Consumers Power Company

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July 11, 1984

Mr Harold R Denton, Director
Office of Nuclear Reactor Regulation
US Nuclear Regulatory Commission
Washington, DC 20555

MIDLAND ENERGY CENTER
MIDLAND DOCKET NOS 50-329, 50-330
NRC REQUEST FOR ADDITIONAL INFORMATION ON
VOLUME IX OF THE SEISMIC MARGIN REVIEW REPORT
FILE: B3.7.1 SERIAL: 29822

REFERENCE: (1) LETTER FROM J W COOK TO H R DENTON
DATED FEBRUARY 9, 1984

(2) LETTER FROM E G ADENSAM (NRC) TO J W COOK
DATED MAY 25, 1984

ATTACHMENT: RESPONSE TO NRC QUESTIONS ON SEISMIC MARGIN REVIEW VOLUME IX

In Reference (1), Consumers Power Company submitted Volume IX of the Seismic Margin Review Report titled, "Balance of Plant Class 1, 2 and 3 Piping, Pipe Supports and Valves," for the Staff's review. Subsequently, in Reference (2) the NRC requested additional information on Volume IX. As an attachment to this letter, Consumers Power Company is submitting responses to the questions contained in Reference (2).

It is expected that this information will enable the NRC Staff to complete its review of Volume IX of the Seismic Margin Review Report.

James W. Cook

JWC/DRW/bjw

CC DSHood, Midland Project Manager, US NRC, Washington DC
JGKeppler, Administrator, NRC Region III
Midland NRC Resident Inspector Office
LJAuge, Manager, ETEC

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CONSUMERS POWER COMPANY
Midland Units 1 and 2
Docket No 50-329, 50-330

Letter Serial 29822 Dated July 11, 1984

At the request of the Commission and pursuant to the Atomic Energy Act of 1954, and the Energy Reorganization Act of 1974, as amended and the Commission's Rules and Regulations thereunder, Consumers Power Company submits additional information on the Seismic Margin Review Report Volume IX titled, "Balance of Plant Class 1, 2 and 3 Piping, Pipe Supports and Valves."

CONSUMERS POWER COMPANY

By James W. Cook
James W Cook, Vice President
Projects, Engineering and Construction

Sworn and subscribed before me this 30 day of July 1984.

Barbara P Townsend
Notary Public
Jackson County, Michigan

My Commission Expires September 8, 1984

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SMA 13701.05M476

RESPONSE TO NRC QUESTIONS ON SEISMIC MARGIN REVIEW
MIDLAND ENERGY CENTER PROJECT
VOLUME IX
BALANCE OF PLANT CLASS 1, 2, AND 3 PIPING
PIPE SUPPORTS AND VALVES

Question 1 (pg. IX-5-3) Explain the derivation of EQ (5-1).

Response (1)

The vector sum of the three orthogonal components of acceleration including deadweight must be equal or less than 3.0g. If the seismic portion of the three acceleration components are increased by a factor F_{SME} to a point that the resulting vector is 3.0g, the equation can be written as:

$$\left[\left(F_{SME}\,A_x\right)^2 + \left(F_{SME}\,A_y + 1\right)^2 + \left(F_{SME}\,A_z\right)^2\right]^{\frac{1}{2}} = 3.0$$

A_y is the vertical seismic acceleration in g's, A_X and A_Z are the two orthogonal horizontal seismic acceleration components in g's and 1 is the deadweight component in g's. If both sides are squared and the equation rearranged, Equation 5-1 results.

Question 2. (Pg. IX-6-1) Explain "Drawings of each pipe support were also reviewed in order to assess appropriateness of stiffness assumptions used in modeling." Was generic stiffness, estimated and/or calculated stiffness or NUPIPE default stiffness used?

