VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

W. L. STEWART
VICE PRESIDENT
NUCLEAR OPERATIONS

July 6, 1984

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
Attn: Mr. Darrell G. Eisenhut, Director
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Serial No. 313
NO/DWL:acm
Docket Nos. 50-280
50-281
50-338
50-339
License Nos. DPR-32
DPR-37
NPF-4
NPF-7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NUREG-0737, ITEM II.F.2-ICC INSTRUMENTATION
SUPPLEMENTAL INFORMATION

On May 3, 1984, members of the NRC staff met with Vepco at the Surry Power Station in order to discuss the status of implementation of NUREG-0737, Item II.F.2. As a result of this meeting, the NRC requested that Vepco provide additional information regarding the Inadequate Core Cooling Instrumentation (ICCI) implementation status. This information is enclosed.

Attachments 1 and 2 provide details of the ICCI layouts for North Anna and Surry, respectively. Attachment 3 provides clarification of the use of the ICCI, requested setpoint information, and testing information. Attachment 3 addressess both North Anna and Surry. Attachment 4 provides a Summary of Conformance to the Design Criteria of NUREG-0737, Appendix B for the ICCI at Surry and North Anna. Additionally, Attachment 4 contains an item by item discussion of the criteria of NUREG-0737, II.F.2 (Attachment 1) which pertains to the requirements of the core exit thermocouple system for use in ICC determinations.

Presently, both Surry and North Anna have implemented revised Emergency Procedures (EP's) which are based on the Westinghouse generic Emergency Response Guidelines (Revision 0). Vepco will upgrade their EP's further (to Revision 1 of the Westinghouse ERG's) as part of the Detailed Control Room Design Review which is currently in progress. The schedule for the DCRDR has previously been provided in Vepco's response to NUREG-0737, Supplement 1 (Generic Letter 82-33). The overall validation of the ICCI will be accomplished through the DCRDR program.

A046
1/1

Please contact us at your convenience if additional information is needed for your review.

Very truly yours,

W. L. Stewart

Enclosures (4)

cc: Mr. James P. O'Reilly
Regional Administrator
Region II

Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing

Mr. James R. Miller, Chief
Operating Reactors Branch No. 3
Division of Licensing

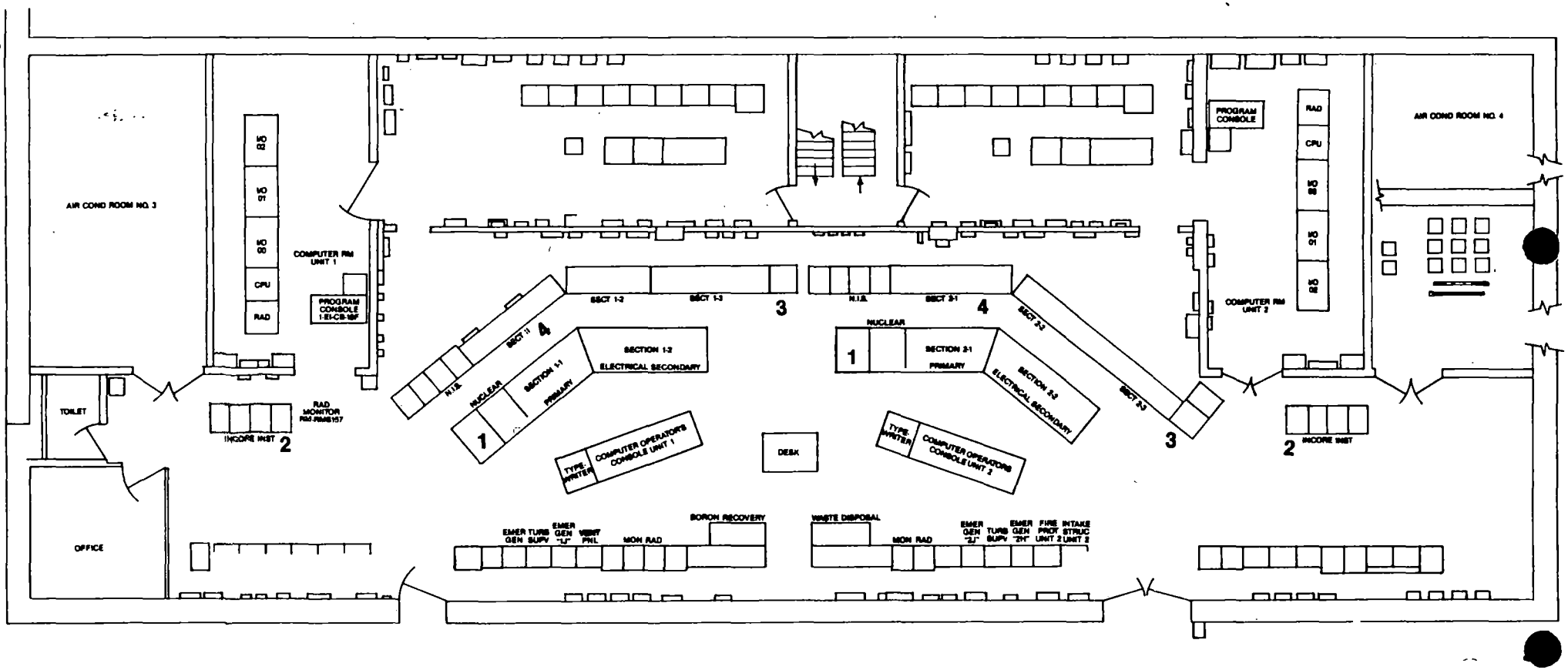
Mr. M. W. Branch
NRC Resident Inspector
North Anna Power Station

Mr. D. J. Burke
NRC Resident Inspector
Surry Power Station

ATTACHMENT 1

NORTH ANNA ICC INSTRUMENTATION

LAYOUT AND DISPLAY DETAILS



LOCATIONS OF RELEVANT COMPONENTS

1. CORE COOLING MONITOR
2. INCORE THERMOCOUPLE TEMPERATURE
3. VESSEL MONITOR
4. SUBCOOLING MARGIN — CORE COOLING MONITORS

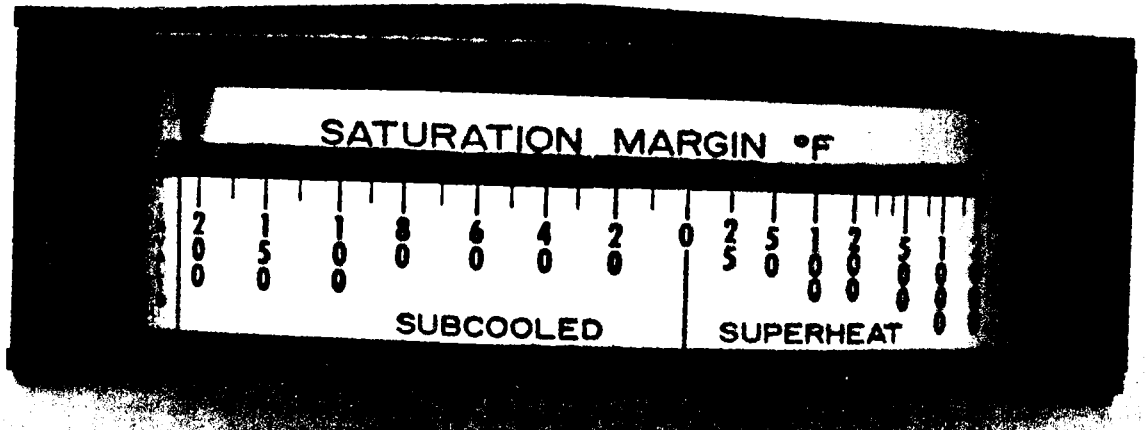
NORTH ANNA UNITS 1 & 2 CONTROL ROOM

REFER TO A.P. 46

(4)

