NOV 16 1984

Docket No. 50-354

Mr. R. L. Mittl, General Manager
Nuclear Assurance and Regulation
Public Service Electric & Gas Company
80 Park Plaza, T22A
Newark, New Jersey 07101

Dear Mr. Mittl:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION

By letter dated February 10, 1984, PSE&G submitted the Hope Creek Plant Unique Analysis Report (PUAR) for NRC review. Typically, the PUAR is reviewed from both a hydrodynamic standpoint and a structural standpoint. The staff and our consultants have completed the structural and hydronamic reviews of the PUAR and conclude that additional information is required. Enclosures 1 and 2 to this letter identify this information.

Enclosure 1, prepared by the staff and the Brookhaven National Laboratory, identifies additional information which is needed to conclude the hydrodynamic loads review of the PUAR. We request that you provide docketed responses to these concerns by February 1, 1985. Enclosure 2, prepared by the staff and the Franklin Research Center, identifies information needed to conclude the structural review of the PUAR. You are requested to provide docketed responses to these concerns by January 4, 1985.

During the review of the Hope Creek PUAR, it was found that a computer code, CMDOF, was used to establish the stress levels of some piping attached to the torus. However, the validity of this program is questionable. In order to demonstrate the validity of the program, Enclosure 3 to this letter identifies a procedure by which validation can be accomplished. Based on telephone conservations between Mr. Bruce Preston of your staff and Mr. Byron Siegel (NRC), we understand that PSE&G is taking part in a generic CMDOF validation program with other Mark I licensees. The staff will review this program when it is submitted.

Should you have any questions about the enclosures to this letter, please feel free to contact us.

Sincerely,

A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

Enclosures:
As stated

cc: See next page

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

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ENCLOSURE 1

REQUEST FOR ADDITIONAL INFORMATION

HOPE CREEK PUAR

HYDRODYNAMIC LOADS

ITEM 1: Provide the Plant Unique Load Definition Report (PULD) for Hope Creek for examination by the staff.

ITEM 2: Hope Creek does not use a vent header deflector. Provide details of the vent header pool swell impact load calculation for Hope Creek.

ITEM 3: In order to analyze the various loads associated with SRV actuation, which line or lines were chosen for calculation purposes and on what basis was the choice made? Could other lines give higher loads than the ones used for analysis?

ITEM 4: For what environmental temperature range have the Hope Creek SRV lines been analyzed?

ITEM 5: Will the confirmatory SRV tests to be carried out in Hope Creek be conducted according to the guidelines provided in NUREG-0763? Is our assumption correct that no load reduction will be requested by the applicant based on these tests and that their only purpose is to confirm the conservatism of the SRV loads provided in the PUAR?

ITEM 6: The Hope Creek torus has ring girders at mid bay as well as near the miter joints between bays, all supported by external columns. What are the loads on these columns due to pool swell and other LOCA loads, as well as SRV discharge?

ITEM 7: Figure 1-2.1-4 of the PUAR shows what is apparently the RCIC turbine exhaust sparger. How were loads associated with this steam discharge into the suppression pool developed? What source terms are used? What submerged structure loads were applied?

ITEM 8: The Hope Creek PUAR states that acceleration drag volumes for structures with sharp corners, such as I-beams, are computed using Table 1-4.1-1 when submerged structure drag loads due to pool swell, CO, chugging and SRV actuation are calculated. Since direct use of Table 1-4.1-1 is not possible for the ring girders, the specific formulas and acceleration volume values used for the ring girders are needed. Provide details of the acceleration volume calculation for drag loads in direction normal to the flange, web and stiffeners, respectively, for both the mitered joint and midcylinder ring beams. Provide final values of acceleration drag volumes in each direction for two or three segments of each beam.

ITEM 9: Table 2-2.2-6 of the PUAR which summarizes the ring beam submerged structure loads states that the loads shown include dynamic amplification factors. What kind of model was used to determine the critical frequencies of the ring beams? What are the critical in-plane and out-of-plane frequencies for the midbay and miter joint ring beam? How were dynamic amplification factors for each of the submerged structure loads listed in Table 2-2.2-6 calculated? Were the same amplification factors used for both the flange and web forces? If so, justify this procedure.

ITEM 10: Section 1-4.2.4 of the PUAR states that dynamic load factors for SRV bubble-induced drag loads in Hope Creek are derived from Monticello in-plant SRV test data. Describe in detail how these factors are derived and applied to Hope Creek, giving numerical values of the factors for major structural components. Describe how extrapolation from test to design conditions is made and why Monticello data provides a conservative basis for Hope Creek.

ITEM 11: Is the rectangular bay model described in Table 1-4.1-2 of the PUAR used for LOCA bubble drag loads also used for CO, chugging and SRV loads on submerged structures? If yes, justify the use of this model for structures near the bay boundary which undergo asymmetric loading conditions. If a different model is used give details.

REQUEST FOR INFORMATION
STRUCTURAL

Item 1: In Section 2-2.4.2 of the PUA report [4], the Licensee indicated that asymmetric loads on the torus are resisted by the horizontal restraints attached to the torus shell, causing shears and bending moments in the torus shell. The stresses resulting from these shears and moments are evaluated by ratioing the shell stress analysis results in the FSAR. Provide a detailed description of this procedure and justify it with respect to an analysis using a 180° model of the torus, as required by the criteria [1].

Item 2: Justify the value of 15.01 ksi for allowable stress for the ring beam to torus shell welds and the column connection to torus shell welds, presented in Table 2-2.3-1 of the PUA report [4].