Response (2)

The architect/engineer piping models used for design were used as information sources for geometry, valve weights, thermal anchor displacements, thermal loading cases, etc. For design, snubbers and other seismic restraints were assumed to be rigid. In the SME study, the design models were reconstructed for use in the NUPIPE computer code. During construction of the NUPIPE models, piping isometrics and support drawings were reviewed to verify the original design input. In almost all cases, the assumption of rigid supports was judged to be reasonable.

In one model of the service water header, actual support stiffnesses for the 36-inch diameter header were calculated. None of the models had fundamental frequencies above 10 Hz, consequently, fine tuning of support stiffness was not considered necessary.

Generic stiffnesses were input into NUPIPE to model the supports as essentially rigid except in the one case cited above.

Question 3. (Pg IX-6-5) Explain why two "Class 1 and 3/4" Class 1 lines were analyzed in accordance with Class 2 rules because of the small line size."

Response (3)

Two 1" and 3/4" Class 1 lines were analyzed in accordance with Class 2 rules because ASME subsection NB3630(d)(1) states that piping of 1" nominal pipe size or less which has been classified as Class 1 in the Design Specifications may be designed in accordance with the design requirements of subsection NC (Class 2).

Question 4 (Pgs IX-6-6, IX-6-32)	Explain your use of 3% (SSE) damping for the 12" nominal line. This is not in agreement with Regulatory Guide 1.61 October 1976. The Regulatory Guide states that 2% (SSE) damping should be used for lines equal to or less than 12."

Response (4)

The damping used is consistent with the criteria and methodology initially proposed to the staff, Reference 1, and included in the Volume I, "Methodology and Criteria" report. Higher than Regulatory Guide 1.61 damping was proposed on the basis that experimental data supported increased damping for piping. After an extensive review of the existing damping data, the pressure vessel research committee (PVRC) has recently recommended damping substantially in excess of the Regulatory Guide 1.61 damping (and the 3% used in the Seismic Margin Review Report) with no differentiation in pipe size, see Figure 4-1 for comparison of Regulatory Guide and PVRC damping. The recent PVRC recommendation does result in lower than Regulatory Guide 1.61 damping for large diameter pipes (greater than 12 inches) at frequencies above about 17 Hz. Fundamental frequencies for the two systems in question are 10 Hz and below. In the first model cited, there are six modes below 17 Hz and in the second model there are 8 modes below 17 Hz. Above 17 Hz there is not a very significant difference in the SME spectra between 2% and 3% damping.

<u>Reference</u>

1. Kennedy, R P and Stevenson, J D, Seismic Margin Review Criteria, Structural Mechanics Associates Report, SMA 13701.01, July, 1981.

