NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

General Offices • Selden Street, Berlin, Connecticut

P.O. BOX 270
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August 6, 1985

Docket No. 50-423
B11611

Director of Nuclear Reactor Regulation
Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Youngblood:

Millstone Nuclear Power Station, Unit No. 3
Seismic Qualification Review Team (SQRT) and Pump and Valve
Operability Review Team (PVORT) Audits

The NRC Staff conducted SQRT and PVORT audits during the week of March 4 through 8, 1985 for Millstone Unit No. 3. A small number of equipment specific questions were raised by the Staff during the SQRT audit. The NRC Staff indicated that these questions were of confirmatory nature and requested NNECO to provide responses in a timely manner. Enclosed are Northeast Nuclear Energy Company's (NNECO) responses to these questions.

Questions raised by the Staff during the PVORT audit were successfully resolved by NNECO representatives and no written response was required.

If there are any questions, please contact our licensing representative directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.
BY NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

J. F. Opeka
Senior Vice President

By: C. F. Sears
Vice President

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me C. F. Sears, who being duly sworn, did state that he is Vice President of Northeast Nuclear Energy Company, an Applicant herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Applicants herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.

Jennifer Powers
Notary Public
My Commission Expires March 31, 1989

Attachment I

Responses to SQRT Audit Questions

NRC SQRT AUDIT QUESTIONS

Generic

Question 1:

Upon completion of the on-going seismic qualification program, NNECO must confirm that all safety-related (Seismic Category 1) equipment has been qualified and installed in a manner consistent with their respective qualification document.

Response:

A response to this question will be submitted by the end of September, 1985.

Status:

Confirmatory.

Question 2:

Upon completion of any as-built piping analysis, NNECO must confirm that the g-values used to qualify pipe mounted equipment was not lower than the g-values obtained from the as-built conditions.

Response:

A response to this question will be submitted by the end of September, 1985.

Status:

Confirmatory.

Question 3:

During their walkdown, the staff noticed several Seismic Category 1 electrical cabinets located in close proximity to other cabinets (seismic category or nonseismic category cabinets). The staff noted that these cabinets were anchored at the floor but unrestrained at their tops. NNECO must confirm that during a seismic event, the dynamic interaction of the Seismic Category 1 cabinets with the adjacent cabinets is precluded by providing restraints at the top of these cabinets or providing adequate clearances.

Response:

The seismic qualification of electrical cabinets presumes that adequate physical separation is provided between the cabinet and adjacent structures, other cabinets and machinery. A walkdown of all Category I free standing electrical cabinets was performed during the weeks of May 6-10, 1985 and May 13-18, 1985. The following is the disposition of Category I cabinets identified as having insufficient physical separation. - 480 Volt Motor Control Center (MCC) - ITE Gould Specification 2425.600-244.

Mark Number	Location
3EHS*MCC1A1	Emergency Generator Enclosure 24 ft. - 6 in.
3EHS*MCC1B1	Emergency Generator Enclosure 24 ft. - 6 in.
3EHS*MCC1A2	Control Building 4 ft. - 6 in.
3EHS*MCC1B2	Control Building 4 ft. - 6 in.
3EHS*MCC1A4	Engineered Safeguards Building 36 ft. - 6 in.

The referenced 480 volt MCCs are located too near structural concrete walls. This problem will be resolved by joining the top of the MCCs to the concrete wall. The motion of the 480 volt MCC will now be in phase with the motion of the concrete wall and no impact against the wall will occur. Structurally the MCCs are stiffened by the additional support; consequently, the MCC response is shifted upward. The change in response of the MCC will not invalidate the seismic qualification of the electrical components mounted to the MCC structure since the electrical components are sine dwell tested at 1/3 octave intervals up to 33 hertz.

- D.C. Battery Charger (CHGR) and Power Supply Line-ups (Inverter (INV) and D.C. distribution panel (PNL) Static Inverter (INV) - Elgar, Specification 2445.300-622

Mark Number	Location
3VBA*INV-1	Control Building 4 ft. - 6 in.
3VBA*INV-2	Control Building 4 ft. - 6 in.
3VBA*INV-3	Control Building 4 ft. - 6 in.
3VBA*INV-4	Control Building 4 ft. - 6 in.

Static Battery Charger - C&D Batteries Division
Specification 2445.200-260

Mark Number	Location
3BYS*CHGR-1	Control Building 4 ft. - 6 in.
3BYS*CHGR-2	Control Building 4 ft. - 6 in.
3BYS*CHGR-3	Control Building 4 ft. - 6 in.
3BYS*CHGR-4	Control Building 4 ft. - 6 in.

Battery Charger 125 Volt D.C. Distribution Panel - Specification 2424.210-262

Mark Number	Location
3BYS*PNL-1	Control Building 4 ft. - 6 in.
3BYS*PNL-2	Control Building 4 ft. - 6 in.
3BYS*PNL-3	Control Building 4 ft. - 6 in.
3BYS*PNL-4	Control Building 4 ft. - 6 in.

The static inverter (INV), battery charger (CHGR) and 125 Volt D.C. Distribution panel (PNL) are not provided with sufficient shake space or separation. The physical dissimilarity of the individual cabinets prevent joining the line-up together in order to prevent the out of phase side to side motion.

The INV, CHGR and PNL will be moved apart in order to provide adequate shake space.
- Isolator Cabinets - System Control Specification 2424.100-644

Mark Number	Location
3CES*PNLBD10	Emergency Generator Enclosure 24 ft. - 6 in.
3CES*PNLBD1P	Emergency Generator Enclosure 24 ft. - 6 in.
3CES*PNLBE1P	Emergency Safeguards Building 36 ft. - 6 in.
3CES*PNLBE20	Emergency Safeguards Building 36 ft. - 6 in.
3CES*PNLBR10-BR50	MCC and Rod Control Area 24 ft. - 6 in.
3CES*PNLBR1P-BR5P	MCC and Rod Control Area 24 ft. - 6 in.