SCI-RC100B

CORE COOLING MONITOR CHANNEL B



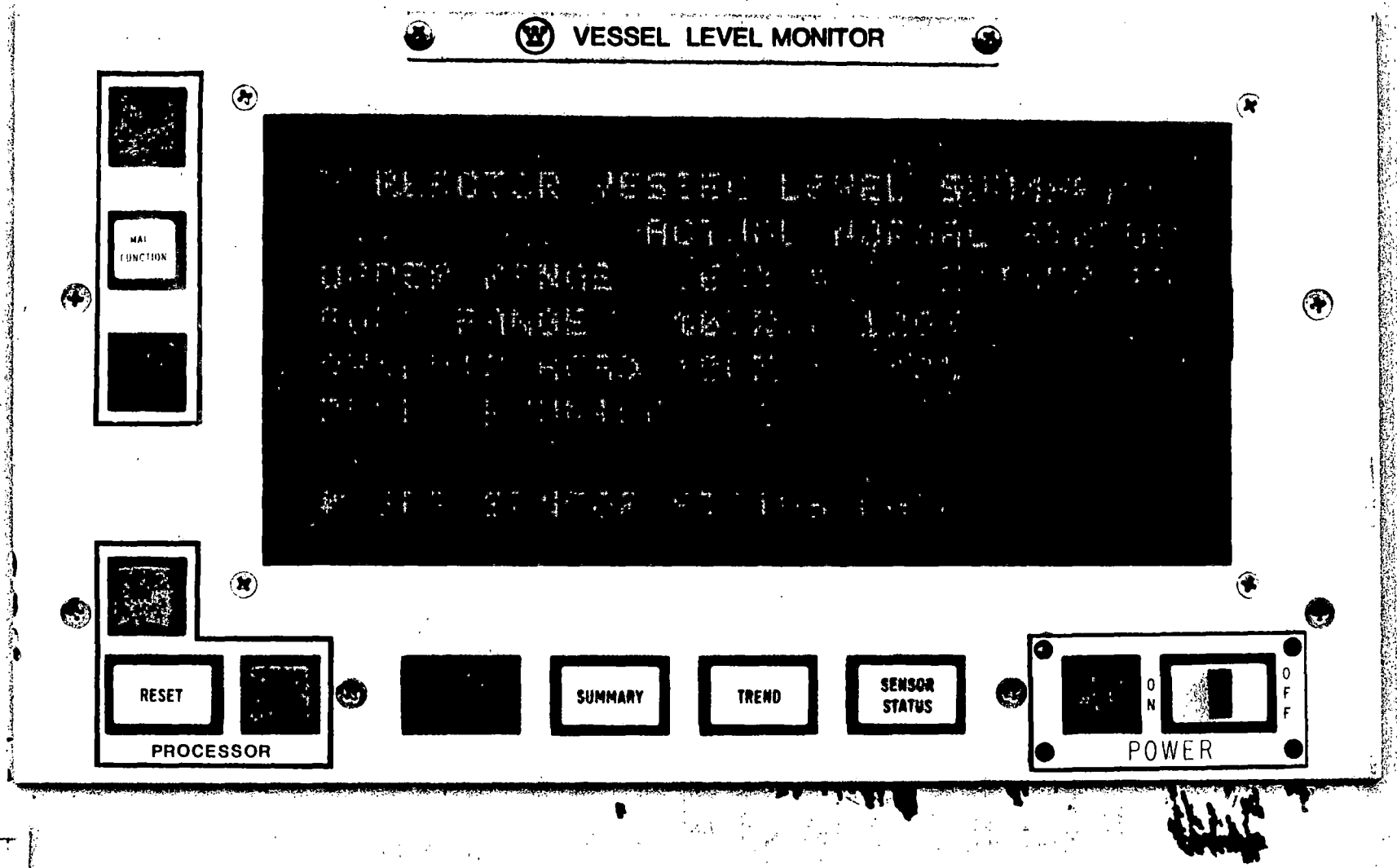
RTD

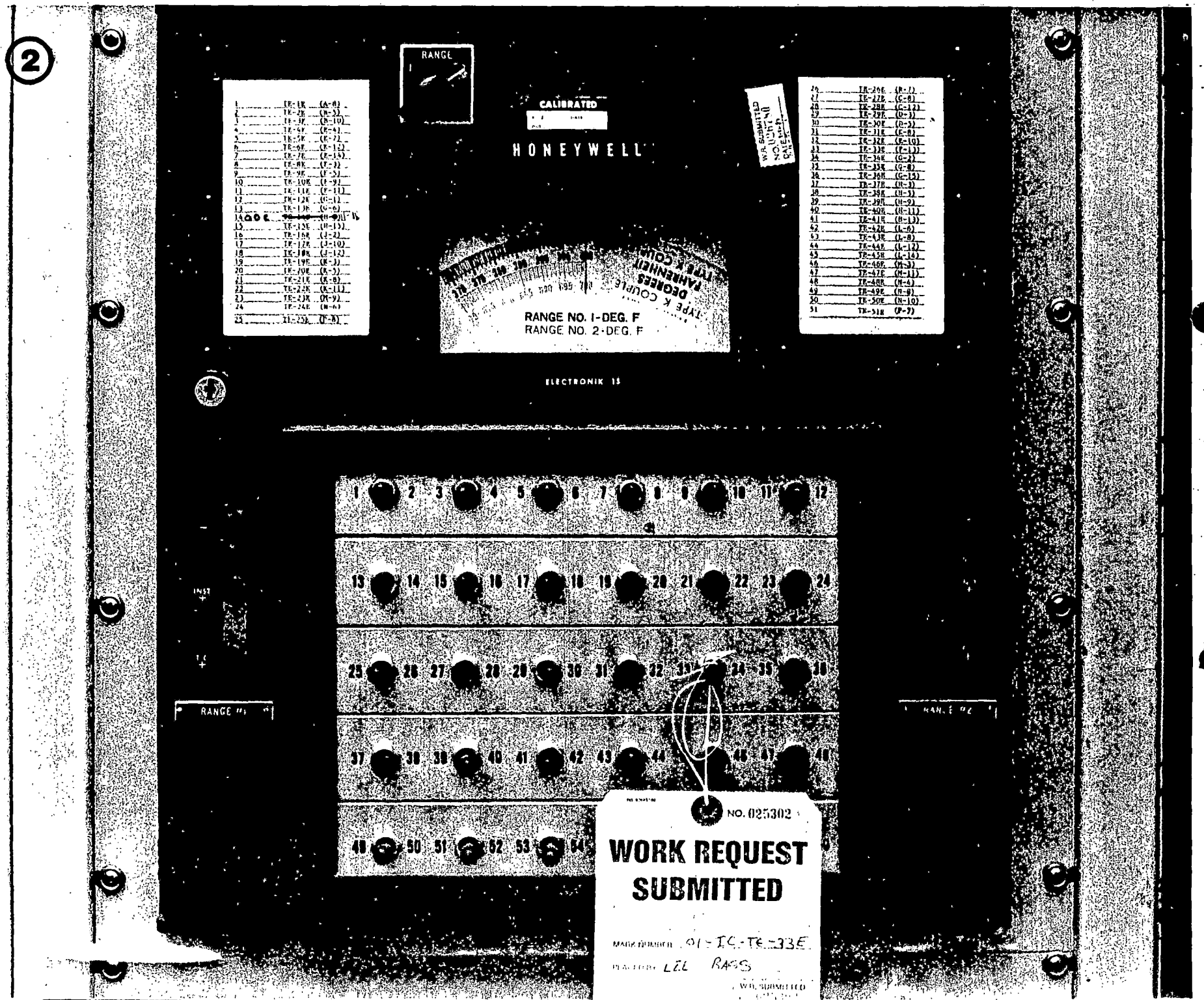
T/C

CALIBRATED
BY FNDR DATE 11-15-83
DUE 5-15-84

REFER TO A.P. 46

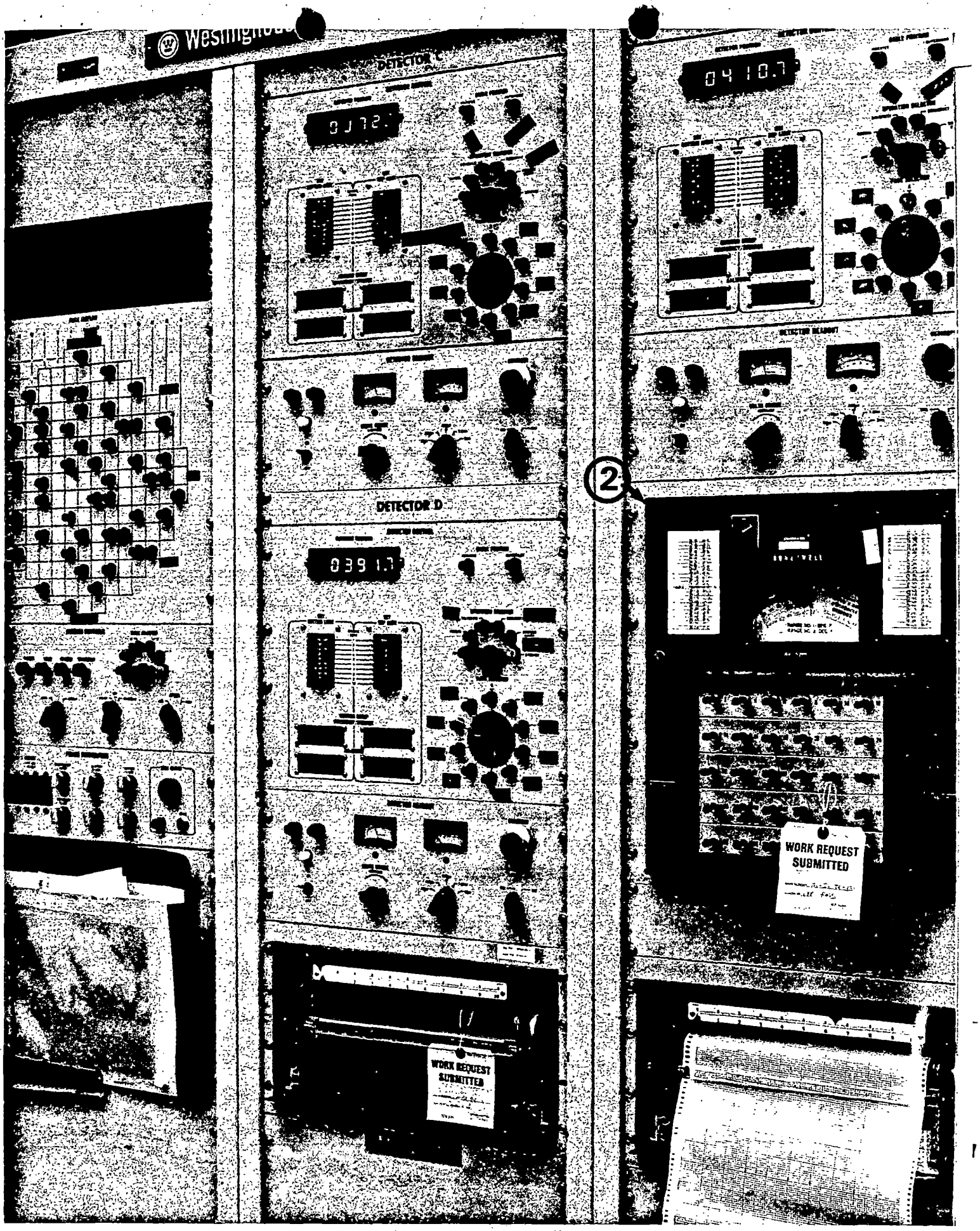
3

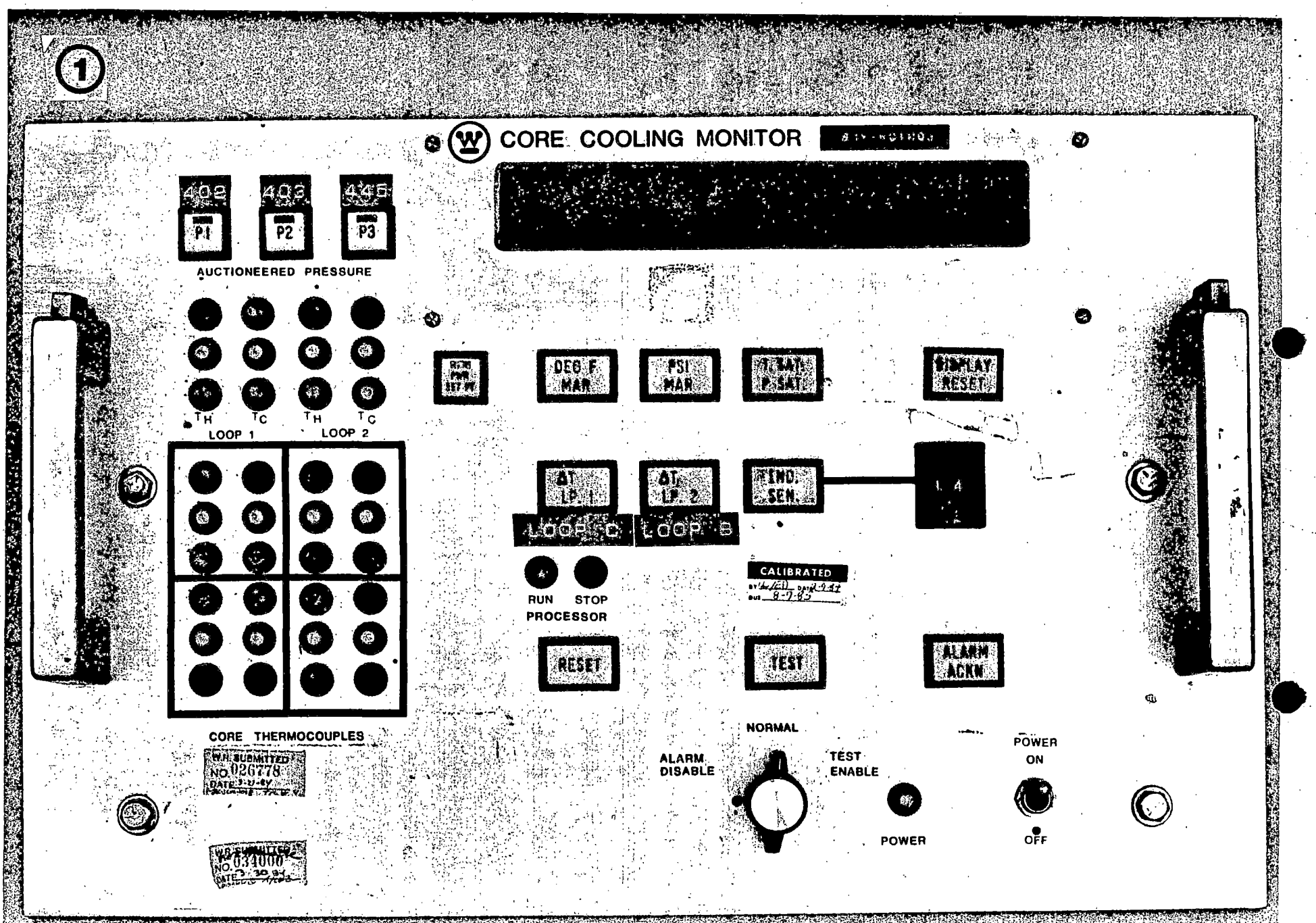

VESSEL LEVEL MONITOR
MAL FUNCTION
RESET
PROCESSOR
SUMMARY
TREND
SENSOR STATUS
ON
OFF
POWER

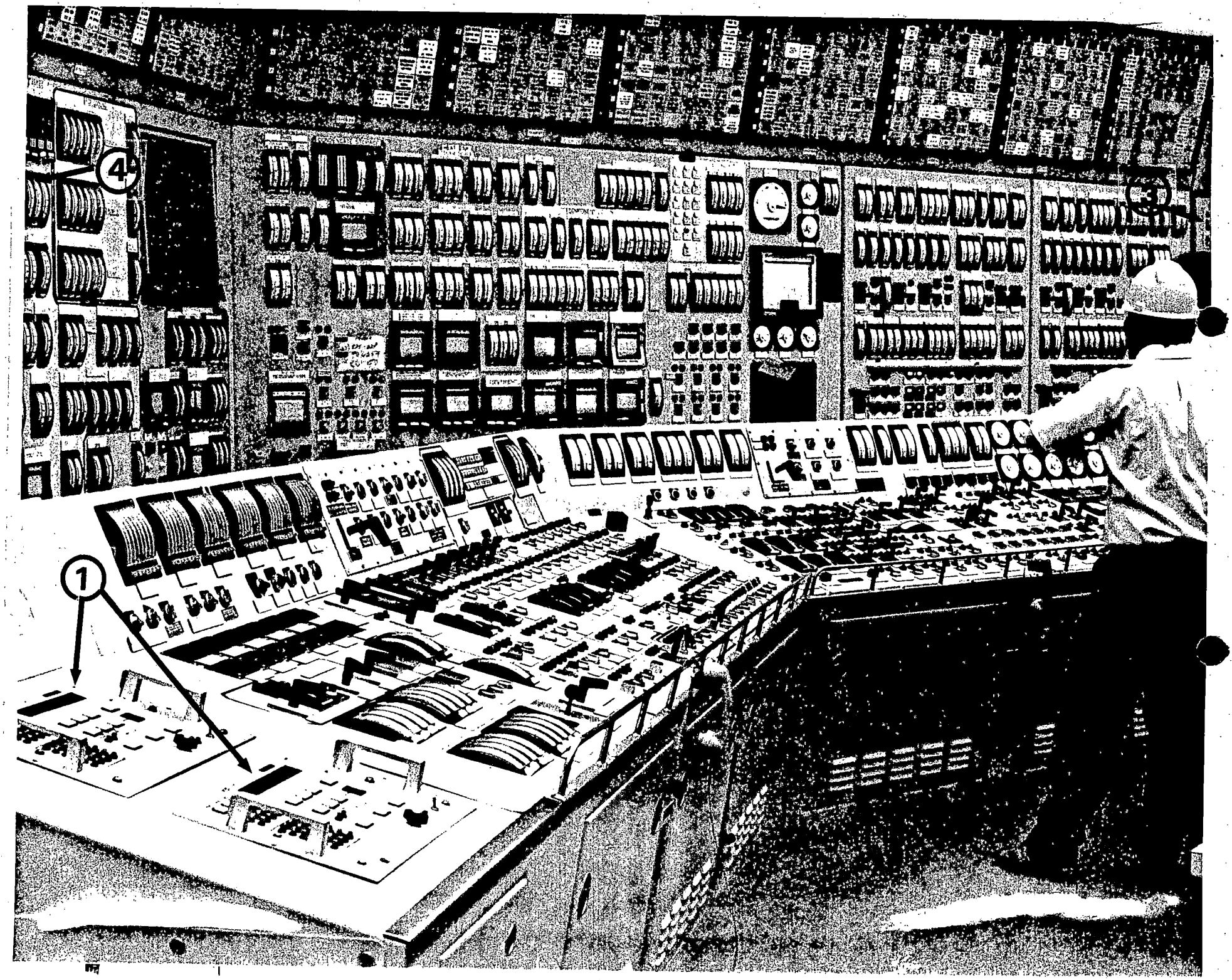

2
RANGE
CALIBRATED
HONEYWELL
W.R. SUBMITTED
NO. 025302
DATE
RANGE NO. 1-DEG. F
RANGE NO. 2-DEG. F
