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RMDiggs
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TBAbernathy
JRBuchanan
ACRS (16)

JAN 8 1976

Docket No. 50-263

Northern States Power Company
ATTN: Mr. L. O. Mayer, Director
Nuclear Support Services
414 Nicollet Mall
Minneapolis, Minnesota 55401

Gentlemen:

RE: MONTICELLO NUCLEAR GENERATING PLANT

As the result of our review of the final report on the Mark I Containment Evaluation Short Term Program and the Proposed Long Term Program, we find that we need additional information to complete our evaluation. The information needed is shown in enclosures 1, 2, and 3. Most of the items listed in the enclosures were discussed with the General Electric Company, Bechtel Corporation, and the Mark I Owners Group during our meetings of December 3 and 4, 1975.

In order to complete our review in a timely manner, we will need a completely adequate response by January 20, 1976.

Please contact us if you need clarification of our request.

Sincerely,

Original signed by
Dennis L. Ziemann

Dennis L. Ziemann, Chief
Operating Reactors Branch #2
Division of Reactor Licensing

p3

Enclosures:
Question Lists

cc: See next page

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DATE	1/8/76	1/8/76				

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ENCLOSURE 1
MARK I CONTAINMENT EVALUATION
SHORT TERM PROGRAM - FINAL REPORT
LONG TERM PROGRAM-ACTIVITY SCHEDULE
STRUCTURAL ENGINEERING BRANCH
REQUEST FOR INFORMATION

A. GENERAL COMMENTS

1. Several generic structural engineering questions which were asked previously regarding the "Mark I Containment Status Report" dated July 31, 1975 remain unanswered in this short term final evaluation report. Possibly, some of these concerns could be addressed in the long term program. If so, justification should be provided which would support the conclusion that the Mark I safety margins would not be significantly reduced by delaying consideration of such items. These unanswered questions are detailed in the following paragraphs of the above referenced structural evaluation:

   item 7., torus supports; item 8., acceptable strain limits; item 10., the effect upon structures when combining "insignificant" loads with significant loads; item 11., the capability of vent headers to resist fallback loads; and, item 15., vent pipe bellows assembly.

2. Throughout this report the yield strength of various members has been exceeded. Yet, no justification for such exceedance has been provided. Provide the bases for concluding that exceeding yield strength is acceptable. Discuss "acceptable strain limits", and provide expected strains and resulting deformations for all members that are expected to yield. Discuss the potential for loss of function and/or leakage in light of possible stress reversals, cracking and/or buckling and the margin of safety against loss of function.

3. In several instances, laboratory tests of critical elements have been conducted. These tests were performed in controlled conditions, with loading rates and loading cycles not necessarily representative of potential loadings, on a specimen which was

fabricated with new materials and under controlled conditions. Provide the bases for determining the applicability of such tests and the degree of confidence in predicting the performance of field constructed members.

4. According to this report, several components, structural elements or connections would fail if subjected to the "most probable" LOCA induced pool swell loads. No short term repairs have been proposed to prevent or mitigate such failures. Describe your conceptual plans for short term repairs, if it is determined that such repairs are necessary.

5. Describe your plan, if any, for in-service surveillance prior to long term repairs of critical structural elements determined to be near yield due to pool swell loads.

B. COMMENTS ON VOLUME I

6. Since the S/R valve discharge loads, alone and in conjunction with the LOCA or less severe accidents, will be addressed in the long term program, provide the structural basis for the conclusion arrived at in item (f) of page 1-3 of Volume I of the report, inspite of the statement in the last paragraph of page 3-1 that such loads have substantial effects.

7. The Addendum which should address the torus and its supports (see footnote on page 1-2 of Volume I) has not been received. Indicate the expected dates when the NRC staff could be briefed on this topic and when Addendum 2 would be submitted for NRC staff review. Provide information on the adequacy of the torus and its supports in as much detail as that provided for other structures, with particular attention to the combined effects of LOCA-induced loads and seismic loads, and the effectiveness of current or proposed tie down assemblies.