The referenced isolator cabinets are near concrete walls or in contact with each other.

The isolator cabinets are rigid and structurally identical. The isolator cabinet line-ups will be joined together at the top of the cabinets assuring in-phase motion. The individual cabinets adjacent to the concrete walls have sufficient clearance to preclude cabinet to wall impact. No modifications are required for isolator cabinets 3CES*PNL BD10, BD1P, BE1P, and BE20.

- Radiation Monitoring Console and Rack - Kaman Instrumentation Specification 2474.030-624

Mark Number	Location
3RMS-CNSL1	Control Room 47 ft. - 6 in.
3RMS*RAK1A	Control Room 47 ft. - 6 in.

The Radiation Monitoring System (RMS) Console (CNSL1) is a Category II component in close proximity (less than 2 inches of space) to a Category I component 3RMS*RAK1A.

E&DCR F-P-40329 specifies that a 1/2 inch shake space between the RMS rack and console is adequate. The RMS rack and console qualification reports K-84-50U(R) and K-83-110-U(R) support this conclusion.

Status:

Closed.

BOP-2 - 3ENS*SWGA

Question 1:

Is there sufficient clearance between the top point of the switchgear and the bus duct to avoid interference during a seismic event? If not, what measures are being taken to resolve this situation?

Response:

There is a two inch overlap between the top corner of the potential transformer (PT) cubicle on the switchgear and the adjacent bus-duct. General Electric, the manufacturer, is to fabricate a new PT cubicle that will have a notched corner to permit the necessary clearance. General Electric will supervise the removal and replacement of the existing PT cubicle.

Status:

Closed.

NRC SQRT AUDIT QUESTIONS

NSSS-5 - 3RPS*RAKNIS

Question 1:

Provide wiring diagrams for the NIS console which distinguishes between Class IE and non-Class IE equipment in the console. For protection set #4 provide weights of the non-Class IE equipment relative to the weights of the tested equipment.

Response:

Information has been provided identifying Class 1E equipment within the NIS console and weights of instrumentation. Westinghouse has provided a letter to NU identifying the power range portion of the NIS console as the only Class 1E equipment addressed in the qualification report. (See attached Westinghouse letter NEU-5678 dated June 6, 1985.)

Status:

Closed.

Question 2:

Westinghouse will provide a Millstone 3 specific demonstration that the tests performed for the NIS console provided the equivalent of 5 OBEs and 1 SSE.

Response:

Background

The Nuclear Instrumentation System (NIS) console was seismically tested using single frequency sine beat tests. The tests performed subjected the NIS console to vibratory motions that conservatively simulated the expected motion at the equipment mounting location during the design basis earthquake. Sine beat vibration waveforms were employed as input at the base in each principal axis of the equipment separately. The equipment was excited at frequencies which were uniformly spaced over the frequency range of 1 to 35 Hz. In addition, testing was performed at equipment resonances determined from a resonance search in the 1 to 25 Hz frequency range prior to performing the sine beat testing.

Five (5) consecutive sine beats were applied at each test frequency, with a minimum pause of two (2) seconds between each sine beat. Each sine beat consisted of ten (10) sine waveform cycles at the required peak test acceleration amplitude. Testing of the NIS console is documented in the following reports:

- WCAP-8587, EQDP-ESE-10, "Equipment Qualification Data Package - Nuclear Instrumentation System (NIS) Console," Revision 5, March 1985.

- WCAP-7821, "Seismic Testing of Electrical and Control Equipment (High Seismic Plants)," Revision 0, December 1971.

The NIS console was qualified for Millstone 3 application to the high seismic level as shown in Figure 1. The predominant natural frequencies of the NIS console were found at 5.0 to 7.7 Hz in the horizontal directions, while the NIS was found to be rigid (resonances above 33 Hz) in the vertical direction. The NIS console is mounted in the Millstone 3 control building at elevation 47 ft. The Millstone 3 response spectra associated with this mounting location are provided in Figures 2 through 7.

Fatigue Evaluation

Westinghouse employs the following criteria to demonstrate that past single frequency seismic testing of the NIS console satisfied the fatigue requirements for the Millstone 3 application by meeting or exceeding the effects of 5 OBEs and 1 SSE at the resonance of the NIS.

Required Seismic Fatigue Stress Cycles

The required seismic fatigue stress cycles shall be computed at the lowest natural frequency in each principal axis of the equipment less than or equal to 33 Hz. For the NIS console the computation shall be based on a natural frequency of 5 Hz. The maximum Millstone 3 spectral accelerations associated with this frequency are 0.55g at 4% damping for an OBE event and 1.05g at 4% damping for an SSE event.

To simplify the computation of required fatigue stress cycles, the OBE and SSE seismic events shall be assumed highly conservative to be sinsoidal dwells for a duration of 20 seconds.

Therefore, the 5 OBEs and 1 SSE fatigue stress cycles can be calculated respectively as 500 fatigue cycles at a spectral acceleration of 0.55g and 100 fatigue cycles at a spectral acceleration of 1.05g, with a 4% damping.

To obtain a spectral acceleration of the fatigue stress cycles associated with the NIS console seismic test for the above OBE and SSE g levels, a single degree of freedom (SDOF) oscillator was subjected to a single frequency sine beat test time history (five beats - 10 cycles per beat) at the given 5 hertz test frequency. Using this time history, the number of stress cycles corresponding to the acceleration amplitude are calculated. From this data the equivalent number of stress cycles associated with the oscillator frequency are calculated. The computation of equivalent number of stress cycles is based on the assumption that fatigue damage at any acceleration level is proportional to the cube of the acceleration level. A second set of computations is also done based on the assumption that the fatigue damage is proportional to the square of the acceleration level. The latter is however, extremely conservative. It can be seen from the S-N curves provided in Section III, Division 1 of ASME Pressure Vessel Code, that an index (which is the negative inverse of the slope of the S-N curve) between 2 and 10 can be used depending upon the stresses that the components are to be subjected to.