TYPE K COUPLE
DEGREES FAHRENHEIT
ELECTRONIK 15
INST
RANGE
NO. 025302
WORK REQUEST SUBMITTED
MADE BY
PLANNED BY LEL RASS
W.R. SUBMITTED

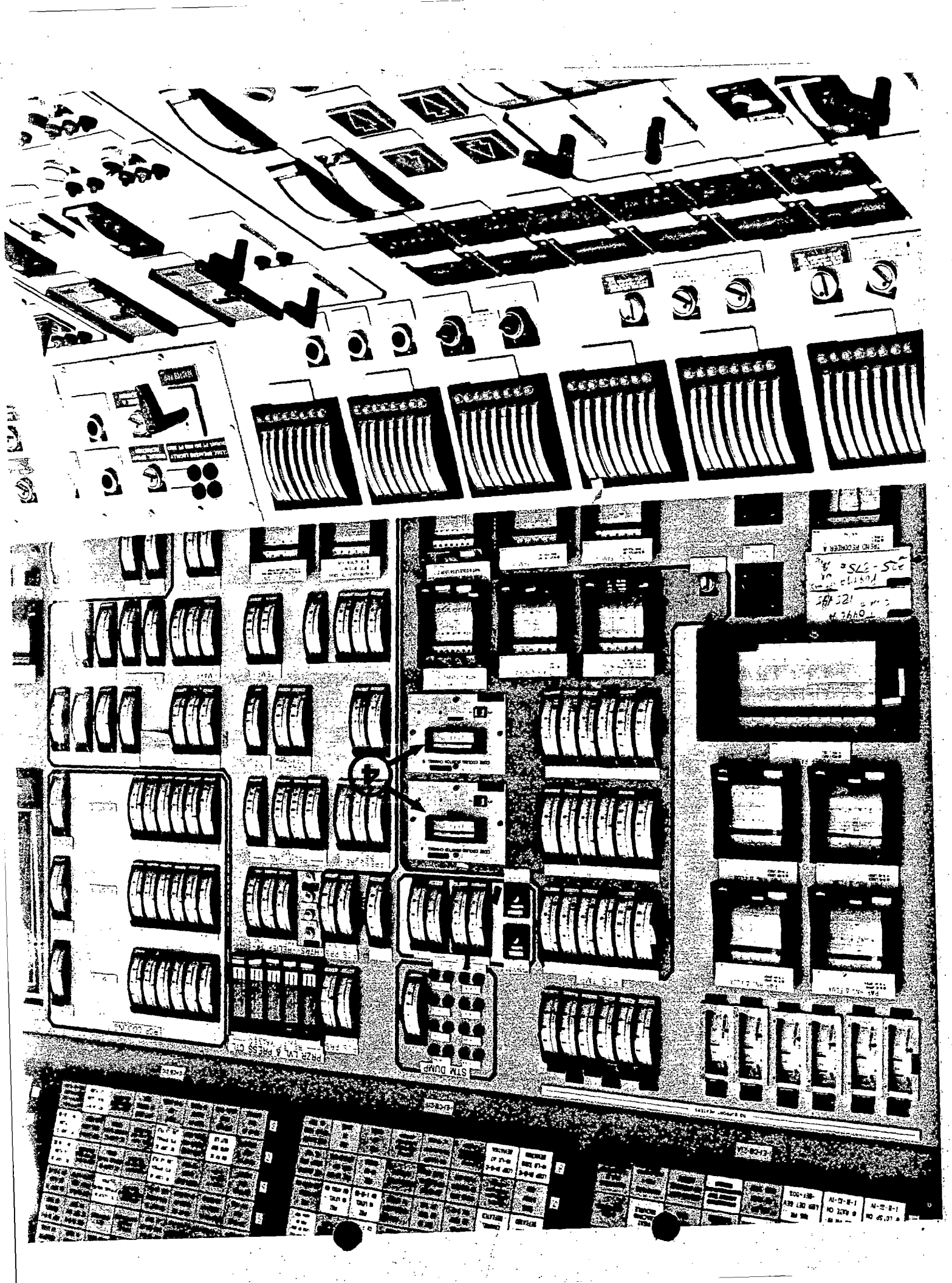

2


Medical and


DETECTOR C
DETECTOR D
WORK REQUEST SUBMITTED
WORK REQUEST SUBMITTED
2


CORE COOLING MONITOR
P1
P2
P3
AUCTIONEERED PRESSURE
TH
TC
TH
TC
LOOP 1
LOOP 2
DEG F MAR
PSI MAR
DISPLAY RESET
ΔT LP. 1
ΔT LP. 2
LOOP C
LOOP B
RUN
STOP
PROCESSOR
CALIBRATED
RESET
TEST
ALARM ACKN
CORE THERMOCOUPLES
NORMAL
ALARM DISABLE
TEST ENABLE
POWER
POWER ON
OFF

