

GENERAL  ELECTRIC

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NUCLEAR ENERGY
PROJECTS DIVISION

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MFN 426-78

December 4, 1978

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

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

Gentlemen:

SUBJECT: MARK I CONTAINMENT ACTIVITY REVIEW - OCTOBER 1978

The purpose of this letter is to forward ten (10) copies of an October 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

for 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

OCTOBER 1978

GENERAL ELECTRIC COMPANY

San Jose, California

I. MEETING SUMMARY

<u>Date</u>	<u>Attendees</u>	<u>Place</u>	<u>Meeting Content</u>
10/2/78	GE/NUTECH	San Jose	Miscellaneous Topics
10/3/78	GE/NUTECH	San Jose	Closure of Mark I SRSS Activities
10/3/78	GE/NSC	San Jose	Task 5.5.3/5.5.4 - Tests and Reports Work Scope and Manpower
10/6/78	GE/NUTECH	San Jose	T-Quencher Thermal Mixing Analysis
10/9/78	GE/NUTECH	San Jose	Miscellaneous Topics
10/10/78	GE/NUTECH/Bechtel	San Jose	Task 3.1.3 - Plant Unique Analysis Application Guide - Finalization of Content
10/16/78	GE/NUTECH	San Jose	Miscellaneous Topics
10/23/78	GE/NUTECH	San Jose	Miscellaneous Topics
10/25/78	GE/NUTECH/TES	San Jose	Structural Acceptance Criteria - Resolution of PUAAG Content
10/30/78	GE/NUTECH	San Jose	Miscellaneous Topics

III. ACTIVITY SUMMARY

Task 3.0 - Structural Acceptance Criteria (SAC)

The draft Basic Torus Shell Analysis (Task 3.1.5.3) report has been rescheduled for early November 1978. The final results indicate a ratio of dynamic to static reserve margin of 1.82 for the torus shell when subjected to pool swell due to a postulated DBA. In accordance with the ASME Code Case N-197, the torus shell Service Level Limit for this load case will be increased to 1.8 S_{mc} in the Plant Unique Analysis Application Guide.

A final draft of the Plant Unique Analysis Application Guide (PUAAG) - Task 3.1.3, was transmitted concurrently for Owner and informal NRC review on Oct. 30, 1978 (see MI-G-288). This version of the document contains the results of the Task 3.1.5.1, 3.1.5.2 and 3.1.5.3 justification activities. Specifically, the conclusions from these activities are as follows:

Task 3.1.5.1 - Vent Header 2-D Ring Analysis

Provides justification for use of Service Level C Limits for the pool swell loading of the vent header.

Task 3.1.5.3 - Limit Analysis of the Downcomer - Ring Header Intersection

Provides justification for utilizing 1.3 S_{mc} as the allowable for the intersection during pool swell, condensation oscillation, and chugging.

Task 3.1.5.3 - Basic Torus Shell Analysis

Provides justification for using 1.8 S_{mc} for the torus shell during pool swell.

Additionally, this draft of the PUAAG contains a completed Section 6.0 - Analysis Guidelines, which is the product of the AE Task Group Meetings of August 8 and 25, 1978 and September 21 and 22, 1978. Also, the intended use of SRSS by the Mark I Program, as discussed with the NRC on August 10, 1978, has been included in Section 6.2.e. The intent is for the SAC Working Group representatives to discuss the draft PUAAG with the NRC by telephone conference call on November 13, 1978. Following resolution of any outstanding NRC concerns, the document will be published for Utility/AE use.

Task 4.0 - Generic Structural Evaluation

The final report on the analysis for Types I and III vent pipe-ring header intersections (Task 4.2.2) has been reviewed and approved by GE and TRC. Several additional review comments generated by the Bechtel Chief Engineer's staff have now been resolved; the revised report is scheduled to be issued in November 1978.

III. ACTIVITY SUMMARY - Continued

Task 5.3 - Flexible Cylinder Tests

The structural analysis of the vent header in the vent bay, with no deflector, has been completed. Preliminary results indicate stresses in the vent bay are within structural acceptance criteria limits for the generic representative plant considered. The results suggest that deflectors may not be required in the vent bay, for plants with comparatively low pool swell velocity. A meeting is scheduled with Bechtel in November to review results of the analysis.

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

The plant unique pool swell test series (Task 5.5.3) has been completed. A draft final report summarizing the last group of tests (Millstone, Oyster Creek, Hatch 1, Vermont Yankee, FitzPatrick and Hope Creek) will be issued by Nuclear Services Corporation (NSC) for General Electric review in December; the draft test report for all seventeen Mark I Owners tests is scheduled to be issued for review in late January 1979.