8. In item (h) of page 1-3 of Volume I and in Section 6.1.3 of Volume IV, it is indicated that catwalks and platforms with solid floor decking "may potentially fail" due to bulk pool swell loads

and may subsequently generate missiles. Provide the basis for concluding that such missiles will not hinder the function of any safety related equipment, electrical lines, instrument lines, piping or structures located above the catwalk or elsewhere within the torus. Describe the missile impact analysis and provide a summary of the results for the plate impacting on the torus or a vent pipe. In view of this potential hazard provide justification why the solid checkered plate platforms should not be replaced with grating, where appropriate, as a short term safety measure. Furthermore, it is also indicated that local yielding will occur at the torus/beam connections. Indicate if this yielding will occur in the torus shell itself and, if so, provide the expected strain, and deformation and discuss the potential effect on leaktight integrity. Also, discuss the possibility of torus compressive loads causing buckling at these locations, especially when subjected to seismic loads.

9. In item (i) of page 1-3 of Volume I and in Section 5.5.3.2 of Volume IV, it is indicated that local yielding of the liner plate (in the concrete suppression chamber) will occur. Provide the basis for your conclusion that the liner will, nevertheless, retain its leaktight integrity. Provide a description of the extent of yielding, i.e., the expected strain, the region of yielding, the effect of attachments, etc.

C. COMMENTS ON VOLUME III

10. In Section 2.2 of Volume III, the suppression chamber shell wall has been listed as a non-critical structure. Section 4.3.10 of the same volume briefly described the analysis performed to arrive at this conclusion. Provide a summary of the resulting stresses or strains due to combined seismic and pool swell loads in critical areas. If stresses are above yield, then provide a justification thereof with particular attention to buckling and leakage

potential at the beam/torus connections that were indicated to be critical. In particular for the Brunswick torus liner, describe the yielded region, the spalling and expected damage of concrete anchors for the liner, and the negative pressure resisting capability and post-buckling behavior of the liner when subjected to safety/relief valve discharge loads that may occur in conjunction with the LOCA

D. COMMENTS ON VOLUME IV

11. Page 3-9. Indicate the basis for determination of comparative vent moments, i.e., the loading condition, moment location, calculation techniques, etc.

12. In Section 4.7, static load combinations S1, S2 and S3 are specified. In Section 5.4 it is stated that only S1 is significant. Provide a summary of the results of an analysis indicating the most severe combination of HR, HT and HV acting concurrently on each leg of a pair of downcomers along with other loads.

13. In Section 4.7, provide the bases for only combining the horizontal load of every fifth downcomer in static load combinations S2 and S3

14. In Section 4, indicate if asymmetric vent clearing and pool swell loads were considered in the analysis and, if so, provide the results of a bending analysis of the vent header and of a torsional analysis of the vent pipe for such loads.

15. In Section 5.5.3, on Page 5-11 you indicated that the yield stress, and the minimum specified strain are exceeded and that the anchor would fail. On Page 5-14 you stated that the vents are expected to buckle. However, on Page 5-11 you conclude that the system will return to the original position by gravity action after the passage of the dynamic load. Provide the basis for such a conclusion, specifying the capability of the yielded system to resist fallback and other LOCA, seismic and safety/relief valve discharge loads.

16. Page 5-14. Due to the failure of the Brunswick header column anchorages, the high stresses in the vents at the drywell may cause localized dishing of the vent shell. You have also stated that the safety function of the assembly will not be impaired. In support of the above statements provide the following information:

(a) The maximum stress at the intersection of the vent and the drywell, the stress distribution at this location, and a comparison with yield stresses,

(b) The maximum strain and strain distribution in this region,

(c) A discussion of the possibility of compressive buckling in the vent pipe due to seismic loads and the bases for your conclusion that the leaktight integrity of the vent pipe is maintained for the remainder of the LOCA event.

