UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

APR 2 1979

Docket No. 50-334

Mr. C. N. Dunn
Vice President
Operations Division
Duquesne Light Company
435 Sixth Avenue
Pittsburgh, Pennsylvania 15219

Dear Mr. Dunn:

Since the Show Cause Order requiring shutdown of your facilit· ·as issued on March 13, 1979, a number of meetings and phone conversations have taken place in which the technical content of the Order and the NRC staff's information needs were discussed. These meetings have indicated the desirability of a specific identification of information that should be provided to the NRC staff for its review. Accordingly, the NRC staff has developed the three enclosures to this letter which describe information that should be documented for NRC staff review for your facility (and for all other affected facilities). As soon as practical and prior to plant startup, you should provide a schedule for submittal of all of that information. We will need a formal submission of the information requested in Enclosure 1 and 2 before we can consider any request to restart your facility. The degree to which the verification requirements in Enclosure 3 need to be completed before restart depends upon the results of the reanalysis. Much of the information may be similar to that which you are planning to submit in connection with your response to the Show Cau.e Order. Nevertheless, this letter is not intended to modify or affect your response to the Show Cause Order within 20 days of the issuance date.

Sincerely,

Victor Stello, Jr., Director
Division of Operating Reactors
Office of Nuclear Reactor Regulation

Enclosures:
1. Items for which Documentation Should Be Provided
2. Material Required for NRC Review of Reanalysis Results
3. Plan for Verification of Stress Codes

cc w/encl:
See next page

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ITEMS FOR WHICH DOCUMENTATION SHOULD BE PROVIDED

1. The Order requires that the licensee show cause why the facility piping systems should not be reanalyzed for seismic loads on all potentially affected safety systems using an appropriate piping analysis computer code which does not combine intramodal loads algebraically. Your response would, of course, require a determination of both those systems which used a code using algebraic summation and those which did not. For those which you conclude did not use algebraic summation you are to verify such conclusions. You are also to provide the computer code listing described in requirement 1 of Enclosure 3 for all computer codes used.

2. Information is also needed on the methods used to determine the placement and design of supports for each safety related piping system that was not subjected to computer seismic analysis, the piping sizes for which these techniques were used, and a justification of the adequacy of such methods for the seismic design of piping.

3. You should submit a status and schedule for compliance with IE Bulletin No. 79-02 entitled, "Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts." Assurance that base plate flexibility has been taken into account and that proper quality assurance procedures have been implemented for anchor bolts may be an element in approving any interim restart approval requested.

4. Provide a table to describe the original analysis method (or the reanalysis method) for all piping in safety systems addressed in 1 and 2 above and non-safety systems which could affect the operation of the safety systems (e.g., name the system and the computer code or other analysis method).

Enclosure 2

MATERIAL REQUIRED FOR NRC REVIEW OF REANALYSIS RESULTS

The following material should be maintained by the utility and be available to the NRC staff for each reanalysis performed for safety systems or systems which could affect the operation of safety systems. Material for those runs which show increases in piping stresses over allowables or forces or moments for anchors, equipment or supports in excess of the original design should be submitted for NRC review. If restart is proposed prior to completion of final support analyses, a justification for the adequacy of each affected support should be supplied.

Reanalysis Information Package

1. Stress Summary Sheet

   - New run
   - Original run (if available)
   - Forces and moments at points over allowable
   - Fundamental frequency from seismic analysis

2. Anchor, Equipment and Support Summary Sheet

   - Forces and moments new runs
   - Original design forces and moments
   - Data on reevaluation (if applicable)

3. MSK Drawings (Isometrics; marked with as-built conditions)

   - Mass point locations and members
   - Support locations
   - System identification

4. Welded Attachment Drawing (Typically Anchors)

   - Criteria and evaluation for welded attachments

5. Design Summary Sheet

   - Pipe material information

   - Design temperature and pressure information

   - Response spectra used in analysis

   - Pipe size and schedule insulation thickness, valve weights if not shown on isometric, etc.

Plan for Verification of Dynamic Analysis Codes

This is a plan for verification of the piping computer codes (programs) used in the analysis and reanalysis of the Maine Yankee, Fitzpatrick, Beaver Valley 1 and Surry 1 & 2 plants. The verification requirements vary depending upon the degree to which we understand that each code is related to the deficiency which was the source of the original concern, i.e., the use of an algebraic summation technique by Stone and Webster for intramodal repsonses in the code SHOCK-2. The verification plan applies to either two or three component design earthquakes, whichever of these approaches was used in the originally accepted design of the plants in question. Although three component earthquake analysis is now required for new plants (and has been since about 1974), this does not necessarily mean that a properly performed two component analysis cannot be verified if the two component approach was approved in the original design.

Requirement 1

Complete computer program listings are to be provided to the NRC staff for the dynamic response analysis portions of the following codes:

- PIPESTRESS/SHOCK 2
- PIPESTRESS/SHOCK 3
- PIPESTRESS/SHOCK 1
- Any other codes used for the piping reanalysis, such as NUPIPE
- Any other codes used for structural analysis of piping in safety systems, including those used by the NSSS vendor

The listing will be reviewed by the staff to the extent necessary to establish that the codes used in analysis or reanalysis do not include the algebraic intramodal response summation technique and to determine the extent to which further verification of the codes is needed (other than that given below.)

