Wisconsin Electric POWER COMPANY
231 W. MICHIGAN, P.O. BOX 2046, MILWAUKEE, WI 53201

March 21, 1983

Mr. H. R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. NUCLEAR REGULATORY COMMISSION
Washington, D.C. 20555

Attention: Mr. R. A. Clark, Chief
Operating Reactors Branch 3

Gentlemen:

DOCKET NOS. 50-266 AND 50-301
REPLY TO GENERIC LETTER NO. 82-28
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

Enclosed is Wisconsin Electric's response to Generic Letter No. 82-28, "Inadequate Core Cooling Instrumentation System", dated December 10, 1982. This response includes answers to the three items contained in the body of the letter, to the questions in the Appendix and to Attachment 1 and Appendix B to II.F.2 of NUREG-0737. Please contact us if you have any additional questions regarding this information.

Very truly yours,

C. W. Fay

Vice President - Nuclear Power

C. W. Fay

Enclosure

Copy to NRC Resident Inspector

Subscribed and sworn to before me
this 21st day of March 1983.

Dorothy Fleischmann
Notary Public, State of Wisconsin

My Commission expires July 1, 1984.

A002

REPLY TO GENERIC LETTER NO. 82-28

INADEQUATE CORE COOLING INSTRUMENTATION SYSTEM
POINT BEACH NUCLEAR PLANT

1. Within ninety days of the date of this letter, identify to the Director, Division of Licensing, the design for the reactor coolant inventory system selected and submit to the Director, Division of Licensing, detailed schedules for its engineering, procurement and installation. References to generic design descriptions and to prior submittals containing the required information, where applicable, are acceptable.

RESPONSE

The Reactor Vessel Water Level Indication System being installed at Point Beach is a differential pressure system utilizing Foxboro gauge and differential pressure transmitters. The transmitters are located inside containment with no isolators in the fluid lines to the transmitters. Signal processing is accomplished in Foxboro SPEC 200 analog process racks. Core exit and fluid line thermocouple outputs are processed by the computer multiplexers which provide scaled and combined signals to the analog racks. The system will provide water level indication from below the reactor core to the top of the reactor vessel. The computer multiplexers and analog process racks involved will be powered by two new Class 1E power supplies. Output displays will be located on new Auxiliary Safety Instrumentaton Panels to be installed in the control room.

An engineering description of the Reactor Vessel Water Level Indication System was provided in our letter of October 20, 1981. Additional information on the system was provided in our letters of July 20, 1982 and January 19, 1983. All portions of the system have been ordered. Schedular information is provided in the response to item 3.

2. Within ninety days of the date of this letter review the status of conformance of all components of the ICC instrumentation system, including subcooling margin monitors, core-exit thermocouples, and the reactor coolant inventory tracking system, with NUREG-0737, Item II.F.2, and submit a report on the status of such conformance.

RESPONSE

The Reactor Vessel Water Level Indication System and Subcooling Monitor were designed to meet the requirements of NUREG-0737. The Core Exit Thermocouple Indication System is being upgraded to meet the requirements of NUREG-0737 and Regulatory Guide 1.97. The status of conformance is indicated in the attached appendix.

3. The installation of the ICC instrumentation system shall be completed during the earliest refueling shutdown consistent with the existing status of the plant and practical design and procurement considerations. It has become apparent, through discussions with owners groups and individual licensees, that schedules must adequately consider the integration of these requirements with other TMI-related activities. In recognition of this and the difficulty in implementing generic deadlines, the Commission has adopted a plan to establish realistic plant-specific schedules that take into account the unique aspects of the work at each plant. Each licensee is to develop and submit its own plant-specific schedule which will be reviewed by the assigned NRC Project Manager. The NRC Project Manager and licensee will reach an agreement on the final schedule and in this manner provide for prompt implementation of these important improvements while optimizing the use of utility and NRC resources.

RESPONSE

The dates items were installed and the schedule for future installation of the remaining ICC instrumentation at Point Beach are as follows:

a. Containment Electrical Penetration Installation

Unit 1	Fall 1980
Unit 2	Spring 1981

b. Lower Tap Connection to Thimble Guide Tube

Unit 1	October 1981
Unit 2	May 1982

c. Upper Tap Connection to Reactor Vessel Head

Unit 1	November 1981
Unit 2	May 1982

d. Delivery and installation of Foxboro SPEC 200 Analog Process Racks

Unit 1 and Unit 2 March 1982

e. Lower Fluid Connection in Keyway

Unit 1 Fall 1982

Unit 2 Spring 1982

f. Upper Fluid Connection in Refueling Cavity

Unit 1 Fall 1982

Unit 2 Spring 1983

g. Pressure and Differential Pressure Transmitter Installation

Unit 1 Fall 1982

Unit 2 Spring 1982

h. Installation of Thermocouples on Fluid Lines

Unit 1 Fall 1982

Unit 2 Spring 1983

i. Installation of cable inside containment for Reactor Vessel Water Level and Subcooling Monitor

