

GENERAL ELECTRIC

NUCLEAR ENERGY
PROJECTS DIVISION

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U. S. Nuclear Regulatory Commission
Division of Operating Reactors
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

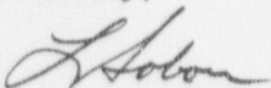
Attention: Mr. C. L. Grimes, Task Manager
Mark I Containment Long-Term Program

Gentlemen:

SUBJECT: MARK I CONTAINMENT ACTIVITY REVIEW - AUGUST 1978

The purpose of this letter is to forward ten (10) copies of an August 1978 Program Activity Review for your information. This review lists the meetings held and provides a brief task-by-task activity summary for the month. It is being provided to you on behalf of the Mark I Owners Group. The document is comprised of information extracted from selected sections of a monthly report prepared by General Electric for the Mark I Owners Group. Sections on contract and billing status have been removed.

Sincerely,



L. J. Sobon, Manager
BWR Containment Licensing

LJS:mks/17F

Enclosures

cc: L. S. Gifford (GE, Bethesda)
File: 2.9.2/2.10

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MARK I CONTAINMENT PROGRAM

PROGRAM ACTIVITY REVIEW

AUGUST 1978

GENERAL ELECTRIC COMPANY

San Jose, California

I. MEETING SUMMARY

<u>Date</u>	<u>Attendees</u>	<u>Place</u>	<u>Meeting Content</u>
8/1/78	GE/NUTECH/EPRI	San Jose, Ca.	3D/2D Pool Swell Load Factor
8/1/78	SS/PASNY/GE/NUTECH/ Bechtel	San Jose, Ca.	Review of Vent Header Structural Assessment
8/2/78	GE/NUTECH/Bechtel	San Jose, Ca.	Pre-Meeting for 8/8, 9 & 10/78 Meetings as Related to AE Task Group and SAC
8/2/78	GE/NUTECH	San Jose, Ca.	1/4 Scale S/RV Test
8/3/78	GE/NUTECH	San Jose, Ca.	GE Quencher Temperature Performance - Dryrun for NRC Meeting on 8/10/78.
8/3/78	GE/SWRI	San Antonio, Texas	Submerged Structures T/Q Analytical Model
8/4/78	GE/NUTECH	San Jose, Ca.	Review of SRSS Presentation for NRC Meeting on 8/10/78.
8/4/78	GE/SWRI/NUS	Clearwater, Fla.	Submerged Structures T/Q Dye Test
8/8/78	AE Task Group	Bethesda, Md.	Guidelines for Structural Analyses
8/9/78	NRC/TRC/GE	Bethesda, Md.	Structural Acceptance Criteria Working Group
8/10/78	NRC/TRC/GE	Bethesda, Md.	SRSS Load Combinations & T-Quencher Pool Temperature Limits
8/11/78	GE/Bechtel/NSC	San Jose, Ca.	Submerged Structures Chugging Load Definition & Application Guidelines
8/11/78	GE/NUTECH	San Jose, Ca.	FSTF

I. MEETING SUMMARY - Continued

<u>Date</u>	<u>Attendees</u>	<u>Place</u>	<u>Meeting Content</u>
8/17/78	GE/NUTECH	San Jose, Ca.	1/4 Scale S/RV Test
8/21/78	GE/NUTECH	San Jose, Ca.	T-Quencher Thermal Performance
8/22/78	GE/NUTECH/AA	San Jose, Ca.	Task Review and Preparation for Utility Meeting - F/SI
8/23/78	TRC/GE/NUTECH/TES	San Jose, Ca.	Miscellaneous Topics
8/24/78	PIC/GE	San Jose, Ca.	Miscellaneous Topics
8/25/78	AE Task Group	San Jose, Ca.	Continuation of 8/8/78 Meeting Agenda Topics
8/31/78	GE/NUTECH	San Jose, Ca.	T-Quencher Water Clearing Loads Report - Comment Resolution - Task 7.1.2.2

III. ACTIVITY SUMMARY

Task 3.0 - Structural Acceptance Criteria

The major discussion topics during the NRC/TRC/GE Structural Acceptance Criteria (SAC) Working Group meeting of August 9, 1978 were as follows:

- 1) Task 3.1.5.1 - Vent Header 2-D Ring Analysis
- 2) Task 3.1.5.2 - Limit Analysis of Downcomer
- 3) Task 3.1.5.4 - Piping Functionality
- 4) Task 3.1.2 - Column Buckling Test
- 5) Task 3.1.3 - Plant Unique Analysis Application Guide (PUAAG)

On Item 1, the NRC stated that the dynamic/static ratio of 2.2 obtained from the program effort was the same order of magnitude as had been obtained for them by Lawrence Livermore Laboratories (LLL) in a similar analysis. The SAC representatives noted that the intent was not to utilize the 2.2 in the PUAAG, but instead to utilize the results to justify Level C Service Level Limits for the ring header. The NRC indicated tentative acceptance of this intention, but noted that they intend to have LLL review the Task 3.1.5.1 report.

