

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-289/84-22

Docket No. 50-289

License No. DPR-50

Priority -

Category C

Licensee: General Public Utilities Nuclear Corporations
P. O. Box 480
Middletown, Pennsylvania 17057

Facility Name: Three Mile Island Nuclear Station, Unit 1

Inspection At: Middletown, Pennsylvania

Inspection Conducted: July 23 - 27, 1984

Inspectors: J. P. Durr for
E. H. Gray, Lead Reactor Engineer

9/30/84
date

J. P. Durr for
A. Manoly, Reactor Engineer

9/30/84
date

J. P. Durr for
J. C. Wen, Reactor Engineer

9/30/84
date

Approved by: J. P. Durr
J. P. Durr, Chief
Materials & Processes Section

9/30/84
date

Inspection Summary: Inspection on July 23 - 27, 1984 (Report No. 50-352/84-22)

Areas Inspected: Routine unannounced inspection of the site welding program, steam generator mechanical rolled plug evaluation, ultrasonic test block P1-P3 material equivalence comparison, decay heat line valve corrosion evaluation (DH-VI), preoperation testing result review of the high pressure injection system, Emergency Feed Water System (EFW) modification and the Reactor Coolant System (RCS) vent installations. The inspection included 72 hours by three inspectors and 19 hours of followup inspection at the regional office.

Results: No violations were identified.

DETAILS

1.0 Persons Contacted

GPU Nuclear

- * R. Barley, TMI 1 Lead Mechanical Engineer
- J. Colitz, Plant Engineering Director TMI-1
- * R. Corbit, Site Weld Engineer
- ** C. Incorvati, Q.A. Audit Supervisor
- J. Janiszewski, Metallurgical Engineer (GPU Reading)
- ** T. Hawkins, Manager, Startup and Testing - TMI-1
- ** C. Hartman, Lead Electrical Engineer - TMI-1
- C. Leonard, Maintenance, Supervisor of Welding TMI-1
- ** H. Hukill, Vice President, TMI-1
- * W. Kimmick, QC, NDE Supervisor
- D. Mc Connell, Weld Engineer
- * D. Kowalchick, Site Tech Functions-Liaison Engineer
- * J. Marsden, QA Engineering Manager
- * T. Noble, Site Liaison Engineer
- * S. Otto, Licensing Engineer
- M. Press, QA Lead Auditor
- ** R. Toole, Director Unit 1, Operations and Maintenance
- * C. Shorts, Manager Tech Functions, TMI Site
- ** C. Smyth, Licensing Manager
- * M. Zeise, QC, NDE/Welding Supervisor

NRC

- ** R. Conte, Senior Resident Inspector
- ** S. Young, Resident Inspector

- * Indicates presence at exit meeting of July 26, 1984
- ** Indicates presence at exit meeting of July 27, 1984

2.0 Licensee Action on Previous Inspection Findings

(Closed) Inspector Follow Item (289/80-06-04). This item concerns ultrasonic (UT) examination of the steam generator weld area (W6-23-A) including A533GRB and A508-64 Class 1 materials. The licensee action remaining on this issue at the conclusion of inspection 289/82-19 was to demonstrate similar acoustic characteristics between the UT test block and the W6-23-A weld area materials. The inspector reviewed the GPU TMI memo ISI/M83014 dated January 24, 1983 which presents the test block material requirements to meet the ASME Code Sections XI and V for UT of W6-23-A. The ASME Code, Section V, Article V considers P numbers 1 and 3 to be equivalent. Additionally, the inspector reviewed the GPU UT data sheet dated November 19, 1982 which demonstrates the similarity of acoustic velocity and attenuation of the P1 and P3 materials. This item is closed.

(Open) Unresolved Item (289/84-08-01). The inspector reviewed the status of licensee action on examination of the DH-V1 valve internal components for evidence of corrosion. The GPU Reading Metallurgical Laboratory reported verbally that no indication of sulfur induced internal corrosion had been observed, and that a final report is in the process of being issued. This issue remains open pending NRC review of the report now in progress. (289/84-08-01)

3.0 Emergency Feedwater (EFW) System Seismic Qualification

The seismic qualification of the EFW system at TMI-1 was performed in response to the requirements in Generic Letter 81-14. The licensee's fourth amended response (on May 31, 1984) technically responds to the above topic and answers the Union of Concerned Scientists (UCS) 2.206 petition to show cause concerning TMI-1 Emergency Feedwater System. The licensee committed to perform various modifications in order to provide reasonable assurance that the EFW system will perform its safety function after a Safe Shutdown Earthquake (SSE). Three specific modifications were reviewed in this inspection and are addressed hereafter.