Unit 1 Fall 1982

Unit 2 Spring 1982 and Spring 1983

j. Installation of dual element Reactor Coolant Loop Hot Leg RTDs

Unit 1 Fall 1982

Unit 2 Spring 1983

k. Installation of cable from containment to Process Racks

Unit 1 October 1982

Unit 2 February 1983

l. Receipt of Auxiliary Safety Instrumentation Panels (Note 1)

Unit 1 and Unit 2 July 1983

m. Installation of Auxiliary Safety Instrumentation Panels in control room (Note 1)

Unit 1 and Unit 2 August 1983

n. Receipt of computer multiplexers (Note 1)

Unit 1 and Unit 2 September 1983

o. Installation of computer multiplexers (Note 1)

Unit 1 and Unit 2 October 1983

p. Installation and termination of cable from Foxboro racks to the Auxiliary Safety Instrumentation Panels (Note 1)

Unit 1 and Unit 2 October 1983

q. Receipt of remainder of computer system (Note 1)

Unit 1 and Unit 2 October 1983

r. Installation of cable and connectors inside containment for Core Exit Thermocouple Upgrade. This item does not include final connection of cables to thermocouples. See item (u.).

Unit 1 Fall 1983

Unit 2 Spring 1983

s. Connection to new Class 1E power supplies

Unit 1 and Unit 2 December 1983

t. Installation and termination of cable to computer multiplexers (Note 1)

Unit 1 and Unit 2 November 1983

u. Computer system startup (Note 1)

Unit 1 and Unit 2 December 1983 to February 1984

v. Final connection of upgraded Core Exit Thermocouples

Unit 1 (Note 2) June 1984

Unit 2 (Note 3) November 1984

w. Functional test of final Subcooling Monitor System

Unit 1 (Note 2) July 1984

Unit 2 (Note 4) December 1984

x. Functional test of final Reactor Vessel Water Level Instrumentation System

Unit 1 July 1984

Unit 2 (Note 5) December 1984

NOTE 1: Schedule is dependent on delivery of equipment from vendor.

NOTE 2: After refueling and steam generator changeout outage from October 1983 to May 1984

NOTE 3: This is the first outage after computer installation.

NOTE 4: Subcooling using hot leg RTDs will be operational when item s. is completed.

NOTE 5: Unit 2 vessel level will be made operational initially using the existing thermocouples or the hot leg RTDs.

APPENDIX TO REPLY TO
NRC GENERIC LETTER NO. 82-28

Checklist for Plant-Specific Review of
Inadequate Core Cooling (ICC) Instrumentation System

For: Point Beach Nuclear Plant, Units 1 and 2

Docket Nos.: 50-266 and 50-301

Operated by: Wisconsin Electric Power Company

The following items for review are taken from NUREG-0737, pp. II.F.2, 3, and 4. Responses should be made to full requirements in NUREG-0737, not abbreviated forms below. Applicants should provide reference to either the applicant's submittal or the generic description under the column labeled "Reference." These items are required to be reviewed on a plant-specific basis by NUREG-0737 for all plants. Differences from the generic descriptions provided by Westinghouse, the Westinghouse Owner's Group, Combustion Engineering, or Combustion Engineering Owner's Group must be indicated by "yes or no" in the column labeled deviations and must be justified Under the column labeled schedule, either indicate that your documentation of the item is complete or provide a proposed schedule for your submittal.

RESPONSE

Wisconsin Electric Power Company has designed the ICC instrumentation systems to fulfill the requirements of NUREG-0737, II.F.2. The description of the systems are provided in the attached responses or the indicated references. Since these systems were not purchased as a system from a vendor, differences from generic descriptions cannot be made. The attached responses and references are intended to fully address the NUREG-0737 requirements.

1. Description of the proposed final system including:

   a. A final design description of additional instrumentation and displays;
   b. Detailed description of existing instrumentation systems; and
   c. Description of completed or planned modifications.

RESPONSE

A description of the proposed Reactor Vessel Water Level Indication System was provided in our letters of October 20, 1981 and July 28, 1982. A

description of the Core Exit Thermocouple Upgrade was provided in our letter of July 28, 1982. A description of the displays is provided in the response to question 5. Existing instrumentation systems are described in the Final Safety Analysis Report for Point Beach.

