KINEMETRICS, INC.
PASADENA, CA
TELECOPY TELEPHONE (818) 795-0868

TELECOPY NO: 569

DATE: Feb 4, 1986

TELECOPY TELEPHONE TO WHICH THIS MESSAGE SHOULD BE SENT: (312) 790 5661

TO: NRC - Chicago
Attn: Jim Muffett

FROM: G. Siegel
Customer Service Dept.

DOCUMENT: Prelim. Data from Earthquake of Jan 31'86 at Perry

REFERENCE: S/O K6028 KMS K6-002

NO. OF SHEETS FOLLOWING THIS PAGE Thirteen

IF YOU HAVE ANY PROBLEM WITH THIS TELECOPY CONTACT GIGI M. CRIST AT (818) 795-2220

4 FEB 86 1:?)

PROCESSING NOTES

1. Sensor Locations:

SMA-3 S/N 165-1 (D51-N101) ⇒ Reactor Bldg Foundation, 575'

SMA-3 S/N 165-2 (D51-N111) ⇒ Containment Vessel Annulus, 682'

2. These plots are preliminary, as they have not been QC-checked. However, no changes are anticipated.

R. Nigbor
Kinemetrics
2/3/86

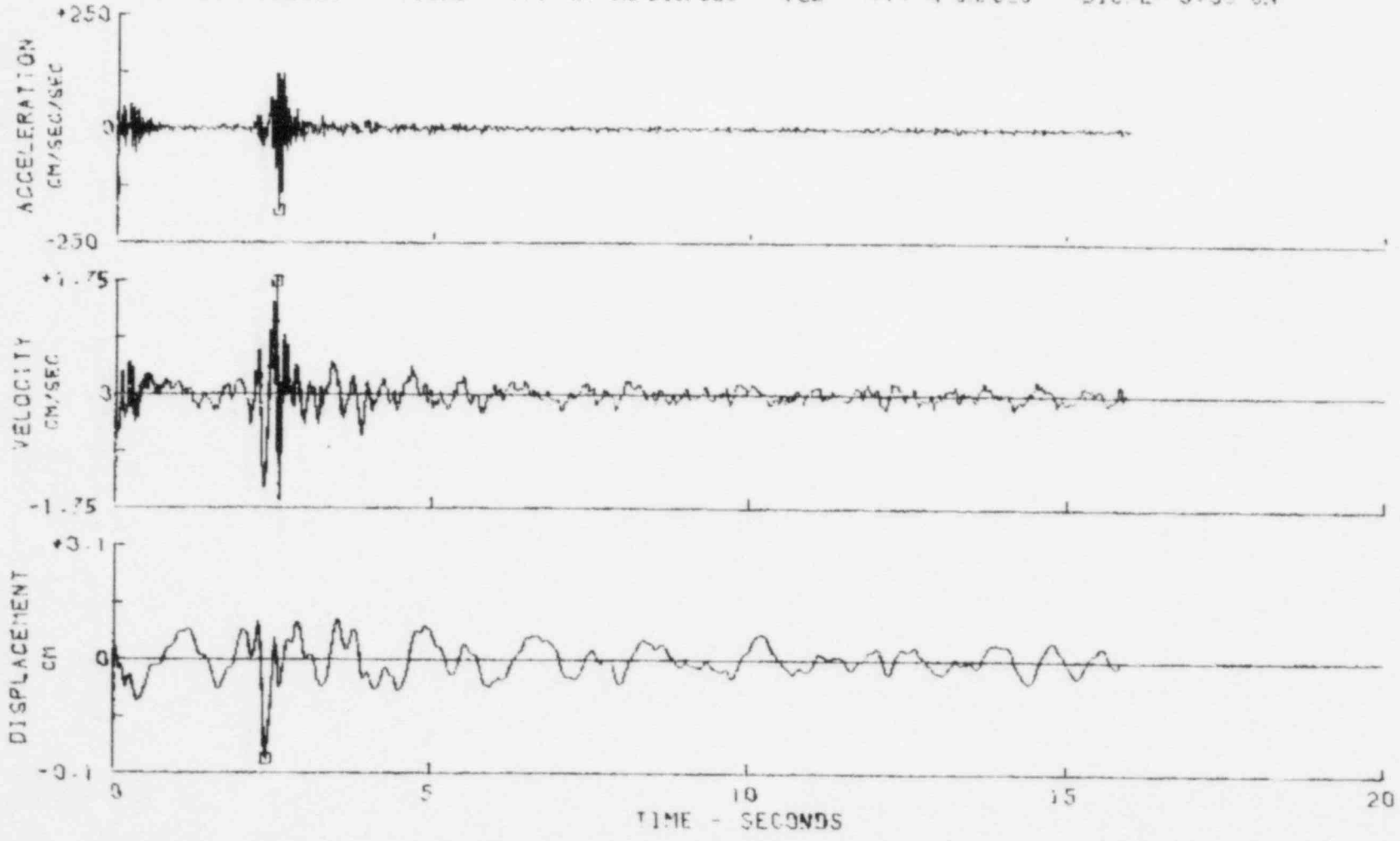
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

I1A900J PERRY NUCLEAR POWER PLANT COMP SOUTH SMA3S'N 165-1L

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.400- 0.625 AND 35.00- 40.00 HERTZ

@ PEAK VALUES: ACCEL= -177.21 CM/SEC/SEC VEL= +1.74 CM/SEC DISPL=-0.09 CM



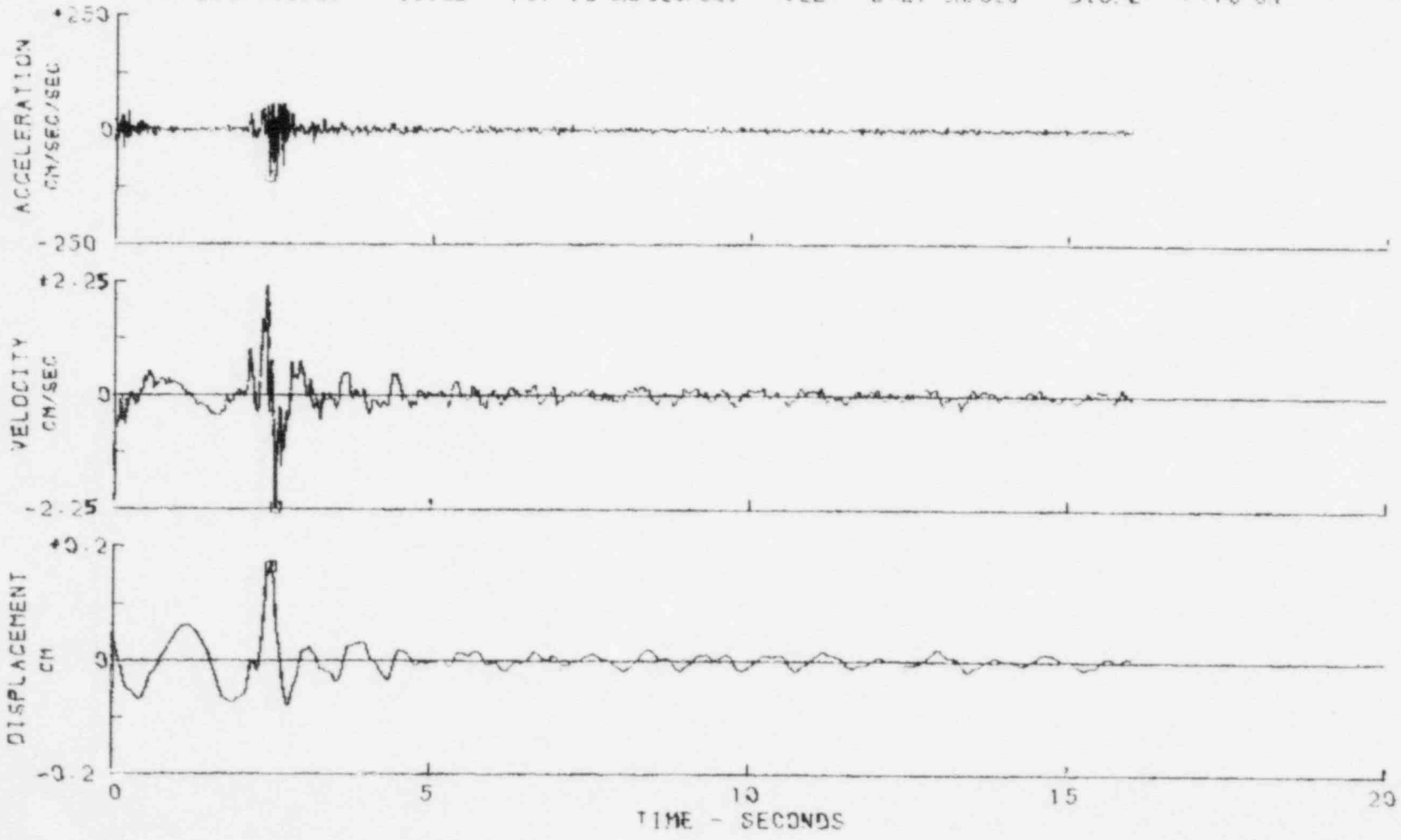
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1985

11A8001 PERRY NUCLEAR POWER PLANT COMP WEST SMA3S/N 165-11

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.400- 0.625 AND 33.00- 40.00 HERTZ

@PEAK VALUES: ACCEL= -101.12 CM/SEC/SEC VEL= -2.21 CM/SEC DISPL= .16 CM



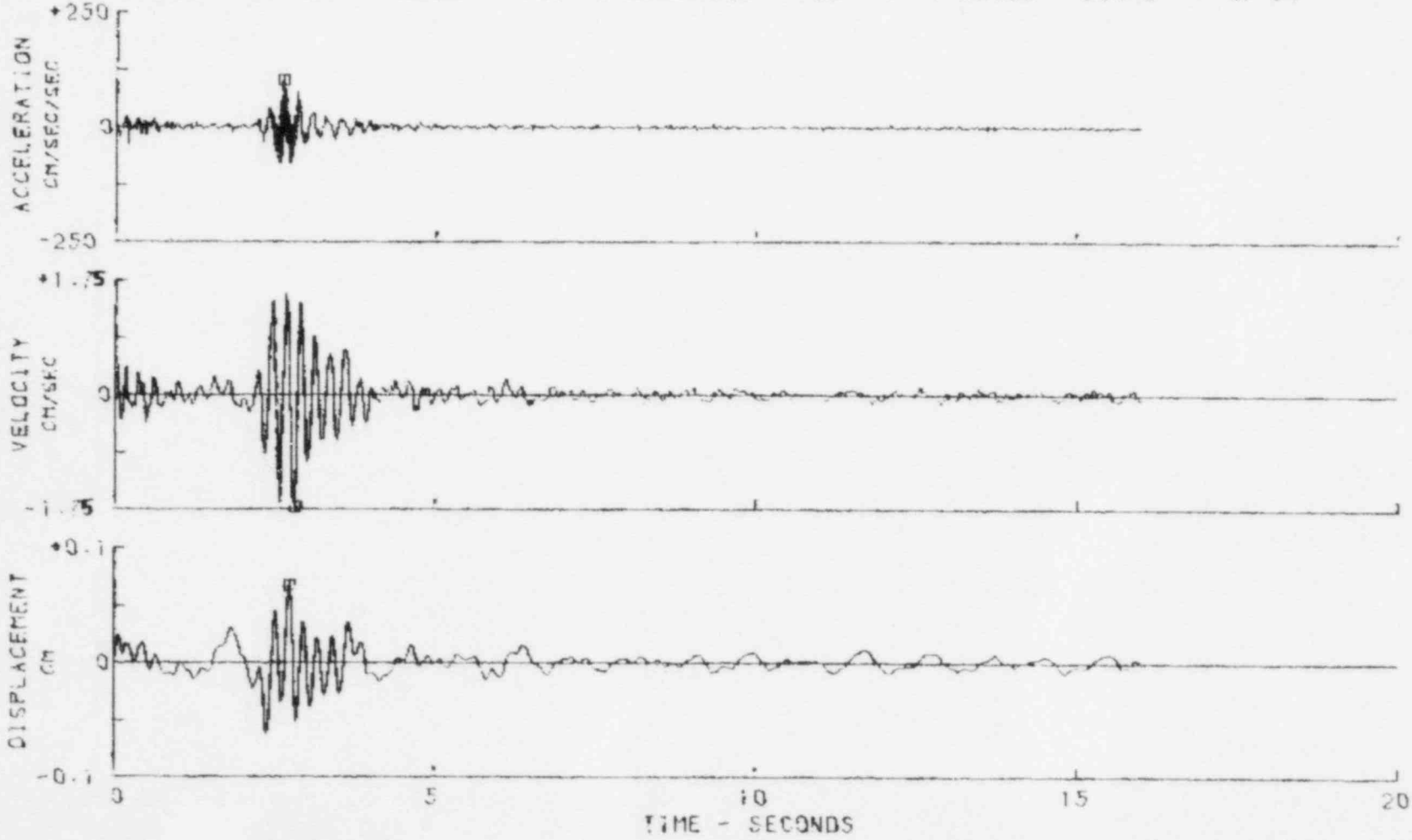
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

TIA900I PERRY NUCLEAR POWER PLANT COMP UP SMA3S/N 165-IV

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.400- 0.625 AND 35.00- 40.00 HERTZ

@ PEAK VALUES: ACCEL= +102.46 CM/SEC/SEC VEL= -1.71 CM/SEC DISPL= +.07 CM



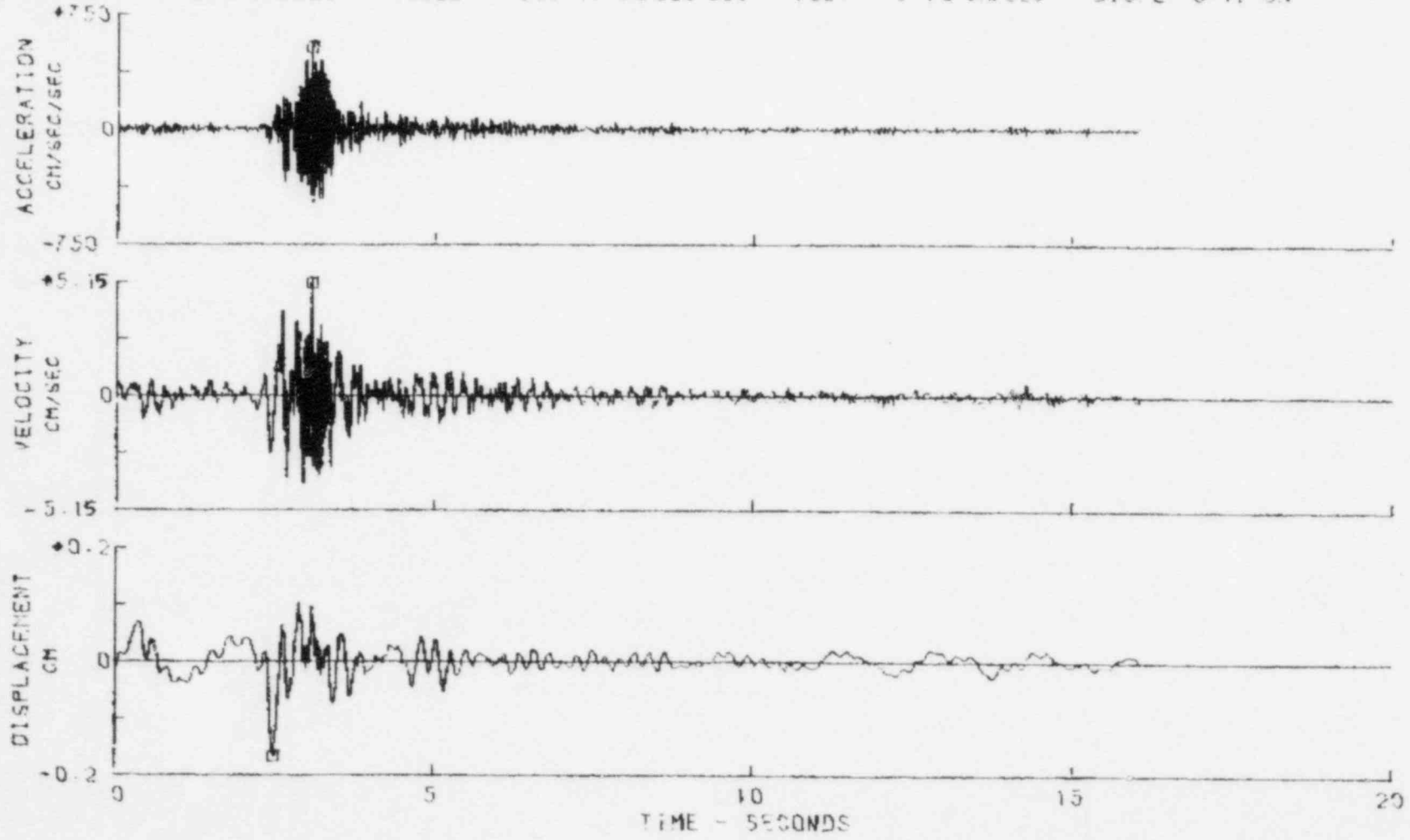
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

TTA8002 PERRY NUCLEAR POWER PLANT COMP SOUTH SMA3S/N 165-2L

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.490- 0.625 AND 35.00- 40.00 HERTZ

@PEAK VALUES: ACCEL= +535.17 CM/SEC/SEC VEL= +5.15 CM/SEC DISPL=-0.17 CM



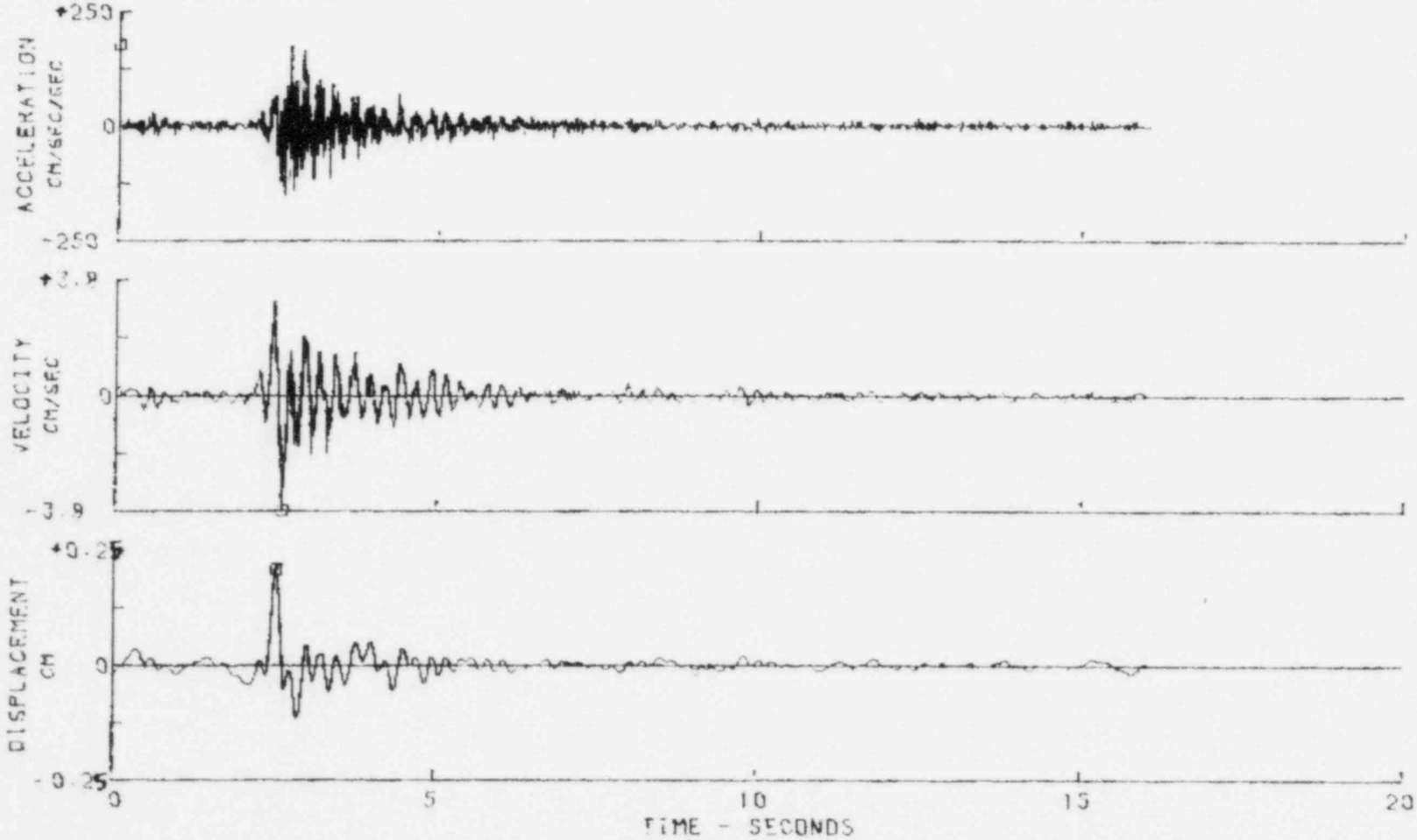
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

1TA8302 PERRY NUCLEAR POWER PLANT COMP WEST SMA3S/N 163-2T

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.400- 0.625 AND 35.00- 40.00 HERTZ

PEAK VALUES: ACCEL= +178.35 CM/SEC/SEC VEL= -3.77 CM/SEC DISPL= +.21 CM



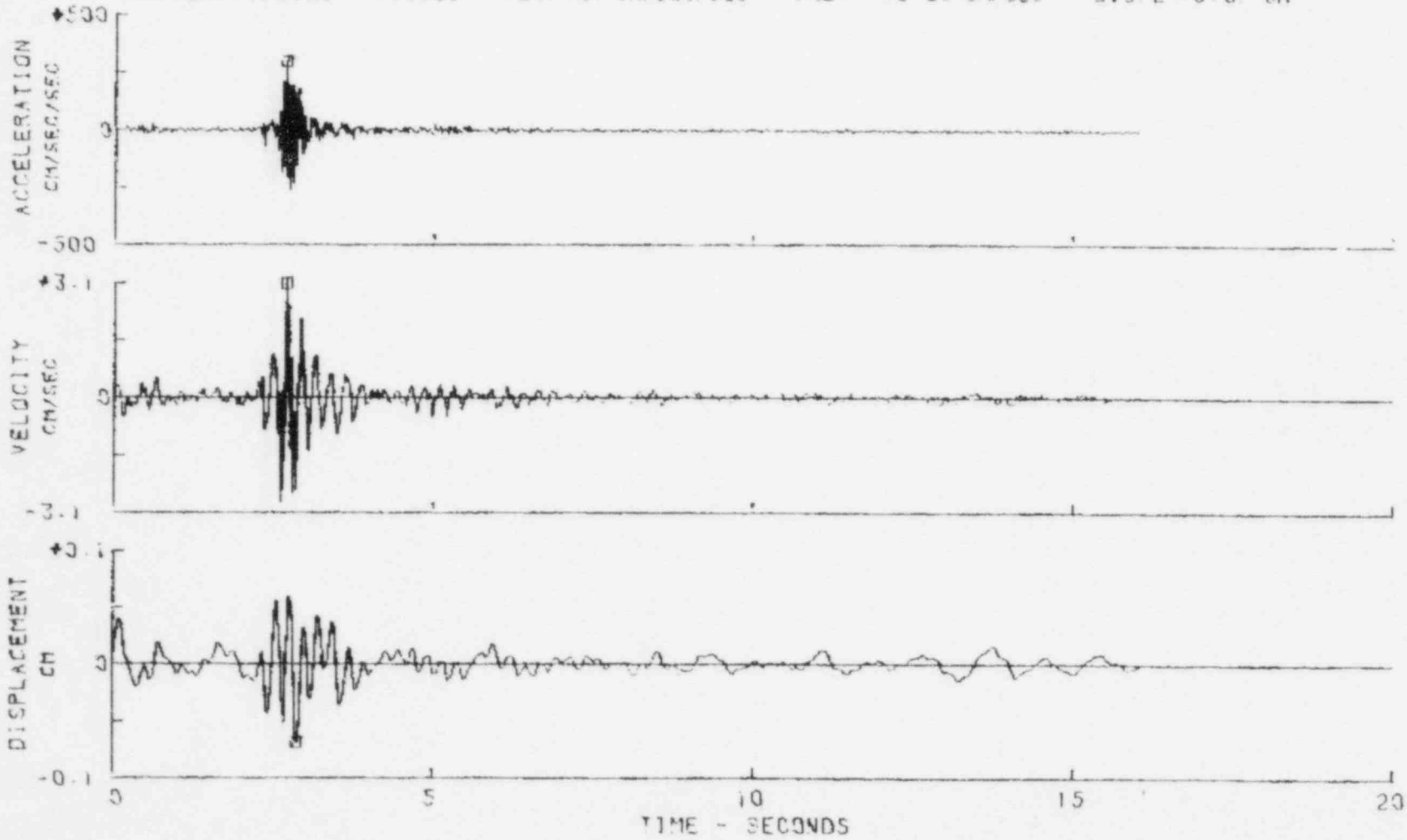
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