During discussion of Item 2 it was noted that the results of the Limit Analysis of the Downcomer-Ring Header Intersection did not support the use of S_y allowables at this intersection. Instead the analysis supports $1.3 S_{mc}$; therefore, it was concluded that this would be the Service Level incorporated into the PUAAG.

On Item 3, the SAC representatives indicated that since the NRC's position on the criteria to be utilized in addressing piping functionality was not firmly established, the original piping design criteria should be utilized in addressing Code compliance. Specifically, the following criteria would apply:

- 1) Functionality would be addressed in a manner consistent with the original design criteria.
- 2) FSAR criteria would be utilized for load combinations involving SSE (i.e., $2.4 S_h$ or S_y).
- 3) For OBE + S/RV, $1.8 S_h$ limits would apply.

During the discussion of Item 4, the NRC stated that in general, they concurred with the scaling relations contained in the Column Buckling Scaling Analysis Report, but that they had some reservations about the conclusion that the torus mass effect was not significant in terms of its contribution to column buckling. The SAC representatives noted that in light of this NRC position and since several plants have stated their intention of installing saddles, it was unclear that the Owners would elect to conduct the Phase II testing.

III. ACTIVITY SUMMARY - Continued

Task 3.0 - Structural Acceptance Criteria (Continued)

The discussion of Item 5 identified the intended changes to the draft PUAAG as a result of both the Owners Group review and LDR Working Group meetings. The conclusion was reached that 1.0 S_{mc} should be the appropriate allowable stress for the ring header-to-main vent intersection until further test or analysis could verify additional capability of the intersection.

The AE Task Group met on August 8, 1978 in Bethesda, and on August 25, 1978 in San Jose. The objectives of the group were established in the first meeting. Also, significant agreements have been reached regarding the approach to be utilized in conducting the final PUAs. This approach will be documented in Section 6.0 of the PUAAG. The current intention is to gain NRC concurrence with the contents of Section 6.0 in conjunction with the next SAC working group discussion, which is tentatively scheduled for mid to late October 1978. The next AE Task Group meeting is scheduled for September 21-22, 1978 in New Orleans.

Task 4.0 - Generic Structural Evaluation

The final report for the Task 4.2.3 analysis of submerged structures using the Moody model was issued in July 1978. The peak drywell pressures used in the analysis were from PLER information; more recent analysis using the M3CPT code has necessitated a revision to the Task 4.2.3 document to account for these changes and also to correct a numerical error in the previous analysis. The revised report is scheduled for release in September 1978.

Task 5.3 - Flexible Cylinder Tests

Bechtel has completed a vent header stress evaluation using a 16" diameter pipe deflector for a plant with relatively high vent header impact velocity. "LDR loads" were used for this analysis and include the latest EPRI 3D factors. The evaluation indicates that certain areas of the vent header, particularly the bottom at mid-bay and between the downcomer pair nearest to mid-bay, predict stresses higher than current allowables. On the basis of this Bechtel evaluation several Mark I Utilities are considering use of a larger pipe deflector, or a pipe deflector with T-sections placed along the sides to increase the effective deflector diameter.

Bechtel has initiated a scoping study to determine the acceptability of the vent bay portion of the vent header without a deflector in the vent bay. The loads are based on Hatch 2 data. The analysis is scheduled for completion in October 1978 and a draft report is to be issued for review in November 1978.

111. ACTIVITY SUMMARY - Continued

Task 5.3 - Flexible Cylinder Tests (Continued)

Since most Mark I Utilities have decided to consider a vent header deflector, General Electric has initiated a task for vent header pool swell impact load definition. This task will first be directed to load screening; then, for the significant loads, conservative load definitions will be provided. A draft report describing these loads will be available in December 1978; these loads will be formally documented in Part B of the LDR, and will be identified henceforth in the Program as Task 7.3.3.

Task 5.5 - 1/4 Scale 2D Pool Swell Tests

Plant unique pool swell tests are continuing to be slightly ahead of schedule. Plants remaining to be tested are Hatch 1, Vermont Yankee, Fitzpatrick and Hope Creek. Vent header deflector specifications for these plants are expected by mid-September 1978.

