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April 25, 1979

Mr. Boyce H. Grier, Director  
U.S. Nuclear Regulatory Commission  
Office of Inspection and Enforcement  
Region I  
631 Park Avenue  
King of Prussia, PA 19406

Subject: IE Bulletin No. 79-07  
Seismic Stress Analysis of Safety-Related Piping  
R.E. Ginna Nuclear Power Plant, Unit No. 1  
Docket No. 50-244

Dear Mr. Grier:

Enclosed is a copy of our response to the subject IE Bulletin.

Very truly yours,

*L.D. White, Jr.*  
L. D. White, Jr.

Enclosure

xc: U.S. Nuclear Regulatory Commission  
Office of Inspection and Enforcement  
Division of Reactor Operations Inspection  
Washington, DC 20555

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Response to IE Bulletin No. 79-07  
Seismic Stress Analysis of Safety-Related Piping  
R.E. Ginna Nuclear Power Plant, Unit No. 1  
Docket No. 50-244

1. Seismic Analysis Methods

- a) The reactor coolant system piping at Ginna was seismically qualified using a combination of model testing and analysis. The results from the dynamic tests were used to analytically evaluate stresses. The computer program ADLPIPE was used for this purpose. However, the analysis did not use either the dynamic response spectrum modal analysis or time history method. The results of this testing and analysis were reported to the AEC in a June 9, 1969 submittal entitled "Additional Information on Seismic Design of Class I Piping".
- b) Class I piping 2.5 inches nominal size and larger at Ginna was seismically qualified using an equivalent static analysis. Dynamic response spectrum modal analyses were performed on portions of two (2) systems to verify the equivalent static analysis method. These pipe runs were the residual heat removal line between the A reactor coolant loop and containment penetration; and the main steam line between the B steam generator and containment penetration. These dynamic analyses were performed with a version of the computer program ADLPIPE which contained algebraic summation of intra-modal responses. The results of these analyses were also contained in the June 9, 1969 submittal referenced above.
- c) In 1971 the charging pump suction piping at Ginna was modified for installation of a filter. The modified piping was seismically qualified using the dynamic response spectrum modal analysis method. The analysis was performed with a version of the computer program ADLPIPE which may have contained algebraic summation of intra-modal responses.
- d) In general, modifications or additions to piping systems at Ginna since initial operation have been seismically qualified using the dynamic response spectrum modal analysis method. These analyses have been performed using the computer programs M003, PIPDYN II, DYNAPLEX, PIPESD, and NUPIPE. These programs do not use algebraic summation techniques.

2. Computer Program Listings

At this time we have been unable to obtain listings of the specific versions of ADLPIPE referenced above. However, it does not appear that review of the program listings is necessary to respond to the basic questions in the bulletin.



### 3. Piping Computer Programs

- a) ADLPIPE - a piping analysis computer program developed by Arthur D. Little, Inc. It is our understanding that information regarding verification of ADLPIPE was provided to the NRC by Arthur D. Little, Inc. in a memorandum dated April 19, 1979.
- b) M003 - a Gilbert/Commonwealth computer program for piping stress analysis. It consists of Southern Service Company's thermal stress program and IBM's scientific subroutine for eigenvalue problems. M003 has been verified against PIPDYN II.
- c) PIPDYN II (Gilbert/Commonwealth version) - a piping analysis computer program developed by Franklin Institute Research Laboratory. It has been verified against ASME Sample Problem No. 1 in the ASME publication "Pressure Vessel and Piping: 1972 Computer Programs Verification"; and ANSYS and PIPESD.
- d) DYNAFLEX - a piping analysis computer program developed by Auton Computing Corp. It has been verified against ADLPIPE and PIPESD.
- e) PIPESD - a piping analysis computer program developed by URS/John A. Bloom and Associates. It has been verified against ANSYS, ADLPIPE, PIPDYN, and SAP IV.
- f) WESTDYN - a structural analysis computer code developed by Westinghouse. Information regarding verification of WESTDYN was documented to the NRC in WCAP - 8252, Revision 1, "Documentation of Selected Westinghouse Structural Analysis Computer Codes," May 1977.
- g) NUPIPE - a piping analysis computer program developed by Nuclear Services Corporation. It has been verified against ADLPIPE and ASME Benchmark Problem No. 5 in the ASME publication "Pressure Vessel and Piping: 1972 Computer Programs Verification".

### 4. Plan of Action

- a) In order to assess the effect of the use of ADLPIPE in the analyses described in 1(b) above, a reanalysis has been performed by Westinghouse using the computer code WESTDYN. The reanalysis was done for the A residual heat removal line inside containment. The reanalysis was based on the original piping system model, response spectrum, and code (B31.1). The analysis is a 2-D seismic analysis where inter-modal responses are combined by square-root-sum-of-the-squares; and the horizontal and vertical modal components are combined absolutely. The seismic stresses are as follows:



<u>Shock Direction</u>	<u>1969 ADLPIPE</u>	<u>1979 WESTDYN</u>
Vert. + Z Horiz.	11,602 psi	10,564 psi
Vert. + X Horiz.	5,988 psi	5,674 psi

The maximum total stresses (seismic + deadweight + pressure) as defined by Formula 8, Paragraph 119.6.4, USAS B31.1-1967 are as follows:

<u>1969 ADLPIPE</u>	<u>1979 WESTDYN</u>	<u>B31.1 Allowable</u>
17,750 psi	16,715 psi	18,300 psi

Since the stresses in the reanalysis are essentially the same as those in the original confirmatory analysis, and below code allowable, it is our conclusion that the results reported in the June 9, 1969 submittal are still valid.

- b) In order to assess the effect of the use of ADLPIPE in the analysis described in 1(c) above, we have performed a review of the original stress report. This review showed that the seismic stresses were substantially less than 50% of allowable stress at all points in the piping. Therefore, it is our conclusion that even if algebraic summation was used for combining intra-modal responses, the results would not change using absolute summation.
- c) Therefore, the capability of the plant to safely withstand a seismic event, as demonstrated by the seismic analyses performed for initial plant licensing, has been confirmed.