I1A8002 PERRY NUCLEAR POWER PLANT COMP UP SMA3S/N 165-2V

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.400- 0.625 AND 35.00- 40.00 HERTZ

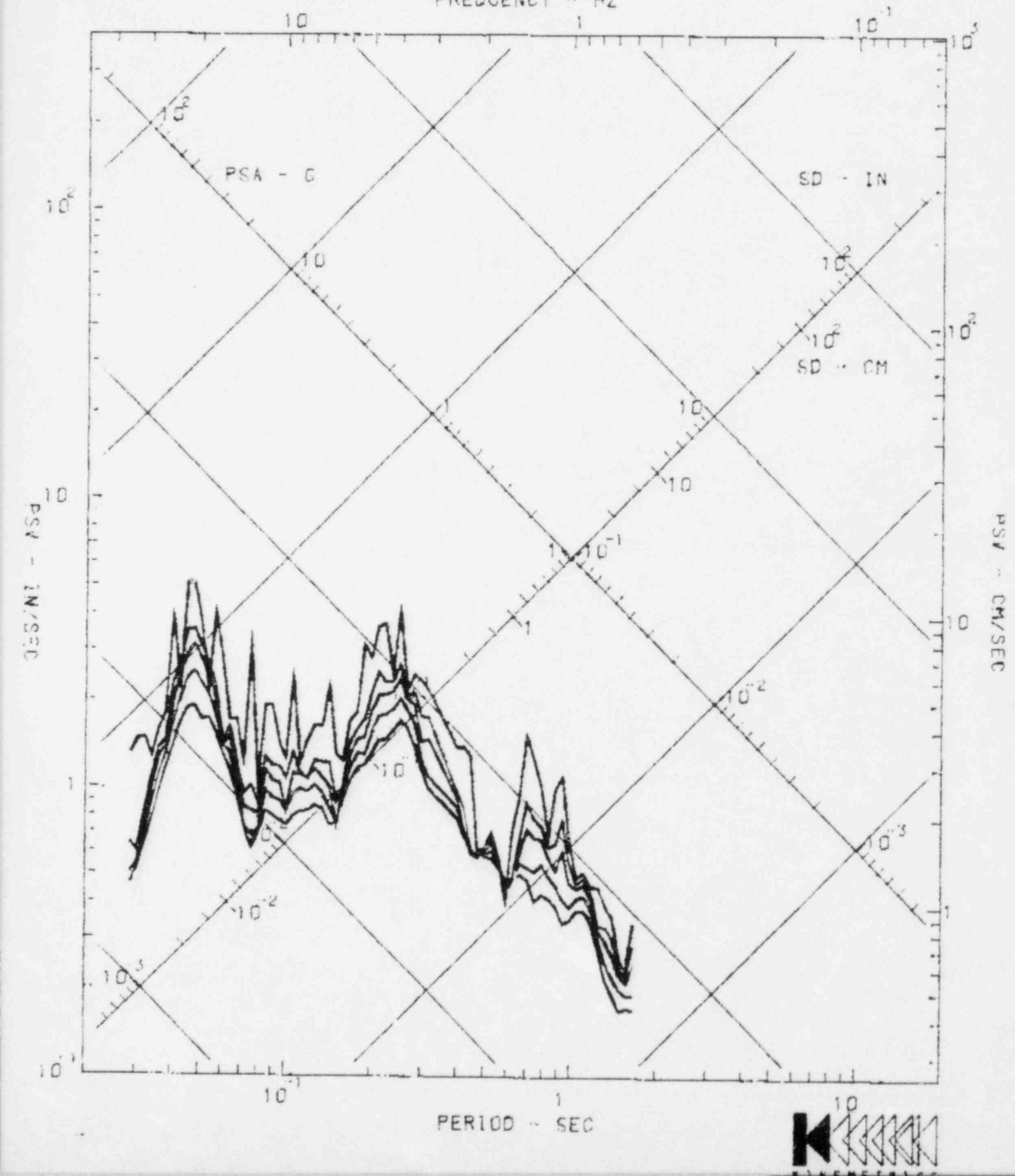
@ PEAK VALUES: ACCEL= +297.21 CM/SEC/SEC VEL= +3.09 CM/SEC DISPL=0.07 CM



ML 5.0 EARTHQUAKE JANUARY 31, 1986

11AR001 PERRY NUCLEAR POWER PLANT COMP SOUTH SMA3S/N 165-1L

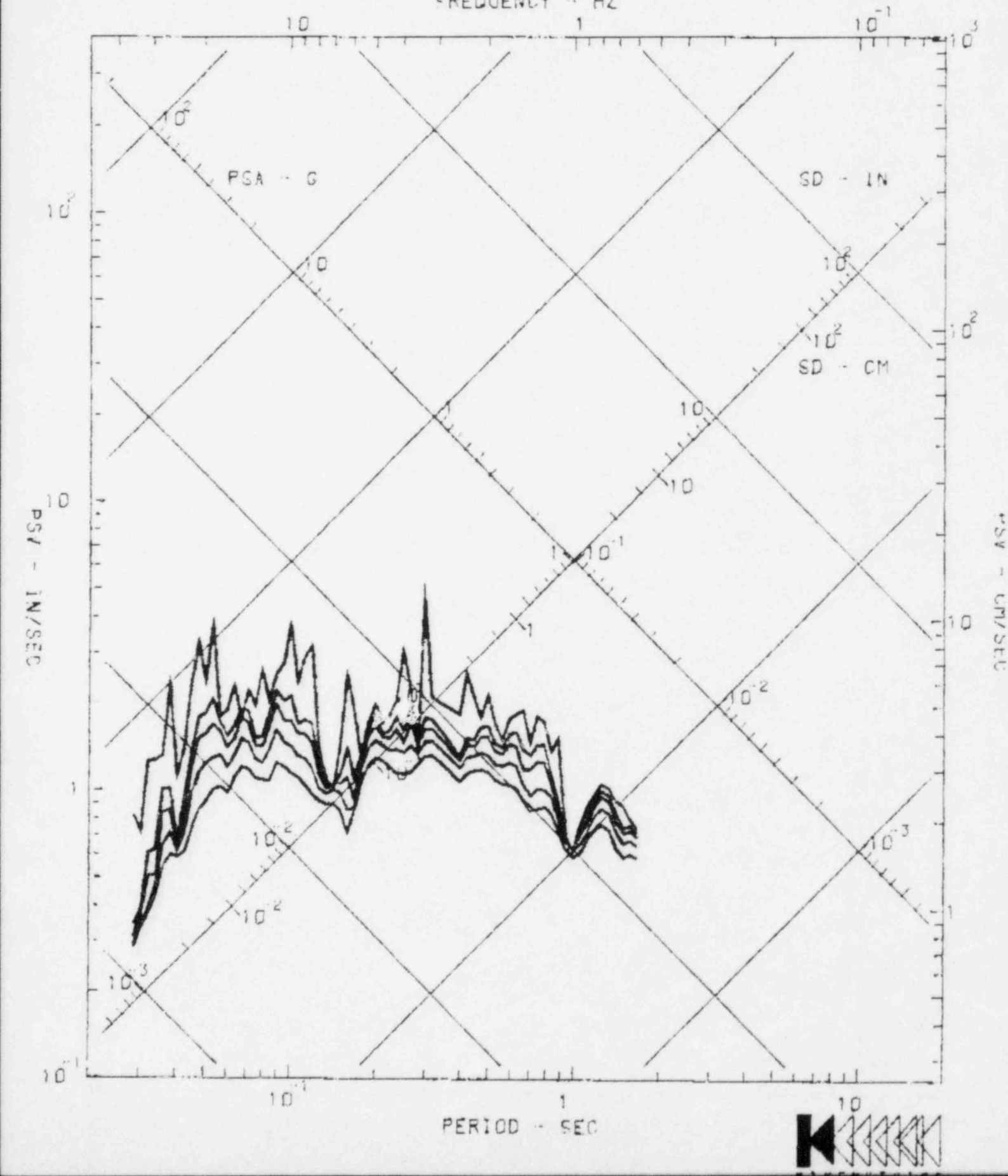
DAMPING VALUES ARE 0. 1. 2. 4. 7 PERCENT OF CRITICAL



ML 5.0 EARTHQUAKE JANUARY 31, 1986

IIA8001 PERRY NUCLEAR POWER PLANT COMP WEST SMA3S/N 165-1T

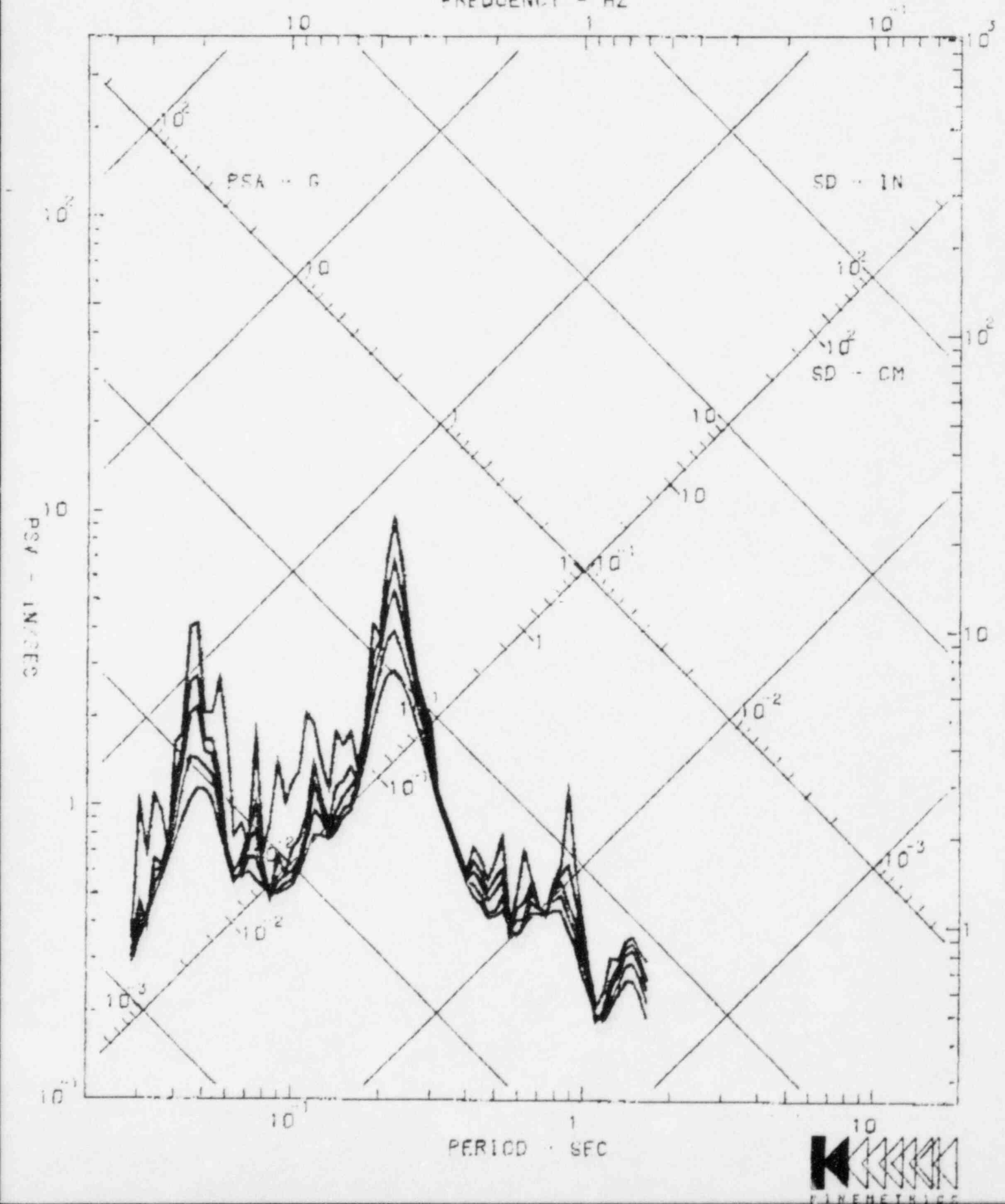
DAMPING VALUES ARE 0. 1. 2. 4. 7 PERCENT OF CRITICAL



ML 5.0 EARTHQUAKE JANUARY 31, 1986

11AB001 PERRY NUCLEAR POWER PLANT COMP UP SMA3S/N 165-1V

DAMPING VALUES ARE 0. 1. 2. 4. / PERCENT OF CRITICAL

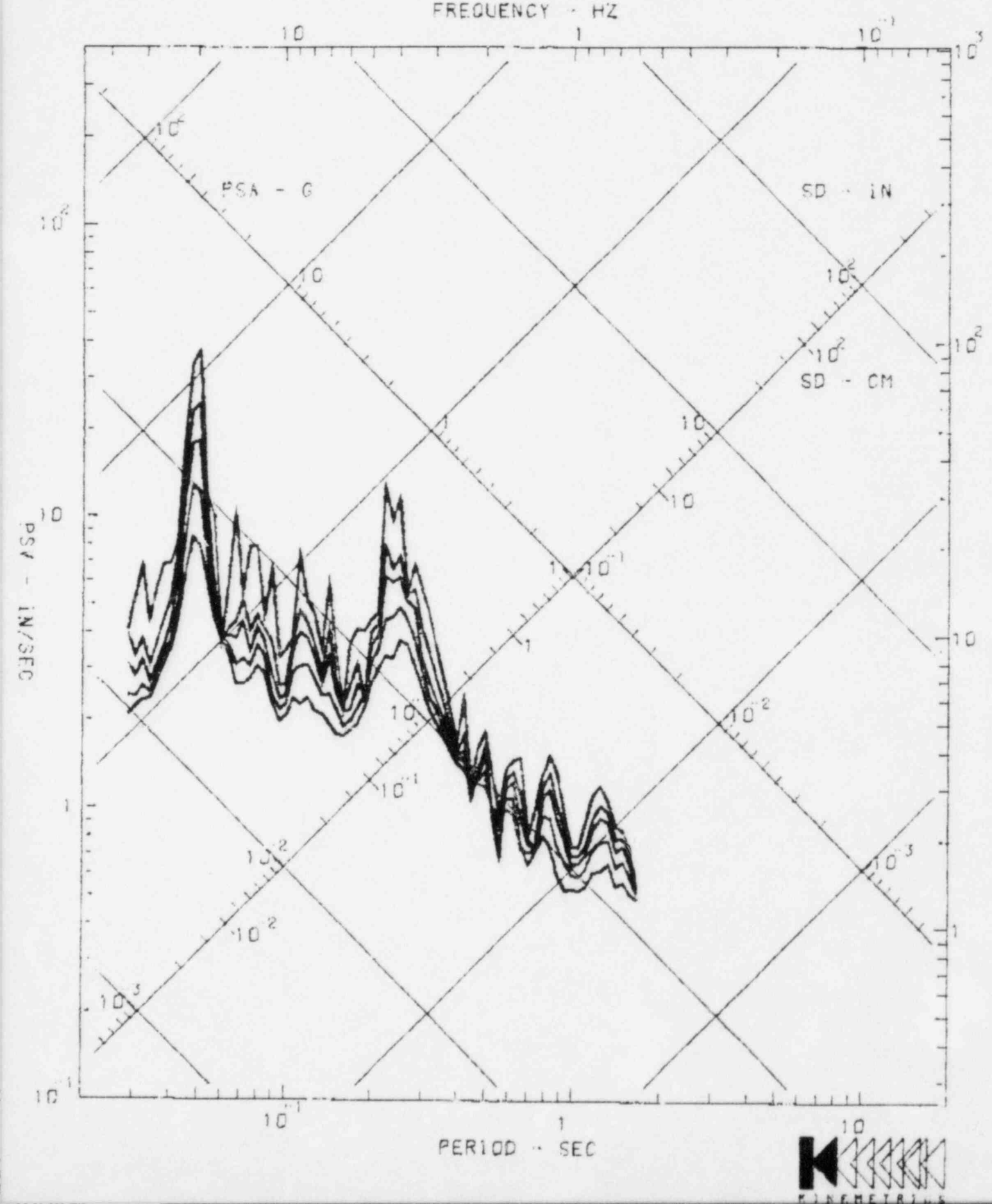


KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

11A8D02 PERRY NUCLEAR POWER PLANT COMP SOUTH SMA3S/N 165-2L

DAMPING VALUES ARE 0, 1, 2, 4, 7 PERCENT OF CRITICAL

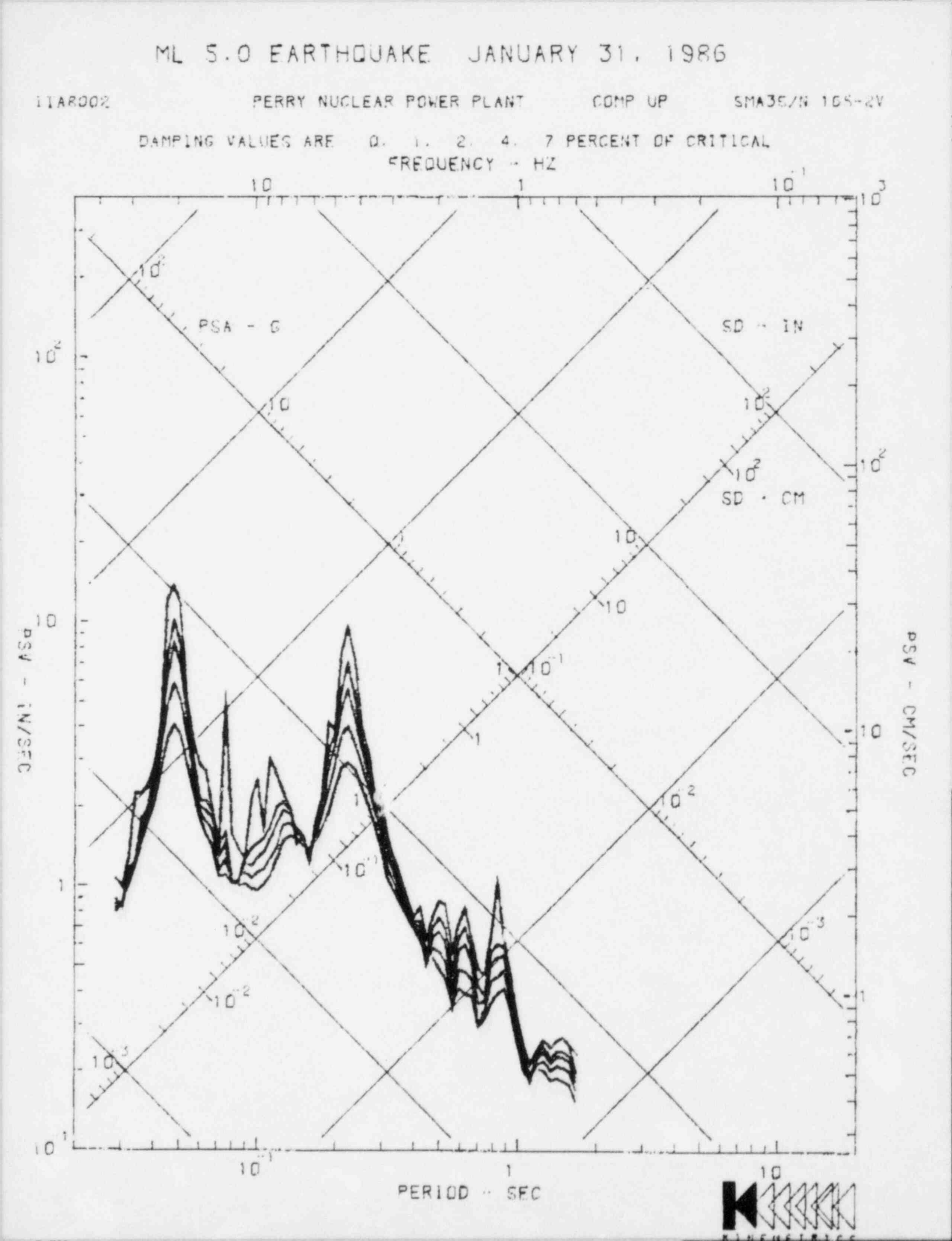


KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

11AR002 PERRY NUCLEAR POWER PLANT COMP UP SMA3S/N 105-2V

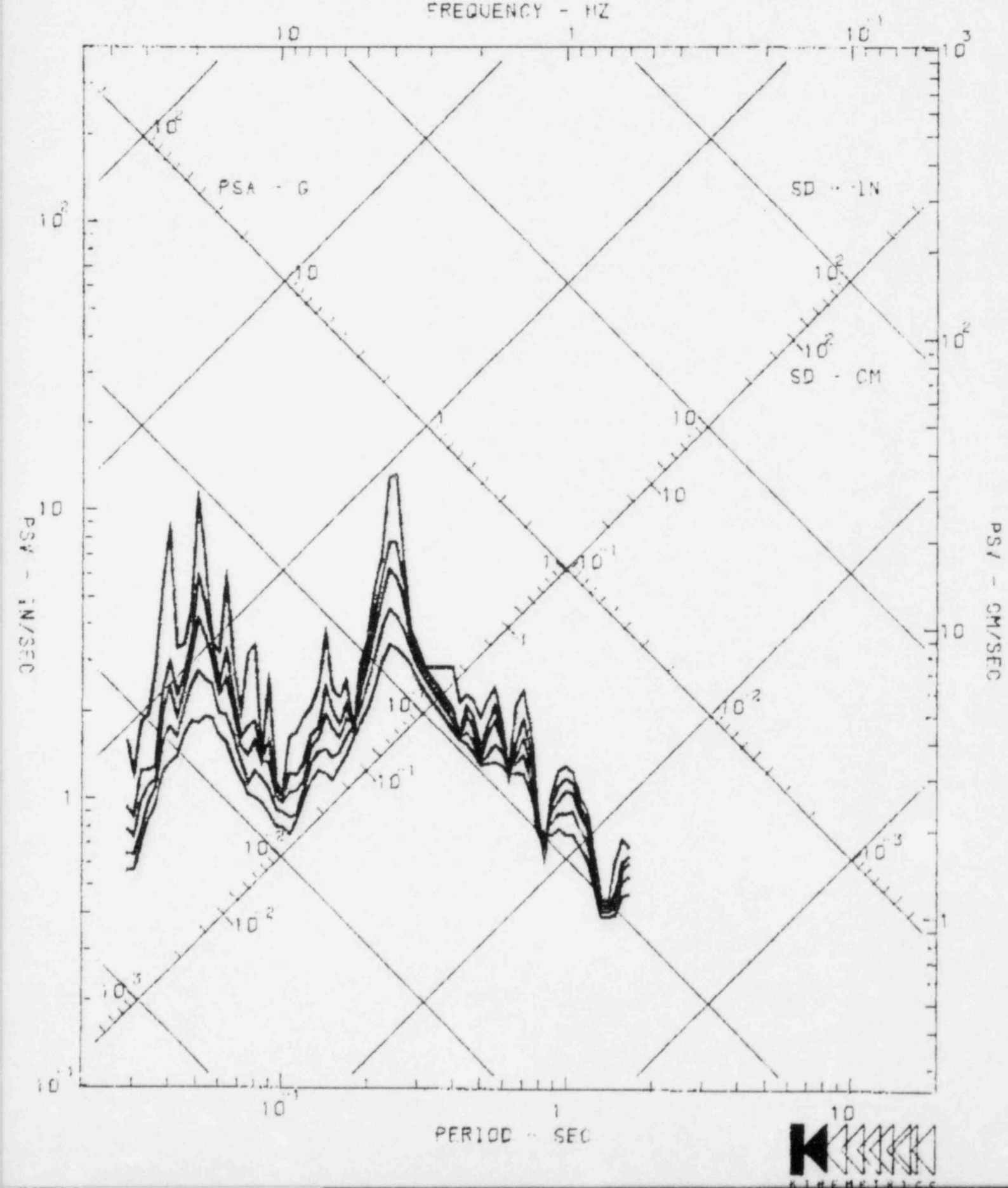
DAMPING VALUES ARE 0. 1. 2. 4. 7 PERCENT OF CRITICAL



ML 5.0 EARTHQUAKE JANUARY 31, 1986

I1AR002 PERRY NUCLEAR POWER PLANT COMP WEST SMA3S/N 165-27

DAMPING VALUES ARE 0. 1. 2. 4. 7 PERCENT OF CRITICAL



ATTACHMENT VI

NRR TRIP REPORT FROM

T. Y. Chang

Leon Reiter

C. Paperiello
Region III

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

FEB 25 1986

MEMORANDUM FOR: Robert J. Bosnak, Chief
Engineering Issues Branch
DSRO, NRR

Frank J. Congel, Chief
Reliability and Risk Assessment Branch
DSRO, NRR

FROM: T. Y. Chang, Task Manager
Leon Reiter, Sr. Reliability and Risk Analyst
DSRO, NRR

SUBJECT: REPORT OF QUICK RESPONSE TRIP TO OBSERVE EFFECTS OF THE NORTHERN OHIO EARTHQUAKE ON THE PERRY NUCLEAR POWER PLANT

Background

An earthquake occurred at 11:48 a.m. on January 31, 1986 near the Perry Nuclear Power Plant in Northern Ohio. Preliminary information from USGS indicated that the earthquake had a body-wave magnitude (m_b) of 5.0, and the epicenter is located approximately 12 miles south of the Perry site.