Some Mark I Utilities have indicated a desire for supplementary plant unique 1/4 scale pool swell tests. Since the current tests will be complete in mid-October 1978, General Electric has requested that the Mark I Owners formally document their test plans by the last week of September 1978 to avoid shutdown of the 1/4 scale 2D test facility. It is expected that up to one-half the Mark I Owners may desire supplementary tests to assist in finalizing their plant modification plans.

Task 5.6 - 1/12 Scale 3D Pool Swell Tests

Pool swell testing in the EPRI 1/12 scale 3D test facility has been completed. The draft test report was issued for review by General Electric and the Mark I Owners in late August 1978; it is targeted for final issue in approximately one month.

III. ACTIVITY SUMMARY - Continued

Task 5.11 - Full Scale Test Facility

All testing authorized by the Mark I Owners has now been completed. The final test, a large liquid break performed at nominal conditions, was conducted on August 22, 1978. As of the end of August, data reports have been generated for seven of the ten matrix tests. All data reports available at General Electric have been transmitted to NUTECH for information.

On August 29, 1978 General Electric forwarded a recommendation to NUTECH that Shakedown Tests 2, 3 and 4A be qualified as Matrix Tests 1, 2 and 3, respectively. The recommendation was made on the basis that the tests were performed in accordance with required quality assurance procedures and that the system, instrumentation and data acquisition performed satisfactorily. The NUTECH response is expected in early September 1978.

At the August 23-24, 1978 TRC/PIC meetings General Electric reviewed the key test results with the Mark I Owners. With the exception of the condensation oscillation loads for Matrix Tests 7 and 8 (large steam and liquid breaks), measured loads have generally been in the expected range. For Tests M7 and M8, maximum peak local wall loads appear to be somewhat higher than previous tests. Data reduction/review efforts are continuing.

Task 5.14 - Submerged Structures

NUS successfully completed the planned series of T-quencher dye tests in early August 1978. Test films and supporting data were forwarded to Southwest Research Institute (SWRI) to provide guidance in the development of an analytical model for T-quencher water jet flow fields. A draft report of this SWRI model has been received by General Electric and is being incorporated into computer codes in support of the LDR.

The analytical model for submerged structures drag forces from condensation oscillation and chugging was issued as a draft report for Mark I and Mark II review in April 1978. An evaluation of loads and resultant stress levels was made for Mark I application; it was judged that the loads derived from the methods proposed in the draft report are acceptable. Therefore, a Mark I version of the document will be issued to preclude any further delays in publication.

III. ACTIVITY SUMMARY - Continued

Task 5.15 - Structural Hydrodynamic Interaction

A comparison of the flexible and rigid plate tests to analytical model predictions has been completed. A draft reporting these comparisons is targeted for issuance by late September 1978, at which time the test report will also be issued for review. Some comparisons of the Anamet/NASTRAN model for FSTF (actually a 4 vent Monticello model) with preliminary FSTF data have been initiated.

Task 5.17 - Condensation Oscillation

A draft report of the semiempirical prediction of vent blowdown frequency is in review at General Electric. The supporting test program at Aeronautical Research Associates of Princeton (ARAP) has been completed. A task review meeting for both of these activities is scheduled for mid-September 1978 at ARAP. At that time, available FSTF data will be reviewed with ARAP for integration of their activities with other CO load definition tasks.

Task 6.2.1 - T-Quencher Development

The 1/4 scale T-quencher testing at NUS is complete and a draft data report was submitted to General Electric. Comparison of the test results with the General Electric quencher bubble code predictions has resulted in the conclusion that the test results provide a valid data base for verification of the analytical model and establishment of empirical correlations for application of Monticello results to other Mark I plants. These results were reviewed with TRC/PIC at the August 23-24, 1978 meetings. At these meetings General Electric noted that additional review effort was required to reconcile several apparent inconsistencies identified in the comparison. This review is continuing and may result in defining a need for additional 1/4 scale tests. This topic will be reviewed with TRC on September 13, 1978.

TRC comments on the T-quencher Load Definition Report (LDR) have been resolved. The document is scheduled for issue in early September 1978. At the August 24, 1978 meeting in San Jose, PIC endorsed a GE/TRC recommendation to issue an addendum to the T-quencher LDR to address the load definitions associated with T-quencher and cap holes. The addendum is scheduled for issue in October 1978. TRC comments on the draft application guides for the SRVDL clearing and water rise transients have been received and the documents are scheduled for issue in September 1978.

