NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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January 30, 1991

Docket No. 50-336
A07623
B13691
Re: Generic Letter 88-17

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

References: (1) D. M. Crutchfield letter to All Holders of Operating Licenses or Construction Permits for Pressurized Water Reactors, "Loss of Decay Heat Removal (Generic Letter No. 88-17), 10CFR50.54(f)," dated October 17, 1988.

(2) E. J. Mroczka letter to U.S. Nuclear Regulatory Commission, "Loss of Decay Heat Removal--GL 88-17," dated December 23, 1988.

(3) E. J. Mroczka letter to U.S. Nuclear Regulatory Commission, "Loss of Decay Heat Removal--GL 88-17," dated January 31, 1989.

(4) G. S. Vissing letter to E. J. Mroczka, "Programmed Enhancements for Generic Letter 88-17, Loss of Decay Heat Removal for Millstone Unit 2," dated May 29, 1990.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 2
Loss of Decay Heat Removal
Generic Letter 88-17 (TAC No. 69754)

On October 17, 1988, the NRC issued Generic Letter (GL) 88-17 to request information from licensees regarding the actions taken to implement the identified expeditious actions, and plans and schedules to implement the identified programmed enhancements concerning operation of the Nuclear Steam Supply System during shutdown cooling or during conditions where such cooling would normally be provided. These expeditious actions and programmed enhancements apply whenever there is irradiated fuel in the reactor vessel. The Staff requested, within 60 days of receipt of Reference (1), that licensees submit a description of actions taken to implement each of the eight recommended expeditious actions identified in the attachment to GL 88-17. In Reference (2), Northeast Nuclear Energy Company (NNECO), on behalf of Millstone Unit No. 2, provided a response to each of the eight recommended

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expeditious actions. The expeditious actions were implemented to support the 1989 refueling outage.

In addition, the Staff requested, within 90 days of receipt of Reference (1), that all licensees submit a description of enhancements, specific plans, and a schedule for implementation for each of the six programmed enhancements identified in the attachment to GL 88-17. In Reference (3), NNECO, on behalf of Millstone Unit No. 2, provided a response to this request.

Reference (4) discussed NNECO's responses contained in Reference (3) and requested notification of any significant schedule changes, notification of implementation, and notification of modification completion. The equipment modifications for programmed enhancements were accomplished on schedule during the 1990 refueling outage. These modifications are now complete and are operational. Attachment 1 summarizes the Millstone Unit No. 2 instrumentation that will be used to monitor the status of the reactor coolant system during a reduced inventory condition.

We trust you find this information satisfactory and responsive. As always, we are available to address any questions the NRC Staff may have.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

E. J. Mroczka
Senior Vice President

cc: T. T. Martin, Region I Administrator
G. S. Vissing, NRC Project Manager, Millstone Unit No. 2
W. J. Raymond, Senior Resident Inspector, Millstone Unit Nos. 1, 2, and 3

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Attachment

Millstone Nuclear Power Station, Unit No. 2

Implementation of Generic Letter 88-17
Programmed Enhancements
Item 1--Instrumentation

January 1991

Millstone Nuclear Power Station, Unit No. 2
Implementation of Generic Letter 88-17
Programmed Enhancements
Item 1--Instrumentation

In response to Generic Letter 88-17, Loss of Decay Heat Removal, Millstone Unit No. 2 has completed implementation of Item 1, Instrumentation. The following describes the features of this completed installation.

Item 1 - Instrumentation

Provide reliable indication of parameters that describe the state of the reactor coolant system (RCS) and the performance of systems normally used to cool the RCS for both normal and accident conditions. At a minimum, provide the following in the control room (CR):

1. Two independent RCS level indications.

2. At least two independent temperature measurements representative of the core exit whenever the reactor vessel (RV) head is located on top of the RV. (We suggest that temperature indications be provided at all times.)

3. The capability of continuously monitoring decay heat removal (DHR) system performance whenever a DHR system is being used for cooling the RCS.

4. Visible and audible indications of abnormal conditions in temperature, level, and DHR system performance.

Response

1. RCS Hot Leg Level Instrumentation Additions

   Level detection instrumentation is installed for monitoring RCS hot leg level. The instrumentation provides input to the integrated control system (ICS) for indication (Figures 2 through 4) and alarms on C03F. Diverse level sensing methods which are unaffected by pressure perturbations or process flow effects are used. These methods are illustrated in Figure 1.

   a. RCS Hot Leg No. 1 Level Detection

      A continuous level detection system is provided in the Hot Leg No. 1 loop area. The scheme (see Figure 1) includes sensors for both local indication and remote indication and alarms. The sensor measures RCS level during reduced inventory conditions via the Hot Leg No. 1 drain line.