The Perry Plant is a General Electric BWR-6 with a Mark III containment. It is not yet licensed. Nuclear fuel is on site but has not been loaded into the reactor core. The owner of the plant is Cleveland Electric and Illuminating Company (CEI). The utility was performing pre-operational tests and according to CEI, most of the safety related systems were running when the earthquake occurred. Although Perry is not an operating plant and is not required to do so, CEI immediately activated the emergency plan in order to assess facility damage and personnel injuries. No injuries occurred. In addition, NRC and other relevant federal and local agencies were notified of this event. The plant was switched to the recovery mode in the afternoon of January 31, 1986. The recovery organization is shown in enclosure 1. A detailed walkdown inspection involving about 40, and at times 65, people was conducted for the whole plant, which covered buildings, equipment, instrumentation, piping systems, etc. Only minor damage was found (see preliminary findings below). The inspection was completed at 2:00 a.m. on February 1, 1986.

An Augmented Inspection Team (AIT) from NRC Region III and staff from NRR were sent to the Perry site on the morning of February 1. The team from NRR consisted of John Stefano (Perry Project Manager), Leon Reiter and T. Y. Chang (both from DSRO). They left Perry on the evening of February 2. The Region III group was led by Carl Paperiello (Director of the Region III Reactor Safety Division). The NRC team held several meetings with the CEI engineering and licensing staff, the Architect/Engineer (Gilbert Associates), CEI consultants (Weston Geophysical) and suppliers of the seismic monitoring instrumentation (Kinemetrics, and Engdahl Enterprises). A list of meeting

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attendees is attached as enclosure 2. The NRC team members reviewed preliminary seismic recordings and conducted a walk-through inspection of buildings and equipment.

PRELIMINARY FINDINGS

1. Seismic Records:

The plant had nine sets of seismic monitoring instrumentation on the site when the earthquake occurred. All but one were operating and recorded the earthquake. They are of three different types: triaxial time-history accelerographs (made by Kinemetrics), triaxial peak response spectra recorders, and triaxial peak accelerographs (both made by Engdahl Enterprises). A list of these instruments and their locations is attached as enclosure 3.

There were some difficulties in interpreting data obtained from the Engdahl peak response recorder. Each of these instruments has 12 tuned reeds, each tipped with a diamond stylus which makes scratches on a recording plate. Some of these instruments are wired to annunciators in the control room. Each annunciator has one set of 12 amber lights and one set of 12 red lights, with each set of lights marked with the corresponding 12 tuned reed frequencies. These amber lights and red lights are pre-set to be activated at FSAR values of 2/3 OBE spectral accelerations and full OBE spectral accelerations respectively for the corresponding tuned reeds. The recording plates have been in these instruments for about a year, and spurious annunications have occurred previously when there were no earthquakes. Paul Engdahl, President of Engdahl Enterprises, was present at Perry during the visit and helped interpret the data obtained from the scratched plates. Enclosure 4 shows the preliminary data from the Engdahl instruments in the reactor building and the auxiliary building as plotted on the FSAR spectra. The 2% damping spectra curves should be used for comparison since the reeds have a built-in 2% damping.

There were some concerns about the way the Kinemetrics instruments were installed at the reactor base mat level. The instruments are not located on the mat, rather they are positioned on brackets bolted on the containment wall 9" above the mat. A "ring" test done by Kinemetrics proved that the brackets are rigid enough to render the data valid.

Partial preliminary time history data obtained from the Kinemetrics instruments located at the reactor building foundation (575') and on the containment vessel annulus (682') and the associated response spectra generated by Kinemetrics are shown in enclosure 5. Note that the grade level of the plant is at 620'.

Enclosures 4 and 5 indicate that there is a strong possibility that both OBE and SSE design response spectra may have been exceeded in the frequency range of approximately 16 Hz and above. The design basis for SSE is a Regulatory Guide 1.60 design response spectra anchored at 0.15g, with the OBE spectra

anchored at 0.075g. Preliminary data indicated a Zero Period Acceleration (ZPA) value of 0.18g at the reactor base mat. These recorded data are being further studied by the NRC and CEI consultants and instrument suppliers.

2. Results of Preliminary Plant Inspection

Damage to the Perry Plant was assessed by CEI and found to be limited to hair line cracks in rad waste and auxiliary building walls and a pipe flange leak in a hot water heater in the rad waste building. In most cases CEI was not able to determine whether or not these cracks were there before the earthquake. The hot water heater supplies clean non-radioactive steam to an evaporator, and the leakage rate was estimated to be about 20 drops per minute. In addition, a rotating disc type protective relay for the turbine generators tripped, which in turn caused an auxiliary boiler to trip. Since the turbine generators were not in operation at the time of the earthquake, there was no voltage across the relay and, therefore, the rotating disc was hanging loose there. It tripped due to the earthquake motion which would be expected. An instrument air compressor tripped; however, one of the three other instrument/service air compressors in the plant automatically started. There was also an indication that suppression pool water level indicators might have malfunctioned during and after the earthquake. CEI is still looking into this matter. Seepage of ground water through the junction of wall and floor and through cracks in the wall was also observed in the rad waste building after the earthquake. The seepage was not considered severe.

The NRC staff participated in a walk-down of the plant to inspect for damage and anomalies. The NRC staff walk-down observations are recorded in enclosure 6.

CONCLUSIONS

1. No damage of any significance was observed at the Perry plant by the NRC staff during the trip.

2. Based on the preliminary records of seismic monitoring instruments at the plant, the staff concluded that there is a strong possibility that the OBE and SSE design response spectra (FSAR values) may have been exceeded in the frequency range above approximately 16 Hz. It has been pointed out that the high frequency range of Regulatory Guide 1.60 spectra is not as conservative as the lower frequency range. However, the records obtained at Perry are still puzzling since the seismic instrumentation on the containment wall at 682 (about 107' above base mat) still shows exceedance of FSAR floor spectra in the frequency range higher than approximately 16 Hz. One would normally expect that the responses in the frequency ranges higher than the building fundamental frequency would be filtered out by the building.

   Further analyses and study of the seismic data by CEI staff engineers and consultants may yield new information on this matter. It should be kept in mind that response spectra do not present all the information

about an earthquake. The energy content as a function of frequency is better represented by the Power Spectral Density (PSD), which is an important indicator of damage potential. Another damage potential indicator is the duration of the earthquake. On both accounts, the effects of the earthquake on the Perry plant were observed to be minimal. Normally responses in the high frequency range do not have much energy content. Furthermore, the peak time history reading at the base mat lasted for only about one half second.

NRC AND SQUG FOLLOW-UP ACTIONS

1. The location, aftershocks and travel mechanism of the earthquake sequence will have to be examined and compared with previous seismicity so as to determine if there is any impact upon the adequacy of assumptions made in the Safety Evaluation Report.

2. DSRO/NRR had a meeting with representatives of the Division of BWR Licensing on 2/3/86 to brief them of the findings at Perry. It was decided that since the investigation of the effects of this earthquake on Perry is plant-specific, the BWR Licensing Divsion should take the lead. DSRO will perform an oversight function and provide technical assistance if needed. R. Hermann and L. Reiter were appointed as team leaders in the structural/mechanical and geoscience areas respectively. A permanent review team is being formed to review the effects of this earthquake on the structural, equipment and geoscience aspects of the Perry plant.

3. A BWR site investigation team was sent to Perry on 2/6/86. This team consists of A. Lee (Engineering Branch/BWR Licensing Division/NRR) and J. Singh (INEL contractor), and will perform an independent review of safety related equipment.

4. Seismic Qualification Utility Group (SQUG) will send a team to Perry on 2/10/86 to collect seismic experience data. This information could be useful for the on-going Unresolved Safety Issue (USI) A-46, "Seismic Qualification of Equipment in Operating Plants."

5. As the analysis and review of the earthquake, and recorded data proceed, additional recommendations to specific generic issues may be forthcoming. among these presently being considered include increased use of parameters other than peak accelerations and response spectra to better reflect the damage potential of earthquake ground motion and a clearer definition of OBE and/or SSE exceedance and their implications.

T. Y. Chang
Task Manager

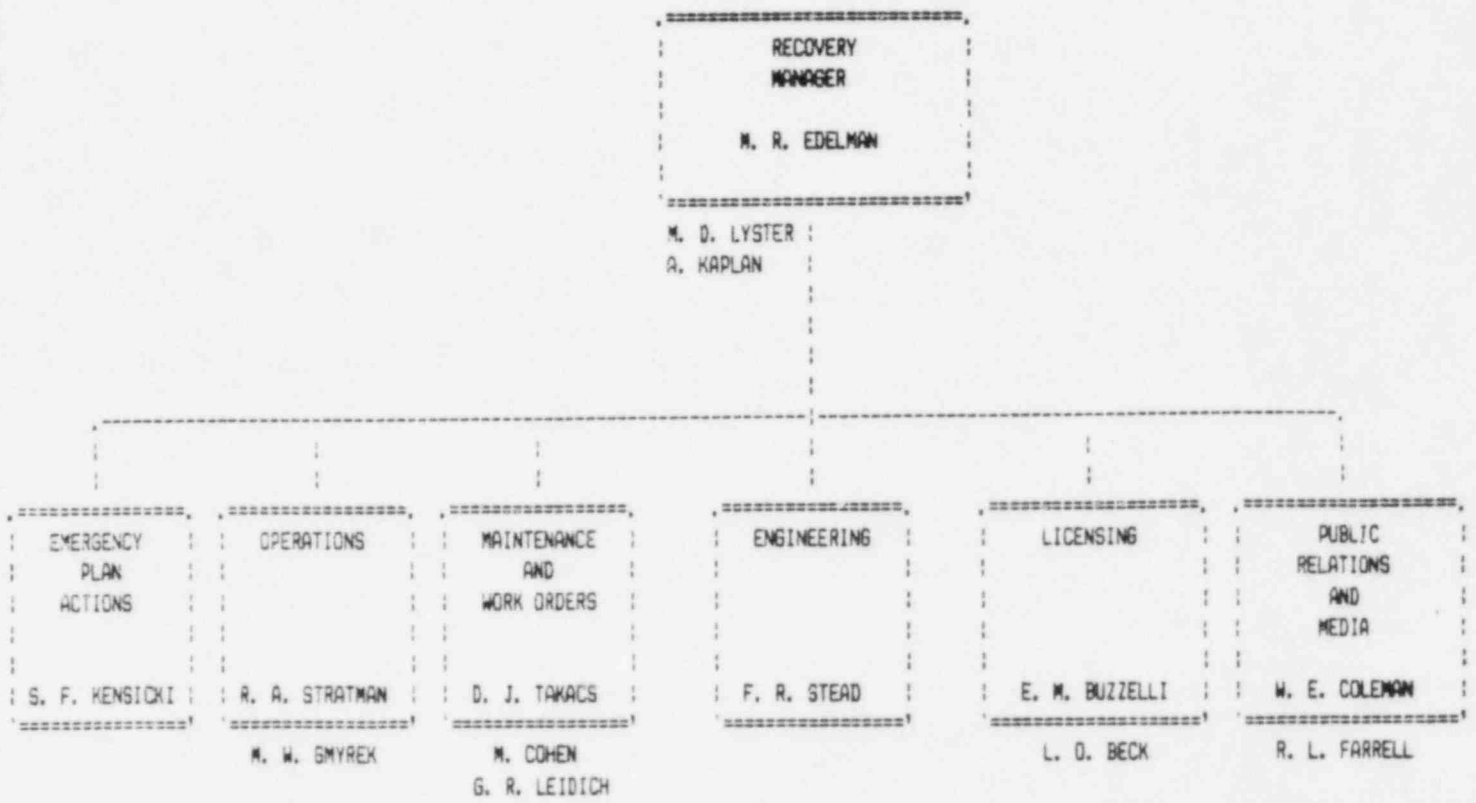
Leon Reiter
Sr. Reliability and Risk Analyst

cc: See Page 5.

cc: H. Denton
D. Eisenhut
R. Bernero
W. Butler
G. Lainas
J. Stefano
S. Stern
T. Speis
B. Sheron
N. Anderson
Lic. Div. Directors
Lic. Div. A/Ds
G. Arlotto, RES
J. Richardson, RES
C. Paperiello, Reg. III
S. Brocoum
L. Heller
N. Chokshi
L. Shao, RES
G. Bagchi
G. Giese Koch
P. T. Kuo
R. Rothman
A. Lee
P. Sobel
R. Hermann
C. P. Tan

ENCLOSURE 1

RECOVERY ORGANIZATION



ENCLOSURE 2

MEETING ATTENDANCE

February 1, 1986 - TEC

NAME	COMPANY	POSITION
N. J. Lehman	CEI	Staff Analyst
J. J . Waldron	CEI	Manager, Technical Dept.
K. A. Connaughton	NRC	Resident Inspector
J. W. Muffett	NRC, Region III	Plant System Section Section Chief
J. J. Harrison	NRC, Region III	Chief, Eng. Branch, DRS
C. J. Paperiello (Team leader)	NRC, Region III	Director, Div. Reactor Safet
C. R. Angstadt	CEI	Lead Structural Engineer
E. M. Buzzelli	CEI	Sr. Licensing Engineer
K. R. Pech	CEI	Gen. Sup. Eng., Nucl Constr.
M. N. Gmyrek	CEI	Sr. Operations Coordinator
R. A. Stratman	CEI	Gen. Supervisor, Operations
H. L. Williams	CEI	Executive Vice President
A. Kaplan	CEI	V.P. Nuclear Operations Div.
M. D. Lyster	CEI	Manager, PPOD
F. R. Stead	CEI	Manager, NED
B. A. Stiles	CEI	Community Relations Asst.
John J. Stefano	NRC/NRR	Perry Project Manager
Leon Reiter	NRC/NRR	Sr. Reliability & Pipe Analyst
T. Y. Chang	NRC/NRR	Task Manager
W. E. Coleman	CEI	GSE, Community Relations
G. R. Leidich	CEI	GSE, Outage Management
D. J. Takacs	CEI	Gen. Sup., Maintenance
J. A. Grobe	NRC	Sr. Resident Inspector
M. J. Hayner	CEI	Licensing Engineer

Attendance - February 1, 1986 - TEC

NAME	COMPANY	POSITION
M. H. Minns	CEI	Licensing Engineer
R. G. Schuerger	CEI	Chairman, NSRC
E. N. Levine	Weston Geophysical	Seismologist, Consultant to CEI
Gabriel Leblanc	Weston Geophysical	Seismologist, Consultant to CEI
Steve Kensicki	CEI	Technical Superintendent
Bill Kanda	CEI	GSE, Technical
Dan Hulbert	CEI	Emergency Planning Sup.
George Siegel	Kinnemetrics	Field Operations Sup.
Vince Concel	CEI	PPTD System Engr. Lead
Paul Engdahl	Engdahl Enterprises	President
Roger Alley	Gilbert, Inc.	Project Structural Eng.
Frank Kocsis	CEI	Independent Safety Eng.
Cyril Shuster	CEI	Manager, QA
Ronald L. Farrell	CEI	Manager, PPSD
Murray R. Edelman	CEI	V.P., Nuclear Group

ENCLOSURE 3

FINAL DRAFT

TABLE 3.3.7.2-1

SEISMIC MONITORING INSTRUMENTATION

INSTRUMENTS AND SENSOR LOCATIONS	MEASUREMENT RANGE	MINIMUM INSTRUMENTS OPERABLE
Triaxial Time-History Accelerographs		
a. D51-N101 Reactor Building Foundation	0.01 - 1.0g	1
b. D51-N111 Containment Vessel	0.01 - 1.0g	1(b)
c. D51-N100 Reactor Building Foundation	0.005 - 0.02g	1(b)
d. D51-N110 Reactor Building Foundation	0.005 - 0.02g	1(b)
Triaxial Peak Accelerographs		
a. D51-R120 Reactor Recirculation Pump	0.05 - 1.0g	1
b. D51-R130 HPCS Piping in Reactor Building	0.05 - 1.0g	1
c. D51-R140 HPCS Pump Base Mat	0.05 - 1.0g	1
Triaxial Seismic Switches		
a. D51-N150 Reactor Building Foundation	0.025 - 0.25g	1(a)
Triaxial Response-Spectrum Recorders		
a. D51-R160 Reactor Building Foundation	2 - 25.4 Hz	1(a)
b. D51-R170 Reactor Recirculation Piping Support	2 - 25.4 Hz	1
c. D51-R180 HPCS Pump Base Mat	2 - 25.4 Hz	1
d. D51-R190 RCIC Pump Base Mat	2 - 25.4 Hz	1

(a) With control room annunciation.

(b) Seismic trigger with control room annunciation.

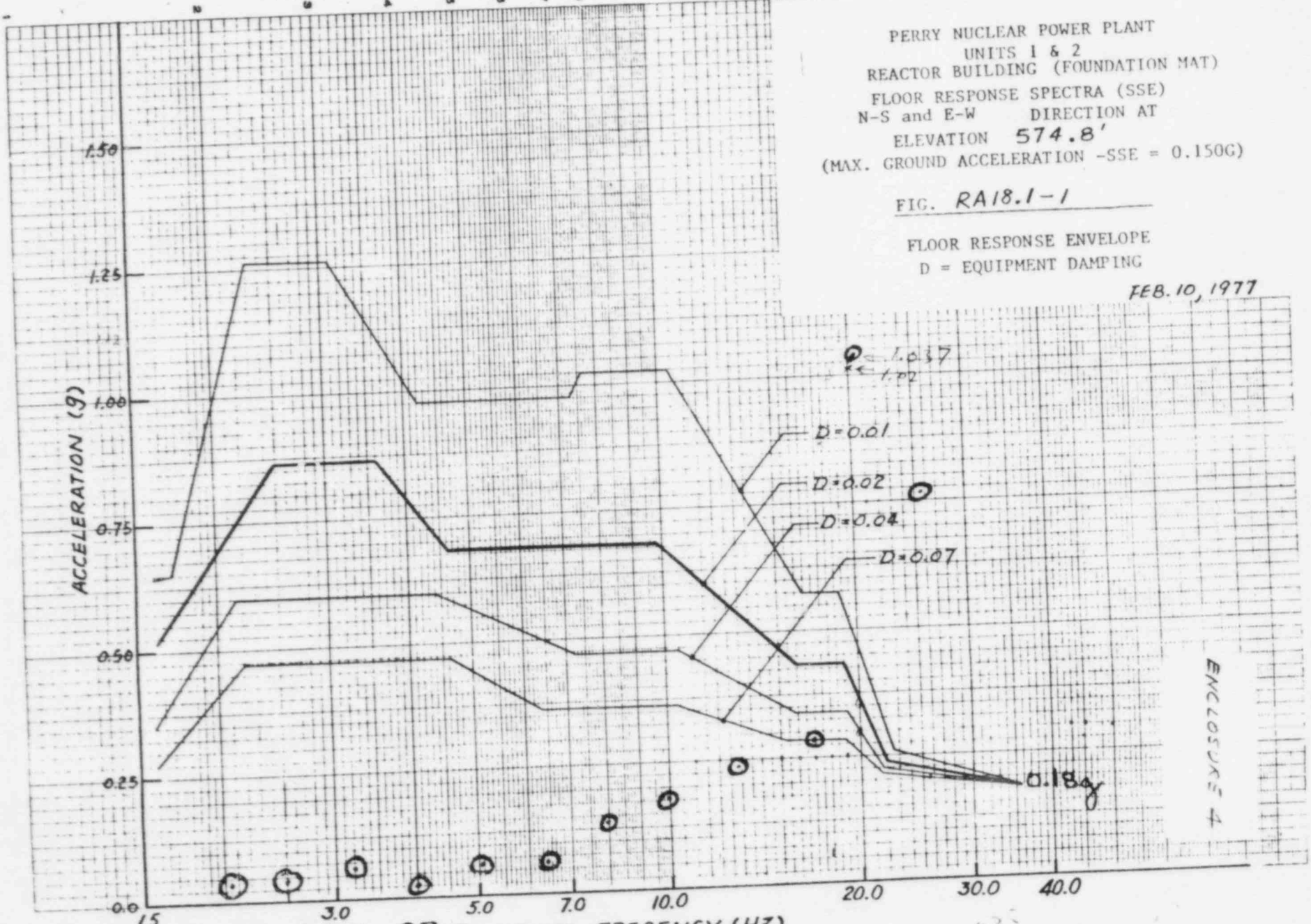
2 CYCLES X 10 DIVISIONS PER INCH

PERRY NUCLEAR POWER PLANT
UNITS 1 & 2
REACTOR BUILDING (FOUNDATION MAT)
FLOOR RESPONSE SPECTRA (SSE)
N-S and E-W DIRECTION AT
ELEVATION 574.8'
(MAX. GROUND ACCELERATION -SSE = 0.150G)

