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January 11, 1985
RHB-85-002

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555

Attention: Mr. D. B. Vassallo, Chief
Operating Reactors Branch No. 2

Subject: Mark I Containment Program
Transmittal of Presentation,
"CMDOF Review Meeting", dated
January 4, 1985

Gentlemen:

On January 4, 1985 Mark I Owners' Group representatives met with NRC Staff and consultants to discuss the theoretical basis and application of the CMDOF computer program. This letter is written to transmit 10 copies of the presentation material discussed in the meeting. It is submitted by NUTECH on behalf of Northern States Power, Iowa Electric Light & Power, Public Service Electric & Gas, and Commonwealth Edison Company.

CMDOF (Coupling of Multiple Degrees of Freedom) was used in the analysis of torus attached piping systems to more accurately represent the effects of torus shell motions caused by the postulated Mark I Long Term Program hydrodynamic loads. During the presentation it was stated that CMDOF is not a newly developed program, nor is its use unique to the Mark I Program. The concept on which CMDOF is based was identified in the 1960's and programs utilizing these concepts have been routinely used since 1969. CMDOF, itself, is a rigorously based mathematical formulation and does not incorporate any compromises in accuracy for the sake of expediency. It was noted that the coupled solutions generated using CMDOF are more accurate than uncoupled solutions. In fact, CMDOF was utilized expressly to insure that totally unnecessary modifications were not made to the torus penetrations and attached piping systems.

Based on the discussion with the Staff and its consultants following the presentation, it is our understanding that the theoretical basis for CMDOF is acceptable. In addition, there are no specific technical issues still outstanding with regard to its Mark I application. Notwithstanding, the Staff and its consultants indicated that they are desirous of further verification and validation for the Mark I application.

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The affected utilities consider that this request is not fully justifiable and consider that it will lead to an unnecessary expenditure of resources and delay to Mark I Program closure. As was experienced earlier in the Mark I program, the performance of an accurate single-pass, fully-coupled torus/piping system analysis is not practicable; and further, its probability of success on a reasonable time frame is unlikely. Instead, the affected utilities request that the CMDOF review be concluded on the following technical bases:

- o CMDOF has been adequately verified and validated using the sample problems to strenuously test program accuracy. In addition, the program has been applied to a free-standing steel Mark III containment, where 20 actual piping systems were analyzed. Note, for this case where the precision of CMDOF results was rigorously demonstrated, the reductions in the reactions at the point of piping system attachment were comparable to those observed for the Mark I.
- o The entire Mark I containment reevaluation was conducted on a conservative basis. In addition to the conservatisms identified specifically in the Mark I Load Definition Report and those inherent when ASME Code requirements are met, two additional specific conservatisms should be considered: first, the applied load frequency was adjusted to match that of the piping system frequency characteristic so as to produce the maximum response; and second, the damping factors utilized for the piping system (Reg. Guide 1.61) were substantially below that currently suggested in the Pressure Vessel Research Council (PVRC) recommendations.

In summary, it is felt that these considerations, together with the sound theoretical formulation of CMDOF, are sufficient bases upon which to conclude CMDOF review.

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Mr. D. B. Vassallo
U.S. Nuclear Regulatory Comm.

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Please contact Mr. G. Neils at (612) 330-6052 or the undersigned at (408) 281-6146 if any questions or issues requiring clarification arise during review of this submittal.

Very truly yours,

RHBuchholz

R. H. Buchholz
Project Manager

RHB/pc

Enclosure

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