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The Northeast Utilities System

OCT 25 1999

Docket No. 50-336
B17897

Re: Generic Letter 87-02

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Millstone Nuclear Power Station, Unit No. 2
Response to Plant Specific Safety Evaluation Report for
USI A-46 Program Implementation (TAC No. M69459)

This letter provides Northeast Nuclear Energy Company (NNECO) response to the NRC Staff's concern[1] that the amplification factor for the intake structure at frequencies between 8 and 9 Hz is too high to justify the use of Method A.1 for the comparison of seismic demand to seismic capacity.

The NRC plant-specific Safety Evaluation Report (SER)[1] for NNECO's Unresolved Safety Issue A-46 implementation program at Millstone Unit No. 2 (MP2) contained a limitation on the use of Generic Implementation Procedure Method A.1 for the intake structure. The limitation was based on the Staff's evaluation of the intake structure's amplification of the seismic motion obtained by comparing the input response spectrum to the calculated in-structure response spectrum. The evaluation was in part based on information provided in MP2's submittal, dated February 8, 1999[2], which had provided clarification of previous responses to NRC requests for additional information regarding Generic Letter 87-02.

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(1) Plant Specific Safety Evaluation Report for USI A-46 Program Implementation at MP2, Unit No. 2 (TAC No. M69459), dated June 30, 1999.

(2) NNECO's Clarification and Response to a Request for Additional Information Regarding the Millstone Unit No. 2 USI A-46/GL 87-02 Seismic Evaluation Report, dated February 8, 1999 (B17618).

A026

PDR ADOCK.

On August 12, 1999, during a telecon between representatives of the NRC, NNECO and EQE Engineering (consultant to the Seismic Qualification Utility Group), the Staff was informed that the NRC assessment (documented in the SER) did not have the benefit of descriptions/explanations for unique levels of conservatism associated with the original seismic analysis of the intake structure. As a result, the Staff requested that additional information be submitted to better define the nature and level of conservatism inherent in the in-structure response spectra for Elevation 14' at the MP2 intake structure. The attachment summarizes the additional sensitivity study completed in response to that request.

There are no regulatory commitments contained within this letter.

Should you have any questions on the above, please contact Mr. Ravi Joshi at (860) 440-2080.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

FOR: Raymond P. Necci
Vice President - Nuclear Oversight and
Regulatory Affairs

BY: _____
David A. Smith
Manager - Regulatory Affairs

Attachment

cc: H. J. Miller, Region I Administrator
R. B. Eaton, NRC Senior Project Manager, Millstone Unit No. 2
D. P. Beaulieu, Senior Resident Inspector, Millstone Unit No. 2

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Attachment 1

Millstone Nuclear Power Station, Unit No. 2

NNECO Response To The Staff's Concern That The Intake Structure Amplification Factor Is Too High To Justify The Use of GIP-2 Method A.1

October 1999

The following provides Northeast Nuclear Energy Company (NNECO) response to the Staff's concern identified during their review of MP2's February 8, 1999 submittal that the amplification factor for the intake structure at frequencies between 8 and 9 Hz is too high to justify the use of Generic Implementation Procedure Method A.1 for the comparison of seismic demand to seismic capacity.

The original MP2 intake structure seismic analyses, which supported the design basis in-structure response spectra, were not documented with enough detail to specifically define the level of conservatism in any greater detail than described in MP2's February 8, 1999 submittal without additional analyses. An understanding of the structural response (and the associated partial level of conservatism) was attained with minimal effort by using the following inputs in a sensitivity study[1] of the intake structure analysis:

- Structural Model (masses, stiffness, node locations, etc.) identical to the Design Basis Bechtel Model;

- Foundation modeled as fixed-base at the –27' elevation while neglecting any effects of structural embedment (identical to the design basis stick model);

- A structural damping of 7% for reinforced concrete structures per Regulatory Guide 1.61 for the safe shutdown earthquake (SSE) load case. Note, while this value is higher than the MP2 licensed basis value of 5% indicated in the Final Safety Analysis Report (FSAR) for the SSE condition, it is valid for use in this study to quantify the structural amplification and is not intended to reflect any design basis conditions.