FIG. RA18.1-1

FLOOR RESPONSE ENVELOPE
D = EQUIPMENT DAMPING

FEB. 10, 1977



ENCLOSURE 4

⊙ DSI-RIGO ENGDAHL-2% DAMPING FREQUENCY (HZ)

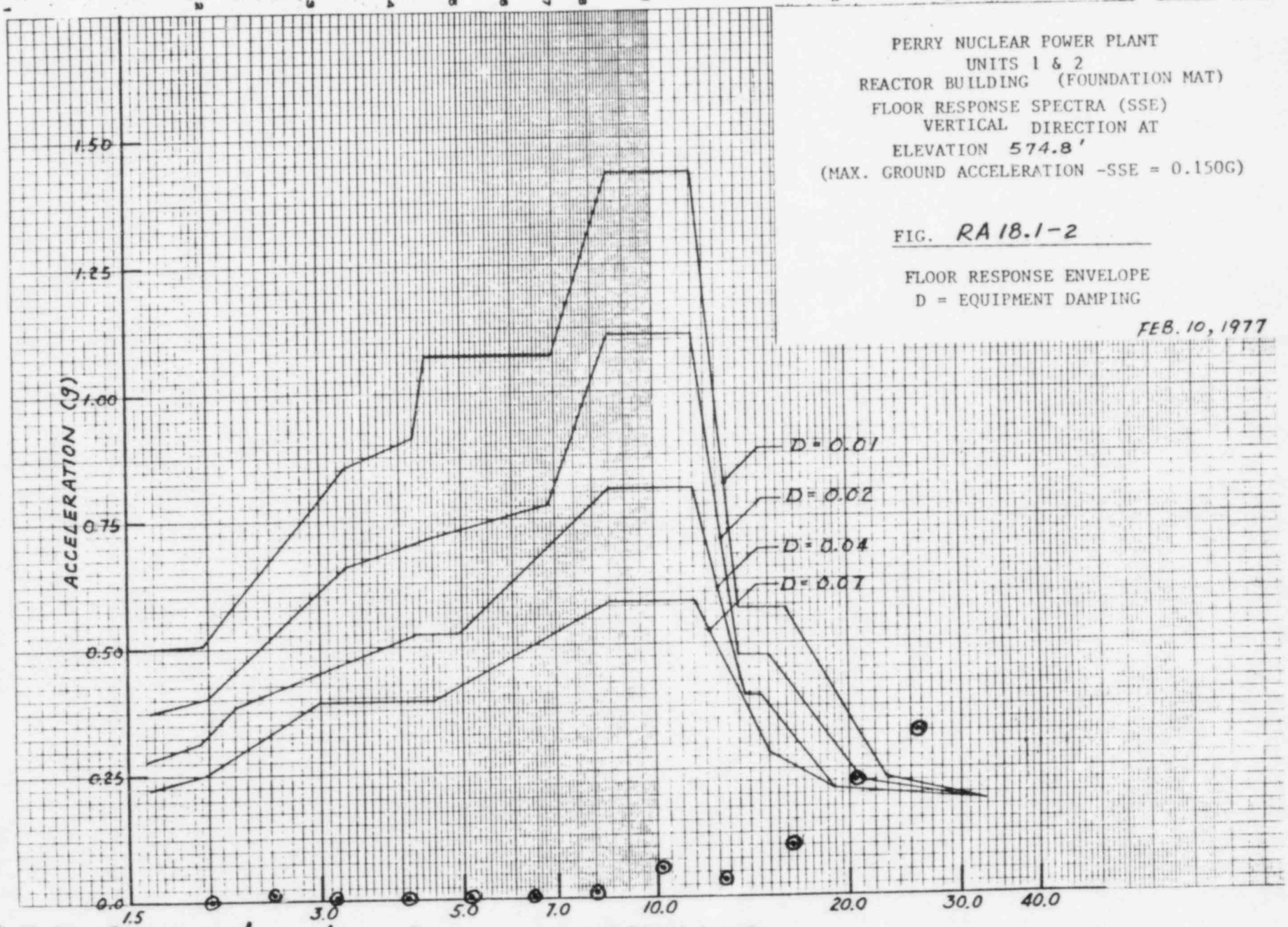
2 CYCLES X 10 DIVISIONS PER INCH

PERRY NUCLEAR POWER PLANT
UNITS 1 & 2
REACTOR BUILDING (FOUNDATION MAT)
FLOOR RESPONSE SPECTRA (SSE)
VERTICAL DIRECTION AT
ELEVATION 574.8'
(MAX. GROUND ACCELERATION -SSE = 0.150G)

FIG. RA 18.1-2

FLOOR RESPONSE ENVELOPE
D = EQUIPMENT DAMPING

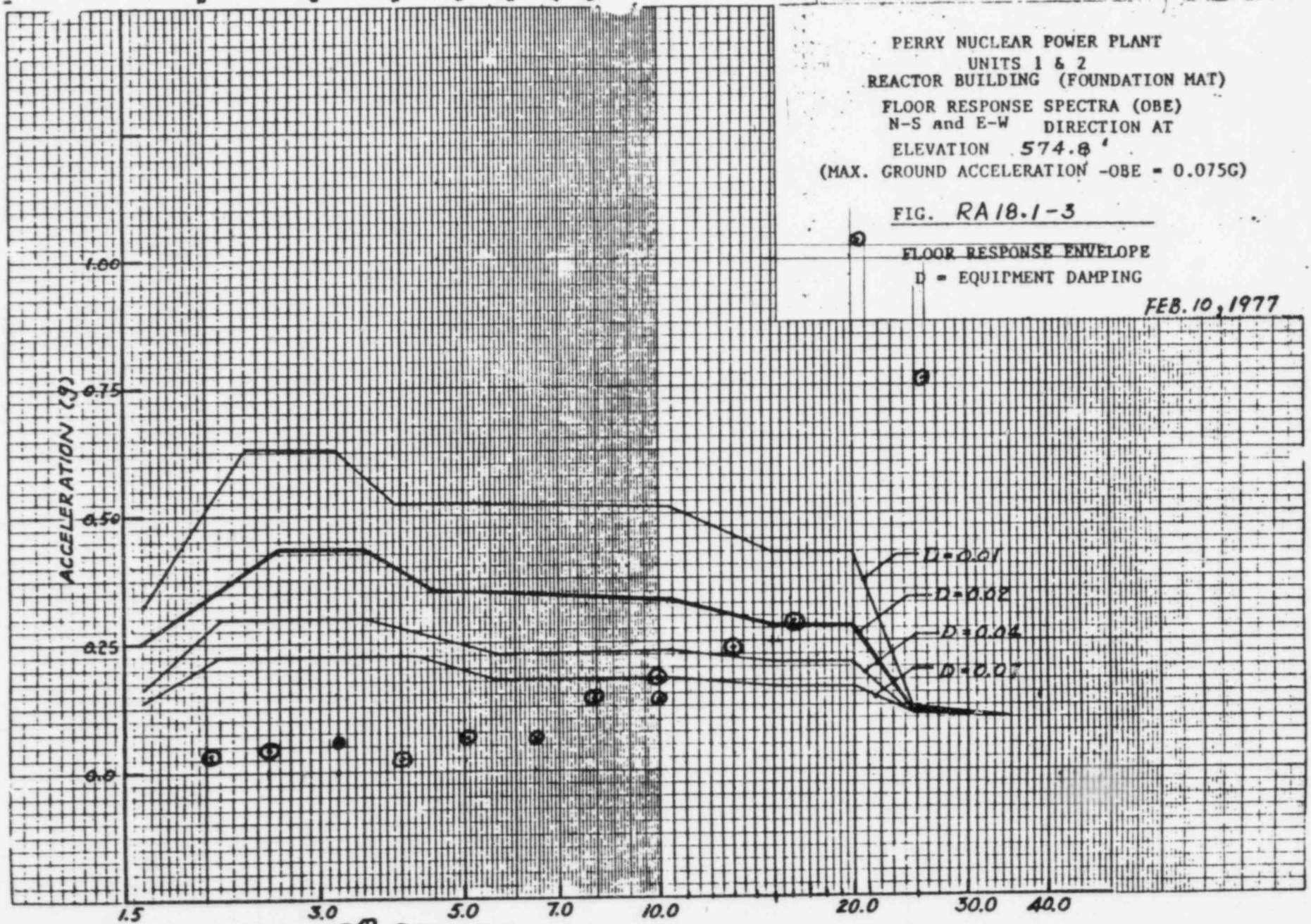
FEB. 10, 1977



⊙ DSI-R160 ENGOAHL - 2% DAMPING,
CALIBRATION DATE 1-11-85

PERRY NUCLEAR POWER PLANT
UNITS 1 & 2
REACTOR BUILDING (FOUNDATION MAT)
FLOOR RESPONSE SPECTRA (OBE)
N-S and E-W DIRECTION AT
ELEVATION 574.8'
(MAX. GROUND ACCELERATION -OBE = 0.075G)

FIG. RA18.1-3



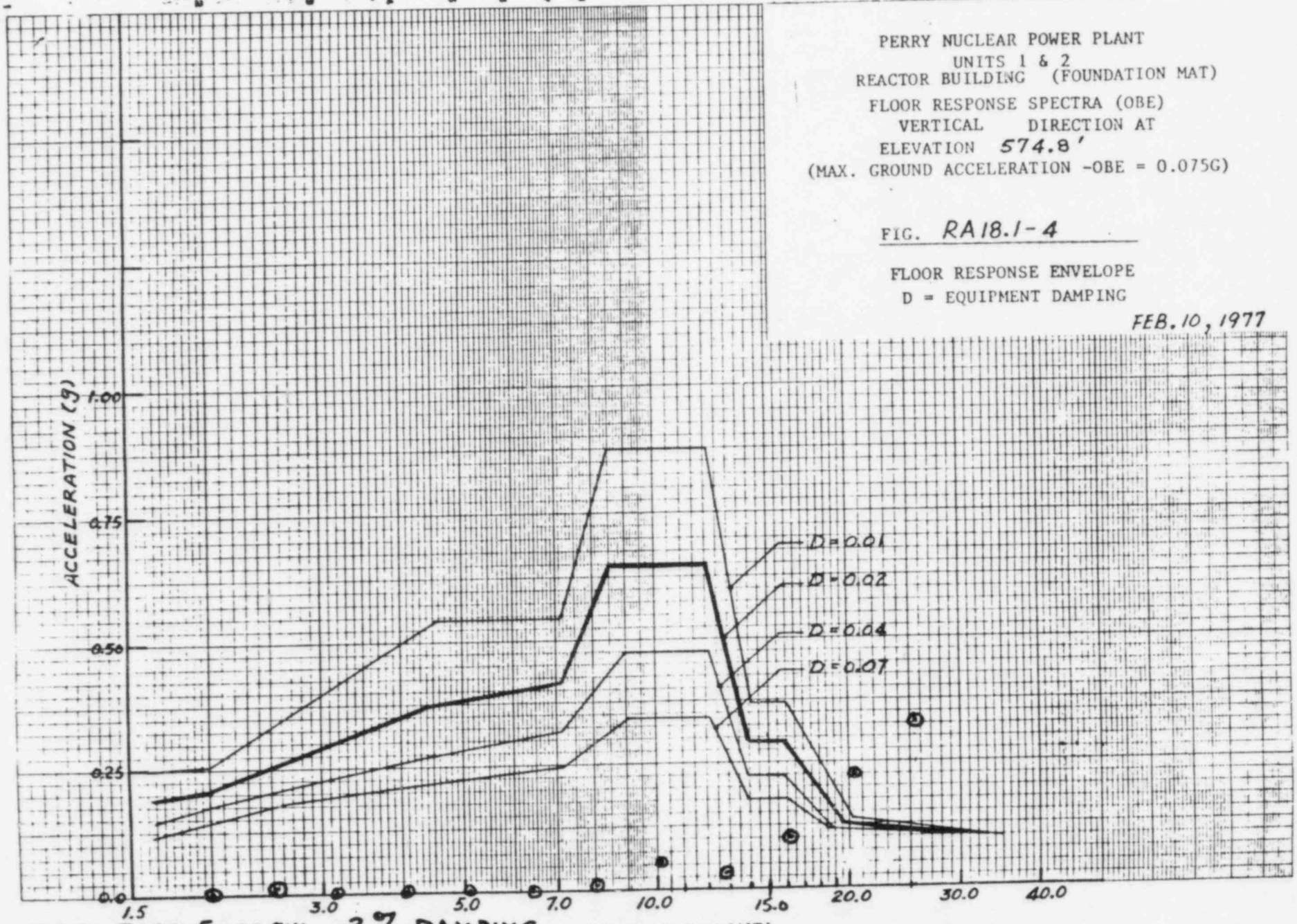
⊙ D51-RIGO ENG DAHL - 2% DAMPING
CALIBRATION DATE 1-16-85

PERRY NUCLEAR POWER PLANT
UNITS 1 & 2
REACTOR BUILDING (FOUNDATION MAT)
FLOOR RESPONSE SPECTRA (OBE)
VERTICAL DIRECTION AT
ELEVATION 574.8'
(MAX. GROUND ACCELERATION -OBE = 0.075G)

FIG. RA18.1-4

FLOOR RESPONSE ENVELOPE
D = EQUIPMENT DAMPING

FEB. 10, 1977



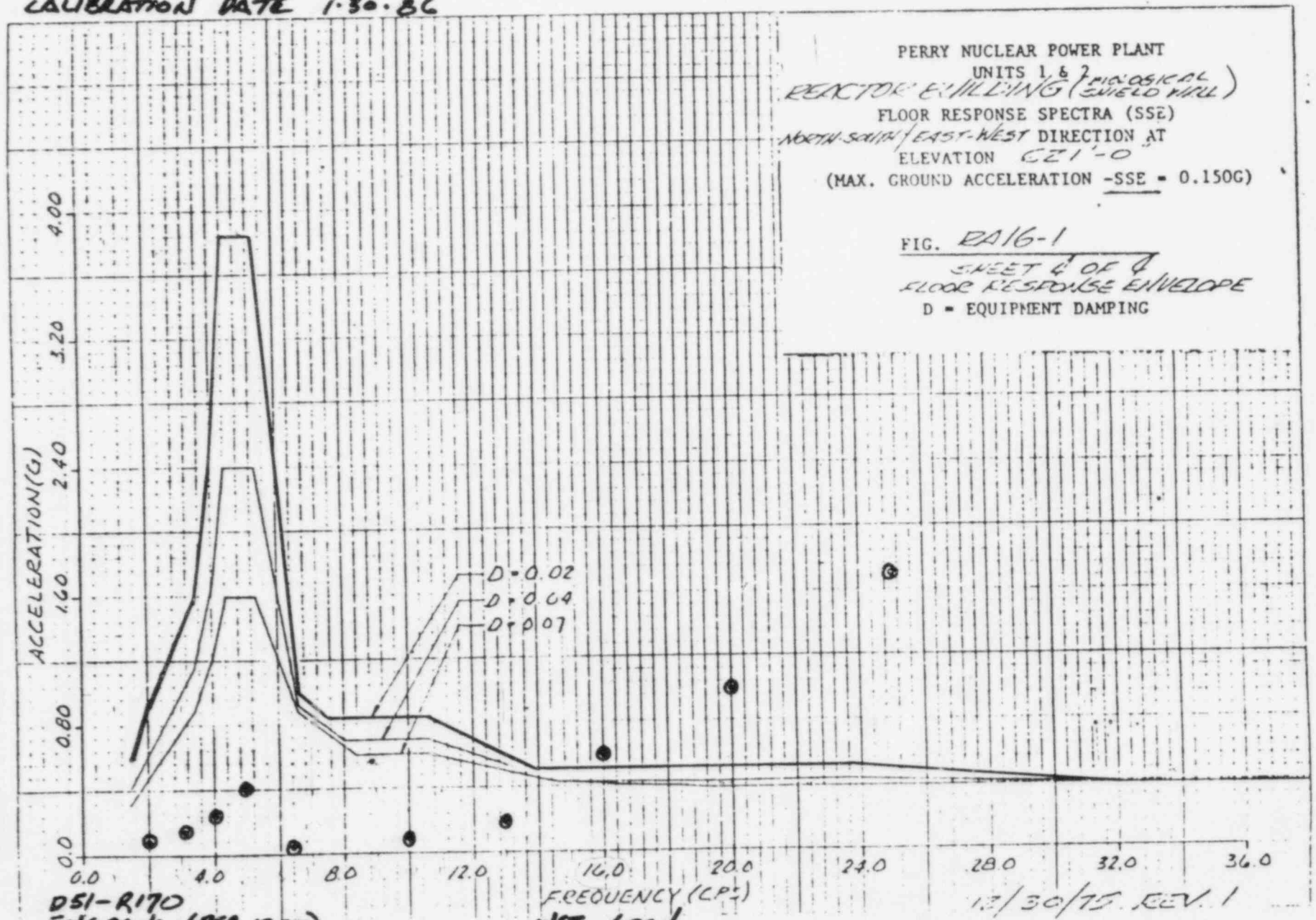
⊙ D51-R160 ENGDAHL - 2% DAMPING

CALIBRATION DATE 1-16-85

CALIBRATION DATE 1-30-86

PERRY NUCLEAR POWER PLANT
UNITS 1 & 2
REACTOR BUILDING (BIOLOGICAL SHIELD WALL)
FLOOR RESPONSE SPECTRA (SSE)
NORTH-SOUTH / EAST-WEST DIRECTION AT
ELEVATION 621'-0
(MAX. GROUND ACCELERATION -SSE - 0.150G)

FIG. RA16-1
SHEET 4 OF 9
FLOOR RESPONSE ENVELOPE
D = EQUIPMENT DAMPING



D51-R170
ENGDAHL (PSR 1200)
E-W 2% DAMPING

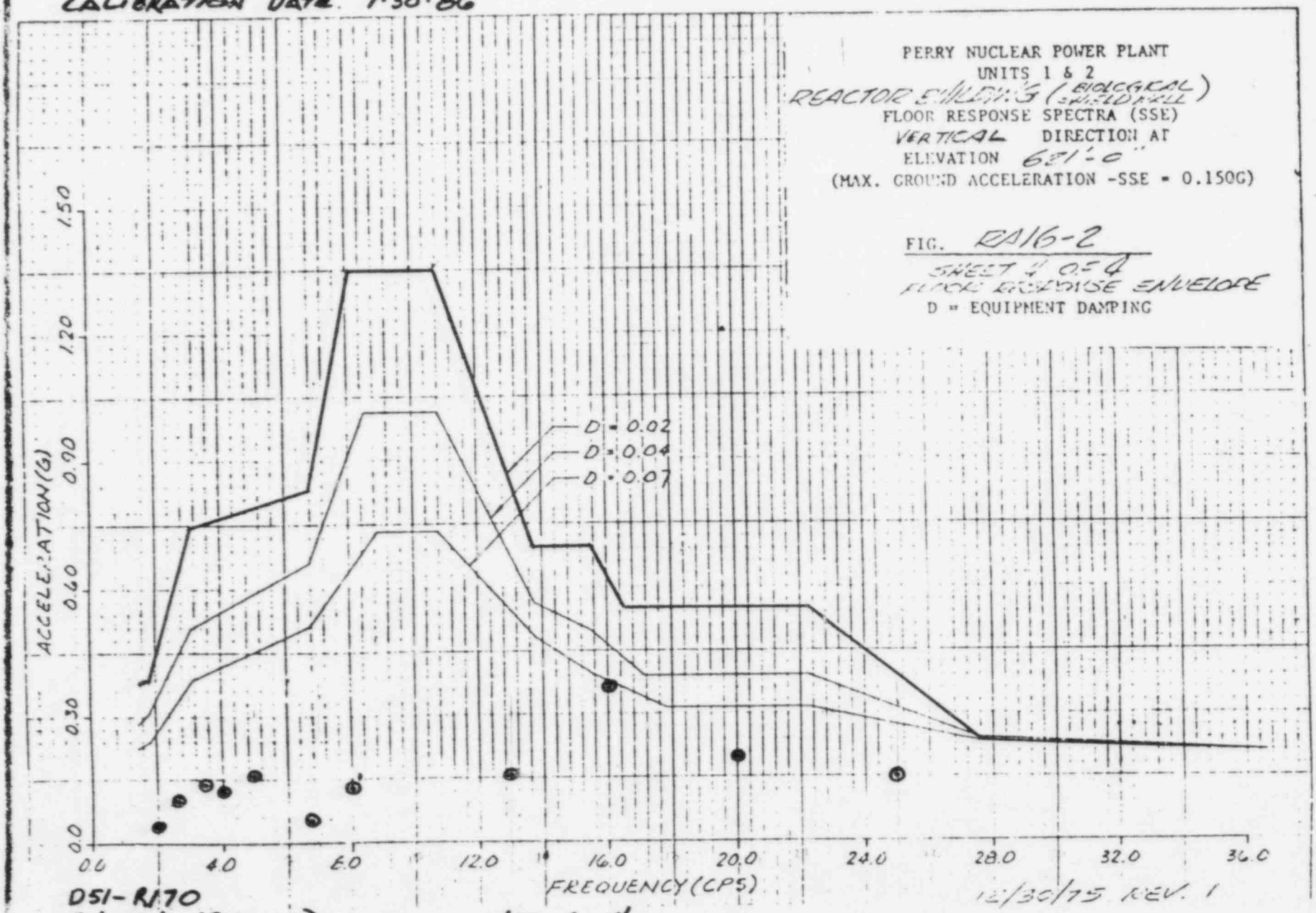
NIST LOCN
EL 630'-1" (R.B. INSIDE DEI)

1/30/75 REV. 1

CALIBRATION DATE 1-30-86

PERRY NUCLEAR POWER PLANT
UNITS 1 & 2
REACTOR BUILDING (BIOLOGICAL SHIELD WALL)
FLOOR RESPONSE SPECTRA (SSE)
VERTICAL DIRECTION AT
ELEVATION 621'-0"
(MAX. GROUND ACCELERATION -SSE = 0.150G)

FIG. RA16-2
SHEET 4 OF 4
FLOOR RESPONSE ENVELOPE
D = EQUIPMENT DAMPING



12/30/75 REV. 1

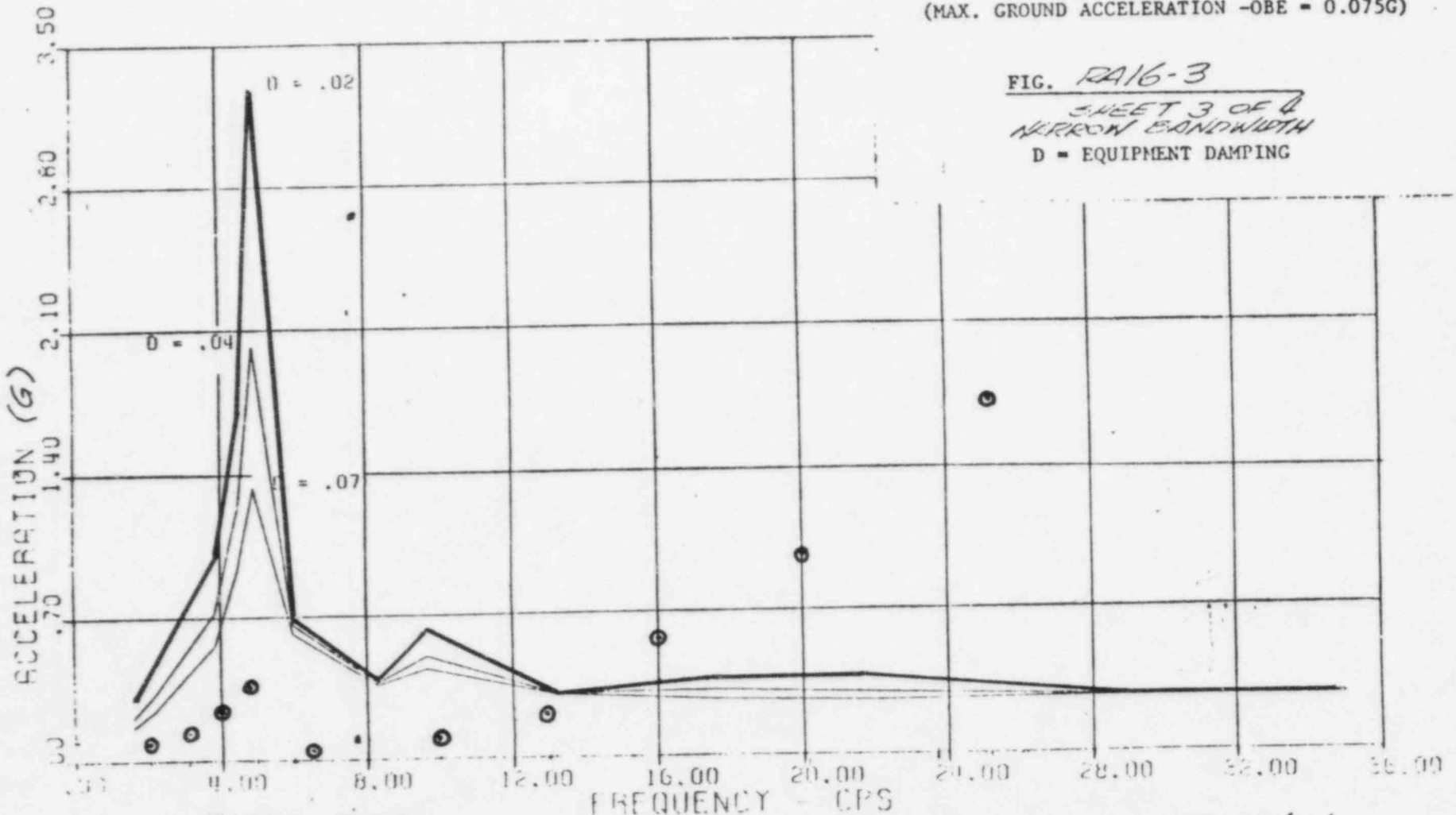
D51-R170
ENGDAHL (PSR 1200)
VERTICAL 2% DAMPING

INST. LOCN.
EL 630'-1" (R.B. INSIDE D.W.)