17. Section 5.8. A finite element analysis was performed to determine the dynamic behavior of a sector of the vent header assembly when subjected to pool swell impact loads. The results of this analysis indicate tensile and compressive strains in excess of ten times the yield strain of the material. Subsequently, this assembly would be called on to resist fallback loads, horizontal vent clearing loads, etc. Describe your method of analyses which consider the post-buckling behavior of compressive elements. Indicate which elements in Figure 5.8-1 are expected to yield due to pool swell impact and their corresponding percent strain. Compare these results with the yielded region identified in the experimental lateral load tests. Confirm that the leak tight integrity of the vent header assembly will be maintained when the post-buckling or post-yield behavior is considered.

18. Section 6.2.2.3. It is indicated that the downcomer/vent-header assembly could be subjected to 250 cycles of lateral loads which are random in magnitude and direction. Utilizing Figure 1 of Volume II compare the fatigue consequences of fewer cycles

of a higher magnitude load versus more cycles of a lower magnitude load. Utilizing these results, demonstrate that a 15 cycle test of high magnitude reversed loading is sufficient to verify the fatigue capability of the assembly.

19. Appendix E, Figure B-11. The lower portion of the Extensometers is located in a region of considerable yielding. Indicate possible errors in the strains reported from measurements with these dial indicators, and the impact, if any, upon the results and conclusions of this test.

E. COMMENTS ON ADDENDUM 1 TO VOLUME IV

20. Upon failure of the Brunswick anchor bar, the vent pipe header assembly is expected to yield and the torus liner is expected to rise 1.73 inches. The bellows assembly must be capable of withstanding the vent pipe deformations caused by the anchor bar failure in conjunction with other loads and still maintain its leak tight integrity. Indicate if this deformation is combined with the pool swell impact load and wetwell compression. Describe the time history of these two loads on the bellows assembly. If superposition of these loads is possible then describe the method of analysis for these combined loads, and the long term program, if any, for experimental verification that the leak tight integrity of the bellows assembly is maintained when subjected to these combined loads.

21. Section 3.1. The reduced scale test was performed on a 36" diameter bellows. A buckling analysis of this assembly has not been discussed. Discuss the applicability of the reduced scale bellows water impact tests to predict the hydrodynamic response of the actual full size assemblies in the local and overall buckling modes.

22. Figure 3.1-1. In order to physically test a partial assembly, the boundary conditions of that partial assembly should approximate the shears, moments, deflections and rotations at the corres-

ponding section in the actual structure. Provide a comparison of the actual anticipated and experimental boundary conditions and discuss their effects on the results and conclusions giving particular attention to the ovaling mode of the vent pipe at these sections and deformations in the torus during pool swell impact.

F. COMMENTS ON VOLUME V

23. On Page 13 it is stated that consideration of various effects such as assembly tolerances, distortions of the structures, etc. could reduce the maximum pressure in the actual structure to close to 50% of that being used in the analysis. Provide a description of the computations and a summary of the results which lead to such a conclusion.

24. On Page 17, it is stated that the conservatisms in load definition and in analytical modeling are such that no yielding will occur in the Browns Ferry support columns, and that failure of the column anchorage in the Brunswick plant will be eliminated. Identify and justify the areas of conservatism in the analytical models and provide a description of the analyses and a summary of the results which support these conclusions.

G. COMMENTS ON THE LONG TERM PROGRAM ACTIVITY SCHEDULE

25. With regard to the in-plant tests for S/R valve discharges discussed in items (1), (2) and (3) of the long-term program, indicate if such tests are planned for concrete suppression chambers. If not, provide justification to show that tests conducted on steel suppression chambers are representative and results therefore are applicable to concrete chambers, particularly since the response of a liner plate is expected to be quite different from that of a steel torus.

26. In item (3) of the program, your objective is to obtain torus shell strain measurements to demonstrate structural adequacy. This is acceptable for ascertaining structural adequacy for the

direct and immediate effects of the R/V discharge loads but not for potential fatigue failure. Describe the tests and/or analysis proposed to ascertain the fatigue life adequacy for the torus and for any other structural member that may be so affected.

27. The schedule proposed for establishing the acceptance criteria for ascertaining structural adequacy is not acceptable to the NRC staff. It is felt that activities for this objective should begin as soon as possible. Provide your plans for ASME Code committee involvement for this purpose. Describe specifically those items that this committee would be requested to study, i.e. load combinations, allowable stresses, variances from existing codes, strain limits, etc.