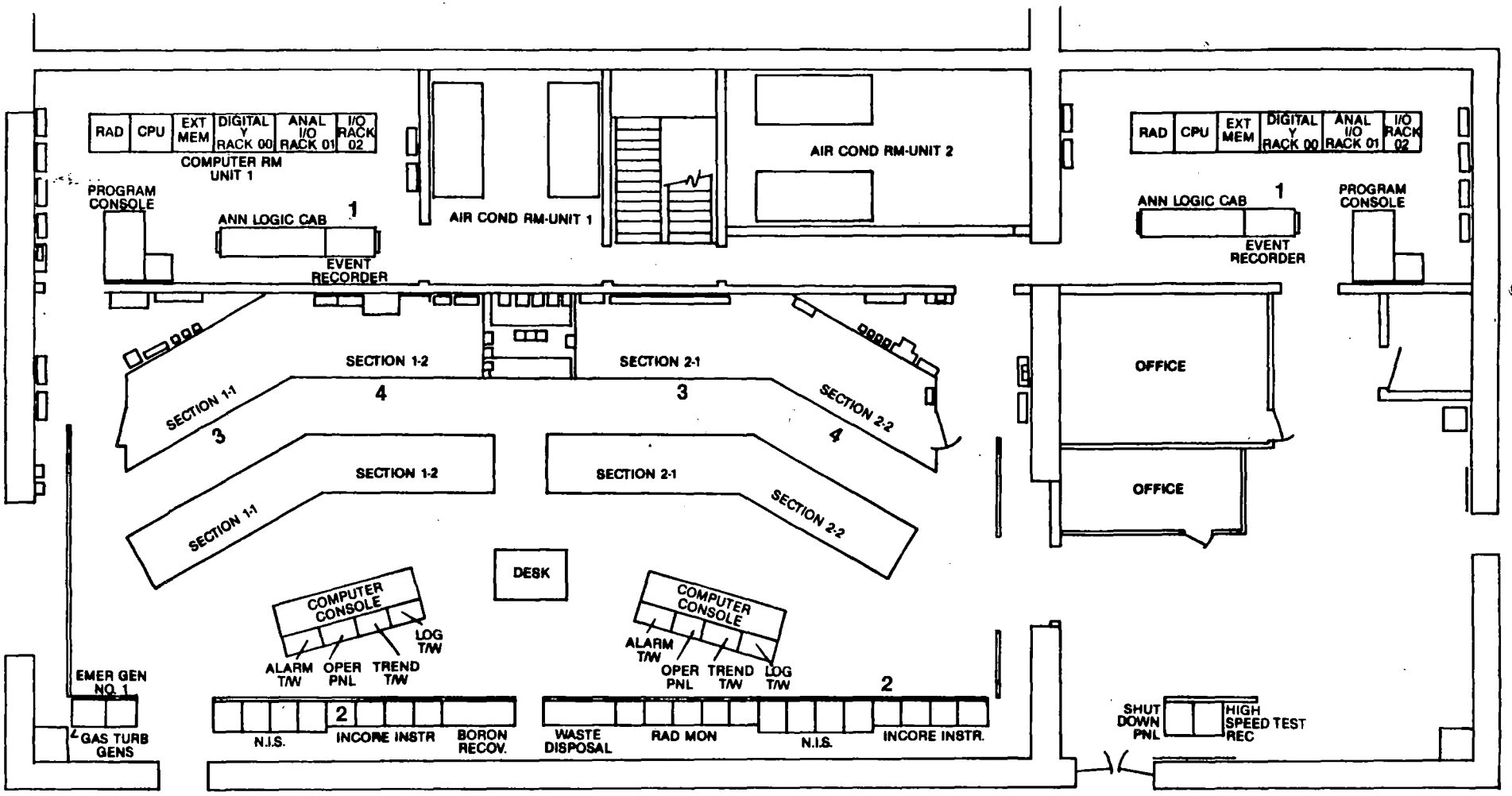

4
7


PRZR LVL & PRESS CH
STM DUMP

ATTACHMENT 2

SURRY ICC INSTRUMENTATION

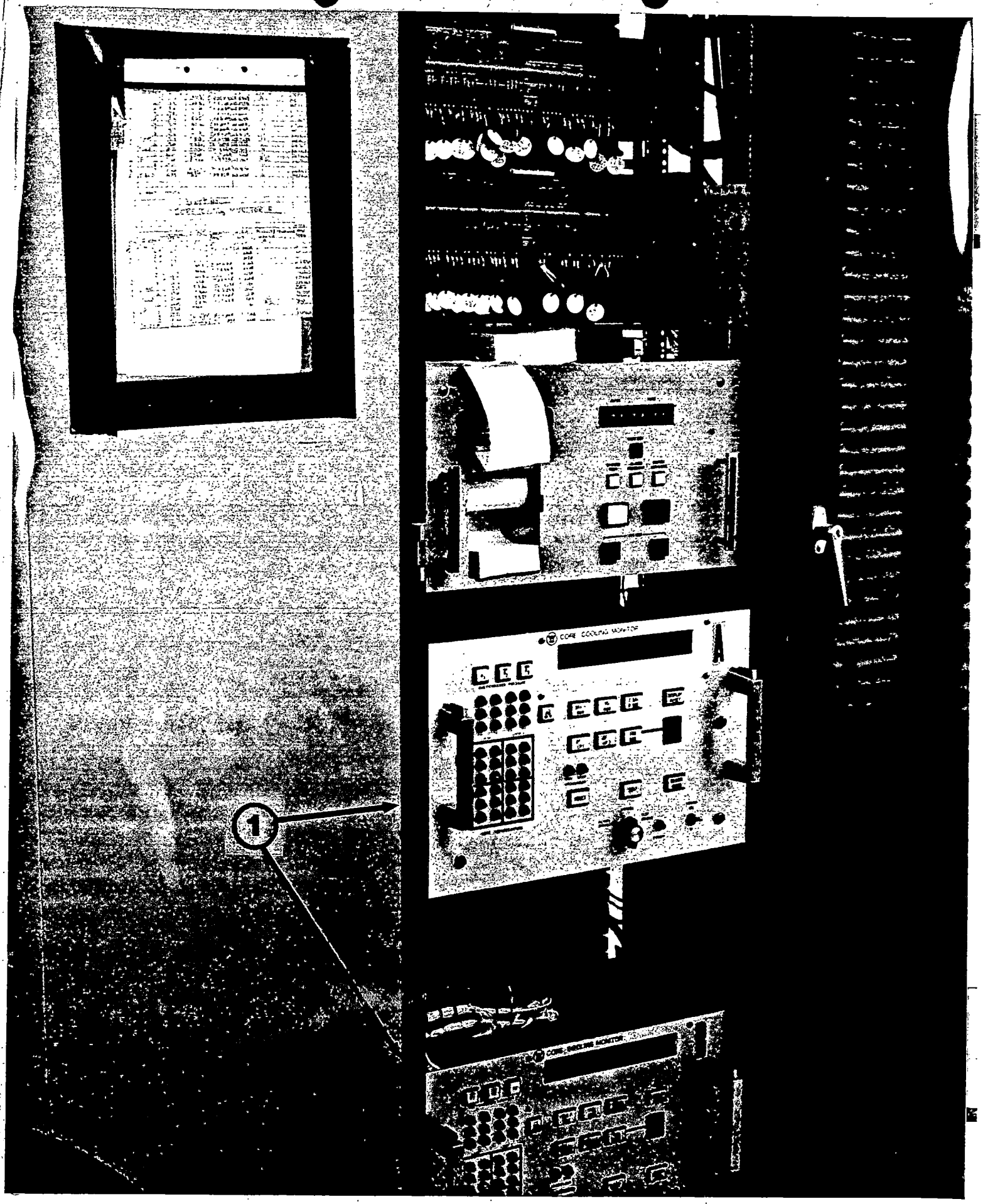
LAYOUT AND DISPLAY DETAILS

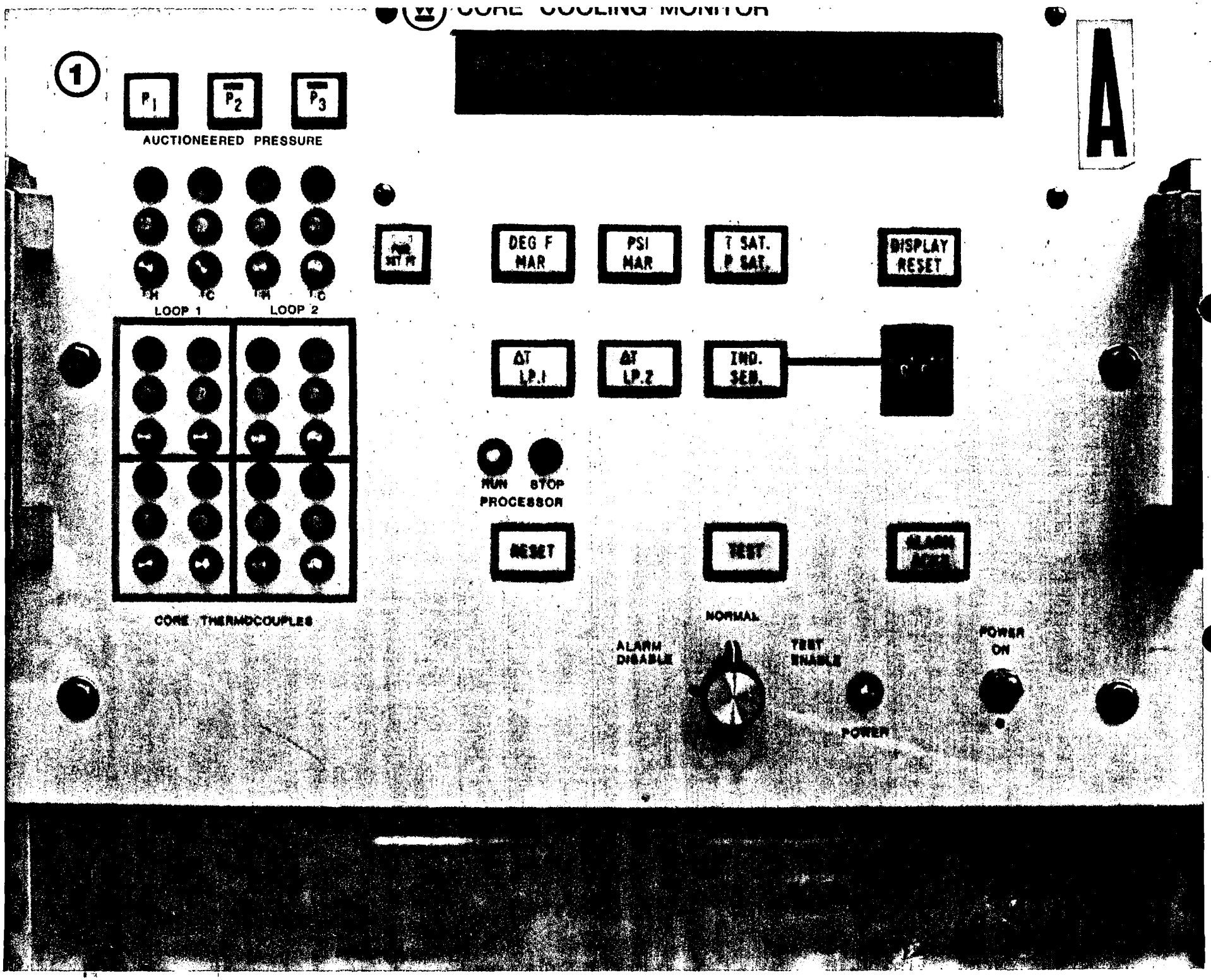