CALIBERATION DATE 1·30·86

PERRY NUCLEAR POWER PLANT
UNITS 1 & 2
REACTOR BUILDING (BIOLOGICAL SHIELD WALL)
FLOOR RESPONSE SPECTRA (OBE)
NORTH-SOUTH, EAST-WEST DIRECTION AT
ELEVATION 521'-0"
(MAX. GROUND ACCELERATION -OBE = 0.075G)

FIG. RA16-3
SHEET 3 OF 4
NARROW BANDWIDTH
D = EQUIPMENT DAMPING



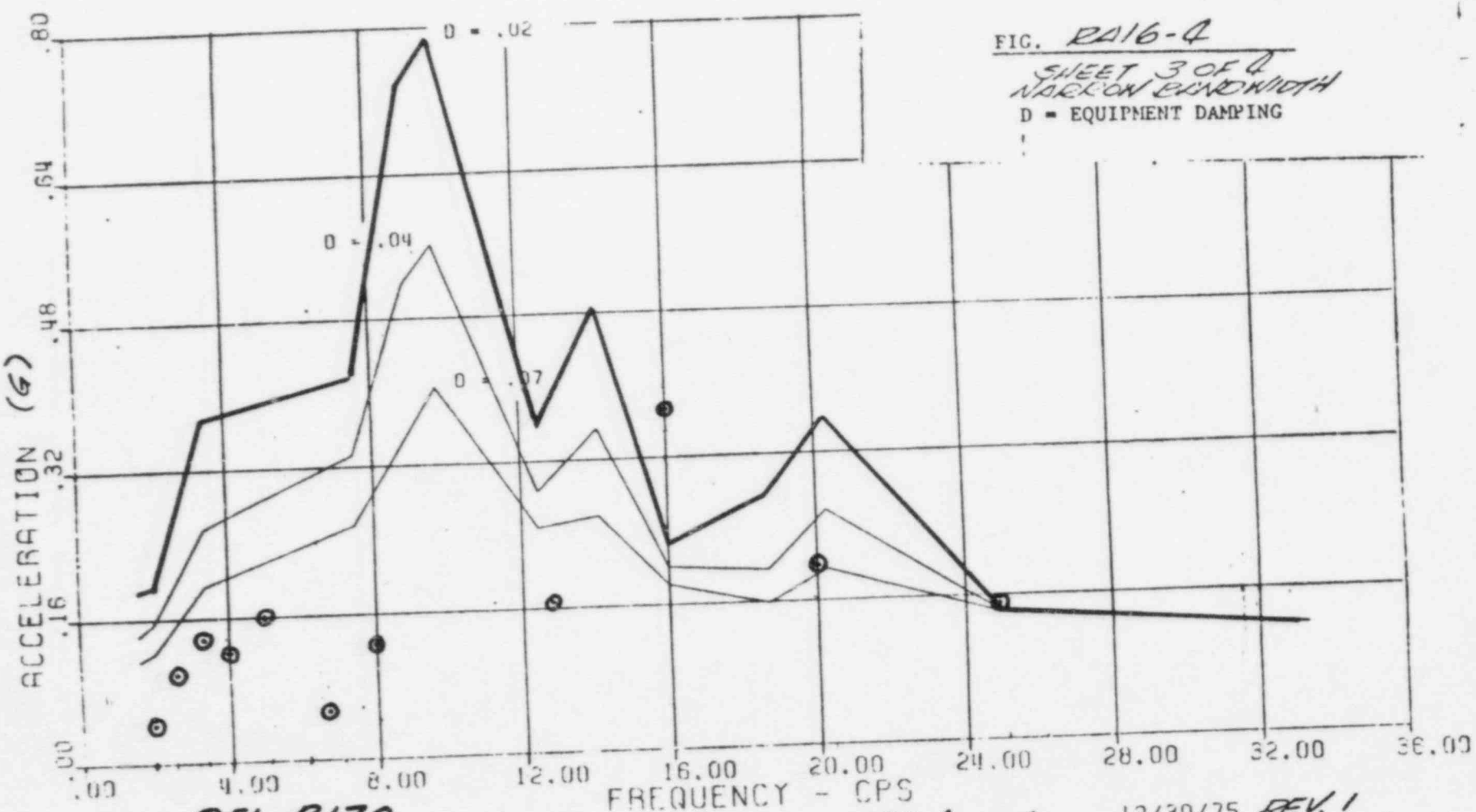
D51-R170
ENDANC (PSR 1200)

INST. LOCN. 12/30/75 REV. 1
EL. 630'-1" (R.B. INSIDE DD)

CALIBERATION DATE 1-30-86

PERRY NUCLEAR POWER PLANT
UNITS 1 & 2
REACTOR BUILDING (BIOLOGICAL SHIELD WALL)
FLOOR RESPONSE SPECTRA (OBE)
VERTICAL DIRECTION AT
ELEVATION 621'-0"
(MAX. GROUND ACCELERATION -OBE = 0.075G)

FIG. RA16-4
SHEET 3 OF 4
NARROW BANDWIDTH
D = EQUIPMENT DAMPING



DSI-R170
ENGDAHL (PSR 1200)
[illegible] % DAMPING.

INST. LOCN.
EL. 630'-1" (R.B INSIDE D.W)

12/30/75 REV. 1

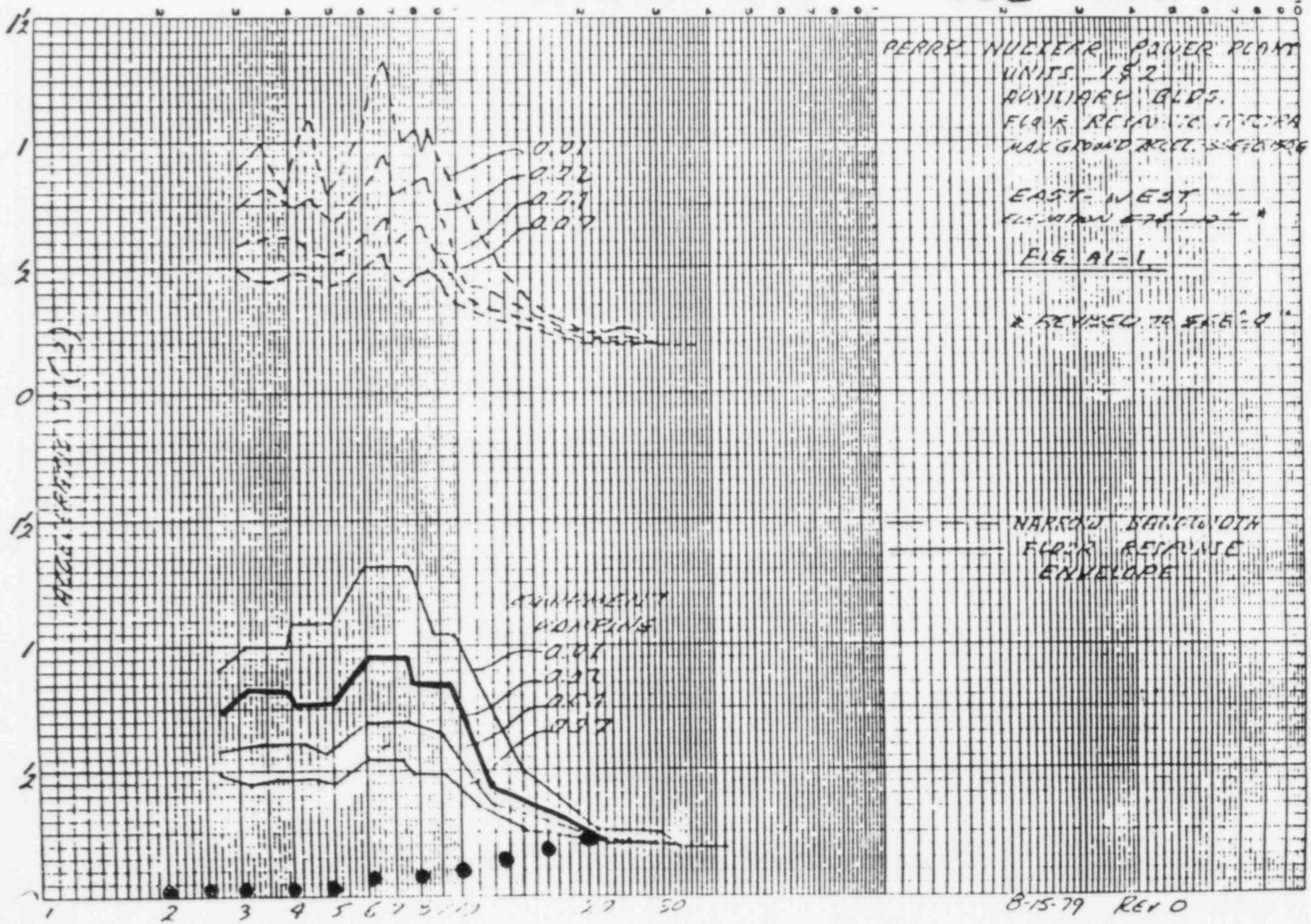
D51-R190

NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

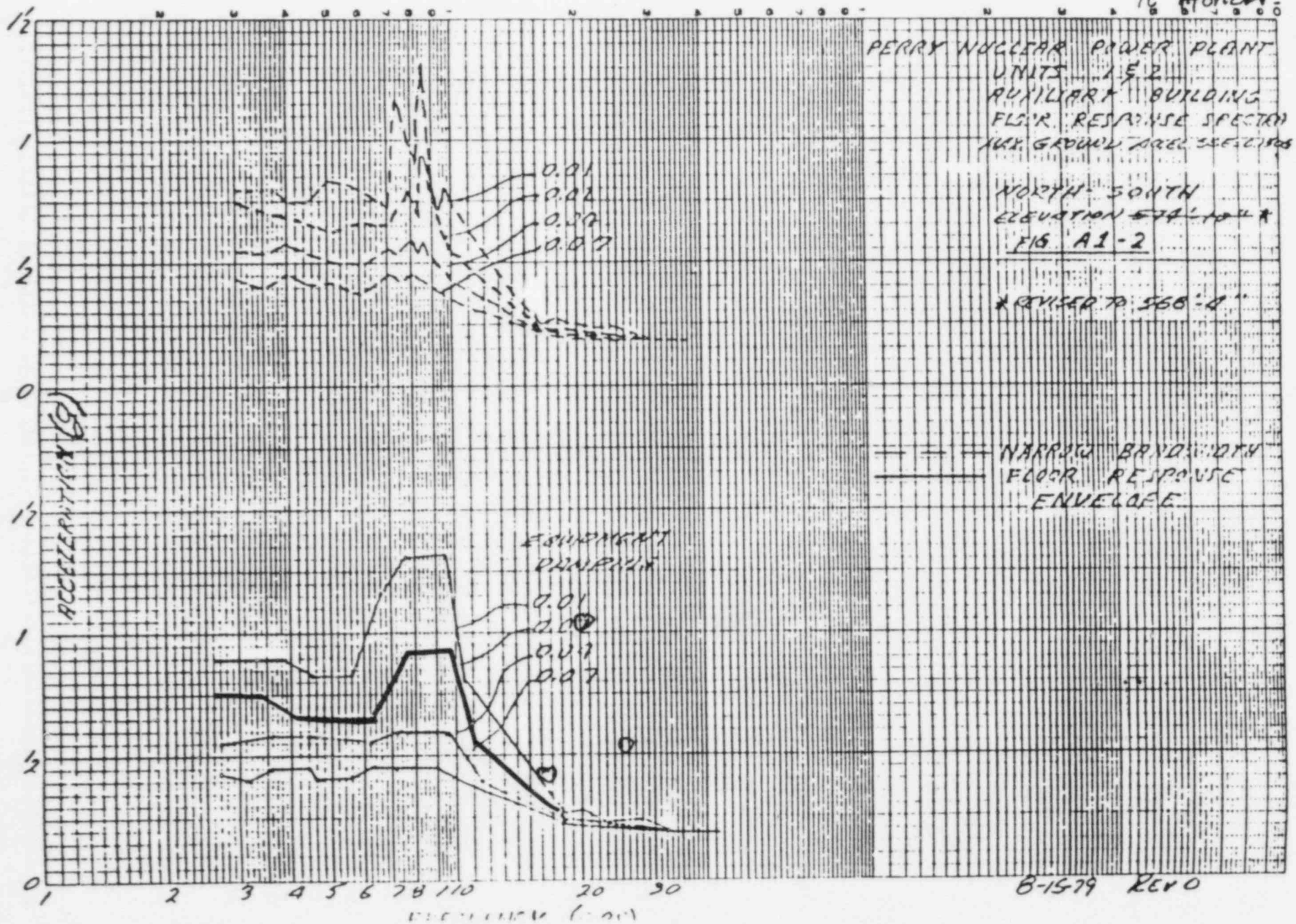
EUGENE DIETZGEN CO.
MADE IN U.S.A.

Aux Bldg El. 568'-0"
FDN MAT
SSE EAST-WEST

● RECORDED DATA



8-15-79 Rev 0


NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH
EUGENE DIETZGEN CO.
MADE IN U. S. A.
SSE
Aux Bldg EL 585
Found Mat
North-South
2% Horizontal
PERRY NUCLEAR POWER PLANT
UNITS 1 & 2
AUXILIARY BUILDING
FLOOR RESPONSE SPECTRA
HORIZONTAL GROUND MOTION SPECTRA
NORTH-SOUTH
ELEVATION 574'-10"*
FIG A1-2
*REFER TO 566'-8"
NARROW BROADENED
FLOOR RESPONSE
ENVELOPE
EQUIPMENT
DAMPING
0.01
0.02
0.03
0.07
ACCELERATION (g)
FREQUENCY (cps)
1
2
3
4
5
6
7
8
10
20
30
0
½
1
B-1579 Rev 0

