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Docket No. 50-410

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Niagara Mohawk Power Corporation
ATTN: Mr. Gerald K. Rhode
Vice President - Engineering
300 Erie Boulevard West
Syracuse, New York 13202

Gentlemen:

As a result of our review of the Mark II Containment Dynamic Forcing Function Reports (GE NEDO 21061 and NEDE 21061, both dated September 1975), we find that we need additional information to continue our evaluation. The additional information we require is identified in the enclosure. Most of the items listed in the enclosure were discussed with representatives from the General Electric Company and the Mark II Owners Group during our meetings on April 29, 1976, and May 20, 1976.

The items in the enclosure are generic to the review of all Mark II containments; therefore, the enclosure is being sent to all Mark II owners. In an effort to expedite the review of the above cited reports, we would expect that, similar to the method used to transmit the reports, the information generated in response to the enclosure would be transmitted directly to us by General Electric for the Mark II owners. However, we would expect each of the owners to adopt the responses by reference. In order to complete our review in a timely manner, we will need a completely adequate response by September 1, 1976.

As a result of the attached request for additional information and the above referenced meetings, we expect that your report, Plant Design Assessment For Safety Relief Valve and Loss of Coolant Accident Loads, dated June 1976, will have to be revised. Please indicate the date when we can expect to receive the revision to that report, 55 copies of which are required for our review.

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OFFICE➤						
SURNAME➤						
DATE➤						

Please contact us if you require clarification of the enclosed requests for additional information.

Sincerely,

Original signed by
D. B. Vassallo

D. B. Vassallo, Chief
Light Water Reactors
Branch No. 4
Division of Project Management

Enclosure:
Request for Additional Information

OFFICE➤	DPM/LWR #4	DPM/LWR #4				
SURNAME➤	WKane;pav	DBVassallo				
DATE➤	07/21/76	07/21/76				

ENCLOSURE

REQUEST FOR ADDITIONAL INFORMATION
MARK II CONTAINMENT DYNAMIC
FORCING FUNCTIONS INFORMATION REPORT (DFFR)

020 Containment Systems Branch

020.1 Clarify the statement that no load should be applied to the containment walls due to condensation oscillations. Figure 5.2-7 indicates that condensation oscillations should be applied to the submerged wetwell and Section 6.1.9 of NEDO-11314-08 identifies the condensation oscillation loading that should be applied to the pool boundary as determined from the PSTF tests.

020.2 Discuss the manner by which the mean and maximum horizontal condensation loads should be applied to a single downcomer.

020.3 Discuss the criteria that are used in the multiple loading of the downcomers due to horizontal condensation loads. Specifically, identify what fraction of the downcomers experience a load acting in the same direction and identify and justify the load to be used.

020.4 It is not obvious how the downcomer horizontal condensation loads, loading time interval, and load period were obtained from the test data presented in NEDE-21078P. Provide specific references and a discussion of how the foregoing parameters were obtained, including any statistical analysis techniques that were used.

020.5 The pool swell model discussed in Section 4.4.1 of the DFFR has been used to calculate the water surface velocity associated with the impact pressures presented in Figure 4.4-24 through 4.4-26. Discuss the adequacy of the model to conservatively predict the velocity of the pool surface considering the assumptions that the entire mass

of water associated with the vent submergence must be accelerated by the bubble pressure.

020.6 Provide the matrix of the "4T" tests that will provide data relative to the Mark II design. Identify the key pool swell parameters that were obtained from the test data. Identify the range of independent variables that were covered by the test program.

020.7 Provide the following additional information related to the "4T" tests:

1. provide a detailed scaling analysis for those parameters that will not be full scale in the tests. Specify the portions of the pool dynamics transient in which the scaling analysis is applicable;
2. discuss the manner by which test data will be applied to specific plant designs. Include in this discussion the influence of vent flow rate (or transient drywell pressure), vent submergence, and wetwell airspace volume;
3. provide a comprehensive error analysis for the key independent variables measured in the test program. Discuss how these errors were factored into a determination of conservative dependent variables;
4. discuss the potential influence of the "4T" geometry and configuration on the test results. Specifically, consider the effects of the tank walls on the measurement of the lateral loads and

pool surface velocity, and the effect on the vent exit (i.e., without bolt flange) on the lateral loads and bubble formation; and,

5. identify any multiple vent test data that can or will be used to substantiate the unit cell approach used in the "4T" test facility.