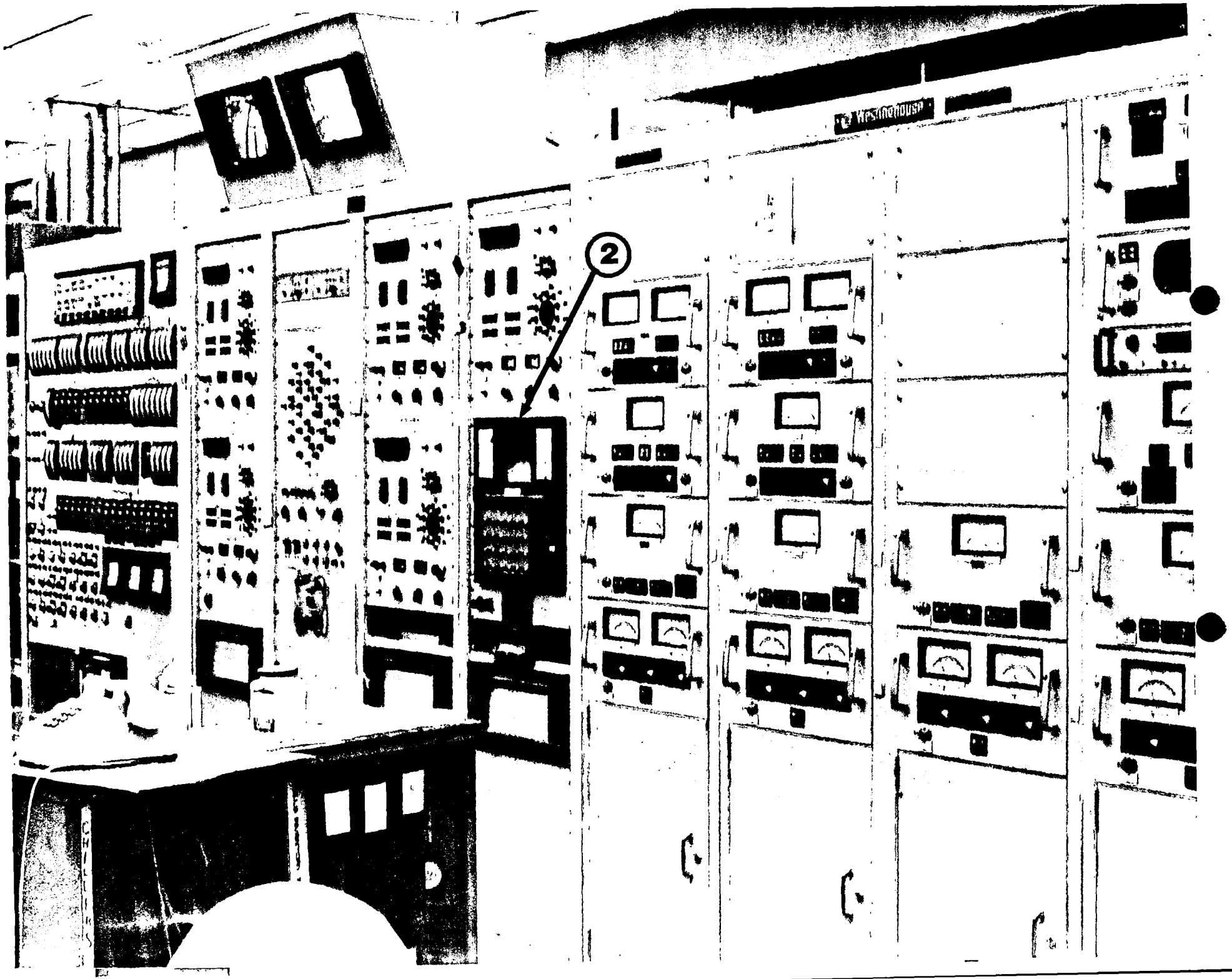
LOCATIONS OF RELEVANT COMPONENTS

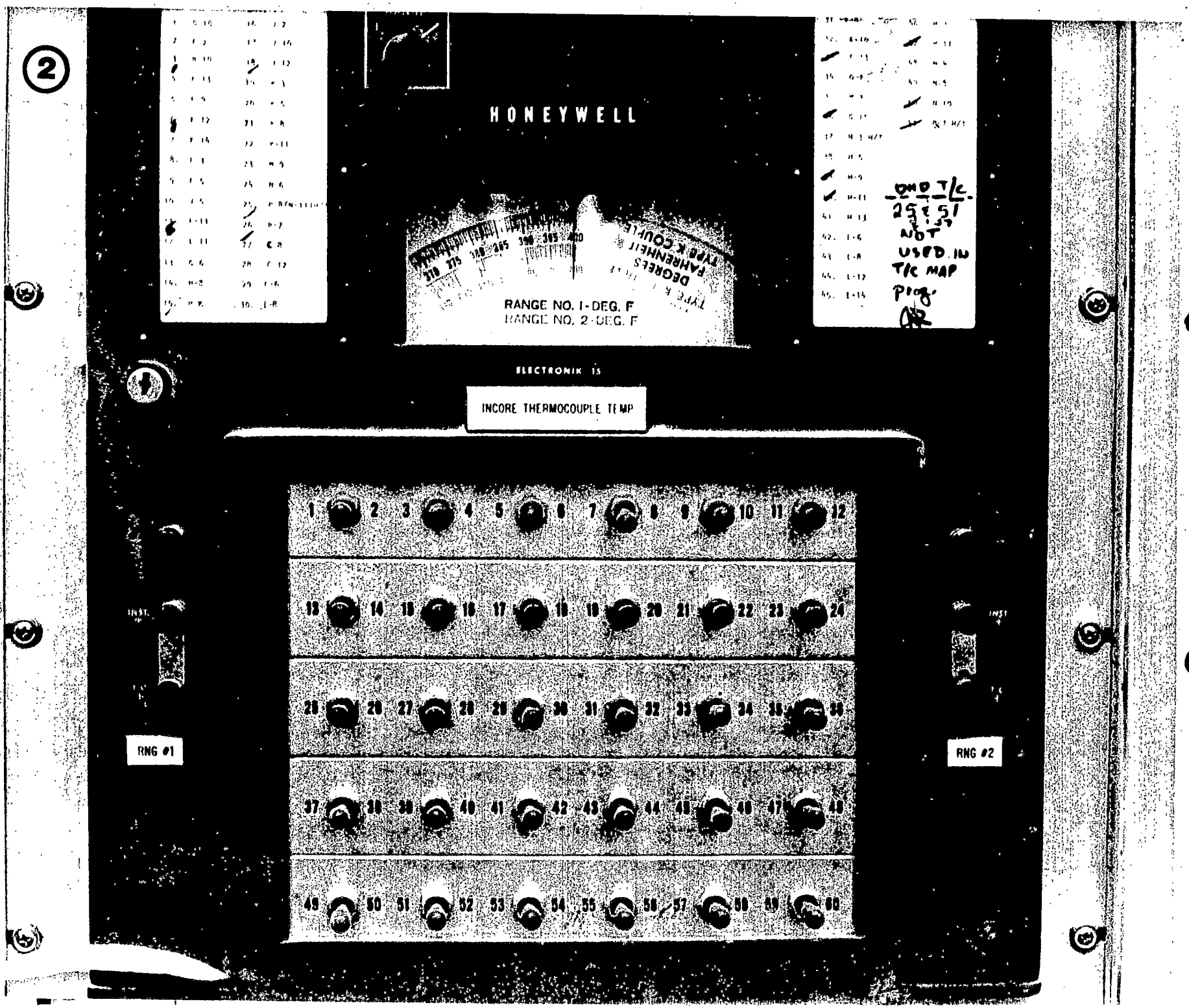
1. CORE COOLING MONITOR
2. INCORE THERMOCOUPLE TEMPERATURE
3. VESSEL MONITOR
4. SUBCOOLING MARGIN — CORE COOLING MONITORS