3.1 Upgrade of EFW Recirculation Line to Seismic Class I Requirements

The inspector performed a walkdown of the above line in the intermediate building at elevations 295 and 306. The licensee had committed to upgrading the 2" recirculation line and supports to seismic I requirements, before the restart of unit #1. The inspector also performed a visual and physical inspection of some of these supports.

The supports inspected are identified below:

- MK - EFH - 136 thru 139 (std. support)
- MK - EFH - 142
- MK - EFH - 144
- MK - EFH - 146
- MK - EFH - 147
- MK - EFH - 148

The supports were inspected for the following requirements:

- checking actual configuration against support drawing, including dimensions
- checking directions in which hangers restrain piping and clearances between pipe and hangers
- checking sizes of welds on hangers
- checking baseplate dimensions and location of structural attachments to the baseplate
- checking baseplate bolts for tightness and minimum edge distance.
- checking for proper grouting of floor mounted supports.
- checking that movement of piping due to vibration, thermal expansion, etc., would not contact other pipes, supports, equipment or components.

The inspector also reviewed the installation specification for the emergency feedwater longterm upgrade modifications (Spec. #T1-IS-412024-001).

No violations were identified.

3.2 Upgrade of Main Steam Safety Valves Vent Stacks to Seismic I Requirements

The requirement for upgrading the vent stacks and supports for main steam valves MS-V-4 A/B and MS-V-22 A/B to seismic class I requirements, was addressed in the licensee response to the UCS petition to show cause concerning the EFW system identified above. The UCS letter pointed out the difficulty of entering the intermediate building to isolate a leak following an earthquake because of steam released by failure of equipment which is not seismically qualified. The licensee's response was to perform and complete the upgrade to seismic I of the MS-V4 A/B and MS-V22 A/B valve supports prior to restart.

The inspector performed a walkdown of these lines in the intermediate building at elevations 295, 306, 322, and 355. The inspector also performed a visual inspection of selected supports identified in Dwg. No. 037-039-016 (Rev. 2). Some of these supports were obstructed by interferences; however, they all had the same configuration. These supports are:

MK - SVH - 1,	MK - SVH - 2
MK - SVH - 6,	MK - SVH - 7
MK - SVH - 13,	MK - SVH - 14
MK - SVH - 15,	MK - SVH - 16

Two other configurations of supports for the vent stacks were detailed on IMPELL DWG. No. 0370-039-015 (Rev. 2). Supports No. MK-MS-309 and 310 have the same configuration and could not be physically inspected because of the inaccessibility of the supports. Supports No. MK-MS-311 and 312 have the same configuration and were physically inspected. Both support configurations were a two-way horizontal restraint. The supports detailed in the above referenced drawing indicate a 0-1/16" clearance in all four sides. The inspector identified a zero clearance in all four sides between the 10" vent stack vertical piping and supports No. MK-MS-311 and 312 which were inspected. Although the supports were constructed according to drawing, it was apparent that installing a two-way seismic restraint on a hot line with zero clearance on all sides, would in effect provide a three-way restraint to the piping at support locations. This design also appears to be in contradiction with the stress analysis of the piping which is based on free axial thermal movement of the piping. The inspector requested the licensee to provide the NRC with the following documents for audit:

1. Stress analysis reports (incl. isometric drawings) for qualification of the vent stack piping for main steam valves MS-V4 A/B and MS-V22 A/B.

2. Listing of all supports on the above lines which were installed with zero clearance on two opposite sides.
3. Design calculation documents for the supports identified in item 2 above.

This item is unresolved (289/84-22-01).

3.3 Intermediate Building Flood Protection Modifications

The modification of the intermediate building was required to provide the operator with approximately 25 minutes to terminate flooding in the intermediate building as a result of a main feedwater line break. The structural modifications to the building are intended to provide more volume for accumulation of flood water before EFW components, not qualified for submergence, would be adversely affected.

