U.S. NUCLEAR REGULATORY COMMISSION
REGION I

DOCKET/REPORT NO. 50-289/95-04

LICENSEE: GPU Nuclear Corporation

FACILITY: Three Mile Island Unit 1
Middletown, PA

DATES: May 3, 1995 - August 24, 1995

INSPECTORS: Steven D. Bloom

Harold Gregg
Harold Gregg, Sr. Reactor Engineer
Systems Engineering Branch
Division of Reactor Safety

10/11/95
Date

APPROVED:

Eugene M. Kelly
Eugene M. Kelly, Chief
Systems Engineering Branch
Division of Reactor Safety

10/11/95
Date

Inspection Summary

The inspector observed GPUN's service water system operational performance inspection (SWSOPI) of TMI-1 and concluded the following:

- All elements of Temporary Instruction (TI) 2515/118, "Service Water System Operational Performance Inspection (SWSOPI)," were satisfactorily accomplished. The team was fully staffed, members were technically competent, and were committed full-time to the inspection.

- The final SWSOPI report findings were substantive and developed in depth. Examples included: (1) questionable thermal hydraulic capabilities of the systems due to lack of performance testing; (2) the heat exchanger open-and-inspect program was not balanced by a performance monitoring program; (3) a need to strengthen the link between the design-basis and system operation; and (4) program improvements to address microbiologically-induced corrosion (MIC) problems.

- The line organization's response to the team's findings was appropriate. A total of 92 action items resulting from the inspection (many already completed) were appropriately prioritized and scheduled for completion.

- GPUN engineering management representatives were kept fully apprised of the SWSOPI team's progress. Management meeting presentations thoroughly addressed the principal issues; at the August 24, 1995 meeting, GPUN provided bases for system operability. The licensee also intends to implement performance monitoring of heat exchangers and update their Generic Letter 89-13 response for TMI-1.

- Strengths at TMI-1 identified by the SWSOPI self-assessment included: operator knowledge of normal and emergency conditions, a proactive program for preventing asiatic clams, effective maintenance that did not require repeat work, and the trending of inservice testing (IST) data.

DETAILS

1.0 INTRODUCTION

On April 5, 1995, the NRC informed GPU Nuclear Corporation (GPUN) that their self-assessment plan, to perform their own Service Water System Operational Performance Inspection (SWSOPI) at TMI-1 in accordance with NRC Temporary Instruction (TI) 2515/118, "Service Water System Operational Performance Inspection," was acceptable. The licensee's team performed the SWSOPI during April and May 1995, and conducted an exit meeting on May 19, 1995. Due to the significance of several findings, the NRC met with the licensee (GPUN) on May 25, 1995, to better understand the process for resolution of the team findings. On-site activities were monitored by NRC inspectors from Region I. The inspectors observed the scope and depth of the self-assessment including: the team's objectivity and independence, the commitment of personnel to the effort, and management oversight of the activities.

The final SWSOPI report for TMI-1 was completed on July 21, 1995, and the NRC held a meeting on August 24, at which the final results were presented including a determination of evaluations already processed, and planned actions.

2.0 SCOPE

The self-assessment was organized and directed by GPUN corporate engineering; the organization responsible for the conduct of the inspection. The inspection plan was to review the safety-related nuclear service river water (NR) and closed cooling water systems (NS), the decay heat river (DR) and closed cooling water (DC) systems, and the reactor building emergency cooling water (RR) system.

The scope and depth of the SW self-assessment were clearly defined prior to the inspection. Internal licensee guidance contained instructions on how to conduct the inspection, including the assignments for each team member. Tasks were broken down into areas of review that corresponded to TI 2515/118 requirements. These areas were then assigned to specific responsible team members for execution. Inspection preparation also included review of the TMI-1 Probabilistic Risk Assessment Study that showed the nuclear services and closed cooling water systems to be significant contributors to core damage.

The assessment team was able to address all the inspection requirements of TI 2515/118 in detail, to assure themselves of adequate assessment in each defined inspection area (design, operations, maintenance, surveillance & testing, quality assurance, and corrective action). The team was also able to determine GPUN's compliance with the requests of Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment." A checklist of inspection attributes for each of these areas was used to facilitate this comprehensive review. By attending several of the team meetings and reviewing their findings, the NRC inspector verified the team's execution of the inspection requirements of TI 2515/118.

The team originated 89 questions, the majority of which required a technical response. Forty-five observations, the next higher tier of finding importance, resulted from the responses. Of the forty-five observations, nineteen were categorized as concerns, the highest level of finding significance.

3.0 OBJECTIVITY AND INDEPENDENCE

NRC inspectors monitored the inspection and observed the SWSOPI team to evaluate their objectivity and independence in dealing with the GPUN TMI staff. The following paragraphs describe the results of the observations.

- Objectivity: The assessment team included four contractors, one Florida Power Corporation representative and two GPUN personnel under the direction of a corporate GPUN manager. It was evident that the GPUN employees who were on the assessment team identified many findings from an objective point of view. The assessment team findings were discussed in detail at daily review meetings prior to acceptance by the team and the team leader. In all cases observed by the inspectors, the assessment team members maintained objectivity they had agreed to prior to the inspection.

- Independence: The two GPUN employees assigned to the assessment team (one was a manager of startup and from the Oyster Creek staff, and the other a consulting engineer from the TMI on-site safety review staff) were full-time members of the team and were removed from their normal (permanent) assignments. The team leader and team members fully maintained their independence throughout the inspection. The inspector observed professionalism and independence equivalent to an NRC team. The response team was also fully staffed with personnel that were separated from their normal duty assignments. Significant additional response team engineering staff was assigned to resolve assessment team findings. The response team was led by the SW system engineer who was knowledgeable concerning the system design requirements, and who also had been a participant in the Crystal River SWSOPI.

Based on observations of the self-assessment team during the inspection, the daily communications between the team members, and the daily interface of the team leaders with corporate executive management, the inspectors concluded that objectivity and independence was maintained. Independence was further assured through the oversight of the corporate Engineering Director responsible for the inspection conduct.

4.0 INSPECTION FINDING, DOCUMENTATION AND REVIEW

Each of the issues identified by the team required a documented description of the question, observation, or concern. Each of the completed issues also required a documented technical resolution from the response team. At daily assessment team meetings, reviews were made of each new finding and each new

response team resolution. Determinations of closure of the finding were discussed by the team and the final decision for item closure was made by the team leaders with the agreement of the team member who initiated the item. The documentation was continually updated by the team and the permanently assigned administrative secretary.

Operability/reportability determination was a response team activity, backed up by a plant review group (PRG) determination. Each issue was documented; the inspector sampled several of these issues and concluded that operability/reportability considerations were adequate, and in accordance with written procedures. Concerning the operability determinations, the inspectors concluded that the disposition process was initially based on engineering judgement, due to the lack of heat exchanger test data. The NRC discussed this issue with GPUN management on May 25, 1995, the week following the assessment team exit meeting. The licensee's presentation to the NRC on August 24, 1995, appropriately addressed operability issues.

5.0 RESPONSE TEAM ACTIONS

The inspectors observed effective cooperation between GPUN personnel (both site and corporate) and the response team in addressing the 45 observations and concerns raised by the SWSOPI team. Some of the responses and corrective actions enabled prompt closure of many of the assessment team's issues, while others raised further questions and identified a need for calculations and design reviews.

A total of ninety-two action items that resulted from the self-assessment were tabulated in the GPUN licensing action tracking program. Each item was identified with a defined action summary, a cross-reference to the question/observation/concern, the personnel responsible for resolution, a priority status, the assigned licensing action number, and a target completion date. As responses evolve, those requiring corrective actions will also be included in the GPUN corrective actions programs that are administered by the licensee's quality verification organization. Both the licensing action tracking system and the corrective action programs assure appropriate management involvement for achieving satisfactory action responses and corrective actions.

The inspectors also reviewed the final TMI-1 SWSOPI report, dated July 21, 1995. The report was found to be comprehensive, and the inspectors concluded that the licensee's actions taken in response to the self-assessment team's findings were appropriate.

6.0 NRC CONCLUSIONS

The GPUN TMI-1 SWSOPI was a comprehensive and challenging self-assessment of five separate safety-related cooling systems. Ninety-two action items resulted from the inspection, of which twenty-nine were assigned highest priority. At the time of the August 24, 1995, final presentation of the SWSOPI findings and planned corrective measures, the resources expended by GPUN were extensive. The assessment team's early start caused initial catch-up problems for the response team. However, the response team recovered

toward the site inspection conclusion and performed exceptionally well in the preparation and completion of actions during the time period between site team exit and the August 24, 1995, presentation.

GPUN representatives responded to each of the major team findings, and provided bases for system operability, made commitments to perform heat transfer monitoring of heat exchangers, and described further planned actions to address the team findings. A total of ninety-two action items resulting from the inspection, many already completed, were prioritized and scheduled for completion. The presentation also defined the need to update the TMI-1 Generic Letter (GL) 89-13 response.

The NRC inspectors evaluated the team findings during the inspection, and selected several they considered significant for further NRC review. The more significant findings were as follows:

1. The SWSOPI team could not verify that the systems were fully capable of performing their function, nor could thermal hydraulic capability be confirmed due to lack of performance testing and incomplete (at the time) calculations. This was a major concern of the inspectors that was initially qualitatively addressed by the licensee's PRG. System hydraulics were later modelled and reassessed to confirm system capability, as presented during the August 24, 1995, meeting. The inspectors concluded that the licensee's actions appropriately addressed this finding.

2. The GPUN practice had previously been to open and clean the nuclear closed cooling and decay heat exchangers. There was no thermal performance monitoring (viz. testing) and, because of prior use of a hydrocarbon corrosion inhibitor (NALCO), heat transfer capability was in question. The licensee was considering development of a shell-side surveillance program and options for performance monitoring. At the August 24, 1995 meeting, they confirmed that a performance monitoring program would be implemented in conjunction with the open-and-inspect program. The inspectors concluded that performance monitoring, combined with the open-and-inspect program provides a better balance for verifying and validating heat exchanger performance.

3. Minimum flows had not been verified under all operating conditions, which pointed to the need to strengthen the link between the design-basis and facility operations. There were various assessment team concerns where analytical design-basis assumptions or calculations did not address acceptance criteria for performance tests. Additional hydraulic calculations for flow balance considerations with reduced flow operation and determination of net positive suction head (NPSH) were recommended by the team. GPUN reassessment of the SWS design was completed (i.e., the models), but verifications and validation via testing and final calculation remains to be done. The inspectors concluded that the licensee had satisfactorily addressed the team's findings and that, in the longer term, the validation of models would provide further assurance that all configurations in operating modes of the SWS were analyzed.

4. There has been evidence of silting and fouling in the TMI-1 nuclear services heat exchangers, but only inspect/clean practices had been employed with no technical acceptance criteria. There also has been evidence of microbiologically induced corrosion (MIC); however, a program for corrective actions in this area was found by the team to be untimely. GPUN subsequently characterized the MIC program as an ongoing activity that will receive additional attention.

7.0 GPUN PRESENTATION OF SELF-ASSESSMENT RESULTS AND PLAN OF ACTION

On August 24, 1995, GPUN staff presented the SWSOPI results and plan of action. The presentation also described issues of macro-fouling degradation due to NALCO, and single pump operation of the NS system which required a PRG determination that the equipment and systems were operable. System hydraulics were modelled and reassessed for pump runout, pump runout and suction head, and degraded system conditions. The NR/NS systems in the normal operating mode were found to be capable of removing the smaller heat loads during emergency operations. Additional presentations also showed that the decay heat removal systems can perform their normal plant cooldown functions, and that the current environmental qualification (EQ) analysis was conservative. Each of the issues identified as NRC significant items were appropriately addressed in the GPUN August 24, 1995 presentation.

Concerning heat exchanger monitoring, a program for performance monitoring of the nuclear service decay heat exchangers and containment building ventilation system chillers is intended to be implemented during refueling outage 11R and Cycle 11. Heat transfer factor determinations will be made during cooler river water temperatures in order to obtain a more reliable baseline.