- Input Motion time history matching a Regulatory Guide 1.60 shape, anchored to 0.1g zero period acceleration (ZPA), which was more readily available than the original Bechtel input. Note, while this motion is different from the "Site Specific Housner," it is valid for use in this analyses to quantify the structural amplification and is not intended to reflect any design basis conditions.

This study evaluates the sensitivity of two substantial sources of conservatism with the original Bechtel analyses:

- Structural Damping – Based on the available data, the original operating basis earthquake (OBE) design basis seismic analyses appears to have been based on a structural damping value of 2%, rather than the licensing basis values of 3% for OBE and 5% for SSE as documented in the FSAR.

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[1] 99-ENG-02922C2, Rev. 0, "MP2 Intake Structure ARS/Amplification Factor Study"

The SSE seismic responses were then scaled, without consideration for damping, to conservatively estimate the SSE in-structure response spectra.

- Time History – As indicated by Figure 5.8-8 of the FSAR, and on page 6 of the SER, the synthetic time history used in the development of the original design basis in-structure response spectra exhibits conservatism for frequencies above 3 Hz when its response spectrum is compared to the smooth design basis site spectrum for 5% damping. Note, even though this effect has already been accounted for in the SER, it is being restated since it is included in this analyses to determine an appropriate estimate of the amplification factor for the intake structure.

Results

Figure 1 shows the results of this limited sensitivity study of the MP2 intake structure consisting of the in-structure response spectra at Elevation 14' using the following input parameters:

- Original design basis structural model neglecting the effects of structural embedment.
- A Regulatory Guide 1.60 type of input motion scaled to 0.1g ZPA.
- Structural damping of 7% per Regulatory Guide 1.61.

The peak of the in-structure response spectra is at approximately 6.75 Hz (this matches the peak of the design basis in-structure spectra and demonstrates the similarity of the models). The amplification at this peak, when compared to the approximate acceleration of 0.27g at 6.75 Hz from the spectrum calculated from the input time history, is:

$$\frac{1.44g}{0.27g} = 5.33$$

This amplification of 5.33 is more consistent with our expectations and our engineering experience for a typical conservative in-structure response spectra for this type of structure. NNECO considers this value to be more appropriate than the value of 14 documented in the SER (TAC No. M69459) which was based on the limited numerical information provided in our February 8, 1999 submittal. This amplification factor is a worse case factor for the entire in-structure response spectra curve and the value would be less (down to about 4.4) for the frequency range at or greater than 8 Hz.

The conservatism beyond the 5.33 factor, which resulted in the amplification factor of 14 referenced in the SER, can be attributed to the very conservative structural damping used in the original seismic analysis of the intake structure. Note, several other

sources of conservatism, such as structural embedment and ground motion incoherence, which were previously discussed in detail in MP2's February 8, 1999 submittal have not been incorporated into this sensitivity study.

Taking this 5.33 factor and dividing it by a reasonable factor of conservatism to account for the inherent differences between a median-centered type response and a design type response results in the following:

$$\text{Amplification} = \frac{5.33}{3.77} = 1.41$$

The 3.77 factor was previously generated based on spectra comparisons between median-centered type response spectra and design type curves for five elevations in different nuclear plant structures[1]. This factor has been reviewed and documented[1] by the NRC. The MP2 intake structure is a heavily reinforced concrete shear wall structure similar to the nuclear plant structures referred to in R. E. Ginna Nuclear Power Plant SER. Note, the MP2 submittal dated February 8, 1999 used a factor of 2.4 to account for median-centered type of response. The NRC SER also referenced the same value of 2.4. However, based on the following, the value of 3.77 is more appropriate:

- The 3.77 factor was developed subsequent to MP2's evaluation and submittal;
- The 3.77 factor is based on five median-centered type analyses, for a broad range of nuclear structures similar to the concrete structures found at MP2, and envelopes several of the conservative factors previously identified as inherent in conservative design basis analyses;
- The 2.4 factor was developed specifically from the MP2 Auxiliary building median-centered seismic analysis, not including structural embedment, which is considered conservative when compared to the more stout, compact and embedded intake structure.