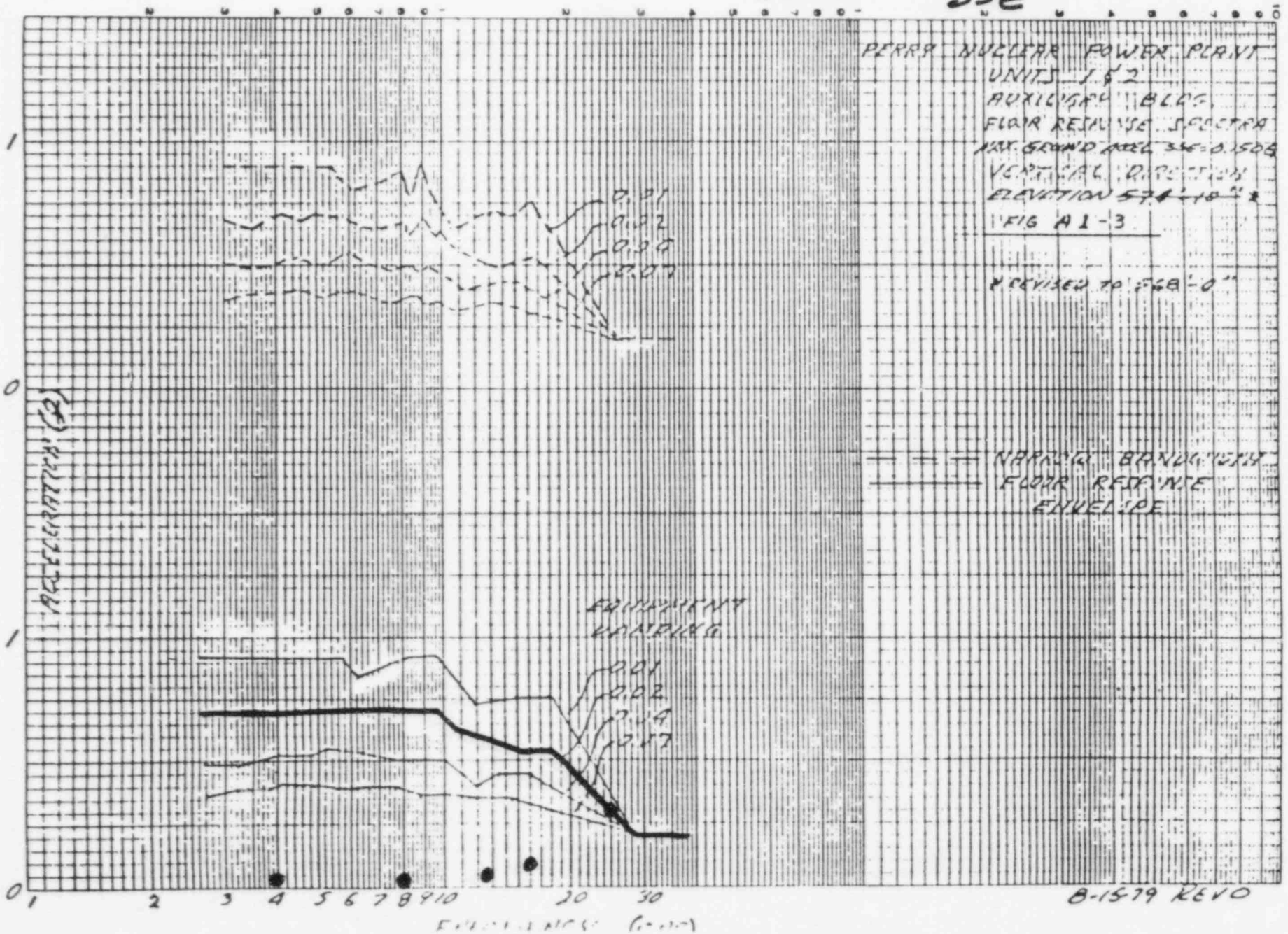
DSI-R190

NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

Aux BLDG, EL. 568'
FOUNDATION MAT
SSE

Vertical



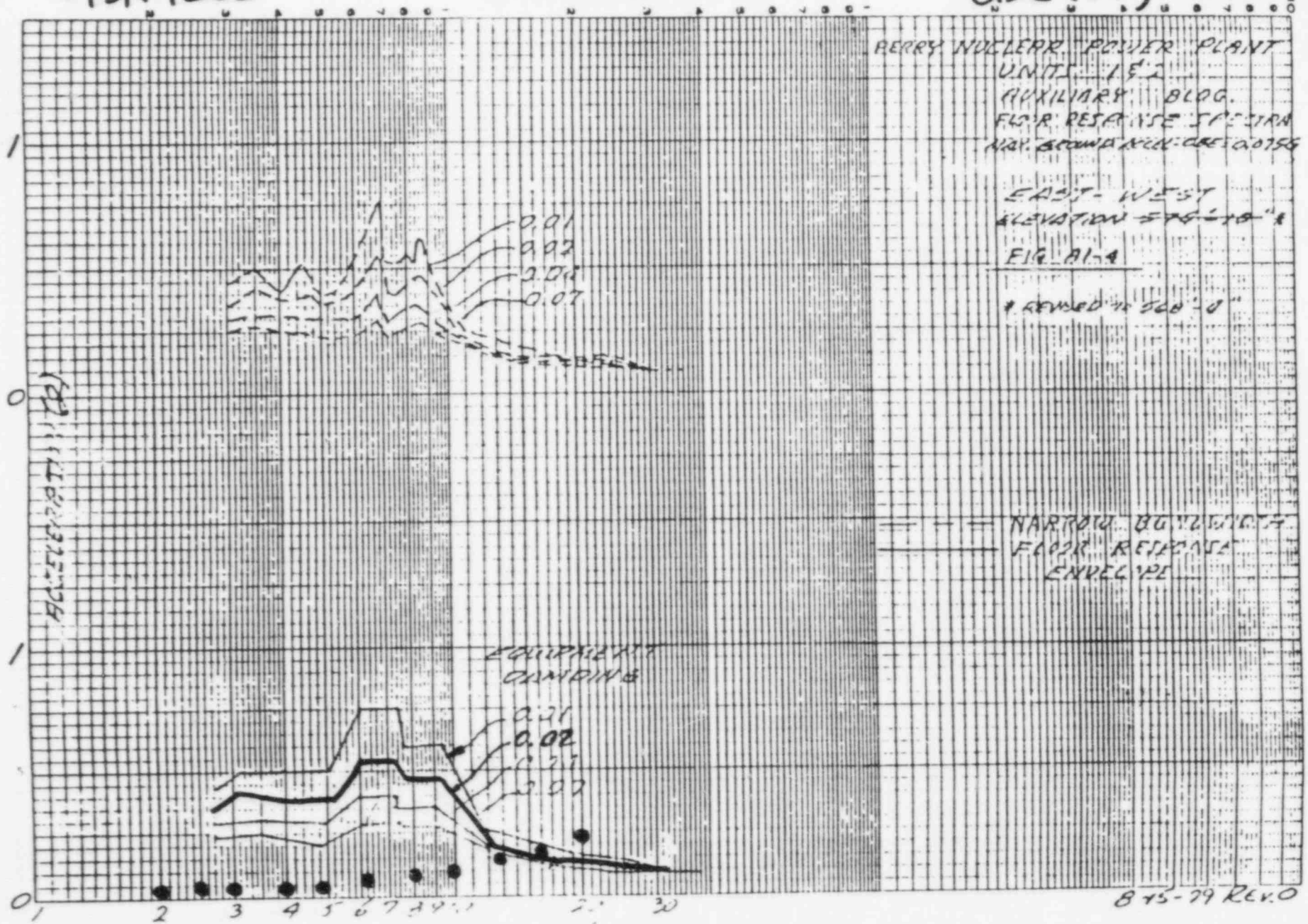
DSI-R190
ENG DAHL
#PSR-1200

NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

AUX BLDG EL 568'-0"
FOUND MAT
OBE (2%) EAST-WEST

● RECORDED DATA

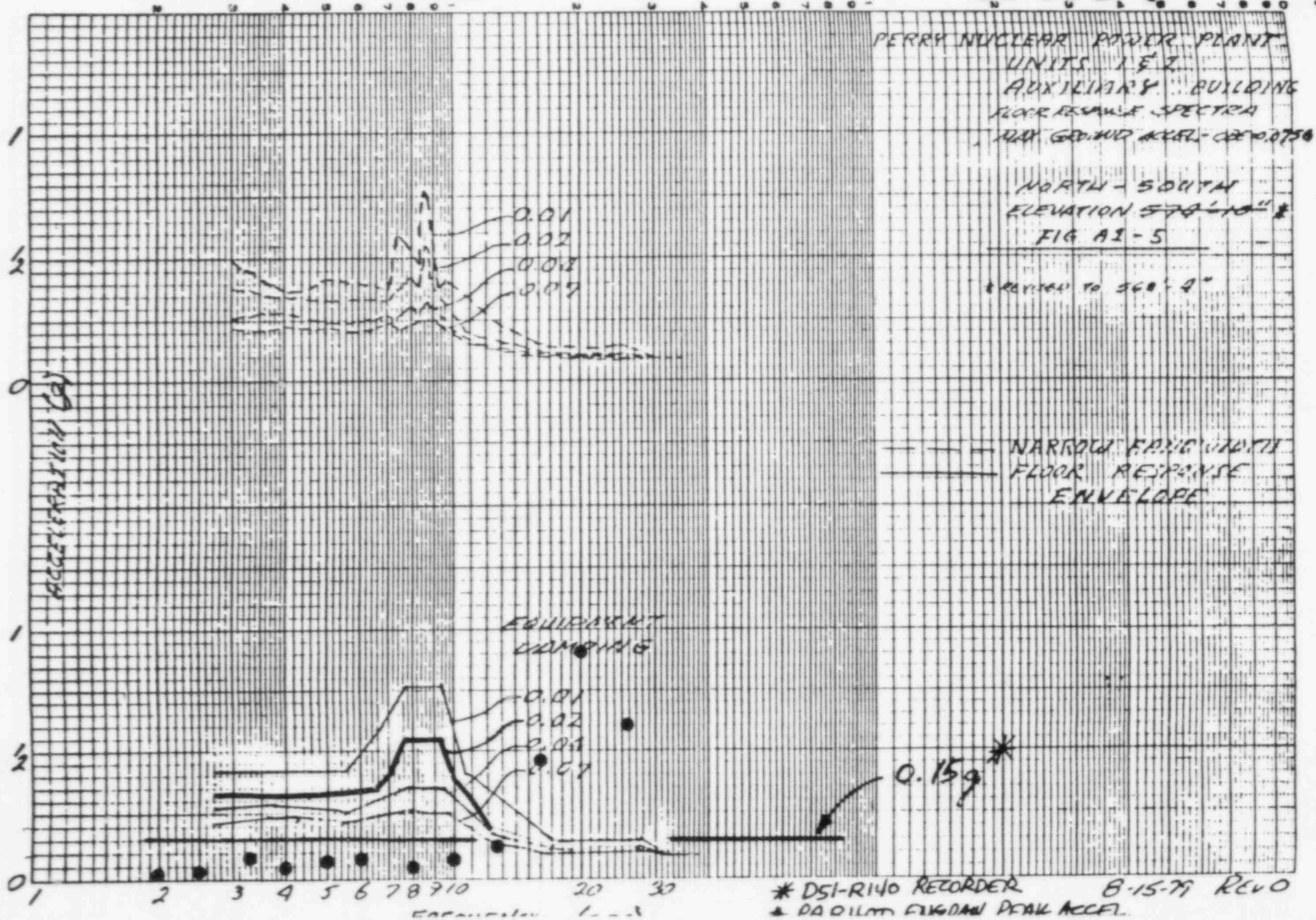


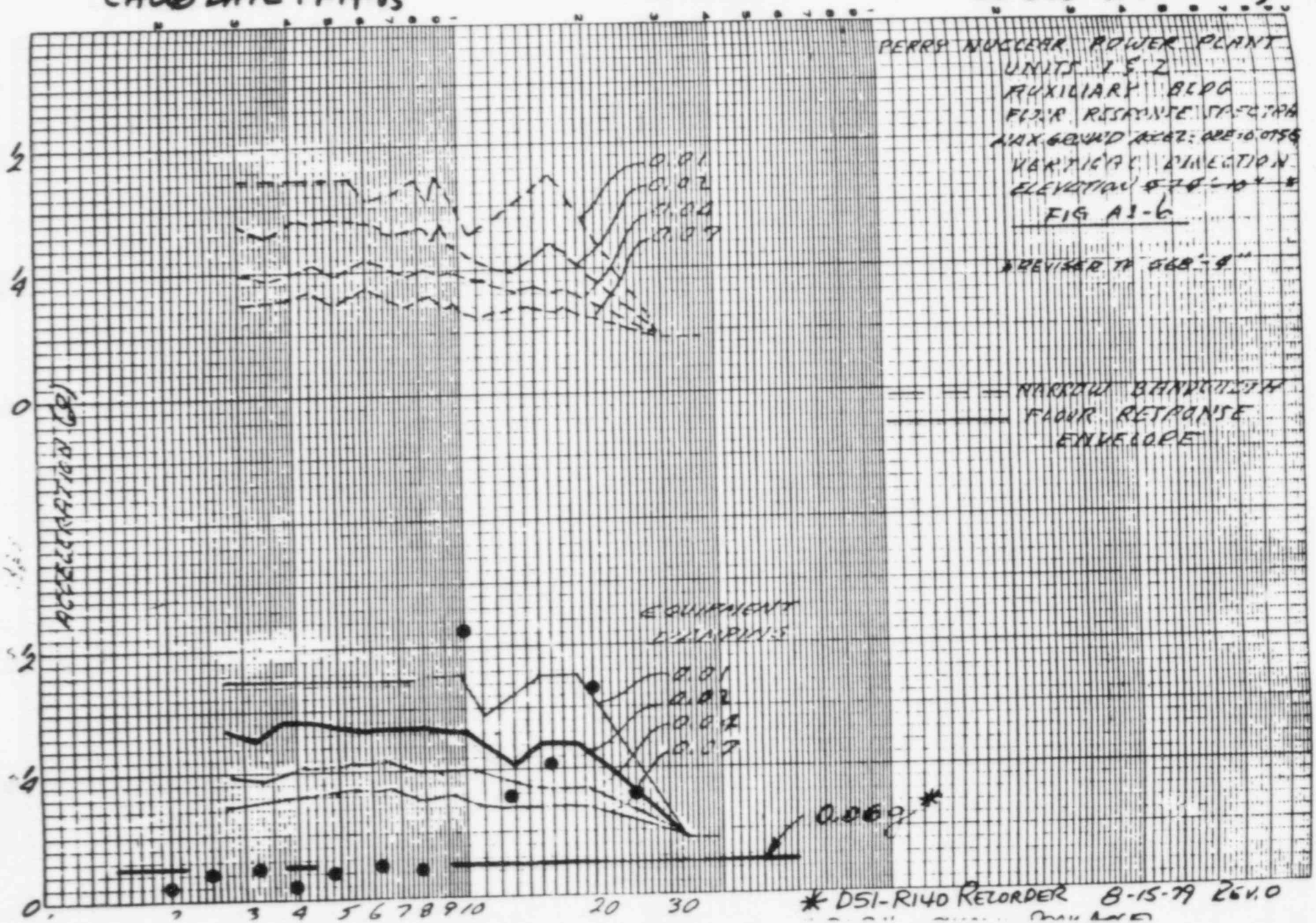
BTS-79 REV. 0

INSTR. # DSI-R180 (2% DAMP)
MODEL # PSR-1200 (ENGDAHL)
CALIB DATE : 1-14-85

• DATA FROM RECORDER

NORTH-SOUTH
AUX BLDG. -OBE (.075 g)
EL. 568' (FDN. MAT)




INSTR # DSI-R180 (2% DAMP)
MODEL # PSR-1200
CALIB DATE: 1-14-85
• DATA FROM RECORDER
Vertical
EAST-WEST
AUX BLDG - OBE (.075g)
EL 568' (FDN. MAT)
PERRY NUCLEAR POWER PLANT
UNITS 1 & 2
AUXILIARY BLDG
FLOOR RESPONSE SPECTRA
MAX GROUND ACCEL: OBE 0.075g
HORIZONTAL EXCITATION
ELEVATION 568'-0"
FIG A3-6
* REVISED TO 568'-9"
0.01
0.02
0.04
0.07
NARROW BAND 33Hz FLOOR RESPONSE ENVELOPE
EQUIVALENT ACCELERATION (g)
0.01
0.02
0.04
0.07
0.06g *
ACCELERATION (g)
1/2
1/4
0
1/2
1/4
0
1 3 4 5 6 7 8 9 10 20 30
* DSI-R140 RECORDER 8-15-79 26V.0

ATTACHMENT V

PRELIMINARY REPORT ON KINEMETRICS DATA

FEB 04 '86 12:37 P01

TELECOPY REQUEST

KINEMETRICS, INC.
PASADENA, CA
TELECOPY TELEPHONE (818) 795-0863

TELECOPY NO: 569

DATE: Feb 4, 1986

TELECOPY TELEPHONE TO WHICH THIS MESSAGE SHOULD BE SENT: (312) 790 5661

TO: NRC - Chicago
Attn: Jim Muffett

FROM: G. Siegel
Customer Service Dept.

DOCUMENT: Prelim. Data from Earthquake of Jan 31 '86 at Perry

REFERENCE: S/O K6028 KMS K6-002

NO. OF SHEETS FOLLOWING THIS PAGE Thirteen

IF YOU HAVE ANY PROBLEM WITH THIS TELECOPY CONTACT GIGI M. CRIST AT (818) 795-2220

4 FEB 86 13:

FEB 04 '86 12:41 P02

PROCESSING NOTES

1. Sensor Locations:

SMA-3 S/N 165-1 (D51-N101) ⇒ Reactor Bldg Foundation, 575'

SMA-3 S/N 165-2 (D51-N111) ⇒ Containment Vessel Annulus, 682'

2. These plots are preliminary, as they have not been QC-checked. However, no changes are anticipated.

R. Nigbor
Kinemetrics
2/3/86

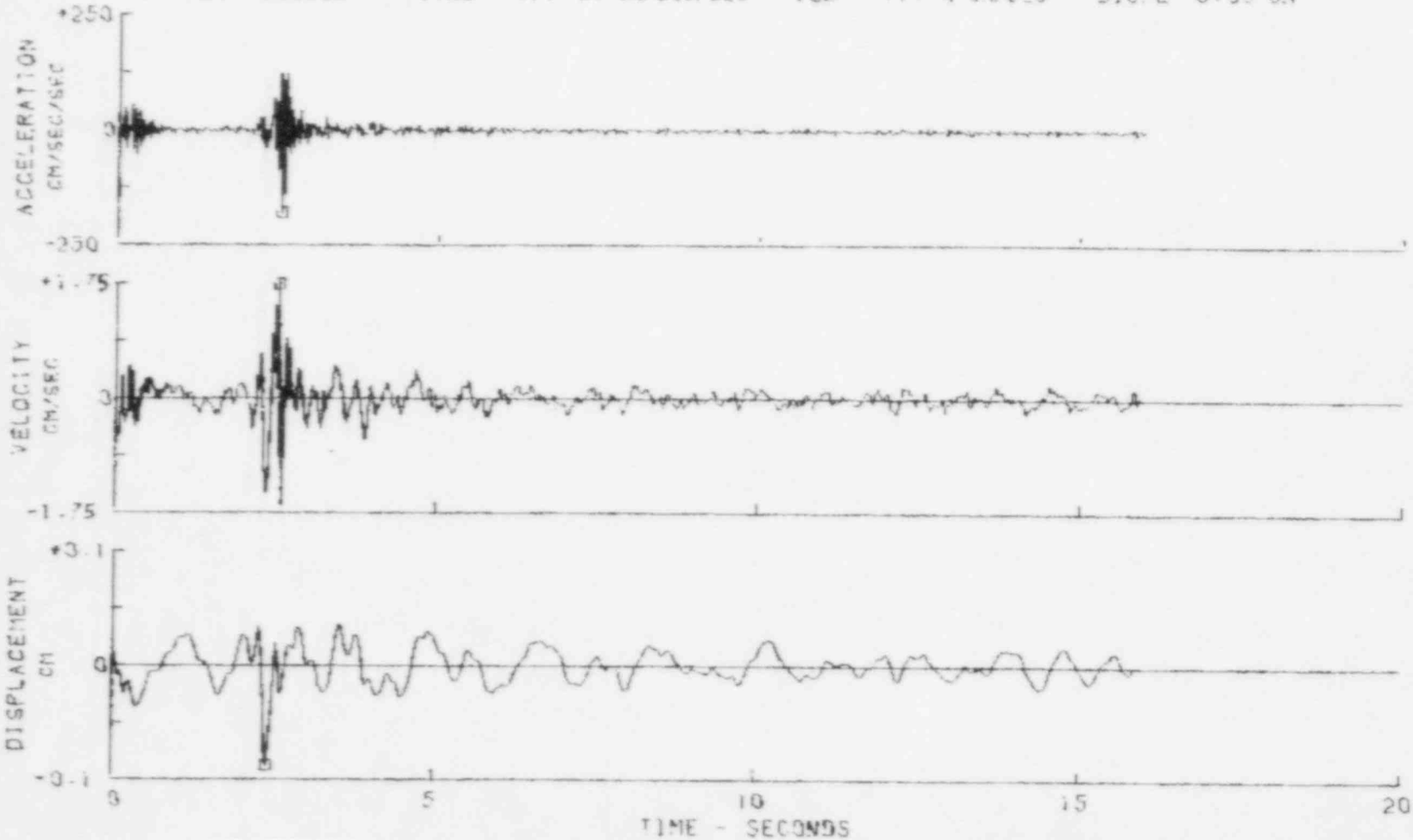
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

ITA800I PERRY NUCLEAR POWER PLANT COMP SOUTH SMA3S/N 163-1L

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.400- 0.625 AND 35.00- 40.00 HERTZ

@PEAK VALUES: ACCEL= -177.21 CM/SEC/SEC VEL= +1.74 CM/SEC DISPL=-0.09 CM



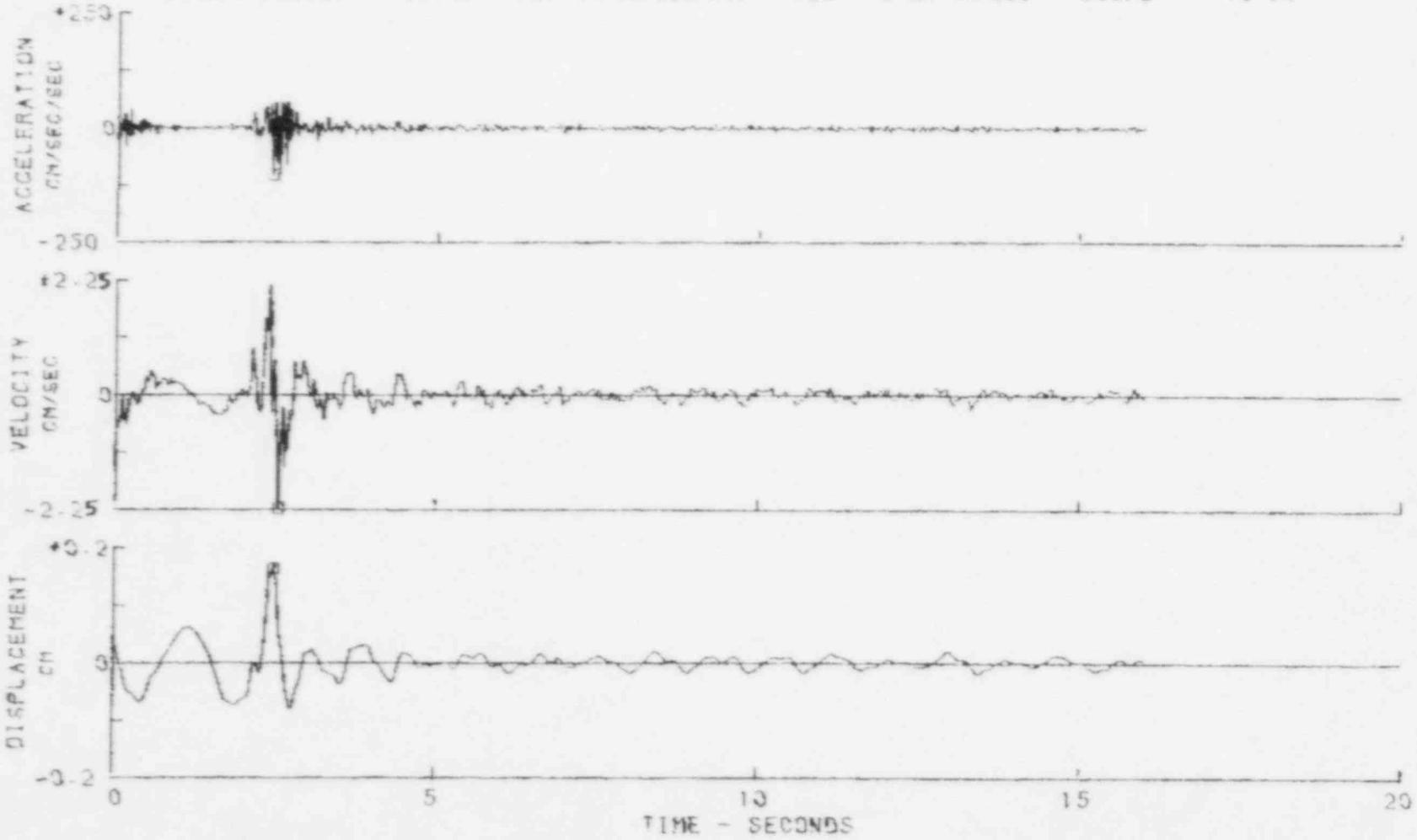
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

[1A803] PERRY NUCLEAR POWER PLANT COMP WEST SMA3S/N 163-11

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.400- 0.625 AND 35.00- 40.00 HERTZ

@PEAK VALUES: ACCEL= -101.12 CM/SEC/SEC VEL= -2.21 CM/SEC DISPL= +.16 CM



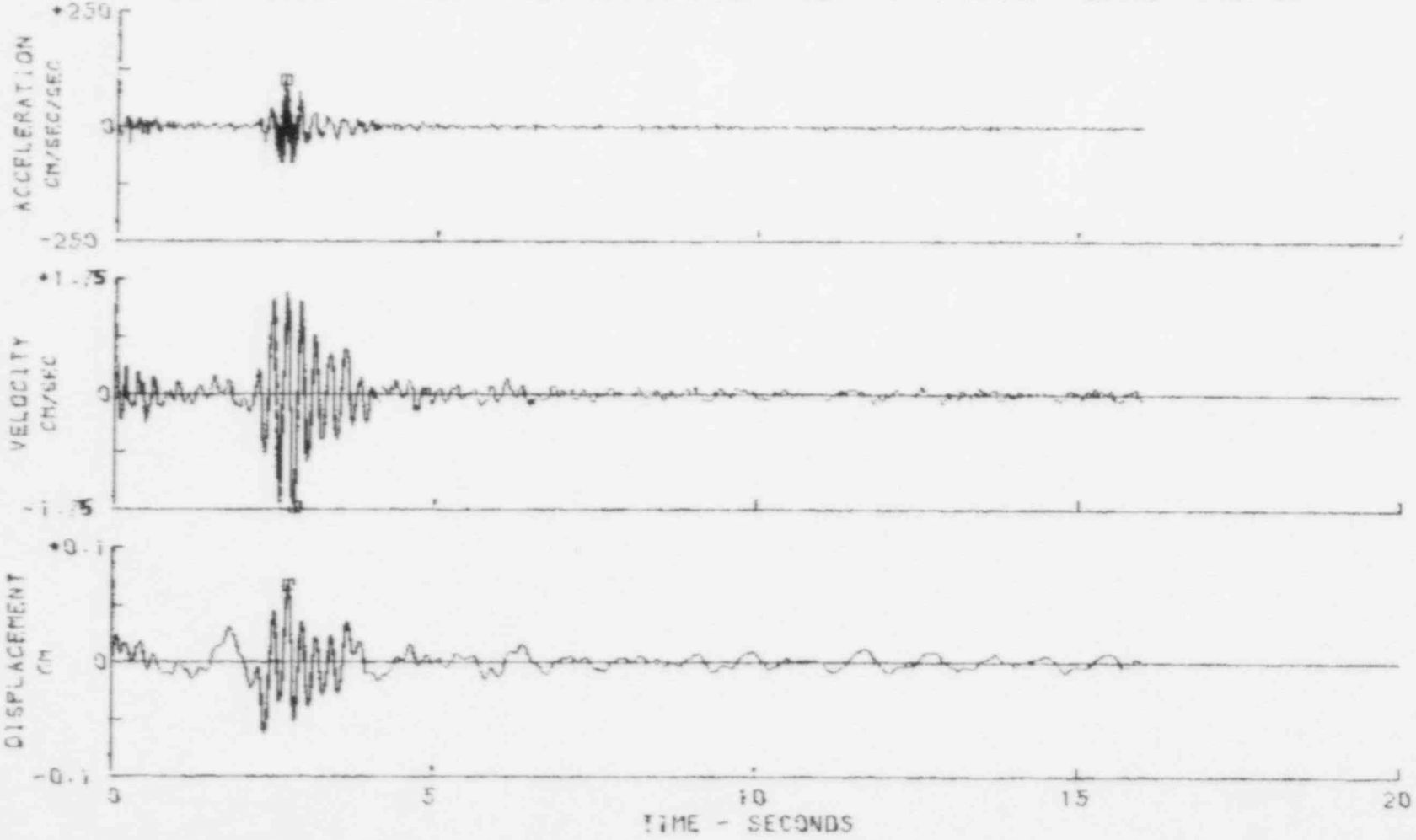
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

ITA903: PERRY NUCLEAR POWER PLANT COMP UP SMA3S/N 155-IV

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.400- 0.625 AND 35.00- 40.00 HERTZ