Task 7.1.3 - Multiple Consecutive S/RV Actuation Evaluation

During a phone conversation in late August 1978, the NRC indicated to the Mark I Program Office that the structural loadings on the shell derived from the analytical procedures developed under this task may not be conservative when compared with the recently submitted S/RV test reports from Millstone and Peach Bottom. A GE/NUTECH/TES meeting was

III. ACTIVITY SUMMARY - Continued

Task 7.1.3 - Multiple Consecutive S/RV Actuation Evaluation (Continued)

conducted on September 6, 1978 to determine the source of the discrepancy between analytical and test results. As a result of this meeting, several areas were identified as needing further investigation. These areas are: 1) differences between the discharge line used in the S/RV test and that previously used to derive the plant unique multipliers; and 2) the method utilized in translating the S/RV test data from extreme fiber stresses to membrane hoop stresses. Additional conferences are planned to resolve these issues since the NRC has identified the S/RV comparisons as a topic for the NRC/TRC/GE LDR Working Group Meeting on September 14, 1978.

Task 7.4.2 - SRSS Load Combinations

During the NRC/TRC/GE meeting on August 10, 1978, Wickman (NRC) briefly discussed the preliminary results of the NRC Task Force on SRSS and distributed some general guidelines which depicted the limitations for Mark I SRSS application. For the most part these limitations have resulted in the following Mark I SRSS approach:

- 1) As a general rule use absolute sum of maximum stress intensities from analyses for individual load cases.
- 2) Use SRSS of maximum stress intensities from individual case if absolute sum does not satisfy criteria.
- 3) Use SRSS at stress component level as appropriate.

Based upon the August 10, 1978 interchange with the NRC, it is unclear whether any additional major Mark I documentation need be produced on this subject. A GE/NUTECH meeting will be conducted in September 1978 to determine the necessary wrapup activities of this task.

III. ACTIV. SUMMARY - Continued

Task 7.5.2 - T-Quencher Thermal Mixing

Planning and preparation for the extended blowdown test at Monticello is proceeding. The test will provide a data base for assessing the effectiveness of the T-quencher end cap holes in promoting thermal mixing.

At the August 24, 1978 meeting, PIC endorsed a TRC recommendation to begin a thermal mixing analysis effort. The purpose of the program is to develop an analytical model for assessing torus pool temperature distribution during the course of an SORV transient. Such a model is considered necessary to evaluate the adequacy of pool technical specification temperature limits and pump NPSH requirements. A proposal to develop this analytical model will be discussed with TRC on September 13, 1978.

Task 7.6 - LDR Report Preparation

As noted in the August 24, 1978 PIC meeting, the draft LDR will be transmitted to the utilities on October 30, 1978. This draft will be complete except for five FSTF data-related sections which will be available on January 12, 1979. Following a one week review of the draft LDR, the designated utility review representatives (LDR Review Team) will meet in San Jose the week of November 6, 1978 to agree upon the suitable approach to resolve all utility comments.

The next, and probably last, NRC/TRC/GE LDR Working Group Meeting is scheduled for September 14, 1978. Although several discussion topics will be on the agenda, the main emphasis will be placed on the load methodology intended to be utilized in defining the chugging, condensation oscillation and lateral loads from the FSTF data.

MARK II CONTAINMENT PROGRAM
STATUS OF TEST PROGRAMS

Task No.	Description	Performing Agency/Facility	Scale	Phenomena Being Tested	Testing Fluid	Date for Completion of Testing	Comments
3.2.1	Column Buckling Test	IES/IES	N/A	Dynamic load Capacity	N/A	February 1977 (Complete)	---
3.2.2	Ring Header/Vent Pipe Intersection Test	Gehtel/Anamet	N/A	Load Capability	N/A	Indefinite	Task put on hold on April 25, 1978. Need being reevaluated
5.1.1	Monticello S/RV Ramshead Test	GE/HSP	Full	S/RV Discharge loads	Air/Steam	July 1976 (Complete)	---
5.1.2	Monticello S/RV Injencher Test	GE/HSP	Full	S/RV Discharge loads	Air/Steam	December 1977 (Complete)	---
5.2	41 High Temperature Tests	GE/GE	Full	Chugging Wall and Vent loads	Steam	July 1976 (Complete)	Mark II Configuration
5.3.2	Flexible Cylinder Tests	EPRI/DSI	1/6 & 1/3	Fluid/Structure Interaction-Vent Header	Water	July 1977 (Complete)	---
5.3.3	Flexible Cylinder Tests	GE/HSC	1/4	Fluid/Structure Interaction-Vent Header	Air/Water	November 1977 (Complete)	---
5.4	Seismic Slosh	GE/SHRI	1/30	Seismic Slnsh loads/Vent Uncovering	Water	July 1977 (Complete)	---
5.5.1	1/4-Scale 2-D Test	GE/HSC	1/4	Pool Swell Scaling Laws	Air	November 1976 (Complete)	---
5.5.2	1/4 Scale 2-D Test	GE/HSC	1/4	Download Oscillation	Air	October 1977 (Complete)	---
5.5.3	1/4-Scale 2-D Test	GE/HSC	1/4	ELWR Loads	Air	October 1978	Plant unique matrix and Vent Deflector Parametric Tests