The sensor providing the signal for remote indication and alarms of RCS level in the CR is a thermal dispersion continuous level sensor manufactured by Fluid Components Inc. (FCI). The Model CL86 level sensor (LE-112) is installed in a standpipe provided by FCI. The standpipe is connected (valved-in) to existing hot leg drain valves (2-RC-214 and 2-RC-433) and RCS common vent header (2-RC-419) only during Modes 5 and 6 evolutions including RCS draindown, reduced inventory, midloop, and fill. The standpipe is isolated (valved-out) for all other operational modes (1 through 4). Existing Tygon™ tubing connections required to vent the pressurizer and RCS via the reactor vessel head vent is replaced with hard tubing. A transition tubing assembly is provided with quick disconnects to connect the RCS head vent on the control element assembly (CEA) shroud to a vent header provided on the steam generator (S/G) No. 1 enclosure wall at approximately the refueling deck level.

A level transmitter (LT-112) located in the east electrical penetration room generates a 4-20 milliamp direct current (madc) output (proportional to the level sensor output) to the ICS for remote indication (Figures 3 and 4) and provide **reduced RCS level** and **Loop 1 hot leg level low** alarm contact outputs to RC22 for annunciation on control room (CR) reactivity control panel (C04). The reduced RCS level alarm alerts the operator that level is approaching reduced inventory conditions; i.e., approximately 3 feet below the reactor vessel flange. The Loop 1 hot leg level low alarm alerts the operator that RCS hot leg level has fallen to a point where air entrainment and possibly onset of vortexing is likely at shutdown cooling (SDC) flows > 1200 gpm. Power for the transmitter is provided at the local racks from VR11.

Local indication is provided via a GEMS Sure Site™ Level Indicator (LI-112), Model 87120. The local level indicator is continuously monitored via camera on a remote CR TV monitor and can be used for cross channel checks of the other RCS level sensors. This level indicator consists of a float in a standpipe similar to the standpipe being provided for the FCI sensor. Indication is provided by high visibility magnetic 'flags' attached to the standpipe which are positioned depending on the elevation of the internal float. The FCI and GEMS standpipe assemblies are connected via flange adaptors.

b. RCS Hot Leg No. 2 Level Detection

A continuous level detection system is provided on Hot Leg No. 2. The scheme (see Figure 1) includes an ultrasonic level sensor, preamplifier, and remote electronics for driving indication and alarms.

This ultrasonic level sensing system is provided by Westinghouse. It measures Hot Leg No. 2 water level nonobtrusively by sensing

water level ultrasonically through the RCS pipe wall. The pipe surface is finished to meet the sensor interface requirements. Piping insulation has been modified to accommodate the sensor.

The sensor is designed to remain strapped to the bottom of the RCS hot leg pipe during operation as well as shutdown. A preamplifier is located in the containment outer loop (-3' 6") area near Rack C-146. The signal processor or level transmitter (LT-122) is located outside of containment in the west electrical penetration area near Rack C-263. The processor includes functions which fail the transmitter output low, i.e., < 4 madc, if either the sensor or preamplifier fails, or the actual level drops below ≈ -17" (below the centerline). The processor cannot reliably detect water levels of less than ≈ 4" above the pipe bottom. Once level rises to ≥ ≈ 4", the processor will reinitialize and resume normal operation.

The transmitter provides a 4-20 madc output signal proportional to RCS Hot Leg No. 2 level for display by the ICS (Figures 3 and 4) and generation of alarms on CR reactivity control panel (C04) by Foxboro SPEC 200 instrumentation located in Cabinet RC-31D. Alarms include **RCS level at hot leg** and **Loop 2 hot leg level low**. The RCS Level at hot leg alarm alerts the operator that level is below the top of the hot leg, and that SDC flow should be reduced, by procedure, to < 2500 gpm. The Loop 2 hot leg level low alarm is redundant to the Loop 1 hot leg level low alarm, and alerts the operator that RCS hot leg level has fallen to a point where air entrainment and onset of vortexing is possible at SDC flows > 1200 gpm. An alarm bypass is provided on C03R to eliminate off-normal alarms from this instrumentation during normal plant operating temperature conditions. The bypass is keylocked and administratively controlled to prevent inadvertent bypass during reduced inventory conditions. Power for the preamplifier and transmitter is provided at the local racks from VR21.