28. It appears as though the long-term program was developed prior to completion of the short term program. Critical structures or elements sited in the short term program are not the subject of further long-term testing. Provide a description of your specific long-term plans to test critical structural elements sited in the Short Term Program final report.

29. Generic analysis of groups of similar plants may be used to predict their overall structural response. However, the structural response, particularly the local response, is affected by plant-unique features and construction or field modifications. Describe the long term plan to account for such plant-unique items.

30. Describe your plans for increased in-service surveillance during the long term program for structural elements found to be critical during the short term program.

31. The hardware tests for potential structural fixes are scheduled to start in the 4th quarter of 1975, prior to establishment of structural acceptance criteria in the 2nd quarter of 1976. This is unacceptable to the NRC staff. Structural acceptance criteria must be established prior to designing and testing structural fixes intended to satisfy these criteria.

ENCLOSURE 2

REQUEST FOR ADDITIONAL INFORMATION
MARK I CONTAINMEMT EVALUATION
SHORT TERM PROGRAM - FINAL REPORT
NEDC-20989 VOLUMES I THROUGH V AND ADDENDUM
CONTAINMENT SYSTEMS BRANCH

I. Short Term Program Documentation

1. Volume II of the Short Term Program reports describes the LOCA related hydrodynamic loads. The bases for many of the loads have not been provided. Provide a table which specifies the primary and secondary loads considered for the STP. For each load, specify the experimental data and/or analyses which form the basis for the load. References to test data should indicate the specific test runs. In addition, the experimental data and/or analyses which will form the load bases in the Long Term Program for each primary and secondary load should be referenced.

2. For the loads considered in the Short Term Program, provide a graphical chronology of these loads. Identify the source of the load (e.g., pool swell or froth impingement), the time interval over which the load is active, and the structures which are affected. Provide the same information for the loads to be considered in the Long Term Program.

3. Throughout the STP reports, the term "most probable load" has been used. To provide clarification for the meaning of this term, discuss how this term applies to each of the primary loads (i.e., vent lateral load, pool swell impact, drag, froth, bubble pressure and air compression in the wetwell).

4. Based on Volume III of the STP reports, the application of some of the primary loads is not clear. Provide the following additional information:

   a. A plot of peak pool swell and froth load versus elevation for cylindrical structures located above the pool surface. Also, indicate the pressure time profile used in the structural analysis for the pool swell and froth loads specified above.

   b. Specify the pool swell load or the drag load applied to each node of a beam sector model for one of the plant models described in Volume IV, Appendix B, of the STP reports. Specify the elevation of each node relative to the initial level of the pool surface. Discuss time phasing of the loads for this model.

   c. Provide information similar to that requested in 4b for the finite element model described in Volume IV, Section 5.8, of the STP reports. Expand on the discussion of the application of the local pool swell loads to the finite element model found on Page 18 and Figure 3.2.2 of Volume III of the STP reports.

5. Loads are specified in Volume III of the STP reports for several structures without providing the basis for these loads. Provide the experimental and/or analytical basis for the magnitude and duration for each of the following loads. References to test data should indicate the specific test runs.

   a. The load for a 5 foot square solid platform described on Page 18 of Volume III of the STP reports.

   b. The load for a 3 inch wide beam described on Page 18 of Volume III of the STP reports.

   c. The basis for the 12 ft/sec crossflow velocity used in calculating the vent header drag load as specified on Page 23 of Volume III of the STP reports.

   d. The basis for the 20 ft/sec sideward flow used in calculating the vent drain lateral drag load specified on Page 41 of Volume III of the STP reports.

   e. The load for open grating described on Page 4-4 of Volume IV of the STP reports.

   f. A 25 psi impact load was specified for the return lines on Page 42 of Volume III of the STP reports. It would appear that this load is applied to the horizontal run of the line.