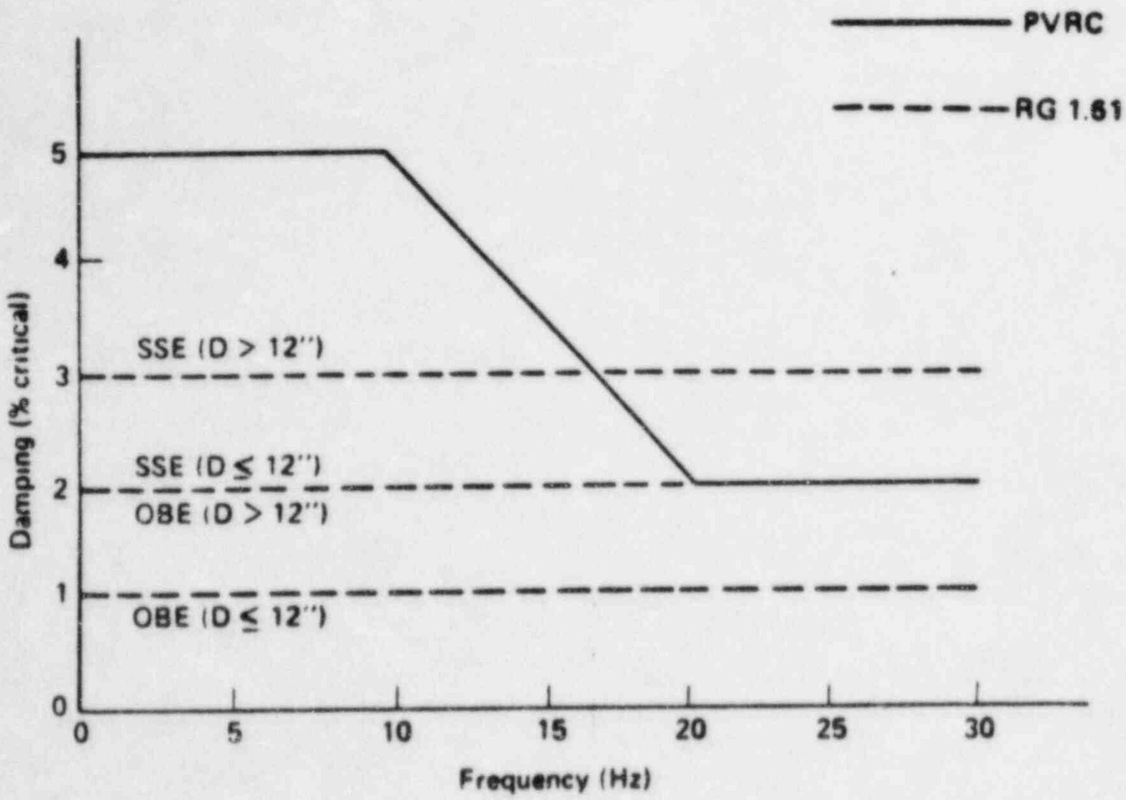

FIGURE 4-1. PVRC proposed damping vs RG 1.61 damping.

Question 5. With respect to thermal anchor displacements, does the Z
Pg IX-6-22 displacement include the radial expansion of the 36" diameter of the 36" - 2 CCA-1 line?

Response (5)

Thermal displacements of the NSSS were provided by Babcock and Wilcox. The maximum Z displacement specified was 0.007 inches at the pipe centerline. The branch piping model begins at the outside diameter of 36"-2CCA-1 and should have included piping radial displacement. The radial expansion is about 0.07 inches at 600^{o}F. The branch line penetrates the 36" line at an angle of about 20^{o} from the vertical (Y) axis. Thus, additional displacements of about 0.024 inches in the Z direction and 0.066 inches in the Y direction should have been included. The effect of neglecting these displacements is anticipated to be small since there is over 44 feet from the piping branch point to the first Z restraint at node 93 and over 40 feet to the first Y restraint at Node 98. The support margins at nodes 93 and 98 are 2.75 and 1.40 respectively relative to code allowables, (see Table IX-7-1). The seismic factors are substantially larger. The increased support reactors from additional radial thermal displacement are not considered to be signficant for such a flexible span of pipe and support margins are judged to be affected very little.

Question 6. Explain why the assumption that the seismic displacement
Pgs. IX-6-32 of the reactor building supports being out-of-phase with the
IX-6-70 auxiliary building supports will always result in higher
IX-6-83 support loads.

Response (6)

Building displacements are calculated using the response spectrum technique. Resulting displacements are unsigned and could occur in either a positive or a negative direction at any point in time. If a piping system is anchored to the reactor bulding at a penetration and is supported in the auxiliary building in the X, Y and Z directions, the largest displacement of the reactor building anchor point relative to the auxiliary building support point is to assume that the two building responses are exactly out-of-phase. That is, the peak displacements occur in diametrically opposing directions simultaneously. The relative displacement used as input is, therefore, the sum of the absolute values of the two building displacements. This results in an upper bound on required flexure of the piping and an upper bound on the support loading.

Question 7.
Pg. IX-6-55

Your statement "With the 3% damped spectra being selected since virtually the entire system consists of large piping equal to or greater than 12-inch nominal diameter" does not agree with Reg. Guide 1.61 October 1976. Large piping is defined as greater than 12" and small piping is defined as equal to or less than 12". Thus the 2% damped spectra should be used for the 12" line 12"-1HCB-6. Justify or correct the value used.