c. Additional RCS Level Indications

Although not specifically credited for level monitoring during reduced inventory conditions, two independent channels of the reactor vessel level monitoring system (RVLMS) are available for RCS temperature monitoring purposes when the RCS is in a reduced inventory condition with the reactor vessel head located on top of the reactor vessel. The RVLMS level channels each provide the operator with eight discrete indication points above the reactor core. Three discrete points correspond to the top, center, and bottom of the hot leg. The RVLMS sensors are continuously displayed on any of three ICS-ICC display pages, as illustrated in Figures 2 through 4.

2. RCS Temperature Monitoring

As discussed in 1.c above, NNECO plans to maintain two independent channels of the RVLMS operable when the RCS is in a reduced inventory condition with the reactor vessel head located on top of the reactor vessel. The unheated thermocouples utilized in each sensor assembly provide a measure of RCS temperature, when in contact with the RCS water, and are available for display on the ICS-ICC display page. Pages 2 and 3 of the ICS-ICC pages display the bottom two thermocouples for each RVLMS sensor, as illustrated on Figures 3 and 4.

3. SDC System Performance Monitoring

Substantial SDC system performance monitoring data is available to the CR operator in the form of continuously updated graphic displays on the ICS. Figure 5 illustrates the SDC display page. The ICS also provides trend capabilities for selection by the operator and computer-generated alarms.

Previous monitoring capabilities included the following:

a. SDC inlet and outlet temperatures.
b. SDC heat exchanger outlet temperatures.
c. SDC low-pressure safety injection pump (LPSI) discharge pressure.
d. SDC system flow.
e. LPSI injection header flows.
f. LPSI pump motor current.

Audible, visible and computer alarms are presently available to the CR operator, as follows:

a. LPSI pump tripped annunciators.
b. LPSI Injection Headers 1A, 2A, 1B, 2B high/low flow.
c. LPSI Pumps A and B high/low discharge pressure.
d. Shutdown Heat Exchangers A and B high/low discharge temperature.

<u>SDC System Instrumentation Upgrades</u>

Additional SDC instrumentation is installed to provide the operator with enhanced SDC performance monitoring capabilities. The completed installations are described as follows:

a. LPSI Pump A and B Suction Pressure Indication and Alarms

Tees and new tubing are added between existing root valves and local suction pressure gauges (PI-3051, 3053). New Foxboro Model 821GM electronic pressure transmitters (PT-3051, 3053) are added to provide a 4-20 madc analog output for remote signal processing. Foxboro SPEC 200 Cabinets RC-31C and 31D perform signal processing

for retransmission to the ICS system for remote indication (Figure 5), and generation of **LPSI Pump A suction pressure lo** and **LPSI Pump B suction pressure lo** alarms at CR engineered safeguards panel (C01). The purpose of the low-suction pressure alarm is to provide a qualitative alert to the operator that pump suction pressure has fallen below that expected during midloop operation. These alarms are interlocked with the LPSI pump motor control switches to eliminate board alarms when the switches (HS-3017, 3018) are in the off position.

b. LPSI Pump A and B High/Low Motor Current Alarms

Current transmitters and signal processing electronics are installed for measuring LPSI pump motor current and provide **LPSI Pump A motor current hi/lo** and **LPSI Pump B motor current hi/lo** alarms at CR engineered safeguards panel (C01). The purpose of the high/low pump motor current alarm is to provide a qualitative alert to the operator that pump motor current has gone outside that range expected for various SDC flow rates during midloop operation. The AC current sensor provides a 4-20 madc output signal proportional to a single phase of the LPSI pump motor current. The AC current sensor is powered by signal processing electronics located in Foxboro SPEC 200 cabinets (RC31C and RC31D) which also generate alarm outputs for annunciation on CR Engineered Safeguards Panel C01F. These alarms are interlocked with the LPSI pump motor control switches to eliminate board alarms when the LPSI pump motor control switches (HS-3017, 3018) are in the off position.

4. Available Alarm and Trend Capabilities

Visible and audible indications of abnormal conditions in temperature, level, and SDC system performance are described in Items 1, 2, and 3 above.