Based on these assumptions, the equivalent number of stress cycles are defined as:

$$N_{i_3}(f_i) = \sum_j n_j \left[\frac{a_j}{a_i}\right]^3$$

$$N_{i_2}(f_i) = \sum_j n_j \left[\frac{a_j}{a_i}\right]^2, \quad \text{respectively}$$

where,

N_i = equivalent number of stress cycles associated with the oscillator frequency

a_j = jth acceleration amplitude as obtained from response time history

a_i = required acceleration amplitude corresponding to the oscillator frequency

n_j = number of stress cycles corresponding to amplitude a_j

Using the above defined method, the equivalent number of stress cycles are calculated and a comparison is shown below with the required number of stress cycles for 5 OBEs and 1 SSE.

Comparison of Millstone 3 Fatigue
Requirements Versus Equivalent
NIS Console Fatigue Cycles at Five Hertz

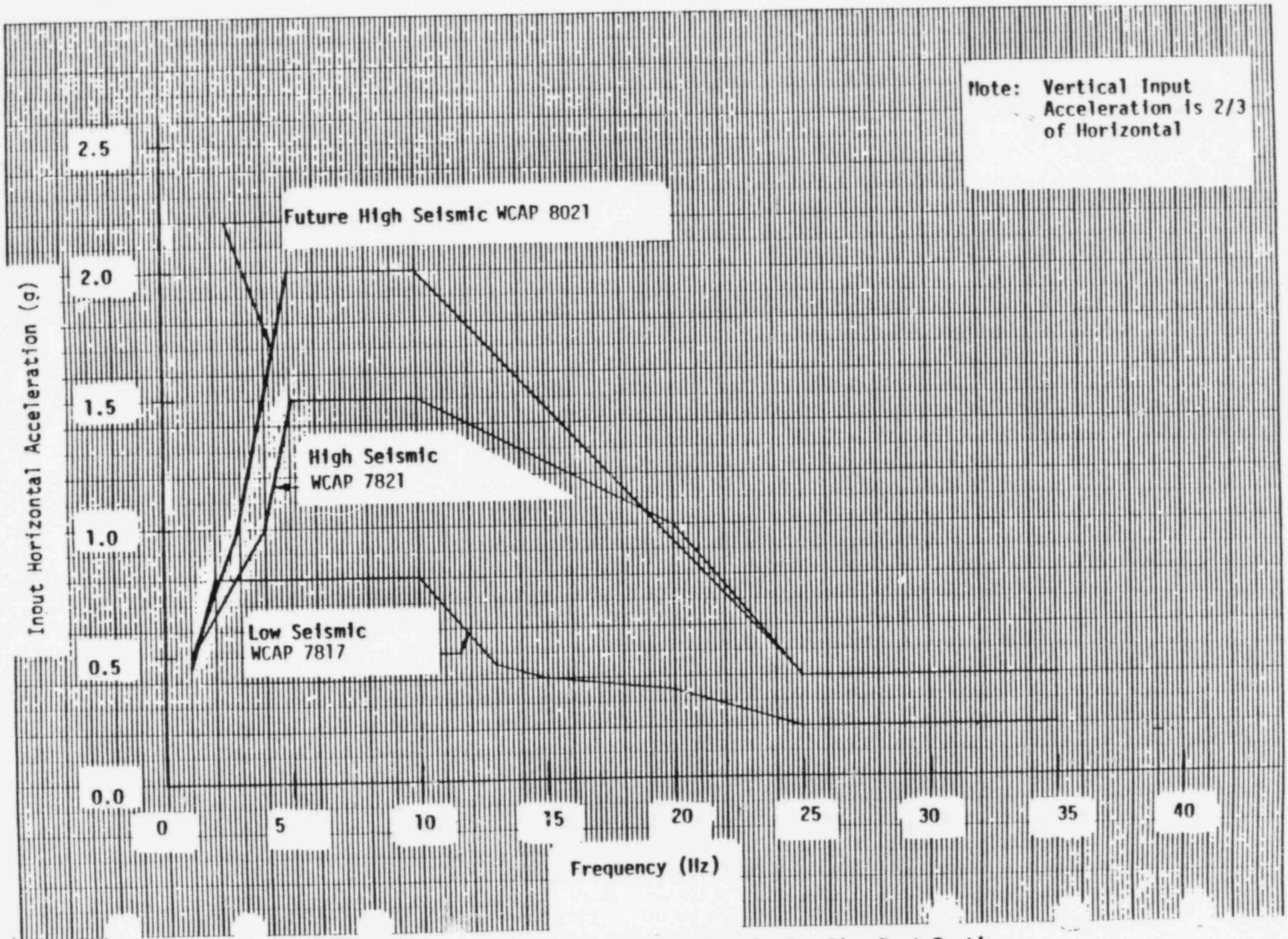
Frequency	Event	Required Spectral Acceleration @ 4% Damping	Required Stress Cycles	Equivalent Stress Cycles from Single Frequency Test Input*	
5 Hz	5 OBEs	0.55g	500	Cubic	222,443
				Square	11,903
	1 SSE	1.05g	100	Cubic	31,970
				Square	3,266

*5 sine beats at 10 cycles per beat were analyzed at 4% damping for direct comparison.

The above comparisons demonstrate the test fatigue stress cycles exceed the required fatigue stress cycles by a considerable amount. Therefore, based on the fatigue evaluation performed and documented herein, it is concluded that the Millstone Unit 3 fatigue requirements have been met by the single frequency seismic testing performed by Westinghouse on the NIS console.

Status:

Closed.



