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February 6, 1985

Office of Nuclear Reactor Regulation
Attn: J. F. Stolz, Chief
Operating Reactor Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Stolz:

Three Mile Island Nuclear Station Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Inadequate Core Cooling (II.F.2 NUREG 0737)

Attached please find revised pages to our July 6, 1984 (5211-84-2173) (SDD 662C Div II) submittal on the Reactor Inventory Trending System and a revised schedule consistent with our NUREG 0737 status response of October 3, 1984 (5211-84-2244). Amended responses to NRC Request for Additional Information dated June 14, 1983 and GPUN response of January 31, 1984 and July 6, 1984 is planned for submittal in March, 1985.

Sincerely,

R. J. Toole for
H. D. Hukill
Director, TMI-1

HDH/spb

cc: R. Conte
J. Van Vliet

Attachment

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Attachment 1

Revised pages to SDD662C Div. II

RCS Inventory Trending System

Replacement Pages

6
10
11
16
18
23
25
26
29 (Fig. 5)
30 (Fig. 6)

504e

Attachment 1

Revision 2

to

SDD 662C Div. II

(July 6, 1984/5211-84-2173)

1.3.1.2 Hot Leg Level Primary Loop B

Differential pressure transmitter RC-LT-1034 is installed between an upper connection at the top of steam generator RC-H-1B's hot leg and a lower connection upstream of decay heat line isolation valve DH-V-1. This instrument measures the water level from the bottom to the top of reactor coolant loop B hot leg piping.

The upper connection for RC-LT-1034 is equipped with a condensate pot and provides a water column reference leg for the transmitter.

Resistance temperature detector RC-TE-1034 senses the temperature of the water in RC-LT-1034's reference leg to compensate for density changes. This signal provides density correction for both RC-LT-1034 and RC-LT-1036, since both reference legs are routed together, and will be exposed to the same ambient temperature.

Thermocouple RC-TE-1055 senses reactor coolant system core exit temperature and is used to compensate for density changes in the reactor vessel head and hot leg fluids. Resistance temperature detector RC-TE-1053 provides a cold junction reference temperature for thermocouple RC-TE-1055.

RC-TE-1055 is mounted in the existing Incore Detector Instrumentation structure, detector well No. 18. RC-TE-1053 is mounted in terminal box T-1119 on the secondary shield wall near the incore detector rack, Reactor Building elevation 346'-0".

RC-LT-1034 is mounted on existing instrument rack No. TR11B at elevation 281'-0" inside the Reactor Building. RC-TE-1034 is pipe mounted on the reference leg outside the D-Ring. Power and signal conditioning for these instruments is provided by existing Signal Conditioning Cabinet B1 located in the Control Building, El. 322'-0".

The density compensated level output signal is displayed via the plant computer.

1.3.1.3 Reactor Vessel Level 1

Differential pressure transmitter RC-LT-1035 installed between an upper connection at the reactor vessel head vent valves and a lower connection upstream of valve DH-V-1. This instrument measures the level from the bottom of the hot leg piping to the bottom of the RV head vent nozzle.

Reference 1.2.2.3. Conduit supports are designed in accordance with Reference 1.2.2.7.

### 1.3.7 Quality Assurance

The RCITS is to be installed, tested and inspected in accordance with the GPUN Operational QA Plan, Rev. 0 (Reference 1.2.2.1). The water level trending subsystem is "Important to Safety" and "Nuclear Safety Related". The void fraction trending subsystem is "Important to Safety" only.

### 1.3.8 Computer Displays Design

The primary sources of computer display data are analog points from the system data base which (for RCITS purposes) have been labelled Group A data and Group B data. Their point numbers and descriptors are:

Group A (Level) Data

| | | |
|---|---|---|
| A1 | A466 | RC Hot Leg A Level |
| A2 | A468 | RC Hot Leg B Level |
| A3 | A467 | Reactor Vessel Head Level 1 |
| A4 | A469 | Reactor Vessel Head Level 2 |

Group B (Void Fraction) Data

| | | |
|---|---|---|
| B1 | C4018 | Void Fraction 1A |
| B2 | C4019 | Void Fraction 1B |
| B3 | C4020 | Void Fraction 1C |
| B4 | C4021 | Void Fraction 1D |

Other sources of data are the following points:

| | |
|---|---|
| A427 | RCP A Power |
| A428 | RCP B Power |
| A429 | RCP C Power |
| A430 | RCP D Power |
| C1679 | Pump Running Index |
| L2776 | CRD Trip confirmed |

The values for Hot Leg and Reactor Vessel Head levels will be derived from signals which have been compensated for primary system temperature and reference leg temperature in the Foxboro Signal Conditioning Cabinets. The values for void fraction will be those calculated by the on-line application software program VOIDF. The program uses RCP power, RCP status (pump running index) and RC inlet temperature as inputs.