Millstone Unit 2
RCS Hot Leg Level Monitoring Instrumentation

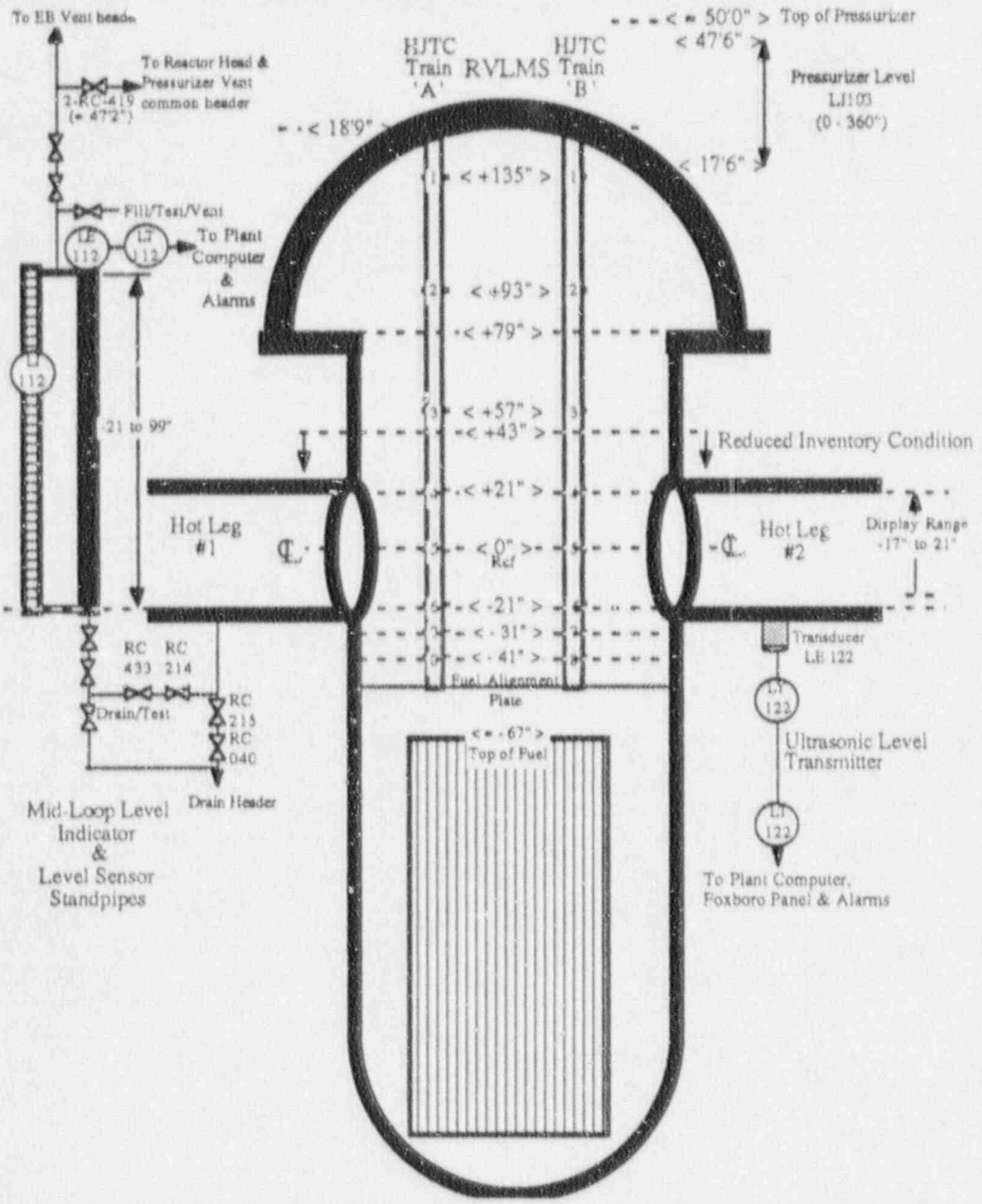

Figure 1

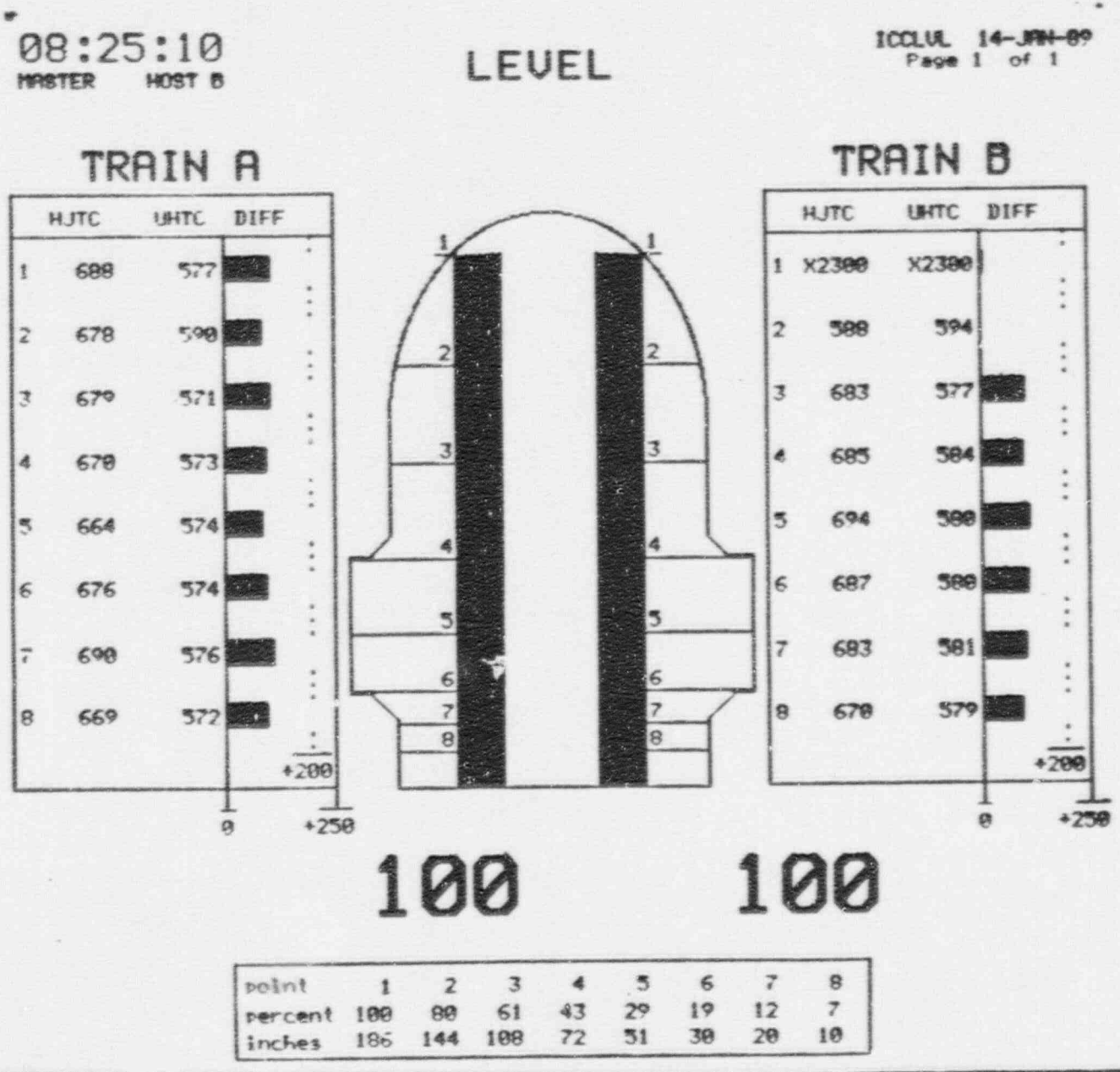

Figure 2
MILLSTONE UNIT 2