The MIC program was also discussed during the presentation and several action items were explained. The action of documenting a remediation plan is complete and a technical data report was issued. The action to establish the mitigating technical data report plan (the how and when of taking samples, and what biocides to use) is scheduled for completion by the end of 1995.

8.0 MANAGEMENT MEETINGS

The inspector met several times with licensee management during the conduct of the self-assessment to provide feedback on the quality of the assessment team's effort and to discuss the potential safety significance of the team's findings. Members of the NRC staff also met with licensee management on May 25, 1995, to discuss the more substantive findings, and the proposed methods to address them. An NRC management meeting with GPUN was held at the TMI Training Center on August 24, 1995, at which time GPUN presented the SWSOPI Team findings and their corrective action plans. The slides from the licensee's presentation at the August 24th meeting and a listing of those in attendance at the meeting are attached to this report.

Attachments:
1. TMI August 24, 1995, SWSOPI Presentation to NRC
2. List of Attendees

ATTACHMENT

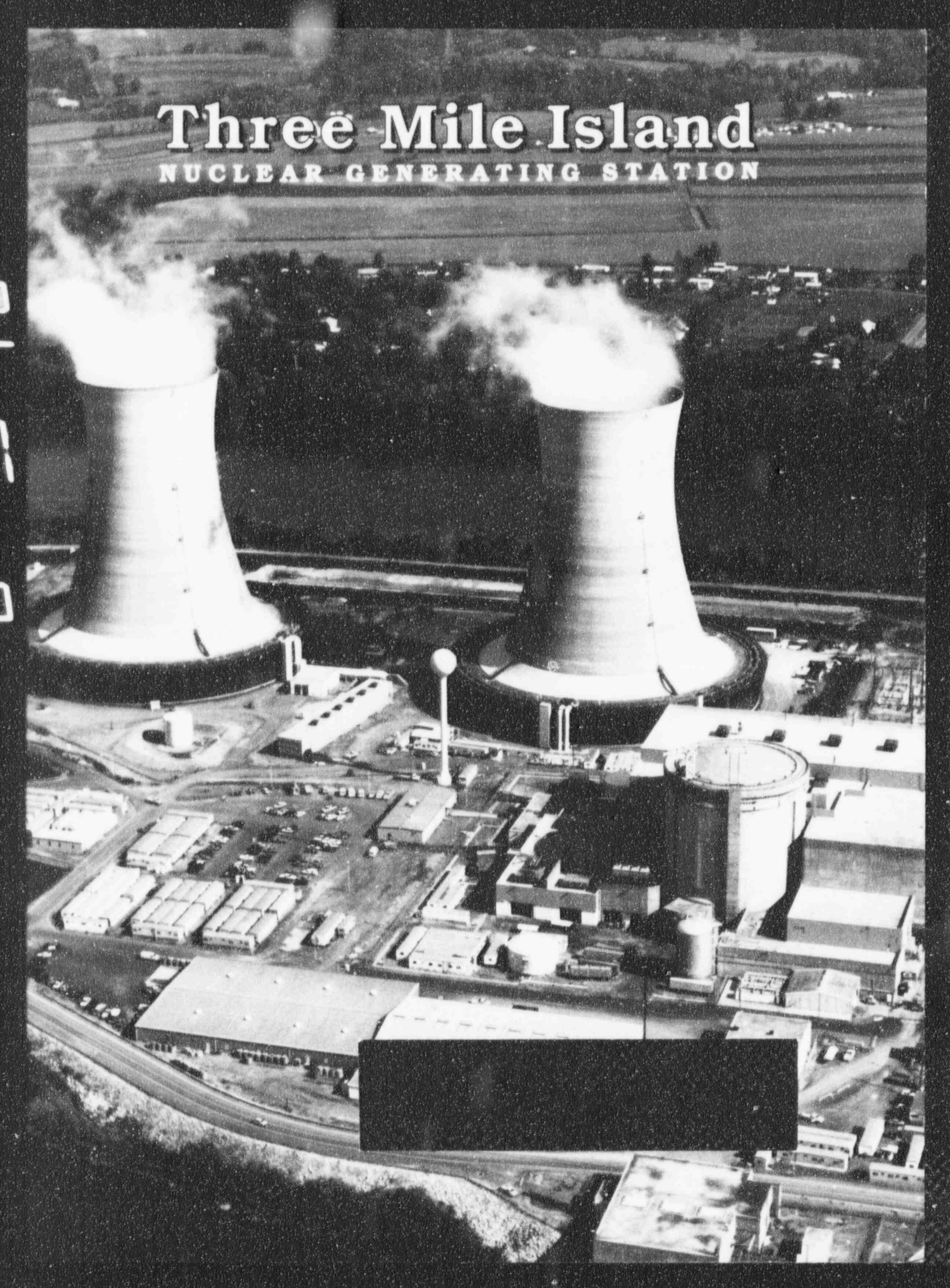
Attendees at TMI-1 Service Water System Operation Performance Inspection (SWSOPI) self-assessment presentation to the NRC on August 24, 1995.

GPU Nuclear Corporation

T. Dempsey	Technical Functions
D. Distel	GPUN Licensing
L. Hixon	Communications
J. Knubel	Vice President - Plant Engineering
J. Link	Technical Functions
J. Logatto	Technical Functions
S. Maingi	PA BRP
D. Masiero	Technical Functions
R. McGoey	Technical Functions, Engineering & Design
A. Miller	Licensing
F. Paulewicz	Technical Functions
V. Sacco	Technical Functions
G. Skillman	Technical Functions
P. Walsh	Plant Engineering
J. Wetmore	Licensing
S. Wilkerson	Technical Functions

U.S. Nuclear Regulatory Commission

J. Durr	Chief, Projects Branch 4, Division of Reactor Projects
M. Evans	Sr. Resident Inspector - TMI
H. Gregg	Sr. Reactor Engineer, DRS
R. Hernan	Project Manager, NRR
E. Kelly	Chief, Systems Section, Division of Reactor Safety


Three Mile Island
NUCLEAR GENERATING STATION

THREE MILE ISLAND UNIT 1 NUCLEAR GENERATING STATION
Londonderry Township, Pennsylvania

Three Mile Island Unit 1 is a pressurized water reactor (PWR). It produces over 800 net megawatts of electricity, enough to supply approximately 500,000 homes. The plant is located in Londonderry Township, Dauphin County, about 10 miles south of Harrisburg, Pennsylvania.

Construction of the plant began in 1968. TMI-1 was placed in commercial operation in September 1974. The plant has a Babcock and Wilcox nuclear steam supply system. The one-million horsepower turbine-generator was supplied by General Electric, the architect-engineer was Gilbert Associates and the construction was performed by United Engineers and Construction.

TMI-1 operated from 1974 to 1979 at a capacity factor of 77 percent. TMI-1 was shutdown from 1979 to October 1985 while undergoing hearings and changes in response to the TMI-2 accident.

Three Mile Island Units 1 and 2 are owned by three subsidiaries of the General Public Utilities System. Metropolitan Edison Company owns 50 percent, and Pennsylvania Electric Company and Jersey Central Power and Light Company each own 25 percent. The plant is operated by GPU Nuclear Corporation — another subsidiary of General Public Utilities Corporation. GPU Nuclear Corporation also is the licensed operator of TMI-2 and the Oyster Creek Nuclear Generating Station in Forked River, New Jersey. GPU Nuclear's headquarters are in Parsippany, New Jersey.

There are more than 900 people in GPU Nuclear devoted to TMI-1 activities — including 700 located full-time at TMI-1.

The plant's fuel core contains 177 fuel assemblies with a total of 90 tons of uranium. The plant consumes about eight pounds of uranium a day during full power operation. About one-third of the core is replaced during refueling outages.

TMI-1 SERVICE WATER SYSTEM OPERATIONAL PERFORMANCE INSPECTION SELF-ASSESSMENT RESULTS AND PLAN OF ACTION

AUGUST 24, 1995

TMI-1
SERVICE WATER SYSTEM
OPERATIONAL PERFORMANCE
INSPECTION

(SWSOPI)

SELF-ASSESSMENT
RESULTS AND PLAN OF ACTION

AUGUST 24, 1995

AGENDA

I.	INTRODUCTION	P. WALSH
II.	OVERVIEW/BACKGROUND	R. McGOEY
III.	ASSESSMENT TEAM	T. DEMPSEY
IV.	RESPONSE TEAM	G. SKILLMAN
V.	MAJOR OBSERVATION AREAS	D. MASIERO
VI.	SYSTEM PERFORMANCE EVALUATIONS	J. LOGATTO/J. LINK
VII.	CONCLUSION	P. WALSH

OVERVIEW/BACKGROUND

- SWSOPI FIFTH TECHNICAL SELF-ASSESSMENT SINCE 1989
- DELAYED TO 1995 UNTIL DBDs WERE PREPARED
- DEVELOPED A PLAN WHICH FOLLOWED THE NRC TEMPORARY INSTRUCTION
- FORMED A LARGE, DIVERSE ASSESSMENT TEAM
- CONDUCTED A FIVE WEEK INSPECTION
- RESPONSE TEAM AND SUPPORT PERSONNEL EXPENDED 5,500 MAN-HOURS DURING INSPECTION
- DEVELOPED FOUR PRONG RESPONSE
  - PLAN OF ACTION
  - PERFORMANCE TEAM
  - PROJECT TEAM
  - INTEGRATED TRACKING/CLOSEOUT
- SIGNIFICANT PROGRESS HAS BEEN MADE EXPENDING AN ADDITIONAL 4500 MAN-HOURS

ASSESSMENT TEAM

TEAM:

- GPUN TEAM LEADER WITH CONTRACT CO - TEAM LEADER
- INSPECTORS:
  - 3 CONTRACTORS
  - 2 GPUN EMPLOYEES
  - 1 FPC EMPLOYEE
- 3 SUPPORT PERSONNEL FOR ADMIN., TECHNICAL AND LICENSING.

SCOPE: TI 2515/118 IN AREAS OF DESIGN, OPS, MAINT., SURVEILLANCE & TESTING AND QA/CORRECTIVE ACTION PER GPUN ASSESSMENT PLAN APPROVED BY NRC

RESULTS:

- COMPLETED ASSESSMENT PER THE APPROVED PLAN.
- 86 QUESTIONS AND 43 OBSERVATIONS/CONCERNS ISSUED.
- EXECUTIVE SUMMARY PRESENTED AT ASSESSMENT EXIT MEETING.
- FINAL REPORT ISSUED (7/26/95).

DESIGN

POSITIVE ATTRIBUTES:

- BASIC DESIGN OF THE SWS IS CONSERVATIVE.
- RECOGNITION BY ENGINEERING STAFF OF NEED FOR DESIGN BASIS FOR IST LIMITS.

OBSERVATIONS/CONCERNS:

- ANALYTICAL BASIS DOES NOT ADDRESS THE ACCEPTANCE CRITERIA FOR PERFORMANCE TESTS OR OPERATING CONDITIONS IN ALL CASES.
- ABILITY TO PRECLUDE RUNOUT IN THE NR/NS SYSTEMS COULD NOT BE VERIFIED SINCE CALCULATIONS DO NOT ACCOUNT FOR WORST CASE RUNOUT CONFIGURATIONS.
- ABILITY TO MAINTAIN NECESSARY PUMP SUCTION CONDITIONS FOR SINGLE NS PUMP OPERATION COULD NOT BE VERIFIED.
- BASIS FOR NOT PERFORMING SINGLE FAILURE ANALYSIS FOR THE NR AND NS SYSTEMS WAS NOT ADEQUATE.

DESIGN (CONTINUED)

- JUSTIFICATION FOR NOT PERFORMING THERMAL PERFORMANCE TESTING AND BASIS FOR THE ALTERNATE OPEN/INSPECT PROGRAM WAS NOT ADEQUATELY DOCUMENTED.

- NALCO NOT ADDRESSED FOR ITS EFFECTS ON HEAT TRANSFER.