Specify the load and load basis applied to the end of vertical lines terminating above the pool surface.

g. Page 24 of Volume II states that the drag value applied is the maximum value observed during the series 5805 PTSF tests. Indicate the specific test run on which this drag load is based.

h. The basis for the 40 ft/sec maximum vent clearing velocity referenced in Section 3.1.3 of Volume III.

6. The pool swell loads applied to the Main Steam Relief Valve lines within the suppression chamber were derived from the impact load used for the ring header. Provide a comparison of this load as specified on Page 2-3 of Addendum to the PSTF pipe load data. In addition, clarify the Teledyne comments in Section 2.1 of Appendix F in Addendum 1 regarding the MSRV load. Teledyne references a 38 psi load of .002 seconds duration for fully rigid pipe targets. Clarify the Teledyne comments since a 38 psi load on pipes has not been specified in the STP reports.

7. Provide the following information related to the EPRI/SRI-1/10 scale Mark I tests.

   a. Figure A-3 in Appendix A to Volume II indicates a pool velocity of 19.1 ft/sec at the center of interface up to impact. It is not apparent which test run this corresponds to of the seven runs reported in the 1/10 scale test description. Section 5, Item 4, in the 1/10 scale preliminary report indicates that Run No. 2 was the closest simulation of scaled prototypical pressure histories. However, a prototypical impact velocity of 23.4 ft/sec was derived from this run as stated within the EPRI report. Provide a detailed description of the analysis and assumptions which resulted in the 19.1 ft/sec specified in Figure A-3 in Appendix A to Volume II.

b. A comparison of the desired and secondary tank pressure waveforms indicates that the test pressure is significantly below the desired pressure for the majority of the pool swell time preceding ring header impact. This is true for most of the runs including Run No. 2. Discuss what effect this nonconservatism in the pressure time waveform will have on the prototypical impact velocity.

c. A number of parameters have been improperly scaled in the 1/10 scale Mark I test. Determine the significance on pool velocity of improper scaling of pressure and fl/D.

8. The screening of structural elements was discussed in Section 4 of Volume III. However, the screening analysis did not include instrument air lines in the torus. One utility with a Mark I containment has examined the possibility of modifying these lines to protect them from pool swell. This was discussed during the December 4, 1975, meeting. Describe the type and location of instrument air lines found in the Mark I containments. Provide a screening analysis similar to that performed for other components in Volume III for instrument air lines in the torus.

9. The failure of baffling screening in the torus is discussed on Page 34 of Volume III. In addition, on Page 6-7 of Volume IV, it is stated that the catwalk system in plants with solid deck plates could suffer extensive damage during the pool swell event. The potential for both baffles and solid deck plates to act as potential missiles is suggested in the STP reports. Damage to the torus walls and vacuum breakers due to these potential missiles has been evaluated. Discuss potential damage to other critical structures in the torus due to missiles including the vent-ring header-downcomer system, vent bellows, instrument air lines and the vent drain lines.

10. The information provided in the STP reports is not clear regarding the most important forces and the most endangered components. Provide a table or list which would facilitate this determination. For each component, provide the type of loading which is considered to be most critical, an estimate of the corresponding stress and strain in the member, the yield stress and maximum allowable strain in the member, the ultimate strength of the material and the stress at which the member would fail.
11. As requested in the April 1975 request-for-information letter sent to utilities with Mark I containments, provide typical arrangement drawings of the suppression chamber which illustrate the structures, equipment, and piping in and above the suppression pool. The drawings should be sufficient to describe all equipment and structural surfaces which could be subjected to suppression pool hydrodynamic loadings. The sketches provided in the STP reports have not met this requirement.
12. Provide missing Figures 4.1-1 and 4.1-2 in Volume II of the STP reports.
13. Analytical confirmation of the pool swell (surface shape and velocity) based on a potential flow model was reported in Section 4.1.2 of Volume II. Provide information regarding the potential flow model and the resultant comparisons.

14. The loads specified in the STP reports indicate an impact/drag load for structures below 5.5 ft and a froth impingement load for structures located above 5.5 ft. Justify the selection of this elevation as 'ransition zone for impact·froth loads in light of the comments on Page 8 of Volume II that PSTF data indicates pool surface rise could be higher and that slug breakup could occur at higher elevations.