REACTOR VESSEL MONITORING

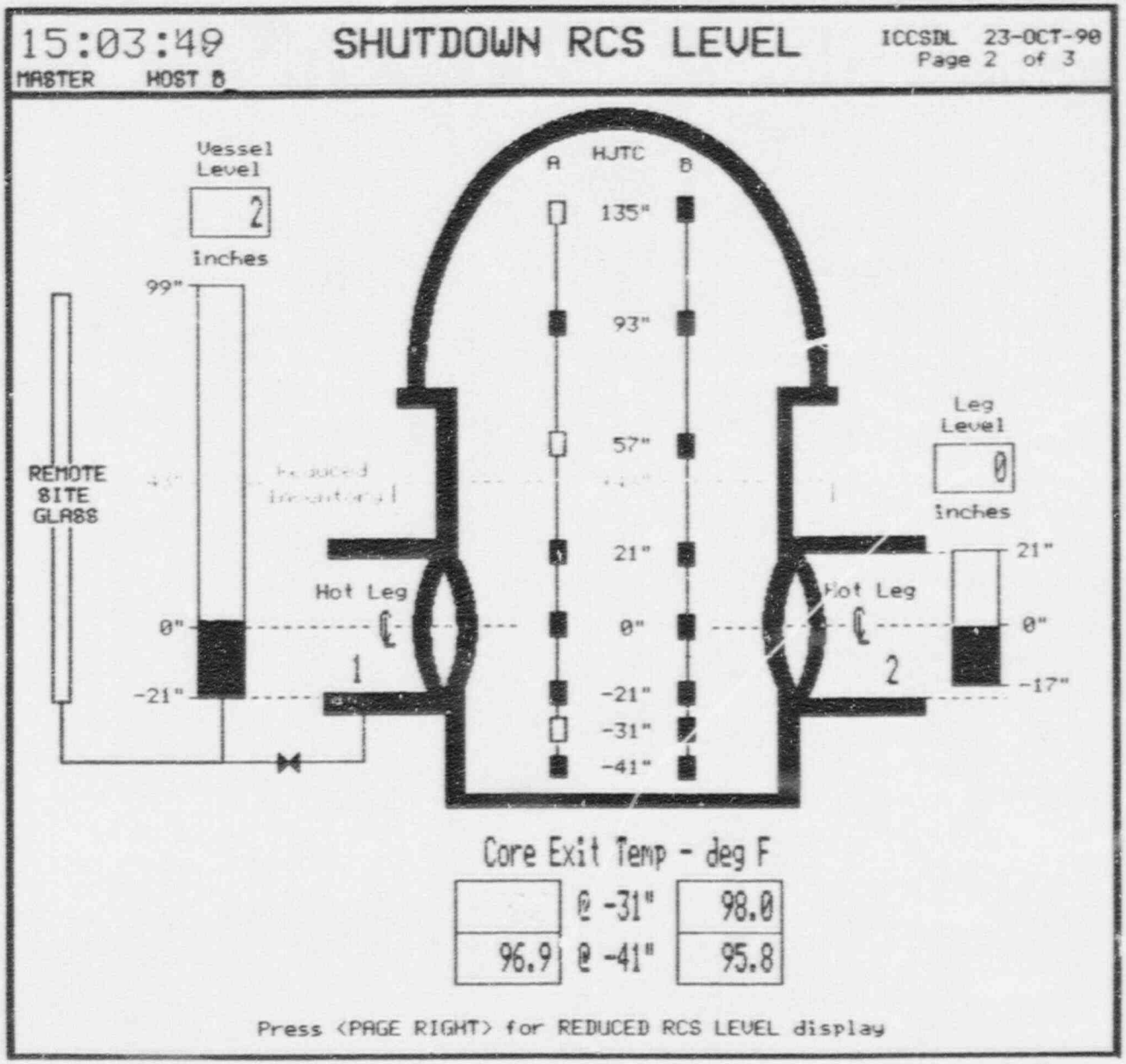
15:03:49
MASTER HOST B
SHUTDOWN RCS LEVEL
ICCSDL 23-OCT-90
Page 2 of 3
Vessel Level
2
inches
99"
0"
-21"
REMOTE SITE GLASS
Reduced Inventory
A HJTC B
135"
93"
57"
21"
0"
-21"
-31"
-41"
Hot Leg
Hot Leg
1
2
Leg Level
0
inches
21"
0"
-17"
Core Exit Temp - deg F
@ -31"
98.0
96.9
@ -41"
95.8
Press <PAGE RIGHT> for REDUCED RCS LEVEL display