020.8 Video tapes of tests performed on a vent system similar to the Mark II design exhibited a significant amount of wave formation in the pool following the initial pool swell transient. Discuss the relevance of this phenomenon to the Mark II design, including the origin and anticipated magnitude of loads due to waves.

020.9 Discuss the design features of the Mark II containment, or potential design modifications, which could be used to mitigate pool dynamic loads.

020.10 In Section 4.4.4 of the DFFR, all of the Mark II plants have been grouped according to key geometric similarities. Discuss the manner by which the solutions of the pool swell model for each of the test cases are to be applied to the other plants in each class. If the solutions for a test case are to be applied equally to all other plants in a particular class, justify the approach with respect to differences in drywell pressure response and geometry between the test case and other plants in the same class.

020.11 Section 4.4.4 of the DFFR identifies Figure 4.4-18 as being the transient suppression pool air space pressure; while Figure 4.4-18 is apparently

the transient bubble pressure. Clarify this discrepancy.

020.12. Discuss the manner by which fluid velocity is determined for the computation of drag loads on submerged structures and piping.

020.13 Section 4.4.5.3 of the DFFR indicates that the bubble pressure should be applied as a uniform increase in hydrostatic pressure.

1. justify this approach with respect to potential differential pressures that could be generated across equipment or structures due to bubble propagation through the pool, specifically consider the reactor pedestal and the drywell deck column supports; and,
2. justify the use of the calculated transient bubble pressures in terms of any relevant test data available from the "4T" tests.

020.14 Section 4.4.5.4 of the DFFR indicates that fallback loads are determined assuming the acceleration under gravity of a two-phase fluid. Discuss the manner by which the density of the two-phase mixture is determined. In addition, since the majority of Mark II plants have an initial wetwell air space height below three times the vent submergence, justify the assumptions of acceleration under gravity with respect to a momentum exchange due to froth impingement on the diaphram (i.e., rebound velocity).

020.15 The DFFR indicates that a 50% design margin <u>may</u> be applied to the impact loads determined for a structure. Discuss the criteria to be used in determining whether a design margin should be applied to a particular load.

020.16 Discuss the manner by which the material in Appendix 4.4 of the DFFR is to be used. In addition, describe how the data points used to generate Figures A4.4-1 through A4.4-3 were obtained.

020.17 Provide a table which summarizes each of the loads depicted in Figures 5.2-1 through 5.2-16. For each load, specify the experimental data and/or analysis which form the basis for the load. References to the test data should indicate the specific test runs.

020.18 Provide the following clarifications regarding the temporal relationships depicted on the load combination histories:

1. how was the 0.7 sec vent clearing time determined?
2. the pool swell event is depicted to occur between 017 sec and 0.9 sec. The calculations in Section 4.4 indicate that the pool swell event takes approximately 0.6 sec. Clarify this inconsistency.
3. how was it determined that condensation loads would begin at 4 seconds following a postulated LOCA?
4. discuss the manner by which the loading time is determined for drag and fallback following impact or froth impingement.

020.19 Provide a multiple regression analysis for the quencher relief valve design using the entire data base available.

020.20 Provide the data base being used for the quencher design evaluation. The data should be in tabular form, listing all sensitive test parameters.

020.21 Provide the design quencher loads to be used and their bases.

020.22 The load combinations to be considered for the design assessment of the Mark II containment are presented in Section 5.2 of the DFFR. The load combinations for the large line break do not consider actuation of a single SRV concurrent with a large break. Consideration of a single active failure will result in this load combination. Accordingly, we will require that the load combination be considered for the Mark II containment design assessment.