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MARK I CONTAINMENT PROGRAM
STATUS OF TEST PROGRAMS

Task No.	Description	Performing Agency/Facility	Scale	Phenomena Being Tested	Testing Fluid	Date for Completion of Testing	Comments
5.6.1	1/12-Scale 3-D Test	EPRI/SRI	1/12	Pool Swell Loads	Air	July 1978 (Complete)	---
5.6.2	1/30-Scale 3-D Test	GE/SRI	1/30	Torus/Cylinder Geometry	Air	September 1977 (Complete)	Qualitative Supplement to 5.6.1
5.8	1/12-Scale 2-D Test	GE/GE	1/12	Pool Swell Scaling Laws	Air	October 1976 (Complete)	---
5.11	Full Scale 3-D Test	GE/Braun	Full	Chugging	Steam	August 1978 (Complete)	---
5.13	1/12-Scale 3-D Test	GE/MITCHEL	1/12	Chugging	Steam	September 1977 (Complete)	Qualitative multivalent effects
5.14	Submerged Structures	GE/WYLE	1/3	Steady State and Transient Drag loads	Air/Steam	June 1977 (Complete)	
		GE/MSC	1/4	Submerged loads	Air	January 1978 (Complete)	---
		GE/SRI	N/A	Components of Drag	Water	February 1978 (Complete)	---
5.15.2	Structural/Hydro-dynamic Interactions	GE/Aerotherm	1/12	Fluid/Structure	Steam	April 1978 (Complete)	Flat plate only. Design level QC implemented.
5.16.1	Reduced Submergence	GE/ GE licensee	Full	Chugging	Steam	April 1977 (Complete)	Testing at Mark I submergence levels
5.16.2	Chugging Mitigation	GE/ GE licensee	Full	Chugging	Steam	May 1977 (Complete)	Testing mitigator at Mark I submergence
5.17	Condensation Oscillation	GE/ARAP	1/12	Condensation Oscillation	Steam	August 1978 (Complete)	Parametric Testing

MARK I CONFINEMENT PROGRAM
STATUS OF TEST PROGRAMS

<u>Task No.</u>	<u>Description</u>	<u>Performing Agency/Facility</u>	<u>Scale</u>	<u>Phenomena Being Tested</u>	<u>Testing Fluid</u>	<u>Date for Completion of Testing</u>	<u>Comments</u>
6.1.1	Chugging Parametrics	GE/MITECH	1/12	Chugging	Steam	March 1977 (Complete)	Scoping parametrics
		GE/Creare	1/12, 1/6, 1/4	Chugging	Steam	July 1977 (Complete)	Scaling parametrics
6.1.2	Chugging Mitigation	GE/MITECH	1/12	Chugging	Steam	March 1977 (Complete)	Scoping mitigation
		GE/Creare	1/6	Chugging	Steam	September 1977 (Complete)	Mitigation screening
6.2.1	S/RV	GE/MITECH	1/12	S/RV Discharge Loads	Steam	June 1977 (Complete)	Mitigation confirmation
		GE/MIS	1/4	S/RV Discharge Loads	Steam	July 1978 (Complete)	Quencher parametrics
6.3.1	Pool Swell Screening	GE/MITECH	1/12	Pool Swell Downloads	Air	September 1976 (Complete)	Screening tests
6.3.2	Pool Swell Mitigation	GE/NSC	1/4	Pool Swell	Air	November 1977 (Complete)	Qualification tests
6.3.3	Vent Header Device	GE/NSC	1/4	Pool Swell	Air	November 1977 (Complete)	Vent Impact mitigation
7.5.2	T-Quencher Thermal Mixing	GE/NSP	Full	Pool Thermal Mixing	Steam	October 1978	---