II. Torus Uplift Load Definition

15. In Volume II, Sections B.1 and B.2, it is stated that the downward bubble pressure and the upward air compression loads on the torus are based on the Humboldt/Bodega tests. Provide specific reference to the test runs and data points that form the basis for these loads. In addition, provide specific reference to the pages in the Humboldt/Bodega test reports where this information can be found. Indicate differences in the Humboldt/Bodega tests (i.e., vent area/pool surface area, wetwell air volume/pool surface area, drywell pressure) that would result in different loads for the Humboldt/Bodega test than for a full size Mark I containment. Discuss the effect of these differences on the Mark I bubble pressure and air compression loads.

16. The application of the downward bubble pressure and the upward air compression loads on the torus are discussed in Volume II

and III, Sections 3.1 and 3.2. Consideration is given to the attenuation of the bubble and the fraction of bubble pressure seen by the bottom of the torus. Provide the experimental and/or analytical basis for the fraction of the bubble pressure used in the determination of the net downward and net upward load applied to the torus.

17. Provide the following information related to the pool swell analytical model discussed in the December 4, 1975, Mark I containment meeting that shows a reduction in upward air compression loads from the results predicted by the Bodega tests.

    a. A detailed description of the model and application of the model to a full size Mark I containment.

    b. The details of model calibration to the Bodega test data and the existing 1/12 scale test data.

    c. A parametric study to show how sensitive the results of the analysis are to assumptions about the various adjustable parameters which appear in the model.

18. Provide the following information related to the additional Mark I 1/12 scale tests that are to be used to determine downward bubble pressure and air compression loads on the torus.

    a. A description of the tests including test apparatus, instrumentation and test matrix.

b. A test schedule to include completion of testing, data reduction and documentation.

c. Describe how inertial effects of a movable spring supported 1/12 scale torus section will be factored into the determination of the upward lift load for a full size Mark I plant. Consider the differences in inertial effects for a spring supported model and the rigid supports of a full size torus.

19. Provide the following information related to the analyses used to determine torus uplift.

a. A detailed description of the methods of analysis used to predict torus lift, with and without consideration of ring header column reaction loads.

b. Results of torus lift analyses, with and without consideration of ring header column reaction loads.

20. Provide the following information regarding torus support design for upward and downward loads.

a. A description and sketches of typical supports currently in use.

b. Upward and downward loads originally considered in the design of the supports.

c. A table showing the types of torus supports for both upward and downward loads for each of the Mark I plants.

d. A description of the types of structural modifications under consideration for torus supports for both upward and downward loads.

21. Provide the results of a sensitivity study considering a spectrum of steam line and recirculation line break sizes and the anticipated torus net uplift load corresponding to each break size.

III. Long Term Program Description

22. Copies of a brief description of the Mark I Long Term Program were sent to the Nuclear Regulatory Commission by individual utilities with Mark I containments early in October 1975. These brief descriptions of the Long Term Program do not contain an adequate description of this program. As a part of the Short Term Program, we required a description of the Long Term Program in sufficient detail, so that we can determine if the planned program is adequate. The following information should be supplied.

    a. For those activities related to LOCA loads, provide the following:

        1. An overview of all tests and analytical efforts directed towards providing additional substantiation of loads. For each primary and secondary load described in the STP reports, discuss planned work for the LTP.

        2. For planned tests (i.e., 1/12, 4T), describe the following: background and objectives, test

configuration, instrumentation, test procedures, test matrix, scaling consideration and an evaluation of test/Mark I differences.