- CONTROL BUILDING CHILLED WATER SYSTEM WAS NOT INCLUDED IN THE GL 89-13 PROGRAM.

- DBA FLOW DISTRIBUTION TO ENSURE SUFFICIENT COOLING OF INDIVIDUAL COMPONENTS COULD NOT BE VERIFIED.

OPERATIONS

POSITIVE ATTRIBUTES:

- OPERATORS HAD THOROUGH KNOWLEDGE OF SWS NORMAL AND EMERGENCY CONDITIONS.
- OVERALL OPERATION OF THE SWS WAS ADEQUATE.
- PROGRAM FOR CONTROLLING ASIATIC CLAMS APPEARS TO PREVENT THE GROWTH OF CLAMS WITHIN THE SYSTEMS.

OBSERVATIONS/CONCERNS:

- PROCEDURES DO NOT PROVIDE GUIDANCE FOR ALL POTENTIAL CONDITIONS.
- PROCEDURES DO NOT PROVIDE GUIDANCE TO THE OPERATORS FOR THROTTLE VALVE CONTROL FOR THE NR AND NS SYSTEMS.

MAINTENANCE

POSITIVE ATTRIBUTES:

- NO REPEAT WORK REQUIRED.
- MAINTENANCE PRACTICES ADEQUATE.
- MATERIAL CONDITION FOR THE SWS AND STRUCTURES WAS ACCEPTABLE.

OBSERVATIONS/CONCERNS:

- SEVERAL INFREQUENTLY USED LINES ARE NOT PART OF A PM PROGRAM FOR FLUSHING & FLOW TESTING.
- SWS HX INSPECTION PROCEDURES DO NOT CONTAIN ACCEPTANCE CRITERIA FOR AMOUNT OF SILTING AND FOULING.
- TECHNICAL JUSTIFICATION FOR THE FREQUENCY OF HX BACKWASHING, INSPECTING AND CLEANING WAS NOT ADEQUATE.
- INSTALLED INSTRUMENTATION NOT ADEQUATE FOR MEANINGFUL TRENDING OF PERFORMANCE.
- HEAT REMOVAL CAPABILITY OF THE NR/NS AND DR/DC HXs COULD NOT BE VERIFIED BECAUSE OF POTENTIAL PROBLEMS WITH NALCO AND BLOCKAGE.

SURVEILLANCE AND TESTING

POSITIVE ATTRIBUTES:

- TRENDING OF IST DATA IS PROACTIVE.
- STAFF RESPONSIBLE FOR IST IS VERY KNOWLEDGEABLE.
- MONITORING ASIATIC CLAMS AND ZEBRA MUSSELS IS PROACTIVE.
- GENERAL HIGH DEGREE OF CLEANLINESS EXISTS FOR THE AIR-SIDE (OUTSIDE) OF THE REACTOR BUILDING EMERGENCY COOLER TUBES.

OBSERVATIONS/CONCERNS:

- CONDITION OF THE REACTOR BUILDING EMERGENCY COOLER (RBEC) TUBES, INTERNAL SURFACES, IS INDETERMINATE WITH REGARD TO HEAT TRANSFER DUE TO LACK OF INSPECTION.
- THE ABILITY OF THE RBEC HOUSINGS TO WITHSTAND AN ACCIDENT PRESSURE TRANSIENT COULD NOT BE VERIFIED BECAUSE THE RELIEF PANELS WERE NOT INCLUDED IN A MAINTENANCE PROGRAM.

QA AND CORRECTIVE ACTION

POSITIVE ATTRIBUTES:

- SYSTEMS AUDITS IN RESPONSE TO ACTION V OF GL 89-13 WERE COMPREHENSIVE.
- ACTIONS TO ADDRESS DAY-TO-DAY OPERATIONAL PROBLEMS WERE TIMELY AND EFFECTIVE.

OBSERVATIONS/CONCERNS:

- IN LONGER-TERM ISSUES SOME EXAMPLES FOUND WHERE CORRECTIVE ACTIONS WERE MISSING OR NOT FULLY EFFECTIVE IN RESPONSE TO SELF-IDENTIFIED CONDITIONS.
- DEVELOPMENT AND IMPLEMENTATION OF A PROGRAM TO ADDRESS MIC IS CONSIDERED UNTIMELY BY THE ASSESSMENT TEAM.

RESPONSE TEAM

- DEDICATED FULL TIME LEADER - ENSURES POTENTIAL OPERABILITY ISSUES ARE ADDRESSED, FACILITATE RESOLUTION OF FINDINGS, ENSURES PROPER STAFFING OF RESPONSE TEAM, AND COMMUNICATES ISSUES TO PLANT MANAGEMENT.

- DEDICATED POINT CONTACT IN EACH AREA OF REVIEW PROVIDES ONE ON ONE ASSIGNMENT OF RESPONSE TEAM MEMBER TO INSPECTOR.

- ADDITIONAL STAFF IDENTIFIED FOR SUPPORT IN EACH AREA.

- INCLUDES SUPPORT FROM ORIGINAL A/E.

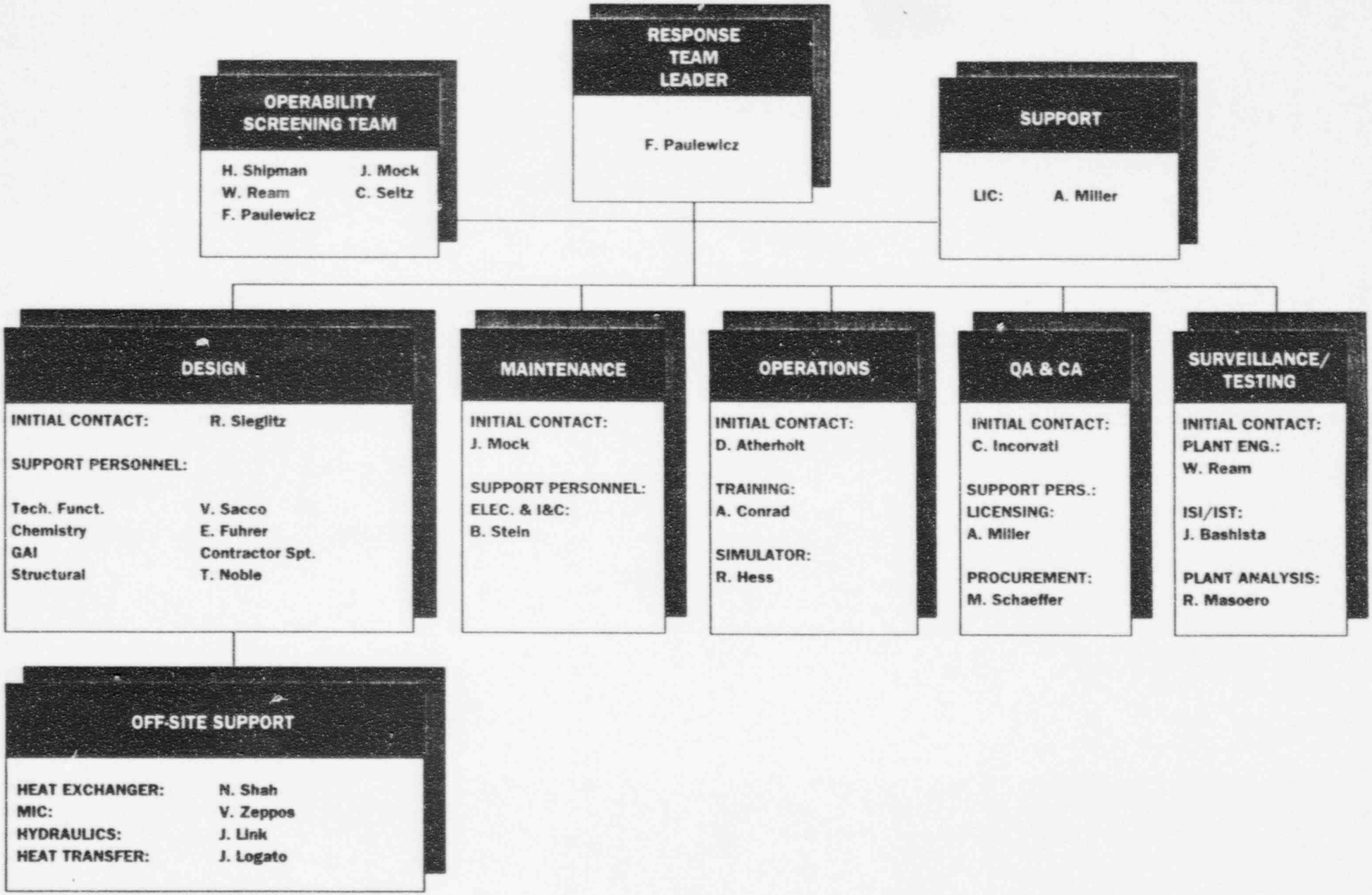
- ASSESSMENT TEAM REQUESTS GIVEN FULL-TIME ATTENTION AS THEY ARE IDENTIFIED.

- RESPONDS TO ASSESSMENT TEAM REQUESTS FOR INFORMATION/WALKDOWNS/INSPECTIONS.

- REVIEWS AND ENTERS RESPONSES IN ASSESSMENT TEAM DATABASE.

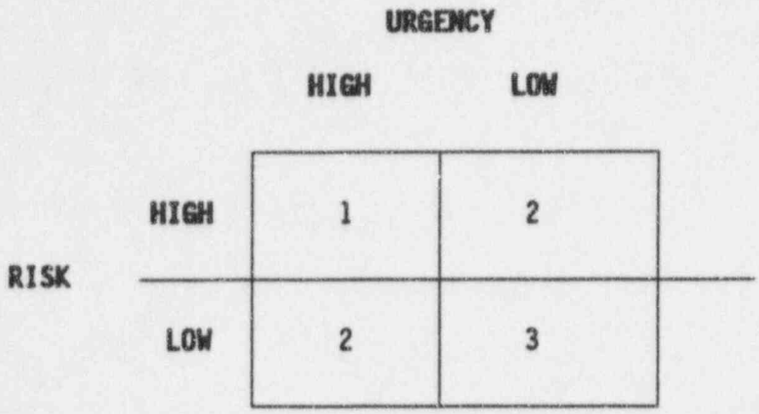
- UNRESOLVED OPEN ITEMS TO BE TRACKED VIA LICENSING INFORMATION TRACKING SYSTEM (LITS).

TMI-1 SWSOPI SELF-ASSESSMENT
RESPONSE TEAM ORGANIZATION



RESPONSE (CONTINUED)

- THE RESPONSE TEAM EVALUATED THE INITIAL 96 ITEMS IN ACCORDANCE WITH THE FOLLOWING MATRIX:



THE 96 ITEMS WERE "BINNED" AS PRIORITY 1, 2 OR 3 BASED ON THE RESPONSE TEAM'S SUBJECTIVE EVALUATION OF THEIR ATTRIBUTES INDICATED ABOVE.

RESPONSE (CONTINUED)

THE "BINNING" RESULTED IN THE FOLLOWING:

PRIORITY 1	28
PRIORITY 2	34
PRIORITY 3	34

- ALL ACTION ITEMS WERE CAPTURED IN THE DATABASE.

- THE MAJOR OPERABILITY ISSUES WERE EVALUATED THROUGH TMI-1's PRG PROCESS ON 5/16/95. THESE ITEMS ARE:

  MACRO FOULING
  DEGRADATION DUE TO NALCO
  SINGLE PUMP OPERATION OF NSCCW

  THE PRG ADDRESSED THESE ISSUES AND FOUND THE HEAT EXCHANGERS, AND ATTENDANT SYSTEMS, OPERABLE.

- ONGOING RESOLUTION EFFORTS HAVE CONFIRMED AND FURTHER SUPPORTED INITIAL OPERABILITY DETERMINATIONS.

- RESOLUTION EFFORT WILL CONTINUE TO ADDRESS OPERABILITY ISSUES WHERE APPROPRIATE.