Peak Horizontal Input Acceleration Levels for Sine Beat Testing

FIGURE 1

EQ6T-EQT-1518

FIGURE 2

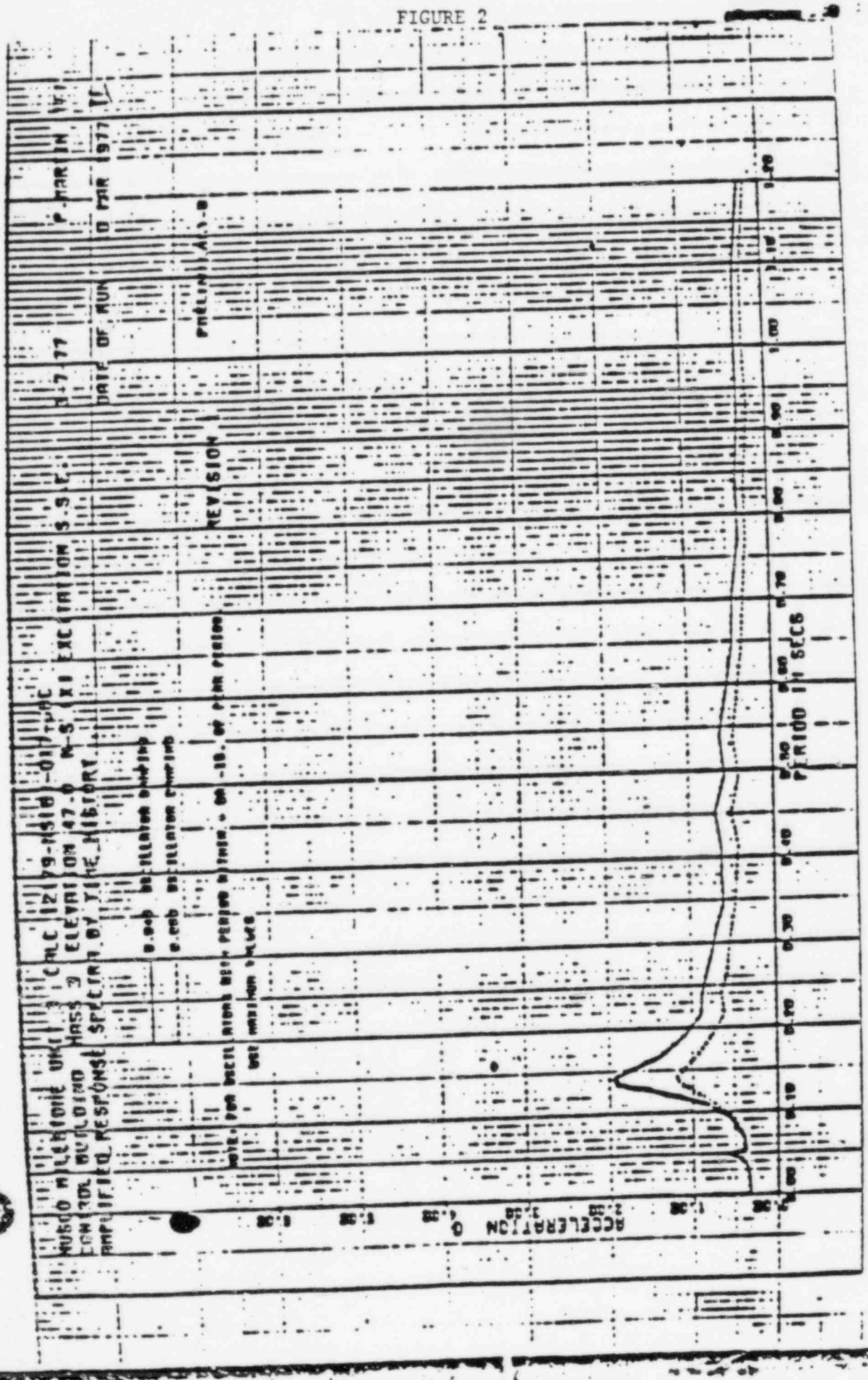


FIGURE 3

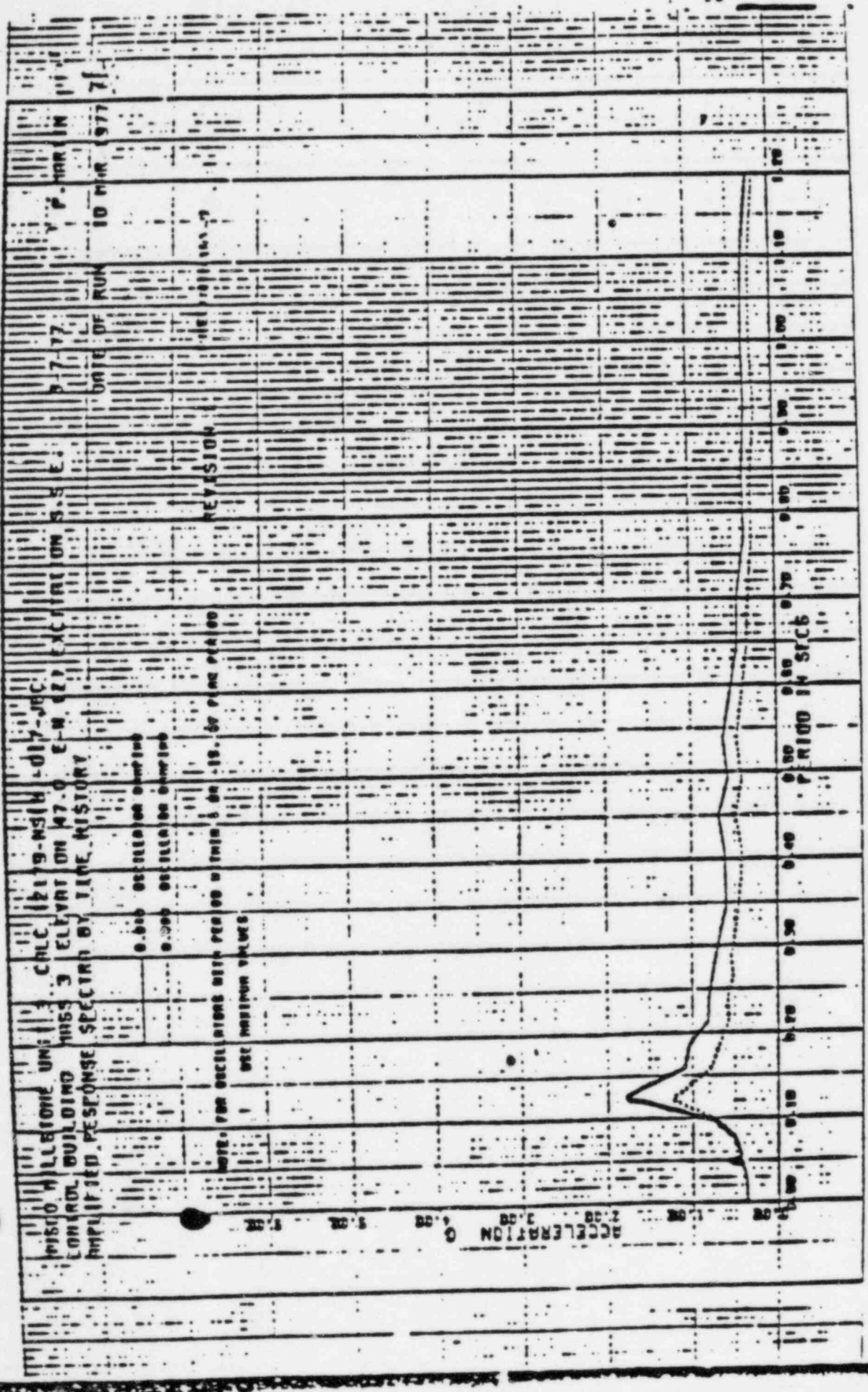
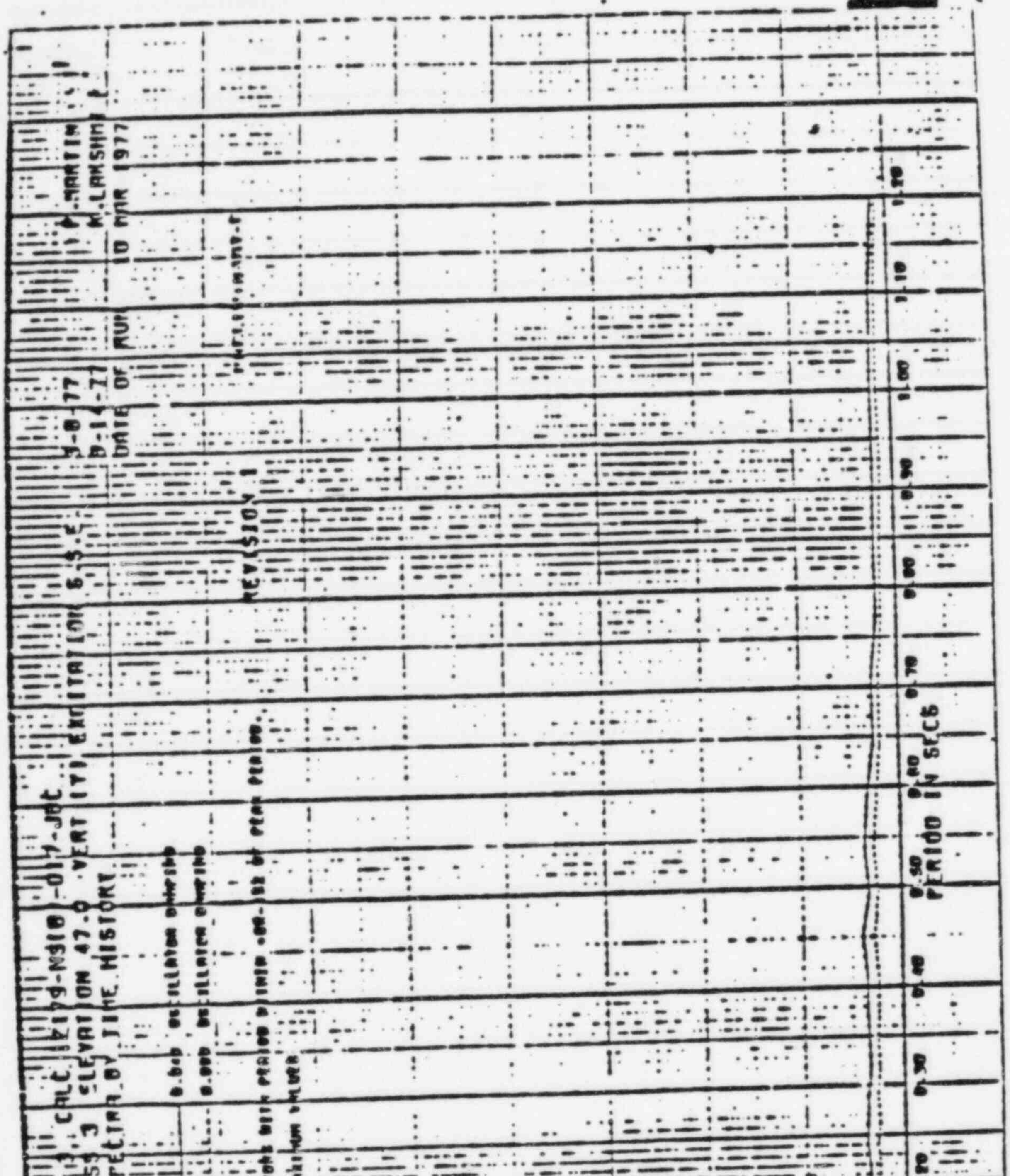


FIGURE 4


NUSCO MILLSTONE UNIT 3, CALC 12179-NS(B)-017-JOC
CONTROL BUILDING MASS 3 ELEVATION 47.0 VERT (Y) EXCITATION S.S.E.
AMPLIFIED RESPONSE SPECTRA BY TIME HISTORY
3-8-77
P.MARTIN
8-14-77
M.LAKSHMI
DATE OF RUN 10 MAR 1977
REVISION 1
ACCELERATION G
PERIOD IN SECS
1.00
1.10
1.20