@ PEAK VALUES: ACCEL= +107.45 CM/SEC/SEC VEL= -1.71 CM/SEC DISPL= +.07 CM



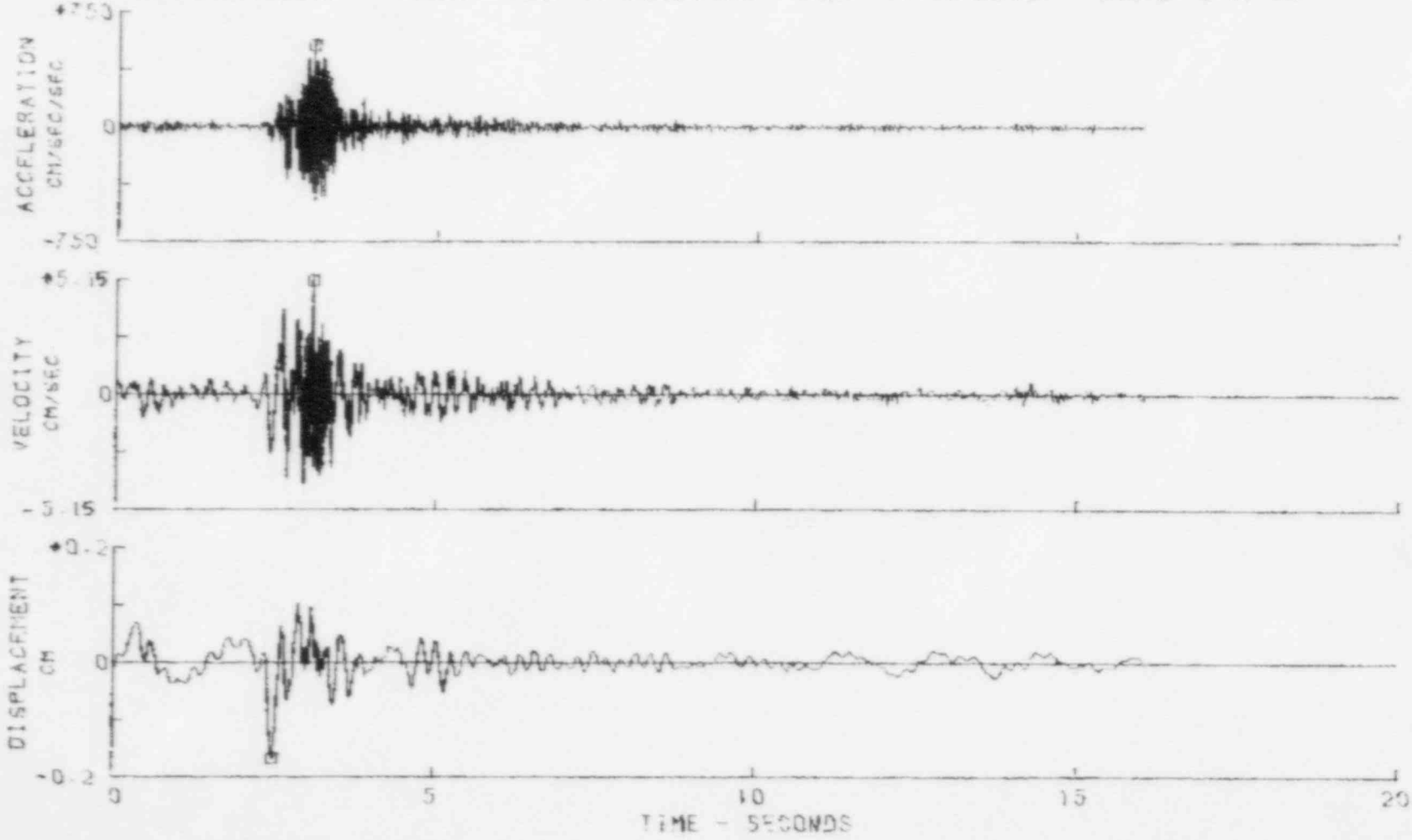
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

I1A8002 PERRY NUCLEAR POWER PLANT COMP SOUTH SMA3S/N 165-2L

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.400- 0.625 AND 35.00- 40.00 HERTZ

@PEAK VALUES: ACCEL= +535.17 CM/SEC/SEC VEL= +5.15 CM/SEC DISPL=-0.17 CM



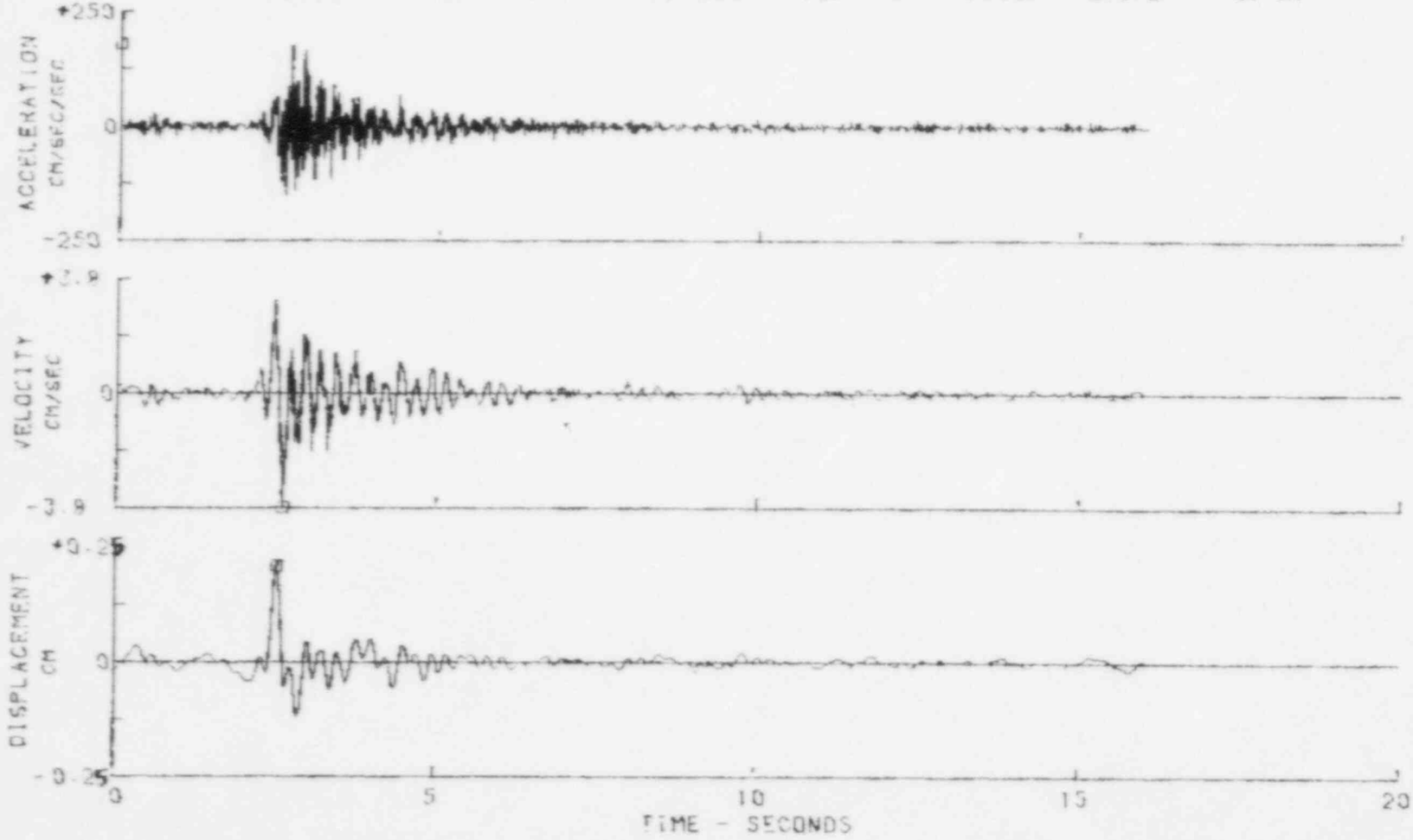
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

TTA8002 PERRY NUCLEAR POWER PLANT COMP WEST SMACS/N 163-2T

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.400- 0.625 AND 35.00- 40.00 HERTZ

@ PEAK VALUES: ACCEL= +178.35 CM/SEC/SEC VEL= -3.77 CM/SEC DISPL= +.21 CM



FEB 04 '86 12:58 P07

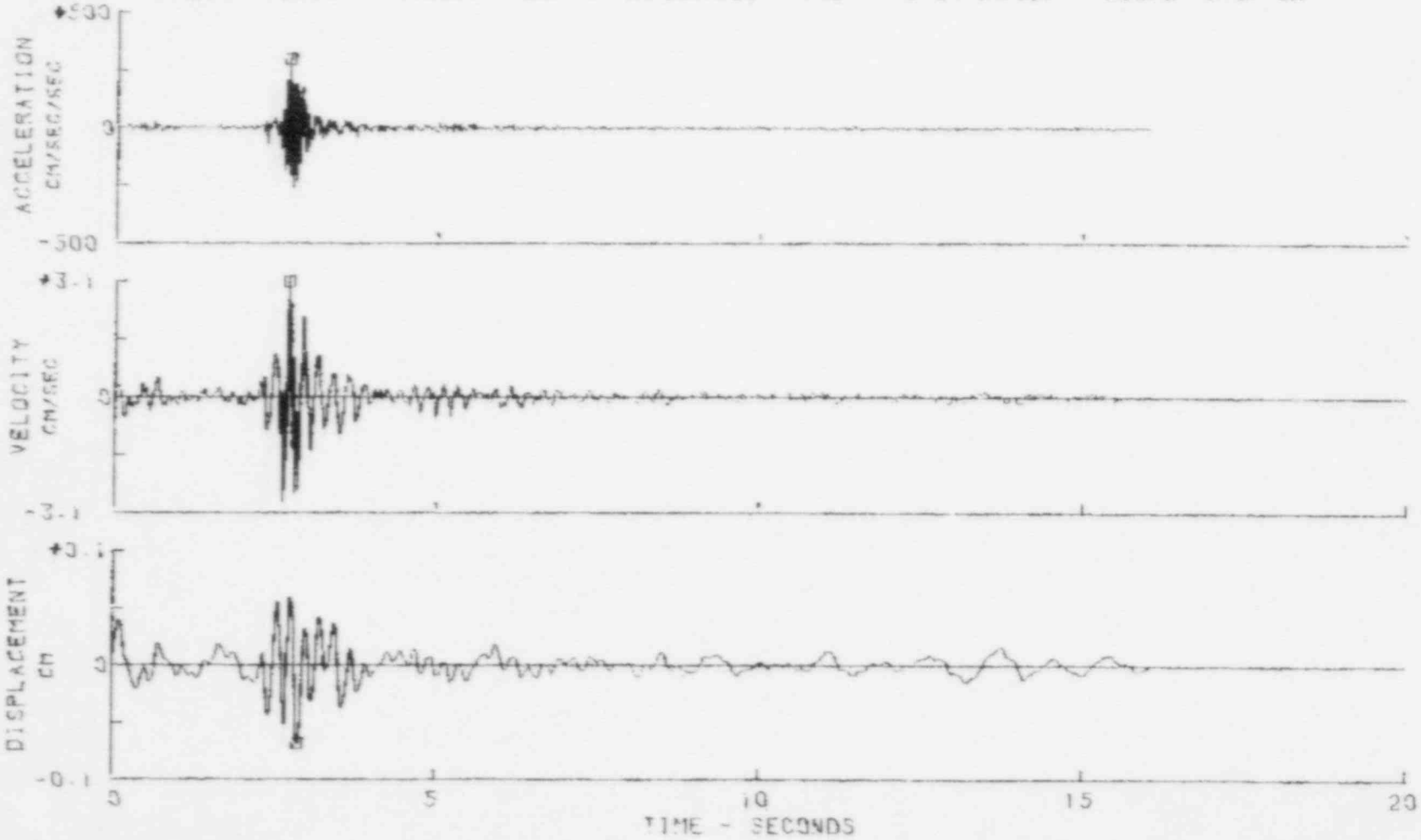
KINEMETRICS

ML 5.0 EARTHQUAKE JANUARY 31, 1986

1TA8002 PERRY NUCLEAR POWER PLANT COMP UP SMA3S/N 165-2V

ACCELEROGRAM IS BAND-PASS FILTERED BETWEEN 0.400- 0.525 AND 35.00- 40.00 HERTZ

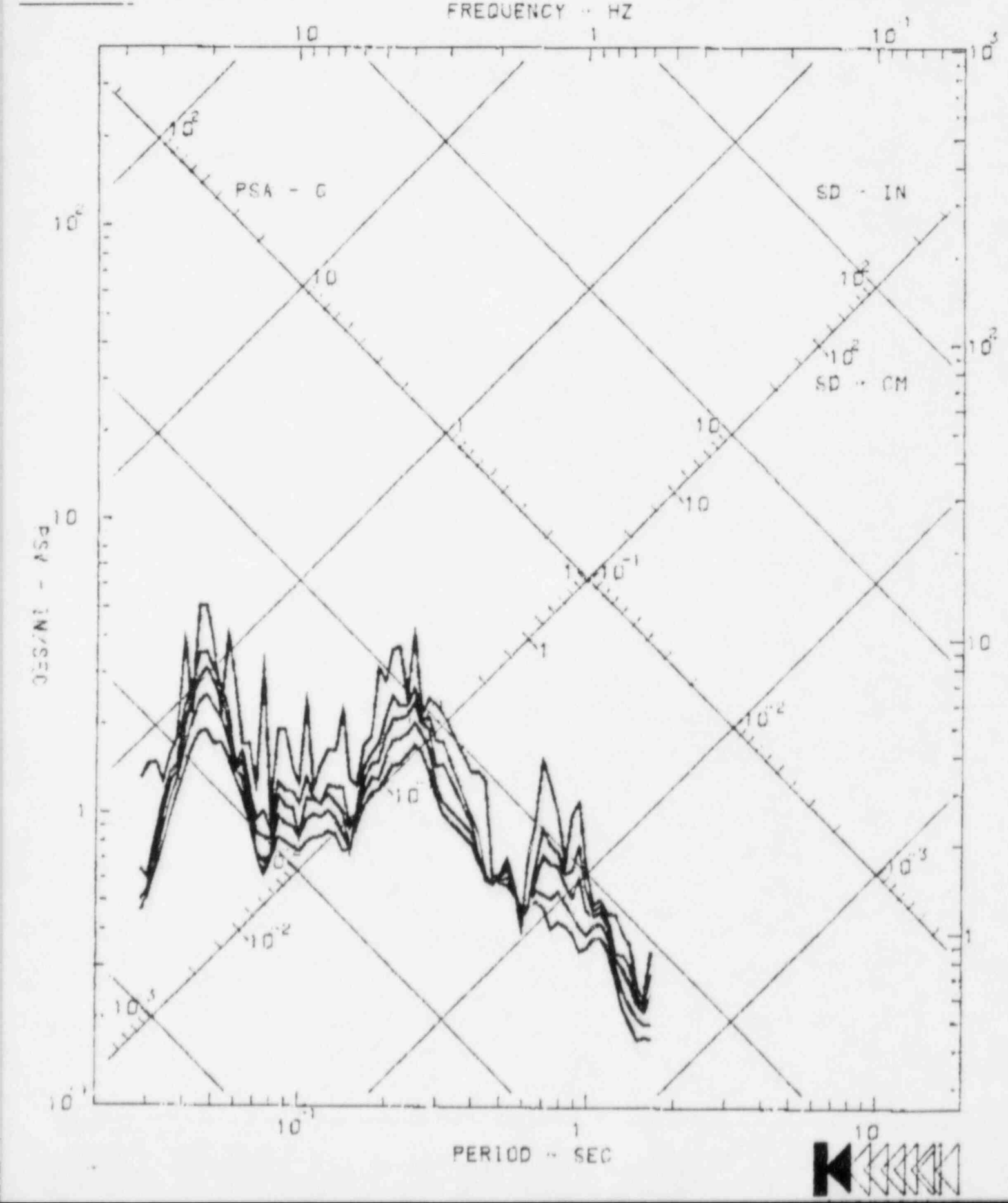
@ PEAK VALUES: ACCEL= +297.21 CM/SEC/SEC VEL= +3.09 CM/SEC DISPL=0.07 CM



ML 5.0 EARTHQUAKE JANUARY 31, 1986

ITABOOI PERRY NUCLEAR POWER PLANT COMP SOUTH SMA3S/N 165-1L

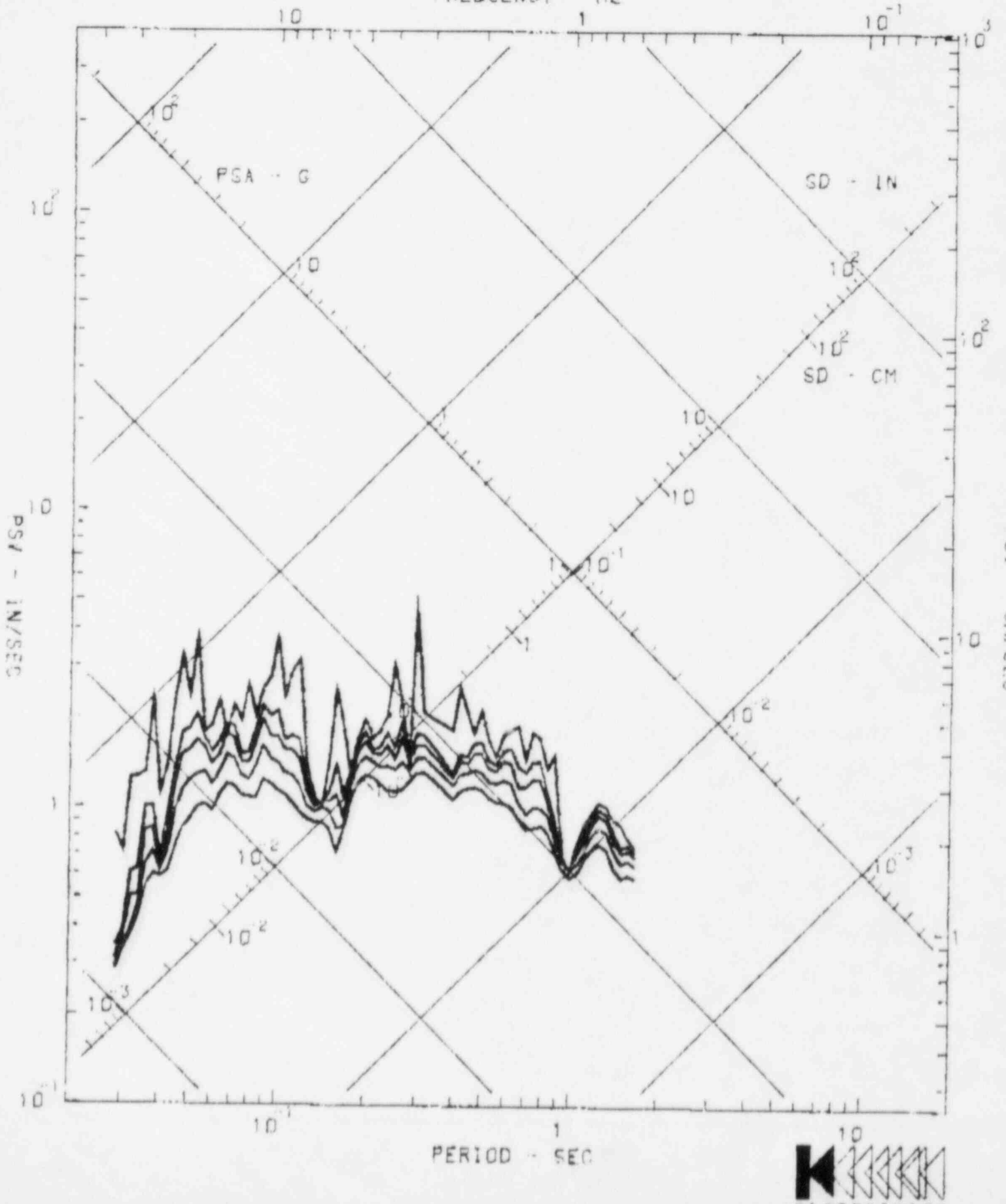
DAMPING VALUES ARE 0. 1. 2. 4. 7 PERCENT OF CRITICAL



ML 5.0 EARTHQUAKE JANUARY 31, 1986

I1A800: PERRY NUCLEAR POWER PLANT COMP WEST SMA35/N 165-1T

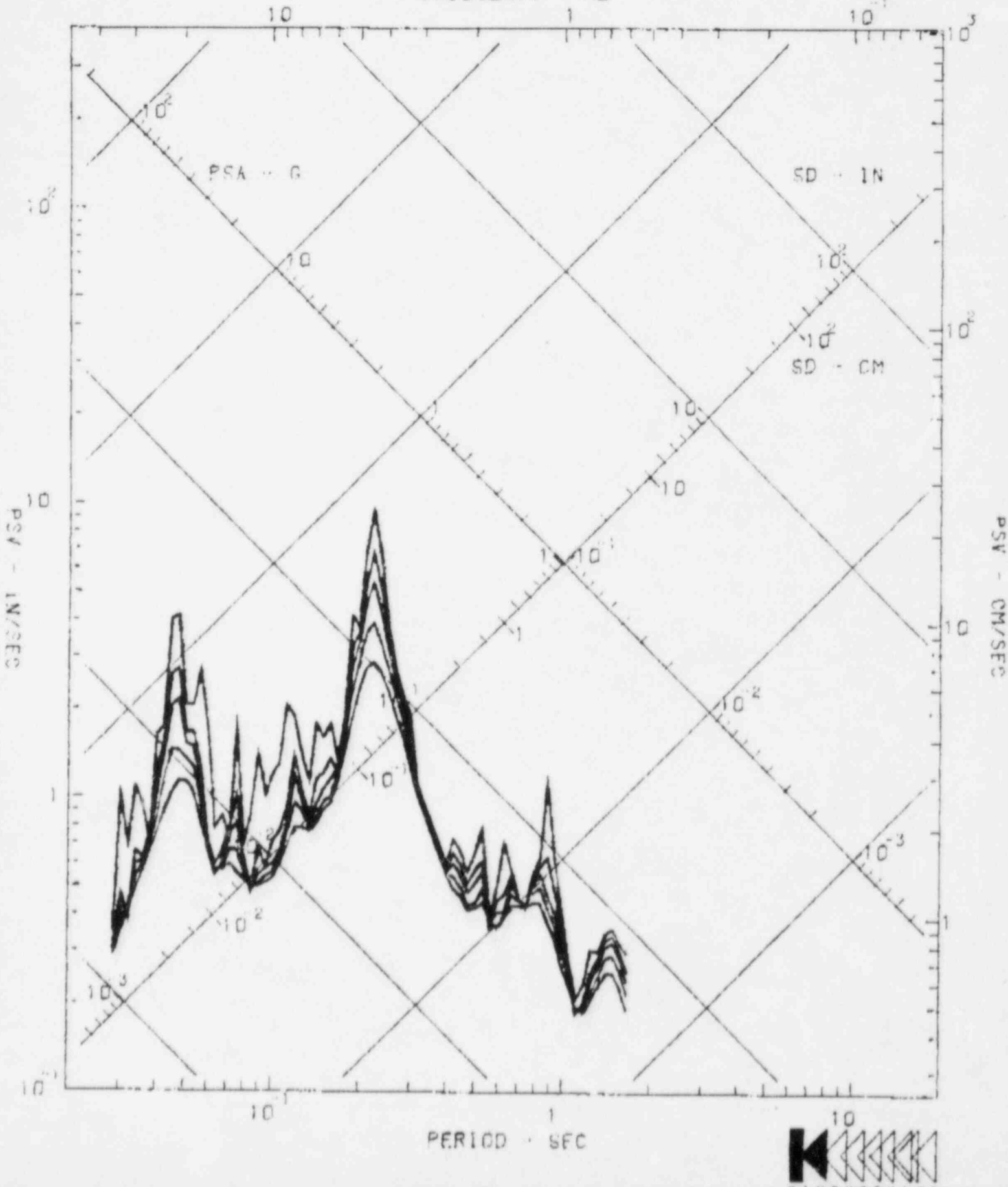
DAMPING VALUES ARE 0, 1, 2, 4, 7 PERCENT OF CRITICAL