RCP power values are derived from watt transducers associated with each RCP motor. The pump running index is calculated by the NSS Application Software (NAS) program PMPIN. PMPIN uses RCP motor breaker status contacts to determine the status of each pump. The reactor trip status is derived from CRD trip confirmed, L2776.

At any given time the operator will view either Group A or Group B data. Depending upon plant operating status, there will be times when the display of Group A or B data on RCITS displays will not be meaningful. Group A (Level) data will be meaningful only when all RCPs are secured. Group B (Void Fraction) data for an RC cold leg will be meaningful only when the associated RCP is running.

To reduce the likelihood of confusion resulting from the viewing of data which is not meaningful when one or more RCPs are running, Group A data will be given a "bad" quality tag, and a request for its value will result in a display of a series of dots (....). This indication of quality and value will be the result of an automatic deletion of Group A points from scan. The deletion from scan (and the return to scan when all RCPs are off) will be performed by the Application Software Program SGHUCD.

The same indications will be used for an RC cold leg's void fraction point when the associated RCP is secured. Assignment of quality in this way is based on a check in VOIDF of the value of

For variables A1 and A2, zero and full scale values are 0 and 50 feet, respectively. For variables A3 and A4, zero and full scale values are 0 and 12 feet, respectively. For variables B1-B4, zero and full scale values are, respectively, 0 and 100 percent.

Running lengthways down the middle of each rectangular box is a line the same color as the box which is the half-scale indication for each box.

1.3.8.3.4 Display Data Interpretation

The "meaningfulness" of both Group A and Group B data will be indicated on the historical data trend display. When either Group A or Group B data is not meaningful, a series of dots extending from the left-hand side of the box to the right-hand side will be displayed. The dots will be blue in color. The dots will be spaced apart in the horizontal direction the width of one character position. In the vertical (time axis) direction, the dots will be spaced apart the height of one character position. Also, the value at the top of a box will be replaced by a series of dots when the box's variable is currently not meaningful. An example which illustrates a case where historical data for the most recent hour was not meaningful is shown by the left-most box of Figure 6.

## 1.4 SYSTEM PERFORMANCE CHARACTERISTICS

### 1.4.1 Process Data

Equipment connected to the primary pressure boundary is subjected to the following conditions:

| | |
|---|---|
| Pressure | 0-2500 PSIG |
| Temperature | 50°-650°F |
| Boron Conc. | 0-2270 PPM |

### 1.4.2 Environmental Performance

1.4.2.1 Equipment inside the Reactor Building is subject to the following conditions:

## 1.6 INSTRUMENTATION AND CONTROLS

A detailed description of instrumentation and controls is included in section 1.3.1 of this SDD. The following are additional details:

Differential pressure transmitters are installed with five valve manifolds.

The design of the computer displays and location of this instrumentation is subject to a human factors engineering review.

### 1.6.1 Instrument Ranges

| Instrument No. | Use | Operating Range |
|---|---|---|
| RC-LT-1033 | Hot Leg Level A | 0-50 FT |
| RC-LT-1034 | Hot Leg Level B | 0-50 FT |
| RC-LT-1035 | Reactor Vessel Level 1 | 0-12 FT |
| RC-LT-1036 | Reactor Vessel Level 2 | 0-12 FT |
| RC-TE-1033 and 1034 | Density Compensation of reference leg fluid | 70-250°F |
| RC-TE-1054 and 1055 | Density Comp. of RCS fluid | 200-700°F |
| RC-TE-1052 and 1053 | Cold Junction Ref. Temp. | 40-275°F |

## 1.7 SYSTEM INTERFACES

### 1.7.1 Electrical Distribution Systems

The interface with the vital busses is via the existing 1E qualified power supplies provided with the (Foxboro) Signal Conditioning Cabinets A2 and B1.