The Subcooling Monitor is mechanized in the Foxboro SPEC 200 Analog Process Racks. There are two redundant monitors in each unit. In the Subcooling Monitor, a function generator is used to derive the saturation temperature from the Reactor Coolant Loop Wide Range Pressure signal. The computed saturation temperature is then subtracted from either the average Core Exit Thermocouple temperature or the temperature indicated by a Hot Leg RTD. This difference in temperature is sent to the computer and also displayed on an indicator located on the Auxiliary Safety Instrumentation Panel in the control room. A switch on the Auxiliary Safety Instrumentation Panel enables the operator to select either the average Core Exit Thermocouple temperature or the Hot Leg RTD temperature for use in the Subcooling Monitor. The output is scaled from 200°F subcooling to 50°F superheat. A loop block diagram of the Subcooling Monitor is attached to this Appendix as Attachment 3.

2. A design analysis and evaluation of inventory trend instrumentation and test data to support design in item 1.

RESPONSE

An error analysis of the Reactor Vessel Water Level Indication System was provided in our letter of January 19, 1983. The Reactor Vessel Water Level Indication System will respond in the same manner as other differential pressure systems and the test data developed at the Semiscale facility can be used to support this design.

3. Description of tests planned and results of tests completed for evaluation, qualification, and calibration of additional instrumentation.

RESPONSE

A description of in-plant tests planned for the Reactor Vessel Water Level Indication System was provided in our letter of July 28, 1982. The testing of a differential pressure system at the Semiscale facility provides an evaluation of internal vessel parameters on a differential pressure system. The equipment will be calibrated per normal plant calibration procedures with some special startup tests as described in our letter of July 28, 1982. All new hardware for these systems that require environmental qualification has either been qualified or is undergoing qualification.

4. Provide a table or description covering the evaluation of conformance with NUREG-0737: II.F.2, Attachment 1, and Appendix B (to be reviewed on a plant-specific basis).

RESPONSE

The evaluation of conformance with NUREG-0737, II.F.2, Attachment 1, and Appendix B is attached to this Appendix as Attachments 1 and 2, respectively.

5. Describe computer, software, and display functions associated with ICC monitoring in the plant.

RESPONSE

The new computer system configuration diagram is provided as Attachment 4. The computer system has three means of displaying ICC instrumentation information; Safety Assessment System (SAS) displays, process computer displays, and multiplexer-driven displays. The Point Beach SAS meets or exceeds the requirements of the Safety Parameter Display System (SPDS).

SAS displays include a high-level display on which the values for subcooling, vessel level and core exit temperature will be shown. The SAS display selection also includes trend plots for the last thirty minutes of data from the ICC instrumentation. The SAS programs also monitor critical safety function parameters, which include subcooling, vessel level and core exit temperature, and display the results on status trees.

Process computer displays include all of the SAS displays plus a core map display showing the location of each core exit thermocouple and its present value.

The multiplexer-driven displays are presented on a 40 character-per-line by 12 line plasma display panel. A summary display presents two sets of core exit thermocouple quadrant tilts, the five highest readings and their locations and the average exit temperature. Two other displays present the individual thermocouple values and locations. One display has twenty thermocouples and the other has nineteen thermocouples. The operator can also select up to twenty of the individual thermocouples for display. The multiplexer processors have programs that calculate subcooling and reactor vessel water level. These calculated values can also be displayed on the plasma panels.

6. Provide a proposed schedule for installation, testing and calibration and implementation of any proposed new instrumentation or information displays.

RESPONSE

Refer to the response to item 3 of this letter for the schedule.

7. Describe guidelines for use of reactor coolant inventory tracking system and analyses used to develop procedures.

RESPONSE

The guidelines for use of the Reactor Vessel Water Level Indication System, Subcooling Monitor, and Core Exit Thermocouples were developed by the Westinghouse Owners Group as part of their Emergency Response Guidelines. The Emergency Response Guideline set has been sent to the NRC by the Westinghouse Owners Group. Our letter of July 28, 1982 contains a discussion of these guidelines as well as copies of some of the applicable guidelines.

8. Operator instructions in emergency operating procedures for ICC and how these procedures will be modified when final monitoring system is implemented.

RESPONSE

It is our intention to follow the operator instructions for ICC that are contained in the Westinghouse Owners Group Emergency Response Guidelines. These procedures will be implemented at the date specified in our response to Supplement 1 to NUREG-0737. The procedures will include the use of subcooling, core exit thermocouples and vessel level. When Unit 1 returns to operation following its 1983-1984 refueling, the ICC instrumentation will be functional and the upgraded emergency procedures using them will be implemented. For Unit 2 the instrumentation will be installed during the spring 1983 refueling outage and made operational to the schedule as described in the response to item 3. If the core exit thermocouples are not in their final configuration when the upgraded emergency procedures are implemented, the existing core exit thermocouple configuration will continue to be used.

9. Provide a schedule for additional submittals required.

RESPONSE

It is our desire that no additional submittals are required.

ATTACHMENT 1 TO APPENDIX TO
REPLY TO NRC GENERIC LETTER 82-28

II.F.2 Attachment 1 (for Core Exit Thermocouples)

In response to item 4 in the above checklist, the following materials should be included to show that the proposed system meets the design and qualification criteria for the core exit thermocouple system.