The inspector performed a walkdown of the intermediate building in the "alligator" pit area at elevation 279'-0" and the Tendon Access Gallery at elevation 262'-9" to inspect the following modifications:

- Removal of sealed doors "A" and "B" at both entrance to the "alligator" pit.
- Removal of entire western water "stop wall" in the "alligator" pit.
- Modification of bulkhead door to the "C" Tendon Access Gallery to prevent inleakage from the C access shaft.

The inspector also reviewed the following modification drawings:

- 0370 - 039 - 005
- 0370 - 039 - 006
- 0370 - 039 - 021

It should be note, however, that these modifications were incomplete and were not yet inspected by the licensee's construction Q.C.

No violations were identified.

3.4 EFW System Seismic Interaction

The requirement to perform a seismic interaction review for the EFW system has arisen from the upgrading of the system to seismic I requirements. Two walkdowns of the system were conducted by the office of Nuclear Reactor Regulation (NRR) and the licensee to identify potential seismic interactions between the EFW system and other systems. The inspector reviewed the licensee's response of July 16, 1984 (letter No. 5211-84-2160) where questions resulting from the walkdown were presented along with their resolutions. The inspector identified specific items for which the licensee's resolutions are vague and not supported by analysis. Since

the subject of EFW system seismic interaction is being handled by NRR in the Safety Evaluation Report (SER), the inspector relayed his observations regarding the licensee's response in the above letter and subsequent letter on July 30, 1984 (letter No. 5211-84-2194), to the Mechanical Engineering Branch (MEB) of the office of NRR. Two modifications were identified in the licensee's response of July 16, as being required for supporting non-seismic equipment and structures whose failure could damage EFW system cable and conduits. The first modification is for the Radiation Monitor RMA-2 which was not anchored to the floor of the cubicle containing instrument air compressor IA-P1A. The other modification involves a ladder mounted on the reactor building wall in EFW-P2B pump room. The ladder mounting bolts were to be replaced to assure SSE qualifications. The inspector also reviewed the licensee's Inter-Office memorandums related to the walkdown of the EFW system and the engineering assessment of effects of miscellaneous equipment and structures on EFW components.

These memorandums are listed below.

- EM - 84 - 1082 on June 6, 1984
- EM - 84 - 1093 on June 18, 1984
- EM - 84 - 1099 on June 22, 1984
- EM - 84 - 1105 on July 2, 1984
- EM - 84 - 1106 on July 2, 1984
- EM - 84 - 1109 on July 6, 1984

The above identified modifications were not completed during this inspection.

No violations were identified.

4.0 Reactor Coolant System (RCS) Vents

The requirement for the RCS vessel head and high point vents is stated in 10 CFR 50.44. Guidance is provided in NUREG-0737, "Clarification of TMI Action Plan Requirement". The licensee's response to the above requirements and the NRC's staff review is provided in a Safety Evaluation (SE) which is based on the Technical Evaluation Report (TER) prepared by the staff consultant LLNL (NRC letter from J. Stolz to H. Hukill on October 17, 1983).

The inspector performed a walkdown of the accessible segments of the Reactor vessel head vent, and the pressurizer high point vent piping. The inspector also reviewed the installation specification for RCS system head and high point vent, Spec. TI-IS-412021-002.

The inspector requested two sets of drawings including isometrics, and as-built drawings of the piping segments and supports which were visually inspected during the walkdown. The inspector also requested the design calculations for the supports in the inspected portion of the high point vents. These documents will be reviewed in the regional office.

No violations were identified.

5. Document Control

As part of the inspection of piping and supports in the EFW system modifications, the inspector requested an updated as-built drawing from the licensee for performing the task. The licensee stated that the procedure for documenting as-constructed conditions, for configuration control of drawings after completion of construction or repair, is provided in the Technical Functions Procedure No. EP-025. According to this procedure, piping and support components need not have an up-dated final as-built. Roll-up Field Change Notices (FCN) contain logs of FCN in as-installed/as-found conditions and are posted against both "As-Built" and "Interim" Drawings. Final "as-builts" are revised only for such documents, as electrical instrumentation and control logic diagram, flow diagrams, Process and Instrumentation Diagrams (PID's) safety sequence diagrams, etc. The inspector reviewed Roll-Up Field Change Notice (FCN) No. C022217 posted against B/A File 412024. The roll-up contained as-installed FCN dwgs. Disposition Summary Sheets which include the change documents posted against installation drawings and specification for the EFW system vent stack modifications (item 3.2 in this report). The Disposition Summary Sheets also lists the drawing affected by the change, and whether the changes are incorporated or not. Some minor discrepancies were observed; however, no violations were identified.