Item 3: With respect to Section 6-3.4c of the PUA report [4], indicate whether any small bore piping branch lines are excluded from evaluation because of the 10% rule of Section 6.2d [1]. Provide calculations demonstrating conformance to this rule. If the 10% rule was not used, indicate and justify the specific criteria used to exclude any pipe from evaluations.

Item 4: Provide a summary of the analysis of drywell/wetwell and torus attached vacuum breaker valves and indicate whether they are class 2 components as required by the criteria [1].

Item 5: Provide and justify all dynamic amplification factors used in the following equivalent static analyses:

- torus evaluation for lateral SRV and chugging loads (Section 2-2.4.2 [4])
- analysis of the vent system for torus shell interaction loads due to pool swell (Section 3-2.4.1 [4])
- analysis of the ring girder and suppression chamber shell for loads due to the attachment of the vent system support columns and upper truss, T-quencher support, monorail, and catwalk (Sections 2-2.4.1.8 and 4-2.4 [4])
- analysis of the wetwell SRV lines for SRV discharge and post-chugging loads (Sections 5-3.4.1.4 a & b and 5-3.4.1.7 b [4])

Also, justify using an equivalent static analysis for SRV discharge thrust loads. The criteria [1] specify, in Section 6.8c, that a time history analysis should be used.

Item 6: With respect to the fatigue analysis of the torus, the vent system, and the torus attached piping penetrations (Sections 2-2.4.3, 3-2.4.5, and 6-6.4 in the PUA report [4]), justify the strength reduction factors of 2.0 for major component stress and 4.0 for component weld stress.

Item 7: With respect to Section 6-6.5 of the PUA report [4], provide the fatigue usage factors for the suppression chamber penetrations.

REFERENCES

1. NEDO-24583-1
"Mark I Containment Program Structural Acceptance Criteria Plant Unique Analysis Application Guide"
General Electric Co., San Jose, CA
October 1979

2. NUREG-0661
"Safety Evaluation Report, Mark I Containment Long-Term Program Resolution of Generic Technical Activity A-7"
Office of Nuclear Reactor Regulation
July 1980

3. NEDO-21888 Revision 2
"Mark I Containment Program Load Definition Report"
General Electric Co., San Jose, CA
November 1981

4. Hope Creek Nuclear Station
Plant Unique Analysis Report, Revision 0
Public Service Electric and Gas Company
NUTECH Engineers, Inc.
February 1984

REVIEW OF THE COMPUTER CODE CMDOF
(Coupling of Multiple Degrees of Freedom)

By V. N. Con
Franklin Research Center
Division of Arvin/Calspan

1. INTRODUCTION

During the review of the analysis of the piping system attached to the torus of the Mark I containment structures, it was found that a computer program (CMDOF - Coupling of Multiple Degrees of Freedom) was used by the NUTECH technical staff to establish the stress level of the attached piping under various hydrodynamic loading conditions. Basically this computer program takes into account the coupling effects between the torus and the attached piping system without having to carry out a coupled analysis.

2. REVIEW OF CMDOF PROGRAM

The normal practice in many plants is to perform an uncoupled analysis in which the torus is analyzed first and the outputs obtained for the attachment point (nodes) based on this analysis are used as input loading for the piping analysis. This approach is known to provide conservative results. The other acceptable option is to carry out a coupled analysis which combines the torus and the attached piping in one model. However, this model is more complicated and results in high computational cost, especially when one has to consider a good number of loading time histories. The NUTECH technical staff has developed a scheme in which an uncoupled analysis is performed and which, using the CMDOF program, accounts for the benefits of coupling effects.

In order to use this program, the modal response characteristics of the torus and attached piping system have to be established first by applying a unit force at the attachment nodes. These modal response characteristics, along with the uncoupled response time histories of the torus at the attachment nodes, will be input into the CMDOF program which will then modify the uncoupled response time histories of the torus; these new modified time histories will become the input loadings to the uncoupled piping system.

This is a commendable undertaking; it is supposed to remove the conservatism of the uncoupled analysis and the computional cost of this method is significantly less than that of a coupled analysis. However, as discussed during a meeting on August 9 and 10, 1984 with NUTECH technical staff, Franklin Research Center (FRC) and the NRC staff indicated that the program for verifying this computer program was not quite comprehensive; the problems being tested were rather simple compared with the problems at hand.

The main concerns are briefly summarized below:

- o Calculated stresses based on this method, in some cases, were close or equal to the stress allowables.
- o Based on recently submitted results by one licensee [1], it was observed that this method could reduce the input loading to the attached piping by as much as 3 or 4 times when compared with a standard uncoupled analysis. Based on these results, one can deduce that if an uncoupled analysis is used the calculated stresses will certainly exceed the allowables.
- o The verification problems provided by NUTECH technical staff were rather simple and the parameters (i.e., mass and stiffness) used in these problems did not resemble a wide range of values of the torus and different attached piping systems.

3. RECOMMENDATION

This program has been used for a number of plants and FRC's review indicated that the calculated stresses from some attached piping systems were fairly close or equal to the allowable values. This constitutes a generic concern regarding the use of this program.

In order to make a conclusive and valid judgment about this program, it is highly recommended that the affected licensees should select a model consisting of the torus and one attached piping system to perform the following:

- A coupled analysis
- An uncoupled analysis.

The results of the above computations will be compared with those previously obtained by using the CMDOF program. These comparisons will help to draw a conclusion about the validity of this program and they also will give a good indication about the level of conservatism that exists in an uncoupled analysis.

Based on the review of information submitted by one licensee [1], it is suggested that the core spray pump suction (a typical 20-in pipe) be used for this purpose.

REFERENCES

1. R. W. McGaughy (Iowa Electric Light and Power Company)
Letter with Attachments to H. Denton, NRC
September 17, 1984