Requirement 2

This requirement is to be applied to the following computer codes:

-PIPESTRESS/SHOCK 2

-PIPESTRESS/SHOCK 3

-Any other code proposed for piping reanalysis, such as NUPIPE.

The requirement is to follow the procedure for the staff's Piping Benchmark Program described in the attachment. Briefly, the program requires the analysis of standard benchmark problems developed by the staff and its technical assistance contractor, Brookhaven National Laboratory, and comparisons with acceptable solutions to those problems obtained by use of the code EPIPE.* These standard benchmark problems were developed for application in the licensing process and were originally intended for initial implementation later in 1979.

*EPIPE is a computer code for performing dynamic analysis of piping systems which was developed by BNL and applied in the Piping Benchmark Program. It is based on the widely accepted code SAP IV, developed at the University of California at Berkeley.

Requirement 3

This requirement is to be applied to the following computer codes:

- PIPESTRESS/SHOCK 1, if systems designed originally with this code are not reanalyzed with another code treated in requirement 2, above.
- Any other dynamic analysis codes used for piping in safety systems in the five units, including those used by the NSSS vendor, if those systems are not to be reanalyzed with another code treated in requirement 2, above.

The codes, whether used with a two or three component earthquake, should be demonstrated to produce solutions to a series of verification problems proposed by the user that are substantially the same as the results obtained by a similar code which is recognized and widely used, with a sufficient history of successful use to justify its acceptability.

Alternatively, the code should be demonstrated to produce solutions to verification problems proposed by the user that are substantially the same as solutions obtain in accepted experimental tests or analyses published in the technical liternature. Comparisons of the user's code calculations with hand calcualtions of simple stress problems are helpful in this method of verification, but are not sufficient by themselves. The documentation will include calculated frequencies and mode shapes, resultant moments, forces, stresses and displacements at corresponding locations of the verification problems.

Another acceptable method for meeting requirement 3 is to meet requirement 2, above. If a two-component earthquake analysis is to be relied upon, then the user should demonstrate its acceptability to the NRC, including a comparison of the user's two and three component analyses of the benchmark problems in requirement 2 to NRC solutions to these benchmark problems.

Requirement 4

As a confirmatory step, the NRC staff is to be provided isometric drawings, material and goemetric properties, response spectra, and other information necessary for modeling and analyzing one of the piping problems reanalyzed for each of the affected plants. It is expected that these problems will already have been reanalyzed using PIPESTRESS/SHOCK 3 and/or NUPIPE. The problem description and the results of its reanalysis (including frequencies, mode shapes, resultant moments and forces at nodes, and, as appropriate, the ASME Code Section III or ANSI B31 code stress values at the nodes) will be submitted to the NRC for transmittal to its technical assistance contractor personnel at Brookhaven National Laboratory.

Using that information, the contractor will model the piping problems using the code EPIPE. Then the seismic response of these problems will be determined using modal and spatial load combination techniques consistent with those used in the reanalysis of the plants (preferably in conformance with Regulatory Guide 1.92). The contractor will compare its calculated responses with those provided by the licensee to supplement the verification provided by requirement 2 above, and to identify significant differences for further consideration and action by the NRC staff.

Attachment

Implementation Procedure for the Piping Benchmark Program

I. Introduction

The Piping Benchmark Program is designed for the verification of computer codes used in the design and analysis of piping systems in nuclear power plants subjected to static and dynamic loading. In this program, the acceptability of a computer code is based on verification that the code generates valid solutions to problems that it is designed to solve. A set of benchmark problems with known solutions are required to be solved using the codes for which verification is sought. These solutions are then compared to solutions obtained under the NRC-Brookhaven National Laboratory Piping Benchmark Program.

II. Steps in the Validation Process

Complete solutions to the Benchmark Problems are to be generated by the code user as follows:

A. NRC will provide the following input information:

1. Data necessary to construct models, such as material and geometrical properties, temperatures, boundary conditions, lumped masses.

2. Dynamic loads in the form of response spectra and support acceleration time histories in three directions.

B. The code user will read in this data in conformance with the read formats of its code and generate the solutions on its computing machine.

C. The user will provide the code output to NRC. The output will include the following:

1. A printout of the input data,
2. A list of the model properties, such as nodal masses, nodal coordinates, degrees of freedom, etc.,
3. The normalized modal shapes and modal frequencies,
4. The modal participation factors and modal amplitudes,
5. The maximum modal displacements,
6. The combined maximum displacements (modal and spatial).
7. The combined internal forces and stresses (axial, shear, bending and torque).

D. The NRC staff and its contractor will compare the code user's solutions with the benchmark solutions generated by EPIPE. Part II will be repeated if significant deviations occur. Codes will be deemed verified if acceptable agreement is obtained.