RESPONSE (CONTINUED)

- THE EVALUATION AND EFFORT BY THE RESPONSE TEAM CAUSED SOME SHUFFLING OF ITEMS. AT PRESENT, THE OPEN ITEM STATUS IS:

	TOTAL ITEMS	ITEMS COMPLETE	FINAL COMPLETION
PRIORITY 1	29	15 (4P)	1ST QTR. '96
PRIORITY 2	44	4 (2P)	1ST QTR. '96
PRIORITY 3	36	14 (3P)	4TH QTR. '97

- APPROACH FROM HERE

  1) CONTINUE TO WORK PRIORITY 1 ITEMS TO COMPLETION.

  2) PROCESS IS THROUGH SYSTEM PERFORMANCE TEAM COMPRISED OF:
     - OPERATIONS
     - MAINTENANCE
     - PLANT ENGINEERING
     - TECHNICAL FUNCTIONS

  3) INCLUDES CLOSEOUT ACCEPTANCE REVIEW BY TECHNICAL FUNCTIONS & LICENSING.

- DUE DATES AND INDIVIDUAL ITEM RESPONSIBILITY ASSIGNED FOR EACH ITEM.

- ITEMS BEING TRACKED ON PLAN-OF-DAY AGENDA FOR CLOSE OUT.

MAJOR OBSERVATION AREAS

- SIGNIFICANT OBSERVATIONS FALL INTO THREE CATEGORIES:

  A. GENERIC LETTER 89-13 ISSUES

  B. HEAT EXCHANGER PERFORMANCE

  C. SYSTEM DESIGN

TMI-1
SERVICE WATER SELF-ASSESSMENT OBSERVATIONS

A. - GENERIC LETTER 89-13 ISSUES

- ACTION IV REEVALUATION
  SINGLE ACTIVE FAILURE REVIEW/UPDATE
  - NR/NS PRELIMINARY REVIEW COMPLETED
  - CHILLED WATER TO BE PERFORMED BY END OF 1995
  - DR/DC/RR ORIGINALLY PERFORMED IN 1991 TO BE REVIEWED/UPDATED BY END OF 1995

- INFREQUENTLY USED LINES/DEADLEGS
  INSPECTION/TEST PLAN
  - ACTION PLAN DEVELOPED FOR LINES IDENTIFIED DURING ASSESSMENT
  - DEVELOP PLAN FOR BALANCE OF 89-13 SYSTEMS BY END OF 1995

- CHILLED WATER SYSTEM
  - WILL BE INCLUDED IN 89-13 PROGRAM

- UPDATE RESPONSE TO GL 89-13
  PERFORMANCE TRENDING/INSPECTION
  - SUBMITTAL SCHEDULED FOR FIRST QUARTER 1996

TMI-1
SERVICE WATER SELF-ASSESSMENT OBSERVATIONS

B. - HEAT EXCHANGER PERFORMANCE

- FINDINGS FOCUSED ON ABILITY TO ADDRESS ISSUES OF TUBE/SHELL SIDE CONDITIONS AND CAPABILITY TO VERIFY PERFORMANCE

  - PERFORMANCE MONITORING PROGRAM TO BE IMPLEMENTED FOR NUC SERVICE, DECAY HEAT SERVICE HXS AND CBVS CHILLER

    DC - DURING 11R (1 TRAIN)
    NS - DURING CYCLE 11
    CBVS CHILLERS - DURING CYCLE 11

  - ADEQUATE INSTRUMENTATION WILL BE UTILIZED AND VERIFIED FOR ACCURACY AND REPEATABILITY
  - VIABILITY IN RR/RBEC SYSTEM UNDER EVALUATION - COMPLETION SCHEDULED FOR END OF 1995
  - CORRELATION WITH DESIGN BASIS

TMI-1
SERVICE WATER SELF-ASSESSMENT OBSERVATIONS (CONTINUED)

- OPEN AND INSPECT PROGRAM ENHANCEMENTS
  - ACCEPTANCE CRITERIA
  - SURVEILLANCE INTERVAL BASIS
  - BACKWASHING AFTER INSPECTION

- PERFORMANCE MONITORING IN CONJUNCTION WITH OPEN AND INSPECT WILL PROVIDE THE DATA NECESSARY TO DEMONSTRATE THAT THE HEAT EXCHANGERS CAN PERFORM THEIR REQUIRED FUNCTIONS

TMI-1

SERVICE WATER SELF-ASSESSMENT OBSERVATIONS

C. - SYSTEM DESIGN

- SYSTEM HYDRAULICS (NR/NS)
  MODEL DEVELOPMENT - SYSTEMS FULLY MODELED
  - PUMP RUNOUT
  - PUMP NPSH
  - FLOW BALANCE (2 VS 1 PUMP)
  - SURGE TANK PRESSURE LOSS
  - DEGRADED CONDITIONS
  - CORRELATION WITH PLANT DATA

  CONFIRMED SYSTEMS MEET DESIGN BASES AND ARE CAPABLE OF PERFORMING THEIR SAFETY FUNCTION

- SYSTEM HYDRAULICS (DC/RR)
  - SYSTEM MODELS UNDER DEVELOPMENT
  - INITIAL ASSESSMENT INDICATES SYSTEMS WITHIN DESIGN BASES AND ARE CAPABLE OF PERFORMING THEIR SAFETY FUNCTION

- EVALUATION OF RR-V-6 BACK PRESSURE REQ.

- PROCEDURAL REVIEW AND UPDATE

- DESIGN BASIS DOCUMENT UPDATE

TMI-1
NR/NS SYSTEM EVALUATION

OBJECTIVE

TO DEMONSTRATE THAT THE EXISTING SYSTEMS ARE CAPABLE OF PERFORMING THEIR DESIGN FUNCTION.

SYSTEM DESIGN FUNCTION

REMOVE HEAT FROM OPERATING EQUIPMENT (SAFETY-RELATED AND NON SAFETY-RELATED) AND DISCHARGE THIS HEAT TO THE ULTIMATE HEAT SINK.

CONCEPT

IF THE SYSTEM IN THE NORMAL SYSTEM CONFIGURATION IS SUCCESSFUL IN REMOVING HEAT LOAD, THEN IT WILL ALSO BE CAPABLE OF REMOVING THE SMALLER HEAT LOAD (WITH ONLY 2 COOLERS) DURING AN EMERGENCY.

INDICATION OF SUCCESS IS SATISFACTORY COOLING OF ALL COMPONENTS SERVED BY NSCCW.

TMI-1
NR/NS SYSTEM EVALUATION

NR/NS SYSTEMS

- NORMALLY OPERATING SYSTEM

- NORMAL HEAT LOADS GREATER THAN EMERGENCY LOADS

- NORMAL SYSTEM CONFIGURATION
  2 NR PUMPS/ 2 NS PUMPS/2-3 COOLERS

- EMERGENCY CONFIGURATION
  1 NR PUMP/1 NS PUMP/2-3 COOLERS

OPERATOR ACTIONS ARE TAKEN AS NECESSARY TO ISOLATE NON-ESSENTIAL LOADS AND TO VALVE IN/OUT THIRD COOLER.

MODE	HEAT REMOVAL REQUIREMENTS
REACTOR INSPECTION	54.24×10^6 BTU/HR (DESIGN)
NORMAL OPERATION	34.59×10^6 BTU/HR
EMERGENCY OPERATION	13.34×10^6 BTU/HR

TMI-1
NR/NS SYSTEM EVALUATION

CONCLUSION

- EMERGENCY CONDITION IS ENVELOPED BY NORMAL OPERATION

- EMERGENCY HEAT LOAD IS LESS THAN NORMAL OPERATING LOADS

- NR/NS IS CURRENTLY PERFORMING ITS DESIGN FUNCTION AS INDICATED BY OPERATION WITHOUT HIGH TEMPERATURE ALARMS

- OUTLET TEMPERATURE HIGH ALARM WILL PROVIDE INDICATION THAT HEAT TRANS PERFORMANCE IS DEGRADED BEFORE MINIMUM CAPABILITY IS REACHED

NR/NS SYSTEM EVALUATION

HEAT TRANSFER CAPABILITY

Heat Loads per SDBD-T1-531 Table 1

MODE	REQUIRED HEAT TRANSFER (MBTU/HR)	NS PUMPS IN SERVICE	NR PUMPS IN SERVICE	HXs IN SERVICE	MINIMUM HEAT TRANSFER CAPACITY AVAILABLE* @ RIVER WATER TEMPERATURE		
					85°F	92°F	95°F
FULL POWER	11.53 per HX 34.59 Total	2	2	3	11.6 @ 44% UD (34.81Total)	11.71 @ 70% UD (35.13 Total)	11.63 @ 92% UD (34.89 Total)
EMERGENCY	6.67 per HX 13.34 Total	1	1	2	8.35 @ 44% UD (16.7 Total)	7.86 @ 70% UD (15.71 Total)	7.4 @ 92% UD (14.8 Total)
EMERGENCY	4.5 per HX 13.34 Total	1	1	3	6.29 @ 44% UD (18.86 Total)	5.8 @ 70% UD (17.4 Total)	5.45 @ 92% UD (16.35 Total)

* NSCCW Outlet Temperature (T-Hout) alarms at 100°F.
This setpoint will be reached at a point above the minimum cleanliness values given above.

**U Design = 215 BTU/HR-°F-Ft² per YUBA Spec Sheet (~ 40% U Clean)

NR/NS SYSTEM EVALUATION

HEAT TRANSFER CAPABILITY

DBD Loads w/ 1 Evaporator Shut Down

MODE	REQUIRED HEAT TRANSFER (MBTU/HR)	NS PUMPS IN SERVICE	NR PUMPS IN SERVICE	HXs IN SERVICE	MINIMUM HEAT TRANSFER CAPACITY AVAILABLE* @ RIVER WATER TEMPERATURE		
					85°F	92°F	95°F
FULL POWER	9.03 per HX 27.09 Total	2	2	3	9.24 @ 32% UD (27.72 Total)	9.88 @ 53% UD (29.64 Total)	10.44 @ 75% UD (31.32 Total)
EMERGENCY	6.67 per HX 13.34 Total	1	1	2	6.69 @ 32% UD (13.38 Total)	6.68 @ 53% UD (13.35 Total)	6.71 @ 75% UD (13.42 Total)
EMERGENCY	4.5 per HX 13.34 Total	1	1	3	5.07 @ 32% UD (15.21 Total)	5.0 @ 53% UD (15.0 Total)	4.96 @ 75% UD (14.87 Total)

* NSCCW Outlet Temperature (T-Hout) alarms at 100°F.
This setpoint will be reached at a point above the minimum cleanliness values given above.

**U Design = 215 BTU/HR-°F-Ft² per YUBA Spec Sheet (~ 40% U Clean)

TMI-1
DH/DC/DR & RR SYSTEMS EVALUATION

OBJECTIVE:

To demonstrate that the existing systems are capable of performing their design functions.