1. Provide diagram of core exit thermocouple locations or reference the generic description if appropriate.

RESPONSE

A diagram of the Core Exit Thermocouple locations for Point Beach is provided as Attachment 5 to the Appendix. The thermocouples are divided into two separated trains, designated as white and yellow and labeled W and Y, respectively, on the diagram.

2. Provide a description of the primary operator displays including:

   a. A diagram of the display panel layout for the core map and description of how it is implemented, e.g., hardware or CRT display;
   b. Provide the range of the readouts;
   c. Describe the alarm system; and
   d. Describe how the ICC instrumentation readouts are arranged with respect to each other.

RESPONSE

The core map will be displayed via computer-driven CRT screens. Each core position will be represented by a "box" with all boxes laid out in a grid representative of the entire core. In each box will be 1) temperature, 2) temperature deviation from average, and 3) relative fuel assembly power. This display can be copied to a line printer.

The range of the display will be the effective range of the measuring thermocouples, 32°F to 2290°F. In the event that a value (measured or calculated) exceeds a predetermined limit, a message will be sent to the CRT alarm screen and printed on an alarm printer. The ICC instrumentation readouts are located in proximity to each other on the Auxiliary Safety Instrumentation Panel.

3. Describe the implementation of the backup display(s) (including the subcooling margin monitors), how the thermocouples are selected, how they are checked for operability and the range of the display.

RESPONSE

On a unit-by-unit basis, nineteen thermocouples and one subcooling margin monitor are measured by one multiplexer. The other twenty thermocouples and subcooling margin monitor are measured by a second multiplexer. These multiplexers send the information to two microprocessors that each drive a 40 character by 12 line plasma display panel. Both microprocessors can display information for either unit. The operator can select to display the first or the second group of thermocouples per unit or a summary page showing the highest five, the average of the thermocouples, and the results of axial tilt calculations. Refer to the response to question 5 of the Appendix for more information.

The multiplexers check operability of the thermocouples based on sensor voltage limits. The range of the display is the effective range of the thermocouples, 32°F to 2290°F.

4. Describe the use of the primary and backup displays. What training will the operators have in using the core exit thermocouple instrumentation? How will the operator know when to use the core exit thermcouples and when not to use them? Reference appropriate emergency operating guidelines where applicable.

RESPONSE

Like any other instrumentation in the control room, the operators will be trained in the design and use of the primary and backup thermocouple displays. This training will include classroom and hands-on training. In addition, the display systems are designed with user friendly man-machine interfaces for display callup. The emergency operating procedures and their associated training will identify when to use the core exit thermocouples. Refer to the Westinghouse Owners Group Emergency Response Guidelines for when to use the core exit thermocouples.

5. Confirm completion of control room design task analysis applicable to ICC instrumentation. Confirm that the core exit thermocouples meet the criteria of NUREG-0737, Attachment 1 and Appendix B, or identify and justify deviations.

RESPONSE

The location and design of the ICC instrumentation in the control room were selected with consideration of human engineering principles and expected operator use of the displayed information. The control room design review task analysis will include evaluation of the ICC instrumentation. The control room design review will not be performed until all the new instrumentation is completely installed and the revised emergency operating procedures have been implemented. It is expected that the control room design review will be performed during the second half of 1984.

6. Describe what parts of the systems are powered from the 1E power sources used, and how isolation from non-1E equipment is provided. Describe the power supply for the primary display. Clearly delineate in two categories which hardware is included up to the isolation device and which is not.

RESPONSE

The extension wires from the Core Exit Thermocouples are terminated in multiplexers which have been seismically qualified and which receive power from Class 1E power sources. Signal transmission from the multiplexers to other equipment, whether 1E or non-1E, is via fiber optic cables which provide isolation. The peripheral switch, computer central processing units and cathode ray tube displays are not seismically qualified but are supplied from a class 1E power source.

7. Confirm the environmental qualification of the core exit thermocouple instrumentation up to the isolation device.

RESPONSE

The Core Exit Thermocouples are those originally installed in the reactor vessel. These will not be changed out. The thermocouple connectors on the vessel head, cables and containment penetrations are being replaced with

environmentally qualified Class 1E hardware. The computer multiplexers which contain the isolation devices are being purchased as seismically qualified.

ATTACHMENT 2 TO APPENDIX TO
REPLY TO NRC GENERIC LETTER NO. 82-28

Appendix B (of NUREG-0737, II.F.2)

Confirm explicitly the conformance to the Appendix B items listed below for the ICC instrumentation, i.e., the SMM, the reactor coolant inventory tracking systems, the core exit thermocouples and the display systems.

