NIAGARA MOHAWK

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

February 15, 1983

Mr. R. W. Starostecki, Director
U.S. Nuclear Regulatory Commission
Region I
Division of Project and Resident Programs
631 Park Avenue
King of Prussia, PA 19406

Re: Nine Mile Point Unit 2
Docket No. 50-410

Dear Mr. Starostecki:

Enclosed is a final report in accordance with 10CFR50.55(e) regarding an error in the GHOSH computer program. This condition was reported by telephone to H. Kister of your staff on October 8, 1982. An interim report on this matter was submitted to you by my letter dated November 5, 1982.

Very truly yours,

C. V. Mangan
Vice President
Nuclear Engineering & Licensing

xc: Director of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Mr. R. D. Schulz, Resident Inspector

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NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT NUCLEAR STATION - UNIT 2
DOCKET NO. 50-410

FINAL REPORT
REGARDING GHOSH PROGRAM

Description

An error was discovered in a structural computer program used in the analysis of the Nine Mile Point Unit 2 (NMP2). The program is used for primary containment and reactor building hydrodynamic loadings described in NUREG 0808. This error was discovered in the GHOSH program (ST200, Version 02, Level 04) used by Stone & Webster Engineering Corporation during the generation of amplified response spectra.

The program was obtained from the National Technical Information Service. It is Publication No. EERC 69-10 dated September 1969, and is entitled "Dynamic Stress Analysis of Axisymmetric Structures Under Arbitrary Loading." The authors are Sukumar Ghosh and Edward Wilson of the University of California at Berkeley. The error was in the original program.

The GHOSH program uses shell elements as well as quadrangular and triangular solid elements. The Nine Mile Point Unit 2 structural model contained 64 solid elements that are used in the rock subgrade portion of the model, 16 of which are triangular. The program is used to generate acceleration response time histories. These are then postprocessed by other programs to generate amplified response spectra for use in the qualification of equipment and piping systems in the reactor building.

The problem occurred in subroutines that performed a summation of individual subtriangular element stiffness matrices for a specified triangular element. If a triangular element is chosen to represent a portion of a structure, the program divides the triangle into three smaller subtriangles with the centroid of the original triangle being a common node to the three subtriangles. The subroutine should have summed the stiffness matrix of the three subtriangles but, instead, used only the stiffness matrix of one of the subtriangles of the element.

Analysis of Safety Implications

The program was revised to correct for the error described earlier. The results of the revised and original programs were compared, and it has been concluded that the differences in the results due to the error were insignificant.

The evaluation was performed by generating amplified response spectra at 49 locations on the containment structure. This was done for representative hydrodynamic load cases with the corrected version of the GHOSH program, Version 3, Level 0.

The resulting amplified response spectra were compared with the spectra generated by the prior version of the program. The evaluation considered both magnitude and frequency shift. Only 5 of the 49 locations showed a relevant difference. A relevant difference has been defined as a shift in frequency of the peak or an increase of the amplitude which is more than 10 percent and also, .1g. The effect has been evaluated and there is no effect on the design. The reason for the minimal change in spectra results is that all of the problem triangular elements were located in the rock subgrade. Soil-structure interaction effects are not significant for this site.

Therefore, we believe that if this problem were to have remained uncorrected, it could not have adversely affected the safe operation of the plant.