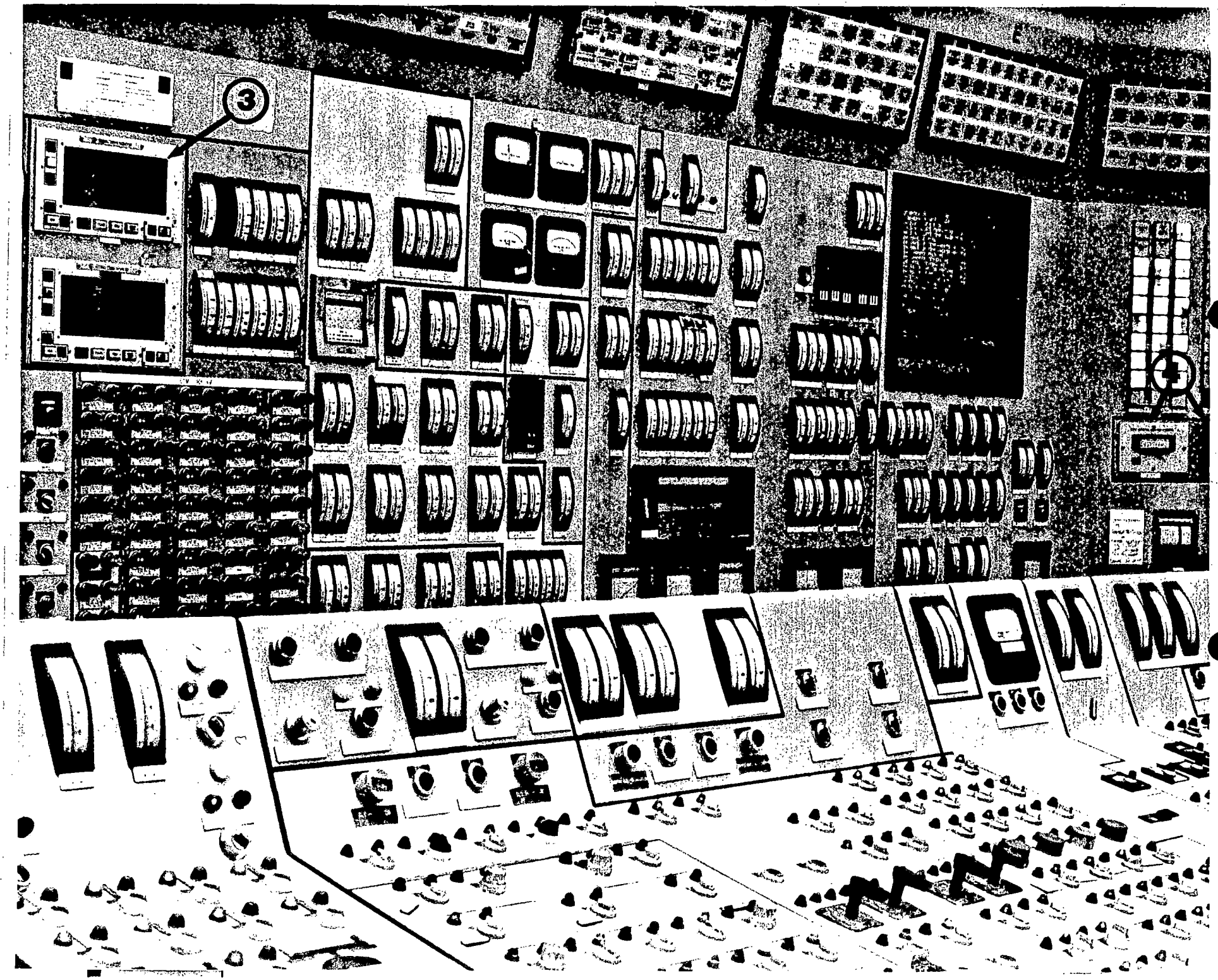
SURRY UNITS 1 & 2 CONTROL ROOM

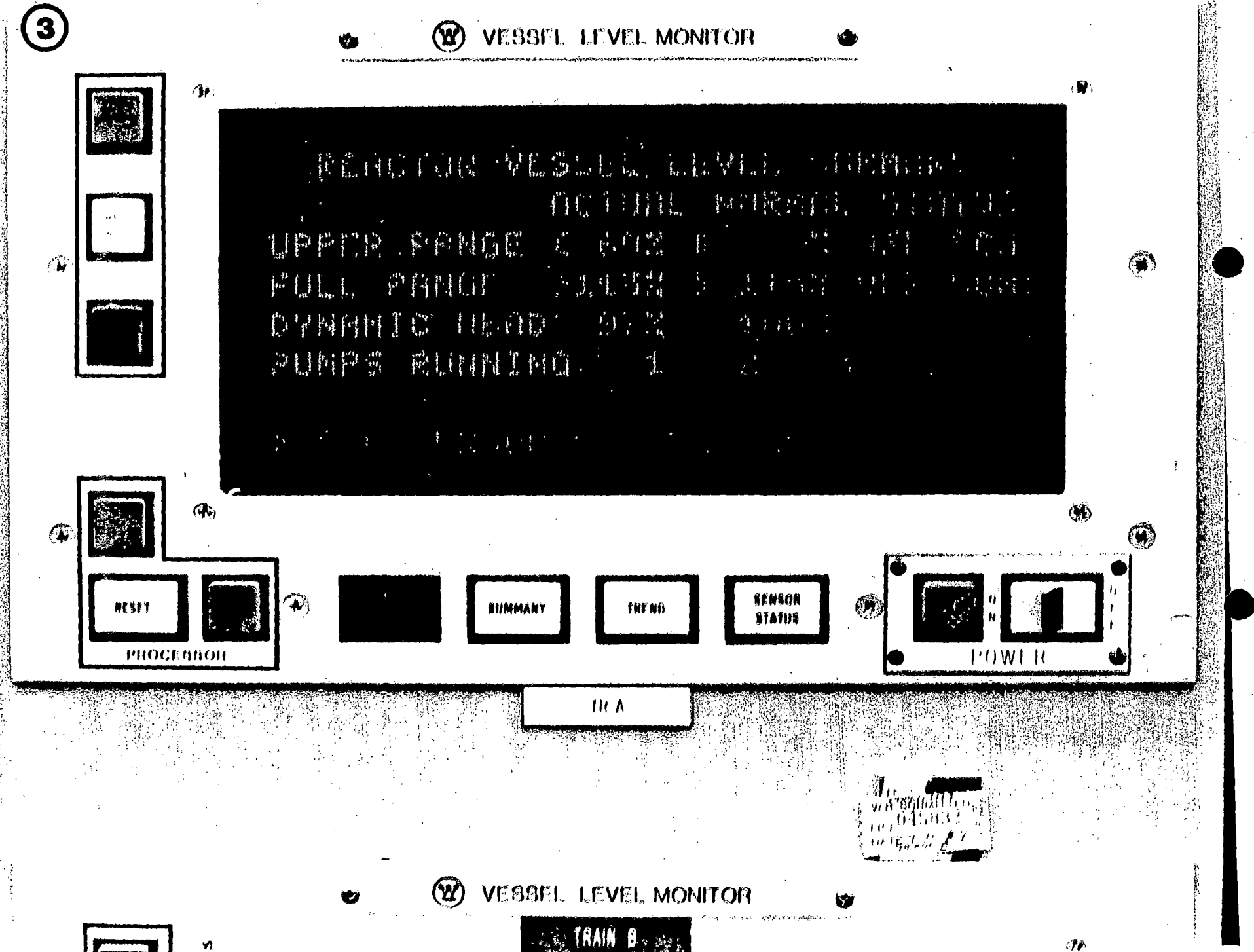

1


CORE COOLING MONITOR
1
A
P_1
P_2
P_3
AUCTIONEERED PRESSURE
TH
TC
TH
TC
LOOP 1
LOOP 2
DEG F MAR
PSI MAR
T SAT. P SAT.
DISPLAY RESET
ΔT LP.1
ΔT LP.2
IND. SEL.
RUN
STOP
PROCESSOR
RESET
TEST
NORMAL
ALARM DISABLE
TEST ENABLE
POWER
POWER ON
CORE THERMOCOUPLES