1. Environmental qualification.

RESPONSE

New hardware associated with ICC instrumentation and located inside containment was purchased to the environmental qualification requirements of IEEE 323-1974 per the guidelines of NUREG-0588 (Category I) and the seismic requirements of IEEE 344-1975. The Core Exit Thermocouples are those originally installed in the reactor vessel. Refer to the response to Attachment 1, question 7. New equipment located outside containment was purchased to the seismic qualification requirements of IEEE 344-1975 up to and including the isolation devices. In addition, the Auxiliary Safety Instrumentation Panel will be qualified to the seismic requirements of IEEE 344-1975. The indicators on the Auxiliary Safety Instrumentation Panel will be qualified to IEEE 344-1975 with the exception of the CRT displays and keyboards and the possible exception of the indicators for the Subcooling Monitor. In the case of the Subcooling Monitor, the seismically qualified indicators are not large enough to meet our visibility requirements and the larger indicators which meet visibility requirements are not seismically qualified.

2. Single failure analysis

RESPONSE

a. Reactor Vessel Water Level Indication System

The pressure and differential pressure transmitters are arranged in two redundant and separate trains. There is a single upper tap fluid connection to the reactor vessel head which is connected to the differential pressure

transmitters. There is a single lower tap fluid connection to the incore instrumentation guide tube which connects to the differential pressure transmitters. Electrical outputs from the transmitters are separated into two trains through the containment penetrations, the Foxboro SPEC 200 process racks and the indicators located on the Auxiliary Safety Instrumentation Panel.

b. Subcooling Monitor

The outputs from redundant reactor coolant system wide range pressure transmitters are separated into two trains through the containment penetrations, the Foxoboro SPEC 200 process racks and the indicators on the Auxiliary Safety Instrumentation Panel. The fluid lines to the pressure transmitters are connected to different loops of the Reactor Coolant System. The core exit thermocouples are routed through three instrumentation ports in the reactor vessel head. At the instrumentation stalks on the head, the thermocouple extension wires are divided into two separated trains. The trains are separated into two trains through the containment penetrations, the computer multiplexers, the Foxboro SPEC 200 analog process racks and the Auxiliary Safety Instrumentation Panel. The existing single-element hot and cold leg reactor coolant loop RTDs are being replaced with dual-element RTDs. At the first junction box, the RTD extension wires are divided into two separate trains. This separation is maintained through the containment penetrations to the Foxboro SPEC 200 racks. The outputs of the redundant Subcooling Monitors are displayed on separate indicators on the Auxiliary Safety Instrumentation Panel.

c. Core Exit Thermocouple Upgrade

See paragraph b for a partial description of the upgrade. From each multiplexer signal, outputs are transmitted to four CPUs for processing.

These CPUs are arranged in two redundant pairs. Loss of any CPU will not prevent generation of the primary core exit thermocouple display. Loss of all CPUs will not prevent generation of the backup displays. Loss of one multiplexer will not prevent generation of the backup display by the other multiplexer.

3. Class 1E power source

RESPONSE

The Reactor Vessel Water Level Indication System, Subcooling Monitor, and Core Exit Thermocouple Upgrade are all powered from Class 1E sources. The analog indicators for subcooling and vessel level and the computer-generated displays for the Core Exit Thermocouples that are on the Auxiliary Safety Instrumentation Panels are powered from Class 1E sources. The computer-generated displays in the control room that are on other panels or control boards are powered from 1E sources.

4. Availability prior to an accident

RESPONSE

All ICC instrumentation and displays are available prior to, during, and after an accident.

5. Quality assurance

RESPONSE

New equipment that was purchased as Class 1E equipment was purchased with the requirement that the manufacturer have a quality assurance program which meets the requirements of 10 CFR 50, Appendix B.

6. Continuous indications

RESPONSE

The indicators for the Reactor Vessel Water Level Indication System and Subcooling Monitor are 4-20 ma panel meters which provide continuous indication.

The computer-generated displays of the core exit thermocouples can be selected by the operator. These displays have an update time of less than thirty seconds. Refer to the response to question 5 of the Appendix for additional information on the displays.

7. Recording of instrument outputs

RESPONSE

The output of the ICC instrumentation are not recorded on paper by recorders. Instead, the historical data of the ICC instrumentation output is available in the Safety Assessment System (SAS) and the Plant Process Computer System (PPCS). The Safety Assessment System has thirty minutes of trend information that can be displayed for vessel level, subcooling and core exit temperature. The Plant Process Computer System has an archival system that will store ICC instrumentation output values for up to one week with the capability for display on a PPCS CRT without loading a magnetic tape containing historical data.

8. Identification of instruments

RESPONSE

All instruments have unique identification.