25

FIGURE 5

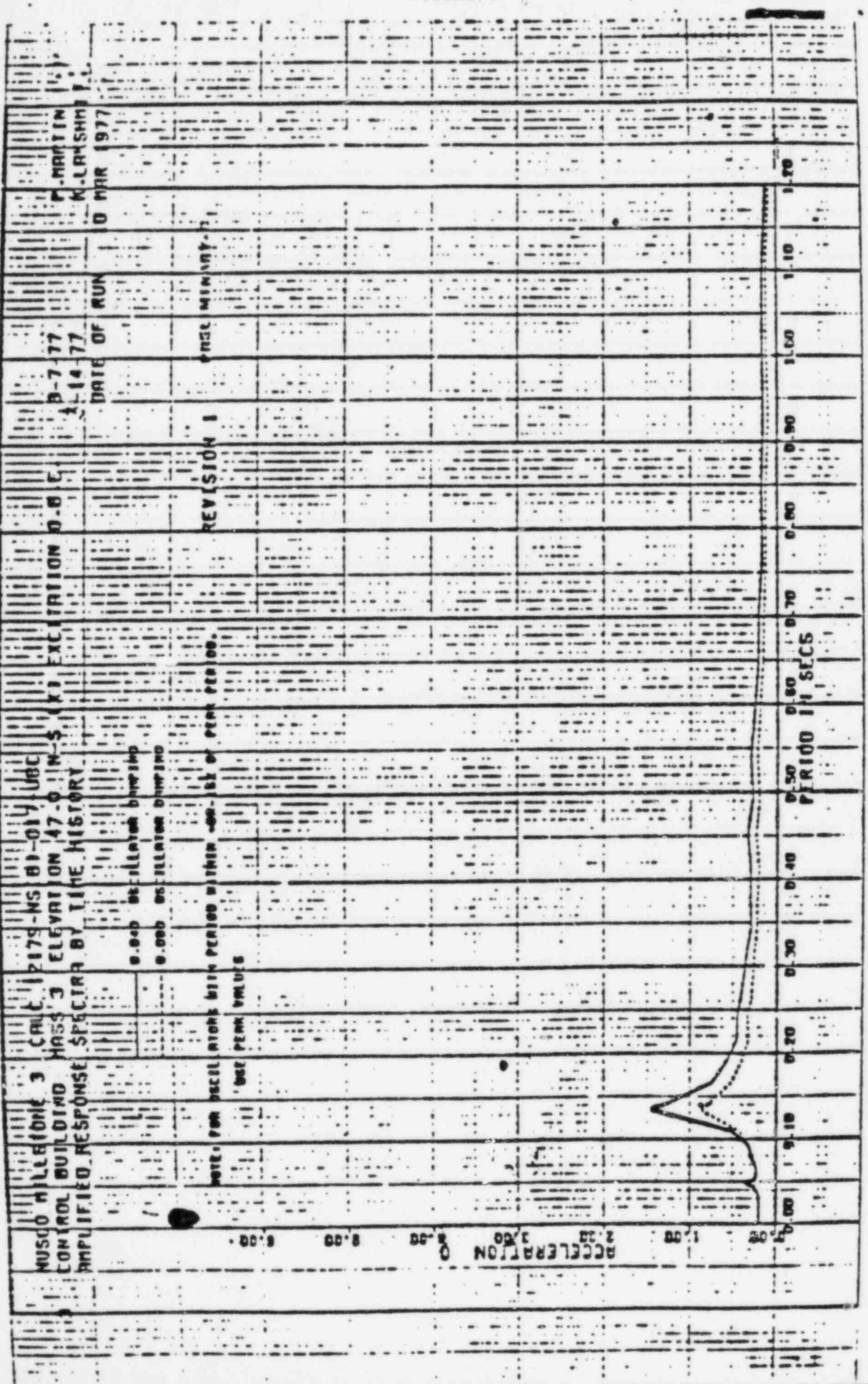

MUSCO ALLAHONE 3 CAL. 2179-NS 80-014 UBC
CONTROL BUILDING MASS 3 ELEVATION 47-0 N-S (X) EXCITATION 0-0 E
AMPLIFIED RESPONSE SPECTRA BY TIME HISTORY REVISION 1
DATE OF RUN 8-7-77 8-14-77
D MAR 1977 P.MARTIN K.LAWSHE
0.00 BASELINE DAMPING
0.05 OSCILLATION DAMPING
NOTE: FOR OSCILLATIONS WITHIN PERIOD WITHIN 90% OF PEAK PERIOD
USE PEAK VALUES
ACCELERATION G
PERIOD IN SECS
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20