WESTINGHOUSE
2

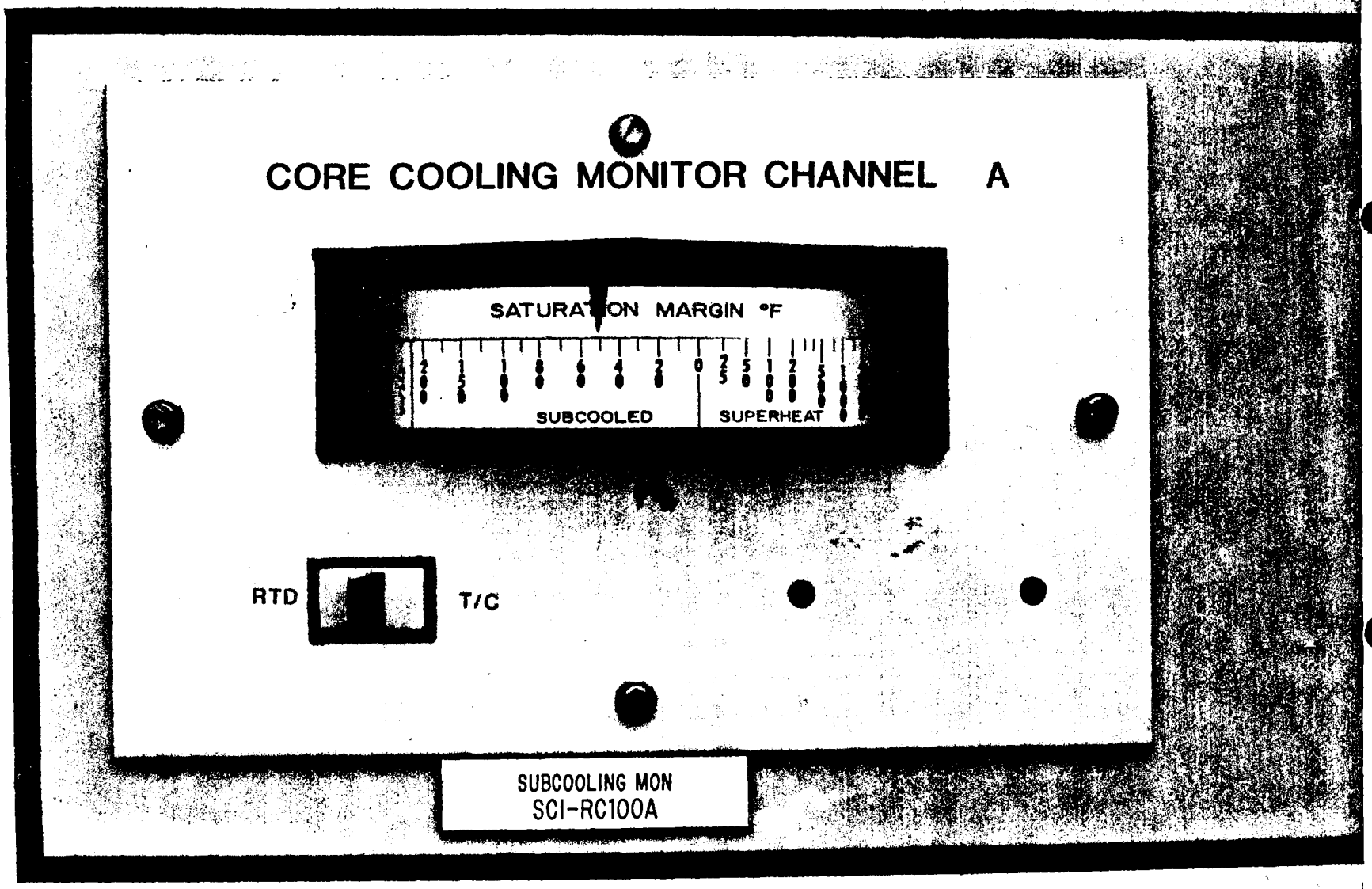

2
HONEYWELL
DEGREES FAHRENHEIT TYPE K COUPLE
RANGE NO. 1-DEG. F
RANGE NO. 2-DEG. F
ELECTRONIK 15
INCORE THERMOCOUPLE TEMP
1 2 3 4 5 6 7 8 9 10 11 12
13 14 15 16 17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32 33 34 35 36
37 38 39 40 41 42 43 44 45 46 47 48
49 50 51 52 53 54 55 56 57 58 59 60
RNG #1
RNG #2
OMIT TC 25 ; 51 NOT USED IN TIC MAP Prog

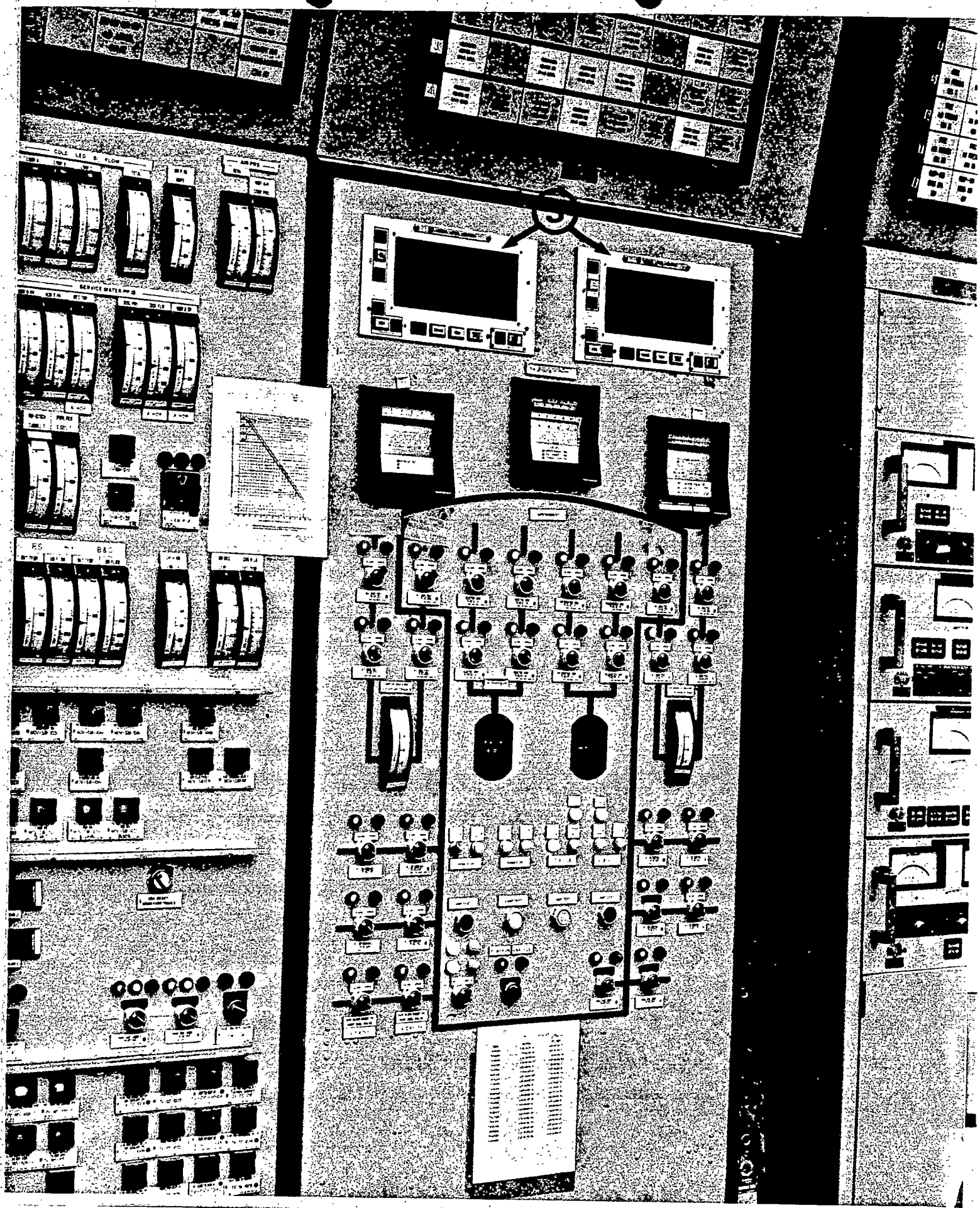

3


3
VESSEL LEVEL MONITOR
RESET
PROCESSOR
SUMMARY
TREND
SENSOR STATUS
POWER
ON
OFF
VESSEL LEVEL MONITOR
TRAIN B

④

TRIP STATUS LIGHTS





ATTACHMENT 3

NORTH ANNA AND SURRY POWER STATIONS

ICCI SYSTEM USE, SETPOINT AND TESTING INFORMATION

SURRY AND NORTH ANNA
ICCI SYSTEM USE, SETPOINTS AND TESTING INFORMATION

The following information is in response to NRC staff ICCI reviewer questions. It is not intended to be a complete document of setpoints and testing for ICC instrumentation.

Core Cooling Monitors

At Surry and North Anna, the indicating status lights on the core cooling monitors indicate in green, amber and red: e.g. green is greater than 25° subcooled, amber less than 25°F subcooled to 0° subcooling, red greater than 0° superheated.

For North Anna, the vertical section of the control panel line indicators has the same colors with sections indicated to coordinate with the status lights on the monitoring panel. At present, Surry plans to color code the core cooling monitor.

Both Surry and North Anna control room annunciators activate at Lo and Lo-Lo subcooling

Lo - 25°F subcooled by RTD or
15°F subcooled by thermocouple

Lo-Lo - 0°F subcooled.

Setpoints were recommendations by the vendor (Westinghouse).

Reactor Vessel Level Indication System (RVLIS)

Periodic testing and calibration of the RVLIS will be consistent with the proposed Technical Specification amendments which have been submitted to the NRC for North Anna and Surry.

At Surry, a monthly Performance Test is used to test the microprocessor and remote display. At each refueling, the differential pressure transmitters are calibrated, isolators are tested, temperature sensors are checked for accuracy, all programmable software is tested, and the microprocessor and remote display are calibrated by simulating different inputs to the microprocessor.

At North Anna, the required procedures have been written and are awaiting approval by the Station Nuclear Safety and Operating Committee prior to implementation. This will be accomplished prior to the return to power from the current refueling outage for Unit 1 and during the upcoming refueling outage for Unit 2.

During the March 1984 Surry Unit 1 maintenance outage RVLIS full range read-out was compared to actual RCS level as determined by an installed standpipe. The RCS was drained and vessel inventory reduced to the approximate mid-nozzle level where a series of data was taken. When including an approximate positive two (2) % level error caused by RV head vent piping, the RVLIS indication compared favorably to the expected indication for a standpipe level in this area.

A functional verification of RVLIS will be accomplished on North Anna Unit 1 and 2. This will be conducted as a Special Test as defined by the Administrative Procedures during the current outage on Unit 1 and during the upcoming Unit 2 refueling outage.

Core Exit Thermocouples (T/C)

Core Exit T/C information is available from various points in the North Anna and Surry control rooms. Discussions with the Training Department and operators at Surry indicate that while the various means of obtaining CETC data are well understood, the concept of "primary" and "back up" displays is not currently being stressed. Rather, the normal practice is to use all available indication to assess status. Typically, the Honeywell read-out would be monitored for a quick "go/no-go" reading followed by computer read out and reading the core cooling monitor as required.

Although the computer read out is convenient and can provide a full core, spatially oriented T/C map, it is believed that the printer backup during an accident would not allow for timely information from the plant computer.

The idea of "primary" and "backup" displays for ICCI in general has just been recently addressed. As a result, both Surry and North Anna have concurred with the following designation of these displays.

FUNCTION/SYS	PRIMARY DISPLAY	SECONDARY DISPLAY
Core Cooling Monitors	Analog	Digital
RVLIS	One channel	The other channel
T/C	T/C panel (Honeywell) (if $>700°$ then PRODAC 250)	Digital Core Cooling Monitors

ATTACHMENT 4

NORTH ANNA AND SURRY POWER STATION

DISCUSSION OF ICCI DESIGN CRITERIA

SUMMARY OF CONFORMANCE TO NUREG-0737, APPENDIX B
FOR ICC INSTRUMENTATION (ITEM II.F.2)

I. Generic Letter 82-28 requested information on the design of ICCI systems. A checklist for plant specific review of ICCI systems was included. One of the items in the checklist was a table of nine design criteria items from NUREG-0737, Appendix B and the request to confirm explicitly the conformance to these nine items. This attachment will utilize the nine categories discussed above to provide a summary of Vepco's conformance to NUREG-0737, Appendix B for both Surry and North Anna.