DECAY HEAT REMOVAL:

Plant Cooldown

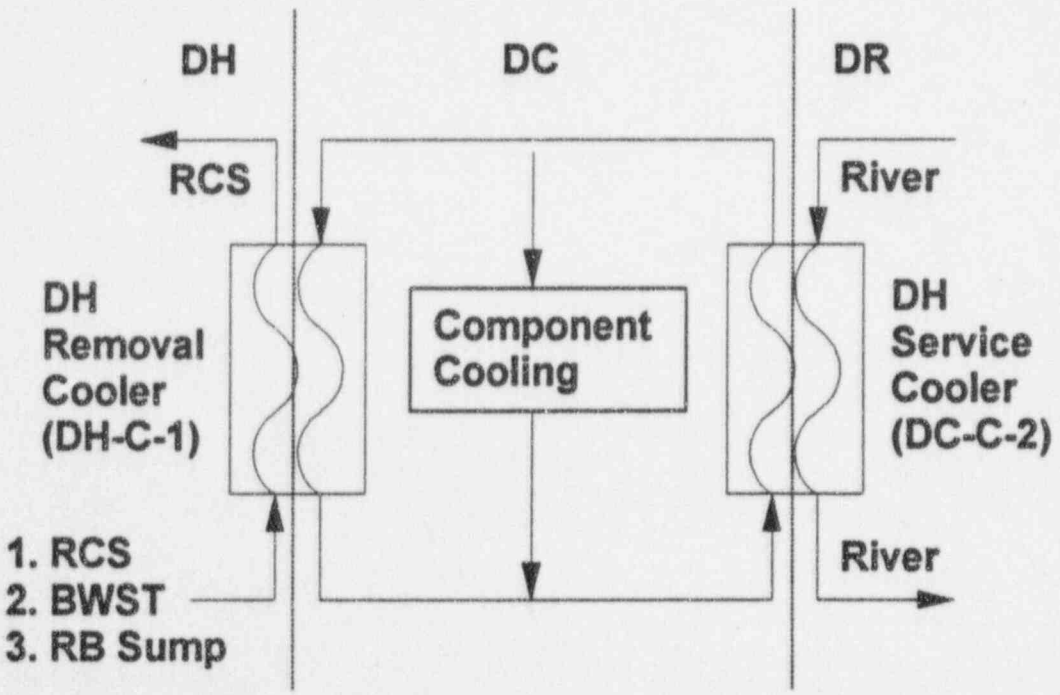
No Tech Spec Requirements (Operational Only)

Component Cooling

DC-P-1, DH-P-1, MU-P-1, BS-P-1

Accident Heat Removal

Core & RB (Conjunction with Fan Coolers)



TMI-1
DH/DC/DR & RR SYSTEMS EVALUATION

REACTOR BUILDING EMERGENCY COOLING WATER:

Normal Containment Cooling
- Alternate Set of Cooling Coils in Air Flow Path

RB Accident Heat Removal
- Loss of Coolant Accident (including HPI Cooling)
  - Alone Prior to Recirculation
  - Conjunction with DHR During Recirculation
- Main Steam Line Break
- Feedwater Line Break

DESIGN:

DH Removal Cooler:	30 MBTU/hr
DH Service Cooler:	135 MBTU/hr
RB Fan Cooler:	80 MBTU/hr

AFFECT OF DEGRADATION:

Normal Plant Cooldown
- Longer Time to Final Temperature

Component Cooling
- Higher Temperature to Cooled Components

Accident Heat Removal
- No impact on Peak RB Pressure & Temperature
- Higher Long-term RB Pressure & Temperature
- Longer to Restore RB Pre-Accident Conditions

TMI-1
DH/DC/DR & RR SYSTEMS EVALUATION

NORMAL PLANT COOLDOWN:

DHR Energy Removal depends on RCS and river water temperatures, flow rates, plugging and fouling.

Cold Shutdown is declared when RCS temperature reaches 200˚F. At 200˚F and heat exchanger degradation from design to 50% U:

It would take 2.5 - 10 hours to match decay heat with 75˚F river water.

It would take 5.5 - 20 hours to match decay heat with 95˚F river water.

The time to reach Cold Shutdown could be longer.

No degradation in the time to reach Cold Shutdown has been observed in the last three Refueling Outages.

CONCLUSION:

Decay heat removal systems can perform their design function of normal plant cooldown.

TMI-1
DH/DC/DR & RR SYSTEMS EVALUATION

COMPONENT COOLING:

The Worst Case configuration is a relatively clean Decay Heat Removal Cooler and a significantly degraded Decay Heat Service Cooler.

With 95F river water, the design loads, the Decay Heat Removal Cooler design U, 50% Decay Heat Service Cooler U:

DHR Inlet (F)	Component Supply (F)
240	114
250	115
260	116

Components will operate with much higher cooling water temperatures.

CONCLUSION:

Decay heat removal systems can perform their design function of component cooling.

TMI-1
DH/DC/DR & RR SYSTEMS EVALUATION

ACCIDENT HEAT REMOVAL:

No credit is taken for energy removal through the DHR system for LOCA analyses.

Original Design Requirement:

Prevent containment pressure from exceeding RB design pressure.

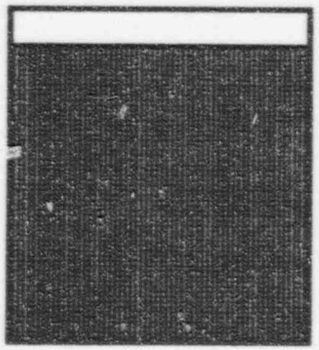
Subsequent Design Requirement:

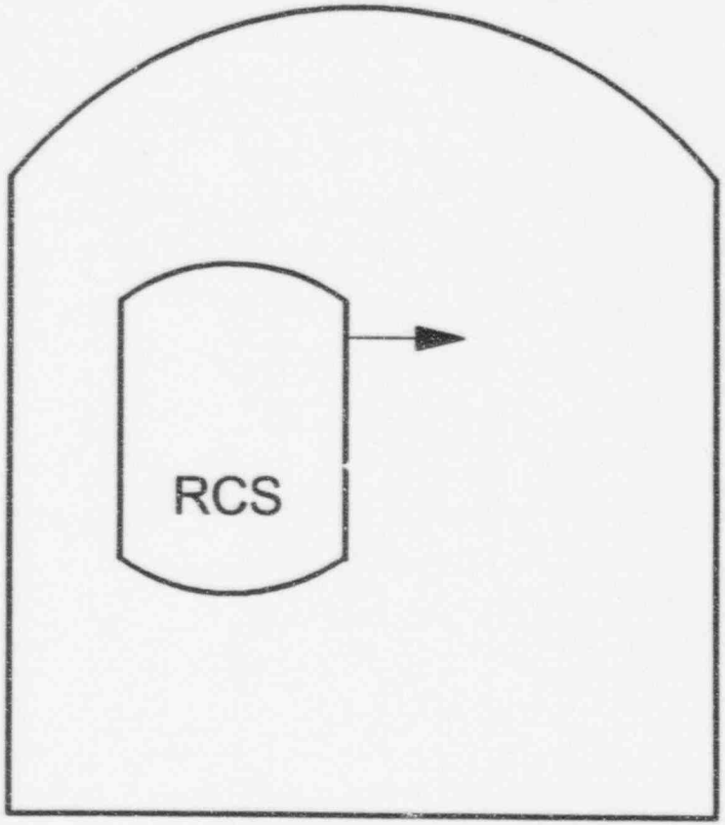
Environmental Qualification of Equipment

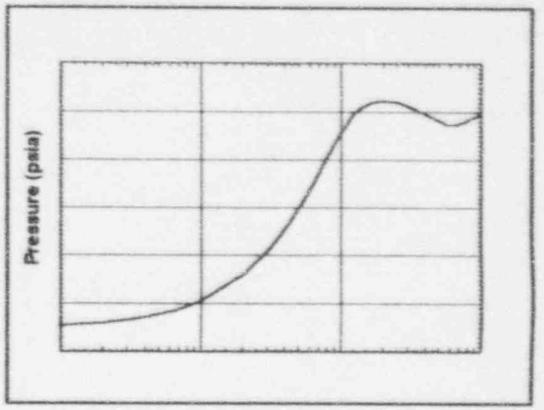
Containment cooling requirements are bounded by the LBLOCA, requiring RB spray, DHR Coolers and RB Fan Coolers.

