CENTRAL FILES

NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION/300 ERIE BOULEVARD WEST, SYRACUSE, N.Y. 13202/TELEPHONE (315) 474-1511

April 25, 1979

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

Dear Mr. Grier:

Re: I. E. Bulletin 79-07
Docket No. 50-220

Your April 14, 1979 I. E. Bulletin 79-07 addresses concerns with piping computer codes used to analyze earthquake loads.

The attachment addresses those concerns.

Very truly yours,

NIAGARA MOHAWK POWER CORPORATION

R. R. Schneider
Vice President-Electric Production

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Attachments

Xc: NRC Office of Inspection & Enforcement
Division of Reactor Operations Inspection
Washington, D. C. 20555

RESPONSE TO I. E. BULLETIN 79-07

ITEM 1

Identify which, if any, of the methods specified below were employed or were used in computer codes for the seismic analysis on safety-related piping in your plant and provide a list of safety systems (or portions thereof) affected:

Response Spectrum Model Analysis:

a. Algebraic (considering signs) summation of the codirectional spatial components (i.e., algebraic summation of the maximum values of the codirectional responses caused by each of the components of earthquake motion at a particular point in the mathematical model).

b. Algebraic (considering signs) summation of the codirectional intermodel responses (i.e., for the number of modes considered, the maximum values of response for each mode summed algebraically).

Time History Analysis:

a. Algebraic summation of the codirectional maximum responses or the time dependent responses due to each of the components of earthquake motion acting simultaneously when the earthquake directional motions are not statistically independent.

Response

The method of algebraic (considering signs) summation of the codirectional spatial components was used for the analysis of safety related piping system at Nine Mile Point #1 during 1972. The piping involved was inside the drywell for the following systems: reactor recirculation, shutdown cooling, emergency condenser returns, reactor cleanup, reactor drain, reactor feedwater, and control rod drive. As indicated in Response 4, all of these systems have been re-analyzed and found acceptable.

No other piping analyses used the methods listed above.

ITEM 2

Provide complete computer program listings for the dynamic response analysis portions for the codes which employed the techniques identified in Item 1 above.

Response

The 1972 Version of ADLPIPE computer code was used for the systems identified in Response 1.

ITEM 3

Verify that all piping computer programs were checked against either piping benchmark problems or compared to other piping computer programs. You are requested to identify the benchmark problems and/or the computer programs that were used for such verifications or describe in detail how it was determined that these programs yielded appropriate results (i.e., gave results which corresponded to the correct performance of their intended methodology).

Response

All Nine Mile Point Unit 1 safety related piping systems were originally seismically analyzed in 1968-1969 using a computer code developed by Niagara Mohawk Power Corporation. The method used is described in the answer to questions I-4 and I-10 of the Second Supplement to the Nine Mile Point Unit 1 Final Safety Analysis Report. Piping systems were analyzed for each of three orthogonal component response spectra (two horizontal and one vertical) separately. The representative maximum value of the three moments M_x, M_y and M_z at any point in the piping system for each independent component of the earthquake was arrived at by taking the square root of the sum of squares for codirectional model responses. Then, the largest absolute value of moment for each direction from the horizontal earthquake components was summed with the codirectional absolute value of the vertical earthquake component.

In 1970, safety related piping systems inside the drywell were re-analyzed for seismic loads using the STARDYNE Code. No algebraic summations were employed in this model. The results of these calculations verified the conservatism of the original calculations. In no instance did newly calculated loads exceed the original code allowable design values.

As stated in Item 1, certain piping systems inside the drywell were re-analyzed in 1972 using the ADLPIPE Code. The methods employed allowed the algebraic summation of the codirectional spatial components.

Response to Item 3 (Continued)

In 1978, the Containment Atmosphere Dilution System was seismically analyzed using the ADLPIPE Code with the Regulatory Guide 1.92 option. This precluded algebraic summations of moments.

In late 1978 through early 1979, seismic analyses was performed for the re-route of the Clean-up System discharge to the Feedwater System. Teledyne Engineering Services performed these analyses for Niagara Mohawk Power Corporation using the TMRSAP Code. The TMRSAP Code calculated the earthquake component effects simultaneously. For each mode codirectional components were added absolutely after which modal values were combined by the Square Root of the Sum of Squares method.

As stated in Item 4, in April 1979, piping analyses performed in 1972 were redone. Teledyne Engineering Services performed this re-analysis using the ADLPIPE computer code. This method analyzed each of three orthogonal component response spectra (two horizontal and a vertical) separately. The representative maximum value of the three moments M_x, M_y and M_z at any point in the piping system subjected to each of the three independent spatial component response spectra was obtained by taking the Square Root of the Sum of Squares of the modal responses for all significant modes of the system. Mathematically, this is expressed as follows:

$$M_j = \left[\sum_{k=1}^{N} M_{jk}^2 \right]^{1/2}$$

where M_j is the representative maximum value of moment, j is the moment component direction x, y, or z. M_{jk} is the peak value of moment component due to the kth mode, and N is the number of significant modes. The M_x, M_y and M_z values for each of the earthquake components were combined by the Square Root of the Sum of Squares method to produce a resultant moment used for stress analysis calculations.

The results from the ADLPIPE Code for each of the earthquake components was compared separately by Teledyne Engineering Services to results from the TMRSAP Code. The comparison was done for the PIPDYN manual example problem. The results for the X-directional seismic spatial loading is shown in the attached Table 1.

ITEM 4

If any of the methods listed in Item 1 are identified, submit a plan of action and an estimated schedule for the re-evaluation of the safety related piping, supports, and equipment affected by these analysis techniques. Also, provide an estimate of the degree to which the capability of the plant to safely withstand a seismic event in the interim is impacted.

Response

With the exception of the cleanup system discharge, all of the piping systems listed in Item 1 were re-analyzed in April 1979 using the ADLPIPE computer code as described in Item 3. None of the methods listed in Item 1 were employed. The results of these re-analyses show that stresses of all piping remain within code allowable ranges and the strength of structural attachments is within the design conditions.

The cleanup system discharge has been re-routed to the Feedwater System. The piping analysis for this re-route was performed prior to April 1979 using methods described in Item 3.

TABLE 1

COMPARISON ANALYSIS

Mode Number	Component	Intensification Factor	ADLPIPE Stress,psi	TMRSAP Stress,psi
3	Run	1.00	411	409
3	Elbow	2.80	1122	1146
4	Elbow	2.80	1105	1108
4	Run	1.00	397	395
8	Branch	1.00	896	894
9	Run	1.00	537	537
9	Elbow	2.71	1448	1452