Several Mark I Owners, after review of their plant unique test results, have requested additional 1/4 scale plant unique testing to ascertain effects of changes in ΔP , submergence or vent header deflector design. The first of these supplementary tests (for Monticello) is in progress.

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

EPRI has issued the final report of the 1/12 scale 3D pool swell tests, thus completing the task as originally defined. In the final report, EPRI noted that vent orifice location may substantially affect measured pool swell loads. (General Electric Task 5.5.3 1/4 scale 2D pool swell tests are based on a "split orifice" concept designed to simulate prototypical losses). Orifice location effects will be discussed in an early November GE/TRC/EPRI meeting; the possibility of additional testing and/or analysis will be considered at that time.

Task 5.10 - Miscellaneous Monitoring

Lawrence Livermore Laboratory (LLL) is continuing the evaluation of 3D/2D factors on pool swell loads. Communication with NRC has indicated that

III. ACTIVITY SUMMARY - Continued

Task 5.10 - Miscellaneous Monitoring (Continued)

the LLL tests indicate an upload of 3D/2D factor of about 1.17. Previous comparisons of EPRI 3D and GE 2D tests do not show this result. GE has informally transmitted to NRC the 1/4 scale 2D pool swell test results for the Peach Bottom plant unique tests (the LLL test configuration was modeled after the Peach Bottom plant). GE is planning to meet with LLL personnel to obtain more specific technical information on their study.

Task 5.11 - Full Scale Test Facility

All scheduled testing in the FSTF has been completed, and the draft test report is scheduled for transmittal to TRC in December 1978. Following TRC review and incorporation of comments, the report will be forwarded to the Mark I Utilities and the NRC in February 1979.

Based on the current FSTF data base, GE has concluded that LDR loads can be developed and reasonably defended through use of analytical efforts and data from existing test programs. Therefore, GE has recommended that the FSTF be placed in layup until the first quarter of 1979. If the need for additional testing is subsequently identified, such testing could be performed as confirmatory. These actions were reviewed with PIC. Initial layup activities are now nearing completion at Wyle.

Task 5.14 - Submerged Structures

Computer programs for submerged structures loads from LOCA bubbles, steam condensation, and ramshead and T-quencher bubbles are being converted to the CDC Cybernet System as an extension of the generic structural evaluation. Bechtel will perform an A/E checkout of these four computer codes.

The evaluation comparing the analytical LOCA bubble model with 1/4 scale submerged structures tests has been completed and is in the internal review cycle. Comparisons are quite reasonable, but some refinements in the model may be necessary.

Issue of the final report for the Mark I analytical model for condensation oscillation and chugging loads has been postponed until December to support the Mark II/NRC meeting on submerged structure criteria.

Task 5.15 - Structural Hydrodynamic Interaction

The results of this task will be documented by (1) a data report summarizing the 1/12 scale chugging test with flexible and rigid plates; and (2) an analysis report comparing the results of these flexible and rigid plate tests to analytical predictions performed using a NASTRAN computer model. Issuance of these reports has been delayed until late November 1978.

Task 6.2.1 - T-Quencher Development

The second phase of test effort at the NUS 1/4 scale facility has been completed. Five additional test series were completed to investigate the effects of varying water leg geometries on the quencher bubble and wall loads. The test results will be reviewed with TRC on November 9, 1978, and the draft test report will be forwarded for TRC review in late November 1978.

III. ACTIVITY SUMMARY - Continued

Task 7.1.3 - Multiple Consecutive S/RV Actuation Evaluation

Additional information has been prepared and discussed with the NRC regarding the change in the shell and column hydrodynamic factors for the five plants which utilized the results of transient analyses to predict the number of S/RVs which would consecutively actuate. The NRC requested the quantification of the change to these factors during the NRC/TRC LDR Working Group Meeting on September 14, 1978. The change in the hydrodynamic factors, which reflects the difference between the median S/RV discharge line and the worst line predicted to consecutively actuate, has minimal impact on the previously reported strength ratios. The finalized results will be formally transmitted to the NRC and the Owners Group in mid-November 1978. With this transmittal, the interim assessment will have been completed.

Task 7.3.3 - Vent Header Load Definition

The analytical tasks to define hydrodynamic loads on the vent header deflector are continuing. Acceleration drag loads have been identified as an important contribution to the vent header deflector load for deflectors relatively close to the pool surface. GE is developing a test for a simple vent header deflector load measurement (to be run concurrent with plant unique supplementary pool swell tests) to provide an experimental assessment of the recently identified acceleration loads. This test plan will be discussed with TRC in early November 1978.