9. Isolation

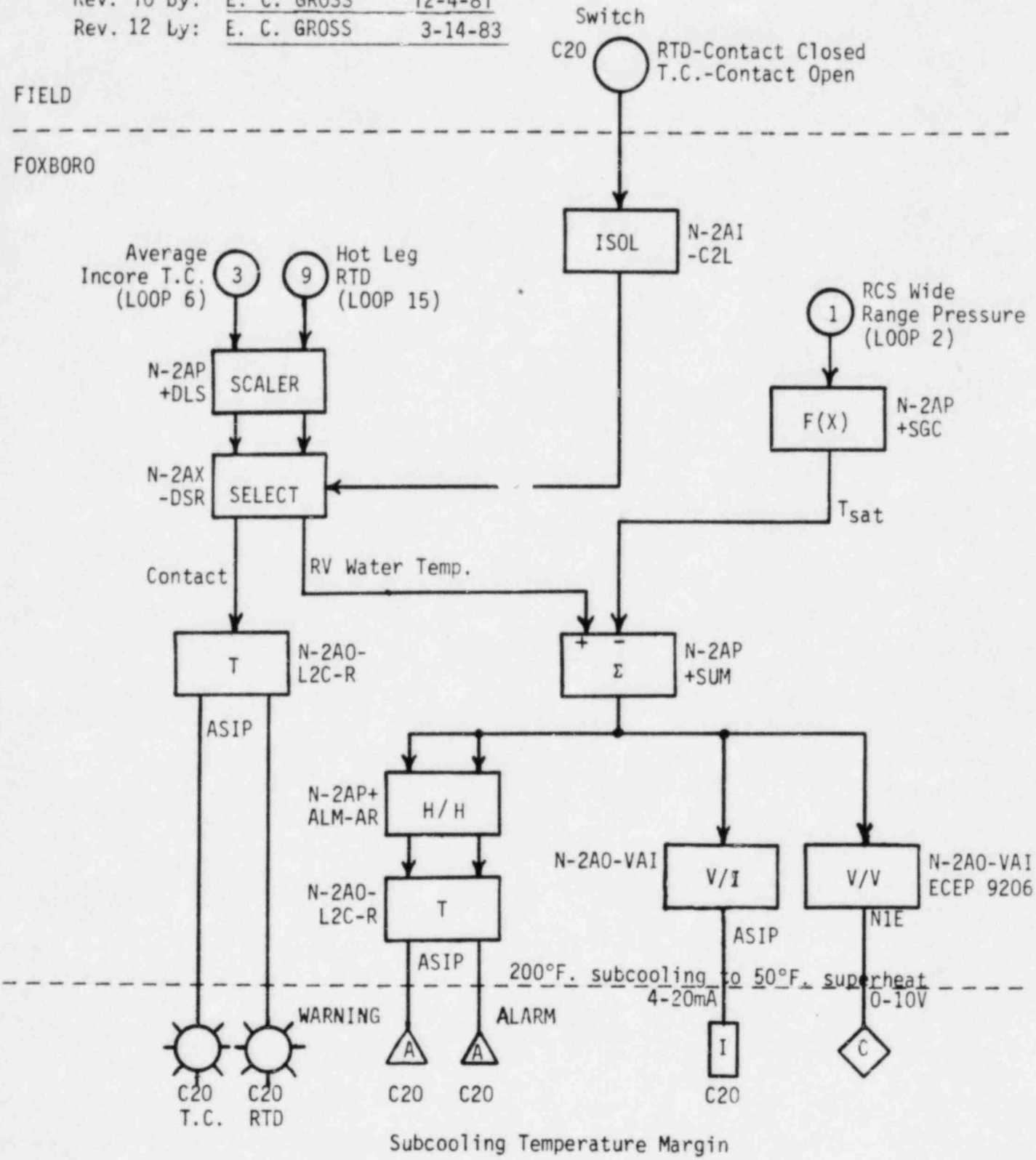
RESPONSE

Outputs from the computer multiplexers and Foxboro SPEC 200 racks are isolated by isolation devices, except for digital and analog outputs from the multiplexers. These signals are isolated when their destination is another item of 1E equipment or non-1E equipment.