6. Building Interface Loads From Pipe Supports

The inspector reviewed the licensee's procedures for addressing pipe support loads on building structural concrete and steel installations. The licensee provided the inspector with Technical Functions procedure No. EP-009 titled, "Design Verification", which is addressed in section 5. Reference is also made to a verification check list in appendix "C" of this procedure. The inspector reviewed the procedure and identified that the topic of building interface loads is addressed only for design or modifications performed by the licensee's corporate office. The licensee will provide a procedure which addresses this topic for design modifications performed by contractors. This item is unresolved pending NRC review of the procedure (289/84-22-02).

7. Site Welding Program

The inspector reviewed the TMI Unit 1 welding program and examined a sample of welding records. The designation of responsibilities and system for control of welding at Unit 1 are detailed in the administrative procedure AP-1042. Procedure AP-1042, Revision 3, dated May 22, 1984, was reviewed by the inspector for comparison to the ASME Code and ANSI requirements. Specific requirements were sampled and compared against site practices and records to determine if AP-1042 was being implemented. The inspector traced the steps in application of welding from weld procedure qualification, welder training and qualification, preparation of work packages requiring welding, assignment of weld inspection points, conduct of welding including production records, control of weld wires and electrodes, trending of weld

quality and turnover of completed work packages involving welding to QC after review by Site Weld Engineering. Specific items reviewed during this inspection include:

- AP #1042 Procedure for Control of Welding.
- Welder Qualifications for B218, E136, F010, F252, F254, F136, F202 and F198.
Procedure MTWA-017, Revision 0, Welder Performance Evaluation
- Work Packages - Documentation and Records including:
 - A 25D-30023, DRF 20635 Rev 0.
 - A 25B-30105, BA 412105
 - DRF 12688 Rev 0, FCR 13366, 22138, 20312,
 - FCR 22136, 22306 and 22308.
- QA Audit Report S-TMI-84-07 as discussed in paragraph 9 of this report.
- GPUN Welding Manual including typical weld procedures.
- Welder Qualification List of June 28, 1984.
- Welder Qualification Matrix of Qualifications versus Weld Procedures and Essential Variable of the Welding Process.
- GPUN Welding Program Training Course

No violations were identified.

8. Radiography

The inspector examined a sample of radiographic film including that for RC 10, RC 12, RC 42 on ID 222-WM007 and RC 38-010, RC 15-009 and RC 39XR-009 on ID 222-WM010 for comparison to the NES Radiographic Procedure 83A0410, Revision 0, and ASME Code/ANSI Standard Requirements. The conditions for viewing and controlling radiographic film were also observed.

While no violations were identified, the inspector did note one radiographic film on weld RC 39XR-009 to contain a Tungsten inclusion; oriented perpendicular to the pipe surface but outside the radiographic area of interest. The Tungsten was determined to be approximately 28% through the weld of this 3/4" diameter, schedule 160 stainless steel pipe. The applicable ASME/ANSI standards and radiographic procedure do not specifically define an inclusion of this dimension and orientation to be rejectable. A subsequent engineering calculation indicated the required ASME CODE minimum wall thickness required for weld 009 to be less than that remaining in the area of the Tungsten inclusion;

therefore, the inspector concluded that the ASME Code, including design requirements, were met by the radiograph and weld. The GPUN NDE supervisor stated that the applicable radiographic procedure(s) would address the problem of inclusions oriented perpendicular to that considered in paragraph B1-140 of ANSI B31.7, Nuclear Power Piping (Appendix B). The inspector had no further questions regarding this matter.