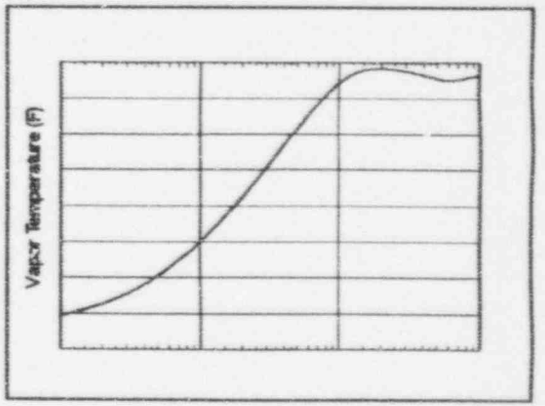
SYSTEM LINEUP DURING BLOWDOWN

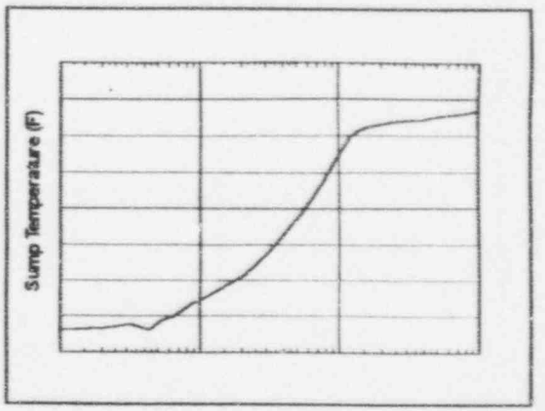
Prior to ECCS Response



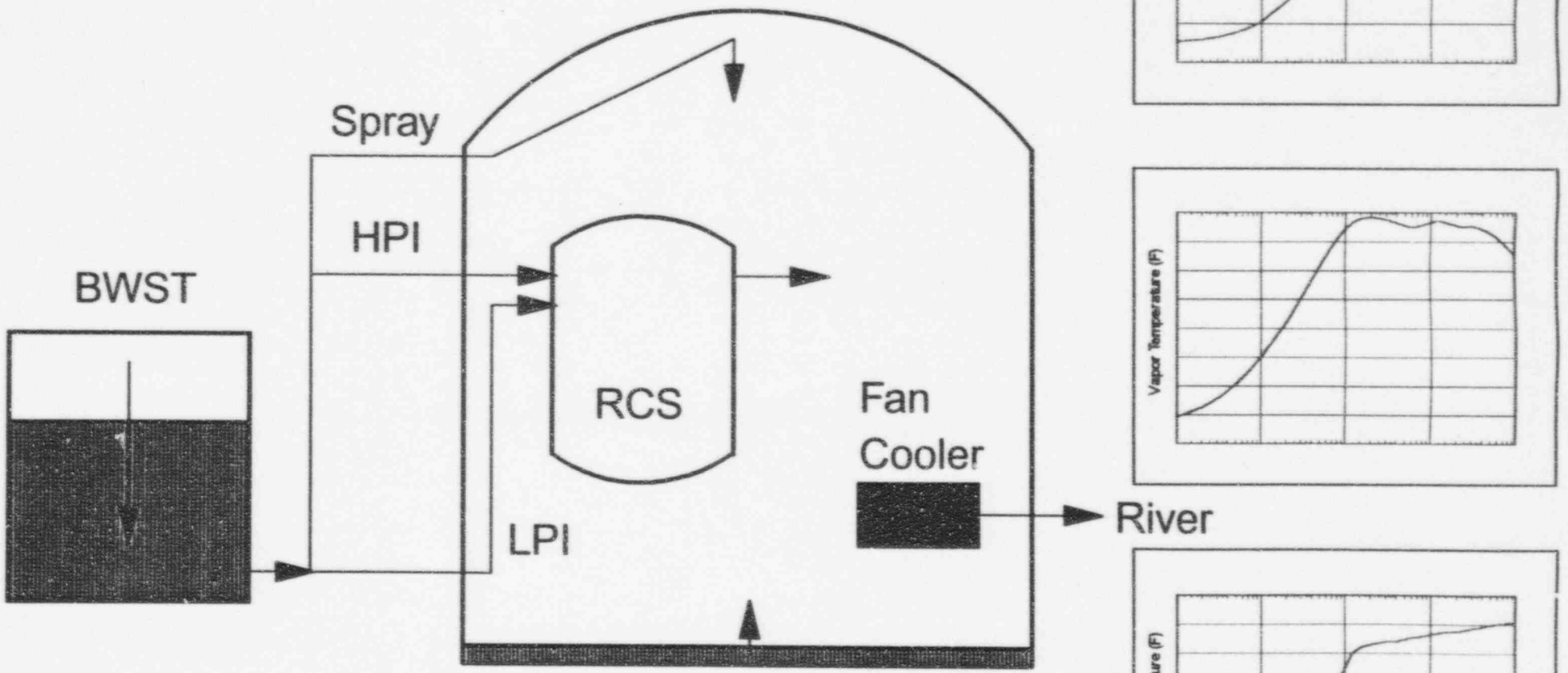


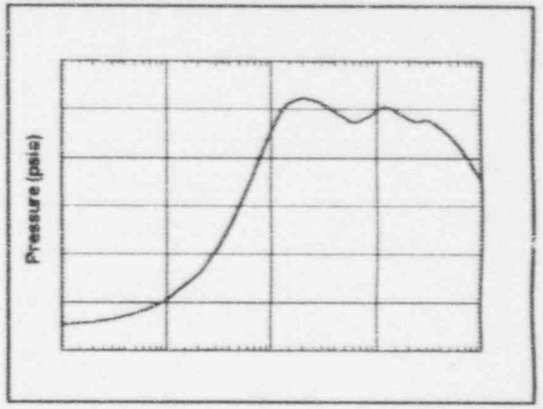


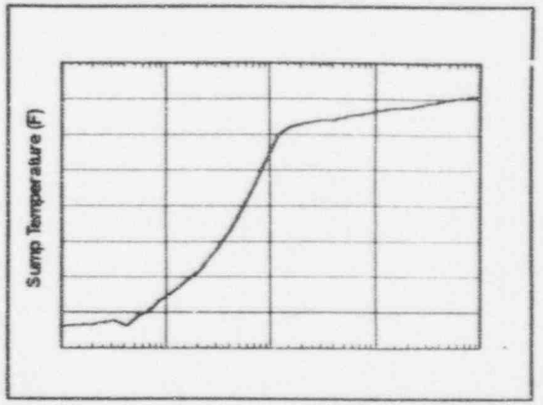




SYSTEM LINEUP PRIOR TO RECIRCULATION

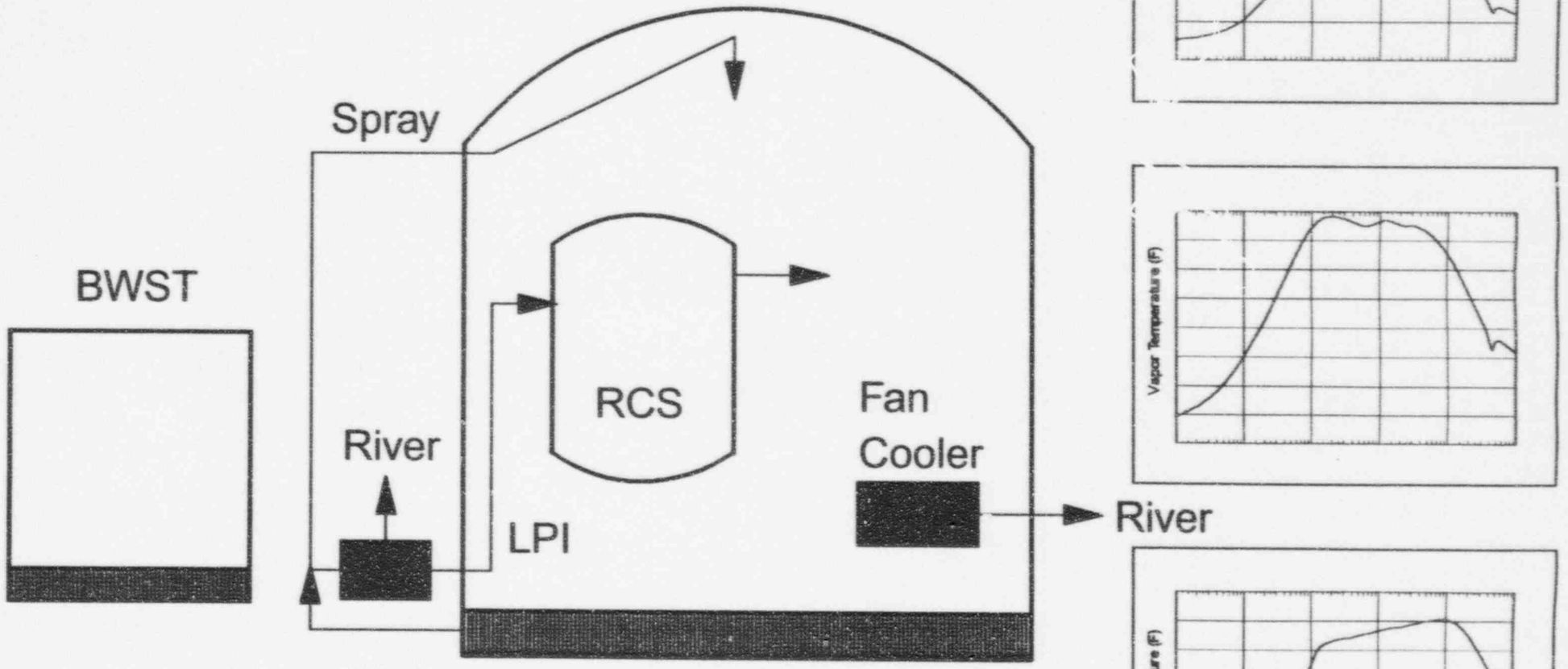


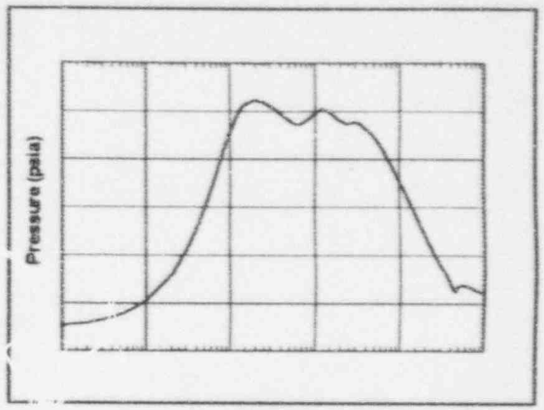


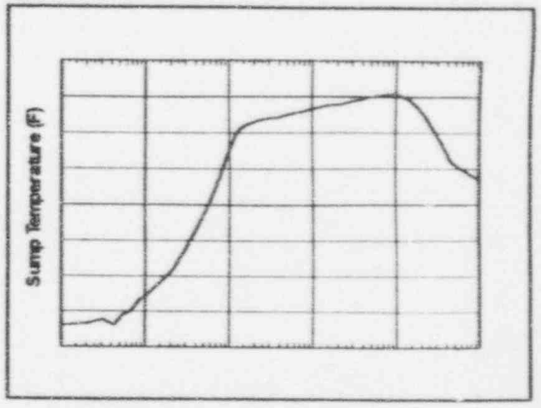


SYSTEM LINEUP DURING RECIRCULATION

HPI Secured When LPI Flow is Adequate



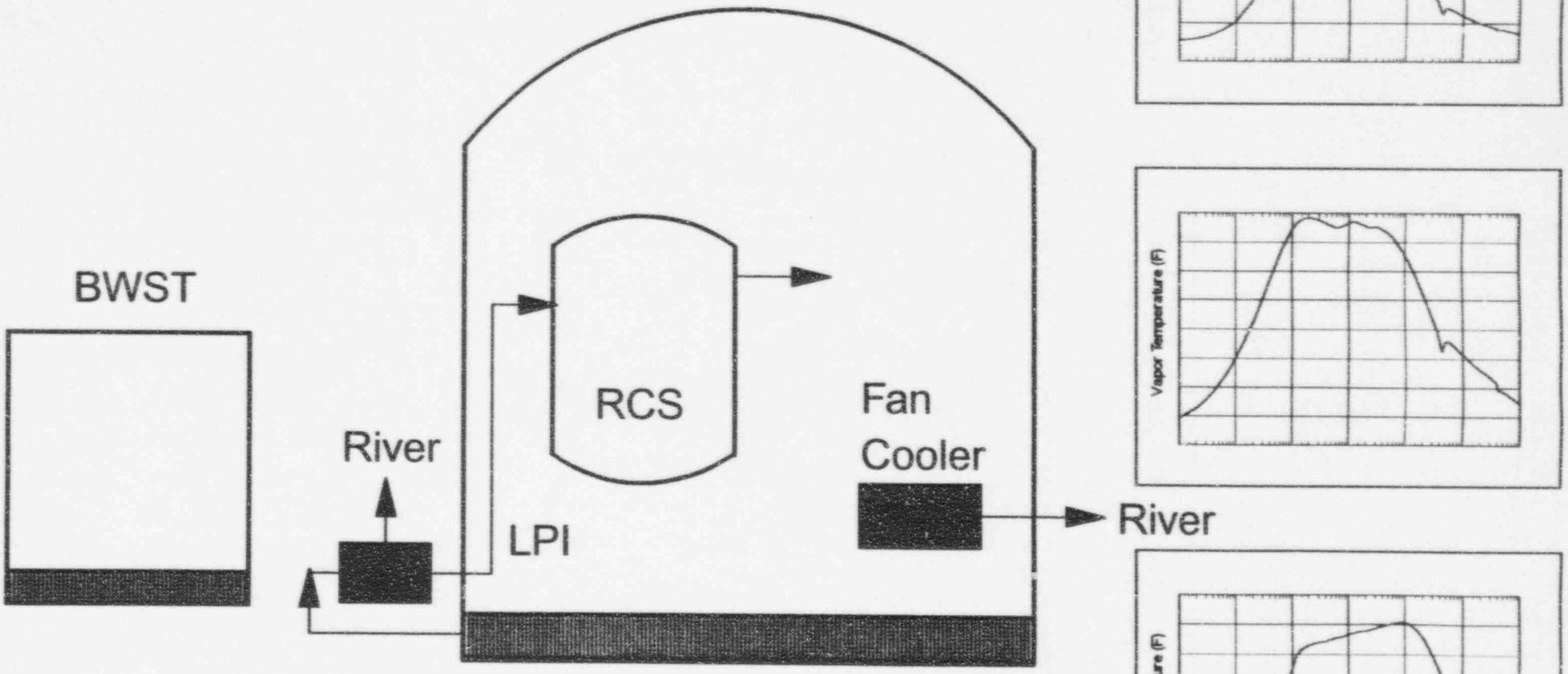


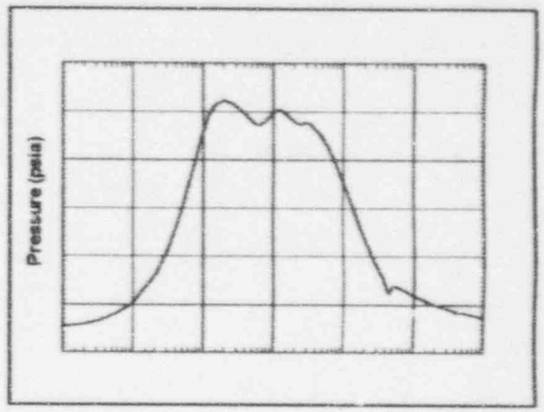


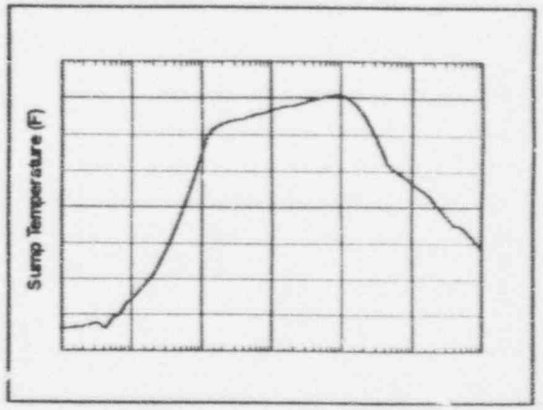
Pump Suction Switched When BWST Level Low