Response (7) See response to Question (4)

Question 8. Pg IX-6-83 — Explain why there is no Z earthquake anchor displacement for anchor nodes 800 and 875.

Response (8)

Z displacements were used in the analysis. Table IX-6-21 was cut off. The missing information is provided in Table 8-1.

TABLE 8-1

ADDITIONAL ANCHOR DISPLACEMENTS FOR LOAD SET 3, MAKEUP AND PURIFICATION SYSTEMS, UNIT 2

		Translational		
Set No	Node	X In	Y In	Z In
3	800	0.00000	0.00000	-.40100
3	120	0.00000	0.00000	.08100
3	550	0.00000	0.00000	.06750
3	863	0.00000	0.00000	.08460
3	875	0.00000	0.00000	-.[illegible]100
3	857	0.00000	0.00000	.07200

Question 9. Pg. IX-6-104 — Explain why all the thermal anchor displacements for the four different operating cases are the same.

Response (9)

Anchor displacements were taken from the architect engineer's piping analysis model and were identical for all four modes. Actual displacements would be different for the four thermal modes. The anchor point in question is a nozzle on the 36" cold leg of the primary coolant loop. Updated information from Reference 2 shows that maximum thermal anchor displacements occur at 100% power and are:

X	0.683 in.
Y	1.374 in.
Z	0.714 in.

Displacements for less than 100% power are lower. The updated maximum displacement values are less than those provided by the A/E and used in the SME study; thus, the constant values used are conservative and envelope all four load cases.

Reference

2. Babcox and Wilcox Specification 18-1235000012-09 for Reactor Coolant System Support and Foundation Loadings, Rev. October 1982.

Question 10. Pg. IX-7-13

The snubber at Node 395 (1-610-3-22) has a seismic margin load of ± 2802 lb and CM and F_{SME} = 4.61. The snubber at Node 406 (1-610-3-45) has a seismic margin load of ± 2785 lb and a CM and F_{SME} = 1.55. Explain why there is a large difference in the CM values.

Response (10)

The snubbers are different sizes. The snubber at Node 395 has a rated load of 11,520 lbs vs 2300 lbs for the one at node 406. The margin for the larger capacity snubber (Node 395) is based upon the supporting steel being the weaker link whereas the margin for the smaller snubber (Node 406) is based upon the snubber rated load capacity, increased for faulted conditions.

Question 11 (Pg IX-7-24) The snubber at Node 214 (0-618-1-502) implies that it may be a Pacific Scientific Snubber Model 10K or equivalent. If this is true explain why its stiffness which is 1.74×10^5 in was not included in the computer model for the 36" piping of the service water system along with the calculated beam and strainer nozzle stiffness.

Response (11)

The snubber is an ITT Grinell size 3 unit, see ITT Grinell Catalogue, Fig 307N, size 3. It reacts in the Z direction on line 36" OHBC-15 (see Figure IX-6-76A). Without the snubber, the line would be very flexible in the Z direction due to the presence of a bellows joint at node 217; thus, the assumption that the support is rigid is justified based on the relative stiffness of the snubber vs the stiffness of the line.

Question 12. General

What ASME Section III Edition Stress Indices for Class 1 Analysis did the NUPIPE computer code use?

Response (12)

The 1974 code with no addenda was used for Class 1 piping. See Volume I, Methodology and Criteria.

Question 13. The staff assumes the following to be typographical errors. Please confirm this assumption, or justify your position:

Page	Staff Comment
IX-4-1	"SSE" should be "SME" (two places).
IX-5-8	"Snubber (z)" should be "Y Restraint." See page IX-7-25.
IX-6-178 and IX-6-198 to 201	"Class 2 Stresses" should be "Class 3 Stresses."

Response (13) They are indeed typographical errors.