9. QA and QC Involvement in Welding Activities

The quality assurance (QA) and quality control (QC) functions are involved in the site welding activity by inspection and examinations identified in work packages requiring specific signoff of operations and through surveillance of in process work activities. A separate QA group, not directly involved with performance of work tasks to work package requirements, is responsible for the QA Audit Function. In the welding area, the NRC inspector reviewed the QA Audit Report number S-TMI-84-07 dated July 16, 1984 for Special Processes and Programs (SPP) for both TMI Units 1 and 2. The report indicates QA Audit activity in applicable areas of both Nondestructive Examination (NDE) and welding to determine the level of compliance of these activities to applicable site procedures and policies. The Audit Report indicates those specific items audited, the findings and provides for initiation of corrective actions as applicable. In review of work packages, the inspector noted that inspection/examination hold points were initialed and dated to indicate completion of QA/QC inspections or examinations as required by the ASME Code and applicable procedures.

No violations were identified by the inspector of the QA Audit Program or QA/QC in work progress inspection/examination requirements.

10. Preoperational Test Results Evaluation

The inspector reviewed the test results of the High Pressure Injection (HPI) System Functional Test (TP 655/1). The test result packages were reviewed to determine compliance with test objectives and to assure technical and administrative completeness of the licensee's review, evaluation, and approval.

To reduce the reliance on operator action for a small break LOCA, modifications have been made to the TMI-1 HPI system. Task RM-14 mechanically interconnected the HPI injection legs and added a cavitating venturi in each HPI leg. These cross-connects will permit an acceptable flow distribution during high-pressure injection in the event of a high-pressure injection line break. Cavitating venturis will limit flow through a ruptured high-pressure injection line. The purpose of this test (TP 655/1) was to demonstrate the adequacy of HPI flow distribution among the four HPI legs and the sufficiency of injection flow to the RCS in the event of small break LOCA.

The test was performed on May 22, 23 and 26, 1984 during hot functional testing (HFT). The inspector noted the preliminary test results from the May 22 and 23, 1984 test as follows:

Case 1: RCS Pressure = 1200 psig, MU-P-1A Running. The measured flow is depicted in the Attachment 1.

The total measured injection flow through the three lowest flow legs exceeded the required flow of 306 gpm. However, the flow readings from the temporary Controlatron external flow measuring instruments were not consistent, as evidenced from the large deviation between FX6 and FX4. Furthermore, reading from MU23 FI2 did not agree with FX2 and FX4. These readings failed to demonstrate the fluid continuity. The licensee's Technical Functions group are currently assessing these problems.

Case 2: RCS Pressure = 600 psig, MU-P-1A Running. No meaningful data was obtained due to difficulty experienced in Controlatron application. However, the flow downstream of venturi was found to be in unsteady, cavitating conditions as expected.

Case 3: RCS Pressure = 800 psig, MU-P-1A Running. Data taken on Controlatrons experienced large variations and did not correlate well with MU-23 FI's readings.