LONG TERM SYSTEM LINEUP

Spray Secured When RB Pressure is Low

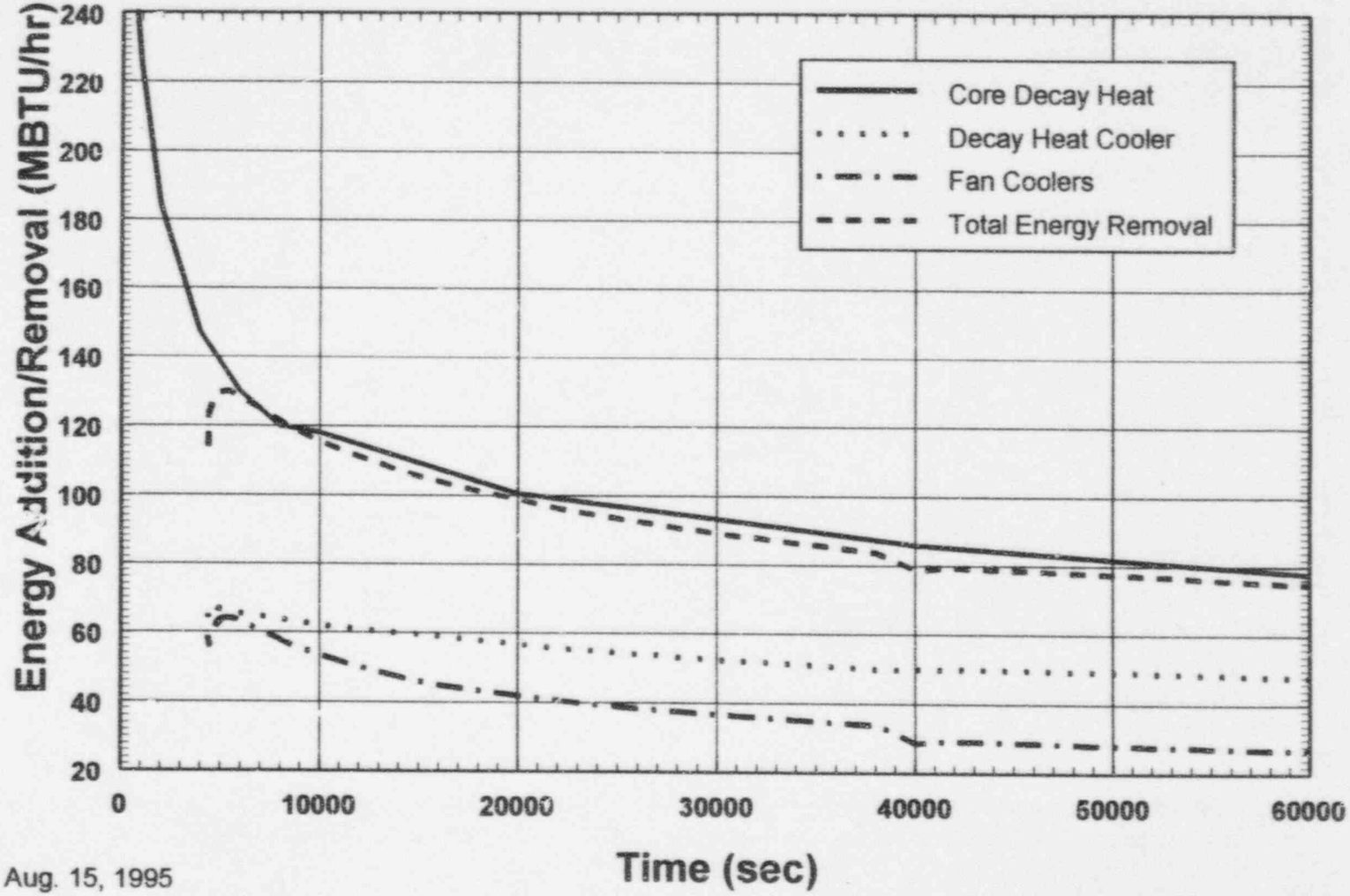






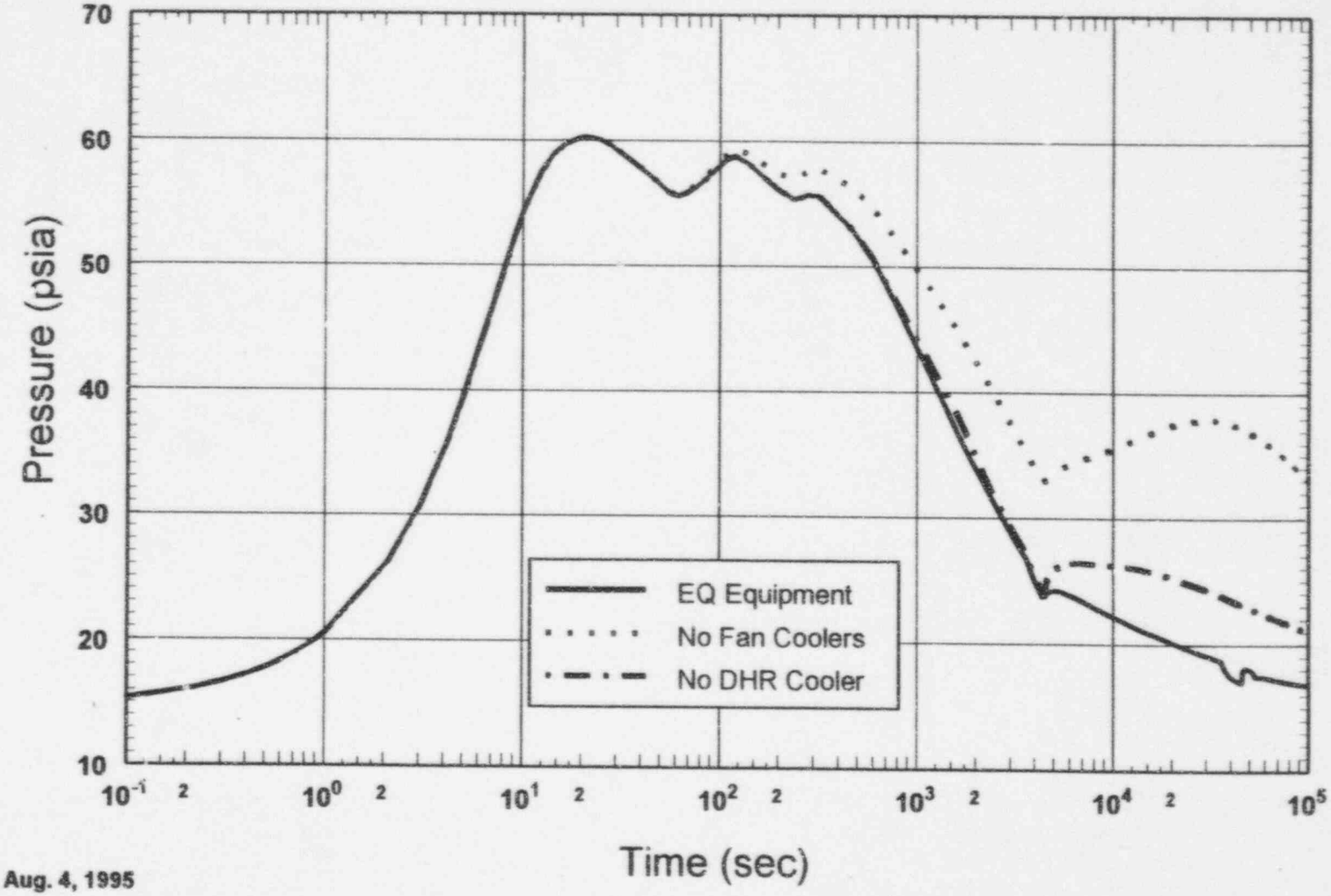
EQ PROFILE ENERGY ADDITION & REMOVAL

Passive Heat Sinks Are Not Included



Aug. 15, 1995

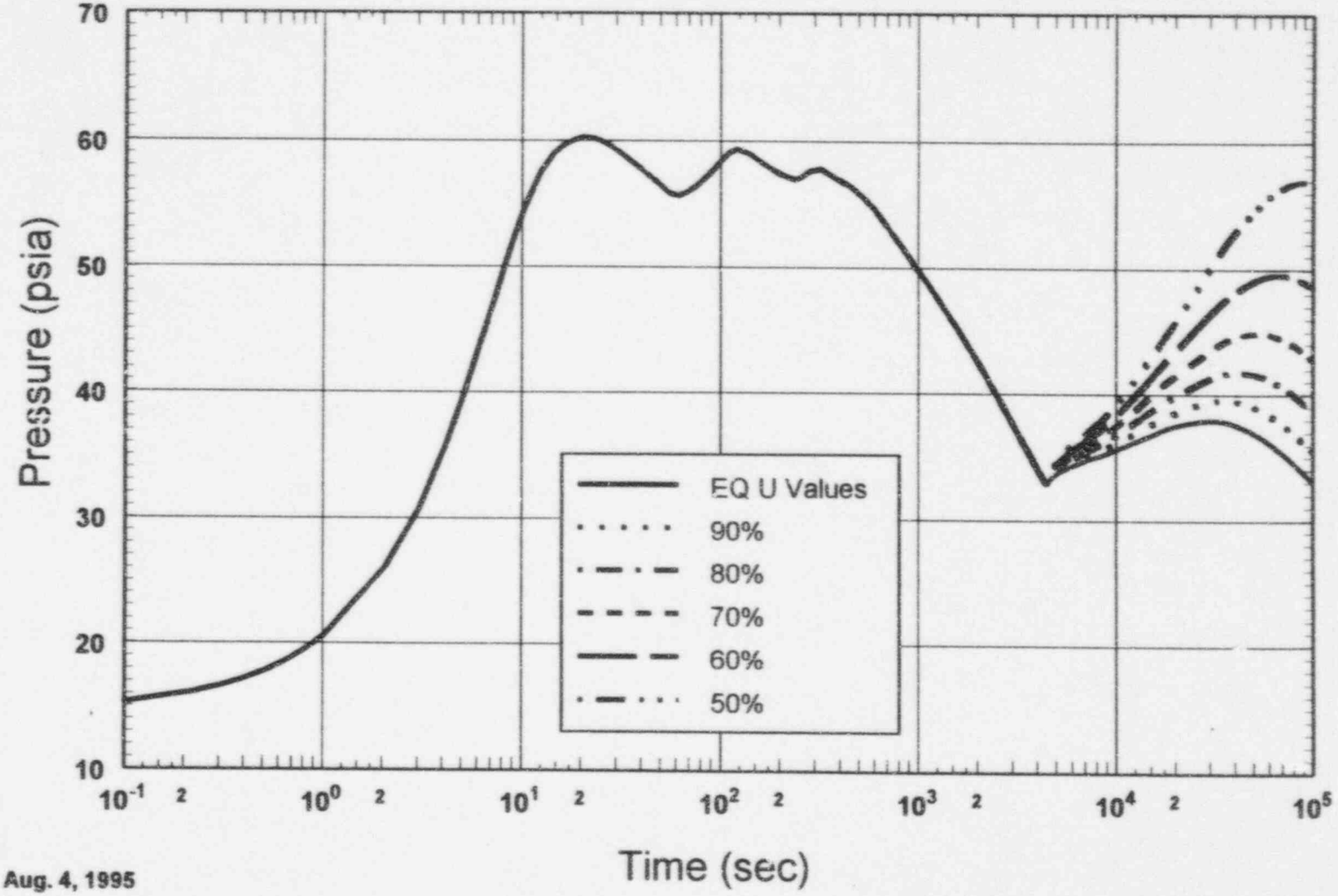
Total Loss of Function



Aug. 4, 1995

No Fan Coolers Cases

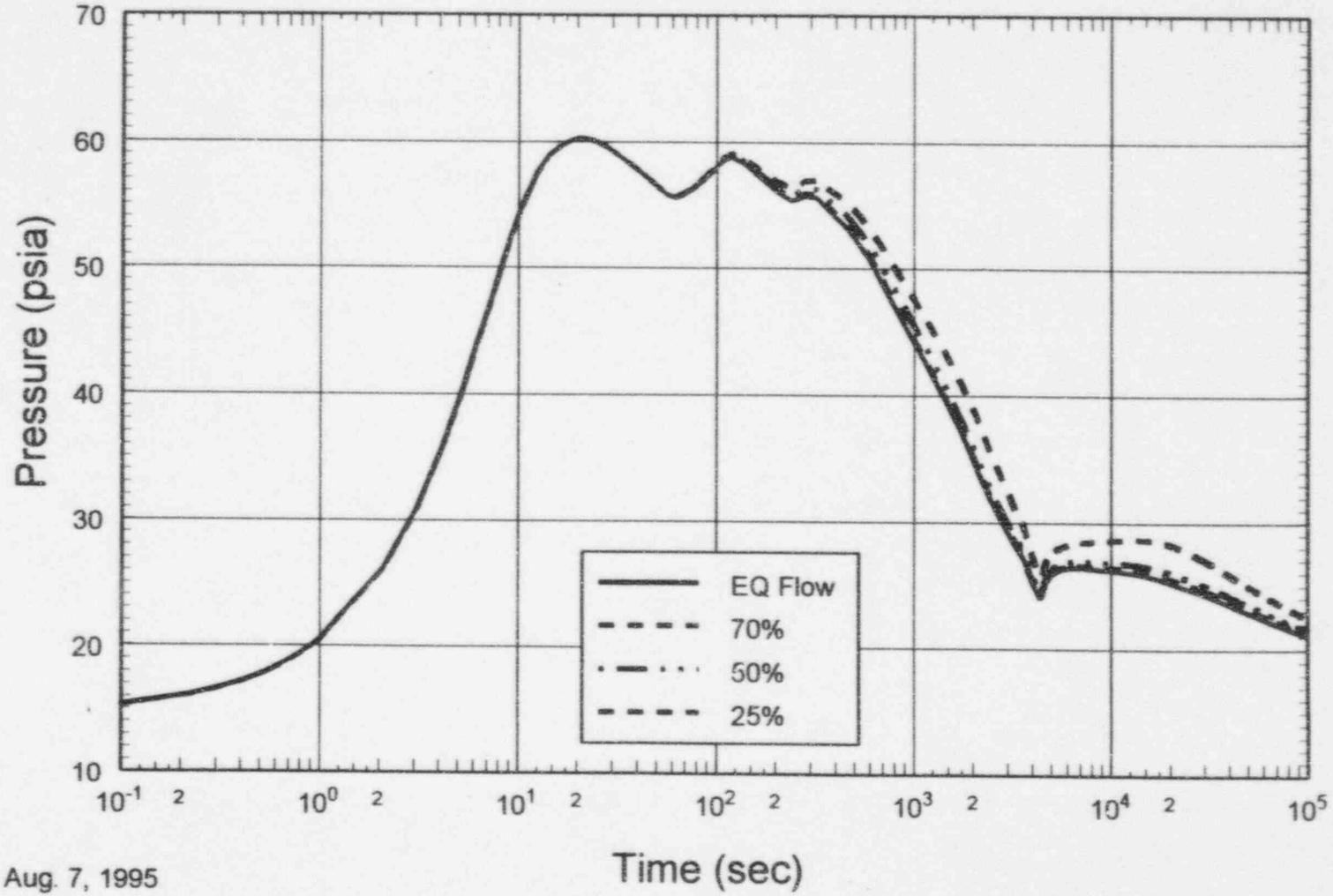
DH-C-1 & DC-C-2 Degradation



Aug. 4, 1995

No DHR Coolers Cases

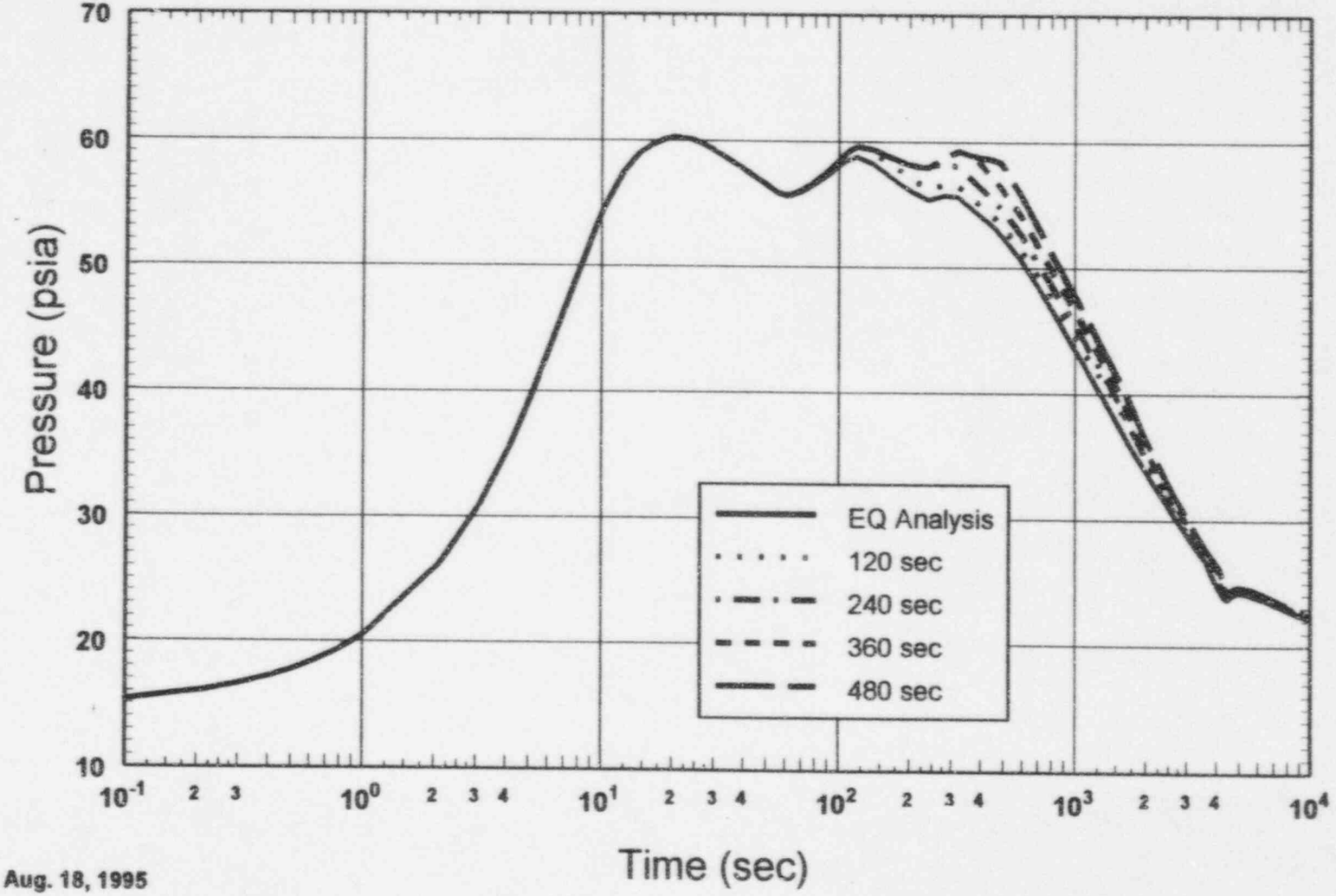
Fan Cooler RBECW Degradation



Aug. 7, 1995

ECCS Delay Cases

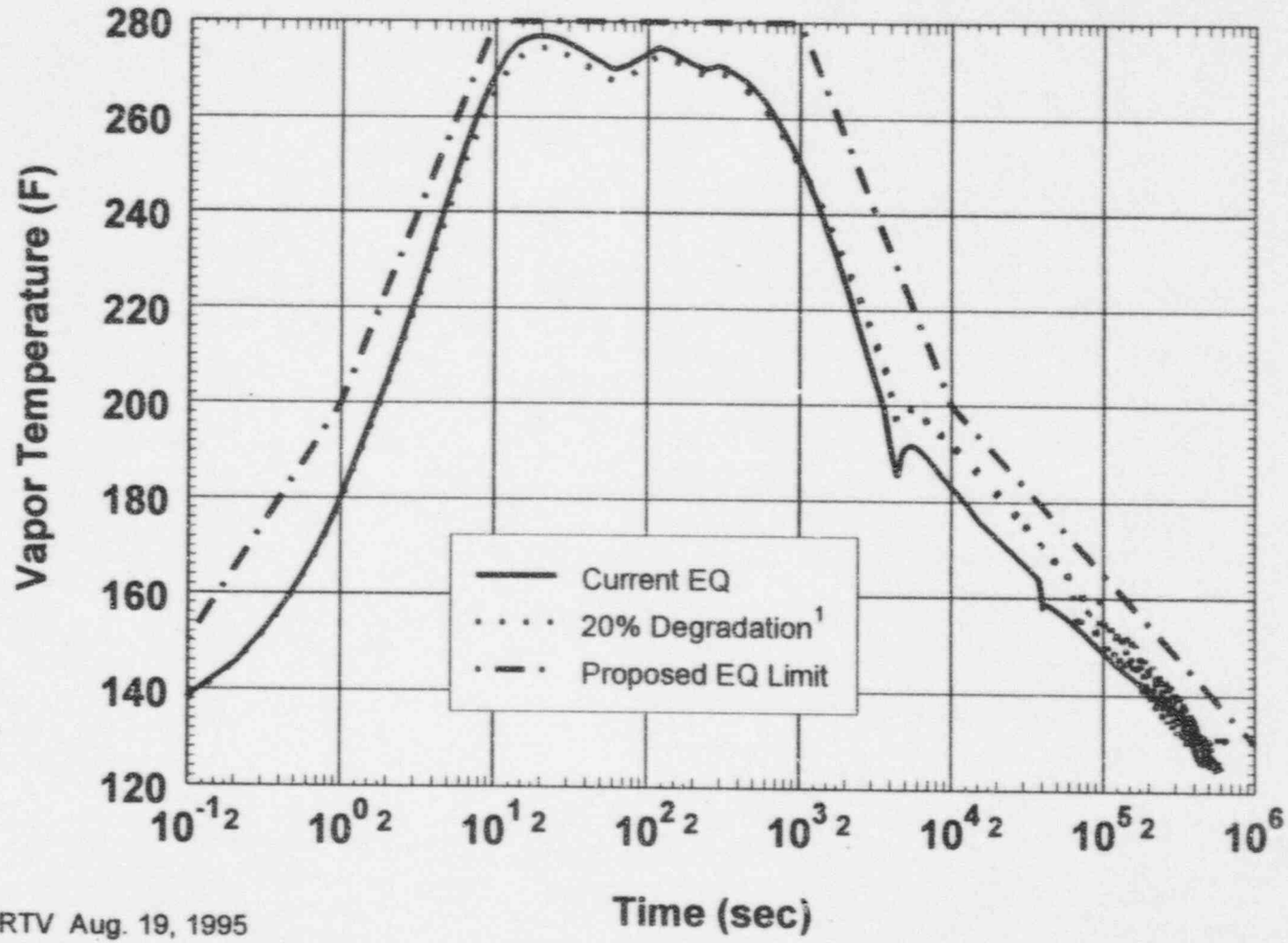
Delay from 30 psi Actuation Signal



Aug. 18, 1995

EQ Profile

[1]Degradation of All Flows, Surface Areas & U's



EQDEGRTV Aug. 19, 1995

TMI-1
DH/DC/DR & RR SYSTEMS EVALUATION

RESULTS:

Containment Peak Temperature and Pressure are not impacted by significant degradation of DH/DC/DR and RBECW coolers.

The long-term RB Temperatures and Pressures are only slightly higher than the current analysis.

The time it takes the RB Temperatures and Pressures to return to pre-accident conditions is only slightly longer.

CURRENT EQ ANALYSIS CONSERVATISM:

Decay Heat after three hours is approximately 20% higher than 1.2 ANS1971.

DH-C-1 is degraded to 67% of Design U.

CONCLUSION:

DH/DC/DR and RBECW systems can perform their design function of containment cooling.