Figure 3

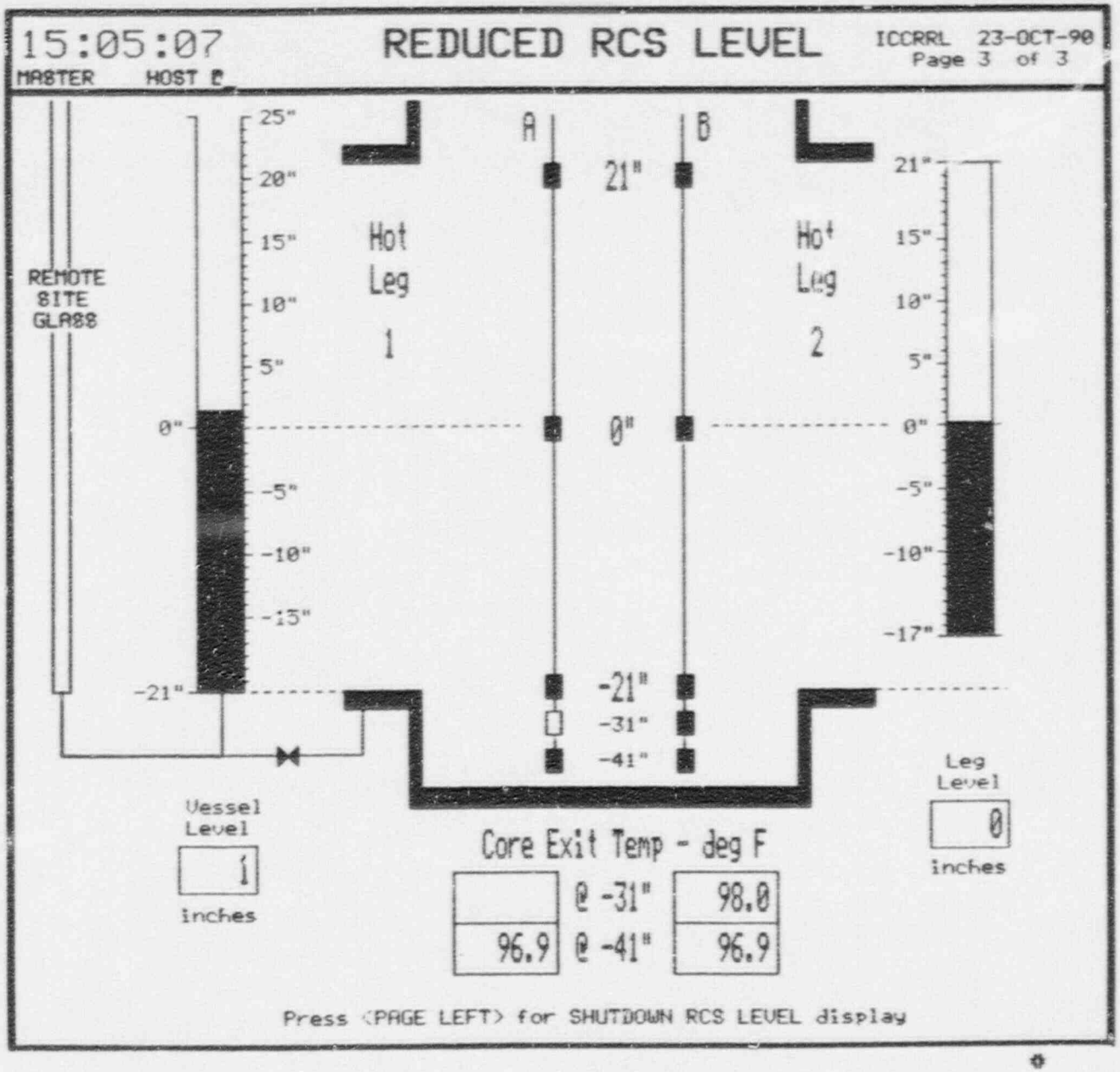
15:05:07
MASTER HOST
REDUCED RCS LEVEL
ICCRRL 23-OCT-90
Page 3 of 3
REMOTE SITE GLASS
25"
20"
15"
10"
5"
0"
-5"
-10"
-15"
-21"
Hot Leg 1
A
B
21"
0"
-21"
-31"
-41"
Hot Leg 2
21"
15"
10"
5"
0"
-5"
-10"
-17"
Vessel Level
1
inches
Leg Level
0
inches
Core Exit Temp - deg F
@ -31"
98.0
96.9
@ -41"
96.9
Press <PAGE LEFT> for SHUTDOWN RCS LEVEL display