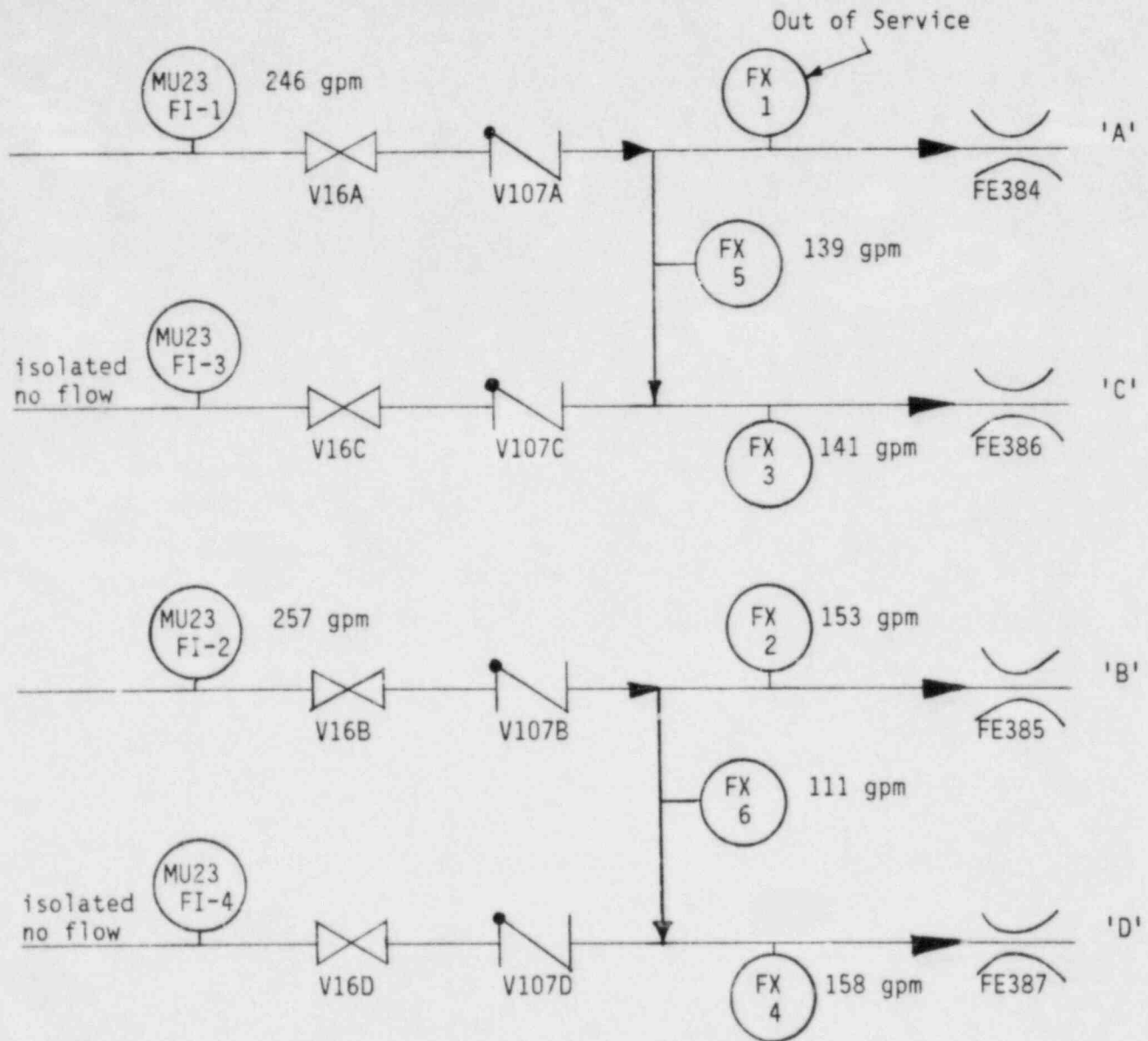
The large variation in the response of the Controlatron flow instruments was attributed to the improper locations of these instruments. The presence of sonic wave obstacles such as cavitating venturis and pipe bends in the instrument nearby, caused the Controlatron reading to be less reliable. The test was repeated on May 26, 1984 with modifications on the Controlatron location. Two Controlatrons were located on each cross leg and the remaining injection line Controlatrons were removed. The test was performed twice at RCS pressure of 800 psig with MU-P1A and MU-P1B running, respectively. The test results are summarized in the Attachment 2.

Only the MU-P1B running case showed consistent readings of Controlatrons. The split flow derived from this set of test data met test acceptance criteria.

The licensee's commitment to perform this test is documented in TMI Unit 1 Restart Report, Supplement 1, Part 3, Response to Question 1. The testing method described in the subject document was based on a two point test. One test point was selected in the cavitating condition (RCS = 600 psig) and the other in the non-cavitating condition (RCS = 1200 psig). The licensee is continuing to evaluate the test results. The completion of the NRC review of this preoperational test remains open pending completion of the licensee's final test result evaluation.

Item 82-BC-04 remains open.