Conclusion

The above analyses have specifically quantified two major sources of conservatism inherent in the original design basis seismic analysis of the MP2 intake structure. Even without considering some unique and significant conservatism that exists in the MP2 intake structure (not including the compacted backfill soil surrounding the structure),

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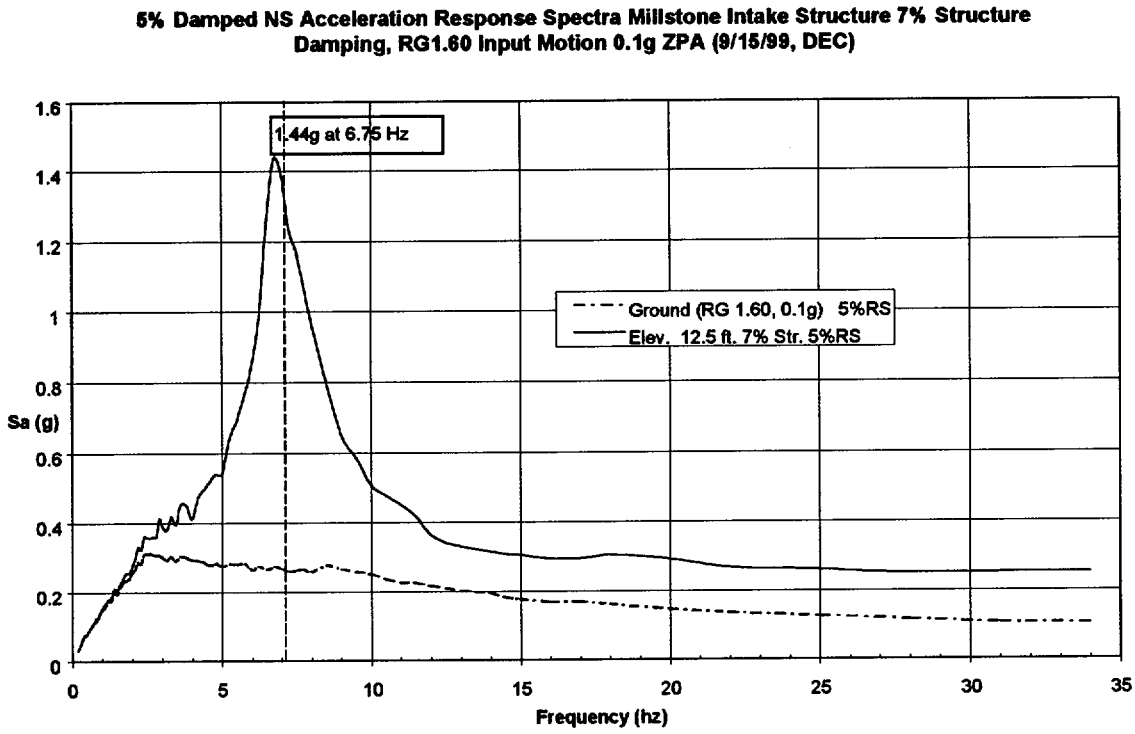
[1] NRC Plant Specific Safety Evaluation Report for USI A-46 Program Implementation at the R. E. Ginna Nuclear Power Plant (TAC No. M69449), June 17, 1999.

this sensitivity study shows that more realistic, median-centered response spectra computations would result in a worst case in-structure response spectra amplification of about 1.4 over the entire frequency range. Therefore, GIP Method A.1 is an acceptable method for evaluating seismic adequacy of equipment in the MP2 intake structure.

Figure 1


5% Damped NS Acceleration Response Spectra Millstone Intake Structure 7% Structure Damping, RG1.60 Input Motion 0.1g ZPA (9/15/99, DEC)
1.44g at 6.75 Hz
Ground (RG 1.60, 0.1g) 5%RS
Elev. 12.5 ft. 7% Str. 5%RS
Sa (g)
Frequency (hz)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
0
5
10
15
20
25
30
35