020.23 In April 1975, generic questions related to pool swell and SRV loads for Mark II type containments were sent to utilities with Mark II containment. In this letter we requested that information be supplied to "describe the manner by which potential asymmetric loads were considered in the containment design. Characterize the type and magnitude of possible asymmetric loads and the capabilities of the affected structures to withstand such a loading profile. . ." This information was not supplied in the DFFR. Accordingly, we require that an evaluation be presented of asymmetric load in the Mark II containment. Potential asymmetric loads resulting from SRV actuation and from asymmetries in vent flow should be considered. In addition, provide an evaluation of the capability of the Mark II containment for asymmetric pool dynamic loads.

020.24 The DFFR provides an analytical evaluation of the pool dynamic loads for Mark II containment. At the April 28, 1976 Mark II meeting dealing with Mark II pool dynamic loads, the Mark II owners group stated that the 4T tests would provide experimental confirmation of the analytical methods described in the DFFR. It is the position of the staff that acceptance

of the pool dynamic loads by the NRC staff is contingent on the NRC review and acceptance of the results of the 4T test program and a comparison of the test data with the analytical methods described in the DFFR.

020.25 We have not received a detailed description of the test matrix to be conducted for evaluation of the Mark II pool dynamic loads. The description of the 4T test program we have received indicates that 4T air tests have not been covered. In the evaluation of pool dynamic loads for the Mark I and Mark III containment design, air tests were conducted to provide data for some of the pool dynamic loads. Because of the potential for a high air fraction in the vent flow during the early portion of a LOCA we currently believe that air tests should be conducted as a part of the Mark II pool dynamic load test program.

020.26 The DFFR presenta a description of a number of LOCA related hydrodynamic loads without differentiating between primary and secondary loads. Provide this differentiation between the primary and secondary LOCA-related hydrodynamic loads. We recognize that this differentiation may vary from plant to plant. We would designate as a primary load any load that has or will result in a design modification in any Mark II containment since the pool dynamic concerns were identified in our April 1975 generic letters.

130.0 Structural Engineering

130.1 Provide in Section V a description of the pressure loadings on the containment wall, pedestal wall, basemat, and other structural elements in the suppression pool, due to the various combinations of SRV discharges, including the time function and profile for each combination. If this information is not generic, each affected utility should submit the information as described above.

130.2 In Section 5.2 it is stated that the load combination histories are presented in the form of bar charts as shown in Figs. 5.2-1 through 5.2-16. It is not indicated how these load combination histories are used. In particular, it is not clear whether only loads represented by concurrent bars will be combined, and it should be noted that depending on the dynamic properties of the structures and the rise time and duration of the loads, a structure may respond to two or more given loads at the same time even though these loads occur at different times. Also, although condensation oscillations are depicted as bars on the bar charts, the procedure for the analysis of structures due to these loads has not been presented. Accordingly, the description of the method should include consideration of such conditions. Also for condensation oscillation loads and for SRV oscillatory loads, include low cycle fatigue analysis.

130.3 In discussing the load factors used for loads in various load combinations, the probabilistic approach given on page 5.2.4 includes comparisons of various load combination probabilities. Explain how the load factors and load combinations are established on such a probabilistic approach and how the various orders of magnitude as indicated on page 5.2-4 are obtained and provide the load factors and load combinations thus established.

130.4 Through the use of figures, describe in detail the soil modeling as indicated in Section 5.4.3 and describe the solid finite elements which you intend to use for the soil.

130.5 Describe the mathematical model which you will use for the liner and the anchorage system in the analysis as described in Section 5.6.3.

130.6 In Section 5.1.1.1 it was stated that SRV discharges could cause axi-symmetric or asymmetric loads on the containment. In Section 5.4.1 an axi-symmetric finite element computer program is recommended for dynamic analysis of structures due to SRV loads, and no mention is made of the analysis for asymmetric loads. Describe the structural analysis procedure used to consider asymmetric pool dynamic loads on structures and through the use of figures, describe in more detail the structural model which you intend to use.

130.7 In Table 5.2-1, load combinations 4a, 5a and 7a are not acceptable to the NRC staff. Discharge of a single safety/relief valve must be combined with the remaining loads of these combinations. A load factor of 1.0 on the SRV loads in these combinations is acceptable to the NRC staff.