3. For planned analytical efforts, describe the areas where analytical efforts are planned, the objectives and scope of the effort. Describe plans to correlate test data and analytical models.
4. A description of efforts directed toward obtaining a better definition of the vent lateral loads.

b. For those activities related to Safety-Relief Valve activities, provide the following:

1. An overview of all tests and analytical efforts planned.
2. For planned tests describe the following: background and objectives, test configuration, instrumentation, test procedures, test matrix, scaling considerations and an evaluation of test/Mark I differences.
3. For planned analytical efforts, describe the objectives and scope of the effort. Describe plans to correlate test and analytical models.
4. Indicate what tests and instrumentation will be used to evaluate the pipe restraint loads.

c. Provide the following related to the Long Term Program schedule and documentation:

1. A schedule specifying major milestones, duration and completion of test and analytical efforts, completion of documentation, and planned review meeting with the Nuclear Regulatory Commission.

2. A description of the type of documentation planned for the major activities in the Long Term Program.

23. Data from the 1/12 scale test are being relied upon for a better definition of a number of the primary loads in the Long Term Program including upward air compression, downward bubble pressure and pool swell impact and drag. Provide the following information related to these tests.

a. Provide a detailed scaling analysis for the tests. Specify the portions of the pool dynamics transient in which the scaling analysis is applicable.

b. Discuss the adequacy of approximations used in the modeling parameters and scaling laws to establish how accurately the scaled model results can be extrapolated to the full-scale system. In addition, discuss inaccuracies brought about by inaccurate simulation of the modeling parameters such as leaks in the test wetwell chamber and difficulties in the proper simulation of the enthalpy flux parameter encountered in the early Mark I-1/12 scale tests.

c. We believe experimental studies should be performed to confirm the major scaling laws. Discuss your plans to include tests of this type in the 1/12 scale test matrix.

d. The 1/12 scale tests consider a downcomer unit cell versus multiple downcomer pairs associated with a single torus vent. Discuss what affect this limitation on the 1/12 scale tests will have on the results as compared to the anticipated results for a full size Mark I containment.

e. Films of the early Mark I-1/12 scale test showed several phenomena which were not included in the Short Term evaluation of the Mark I containment. These phenomena include: (1) The formation of water jets upon impact of the pool with the ring header (these jets are directed toward the top of the torus walls); and (2), Channeling of the pool water following bubble breakthrough from the top of the torus around the sides of the torus walls back to the ring header.

While it is recognized that the tests are valid only to the time of bubble breakthrough, it would appear that similar phenomena would be encountered following a LOCA. Discuss these phenomena including their origin, anticipated magnitude and the effect of the vent system on pool swell. Describe the difference in these phenomena in the 1/12 scale test and in a Mark I containment. Include tests or analyses planned to quantify loads resulting from these phenomena.

24. Provide the following information related to consideration of combined pool swell LOCA loads and loads resulting from actuation of Safety/Relief Valves.
    a. A description of combinations of these loads to be considered in the Long Term Program and how the loads are to be combined.
    b. Provide the largest break size that would result in ADS operation for a typical plant with a Mark I containment, without consideration of single active failures resulting in ADS operation.
    c. Provide the ESF signals that would result in ADS actuation and the range of time delays related to actuation of the system following a LOCA.
    d. Provide a description of those accidents that would result in Safety/Relief Valve actuation concurrent with a LOCA considering the limiting

single active failure. If LOCA and R/V loads are not considered as superimposed peak values, discuss the rationale for elimination of this possibility.

e. Provide a sensitivity study of primary pool dynamic loads versus break area.

25. Discuss the possibility of opening the vacuum breakers during the pool swell process for those plants with vacuum breakers located inside the torus, and determine potential torus pressurization resulting from pool bypass through these vacuum breakers.

26. A description of the pool swell load considered in the evaluation of the vent bellows was presented in Addendum 1 to Volume IV of the STP reports. The load used in the STP has some basis and is considered adequate for the STP. However, a more accurate determination of the load in the Long Term Program is warranted considering the reduced size of the bellows tested, the nature of the test, and the convoluted shape of the bellows. It is difficult to accurately balance conservatisms and nonconservatisms in the load specified for the bellows evaluation. Discuss plans to provide additional tests to confirm the bellows load in the Long Term Program.

27. On Page 14 in Volume II, it is stated that asymmetric torus loads due to variations in drywell pressure will be insignificant because of the open nature of the Mark I drywell. The open nature of the Mark I drywell is not apparent. Discuss

LTP plans to analyze variations in the drywell pressure due to structures and components in the drywell.

