REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8407030432 DOC.DATE: 84/06/27 NOTARIZED: YES DOCKET #
FACIL:50-438 Bellefonte Nuclear Plant, Unit 1, Tennessee Valley Au 05000438
50-439 Bellefonte Nuclear Plant, Unit 2, Tennessee Valley Au 05000439
AUTH.NAME AUTHOR AFFILIATION
MILLS,L.M. Tennessee Valley Authority
RECIP.NAME RECIPIENT AFFILIATION
ADENSAM,E. Licensing Branch 4

SUBJECT: Submits two developments reported by pressure vessel research committee to be utilized in future seismic analysis of rigorously analyzed piping at facilities.

DISTRIBUTION CODE: B001S COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 4
TITLE: Licensing Submittal: PSAR/FSAR Amdts & Related Correspondence

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	NRR/DL/ADL	1	0	NRR LB4 BC	1	0
	NRR LB4 LA	1	0	NRR LB4 PM 01	1	1
INTERNAL:	ELD/HDS2	1	0	IE FILE	1	1
	IE/DEPER/EPB 36	3	3	IE/DEPER/IRB 35	1	1
	IE/DQASIP/QAB21	1	1	NRR/DE/AEAB	1	0
	NRR/DE/CEB 11	1	1	NRR/DE/EHEB	1	1
	NRR/DE/EQB 13	2	2	NRR/DE/GB 28	2	2
	NRR/DE/MEB 18	1	1	NRR/DE/MTEB 17	1	1
	NRR/DE/SAB 24	1	1	NRR/DE/SGEB 25	1	1
	NRR/DHFS/HFEB40	1	1	NRR/DHFS/LQB 32	1	1
	NRR/DHFS/PSRB	1	1	NRR/DL/SSPB	1	0
	NRR/DSI/AEB 26	1	1	NRR/DSI/ASB	1	1
	NRR/DSI/CPB 10	1	1	NRR/DSI/CSB 09	1	1
	NRR/DSI/ICSB 16	1	1	NRR/DSI/METB 12	1	1
	NRR/DSI/PSB 19	1	1	NRR/DSI/RAB 22	1	1
	NRR/DSI/RSB 23	1	1	REG FILE 04	1	1
	RGN2	3	3	~~RM/DDAMI/MIB~~	1	0
EXTERNAL:	ACRS 41	6	6	BNL(AMDTS ONLY)	1	1
	DMB/DSS (AMDTS)	1	1	FEMA-REP DIV 39	1	1
	LPDR 03	1	1	NRC PDR 02	1	1
	NSIC 05	1	1	NTIS	1	1

TOTAL NUMBER OF COPIES REQUIRED: LTTR 53 ENCL 46

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

June 27, 1984

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of	)	Docket Nos. 50-438
Tennessee Valley Authority	)	50-439

TVA is in the process of reanalyzing many of the piping systems at the Bellefonte Nuclear Plant due to changes in seismic response spectra for some structures. Since use of new developments in determination of appropriate damping values and response spectra peak broadening technique in this reanalysis would save a substantial amount of time and money, we are proposing to utilize these new methods in our efforts. We note that NRC Staff has previously approved these approaches on Southern California Edison's San Onofre Nuclear Plant in a letter from H. Denton to K. Baskin dated February 8, 1984. In order to expedite resolution of these matters, we request that NRC staff members review and respond to the enclosed information promptly.

If you have any questions concerning this matter, please get in touch with K. Mali at FTS 858-2680.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Licensing

Sworn to and subscribed before me
this 27th day of June 1984

Paulette D. White
Notary Public
My Commission Expires 9-5-84

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Mr. James P. O'Reilly Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

A001
1/1

ENCLOSURE

USE OF HIGHER VARIABLE DAMPING VALUE AND AN ALTERNATE PEAK BROADENING TECHNIQUE FOR THE SEISMIC RIGOROUS ANALYSIS OF PIPING SYSTEMS AT TVA'S BELLEFONTE NUCLEAR PLANT

TVA proposes to utilize the following two developments reported by the Pressure Vessel Research Committee (PVRC) in any future seismic analysis of the rigorously analyzed piping at Bellefonte Nuclear Plant. Use of these techniques will still produce conservative results for Bellefonte seismic analyses. These developments by PVRC (with TVA participating) have been submitted by PVRC to NRC for approval.

Variable Damping Values for Piping Analysis

The Task Group on Damping Values of the PVRC Technical Committee on Piping Systems has recently completed a review of a significant data base of damping tests. The results of the review clearly indicate the justification for increasing the present damping values for seismic design of nuclear power plant piping above those specified in Regulatory Guide 1.61. Based upon their evaluations, the current recommendation of the Task Group members is that damping of 5 percent is acceptable to 10 Hz, linearly decreasing to 2 percent at 20 Hz, and held constant at 2 percent to 33 Hz. Recommendations are for both operating basis earthquake and safe shutdown earthquake and are independent of pipe diameter.