FIGURE 6

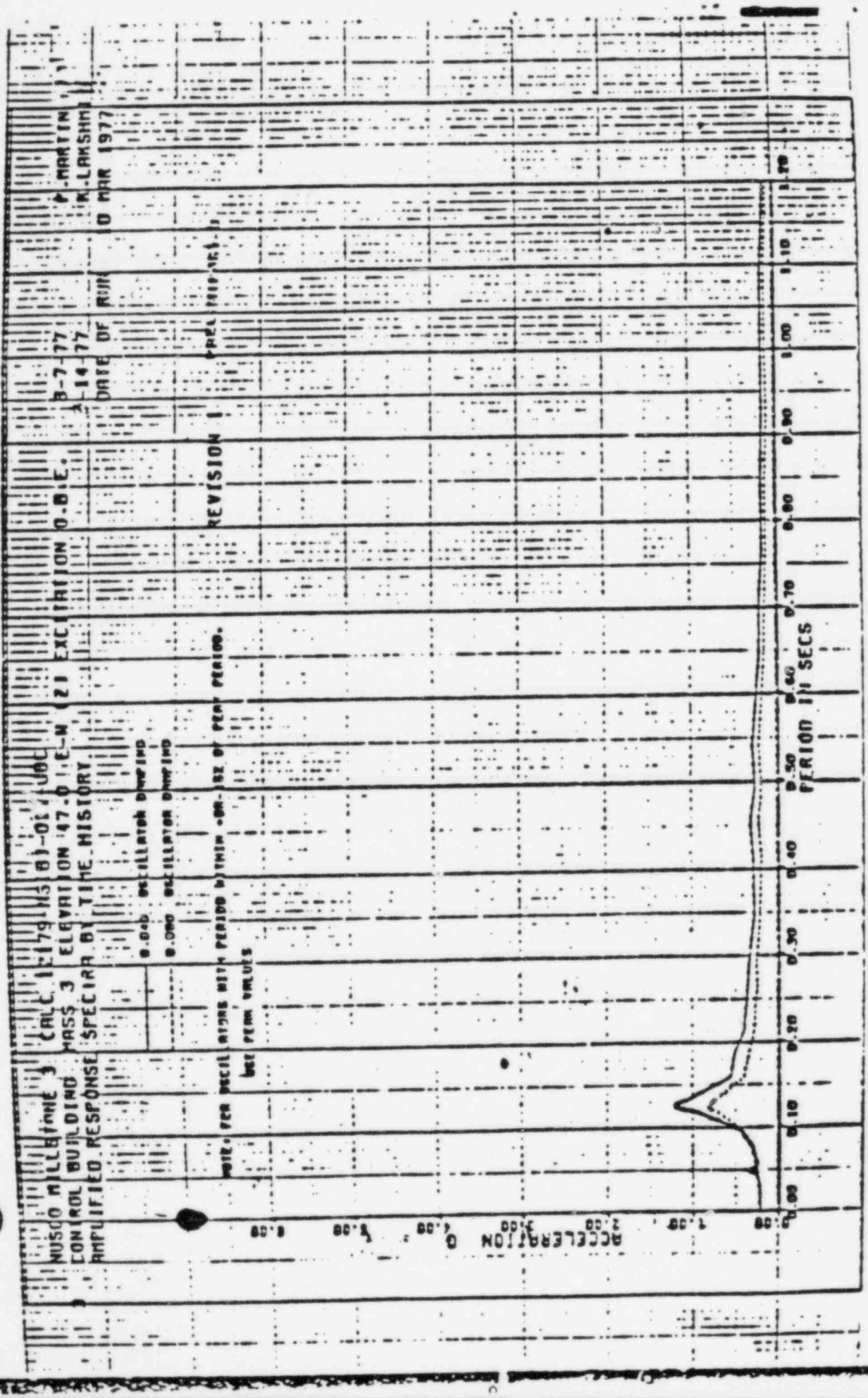
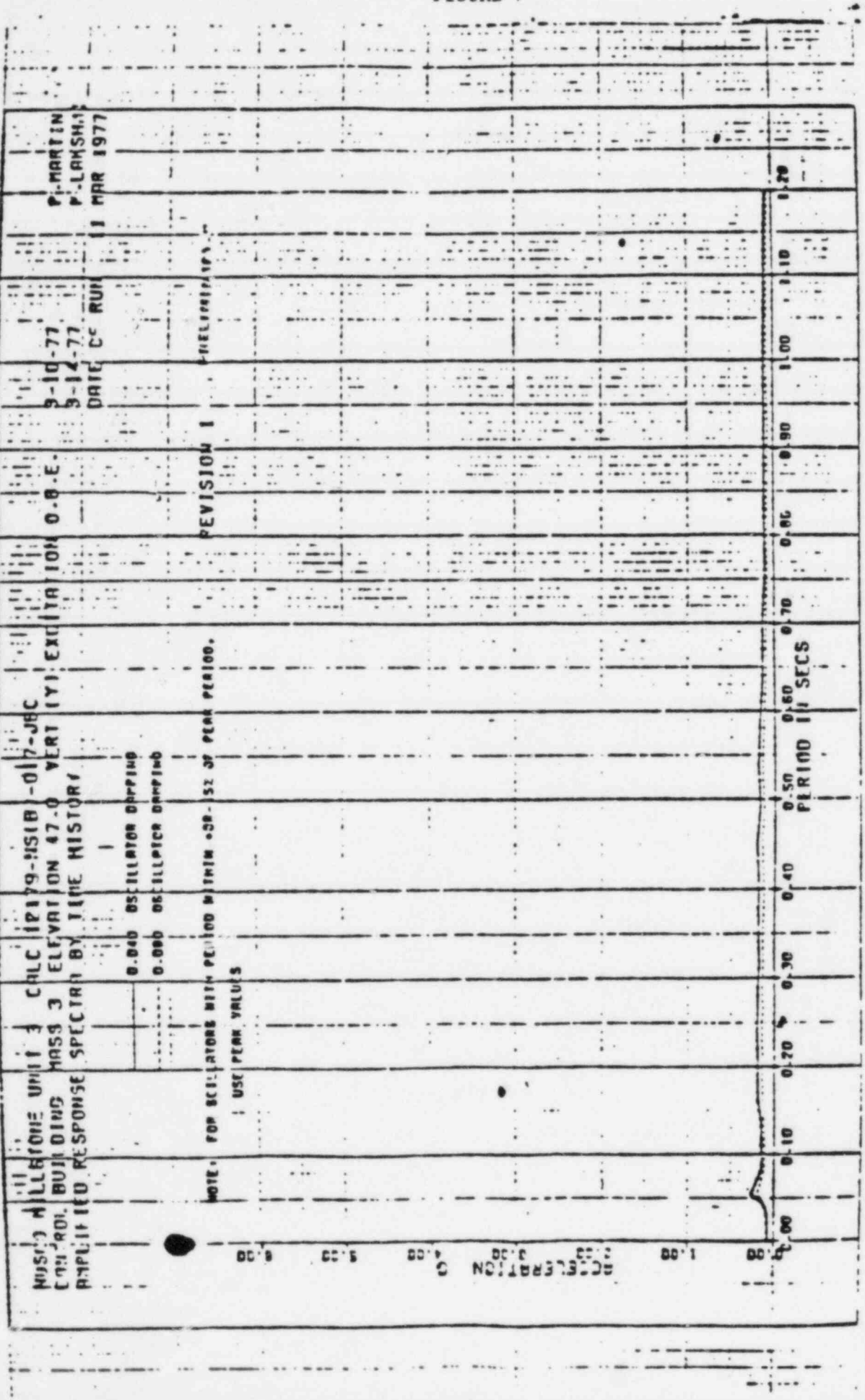