ATTACHMENT 3

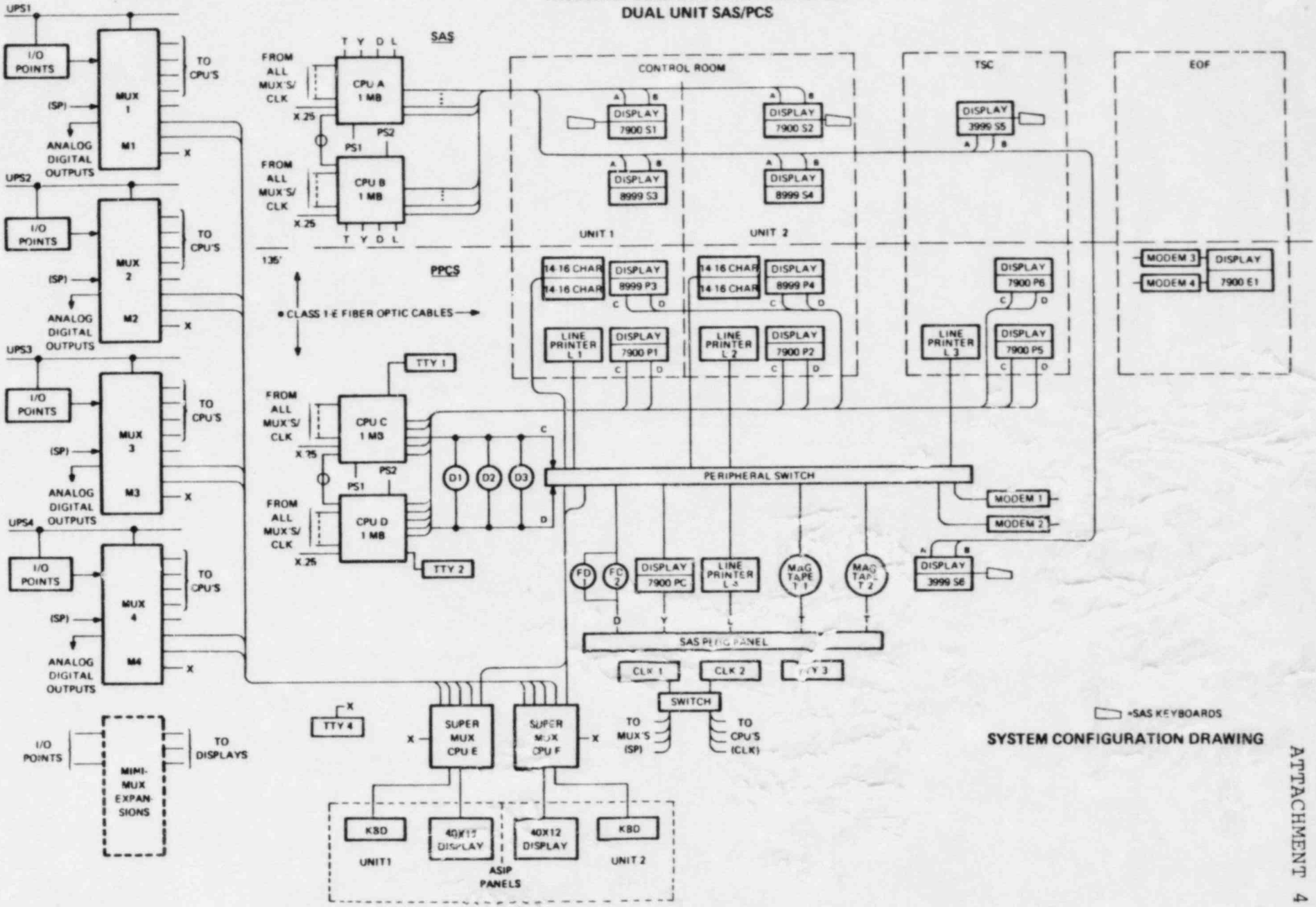
SUBCOOLING MONITOR

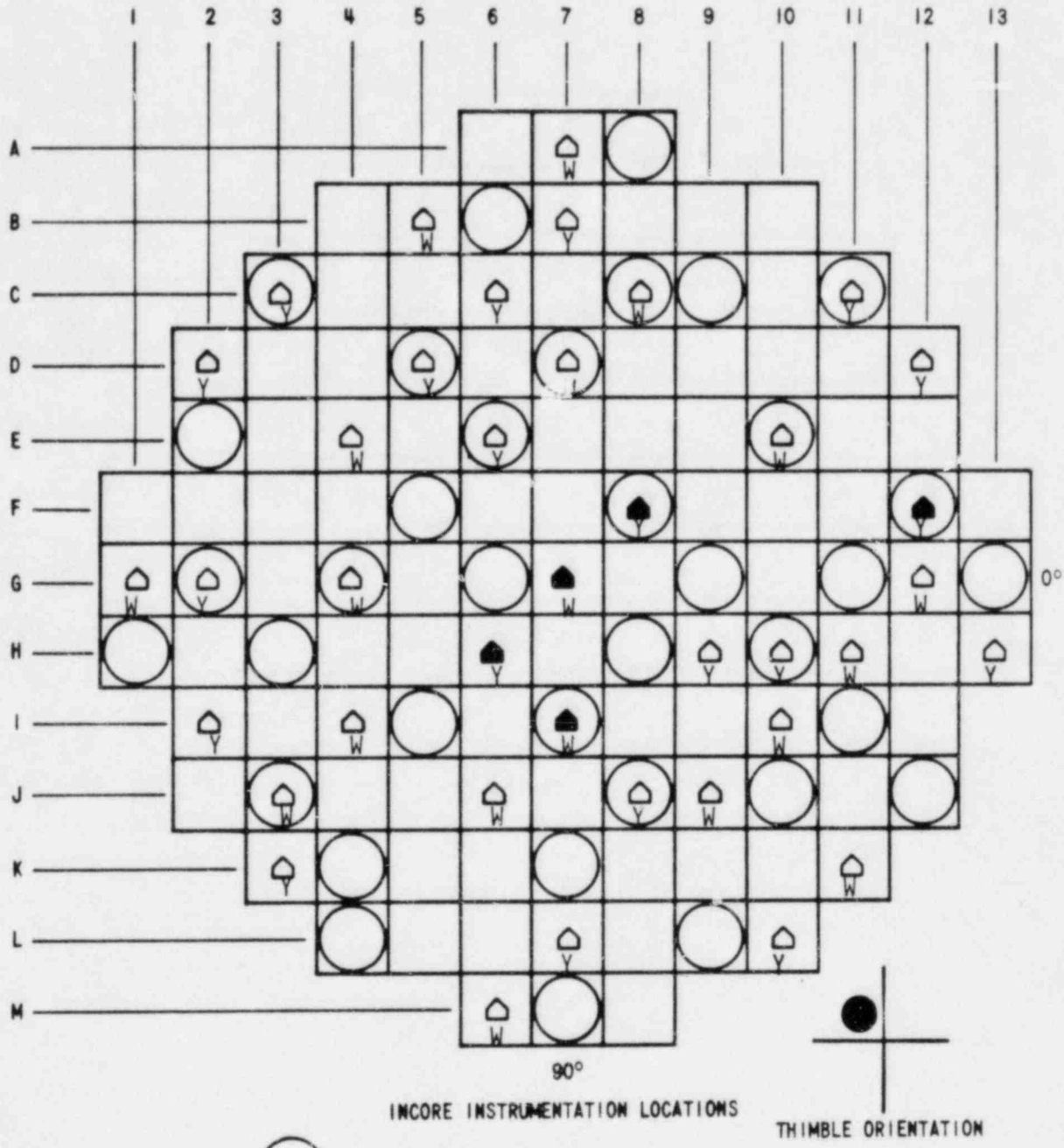
Made by:	B. F. RANCOURT	7-22-80
Rev. 8 by:	S. F. MAYER	4-14-81
Rev. 9 by:	M. E. HELMINSKI	8-19-81
Rev. 10 by:	E. C. GROSS	12-4-81
Rev. 12 by:	E. C. GROSS	3-14-83



Subcooling Temperature Margin

NOTES:
1. Two Loops required per unit: WHITE & YELLOW
2. Tag numbers for the Subcooling Monitor are: TM970 (WHITE) and TM971 (YELLOW)


WISCONSIN ELECTRIC POWER COMPANY
DUAL UNIT SAS/PCS
SAS
PPCS
CONTROL ROOM
TSC
EOF
UNIT 1
UNIT 2
UPS1
UPS2
UPS3
UPS4
I/O POINTS
(SP)
ANALOG DIGITAL OUTPUTS
MUX 1
MUX 2
MUX 3
MUX 4
M1
M2
M3
M4
TO CPU'S
MIMI-MUX EXPAN-SIONS
TO DISPLAYS
CPU A 1 MB
CPU B 1 MB
CPU C 1 M3
CPU D 1 MB
FROM ALL MUX'S/ CLK
X.25
X.75
PS1
PS2
T Y D L