1) ENVIRONMENTAL QUALIFICATION: The equipment and systems (or portions of systems) for ICC detection which require environmental qualification will be qualified in accordance with the technical requirements of NUREG-0588 (or IEB 79-01B, as appropriate) with the exception of the Type K core exit thermocouples. As per the guidance of Regulatory Guide 1.97, Revision 3, Type K thermocouples are considered qualified for the portions located inside the reactor vessel. Additionally, North Anna narrow range pressure transmitters will be environmentally qualified in accordance with our implementation schedule of Regulatory Guide 1.97.

   Seismic qualification of the ICCI is in conformance with the original design basis for each plant. Certain portions of the ICC detection system are installed in accordance with IEEE 344/71 for Surry and North Anna Unit 1 and IEEE 344/74 for North Anna Unit 2. However, equipment categorized as non-Class 1E in the original design basis for each plant are not seismally qualified. The newly installed microprocessors for RVLIS meet the requirements of Regulatory Guide 1.100, as clarified by Appendix B to NUREG-0737, as will new portions (as applicable) of the upgraded core exit thermocouple system to be installed per Regulatory Guide 1.97, Revision 3.

2) SINGLE FAILURE ANALYSIS: The equipment and systems for ICC detection are in conformance with the original design basis of the stations which meet the criteria of Appendix B except for separation criteria. The separation criteria of Regulatory Guide 1.75 is met for the most part, but not in total.

3) CLASS 1E POWER SUPPLY: The ICC detection systems are all powered from reliable power sources. All systems are powered from Class 1E, Vital buses (battery backed) except for the Surry and North Anna core cooling monitors which are powered from the station semi-vital buses.

   Because of the limited load capacity of the vital buses, the semi-vital buses were chosen since the Subcooling Monitor System provides indication only. On the event of a loss of offsite power, power to the semi-vital buses would be lost for up to thirty (30) seconds. The 30 second delay is the maximum amount of time that the semi-vital buses are unpowered until the emergency diesels come on line. Core subcooling information is available if needed via thermocouple readings (Vital bus) and the backup hand calculation with saturation curves.

4) AVAILABILITY PRIOR TO AN ACCIDENT: Availability of core cooling information will be assured through Technical Specifications for minimum operable channels of RVLIS and core subcooling monitors. Technical Specifications are not planned for the entire thermocouple system since the core subcooling monitor spec provides a high degree of confidence that operable thermocouples will be available.

Technical Specifications for the core cooling monitors are in place. Proposed Technical Specifications for RVLIS have been submitted for NRC approval.

5) QUALITY ASSURANCE: The ICCI systems have been designed, installed and maintained in accordance with the Vepco QA program. The Vepco QA program has been reviewed and approved by the NRC. Any exceptions to the QA related Regulatory Guides listed in NUREG-0737, Appendix B have been authorized by NRC review.

6) CONTINUOUS INDICATION: The Surry and North Anna ICCI systems meet the criteria for continuous indication as specified in NUREG-0737, Appendix B. No exceptions are taken.

7) RECORDING OF INSTRUMENT OUTPUTS: The Surry and North Anna ICCI systems meet the criteria for instrument output records as specified in NUREG-0737, Appendix B. No exceptions are taken.

8) IDENTIFICATION OF INSTRUMENTS: All ICC instruments will be clearly identified to the extent deemed necessary for operator use during accident conditions. Identification will be validated as part of the Detailed Control Room Design Review program. No exceptions are taken to this criteria.

9) ISOLATION: Isolation devices are installed in accordance with the criteria of NUREG-0737, Appendix B for all ICC detection instruments. These isolation devices are qualified except for the signals for RCP status to the RVLIS microprocessor. The isolator in this system is commerical grade but of the same quality as the isolator used for this signal to the Reactor Protection System circuitry.

NUREG-0737, Appendix B items 10 through 18 primarily deal with administrative control over testing, setpoints and calibration. No exceptions are taken to these items in Appendix B.

II. Additional Design Criteria for Core Exit Thermocouples

(Attachment 1 to NUREG-0737, Item II.F.2)

Requirement 1:

(1) Thermocouples located at the core exit for each core quadrant, in conjunction with core inlet temperature data, shall be of sufficient number to provide indication of radial distribution of the coolant enthalpy (temperature) rise across representative regions of the core. Power distribution symmetry should be considered when determining the specific number and location of thermocouples to be provided for diagnosis of local core problems.

Response

Vepco presently has 51 core exit thermocouples locations in North Anna Units 1 and 2 and Surry Unit 2 and 48 core exit thermocouples in Surry Unit 1 to provide indication of radial distribution of the coolant enthalpy (temperature) rise across representative regions of the core.

The locations are considered satisfactory to address power distribution symmetry. Prior to reducing the number of thermocouples in any future thermocouple upgrade, the location and number to be upgraded will address power distribution symmetry in addition to other technical concerns.

Requirement 2(a):

(2) There should be a primary operator display (or displays) having the capabilities which follow:

(a) A spatially oriented core map available on demand indicating the temperature or temperature difference across the core at each core exit thermocouple location.

Response

A spatially oriented core map on demand is presently available via the PRODAC P-250 process computer.

When the Emergency Response Facility upgrade is completed at the conclusion of the 1988 refueling outages, the operator will have the capability of calling up a spatially oriented core map on CRT's which will display the temperature or temperature difference across the core at each core exit qualified thermocouple location.

Note: Our present commitment is to have the Emergency Response Facility upgrade completed at the conclusion of the 1986 refueling outages. The incore thermocouple upgrade is presently scheduled to be completed by the conclusion of the 1988 refueling outages with every reasonable attempt to be completed by the end of the 1986 refueling outages. A letter identifying final implementation schedules for thermocouple upgrade is due in August 1984.

Requirement 2(b):

(b) A selective reading of core exit temperature, continuous on demand, which is consistent with parameters pertinent to operator actions in connecting with plant-specific inadequate core cooling procedures. For example, the action requirement and the displayed temperature might be either the highest of all operable thermocouples or the average of five highest thermocouples.

Response

The specifics of the T/C displays are not yet available. Vepco plans, however, to ensure that appropriate information of operator use is available, consistant with procedure requirements. This would be confirmed as part of the planned DCRDR.

Requirement 2(c):

(c) Direct readout and hard-copy capability should be available for all thermocouple temperatures. The range should extend from 200°F (or less) to 1800°F (or more).

Response

Direct readout and hard-copy capability is presently available for top mounted core exit thermocouple temperatures. Direct readout is not available for the 10 bottom mounted core exit thermocouples which have been placed in Surry Unit 1. Temperature ranges for hard-copy capability are presently 30 to 1800°F for Surry and 400 to 1700°F for North Anna. Once the Emergency Response Facility and incore-thermocouple upgrade is complete, the hard-copy capability will meet this requirement.

Requirement 2(d):

(d) Trend capability showing the temperature-time history of representative core exit temperature values should be available on demand.

Response

Trending capability is presently available from the PRODAC 250 plant computer and is available in the control room. This capability presently meets the intent of this requirement.

Requirement 2(e):

(e) Appropriate alarm capability should be provided consistent with operator procedure requirements.

Response

Alarm capability is presently available from the PRODAC 250 plant computer and is consistent with operator procedure requirements. This capability meets the intent of this requirement.

Requirement 2(f):

(f) The operator-display device interface shall be human-factor designed to provide rapid access to requested displays.

Response

The existing operator-display device interfaces are being evaluated under NUREG-0700 in response to NUREG-0737 Supplement 1 for human-factor design.

Any new system upgrades will be human-factor designed prior to implementation in the control room.

Requirement 3:

(3) A backup display (or displays) should be provided with the capability for selective reading of a minimum of 16 operable thermocouples, 4 from each core quadrant, all within a time interval no greater than 6 minutes. The range should extend from 200°F (or less) to 2300°F (or more).

Response

Presently installed are two core cooling monitor microprocessors, each capable of displaying two thermocouples/quadrant with a digital temperature range of 0 to 2300°F, (calibrated 0-1500°F). These microprocessors display capability meet the intent of this requirement.

Requirement 4:

(4) The types and locations of displays and alarms should be determined by performing a human-factors analysis taking into consideration:

(a) the use of this information by an operator during both normal and abnormal plant conditions.

(b) integration into emergency procedures,

(c) integration into operator training, and

(d) other alarms during emergency and need for prioritization of alarms.

Response

These requirements are being addressed under NUREG-0700 in response to NUREG-0737 Supplement 1. Any new system upgrades will be human-factor designed prior to implementation in the control room.

Requirement 5:

(5) The instrumentation must be evaluated for conformance to Appendix B, "Design and Qualification Criteria for Accident Monitoring Instrumentation," as modified by the provisions of items 6 through 9 to Attachment 1.

Response

The present incore thermocouple system does not meet these requirements. The new system will meet the intent of Appendix B as clarified below:

The existing incore thermocouples (inside reactor vessel) are considered environmentally qualified. This is supported by Rev. 3 to R.G. 1.97 which states "Instrumentation that is part of the final ICC detection system should meet the design requirements specified in II.F.2 of NUREG-0737. (When Type K thermocouples become part of the system, they are considered to meet the requirements. However, the remainder of the detection system that is outside the reactor vessel should meet the requirements specified.)" The connectors, cable and hardware external to the reactor vessel and located in a harsh environment will meet the requirements of NUREG-0588 Category 1. In addition, seismicity for connectors, cable, hardware and backup display will meet the requirements of R.G. 1.100 as clarified in the criteria. Excluding the backup display, qualification (environmental and seismic) will be applied up to and including channel isolation devices which will be located in a mild environment which meets the intent of II.F.2. The backup display and associated hardware will be Class 1E and meet the requirements of II.F.2.

Cable routing will not necessarily be to the requirements of Reg. Guide 1.75 as this was not a licensing basis for either North Anna or Surry. The new system will be purchased, designed and installed per the NRC approved Vepco Quality Assurance Program which is in accordance with 10CFR50 Appendix B, ANSI 45.2 and meets the intent of II.F.2. Once the thermocouple upgrade is complete, we will be in compliance with the intent of II.F.2.