NUSCO MILLSTONE 3
CONTROL BUILDING
AMPLIFIED RESPONSE SPECTRA BY TIME HISTORY
CALC. 1-1794-NS-81-01 / UBC
MASS 3 ELEVATION 47-0 E-W
REVISION 1
ACCELERATION G
PERIOD IN SECS

FIGURE 7


MUSEO ARTILLERIA UNIT 3 CALC IP179-NSIB-017-JBC
CONTROL BUILDING MASS 3 ELEVATION 47.0 VERT (Y) EXCITATION O.B.E.
APPLIED RESPONSE SPECTRA BY TIME HISTORY
0.040 OSCILLATOR DAMPING
0.000 OSCILLATOR DAMPING
NOTE: FOR OSCILLATORS WITH PERIOD WITHIN +5% -5% OF PEAK PERIOD,
USE PEAK VALUES
REVISION 1
DATE OF RUN 9-10-77
9-14-77
11 MAR 1977
P.MARTIN
P.LAMSH.
ACCELERATION G
PERIOD IN SECS
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
1.10
1.20

S4

NEU-5678

Westinghouse Electric Corporation
Water Reactor Divisions

Box 355
Pittsburgh Pennsylvania 15230-0355

June 6, 1985

NS-PL-13405
S.O. NEU-4604

Mr. R. W. Ackley, Project Engineer
Stone and Webster Engineering Corp.
P.O. Box 345
Waterford, Connecticut 06385

NORTHEAST UTILITIES SERVICE COMPANY
MILLSTONE NUCLEAR POWER STATION
UNIT NO. 3
NIS Console Seismic Qualification

Dear Mr. Ackley:

As a result of the NRC SQRT Audit, Westinghouse committed to send NUSCO a letter identifying the power range portion of the NIS console as the only Class 1E equipment addressed in the Qualification Report.

Although the entire cabinet and components were seismically tested, the only equipment functionally tested were the power range channels. This was because the power range instrument is the only one required to function during a seismic event. The remaining channels need only demonstrate structural strength in order not to damage the power range signal, but need not provide an output. The power range portion of the NIS console is, therefore, the only Class 1E equipment addressed in the Qualification Report.

If you have any questions, please do not hesitate to contact me.

Very truly yours,
WESTINGHOUSE ELECTRIC CORPORATION

J. N. Steinmetz, Manager
Millstone 3 Project

J. M. Grigsby/bek/0365n

cc: S. Orefice, 3L
R. W. Ackley, 1L
J. O. Crockett, 1L
S. Stamm, 3L
R. Joshi, 1L

0365n/JMG/6-85

NRC SQRT AUDIT OPEN ITEMS

NSSS-6 - 3RPS*SWG

Question 1:

Show that Westinghouse FCN #NEUM 10564 has been implemented.

Response:

An Engineering and Design Coordination Report (E&DCR) T-C-00950 was issued to change the undervoltage trip assembly and to add an auto-shunt trip. The work has been completed per Automated Work Order (AWO) M38412663.

Status:

Closed.

NRC SQRT AUDIT OPEN ITEMS

NSSS-8 - 3RPS*RAKSET

Question 1:

Check on the design of the splice between the 7300 Process Protection Cabinet and adjacent cabinets. Provide justification for the number of shims used to account for differences in panel heights.

Response:

A response to this question will be submitted by the end of August 1985.

Status:

Confirmatory.

Question 2:

Show that FCN# NEUM 10583 has been implemented.

Response:

A response to this question will be submitted by the end of August 1985.

Status:

Confirmatory.

Question 3:

Westinghouse should provide a signed cover page showing approval of all documents labeled "Draft."

Response:

Attached are the signed cover pages for the Equipment Qualification Data Package for the Process Protection System (EQDP-ESE-13) and the Equipment Qualification Test Reports for the Process Protection System (E13C and E13D).

Status:

Closed.

EQDP-ESE-13
Rev. 5, 6/85

EQUIPMENT QUALIFICATION DATA PACKAGE

This document contains information, relative to the qualification of the equipment identified below, in accordance with the methodology of WCAP 8587. The Specification section (Section 1) defines the assumed limits for the equipment qualification and constitutes interface requirements to the user.

PROCESS PROTECTION SYSTEM

APPROVED: _____
for E. P. Rahe, Manager
Nuclear Safety Department

Westinghouse Electric Corporation
Nuclear Energy Systems
P.O. Box 355
Pittsburgh, Pennsylvania 15230

WCAP-8687
Supp. 2-E13C
Revision 1

EQUIPMENT QUALIFICATION TEST REPORT

PROCESS PROTECTION SYSTEM
(Seismic and Environmental Testing of Printed Circuit Cards)

By

J. A. Capone
S. Channarasappa

Edited By:

B. J. Metro

June, 1985

APPROVED:

E. P. Rahe, Manager
Nuclear Safety

J. M. Ludwiczak, Manager
Equipment Qualification and Testing

D. E. Rygg, Manager
Equipment Qualification

Westinghouse Electric Corporation
P. O. Box 355
Pittsburgh, Pennsylvania 15230

WESTINGHOUSE PROPRIETARY CLASS 2

WCAP-8687
Supp. 2-E130
Revision 1

EQUIPMENT QUALIFICATION TEST REPORT

PROCESS PROTECTION SYSTEM (Supplemental Testing of Power Supplies and Circuit Breakers)

By

J. A. Capone
S. Channarasappa

Edited By:

B. J. Metro

April 1985

APPROVED:

for E. P. Rahe, Manager
Nuclear Safety

J. M. Ludwiczak, Manager
Equipment Qualification and Testing

D. E. Rygg, Manager
Equipment Qualification

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