The main steam lines at TVA's Bellefonte Nuclear Plant were reanalyzed before the PVRC findings due to the revised seismic spectra for various buildings. The damping values used in the spectral analysis method were in accordance with NRC Regulatory Guide 1.61. The reanalysis resulted in overloading of several rigid and seismic pipe supports.

Based on the PVRC recommendations, TVA performed a second iteration on the analysis of main steam lines using the new damping values. The pipe support loads obtained by using these variable damping values (5 percent to 2 percent) were compared with those obtained by using standard damping values from Regulatory Guide 1.61. As a result of this comparison, it was discovered that fewer pipe supports exhibited significant load increase. Four rigid supports and ten dynamic snubbers, which were overloaded in the earlier analysis, did not overload in the later analysis using higher damping values.

Spectra Shifting

Regulatory Guide 1.122 recommends that the calculated dominant peaks of the floor response spectra be broadened to account for uncertainties in the structural frequencies owing to uncertainties in the material properties of the structure and soil and to approximations in the modeling techniques. This method of peak broadening is very conservative. An alternative method

of broadening of the structural peaks can be based on a probabilistic approach. In the particular case where there is more than one piping frequency located within the frequency range of a widened spectrum peak, the floor spectrum curve may be more realistically applied in accordance with the following criterion.

Based on the fact that the actual natural frequency of the structure can assume only one single value within the frequency range defined by $f_j \pm \delta f_j$, but not a range of values, only one of these piping modes can respond with the magnitude of the peak spectral value. Therefore, seismic analysis of piping systems using the broadened floor design response spectra may be accomplished by the following alternative:

1. Determine the natural frequencies (f_e) of the piping system to be qualified.

2. Consider all piping natural frequencies in the interval

$$f_j - .15\ f_j \leq (f_e)_n \leq f_j + .15\ f_j$$

where f_j is the frequency of maximum acceleration in the unbroadened spectra, and n = 1 to K (K is the number of natural frequencies within the interval).

3. The piping system shall then be evaluated by sequentially performing K + 3 analyses using the unbroadened floor design response spectrum and also the unbroadened spectrum modified by shifting the frequencies associated with the spectral values by a factor of +.15, -.15, and $[(fe)_n - f_j]/f_j$, where n = 1 to K.

4. The results of these separate analyses shall then be enveloped to obtain the final resultant desired (pipe stress, support loads, accelerations, etc.).

If no piping system natural frequencies exist in the interval associated with the maximum acceleration peak, then the interval associated with the next highest peak shall be used in the above procedure.

It is obvious that the analysis utilizing peak broadening becomes cumbersome and less efficient for multiple support motion (multiple zones) and also if there is more than one peak within a defined frequency range of interest. It is TVA's intent to use peak broadening technique only if relief is required on a particular pipe support and where substantial rework is determined to be required by the standard method.

Recommendations

The proposed recommendations have been accepted by the PVRC Task Group on Damping, the Technical Committee on Piping Systems, and the Steering Committee on Piping Systems. The proposals have been forwarded to NRC (reference 1) and considered by ASME (reference 2) for review and approval

on a generic basis. NRC was represented on the PVRC committees. Dr. S. N. Hou and Dr. W. F. Anderson were on the Technical Committee on Piping Systems, Task Group on Damping, and R. J. Bosnak participated on the Steering Committee on Piping Systems. The response spectra peak shifting method has been accepted by NRC for inclusion in Standard Review Plan 3.9.2. The Damping proposal has been accepted by NRC for use by Southern California Edison on San Onofre unit 1 (reference 3).

We believe that the changes proposed by PVRC for higher damping values and for an alternative to peak broadening are more realistic but still result in a conservative design. Such findings were substantiated by the Lawrence Livermore National Laboratory on three piping systems at Zion Nuclear Plant (reference 4). Pending NRC's approval, TVA plans to employ these two techniques in future rigorous analysis efforts for Bellefonte Nuclear Plant.

Reference

1. Letter from L. J. Chockie, Chairman of PVRC, to N. J. Palladino, Chairman of NRC, dated June 9, 1984.

2. Minutes of the Special Working Group on Dynamic Analysis of ASME Section III, February 6, 1984.

3. Letter from Harold R. Denton, Director of the Office of Nuclear Reactor Regulation, to K. Baskin, Vice President, Nuclear Engineering Licensing and Safety Department of Southern California Edison Company, dated February 8, 1984.

4. "Impact of Changes in Damping and Spectrum Peak Broadening on the Seismic Response of Piping Systems," NUREG/CR-3526, December 1983.