Reactor coolant pump power is obtained from the RCP Power Monitor Rack located at the 322' elevation of the Control Building. Pump status is obtained from the associated switchgear. The Bailey 855 computer is powered from inverter 1E (which receives vital power from either station battery 1C or diesel generator 1A) with backup vital power provided from diesel generator 1B. The ModComp computer receives power from an electrical bus which is backed up by diesel generator 1B.

sirable during water solid (i.e., feed and bleed) since the RCS pressure will be higher than if only two pumps are operating. Additionally, three HPI pumps should only be run if the RCS cooldown rate is less than 100 F/hr.

3.8.5 PORV Operation

If hot leg level drops below the surge line elevation, 42 feet below the top of the hot leg, evaluate opening the PORV and leaving it open until LPI is in operation. Do not open the PORV unless a source of water addition is available to the RCS (HPI, LPI or CFTs).

Basis: Once the surge line is uncovered, the PORV will be relieving steam. Steam relief provides the most effective means of cooling and depressurization from a given inventory loss. This action will even be effective under conditions where all HPI has been lost since it maximizes the chances of reaching CFT actuation pressure. If no makeup is available to the RCS, then inventory losses should be minimized while the operators attempt to provide a source of water to the RCS. Note that the PORV is also opened by existing procedures when the RCS pressure reaches 2300 psig and these two actions are complimentary to each other.

3.8.6 The following notes should be added to the Abnormal Transient Procedures:

a. Hot leg level indication is invalid when the hot leg high point vents are open.

b. RCS void fraction is only valid when the RCPs are operating.

c. RV head level indication is invalid when the head vent is open.

4.0 CASUALTY EVENTS AND RECOVERY PROCEDURES

Neither the void fraction nor hot leg level instruments initiate any automatic control actions. Their failure in either the high, low or intermediate position will require detection by comparison with other instruments. This situation is true for the failure of any indication and does not represent a unique situation for the operator to deal with.

Failure of the instrument piping associated with the RCITS does not result in a LOCA, but does represent a substantial leak.

## 5.4 INSERVICE INSPECTION AND TESTING

Testing/calibrating of the level instrumentation will be performed during each refueling by simulating the compensating signals, as done for existing similar level instrumentation (e.g. pressurizer).

The inservice inspection program requires periodic non-destructive examinations be performed during plant outages. The type extent and frequency of examinations will be specified in accordance with Procedure 6150-ADM-3272.01 of the GPU Nuclear Inservice Inspection Manual (Ref. 1.2.2.10).

Differential pressure transmitters and resistance temperature detectors associated with this modification have been qualified for in-containment service. As such, the qualified environmental barriers must be maintained throughout the maintenance and calibration cycles. Some of these barriers are consumable and must be replaced each cycle. Refer to manufacturer's instruction manual for specifics relative to maintaining the integrity of environmental barriers.

## 6.0 TESTING

The following tests must be accomplished for an acceptable RCITS system.

1. Hydrostatic pressure test of piping and tubing system.
2. Functional test as required by the control system's supplier (Foxboro Spec. 200).

## 7.0 HUMAN FACTORS

GPUN Human Factors Engineering has reviewed the RCITS design. A review of display type, information and format has been conducted in conjunction with Plant Analysis. Plant Analysis input for the displays has been incorporated into the design and no new hardware interface is involved. All displays recommended by Plant Analysis are in accordance with the principles of human engineering. A post-construction walkdown will be performed to assure that scale, labels, and other man-machine interface items are acceptable.

AREA 3 GROUP 37 RC INVENTORY TRACKING

A466 RC Hot Leg A Level
A468 RC Hot Leg B Level
A467 Reactor Vessel Head Level 1
A469 Reactor Vessel Head Level 2

C4018 Void Fraction 1A
C4019 Void Fraction 1B
C4020 Void Fraction 1C
C4021 Void Fraction 1D

A427 RC-P-1A Power
A428 RC-P-1B Power
A429 RC-P-1C Power
A430 RC-P-1D Power
L2776 CRD Trip Confirmed