28. The froth loading model used in the STP was based on a jet impingement model as described in Page 22 of Volume II. It is indicated that this model is conservative since it uses a froth velocity equal to the maximum surface velocity of the pool. It would appear that higher froth velocities than the maximum pool surface velocity are possible. Describe plans for additional tests and correlation of the analytical model to the tests in the LTP to confirm this load.

29. The pool swell impact load described in Volumes II and III of the STP for the vent-ring header-downcomer system is based on extrapolation of PSTF data to determine the hydrodynamic mass of a simple 57 inch cylinder characteristic of the ring header. In a Mark I plant the vent-ring header-downcomer system is a more complex system than a simple cylinder. The system consists of a variety of cylinders, some larger than the ring header, connected to each other at a variety of angles. While the vent header load specified for the STP appears reasonable, it is difficult to balance conservatisms and nonconservatisms in the impact load. Discuss plans in the Long Term Program for additional tests or analysis to provide a better definition of impulse or hydrodynamic mass for the vent-ring header-downcomer system.

ENCLOSURE 3
MECHANICAL ENGINEERING BRANCH

REQUEST FOR ADDITIONAL INFORMATION
MARK I CONTAINMENT EVALUATION

1. Discuss justifications for applying the equivalent static pressure of 25 psi to the vacuum breaker assembly.

2. Verify that the original design functions of the spray header and vacuum breaker air line will not be impaired due to the occurrence of inelastic strain or large displacement during a postulated LOCA. Discuss further the bases for concluding that vacuum breaker nozzles for all plants will withstand the pool swell loads.

3. Identify loading combination criteria and design limits for ECCS piping and mechanical components essential to safety. The functional capability of these components must be maintained under faulted plant conditions.

4. Assess the functional operability of the section of ECCS piping near the torus penetration if the torus supports fail to hold torus in place during pool swell.

5. Describe the earthquake induced sloshing effects on ECCS piping and mechanical components essential to safety. One of the required design considerations is the combined effect of LOCA + SSE loading.

6. Provide adequate details on analysis methods used to calculate the dynamic response. Conservatism should be demonstrated if simplified analyses are used, such as equivalent static or single degree-of-freedom analyses as shown in the short term program final reports.

7. Provide original design criteria for the Section of MSRV line inside the torus. As a minimum, the criteria should include the quality group classification in terms of ASME Code class and/or ANS Safety Class, and stress limits for design and operational conditions.

8. The impact duration was stated to be 15 milliseconds in Subsection 2.2 of Addendum I. However, Figure 2.2-1 and Tables B-2 and B-3 show the duration to be 3.0 milliseconds. Verify that the value used is 15 milliseconds. If the 3.0 millisecond duration is indeed used in both response and parametric analyses, provide the justification for reducing it from 15.0 to 3.0 milliseconds.

9. The maximum stress in the MSRV discharge piping was shown to exceed the minimum yield strength at temperature. Therefore, the calculated displacements may not be realistic. Provide justifications for the conclusion that the function of the piping can be maintained. Also, provide the calculated strains associated with the displacements and stresses shown in Table 2.3-1, Addendum I, and discuss any strain concentration at pipe bends.

10. Provide a summary of calculated stresses and strains at all nodes or elements shown in Figure 2.1-1, Addendum I, for the Peach Bottom Units 2 and 3, including those at restraints; i.e., hangers, vent pipe penetration, and anchor bolts. Also indicate the load-carrying capabilities at all restraints.

11. Most of the analyses submitted in response to our request to show the adequacy of the restraints on MSRV lines inside the torus consider only the initial blowdown loads, which is not completely acceptable. The effects due to any bubble formation, bubble oscillation, and sequential operation were not included in the assessment. Provide a definitive test program to obtain load data for use in evaluating the adequacy of pipe restraints in each plant. The test program may consist of tests to obtain load history during a single and a multiple discharging, coupled with direct strain measurements at restraints.