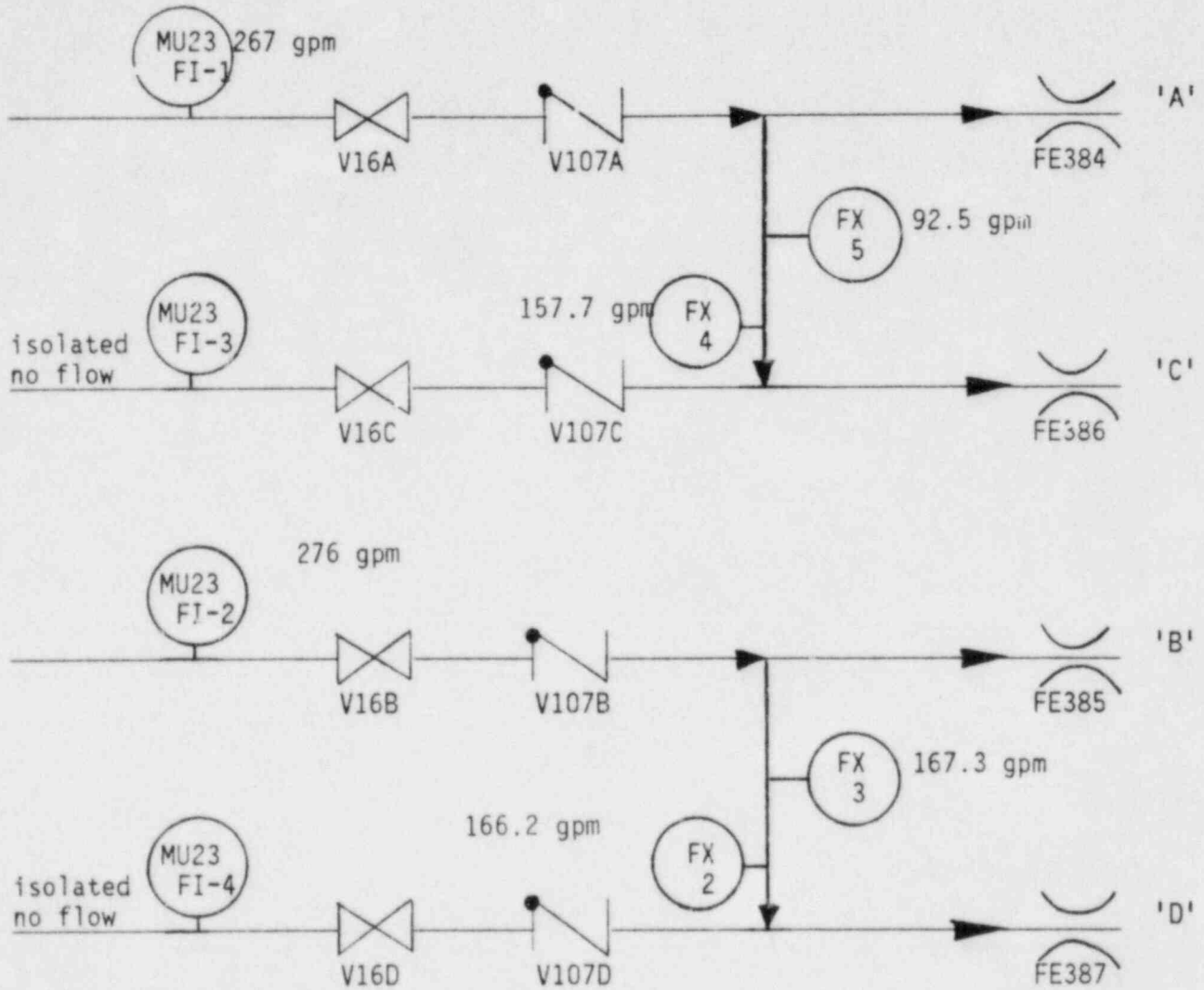
Attachment 1 May 22, 1984 HPI TEST RESULTS



