



Northern Indiana Public Service Company

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EUGENE M. SHORB
FIRST VICE PRESIDENT

May 21, 1979

Mr. James Keppler, Director
Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Re: NRC I. E. Bulletin No. 79-07

Dear Mr. Keppler:

I. E. Bulletin No. 79-07, dated April 14, 1979 raises questions concerning the methods of combination of earthquake directional response used for piping analysis for safety-related piping systems in both operating nuclear plants and plants under construction.

Northern Indiana Public Service Company (NIPSCO) has retained Sargent & Lundy Engineers as Architect Engineer for the Bailly Generating Station Nuclear 1. The "DYNAPIPE" and "PIPSYS" computer programs used by Sargent & Lundy in their seismic analysis of piping systems were developed independently of computer programs used by other AEs and other programs that were and are commercially available. The Sargent & Lundy programs work first with each direction of response (X, Y, or Z) and combine modal responses for a given direction in accordance with applicable regulatory guide requirements. The combined responses for each direction are then added by the SRSS method. Thus the cancelling effect experienced in other piping analyses does not occur in the Sargent & Lundy seismic analysis.

I. E. Bulletin No. 79-07 requests responses to four specific action items regarding the seismic analysis of safety-related piping. NIPSCO's response is as follows:

- NRC Item (1) The DYNAPIPE and PIPSYS computer programs used by Sargent & Lundy for the response spectra seismic analysis of safety-related piping do not employ algebraic summation routines for combining responses, either intermodal or for any other

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component or response. Sargent & Lundy does not use the time history method for the seismic analysis of piping.

NRC Item (2) None of the computer programs used by Sargent & Lundy for the seismic analysis of safety-related piping employ the algebraic techniques described in Item (1) of I. E. Bulletin No. 79-07.

NRC Item (3) The S&L computer program DYNAPIPE (09.7.052) and PIPSYS (09.5.065) were used in piping seismic analyses. These programs have a long history of use within S&L - e.g., DYNAPIPE since 1969 and PIPSYS since 1972. They have been validated several times since that time. For the seismic portions of the program, this has been done by checking computer results by hand calculations and checking results against the computer programs referenced below. Each new version of the program is extensively checked against the older version through a series of test problems. The following validation procedure was performed for the initial validation:

A. Check Against DYNAL⁽¹⁾ (1969)

A typical hot reheat piping system was analyzed on DYNAPIPE and DYNAL⁽¹⁾. The element forces for a specified response spectra were compared and found to be comparable. The frequencies of modes 1 through 6 were also in close agreement.

B. Check Against MEC-21 (2) (1969)

In 1969, no public-domain seismic analysis code had the capability of curved elements to model pipe elbows. To validate this feature of the S&L programs, the piping system given in example problem No. 2 of the MEC-21 computer code was analyzed by the S&L program. Seismic analysis was performed using the response spectrum method. Member forces, joint displacements, and joint inertia forces were printed for each mode. The same system was then analyzed using the MEC-21 code with a static load equal to the modal inertia free forces, and joint displacements obtained from the two codes were compared and found to be in good agreement.

C. PIPSYS & DYNAPIPE Comparison (1972)

In 1972, when the PIPSYS program was developed, it

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was extensively benchmarked against the DYNAPIPE program. Typical piping systems were run on the two programs and found to yield the same responses on the two codes.

D. PIPSYS & DYNAPIPE Check against DYNAL⁽¹⁾ and
NASTRAN⁽³⁾ (1972)

In 1972 the modal periods and time history of response to pipe transients using the modal time history method on PIPSYS and DYNAPIPE were checked against those obtained from DYNAL and NASTRAN. Good agreement was obtained in responses from the four codes.

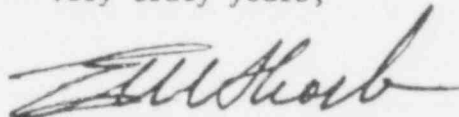
In addition, NIPSCO and Sargent & Lundy would welcome a generic review of our piping program by the NRC Licensing Staff. This review could most effectively be conducted at the S&L offices where all documentation and key personnel would be available to the Staff.

NRC Item (4) None of the computer programs used by Sargent & Lundy for seismic analysis of safety-related piping employ the algebraic techniques described in Item (1) of I.E. Bulletin No. 79-07, therefore no reanalysis of any safety-related piping is necessary.

References:

1. ICES DYNAL User's Manual, McDonald-Douglas Automation Co.
2. MEC-21, 7094, "A Piping Flexibility Analysis Program for the IBM 7090 and 7094", Los Alamos Scientific Laboratory, University of California, 1964.
3. NASTRAN User's Manual, NASA SP-221.

Very truly yours,



EMS:bw

cc: Office of Inspection and Enforcement
Division of Reactor Construction Inspection
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

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