Task 7.4.2 - SRSS Load Combinations

The Mark I approach to utilizing the SRSS load combination technique has been included in Section 6.2.e of the PUAAG - Task 3.1.3. As presented to the NRC on August 10, 1978, this approach first combines the responses from dynamic loads by absolute sum; then, if the structural acceptance criteria for the case under consideration cannot be met, SRSS will be utilized to combine the responses first as maximum stress intensities, and then by the stress components if needed. The summary Mark I CDF case studies report which will be completed by NUTECH and transmitted to the Owners in late November 1978 will support the justification of this approach. It is anticipated that SRSS will be discussed in the telephone conference call on the PUAAG between the NRC and the SAC Working Group representatives on September 13, 1978.

Task 7.5.2 - T-Quencher Thermal Mixing

Test procedures and specifications for the Monticello thermal mixing tests are being finalized. Testing will be conducted to assess the effect of T-quencher end cap holes to promote torus pool thermal mixing with and without RHR circulation. The tests are currently scheduled for the weekend of November 18, 1978 during plant startup following the ongoing refueling outage.

III. ACTIVITY SUMMARY - Continued

Task 7.5.2 - T-Quencher Thermal Mixing (Continued)

On October 6, 1978 GE and NUTECH met and agreed upon a scope of work for the T-quencher thermal mixing analysis. The analysis will be based on energy and momentum balances linked by utilization of data from the previous extended blowdown test at Monticello. The status of the analysis will be reviewed with TRC on November 9, 1978

Task 7.6 - LDR Preparation

The draft LDR and its associated Application Guides were transmitted for Utility review on October 30, 1978. The utility review teams met to review the LDR and the Application Guides in San Jose on November 6-8, 1978. This review identified various action items which must be addressed prior to LDR issuance on December 29, 1978.

MARK I CONTAINMENT 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>
3.2.1	Column Buckling Test	TES/TES	N/A	Dynamic Load Capacity	N/A	February 1977 (Complete)	---
3.2.2	Ring Header/Vent Pipe Intersection Test	Bechtel/Anamet	N/A	Load Capacity	N/A	Indefinite	Task put on hold on April 25, 1978. Reactivation of task will depend upon identification of need.
5.1.1	Monticello S/RV Ramshead Test	GE/NSP	Full	S/RV Discharge Loads	Air/Steam	July 1976 (Complete)	---
5.1.2	Monticello S/RV Quencher Test	GE/NSP	Full	S/RV Discharge Loads	Air/Steam	December 1977 (Complete)	---
5.2	4T High Temperature Tests	GE/GE	Full	Chugging Wall & 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/NSC	1/4	Fluid/Structure Interaction-Vent Header	Air/Water	November 1977 (Complete)	---
5.4	Seismic Slosh	GE/SWRI	1/30	Seismic Slosh Loads/Vent Uncovering	Water	July 1977 (Complete)	---
5.5.1	1/4-Scale 2D Test	GE/NSC	1/4	Pool Swell Scaling Laws	Air	November 1976 (Complete)	---
5.5.2	1/4-Scale 2D Test	GE/NSC	1/4	Download Oscillations	Air	October 1977 (Complete)	---
5.5.3	1/4-Scale 2D Test	GE/NSC	1/4	LDR Loads	Air	October 1978 (Complete)	Plant unique matrix and Vent Deflector Parametric Tests.

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MARK I CONTAINMENT 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>
5.6.1	1/12-Scale 3D Test	EPRI/SRI	1/12	Pool Swell Loads	Air	July 1978 (Complete)	---
5.6.2	1/30-Scale 3D Test	GE/SWRI	1/30	Torus/Cylinder Geometry	Air	September 1977 (Complete)	Qualitative supplement to 5.6.1.
5/8	1/12-Scale 2D Test	GE/GE	1/12	Pool Swell Scaling Laws	Air	October 1976 (Complete)	---
5.11	Full Scale 3D Test	GE/Braun	Full	Chugging	Steam	August 1978 (Complete)	---
5.13	1/12-Scale 3D Test	GE/NUTECH	1/12	Chugging	Steam	September 1977 (Complete)	Qualitative multivalent effects.
5.14	Submerged Structures	GE/Wyle	1/3	Steady State & Transient Drag Loads	Air/ Steam	June 1977 (Complete)	---
		GE/NSC	1/4	Submerged Loads	Air	January 1978 (Complete)	---
		GE/SWRI	N/A	Components of Drag	Water	February 1978 (Complete)	---
5.15.2	Structural/Hydrodynamic 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 CONTAINMENT 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/NUTECH	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/NUTECH	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/NUTECH	1/12	S/RV Discharge Loads	Steam	June 1977 (Complete)	Mitigation confirmation.
		GE/NUS	1/4	S/RV Discharge Loads - Phase I	Steam	July 1978 (Complete)	Quencher parametrics.
				Phase II		October 1978 (Complete)	Quencher parametrics.
6.3.1	Pool Swell Screening	GE/NUTECH	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-Phases I & II	Steam	November 1978	---