C1679 Pump Running Index

Figure 3 RC INVENTORY TRACKING GROUP DISPLAY

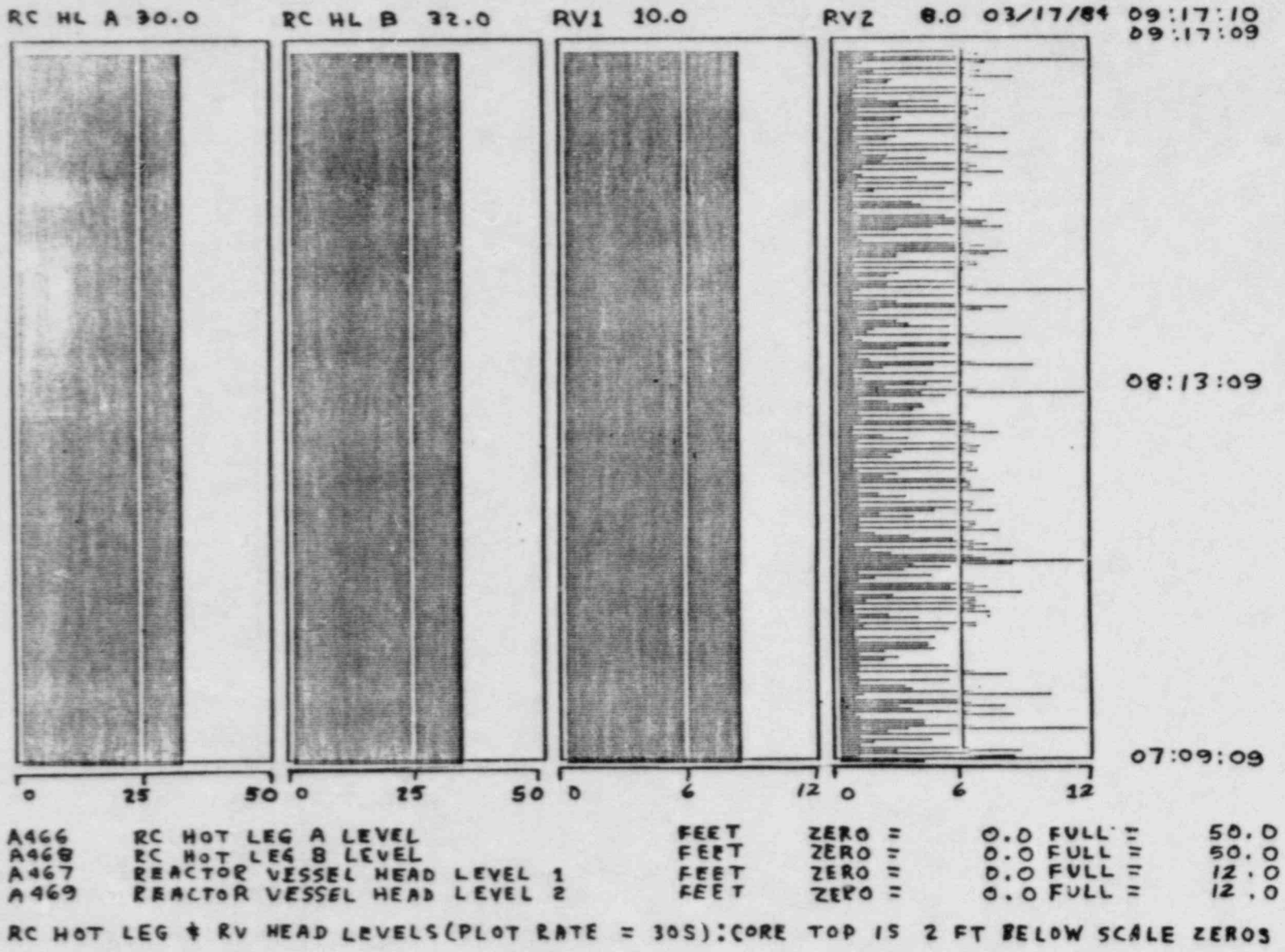


Figure 5. RC HOT LEG & RV HEAD LEVELS HISTORICAL DATA TREND DISPLAY

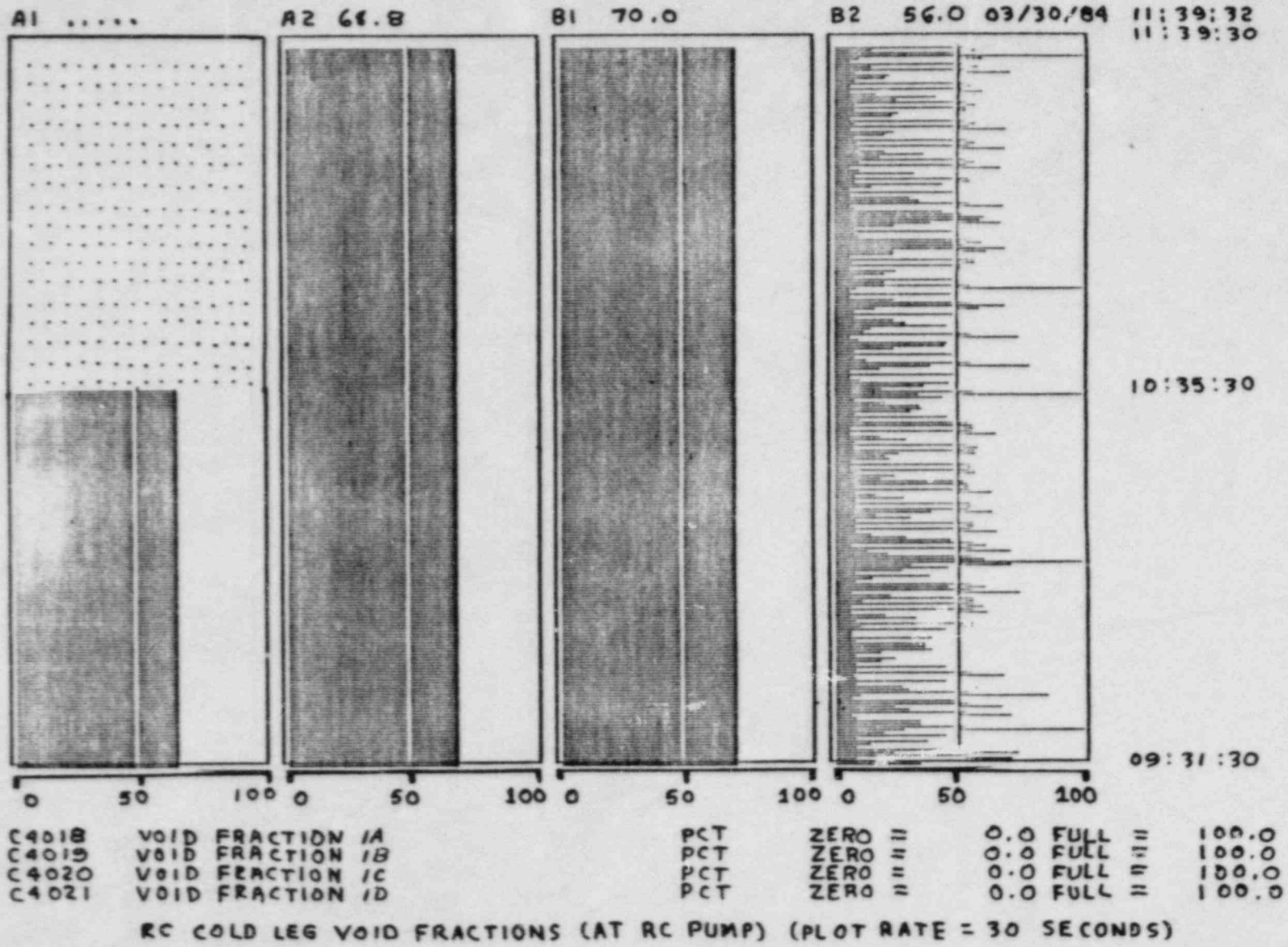


Figure 6. RC COLD LEG VOID FRACTIONS HISTORICAL DATA TREND DISPLAY

Attachment 2

## ICC Instrumentation Schedule (RITS)
Rev. 2

| | |
|---|---|
| a) Operating and Emergency Procedure Mods* | 2/85 |
| b) Submit Technical Specifications for ICC Instrumentation | 3/85 |
| c) Complete Installation of RITS | completed 12/84 |
| d) Complete Installation of Safety Grade SMM | 3/85 |
| e) Complete Testing and Calibration of RITS | 3/85 |
| f) Complete training of RO/SRO | Completed 12/84 |
| g) Operational date of RITS | Based on approval of NRC |
| h) Environmental Qualification of RITS and Incore Thermocouples** | 11/85 |

* Pending review by NRC
** Schedular extension to be submitted by January 31, 1985

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