CLASS 1-E FIBER OPTIC CABLES
135'
DISPLAY 7900 S1
DISPLAY 7900 S2
DISPLAY 8999 S3
DISPLAY 8999 S4
DISPLAY 3999 S5
DISPLAY 3999 S6
DISPLAY 8999 P3
DISPLAY 8999 P4
DISPLAY 7900 P1
DISPLAY 7900 P2
DISPLAY 7900 P5
DISPLAY 7900 P6
DISPLAY 7900 E1
DISPLAY 7900 PC
14 16 CHAR
LINE PRINTER L 1
LINE PRINTER L 2
LINE PRINTER L 3
LINE PRINTER L 5
MODEM 1
MODEM 2
MODEM 3
MODEM 4
PERIPHERAL SWITCH
SAS PERIPHERAL PANEL
SWITCH
TTY 1
TTY 2
TTY 3
TTY 4
CLK 1
CLK 2
FD 1
FD 2
MAG TAPE T 1
MAG TAPE T 2
D1
D2
D3
SUPER MUX CPU E
SUPER MUX CPU F
TO MUX'S (SP)
TO CPU'S (CLK)
KBD
40X12 DISPLAY
UNIT1
UNIT 2
ASIP PANELS
•SAS KEYBOARDS
SYSTEM CONFIGURATION DRAWING
ATTACHMENT 4



W Thermocouples that are associated with the white train

Y Thermocouples that are associated with the yellow train