ML 5.0 EARTHQUAKE JANUARY 31, 1986

I1A800I PERRY NUCLEAR POWER PLANT COMP UP SMA3S/N 165-1V

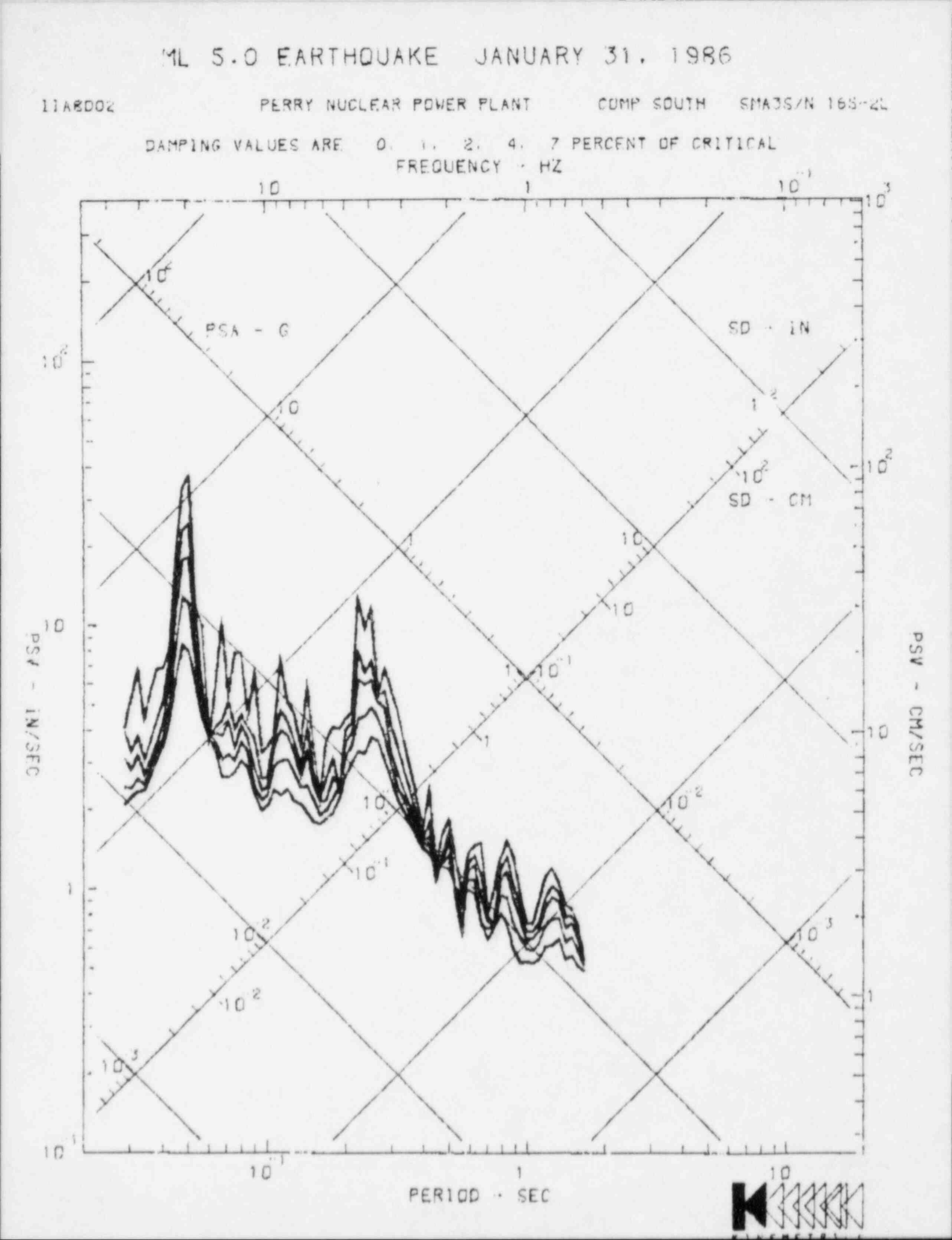
DAMPING VALUES ARE 0. 1. 2. 4. / PERCENT OF CRITICAL



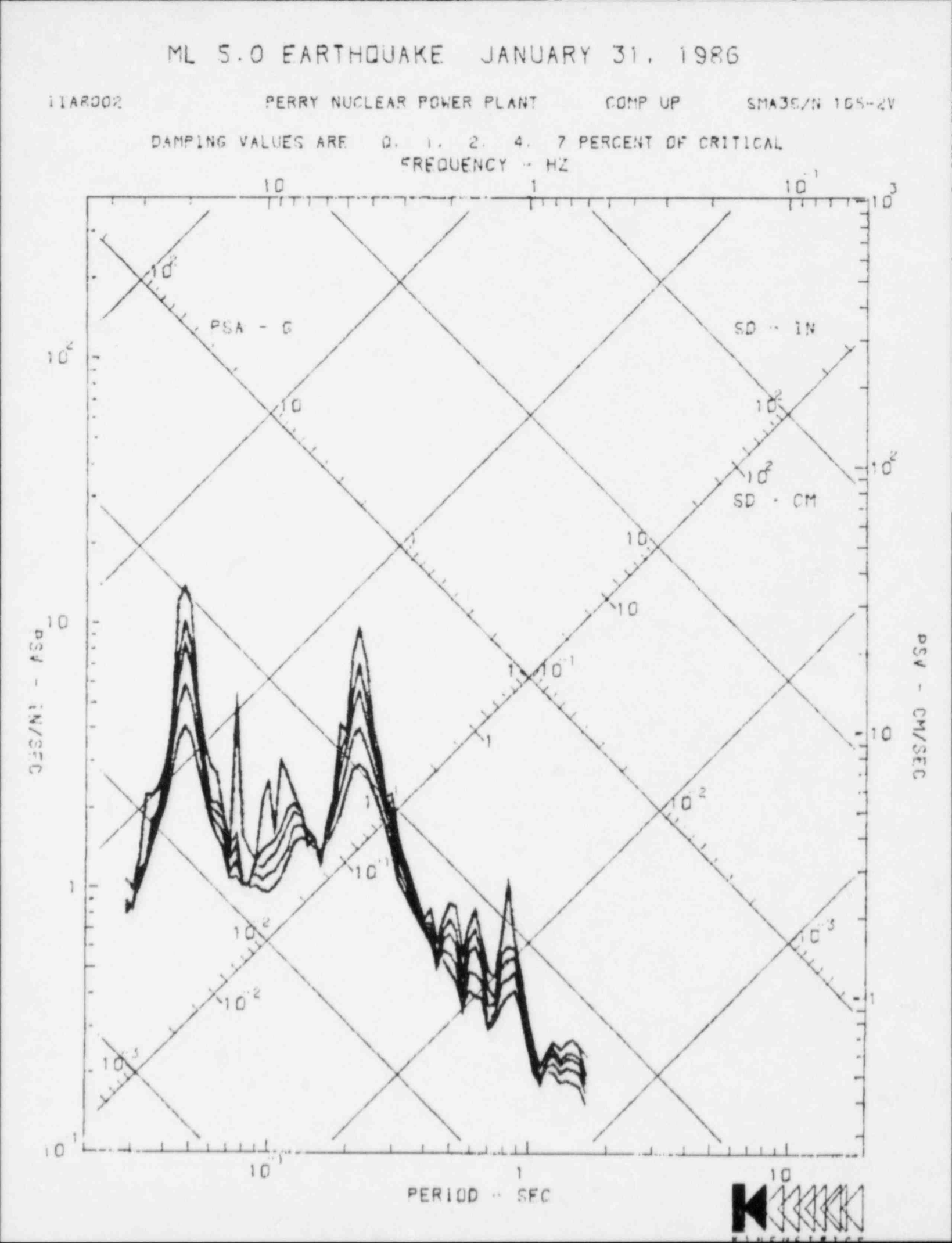
ML 5.0 EARTHQUAKE JANUARY 31, 1986

11ABD02 PERRY NUCLEAR POWER PLANT COMP SOUTH SMA3S/N 165-2L

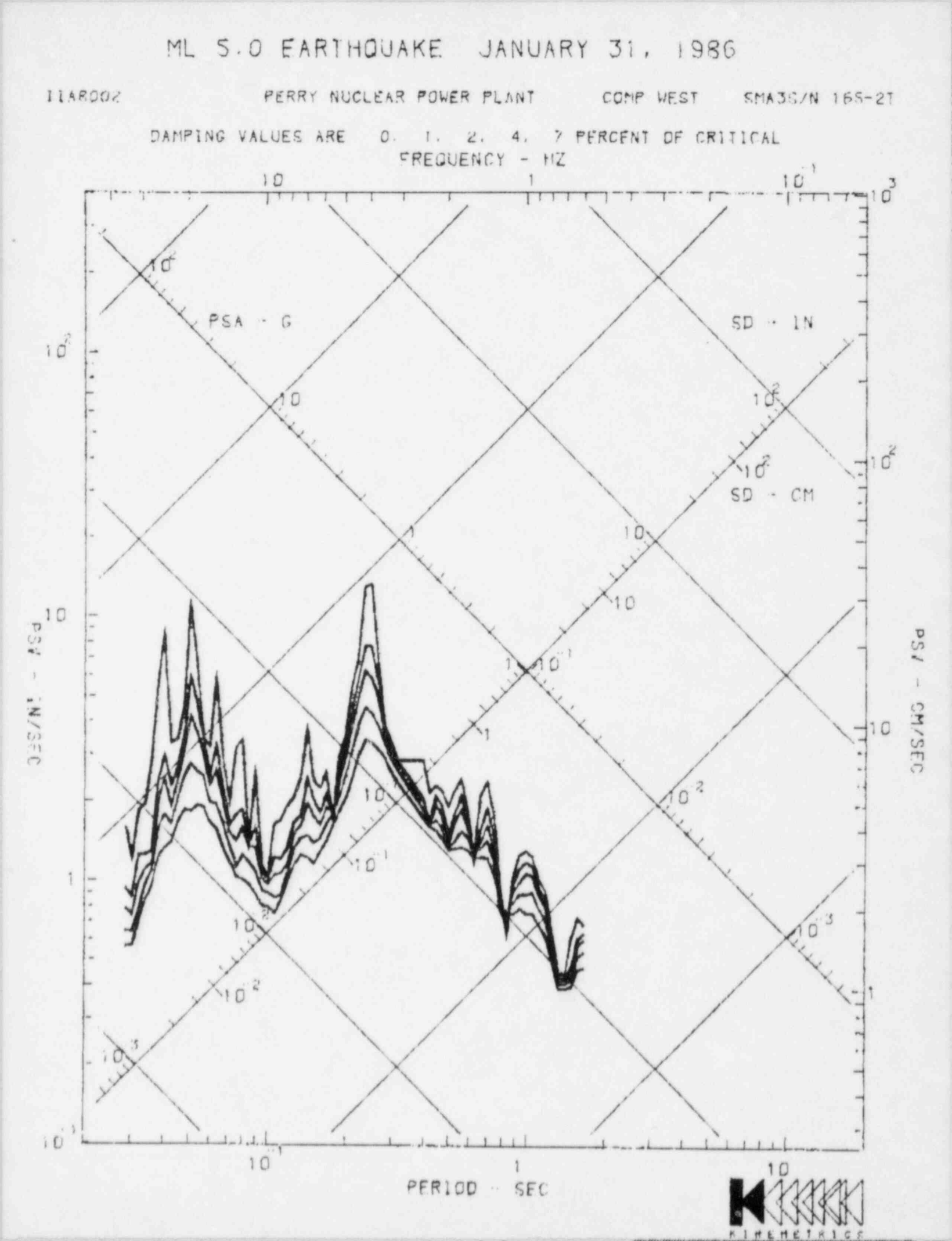
DAMPING VALUES ARE 0, 1, 2, 4, 7 PERCENT OF CRITICAL



ML 5.0 EARTHQUAKE JANUARY 31, 1986



ML 5.0 EARTHQUAKE JANUARY 31, 1986



ENCLOSURE 6

2/7/86 Walk-down

grade level: 620'

①

T. Y. Chang

① Air compressor for instrumentation tripped.

Make: Worthington Centrifugal Compressor
Type: CAP-15
Serial No: T96714
Location: Control Complex
Elevation: 574'

There are 1 instrumentation compressor & 1 service compressor for each unit. All 4 are connected to a common header. Anyone will provide enough compressed air for 1+2 units.

Axial - thrust (set pt 1.6 mil) & vibration monitor (set pt 1.8 mil)* are to measure shaft deflection, but both were not triggered by the earthquake. The applicant believed that however the earthquake caused the trip

* Bently Nevada Corp Model 5075-14

② Main turbine generator breaker tripped because of trip of No. 86 relay (Turbine generator protection)

86 Relay ← Both on "generator relay panel" → 40-1 relay (generator loss of excitation relay)

86 Relay:
make/type GE HEA lockout relay (toggle type)
Location: Control room
Elevation: 654'
Safety Related: no

40-1 relay:
make/type GE Model 12CEH51A1A No. 40-1, rotating disc
Impedance type (over current, voltage restraining)
Location: Control room
Elevation: 654', Safety Related: no

No. 86 relay (lockout relay) tripped because of trip of No. 40-1 relay. At the time of earthquake, the turbine generator was not operating. There was no voltage on 40-1 since turbine was not working, and the disk was flopping there when earthquake comes and caused the trip. Applicant said that had the generator been working, the relay probably would not have tripped. The trip is anticipated in view of the fact that the generator was not working

(3) Auxiliary Boiler tripped —

make: Burn Corp Shut off valve (Maxon) shut.

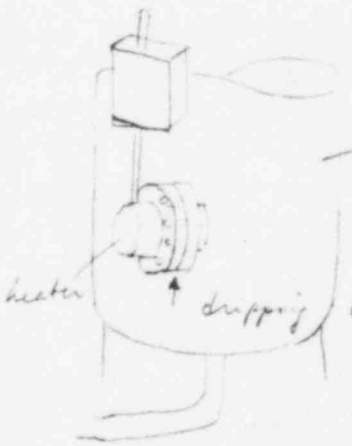
Location: Aux boiler room

Elevation: 620'

This aux boiler tripped because of trip of No. 86 relay. (Tripped during transfer from aux. transformer to main transformer — by design)

(4) • Hot water heater pipe flange leaked.

Location: Rad Waste Bldg
Elev. 623' See attached floor plan



This heater provides clean steam to evaporator, has nothing to do with radiation waste

known definately was there

2 vertical, 1 diagonal
→ hairline cracks (don't know what this is there before earthquake or not

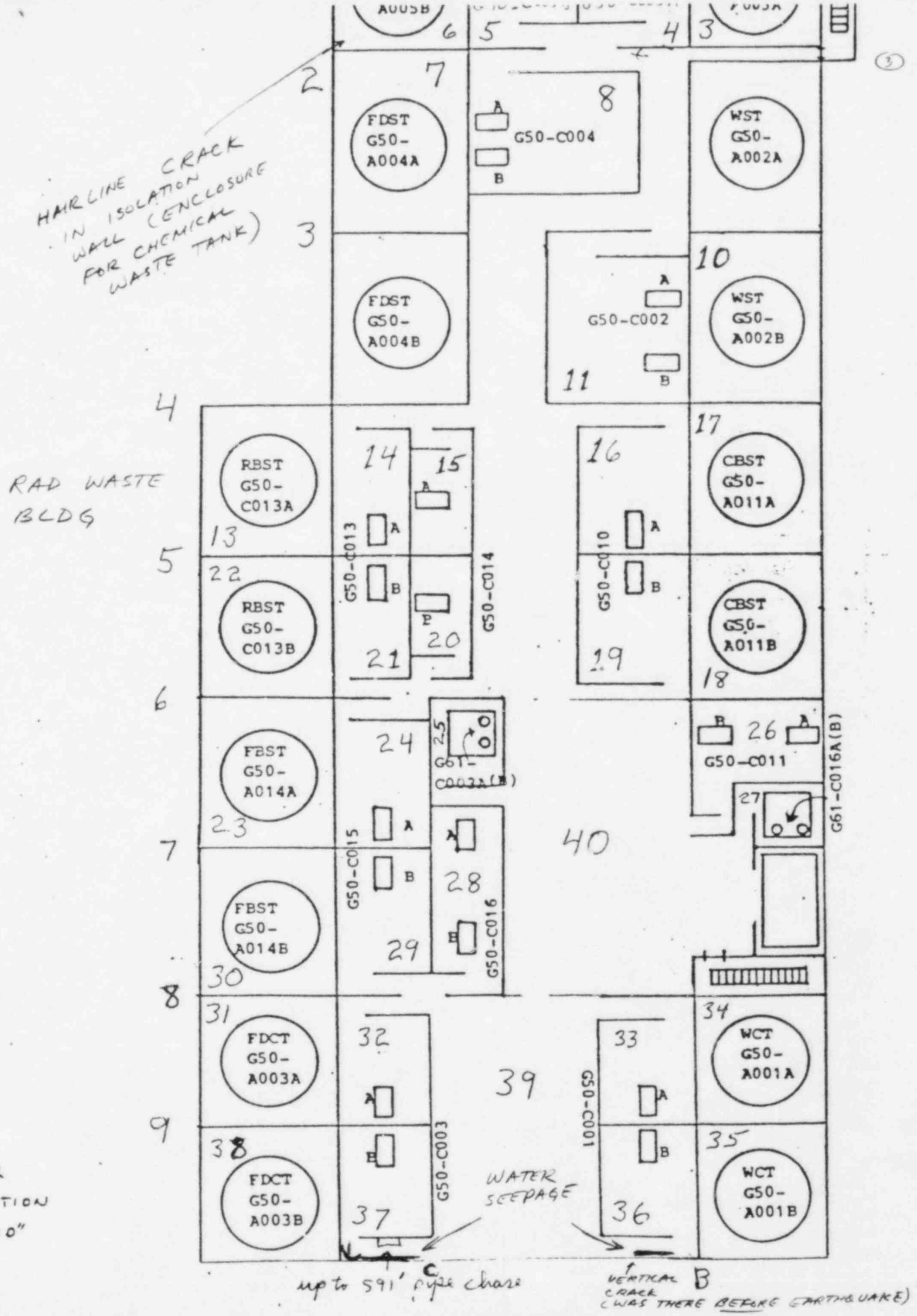
• Wall crack for enclosure of chemical waste tank (2' reinforced concrete wall) — see attachment for location

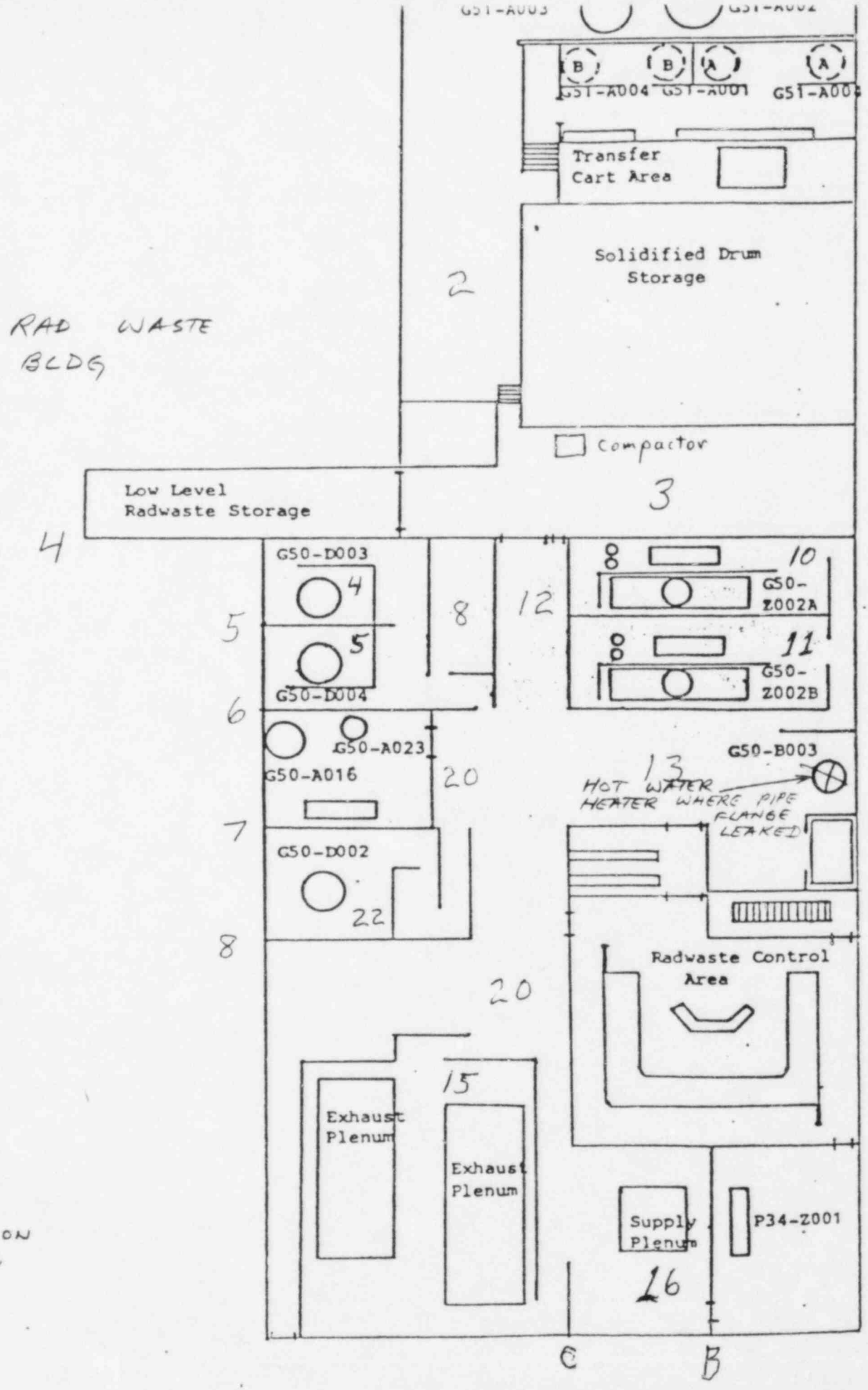
wall crack in aux bldg.

• Seepage through Rad Waste room wall. (~~ground~~ from Hdle water)

(5) Suppression pool level indicator

right after earthquake, water level rose 1" → 1½", measured at 4 places P-11 valve leakage Water level rose 1' → 1½' on ~~Sun~~ Saturday night. Still looking into this (recalibration?)


A005B
6
5
4
3
2
7
8
FDST G50-A004A
G50-C004
A
B
WST G50-A002A
HAIR LINE CRACK IN ISOLATION WALL (ENCLOSURE FOR CHEMICAL WASTE TANK)
3
FDST G50-A004B
10
G50-C002
WST G50-A002B
11
4
RAD WASTE BLDG
RBST G50-C013A
14
15
16
17
CBST G50-A011A
13
G50-C013
G50-C010
5
22
RBST G50-C013B
G50-C014
CBST G50-A011B
21
20
19
18
6
FBST G50-A014A
24
25
G61-C002A(B)
26
G50-C011
27
G61-C016A(B)
23
7
G50-C015
40
FBST G50-A014B
28
29
G50-C016
30
8
31
FDCT G50-A003A
32
33
34
WCT G50-A001A
39
G50-C001
9
38
FDCT G50-A003B
G50-C003
WATER SEEPAGE
35
WCT G50-A001B
37
36
C
B
up to 591' pipe chase
VERTICAL CRACK (WAS THERE BEFORE EARTHQUAKE)
FOOR LEVATION 74'10"



FLOOR ELEVATION 622'6"