Figure 4

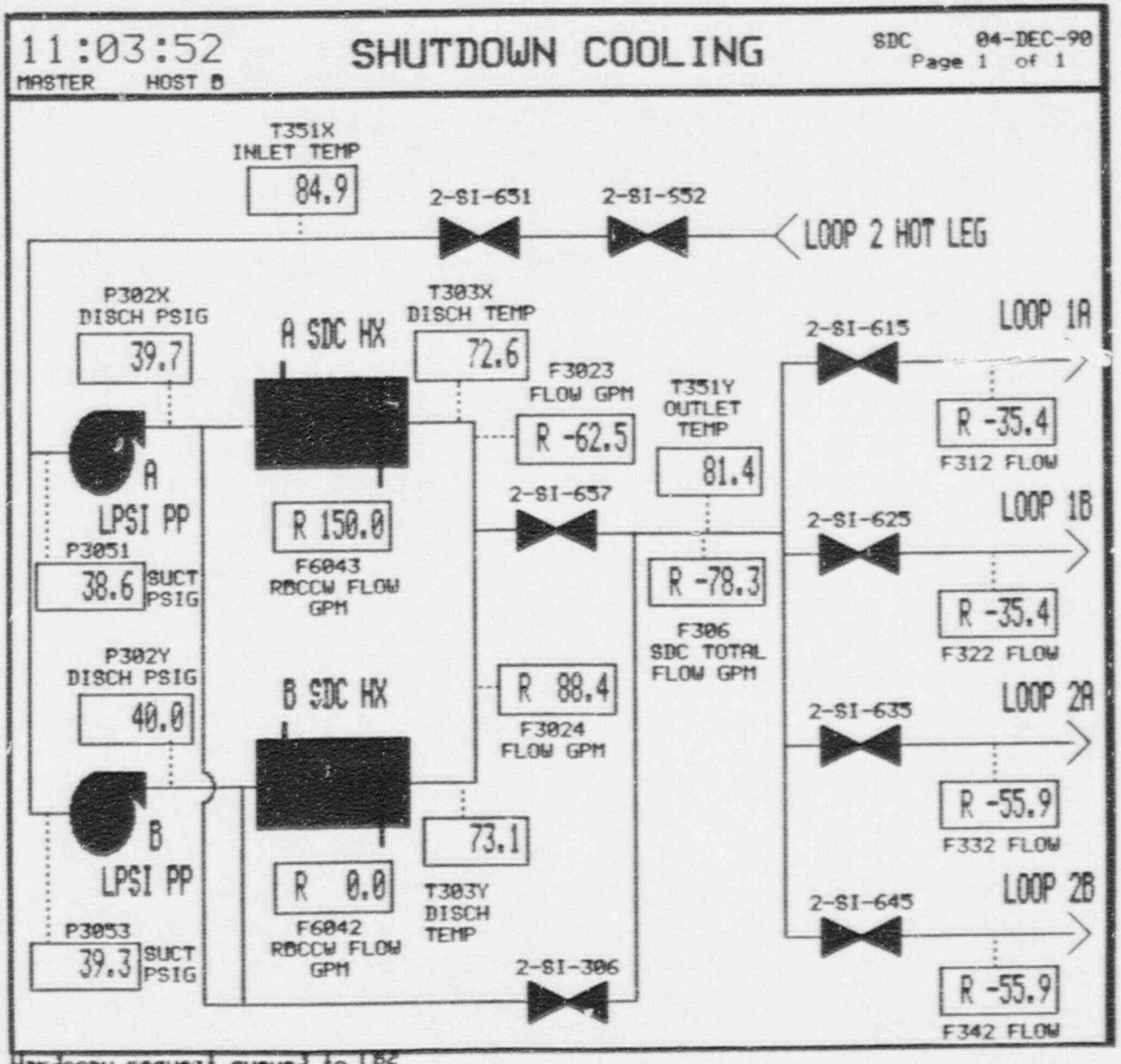
11:03:52
MASTER HOST B
SHUTDOWN COOLING
SDC 04-DEC-90
Page 1 of 1
T351X
INLET TEMP
84.9
2-SI-631
2-SI-552
LOOP 2 HOT LEG
P302X
DISCH PSIG
39.7
A SDC HX
T303X
DISCH TEMP
72.6
F3023
FLOW GPM
R -62.5
T351Y
OUTLET
TEMP
81.4
2-SI-615
LOOP 1A
R -35.4
F312 FLOW
A
LPSI PP
P3051
38.6
SUCT
PSIG
R 150.0
F6043
RBCCW FLOW
GPM
2-SI-637
2-SI-625
LOOP 1B
R -78.3
F306
SDC TOTAL
FLOW GPM
R -35.4
F322 FLOW
P302Y
DISCH PSIG
40.0
B SDC HX
R 88.4
F3024
FLOW GPM
2-SI-635
LOOP 2A
R -55.9
F332 FLOW
B
LPSI PP
73.1
T303Y
DISCH
TEMP
R 0.0
F6042
RBCCW FLOW
GPM
P3053
39.3
SUCT
PSIG
2-SI-645
LOOP 2B
2-SI-306
R -55.9
F342 FLOW
Hardcopy request queued to LP6

Figure 5