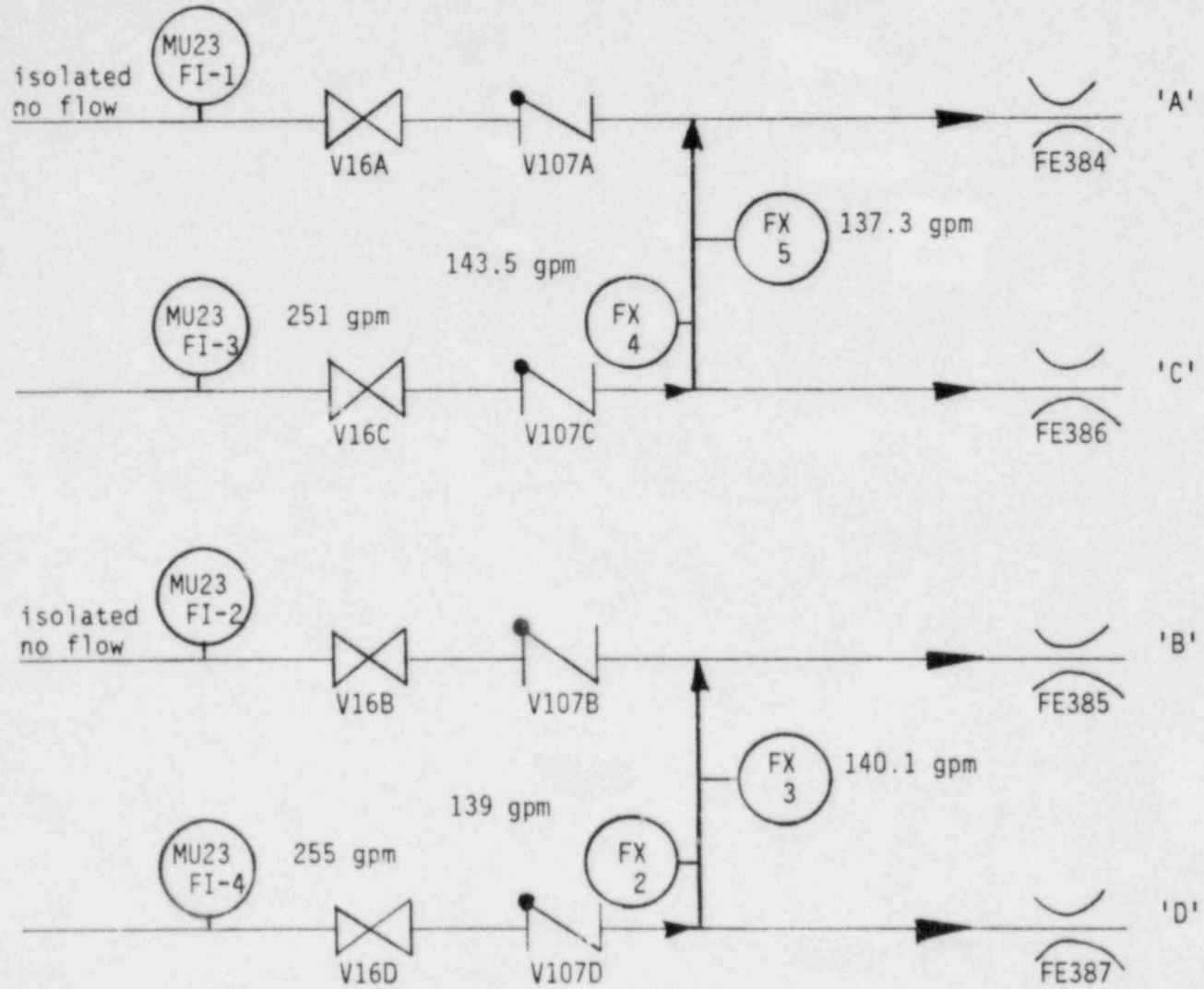
Where: FX-i : Controlatron Reading (Temporary Flow Station)
 MU23 FI-i : High Pressure Injection Flow Indication (Control Room)
 FE384+387 : Cavitating Venturi
 'A' : HPI Connects to RCP 'A' Cold Leg
 'B' : HPI Connects to RCP 'B' Cold Leg
 'C' : HPI Connects to RCP 'C' Cold Leg
 'D' : HPI Connects to RCP 'D' Cold Leg

Attachment 2 May 26, 1984 HPI TEST RESULTS

Case 1 : MU-P1A Running



Case 2 : MU-P1B Running



11) Steam Generator Mechanical Rolled Plugs

During tubesheet plug inspection of the steam generators by GPUN, six of approximately 1000 rolled mechanical tube plugs were missing. The inspector viewed video inspection tapes of tube conditions in the areas missing plugs and discussed site activity on the problem with the Lead Mechanical Engineer. GPUN and the plug contractor were in the process of evaluating plug data, planning supplemental testing, developing a program to establish the significance of the missing plugs and to provide for corrective action. NRR and the site resident inspectors are providing followup to this problem. No violations were identified.

12) Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable, violations or deviations. Unresolved items are discussed in paragraphs 3.2, 6 and 10.

13) Exit Meetings

The inspectors met with licensee representatives, listed in paragraph 1, at the conclusion of the inspection to summarize the scope and findings of the inspection. At no time during this inspection was written material provided to the licensee by the inspectors.